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SOME ASPECTS OF WATER QUALITY IN A SHALLOW POND OF UDAIPUR, RAJASTHAN

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INTRODUCTION

Shallow water cemented ponds are commonly used for rearing carp seed, ornamental fish and plants. Such pond eco-systems are also comparable to the standing waters of swimming pools. In latter, the maintenance of water quality is an important aspect for having reduced algal population and high transparency. Thus, the studies on shallow water eco-systems may prove useful in efficient management of such systems for their appropriate use.

Udaipur waters including large reservoirs, lakes and temple tanks have been the foci for limnological researches (Vyas, 1968 ; Sharma, 1980 ; Sharma and Durve, 1982 ; Madhusudan *et al.*, 1984 ; Kumar, 1987 ; Rao, 1987 and Karki, 1988). In the present investigation, a shallow water pond of Udaipur has been studied.

MATERIAL AND METHODS

The shallow ponds selected for this study is located in the College campus (73°43′10″E long. and 24°34′46″N lat.) at Udaipur. This pond has a water spread of 242 sq. m. and average depth of 0·80 m. Surface and bottom water samples from shallow pond mentioned above were collected during April-June, 1988. A vandorn sampler was used for collecting bottom water samples at weekly intervals. Measurements for water clarity, air and water temperature were made at the pond site. Similarly, analysis for pH, dissolved-oxygen, free carbondioxide and alkalinities were made at the pond site immediately after collecting the sample. However, for analysing rest of the parameters *viz.* electrical conductivity, nitrate and orthophosphate, the samples were brought

Table 1 : Variation in physico-chemical factors in R. C. A. pond during April-June, 1988.

Parameters		April		May				June						Overall Average
		23	29	5	11	17	23	29	4	10	16	22	29	
Depth of Visibility (Cm)		87	61·50	61	63	64	66·30	90	80	78	75·50	82	80	74·35
Water Tempt.	(S)	26·5	29	28	29·5	28	30	28 5	30	30·5	29	29	29	28·91
	(B)	26	28·5	27·5	29	27	28·5	27·5	29	29	28	29·5	28	28·12
pH	(S)	7·60	7·50	7·00	7·50	7·55	7·80	7·95	8·10	8·05	8·10	8·00	7·80	7·74
	(B)	7·50	7·50	7·20	7·20	7·40	8·10	7·80	8·00	8·00	8·05	8·00	7·95	7·72
Dissolved	(S)	4·48	3·92	4·20	1·82	3·64	3·08	2·80	1·82	1·68	1·96	2·46	8·26	3·34
Oxygen (ppm)	(B)	3·36	3·64	3·64	1·68	3·36	3·41	2·24	1·51	1·54	1·68	2·12	7·84	3·00
Free CO_2	(S)	00	00	00	00	00	50·16	11·00	11·00	14·96	11·44	12·32	15·42	10·52
(ppm)	(B)	00	00	00	00	00	52·80	12·32	13·20	11·40	10·56	15·84	13·20	10·78

Alkalinity (ppm as $CaCo_3$)													
Total Alkalinity (S)	490	462	364	446	495	540	560	600	590	600	580	530	521·41
Carbonate	60	22	14	26	15	00	00	00	00	00	00	00	11·41
Bicarbonate	430	440	350	420	480	540	560	600	590	600	580	530	510·00
Total Alkalinity (B)	470	471	424	430	470	600	540	580	580	585	570	560	523·33
Carbonate	30	21	24	20	20	00	00	00	00	00	00	00	9·58
Bicarbonate	440	450	400	410	450	600	540	580	580	585	570	560	513·75
Inorganic phosphate (ppm)	0·10	0·12	0·12	0·13	0·10	0·15	0·14	0·13	0·16	0·18	0 14	0·15	0·135
Nitrate Nitrogen (ppm)	0·77	0·52	0·64	0·57	0·52	0·58	0·56	0·61	0·65	0·75	0·71	0·76	0·638
Electrical (S)	430	420	420	480	453	450	450	425	450	560	433	420	449·25
conductance (B) µmhos/cm	420	451	430	470	445	443	455	435	445	465	430	4.5	442·83

Note : (S) = Surface (B) = Bottom

to the laboratory soon after collection. APHA (1976) methods were followed for water analysis.

Results and Discussions

It is evident from Table 1 that the water temperature in general followed variations in air temperature. The surface to bottom gradient varied from 0·5 to 1·5°C. The relative humidity fluctuated between 33 in May to 64·25 in June. Moreover, the daily sunshine hours were more in April (10·80) and May (11·26).

Karki (1988) reported visibility values between 34-61 for a temple tank of Udaipur. In the present study, however, depth of visibility varied between 61-90 cm. Thus indicating higher water clarity due to meagre density of phytoplankton in this pond (Gupta, 1988). Based on water clarity values, pond could be designated as eutrophic (Sharma and Durve, 1991).

The temperature of air and water indicated significant positive correlation (0·8632) which is expected in such small waters (Ganpati, 1963 and Verma, 1967). However, Michaeal (1964) and Timms (1970) did not find such a relationship between air and water temperatures. water temperature and dissolved oxygen showed inverse relationship (Reid, 1 In this pond occasional low levels of dissolved oxygen probably caused asphyxiation in the stocked major carps, which died subsequently. However, common carps and golden carps being hardy fishes, could tolerate such low levels of dissolved oxygen. Thermal structure of shallow pond studied herein has indicated rather weaker thermal gradient (Table 1). Such minor differences in temperature have not been considered as thermocline (Ruttner, 1963) but a case of weak thermal stratification (Sreenivasan, 1968). Ruttner (1963) stated that for a thermocline development, there should be a gradient 3°C per meter. Considering this, the gradient observed in the present study could be explained as a case of weak thermal stratification (Sreenivasan, 1968). Ruttner (*Op. cit.*) while explaining the mode of thermal stratification in tropical waters stated that in such cases effective transfer of heat occurs between surface and bottom waters with slight cooling of surface water.

The water remained alkaline throughout the study period. 5·8-9·1 in arid region of Rajasthan. Interestingly, at times higher pH in the bottom waters may be accounted for higher photosynthetic activity at pond bottom by the periphytonic algae. This is further evidenced by highly significant (0·998) correlation between pH and

total alkalinity in bottom waters. Further, carbondioxide showed significant correlation with the total alkalinity and bicarbonates in bottom waters. The GPP and zooplankton population as such failed to exhibit clear relationship in the pond.

From Table 1 it is evident that in general the decline in carbonate was associated with a rise in bicarbonate and total alkalinity. The gradient in respect of carbonate and bicarbonate varied between 1-30 and 10-60 ppm respectively, which could be due to specific rates of photosynthetic activities in different strata of pond water. Wallen (1955) also considered importance of alkalinity because of its relationship with carbondioxide and photosynthesis. Barrett (1953) considered waters having total alkalinity above 80 ppm as productive. Similarly, Spence (1964) while investing Scotish lakes classified lakes with more than 60 ppm of total alkalinity as 'nutrient rich'. From this point of view, water quality of the shallow pond clearly speaks of its nutrient rich and productive status.

Atkins (1923) stated that phosphates in excess of 0·5 ppm are indication of pollution. Srinath and Pillai (1972) opined that concentration of phosphate in water should be less than 0·05 ppm for the control of algal growth. The data (Table 1) on inorganic phosphate obtained in the present study thus justifies non-polluted status of this water body.

Ganpati (1960) suggested that in Indian waters because of daily formation of and breaking of thermal gradient, adequate amount of phosphate is made available for production. In shallow water system, therefore, such a phenomenon could be expected to operate more efficiently due to small depth. The present findings (Table 1) are in confirmity to the observations of Sreenivasan (1972), who observed traces of phosphates in some waters of South India. Further, on the basis of E. C. values the shallow pond could be considered productive (Rawson, 1960).

In view of the trophic status of the shallow pond studied, the same could be used for rearing juvenile fishes or ornamental fishes after making arrangement for artificial aeration to cope with the occasional depletion in dissolved oxygen. Further studies on the use of various organic manures for the production of zooplankton and fishes may provide useful information for managing such shallow water systems efficiently.

SUMMARY

A shallow pond (22 x 11 x 0·8 m) located in the college campus was studied for selected water quality parameters during April-June, 1988. This pond indicated maximum

thermal gradient of 1·5°C and alkaline water (pH 7·73 ; total alkalinity 522·37 ppm)- Dissolved oxygen showed wide variations from 1·68 to 8·26 ppm. Occasional oxygen depletion led to elimination of major carps from this eco-system. However, common carp and golden craps could tolerate low dissolved oxygen. Considering nutrient level of inorganic phosphate (0·135 ppm), nitrates (0·638 ppm) and elecrical conductance (446·04 µmhos/cm), this pond can be considered moderately eutrophic. Based on the water quality, this pond has been proposed for the culture of ornamental fish or rearing of fish seed after ensuring mechanical aeration to cope with the occasional anoxia.

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