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Assessment of Macro Benthic Organisms in Relation to Physico-Chemical Parameters of Water At Hebbal Lake, Bangalore

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ABSTRACT *Lake study was conducted from April-2013 to March-2014, to evaluate the water quality using the macro benthic invertebrate community. Physico-chemical variables were determined using standard methods. A total of 2546 macro invertebrates were recorded. Ten different taxa were recorded. The high number of Diptera (1932) was recorded, followed by Annelida. The physico-chemical condition of the studied lake polluted during the summer months.*

KEYWORDS : Lake, Macro invertebrates, water quality.

INTRODUCTION:

Macro benthos constitutes important sea-bed fauna. Some species of this group are considered to be useful biological indicators for aquatic ecosystems. They play 2 important roles, firstly they act as connecting link in the food web and secondly they are used to purify the polluted water. The water, soil characteristics of the water bodies have a strong influence on the diversity of Macro benthos (Hellawell, 1983; Paul and Nandi, 2003).

Macro invertebrate organisms form an integral part of an aquatic environment and are of ecological and economic importance as they maintain various levels of interactions between the community and the environment (Anderson and Sedel, 1979). According to Marques *et al.* (2003) knowledge of the structure of the benthic macro invertebrate community provides precise and local information on recent events, which can be seen in their structuring. The use of invertebrates and fish as Bio indicators of water quality has been advocated by several researchers (Victor and ogbeibu, 1985; Ofojekwu et.al., 1996; Edokpayi and Osimen, 2001; Adakole and Annune, 2003).

Present study deals with the relation of the aquatic macro benthos diversity and physico-chemical status of the Hebbal Lake aquatic ecosystem.

MATERIALS AND METHODS:

STUDY AREA

Hebbal Lake is located about 10kms towards North of Bangalore and covers a water spread area of about 4.5 hectares. The geographic location details of the lake are 13^{O}02.569N latitude and 77^{O}35.418E longitude at a mean altitude of 917m above MSL.

SAMPLE COLLECTION AND ANALYSIS

Water samples were collected 30 cm below the surface water once in a month for one year from April-13 to March-14 and water parameters like BOD, DO, Alkalinity, Total Hardness, Chloride, P^{H}, DS were analyzed following standard methods of APHA (2003). The water and Macro benthos were collected from 3 stations of the lake. Macro benthic invertebrates were collected by Kick method (Lenat *et.al.*, 1981; Victor and Ogbeibu, 1985).

The macro benthos were killed in the field using small quantities of 40% formaldehyde and later preserved in 70% ethanol for further examination. The macro benthic invertebrates were identified using manuals of Pennak (1953); Needham and Needham (1962); Victor and Ogbeibu (1985); Egborge (1995).

RESULT AND DISCUSSION

The average value of water quality parameters of the study area is given in Figure 1. The water temperature followed closely that of the ambient temperature maximum in the month may-2013. Alkaline P^{H} was recorded during the winter and summer months. However it reduced to neutral during the rainy season. DO was low during the summer months (ranged from 4.2 to 6.4 mg/l). While BOD was high during the summer months (ranged from 3.0 to 10 mg/l).

The overall macro benthic invertebrate composition, abundance and distribution in the study area are summarized in Figure 2. Ten taxa were identified from total 2546 individuals collected.

The abiotic factors of a lake ecosystem had significant role because of their functional role in the tropic dynamics. Most parameters showed significant positive correlation with the abiotic factors (Table 1). The water parameters were correlated with production of benthic fauna (Sharma and Chowdhury, 2011; Carlisle et.al. 2007). The DO level of water could be used as an indicator to assess the water quality (Ghosh *et.al.*, 2008). The chemical status of the soil seemed to influence the production of bottom fauna (Quasin *et.al.,* 2009). The abundance of vegetation and aquatic plants of the lake supported the availability of more organic matter in the lake. The low species diversity could be due to some physico-chemical conditions like water flow, variation in P^{H} and low DO of the water. Odum (1971) had reported that diversity tends to be low in physically controlled systems. These factors probably caused disruption of life cycle, reproductive cycle, food chain and migrations or exposed physiological stress can even the tolerant macro invertebrates (Adakole and Annune, 2003).

The Taxonomic breakdown of the macro invertebrates indicated the dominance of Diptera, followed by Annelida and mollusca. Chironomus larvae were the dominant Diptera. The Chironomus larva, *Culex* larva and *Anopheles* larva can renew their oxygen supply directly from the atmosphere, they are thus unaffected by oxygen depleting wastes. While others possess special adaptations for obtaining oxygen (Marques *et.al.*, 2003). In this study, same thing is observed and these are more abundant during the summer months.

Pollution tolerant species, few species of odonata obtained in this study, associated with clean water quality were recovered only during the rainy months. This could be due to dilution during the rains, which caused some improvement in the water quality. The signs of *Tubifex* species indicated that there is moderate pollution of lake water. The mollusca can be regarded as bio-indicator species of fresh water. Few species found during rainy season months. So it was concluded that Hebbal lake is moderately polluted lake.

Figure 1. Monthly average values of Physico-chemical parameters recorded at Hebbal Lake (April-2013 to March 2014)

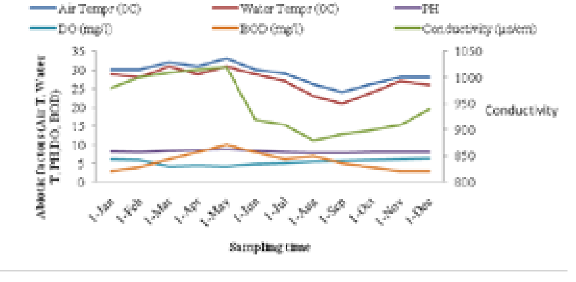

Figure 2. Monthly average abundance of Macro benthic invertebrates at the studied Hebbal Lake (April-2013 to March 2014)

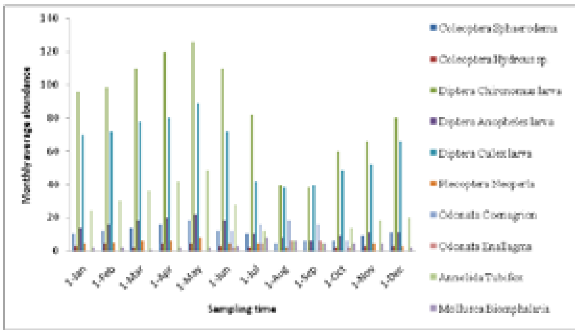

Table 1. Correlation between abiotic factors and macrobenthos

	Sphaerodema	Hydrous sp.	Chironomus larva	Anopheles larva	Culex larva	Neoperla	Coenagrion	Enallagma	Tubifex	Biomphalaria
Air Tempr (^{0}C)	.919**	.759**	.958**	.937**	.888**	.956**	-.610*	-.725**	.922**	-.523
Water Tempr (^{0}C)	.875**	.770**	.943**	.906**	.869**	.913**	-.646*	-.778**	.885**	-.540
Conductivity (µs/cm)	.879**	.728**	.863**	.864**	.911**	.837**	-.758**	-.752**	.916**	-.743**
P^H	.915**	.681*	.908**	.942**	.867**	.835**	-.457	-.560	.928**	-.501
DO (mg/l)	-.655*	-.173	-.630*	-.689*	-.498	-.645*	-.027	.067	-.631*	.119
BOD (mg/l)	.506	.100	.462	.578*	.372	.500	.220	.137	.503	.013

**** Correlation is significant at the 0.01 level (2-tailed).**
*** Correlation is significant at the 0.05 level (2-tailed).**

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