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WATER QUALITY PARAMETERS AND INCIDENCE OF FISH DISEASES IN SOME WATER BODIES IN NATORE, BANGLADESH

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Abstract: Monthly variations of the physicochemical parameters in some selected water bodies (12 Beels and 210 ponds) in Natore during July 2006 and June 2007 have been studied. The highest values for water temperature, alkalinity, ammonia, free CO_2, DO, pH and total hardness in Beel waters were 31.5°C (May '07), 180ppm (January and February '07), 2.5ppm (September '06), 9.6ppm (April '07), 7.5ppm (January '07), 8.6 (December '06) and 190ppm (February '07), respectively and the lowest values were 15°C (February '07), 35ppm (October '06), 0.5ppm (December '06), 6.3ppm (January '07), 4.8ppm (April '07), 6.8 (September '06) and 50ppm (September '06), respectively. The highest and lowest values of these parameters in pond waters were 33°C (May '07), 200ppm (March'07), 2.3ppm (July '06), 9.3ppm (April '07), 7.5ppm (January '07), 8.6 (November '06) and 200ppm (February '07) respectively, and 17°C (December '06), 50ppm (October '06), 0.6ppm (December '06 and January '07), 6.4ppm (January '07), 5.0ppm (May '07), 6.2 (April '07) and 40ppm (September '06) respectively. Changing in water quality parameters resulted in a stress response in the fishes, making them more susceptible to parasitic attacks and diseases, many of them being fatal.

Key words: Beels, ponds, water quality parameters, fish diseases

mvivsk: RjvB 2006 ‡_‡K Rb 2007 chš bv‡U‡ii KwZcq wej Ges cK‡ii cwbi †fŠZ-ivmvqwbK ¸‡Yi gwmK Mo cwieZb ch‡e¶Y Kiv nq| Rjvk‡qi cwbi Zvcgv Îv, ¶viZ, A¨v‡gwbqv, g³ Kveb WvBA·vBW, `exfZ Aw·‡Rb, wc.GBP Ges †gvU LiZvi m‡ev"P Mo gvb h_vµ‡g 31.50°‡m (†g ÔO7), 180wcwcGg (Rvbqvix Ges †de"qvix ÔO7), 2.5wcwcGg (†m‡Þ¤i ÔO6), 9.6wcwcGg (Gwcj ÔO7), 7.5wcwcGg (Rvbvqvix ÔO7), 8.6 (wW‡m¤i ÔO6) Ges 190wcwcGg (†de"qvix ÔO7) cvIqv hvq Ges H mKj c¨viwgU‡ii mewbg gvÎv h_vµ‡g 15°‡m (†de"qvix ÔO7), 35wcwcGg (A‡±vei ÔO6), 0.5wcwcGg (wW‡m¤i ÔO6), 6.3wcwcGg (Rvbqvix ÔO7), 4.8wcwcGg (Gwcj ÔO7), 6.8 (†m‡Þ¤i ÔO6) Ges 50wcwcGg (‡m‡Þ¤i ÔO6) cvIqv hvq| cK‡ii cwbi H me c¨viwgU‡ii m‡ev"P gvb h_vµ‡g 33°‡m (†g ÔO7), 200wcwcGg (gvP ÔO7), 2.3wcwcGg (RjvB ÔO6), 9.3wcwcGg (Gwcj ÔO7), 7.5wcwcGg (Rvbvqvix ÔO7), 8.6 (b‡f¤i ÔO6) Ges 200wcwcGg (†de"qvix ÔO7) cvIqv hvq Ges H mKj c¨viwgU‡ii m‡ewbg gvÎv h_vµ‡g 17°‡m (wW‡m¤i ÔO6), 50wcwcGg (A‡±vei ÔO6), 0.6wcwcGg (wW‡m¤i ÔO6 Ges Rvbqvix ÔO7), 6.4wcwcGg (Rvbqvix ÔO7), 5.0wcwcGg (†g ÔO7), 6.2 (Gwcj ÔO7) Ges 40wcwcGg (‡m‡Þ¤i ÔO6) cwijw¶Z nq| cwbi GBme ¸Yv¸‡Yi gvÎv cwieZb gv‡Qi AvµgYkxj ciRvexi cwZ ms‡e`bkxj K‡i gvQ‡K cwo‡b mvov †RvMvq| nVvr cwbi ¸bv¸‡Yi cwieZb gv‡Qi †ivM NUvq hv gv‡Qi gZ¨i KviY n‡q `vovq|

Introduction

One of the most important prerequisite of production of fishes is the availability of healthy fish fry and fingerlings. The occurrence and magnitude of infections are closely related to the sanitary conditions prevalent in the water and also the general health of the fishes themselves. The death of fishes caused by diseases are of highest significance in fish culture, hence to achieve healthy fish stock one should implement programme like fish parasitological research, control of diseases and maintenance of health relationship between fishes and their environment.

The parasite community of fishes shows considerable variation with the environmental conditions in which they live. Various physicochemical factors such as water temperature, alkalinity, ammonia, free carbon dioxide, dissolved oxygen (DO), pH and total hardness have strong influence on fish health and their resistance against the disease causing agents (Welch 1941; Snieszko 1974; Plumb *et al*. 1988; Shresta 1994; Hossain 1990). The physiological and biological features of the host affect the composition of parasites (Dogiel 1961). Poor condition of physicochemical properties of water is O_2 depletion, excess ammonia, carbon dioxide, excess CO_2 in water and temperature change. As no elaborate studies have been done before, a study on water quality parameters and their effects on freshwater fishes of some water bodies in Natore was undertaken.

Materials and Methods

The water samples collected during July 2006 and June 2007 from 12 Beels and 210 ponds in and around Natore were brought to the laboratory of the Department of Fisheries, Rajshahi University. A centigrade pocket thermometer (No. 2676400, Hach Company) was used to record the temperature. For the measurement of total alkalinity, Bromcresol Green Methyl Red Indicator powder Pillow was used. Total alkalinity calculation was done by gpg × 17.1= mg/l as $CaCO_3$ (gpg = grains per gallon). The Nessler method (Drum *et al.* 2000) was used for measurement of ammonia. The free CO_2 was recorded by using the Fish farming test kit box Hach (Model FF-1 A, Cat. No. 2430-02). It was determined by titration

procedure using a standard base solution with phenolphthalein as end point indicator. The dissolved oxygen (DO) was recorded by the Winkler method (Laitinen 1960). Colour comparator Box (Cat. No.1732-00), colour disc, wide range pH, sodium thiosulphate, standard solution and colour viewing tubes were used to measure pH of the sample water. In total hardness test, the water sample was buffered to a pH of 10.1 where the test functioned best. An organic dye was added and then titrated with standard EDTA to blue end point. The amount of EDTA titrant added was directly proportional to the concentration of total hardness (as $CaCO_3$). Diseased fishes were collected from the sampled water bodies, and different diseases were identified according to the symptoms and behaviour of the fishes (Kabata, 1985; Amlacher, 1997). Incidence (%) of fish diseases was calculated from the number of diseased fishes out of the total number of fish collected during the study period.

Results and Discussion

Monthly fluctuation of water quality parameters in Beels and ponds in Natore areas are presented in Tables 1 and 2 respectively. The findings are narrated below.

Water temperature (°C): Water temperature showed variations in different months of the year. The highest water temperature of the Beels was 31.50 in the month of May 2007, the lowest was 15 in the month of February 2007. The highest water temperature of ponds was 33.0 in the month of May 2007 and the lowest 16.9 in the month of January 2007.

Total alkalinity (ppm): The minimum and maximum total alkalinity of the Beel waters was 35 (October '06) and 180 (January and February '06), respectively. The values for pond waters was 50 (October '06) and 200 (March '07), respectively.

Ammonia (ppm): The highest amount of ammonia in Beel waters was 2.5 in September '06 and the lowest (0.5) in December '06 while pond water had 2.3 in July '06 and 0.6 in December'06 and January'07, respectively.

Free CO_2 (ppm): The maximum free CO_2 in the Beel waters was 9.6 in April '07 and the minimum of 6.3 in January '07. The values for pond waters were 9.3 in April '07 and 6.4 in January '07, respectively.

Dissolved oxygen, DO (ppm): The highest and lowest concentrations of DO in Beel waters were 7.5 and 4.8 in the months of January 2007 and April 2007, respectively. The amounts in pond waters were 7.5 and 4.8 in the months of January 2007 and April 2007, respectively.

pH (Hydrogen ion concentration): The Beel waters had pH of 8.6 and 6.8 in the months of December 2006 and September 2006, respectively while the values for pond waters were 8.6 and 6.2 in the months of November 2006 and April 2007, respectively.

Total hardness (ppm): The highest and lowest values for total hardness in Beel waters were recorded 19 in February 2006 and 50 in September 2006, respectively. The values for pond waters were 200 in February 2007 and 40 in September 2006, respectively.

Incidence of fish diseases (%): The monthly incidence of different diseases of fish during the study period is shown in Table 3. Fifteen fish diseases were observed in the water bodies under study. The highest incidence (92) was of Trichodiniasis in July 2006 and the lowest (13) of whirling disease in February 2007. Three diseases namely, Trichodiniasis, myxoboliasis and pernicious anaemia, were found throughout the year. The highest and lowest percentages of disease respectively were 42.87 in the month of December 2006 and 9.87 in the month of June 2007.

Table 1. Monthly fluctuation of water quality parameters of Beels in Natore during July 2006 and June 2007

Years	Months	Water temp (°C)	Alkalinity (ppm)	Ammonia (ppm)	Free CO_2 mg/l	DO mg/l	pH	Total hardness (ppm)
2006	July	31.0	115	2.2	7.5	6.2	7.3	120
	August	30.0	100	1.6	7.4	6.7	7.8	110
	September	30.0	55	2.5	7.7	5.0	6.8	50
	October	29.0	35	2.1	8.4	5.0	7.8	60
	November	19.0	110	0.9	6.5	7.0	7.6	130
	December	18.0	150	0.5	7.0	6.0	8.6	135
2007	January	16.0	180	0.6	6.3	7.5	8.2	180
	February	15.0	180	1.0	7.4	6.2	7.8	190
	March	27.0	170	1.7	7.0	6.6	7.6	170
	April	31.0	170	2.0	9.6	4.8	8.0	160
	May	31.5	150	2.0	8.2	5.2	7.0	140
	June	28.0	130	1.8	7.5	6.2	7.4	145
Mean± SD		25.46±6.16	129.17±46.27	1.57±0.63	7.54±0.85	6.03±0.83	7.6±0.47	132.5±41.51

On introducing a fish into water, which is too cold (4°C) or too warm (35°C), a thermal shock is produced (Jhingran 1988). Unionized ammonia (NH_3) is toxic to fish, while the ammonium ion (NH_4^+) is nontoxic. The concentration of unionized ammonia should not exceed more than 0.025ppm (Jhingran 1988). Fish releases CO_2 through its skin and gills. This activity is hampered if the amount of this gas is more in the water. As a result fish suffers from suffocation leading to death (Jhingran 1988). According to Swingle (1967), free CO_2 at a concentration of more than 15ppm is detrimental for pond fishes. Prolonged exposure to low concentrations of DO can be harmful to fish life because they will die at a level of 1mg/l. Growth and feeding decreases at 1-5 mg/l of DO and growth and production is optimum at more than 5mg/l (Jhingran 1988).

Lower concentration of pH increases the toxicities of hydrogen sulphide (H_2S), copper and other heavy metals to fish. Fishes are prone to attack of parasites and diseases in acidic waters. When pH rises over 11, the gills and lens and cornea of fish eyes are destroyed (Jhingran 1988). As a result the fishes become weak and infected by parasites. The present data on pH, free CO_2 and hardness are similar to those reported by Shahjahan *et al.* (2001). Water with less than 5ppm $CaCO_3$ equivalent causes slow growth, distress and eventual death of fishes. Primary production of pond decreases if hardness rises over 300ppm (Verma 1969). Miller and Rabe (1969) reported that the highest concentration of free CO_2 was recorded in August and in winter months. Sahai and Singha (1969) also observed high levels of free CO_2 in June and lower levels in January. Roy *et al.* (1966) and Islam *et al.* (1974) reported similar conditions of some water bodies. In addition, the stress due to water quality also influences the outbreak of fish diseases (Phillips and Keddie 1990). The deterioration of water quality parameters found in the present water bodies may be responsible for inducing fish diseases, resulting in lower fish population and eventual death of the fishes. Reduced number and low fish diversity, its survival and reproduction were suggestive of the occurrence of various diseases in the surveyed water bodies. The present results on the incidence of fish diseases are in agreement with Patra and Azadi (1987) and Hossain *et al.* (1993).

Table 2. Monthly fluctuations of water quality parameters of ponds in Natore during July 2006 and June 2007

Years	Months	Water temp. (°C)	Alkalinity (ppm)	Ammonia (ppm)	Free CO_2 mg/l	DO mg/l	pH	Total hardness (ppm)
2006	July	32.0	110	2.3	7.9	5.9	8.4	100
	August	31.0	95	1.6	7.2	6.8	7.9	80
	September	31.5	55	2.1	8.6	5.3	7.0	40
	October	29.0	50	2.1	8.2	6.1	7.3	60
	November	19.0	110	0.9	6.7	6.5	8.6	130
	December	17.0	135	0.6	6.9	7.1	7.9	120
2007	January	16.9	160	0.6	6.4	7.5	8.5	160
	February	17.5	195	1.2	6.5	7.0	8.5	200
	March	29.0	200	1.6	7.4	6.4	7.9	190
	April	31.0	190	2.1	9.3	4.8	6.2	160
	May	33.0	170	2.0	8.7	5.0	6.7	160
	June	29.0	110	1.8	7.5	6.2	7.2	90
Mean ± SD		26.32±6.40	131.67±49.72	1.57±0.58	7.6±0.89	6.22±0.81	7.68±0.74	124.17±49.07

Conclusion

The present study concludes that there is a direct relationship between disease outbreaks among fishes and the water quality parameters of the water bodies. During the seasons of disease occurrence, the water parameters were quite different from that of the other seasons. The causes of disease were not ascertained in the present investigation but the variations in the water quality parameters were recorded in the disease occurring months. The results might contribute largely to the formulation of proper management measures for the fish farmers and fishermen of this region and of Bangladesh as a whole.

Table 3. Monthly incidence of diseases in fish (%) in some water bodies in Natore during July 2006 and June 2007

Diseases	2006						2007					
	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
EUS	0	0	0	0	52	66	72	75	0	0	0	0
Abdom. Dropsy	0	0	0	0	0	0	20	22	25	21	0	0
Ichthyophthiriasis	32	36	48	54	52	44	50	51	39	45	0	0
Trichodiniasis	92	81	79	68	52	64	78	61	65	72	70	78
Chilodonelliasis	0	0	0	0	78	69	0	0	0	0	0	0
Myxoboliasis	68	59	54	50	48	44	51	48	45	55	60	56
Argulosis	0	0	0	0	0	0	0	0	55	46	38	0
Dactylogyrosis	0	0	0	0	50	56	67	69	75	0	0	0
Gyrodactylosis	0	0	0	0	62	68	66	58	50	0	0	0
Pernicious anaemia	30	32	35	37	40	36	26	22	20	18	17	14
Red spot disease	0	0	0	0	74	82	80	78	76	72	68	0
Red pest disease	0	0	0	0	0	55	53	50	0	0	0	0
Mouth fungus	0	0	0	0	43	41	39	32	30	28	26	0
Gill rot	0	0	0	0	0	0	0	0	60	70	65	0
Whirling disease	0	0	0	0	15	18	16	13	0	0	0	0
Mean	14.8	13.87	14.4	13.93	37.73	42.87	41.2	38.6	36	28.47	22.93	9.87

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