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RESEARCH ARTICLE

Assessment of Physico chemical changes in Nigeen lake.

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Abstract

A study of the water quality changes of NigeenLake was conducted for 6 months, which began in August 2010to Feburary 2011. Three sampling stations were selected representing the different areas in the lake. A total of 11 water quality parameters were measured. The physical and chemical variables were temperature, dissolved oxygen, conductivity, pH, total dissolved solid, turbidity, ammonia-nitrogen, nitrate-nitrogen and ortho- phosphate
. Due to siltation, encroachment and pollution the lake has become shallower and the lake shore has turned into marsh at various places.The higher ranges for Sp. Conductance (192-560 µScm-^{1} @ 25^{0}c), Total-Alkalinity (106-435 mgl^{-1}), Calcium (29.6-44 mgl^{-1}), Nitrate-Nitrogen (275-931 µgl^{-1}), Ammonical-Nitrogen (38-360 µgl^{-1}), Total-Phosphorus (122-722 µgl^{-1}) which exceed the permissible limits is a cause of concern. Hence, the water quality is found to be poor due to increased anthropogenic pressures from the catchment area.

Introduction:-

Dal lake (34°- 06′N, 74° - 45′E; altitude 1583 m) is a post glacial lake with a shallow depth, bounded on the south–west by the capital city Srinagar and encompassed on the other sides by terraced gentle slopes at the base of the precipitous mountains. The Dal lake and its adjunct Nigeen has remained at the focal point of Kashmir's illustrious history, culture and tourism. Situated against the backdrop of Zabarwan, Shankaracharya and KohiMaran, the serene and placid waters have bestowed unparallel beauty and magnificence, attracting the tourists from all over the world. The Nigeenlake offers a novel attraction to tourist because of its calm, placid and serene waters, water sports like skiing, swimming and staying in houseboats. The lake ecosystem of varied cultural ethos offers recreation to tourists who want to fish in its waters or indulge in bird watching. The sunset in Nigeenlake when the entire body of the Nigeen looks like a sparkling jewel to which the word 'Nigeen' is related.

Although extensive research has been conducted on Dal lake but the aim of present study is to provide the status of theNigeen lake (which is an important basin of Dal lake) on the basis of physico-chemical analysis of water.

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Materials and Method:-

Study site:-

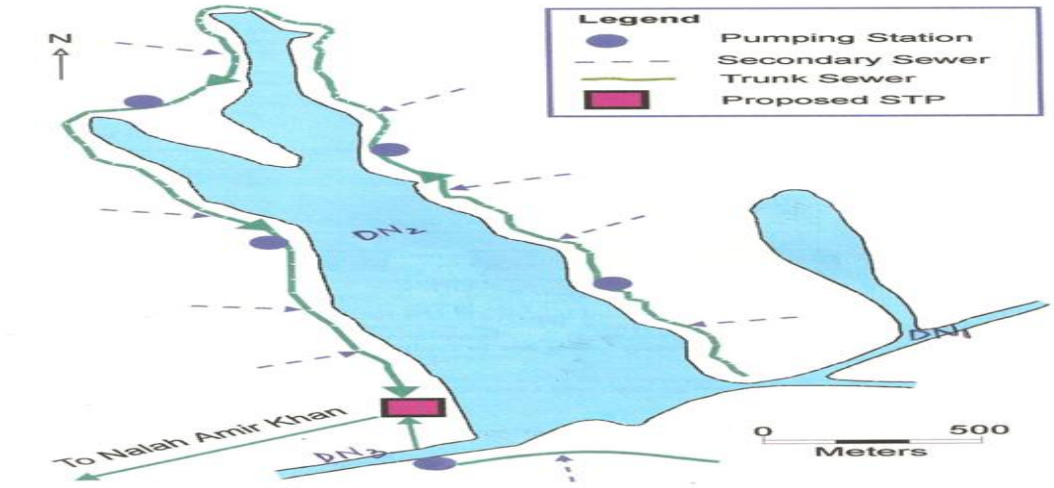

Fig.1:- Outline map Nigeen lake showing sampling sites

Table 1:- Description of sampling sites.

Site	Code	Site image
DN 1	Entry of water into Nigeen via Dal lake	
DN 2	Nigeen Centre	
DN 3	Exit of water from Nigeen to Anchar lake via Nallah Amir Khan	

Methodology:-

The water sampling at the desired sites and depths were taken by Ruttner's sampler. The sampling was done usually between 10:00 to 11:00 hours. The samples were immediately transported to the lab. for detailed analysis.The water analysis was carried out using the methods outlined in APHA, AAWA, WPEF (1997), Golterman and Clymo (1969) and Mackereth (1963), P. K. Gupta (2004).

S. No	Parameter	Method / Equipment
1.	Water Temperature (^{0}C)	Digital Thermometer
2.	Water Depth (cm)	Lead Weight
3.	Water Transparency (cm)	Secchi Disc (20 cm dia)
4.	Water pH	Digital pH Meter MK VI
5.	Specific Conductivity (µS)	Digital Conductivity meter (Systronics)
6.	Dissolved Oxygen (mg/l)	Winkler's Method -Azide Modification (APHA, 1998)
7.	Chloride (mg/l)	Argentometric Method (APHA, 1998)
8.	Alkalinity (mg/l)	Titrimetric Method (APHA, 1998)
9.	Ammonia (µg/l)	Phenate Method (APHA, 1998)
10.	Nitrate (µg/l)	Salicylate Method (CSIR, 1974)
11.	Ortho-Phosphorus (µg/l)	Stannous Chloride Method (APHA, 1998)

Results and Discussion:-

The monthly air temperature (fig 2) ranged between 6.5 ^{o}C (Jan, 2011) to 30 ^{O}C (Aug, 2010at DN1 & DN3) with an overall average of 16.5 ^{o}C during the investigating period.

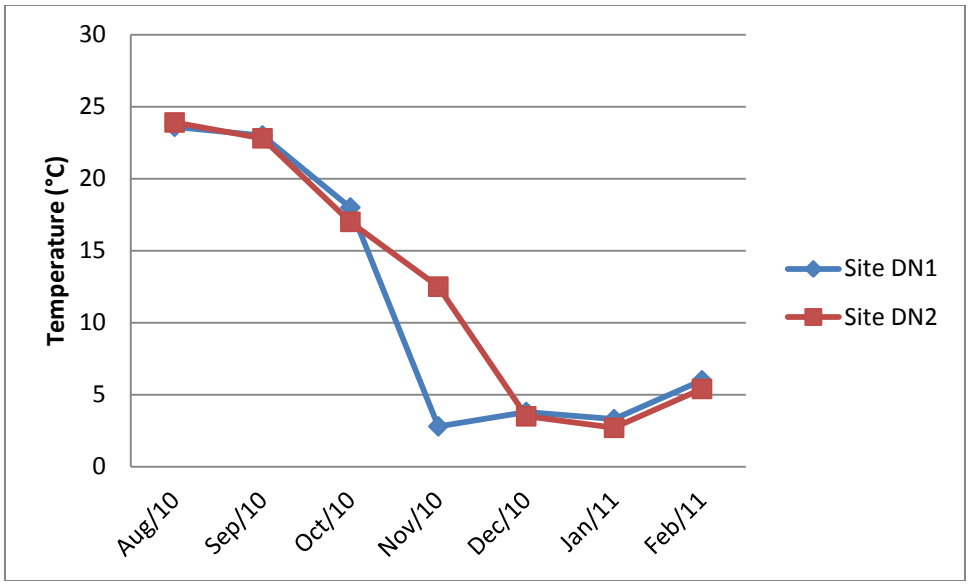

Fig. 2:- Monthly variation in Air Temperature (°C) at various sites of Nigeen Lake.

The monthly water temperature (Fig.3) ranged from 2.8 ^{o}C (Nov, 2010 at DN1) to 25.0 ^{o}C (Aug, 2010 at DN3) with an overall average of 11.9 ^{o}C during the study period.

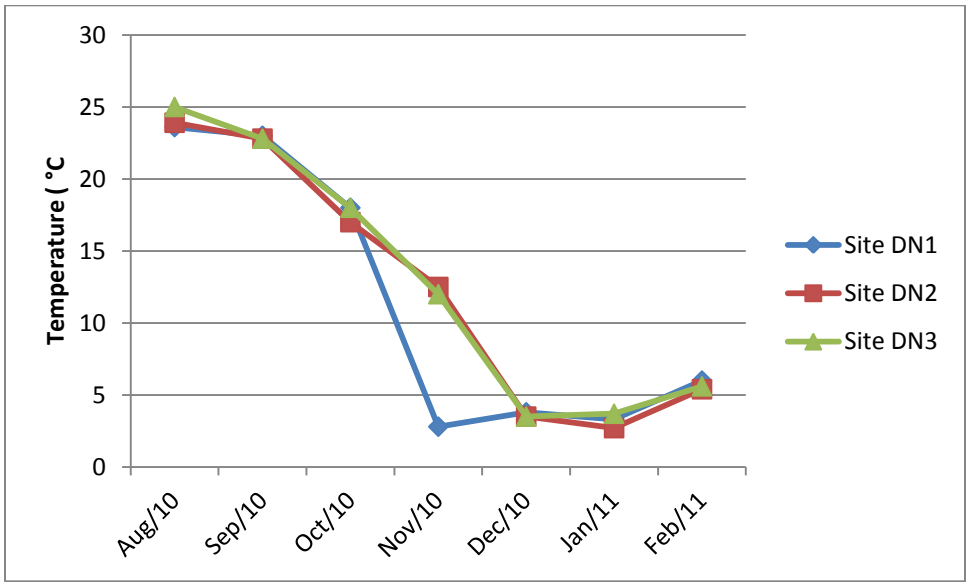

Fig. 3:- Monthly variation in Water Temperature (°C) at various sites of Nigeen Lake.

The monthly transparency measured at the study sites of Nigeen Lake is given in Fig 4. The value for transparency ranged from 0.6m (Sept,Oct, 2010 at DN1) to 2.7m (Jan, 2011 at DN2'S')with an overall average of 1.3m during study period.

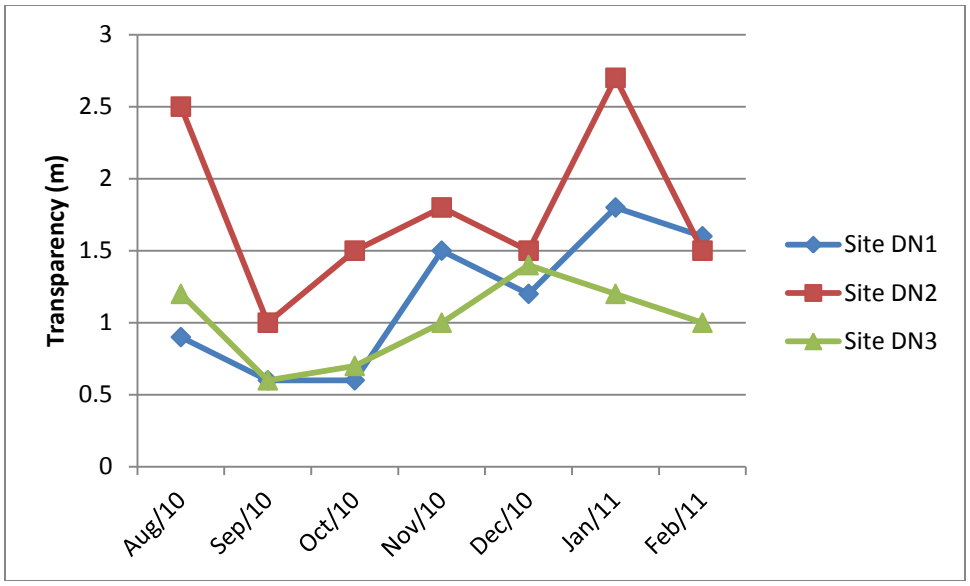

Fig 4:- Monthly variation in Transparency(m) at various sites of Nigeen Lake.

The monthly pH measured at the monitoring sites of Nigeen Lake is given in table (05). The value for pH ranged from 7.6 (Jan, 2011 at DN1) to 8.5 (Aug, 2010 in surface water at DN2) with an overall average of 7.8 during the study period.

The pH of water ranged between 7.5 to 8.5 during the study period and depicted alkaline nature of the water.No major shift has been recorded in pH concentration when compared with earlier records(table 1).The waters of Nigeen lake are thus well buffered which is in conformity with the findings of Edmodson and Hutchinson(1939),Zutshi(1968)and Kundangar and Adnan (2006).

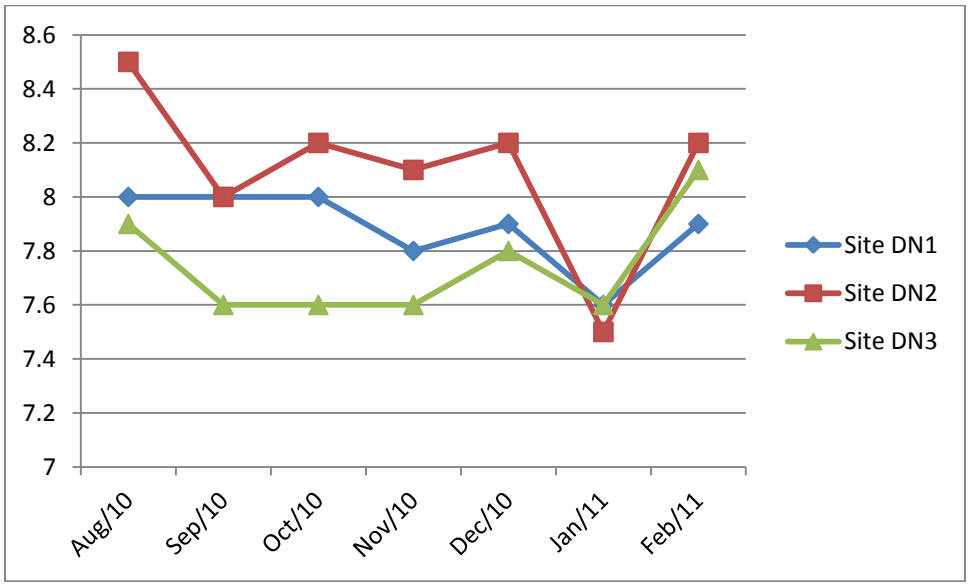

Fig 5;- Monthly variation in pH values at various sites of Nigeen Lake.

The monthly specific conductivity measured at the study sites of Nigeen Lake is given in Fig (06). It ranged between 192 µS (Aug, 2010 in surface water at DN2 &DN3 respectively) to 560 µS (Aug, 2010 in bottom water at DN2) with an overall average of 302.25 (µS at 25^{o}C) during the study period.

The specific conductance of Nigeen water ranged from 192µSm at 25˚C to560µSm at 25˚C which is higher than earlier records. Zutshi (1987)observed moderate conductivity value in Dal lake during 1980-1982 while as Kundangar*et al.*(1992-93)andKundangar and Adnan(2006)reported progressive increase in conductivity values of Nigeen waters. Mathew and Vasudevan(2000)attributed the higher values of sp.conductivity to the mineral inputs while Agarwal and Kanan (1996) hold the concentration of particular ions,TDS and Electical conductivity when keep rising,water quality may deteriorate.Nararian et al(1995) Jain *et al.*(1998) are of the view that rising electric conductance will deteriorate the physico-chemical and bacteriological status of the waters to a greater extent.

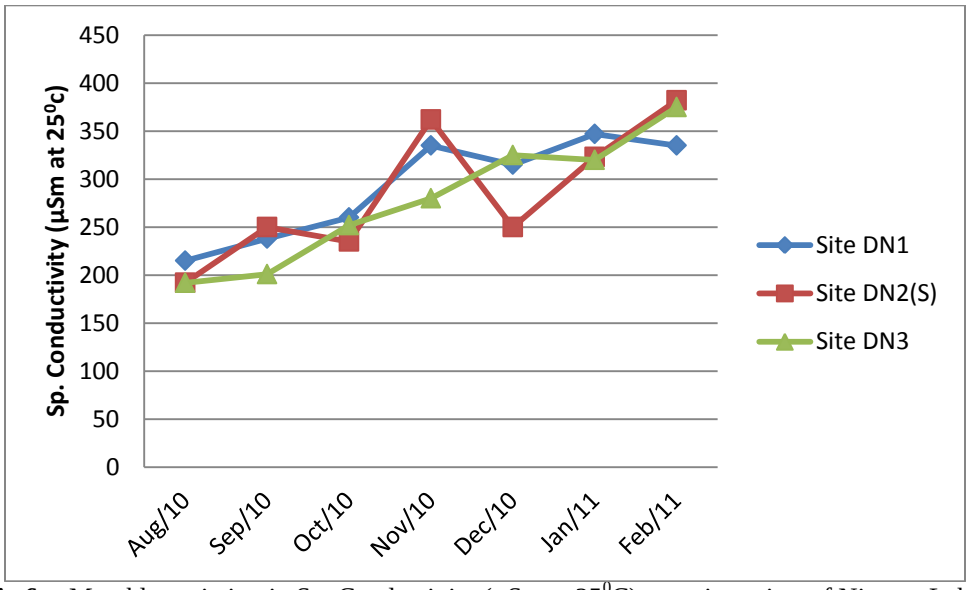

Fig 6:- Monthly variation in Sp. Conductivity (µSm at 25^0C) at various sites of Nigeen Lake.

The monthly dissolved oxygen(mgl^{-1}) measured at the monitoring sites of Nigeen lake is given in Fig. 7. The value for dissolved oxygen ranged between 5.5mgl^{-1} (Oct, 2010 at DN1) to 12.0mgl^{-1} (Sept, 2010 at DN3) with an overall average of 6.4 mgl^{-1} during the investigating period.The oxygen content in Nigeen waters ranged from 4.0 to 12mgl^{-1} and no major shift was observed than the earlier records where the oxygen content was recorded between 5.9 to 13mg-1 Kundangar*et al.* (1992-93).However the oxygen depletion was observed in the bottom waters which can be attributed to summer stratification.These findings are in agreement with those of Zutshi(1987).

Das and Pande(1982) attributed the depletion of oxygen content in the bottom waters to anaerobic bacteria who take over the process of decomposition of biological organic matter releasing foul smelling hydrogen,methane and ammonia(aerobic bacteria evolve only co_2 when organic matter is decomposed in presence of oxygen)these gases not only deplete oxygen in water but are toxic,killing most of the plankton,algae and zooplankton in the lake.A difference of 8mgl-1 of oxygen content was recorded by Kundangar*et al.* during (1992-93).According to Vass (1980)Nigeen shows a positive heterograde along with clinograde type of oxygen curve,which according to the author was biogenic.Kundangar and Adnan(2006) observed the depletion of oxygen content in the bottom waters of nigeen throughout the year which according to authors depicted the shift in oxygen regime.

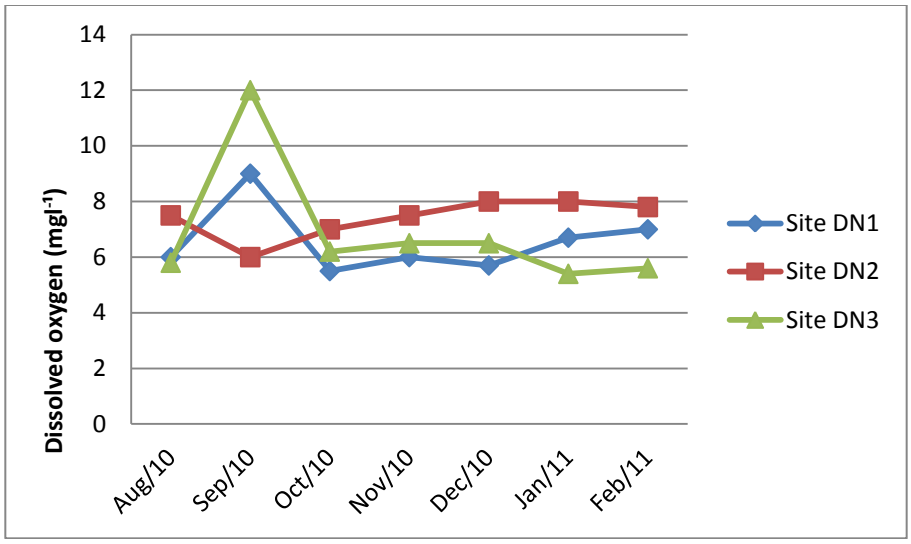

Fig. 7:- Monthly variation in Dissolved oxygen (mgl^{-1}) at various sites of Nigeen Lake.

The monthly total alkalinity measured at the study sites of Nigeen Lake is given in Figure 8. The value for total alkalinity ranged between $106mgl^{-1}$ (Aug, 2010 in surface water at DN2) to $435mgl^{-1}$ (Jan, 2011 in surface water at DN2) with an overall average of 226 mgl^{-1} during the investigating period.

The total Alkalinity of the waters in Nigeen ranged between 106 to 435mgl-1 which was comparatively much higher than the earlier records of Kundangar*et al.*(1992-93).The alkalinity was of bicarbonate type which is in conformity with Freiser and Ferriande(1996) who stated that when total-alkalinity is higher,the carbonate system persists and p.H usually remains alkaline.

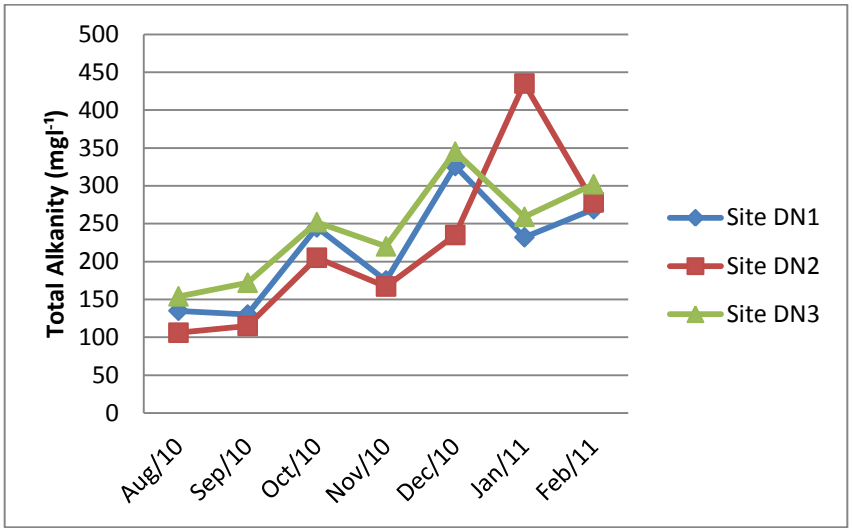

Fig 8:- Monthly variation in Total Alkanity (mgl^{-1}) at various sites of Nigeen Lake**.**

The monthly calcium measured at the investigated sites of Nigeen Lake is given in Figure (9). The value for calcium ranged from 29.6 mgl^{-1} (Nov,2010 in surface water at DN2) to 44.0 mgl^{-1}(Aug,2010 at DN3) with an overall average of 36..3 mgl^{-1} during the investigating period.

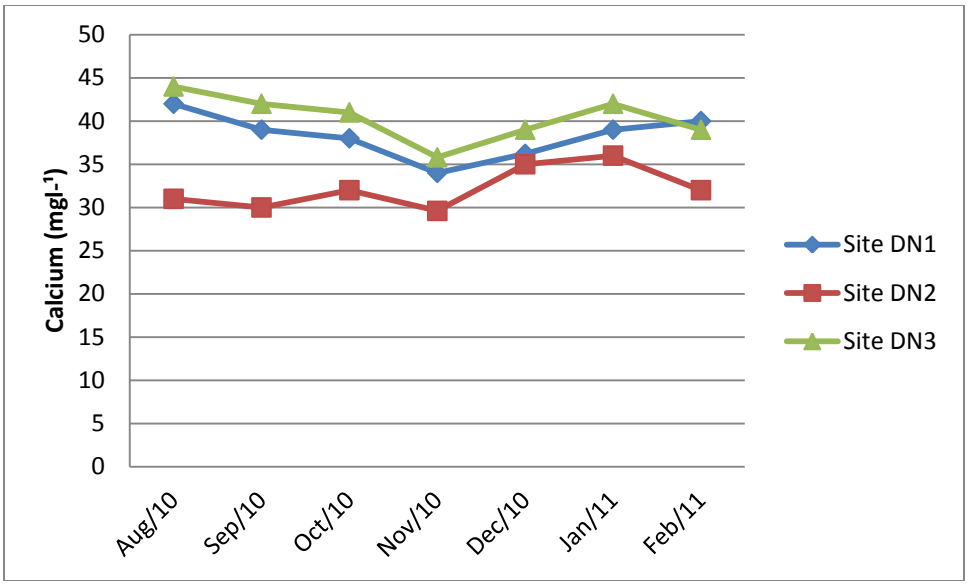

Fig 9:-.Monthly variation in Calcium (mgl-¹) at various sites of Nigeen Lake.

The monthly magnesium measured at the monitoring sites of Nigeen Lake is given in Figure 10. The value for magnesium ranged from 0.9 mgl^{-1} (Feb, 2011 at DN1) to 6.0 mgl^{-1} (Aug, 2010 at DN3) with an overall average of 4.0 mgl^{-1}during the study period.

The calcium content during the study period was recorded between 29.6 – 44mgl-1 which shows the lake water is basically a marl lake and the water is rich in calcium,similar observation were made by Kundangar*et al.* (1992-93)and Kundangar and Adnan *et al.*(2006).The values of calcium are much higher than those of zutshi and khan(1988).According to Kundangar andAdnan(2006) the high levels of calcium in water and presence of marl on the leaves and stems of the macrophytes in all the basins of Dal lake may adsorb liable organic substance and there by limits the plankton growth.

The direct relationship between bicarbonates and calcium has been observed by Pearsall(1923)and Zaffar(1964),whereas the inverse relationship between carbonates and bicarbonates has been noted by Ganapati(1940).Average Magnesium content in the lake water with high dissolved organic content are alkaline in nature and magnesium salts are more soluble in them which is in conformity with the finding of Adnan and Kundangar(2008) while studying the ecological status of some flood plains lakes with jehlum river basin of Kashmir.

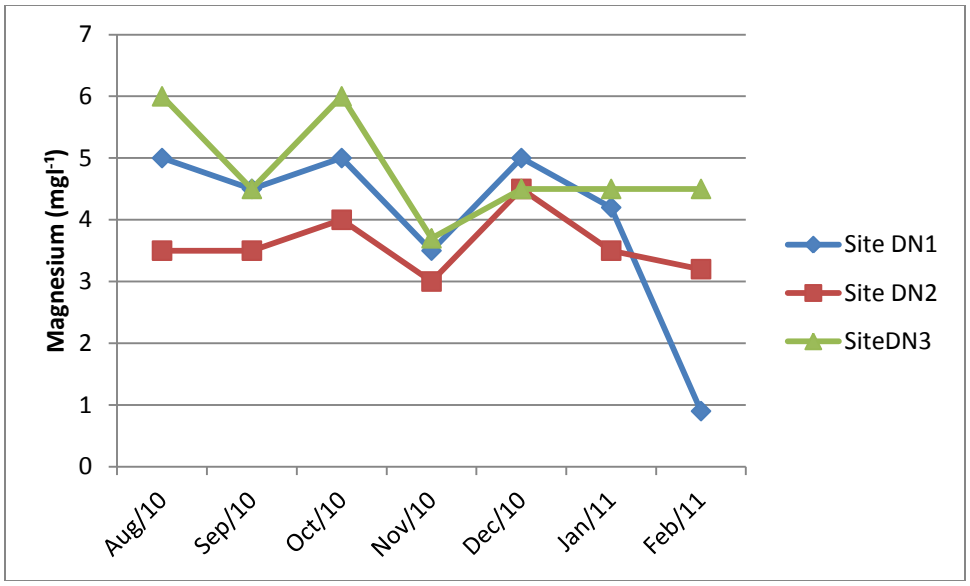

Fig 10:- Monthly variation in Magnesium (mgl^{-1}) at various sites of Nigeen Lake.

The monthly nitrate-nitrogen measured at the investigated sites of Nigeen Lake is given in table (13). The value for nitrate-nitrogen ranged from 275 μgl^{-1} (Dec, 2010 in surface water at DN2) to 931 μgl^{-1} with an overall average of 483.42 μgl^{-1} during the investigating period.

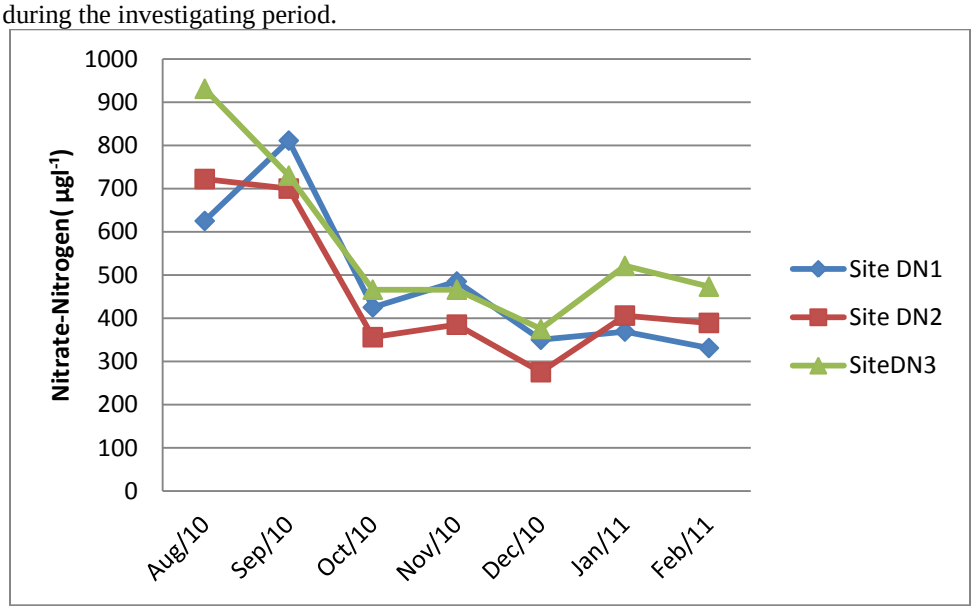

Fig 10:- .Monthly variation in Nitrate-Nitrogen(μgl^{-1}) at various sites of Nigeen Lake.

The nitrate-nitrogen and Ammonical-nitrogen content in the Nigeen waters ranged from 275-931µgl-1 and 36-360µgl-1 respectively which is comparatively much higher than the earlier records of Vass(1980),Zutshi and Khan(1988),Kundangar*et al.*(1992-93) and Kundangar and Adnan(2006).Besle and Suckling(1944) have attributed the nitrogen richness of a fresh water body to the pollution of animal origin.

The monthly Ammonical nitrogen, measured at the monitoring sites of Nigeen Lake is given in figure 11. The value for Ammonical nitrogen ranged from 38 μgl^{-1} (Aug,2010 in surface water at DN2) to 360 μgl^{-1}(Jan,2011 in bottom water at DN2) with an overall average of 133.57 μgl^{-1}.

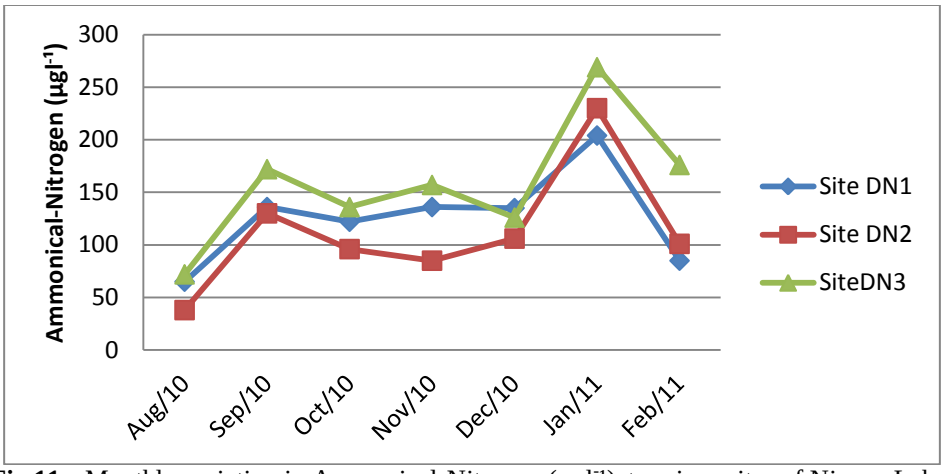

Fig 11:- Monthly variation in Ammonical-Nitrogen (µgl^{-1})at various sites of Nigeen Lake.

The monthly ortho- phosphorus measured at the study sites of Nigeen Lake is given in fig. 12. The value for ortho-phosphorus ranged from 34 µgl^{-1} (Nov,2010 at DN1) to 432 µgl^{-1} (Nov, 2010 in bottom water at DN2) with an overall average of 132.13 µgl^{-1} during the study period.

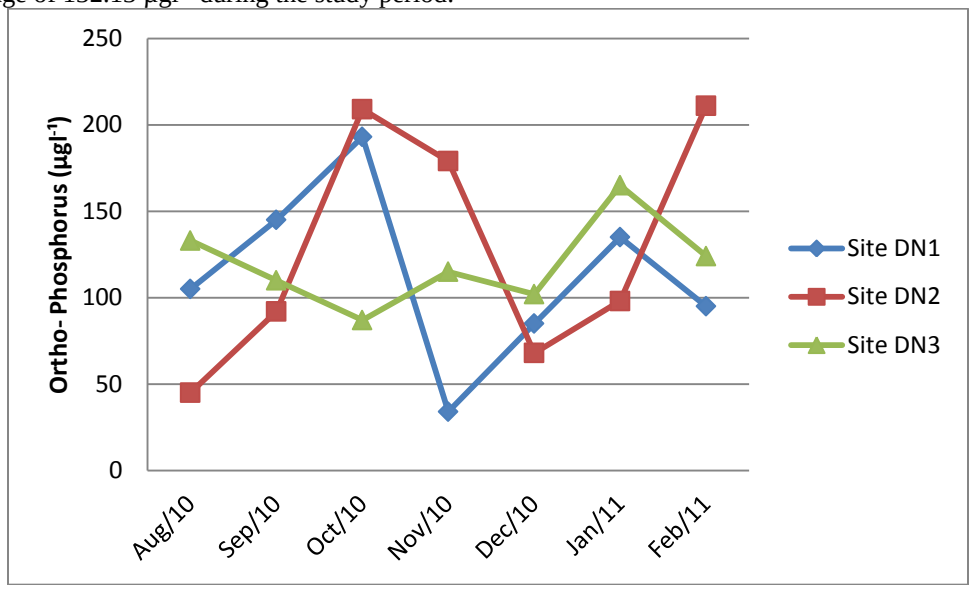

Fig 12:- Monthly variation in Ortho- Phosphorus (µgl^{-1}) at various sites of Nigeen Lake.

The Phosphorus content in the Nigeen waters ranged between 122-722µgl-1 the values are much higher than those of earlier records.The higher Phosphorus content in the lake water can be attributed to the influx of raw sewage entering the lake through surface drains.Hutchinson(1957)also reported the increase of Phosphorus as a result of sewage contamination. Schindler *et al.*(1971) singled out phosphorus for attention because it is believed to be nutrient frequently controlling Eutrophication.

Lund(1965) and Einsele(1936)support the view that phosphorus play a major role in eutrophication as well as in production.Wetzel(1975)holds in the view that number of bacteria increase with increasing productivity and concentration of organic and inorganic compounds in lake.

In case of Nigeen waters Nitrogen and Phosphorus can be considered as two major elements responsible for pollution and limiting primary production.In this lake phosphorus is expected to be released in water from bottom mud during the oxygen deficiency in the bottom waters during the summer months. The water quality is found to be poor due to increased anthropogenic pressures from the catchment area.

Conclusion:-

The observation recorded during the study period reveal that the Nigeenlake has undergone marked change in morphometery including the depth. Due to siltation the lake has become shallower and the lake shore has turned into marsh at various places.The excessive inflow of nutrient rich effluents from the immediate catchment and also due to sedimentation the lake bed has not only become shallower but has resulted in serious weed infestation.

The unabated encroachments by way of extension of floating gardens beyond legal titles coupled with fertilizing method of using lake mud and weeds which eventually reaches to the bottom of the lake transforms floating gardens into permanent dry lands. Over a period of time such practices have continued and encroaching of open water body has become an unending problem.

The drainage, natural sedimentation and continued reclamation of the lake basin to provide vegetable growing land besides enormous increase in the area of floating garden have combined with natural process to reduce the area of open water within the basin.On assessment of physico chemical parameters,The lower values are recorded in dissolved oxygen content reaching to an anoxic condition at certain times which lead to algal blooms and fish kills.The pH has remained throughout alkaline indicating buffered nature of lake waters.The population explosion in the immediate catchment of Nigeen and increasing sewage loads has aggravated the ecological problems of the Nigeenlake. The changes in the water quality over a period of time must have brought insignificant changes in the biodiversity of the lake.

The laying of garland sewer for pollution abatement though initiated has not yet been completed, the construction of sewage treatment plants and their doubtful working have jeopardized the entire sewage scheme.The sewage treatment and solid waste management of the houseboats has remained an unaccomplished job till date and has become a matter of grave concern.The program of lake conservation for last three decades has been very slow and more of engineering nature rather than scientific.

The higher ranges for Sp. Conductance (192-560 µScm-^{1} @ 25^{0}c), Total-Alkalinity (106-435 mgI^{-1}), Calcium (29.6-44 mgI^{-1}), Nitrate-Nitrogen (275-931 µgI^{-1}), Ammonical-Nitrogen (38-360 µgI^{-1}), Total-Phosphorus (122-722 µgI^{-1}) which exceed the permissible limits are worrisome as the lake waters are used for portable purpose by the PHE Deptt. Since the conventional treatment plants cannot remove the Nitrate-Nitrogen and Total Phosphorus content of the water, thus putting the health of thousands of consumers at stake.

References:-

1. Adnan Abubakr and M.R.D. Kundangar.(2005). Bacterial dynamics of Dal Lake, a Himalayan temperate freshwater lake.*Nat.Env.Poll.Tech.Vol4,PP291-298.*
2. Adnan Abubakar and M.R.D. Kundangar.(2009). Three decades of Dal Lake pollution-Restoration.*Eco.Env and Cons.15(4) PP 825-833*
3. Adnan Abubakar. (2010). Sanative role of Macrophytes in Aquatic Ecosystems.*Nat. Env. Poll.Tech.Vol9(4) PP 654-662*
4. Anonymus.(1993). Action Plan on Dal Lake and Nigeen lake conservation J&K UEED.
5. Anonymus.(1998). Technical report on Dal lake J&K lakes and Waterways Authority Srinagar.
6. Anonymus.(1999). Tech. Report on Dal Lake J&K LAWDA Sgr.
7. Anonymus.(2000). Tech. Report on Dal Lake J&K LAWDA Sgr.
8. Anonymus.(2009). Monitoring of Dal-Nigeen lakes and other water bodies-A status report for May-July-2009 J&K PCB.
9. APHA, AAWA. WPEF.(1997). Standard Methods for the Examination of water and waste water.21st edition Washington D.C.
10. Ashok, K. Pandit, J.A. Javeed and AnjumBanday. (2006). Current limnology of Dal Lake in Trends In Bio-diversity & Aqua culture. edit. A. Wanganeo. Langer
11. De-Terra,H. and Paterson T.T. (1939). Studies in the ice-age in India and associated human culture. Carnegie Inst. Washington, D.C.
12. Dianella, G. (1992). Studies sulGlaciale sped. *Ital de fillipi.Res.sci 3.*
13. Drew, F. (1875).The Jammu and Kashmir territories London.
14. Edmonson W.T. and Hutchinson,G.E. (1939). Report on Rolatoria. *Mem.Conn.Acad.10: 153-186.*
15. Enex.(1978). Pollution of Dal lake.Enex of New Zelandinc.

16. Golter, C. R., and Clymo, R. S. (1969).Method for chemical analysis for fresh waters.*IBP Handbook.Blackwell Scientific Pub. Oxford.*
17. Gupta, P. K., (2004). Methods in environmental analysis Agrobios (India) Jodhpur.
18. Hassan, G.S. (1885). Tarikhi-Hassan Vol.1 Directorate of Research and Publications Srinagar (Rep.1954).
19. HumariaQadri and A.R. Yousf.(2004). Macro zoo-benthos in Nigeen Lake.*Jr. of Res & Dev. Vol 4.CORD, Univ. of Kashmir.*
20. Kachroo,and B.L. Suri . (1987). A decade of pollution in Dal Lake Kashmir.*Acad.Of env.Biology.AEB and Symp.*
21. Kango, R.A., Dubey,K.PZutshi,D.P. (1987). Sediment chemistry of Kashmir Himalayan Lake.Clay Mineralogy chemical.*Geology. 64;121-126.*
22. Kant, Shahsi and P.Kachroo.(1977). Limnological studies in Kashmir lakes.Hydrobiological features, composition and periodicity of phytoplankton in the Dal and Nigeen lakes *Phykos 16:77-97.*
23. Kaul, V. Trisal C.L. and Kaul, S. (1980). Mineral removal potential of some macrophytes in two lakes of Kashmir.*J.Ind. Bot.Soc. 59:108-118*
24. Kundangar,M.R.D. (1973). Limnological data of Dal and Nigeenlake during 1971-1972 (unpublished).
25. Kundangar ,M.R.D.,S.G. Sarwar and M.A. Shah. (1995). Hydro biological features of Nigeen lake 1992-1993.tech report no 3(B) Hydrobiology Res.labS.P.CollegeSgr.
26. Kundangar ,M.R.D. and S.G. Sarwar. (1997). A monograph on Dal Lake UEED J&K Govt.
27. Kundangar, M.R.D. (1999). "Is water quality at pokhribal-nigeen fit for potable purposes" ? *5th. Nat. seminar on fish & their env. (abst) P.G. Deptt. Of zoology Univ. of Kashmir.*
28. Kundangar,M.R.D. and Adnan Abubakar. (2004). Thirty years of ecological Research on Dal Lake Kashmir.*Jr. of Res and Dev. Vol. 4.Univ.Of Kashmir.*
29. Kundangar,M.R.D. and Adnan Abubakar . (2006). Comprative limnology of Himalayan Dal Lake Kashmir in Wanganeo and R.K. Langer Ed. Trends of biodiversity and aqua culture .Daya publishing House, Delhi.
30. Lawrence, R.W. (1895). The valley of Kashmir Oxford university Press.
31. Mackereth, F. J. H. (1963). Water analysis for limnologist.*Fresh water biology association, 21:70 pp.*
32. S. Murtaza, M. A. Aziz, S. M. Fazshi Ah. and S. A. Hassan. (2010). Physico-chemical characteristics of Dal Lake water, temperate Conditions of Kashmir.(*forestry Nepal.Org*).
33. SameeraSiraj, A.R. Yousuf and Muni Parveen. (2003). Impact of floating gardens on the water quality and Cladocera population.*Jr. Res and Dev. Vol4 Univ.Of Kashmir.*
34. Sarwar, S.G. A.R. Naqashi and G.R.Mir . (1996). Impact of floating gardens on the limnological features of Dal Lake poll. *Res.15(3):217-221*.
35. Sarwar, S.G. M.A. Shah and P.A.Raashid.(1999). Variations in the hydro biological characteristics of Nigeen Lake.*Fifth national Seminar on fish and their environment.(Abst) P.G. Deptt. Of Zoology Univ.Of Kashmir.*
36. Trisal, C.L (1987). Ecology and Conservation of Dal Lake Kashmir.*Butterworth and Co. Pub.co.*
37. Urfi,S. (1985). Physical, chemical and trace metal analysis of Dal Lake.*M.Phill dissertation, Univ.Of Kmr.*
38. Vass,K.K.Zutshi,D.P. (1979). Limnological studies on Dal Lake.Morphometry and Physical features. *J.Ind.fish.Soc.India.(11)-12-20.*
39. Vass,K.K. Zutshi,D.P. (1983). Energy flow, trophic evolution and ecosystem management of a Kashmir Himalayan Lake Arch. *Hydrobiology, 9:39-59.*
40. Wadia, D.N. (1947). Geology of India *McMillan,U.K.*
41. Wanganeo.A R. Wanganeo.(1994). Hydraulic detention period carrying capacity of a system *J.hydrobiol. 10(1)1-6*
42. Zutshi, D.P. (1968). Ecology of some Kashmir lakes Ph.D. Thesis J&K university (unpublished).
43. Zutshi, D.P. and Vass K.K. (1973).Variation in water quality of some Kashmir lakes.*Trop. Ecol. 14:182-196.*
44. Zutshi, D.P. and Khan, M.A. (1978).On lake topology of Kashmir.*Env. Physiol. Ecol. Plants:465-472.*
45. Zutshi, D.P. and M.R.D. Kundangar.(1983). Modification In physical and chemical environment of Dal Lake national workshop on conservation of Dal lake.*Octr.15-17 (Abst) CORD Univ.Of Kashmir.*
46. Zutshi, D.P. and A. Wanganeo.(1988). Nutrient dynamics and trophic statues of Kashmir lakes *Ind.sciCongr. Jubilee Session Pun.*