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ABUNDANCE OF FRESHWATER ZOOPLANKTON AND PHYSICO-CHEMICAL PARAMETERS IN QUAID-E-AZAM PARK LAKE, KARACHI, PAKISTAN

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ABSTRACT

Lakes are the most fertile , productive and interactive ecosystems in the world . Quaid – e –Azam Park is gifted with lake. It is located in Steel Town, coordinates: 24°51′41″N, 67°19′54″E. The present study was designed to determine the monthly variation in physico-chemical parameters and zooplankton population dynamics at Quaid – e – Azam park Lake for a period of six months from April to September, 2011. Water samples were collected on monthly basis and were analyzed for estimation of water colour, pH, Dissolved Oxygen, Acidity, Sulphate and Phosphate contents. The significant monthly variations were found in all the parameters under study. The zooplankton groups found in the lake were in the order Copepoda > Ostracoda > Cladocera > Rotifera.

Key words: Zooplankton, abundance, physico-chemical, Quaid-e-Azam Park.

INTRODUCTION

Pakistan is home to several natural and man made lakes and reservoirs. The sites of these lakes are important as breeding, staging, passage and wintering water birds. Karachi is one of such places and is rich in artificial lakes and ponds. One of them is Quaid – e – Azam park Lake. The examination of water and aquatic reservoirs in the past were made for many and varied reasons. In Pakistan particularly in Sindh noticeable work has been done by Baqai and Rehana (1973), Baqai *et al.* (1974a), Baqai *et al.* (1974b), Siddiqui (1987), Arain *et al*., (2008) and Korai *et al*., (2008).

In aquatic habitats, environmental factors include various physical properties of water such as the solubility of gases and solids, light penetration, salinity, temperature and density and chemical factors such as hardness, sulphate, phosphate and nitrates which are very important for growth of primary productivity. Estimation of water quality is among frequently conducted research activities in parks. Hence, the present study was based on the examination of the physico-chemical parameters (color, temperature, pH, dissolved oxygen content, alkalinity, phosphate, sulphate and acidity) and zooplankton population dynamics.

DESCRIPTION OF AREA

Quaid-e-Azam Park which is located in Steel Town, coordinates 24°51'41"N, 67°19'54"E. It was constructed in around 1985. It is 20 to 22 feet deep at the center. The park has many kinds of vegetations and green grass with dense trees around the lake. The lake contains many fishes, zooplankton, coelentrates, many water plants, algae, etc.

MATERIALS AND METHODS

Regular monthly trips were carried out from April to September, 2011. The samples were collected in brown and white glass bottles to study the physico-chemical parameters and in plastic bottles of 1.5 litre capacity. At the time of sampling the color was noted by the naked eye, air and water temperatures were recorded by using mercury thermometers, pH was noted by using the Merck Rollen form pH paper ranged between 5.5-9.0. Dissolved oxygen was determined by Winkler's method, salinity by Mohr's method, acidity by Hanna Acidity Test Kit No.HI-3820, phosphate by Hanna Phosphate Test Kit No. HI-3833 and sulphate by Hanna Sulphate Test Kit No.HI-38000. All results were re-confirmed by using spectrophotometer (Model No. UV-160). Minitab was used for all statistical analyses.

For the sampling of zooplankton, tow net hauls with 25 meshes/ sq. inch, were made for about 10 minutes. The zooplankton samples were preserved immediately in 4% formalin and were taken out in a counting tray. Different groups of zooplankton were identified with the help of key provided by Battish (1992) and Ward and Whipple (1959) and their numerical count was made under light microscope.

RESULTS

The overall results of physico-chemical parameters are represented in Table 1 which reveals that observed color was green which remained same throughout the study period. The mean of air and water temperature, pH,

dissolved oxygen, acidity, sulphate and phosphate were 33.6±1.366, 31.00±1.549, 6.41±0.204, 5.951±3.004, 52.000±24.584, 7.833±6.306 and 9.383±7.079 respectively.

Table 1. Physico-Chemical parameters of Quaid-e-Azam Park Lake during April to September , 2011.

Parameters	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sep.**	**Mean ± SD**
Colour	Green	Green	Green	Green	Green	Green	
Temp. of air	34	35	34	34	31	34	33.66 ± 1.366
Temp. of water	31	32	32	32	28	31	31.0 ± 1.549
pH	6	6.5	6.5	6.5	6.5	6.5	6.41 ± 0.204
Diss.oxygen (mg/L)	7.94	4.25	9.92	7.08	1.42	5.10	5.951 ± 3.004
Acidity (mg/L)	63	46	34	48	95	26	52.00 ± 24.584
Sulphate (mg/L)	2	3	18	11	10	3	7.833 ± 6.306
Phosphate (mg/L)	8	1.2	1	17	12.5	16	9.383 ± 7.079

ZOOPLANKTON

A total of 4 groups of zooplanktons were observed during the six months period comprising of Copepods, Cladocera, Ostracoda and Rotifera. The highest percentage recorded belonged to Copepods and it was 80.36 % while the lowest percentage recorded belonged to Rotifers and it was 1.46 % as shown in Table 2.

The relative analysis indicated that the cladoceran population was gradually increasing from April to June and completely disappeared in July .The lowest population was observed in April (0.92 %) while the highest population of Cladocera was observed in June (36.54 %). Throughout the study period the population of copepod gradually decreased from April (98.16) to June (42.31). The highest population appeared in the month of April while the lowest was observed in August.

According to Table 2, the maximum density of ostracoda was observed in August (50.00 %) while the lowest density appeared in April (0.31 %) and it completely vanished in July. The population gradually decreased from May (23.72 %) to July (0.00 %). The rotifer population gradually increased throughout the study period. It was highest in August (5.17 %) while the lowest percentage appeared in April (0.61 %).

Table 2. Population dynamics of zooplankton of Quaid-e-Azam Park Lake during April to September, 2011.

Zooplankton	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sep.**	**Total**	**Mean ± SD**
Cladocera (%)	0.92	16.66	36.53	0.00	17.24	10.37	8.72	12 ± 9.77
Copepods (%)	98.16	58.33	42.31	97.96	27.59	87.41	80.37	110.5 ± 110.72
Ostracoda (%)	0.31	23.72	19.23	0.00	50.00	0.74	9.45	13 ± 16.11
Rotifers (%)	0.61	1.28	1.92	2.04	5.17	1.48	1.45	2 ± 0.63

DISCUSSION

The color of the Quaid – e – Azam Park Lake was green which could be due to suspended solids, green plants or algae or phytoplankton etc. (Baqai *et al.*, 1974, a and b, Schmitt, 2005).

The minimum value of air temperature was observed in August which may be due to rainfall, cloudy sky and windy atmosphere where as the highest temperature was observed in May which may be associated with longer photoperiod, bright sunshine and dry wind (Manikannan, *et al.*, 2011).

The variation in water temperature occurred throughout the study period but it remained within a particular range 28 – 32 °C. From May to July the water temperature remained constant at 32 °C identical to those found in three vulnerable freshwater lakes of Suburban Chennai, (Chennakrishnan *et al.*, 2008) which may be due to longer solar radiation (Saravanakumar *et al.*, 2008), while in April and September it was 31 °C whereas in August there

was a gradual decrease in temperature to 28 °C which may be due to rainfall, cool and windy atmosphere, short day length and less sunlight.

The pH remain slightly acidic to almost neutral throughout the study period which is very suitable for the growth of animals and plants, found within the waters of Quaid – e - Azam park Lake.

Dissolved oxygen values ranged from 1.4 to 9.9 mg /L with a total mean value 5.9 mg/L throughout the study period. The values of dissolved oxygen varied constantly throughout the study period but it was always within the acceptance range of BIS i.e., > 4 mg/ L (Shilpa *et al.,* 2011) except in August where it was 1.4168 mg/L, well below the acceptance range. This may be due to the increased pollution caused by the oil spill from boats in the water and low temperature. The fluctuations in the dissolved oxygen content throughout the study period could be due to varying atmospheric oxygen and photosynthetic production of oxygen by the phytoplankton.

It was analyzed that the acidity values first gradually decreased from April to June and then it started increasing gradually till August but in September there was again a sudden decrease in the acidity levels. The maximum value for acidity was observed in August and the minimum in September. In natural unpolluted waters, the acidity is mainly contributed by the dissolved carbon dioxide. In polluted waters weak acids like acetic acid may contribute significantly to total acidity. In some industrial wastes, organic acids may also contribute to acidity (Abbasi, 1998). Anaerobic condition in the sediment (basin of the Lake) is responsible for the biodegradation of the organic matter into short chain organic acids like: acetic, propionoic, butyric acids etc. (Ali *et al.,* 2004).

The sulphate concentration gradually increased from April to June and then decreased till the end of the study period i.e. September. The minimum value was observed in April whereas the value maximum was observed in June. Higher concentrations of sulphate were observed during summer in three freshwater lakes of suburban Chennai, India, due to insufficient inflow of rain water by Chennakrishnan *et al.,* (2008).

Phosphate level was 8 mg/l during April and then it started decreasing till the month of June and afterwards it varied considerably throughout the study period. The phosphorous content (orthophosphate) in water may be due to the geological reasons and human activities, particularly from detergents (Khuhawar *et al.,* 2009).

The abundance of different zooplankton group was copepoda > ostracoda > cladocera > rotifera. The maximum number of copepods were found in April which started decreasing gradually till June. Afterwards there was a sudden increase in their number in July and then eventually it again decreased in August (minima) which was may be due to over grazing by fish, low oxygen content etc. whereas in September the copepod population climbed back to normal amount similar to the earlier months. According to Nordlie (1976) areas where climate remains warmer in most of the months, abundance of copepods was observed.

The maximum population of ostracods was observed during the month of August and the minimum population was observed during the April. The ostracods were completely absent in the month of July. The absence of ostracoda shows that they might be in egg stage (Ferguson, 1944). According to Malmqvist *et al*. (1977) ostracods are extensively parthenogenetic that causes sudden appearance and disappearance of their population in a water body.

The third most abundant group was Cladocera. The maximum number appeared in the month of June while in all the other months their number remained quite low with the least number appearing in the month of April and was completely absent during July might be due to food and predation that affect the abundance of cladocera (Dawidowicz and Pijanowska, 1984). According to Byron *et al*. (1984) cladocera are not dominant in oligotrophic lakes. The cladoceran population was maximum in the month of June when temperature was also near maximum that is suitable for them Patalas and Salki (1984).

The number of rotifers increased gradually throughout the study period i.e. from April till August, after this it deceased suddenly in the last month of the analysis i.e. September. Morales and Lopez (1998) also found similar month of maximum population in Burro Negro reservoir. Rotifer's biomass is partly sustained by availability of carbon through the bacterial pathway and that competitive exclusion for food by nauplii and ciliates probably keeps rotifer abundance low (Mengestou *et al.,* 1991).

Temperature control the seasonal cycles and population size of zooplanktons (Moore, 1980) which is similar to the results found in our study. Das (2000) concluded that dissolved oxygen concentration if increases more than 5.00 mg/L, will favour good growth of flora and fauna, and biological life. This statement is very much true because in Quaid – e – Azam park Lake zooplankton population was maximum when the dissolved oxygen concentration was 7.9 (Table 1 and 2).

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