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Research article

ZOOPLANKTON DIVERSITY IN SHALLOW LAKE OF SULTANPUR NATIONAL PARK, GURGAON (HARYANA)

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ABSTRACT: Abundance, community composition and density of zooplankton were analyzed in the shallow lake of Sultanpur National Park, Gurgaon, Haryana (India) from February, 2011 to January, 2012. A total of 42 species of Zooplanktons (23 species of Rotifers, 15 species of Brachiopods, 3 species of Copepods and 1 species of Ostrachopod) belonging to 19 genera, 12 families, 7 orders and 4 classes were recorded during the study period. Rotifers were the dominant group among zooplankton community, with 23 species and 9 genera, constituting 55 % of the total zooplankton population. High Shannon diversity index (2.5±0.05) was recorded during the season of monsoon indicating high diversity and minimum Simpson's index (0.13±0.03) was recorded in the same season indicating low species dominance. Pielou's evenness ranged from 0.64 to 0.97 but average evenness among the different seasons were not significantly variable indicating uniformity in zooplankton community.

Key words: Zooplankton, Community Structure, Population Density, Sultanpur National Park.

INTRODUCTION

Water assessment generally involves analysis of physico- chemical and biological parameters in an aquatic ecosystem and reflects its abiotic and biotic status (Kulshrestha and Sharma, 2006; Mulani *et al.*, 2009). Ecologically zooplanktons are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem such as food chains, food webs, energy flow and cycling of matter (Dadhick and Sexena, 1999; Park and Shin, 2007).

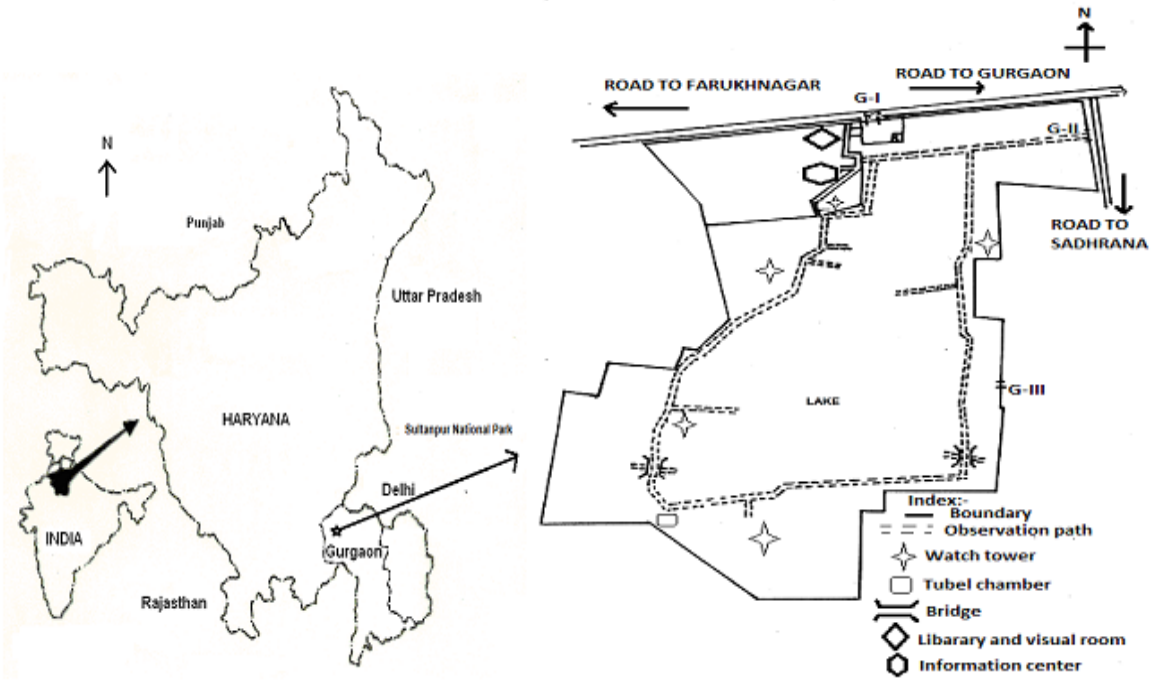
Therefore, for better understanding of life processes in any lentic or lotic water body, adequate knowledge of zooplankton communities and their population dynamics is major requirement. Since eutrophication influences both the composition and productivity of zooplankton and the latter are considered as indicators of environmental quality and water contamination levels in lakes, rivers etc., therefore, these are very important for pisciculture (Berzins and Pejler, 1987; Mikschi, 1989; Sharma, 1983; Saksena, 1987; Akbulut, 2004; Bhora and Kumar, 2004).

Sultanpur National Park is known for various migratory birds which come along different countries to escape harsher environment conditions and for breeding, roosting and feeding(Kalpavriksh, 1994; Harvey, 2003; Sunder, 2005; Urfi, *et al.*, 2007). In India, considerable investigations have been made by various researchers in aquatic ecosystem (Sharma, 1983; Saksena, 1987; Jha and Barat, 2003; Kulshrestha and Sharma, 2006; Jayabhaye and Madlapur, 2006 and Kumar *et al.*, 2010). However, little information is available on limnological studies of Sultanpur National Park. Hence, an attempt has been made to know the zooplankton population along with composition and abundance in this protected area.

MATERIAL AND METHODS

Study area: Sultanpur National Park (latitude 28°28'N and longitude 76°53'E) is located in district Gurgaon, Haryana (India) (Fig. 1). The national park covering total area of 13,727 ha includes a low lying shallow lake with irregular margins within an area of 143 ha. (Islam and Rahmani 2004) The area harbours a variety of local and migratory bird species, hence it was declared as a bird sanctuary by Haryana state government in 1971 and later on April, 1991 upgraded to national park (Kalpavriksh, 1994). Monthly sampling of the zooplankton was carried out from February 2011 to January, 2012 at selected sampling sites of Sultanpur Lake.

The samples were collected in triplicate by filtering 50 L of water through plankton net of mesh size 50 µm and the concentrated samples were preserved in 4% formalin solution. The samples were analyzed quantitatively and qualitatively in the laboratory. Species diversity was calculated by Shannon-weaver diversity index (Shannon-weaver, 1949), species dominance was calculated by Simpson diversity index (Simpson, 1949) and species evenness was calculated following Pielou (1966). Identification of Zooplankton up to generic level was carried out following Needham and Needham (1962); Mellanby (1963); Tonapi, (1980); Ahmad, (1996).



(a) (b) Not to be scaled.

Fig. 1 (a) Sultanpur National Park, Haryana (India) and (b) Overview of Sultanpur National Park.

RESULTS AND DISCUSSION

During the study period, a total number of 42 species (23 species of Rotifers, 15 species of Branchiopods, 3 species of Copepods and 1 species of Ostrachopods) of Zooplanktons belonging to 19 genera, 12 families, 7 orders and 4 classes were recorded in Sultanpur National Park of (Table 1). Rotifers were the dominant group among zooplankton community with 23 species and 9 genera, namely, *Brachionus; Keratella; Monostyla; Anuraeopsis; Lepadella; Trichocera; Lacena; Philodina* and *Filinia* constituting 55 % of the total zooplankton population (Fig-2a). Earlier also, high populations of rotifers particularly, Brachionous were considered typical and frequent for tropical environment (Dadhick, and Saxsena, 1999; Mulani *et al.*, 2009). Genus *Brachionous* is one of the most ancient genes of Monogonont rotifers and is represented by 46 species in India (Sharma, 1983 and Kumar, 2001). In the present study, 9 species of *Brachionous* were recorded which contributed highest among rotifer population (Table-1). The present study revealed that population density of rotifers varied in different seasons. It was maximum in summer and minimum in autumn and monsoon seasons (Fig-2b). According to Holz *et al.*, (1990), increase in temperature and high evaporation during summer enhances the rate of decomposition due to which the water becomes nutrient rich resulting in increase in population density of zooplanktons during. Further, Jayabhaye and Madlapur, (2006) have reported that higher rotifer population occurs during summer might be dominant due to hypertrophical conditions of the water body at high temperature and low level of water. Low population density during monsoon may be attributed to the dilution factor by rain and high water level (Akbulut, 2004 and Mulani *et al.*, 2009).

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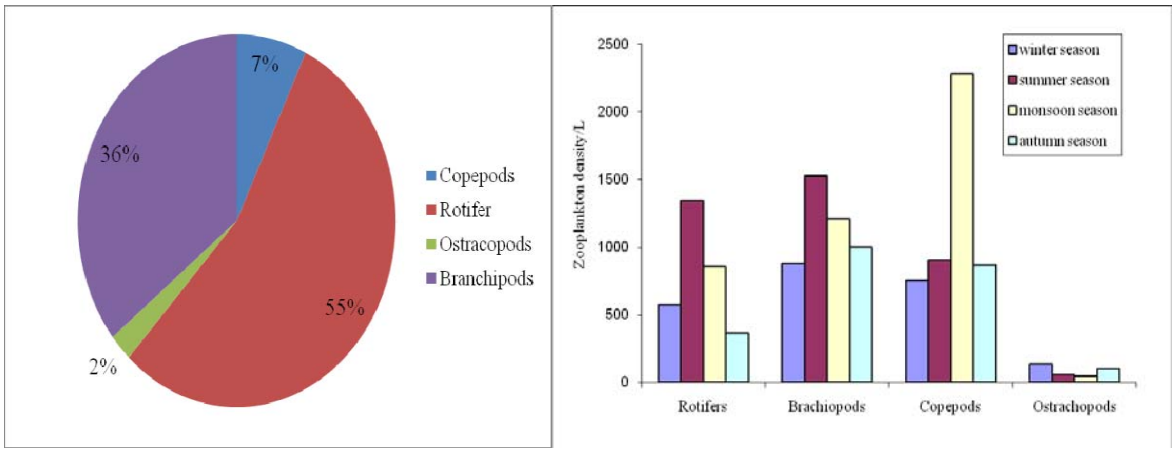
Table -1 Systemic position and seasonal variation of zooplankton of Sultanpur National Park.

S.No	Class	Order	Family	Species	**Autumn**	**Monsoon**	**Summer**	**Winter**
1	**Copepoda**	Calanoida	Diaptomidae	*Diapotomus sp*	+	+	+	+
2		Cyclopoida	Cyclopidae	*Cylopes sp.*	+	+	+	+
3				*Nauplius larvae*	+	+	+	+
4	**Rotifers**	Monogononta	Brachionidae	*Brachionus sp.*	+	+	+	+
5				*Brachionus bidentata*		+	+	
6				*Brachionus diversicornis*		+	+	
7				*Brachionus calyciflorus*	+			
8				*Brachionus forficula*	+	+		
9				*Brachionus plicatilis*	+			+
10				*Brachionus quadridentatus*	+	+	+	
11				*Brachionus patulus*		+		
12				*Brachionus caudatus*		+	+	_
13				*Keratella sp.*	+	+	+	+
14				*Keratella tropica*	+	+	+	_
15				*Monostyla sp.*	+	+	_	_
16				*Monostyla closterocerca*	_	+	_	+
17				*Anuraeopsis sp.*	+	+	+	+
18				*Lepadella sp.*	_	+	+	_
19			Trichocercidae	*Trichocera sp.*	+	+	_	+
20			Lecanidae	*Lacena sp.*	+	_	_	+
21				*Lacena luna*	+	+	+	+
22				*Lacena ploenensis*	_	+	+	_
23		Bdelloidea	Philodinidae	*Philodina sp.*	_	_	+	_
24		Floscullariaceae	Testudinellidae	*Filinia sp.*	+	+	+	+
25				*Filinia longiseta*	+	+	_	_
26				*Filinia terminalis*	+	+	+	_
27	**Branchipods**	Cladocera		*Daphnia sp.*	+	+	+	+
28				*Simocephalus sp.*	+	+	+	+
29				*Simocephalus acutirostratus*	+	+	_	_
30			Chydoridae	*Chydorus sp.*		+	+	+
31				*Chydorus sphaericus*	+	+	+	+
32				*Cerodaphnia sp.*	+	+	_	+
33				*Cerodaphnia cornuta*	_	+		+
34				*Leydigia sp.*	+	+	+	+
35				*Leydigia acanthocercoides*	_	+	_	+
36				*Leydigia citiata*	+	+	+	+
37			Moinidae	Moina *sp.*	+	_	_	+
38				*Moina brachiata*	_	+	+	+
39				*Moina weismanni*	_	+	+	_
40			Sididae	*Diaphanosoma sp.*	+	+	+	+
41				*Diaphanosoma sarsi*	_	_	+	_
42	**Ostracoda**	Podocopidae	Cyprididae	*Cypris sp.*	+	+	+	+

Dominance of Rotifera is characteristic of tropical water bodies (Bidwell and Clarke, 1977; Egborge, 1981 and Mwebaza-Nadwula, 2005). Presently also, Rotifera class was dominant among all the zooplanktonic groups in all the seasons, *Brachionus caudatus; B. quadridentatus; Filinia terminalis; Keritella tropica; Lecena luna and Monostya decipiens* were reported species. Branchiopods were represented by 6 genera and 15 species and constituted 36 % of the total identified zooplankton (Fig-2a). *Moina weismanni, M. brachiata, Leydigia citiata, L. acanthocercodes, Semocephalaus acutirostratus and Chydorus sphaericus* were dominant among Branchiopods. Higher population density of Branchiopods was encountered during summer season and minimum during winter season in the present study (Table-1). Earlier, Joseph and Yamakanamard, (2011) have reported that low temperature, low turbidity and high alkalinity during winter influence the population of Branchiopods.

The Copepods constitute dominant planktonic group of both fresh and marine habitat *(*Dadhick and Sexena, 1999; Park and Shin, 2007*)*. During present study, Copepods constituted 7 % of the total identified zooplankton of which *Cyclopes*, *Diapotomus* and *Nauplis* were recorded in all the seasons. *Nauplius* larvae were dominated in the monsoon season. The total density of copepods was recorded higher during monsoon season and low during winter season (Fig-2b). Purandara *et al*. (2003) earlier have reported that during monsoon, high turbidity, high alkalinity and high pH affect the copepods population.



(a) **(b)**

Fig-2 Showing (a) Per cent composition and (b) Density of Zooplankton in Sultanpur National Park

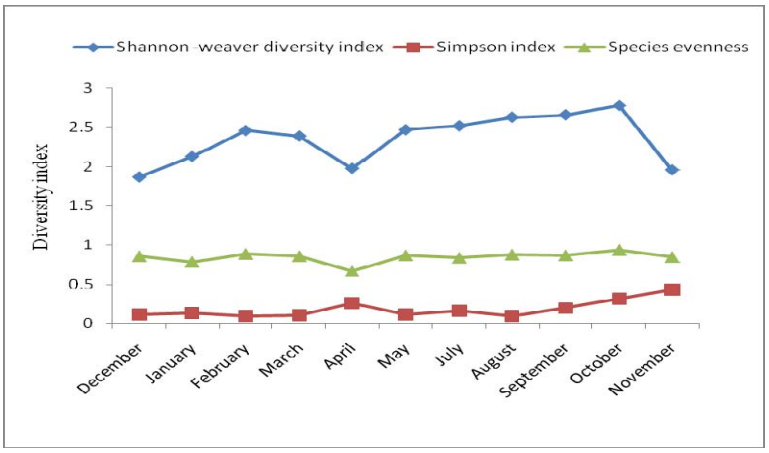


Fig.3- Graph showing monthly variation in species indices.

Ostracods were found in a wide variety of aquatic habitats and were considered very common in most inland water (Kulshrestha and Sharma, 2006; Mulani *et al.*, 2009). During the present study only one member, i.e., *Cypris sp*. of class Ostracods was encountered. Seasonal variation in population density indicated maximum population during winter and autumn season and minimum during monsoon season (Fig-2b). On the contrary, Kumar (2001) have who reported maximum abundance of Ostracod during rainy season and minimum during winter season in fresh water lake of Dharmapuri district of Tamilnadu .

Zooplankton diversity index ranged from 1.87 to 2.73, being maximum in autumn and minimum in winter (Table-2) but average diversity was maximum in monsoon and minimum in winter. High Shannon diversity index (2.5±0.05) during monsoon indicating high diversity and minimum Simpson's index (0.13±0.03) revealed that all species were uniformly distributed. However, the overall density was minimum during the monsoon season due to the dilution effect and density was minimum during the autumn season which can be relate with manual cleaning of the lake by authorities.

Table-2: Showing monthly variation in Shannon Weaver index, Simpson index and species Evenness.

Season	Diversity indexes	Shannon -weaver diversity index	Simpson index	Species evenness
Winter	December	1.87	0.16	0.86
	January	2.13	0.14	0.79
	February	2.46	0.12	0.89
	Mean ± S.E	2.15±0.17	0.14±0.02	0.84±0.02
Summer	March	2.39	0.11	0.86
	April	1.98	0.26	0.67
	May	2.47	0.12	0.87
	Mean ± S.E	2.28±0.15	0.16±0.08	0.8±0.06
Monsoon	July	2.52	0.17	0.84
	August	2.63	0.1	0.88
	Mean ± S.E	2.5±0.05	0.13±0.03	0.86±0.02
Autumn	September	2.66	0.2	0.87
	October	2.78	0.32	0.94
	November	1.96	0.5	0.85
	Mean ± S.E	2.4±0.22	0.34±0.08	0.88±0.02

***Sampling of June was not carried out because of excessive dryness of lake.**

Pielou's evenness ranged from 0.64 to 0.97 but average evenness among the different seasons were not significantly variable, indicating homogeneity in zooplankton community. Zooplankton are very important in biomonitoring of pollution, it is therefore, suggested that Sultanpur lake requires further research to preserve the ecosystem for effective management of lake and support of large number of migratory birds coming from distant places from all over the world.

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REFRENCES

Ahmad, M.S. (1996). Ecological survey of some algal flora of polluted habitats of Darbhanga.J.Environ. Pollut., 3: 147-151.

Akbulut, E.N. (2004). The Determination of Relationship between Zooplankton and Abiotic Factors Using Canonical Correspondence Analysis (CCA) in the Ova Stream (Ankara/Turkey), Acta Hydrochimica Hydrobiologica, 32(6): 434-441.

Berzins, B. and Pejle, R. B. (1987). Rotifer Occurence in Relation to pH Hydrobiol, 147: 107-16.

Bhora, C. and Kumar, A. (2004). Plankton diversity in the wetland of Jharkhand. A.P.H. Corp, New Delhi. 91-123.

Bidwell, A. and Clark, N.V (1977). The invertebrates' fauna of Lake Kainj. Nigeriai Field. 42, 104-110.

Dadhick, N. and Saxsena, M.M. (1999). Zooplankton as indicators of tropical status of some desert waters near Bikaner. J. Environ. Pollut., 6: 251-254.

Egborge, B.M. (1981). The composition, seasonal variation and distribution of zooplankton in Lake Asejire, Nigeria. Rev. Zoo. Afr., 95: 136-180.

Harvey, B. 2003. Checklist of the birds of Sultanpur. Retrieved August, 18, 2010 from http://www.delhibird.net/content/view/73/89.

Holz, J.C. and Hoagland, K.D. (1996). Experimental microcosm study of the effects of phosphorus reduction on plankton community structure. J. Fish Aquat Sci., 53: 164-175.

Jayabhaye, U.M. and Madlapure, V.R. (2006). Studies on zooplankton diversity in parola dam, hingoli, Maharashtra, India. J. Aqua. Bio, 21(2): 67-71.

Jha, P. and Barat, S. (2003). Hydrobiological study of Lake Mirik in Darjeeling, Himalaya. J Environ Biol., 24(3): 39-44.

Joseph, B. and Yamakanamardi, S.M. (2011). Monthly changes in the abundance and biomass of zooplankton and water quality parameters in Kukkarahalli Lake of Mysore, India, J. Environ. Biol., 32: 551-557.

Kalpavriksh, 1994. Small and beautiful Sultanpur National Park. NewDelhi: Kalpavriksh.

Kulshrestha, H. and Sharma, S. (2006). Impact of mass bathing during Ardhkumbh on water quality status of river Ganga. J. Environ Biol., 27: 437-440.

Kumar, K.S. (2001). The freash water zooplankton of some lakes in Dharmapuri district Tamilnadu. J. Aqua.Biol., 16: 5-10.

Kumar, P., Sonaullah, F. and Wanganeo, A. (2010). A preliminary Limnological study on Shershah Suri Pond, Sasaram, Bihar. Asian J. Exp. Sci., 24(2): 219-226.

Mellanby, H. (1963). Animal life in fresh water. 6th Ed. Chapman and Hall Ltd., London.

Mikschi, E. (1989). Rotifer Distributions In Relation to Temperature and Oxygen Content. Hydrobiol, 186 (87): 209-214.

Mulani, S.K., Mule, M.B. and Patil, S.U. (2009). Studies on water quality and zooplankton community of the Panchganga River in Kolhapur city. J. Environ. Biol., 30: 455-459.

Mwebaza-Nadwula, M., Sekiranda, L., and Kiggundu, V. (2005).Variability in zooplankton community along a section of the Upper Victoria Nile, Uganda. Afr. J. Ecol., 43: 251-257.

Needham, J.G. and Needham, R.R. (1962). A Guide to study of fresh water biology. Holden Day. Inc., San Francisco., USA.

Park, K.S. and Shin, H.W. (2007). Studies on Phyto-and-Zooplankton composition and its relation to fish productivity in a west coast fish pond ecosystem. J. Environ. Biol., 28: 415-422.

Pielou, E.C., (1966). The measurement of the diversity in different types of biological collection, J. Theoret. Bio., 13: 131-144.

Purandara, B.R., Varadarajan, N. and Jayashree, K. (2003). Impact of swage on ground water quality-A case study. Pollut. Res., 22: 189-197.

Saksena, N.D. (1987). Rotifer as indicators of water quality, Acta Hydrocim. Hydrobiol. 15: 481-485.

Shannon, C.E. and Weaver, W. (1949). The mathematical theory of communication, *University of Illinois Press, Urbana*.

Sharma, B.K. (1983). The Indian species of the genus Brachionus (Eutatoria: monogononta: brachionidae). Hydrobilogia. 104: 31-39.

Simpson E. H. (1949). Measurement of diversity, Nature. 163- 688.

Sundar, K.S.G. (2005). Predation of fledgling Painted Stork Mycteria leucocephala by a Spotted Eagle Aquila species in Sultanpur National Park, Haryana. Indian Birds, 1: 144–145.

Tonapi, G.T. (1980). Fresh water animals of India (an ecological approach). Oxford and IBH. New Delhi: 341.

Urfi, A.J., Meganathan, T. and Kalam, A. (2007). Nesting ecology of the Painted Stork, Mycteria leucocephala at Sultanpur National Park, Haryana, India. Forktail, 23: 150-153.