

Limnological Characteristics of Ponds Fertilized with Different Nitrogen Sources on the Basis of Live Body Weight of Fishes

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ABSTRACT

Seasonal and diurnal variations in the limnological characteristics of two fertilized ponds were studied at Fisheries Research Farms, University of Agriculture Faisalabad for a period of five months. Seasonal variations showed highly significant effect on all the ecological parameters except biomass and light penetration. However, seasonal effect on dissolved oxygen, calcium and magnesium was significant. Water temperature of ponds was lower in early months but in the later part of study reverse was the case. pH remained alkaline and neutral and CO₂ remained absent. Diurnal variations were highly significant on the temperature and dissolved oxygen, significant only on electrical conductivity and non-significant for the remaining ecological parameters.

Key Words: Fish; Nitrogen; Pond; Limnological characters

INTRODUCTION

Limnology is commonly defined as "that branch of science which deals with the biological productivity of inland waters and with all the causal influences which determine it". A suitable environment is necessary for any organism for proper exchange of essential substances between the organism and its surroundings. The chemical nature and physical conditions of water and presence of biotic flora and fauna have profound effect on the physiological process, growth performance, population density and geographical distribution of both animal and plant species (Welch, 1952).

Quality of water for fish ponds depends upon the nature of soil, source of water and also on the location of ponds (Boyd, 1981). Water quality is determined by physico-chemical criteria of the water (Zakhia & Cuq, 1993).

It is well established that the productivity of a pond depends on its ecological conditions and by monitoring water quality control, the productivity can be increased for obtaining maximum sustainable yield of fish (Love, 1974). Maintenance of healthy aquatic environment and production of sufficient food organisms in ponds are primarily linked with successful pond culture operations. To keep the aquatic habitat favorable for existence of fish, physical and chemical factors like temperature, turbidity, pH, odour, dissolved gases (oxygen and CO₂), salts nutrients etc. Must be watched regularly, individually or synergistically (Banerjee, 1967). Activity of fish is influenced by the seasonal and diurnal changes of these parameters.

The present experiment was conducted to study the limnological characteristics in two fertilized ponds for a

period of five months from 21 May 1998 to 24 September 1998.

MATERIAL AND METHODS

Water samples for the study were collected from two earthen fertilized ponds of equal size each having dimensions of 22 x 7.5 x 1.8 m (length x width x depth) located at Fisheries Research Farms, University of Agriculture, Faisalabad. The ponds were served with tube well water. Both the ponds were fertilized with two different sources of nitrogen fertilizers i.e. NH₄NO₃ and urea while single super phosphate was added in both pond in 1:1 ratio with nitrogen fertilizer. Water samples were collected before sunrise and sunset fortnightly in polythene bottles. Air and water temperature were recorded with the help of alcohol thermometer Secchi's disc was used for determination of light penetration, while electrical conductivity, CO₂ and pH were determined at pond site. Dissolved oxygen, total hardness, magnesium, calcium, total alkalinity, carbonates, bicarbonates, total solids and total dissolved solids were estimated according to Boyd (1981). Data obtained was subjected to statistical analysis using microcomputer IBM-PC with the help of software program i.e. MSTAT and MICROSTAT.

RESULTS AND DISCUSSION

Results have been presented in Tables I-IV. Statistical analysis showed highly significant effect of seasonal diurnal changes on the temperature. Water temperature remained higher than air temperature for most of the time of study period, which is not accordance with Welch (1952). Highly significant effect of seasonal variations was found on pH

while diurnal effect was non-significant. Non-significant effect of seasonal and diurnal variations was found in the values of light penetration. Free CO₂ was found to be absent through out the study period. Dissolved oxygen values were higher in cooler months and evening time and were lower in warmer months at dawn, also reported by Kumar (1992). Diurnal effect was highly significant but seasonal effect was significant only. Dissolved oxygen values range from 0.18 mg/L to 6.8 mg/L in the morning time but in the evening it ranged from 2.8 mg/L to 17.2 mg/L. Total alkalinity values remained higher than the total hardness values. Highly significant variations were found but diurnal variations were

non-significant. In the morning, the variations ranged from 300 mg/L to 520 mg/L while in the evening it ranged from 260 mg/L to 620 mg/L. Total hardness showed highly significant seasonal variations while diurnal effects was non-significant. Morning values of total hardness fluctuated between 100 mg/L to 382 mg/L but evening values ranged from 174 mg/L to 340 mg/L. Highly significant effect of seasonal variations was found in the amounts of chlorides while diurnal effects was non-significant. In the morning the variations were ranged from 82 mg/L to 230 mg/L but in the evening the variations ranged from 81 mg/L to 212 mg/L. Seasonal and diurnal variations in the amount of biomass

Table I. Seasonal and diurnal observations of water and air temperature of two experimental ponds

Date	Morning			Evening			Mean
	Air Temp.	Water Temp.		Air Temp.	Water Temp.		
		Pond 1	Pond 2		P1	P2	
21-05-98	28.0	27.0	26.9	36.0	32.5	32.0	29.600 c
04-06-98	25.8	25.4	25.6	37.0	33.4	33.0	29.250 c
18-06-98	28.0	29.0	29.0	38.0	34.0	33.5	31.375 a
02-07-98	25.5	30.0	30.4	28.5	33.0	33.0	31.600 a
16-07-98	25.0	28.9	28.9	31.0	32.3	32.0	30.450 b
30-07-98	25.5	30.0	29.8	28.5	33.5	33.8	31.775 a
13-08-98	26.0	29.9	30.0	28.0	31.0	32.0	30.723 b
27-08-98	25.0	27.0	27.5	29.0	32.0	31.5	29.500 c
10-09-98	27.0	29.0	29.0	28.0	32.0	32.3	30.575 b
24-09-98	25.0	27.0	27.0	26.0	28.0	28.5	27.623 d
Mean		28.32	28.41		32.10	32.16	30.247

Means= Water temperature Pond 1 = 30.21 A; Morning = 28.365; Water temperature; Pond 2 = 30.28 A; Evening = 32.130

Table II. Seasonal and diurnal observations of dissolved oxygen (mg/L) of two experimental ponds

Date	Morning		Evening		Mean
	Pond 1	Pond 2	Pond 1	Pond 2	
21-05-98	3.6	6.4	10.0	8.8	7.20 ab
04-06-98	6.8	5.6	17.2	8.0	9.40 a
18-06-98	1.6	1.2	10.0	12.4	6.30 ab
02-07-98	1.2	0.8	6.8	6.4	3.80 b
16-07-98	1.2	1.2	7.6	3.6	3.40 b
30-07-98	3.6	2.0	5.2	6.0	4.20 b
13-08-98	1.2	4.0	4.4	5.6	3.80 b
27-08-98	1.6	1.6	2.8	9.2	3.80 b
10-09-98	1.2	1.6	4.4	8.4	3.90 b
24-09-98	4.4	4.4	9.2	7.2	6.30 ab
Mean	2.64	2.88	7.76	7.56	5.22

Means= Pond 1 = 5.20; Morning = 2.76; Pond 2 = 5.22; Evening = 7.66

Table III. Seasonal and diurnal observations of total alkalinity (mg/L) of two experimental ponds

Date	Morning		Evening		Mean
	Pond 1	Pond 2	Pond 1	Pond 2	
21-05-98	340	360	420	400	380 cd
04-06-98	500	360	520	400	445 b
18-06-98	480	400	540	480	475 b
02-07-98	480	400	400	420	425 bcd
16-07-98	520	400	620	620	540 a
30-07-98	460	460	420	420	440 bc
13-08-98	500	520	440	340	450 b
27-08-98	300	400	260	280	310 e
10-09-98	400	340	400	340	370 de
24-09-98	480	440	460	360	435 bc
Mean	446	408	448	406	427

Means= Pond 1 = 447; Morning = 427; Pond 2 = 407; Evening = 427

Table IV. Seasonal and diurnal observations of total hardness (mg/L) of two experimental ponds

Date	Morning		Evening		Mean
	Pond 1	Pond 2	Pond 1	Pond 2	
21-05-98	218	224	174	260	319.00 de
04-06-98	132	100	302	270	201.00 e
18-06-98	274	276	230	236	254.00 cde
02-07-98	280	240	286	252	264.50 bcd
16-07-98	274	266	234	210	246.00 cde
30-07-98	260	216	210	196	220.50 de
13-08-98	302	304	292	268	291.50 abc
27-08-98	270	228	236	212	236.50 de
10-09-98	382	300	294	380	339.00 a
24-09-98	300	320	340	302	315.50 ab
Mean	269.20	247.40	259.80	258.60	258.75

Means= Pond 1 = 264.50; Morning = 258.30; Pond 2 = 253.00; Evening = 259.20

were non-significant. The morning values ranged from 16 mg/L to 192 mg/L while the evening values fluctuated between 26 mg/L to 206 mg/L in both the ponds.

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