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POTENTIALITIES OF POND FISH FARMING IN KALIAKAIR UPAZILA UNDER GAZIPUR DISTRICT, BANGLADESH

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Potentials and prospects of pond fish farming in improving aquaculture system in Kaliakair upazila under Gazipur district, Bangladesh were investigated. Data were collected from 60 selected fish farmers through questionnaire survey and Focus Group Discussion (FGD) during June to November, 2014. The research revealed that a highest number of pond fish farmers (61.67%) were out of training facilities and a good portion (23.33%) had no education. Pond water was found turbid seasonally (71.66%) and farmers did not exchange water during culture periods (66.67%). As a result water quality deteriorates day by day and depletion of oxygen occurs during pond farming. The average stocking density of fish was higher in the study area and the highest was found in monoculture of Climbing perch (*Anabas testudineus*) (1200 individual/decimal) and lowest in carp polyculture system (195 individual/decimal). Fish production was higher in Pangus monoculture system (17.89 MT/ha/yr) and lower in Climbing perch monoculture system (10.78 MT/ha/yr), but profit was higher in Climbing perch monoculture produced 1318100 Tk./ha/yr and lower in Tilapia monoculture 397886 Tk./ha/yr. Benefit Cost Ratio was higher in Climbing perch (2.32) and lower in Pangus culture (1.34). The problems faced by the fish farmers were broadly categorized as financial, natural, technical and social. Therefore, necessary training facilities with institutional and organizational supports, credit facilities, extension services and awareness development are essential to improve aquaculture system as well as the fishers' livelihoods in Kaliakair upazila of Gazipur district.

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INTRODUCTION

The inland fisheries of Bangladesh are one of the most productive resources in the world (Islam and Dewan, 1986). There are about a total of 13 Lac ponds in Bangladesh which covers about 3.05 Lac ha and 2400 km long rivers which covers about 10.32 Lac ha (DoF, 2010). In the year 1998-1999 the total fish production from pond culture system was only 4.99 Lac MT and it was increased 14.47 Lac MT in 2012-2013 year (DoF, 2014). To estimate total number of benefiting people from direct employment in aquaculture and for the improvement of cultural system and future planning, the information regarding present aquaculture practices at the grass root level is absolutely necessary. Survey method is an important necessary way to collect information from bottom level. The area of Kaliakair upazila has huge fisheries resources but its production was lower than other areas like Mymensingh, Narshingdi and even in the average annual fish production in Dhaka division. The river production in the area is decreasing day by day due to decreasing river area and development activities. On the other hand the population of the area was increased to change over time. Although there are huge future prospects of pond fish farming development and to improve livelihood of fish farmer in the area but the information on the said issue is very imperfect. From this point of view, the study was undertaken to determine the potentialities of pond fish farming specially discover the constraints associated with fish farming and the livelihood status of the fish farmers. Thus, the study was initiated with the following objectives:

- Assessment and evaluation of the status and practices of existing pond fish farming in Kaliakair upazila,
- Exploration of the livelihood status and constrain of pond fish farming, and
- Formulation of suggestion and recommendation for improvement and development of pond fish farming in the study area.

MATERIALS AND METHODS

Study area and period

The study was conducted for a period of six months from June, 2014 to November, 2014 in the Kaliakair upazila under Gazipur district of Bangladesh (Map 1). It is very close to the capital city of Dhaka. The site was selected because of the availability of aquatic resources, huge people involvement in fish farming practices, and lack of research activity in this area.

Map 1. Showing the study area

Research design

The design of the study is outlined below:

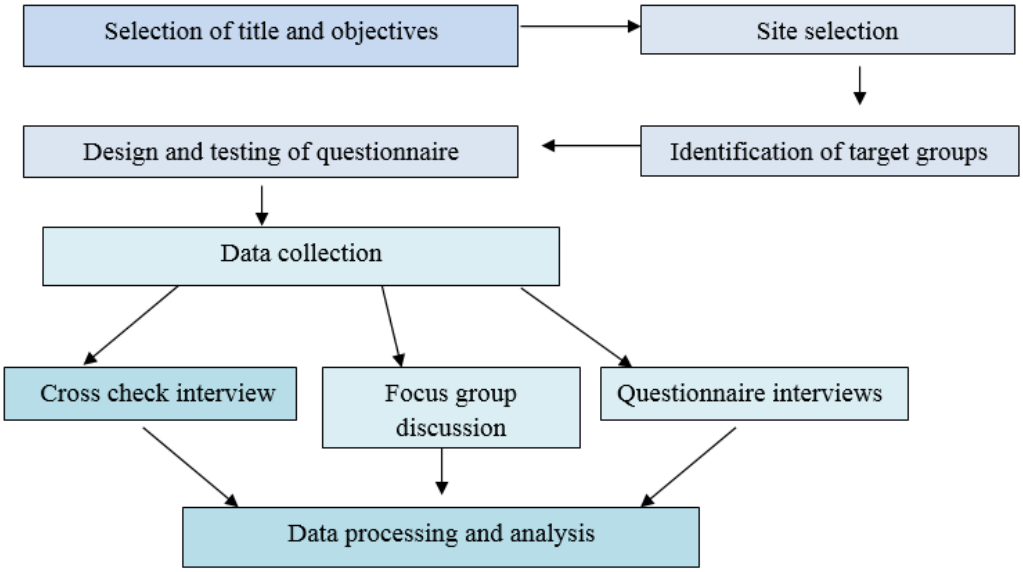


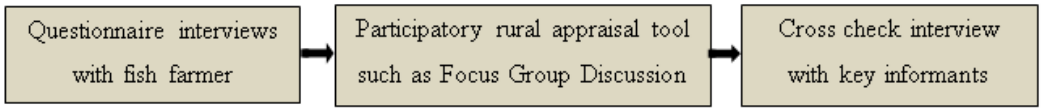
Figure 1. Outline of research activities

Target group

The people who have pond and culture fish were selected as respondents. Data were collected from 60 randomly selected fish farmers covering the selected study area (Figure 1). Most of the farmer culture fish as their primary choice to support their family and to improve their social condition.

Design and test of questionnaire

A set of questionnaire interview schedule was designed. The draft questionnaire was tested with 10 fish farmers in the study area. In the pilot survey, much attention was given to any new information which was not designed but was important and informative towards the objective. The questionnaire was changed, modified and rearranged according to the experience gathered in pre-testing of questionnaire. The final interview schedule was then developed in logical sequence so that fish farmers could answer systematically. Data were collected by direct interview using questionnaire and cross check interview. Fish farmers were interviewed at their house or farm sites and the information was recorded by the researcher himself.



The data were collected through questionnaire interviews and FGD, and the cross check interviews were conducted with key informants such as Upazila Fisheries Officer (UFO) and relevant NGO workers.

Data processing and analysis

All the collected data were summarized and scrutinized, and analyzed and recorded carefully. Finally the relevant tables were prepared in accordance with the objectives of the study. Data were presented mostly in the tabular form because it was simple in calculation and easy to understand.

RESULTS AND DISCUSSION

Demographic profile

According to the census of Bangladesh population in 1981, 1991, 2001 and 2011 the total populations of the upazila were 165766, 232915, 267003 and 483308, respectively. This showed that the population of the area was increased in a dramatic rate. The total population in the census 1981 was 165766 that reached 483308 in 2011 census. The rate of increase of male population was higher than female population in every census.

Fisheries resources

Ponds, rivers, beels and ditches were found as water resources in the study area (Table 1). Most of the areas were related with fish culture and agriculture.

Table 1. Fisheries resources in Kaliakair upazila

Serial	Resources	Number/area
1	Total land area	314.14 sq.km
2	River	3
3	River area	2824 ha
4	Flood plain area	2833 ha
5	Pond	2852
6	Pond area	1017 ha
7	Fish farmer	2935
8	Fishermen	1514
9	Fish hatchery	1
10	Beel nursery	2311
11	Feed mill	4
12	Fish Suntuary	22

Source: Citizen Charter, Upazila Fisheries Office, Kaliakair, Gazipur

River and its present status in Kaliakairupazila

Three rivers name Turag, Bongsi and Gualia are flow through the Kaliakair upazila. The total river area of the upazila is gradually decreasing due to political and local tenant, continuous industrial development, construction of roads and highway, unplanned growth of living areas, building of market in the bank of river. In 2008, the total river area was 3234 ha but it decreased in 2015 and reached in 2824 ha. Fish production in the river is also decreasing. Therefore, to meet the demand and to supply necessary fish protein for the increasing people, it is urgently needed to develop the aquaculture system of the area.

Socio-economic condition and livelihood status of pond fish farmer

From the study it was found that about 41.67% monoculture farmers were middle age (36-45 years), 16.67% young and 5% old. The result of the study revealed that young and middle age farmers were more involved in monoculture farming, on the other hand middle and old age farmers involved in polyculture farming. Ali et al., (2008) studied on socio-economic condition of small farmer and reported that most of the farmers were belonged to the age category of 31 to 40 years. About100% monoculture farmer and 90.09% polyculture farmer was male that means that no females involved in monoculture fish farming systems. But if women can be involved in fish farming activities, they can utilize their leisure period simultaneously support farming activities and earn money. Zaman et al., (2006) studied on the assessment of livelihood status of fish farmers in some selected areas of Mohanpur upazila under Rajshahi district and found that 85% male and 15% female farmers were involved in pond fish farming activities. Religious status of fish farmer was 95% Muslim and 5% Hindu. Family size of monoculture farmer (36.66%) was medium size (6-9 members) and 10% family of polyculture farmer was small size. In surveyed area about 56.67% farmer received fish farming as their main occupation and also found 10% service, 20% business, 13.3% agriculture as their main occupation.

The education level of the fish farming community in the study area was lower (Figure 2). In case of polyculture pond fish farming the majority of the respondent (18.33%) was in illiterate. The mean literacy was found 8.56±2.24 in monoculture and 6.91±1.3 in polyculture farming system. Among the respondent a major portion (23.33%) had no education that they were illiterate and the highest portion (25%) had only secondary level of education. The literacy of the fish farmers is an important factor, which determines their communication behavior, access to the printed and mass media as well as acquainted with the local and world market.

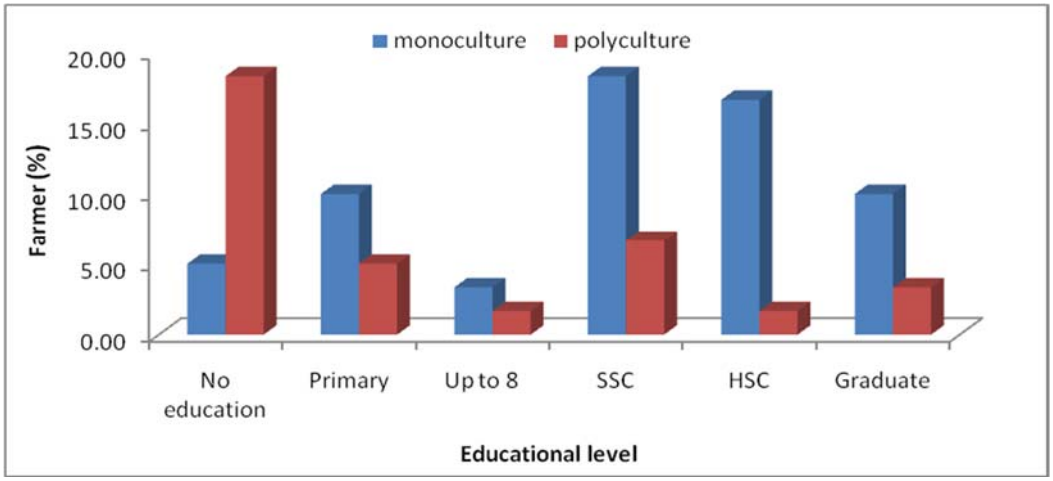


Figure 2. Educational status of farmer in the study area

Rahman (2012) studied an experiment on socio-economic condition of commercial climbing perch fish farmer in Muktagacha uapzila, Mymensingh district and found that about 28% of the fish farmers had literacy up to primary level, 4% were illiterate, and 46% up to secondary level and 14% could sign only. The study revealed that the sanitary conditions of the fish farmer were not satisfactory in the study area. Sanitary facilities of polyculture farmer was very poor about 43.33% had non-constructed facility. Kabir et al., (2012) found in their study that 60% of the farmers had semi-constructed, 30% non-constructed and 10% had no sanitary facilities in their study area. A significant proportion of fish farmers (55%) had taken their health service from village quack doctor (who actually possess no knowledge on medical science) and it was found that 43.33% fish farmers were living in tin shed house (non-constructed). It was observed that 68.33% fish farmers had no own land, they culture fish in lease pond and the famers spent their maximum profit for paying the lease pond. Bank loan was higher in monoculture farmers about 33.33% received loan for fish culture and a total of 36.67% respondents invest their own money for fish culture. The involvement of NGO in monoculture farming system was very minor only 5%. Mean annual income of monoculture farmers were 556972 BDT and polyculture farmers 27022 BDT. The polyculture farmers usually do not consider farming as a business. As their farms are not commercial in nature, they do not seriously think about profit and loss.

Status of pond fish farming system

Physical structure and condition

Pond ownership

Surveyed ponds were classified into four categories on the basis of ownership. In monoculture farming system, it was observed that 18.33% ponds under single ownership, 41.67% under multiple ownerships with 2-3 owners and the rest 3.33% ponds were public property. Ownership pattern of polyculture ponds were observed that 23.33% of total surveyed pond under single ownership, 11.67% under multiple ownerships ranging from 2-3 owners and the rest 1.67% ponds were public property or property of some organization. Ali et al., (1982) studied the ponds ownership of six upazila's of Mymensingh district and found that 84% under joint ownership and only 16% under single ownership. From this discussion it was observed that researcher studied on pond ownership found that majority of pond under joint owner. This is also similar to the findings of present study.

Farm size

Farm size is an important variable for the production of fish (Islam and Dewan, 1986). In the study the respondents were classified into three categories according to their farm size and their farm size ranging from 0.3 to 1.7 ha. The mean (±SD) farm size of the monoculture and polyculture farmers were 0.45±0.05 ha and 0.64±0.01 ha, respectively.

In monoculture farm, about 20% of the respondents had small size farm and 36.67% had medium size and only 6.67% had large size farm. It was found that the highest percentage (36.67%) of respondent had medium size farm and involved in single species culture activities and lowest had (5%) larger size farm and involved in multi-species culture system. The farmers had very small size farm, they didn't earn enough profit from fish culture. On the other hand a major portion of large farm size farmers didn't culture fish in scientific methods, so, they also not earn enough money from fish culture. Rahman (2003) found in his study that the average farm size was 0.12 ha with a range from 2.50 to 15.0 ha in Gazipur district. Saha (2003) observed that the range of farm size were within 0.05 to 0.15 ha in his study.

Water quality condition

Depth and source of pond water

The water depth was found 3-5 ft, 5-8 ft and above 8ft in the category of small, medium and large, respectively. Among the study the water depth of 36.67% monoculture ponds and 23.33% polyculture ponds were 5-8 feet (1.52-2.44 m) during rainy season. According to Jone and Paul (2012) the depth of ponds is generally in the range of 0.8 to 1.8 m (2.62-5.90 ft) these depths allow adequate light penetration for primary productivity. In the study water depth was higher than recommended depth for pond fish culture. It was found that about 46.67% monoculture farmer supply water in their pond from ground water source by using deep tube well and 33.67% polyculture farmer depend on rain and river water as a source of pond water. In the study it was found that a large number of farmers (55%) depend on rain and ground water for fish culture in their ponds. During the time when rainfall is low, they totally depend on ground water. As a result increased their production cost and simultaneously decreased their profit.

Water exchange

In the study, about 46.67% monoculture farmers and 20% polyculture farmers did not exchange water during culture periods. Rahman (2007) studied on pond fish farming and livelihoods of rural fish farming in some selected areas of Kurigram district and observed that farmers have no facilities to exchange water. From the study it was found that 66.67% farmers did not exchange water during culture periods from their ponds. But during culture of fish, large amounts of metabolites were continuously excreted and deposited into the pond bottom and moreover, where excess, unconsumed feeds also added to the bottom load and serve to pollute the water. To prevent the deterioration of the pond environment, pond water is continuously freshened by the entry of new water from the water source, while old water is drained through the outlet/drainage gate.

Turbidity and water colour

Turbidity is the degree of opaqueness produced in water by suspended particulate matter. Intensity of turbidity varies with soil type, season, amount of surface runoff, amount of organic decomposition and others. In the study three types of water color observed in farmers' ponds. Water colour of monoculture farm was 43.33% muddy, 13.33% brown, 6.67% light green and 28.33% muddy, 6.67% brown and 1.67% light green in polyculture farm. Dosdat et al., (2001) studied on the environment impact of aquaculture and found that water colour affects different element in pond. In the study it was found that about 71.66% ponds water was turbid seasonally with clay or soil particles.

Measurement of water quality

Production of sufficient fish food organisms highly depend on the water quality. In the study it observed that all farmers were not able to measure the important physical and chemical parameter (Table 2) of pond water due to lack of instrument, high cost of equipment, lack of technological knowledge and high cost associated with water quality measurement. The farmers were measured some of the physico-chemical

parameters of their ponds with the help of upazila fisheries office and LEAF (Local Extension Agent for Fisheries). Hasan and Ahmed (2001) studied on issues in carp hatcheries and nurseries in Bangladesh, with special reference to health management and aquaculture development and found that some of the rural small scale farmers observed water quality parameter of their culture pond.

Table 2. Water quality parameter measured by the farmers in the study area

Parameter	Monoculture		Polyculture	
	Respondent	Percentage (%)	Respondent	Percentage (%)
Temperature	12	20	6	10
pH	3	5	-	-
Dissolved oxygen	3	5	2	3.33
Transparency	30	50	14	23.33
Alkalinity	2	3.33	-	-
Ammonia	-	-	-	-
Phosphorus	-	-	-	-
Nitrate	-	-	-	-
Chlorophyll-*a*	-	-	-	-

Sources of fish seed

In Kaliakairupazila had only one private hatchery and no government hatchery. The hatchery produced only carp seed and not full fills the farmers demand. It was observed that only 15.33% farmers' got fish seed from private hatcheries of Gazipur district. Therefore, to full fill the demand, farmers collect fish seed from the hatcheries of Mymensingh, Bogra and Rajshahi district (Table 3).

Table 3. Sources of fish seed in the study area

Sources	Monoculture		Polyculture	
	Respondent	Percentage (%)	Monoculture	Percentage (%)
Private hatchery (Mymensingh)	21	12	43.33	20
Private hatchery (Rajshahi)	6	1	10	1.67
Private hatchery (Bogra)	8	4	13.33	6.67
Private hatchery near farm	3	7	5	8.33
Natural sources	0	0	0	0

Stocking density

Stocking activities depends on supply and availability of fish seed. Most of the farmers stocked fish fry/fingerling in the month of June-July when the pond had accumulated about 5-8 feet of rain water. Farms with a perennial water source were stocked as early as the month of April-May. Generally, farmers were released of fish fingerlings to ponds in around June and cultured as long as sufficient water retained in the pond. Stocking density of monoculture (Tilapia), monoculture (Pangus), monoculture (Climbing perch) and polyculture (Indian major carp) were 48782 individuals/ha, 58508 individuals/ha, 288166 individuals/ha and 43225 individuals/ha, respectively (Table 4).

Table 4. Stocking density of fish fingerling in the study area

Culture strategy	Stocking density/decimal	
	Mean	SD
Monoculture (Pangus)	236	56.35
Monoculture (Climbing perch)	1165	242.21
Monoculture (Tilapia)	197	52.82
Polyculture (Indian major carp)	175	23.24

According to Islam (2012) the average stocking density of fish better for pond aquaculture was 17,370 fry/ha/year. Parvin (2011) reported that average stocking density in case of Pangus 32,000-45000 fingerlings/ha and in case of Climbing perch 80,000-90,000 fingerlings/ha in three upazila of Mymensingh district. In the study area the lower (mean ± SD) stocking density was 175 ± 23.24 fingerlings/decimal in polyculture system, while the higher (mean ± SD) stocking density was 1165 ± 242.21 fingerlings/decimal of Climbing perch in monoculture system. The average stocking density of fish was higher in the study area and in case of monoculture Climbing perch it was very high. It means that "More stocking gives more production" was the main idea of farmer in the study area. Sometimes they denied the suggestions of UFO, specialist or extension personnel.

Feeds and feeding strategy

In the study areas farmers mainly used three types of feed such as homemade feed (locally called loose feed), commercial feed and homemade feed both (loose + pellet). Farmers prepared feed by their own feed machine. Farmers used rice bran, wheat bran, mustard oil cake, fish meal, bone meal and vitamin-minerals premixed as major ingredients for the preparation of homemade feed. Among the commercial feed, farmers frequently bought feed from Quality, Saudi-Bangla, ACI feed, Aftab feed and Mega feed company. Price and quality differs from one company to another and within the same company. In case of monoculture farming practice, about 43.33% farmers used both types of homemade feed (loose + pellet), 6.67% farmer used only homemade feed (loose) and while 13.33% farmers used commercial feed. Farmers applied feed at an average or 4.5% body weight with a range of 3-5% body weight. Farmers reported the FCR (Food Conversion Ratio) value ranged from 1.5 to 2.0 with different feeds. Rasel (2011) found in his studied that about 85% farmers used commercial feed and 15% used homemade feed in Tilapia farming in Mymensingh district. In case of polyculture system, the study reveals that 28.33% farmers used commercial pellet, 1.67% used both type of homemade feed (loose and pellet), 6.67% farmer used only homemade feed (loose). In the study, maximum farmers used rice bran because it is available and low price. Farmers generally used different hormones, antibiotics and growth promoter that could be sometimes harmful.

Use of chemicals, drugs, antibiotics and toxic substance

In the study area it was found that all (100%) respondents used lime, 90% of monoculture farmer used Zeolite, Panvit aqua, Zeofresh, Gasonex and Biomax in their pond by the instruction of company agents. About 10% farmers used KMnO4, 75% used antibiotics, 2% used Dipterex, 8% used copper Sulphate, 5% used Malachite green, 5% used Methylene blue and 3% farmers used Calcium hypochlorite when disease problems appear. It also found that 82% of monoculture farm used antibiotics. Aoki (1992) reported that the use and sometimes abuse of antibiotics in more intensive farming led to multiple drug resistance among pathogens. Pillay (1992) stated that there is a possibility of generating drug-resistant strains of pathogens by the use of antibiotics for treating diseases into the environment.

Production of fish

In the year 2013, annual yield of monoculture Tilapia, Pangus and Climbing perch were 15.8 MT/ha/yr, 16.95 MT/ha/yr and 10.12 MT/ha/yr, respectively and the polyculture of Indian major carp was 11.86 MT/ha/yr in Kaliakair upazila (Table 5). Parvin (2011) found the average yield of Pangus was 25,811 kg/ha and Climbing perch 53,350 kg/ha in three upazila of Mymensingh district.

Table 5. Fish production, cost, revenue, profit, and BCR per hectare in the year 2014 in the study area

Species	Production (MT)	Cost (Tk.)	Revenue (Tk.)	Profit (Tk.)	BCR
Tilapia	16.27	1081656.88	1479543.33	397886.45	1.37
Pangus	17.89	1257208.98	1690066.23	432857.25	1.33
Climbing perch	10.78	996741.0565	2314841.92	1318100.86	2.32
Indian major carp	12.16	1650856.957	2487573.74	836716.78	1.51

The highest species wise fish production was Pangus (17.89) and lowest was in Climbing perch (10.78). The above discussion indicated that the fish production was increased in the study area but it is fur from the national target and it is possible to further increase. In the year 2012-2013 the annual fish production of pond in Kaliakair upazila was 2.99 MT/ha but the national annual fish production in pond was 3.89 MT/ha (FRSS, 2014). According to FRSS, 2014 the annual fish production of pond was 5.48 MT/ha in intensive pond fish farming and it was increased up to 22.70 in highly intensive pond fish farming. In the year 2013-2014 the annual pond fish production in Kaliakair upazila was 3.80, but the average national annual pond fish production was 4.1 (Azad, 2015). According to Azad, 2015 if all the pond of the country will be taken under sustainable aquaculture through the extension of appropriate technology then it will be possible to produce 5.0 MT/ha of fish in the pond within 2020-2021.

Gross and net return from pond fish farming

In the study, it was found that the average annual return from the production of Tilapia, Pangus, Climbing perch and Indian major carp were 1479543.34 Tk./ha/yr, 1690066.23 Tk./ha/yr, 2314841.92 Tk./ha/yr, 2487573.74 Tk./ha/yr, respectively. Rahman (1995) observed that the average gross and net returns of carp were 72,910 Tk./ha/yr and 15,833 Tk./ha/yr, respectively in Tarakanda upazila of Mymensingh district. In the study it found that the highest return was in polyculture of Indian major carp and lowest in Tilapia farming.

Benefit Cost Ratio (BCR)

In the present study it was found that the average BCR in monoculture pond farming of Tilapia, Pangus and Climbing perch were 1.37, 1.33 and 2.32, respectively and in polycuture pond farming of Indian major carp was 1.51. Awal et al., (2001) was estimated the overall economic return (net return) and BCR of Pangus culture as 23964 Tk./ha and 2.73, respectively in Jamalpur and Sherpur District. Sohag (1996) found in his studied that the BCR of Tilapia was 2.02 in Nandail Thana Mymensingh district. From the study it observed that the highest BCR (2.32) was in Climbing perch and lowest (1.33) in Pangus farming. The study also revealed that the benefit was higher in monoculture Climbing perch farming compare to polyculture of Indian major carp.

Harvesting and marketing of fish

The farmer intermittently harvested fish for family consumption or at 1-2 times for marketing. The peak period of harvesting was September to November month. Most of the farmers (64%) practiced total harvest and others (36%) practiced partial harvest in the month of August to November for selling. Farmers harvest their fish by using cast net and seine net or by total drying of pond. It was found that about 70% of fish sold to the wholesalers or local agents for transportation to the Dhaka city and the rest (30%) sold for local retail market. The harvested fish reached from culture pond to consumer by three different ways (Figure 3). Farmers reported that they were facing some problems during marketing due to narrow muddy road, lack of transport facilities and poor marketing system.

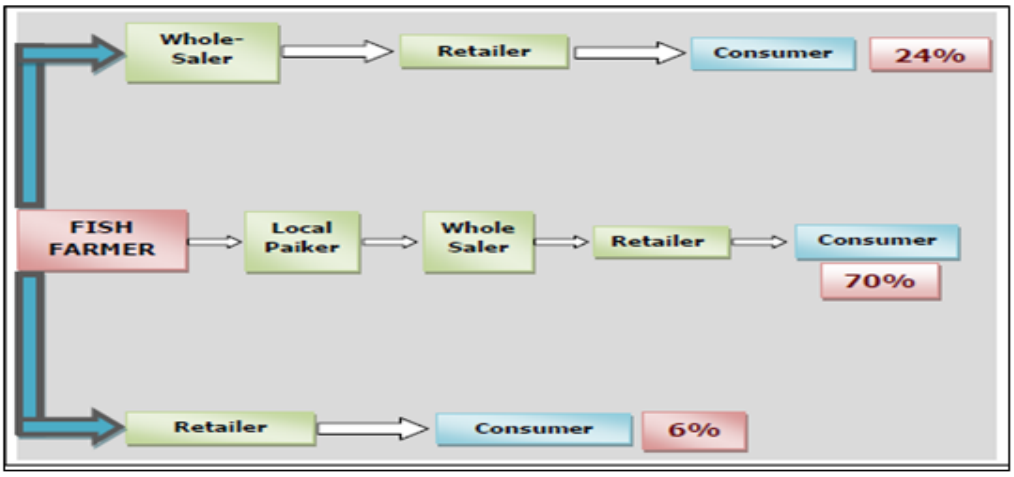


Figure 3. Marketing channel of fish in Kaliakair upazila

Constraints of pond fish farming in the study area

In the study area had only one private hatchery and no government hatchery, and the existing hatchery produced only carp seed. On the other hand the hatchery not full fills the demand of fish seed. So, to meet up the demand the farmers collect fish seed from a long distance according to availability, these increase the cost of production. The pond fish farmers in the study area were also facing various problems during culture of fish. These problems broadly categorized as financial, natural, technical and social. The farmers confronted the problems during pond fish farming were ranked and index in the following Table (Table 6).

Table 6. Rank order of problems in monoculture farming in the study area

Problem	Score of extent of problem confrontation					
	H	M	L	N	PCI	Rank
Inadequate supply of fish seed/fry/fingerling	84	21	9	0	109	1
Lack of finance	78	20	6	0	104	2
Low growth rate of fish	75	21	6	0	102	3
High prices of fish feed	75	18	6	0	99	4
Low quality of feed	69	`20	9	0	98	5
Water sources to fill up pond	63	22	10	0	95	6
Mortality of fish	60	20	10	0	90	7
Water quality deteriorated	60	20	9	0	89	8
Industrial pollution	54	22	11	0	85	9
Training facilities	51	18	10	0	78	10
Availability of preservation (ice) materials	48	14	12	0	73	11
Multiple ownership	42	12	11	0	68	12
Poaching of fish	36	12	10	0	61	13
Availability of manpower	33	14	7	0	54	14
Poor marketing facilities	30	16	9	0	50	15
Political problems	24	16	8	0	48	16
Fertilizer and manure application	18	14	12	0	44	17

H = High, M = Medium, L = Low, N = Not at all, PCI = Problems Confronting Index
Here, PCI = (H*3+M*2+L*1+N*0)

CONCLUSION AND RECOMMENDATION

Based on the major findings of the study and their logical interpretation the following conclusions were drawn:

- Farming practices of monoculture and polyculture farmers were not satisfactory due to lack of sufficient fish seed, training facilities and knowledge on intensive farming system.
- Pond size, fry size, stocking density, water quality, embankment condition of pond was not satisfactory for monoculture and polyculture farming.
- Indiscriminate use of feed, chemicals, antibiotics and fertilizer decreasing sustainability of pond fish farming.
- No female member were involved in monoculture farming system and in case of polyculture system only few female members were involved.
- The education level of the fish farming community in the study area was lower.

Based on the major findings, problems and conclusion the following recommendations were made:

- Women and young age people could be more involved in monoculture system to increase aquaculture production.
- Regular checking of water quality parameter should be made and a control measure should be taken against the indiscriminate use chemical and drug.
- Natural and artificial water reservoirs should be constructed for supplying water during dry season.
- Educational institution should be set up to improve educational status.
- Government, private sector and NGOs should come forward to establish fish hatchery and fish processing plant.
- Government and other institution should provide sufficient fund and facilities.

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