http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 3 (8): 1349-1351, 2000

Investigation of Water Quality Parameters in Carp Nursery under Two Different Pond Conditions

Z.F. Ahmed[1], M.A. Wahab[1], M.A.H. Miah[2] and M.E. Azim[1]
[1]Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh
[2]Marine Biology Discipline, Khulna University, Khulna, Bangladesh

Abstract: Observation of water quality parameters was made in carp nursery ponds at Bangladesh Agricultural University, Mymensingh, Bangladesh under two different conditions. Mean values of temperature, Secchi depth, dissolved oxygen, pH, chlorophyll-a, total alkalinity, nitrate nitrogen, ammonia nitrogen and phosphate phosphorous were 30.58°C, 51.83 cm, 5.7 mg L^{-1}, 6.88, 5.27 mg L^{-1}, 26 mg L^{-1}, 1.12 mg L^{-1}, 0.02 mg L^{-1} and 0.78 mg L^{-1} respectively over the experimental period. All the measured physico-chemical characteristics varied little among the ponds and no distinguishable trends were discernible in either or between conditions.

Key words: Water quality parameters, carp, nursery, pond

Introduction

The term water quality in its broadest sense includes all physical, chemical and biological characteristics of water. Environmental parameters exert an immense influence on the maintenance of a healthy aquatic environment and production of sufficient fish food organisms as well as affect directly on fish physiology. Fish culturists are more concerned with those aspects of water quality which regulate the suitability of water for holding or rearing fish. The quality and quantity of plant and animal life on which the fish subsist are immensely influenced by the inherent water properties of the habitat. So, the factors controlling aquatic fertility need to be understood in order to perform adequate management of the water bodies to enhance fish production. Though a large volume of works on water quality parameters of fresh water ponds and lakes in this region was undertaken (Islam *et al*., 1974; Islam and Saha, 1975; Oppenheimer *et al*., 1978; Rahman *et al*., 1982; Dewan *et al*., 1991; Wahab *et al*., 1994, 1995) but there is still scarce of information on suitable range of different water quality parameters necessary for carp nursing in polyculture. Considering the paucity of knowledge in this very important field, the present research was designed to investigate several water quality parameters deemed important for fish culture.

Materials and Methods

Ponds, fertilization, stocking of fish and feeding: Research was conducted at the experimental pond facilities of the Department of Fisheries Biology and Limnology, Bangladesh Agricultural University, Mymensingh, Bangladesh. Six rain-fed earth ponds each having surface area of 0.01 hectare and depth of 1.5 meter were used. The ponds numbered arbitrarily as 1, 2, .., 6 were randomly divided into two sets for two different treatments. One set was treated with only fertilizers and the other with both fertilizers and supplementary feed. After filled with rainwater during early May, all ponds were fertilized with urea, triple super phosphate, muriate of potash and mustard oilcake at the standard rate two weeks before stocking of the spawn of fish. Four days old spawn of rohu and catla weighing 25 g at the ratio of 1:1 were transferred from hatchery to each pond at 0900h. Hundred gram of mustard oilcake soaked with water per pond was employed once daily at 1000 h.

Analyses of water quality parameters: Recording of water temperature, Secchi disc depth, pH and dissolved oxygen were done daily between 0900 and 1000 h on the spot. Every 4 days total alkalinity, nitrate nitrogen, ammonia nitrogen, phosphate phosphorous, chlorophyll-a analyses were carried out on depth-integrated water samples taken from each pond. Temperatures was recorded using a Celsius thermometer. Dissolved oxygen (DO) and pH were measured directly by a digital DO meter (Jenway, model, 9070) and a digital pH meter (Jenway, model 30501 respectively. Secchi disc value was determined using a Secchi disc. Alkalinity was titrated and measurement of ammonia, nitrate and phosphate was carried out by a Hach Kit (DR/2,000, direct reading, spectrophotometer). Chlorophyll-a was measured following the standard procedures and methods (APHA, 1989).

Statistical analysis: One-way Analysis of Variance (ANOVA) and Multiple Range Test (MRT) were performed on the data as recorded for each parameter to observe the difference between fertilized and fertilized and fed ponds using a personal computer.

Results

Analyses of the various physical, chemical and biological factors of water facilitated accumulation of large number of data. The overall mean values of each water quality parameter of all ponds for the whole experimental period are presented in Table 1. Combined graphical representations of the water quality parameters are shown in Fig. 1-4.

Temperature: Temperature of both surface and bottom of the ponds were found to range from 29.0 to 34.0°C and from 28.1 to 33.0°C respectively. Temperature varied little over the course of the trials and difference of 0.5-1.0°C was usually occurred between pond surface and bottom.

Dissolved oxygen: Mean dissolved oxygen values for the fertilized ponds were found to vary from 5.8 to 6.8 mg L^{-1} and those for the fertilized and fed ponds were from 4.8 to 6.0 mg L^{-1}.

pH: Throughout the study period, the pH level of the pond water was found to be approximately neutral. No marked heterogeneity in pH among ponds was noted. The lowest and highest mean values of pH were observed to be 6.7 and 7.2 respectively for the fertilized ponds and those

Table 1: Mean values (±S.E.) And range of water quality observations from ponds during experimental period

Temperature quality parameter	Fertilized 1	Fertilized 3	Fertilized 5	Fertilized & fed 2	Fertilized & fed 4	Fertilized & fed 6
Temperature (°C)						
Surface	29.6 ± 0.6 (28.4-31.4)	30.7 ± 0.50 (29.5-34.0)	30.8 + 0.55 (29.9-33.9)	30.8 ± 0.50 (29.0-34.0)	30.8 ± 0.48 (29.9-33.9)	30.8 ± 0.49 (29.0-34.0)
Bottom	28.5 + 0.27 (27.5-30.0)	29.8 ± 0.46 (28.7-32.8)	30.0 ± 0.47 (29.1-33.2)	29.7 ± 0.50 (28.5-33.0)	30.0 ± 0.45 (29.0-32.8)	29.9 ± 0.42 (29.1-32.6)
Secchi depth (cm)	48 + 2.33 (28-58)	45 ± 4.05 (37-72)	60 ± 5.5 (44-88)	42 ± 1.92 (31-48)	58 ± 4.39 (42-77)	58 ± 5.64 (33-82)
Chlorophyll-a (mg L^{-1})	5.4 ± 0.35 (4.2-7.5)	6.1 ± 0.45 (3.4-7.4)	4.5 ± 0.51 (2.2-6.2)	6.1 ± 0.27 (5.2-7.7)	4.6 ± 0.39 (3.0-6.2)	4.9 ± 0.59 (2.7-7.901
pH	7.2 ± 0.18 (6.6-8.3)	6.7 ± 0.05 (6.7-7.2)	7.0 ± 0.23 (6.4-8.4)	6.8 ± 0.11 (6.6-7.6)	6.8 ± 0.07 (6.6-7.2)	6.8 ± 0.19 (6.4-8.0)
Dissolved oxygen (mg L^{-1})	5.9 ± 0.64 (29-35)	6.8 ± 0.76 (20-33)	5.8 ± 0.73 (15-25)	4.8 ± 0.40 (18-231	6.0 + 0.76 (29-43)	4.9 ± 0.68 (18-29)
Total alkalinity (mg L^{-1})	32 ± 0.65 (29-35)	26 ± 1.35 (20-33)	19 ± 1.25 (15-251	20 ± 0.71 (18-23)	35 ± 1.98 (29-43)	24 ± 1.35 (18-29)
Nitrate nitrogen (mgL^{-1})	0.9 ± 0.12 (0.6-1.91	1.2 ± 0.14 (0.8-1.9)	1.0 ± 0.11 (0.6-1.4)	1.0 ± 0.10 (0.7-1.6)	0.9 ± 0.18 (0.4-1.9)	1.7 ± 0.15 (1.1-2.2)
Ammonia nitrogen (mg L^{-1})	7.5 ± 2.5^{-3} (0.0-0.03)	0.02 + $2.9'^{3}$ (0,0-0.681	0.03 ± 0.02 (0.01-0.49)	0.01 ± 3.3^{-3} (0.0-0.22)	0.04 ± 0.02 (0.00-0.28)	0.02 ± 3.5^{3} (0.0-0.261
Phosphate Phosphorous (mg L^{-1})	1.67 ± 0.22 (1.3-2.39)	0.63 ± 0.22 (0.06-1.5)	0.25 ± 0.11 (0.03-0.92)	0.85 ± 0.06 (0.49-1.00)	0.79 ± 0.21 (0.21-1.98)	0.49 ± 0.08 (0.12-0.92)

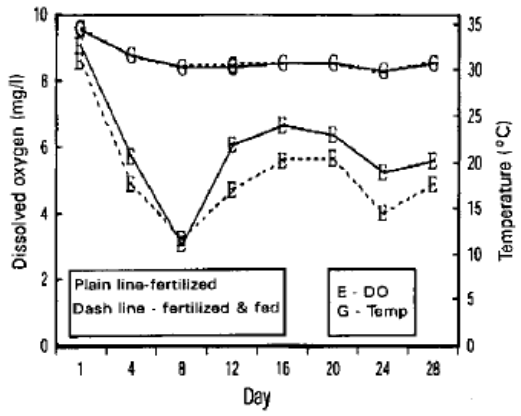

Fig. 1: Relationship between mean dissolved oxygen and temperature during the experimental period

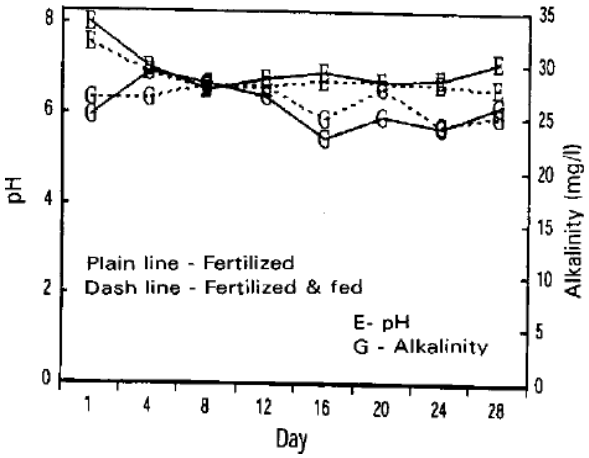

Fig. 2: Changes in mean pH and total alkalinity during the experimental period

were equal i.e., 6.8 for fertilized and fed ponds.

Total alkalinity: The values of total alkalinity showed variation during the study period when they were considered for individual pond. Alkalinity was always relatively low in all ponds. In fertilized ponds mean values of alkalinity were from 19 to 32 mg L^{-1} and in case of fertilized and fed ponds those varied from 20 to 35 mg L^{-1}.

Secchi depth: Mean Secchi disc values showed variation with sampling dates and it ranged from 45 to 60 cm in fertilized ponds while it varied from 42 to 58 cm in fertilized and fed ponds.

Chlorophyll-a: For fertilized and fertilized and fed ponds, Chlorophyll-a concentrations were recorded from 4.5 to 6.1 and from 4.6 to 6.1 mg L^{-1} respectively.

Nitrate nitrogen (NO_3-N): Mean nitrate ranges of both differently treated ponds were low in concentration. It was

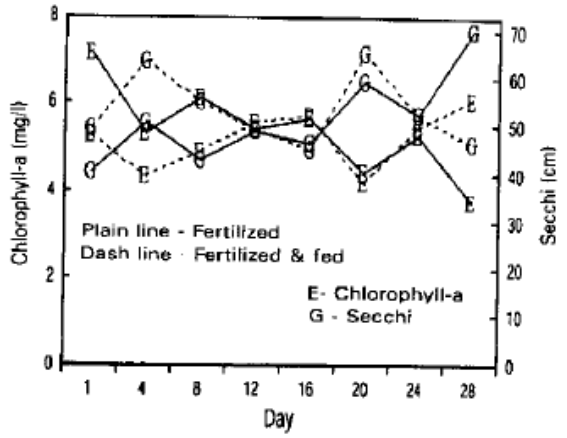

Fig. 3: Mean Secchi disc and chlorphyll-a values during the experimental period

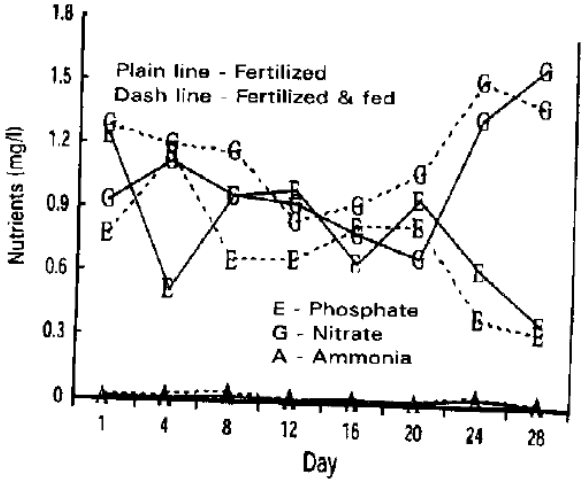

Fig. 4: Changes in mean phosphate, nitrate and ammonia during the experimental period

recorded as 0 . 9-1.2 mg L^{-1} in fertilized ponds while 0.9-1.7 mg L^{-1} in fertilized and fed ponds.

Ammonia nitrogen (NH_3-N): The level of unionized ammonia measured over the experimental period was not harmful for fish culture. It was found to range from 7.5^{-3} to 0.03 mg L^{-1} and from 0.01 to 0.04 mg L^{-1} in fertilized and fertilized and fed ponds respectively.

Phosphate phosphorous (PO_4-P): The average values of reactive phosphorous were found to vary from 0.25 to 1.67 mg L^{-1} in fertilized ponds whereas from 0.49 to 0.85 mg L^{-1} in fertilized and fed ponds.

Taking all the results into consideration, it was evident that there was no distinguishable trend in each water quality parameter of both fertilized and fertilized and fed ponds during the experimental period. Water quality was recommended within the acceptable ranges for all parameters for fish culture. One-way Analysis of Variance (ANOVA) and Multiple Range Test (MRT) performed on the data as recorded for each parameter illustrated that there was no significant difference between fertilized and fertilized and fed ponds (95% confidence level).

Discussion

The physical and chemical factors measured over the entire period of study in both treatments of this present experiment were found to be more or less similar with the findings of several previous works (Lakshmanan *et al.,* 1971; Dewan, 1973; Ali *et al.,* 1982; Mumtazuddin *et al.,* 1982; Wahab *et al.,* 1996).

Our study measured low value of total alkalinity. Moyle (1946) reported that ponds and lakes with the range of total alkalinity of 0.0-20.0 mg L^{-1} are of low productivity, those with 20.0-40.0 mg L^{-1} are of medium productivity and those with 40.0-90.0 mg L^{-1} are of medium to high productivity. Lakshminarayana (1965) and Dewan (1973) observed that the total alkalinity was found to be higher during the winter and lower in the monsoon. Dewan *et al.* (1991) observed an inverse relationship between chlorophyll-a concentrations and Secchi depth values in fry-fingerling rearing ponds in their study. A similar relationship between transparency and plankton production was also observed by Sahai and Sinha (1969).

References

APHA., 1989. Standard Methods for the Examination of Water and Waste Water. 17th Edn., American Public Health Association, Washington, DC.

Ali, S., A.A. Rahman, A.R. Patwary and K.H.R. Islam, 1982. Studies on the diurnal variations in physico-chemical factors and zooplankton in a freshwater pond. Bangladesh J. Fish., 2-5: 15-23.

Dewan, S., 1973. Investigation into the ecology of fishes of a Mymensingh Lake. Ph.D. Thesis, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Dewan, S., M.A. Wahab, M.C.M. Beveridge, M.H. Rahman and B.K. Sarker, 1991. Food selection, electivity and dietary overlap among planktivorous Chinese and Indian major carp fry and fingerlings grown in extensively managed, rain-fed ponds in Bangladesh. Aquacult. Res., 22: 277-294.

Islam, A.K., M. Nurul, A.K.Y. Haroon and K.M. Zaman, 1974. Limnological studies of the river Buriganga: I. Physical and chemical aspects. Dacca Univ. Stud. Part B, 22: 99-111.

Islam, A.K.M.N. and J.K. Saha, 1975. Limnological studies of the Ramna lake at Dhaka. Dhaka Univ. Stud. Bull., 23: 39-46.

Lakshmanan, M.A.V., K.K. Sukumaran, D.S. Murty, D.P. Chakraborty and M.T. Philipose, 1971. Preliminary observations on intensive fish farming in freshwater ponds by the composite culture of Indian and exotic species. J. Inland Fish. Soc. India, 2: 1-21.

Lakshminarayana, J.S.S., 1965. Studies on the phytoplankton of the River Ganges, Varanasi, India, Part II 'The seasonal growth and succession of the plankton algae in the river Ganges'. Hydrobiologia, 25: 138-165.

Moyle, J.B., 1946. Some indices of lake productivity. Trans. Am. Fish. Soc., 76: 322-334.

Mumtazuddin, M., M.S. Rahman and G. Mostfa, 1982. Limnological studies of four selected ponds at the aquaculture experiment station, Mymensingh. Bangladesh J. Fish., 2-5: 83-90.

Oppenheimer, J.R., M.G. Ahmed, A. Hug, K.A. Hague and A.K.M. Ashraful¬Alam *et al.*, 1978. Limnological studies of three ponds in Dacca, Bangladesh. Bangladesh J. Fish., 1: 10-28.

Rahman, M.S., M.Y. Chowdhury, A.K.M. Amin-ul-Hague and M.S. Haq, 1982. Limnological studies of three ponds. Bangladesh J. Fish., 25: 11-12.

Sahai, R. and A.B. Sinha, 1969. Investigation on hip-ecology of inland waters of Gorrakpur (U.P.), India. Hydrobiologia, 34: 433-447.

Wahab, M.A., M.E. Azim, M.M. Haque and Z.E. Ahmed, 1996. Effects of frequency of fertilization on water quality and fish yields. Progress. Agric., 7: 33-39.

Wahab, M.A., Z.F. Ahmed, M.A. Islam, M.S. Haq and S.M. Rahmatullah, 1995. Effects of introduction of common carp, *Cyprinus carpio* (L.), on the pond ecology and growth of fish in polyculture. Aquacult. Res., 26: 619-628.

Wahab, M.A., Z.F. Ahmed, M.S. Haq and M. Begum, 1994. Compatibility of silver carp in the polyculture of cyprinid fishes. Prog. Agric., 5: 221-227.