Nature Environment and Pollution Technology *An International Quarterly Scientific Journal*	Vol. 9	No. 1	pp. 161-166	2010

Original Research Paper

Cladoceran Community in Relation to Eutrophication of Wular Lake, Kashmir

Aijaz R. Mir, A. Wanganeo, A. R. Yousuf* and R. Wanganeo**
Department of Limnology, Barkatullah University, Bhopal-462 026, M.P.
*CORD, University of Kashmir, Srinagar-190 006, Kashmir
**Department of Zoology, S. V. College, Bairagarh, Bhopal, M.P.

Nat. Env. Poll. Tech.
ISSN: 0972-6268
www.neptjournal.com

Key Words:
Cladocera
Water quality
Wular lake
Eutrophication

ABSTRACT

The present communication reveals the impact of Cladocera on water quality in Wular lake. The water is eutrophic as indicated by high nutrient levels. The Cladocera was dominated by Chydoridae with the main contribution of *Alona* sp., *Alonella* sp. and *Chydorus* sp. Shallow sites support more Cladoceran members in comparison to other sites, and all the sites contain almost same species. Population density seems to be governed by the influx of human interference and related to the nutrient enrichment and other abiotic factors including decaying organic matter, which provides food for Cladocera.

INTRODUCTION

The Wular lake in the valley of Kashmir, a largest freshwater lake of India, has a significant role to play in the hydrographic system of the Kashmir valley by acting as predominant absorption basin for the annual flood water. Taking into consideration, the biological, hydrological and socio-economic significance of the lake, it was included as a wetland of National importance in 1986 under the wetlands programme of the ministry of Environment and Forests, Government of India and in 1990 was designated as the wetland of international importance under the Ramsar convention (MOEF 1986, 1990). Wular lake (34°16' N-74°33' E) is situated in Bandipur district of Jammu and Kashmir state. River Jhelum traverses through it enters at Gurur and leaves at Ningli Sopore (Fig. 1). The lake is wintering site for migratory birds, such as Common teal, Pintail, Shoveller and others. It is also the important habitat for fish and contributes 60% of the fish yield of Kashmir valley. Presently, large area of the lake encroachments has resulted in converting vast catchment area into agricultural land. Pollution from fertilizers, animal wastes and untreated wastes entering the lake have led to the deterioration of the lake and siltation resulting in reduction of the lake area with mean depth not more than 3m that poses threat to its extinction.

STUDY AREA

Data have been collected from five sites of the lake (Fig. 1). Site 1 is Gurur where the river Jhelum enters the lake; the site receives heavy load of domestic pollution as huge population lies to the close vicinity of the site. Site 2 lies at the north of lake close to the village Laharwalpur. Site 3 is Ashtingoo. Site 4 is Wutlab, which lies close to the hills of Baba Shakurdin shrine, and site 5 is Ningli which represents the exit of Wular lake where the lake merges into the River Jhelum which is the main feeding channel of the lake traversing through it as it enters the lake at site 1 and leaves at site 5.

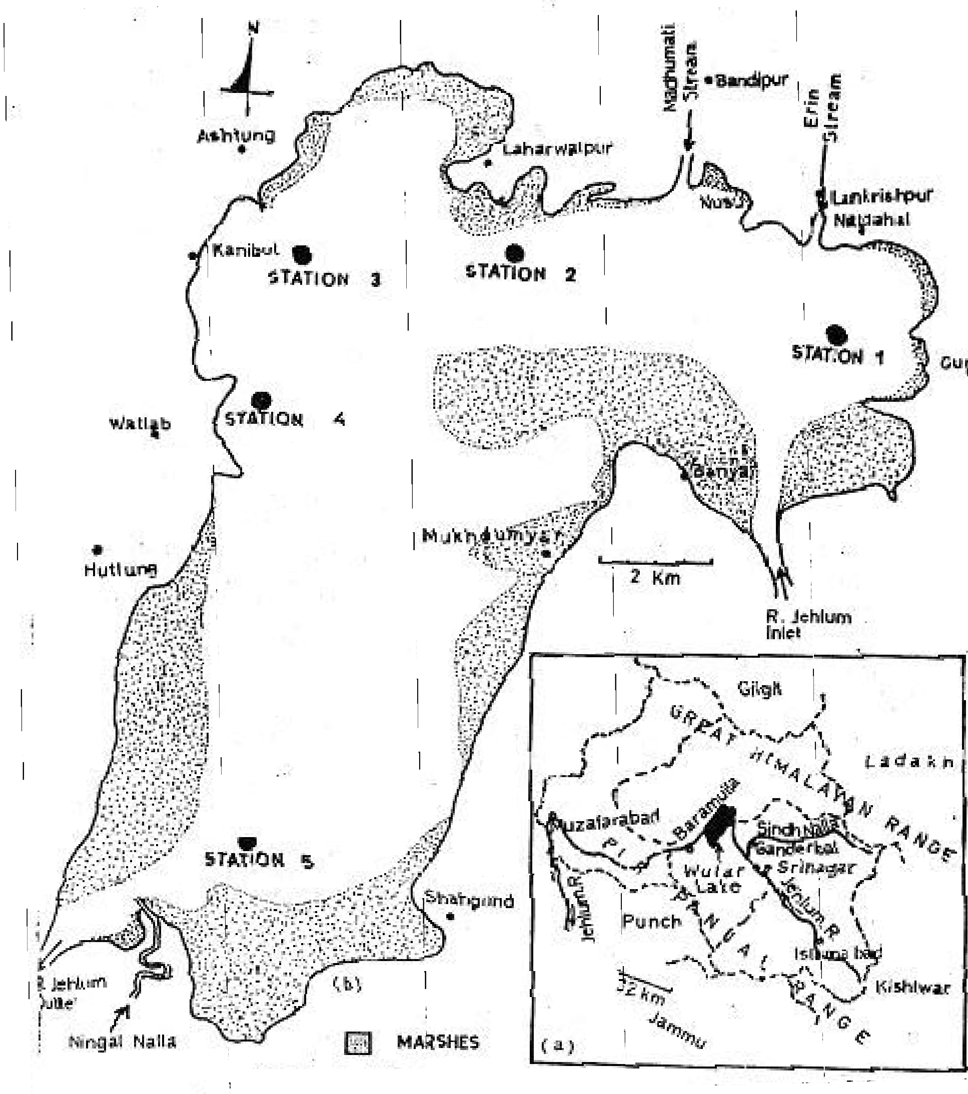

Fig. 1: Location and map of Lake Wular.

MATERIALS AND METHODS

Water samples were collected monthly during March 2002 to February 2004 in one litre polythene bottle from the pre-selected stations (Fig. 1) differing in water depth, vegetation and other biotic characteristics. Analysis of water samples for different physicochemical characteristics was made according to standard methods of APHA (1998), Golterman & Clymo (1969) Mackereth (1963) and EPA (1976).

Table 1: Physicochemical characteristics of Wular lake (2002-2004).

Parameters	Site1	Site2	Site3	Site4	Site5	Mean	S.E
Air temperature (°C)	8-31.5	9.5-30.5	9-30	9-34	9-32.5	20.39	1.00
Water temperature (°C)	5.5-28	5.5-27.5	5.5-27	5.5-29.5	6-28	17.17	1.01
Water depth (m)	0.23- 1.6	0.43- 1.65	0.48- 1.65	0.68- 1.65	0.73- 2.6	1.02	0.07
Transparency (m)	0.55-0.325	0.145-0.750	0.225-0.700	0.290-0.610	0.300-0.825	0.39	0.021
Conductivity (µS at 25°C)	133-329	73-239	100-226	108-266	108-258	190.62	7.73
pH (Units)	7.07-7.31	7.1-7.6	7.0-7.5	7.2-7.5	7.1-7.7	7.35	0.02
D.O. (mg/L)	3.3-8.4	5-9	4.1-9.2	4.2-8.9	5.4-9.0	6.8	0.20
Free CO_2 (mg/L)	2-4	1-3.5	1-3.5	1.5-3.5	1-4	19.24	0.11
Alkalinity (mg/L)	50-180	53-170	62-135	55-150	75-174	101.56	4.31
Chloride (mg/L)	19.5-32	18.5-28	18-26	18.5-27.5	15-24.5	19.24	0.53
Total hardness (mg/L)	66-195	40-150	53.2-170	52-148	41-205	110.58	5.01
Calcium hardness (mg/L)	21.65-61	19-33.92	18.67-45.95	19.4-48.48	39	36.57	3.54
Magnessium (mg/L)	13.29-37.25	5.18-28.97	6.34-32.11	7.74-25.5	5.79-37.94	19.18	0.95
Ammonia (µg/L)	73.5- 107.5	65-99	68- 97	68- 96.5	63-95	81.22	1.49
Nitrate (µg/L)	240-428	205-390	218-320	207-438	183-305	284.15	8.47
Ortho-phosphate (µg/L)	82.5-145	72.5-140	75-142.5	72.5-150	72.5-102.5	98.09	2.56
Total phosphate (µg/L)	195-290	165-328	170-310	175-295	125-223	229.52	5.75

The Cladoceran samples were collected by filtering lake water through a planktonic net of bolting silk. The sieved residue was preserved in 4% formalin in a bottle and the samples were then reduced to 15, 30 mL by centrifugation. Enumeration of plankton was done by taking 1 mL of sub-sample in a Sedgwick Rafter chamber and counting its entire contents to obtain the statistical accuracy. The results have been expressed as individuals/L. The works of Edmondson (1959), Penak (1978) and Michael & Sharma (1998) were consulted for identification.

RESULTS AND DISCUSSION

The physicochemical characteristics of Wular lake are presented in Table 1. Water temperature depicted slight variation. Minimum temperature was recorded in January, and maximum in July-August that can be correlated with the solar intensity, which varies from season to season. The temperature of the lake revealed negative correlation with dissolved oxygen, alkalinity, hardness, but positive correlation with lake depth (Table 2) as with the increase in temperature the decomposition rate gets increased thereby reducing the oxygen carrying capacity of the lake water. However, the increase in temperature results in melting of ice from the snow covered glaciers resulting increase in lake depth. Lake depth and Secchi disc transparency varied from minimum at site 1 to maximum at Site 5 on account of presence of high decomposition rate, luxuriant macrophytic growth and high pollution load at site 1 but least at site 5 due to its lotic nature and complete absence of macrophytic vegetation at site 5 . A slight difference was recorded in carbon dioxide concentration, while pH was slightly neutral during course of the investigation, which may be probably due to the production of salicylic acid by the hydrolysis of silicates in the rock beds of the catchment area (Zutshi et al. 1980). The overall conductivity of the lake was high, however, it was comparatively higher at site 1 as compared to other sites thereby depicting high concentration of electrolytes on account of maximum anthropogenic pressure at site 1. Nitrate and phosphate was high during the course of investigation depicting positive correlation with conductivity and negative correlation with dissolved oxygen and alkalinity (Table 2).

Table 2: Correlation of different physicochemical parameters in Wular lake (2002-2004).

Parameters	D.O.	Alkalinity	Hardness	Conductivity	Depth
Water temperature	-0.76	-0.29	-0.3	-0.09	0.196
CO_2	-0.34	-0.27	-0.04	0.09	-0.023
pH	0.24	0.13	-0.26	-0.42	0.41
Transparency	-0.07	0.8	-0.11	0.17	0.36
NO_3	-0.69	-0.23	-0.07	0.17	-0.22
PO_4	-0.59	0.2	-0.21	0.19	0.22

Table 3: Classification of Cladocera found in Wular lake.

Family:	**Sididae**
	Diaphanosoma exisum
	Pseudosida bidentata
	Sida crystallina
Family :	**Daphnidae**
	Ceriodaphnia cornuta
	C. reticulata
	C. quadriangula
	Daphnia carniata
	D. longispina
	D. hyalina
	D. magma
	D. obtuse
	D. pulex
	Scapholebris kingi
	Simocephalus expinosus
	S. ventulus
Family:	**Bosminideae**
	Bosmina coregoni
	B. longirostris
Family:	**Moinidae**
	Moina daphnia
	M. micrura
Family:	**Microthricideae**
	Macrothrix laticornis
	M. spinosa
Family:	**Chydoridae**
	Chydorus faviformis
	C. sphaericus
	Pleoroxus denticulatus
	P. laevis
	P. similis
	P. trigonella
	Graptolebris testudinaria
	Alona davidi
	A. intermedia
	A. rectangula
	Alonella exisa
	A. nana
	Leydigia sp.
Family:	**Leptodorideae**
	Leptodora sp.

On account of increase in agricultural intensification along the lake borders, by and large the input of domestic waste into the lake is also responsible for the lake deterioration, which can also be coincided with higher concentration of chloride in the lake (Table1).

Cladoceran population comprises of 35 species represented by seven families, which include Sididae, Daphnidae, Bosminidae, Moinidae, Macrothricidae, Chydoridae and Leptodoridae (Table 3). Chydorideae was the prominent group with maximum number of species followed by Daphnideae, and the groups were present at all the sites but vary in population density on account of variations in the physicochemical characteristics of the lake. The presence of *Chydorus* sp., *Graptolebris testudanaria* and *Pleuroxis* sp. is indication of eutrophication and the results are in agreement with Patalas (1970) and Hakari (1967, 1977). However, Gulati (1972) reported that *Bosmina longirostris* survives from oligo to eutrohic conditions. In the valley lakes the dominance of *Chydorus sphaericus, Graptolebris testudanaria, Alona rectangula* and *Alona exisa* has been reported by Raina (1981), Yousuf et al. (1983) and Balkhi (1983, 1988). Balki & Yousuf (1992) reported *Alona monocantha, Chydorus sphaericus, B. longirostris, Diaphanosoma brachyurum, Graptolebris testudanaria, Macrothrix* sp. and *Pleuroxis trigonellu*s in meso and eutrophic lakes. Wanganeo & Wanganeo (2006) reported *Chydorus sphaericus, Graptolebris testudanaria*, *Macrothrix* sp., *Moina* sp., *Camptocercus retirostris, Pleuroxis denticulatus* and *Pleuroxis* sp. in eutrophic lakes of Kashmir Himalayas.

Eutrophication is the direct result of human interference in the watershed by use of fertilizers, domestic wastes and faecal matter, which directly finds its way into River Jhelum, the main feeding channel and source of water for the Kashmir valley thereby allowing the tones of wastes to enter the Wular lake and posing threat to its extinction by effecting its aquatic biodiversity, in general, and fish in particular. The results of physicochemical parameters revealed that the lake is moving towards deterioration, which has adverse impact on the growth and development of the fisheries, in general, and sensitive species like *Schizothorax* in particular so the timely measures should be adopted to conserve the world famous waterbody from extinction.

REFERENCES

APHA 1998. Standard Methods for Examination of Water and Wastewater. American Public Health Association, Washington, DC.

Balkhi, S.M.H. 1983. Zooplankton communities of Nilnag lake, Kashmir. M. Phil. Thesis, Univ. of Kashmir.

Balkhi, S.M.H. 1988. Freshwater microcrustacea of Kashmir. Ph. D. Thesis, Univ. of Kashmir.

Balkhi, S.M.H. and Yousuf, A.R. 1992. Community structure of Crustacean plankton in relation to trophic conditions. Int. J. of Eco. and Env. Sci., 18: 155-168.

EPA 1976. Methods for Chemical Analysis of Water and Wastes. Environmental Monitoring and Support Laboratory, ERC, Cincinati, Ohio, USA.

Edmondson, W.T. 1959. Freshwater Biology, John Wiley, N.Y.

Hakari, L. 1967. Lievestuoreen sulfiittiselluloosatehtaan Jatevesien Vaikutuspiirissa Olevien Vesuistonosien ela inplanktonista Kalatalovssaation monistelluja Julkadsuja 19, liite 5: 1-20.

Hakari, L. 1977. On the productivity and ecology of zooplankton and its role as food for fish in some lakes in central Finland. Biol. Res. Univ. Jyvaskyla, 4: 3-87.

Gulati, R.D. 1972. Limnological studies on some lakes in Netherlands. Freshwater Biol., 2: 37-54.

Patalas, K. 1970. Primary and secondary production in a lake heated by a thermal power plant. Proc. Annual Tech. Meeting Inst. Environ. Sci., Boston, 267-271.

Penak, R.W. 1978. Freshwater Invertebrates of United States. John Wiley and Sons, N.Y. 803 pp.

Golterman, H. I. and Clymo, R.S. 1969. Methods for Physical and Chemical Analysis of Freshwaters. IBP Handbook No. 8., Blackwell Scientific Publications, Oxford, Edinburg.

Mackreth, F.H.J. 1963. Water Analysis for Limnologists. Freshwater Biol. Assoc., 21: 1-70.

Michael, R.G. and Sharma, B.K. 1998. Fauna of India and Adjacent Countries. Indian Cladocera (Crustacean: Branchiopoda Cladocera). Zool. Surv. India.

MOEF 1986, 1990. Wular as a Wetland of National and International Importance. Conservation of Wetlands in India: A Profile (Approach and Guidance), Ministry of Environment and Forests, Govt. of India.

Raina, R. 1981. Plankton dyanamics and hydrobiology of Bod-Sar Lake, Kashmir. Ph D. Thesis, University of Kashmir.

Wanganeo, A. and wanganeo, R. 2006. Variation in zooplankton population in two morphologically dissimilar rural lakes of Kashmir Himalayas. Proc. Nat. Acad. Sci., India, 76 (B), III.

Yousuf, A.R., Qadri, M.Y., Shah, G.M., and Naquash, S.A. 1983. Crustacean communities of freshwaters of Kashmir. J. Indian Inst. Sci. , 64 (C): 83-89.

Zutshi, D.P., Subla, B.A., Khan, M.A. and Wanganeo, A. 1980. A comparative limnology of nine lakes of Jammu and Kashmir Himalayas. Hydrobiologia, 72(1-2): 101-112.