



Assessment of Physico Chemical Parameters of Sanjul Lake, Phulambri, Dist. Aurangabad (M.S.) India

Rafatunisa Nahri

Sir Sayyed College, Aurangabad, India

ABSTRACT

The water quality assessment of water from Lentic habitat, Sanjul Lake has been reported. In this paper atmospheric temperature, water temperature, Humidity, rainfall, pH, acidity, alkalinity, Dissolved oxygen, total nitrogen, sulphates, phosphates, chlorides, total solids etc., is monitored for two years 2014-2015 and 2015-2016. The seasonal variation in these physico chemical parameters has been discussed.

Keywords: Water quality; Pollution; Lentic habitat

INTRODUCTION

Monitoring the water ponds is essential, to find out the pollution status of the water bodies. There is usually a positive co-relation between the seasonal changes in physico chemical characteristics of water and the productivity of a lentic body. Fluctuations in water quality from season to season affect the composition of the living community.

Lakes and ponds are lentic systems, many of which are fed and drained by rivers and streams, natural lakes and ponds are found predominantly in mountainous regions. Many artificial lakes and reservoirs are constructed for agricultural or industrial purpose.

The physico chemical parameters are also important because different aquatic species relates with the physico chemical parameters of the water bodies. Some parameters are required for the healthy growth, whereas some of the parameters adversely affect the growth of the aquatic species.

EXPERIMENTAL SECTION

Water samples were collected from about 15 cm below the surface of water in wide mouthed screw capped airtight and opaque polythene containers. The samples were collected fortnightly from June 2014 to May 2016. The samples were collected on 1st and 15th of every month around 9.00 a.m. The atmospheric and water temperature was recorded with the help of digital portable kit. The digital portable kit is an excellent instrument for field operations. The date of humidity and rainfall was collected from meteorological department Chikalthana, Aurangabad. The pH of the sample was recorded with "Systronic portable pH meter".

Dissolved oxygen, Acidity, total alkalinity, hardness, Nitrogen, Sulphate, phosphates, total solids etc. has been determined as per the procedures given in literature [1-9].

There are three seasons during a year in this region, namely summer (February to May), Monsoon (June to September) and winter (October to January). The summer season is characterized by clear sky with relatively longer duration of day and more intensity of light. During monsoon, the sky is cloudy humidity is relatively more and temperature is moderate to high. The winter has relatively brighter days with clean sky and lesser during of day. As all ecological factors are influenced by the duration and intensity of sunlight, humidity, atmospheric

and water temperature, various physico chemical variables were studied season wise and at the selected sample station, during the present study over a period of two years.

RESULTS AND DISCUSSION

Atmospheric temperature

The effect of temperature as an environment factor is evident; however its influence is not direct. The annual range of temperature was 16.4°C-31.2°C during 2014-2015 and 15.2-31.1°C during 2015-2016. The range of temperature during 2014-2015 in monsoon was 22.2-27.4°C, in winter 15.0°C-28.0°C and in summer 16.2°C-31.2°C while during the year 2015-2016 the range was 22.3°C-29.2°C, 16.0°C-24°C and 17.6°C-31.5°C in monsoon, winter and summer respectively. During 2014-2015 the range of temperature was narrow in monsoon (0.5°C) wide in winter (13.0°C), much wider in summer (16.2°C). During 2015-2016 the range was narrow and almost identical in monsoon and winter (6.90 and 8°C) respectively, while in summer it was much wider (13.9°C).

Water temperature

The Water temperature was consistently lower than the atmospheric temperature by 1°C-3°C throughout (Table 1).

Table 1. Showing the variations in water temperature (°C) during 2014-2015 (*) and 2015-2016 ().**

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	*	17.4	21.2	19.3	21.3	23.6	24.7	21.6	22.2
	**	24.9	24.8	24.1	23.6	26.1	27.2	28.3	29.1
Winter	*	21.4	23.7	23.1	24.9	18.7	12.3	13.2	13.1
	**	27.1	24.9	22.2	23.7	26.1	22.8	11.4	12.6
Summer	*	13.1	16.4	16.9	18.3	21.2	23.6	23.6	27.3
	**	31.7	31.4	31.6	34.7	34.7	33.8	34.8	38.4
	**	31.6	31.3	33.3	32.7	35.8	32.4	39.1	38.8

Humidity

The range of percentage of humidity during 2014-2015 was 15%-85% during 2015-2016 it was 20%-92%. The range of percentage of humidity during 2014-2015 was 41%-62%, 61-84% and 15%-65% in winter, monsoon, and summer respectively. Thus, the rate of humidity was narrow in winter, wide in monsoon and much wider in summer being 21%, 23% and 50%. During 2015-2016 the range in winter and 35%-83% in monsoon 66%-92% and in summer 20%-69%. Thus, the range was narrow in monsoon, wide in winter and wider in summer being 26%, 48% and 49% respectively (Table 2) [10,11].

Table 2. Showing the variations in humidity (%) during 2014-2015 (*) and 2015-2016 ().**

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	**	64	71	20	31	31	22	26	22
	*	78	62	73	68	79	85	73	81
Winter	**	68	90	74	80	82	92	92	92
	*	50	43	51	59	60	51	41	49
Summer	**	82	75	62	34	43	46	80	62
	*	50	55	65	30	15	56	64	39
Summer	**	64	71	20	31	31	22	26	22

Rainfall

The total rainfall recorded during 2014-2015 was 394.6 mm and during 2015-2016 584.4 mm. The season wise analysis of the rainfall showed that it was at its peak during monsoons and least during summers of both the years. The range of rainfall recorded was 0.1-6.1 mm and 2.1-5.2 mm in monsoon and winter respectively during 2014-2015. During 2015-2016 in monsoon the range was 3.89-30.7 mm and in winter it was recorded in I and II fortnight of October, November, and December. It was not recorded during summers of both the years (Table 3).

Table 3. Showing the variations in Rainfall (mm) during 2014-2015 (*) and 2015-2016 ().**

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	*	-	0.6	-	0.1	-	3	-	6.1
	**	30.7	-	18.4	-	-	10.4	-	3.8
Winter	*	-	5.2	2.1	-	-	-	-	-
	**	25.5	-	13.3	-	-	0.7	-	-
Summer	*	-	-	-	-	-	-	-	-
	**	-	-	-	-	-	-	-	-

Hydrogen ion concentration (pH)

The acid or the base character of any aqueous solution can well be defined by means of a single variable the hydrogen ion activity. During the present study, the range was 6.9-7.9 and 6.6-7 during 2014-2015 and 2015-2016 respectively. It was maximum in winter and minimum in monsoon during both the years. The range was 6.7-7.3 in monsoon, 7.5-7.9 in winter and 6.8-7.6 in summer during 2014-2015. The range was narrow in winter (0.4), wide in monsoon (0.6) and relatively wider in summer (0.8). During 2015-2016 the range was 6.9-7.3, 7.2-7.6 and 7.0-7.7 in monsoon, winter, and summer, respectively. The range was narrow and identical during monsoon and winter (0.4) and wide in summer (0.7) (Table 4).

Table 4. Showing the variations in Hydrogen ion Concentration (pH) during 2014-2015 (*) and 2015-2016 ().**

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	**	6.8	6.9	7	7.2	7.4	7.1	7.3	7.1
	*	6.8	6.7	6.9	7.2	7.1	7.3	7	7.2
Winter	**	6.9	7.1	7.2	7	7.3	6.9	7.2	7.1
	*	7.8	7.9	7.6	7.8	7.6	7.7	7.5	7.8
Summer	**	7.4	7.2	7.3	7.5	7.6	7.5	7.4	7.6
	*	6.8	6.9	7.1	7.2	7.4	7.1	7.5	7.6
Summer	**	7.2	7	7.1	7.3	7.4	7.5	7.7	7.6
	**	6.8	6.9	6.8	7.1	7	7.2	7.3	7.1

Acidity

The acidity in natural water is primarily due to dissolved carbon dioxide. However, in water polluted by industrial water it is because of mineral acids. During the present study, an amount of CO₂ was recorded occasionally and that too in very low quantities. It was recorded in 1st fortnight of April, May and June and 2nd fortnight of April during 2014-2015 and during 2015-2016 it was recorded in 1st fortnight of June, July and May and 2nd fortnight of March, April, May and June. It was 0.25-0.75 ppm during both the years (Table 5).

Table 5. Showing variations in Acidity (PPM) during 2014-2015 (*) and 2015-2016 (**).

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	*	0.25	-	-	-	-	-	-	-
	**	0.25	0.25	0.25	-	-	-	-	-
Winter	*	-	-	-	-	-	-	-	-
	**	-	-	-	-	-	-	-	-
Summer	*	0.25	-	-	-	0.25	0.5	0.5	-
	**	-	-	-	0.75	-	0.25	0.75	0.75

Total alkalinity

Alkalinity is the contribution of hydroxide, carbonate, and bicarbonate. Numerically it is an equivalent concentration of titratable base and is determined by titration with a standard solution of strong acid, to certain equivalence points as given by the indicator solution. Natural waters contain appreciable amounts of carbonate and bicarbonate alkalities. The range was 51.90-77.75 ppm in 2014-2015 and 48.99-74.18 ppm in 2015-2016. The season wise analysis of total alkalinity showed that it was maximum in monsoons and minimum in winters of both years. During 2014-2015 the total alkalinity ranged between 62.59-78.45 pm, 51.98-61.76 ppm and 56.13-74.53 ppm in monsoon, winter, and summer, respectively. The range was narrow in winter (9.78), wide in monsoon (15.86 ppm) and wider in summer (18.4 ppm). During 2015-2016 the range was 62.74-74.12 ppm, 48.14-61.46 ppm and 51.32-70.30 in monsoon, winter, and summer, respectively. The range was narrow in monsoon (11.38 ppm) wide in winter (13.32 ppm) and much wider in summer (18.98 ppm) (Table 6).

Table 6. Showing variations in total alkalinity (PPM) during 2014-2015 (*) and 2015-2016 (**).

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	*	64.11	62.59	65.23	72.33	76.32	71.04	69.12	78.45
	**	52.74	53.96	58.28	59.32	55.89	56.11	60.87	61.76
Winter	*	60.89	61.76	56.76	54.5	58.96	59.36	54.04	51.98
	**	61.02	61.46	60.31	59.82	54.13	53.91	48.76	48.14
Summer	*	56.13	58.04	62.43	64.36	69.3	70.94	73.89	74.53
	**	70.3	69.33	65.53	64.24	63.92	53.83	51.32	52.3
	**	25.09	27.03	29.04	30.76	34.53	36.24	37.16	37.01

Total hardness

Hardness of water is caused by the bivalent metallic ions as cation Ca, Mg, Sr, Fe, Mn, and anions HCO_3^- , SO_4^{2-} , Cl^- , NO_3^- and SiO_3^{2-} . Temporary hardness is caused by the presence of HCO_3^- of Ca and mg. Permanent hardness is mostly due to SO_4^{2-} . The annual range of total hardness during 2014-2015 was 30-58.2 ppm and during 2015-2016 the range of the hardness was 35.2-58.3 ppm. Seasonal analysis showed that the hardness recorded during present study was maximum during summer and minimum during winter of both the years. It showed the range of hardness recorded was 40.3-51.6 ppm, 35.8-48.8 ppm and 32.6-53.0 ppm in monsoon, winter, and summer respectively during 2014-2015. The range was narrow and almost identical in monsoon (11.3 ppm) and winter (13.0 ppm) wider in summer (20.4 ppm). During 2015-2016 the range was 47.5-55.2 ppm in monsoon, 40.2-52.8 ppm in winter and 43.6-63.3 ppm in summer, with a narrow range in monsoon (7.2 ppm), wide range in winter (12.6 ppm) and much wider range in summer (19.7 ppm) (Table 7).

Table 7. Showing variations in quantity of total Hardness (PPM) during 2014-2015 (*) and 2015-2016 (**).

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
	**	68.2	64.4	80.7	93.8	93.6	82.4	88.9	94.4
Monsoon	*	45.4	40.3	42.4	46.3	50.4	51.6	49.8	50.6
	**	47.5	49.9	48.9	46.5	49.3	52.4	55.2	54.6
Winter	*	35.8	38.6	42.5	39.6	48.8	46.2	47.7	44.2
	**	42.3	40.2	43.1	45.4	51.2	49.3	52.2	52.8
Summer	*	32.6	34.6	36.9	42.2	44.5	46.2	53	51.7
	**	43.6	44.7	53.4	55.5	57.3	61.6	63.3	62.9

Dissolved oxygen

The annual range of dissolved oxygen was 5.20-12.46 ppm. The range of dissolved oxygen recorded was 5.71-8.91 ppm, 8.5-12.16 ppm and 6.06-11.02 ppm in monsoon, winter, and summer respectively during the year 2014-2015. The range was narrow and almost identical in monsoon and winter (3.20 and 3.66 ppm) and wide in summer (4.96 ppm). During 2015-2016 the range was recorded 3.98-6.98 ppm in monsoon, 4.48-8.48 ppm in winter and 4.02-8.41 ppm in summer. The range was narrow in winter (1.98 ppm), wide in monsoon (3.00 ppm) and much wider in summer (4.00 ppm) (Table 8).

Table 8. Showing variations in dissolved oxygen (PPM) during 2014-2015 (*) and 2015-2016 (**)

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	*	5.71	6.61	7.12	6.74	7.96	8.7	8.91	8.12
	**	4.12	3.98	4.92	5.71	6.02	5.84	6.56	6.98
Winter	*	8.5	9.92	9.89	11.41	10.89	11.83	12.16	12.12
	**	4.48	5.33	6.29	7.49	6.84	7.38	8.2	8.42
Summer	*	6.96	6.06	8.12	8.63	9.96	11.02	10.87	11
	**	4.02	5.26	6.67	7.43	6.18	5.96	7.23	8.41

Total nitrogen

Nitrogen estimation is significant to assess the quality of water. Presence of organic and ammonia nitrogen called total nitrogen is the chemical evidence of organic pollution particularly of animal origin.

The quantity of total Nitrogen recorded was 2.26-3.24 ppm and 1.97-2.61 ppm during 2014-2015 and 2015-2016 respectively. A season wise analysis of the total nitrogen showed that it was maximum in monsoon and minimum in winter during both the years. The range in monsoon was 2.79-3.21 ppm, in winter 2.16-2.72 ppm and in summer 2.47-3.04 ppm during 2014-2015. The range was narrow in monsoon (0.42 ppm) relatively wider and almost similar in winter and summer (0.56 and 0.57 ppm). During 2015-2016 the range was 2.47-2.91 ppm, 1.96-2.38 ppm and 2.18-2.57 ppm in monsoon, winter, and summer, respectively. The range was narrow in summer (0.39 ppm) wide and almost identical in monsoon and winter (0.44 and 0.42 ppm) (Table 9).

Table 9. Showing variations in Quantity of Total Nitrogen (PPM) during 2014-2015 (*) and 2015-2016 (**).

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
	**	0.75	0.81	0.84	0.92	0.94	1.02	1.08	0.99

Monsoon	*	2.8	2.79	2.87	3.1	2.99	3.21	3.18	3.11
	**	2.47	2.49	2.54	2.59	2.61	2.73	2.91	2.89
Winter	*	2.16	2.24	2.32	2.43	2.51	2.66	2.68	2.72
	**	2.02	1.96	1.99	1.98	2.18	2.27	2.31	2.38
Summer	*	2.47	2.52	2.67	2.75	2.86	2.98	3.04	3
	**	2.18	2.22	2.43	2.55	2.24	2.37	2.48	2.57

Sulphates

The annual range of the quantities of sulphates was 1.66-2.10 ppm and 1.86-2.84 ppm during 2014-2015 and 2015-2016 respectively. The range was 1.88-2.03 ppm, 1.59-1.85 ppm and 1.67-2.06 ppm in monsoon, winter, and summer, respectively. The range was narrow in monsoon (0.15 ppm), wide in winter (0.26 ppm) and much wider in summer (0.39). During 2015-2016 the range was 2.25-2.72 ppm in monsoon, 1.89-2.45 ppm in winter and 2.11-2.90 ppm in summer. The range was narrow in monsoon (0.47 ppm), wide in winter (0.56 ppm) and still wider in summer (0.80 ppm) (Table 10).

Table 10. Showing variations in the quantity of sulphates (PPM) during 2014-2015 (*) and 2015-2016 ().**

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	**	1.81	1.7	1.84	1.88	1.93	1.95	1.92	1.91
	*	1.88	1.9	1.95	2.03	1.99	2.01	1.98	2
	**	2.25	2.43	2.48	2.57	2.69	2.7	2.72	2.5
Winter	*	1.59	1.62	1.67	1.73	1.77	1.81	1.83	1.85
	**	1.89	1.93	1.97	2.21	2.33	2.38	2.45	2.42
Summer	*	1.67	1.69	1.74	1.87	1.92	1.98	2.06	2.02
	**	2.2	2.11	2.29	2.36	2.52	2.73	2.84	2.9
	**	2.78	2.81	2.91	2.94	2.89	3.1	3.04	3.14

Phosphates

The presence of phosphates in large quantities in fresh water indicates the pollution through sewage or industrial waste. The quantities of phosphates recorded the annual range 0.06-0.19 ppm and 0.08-0.17 ppm during 2014-2015 and 2015-2016 respectively. A range of 0.10-0.19 ppm in monsoon, 0.07-0.11 ppm in winter and 0.08-0.14 ppm in summer during 2014-2015. The range was narrow in winter (0.04 ppm), wide in summer (0.06 ppm) and wider in monsoon (0.09 ppm). During 2015-2016 the range was 0.12-0.16 ppm, 0.08-0.11 ppm and 0.11-0.15 ppm in monsoon, winter, and summer respectively. The range was narrow and almost identical in monsoon, winter and summer (0.04, 0.03 and 0.04 ppm) (Table 11).

Table 11. Showing variations in the quantity of Phosphates (PPM) during 2014-2015 (*) and 2015-2016 ().**

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Monsoon	**	0.07	0.08	0.09	0.1	0.07	0.08	0.11	0.09
	*	0.12	0.1	0.11	0.14	0.12	0.19	0.17	0.18
	**	0.13	0.12	0.15	0.16	0.14	0.13	0.16	0.13
Winter	*	0.07	0.09	0.08	0.09	0.1	0.07	0.08	0.11
	**	0.08	0.09	0.08	0.11	0.1	0.08	0.1	0.11

Summer	*	0.08	0.1	0.09	0.12	0.11	0.13	0.09	0.14
	**	0.11	0.14	0.12	0.13	0.14	0.15	0.11	0.12
	**	0.06	0.04	0.05	0.07	0.08	0.06	0.09	0.09

Chlorides

Chlorides occur in all-natural waters in widely varying concentrations, uplands and mountain streams are usually low in chloride concentration. The quantities of chlorides increase during underground formations, seepage, animal excreta, industrial waste etc. The range of concentration of chlorides was between 15.59-41.38 ppm during 2014-15 and 12.86-38.00 ppm during 2015-2016. The range was between 24.16-33.18 ppm, 15.69-25.11 ppm and 19.3-41.89 ppm in monsoon, winter, and summer, respectively. The range was narrow and almost identical in monsoon and winter (9.02 and 9.42 ppm) and wider in summer (22.58 ppm). The range was 26.36-32.08 ppm, 15.08-25.12 ppm and 17.24-40.32 ppm in monsoon, winter, and summer respectively during 2015-2016. The range was narrow in monsoon (5.72 ppm), wide in winter (10.08 ppm) and much wider in summer (23.08 ppm) (Table 12).

Table 12. Showing variations in the quantity of chlorides (PPM) during 2014-2015 (*) and 2015-2016 ().**

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Summer	**	26.63	30.81	37.32	39.14	44.63	49.23	54.12	53.9
	*	28.17	25.36	24.16	29.31	30.52	31.37	33.18	32.4
	**	29.18	31.19	28.14	26.36	31.33	32.08	30.72	31.85
Winter	*	25.11	24.9	22.46	20.48	23.44	21.09	18.35	15.6
	**	24.92	25.12	23.73	22.09	18.2	15.08	16.37	17.41
Monsoon	*	19.31	24.34	22.18	34.82	36.64	38.93	41.89	40.7
	**	17.24	19.7	24.31	28.44	30.95	36.83	40.32	39.66
	**	14.32	15.22	21.64	18.75	20.64	23.74	24.11	23.61

Total solids

The annual range of quantities of the total solids recorded was 508.4-547.5 during 2014-2015 and during 2015-2016 it was 498.4-530.6 ppm. The range recorded was 518.6-538.8 ppm in monsoon, 511.3-522.5 ppm in winter and 512.1-548.5 ppm, in summer during 2014-2015. The range in winter was narrow (11.2 ppm), wide in monsoon (20.2 ppm) much wider in summer (36.4 ppm). The range in monsoon, winter and summer was 518.0-525.9 ppm, 499.1-516 ppm and 510.2-540.6 ppm respectively during 2015-2016. The range was narrow in monsoon (7.9 ppm), wide in winter (17.8 ppm) much wider in summer (30.4 ppm) (Table 13).

Table 13. Showing variations in the quantity of total solids (PPM) during 2014-2015 (*) and 2015-2016 ().**

Season	Year	Months							
		1		2		3		4	
		I	II	I	II	I	II	I	II
Summer	**	436.9	441.3	446.8	451.8	494.9	456.6	454.1	454.1
	*	538.8	532.2	531.6	524.6	520.6	518.6	520.4	524.6
	**	525.9	524.4	521.4	520.8	519.9	523.5	522.7	518
Winter	*	522.5	521.8	517.3	520.9	511.3	512.4	515.6	520.3
	**	516.9	515.2	513.4	507.3	507.8	514.7	500.8	499.1

Summer	*	512.1	521.4	530.9	534.7	538.6	541.5	547.8	548.5
	**	510.2	511.7	519.2	522.5	531.7	536.1	539.9	540.6
	**	288.3	289.3	290.5	296.6	299.2	300.4	298.4	297.1

CONCLUSION

The atmospheric temperature, water temperature, Humidity, rainfall, pH, acidity, alkalinity, Dissolved oxygen, total nitrogen, sulphates, phosphates, chlorides, total solids were studied in 2014-2015 and 2015-2016 respectively and on an average, during 2015-2016 the range of all these factors was narrow and almost identical in monsoon and winter and much wider in summer.

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