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ANTHROPOGENIC PRESSURE ON ZOOPLANKTONS OF WULAR LAKE, KASHMIR

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ABSTRACT

The Wular Lake was a valuable economic resource of the Kashmir but due to anthropogenic pressures such as refining, vehicular emissions, agricultural operations, sewage discharge, and waste disposal , encroachment over open water area and entry of sewage and disturbance in the catchment area have affected water quality and consequently its zooplankton potential adversely and also causes negative effects on the health of the organisms. The occurrence and abundance of zooplankton depends on the productivity of the lake, which in turn is influenced by physico-chemical parameters and the level of nutrients in the water body. The abiotic factors and nutrient status of water body play an important role in governing the production of zooplankton which is the natural food of many species of fishes and also provide the necessary amount of protein for the rapid growth of larval carps The present literature review the effect of pollution on zooplanktons, includes water quality, pesticide, chemical miscellaneous and physical pollution. The present study will also reveal the impact of de-weeding and the magnitude of threat imposed by discharges from anthropogenic activities to the ecology of the lake, so that possible conservative measures could be undertaken to restore the aquatic life.

Keywords: wular lake, anthropogenic pressure, zooplanktons, physico-chemical parameters

I.INTRODUCTION

The Wular wetland is located in rural area in the north-west region about 50 km from Srinagar city, in the district of Bandipora, Jammu and Kashmir. It lies in the flood-plains of Jhelum River (34°16´-34°20´N lat. and 74°35´-74°44´E long.) at an altitude of 1580m above msl. Wular Lake is one of the largest freshwater lakes in Asia. It plays a significant role in the hydrological functions of the Kashmir Valley by acting as a huge absorption basin for the annual flood waters. This was included as a wetland of national importance in 1986 by the Ministry of Environment and Forests, Government of India and subsequently this became one of the 23 Indian wetlands designated as a wetland of International importance in 1990 by the Ramsar Convention (IUCN–1971). The Jhelum empties into Wular Lake at Banyari Bandipora and the river outflows at Sopore (Baramulla). In an aquatic ecosystem the life of aquatic biota is closely dependent on the physical, chemical and biological characteristics of water, each of which directly acts as a controlling factor. Therefore, for understanding the

dynamics of an organism, a population or a community, knowledge of both the organism and its environment is required. It is in this backdrop of the rich biodiversity of the world famous Wular lake, a Wetland of International Importance confronting a number of anthropogenic stresses, the present study on zooplanktons, an important community of plankton in terms of its diversity and abundance has been undertaken during April to September 2017 with a view to obtain the baseline data on such an important group of animals serving as an important link in the aquatic food chain and being very good and sensitive bio indicators to monitor the trophic status of the water body forms vary in their relative abundance.

II.MATERIALS AND METHODS

2.1 Water sampling

The study of physico-chemical parameters of water samples of Wular Lake was carried for a period of six months. Physico-chemical analysis of water samples was done using standard methods . Air and water temperature was measured by mercury bulb thermometer (0C); electrical conductivity, TDS, salinity, pH were measured by Century water/ soil analyser kit, CMK 731; turbidity was observed by turbidity meter , DO, BOD by titration method.

2.2 Zooplankton sampling;

Zooplankton samples were collected between April to September 2017 from the different study sites by filtering 100 liters of water through a net from the littoral as well as the limnetic zones of the lake in every month. The samples were collected in clear polyvinyl bottles and preserved in 5% formalin. Identification of the taxa were made by using different keys (Koste, 1978[1]; Edmondson; 1992[2]; Segers, 1995[3]; Sharma and Sharma, 2008[4]). Bray-Curtis analysis was performed by the software Biodiversity Pro to predict the similarity between the sites The identification was done with thehelp of keys given by Ward and Whipple,1959[5], Mellanby 1963[6], Pennak ,1978[7] and Tonapi ,1980[8].

III. RESULTS AND DISCUSSIONS

The physico-chemical features of water are summarized in Table 1

S.No	Parameters	Value
1	PH	8.01 ±0.20
2	Calcium	33.18±9.45
3	Total alkanity	81.38±12.01
4	Temperature	19.01±1.01
5	DO	4.2±1.33
6	Chloride	20.77±1.20
7	Magnesium	17.90±4.05

8	Total phosphorus	1.01±0.78

The pH recorded during the present study 8.01± 0.20 is an indicative of alkaline nature of water. The water temperature was observed as 19.01±1.01 ºC (Table 1). Surface water temperature is one of the most important parameter as it influences inborn physical qualities of water . Low concentration of DO indicates the presence of organic matter in water Lower alkalinity values at site can be attributed to the copious growth of macrophytes (Duggan et al., 1998; 2001)[9]. The total alkalinity showing that the water is moderately hard. The rich chloride contents in the Lake indicate the presence of organic pollution. Overall, the Wular lake water is alkaline, moderately hard and nutrient rich.

During the entire study period, 10 rotifers represented by 4 families were recorded. . Among the reported families, Brachionidae and Lecanidae were the most dominant, perhaps due to their adaptability to diverse and harsh environmental conditions (Pejler 1977[10]; Shiel et al. 1998[11]; Nandini et al. 2007[12]; George et al. 2011)[13]. Segers, 1995[14] opined that Lecanidae is the second largest family among rotifers with about 160 valid species. Further, Rotifers showed a prominent growth peak in summer in terms of population density in par with high abundance of macrophytes (Ferreiro et al., 2011[15]; Sousa et al., 2011,[16]. Similar summer peaks in terms of density were observed by many workers (Sharma and Srivastav; 1986[17]; Duggen et al., 1998[18]; Bruno et al., 2005[19]; School and Kiss, 2008[20]; Ezhiliet al., 2013[21]. However, some workers have reported population peaks in late summer and early autumn (Whitman et al., 2004[22]; Castro et al., 2005[23]; Paulose and Meheshwari, 2007[24]. Further, Shyeshefer et al., 2008[25] attributed high rotifer peak in summer to high temperature, long ph. A total of 8 species of copepods belonging to three families (Cyclopoida with 4 species, Calanoida and Harpticoida with one species each) were identified (Table 3). Cyclopoids predominated over calanoids in the present study. This is quite expected as the wetland under study is weed infested. Rundle and Ormerod (1992., [26]) also found the abundance and richness of cyclopoids in wetland with high weed infestation. Boxshall and Jaume 2000[27] opined that Cyclopoids are one of the most con-spicuous and diverse group of freshwater copepods and tend to have wide distributional patterns with many species being cosmopolitan in nature (Reid,1998,[28]). Many studies suggest that species of the family Cyclopoida tend to increase stronger with eutrophication than species of Calanoida (Gliwicz, 1969[29]; Patalas, 1972[30]; Straile and Geller, 1998[31]; Anneville et al. 2007[32]). This variability in diapause strategies has been observed in a variety of species and is suggested to be induced by environmental conditions. Further, zooplankton use a variety of environmental parameters such as temperature (Marcus, 1982[33]), photoperiod Hairston and Kearns, 1995[34]; Alekseev et al., 2007[35] and food quality to optimize the timing of diapause initiation and/or termination. Furthermore, maternal effects might also be important for the production of diapausing stages (La Montagne and McCauley, 2001[36]). However, high predation pressure can be ultimate cause of lower population density at all biotopes. Diversity indices are important tools for ecologists to understand community structure in terms of richness, evenness or total number of existing individuals underlying the basis of diversity indices (Wilhm and Dorris[37]).

Table 2.Rotifera Enumeration for the month of April to September 2017

	ROTIFERA	Apr	May	June	July	Aug	Sep
	Family Brachionidae						
1	*Platyias patulus (O. F. Muller, 1786)*	+	+	+	+	-	+
2	*Anuraeopsis sp.*	+	+	+	+	+	-
3	*B. calyciflorus (Ehrenberg, 1838)*	+	+	+	-	+	+
4	*Brachionus sp*	+	+	+	+	+	-
	Family Lecanidae						
5	*Lecene sp.*	+	+	+	+	+	+
6	*Monostyla sp.*	+	-	+	-	-	+
7	*Monostyla bulla (Gosse, 1867*	-	+	+	+	+	-
	Family Filiniidae						
8	*Filiniasp.*	+	+	+	+	+	+
9	*Filinia terminalis(Plate, 1886)*	-	-	-	+	-	+
	Family Mytilinidae						
10	*Mytilina sp.*	+	+	+	-	-	-
	Grand Total	8	8	9	7	6	6

+ = present, - = absent

Table 3. Copepoda Enumeration for the month of April to September 2017

S.No	COPEPODS	Apr	May	June	July	Aug	Sep
	Cyclopoida						
1	*C. vicinus*	+	+	+	+	-	+
2	*C. panamensis*	-	-	+	-	-	+
3	*C. latipes*	+	+	+	-	+	+
4	*Cyclops bicolor*	+	-	-	-	+	-
5	*Paracyclops affinis*	-	-	+	+	+	-
6	*Eucyclops agilis*	-	+	+	+	+	+
	Calanoida						
7	*Bryocamptus minutes*	+	+	+	+	+	+
	Harpacticoida						
8	*Diaptomus sp.*	+	-	-	-	-	+
	Grand Total	5	4	6	4	5	6

+ = present, - = absent

The various anthropogenic pressures along the catchment area have adversely affected the zooplankton density in the lentic and lotic water systems of Kashmir (Khan 2004[38]). The various anthropogenic threats have been observed during the study period like non-point pollution from agriculture field with insecticides, pesticides, weedicides and chemical fertilizers is a major concern to this wetland. It is noted that during the present study wetland receives domestic sewage from adjoining villages and cities and the introduction of pesticides and weedicides have also been established well into this wetland posing a major threat to its fauna. However, over a period of one decade, there has been a decline in the number of taxa of rotifera in the Lake However, during the studied period from April to September 2017, the zooplankton diversity has shown a considerable decrease over a period of time.

IV.CONCLUSION

The results can conclude that the rotifers were abundant during warm environmental conditions and were abundant in sites having high anthropogenic pressures suggesting that these animalcules act as bioindicators to assess the trophic status of wetland. Further, the distribution and diversity of rotifers and copepods are controlled by combination of both physical as well as biological factors. The study of Wular Lake indicates that lake is under anthropogenic pressure from the various sources like tourism, construction, sewage and domestic waste, agricultural runoff. Therefore, it can be concluded that change in topography, lacustrine ecology and human activities is resulting in acceleration of the process of eutrophication which is deteriorating the water quality of Wular lake and in turn, affecting the health and well being of the inhabitants living in the vicinity. Thus, proper management strategies and environmental monitoring of lake water quality is very important and highly recommended in order to control its further deterioration Several measures are being taken to restore the pristine glory of the wular back. However, few measures adversely affect the Lake ecology in general. The machines in place for the removal of nutrient rich sediments and aquatic plants from the Lake resulted into loss of biodiversity as is evident from this study. The use of mechanical de-weeder has also resulted into the loss of species diversity of Zooplankton in the Lake over a period of time. The entry of untreated sewage, agricultural run-off from the floating gardens and solid waste within and outside into the Lake water has resulted in nutrient enrichment of the water that has led to luxuriant growth of aquatic plants. In the recent past reduction/erratic precipitation levels has led to decrease of fresh water entry into the Lake. At present, there is a very little control over point and non-point source of pollution and the lack of public participation have also resulted into deterioration of the Wular lake water.

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