

## Effect of Multi-Ownership on Pond Aquaculture Production in Bhola District, Bangladesh

Jewel Chandra Pall, Shuvagato Mondal, Priyanka Rani Majumdar\* and Md. Abul Hossain

Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali, Bangladesh

\*Corresponding author: Priyanka Rani Majumdar, Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali, Bangladesh, Tel: +88 01718418647; E-mail: priyanstu@gmail.com

Received date: August 19, 2018; Accepted date: September 21, 2018; Published date: September 28, 2018

Copyright: © 2018 Pall JC, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

### Abstract

The study was carried out to appraise the effect of multi-ownership on management system and present situation of pond aquaculture in Bhola district, Bangladesh. Data were collected by personal questionnaire interview from randomly selected 200 farmers at four Upazilas of Bhola district. Participatory rural appraisal (PRA) tools were applied for verification of the collected data. A total number of 32,877 ponds with an area of 8,061 acre were found in the study area. Both multi-ownership (72.5%) and single ownership (27.5%) were observed in management approach of the ponds. 57.3%, 26.52% and 16.18% of the ponds were cultured, cultural and derelict respectively in the study area. Among the cultured ponds, most of the ponds (90%) were used for poly culture, 8% for mono culture and only 2% ponds were for fish seed nursing purposes. Extensive (60%), improved traditional (25%) and semi-intensive (15%) management practices were found in the study area. The study also revealed that farmers use both organic and inorganic fertilizers with an average dose of 850 Kg/acre and 44 Kg/acre respectively for single owner ponds and 560 Kg/acre and 24 kg/acre for multi-owner ponds. For fish production farmers found to be applied supplementary feed parallel with fertilizers in their ponds which facilitate annual average fish production as 1,810 kg/acre. The average total cost of fish production was determined as BDT 49,221/acre/year and BDT 38,850/acre/year for single owner and multi-owner ponds respectively. In the study area highest amount of production cost was spent for feeding purpose 23.07% and 22% in single owner and multi owner ponds respectively. The study also revealed that the average profit of fish production was identified as BDT 54,050/acre/year in multi-owner ponds and BDT 80,229/acre/year in single owner ponds. So multi ownership of ponds has negative effect on the production of pond aquaculture in Bhola District.

**Keywords:** Pond; Aquaculture; Fish; Multi-ownership; Single-ownership; Management; Production

### Introduction

Fish is a popular complement to rice in the national diet, giving rise to the adage Maache-Bhate Bangali (“a Bengali is made of fish and rice”) [1]. The fisheries can broadly be classified into three categories: inland capture fisheries, inland aquaculture and marine fisheries, of which the inland aquaculture sector is contributing more than 55% of the total production. The major portion of total fish production (83.72%) of the country comes from inland water bodies, where inland open water bodies and inland closed water bodies contributes 27.8% and 55.92% respectively. Pond aquaculture contributes the major portion (43.79%) of total inland fish production. The overall pond area of the country is 3,72,397 ha and ox-bow lakes (baors) are 5,488 ha [2]. In Bangladesh, aquaculture production systems are mainly extensive and improved extensive with some semi-intensive and intensive systems in very few cases [3].

Pond aquaculture is the traditional and ancient practice in the country but in recent time some advanced culture system has also been practiced to increase the production rate. At the same time in many regions a significant number of ponds are not taken under culture management system.

The Department of fisheries of Bangladesh had classified all ponds into three categories; (i) derelict pond (9.42%) (ii) culturable pond (17.54%) and (iii) cultured ponds (63%). The total fish production

from ponds is around 250 thousand metric tons [4]. But derelict and culturable ponds depend on natural stocking of the fish fries and only a small quantity of fish is harvested from these sources. If all derelict and culturable ponds could be converted into cultured ponds and thus introduced just semi-intensive method of fish culture which is manageable with local resources and technology, it would be possible to increase the pond fish production 15 times to 20 times four folding the total fish production of Bangladesh [5].

Hence the present study was carried out to assess the practiced management system of pond aquaculture and the effect of pond multi ownership on management and production of pond aquaculture in Bhola district, Bangladesh.

### Materials and Methods

The study area was selected in Bhola district with an area of 3,403 sq.km located in the northern regions of Bangladesh. Bhola Sadar, Tazumuddin, Lalmohon and Charfashion Upazilas were selected for the study to obtain detailed information about pond aquaculture system among the 7 Upazilas of Bhola district.

### Data collection

Data were collected by personal questionnaire interview from randomly selected 200 pond owners in the study area. For this purpose a well-structured questionnaire was prepared in accordance with the objectives set for the study. After collecting the primary data and

secondary data (sources: field observation, key informants, journals, published documents and report books), Focus Group Discussion (FGD) were conducted for verification of the data.

### Data analysis

All the collected data were accumulated, summarized and analyzed by MS-Excel and then presented in textual, tabular and graphical forms to understand the management and culture system of the pond aquaculture in the study area.

## Results and Discussion

### Structural characteristics of fish ponds

**Total area of waterbody:** In Bhola district, the total area of waterbody was 8573 acre where 8061, 36 acre and 477 acre were

occupied by 32,877 numbers of ponds, 40 dighees and other waterbodies respectively (Table 1). Among the four Upazilas of Bhola district, highest number of ponds (11760) were found in Bhola Sadar which occupied 2352 acre area and the lowest number (4250) was found in Tazumuddin Upazila with an area of 1290 acre. Sarwer et al. [6] found that the total area of pond was 0.67 acre in Subarnachar Upazila.

Upazila name	Pond		Dighee		Area of other water bodies (acre)	Total area (acre)
	Number	Area (acre)	Number	Area (acre)		
Bhola Sadar	11760	2352	10	12	224	2588
Tazumuddin	4250	1290	30	24	15	1329
Lalmohon	6367	2101	0	0	66	2167
Charfashion	10500	2318	0	0	172	2489
Total	32877	8061	40	36	477	8573
Mean ± SD	8219 ± 3508	2015 ± 496	10 ± 14	9 ± 11	119 ± 95	2143 ± 571

**Table 1:** Total number and area (acre) of waterbody in Bhola district.

**Pond types:** It was found that in study area, 57.30% ponds were used for fish culture, whereas 26.52% and 16.18% ponds were cultivable and derelict respectively (Table 2). There are an estimated 1.3 million fish ponds in the country, covering an area of 0.151 million ha, of which 55.30% is cultured, 28.52% is cultivable and 16.18% is unused [7]. About 5% ponds were derelict in Bangladesh [8].

Pond types	Percentage (%)	Area (acre)
Cultured	57.3	5820
Cultivable	26.52	1434
Derelict	16.18	715

**Table 2:** Different types of pond in four Upazila of Bhola district.

Upazila	Ownership (Number)		Ownership (%)		Average (%)	
	Single	Multiple	Single	Multiple	Single	Multi-owner
Bhola Sadar	3528	8232	30	70	27.5	72.5
Tazumuddin	1487	2762	35	65		
Lalmohon	1591	4775	25	75		
Charfashion	2100	8400	20	80		

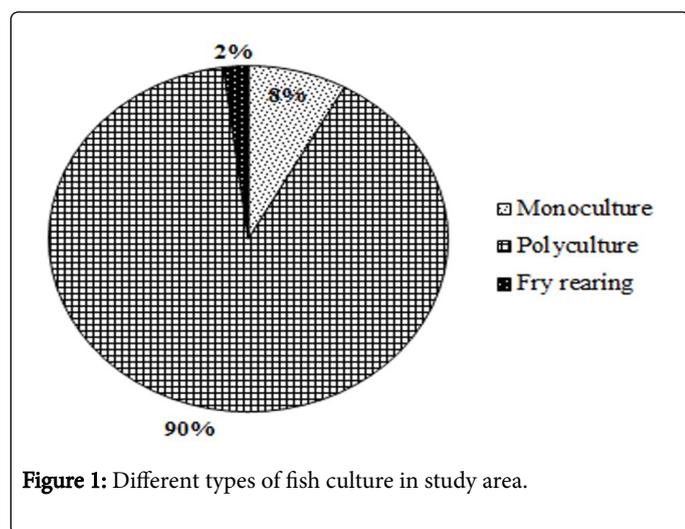
**Pond ownership:** The study showed that the highest number of ponds (72.5%) was under multi ownership while the rest 27.5% under single ownership among the four Upazilas of Bhola district (Table 3). Whereas Pravakar et al. [9] found that 85% of ponds were occupied by the single owners and 15% was occupied by multiple owners in Shahrasti Upazila of Chandpur District. 56% and 34% of the farmers had single and multiple ownership ponds respectively and the remaining 10% farmer cultured fish in leased ponds in Mithapukur Upazila of Rangpur district [10]. About 34% of the total ponds were under joint ownership and 54% were under single ownership and the rest 12% ponds were public and organizational property in Demra, Dhaka [11]. About 60% of the pond area are jointly owned by private households and 56% jointly operated in Bangladesh [12].

Total	8706	24169	-	-		
-------	------	-------	---	---	--	--

**Table 3:** Pond ownership status in four Upazila of Bhola district.

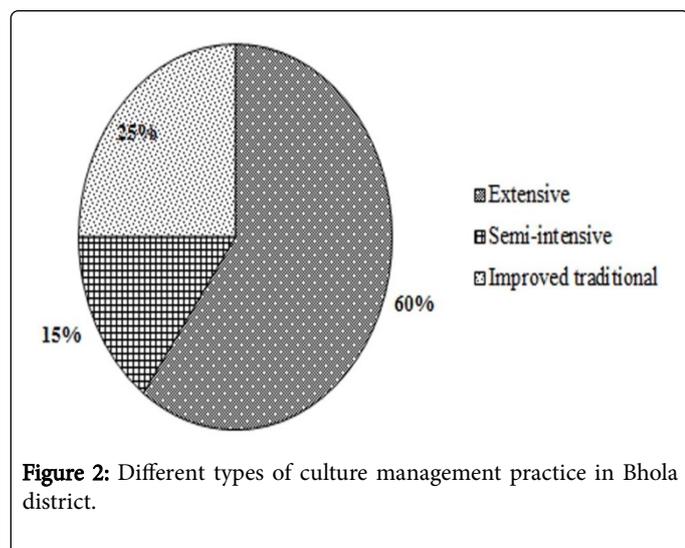
### Fish culture and management practice

**Types of fish culture:** In the study area, 90% culture ponds were found to be used for polyculture while 8% for monoculture and the rest 2% used for fry rearing purposes (Figure 1). Majority of the farmers (99%) carried out polyculture and the rest 1% were under integrated culture system [9]. Polyculture was carried out in 97% ponds, 2% ponds were under monoculture system and 1% ponds were under integrated culture system in Dhamrai Upazila of Dhaka District [13].



**Figure 1:** Different types of fish culture in study area.

**Pond management systems:** Pond management system in Bhola district were characterized by extensive (traditional), improved traditional and semi-intensive system. It was recorded that extensive, improved traditional and semi-intensive culture method were practiced in 60%, 25% and 15% ponds of Bhola district respectively (Figure 2).



**Figure 2:** Different types of culture management practice in Bhola district.

In Bangladesh, fish culture systems are mainly extensive and improved extensive, with some semi-intensive, and in very few cases intensive systems [14]. 83% of the fish farmers adopted extensive technology and rest 17% semi-intensive technology in Gomastapur Upazila of Chapai Nawabgonj District [15].

**Cultured fish species and stocking density:** In the study area, most of the farmers cultured Indian major carps viz., Rohu, Catla, Mrigal and Exotic fish viz. Silver carp, Grass carp, Common carp, Bighead carp, Olive barb/Sarpunti, Tilapia etc. This finding was more or less similar with Halim et al. [10,13,16]. In the study area, the season of fish culture was April to October which was more or less similar with the findings of Pravakar et al. [9,10,13]. In case of seasonal ponds the fish farming duration was June to November and in perennial ponds March to November in Sreemangal Upazila of Moulvibazar district [17].

Stocking density is important for fish culture to obtain more production. The average stocking density was found to be 6,668 fry/acre in the present study area. Two categories of stocking densities viz., low and high were found to be maintained in this area. The low stocking density is used to produce large sized fish of above 0.4 kg and the higher stocking density produces moderately small sized fish around 250 g (Table 4). The average stocking density for fish culture was 200 fingerlings/ decimal in the pond of Barisal district [16]. The range of stocking density was from 10,000/ha to 31,000/ha in a village of Mymensingh district which was higher than the present study [18]. Inland pond culture act as the backbone of aquaculture in Bangladesh because more than 80% of the total recorded aquaculture production come from pond culture, and is presently dominated by carps (indigenous and exotic), Mekong pangas and tilapia [14].

Scientific name	Common name	Stocking density (Fry/decimal)	
		Lower (For producing large sized fish)	Higher (For producing small sized fish)
<i>Labeo rohita</i>	Rohu	05-06	9-10
<i>Cirrhinus cirrhosus</i>	Mrigal	04-08	13-15
<i>Gibelion catla</i>	Catla	02-03	06-07
<i>Hypophthalmichthys molitrix/ Hypophthalmichthys nobilis</i>	Silver carp/Bighead carp	08-12	17-18
<i>Oreochromis niloticus</i>	Tilapia	02-03	05-07
<i>Cyprinus carpio</i>	Common carp	02-06	05-06
<i>Puntius sarana</i>	Olive barb/Sarpunti	04-06	06-08
<i>Ctenopharyngodon idella</i>	Grass carp	08-10	04-06

**Table 4:** Stocking density of fish in Bhola district.

**Fertilization and liming:** In the present study area, the average dose of organic and inorganic fertilizers was 850 Kg/acre and 44 Kg/acre respectively for single owner pond and 560 Kg/acre and 24 kg/acre for multi owner pond (Table 5). The average dose of cow dung, urea and TSP (Triple Super Phosphate) were (250, 40 and 20) kg/ha in Sreemangal Upazila [17]. The average doses of Urea, TSP and MP used by the farmers for mixed fish culture were (350, 250 and 125) kg/ha/year in Dhamrai Upazila [13]. Fertilization in pond is necessary to increase the fish production by enhancing the natural food organism's

production. Generally cow dung, poultry manure, compost etc. are used as organic fertilizers and urea, triple super phosphate (TSP) and murate of potash (MP) are used as inorganic fertilizer in the pond fish culture of Bangladesh. The rate of using organic fertilizer like cow dung was higher than inorganic fertilizers due to its availability and easy application. To obtain good production fish pond should be fertilized with fertilizers at the rate of 500 kg/ha/year to 600 kg/ha/year in 15 days [19].

Name of the fertilizer	Application rate (kg/dc)	Number of pond	Fish production (kg/dc)
Cow dung	10-12 (wet matter basis)	600	-
Poultry manure	3-5 (dry matter basis)	280	-
TSP (Phosphate)	Up to 1.1	55	15
	1.1-2.0	50	18
	2.1-3.0	60	17
	Not applied	35	10
Urea	Up to 1.1	20	14
	1.1-2.0	50	10
	2.1-3.0	76	15
	Above 3.0	32	18
MP(Potash)	Up to 0.25	16	19
	Not applied	22	11
	Not applied	184	14

**Table 5:** Doses of different types of inorganic fertilizers used in Bhola district.

In the study area it was observed that maximum fish farmers (82%) used lime at the rate of 0.1 kg/decimal to 3 kg/decimal in their pond while the rest (18%) did not use lime. All farmers of Sreemangal

Upazila dried their ponds after harvesting of fish in the dry season and used lime at 250 kg/ha [17]. In Trishal Upazila of Mymensingh district about 86% ponds farmer dried their pond after deteriorating water

quality and, among them 54% and 46% farmer applied lime at 247 kg/ha and 370 kg/ha, respectively during pond preparation [20]. The fish farmer of Panchagar used lime at the rate of 247 kg/ha/year in the pond for obtaining more fish production [21]. 40% fish farmers did not apply lime and fertilizers in the fishermen community at Terakhada Upazila of Khulna District [22].

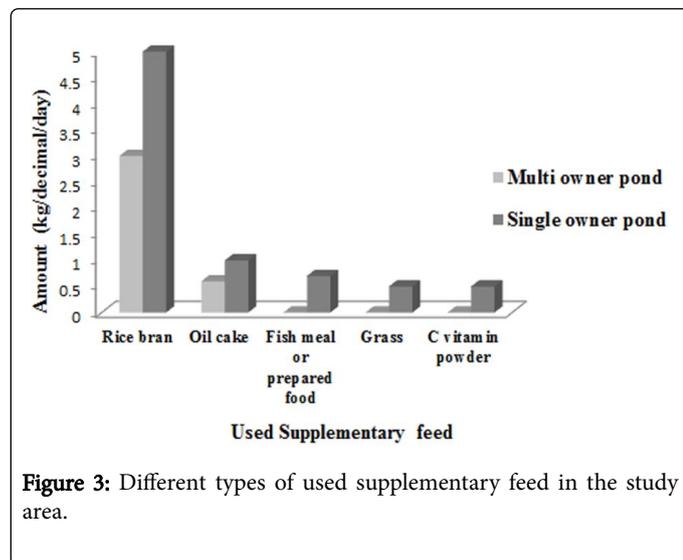
**Use of pesticides:** To eradicate undesirable species three types of pesticides were used in the studied area.

Name of the pesticide	Dose (ml/decimal)	% of the Fish Farmers
Thiodine	15	75
Rotenone	30	21
Agro fish	6	4

**Table 6:** Doses of different types of pesticide in Bhola district.

Among these, Thiodin is predominantly used because of its low price and availability in that region (Table 6). Most of the farmers (90%) used netting method and the rest 10% used rotenone and phostoxin [17].

**Feed and feeding practice:** Quality fish production depends on the proper quality and quantity of the supplied feed. In the present study, farmers applied supplementary feed parallel with fertilizers in their pond. But the rate of using supplementary feed for pond fish culture was much higher in single owner pond than the multi owner pond in Bhola District (Figure 3).

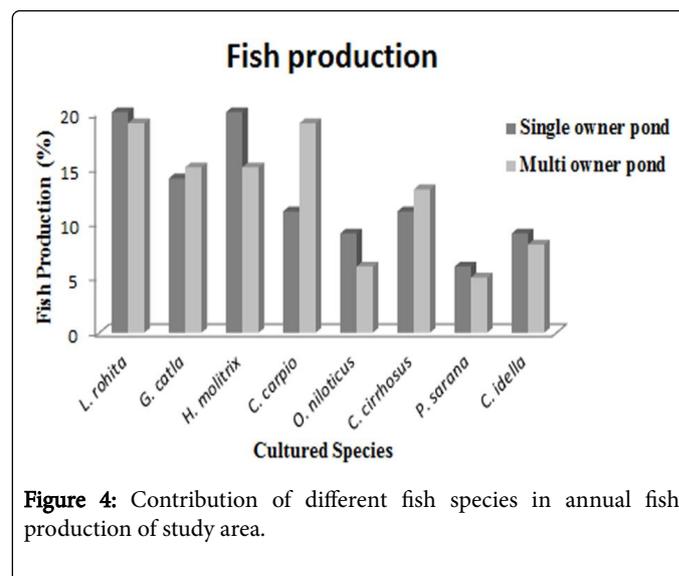


**Figure 3:** Different types of used supplementary feed in the study area.

Generally fish farmers did not use artificial or pellet feed due to its high cost and unavailability. The fish farmers of present study area never follow scientific feeding method or frequency. Feeding frequency vary from farmer to farmer. In the study area, about 65% farmers delivered feed twice a day, whereas 35% of farmers supplied feed once a day. 26% of fish farmers in Barisal District used balance food but 74% of farmers used supplementary feed [16]. 45% of the farmers of Sreemangal Upazila supplied farm made supplementary feed prepared with rice bran and mustard oil-cake (80% and 20% ratio) and 55% farmers used artificial pellet feed [17]. Pravakar et al. [9] found that 95% of the farmers in Shahrasti Upazila of Chandpur District supplied supplementary feed such as rice bran, mustard oil cake and

commercially manufactured feed which is the similar findings of Halim et al. [10] where 87% farmer supplied the feed in Mithanpukur, Rangpur District.

**Fish production:** The fish production of study area varies in every year because of differences in farms size, feed quality and quantity, seed quality, other inputs and management measures. The annual average fish production was observed as 1810 kg/acre (Figure 4). The average yield of fish from pond farming of Shahrasti Upazila was found to be 2900 kg/ha/year [9]. In the average fish production of study area, the contribution of single owner poly culture pond (1750 kg fish/acre) was higher than multi owner poly culture pond (1100 kg/acre).



**Figure 4:** Contribution of different fish species in annual fish production of study area.

### Cost return analysis of fish production

**Production cost:** In the study area, the average fish production cost was found to be BDT 49,221/acre/year in single owner ponds and BDT 38,850/acre/year in multi owner ponds. But the fish production cost was found to be varied in every year of study area due to the variation of the price of fingerlings, feeds, fertilizers, drugs, chemicals and labor. The average fish production cost was calculated at BDT 50,504 ha/year [23]. The average total cost of fish production in pond was BDT 80850/ha/year in Shahrasti Upazila of Chandpur District [9]. In the study area, among all variable cost highest amount of fish production cost spent for fish feed in case of both single owner (23.07%) and multi owner ponds (22%) (Figure 5).

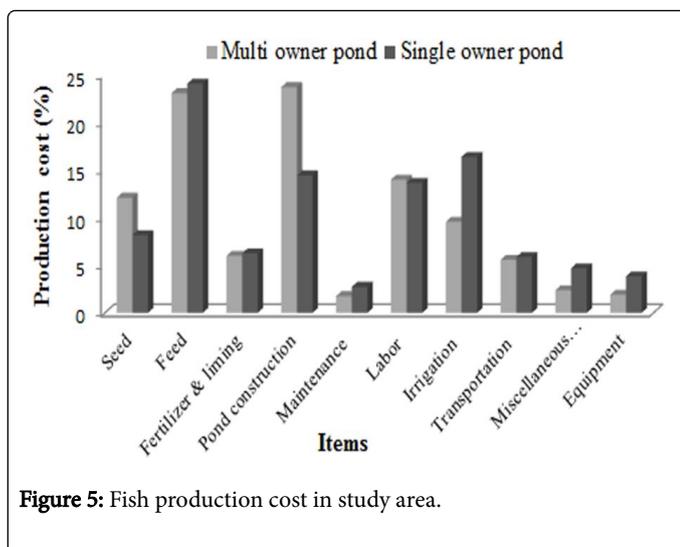


Figure 5: Fish production cost in study area.

**Profit from fish production in pond:** Farm profit can be measured in terms of yield, gross return and net return which are interrelated. In the study area, the average profit of fish production was identified as BDT 54,050/acre/year in the case of multi owner ponds and BDT 80,229/acre/year in single owner ponds (Table 7). In Demra, Dhaka the net profit from fish culture were BDT 46,600; BDT 63,000 and BDT 92,000 in case of extensive, improve extensive and semi-intensive culture respectively [11]. The profit in fish culture was found relatively higher in the study area. The average gross return from carp polyculture was BDT 1,60,210 [24]. In the present study, the benefit-cost ratio (BCR) of fish production was 1.39 in the case of multi owner ponds and 1.63 in single owner ponds (Table 7).

Pond categories	Average gross cost	Average gross return	Average Profit/Benefit	Benefit-Cost ratio
Multi owner pond	38,850	92,900	54,050	1.39
Single owner pond	49,221	1,29,450	80,229	1.63

Table 7: Cost benefit analysis (BDT/acre/year).

From the present study, it was found that the average profit was higher in single owner ponds than the multi-owner ponds. Multi owners of pond cannot reach in uniform opinion easily in any decision of pond farming. A majority of multi owner pond fish farmers are not so much concerned in fish culture as like as single owner. A major portion of multi owner of pond don't fell the necessity of proper management in fish ponds for obtaining better production but interested in earning maximum profit by giving less input. Integration facility like poultry cum fish culture, vegetable cum fish culture was found to be practiced in some of the single owner pond which is more profitable and this kinds of practices was completely absent in the multi-owner pond. The multi-ownership was a problem for pond fish culture in Rajshahi District which can be resolved by leasing out the pond to a person interested in fish culture [25].

## Conclusion

The findings of present study clearly indicate that the multi-ownership was the main problem in pond based farming. Though the four Upazilas in Bhola district was found to be potential area for fish culture but the expected production was not found from the pond farming due to multi-ownership of pond. To get rid of this problem, farmers should be given training facilities to grow interest among multi owners of pond about the proper management and profit in pond farming. They should also be motivated to culture fish in all types of water body and adopt integrated culture for obtaining maximum production at a same time. For understanding and executing the above facts, the farmers should be give facilities for education. Finally it can be concluded that fish culture has significant socio-economic benefits for the fish farmers, if the farms are managed in a proper way.

## Acknowledgement

The authors want to thank all the pond owners and persons related to the pond aquaculture in Bhola district for their valuable informations. Any financial support was not taken from any funding agencies for conducting this research work, so there is no conflict of interest.

## References

1. Ghose B (2014) Fisheries and aquaculture in Bangladesh: Challenges and opportunities. *Annals of Aquaculture and Research* 1: 1-5.
2. DoF (2016) National fish week compendium. Department of Fisheries, Ministry of Fisheries and Livestock, Government of Bangladesh.
3. Hossain MAR (2014) An overview of fisheries sector of Bangladesh. *Research in Agriculture Livestock and Fisheries* 1: 109-126.
4. Majid MA (1995) Report on a Regional Study and Workshop on the Environmental Assessment and Management of Aquaculture Development. Food and Agricultural Organizations, Bangkok, Thailand pp: 62-65.
5. Islam S, Dewan S (1987) An Economic Analysis of Pond Fish Production In Some Areas of Bangladesh. Bureau of Socio-economic Research and Training, Bangladesh Agricultural University.
6. Sarwer MG, Ali MY, Bhowmik S, Asadujjaman M, Sharmin MS (2016) Pond Farming and Livelihood Status of Fish Farmers in Subarnachar, Noakhali, Bangladesh. *Agriculture and Biology Journal of North America* 7: 134-139.
7. BBS (2002) Statistical Yearbook of Bangladesh: Bangladesh Bureau of Statistics. Statistical Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.
8. DoF (2001) Brief on Department of Fisheries Bangladesh. Department of Fisheries, Ministry of Fisheries and Livestock (MoFL), Dhaka, Bangladesh.

9. Pravakar P, Sarker BS, Rahman M, Hossain MB (2013) Present Status of Fish Farming and Livelihood of Fish Farmers in Shahrasti Upazila of Chandpur District, Bangladesh. *American-Eurasian J Agric Environ Sci* 13: 391-397.
10. Halim MA, Rayhan A, Sharmin S, Mondal DK (2017) Status of Pond Fish Farmers in Some Selected Areas of Mithapukur Upazila under Rangpur District, Bangladesh. *SSRG International Journal of Agriculture & Environmental Science* 4: 13-17.
11. Quddus MA, Rahman MS, Moniruzzaman M (2000) Socio-economic conditions of the pond owners of Demra, Dhaka. *Bangladesh Journal of Fisheries Resources* 4: 203-207.
12. World Bank (1991) Bangladesh - Fisheries sector review (English). Report no: 8830-BD, 56-60. Washington, DC: World Bank.
13. Moslem UM, Harun-Ar RM (2017) Assessment of Aquaculture and Livelihood Status of Fish Farmers in Dhamrai Upazila of Dhaka District, Bangladesh. *Annals of Veterinary and Animal Science* 4: 31-42.
14. Shamsuzzaman MM, Islam MM, Tania NJ, Mamun MAA, Barman PP, et al. (2017) Fisheries resources of Bangladesh: Present status and future direction. *Aquaculture and Fisheries* 2: 145-156.
15. Alam M, Kumar Paul SK, Marma K (2017) Study on Existing Technology and Knowledge on Aquaculture by Fish Farmers in Gomastapur Upazila of Chapai Nawabgonj District, Bangladesh. *Fish Aqua J* 8: 217.
16. Ali MM, Hossain MB, Rahman M, Rahman S (2014) Post Stocking Management Practices by the Pond Fish Farmers in Barisal District, Bangladesh. *Global Veterinaria* 13: 196-201.
17. Sarker B, Ali MF (2016) Fish Farming Status at Sreemangal Upazila of Moulvibazar District, Bangladesh. *Research in Agriculture, Livestock and Fisheries* 3: 361-368.
18. Hossain MS, Dewan S, Islam MS, Hossain SMA (1992) Survey of pond fishery resources in a village of Mymensingh district. *Bangladesh J Aquaculture* 14: 33-37.
19. DoF (2002) Fisheries Resource Information of Bangladesh in Sankalon. Department of Fisheries, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh, Bangladesh pp: 120.
20. Sheheli S, Fatema K, Haque SM (2013) Existing Status and Practices of Fish Farming in Trishal Upazila of Mymensingh District. *Progressive Agriculture* 24: 191-201.
21. Islam MR, Haque MR (2010) Impacts of Northwest Fisheries Extension Project (NFEP) on pond fish farming in improving livelihood approach. *Journal of Bangladesh Agricultural University* 8: 305-311.
22. Shil (2003) A case study on the socio-economic conditions and alternative livelihood strategies of fisher community in the Terakhada Upazila under Khulna District. *Khulna University, Khulna* pp: 16-40.
23. Ara Y (2005) Assessment of Small Scale Fresh Water Fish Farming for Sustainable Livelihoods of the Rural Poor Farmers. *Bangladesh Agricultural University, Mymensingh* pp: 32.
24. Kausari MMT (2001) An economic study of pangus fish culture in selected area of Mymensingh and Jamalpur district. Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh pp: 89.
25. Zaman T, Jewel MAS, Bhuiyan AS (2006) Present status of pond fishery resources and livelihood of the fish farmers of Mohanpur Upazila in Rajshahi District. *Univ j zool Rajshahi Univ* 25: 31-35.