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STUDY OF SEASONAL VARIATIONS IN PHYSICO-CHEMICAL PARAMETERS OF A FISH FARM

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Abstract: Various types of physico-chemical parameters were studied in a fish farm near Multan, (Pakistan). The air temperature ranged from 23 ^{O}C to 44.2 ^{O}C and the water temperature was found to be 18.8 ^{O}C and 34.1 ^{O}C. Secchi's disc reading varied from 14.6 cm to 31.6 cm. The pH fluctuated within a narrow limit 7.51-8.57 and did not show seasonal pattern. However, dissolved oxygen showed an inverse relationship with water temperature. Total solids ranged from 1.0 to 2.2 mg/g.

Key words: Seasonal variation, physico-chemical, fish farm.

INRODUCTION

In recent years, aquaculture is being projected as a possible solution to the food problems faced by the masses. It gives higher productivity/unit as compared to agriculture and animal husbandry. Water quality studies are important and have been taken up because these play a key role in aquaculture (Sinha and Srivastava, 1991). The water quality ultimately determines the survival and growth of the cultured animals and plants (Dehadri, 1992). The productivity depends on the physico-chemical characteristics of the pond water. The maximum production is obtained when the physical and chemical factors are at the optimum level (Huet, 1986). The fresh water fisheries resources of Pakistan are not being adequately exploited or developed due to lack of active research. Research on the limnological aspects is of paramount significance in developing freshwater fisheries. The present study describes the seasonal variation in physico-chemical factors in a commercial fish farm.

MATERIALS AND METHODS

This study was carried out on Zaidi Aqua farm located on the left side of Muzaffargarh road, at a distance of 16km from Multan. This is a commercial aquatic complex covering an area of 6 hectares. The pond selected for sampling in the present study covers a water area of 0.5 hectare with a maximum depth of 7 feet. The pond had a stocking combination of major carps *i*.e. *Labeo rohita, Catla catla* and *Cirhinus mrigala* alongwith two Chinese carps *i.e. Hypophathalmicthys molitrix* and *Ctenopharyngodon idella*. The study was carried out for a growth period of eight months *i.e.* from March to October, 1993.

At the time of sampling, air and water at 6" depth temperature was recorded using a mercury thermometer. The light penetration was recorded with the help of Secchi's disc. The dissolved oxygen was determined using an oxygen meter (Model 9070) immediately after samplig. The pH was determined using a digital pH meter (Model CD. 640) in the laboratory. For the determination of total solids, water samples were

taken at 6" depth in preweighed glass bottles and then reweighed. The samples were evaporated to dryness at 80 °C in a drying oven (Memmert). After evaporation, the glass bottles were reweighed and the amount of total solids in the sample was determined and expressed as mg/g of water. The data for humidity was collected from Meteriological department, Multan.

RESULTS

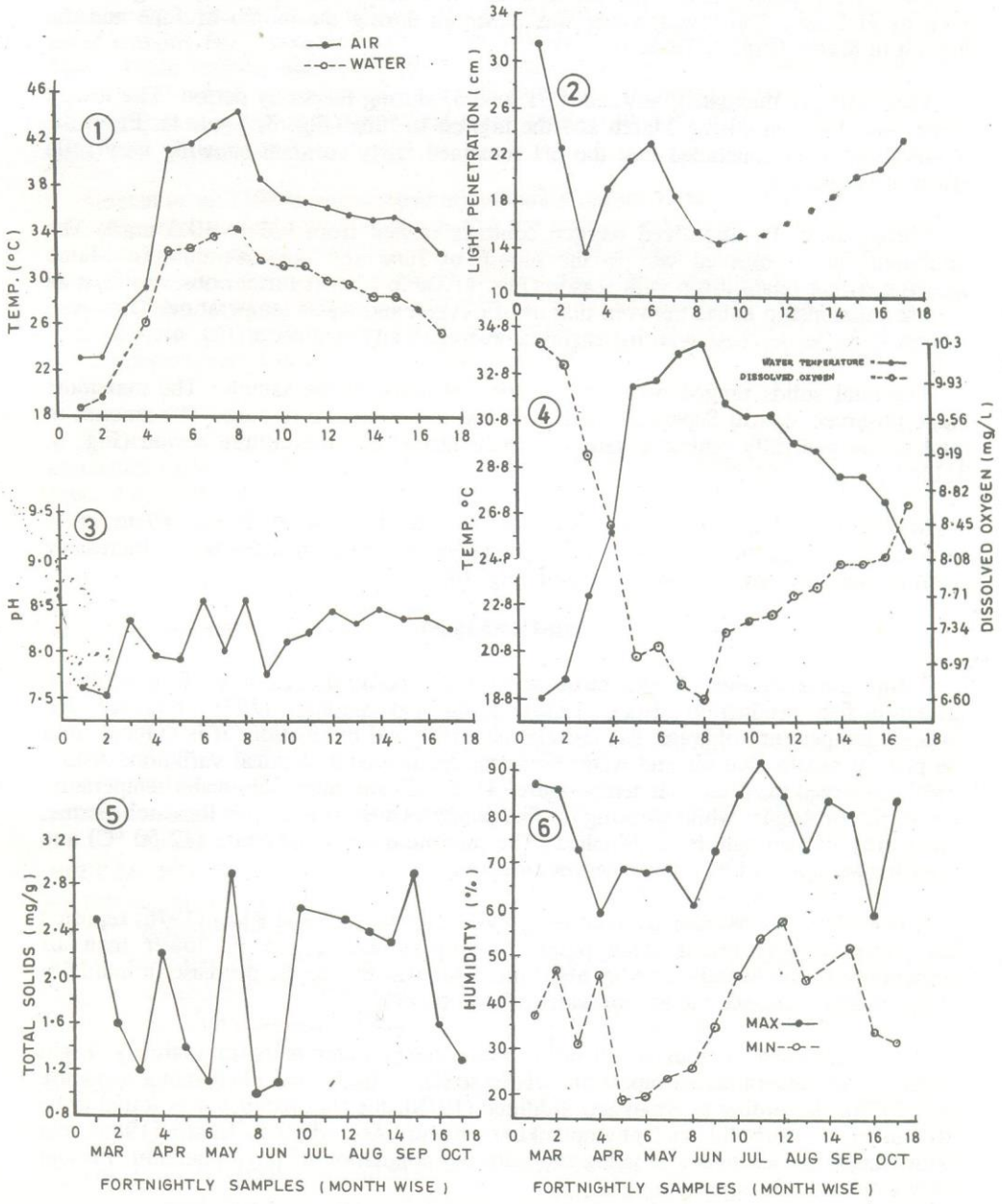
The overall range in atmospheric temperature observed was 23 - 44 °C while the water temperature fluctuated between 18.8 and 34.1 °C. The maximum and minimum temperatures were recorded during months of March and June, respectively (Fig. I, Table I). There is a direct relationship in the seasonal fluctuations between atmospheric and water temperature (Fig. 1).

Table I. Seasonal changes in physico-chemical parameters of a fish farm

Date	Temperature		Light	pH	Dissolved	Total solids	Humidity	
	Air (°C)	Water (°C)	penetra-tion		Oxygen (mg/l)	(mg/g)	max.(%)	min.(%)
1.3.93	23.0	18.8	31.6	7.61	10.3	2.5±.0054	87	37
15.3.93	23.0	19.6	22.6	7.51	10.1	1.6±.0015	86	47
30.3.93	27.3	23.2	13.7	8.35	9.15	1.2±.0003	73	31
13.3.93	29.1	26.0	19.2	7.96	8.45	2.2±.0004	59	46
28.4.93	41.0	32.3	21.7	7.91	7.05	1.4±.0016	69	19
13.5.93	41.4	32.5	23.2	8.55	7.16	1.1±.0003	68	20
28.5.93	43.0	33.7	18.6	8.07	6.72	2.9±.0045	69	24
12.6.93	44.2	34.1	15.6	8.57	6.60	1.0±.0003	61	26
27.6.93	38.5	31.5	14.6	7.85	7.28	1.1±.0029	73	35
12.7.93	36.7	31.0	15.3	8.11	7.40	2.6±.0033	85	46
27.7.93	36.6	31.0	15.4	8.30	7.49	2.3±.0023	92	54
11.8.93	36.1	29.8	16.4	8.45	7.69	2.5±.0014	85	58
26.8.93	35.5	29.5	17.6	8.30	7.77	2.4±.0021	73	74
10.9.93	35.1	28.4	18.7	8.45	8.01	2.3±.0011	84	49
25.9.93	35.3	28.4	20.5	8.34	8.01	2.9±.0030	81	52
10.10.93	34.3	27.3	21.1	8.36	8.06	1.6±.0010	59	34
25.10.93	32.1	25.2	23.5	8.22	8.64	1.3±.0021	84	32

Fig. 1-6. Some physico-chemical parameters of a fish farm: temperature (1), light penetration (2), pH (3), dissolved oxygen and relationship between dissolved oxygen and temperature (4), total solids (5) and humidity (6).

SEASONAL VARIATIONS IN PARAMETERS OF A FISH FARM



The light penetration interpretted in terms of Secchi's disc visibility ranged from 14.6 to 31.6 cm. The lowest value was observed during the month of June and the highest in March (Fig. 2, Table I).

Values of pH fluctuated between 7.61 to 8.57 during the study period. The lowest value was observed during March and the highest in June (Fig. 3, Table I). From the observations it is concluded that the pH remained fairly constant showing very little effect of the season.

Variations in the dissolved oxygen contents ranged from 6.6 to 10.3 mg/l. The minimum value observed was in the month of June and the maximum in March showing strong relationship with season (Fig. 4, Table I). It is further observed that an inverse relationship exists between dissolved oxygen and water temperature. Dissolved oxygen contents decrease with increasing temperature and vice versa (Fig. 4).

The total solids ranged between 1.0 and 2.9 mg/g of the sample. The maximum value observed was in September and May and the minimum in June. The amount of total solids generally remained fairly constant throughout the culture period (Fig. 5, Table I).

Maximum and minimum humidity ranged between 59 to 92% and 19 to 58%, respectively, being the highest in August and lowest in April showing an increasing trend in humidity with season after April (Fig. 6).

DISCUSSION

Temperature is one of the most important among the external factors which influence fish production (Huet, 1986). Khan and Siddiqui (1978) reported that constant temperature of water has correlation with pond production. It is evident from the present results that air and water temperature showed a seasonal variation. Ashraf (1987) observed maximum air temperature (35.57 °C) and maximum water temperature (33.50 °C) in August while working on fish ponds located at Fisheries Research Farms, Universitly of Agriculture, Faisalabad. The minimum air temperature (12.50 °C) and water temperature (11 °C) was noted in January.

It is evident that Multan has relatively severe climate. Ali and Khan (1976) reported that water temperature of some ponds in Aligarh was 2 - 5 °C lower than air temperature in the Months of May and June. This was due to the decrease in humidity which greatly increased the loss of water by evaporation.

One of the most obvious and familiar properties of water is its transparency. Light exerts a profound influence upon the whole series of biological phenomena in nature (Ali, 1976). According to Khan and Siddique (1978), the transparency was found to be effected by the turbidity and phytoplankton growth. According to Khatri (1985), the transparency has an inverse relationship with the population of phytoplankton. Present study confirms this observation.

In ponds, seasonal and diurnal variations in pH may be noticeable and are usually

related with photosynthesis and respiratory processes of the various organisms concerned (Boyd, 1979). Biological conditions are considered better when pH of the water remains fairly constant rather than in water undergoing considerable variations (Huet, 1986; Jeffries and Mills, 1992). The pH of the pond in this study ranged from 7.51 to 8.57 which was relatively constant showing little effect of season. Mahboob *et al.* (1988) also observed a similar pH range of 7.45 to 8.50 while working on Ajmla Fish Farm, Faisalabad.

Singhal *et al.* (1986) investigated significantly higher values of dissolved oxygen in the colder months and lower values during the warmer months of the season similar to the observations made in this work. The dissolved oxygen of the pond under study showed a gradual decrease from March to June and then gradual increase from June to October. This trend in seasonal fluctuation of the dissolved oxygen is inversely related to pond water temperature. The decrease in oxygen content was correlated with rise in water temperature. Quadri *et al.* (1981) reported similar pattern in dissolved oxygen contents.

The concentration of total solids in our study varied between 1.0 and 2.9 mg/g. The maximum value was observed in May and September while minimum was observed in June. Ali, (1976) also observed maximum concentration of total solids in the month of September and minimum in June.

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