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Research Article

STATUS EVALUATION OF TWO NEARBY PERENNIAL PONDS OF LOWER SHIWALIKS

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ABSTRACT

The seasonal variations in the physico-chemical parameters of Barjaani Talaab and Baba Santokh Singh Ji Temple pond of Jammu were studied from February, 2016 to January 2017. The parameters that were determined included temperature, pH, transparency, depth, dissolved oxygen (DO), free carbon dioxide, alkalinity, hardness (calcium, magnesium), chloride, biological oxygen demand (BOD), phosphate, sulphate and nitrate concentrations. Monthly variability of various physicochemical parameters was analyzed and statistically, relationships between various physicochemical parameters were also calculated which indicated the strong correlation between various parameters like water temperature, DO, SO_4^{2-}, FCO2, Ca^{2+}, Mg^{2+} etc. The results indicated that the water quality was polluted in both the ponds and the consistent rise in the values of these parameters due to increased input of domestic waste and agricultural runoff from the catchments may further degrade the quality of the water bodies. Also a comparative account of these two ponds indicated that as such the values in case of Barjaani Talaab were higher, so this pond was found to be more polluted than the Baba Santokh Singh Ji Temple Pond. In this attempt the analysis of these abiotic components also revealed the fact that abiotic components are governed by various anthropogenic activities and they in turn affect the biotic components of the water body and so set guidelines for the population dynamics and seasonality of various groups of zooplankton inhabiting any water body.

INTRODUCTION

The physico-chemical parameters of an aquatic ecosystem have direct influence on the life inhabiting it. Any excessive and unwanted changes in these parameters lead to the creation of a harsh environment which limits the growth of organisms by interfering in their physiological processes, ultimately leading to the change in the community structure. India has been bestowed with an ample number of freshwater sources which have different physico-chemical conditions governed by geographical location and also changing seasons. Thus, these physico-chemical conditions are good indicators of the information regarding the status of any water source. Presently an attempt has been made to analyse the seasonal fluctuations as well as record the alarming ratios of various physical and chemical parameters so as to designate the status of two perennial ponds of lower Shiwaliks: Barjaani Talaab and Baba Santokh Nath Ji Temple Pond.

MATERIAL AND METHODS

Study Area: Baba Santokh Nath Ji Temple Pond (POND I) is also located in the District Samba of Jammu and Kashmir at a latitude and longitude of 32.6306 and 74.9613 respectively and covers an area of 12140.57m^2. It is a cemented pond, properly maintained and is perennial in nature; the source of water is the rainfall and the tube well water.

Barjaani Talaab (POND II): It is an important pond in the District Samba of Jammu and Kashmir, known by its local name. It is located at a latitude and longitude of 32.6340 and 74.9430 respectively. It covers an area of 8093.71 m^2. It is a natural pond covered on all sides by heavy vegetation, the source of water being the catchment area and rainfall.

Sampling: The water samples were collected from the pond on monthly basis for a period of 12 months.

S.NO	Physicochemical parameter	Method adopted
1	Air Temperature	Thermometer
2	Water Temperature	Thermometer
3	Depth	Meter rod
4	Transparency	Secchi disc
5	pH	Hanna pH meter
6	DO	Winklers method
7	FCO_2	APHA, 1985
8	CO_3^{2-}	APHA, 1985
9	HCO_3^-	APHA, 1985
10	Ca^{2+}	APHA, 1985
11	Mg^{2+}	APHA, 1985
12	Cl^-	APHA, 1985
13	SO_4^{2-}	APHA, 1985
14	PO_4^{2-}	APHA, 1985
15	NO_3^-	APHA, 1985
16	BOD	APHA, 1985

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The water samples were collected in dried plastic bottles of 1 Litre capacity and brought to the laboratory and immediately analyzed. The sample collection was made during the morning hours between 7:00 AM to 9:30. In total, 16 parameters were analysed; viz: Water Temperature, Air Temperature, Water Depth, Transparency, pH, Dissolved Oxygen, Free Carbon Dioxide, Carbonates, Bicarbonates, Calcium, Magnesium, Chlorides, Phosphates, Nitrates, Sulphates and Biological Oxygen Demand. Out of these, 9 were analysed on the spot at the time of sampling itself and the rest in the laboratory. The methodology followed is described as under:

RESULTS AND DISCUSSION

Temperature

Temperature can be defined as the amount of heat that is stored in volume of water.

In the present investigation atmospheric temperature varied from a minima of 12^0C (Jan) to a maxima of 30^0C (June and July) in Pond I and in Pond II a minima of 13.5°C (Jan) to a maxima of 31°C (June) was recorded and that of the water temperature followed from a minima of 9.5^0C (January) to a maxima of 31^0C (July) in Pond I and in Pond II, a maxima in June and July (30°C) and minima in Jan (9°C) have been reported . Increase in the temperature in the summers may be due to the clear atmosphere and greater amount of sunlight as reported by Zutshi *et al*, 2014 and Khan *et al*, 2015, increased photoperiod which resultes in the increase in day length which causes increased temperature (Sharma *et al*, 2015). Decline in air and water temperature in winters may be due to the oblique incident rays and low solar radiations. (Gayatri *et al*, 2013 and Zutshi *et al*, 2014). A close relationship between air and water temperature has been recorded in the presently studied water body as also strengthened by positive correlation (r = 0.95) at Pond I and (r = 0.98) at Pond II. (Table: 3 & 4)

The minimum depth was reported during the summer season 72cm (May and June) and maximum depth was reported in the monsoon season 110cm (August) in Pond I and in Pond II, the minima of 95 cm in April and May and maxima of 121 cm in August was recorded. The possible reasons for monsoon maxima in depth may be the heavy rainfall and influx of water from the catchment (Sawhney, 2004; Sawhney, 2008 and Choudhary, 2011). The decline in the values of depth in the summers may be due to increased rate of evaporation due to strong sun rays and higher air temperature. At Pond I a positive correlation was observed in between depth and air temperature (0.763) and depth and water temperature (0.544).(Table: 3). Similarly at Pond II positive correlations have been calculated between water depth and air temperature (0.064), water depth and water temperature (0.024), depth and pH (0.502), depth and DO (0.061). Negative correlations have been observed between depth and magnesium (-0.065) and between depth and transparency (-0.887). (Table: 4)

Transparency

Transparency or light penetration is essentially a function of the reflection of light from water surface that depends on the intensity of sunlight, suspended soil particulate, turbid water received from catchment area and density of plankton etc.

The transparency in Pond I varied from a minima of 10 cm (July and August) to a maxima of 30 cm (May). In case of Pond II, the transparency fluctuated between a minima of 14cm (August) a maxima of 30cm (April and June). Least transparency observed in monsoons may be due to heavy rains (Saxena, 2012; Gayatri *et al*, 2013), turbidity of water due to rains which fall directly into the water body and cloudiness. (Gayatri *et al*, 2013). Relationships between transparency and air and water temperature were statistically calculated and it was found to be positively correlated with air temperature (0.76), pH (0.139), DO (0.656), bicarbonates (0.907), Calcium (0.903)and Magnesium(0.928) and negatively correlated with water temperature (-0.88), carbonates (-0.710), chlorides (-0.886), sulphates (-0.796), phosphates(0.836), nitrates (0.840) and BOD (0.426) at Pond 1.(Table: 3) and at Pond 2 it was correlated positively with air temperature (0.3225) and water temperature (03247) and negatively correlated with depth (-0.8871).(Table 4)

Table 1 Showing Monthly Variations in Physico-Chemical Parameters at Pond I from FEB, 2016 to JAN, 2017

Months / Parameters	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN	Mean	Standard deviation
Air Temp (^{0}C)	17	23	29	29	30	30	29	28	20	15.5	15	12	23.12	±6.85
Water Temp (^{0}C)	16.5	21	24	27	30	31	27	27	23	15	11	9.5	21.83	±7.27
Depth (cm)	101	100	93	72	72	108	110	109	100	100	102	102	97.41	±12.75
Transparency (cm)	19.5	21	29	30	25	10	10	11	13	15	18	15	18.04	±7.04
pH	8.1	8.3	8.1	8.1	8.2	8.4	8.3	8.3	8.4	8.5	8.4	8.1	8.26	±0.14
DO (mg/lt)	7.2	5.2	2.8	2.4	2.4	3.6	4.0	5.2	3.6	6.4	7.2	8.0	4.83	±1.99
FCO_2	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent		
CO_3^{2-} (mg/lt)	54	72	84	60	66	90	108	96	72	48	54	30	69.50	±22.22
HCO_3^- (mg/lt)	341.60	248.88	224.48	195.20	175.68	183.00	312.32	263.52	341.60	370.88	414.80	412.36	290.36	±86.91
Ca^{2+} (mg/lt)	27.753	33.64	20.184	20.184	24.389	26.071	27.753	26.912	27.753	33.64	38.686	37.845	28.73	±6.10
Mg^{2+} (mg/lt)	26.30	20.985	13.077	9.675	13.513	11.160	20.958	22.620	23.388	26.817	28.990	28.220	20.47	±6.92
Cl^- (mg/lt)	35	38	48	48	51	65	62	54	44	30	31	33	44.91	±11.82
SO_4^{2-} (mg/lt)	0.0018	0.0018	0.00200	0.00200	0.00206	0.00206	0.00205	0.00205	0.00206	0.00200	0.0018	0.0018	0.0019	±0.00011
PO_4^{2-} (mg/lt)	0.2361	0.4980	0.4754	0.4754	0.4754	0.45194	0.4519	0.4754	0.4980	0.2295	0.2201	0.2301	0.3931	±0.12207
NO_3^- (mg/lt)	0.57240	0.57250	0.57250	0.57250	0.57250	0.57250	0.57250	0.57253	0.57253	0.57240	0.5724	0.5724	0.5724	±0.00054
BOD (mg/lt)	0.4	0.8	1.2	1.4	2.0	1.4	1.2	0.8	1.2	0.8	0.4	0.4	1.05	±0.54

DEPTH

Water depth plays an important role in governing the water quality of any water body and its fluctuations are mainly due to various climatic factors that operate in an aquatic ecosystem. It exhibits an indirect correlation with the differential activities and the life processes of aquatic biota (Kaushik and Saksena, 1991).

Table 2 Showing Monthly Variation in Physico-Chemical Parameters at Pond II From FEB, 2016 To JAN, 2017

Months / Parameters	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN	Mean	Standard Deviation
Air Temp (^0C)	18	23	28	30	31	30	28	29	22	17	16	13.5	23.79	±6.33
Water Temp (^0C)	16	23	25	29	30	30	26	26.5	19	16	10	9	21.62	±7.48
Depth (cm)	102	100	95	95	99	115	121	110	108	103	104	106	104.83	±7.77
Transparency (cm)	22	25	30	28	30	16	14	18	21	20	18	18	21.66	±5.43
pH	8.1	8.5	8.4	8.4	8.5	8.7	8.8	8.5	8.3	8.1	8.3	8.1	8.39	±0.22
DO (mg/lt)	8.4	8.0	6.0	4.8	4.0	4.8	6.4	6.8	7.2	8.4	10	9.2	7	±1.88
FCO_2 (mg/lt)	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent		
CO_3^{2-} (mg/lt)	36	48	54	48	42	60	54	36	36	30	24	24	41	±11.95
HCO_3^- (mg/lt)	292.8	253.76	248.88	244	239.12	246.44	253.76	268.44	317.2	341.6	344.04	348.92	283.24	±43.31
Ca^{2+} (mg/lt)	26.071	20.184	15.979	16.820	19.343	20.184	24.389	26.071	26.071	31.958	32.899	14.667	22.88	±5.98
Mg^{2+} (mg/lt)	12.696	11.619	10.697	10.492	8.907	8.217	10.670	11.646	12.618	12.646	13.899	14.667	11.56	±1.89
Cl^- (mg/lt)	28	33	37	40	40	44	48	39	32	29	27	31	35.66	±6.69
SO_4^{2-} (mg/lt)	0.0018	0.0018	0.00200	0.00200	0.00206	0.00206	0.00205	0.00205	0.00205	0.00200	0.0018	0.0018	0.0019	±0.0001
PO_4^{2-} (mg/lt)	0.2361	0.4980	0.4754	0.4754	0.4754	0.4519	0.4519	0.4754	0.4754	0.2295	0.2201	0.2301	0.3912	±0.1204
NO_3^- (mg/lt)	0.57240	0.57250	0.57250	0.57250	0.57250	0.57250	0.57250	0.57253	0.57253	0.5724	0.5724	0.5724	0.5724	±0.000011
BOD (mg/lt)	0.6	1.2	1.2	2.2	2.4	2.8	3.1	2.2	1.8	1.0	1.4	1.0	1.77	±0.93

pH (Potentia Hydrogenii)

The ionization of the water results in the hydrogen ions and hydroxyl ions concentration. These two ions are responsible for the acidity and basicity of the water.

The pH of water varied from a minima of 8.1 (Feb, Apr, May, Jan) to a maxima of 8.5 (Nov) at Pond I during the period of study. At Pond II it fluctuated between a maximum of 8.8 (Aug) to a minima of 8.1 (Feb, Nov, Jan). Interestingly, it was observed that the pH showed a distinct pattern and remained alkaline throughout the study period in both the ponds. High value of pH in winters may be due to the high DO level as DO and pH are positively correlated, abundance of phytoplankton growth which produces more DO and increases pH, less organic matter that produced less carbon dioxide thus shifting pH towards alkaline side and absence of free carbon dioxide and presence of carbonates and bicarbonates. Low pH in summers may be attributed to the universal fact that during the summer with increase in the water temperature, decay and decomposition activities enhance. Statistical analysis has also been worked out which showed a positive correlation between pH and air temperature (0.153), water temperature (0.233), transparency (0.139), and pH and DO (0.105) at Pond I. There was negative relationship only between pH and depth (-0.319) and pH and phosphates (-0.056). (Table 3)

At Pond II, positive correlation between pH and air temperature (0.790), pH and water temperature (0.769), pH and carbonate (0.800). negative correlations have been calculated between pH and transparency (-0.155), pH and DO (-0.596), pH and bicarbonate(-0.790), pH and calcium (-0.150), pH and magnesium (-0.747). (Table: 4)

Dissolved Oxygen (DO)

Dissolved oxygen is essential for most of the aquatic organisms as it helps in the process of respiration. The presence of oxygen in any aquatic ecosystem is mainly determined by the input of oxygen from the atmosphere and by photosynthesis and by the output from chemical and biological oxidation process.

During the present studies, the DO values varied from a minimum of 2.4mg/litre (May & June) to a maxima of 8.0mg/litre (Jan) at Pond I and in Pond II the values were fluctuated between a minima of 4.0mg/litre (June) to a maxima of 10mg/litre (Dec). Low values of DO in summers may be due to increased water temperature which decreases solubility of DO and also enhances metabolism of organisms (Gayathri *et al*, 2013 and Patel, 2016), high light intensity during summers act as a limiting factor for photosynthesis and hence lowers the photosynthetic activity which ultimately reduces DO. (Singh, 2004) and high rate of oxidation of organic matter. (Harney *et al*, 2013; Patel, 2016).

Table 3 Showing Correlation among Various Physico-Chemical Parameters At Pond I

	Air temp	Water temp	Depth	Transparency	pH	DO	FCO_2	CO_3^{2-}	HCO_3^-	Ca^{2+}	Mg^{2+}	Cl^-	So_4	PO_4	NO_3	BOD
Air temp	1															
Water temp	0.947	1														
Depth	0.763	0.544	1													
Transparency	0.763	-0.870	0.572	1												
pH	0.153	0.233	-0.319	0.139	1											
DO	-0.683	-0.861	-0.071	0.656	0.105	1										
FCO_2	-	-	-	-	-	-	1									
CO_3^{2-}	0.978	0.937	0.675	-0.710	0.193	-0.574	-	1								
HCO_3^-	-0.971	-0.958	-0.715	0.906	0.232	0.839	-	-0.516	1							
Ca^{2+}	-0.869	-0.979	-0.407	0.903	0.399	0.845	-	0.794	-0.512	1						
Mg^{2+}	-0.888	-0.982	-0.472	0.928	0.283	0.890	-	0.938	-0.444	0.833	1					
Cl^-	0.940	0.922	0.745	-0.886	0.004	-0.706	-	-0.696	0.845	-0.642	-0.696	1				
So_4	0.746	0.894	0.206	-0.796	0.261	-0.761	-	-0.547	0.624	-0.659	-0.577	0.739	1			
PO_4	0.834	0.935	0.415	-0.836	-0.056	-0.861	-	-0.784	0.716	-0.681	-0.725	0.722	0.627	1		
NO_3	0.864	0.946	0.467	-0.840	0.019	-0.820	-	-0.717	0.761	-0.657	-0.653	0.754	0.691	0.981	1	
BOD	0.472	0.700	-0.191	-0.426	0.098	-0.911	-	-0.761	0.395	-0.649	-0.797	0.624	0.738	0.673	0.626	1

Correlation analysis showed a negative correlation of DO with air temperature (-0.6831), water temperature (-0.8619) and depth (-0.0715) whereas a positive correlation with transparency (0.6562) and pH (0.1059) at Pond I. Similarly at Pond II negative correlation with air temperature (-0.927), water temperature (-0.928), transparency (-0.436) and pH (-0.596) was observed. [Table 3 and 4]

Table 4 Showing Correlation among Various Physico-Chemical Parameters at Pond II

	Air temp	Water temp	Depth	Transparency	pH	DO	FCO2	CO32-	HCO3-	Ca2+	Mg2+	Cl-	So42-	PO42-	NO3-	BOD
Air temp	1															
Water temp	0.980	1														
Depth	0.064	0.024	1													
Transparency	0.322	0.342	-0.887	1												
pH	0.790	0.769	0.502	-0.155	1											
DO	-0.927	-0.928	0.061	-0.436	-0.596	1										
FCO2	-	-	-	-	-	-	-									
CO32-	0.799	0.833	0.137	0.200	0.800	-0.743	-	1								
HCO3-	-0.918	-0.947	0.061	-0.424	-0.790	0.851	-	-0.876	1							
Ca2+	-0.390	-0.365	0.300	-0.471	-0.150	0.484	-	-0.462	0.510	1						
Mg2+	-0.903	-0.933	-0.065	-0.295	-0.747	0.921	-	-0.849	0.875	0.354	1					
Cl-	0.854	0.825	0.440	-0.068	0.869	-0.783	-	0.786	-0.774	-0.412	-0.791	1				
So42-	0.741	0.705	0.274	0.053	0.443	-0.751	-	0.496	-0.468	-0.052	-0.674	0.697	1			
PO42-	0.870	0.860	-0.016	0.396	0.685	-0.749	-	0.745	-0.825	-0.276	0.708	0.708	0.620	1		
NO3-	0.840	0.808	0.110	0.259	0.661	-0.698	-	0.660	-0.732	-0.340	0.692	0.692	0.691	0.976	1	
BOD	0.778	0.758	0.573	-0.274	0.840	-0.701	-	0.585	-0.586	-0.069	0.933	0.933	0.746	0.635	0.671	1

Alkalinity (Carbonates and Bicarbonates)

As acidity is determined by free carbon dioxide, so is the alkalinity which is determined by carbonates and bicarbonates, which is the measure of buffering capacity of water.

The carbonates fluctuated between a minima of 30mg/litre (Jan) to a maxima of 108mg/litre (August) in Pond I and in Pond II, the values remained between a minima of 24mg/litre (Dec and Jan) to a maxima of 60mg/litre (July). Monsoon maxima of carbonates may be due to complete absence of FCO_2 due to uptake of phytoplankton community (Sharma, 1999; Sharma, 2002 and Singh, 2004) and inverse relationship with free carbon dioxide (Ahmed, 2004). The maximum value of bicarbonates was 414.80 mg/litre in December and minimum in 175.68 mg/litre in June at Pond I. At Pond II, the maxima was observed in the month of January, 348.92mg/litre and minima was reported in June 239.12 mg/litre.. The possible reasons for winter maxima of bicarbonates may be the reduction in the photosynthetic activity during the winters which result in decreased demand for the bicarbonates as a source of carbon in photosynthesis. (Sharma, 2013) and conversion of insoluble marls into soluble bicarbonates by free carbon dioxide. Correlation analysis showed a negative correlation between bicarbonates and air temperature (-0.971), water temperature (-0.958), depth (-0.715) and positive with transparency (0.906), pH (0.232) and DO (0.839) at Pond I (Table: 3) and at Pond II a negative correlation of pH and bicarbonates (-0.790), air temperature (-0.918), water temperature (-0.947), transparency (-0.424), chloride (-0.774), sulphate (-0.468), phosphates (-0.825), nitrates (-0.732) and BOD (-0.586) has been worked out. (Table: 4)

Free Carbon Dioxide

The free carbon dioxide in any water body is due to the decay and decomposition activities carried out by microbes and by respiration. It adds to the acidity of the water body by the formation of carbonic acid. The amount of free carbon dioxide is dependent on two major processes: photosynthesis and respiration. The complete absence of free carbon dioxide at both the ponds during the period of study may be due to the presence of appreciable amount of carbonates and bicarbonates in water body (Annalakshmii and Amsath, 2012), higher amount of dissolved oxygen as DO and FCO_2 share an inverse relation with each other (Joshi *et al*, 1993; Prakash *et al*., 2009) and high rate of photosynthesis (Vijayvergia 2012).

Total Hardness (Calcium and Magnesium)

Total hardness is an important component of any aquatic ecosystem in detecting the water pollution. It is mainly found as carbonates and bicarbonates of calcium and magnesium and sometimes as sulphates and chlorides of calcium and magnesium. Having higher solubility than calcium, magnesium adds to the hardness of the water body together with the calcium and both of them play an important role in antagonizing the toxic effects of various ions by neutralizing excess acid produced (Munawar, 1970).

The calcium and magnesium values were high in winters and low in summer during the study period and were found to be within a minima of 20.184 mg/litre (Apr and May) and a maxima of 38.686 mg/litre (Dec) at Pond I for calcium and and at Pond II, these varied from a minima of 15.979 mg/litre (Apr) to a maxima of 32.899 mg/litre (Dec). Similarly the values of magnesium varied from a minima of 9.675mg/litre in May to a maximum of 28.990 mg/litre in December at Pond I and at Pond II Magnesium fluctuated between a minima of 8.217 mg/litre (July) to a maxima of 14.667 mg/litre (Jan).

The maxima of calcium and magnesium in winters may be due to the reduced evaporation due to low temperature which increases solubility (Sawhney, 2004; Abdel- Satar, 2005; Sawhney, 2008; Garg *et al*, 2009 and Singh and Gupta, 2010). The minima of calcium and magnesium was found to be in summer as in summers, there is high phytoplanktonic growth, so maximum uptake of calcium and magnesium takes place which results in the reduction in this period. (Munawar, 1970; Sawhney, 2008; Sharma, 2013) and also that the solubility of calcium and magnesium at high temperature decreases. (Wetzel, 1974 and Abdel-Satar, 2005). Correalation analysis revealed that there existed a positive correlation between calcium and transparency (0.903), pH (0.399), DO (0.845), carbonates (0.794) and magnesium (0.833) at Pond I. Similar correlations have been observed for Magnesium as well. In Pond II, positive correlations of magnesium have been calculated for depth (0.300), DO (0.484), bicarbonates (0.510) and Magnesium (0.355). [Table 3 and 4].

Chlorides

Chloride is one of the essential anion and a vital micronutrient occurring in variable quantities in all water bodies. It influences the salinity and ion exchange. Higher chloride content indicates high pollution level mostly due to the sewage and industrial wastes.

During the period of study it was observed that the minimum record of chloride was 30mg/litre in the month of November and the maximum value was 65mg/litre in the month of July at Pond I. Similarly at Pond II, the values were between a minima of 27mg/litre in December and a maxima of 48mg/litre in August. Winter minima of chlorides may be because of the low temperature that loweres the rate of decomposition of organic matter thereby lowering the recycling of minerals including release of chloride ions.

The higher values of chloride ions in the months of monsoon season may be attributed to a most accepted fact that the monsoon rains bring along with them the salts containing chloride ions from the catchment areas, thus increasing the amount of chlorides in the water body. Similar reasons have been cited by Sharma *et al*. (2010) in Gundolav Lake, Kishangarh, Sinha & Biswas (2011) in Kalyani Lake and Slathia, 2014 in Lake Mansar. Correlation between chlorides showed that there was a positive relationship with all the parameters except transparency (-0.886), DO (-0.7065), carbonate (-0.696) and calcium (-0.642) in Pond I and in Pond II, similar relationships have been found between these parameters like transparency showing a negative correlation (-0.068), DO (-0.783), bicarbonate (-0.774) and Calcium (-0.412). [Table 3 and 4]

Sulphates

It is one of the most important and abundant forms of sulphur present in the water bodies. It is necessary for the proper growth of plankton. It is an important parameter while determining the trophic status of any aquatic ecosystem, thus rendering the water body as fit or unfit for consumption.

The sulphur content in the water bodies varied from a minima of 0.0018mg/litre (Feb, Mar, Dec, Jan) to a maxima of 0.00206mg/litre (June, July, Oct) at Pond I and at Pond II these values fluctuated between a minima of 0.0018mg/litre (Feb, Mar, Dec, Jan) and a maxima of 0.00206mg/litre in June and July.

The monsoon maxima at both the Ponds may be due to the rains which bring along with them small amount of sulphates. The winter minima of sulphates may be due to dilution effect caused by rains and low temperature resulting in the decrease in microbial activity, thus increasing the reduction of sulphates into sulphides.

Phosphates

Phosphorus is a very essential element for all the living organisms. In aquatic ecosystems, it is mainly present as soluble orthophosphates. It is one of the most important limiting factors which is helpful in determining the water quality. Any deficiency in the quantity of phosphorus leads to the decline in the productivity of the water body.

The phosphate showed bimodal peak, one in the month of March (0.4980mg/litre) and the other with the same amount of phosphate in the month of October (0.4980mg/litre) and a minima of 0.2201mg/litre in the month of December at Pond I. In case of Pond II, a minima of 0.2201mg/litre was recorded in the month of December whereas a maxima of 0.4980mg/litre was observed in the month of March.

The possible reason for winter minima may be the uptake of phosphates by algae which increases in winter and its precipitation with carbonates at high pH in winters. (Sawhney, 2008). The maxima in summer may be because of the reduction in volume of water due to evaporation of water and increase in the rate of organic matter decomposition at higher temperature leading to release of the nutrient in the water by recycling (Reddy *et al*., 2007). Statistically calculated correlations revealed that there is a positive correlation between Phosphates and air temperature (0.835), water temperature (0.935), depth (0.415), bicarbonates (0.716), chlorides (0.722) and Sulphates (0.627) at Pond I. (TABLE: 3) At Pond II, positive correlations have been recorded with all except with the depth (-0.808), DO (-0.749), bicarbonate (-0.825) and calcium (-0.276). (TABLE: 4)

Nitrates

Nitrates represent the oxidized form of nitrogen which is the end product of aerobic decomposition in aquatic environment. The existence of nitrates is mainly dependent upon the action of nitrifying bacteria, and the nature of the surrounding catchment areas which may contain nitrates. The variations in the amount of nitrates in a water body are also an important criterion for the assessment of water quality.

In the present investigation the values of nitrates at both the ponds fluctuated between a minima of 0.5724mg/ litre in Feb, Nov, Dec, Jan and a maxima of 0.57253mg/litre in the months of September and October i.e. in monsoons.

The monsoon maxima in the value of nitrates during the study period may be due to the influx of water due to inflow from the catchment. (Shukla *et al*, 1989) and the values were minimum in the winters may be due to the uptake of nitrate by phytoplankton community of aquatic ecosystem and by reduction of nitrates by denitrifying bacteria (Abdel-Satar, 2001). Statistically, in Pond I, negative correlations of nitrates have been established with transparency (-0.840), DO (-0.911), carbonate (-0.717), calcium (-0.657) and magnesium (-0.653) and in Pond II negative correlations have been calculated only for DO (-0.698), bicarbonate (-0.732) and Calcium (-0.340). [Table 3 and 4].

Biological Oxygen Demand

It is defined as the quantity of oxygen required by the microbes to decompose the organic matter present in the water body under aerobic condition. The presence of BOD in the water body hints towards the occurrence of organic matter in the water which consumes dissolved oxygen and indicates the pollution load. Higher the amount of BOD, higher is the pollution.

The present investigations indicated higher amount of BOD in the summer season, values of BOD ranged between a minima of 0.4mg/litre (Dec and Jan) and a maxima of 2mg/litre (June) at Pond I and a minima of 0.6mg/litre (Feb) and a maxima of 3.1mg/litre (Aug) was in the Pond II. The maxima of BOD in summer may be because of high temperature which increases metabolism, thus increasing the oxygen uptake and increases microbial activity of decomposition of organic matter, the process which requires higher amount of oxygen.

The winter minima of BOD may be because of high DO and also because of lower temperature reduces the microbial action. (Shiddamallayya and Pratima, 2008).

CONCLUSION

Management of any water body like pond essentially requires an understanding of the physico-chemical and biological characteristics. The aquatic ecosystem is an area controlled by the changes in factors such as light, heat, humidity and contamination of various effluents in the water body. It can also be said that the overall productivity of any water body is directly regulated by physico-chemical as well as by biological parameters. Presently it appears from the compiled data that although the two water sources are within the same latitude, still they show variability in the physico- chemical characteristics. It appears that not only the geographic and seasonal factors regulate such variabilities but also that the influence of certain external pressure like domestic activities of bathing, washing, addition of industrial effluents make a remarkable change in these characteristics. An investigatory view of the data supports the fact that Pond I is most under such anthropogenic pressure and thus comparatively more towards the high trophic status.

References

Abdel-Satar, A.M. (2005). Water quality assessment of river Nile from Idfo to Cairo. *Egyptian Journal of Aquatic Research*, 31(2): 200-223.

Annalakshmi, G. and Amsath, A. (2012). Studies on the hydrobiology of river Cauvery and its tributaries Arasalar from Kumbakonam Region (Tamilnadu, India) with reference to zooplankton.

Choudhary, A. and Ahi, J. (2015). Analysis of water quality in Polluted Sagar Lake by investigating different physico-chemical parameters. *International Journal of Multidisciplinary Research and Development,* 2(9): 25-30.

Garg R.K., Rao R.J. and Saksena D.N. (2009). Correlation of molluscan diversity with physico-chemical characteristics of water of Ramsagar reservoir, India. *Inter. J. Biodivers. Conserv.,* 1(6): 202-207.

Gayathri, S., Latha, N. and Ramachandra Mohan, M. (2013). Impact of Climate Change on Water Quality of Shoolkere Lake, Bangalore. *Journal of Academia and Industrial Research*. 2(6): 362-368.

Harney, N.V., Dhamani, A.A. and Andrew, R.J. (2013). Seasonal variations in the Physico-chemical parameters of Pindavani pond of Central India. *Weekly Science*, 1(6): 1-8.

Joshi, B.D. and Bisht, R.C.S. (1993). Some aspects of physico-chemical characteristics of western Ganga canal near Jwalapur at Haridwar. *Himalayan Journal of Environment and Zoology*, 7: 76-82.

Kaul, V. (2000). Effect of industrial wastes and domestic sewage on abiotic and biotic (macrobenthic invertebrates and fish) components of Behlol nullah, Jammu. Ph.D Thesis, University of Jammu, Jammu.

Kaushik, S. and Saksena, D.N. (1995). Trophic status and rotifer fauna of certain water bodies in Central India. *Journal of Environmental Biology*, 16(4): 283-291.

Kaushik, S. and Saksena, D.N. (1999). Physico-chemical limnology of certain water bodies of central India. *Vijaykumar, K. Freshwater ecosystem of India. Daya Publishing House, Delhi*, 1-336.

Kaushik, S. and Saxena, D.N. (1991). Water quality of Suraj kund, Gwalior and its management. *Envi. Poll. And Resource of Land and Water*, 181-188.

Khan, A.A., Shammi Q.J., Dar, S.H. and Nabi, N.G. (2015). Seasonal variations in physicochemical parameters in upper lake of Bhopal (M.P). *International Journal of Applied and Universal Research*. 2(2).

Manawar, M. (1970). Limnological studies on freshwater ponds of Hyderabad-India I. The Biotope. *Hydrobiologia*, 35(1): 127

Patel, P.K. (2016). Water Analysis of Fish Pond of Shahdol (M.P) India. *International Journal of Applied Research,* 2(1): 235-238.

Prakash, K.L., Raghavendra, K. and Sonashekhar, R.K. (2009). Temporal scale spectral variability analysis of water quality parameters to realize seasonal behavior of a tropical river system- river Cauvery, India. *Journal of Environmental Biology,* 30(2): 235- 240.

Reddy, K.R., Fisher, M.M., Wang, Y., White, J.R. and James, R.T. (2007). Potential effects of sediment dredging on internal phosphorus loading in a shallow, subtropical lake. *Lake and Reservoir Management,* 23: 27-38.

Sawhney, N. (2004). Limnology of Ban-Gangawith special reference to some consumers inhabiting the stream. M.Phil Dissertation, University of Jammu, Jammu.

Sawhney, N. (2008). Biomonitoring of river Tawi in the vicinity of Jammu city. Ph. D Thesis, University of Jammu, Jammu.

Sharma, V. (2013). Sediment Characterization of some sections of River Tawi and its impact on Macrobenthic invertebrayes faunal diversity. PhD Thesis, University Of Jammu.

Shiddamallayya, N. and Pratima, M. (2014). Impact of domestic sewage on fresh water body. *Journal of Environmental Biology*, 29(3): 303-308

Singh, H.P., Mishra, J.P. and Mahaver, L.R. (1998). Observation on certain physicochemical characteristics of water in relation to pollution of river Ramganga. *Journal of Environment Biology,* 19(4): 353- 356.

Sinha, S.N. and Biswas, M. (2011). Analysis of physico-chemical characteristics to study the water quality of a lake in Kalyani, West Bengal. *Asian Journal of Experimental and Biological Sciences,* 2(1), 18-22.

Vijayvergia, R.P. (2012). Ecological studies of lake Udaisagar with reference to its physico-chemical environment. *Nature, Environment and Pollution Technology*, 11(2): 257-259.

Zutshi, B., Noor, N. and Sreekala, G. (2014). Seasonal Assessment of water quality and trace metal content in Vengaiah and Yellamalappa Chetty Lakes of Bangalore City, Karnataka. *The Ecoscan*, VI: 413-422.

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