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ABUNDANCE OF FRESH WATER ZOOPLANKTON WITH PHYSICO-CHEMICAL PARAMETERS IN HILL PARK LAKE, KARACHI, PAKISTAN

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ABSTRACT

Hill park lake, a small, shallow and recreational water body of Karachi (Pakistan) was studied through monthly survey for six months from April, 2011-December, 2011 for physico-chemical parameters and zooplankton abundance. Air and water temperature varied from 30°C to 35°C and 27 C to 33°C, respectively. pH ranged between 5.5-6.5, salinity from 0.6 to 0.766 mg/L, dissolved oxygen and acidity ranged between 0.453 to 2.834 mg/L and 105 to 225 mg/L, respectively, phosphate 48 to 95 mg/L and sulphate 13 to 51 mg/L.

Among total zooplankton population, 4 groups included Rotifera, Cladocera, Copepoda and Ostracoda were identified and quantified. These zooplankton were abundant in September but they declined in May. The order of dominance of zooplankton was Copepoda > Ostracoda > Rotifera > Cladocera .

Key-words: Zooplanktons, Hill park lake, Karachi, physico-chemical parameters.

INTRODUCTION

Karachi has a variety of ponds, streams, artificial and natural water reservoirs such as Manghopir stream, Safari Park Lake, Quaid-e-Azam Park Lake, Aziz Bhatti Park Lake and Hill Park Lake, which inhabit several groups of animals like birds, amphibians, fishes, insects and zooplanktons.

Hill Park is situated at the top of a hill surrounded by a residential area known as PECHS, neighborhood of Jamshed Town in Karachi. The administration of Ayub Khan approved Hill Park in the mid-1960s. In 1969, when the construction completed, the park turned into a picnic spot. The lake was constructed in early 1970s in the middle of the park.

In aquatic habitats, environmental factors including physical properties of water such as solubility of gases and solids, light penetration, temperature and density. Chemical factors such as hardness, phosphate and nitrates are very important for growth of primary productivity (Lashari e*t al*., 2009). Primary production studies are of great interest in understanding the effect of pollution on system efficiency. High rates of production both in natural and cultural ecosystems occur when physico-chemical factors are favourable (Sultan *et al*., 2003).

The investigations of zooplankton constitute the intermediate level between the primary producers and nektons. In the pelagic food chains, zooplankton serves as the connecting link between primary producers and secondary consumers. Studies on the long term fluctuations in the abundance of plankton are, therefore, important in relation to the conservation of aquatic resources. The availability of zooplankton as food for larval fish is thought to be one of the key factors that determine the strength of commercial fish (Cushing, 1978., Kane, 1993).

In this regard, an investigation was made to study zooplankton and physico-chemical parameters of this lake during April to September,2011.

MATERIALS AND METHODS

STUDY SITE

Hill Park is situated in Usman Essa Bhai Road, PECHS, Karachi. The park is located at 24°52´7´´N and 67°4´16´´E. The lake has a surface area of approximately1700 sq. meter. When the lake was constructed its depth was about 1.25 to 1.5m but due to deposition of silt and other waste materials its depth is reduced up to 0.90 to 1.1m.

SAMPLING

For the sampling of zooplankton horizontal hauls were made for about 20 minutes from brink by using silk bolting cloth plankton net No.25 from Hill Park lake at regular monthly intervals from April 2011 to September 2011.The plankton samples were preserved immediately in 4% formalin. The plankton catch was stirred and homogenous sample was taken in a measuring cylinder of 10 ml and transferred into the counting tray and under a

light compound microscope, zooplanktons were identified up to class level with the help of Ward and Whipple (1959) and Battish (1992) and then counting was made.

Samples for physico-chemical analysis were collected in one litre plastic bottles. Glass stoppered bottles and reagents were taken from the carriers and samples were examined or fixed on the spot.

ANALYSIS OF PHYSICO-CHEMICAL PARAMETERS

Water color of the lake was observed by the naked eye during the period of sampling. The standard mercury thermometer was used to measure the air and water temperature. The pH was determined by using the Merck Rollen form pH paper ranged between 5.5 and 9.0. The estimation of salinity was done by Mohr's method. Dissolved oxygen of water was analyzed by Winkler's Method. Hanna Acidity Test Kit No.HI-3820 was used to determine the acidity of water samples. For the estimation of phosphate concentration the Hanna Phosphate Test Kit No. HI-3833 was used. Determination of sulphate was carried out by the Hanna Sulphate Test Kit No.HI-38000.

RESULTS

Physico-chemical parameters

The physico-chemical parameters and nutrient contents of water play a significant role in the distribution patterns and species composition of primary organisms (Sahato *et al.,* 2004).In aquatic habitat physical and chemical properties are specially considered. The chemical factors are very important for growth and dispersal of phytoplankton on which zooplankton and higher consumers depend for their existence (Lashari *et al.,* 2009).So, hydrographic condition of every lake, seasonal and physico-chemical changes in water bodies affect the abundance and distribution of biodiversity. The physico-chemical characteristics of Hill Park Lake during the study are presented in Table 1:

Table1. Physico-Chemical Parameters of Hill Park lake during April to September, 2011.

Parameters.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Mean ± SD
Colour	yellowish brown	yellowish brown	yellowish brown	yellowish brown	yellowish brown	yellowish brown	
Temperature of air (C°)	30	33	35	34	33	32	32.83 ± 1.72
Temperature of water (C°)	27	31	33	32	31	30	30.67 ± 2.06
pH	6.5	5.5	5.5	5.5	5.5	5.5	5.67 ± 0.41
Salinity (mg/L)	0.76	0.63	0.73	0.66	0.63	0.6	0.67 ± 0.06
Dissolved O_2 (mg/L)	2.15	1.87	0.45	1.13	1.78	2.83	1.70 ± 0.82
Acidity (mg/L)	130	140	125	225	115	105	140 ± 43.36
Phosphate (mg/L)	94	76	48	95	61	83	76.17 ± 18.67
Sulphate (mg/L)	51	30	17	43	13	19	28.83 ± 15.37

Lake water was yellowish brown in colour throughout the study period. The air temperature showed a monthly fluctuation (30°C -35°C) with an average value of 32.83±1.72°C at the sampling area (Table.1). The maximum air temperature was recorded in June and the minimum in April. A decrease in air temperature was observed from June to September.

Water temperature of Hill Park Lake, fluctuated between 27°C (April) to 33°C (June) with the mean value of 30.67 ± 2.07°C.The maximum pH value was recorded only in the month of April that was 6.5 while 5.5 was the minimum pH value observed from May to September with the mean value of 5.67±0.41. The mean salinity value was recorded 0.67 ± 0.07 mg/L. The value ranged between a minimum of 0.6mg/L in September and maximum of 0.766 mg/L in April. The values of dissolved oxygen varied from 0.453 mg/L to 2.834 mg/L with an average of 1.70 ± 0.82mg/L. Minimum dissolved oxygen was recorded in July that was 0.453mg/L while maximum 2.834mg/L was observed in September.

The value of acidity during the study period ranged between minimum of 105mg/L in September and maximum of 225 mg/L in July with a mean value of 140±43.36 mg/L. The phosphate concentration varied between 48mg/L to 95 mg/L (Table 1).The highest and lowest values of phosphates were recorded in the months of July and June

respectively with an average of 76.17±18.67 mg/L. The sulphate concentration in Hill Park lake fluctuated greatly between 13mg/L to 51 mg/L throughout the period of survey. Sulphate concentration reached its peak during April while minimum value was found in August with the mean value of 28.83±15.37 mg/ L.

Table 2. Population dynamics of zooplankton of Hill Park lake during April to September 2011.

Zooplankton	Apr.	May	Jun.	Jul.	Aug.	Sep.	Total (%)	Mean ± SD
Cladocera (%)	1.91	2.10	5.69	2.26	2.59	4.05	3.29	25 ± 16.89
Copepoda (%)	77.94	91.24	76.82	77.97	83.68	88.79	83.19	631.83 ± 227.59
Ostracoda (%)	11.47	6.30	10.99	12.07	5.48	4.06	7.97	60.5 ± 22.38
Rotifera (%)	8.68	0.35	6.49	7.69	8.23	3.08	5.55	42.17 ± 20.88

ZOOPLANKTON

In Hill Park Lake the maximum population was estimated in September (27.035%) while minimum was in May (12.530%). Cladocera comprised of 3.29 % of total zooplankton population. It was observed that the maximum Cladocera were found in June (5.69%) and minimum were observed in April (1.91%). From the observations, it was noticed that the population of Cladocera was found to be increased from April to June and then again in July to September. Copepods showed the maximum value in in May while minimum in June with 91.24% and 76.82% respectively. It was the most abundant group among all the zooplankton populations which made a high proportion of about 83.19 %.

Ostracods comprised of 7.97% of the total zooplankton population in Hill Park Lake. The values ranged between 4.06% (September) to 12.07% (July). Rotifers' population ranged between 0.35% (May) to 8.68 % (April). Rotifers constituted 5.55% of the total zooplankton population.

DISCUSSION

Yellowish brown colour of water in Hill Park Lake might be due to presence of insoluble oxidized iron (rust) and manganese oxide that yield a yellow-brown hue (DFAS, 2004). In Hill Park Lake the air temperature showed monthly variation of about (30-35°C) in April and June, respectively. The maximum surface water temperature was noticed in June (33°C), while minimum was noticed in April (27°C).

The standard pH values for fresh water were given by ICMR standard is (6.7 to 8.4). pH of Hill Park Lake was observed below the standard values that was maximum (6.5) in April and minimum (5.5) was recorded from May to September. The water of Hill Park Lake was thus acidic in nature (6.5-5.5) throughout the survey period. pH of Hill Park Lake was observed high when the surface water temperature was low and it was found to be as low when surface water temperature was high. This condition shows that pH and temperature are inversely proportion to each other (Korai *et al*., 2008). The maximum salt concentration 0.766 mg/L was observed in April while minimum value 0.6 mg/L was recorded in September due to addition of rains. Overall result showed high values of salinity might be due to evaporation in summer when the temperature was high and comparatively low in winter.

The least value of dissolved oxygen (0.453 mg/L) was observed in July while higher value (2.834mg/L) was recorded in September that showed minimum values in summer while maximum in winter. This condition is in consistency with the dissolved oxygen values of Gupta *et al.* (2011), Rani *et al*. (2004), Leghari *et al*. (1997) for Bakar Lake, district Sanghar, Leghari *et al*. (2000) for Sonharo, Mehro, Pateji, and Cholari lakes district Badin and Leghari *et al*. (2005) for Makhi lake district, Sanghar. This can be possible due to increased decomposition rate of organic matter and limited flows of water, leading to consumption of O_2 from water (Jameel, 1998).

The value of acidity during the study period ranged between minimum of 105 mg/L in September and maximum of 225 mg/L in July. Acidity showed a decrease from July to September. In natural unpolluted waters, the acidity is mainly contributed by the dissolved carbon dioxide. The phosphate concentration varied between 48 mg/L in June to 95 mg/L in July. The high phosphate in July was identical with the results of Manchar Lake by Mahar (2003) . The sulphate concentration varied between 13 mg/L in August to 51 mg/L in April (Table 1). Highest values were during summer and pre-monsoon period. It may also indicate enrichment due to insufficient inflow of rainwater.

Zooplanktons are considered to be the ecological indicators of water bodies (Gajbhiye and Desai 1981).In terms of quantity, the copepods had the highest number of individual (83.19 %) of the total zooplankton formed in the lake and was followed by the Ostracods (7.97 %), then Rotifers(5.55 %) and then the Cladocerans (3.29 %). Copepods showed the maximum value in May while minimum in June with 91.24% and 76.82%, respectively. In May, copepods were observed as maximum while Rotifers were recorded as minimum. This is due to the fact that copepods utilize rotifers as their food (Brandl, 2005).

The second most abundant group found was the Ostracoda. Maximum population was estimated in July while minimum was in September. Records showed that the ostracods population increased from May to July and decreased from July to September. Their population varied constantly throughout the study period. According to Ranta (1979) maximum number of ostracods produced in summer.

Rotifers population ranged between 0.350% to 8.676% that was minimum in May due to predation by copepods as copepods were maximum in May and maximum in April when copepods comparatively low in density. In present study rotifers were abundant in rainy season while their population was low in dry season that is similar to the study of Isumbishu *et al*. (2006).Cladocera was the least abundant group during the present study. The maximum population was observed in June and minimum were observed in April. From the observations it was noticed that the population of cladocera was found to be increased from April to June due to the maximum temperature that is suitable for them (Patalas and Salki, 1984).The dominance of cladocera followed rotifera in streams (Nai) in Kirthar range by Baloch *et al.* (2008) that is similar to the present study. According to Dawidowicz and Pijanowska (1984) food and predation affect the abundance of cladocera.

The variation of zooplankton density appeared to be related to air and water temperature and pH (Sanchez and Ramirez, 2000). Phosphate , dissolved oxygen and temperature affect the community structure of zooplankton (Lynch,1978; Moore and Folt, 1993). In autumn and summer as predation increased with increase in available food, zooplankton population declined (Havens *et al*., 2000). According to him areas where climate remains warmer in most of the months, abundance of copepods was observed with least number or absence of cladocerans. Das (2000) concluded that if dissolved oxygen concentration increases, it should favour good growth of flora and fauna. In our studies the dissolved oxygen that was maximum in September when zooplankton population was also high in September.

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