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Study on Physico-Chemical Parameters of Water Samples Collected from Palair Lake, Khammam, Telangana, India

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ABSTRACT:
Water is one of the most abundant compounds and comes in a variety of forms. Lakes are vital lentic freshwater habitats, with water quality influenced by a variety of environmental and seasonal factors. The purpose of this study was to examine the physico-chemical parameters of Palair Lake. Water samples were obtained at three stations for this study between June 2013 and May 2015. The range of physico-chemical parameters were observed Temperature (21.2°C to 25.6°C) 0C, pH (7.2 to 8.3), CO_3^{-2} (16.56 to 40.68) mg/l, HCO_3^- (237.26 to 267.56) mg/l , Cl^- (118.25 to 147.98) mg/l, DO (7.1 to 11.2) mg/l, BOD (15 to 30) mg/l, COD (16.2 to 36.11) mg/l, T.H (60.03 to 84.44) mg/l, Ca^{++} (31.46 to 55.65) mg/l ,Mg^{++} (18.16 to 37.26) mg/l, SO_4^{-2} (24 to 42) mg/l, PO_4^{-3} (0.52 to 0.94) mg/l, NO^{3-} (0.56 to 0.88) mg/l, T.S (119 to 198) mg/l, T.D.S (88.69 to 119.5) mg/l during the study. The analysed result is compared to WHO and BIS permitted limits for drinking water quality. Temperature, pH, dissolved oxygen, biological oxygen demand, chemical oxygen demand, calcium, and hardness were found to be within WHO and BIS guidelines. The findings show that the water is safe for recreational and household use, but human activities surrounding the lake must be regulated to ensure long-term use and preserve the lake's beauty.
Keywords: Lentic, water quality, physico-chemical, freshwater habitats, drinking water

INTRODUCTION:

Water is necessary for life to exist on Earth; without it, life would be impossible. Water covers seven tenths of the earth's surface. Water is continually threatened by pollution due to its high solvent power. The demand for water in all forms of life, from microorganisms to humans, is a severe concern today, as all water supplies have been depleted as a result of uncontrolled urbanisation and industrialisation. Singh et (2002). Water is a chemical compound that is a vital requirement for human survival and quality of life (Chauhan and Verma, 2015). Surface water, which includes rivers, lakes, ponds, and streams, makes up a small portion of this (Sigee, 2005). Surface water is essential for life, and its quality is a barometer of environmental health (Williamson et al., 2009). Lakes account about 90% of available surface fresh water, and surrounding populations rely heavily on them for home and occupational purposes. The flora and fauna, as well as the quality of lake water, are affected by the complicated circulation and mixing pattern of lake water, as well as chemical and biological processes in the lake water column, as a result of the extended retention (Agarwal and Rajwar, 2010; Read et al., 2015). Weathering of catchment rocks produces elemental ions, which operate as a natural pollutant source in the lakes (Das 2005). Lakes also have considerable economic values, such as providing water for agriculture, electricity generation, food via fish and aquatic products, and maintaining the health and biodiversity of vital life support ecosystems (ILEC 2003). In general, lake water chemistry refers to the seasonal fluctuations in dissolved ion behaviour as well

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as catchment properties (Anshumali and Ramanathan 2007). The natural chemical quality of groundwater is generally satisfactory, although a number of elements can pose difficulties for water use at higher concentrations (A. B. Gebrehiwot, N. Tadesse, and E. Jigar,2011). Lakes and its environs are extremely uncommon and valuable natural resources for both civilization and the environment. These are materials with a lot of social, cultural, and artistic value. The preservation of a healthy environment is aided by maintaining the quality of lake water.

STUDY AREA

Palair lake is located in the Palair village in Kusumanchimandal, Khammam.Khammam is a district in Telangana, India.

In our investigation we have taken three stations of Palairlake which are as follow:

1. Station I
2. Station II
3. Station III




MATERIALS AND METHODS

Water Samples And Preservation

Lake water samples were gathered at periodic intervals. Water was collected in two-liter polythene bottles from several sampling locations and transported to the lab in an icebox for physic-chemical analysis. The temperature of the water at the sampling sites was recorded in real time using a Celsius thermometer. Dissolved oxygen from lake water was fixed on sample sites with manganoussulphate

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and alkyl iodide azide for transportation. On the same day, the samples were tested for a variety of physico-chemical characteristics.

Analysis Of Lake Water

The present investigation was conducted at Palair lake, Khammam, Telangana, India during June 2013 to May 2015 for the assessment of Physico-chemical characteristics of waterand were analyzed by using methods as described in American Public Health Association (APHA) 1998.

1.Temperature (APHA 1998):

At the time of sampling, the temperature of lake water was measured using a Celsius thermometer and stated in degrees Celsius (0C).

2.pH (APHA 1998):

Using a pH metre

3.Carbonates (APHA 1998):

Using phenolphthalein as an indicator, a 50 mL sample was titrated against N/20 H2SO4.

4.Bicarbonate (APHA 1998):

By titrating a ten millilitre extract of water against a standard 0.01N H2SO4 solution using methyl red as an indicator, the bicarbonate concentration in water samples was determined.

5.Determination of Chlorides (APHA 1998):

The chloride concentration in the sample water was determined using Mohr's technique. Using potassium chromate as an indicator, the water was titrated with silver nitrate. The chloride content was determined using the formula below.

Chloride (mg/L) = (a-b) x N x 35.45 x 100 mL sample

a = volume of Ag NO_3 used for the sample; b = volume of Ag NO_3 used for the blank; N = normality of Ag NO_3 (0.0141 N)

6.Dissolved Oxygen (DO) (APHA 1998):

By converting the iodide ion to iodine, certain oxidising and reducing chemicals can effectively interfere with oxygen detection. In the water sector, D.O. analysis is crucial. The Wrinkler or iodometric method and the electrometric approach using a membrane electrode are both employed.

Dissolved Oxygen (mg/l) = No. of ml of Na2S2O3 solution X 4

7.Biochemical Oxygen Demand (BOD) (APHA 1998):

The amount of oxygen consumed by organisms that digest organic waste materials in water is referred to as BOD. As a result, it is used to determine the level of specific types of organic pollutants in water. In order to determine BOD, samples are incubated for 5 days at 200°C.

BOD (mg/l) = DO (initial) – DO (5 days)

Decimal fraction of dilution

8.Chemical Oxygen Demand (C.O.D.) (APHA 1998) :

The COD of water shows the amount of oxygen required for a powerful chemical oxidant to oxidise all organic materials, both biodegradable and non-biodegradable (KMnO4).In a conical flask, 50 ml of water sample and 50 ml of distilled water (blank) are combined, and 5 ml of KMnO4 is added to each flask. Both flasks were warmed for one hour on a waterbath at boiling temperature. After cooling, both flasks were filled with 5 mL potassium iodide (10%) and 10 mL H2SO4 (25 percent v/v). With starch as an indication, both flasks were titrated with 0.1 N sodium thiosulphate.

COD (mg/l) = (B-S) X N X 8 X 1000

Sample volume in ml

B = Volume of titrant used in blank; S = Volume of titrant used in sample; N = Strength of the titrant

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9. Total Hardness(APHA 1998)

In a conical flask, a suitable volume of sample (50 mL) was added, along with 1 mL NH4Cl +NH4OH buffer solution. Eri chrome Black-T was used as an indicator against 0.01M EDTA to measure this concentration. The following formula was used to calculate the hardness:

Hardness as (mg/lit) $CaCO_3$ = ml of EDTA used x 1000/ ml of sample

10. Calcium (Ca_2^+) (APHA 1998)

A suitable volume of sample (50ml.) was taken in a conical flask, and 2 ml. of NaOH was added. 0.01M EDTA was used to determine this value.

Reagents: i) 0.01 M EDTA solution, ii) 8 % NaOH solution, iii) 40 % ethanol, iv) Murexide indicator, v) 1N ammonium acetate solution

11. Magnesium (Mg_2^+) (APHA 1998)

Reagents:i) 0.01 M EDTA solution , ii) NH4Cl-NH4OH buffer solution,iii) Eri chrome black-T indicator

12.Sulphate (SO42-) (APHA 1998)

The sulphate concentration was determined via gravimetric analysis. A suitable volume of sample was heated for five minutes with conc. HCl (0.5 ml), then 20 ml of 5% barium chloride solution was added dropwise. Filter the barium sulphate precipitate through a Whatman filter paper no.42 and wash with hot distilled water after about a half hour. The precipitate was then dried, burned, and weighed after that.

Reagents: i) Methyl red indicator, ii) Hydro choric acid, iii) Barium chloride solution, iv) AgNO3 -HNO3 acid regent

13.Phosphates (APHA 1998)

In Nessler's cylinders, a 50ml sample of water was taken. 5 drops of stannous chloride were added. The sample was measured at 690nm with a spectrophotometer once the blue hue formed, and the results were compared to KH2PO4phosphate standards.

14.Nitrate (NO_3-) (APHA 1998):

Although it is preferable to evaluate nitrate in freshly collected water, if the water must be preserved, it should be dried at a temperature of no more than 550 degrees Celsius. The APHA 4500 NO3- B method was used to determine NO3- in water samples.

Reagent:i) Nitrate extraction solution, ii) Calcium hydroxide (solid),iii) Magnesium carbonate (solid)

15.Total Solids (TS) (APHA 1998):

The residue left following unfiltered sample evaporation is referred to as total solids. A 50 mL sample of unfiltered water was heated until fully dry in a clean and reweighed beaker. The beaker is weighed and refrigerated before being used. Preheat the oven to 103–1050 degrees Fahrenheit. The total solids content was then calculated using the formula below.

Total solids, (mg/lit.) = (A-B x 1000)/V

Where,A = Final weight of beaker in gm.; B = Initial weight of beaker in gm.; DF = Dilution factor.;V = volume of sample taken in ml.

16.Total Dissolved Solids (TDS) (APHA 1998):

The residual evaporating residue at 103°C–105°C is described as TDS water and waste water content. The total amount of floating, suspended, resetting, and dissolved solid in the water sample must be added together. TDS was calculated using a formula (USD manual Richards)

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RESULTS

The results are represented in tabular format

Table 1: PHYSICO-CHEMICAL PARAMETERS: Station-I

All Parameters are expressed in mg/L except pH and Temperature (^{0}C)

Month-year	Tem	pH	CO_3^{2-}	HCO_3^-	Cl^-	DO	BOD	COD	TH	Ca^{2+}	Mg^{2+}	SO_4^{2-}	PO_4^{3}	NO_3^-	TS	TDS
Jun-13	23.2	7.9	43.10	225.26	141.42	8.1	10.02	22.56	64.41	46.25	18.16	44	0.27	0.4	330	109.08
Jul-13	23.6	8.3	42.52	222.42	123.12	7.3	20.12	32.78	72.24	52.12	20.12	48	0.64	0.2	250	121.08
Aug-13	22.4	7.5	23.01	264.45	141.25	8.5	30.20	25.44	81.43	65.30	16.13	43	0.66	0.7	315	125.79
Sep-13	22.6	8.2	17.21	243.52	158.48	8.2	16.15	30.66	51.58	30.42	21.16	32	0.42	0.6	295	84.6
Oct-13	23.4	7.5	47.60	231.62	161.65	7.2	20.18	35.88	84.87	65.12	19.75	45	0.62	0.5	280	130.99
Nov-13	22.7	8.2	24.31	238.12	142.23	7.8	30.20	28.35	69.93	48.25	21.68	38	0.32	0.9	340	109.15
Dec-13	21.2	7.6	25.22	262.42	120.45	8.6	12.13	32.99	77.84	55.32	22.52	28	0.28	0.8	297	106.92
Jan-14	21.5	8.2	24.12	256.01	129.31	10.5	20.12	36.11	62.77	35.65	27.12	28	0.62	0.6	332	91.99
Feb-14	21.2	7.8	22.42	234.53	140.61	7.6	30.13	26.44	64.30	42.52	21.78	34	0.42	0.7	340	99.42
Mar-14	22.7	8.3	24.61	276.12	144.16	8.1	20.14	28.35	64.61	41.65	22.96	48	0.52	0.5	294	113.63
Apr-14	24.6	8.1	22.46	284.64	126.25	9.1	10.16	34.76	74.68	46.12	28.56	52	0.26	0.4	357	127.34
Ma	25.4	7.9	19.	281	13	8.3	20.	25.	78.	53.	25.	46	0.5	0.8	276	125

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 7274 - 7286
Received 15 December2020; Accepted 05 January2021.

y-14			20	.33	4.51		15	23	51	35	16		4			.85
I year Avg	**22.875**	**7.958333**	**27.98167**	**251.7033**	**138.62**	**8.275**	**19.975**	**29.9625**	**70.5975**	**48.50583**	**22.09167**	**40.5**	**0.464167**	**0.591667**	**308.8333**	**112.1533**
Jun-14	24.4	7.5	20.16	242.82	126.41	8.3	20.12	34.23	74.28	52.12	22.16	34	0.82	0.9	290	110
Jul-14	23.2	7.6	22.16	265.41	132.22	8.6	10.25	28.96	69.79	50.68	19.11	38	0.62	0.8	350	109.21
Aug-14	23.6	8.2	11.27	265.65	141.32	9.2	20.15	32.76	60.33	38.65	21.68	25	0.42	0.5	236	86.25
Sep-14	22.9	7.8	19.26	264.46	143.65	7.8	30.20	26.55	77.73	57.12	20.61	28	0.89	0.7	357	107.32
Oct-14	23.3	8.3	23.42	271.65	129.62	8.2	20.45	32.99	60.87	42.65	18.22	38	0.86	0.6	270	100.33
Nov-14	22.7	7.9	33.62	263.41	130.52	7.9	10.15	26.44	72.17	52.62	19.55	28	0.68	0.8	275	101.65
Dec-14	22.4	8.1	23.20	234.51	115.76	8.2	30.25	28.55	59.90	39.22	20.68	32	0.92	0.6	323	93.42
Jan-15	22.2	7.7	19.42	281.65	130.81	7.8	20.30	34.77	58.41	36.16	22.25	26	0.48	0.8	276	85.69
Feb-15	23.8	7.5	21.86	268.45	125.21	10.5	15.40	32.58	76.04	49.42	26.62	40	0.87	0.9	320	117.81
Mar-15	23.6	7.4	25.76	284.43	141.50	9.6	18.15	29.34	68.58	41.22	27.36	36	0.66	0.8	266	106.04
Apr-15	24.2	7.2	41.42	287.65	128.23	8.6	20.56	36.12	62.62	38.22	24.40	28	0.65	0.5	322	91.77
May-	24.6	8.3	18.02	227.80	139.	11.1	30.65	33.45	63.76	40.55	23.21	42	0.72	0.6	327	107.08

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 7274 - 7286
Received 15 December2020; Accepted 05 January2021.

15					47											
II yearAvg	**23.4083333**	**7.791667**	**23.2975**	**263.1575**	**132.06**	**8.816667**	**20.5525**	**31.395**	**67.04**	**44.88583**	**22.15417**	**32.91667**	**0.715833**	**0.708333**	**301**	**101.3808**
2years Avg	**23.1416667**	**7.875**	**25.63958**	**257.4304**	**135.34**	**8.545833**	**20.26375**	**30.67875**	**68.81875**	**46.69583**	**22.12292**	**36.70833**	**0.59**	**0.65**	**304.9167**	**106.7671**

Temp. =Water temperature, CO_3^{2-}=Corbonates, HCO^{3-} = Bicarbonates,Cl^-= Chlorides, DO = Dissolve Oxygen, BOD= Biological Oxygen Demand, COD = Chemical Oxygen Demand, TH = Total Hardness,Ca^{2+}= Calcium,Mg^{2+} =Magnesium, TS=Total Solids,TDS=Total Dissolved Solids , SO_4^{2-} =Sulphates, PO_4^{3-}=Phosphates, NO^{3-}= Nitrates.

Table 2: PHYSICO-CHEMICAL PARAMETERS: Station-II

All Parameters are expressed in mg/L except pH and Temperature (^{0}C)

Month-year	Tem	pH	CO_3^{2-}	HCO_3^-	Cl^-	DO	BOD	COD	TH	Ca^{2+}	Mg^{2+}	SO_4^{2-}	PO_4^{3}	NO_3^-	TS	TDS
Jun-13	22.5	7.3	16.64	241.12	124.12	10.2	10	16.20	83.58	45.46	38.12	34	0.62	0.62	310	118.82
Jul-13	23.6	8.2	24.26	258.12	138.22	9.6	20	22.55	83.46	38.28	45.18	30	0.56	0.82	350	114.84
Aug-13	22.4	7.9	36.15	248.16	142.56	9.2	10	20.34	70.97	44.41	26.56	26	0.84	0.72	290	98.53
Sep-13	24.2	7.5	38.26	238.64	148.22	8.2	30	18.23	82.75	38.45	44.30	30	0.64	0.84	250	114.23
Oct-13	23.6	8.1	44.68	242.68	126.52	8.4	20	28.22	75.50	36.28	39.22	28	0.52	0.78	275	104.8
Nov-13	24.6	7.9	28.25	236.22	152.12	9.6	20	26.34	73.13	44.68	28.45	38	0.84	0.82	305	112.79
Dec-13	23.5	7.5	38.12	250.62	146.46	11.2	10	20.56	81.79	39.65	42.14	26	0.92	0.90	390	109.61
Jan-14	25.1	7.8	40.42	272.12	130.36	8.8	30	25.12	58.90	34.62	24.28	22	0.66	0.88	330	82.44
Feb-14	22.8	8.3	18.30	262.50	164.12	9.2	20	28.23	68.98	42.66	26.32	36	0.76	0.58	360	106.32
Ma	22.4	7.4	20.	270	120	10.	10	22.	84.	52.	32.	28	0.8	0.6	33	114

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 7274 - 7286
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r-14	6		18	.40	.18	6		98	84	42	42		2	6	0	.32
Apr-14	23.6	7.6	36.12	248.25	126.20	8.8	20	18.76	84.68	56.12	28.56	20	0.90	0.74	316	106.32
May-14	23.5	8.2	25.68	252.32	132.42	8.2	10	23.67	78.87	46.45	30.42	34	0.86	0.82	394	114.55
I year Avg	**23.4883333**	**7.808333**	**30.58833**	**251.7625**	**137.625**	**9.333333**	**17.5**	**22.6**	**77.2875**	**43.29**	**33.83083**	**29.33333**	**0.745**	**0.765**	**325**	**108.1308**
Jun-14	24.5	8.1	36.45	232.81	128.62	8.2	20	16.87	76.36	44.24	32.12	36	0.92	0.92	240	114.2
Jul-14	23.4	7.2	24.63	224.52	132.62	10.2	30	23.98	82.41	44.15	38.26	40	0.74	0.82	323	123.97
Aug-14	23.5	7.4	38.42	262.12	144.42	9.8	20	26.43	78.74	46.32	32.42	46	0.82	0.84	390	126.4
Sep-14	21.2	7.6	42.60	246.46	152.45	9.6	10	18.34	75.40	49.28	26.12	38	0.72	0.76	330	114.88
Oct-14	24.8	7.3	44.26	287.64	132.65	8.8	30	20.12	68.68	40.12	28.56	28	0.68	0.68	385	98.04
Nov-14	22.6	7.5	28.12	260.84	126.12	11.2	20	24.39	84.44	50.32	34.12	32	0.72	0.78	450	117.94
Dec-14	23.8	8.3	52.42	228.42	160.22	10.4	10	18.89	75.78	47.12	28.66	42	0.68	0.68	310	119.14
Jan-15	23.4	8.2	48.26	280.52	148.65	10.8	20	24.76	75.24	44.82	30.42	46	0.72	0.78	323	122.74
Feb-15	24.2	7.8	38.42	262.46	144.22	9.8	20	23.34	77.16	48.28	28.88	40	0.68	0.88	360	118.72
Mar-15	22.8	8.1	42.66	252.32	138.32	10.6	10	27.45	68.62	42.16	26.46	38	0.92	0.68	280	108.22
Apr-15	25.4	7.9	44.12	248.12	142.12	8.6	30	25.56	78.58	44.32	34.26	34	0.86	0.82	315	114.26
May-	23.6	7.5	40.18	268.46	126.42	9.2	10	18.34	89.24	53.12	36.12	46	0.56	0.70	407	136.5

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 7274 - 7286
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15																
II year Avg	**23.6**	**7.741667**	**40.045**	**254.5575**	**139.7358**	**9.766667**	**19.166667**	**22.3725**	**77.55417**	**46.1875**	**31.36667**	**38.83333**	**0.751667**	**0.778333**	**342.75**	**117.9175**
2years Avg	**23.5464**	**7.773667**	**35.5058**	**253.2159**	**138.7226**	**9.558667**	**18.366667**	**22.4817**	**77.42617**	**44.7967**	**32.54947**	**34.27333**	**0.748467**	**0.771933**	**334.23**	**113.2199**

Temp. =Water temperature, $CO_3{}^{2-}$=Corbonates, HCO^{3-} = Bicarbonates,Cl^-= Chlorides, DO = Dissolve Oxygen, BOD= Biological Oxygen Demand, COD = Chemical Oxygen Demand, TH = Total Hardness,Ca^{2+}= Calcium,Mg^{2+} =Magnesium, TS=Total Solids,TDS=Total Dissolved Solids , $SO_4{}^{2-}$ =Sulphates, $PO_4{}^{3-}$=Phosphates, NO^{3-}= Nitrates.

Table 3: PHYSICO-CHEMICAL PARAMETERS: Station-III

All Parameters are expressed in mg/L except pH and Temperature (^{0}C)

Month-year	**Tem**	**pH**	**$CO_3{}^{2-}$**	**$HCO_3{}^-$**	**Cl^-**	**DO**	**BOD**	**COD**	**TH**	**Ca^{2+}**	**Mg^{2+}**	**$SO_4{}^{2-}$**	**$PO_4{}^3$**	**$NO_3{}^-$**	**TS**	**TDS**
Jun-13	23.2	8	24.12	253.78	144.66	8.2	20	19.23	71.63	42.85	28.78	32	0.56	0.64	265	104.83
Jul-13	24.4	7.7	18.56	234.98	138.45	8.5	30	21.45	68.77	40.65	28.12	36	0.52	0.56	306	105.85
Aug-13	23.9	7.9	12.44	224.16	142.87	9.2	20	24.76	75.03	44.58	30.45	38	0.64	0.76	275	114.43
Sep-13	24.6	7.9	26.45	268.56	138.66	9.6	10	18.68	71.23	38.56	32.67	40	0.58	0.86	253	112.67
Oct-13	23.8	7.7	22.98	246.88	146.67	9.8	20	22.56	66.78	39.89	26.89	36	0.66	0.82	294	104.26
Nov-13	22.7	8.1	19.76	278.67	152.98	8.7	30	24.58	67.12	44.67	22.45	42	0.72	0.78	321	110.62
Dec-13	21.8	8.3	20.67	287.56	148.12	10.2	20	26.78	75.57	46.23	29.34	34	0.48	0.73	361	110.78
Jan	21.2	7.8	28.	234	13	8.2	10	22.	62.	39.	22.	39	0.7	0.8	273	102

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 7274 - 7286
Received 15 December2020; Accepted 05 January2021.

-14			34	.98	7.45			48	03	34	69		4	4		.61
Feb-14	22.4	7.7	24.98	210.45	132.78	8.6	30	28.45	69.06	42.67	26.39	32	0.92	0.74	353	102.72
Mar-14	23.8	7.8	20.12	262.87	145.23	9.8	20	17.36	78.14	48.58	29.56	42	0.82	0.69	382	121.65
Apr-14	24.6	7.8	30.43	256.43	138.56	8.9	30	23.58	73.70	46.12	27.58	44	0.86	0.68	270	119.24
May-14	24.9	8.2	29.67	248.29	144.89	8.2	10	28.45	71.56	39.78	31.78	28	0.78	0.76	361	101.1
I year Avg	**23.4416667**	**7.90833333**	**23.21**	**250.6342**	**142.61**	**8.991667**	**20.83333**	**23.19667**	**70.885**	**42.82667**	**28.05833**	**36.91667**	**0.69**	**0.738333**	**309.5**	**109.23**
Jun-14	24.2	7.7	20.34	242.98	152.79	9.2	30	18.45	71.43	38.56	32.87	38	0.68	0.83	351	110.94
Jul-14	23.5	7.9	18.98	287.45	128.67	9.8	20	22.56	71.31	42.86	28.45	28	0.82	0.68	321	100.81
Aug-14	23.8	7.6	26.87	276.23	146.24	9.6	20	24.12	76.01	46.89	29.12	32	0.78	0.75	280	109.54
Sep-14	23.1	8.2	22.66	264.98	158.62	10.2	30	26.78	67.93	36.26	31.67	36	0.82	0.79	296	105.54
Oct-14	23.6	7.8	16.98	267.12	152.77	8.6	10	20.67	54.94	28.46	26.48	40	0.92	0.86	367	96.72
Nov-14	22.4	7.8	28.79	258.98	126.89	8.7	30	22.98	67.87	44.89	22.98	38	0.88	0.64	237	107.39
Dec-14	21.8	7.9	24.68	249.67	136.29	9.2	20	24.67	68.23	46.98	21.25	32	0.78	0.62	232	101.72
Jan-15	21.4	8.1	19.68	274.78	142.	8.4	10	19.56	62.25	34.69	27.56	26	0.82	0.76	280	89.83

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 7274 - 7286
Received 15 December2020; Accepted 05 January2021.

					78											
Feb-15	22.7	7.5	22.78	287.34	128.68	9.5	30	26.48	65.16	38.35	26.81	28	0.94	0.78	305	94.88
Mar-15	23.5	7.6	27.45	268.34	148.56	8.9	20	28.34	72.24	42.12	30.12	31	0.86	0.69	335	104.79
Apr-15	24.2	7.7	24.98	282.56	152.78	9.4	10	24.78	76.40	47.64	28.76	34	0.82	0.77	352	111.99
May-15	25.6	8.1	23.87	248.98	156.89	10.4	20	18.69	66.04	39.46	26.58	24	0.94	0.78	242	91.76
II yearAvg	**23.3166667**	**7.825**	**23.17167**	**267.4508**	**144.33**	**9.325**	**20.83333**	**23.17333**	**68.3175**	**40.59667**	**27.72083**	**32.25**	**0.838333**	**0.745833**	**299.8333**	**102.1592**
2years Avg	**23.3791667**	**7.86666667**	**23.19083**	**259.0425**	**143.47**	**9.158333**	**20.83333**	**23.185**	**69.60125**	**41.71167**	**27.88958**	**34.58333**	**0.764167**	**0.742083**	**304.6667**	**105.6946**

Temp. =Water temperature, $CO_3{}^{2-}$=Corbonates, HCO^{3-} = Bicarbonates,Cl^-= Chlorides, DO = Dissolve Oxygen, BOD= Biological Oxygen Demand, COD = Chemical Oxygen Demand, TH = Total Hardness,Ca^{2+}= Calcium,Mg^{2+} =Magnesium, TS=Total Solids,TDS=Total Dissolved Solids , $SO_4{}^{2-}$ =Sulphates, $PO_4{}^{3-}$=Phosphates, NO^{3-}= Nitrates.

DISCUSSION ON TABLES:

1. **Water temperature**: Temperature plays an important function in regulating Physico-chemical operations in the aquatic environment. During the years 2013-2014 and 2014-2015, the water temperature at Station-I ranged from 21.2 to 25.40°C, at Station-II it ranged from 21.2 to 25.4°C, and at Station-III it ranged from 21.2 to 25.6°C. The water temperature has fluctuated seasonally. The temperature of the water is expressed in ° C. (Table no. -1,2,3).
2. **pH:**The strength of acidity and alkalinity is expressed by the pH, which is an indicator of hydrogen ion concentration. During the years 2013-2014 and 2014-2015, the pH of Station I ranged from 7.2 to 8.3, Station II from 7.2 to 8.3, and Station III from 7.5 to 8.3. (Table no. -1,2,3).
3. **Carbonates:** The carbonates of Station I ranged from 11.27 mg/L to 47.6 mg/L, Station II ranged from 16.64 mg/L to 52.42 mg/L and Station III ranged from 12.44 mg/L to 30.43 mg/L during the years 2013-2014 and 2014-2015 (Table no. -1,2,3).
4. **Bi-carbonates:** The Bi-carbonates of Station I ranged from 222.42 mg/L to 287.65 mg/L, Station II ranged from 224.52 mg/L to 287.64 mg/L and Station III ranged from 210.45 mg/L to 287.56 mg/L during the years 2013-2014 and 2014-2015 (Table no. -1,2,3).
5. **Chlorides:**In water and waste water, chlorides are the most abundant inorganic anions. In the present case. During the years 2013-2014 and 2014-2015, the chlorides in Station I ranged from 115.76

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 7274 - 7286
Received 15 December2020; Accepted 05 January2021.

mg/L to 161.65 mg/L, Station II from 120.18 mg/L to 164.12 mg/L, and Station III from 126.89 mg/L to 158.62 mg/L. (Table no. -1,2,3).

6. **Dissolved oxygen**: Dissolved oxygen is an important limnological parameter that indicates the quality of the lake's water and organic production. During the years 2013-2014 and 2014-2015, the dissolved oxygen of Station I ranged from 7.2 mg/L to 11.1 mg/L, Station II from 8.2 mg/L to 11.2 mg/L, and Station III from 8.2 mg/L to 10.4 mg/L. (Table no. -1,2,3).
7. **Biological Oxygen Demand (BOD):**The amount of oxygen required for biological oxidation of organic matter with the help of microbial activity is determined by biochemical oxygen demand. During the years 2013-2014 and 2014-2015, the BOD of Station I ranged from 10.02 mg/L to 30.65 mg/L, Station II from 10 mg/L to 30 mg/L, and Station III from 10 mg/L to 30 mg/L. (Table no. -1,2,3).
8. **Chemical oxygen demand (COD):**The amount of oxygen required for chemical oxidation of most organic matter and oxidizable inorganic compounds with the help of a strong chemical oxidant is determined by chemical oxygen demand. During the years 2013-2014 and 2014-2015, the COD of Station I ranged from 22.56 mg/L to 36.12 mg/L, Station II from 16.2 mg/L to 28.23 mg/L, and Station III from 17.36 mg/L to 28.45 mg/L. (Table no. -1,2,3).
9. **Total Hardness:** Total hardness refers to the amount of calcium and magnesium in a sample of water. The Total Hardness of Station I ranged from 51.58 mg/L to 84.87 mg/L, Station II ranged from 58.9 mg/L to 89.24 mg/L and Station III ranged from 54.94 mg/L to 78.14 mg/L during the years 2013-2014 and 2014-2015 (Table no. -1,2,3).
10. **Calcium:**Ca is an important nutrient present in large quantities in natural water basins. The Calcium of Station I ranged from 30.42 mg/L to 65.3 mg/, Station II ranged from 34.62 mg/L to 56.12 mg/L and Station III ranged from 28.46 mg/L to 48.58 mg/L during the years 2013-2014 and 2014-2015 (Table no. -1,2,3).
11. **Magnesium:**Mg is an essential mineral that controls cellular enzymatic conversions. The Magnesium of Station I ranged from 16.13mg/L to 28.56 mg/L, Station II ranged from 24.28 mg/L to 45.18 mg/L and Station III ranged from 21.25 mg/L to 32.87 mg/L during the years 2013-2014 and 2014-2015 (Table no. -1,2,3).
12. **Sulphate:**Agricultural runoff, sewage outflow, and industrial discharge are the main sources of sulphate. The Sulphate of Station I ranged from 25 mg/L to 52 mg/L, Station II ranged from 20 mg/L to 46 mg/L and Station III ranged from 24 mg/L to 44 mg/L during the years 2013-2014 and 2014-2015 (Table no. -1,2,3).
13. **Phosphates:**Phosphorus can be found in a variety of places in nature, including plants, microorganisms, animal excrement, and so on. It's a common agricultural fertiliser and a key ingredient in detergents, especially those for household use. During the years 2013-2014 and 2014-2015, the phosphorus levels in Station I ranged from 0.26 mg/L to 0.92 mg/L, Station II from 0.52 mg/L to 0.92 mg/L, and Station III from 0.48 mg/L to 0.94 mg/L. (Table no. -1,2,3).
14. **Nitrate:**The majority of nitrate in natural streams comes from organic and inorganic sources, with only a small percentage coming from mineral sources. During the years 2013-2014 and 2014-2015, the Nitrate of Station I ranged from 0.2 mg/L to 0.9 mg/L, Station II from 0.58 mg/L to 0.92 mg/L, and Station III from 0.56 mg/L to 0.86 mg/L. (Table no. -1,2,3).
15. **Total Solids:**The term "total solids" refers to the inorganic salts and small amounts of organic matter that are present in solution in water. The Total Solids of Station I ranged from 236 mg/L to 357

mg/L, Station II ranged from 240 mg/L to 450 mg/L and Station III ranged from 232 mg/L to 382 mg/L during the years 2013-2014 and 2014-2015 (Table no. -1,2,3).

16. **Total Dissolved Solids:**TDS is a measurement of all dissolved organic and inorganic compounds in water. During the years 2013-2014 and 2014-2015, the Total Dissolved Solids of Station I ranged from 84.6 mg/L to 130.99 mg/L, Station II from 82.44 mg/L to 136.5 mg/L, and Station III from 89.83 mg/L to 121.65 mg/L. (Table no. -1,2,3).

CONCLUSION

The object of this study is to look at the water quality and contamination in PalairLake using physico-chemical and biological parameters. The water in PalairLake is not contaminated because physico-chemical parameters such as chlorides, total hardness, calcium, magnesium, phosphates, BOD, total solids, and total dissolved solids were all within permissible limits, and the dissolved oxygen concentration was always higher than the WHO (1971), ISI (1982), and BIS (1998). Lake's water is pure, clean, and well-aerated. The findings show that the lake is safe to utilise for household and irrigation purposes. The key recommendations given in this study are that raising public awareness about environmental protection and pollution reduction through the media will aid in the conservation of the ecosystem of these water bodies.

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