

Water quality status of Golden Key Lake in Clement Town, Dehradun, Uttarakhand

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Abstract: An attempt has been made to understand to provide information on the physico-chemical characteristics of Golden Key Lake which is being used for aquaculture, were studied between Nov 2008 to Feb 2009. All the parameters has been correlated with each other and each parameters has shown correlation matrix with different parameters at selected sites.

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Keywords: TDS, TSS, pH, DO, COD, Ca, Mg, K, Golden Key Lake.

Introduction:

Physico-chemical features of water and sediment play important role in structure and functioning of the lake ecosystem Okram, *et al.*, 2003). Water is one of the most abundant compounds found in nature covering approximately three-fourths of surface of the earth (Beebi *et al.*, 2004). Water is the elixir of life, a precious gift of nature of mankind and millions of other species living on the earth. It is fast becoming a scare commodity in most part of the world (Usharani *et al.*, 2010). Water is an essential requirement of human and industrial development and also it is one of the most delicate parts of the environment (Das and Acharya, 2003). Attention on water contamination and its management has become a need of the hour because of for reaching impact on human health (Sinha and Srivastava, 1995). Continuous assessment of physical, chemical and biological parameters of water is an essential part of current water quality control programmes. These efforts lead to accumulation of considerable information which cannot usually produce direct judgmental determination of water quality (Sharifi, 1990). In the present study the physico-chemical status of Golden Key Lake, Clement Town, Dehradun, Uttarakhand State of India was investigated.

Material and Methods:

Study Area: Dehradun is capital of Uttarakhand, famous for its beauty, basmati rice, litchi and also a centre of various research institutes as well. It is bounded in the north by the higher range of lesser Himalaya and in the south by the younger Shivalik ranges. The river Yamuna and Ganga from the

valley's western and eastern boundaries in the NW and SE direction, respectively. Geographically the Doon valley lies between latitude 29° 55'N and 38° 30'N, longitude 77° 35'E and 78° 20'E covering an area of about 3088 sq. km, with a population of 12, 82,143 (as per 2001 census). (Chauhan, 2008).

Study Sites: The study carried out between November 2008 to February 2009 to assess the physico-chemical characteristics of Golden Key Lake in Clement Town of Dehradun. The lake divided in to two compartment Ist & IInd, the Ist compartment has an area about 2000 m³ while the IInd compartment has an area about 4500 m³. The lake is used for aquaculture purpose and various species like *catla catla*, rohu, silver carp etc. are cultured here and various types of trees and plant grow on its bank. Four sites were selected for evaluation the physico-chemical properties of Golden Key Lake, site 1 lies in east direction of lake whereas site 2 is located in the centre of the lake while site 3 is located in the south-west direction of the lake and site 4 is located in north direction of lake.

Result and discussion:

Physico-chemical parameters were studied during November 2008 to February 2010 for the samples collected from four selected sites of Golden Key Lake. Physico-chemical parameters for the selected sites are presented in Table-1-4, while correlation matrix values among these parameters are given in Table 5-8.

pH value observed between 6.5 to 7.10, 6.9 to 7.08, 7.01 to 7.43 and 7.54 to 8.0 at site 1, 2, 3 and 4, respectively. TDS value was reported between as 120.0 to 146.0, 308.0 to 400.00, 200.1 to 217.0 and 363.0 to 400.0 mg/L at site 1, 2, 3 and 4, respectively. DO was reported as between 20 to 2.9, 5.8 to 6.7, 5.9 to 6.9 and 5.9 to 6.1 mg/L at site 1, 2, 3 and 4, respectively, whereas the value of COD was reported as ranged between 200 to 290.0, 100.0 to 104.0, 112.0 to 115.0 and 109.0 to 110.8 mg/L at site 1, 2, 3 and 4, respectively. While in case of chloride was ranged between 54.6 to 65.1, 17.9 to 26.1, 9.9 to 19.1 and 5.9 to 12.7 mg/L at site 1, 2, 3 and 4,

respectively. Negi et al., have studied 13 physico-chemical parameters viz. water temperature, DO, Free CO₂, alkalinity, TDS, total hardness, chloride, phosphates and nitrates of Hinval freshwater stream and Ganga River water during 2005-2007. Nagdali and Gupta also reported some important physico-chemical parameters and nutrients of Metropole of famous Nainital Lake of Uttarakhand, India. Okram et al., (2003) also studied the physico-chemical parameters of Waithou Lake in Manipur state of India on monthly basis. Spence (1967) reported that pH of the oligotrophic lakes ranges from 4.8 to 8.0 whereas in the eutrophic lake he range is 7.7 to 9.6.

Table: 1, showing monthly variations in physico-chemical characteristics of Golden Key Lake at site 1.

Parameters	Months			
	Nov. 2008	Dec. 2008	Jan. 2009	Feb. 2009
Temperature (°C)	14.20	16.30	10.20	20.10
Transparency (cm)	10.00	9.30	9.00	9.00
TDS (mg/L)	120.00	130.00	141.00	146.00
TSS (mg/L)	400.00	600.00	673.00	674.00
pH (mg/L)	7.01	7.10	6.50	6.70
Total Hardness (mg/L)	280.00	300.00	331.00	341.00
Total Alkalinity (mg/L)	560.00	590.00	594.00	600.00
Chloride (mg/L)	54.60	60.10	63.20	65.10
Calcium (mg/L)	179.00	184.00	160.00	164.00
Magnesium (mg/L)	24.54	28.18	34.20	35.70
Sodium (mg/L)	37.00	40.00	43.00	47.00
Potassium (mg/L)	10.00	12.00	14.00	14.00
Dissolved Oxygen (mg/L)	2.80	2.90	2.00	2.10
Chemical Oxygen Demand (mg/L)	200.00	250.00	263.00	290.00
Nitrate-Nitrogen (mg/L)	1.80	1.03	2.10	2.70
Phosphate-Phosphorus (mg/L)	1.01	1.03	1.00	1.20

Table: 2, Monthly variations in physico-chemical characteristics of Golden Key Lake at site 2.

Parameters	Months			
	Nov. 2008	Dec. 2008	Jan. 2009	Feb. 2009
Temperature (°C)	16.00	16.90	17.60	18.40
Transparency (cm)	65.00	61.00	58.10	57.90
TDS	400.00	390.00	309.00	308.00
TSS	300.00	342.00	300.00	310.00
pH	7.08	6.90	7.00	7.00
Total Hardness	214.00	234.00	241.00	253.00
Total Alkalinity	260.00	281.00	287.00	293.00
Chloride	17.90	21.90	26.10	25.20
Calcium	142.00	156.00	157.00	160.00
Magnesium	17.49	18.90	20.40	22.5
Sodium	17.00	19.00	23.00	25.00
Potassium	1.00	5.00	5.00	5.00
Dissolved Oxygen	6.70	6.10	5.8	5.90
Chemical Oxygen Demand	102.00	104.00	100.00	101.00
Nitrate-Nitrogen	0.06	0.07	0.09	0.08
Phosphate- Phosphorus (mg/L)	0.006	0.007	0.007	0.006

Table: 3, Monthly variations in physico-chemical characteristics of Golden Key Lake at site 3.

Parameters	Months			
	Nov. 2008	Dec. 2008	Jan. 2009	Feb. 2009
Temperature (°C)	15.00	17.00	18.00	18.70
Transparency (cm)	74.00	73.00	65.00	64.80
TDS	200.10	210.00	211.00	217.00
TSS	100.00	107.00	113.00	117.00
pH	7.43	7.01	7.02	7.03
Total Hardness	216.00	222.00	231.00	233.00
Total Alkalinity	260.00	287.00	289.00	290.00

Chloride	9.90	13.70	17.30	19.10
Calcium	143.00	121.00	127.00	132.00
Magnesium	25.02	24.50	25.20	24.50
Sodium	17.10	17.10	18.10	20.10
Potassium	1.00	3.00	4.00	4.00
Dissolved Oxygen	6.90	6.30	6.10	5.90
Chemical Oxygen Demand	115.00	114.00	112.00	112.00
Nitrate-Nitrogen	0.04	0.06	0.06	0.08
Phosphate- Phosphorus (mg/L)	0.002	0.002	0.005	0.007

Table: 4, Monthly variations in physico-chemical characteristics of Golden Key Lake at site 4.

Parameters	Months			
	Nov. 2008	Dec. 2008	Jan. 2009	Feb. 2009
Temperature (°C)	16.80	17.90	19.00	19.20
Transparency (cm)	85.00	83.00	76.20	75.40
TDS	400.00	380.00	363.00	367.00
TSS	10.00	14.00	21.00	23.00
pH	7.54	8.00	7.90	7.60
Total Hardness	216.00	240.00	215.00	219.00
Total Alkalinity	240.00	249.00	253.00	259.00
Chloride	5.90	11.80	12.10	12.70
Calcium	102.00	143.00	121.00	126.00
Magnesium	27.70	23.50	22.80	22.50
Sodium	15.00	16.00	16.00	20.00
Potassium	2.00	6.00	9.00	7.00
Dissolved Oxygen	6.10	5.90	6.00	6.00
Chemical Oxygen Demand	109.00	109.00	109.00	110.80
Nitrate-Nitrogen	0.02	0.05	0.07	0.09
Phosphate- Phosphorus (mg/L)	0.005	0.004	0.005	0.005

Table-5, Correlation matrix of physico-chemical parameters at site-1.

	Temp	Trans	TDS	TSS	pH	Hard	Alka	Chloride	Ca	Mg	Na	K	DO	COD	
NO ₃ -N ₂															
Trans	-0.115														
TDS	0.232	-0.945													
TSS	0.123		-0.999	0.935											
pH	0.328	0.673	-0.772	-0.649											
Hard	0.189	-0.929	0.997	0.917	-0.814										
Alk	0.267	-0.984	0.921	0.987	-0.543	0.894									
Chloride	0.255	-0.977	0.988	0.97	-0.695	0.976	0.970								
Ca	0.188	0.668	-0.809	-0.643	0.987	-0.849	-0.554	-0.723							
Mg	0.161	-0.930	0.996	0.918	-0.828	1.000	0.890	0.973	-0.860						
Na	0.421	-0.873	0.976	0.863	-0.681	0.970	0.876	0.956	-0.751	0.962					
K	0.076	-0.978	0.982	0.971	-0.800	0.979	0.938	0.983	-0.806	0.982	0.917				
DO	0.118	0.736	-0.866	-0.713	0.977	-0.900	-0.635	-0.791	0.994	-0.909	-0.813	-0.860			
COD	0.387	-0.955	0.967	0.954	-0.589	0.945	0.974	0.989	-0.631	0.939	0.959	0.944	-0.709		
NO ₃ -N ₂	0.240	-0.377	0.656	0.350	-0.731	0.694	0.321	0.539	-0.828	0.691	0.724	0.548	-0.821	0.504	
PO ₄ -P	0.859	-0.443	0.634	0.438	-0.198	0.615	0.529	0.609	-0.340	0.593	0.787	0.481	-0.403	0.687	0.668

Whereas, Temp = Temperature, Trans = Transparency, TDS = Total Dissolved Solids, TSS = Total Suspended Solids, Hard = Hardness, Alka = Alkalinity, Ca = Calcium, Mg = Magnesium, Na = Sodium, K = Potassium, DO = Dissolved Oxygen, COD = Chemical Oxygen Demand, NO₃-N₂ = Nitrate-Nitrogen, PO₄-P = Phosphate-Phosphorus.

Table-6, Correlation matrix of physico-chemical parameters at site-2.

	Temp	Transp	TDS	TSS	pH	Hardn	Alka	Chloride	Ca	Mg	Na	P	DO	COD	NO ₃ -N ₂
Transpar	-0.948														
TDS	-0.905	0.908													
TSS	-0.031	-0.025	0.391												
pH	-0.290	0.423	0.003	-0.895											
Hardness	0.988	-0.960	-0.853	0.115	-0.434										
Alkalini	0.956	-0.980	-0.831	0.185	-0.534	0.987									
Chloride	0.909	-0.991	-0.925	-0.056	-0.368	0.915	0.945								
Calcium	0.905	-0.950	-0.741	0.328	-0.657	0.958	0.988	0.909							
Magnesi	0.993	-0.905	-0.899	-0.094	-0.199	0.966	0.915	0.861	0.852						
Sodium	0.983	-0.941	-0.966	-0.202	-0.149	0.950	0.915	0.923	0.843	0.981					
Potassiu	0.800	-0.904	-0.642	0.436	-0.769	0.877	0.940	0.874	0.977	0.725	0.730				
DO	-0.877	0.982	0.834	-0.137	0.544	-0.913	-0.963	-0.980	-0.957	-0.813	-0.861	-0.951			
COD	-0.492	0.494	0.801	0.853	-0.543	-0.376	-0.336	-0.568	-0.201	-0.517	-0.641	-0.098	0.399		
NO ₃ -N ₂	0.797	-0.926	-0.915	-0.208	-0.245	0.790	0.836	0.969	0.789	0.742	0.849	0.775	-0.929	-0.680	
PO ₄ -P	0.028	-0.331	-0.052	0.464	-0.705	0.141	0.302	0.380	0.396	-0.093	0.000	0.577	-0.501	0.169	0.447

Whereas, Temp = Temperature, Trans = Transparency, TDS = Total Dissolved Solids, TSS = Total Suspended Solids, Hard = Hardness, Alka = Alkalinity, Ca = Calcium, Mg = Magnesium, Na = Sodium, K = Potassium, DO = Dissolved Oxygen, COD = Chemical Oxygen Demand, NO₃-N₂ = Nitrate-Nitrogen, PO₄-P = Phosphate-Phosphorus.

Table-7, Correlation matrix of physico-chemical parameters at site-3.

	Temp	Trans	TDS	TSS	pH	Hard	Alkal	Chlor	Calcium	Magnesi	Sodium	Potassium	DO	COD
NO ₃ -N ₂														
Transpar	-0.885													
TDS	0.977	-0.788												
TSS	0.990	-0.928	0.961											
pH	-0.883	0.615	-0.880	-0.810										
Hardness	0.972	-0.969	0.912	0.989	-0.775									
Alkalini	0.935	-0.703	0.926	0.877	-0.992	0.846								
Chloride	0.990	-0.938	0.952	0.999	-0.812	0.994	0.879							
Calcium	-0.581	0.230	-0.594	-0.462	0.894	-0.421	-0.831	-0.468						
Magnesi	-0.319	-0.083	-0.512	-0.273	0.398	-0.127	-0.382	-0.237	0.372					
Sodium	0.791	-0.823	0.804	0.859	-0.437	0.831	0.541	0.845	0.000	-0.341				
Potassiu	0.981	-0.861	0.936	0.954	-0.931	0.950	0.967	0.960	-0.683	-0.223	0.667			
DO	-0.997	0.849	-0.985	-0.979	0.910	-0.953	-0.955	-0.977	0.629	0.369	-0.764	-0.982		
COD	-0.949	0.981	-0.867	-0.967	0.755	-0.994	-0.826	-0.976	-0.482	0.022	-0.786	-0.943	0.926	
NO ₃ -N ₂	0.939	-0.754	0.985	0.937	-0.796	0.874	0.851	0.922	0.874	-0.590	0.866	0.866	-0.945	-0.816
PO ₄ -P	0.854	-0.945	0.812	0.918	-0.511	0.926	0.615	0.915	0.945	-0.129	0.962	0.770	-0.819	-0.907

Whereas, Temp = Temperature, Trans = Transparency, TDS = Total Dissolved Solids, TSS = Total Suspended Solids, Hard = Hardness, Alka = Alkalinity, Ca = Calcium, Mg = Magnesium, Na = Sodium, K = Potassium, DO = Dissolved Oxygen, COD = Chemical Oxygen Demand, NO₃-N₂ = Nitrate-Nitrogen, PO₄-P = Phosphate-Phosphorus.

Table-8, Correlation matrix of physico-chemical parameters at site-4.

	Temp	Trans	TDS	TSS	pH	Hardness	Alkalinity	Chloride	Calcium	Mg	Na	K	DO	COD	NO ₃ -
N ₂															
Trans	-0.970														
TDS	-0.981	0.928													
TSS	0.988	-0.992	-0.945												
pH	0.252	-0.054	-0.419	0.103											
Hardness	-0.144	0.379	0.073	-0.271	0.647										
Alkalinity	0.882	-0.740	-0.918	0.802	0.618	0.325									
Chloride	0.902	-0.769	-0.924	0.831	0.560	0.294	0.997								
Calcium	0.442	-0.210	-0.504	0.316	0.762	0.823	0.804	0.785							
Magnesium	-0.932	0.816	0.952	-0.869	-0.529	-0.217	-0.992	-0.997	-0.733						
Sodium	0.722	-0.721	-0.582	0.770	-0.281	-0.096	0.558	0.617	0.294	-0.626					
Potassium	0.919	-0.847	-0.978	0.860	0.575	0.000	0.915	0.907	0.544	-0.931	0.409				
DO	-0.405	0.170	0.490	-0.270	-0.837	-0.831	-0.788	-0.759	-0.992	0.709	-0.184	-0.555			
COD	0.586	-0.623	-0.420	0.661	-0.475	-0.198	0.369	0.436	0.119	-0.448	0.977	0.226	0.000		
NO ₃ -N ₂	0.979	-0.944	-0.928	0.977	0.149	-0.090	0.864	0.895	0.470	-0.917	0.843	0.834	-0.410	0.726	
PO ₄ -P	0.195	-0.429	-0.100	0.330	-0.713	-0.990	-0.287	-0.247	-0.790	0.172	0.225	0.000	0.816	0.333	

Whereas, Temp = Temperature, Trans = Transparency, TDS = Total Dissolved Solids, TSS = Total Suspended Solids, Hard = Hardness, Alka = Alkalinity, Ca = Calcium, Mg = Magnesium, Na = Sodium, K = Potassium, DO = Dissolved Oxygen, COD = Chemical Oxygen Demand, NO₃-N₂ = Nitrate-Nitrogen, PO₄-P = Phosphate-Phosphorus.

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