

Seasonal variation in physico-chemical aspects of a fish pond, Jammu, India

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ABSTRACT

In the present investigation (from march 2004 – February 2005), a fish pond was selected at University of Jammu, Jammu to study the physico-chemical properties of water for the assessment of its quality. The physico-chemical factors such as temperature, pH, free carbon dioxide, Dissolved oxygen (DO), Calcium (Ca⁺⁺), Magnesium (Mg⁺⁺), Carbonate (CO₃²⁻), Bicarbonate (HCO₃⁻) and Chloride were investigated. Temperature fluctuated from 11°C to 28°C, pH from 7.7 to 9, DO from 7.2 mg/l to 14 mg/l, Cl⁻ from 15.97 mg/l to 49.9 mg/l, CO₃⁻ from 30 mg/l to 597.7 mg/l, Ca⁺⁺ from 12.03 to 28.06 mg/l, Mg⁺⁺ from 6.86 mg/l to 19.37 mg/l and free carbon dioxide remained absent through out the study period.

Key words:Physico-chemical parameters, pond, physico-chemical parameters.

INTRODUCTION

The survival, distribution and growth of a species are attributes necessary to build healthy population which depend upon various ecological factors (abiotic and biotic) operating in an ecosystem. Therefore, for understanding adjustibilities & adaptations that an organism has to undertake for successful completion of its life cycle, it is imperative that one makes an inquisite study of organisms and its interaction with environment (Welch, 1952). Several workers who have analysed the physico-chemical properties of various ponds of jammu are Puri, 1989; Dalpatia, 1998; Akhtar, 2003; Shvetambri (2007).

MATERIAL AND METHODS

Fish pond is a concrete inland depression of rectangular shape with an area of 157 m² and a depth of 9 feet. The source of water in the pond

was tube well. Fishes inhabiting the pond were *Tor putitora*, *Tor tor*, *Cyprinus carpio*, *Catla catla*, *Cirrhinus mrigala*, *Labeo rohita* and *Puntius* sps. Monthly sampling of water from fish pond was carried during March 2004-February 2005. Physico-chemical parameters were analysed as per ISI (1973) and A.P.H.A. (1985).

RESULTS AND DISCUSSION

During the period of present investigations the water temperature of fish pond was observed to fluctuate from a minimum of 11°C in February to a maximum of 28°C in the month of June. The variations in the water temperature follow closely the variation in air temperature as has been suggested by other workers in the past (Qadri and Yousuf, 1980; Raina *et al.*, 1982; Singh & Singh, 1995; Pandey & Lal, 1995; Siraj *et al.*, 2006 and Shvetambri, 2007). The perusal of table 1 reveals that though the water temperature closely follows

the air temperature yet its value being lower than air temperature in summer and higher than air temperature in winter which is an interesting feature and could be linked to the thermal attributes of water i.e.

- ✓ Water has a high specific heat and
- ✓ Water has a latent heat of fusion.

pH, the measure of hydrogen ion concentration of water in fish pond remained alkaline throughout the study period ranging from 7.7 to 9. Similar observation has been made by Das & Srivastva (1956), Vijaykumar (1992) and Pappa (1995).

The concentration of DO in fish pond recorded seasonal variations from a minimum of 7.2 mg/l in the month of march to a maximum of 14 mg/l in October and January (Table 1). This higher level of DO in winter as compared to summer could possibly be linked with its miscibility with water at lower temperature because of enhancement in gas retaining capacity of oxygen at lower temperature (Jhingran, 1975 and Khalaf and MacDonald, 1975). Free carbon dioxide during the investigation period remained absent in the water of fish pond throughout the year (Table 1). Absence of FCO_2 in water bodies, has often been linked with its consumption in photosynthesis and for formation of carbonates as suggested by Hutchinson (1957), Cole (1975), Wetzel (1975), Jhingran (1982), Patil et al. (1985), Shardendu and Ambasht (1988), Puri (1989), Khajuria (1992) and Dalpatia (1998) in various water bodies.

Chloride content of the water of fish pond (Table 1) was observed to vary from a minimum of 15.97 mg/l (June) to a maximum of 49.9 mg/l (August). The increase of Cl^- in monsoon could have been due to flushing of materials from catchmen area into pond by monsoon rains.

Perusal of table 1 reveals continuous presence of carbonate with their concentration varying from 30 mg/l in April to 78 mg/l in February. Presence of carbonate and concomitant absence of FCO_2 may speak for use of later in converting it into carbonates & bicarbonates (Sehgal, 1980; Patil et al., 1985 and Khajuria, 1992).

Table 1: Mean seasonal variation in physico-chemical parameters pond (March 2004-February 2005)

Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Weather	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Cloudy	Partial cloudy	Sunny	Sunny	Sunny	Sunny
A. temp. (°C)	31(°C)	40(°C)	34(°C)	34(°C)	27(°C)	26(°C)	22(°C)	20(°C)	22(°C)	14(°C)	13(°C)	15(°C)
W:temp (°C)	24(°C)	20(°C)	26(°C)	28(°C)	25(°C)	23.5(°C)	22(°C)	22(°C)	18(°C)	12.5(°C)	12(°C)	11(°C)
pH	7.9	7.7	8.5	8.9	8.3	8.6	7.8	8.9	8.3	8.9	9	8
DO(mg/l)	7.2	8.4	10	10.8	11.6	10.4	8.8	14	10.6	9.6	1	8.4
FCO_2 (mg/l)	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Cl^- (mg/l)	25.948	29.94	31.936	15.968	23.952	49.9	23.952	35.928	17.964	33.931	29.98	29.94
CO_3^{2-}	42	30	60	54	48	42	50	72	42	42	54	78
HCO_3^- (mg/l)	333.4	3.05	176.9	189.1	195.2	201.3	396.3	362.3	372.1	592.8	597.7	390.4
Ca^{++} (mg/l)	25.288	28.06	24.02	14.436	12.03	24.06	15.238	19.03	20.05	17.228	17.03	21.654
Mg^{++} (mg/l)	11.15	15.832	19.37	9.832	6.86	14.58	10.066	7.021	17.01	6.964	10.59	16.524

A look at table 1 exhibits that bicarbonate maxima was recorded in the month of January (597.7 mg/l) and minima in the month of May (76.9 mg/l). Similar trend of summer decrease and winter increase has been shown by Bhatnagar & Sharma (1978), Qadri & Yousuf (1980) and Shafiq (2004).

Calcium is an important macronutrient essential for the various metabolic processes in all the living organism as it provide structural and skeletal material for them. The mean value of calcium ranges from a minimum of 12.03 mg/l in July to maximum of 28.06 mg/l in the month of April (Table 1) during the period of present investigation. The lowest value of calcium during July (monsoon) may be attributed

to dilution of calcium in the pond water by rain (Jhingran, 1975 and Reid & Wood, 1976).

Perusal of table 1 reveals that the concentration of magnesium ranges from a minimum of 6.86 mg/l in the month of July to maximum of 19.37 mg/l in the month of May. Summer increase in magnesium has also earlier been reported by Shastree *et al.* (1991) who have suggested that microbial decomposition of organic matter and fall in water level as a result of evaporation caused by high temperature of summer may be the causative factors for summer maxima of magnesium. Monsoon decrease in mg^{++} due to dilution by rain has also been suggested by Sutcliffe and Carrick (1973)

REFERENCES

1. A.P.H.A., Standard methods for the examination of water, 17th Ed. *American Public Health Association* (1985).
2. Akhtar, R., Assessment of water quality of two high altitude ponds (Sarkoot and Shalimar) with special reference to fish performance. M Phil dissertation, University of Jammu, Jammu (2003).
3. Bhatnagar, G.P. and Sharma, G.P., Physico-chemical features of sewage polluted lower lake Bhopal. Proc. Int. Sympo. On Environmental agents and their biological effects. *Ind. J. Heredity*, Suppl. 2: 212-223 (1978).
4. Cole, C.A., A textbook of limnology. 2nd Edn. New York. The E.V. Mosley Co., London (1975).
5. Dalpatia, B.D., Studies on ecology and population dynamics of zooplankton of some sub-tropical ponds of Jammu. *Ph.D. thesis*, University of Jammu, Jammu (1998).
6. Das, S.M. and Srivastava, V.K., Quantitative studies of freshwater Plankton II. Correlations between plankton and hydrological factors. *Proc. Nat. Sci., India* (B) 26: 243-256 (1956).
7. Hutchinson, G.E., A treatise on limnology Vol. I. Geography, Physics and Chemistry. John Wiley and Sons, Inc. New York (1957).
8. I.S.I. For sampling and test (Physical and Chemical) for water used in Industry. Indian standard Institute, Standard Institute, Manak Bhavan, New Delhi (1973).
9. Jhingran, V.G., Fish and fisheries of India. Hindustan Publishing corporation (Indian), Delhi: 954 (1975).
10. Jhingran, V.G., Fish and Fisheries of India. Hindustan Publishing Corporation (India), Delhi (1982).
11. Jyoti, M.K. and Sehgal, H., Ecology of rotifers of Surinsar, a subtropical freshwater lake in Jammu (J&K) (1979)
12. India. *J Hydrobiologia*, 65(1): 23-32.
13. Khajuria, A., Studies on nekton and benthos of lake Mansar. Ph. D. thesis, Department of Bioscience, University of Jammu, Jammu (1992).
14. Khalaf, A.N. and MacDonald, L.J., Physico-chemical condition in temporary pond in the New forest. *J Hydrobiol.* 47(2): 301-318 (1975).
15. Kumar, S., Dutta, S.P.S., Malhotra, Y.R. and Kumari, V., An ecological study of rotifers in Kunjwani pond, Jammu. *J. Hydrobiol.* 7(1): 41-45 (1991).
16. Pandey, K.K. and Lah, M.S., Limnological studies of Garhwal Himalayan Hill stream Khanda God: Seasonal fluctuation in Abiotic Profile. *J. Freshwater Biol.* 7(1): 7-11 (1995).
17. Pappa, A., Preliminary studies on limnology of Gobbur Tank. M.Phil. Dissertation,

- Gulbarga University. Gulbarga. 66 (1995).
18. Patil, S.G., Harshey, D.K. and Singh, D.P., Limnological studies of a tropical fresh water fish tank of Jabalpur, M.P. *Geobios New Reports*, 4(2): 143-148 (1985).
 19. Puri, A., Limnology of some ponds along the river Tawi near Nagrota, Jammu with reference to the plankton and macrophyte. M. Phil. dissertation, University of Jammu, Jammu (1989).
 20. Qadri, M.Y. and Yousuf, A.R., Limnological studies on Lake Malpur. *Geobios*, 7: 117-119 (1980).
 21. Raina, R., Subla, B.A. and Zutshi, D.P., Water quality and plankton of Jhelum river. *Int. J. Environ. Sci.* 8: 11-17 (1982).
 22. Reid, G.K. and Wood, R.D., Ecology of inland water and estuarial. D. Van. Norstand Company, New Delhi (1976).
 23. Sehgal, H.S., Limnology of lake Surinsar, Jammu with reference to zooplankton and fishery prospects. *Ph. D. thesis*, University of Jammu, Jammu (1980).
 24. Shafiq, M., Limnological assessment of Ranjit Sagar reservoir with special reference to commercial fishery prospects. M. Phil. Dissertation, University of Jammu, Jammu (2004).
 25. Shardendu and Ambasht, R.S., Limnological studies of a rural and an urban tropical aquatic ecosystem. Oxygen forms and ionic strength. *Tropical Ecology*, 29(2): 98-109 (1988).
 26. Shastree, N.K., Islam, M.S., Pathak, S. and Afshan, M., Studies on the physico-chemical dimensions of the lentic hydrosphere of Ravindra Sarovar (Gaya). In : Current Trends in Limnology vol. 1 (Ed. N.K. Shastree) Narendra Publishing House, Delhi. 133-152 (1991).
 27. Shvetambri, Rotifer diversity and polymorphism in some sub-tropical ponds of Jammu. M.Phil. dissertation, University of Jammu (2007).
 28. Singh, P.K. and Singh, S.P., Physico-chemical conditions of river sone at Dalminagar (Bihar). *Freshwater Biol.* 7(2): 93-98 (1995).
 29. Siraj, S., Yousuf, A.R., Bhat, F.A. and Parveen, M., Impact of floating gardens on the water quality and zooplankton community in Dal lake, Kashmir. *Journal of Research & Development.* 6: 25-34 (2006).
 30. Sutcliffe, D.W. and Carrick, T.R., Studies on the mountain streams in English Lake districts Aspects of water chemistry in river Duddon. *Fresh Biol.*, 3: 56-568 (1973).
 31. Vijay Kumar, K., Limnological studies of Perennial and seasonal standing water bodies of Gulbarga area. *Ph.D. Thesis* Gulbarga University. 160 (1992).
 32. Welch, P.S., Limnology. Mc Graw Hill Book Company. New York, London 538 (1952).
 33. Wetzel, R.G., Limnology. W.B. Saunders College Publishers. Philadelphia. 743 (1975).