E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2018; 6(5): 06-09

www.fisheriesjournal.com
Received: 02-07-2018
Accepted: 03-08-2018

Mst. Masuma Khatun
Department of Aquaculture, Faculty of Fisheries, Hajee Mohammad Danesh Science & Technology University, Dinajpur, Bangladesh

Md. Abu Sayed Jewel
Department of Fisheries, University of Rajshahi, Rajshahi, Bangladesh

Md. Abdur Razzaq Joadder
Department of Fisheries, University of Rajshahi, Rajshahi, Bangladesh

Mst. Samsad Khatun
Department of Fisheries, University of Rajshahi, Rajshahi, Bangladesh

Correspondence
Md. Abu Sayed Jewel
Department of Fisheries, University of Rajshahi, Rajshahi, Bangladesh

Different water quality parameters and economics of four carp polyculture ponds in Rajshahi division, Bangladesh

Mst. Masuma Khatun, Md. Abu Sayed Jewel, Md. Abdur Razzaq Joadder and Mst. Samsad Khatun

Abstract
The present study was carried out in four carp polyculture ponds situated in two districts of Rajshahi division in the northern part of Bangladesh. Low water level, short term culture period and comparatively high temperature are the crucial features about the northern region because some of these areas are highly and some are slightly drought prone barind area. The corresponding study was conducted due to uncover the present conditions of pond based carp polyculture in those regions and also to address the problems that are faced by the rural farmers. A well defined and understandable questionnaire was made to collect data from the farmers through interview method. After the primary data collection, secondary information was used to figure out the water quality parameters and the economical sector. Among the four studied ponds two ponds were leased and rest of them were personal and it became a significant factor for the reduction of the profit level. The water quality parameters like temperature, turbidity, P^H, dissolved oxygen and alkalinity were found to be in range those are needed for fishes normal growth. In some cases temperature, turbidity and P^H were slightly fluctuated but could not make significant difference. The economical calculation of the culture ponds were positive but could be improved by implementing proper improvement plan.

Keywords: Carp polyculture, ponds, water quality, economics, Bangladesh

1. Introduction
Polyculture of fish is based on the concept of total utilization of different trophic and spatial niches of a pond to ensure maximum production. Various kinds of compatible species of fish of different trophic levels and spatial niches are cultured together to ensure the utilization of all sorts' natural foods. Bangladesh is considered to be the most suitable regions for fisheries in the world because of its vast wetlands and aquatic biodiversity. This sector is working appreciably to provide food security and to ensure safe and quality animal protein. Bangladesh ranks in leading fish producing countries with a total production of 41.34 lakh MT where only aquaculture contributes 56.44 percent to the total production [1]. Pond based carp polyculture is very much needed to enhance fish production in Bangladesh [2].In the last ten years production from aquaculture sector became double whereas only carp contributed about 45.35% [3]. In the year 2016-17 the obtained productivity from ponds is 4765 kg/ha [1]. Carp polyculture has the highest potential to improve the fish production in comparison with the others but in spite of having such prospective average fish production from aquaculture, pond and ditch is still lower than the other carp producing countries [4]. In Bangladesh basically greater Dinajpur and Rajshahi are known as barind tracts. These regions are especially diverse because of the changes of water and soil quality influenced by the climatic conditions. Some of these areas are highly affected by drought and low water level and some are mildly. Fish culture in these regions is in need of repeated study and specific research to unveil the present condition and to prepare a need based improvement plan. So that the production from the northern region would be able to reach the output level comes from the other parts of Bangladesh. Different kinds of researches have been completed based on pond aquaculture. Mumtaz uddin *et al.* [5] worked on some fishponds in Mymensingh while in Rajshahi hatchery, Biswas [6] studied the Limnological features of three fishponds. Ameen *et al.* [7] completed a study on physico-chemical and biological conditions of some fishponds in Dhaka. But research on water quality

and economic study of carp polyculture pond in northern part of Bangladesh especially barind area are very limited. So, the present study deals with present status of water quality and economic study of carp polyculture ponds in northern region of Bangladesh.

2. Materials and methods

2.1 Location of study site

The study was carried in four different ponds in two districts as Chapai-nawabganj and Rajshahi which belong to Rajshahi division (Fig. 1). Rajshahi division consists of 8 districts and located in the northern region of Bangladesh. The first two ponds were from Rajshahi and the rest of two ponds from Chapai-nawabganj. The study was conducted from May 2010 to August 2010.

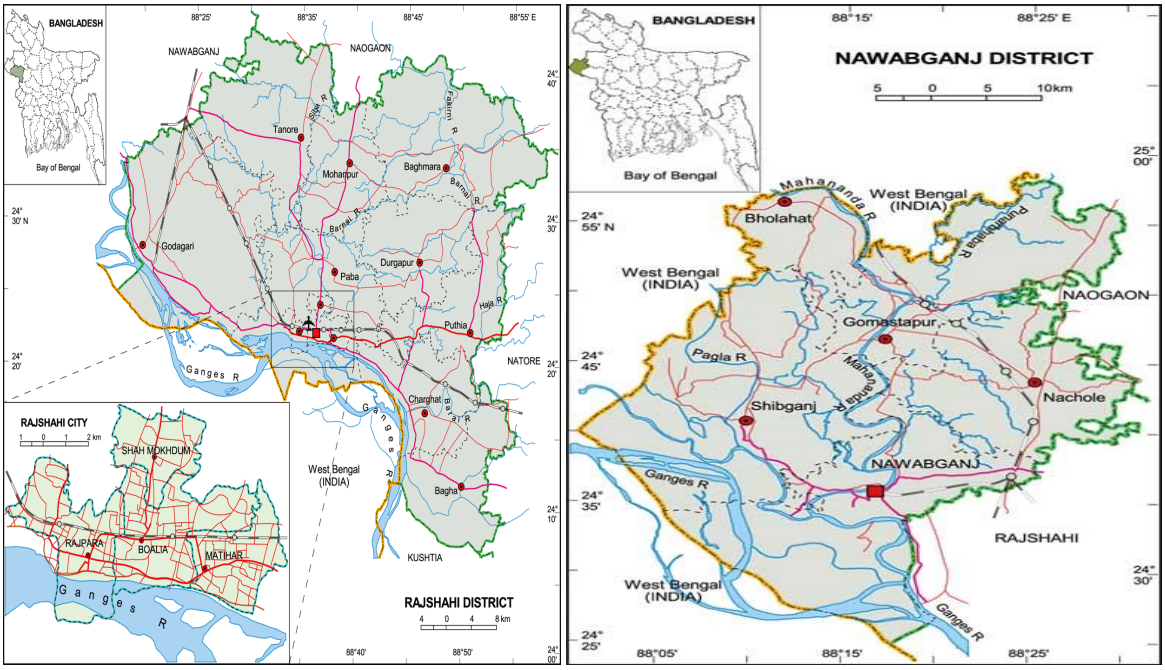

Fig 1: Geographical location of Rajshahi and Nawabganj districts

2.2 Area and status of the study ponds

Highest pond area was found from Chapai-nawabganj and the lowest pond area was from Rajshahi. Ponds from Rajshahi were leased and the other ponds from Chapai-nawabganj were self-owned. All the ponds were considered as homestead.

2.3 Research structure for the survey

Experimental structure of the research was designed to perform to gather random information from the fish farmers belonging to those study areas.

2.3.1 Management practices

Different kinds of data associated with the management of those corresponding ponds were collected by direct interview method. An interview schedule was organized for the collection of information from the farmers. Each of the respondents was given a brief introduction of the purpose of the study during the interviews. All the questions asked to the farmers were simple and easily understandable and made according to the standard.

2.3.2 Sampling

The water samples were collected at monthly interval to study physical, chemical and biological parameters.

2.3.2.1 Different water quality parameters

Water temperature was measured using a Celsius thermometer. Water transparency was measured by using a secchidisk. Water pH was measured using an electronic pH meter (Jenwary, 3020). Dissolved oxygen (DO) and alkalinty were measured by using a portable aquaculture kit (Model FF2, HACH, USA).

2.3.2.2 Abundance of plankton

Water samples were collected by using plankton net then the samples were preserved in plastic vials with 5% formalin and then studied under light microscope for plankton count and identification.

3. Results and discussion

3.1 Physico-chemical parameters

Various water quality parameters of studied ponds such as temperature, transparency, P^H, dissolve oxygen and alkalinity are mentioned in Table 1. Water temperature varied from 29.2±2.06 ^{0}C to 30.00±2.16 ^{0}C which is more or less similar to the findings of Boyd [8]. Wahab *et al.* [9] stated that, the temperature range suitable for plankton growth is 27.2 ^{0}C to 32.4 ^{0}C. The recorded temperature range was also supported by Islam [10]. During the present the transparency level of studied ponds were in between 20.37±2.05 to 38.50±3.62 cm. In case of pond 3 and 4 (typical barind area) the transparency level was lower as 20.37±2.05 to 21.25±1.89 cm and according to Hossain and Bhuiyan [11], the reason of lower transparency in barind area might be higher clay turbidity in the red soil zone. Turbidity found in pond 1 and 2 were 37.85±2.43 to 38.50±3.62 cm which is supported by Boyd [12] who recommended the transparency within 30 to 40 cm as appropriate for fish culture. The P^H range observed from the present study was recorded as 6.67±0.54 to 7.52±0.25 which is closer to Hossain [13]. Singh and Singh [14] mentioned that

for the appropriate growth and survival of major carps, P^H range should be in between 6.0 to 7.8 which indicate that the P^H range was more or less suitable. On the other hand in Pond 3 and 4 the P^H value was slightly acidic which might be due to effect of red soil in this two ponds. Dissolved oxygen content in all the study ponds varied from 3.52±0.25 to 4.79±0.59 mgL^{-1}. Uddin [15] obtained dissolved oxygen range between 3.7 to 6 mgL^{-1} in some fish culture ponds which is much closer to the observations gained from the present study. But Alikunhi [16] stated that good pond water for fish culture must have a fair amount of dissolved oxygen and that should be in between 5.0 to 7.0. It is clear that the dissolved oxygen content in the study ponds were slightly under the optimum range and this could be because of high temperature, low transparency, decomposition of organic matters etc. During the study alkalinity level found in the ponds were in between 69±8.20 (mgL^{-1}) to 91±3.40 (mgL^{-1}). Boyd [17] mentioned by his research that acceptable total alkalinity range should go within 40 to 200 mgL^{-1}.

Table 1: Different physico- chemical parameters in the corresponding study ponds

Parameter	Pond-1 (Mean±std)	Pond-2 (Mean±std)	Pond-3 (Mean±std)	Pond-4 (Mean±std)
Water temperature (^0C)	30.25±2.06	29.2±2.06	30.25±1.70	30.00±2.16
Water transparency (cm)	37.85±2.43	38.50±3.62	20.37±2.05	21.25±1.89
P^H	7.15±0.26	7.52±0.25	6.7±0.47	6.67±0.54
Dissolved oxygen (mgL^{-1})	4.79±0.59	4.37±0.47	3.52±0.25	4.50±0.42
Alkalinity (mgL^{-1})	85±4.50	91±3.40	77±6.50	69±8.20

3.2 Abundance of planktons

Plankton plays a significant role in fish culture as it is the main and primary food for fish. The occurrence and abundance of various planktons in nature are regulated by a package of environmental features such as temperature, light, dissolve oxygen, P^H, nutrient concentration and soil conditions etc. Both the phytoplanktons and zooplanktons were recorded in the study ponds are shown in Table 2. The recorded available zooplanktonic organisms were copepods, cladocera, rotifers and crustacean larvae. In case of all the ponds the first dominant zooplankton group was copepode (40.00%), second dominant group was rotifera (25.00%), and the least dominant zooplankton group was crustacean larvae (10.00%). The observed prominent zooplanktons were *Cyclops, Daphnia, Keratella, Moina, Diaptomus*, and Nauplius larvae etc. Four categories of phytoplanktons were available in the study ponds. Among them the first dominant phytoplankton group was Chlorophyceae (35.00%), second dominant group was Bacillariophyceae (30.00%) whereas the least dominant phytoplankton group was Euglenophyceae (15.00%). The observed available phytoplanktons were *Spirogyra, Volvox, Diatom, Anabaena*, and *Microcystis* etc.

Table 2: Abundance of different kinds of planktons observed in the study ponds.

Zooplankton	% Abundance	Phytoplankton	% Abundance
Copepode	40.00	Chlorophyceae	35.00
Rotifera	25.00	Bacillariophyceae	30.00
Cladocera	20.00	Cyanophyceae	20.00
Crustacean nauplii	10.00	Euglenophyceae	15.00

3.3 Economics of the polyculture ponds

In the studied ponds most commonly cultured species were *Catla catla, Labeo rohita, Labeo bata, Cirrhinus mrigela*. After the culture period, all the fishes were marketed by the farmers. And then different types of cost for different kinds of production purpose were analyzed. A very simple cost-benefit analysis was done to investigate the economics of those four carp polyculture ponds (Table 3). It is stated that the first two ponds were taken by the farmer as leased ponds while the others two ponds were personal which increased the production cost of the first two ponds. Total production cost was highest in pond 2 as 202046 BDT ha^{-1} and lowest in pond 3 as 143260 BDT ha^{-1} whereas net profit was highest in pond 3 as 165490 BDT ha^{-1} and lowest in pond 1 as 119671.5 BDT ha^{-1} (Table 3). Asadujjaman and Hossain [2] observed total cost as 123430.5 to 235930.5 BDT ha^{-1}; net benefit as 111639±2056.87 to 206744.85±3221.73 BDT ha^{-1} which is very much closer to the present findings. In the present study highest CBR was found in pond 3 and lowest CBR was found in pond 1 (Table 3).

Table 3: Economics of different polyculture ponds in the study area

Parameter	Pond-1	Pond-2	Pond-3	Pond-4
Ownership	Leased	Leased	Personal	Personal
Total production cost (BDT ha^{-1})	189,078.5	202,046	143,260	150,670
Total gross return(BDT ha^{-1})	308,750	353210	308,750	291,460
Net profit(BDT ha^{-1})	119,671.5	151,164	165,490	140,790
CBR	0.63	0.74	1.15	0.93

4. Conclusion

The present situation of the farmers of northern Bangladesh is that they have been practicing same kind of fish cultures techniques years after years. After completing the study it is pretty much clear that the fish farmers in both the districts are practicing improved traditional method for fish culture which could be the hindrance to the high productivity of that specific area. According to Mondal and Das in case of the asian countries, lack of technical proficiency and systematic acquaintance is reported to be a very common problem [18].In case of Rajshahi and Chapai-nawabganj districts the most popular and common fish culture form is carp polyculture**.** Many farmers of this area are dependent for their livelihood on fish culture. Inspite of having some constraints of different climatic conditions the farmers are getting more or less good productivity. But they need to make aware of the fact that the

image of their fish culture economics can be changed and also they can go beyond their expectations by adopting some improved and region based aquaculture technologies.

5. References

1. DoF. Yearbook of Fisheries Statistics of Bangladesh 2016-2017. Fisheries Resources Survey System (FRSS), Department of Fisheries, Bangladesh: Director General. DoF. 2017; 34:129.
2. Asadujjaman M, Hossain MA. Fish growth, yield and economics of conventional feed and weed based polyculture in ponds. Journal of Fisheries. 2016; 4(1):353-360.
3. DoF. National Fish Week 2017 Compendium. Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh, 2017, 160 (in Bengali)
4. Dey MM, Paraguas FJ, Bhatta R, Alam F, Weimin M, Piumsombun S *et al*. Carp production in Asia: Part treands and present status. In: Carp Genetic Resources for Aquaculture in Asia (Eds. Penman, D.J.; Gupta, M.V. and Dey, M.M.). World Fish Center, Penang, Malaysia, 2005, 152.
5. Mumtazuddin M, Rahman MS, Mostafa G. Limnological studies of four selected rearing ponds at the aquaculture experiment station, Mymensingh. Bang. J Fish. 1982; 2-5(1, 2):83-90.
6. Biswas A. Limnology of three fishponds in Rajshahi Hatchery. Unpubl. M. Sc. Thesis, Department of Botany, Rajshahi University, 1993, 155.
7. Ameen M, Begum ZNT, Ali S, Rahman MM, Roy TK. A Comparative study of two fishponds Raipur. Dhaka Uni. Stud. E. 1986; 1(1):25-34.
8. Boyd C, Zimmermann S. Grow-out systems water quality and soil management. Blackwell Science. Oxford, UK, 2000, 221-238.
9. Wahab MA, Ahmed ZF, Islam A, Rahmatullah SM. Effect of introduction of common carp, *Cyprinus carpio* (L) on the pond ecology and growth of fish in polyculture. Aquaculture research. 1995; 26:619-628.
10. Islam ML. Impact of introduction of mola (*Amblypharyngodon mola*) in the polyculture with carps. M.S. Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, 1997, 38-41.
11. Hossain MA, Bhuiyan AS. Study of water quality in fish ponds under the red soil zone of northern Bangladesh. Journal of Subtropical Agricultural Development. 2007; 5(5):347-351.
12. Boyd CE. Water quality management for pond fish culture. Elsevier Science Publishers B. V., 1000 AH Amsterdam, Netherlands, 1982, 318.
13. Hossain MY. Effects of iso-phosphorus organic and inorganic fertilizers on water quality parameters and biological production. M.S. Dissertation. Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, 2000, 24.
14. Singh CS, Singh KP. Feeding experiments of Indian major carps in trial ponds. Journal of Inland Fisheries Society of India. 1975; 7:212-215.
15. Uddin MJ. Effects of fish culture in rice fields on the yields of rice and nutrients availability in soil, straw and grain. MSc. Thesis, Department of Fisheries, 1998.
16. Alikunhi KH. Fish culture in India. Fm. Bull. Indian Coun. agric. Res., 1957; (20):144.
17. Boy CE. Water quality for fish pond. Aquaculture Research and Development Series No. 43. Auburn University, Alabama. USA, 1998, 37.
18. Mondal A, Das SK. Status and problems of bundh breeding in Bankura, West Bengal. Journal of Inland Fisheries Society. 2005; 37(2):69-74.