International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 3 Issue 11, October 2016

ISSN: 2394-4404

Assessment Of Physico-Chemical Parameters Of Dal Lake, Srinagar Kashmir

Sajad Husssain Dar

Asrar Amin Khan

Tasleem Arif Shah

Q. J. Shami

Department of Zoology and Aquaculture,
Barkatullah University, Bhopal M.P, India

Abstract: ***Present survey has been carried out in Dal Lake Srinagar to determine its variation in physio-chemical parameters. Sampling was done on monthly basis with a gap of two month duration from10 January 2014 to 20 October 2015. Total number of physio-chemical parameters was restricted to 15 and its analysis was carried out in five basins. Each basin was divided into two sampling stations for monitoring purpose, so the number of sampling stations was 10. Anthropogenic activity, sewage and urbanization were main causative agents for the deteriorating quality of water which is the real essence of life and property. The present work highlights the deteriorating quality of water and provides "water quality index" in a simplified way for reference purpose and as a reliable picture of water quality. Few of the parameters were analyses at sampling sites immediately and rest of them were carries out in laboratory.results of all major parameters indicate that Dal Lake has become a biological sink for refuge, ions, slit and human interference.***

I. INTRODUCTION

Ancient Sanskrit texts mentioned Dal Lake as Mahasar. The Mughal rulers of India designated Srinagar as their summer resort; they developed Dal in Srinagar with enchanting Mughal gardens and pavilions as enjoyable and pleasant resort. Dal lake is a world famous water body and referred as lake par excellence by sir walter Lawrence. Dal is a shallow, entropic, and semi-urban lake situated in the heart of Srinagar city. Its latitude is 34^0 18'North and longitude 74^0 91'East at an average altitude of 1,583 metres. After the independence of India, the Kashmiri Hanji built, owned and maintained houseboats, and developed floating gardens to produce valuable commodities for the market, which in forth coming years become centre of their livelihood. The first attempt to restrict construction in Dal lake and its peripheral area was done by Dogra Maharaja of Kashmir and this law was scraped by British empire and allowed construction of houseboats in and around dal lake which favoured a famous quotation of little piece of England afloat on Dal. In the course of time houseboats close to Dal began to provide accommodation to tourists in Srinagar, which ultimately, become full flourished industry and an economical service in Srinagar. The magnificent and pleasant view resulted in the universal epithet, "jewel in the crown of Kashmir". The lake is located in the foothills of the Shankracharya hills, called Zabarwan mountain valley, with a catchment area covering 316km^s (122sq miles) the lake stretches between east and north of Srinagar city covering an area of 18 km^2(6.9miles^2). By including the floating gardens of lotus blooms, an estimated figure of 22-24km^2 is mentioned. Dal Lake is divided into five basins and navigational channel for transportation links connects these basins. The interconnected basins are; the Nehru park basin, the Nishat basin, the Barari Nambad basin, the Hazratbal basin, and the Nagin basin. The deepest point is in Nagin lake 6 meters (20 ft) and shallowest at Gagribal with an elevation of 1,583 meters. The flat bed ratio is the maximum and minimum depth ratio between two seasons and is about 0.25-29.The average length of lake is 7.44 km and width of 3.5 km, At the foothill of Shankaracarya

and Zabarwan, restrictions on the flow of the lake resulted in marshy lands on the peripheral zone and these marshy lands have been converted into large residential complexes.

The lake is classified under the sub-tropical lake category as 'warm monomictic' the perennial flow from Dachigam-Telbal Nallah, Dara Nallah and number of small streams are the permanent feeding source to the Dal lake. No substantial spring source is worth mentioned, but during summer snow of the catchment area from higher reaches melts down and results in small streams which joins themselves and forms inflow into the lake. The maximum discharge of Telbal Nallah is estimated as 291.9 million cubic metres, accounting for 80% contribution and 20% from other sources. Dal Lake is the second largest in the state, and also commercial centre of Hanjis for fishing and harvesting Hydrophytes and its products.

The shore line encompassed by a boulevard road lined with Mughal gardens, houseboats and hotels. During winter chilling temperature up to -11^{o}c results in freezing. The two outlets of the lake are Amir Khan Nallah and Dalgate that connects the lakes of Nagin and Anchar Lake. The outflow from these outlets has been estimated as, 275.6 million cubic metres. Weir and lock system is used to control the Dalgate. Huge quantity of untreated sewage and superfluous fertilizers from inlet channels produces algal blooms and various types of macrophytes which ultimately results in eutropication. These fertilizers and untreated sewage has become nuisance for fish, boating and also slit load reduces carrying capacity of the lake. For the purpose of restoring ecological stability and biological monitoring LAWDA (Lake and waterways development authority under state government is undergoing deseeding, deweeding, and dredging. Massive investment of approximately US$275 million is being made by government of India to restore the lake in its original position.

The special feature especially floating gardens are termed as 'Rad' in Kashmiri language. The detached material from bottom of the lake is drawn to special places over wooden slabs. This anchored material; rich in nutrients provide noteworthy results in production of cucumber, melons and tomatoes. The yield is harvested early in season and supplied to city. In addition to this dal lake is a commercial source of fish. The common fish found in Dal Lake includes crossochelius latius, schizothorax niger, schizothorax curviformis, schizothorax esocunus, and economically important cyprinus carpio specularis. Fishing is the second largest industry and a permanent source of livelihood for many people residing over peripheral area of Dal. Fishing is done by locally manufactured net, as an average catch constitutes 70% carp, 20% schizothorax and other 10% species. The gradual increase in pollution load results in decline of fish harvest and extinction of endemic verities of fish. The cause for such deterioration should be addressed and immediate measures taken. Water quality has deteriorated due to intense pollution and the original size of lake shrinks day by day due to heavy slit load and also by encroachment of water channels. The rate of shrinking from 22 square kilometres to 18 square kilometres is matter of concern. Deforestation of catchment area enhances slit load and untreated sewage water adds to the deterioration, combined with the solid waste from houseboats. Furthermore, nitrogen and phosphorus-rich run- off leads to eutrophication.

Under the financial assistance of government of India a multidisciplinary team of experts have prepared a detailed project report entitled "Conservation and Management of Dal" a responsible management plan to achieve environment sustainability. Dal Lake is centre of attraction and a summer resort. Harvesting of food and fodder plants are carried out in Dal Lake as a surplus activity to support and keep available processed food for people and animals. Weeds are extracted and converted into compost to boost gardens. It also serves as a flood channel and reservoir for Jhelum. Winter sports including snow skiing is done especially during severe winter and also water support canoeing is practised on the lake.

The famous and fabulous landmark in Dal Lake is an island called char chinare (platanus orientalis). Char chenar in Urdu language means four chinar trees. Nageen Lake remains a point of discussion for few, and a debatable part, whether to consider it as a separate or a part of Dal Lake. The strong fact to support the argument for its inclusion with Dal Lake is a causeway which permits bikers and walkers to enter the lake premises. It carries a pipeline to the eastern part of Srinagar city. The lake is bounded by the shankaracharya hill on the south and Hari parbat on the west. The famous Mughal Gardens of Kashmir Naseem Bagh, Shalimar, Nishat and Cheshms Shahi are situated on the bank of Dal Lake. Bode Dal is characterised by the presence of famous Shrine of Hazaratbal in Naseem Bsgh as well as Kashmir university. In spite of scenic beauty Dal Lake is remarkable in having majestic mountains in its backdrop. Dal Lake is also called as "Liquid heart" of Srinagar, the summer capital of Jammu and Kashmir surrounded by mushroom growth of hotels which attracted the attention of various ecologists, keeping in view the ecological and socio-economical importance of the lake. According to report prepared by the University of Roorkee's Alternate Hydro Energy Centre, the major contributor of pollution is sewage which brings Nitrogen and Phosphorus and changes chemical and physical properties of Dal water. Fifteen major drains of city open into the Dal Lake. In contrast to the Dal dwellers with twelve hundred houseboats are responsible only to three percent pollution. However, the biggest culprit is untreated sewage water. Total quantity of phosphorus from all sources to the Dal Lake is 156.62 tons. Inorganic Nitrogen (in the form of No_3-N and NH_3-N) was estimated to be 241.18 and 77.609 likewise; 4.5 tons of total phosphate and 18.14 tons of nitrogen are added from non point sources to the lake. Daily Excelsior, published on 19/09/2012. Dal Lake "Delight of the World" has become a biological sink, where every kind of human interference and its waste ultimately finds its way, resulting in the accelerated growth of weeds and mineral concentration need to be preserved for generations to come.

II. STUDY AREA

Dal Lake is located in the eastern part of Srinagar, on the right bank of river Jhelum and is the main reservoir of watersheds in the city. One of the significant features of a Dal lake is its diverse nature of watershed, spread over 331 km^2

with sub and secondary branching. The out washing of these watersheds bring contamination as they approach congested areas up to the mouth of the Dal Lake. Dal Lake is famous not only for its beauty, but also for its unique life style anywhere in the world. The inhabitant of Dal Lake called Hanjies had lived for centuries and is acclimatized with the harsh climatic conditions as well as complete infrastructure that help them to thrive well within it. The one and only life line of Srinagar city is unfortunately, under constant pressure as these Hanjies are also involved in land transformation and their focus on land expansion. The Multi-basined Lake is having five main stations with evident geographical and morphological features. These basins include Bod Dal, Lokut Dal, Nageen, Gagribal and Hazatatbal. The two main outlets are Dal Gate and Pokhribal Nallah and also supplied by two main watersheds called Dhara Danihama and Dachigam. Dal Lake is second largest lake covering an area of 316 square kilometers in zabarwan mountain valley with diverse watershed. The main problem of these watershed and aquatic ecosystems is enrichment of nutrients from residential and catchment areas as well as, runoff from agriculture fields. Catchment area of the lake stretches from North of Dal Lake to areas that border the lake on the north and covers an area of 337.44 km^2. In this way multi-linage water source is under constant threat and the deteriorating quality of drinking water results in amalgamation of different diseases, and the constant anthropogenic pressure with its tremendous deterioration results in shrinkage of lake surface area. The average latitude of these sites varies from 34^o $04'$ $54.8''$ North to 74^0 52 $'$ $34.8''$ E. The geographical coordinate of Dal Lake lies between 34^0 $07'$ N, 74^0 $52'$ E.

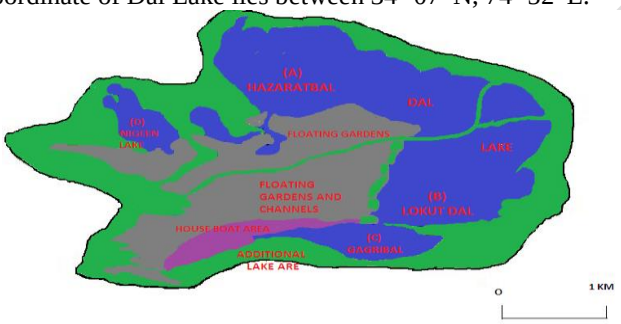


Figure 1: Representing study area

III. METHOD AND MATERIAL

SAMPLING DESIGN AND SITE SELECTION

The samples were collected between 9am to5pm and ten sites were selected, based on difference in geographical profile of the lake. Ten sampling stations were chosen within the lake for the study of physio-chemical characteristics of water. Two sampling stations (S1, S2), were chosen from Nageen basin near Houseboats directly fed by sewage from houseboats with an average depth of 2.75 meters. Site third and fourth (S3, S4), is situated in Nishat basin near LAWDA. This site is constantly disturbed during summer by manual deweeding process by local Hanjies. The average depth of this site is 2.65 meters. Site fifth and sixth (S5, S6), with average depth of 4.15 were chosen from Gagribal basin characterised by dense growth of macrophytes. In the same way two more sampling sites designated as site seventh and eighth (S7, S8), where chosen from floating gardens of Kandmohalla with an average depth of 2.9 meters. Another two sites where selected from Habak designated as site ninth (S9) with an average depth of 2.95meters and last tenth (S10) site was selected from Dal gate.

PHYSICO - CHEMICAL PARAMETERS OF WATER

From all the ten stations, samples were collected seasonally in two replicates from 10 January 2014 to 20 October 2015. Physico-Chemical parameters were analyzed by the following method of water chemistry as given in APHA (1995) and Adoni, A.D. (1985) Water samples were collected in 1 litre plastic cane with the help of Ruttner water sample from each station. At the sampling station analysis of some of the Physico-Chemical parameters were carried out immediately, which include air and water temperature, depth, transparency, pH, conductivity and TDS.

IV. RESULT

AIR TEMPERATURE

The air temperature oscillated between 5 ^{0}C to 31.6 ^{0}C. The minimum temperature 5 ^{0}C was recorded at station S8 winter. The maximum air temperature was recorded in June, at station 4. The air temperature showed highest peak in summer and showed declined trend towards the winter.

WATER TEMPERATURE

The range of surface water temperature was between, 3.4 – 26.5^{o}C. The lowest value was recorded at station 6 during winter and the maximum value was recorded at station 9 during summer, the maximum temperature in summer may be regarded due to low water level, clear atmosphere and greater solar radiation as stated by Vyas (1986), the turbid water is likely to be warmer.

TRANSPARENCY

The transparency of the system showed narrow fluctuation and ranged between 0.5 – 6.3 cm. The lowest value was recorded in March at station 4 and maximum during winter at station 10.

CONDUCTIVITY

Conductivity ranged between 115 - 385 µmhos in surface water. The maximum value 385 µmhos was recorded at station 4 during March, while as the minimum value 115 µmhos was recorded at station 5, Winter, Dakshini and Gupta (1984) reported its range 112.05 – 228.96 µmhos/cm in Badkhal Lake,

PH

The pH value ranged from 7 – 8.7. There was no appreciable variation in pH from station to station in the water

body. The highest value 8.7 was recorded at station 10 during October, whereas the lowest value 7 was recorded at stations 7 in August. Ruttner (1931) noticed pH value as 8 in tropical water of Indonesian lakes. Nair *et al.* (1988) found a range from 7.8 – 9.0 in a village pond, Imalia Vidisha, M.P. In present study generally high values were found during winter season due to low water level in the lake.

DISSOLVED OXYGEN

In surface water DO oscillated between 3.2-8.2 mg/l. The maximum value 8.2 mg/l was registered at station 2 during spring, whereas the minimum value 3.2 was recorded at station 1 during summer. Khan *et al.* (1986) reported DO in the range of 6.05 - 9.38 and Tiwari (1988) reported 6.3 - 12.5. In lower lake, Bhatnagar (1984) found its range between 0.6 - 1.4 in bottom water.

CHLORIDE

Chloride content ranged between 7 – 24 mg/l. The maximum value 24 mg/l was recorded at station 4 during summer. Whereas the minimum value 7 mg/l was recorded at station 6 in spring. According to Sreenivasan (1964) low chlorides 4 - 10 ppm indicate the purity of water and freedom from pollution, whereas high value of chloride is denoted as pollution of organic matter particularly that of animal origin, (Singh 1960, Sarkar and Rai 1964 and Verma 1969).

TOTAL ALKALINITY

Total alkalinity ranged between 47 – 373 mg/l. The maximum value 373 mg/l was recorded at station 1 during spring. Whereas the minimum value 47 mg/l was recorded at station 5 during August. Garg *et al.* (2009) reported alkalinity in the range of 64.25 – 146.24 mg/l in Ramsagar reservoir.

TOTAL HARDNESS

Total Hardness fluctuated between 38 – 496 mg/l. The maximum value 496 was recorded at station 1 during summer whereas the minimum value 38 was recorded at station 6 during October. Similar observations were noticed by (George 1976 and Singh 1960). Garg *et al.* (2009) reported total hardness in the range of 34 – 75 mg/l in Ramsagar reservoir. Sharma *et al.* (2007) reported total hardness in the range of 52 – 136 mg/l in three seasonal ponds of Rajasthan.

CALCIUM HARDNESS

Calcium content varied from 28 – 287 mg/l. The maximum value 287 mg/l was registered at station 5 during August and the minimum value 28 mg/l was recorded at station 5 during October. Awatramani (1980) also recorded increased calcium concentration in deeper layer of Sagar Lake, Sastry *et al.* (1980) observed its range 14-64 mg/l, and MPNNM (1981) found its range 24-94 in Upper Lake respectively.

MAGNESIUM

Mg varied between 3 – 87 mg/l. The maximum value 87 mg/l was recorded at station 1 during summer and minimum value 3 mg/l was recorded at station 3 during spring. Sharma *et al.* (2007) reported magnesium in the range of 6 – 10.2 mg/l in three seasonal ponds of Rajasthan. Values of magnesium were always lower than the calcium, also reported by (Sastry *et al.* 1970,

FREE Co_2

Free Co_2 was less or almost absent. But at the same time high bottom accumulation range 2 – 17.5 mg/l maximum value was registered during October at station 3 and minimum value was registered at station 2 during March. Garg *et al.* (2009) reported free CO_2 in the range of 0 – 6.32 mg/l in Ramsagar reservoir. Sharma *et al.* (2007) reported free CO_2 in the range of 2 – 18 mg/l in three seasonal ponds of Rajasthan

NITRATE

In surface water it varied between 0 – 7.7 mg/l. The maximum value 7.7 mg/l was recorded at station 6 during summer and the minimum value 0 mg/l was recorded at station 3, 4, 5 during January. Garg *et al.* (2009) reported nitrate in the range of 0.011 – 0.033 mg/l in the Ramsagar reservoir. Bhatnagar (1984) reported their range from 1.14-2.25 mg/l at deepest point of Lower lake.

ORTHOPHOSPHATE

In surface water, it ranged between 0 - 116 mg/l. The maximum value 116 mg/l was registered at station 1 during October while the minimum value 0 mg/l was recorded at station 2, 4 during January.

PARAMETERS	Minimum	Maximum	Range	Mean	Median	Standard error	Variance	Average deviation	Standard deviation
AIR TMPERATURE	3.4	7.5	4.1	5.98	6.15	0.48621	2.364	1.188	1.53753
WATER TEMPERATURE	3.4	6.2	2.8	4.7	4.95	0.280872	0.788889	0.7	0.888194
DEPTH	1.2	4.7	3.5	3.08	2.9	0.316509	1.001778	0.756	1.000888
TRANSPARENCY	1.1	6.3	5.2	2.73	2.3	0.55258	3.053444	1.268	1.747411
Ph	7.6	8.6	1	8.2	8.35	0.109545	0.12	0.28	0.34641
CONDUCTIVITY	115	234	119	187.6	185	9.841183	968.4889	20.52	31.12055
DISSOLVED OXYGEN	3.2	5.5	2.3	4.34	4.4	0.202868	0.411556	0.48	0.641526
FREE CO2	2.4	6.4	4	4.3	4.5	0.426093	1.815556	1.08	1.347426
CHLORIDE	9	14	5	11.4	11.5	0.6	3.6	1.6	1.897367
ALKALINITY	125	165	40	151.5	156	3.786673	143.3889	8.7	11.97451
TOTAL HARDNESS	83	217	134	168.8	176.5	12.41129	1540.4	30	39.24793
CALCIUM HARDNESS	65	133	68	109.8	115.5	7.028197	493.9556	16.12	22.22511
Mg HARDNESS	7	24	17	14.2	13	1.428286	20.4	3.24	4.516636
AMMONIA	0	0	0	0	0	0	0	0	0
NITRATE	0	16	16	8.9	11.5	2.030052	41.21111	5.34	6.419588
ORTHOPHOSPHORUS	0	32	32	10.1	7	3.547926	125.8778	8.92	11.21953

Table 1: Shows statistical analysis for the month of January

ISSN: 2394-4404

PARAMETERS	Minimum	Maximum	Range	Mean	Median	Standard error	Variance	Average deviation	Standard deviation
AIR TEMPERATURE	12	21.8	9.8	17.96	18.5	0.950813	9.040444	2.368	3.006733
WATER TEMPERATURE	13.5	15	1.5	14.12	13.95	0.181842	0.330667	0.504	0.575036
DEPTH	1.3	3.8	2.5	2.21	2.2	0.245606	0.603222	0.592	0.776674
TRANSPARENCY	0.5	1.7	1.2	1.23	1.25	0.119304	0.142333	0.27	0.377271
Ph	7.4	8.5	1.1	8.18	8.3	0.11907	0.141778	0.272	0.376534
CONDUCTIVITY	214	387	173	312.9	325	19.47674	3793.433	47.94	61.59085
DISSOLVED OXYGEN	4.6	8.2	3.6	6.69	6.75	0.336469	1.132111	0.772	1.064007
FREE CO2	2	15	13	8.91	8.4	1.241008	15.401	3.09	3.924411
CHLORIDE	13	24	11	18.8	19	1.083205	11.73333	2.64	3.425395
ALKALINITY	51	373	322	148.4	147	27.47815	7550.489	47.28	86.89355
TOTAL HARDNESS	105	154	49	122.9	124	4.420784	195.4333	10.1	13.97975
CALCIUM HARDNESS	18	97	79	78.4	87	7.447893	554.7111	15.84	23.55231
Mg HARDNESS	3	8	5	5.6	5.5	0.476095	2.266667	1.2	1.505545
AMMONIA	0	345	345	128.4	84.5	35.47243	12582.93	89.28	112.1737
NITRATE	0	41	41	27.7	29	3.850108	148.2333	8.9	12.17511
ORTHOPHOSPHORUS	0	87	87	55.2	62.5	7.777175	604.8444	16.88	24.59359

Table 2: Shows statistical analysis for the month of March

PARAMETERS	Minimum	Maximum	Range	Mean	Median	Standard error	Variance	Average deviation	Standard deviation
AIR TMPERATURE	24.5	31.6	7.1	27.71	27.55	0.716388	5.132111	1.732	2.265416
WATER TEMPERATURE	19.5	26.5	7	23.09	23.85	0.740488	5.483222	1.892	2.341628
DEPTH	1.4	7.8	6.4	4.42	3.75	0.673432	4.535111	1.804	2.12958
TRANSPARENCY	0.9	2.7	1.8	1.83	1.8	0.173877	0.302333	0.436	0.549848
Ph	7.2	8	0.8	7.56	7.55	0.081921	0.067111	0.2	0.259058
CONDUCTIVITY	106	304	198	176.2	178.5	20.54091	4219.289	54.4	64.95605
DISSOLVED OXYGEN	3.2	5.4	2.2	4.39	4.5	0.210528	0.443222	0.474	0.665749
FREE CO2	2	8.2	6.2	5.79	6.5	0.748695	5.605444	2.012	2.367582
CHLORIDE	15	24	9	19.4	20	1.0873	11.82222	3	3.438346
ALKALINITY	57	156	99	135	145	9.315459	867.7778	18.8	29.45807
TOTAL HARDNESS	165	496	331	292.8	286	28.2614	7987.067	64	89.37039
CALCIUM HARDNESS	87	184	97	128.6	125.5	9.273858	860.0444	20.52	29.32651
Mg HARDNESS	12	87	75	31.7	25.5	6.875157	472.6778	14.44	21.74115
AMMONIA	0	205	205	74.7	81.5	23.47341	5510.011	64.5	74.22945
NITRATE	4	77	73	33.5	43	7.573712	573.6111	20.2	23.95018
ORTHOPHOSPHORUS	12	65	53	35.2	36.5	4.887171	238.8444	11.8	15.45459

Table 3: Shows statistical analysis for the month of June

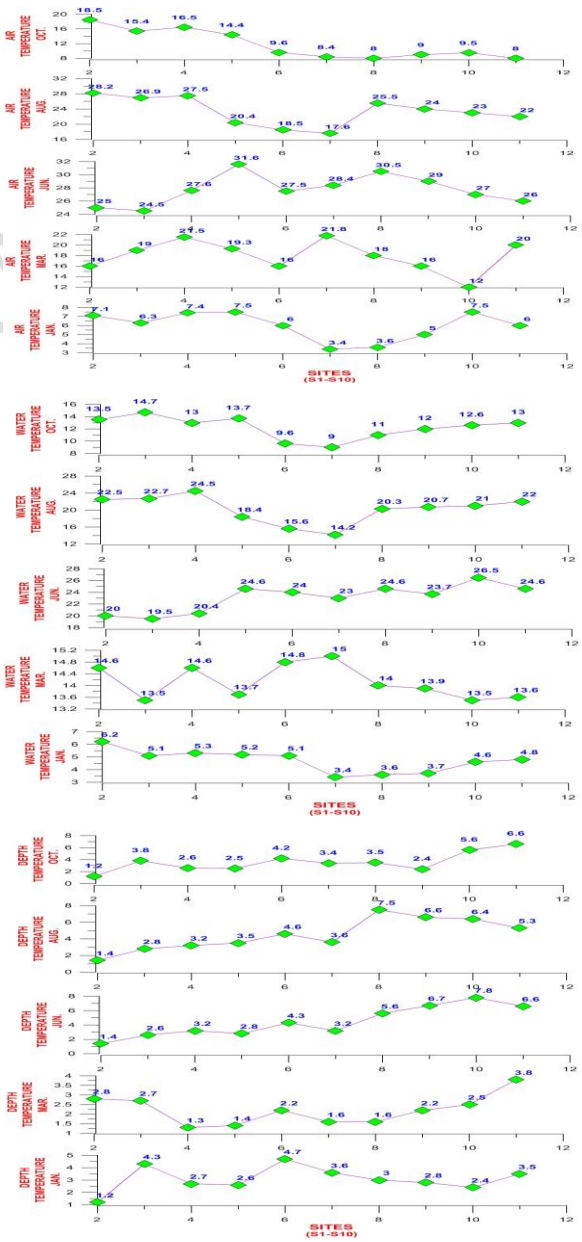
PARAMETERS	Minimum	Maximum	Range	Mean	Median	Standard error	Variance	Average deviation	Standard deviation
AIR TEMPERATURE	17.6	28.2	10.6	23.36	23.5	1.181449	13.95822	3.06	3.73607
WATER TEMPERATURE	14.2	24.5	10.3	20.19	20.85	1.025069	10.50767	2.474	3.241553
DEPTH	1.4	7.5	6.1	4.49	4.1	0.611637	3.741	1.59	1.934166
TRANSPARENCY	1.2	2.5	1.3	2.02	2.2	0.143604	0.206222	0.372	0.454117
Ph	6.8	7.8	1	7.36	7.4	0.094516	0.089333	0.228	0.298887
CONDUCTIVITY	143	210	67	181.7	189	7.441699	553.7889	19.36	23.53272
DISSOLVED OXYGEN	4.3	6.5	2.2	5.38	5.4	0.267831	0.717333	0.684	0.846955
FREE CO2	4.4	15.6	11.2	11.73	14.55	1.422756	20.24233	3.864	4.499148
CHLORIDE	7	20	13	15.1	15.5	1.149396	13.21111	2.5	3.634709
ALKALINITY	47	155	108	115.9	137.5	13.90799	1934.322	37.74	43.98093
TOTAL HARDNESS	215	417	202	313.5	316.5	19.46293	3788.056	48	61.54718
CALCIUM HARDNESS	135	287	152	180.9	162	17.5989	3097.211	40.64	55.65259
Mg HARDNESS	11	45	34	30.8	33.5	3.773592	142.4	9.84	11.93315
AMMONIA	159	475	316	324	325.5	28.65736	8212.444	59	90.62254
NITRATE	0	56	56	20.8	12	6.518009	424.8444	16.72	20.61176
ORTHOPHOSPHORUS	0	16	16	4.6	4.5	1.613829	26.04444	3.8	5.103376

Table 4: Shows statistical analysis for the month of August

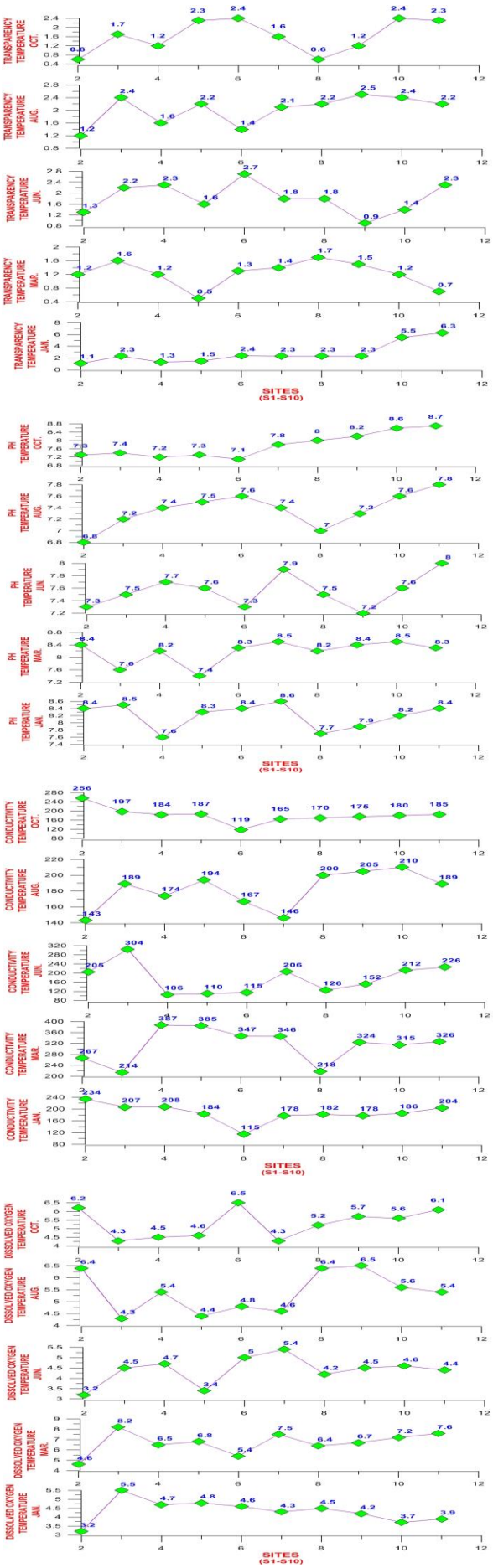
PARAMETERS	Minimum	Maximum	Range	Mean	Median	Standard error	Variance	Average deviation	Standard deviation
AIR TEMPERATURE	8	18.5	10.5	11.73	9.55	1.269562479	16.11789	3.576	4.014709
WATER TEMPERATURE	9	14.7	5.7	12.21	12.8	0.578398171	3.345444	1.448	1.829056
DEPTH	1.2	6.6	5.4	3.58	3.45	0.503940032	2.539556	1.176	1.593598
TRANSPARENCY	0.6	2.4	1.8	1.63	1.65	0.225610283	0.509	0.59	0.713442
Ph	7.1	8.7	1.6	7.76	7.6	0.18690461	0.349333	0.5	0.591044
CONDUCTIVITY	119	256	137	181.8	182	10.64247256	1132.622	20	33.65445
DISSOLVED OXYGEN	4.3	6.5	2.2	5.3	5.4	0.264154837	0.697778	0.72	0.835331
FREE CO2	4.5	17.5	13	12.9	13.5	1.262273082	15.93333	3.02	3.991658
CHLORIDE	12	23	11	18.9	20.5	1.187434209	14.1	3.12	3.754997
ALKALINITY	112	602	490	174.3	125.5	47.70605599	22758.68	85.54	150.8598
TOTAL HARDNESS	38	61	23	51.45	54.25	2.345740821	55.025	6.36	7.417884
CALCIUM HARDNESS	28	75	47	54.7	55.5	4.630934631	214.4556	10.3	14.6443
Mg HARDNESS	3	11	8	7	6	0.906764701	8.222222	2.4	2.867442
AMMONIA	0	716	716	152.6	98	67.27674189	45261.6	136.64	212.7477
NITRATE	5	22	17	11.75	8.5	2.240101684	50.18056	5.95	7.083824
ORTHOPHOSPHORUS	0	116	116	41.2	19.5	13.93062175	1940.622	38.04	44.05249

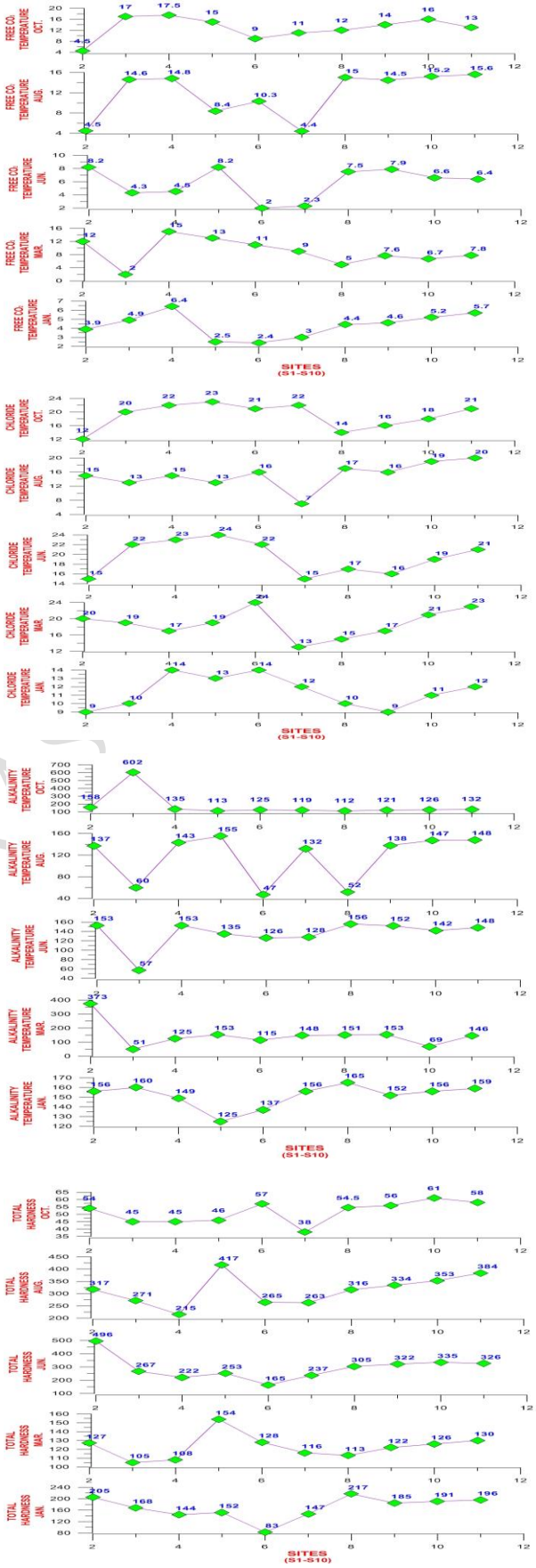
Table 5: Shows statistical analysis for the month of October

GRAPHICAL REPRESENTATION OF ECOHYDROLOGY (DAL LAKE)

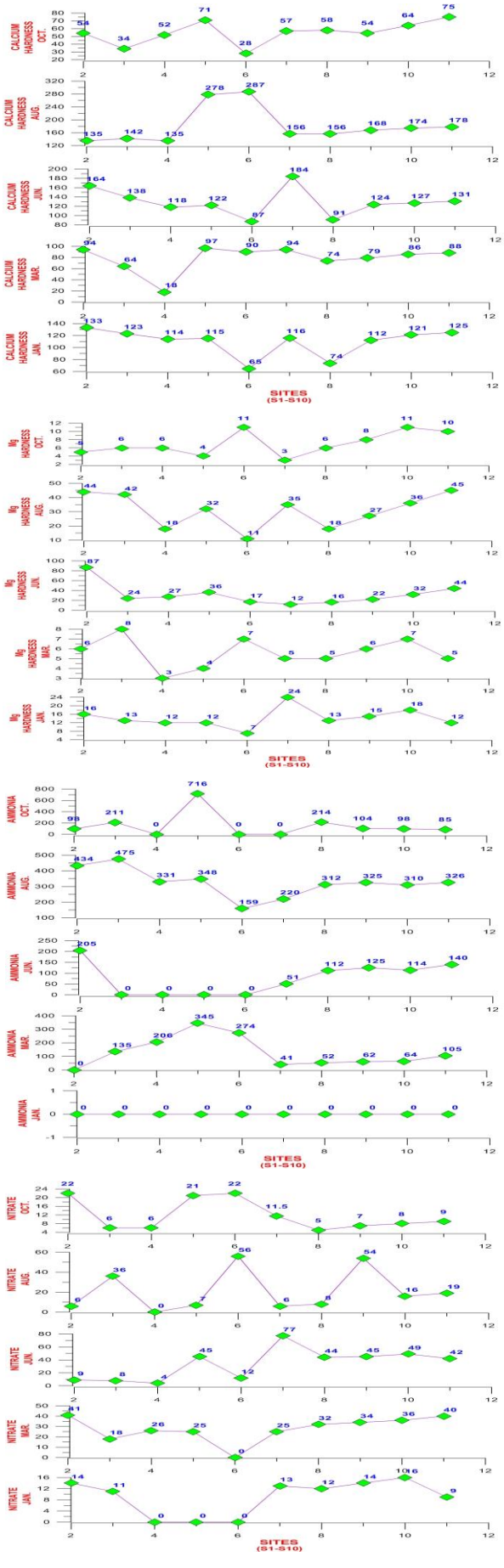


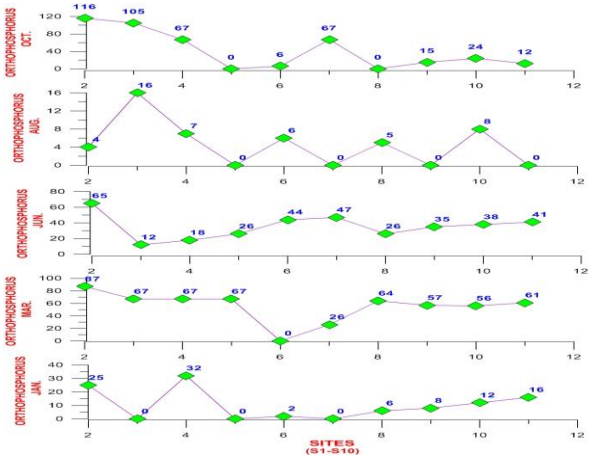
ISSN: 2394-4404





ISSN: 2394-4404





V. CONCLUSION

Dal Lake is supportive ground for diverse organisms due to heavy load of organic and inorganic wastes. Inorganic wastes including Nitrogen and phosphorus results in algal blooms which ultimately form the food source for zooplanktons and benthos. Current operations including dredging forms turbidity and untreated sewage combined with solid waste as well as anthropogenic pressure results in pollution. Eutropication in Dal Lake is severe and a matter of concern for ecologists as the enormous rate of slit load changes dimensions of this wet land and effects several other parameters. Encroachment is a menace of daily routine with blocked water channels. Moreover, rich source of chemical ions is the base of energy transformation with tremendous growth of macrophyte leading to succession. Due to lack of control in point and none point source of pollution and public awareness also results in deterioration of the Dal Lake. Dal lake needs immediate measures to restore pristine glory of past.

REFERENCES

[1] Adoni, A.D. (1985). Work book of Limnology, *pratibha publication Sagar, M. P. India*.
[2] Adoni, A.D. and Joshi, G. (1987). Physio-chemical regime of three freshwater bodies in and around Sagar (M.P) Geobios new reports, 6 (1): 43-46orea. *Marine Pollution Bullettin* 30:200-206.
[3] Awatramani, G. M. (1980). Limnological studies of Sagar Lake, *PhD thesis, University, of Sagar, M.P. India.*
[4] Bhatnagar, G. P. (1984). Limnology of Lower Lake Bhopal with reference to sewage pollution and eutrophication. Tech. report. MAB programme, dept. of env. Govt. of India New Delhi, pp 1 – 77.
[5] Bhat, S. A. Rater, S. A. and Pandit, A. K. (2001). Impact of effluents from Sheri-Kashmir institute (SKIMS) of medical science Soura on Anchar Lake (Kashmir). *J. Res. Dev. 1:30-37.*
[6] Dakshini, K. M. M and Gupta, S. K. (1984). Physiographic and Limnology of three lakes in the

environ. of the Union territory of Delhi, *India Proc. Indian Nat. Sci. Acad*. B. 45: 564-570.

[7] Dar FA, Perrin J, Ahmed S, Narayana AC, and Riotte J (2914) Hydro-geochemical characteristics of Karst Aquifer from a semi-arid region of Southern India and impact of rainfall recharge on groundwater chemistry. *Arabian journal of Geosciences ISSN 1866-7511, ARAB J GEOSCI DO 10.1007/s12517-014-1440-9.*

[8] Garg, R. K, Rao, R. J. and Saksena. D. N. (2009). Correlation of molluscan diversity with physicochemical characteristics of water of Ramsagar reservoir, India. *Int. J. Bio. Vol. 1 (6) pp. 206-207*.

[9] Issac. M and Kaul V (1988) calcium and magnesium in Dal lake a high attitude marl lake in Kashmir Himalaya. *Int. Revue .ges. Hydroboil 73[4]:431-439*

[10] Jeelani,G& shah AQ (2006) .Natural & anthropogenic influences of the water & sediment chemistry of the Dal lake, Kashmir Himalayas. *Oceologia, 0029-8549(print) 1432-1939(online).*

[11] Khan, M. A. (1986). Hydrobiology & organic production in Marl lake of Kashmir Himalayan valley. *Hydrobiologia 135:233-242.*

[12] Khan, M. Raza, S. A. Iqbal, S. A. Chagatai, T. S. and Hussain, I. (1986). Limnochemistry and water quality aspect of the upper lake Bhopal during winter season, *Ind. J. Applied and pure Biol*. I. 47-50.

[13] Khan, M. A & Zuthshi, D. P (1980). Contribution to high attitude limonology of himalayan system &primary productivety of plankton community of Nilnaag lake Kashmir. *Hydrobiology. 75:103:112.*

[14] Lone SA, Faried A, Lori SM, Zubar SM (2013) Physicochemical characterization of Lotic systems of Kashmir: a case study of river Jhelum. *Society for Science and Nature (SFSN) I.J.S.N Vol.4 (4) 579-582. ISSN 2229-6441*

[15] NEERI (1985). Manual of water and waste water analysis. *NEERI, Nagpur. pp 174*.

[16] Pandit A. k. Rather, S .A and Bhat. S.A (2001) limnological features of fresh waters of uri, Kashmir. *JRes. Dev. 1: 22 -28.*

[17] Pandit A.k (1996). Lakes in kashmir himalaya *P.1-40 in Ecol. Env.and energy* (A.H. khan& A.K pandit, Eds) uni. kashmir sgr. J&K.

[18] Pandit, A.K and Yousuf, A.R (2002). Tropic status of Kashmir Himalayan lakes as depicted by water chemistry *J. of Res and dev. Vol 2 pp 1-12.*

[19] Pandit, A.K Haroon Ul Rashid, Rather, G.H and Helal A. Lone (2006). limnological survey of some fresh water in kupwara reg. of Kashmir. Him, *1: 92-97 J. Res. Dev, Vol.2*

[20] Qadree, M. Y and Yousuf, A. R (1980) limnological studies on Lake Malpur Sar 1. *The boitope geobios, 7:117:119*.

[21] Qadri, M.Y and Yousuf, A.R (1988). A comparative study of the limnology of three typical water bodies of Kashmir. *In; rec. Adv. Fish Ecol limnol. Eco conservation (ed.S.nath) creative Pub. N. Delhi. Pp 79-91*.

[22] Quadri, M. Y. and Shah, G. M. (1984). Hydrobiological features of Hokesar, A typical wetland of Kashmir. *J. Biotope. Indian J. Eco*l. II, 2: 203-206.

[23] Madhya Pradesh Pradushan Niwaran Mandal Bhopal. (1981*). Natural water quality survey 1973-1981*.

[24] Ruttner, F. (1931). Hydrographische and hydrochemische bcolachtengen auf. *Hydrobiol. Suppl*. 8: 197-454.

[25] Sarkar, H. L and Rai, H. (1964). The limnology of Suraj Kund, India, physio-chemical conditions and plankton. *Trans. Amer. Soc*. 73: 260-266.

[26] Sarah S, Jeelani GH, and Ahmad S. (2011) Assessing variability of water quality in a groundwater-fed perennial lake of Kashmir Himalayas in linear geostatistics. *Indian Academy of Sciences. J. Earth syst. Sci. 120*, pp. 399-4111.

[27] Saima. M and Yousuf, A.R (2006) Physico-chemical limnology of Dagwan Stream in Kashmir. *J.res & Dev. Vol. 2 1: 124-129.*

[28] Sarwar. S. G. Kundangar, M.R.D. and Abida Waheed. (1988) Physico-Chemical environment of some springs of Kashmikr. *Geobios new reports, 7: 187-189*.

[29] Sreenivasan, A. (1970). Limnology of tropical impoundment. A comparative study of major reservoirs in Madras state, India. *Hydrobiology. 36(314): 443-446*.

[30] Sreenivasan, A. (1964). Limnological studies and fisheries in the three upland lakes of Madras state, India, *Limnol. Oceagor*. 9: 564-575.

[31] Sharma, L. L. Sarang. N. and Sharma, B. K. (2007). Occurrence of macroinvertebrates in relation to water and sediment quality in three seasonal ponds on southern Rajasthan. *J. Aqua. Biol.*, Vol. 22(2), 49-54.

[32] Vass, K. K. and Zutshi, D. P. (1979). Limnological studies on Dal Lake Kashmir. *Inland fish Soc. India.11 (1).*

[33] Singh, V. P. (1960). Phytoplankton ecology of inland water of Utter Pradesh. Proc. Symp. *On Alga logy, 1959 ICAR.1960, pp43-371*.

[34] Tiwari, R. K. Saxena, A. K. and Kulshrestha, S. K. (1988). Evaluation of certain aquatic worms as indicator of water quality of lower Lake of Bhopal. *Proc. Nat. Symp. Past, Present and Future of Bhopal lakes.67-76.*

[35] Verma, M. N. (1969). Hydrobiological study of a tropical impoundment Tekampur reservoir, Gwalior, India with special reference to breading of Indian Corp. *Hydrobiologia, 34 (3-4): 358-368.*

[36] Yousuf, A.R and Shah, G.M (1988) comparative limnology of some freshwater habitat of Kashmir *Geobios new report 7: 58-61*.

[37] Vyas, L. N. (1968). Studies in phytoplankton ecology of Picchola Lake, Udaipur, *Proc. Symp. Recent. Adv. Trop. Ecol*. 334-347.

[38] Zutshi, D. P. and Khan, A. V. (1988). Eutrophic gradient in the Dal lake Kashmir, *Indian J. Environ. Hlth. Vol. 30, (4) 348-354.*