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Seasonal abundance of Zooplankton in relation to physico-chemical features in Rabindra Sarobar, Kolkata

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Abstract

Physico-chemical analysis and zooplankton survey of Rabindra Sarobar was carried out on a monthly basis for the period of one year. pH denoted alkaline nature of the lake, ranging from 7.38 to 7.82. DO was recorded in the range of 6.35 to 7.38 mg/l , while other parameters recorded were total alkalinity (132 to 188.73 g/l), total hardness (68.40 to 89.40 mg/l), total dissolved solids (304-371 mg/l), BOD (1.91 -4.40 mg/l) and COD (74.50 -80.80 mg/l). The study revealed the presence of 31species of zooplankton comprising of 4 groups viz. Rotifera (17 spp.), Cladocera (10spp.) Copepoda (3spp.) and Ostracoda (1sp.). The highest number of zooplankton were recorded in the monsoon months and lowest in the winter season. Copepods were most dominant and their population ranged from 217-902/l. Rotifera, and Ostracoda showed low density. High water temperature alongwith high level of total hardness, DO, BOD, COD, phosphate and sulphate may have a positive relationship with the abundance of Cladocera, Copepoda and total zooplankton population. Rotifera exhibited high species richness and diversity.

Key Words: physico-chemical properties, zooplankton, Cladocera, Copepoda, Rotifera.

Introduction: Zooplankton forms a vital component of the aquatic ecosystem. They are the faunal component which occupies the primary consumer level and form a link between microscopic photosynthetic algae and fish. They feed on the phytoplankton and are in turn devoured by insects, fish and other macro-invertebrates (Sharma, 1998). Zooplankton communities are dependent on the nutrient content of an aquatic system (Dodson, 1992) and rapidly respond to changes in it. Their diversity and abundance indicate the health status of an aquatic system or whether there are any damages and threat to the ecosystem.

A change in the abiotic components viz. the physio-chemical conditions of a water body brings about a corresponding change in the relative composition and diversity of the zooplankton (Rosenberg et. al. 1993)

Materials and method Study area: During the second decade of the twentieth century, Calcutta Improvement Trust undertook a programme to extend the city southward by acquisition of marshy land and large scale excavations were undertaken. Eventually Rabindra Sarobar (22°30'30'' - 22°30'42'' N and 88°21' - 88°22' E) or Dhakuria Lake and its adjoining area was developed in 1940. It is a National Lake in West Bengal covering an area of about 73 acres and is an important

wetland ecosystem for its biological diversity, aesthetic beauty and multifarious features like fishing, water sports etc. It plays an active role in controlling the water cycle and cleaning the environment. It is a natural sink for removal of pollutants from the surrounding areas. Hence, the present study was undertaken to evaluate

1] the physic-chemical properties of water.
2] to study the diversity and population of zooplankton.
3] to understand the relation between the abiotic parameters and the abundance of zooplankton.

MAP OF THE STUDY AREA

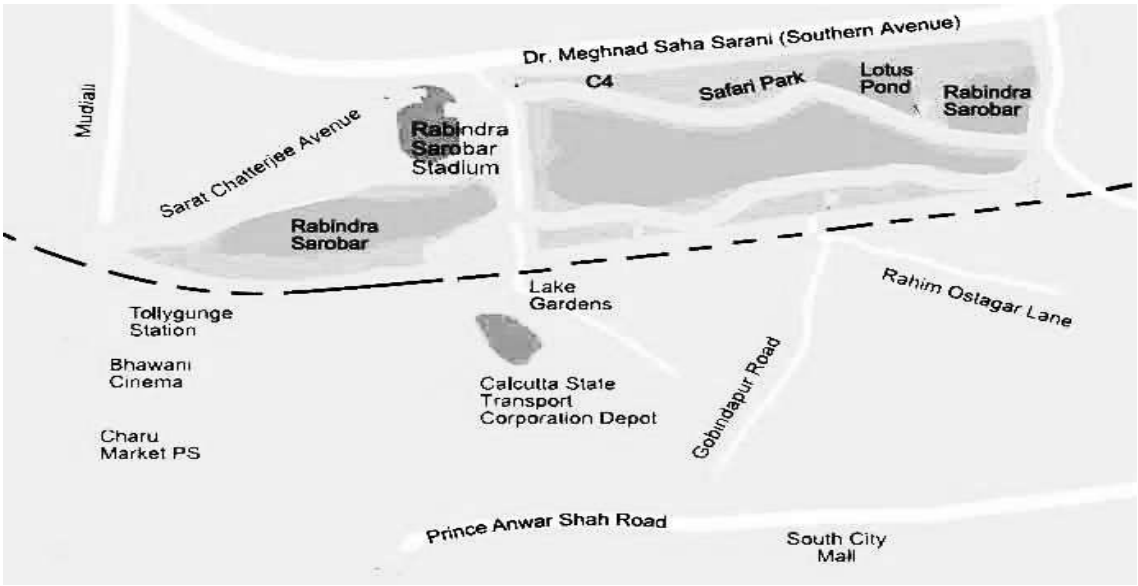


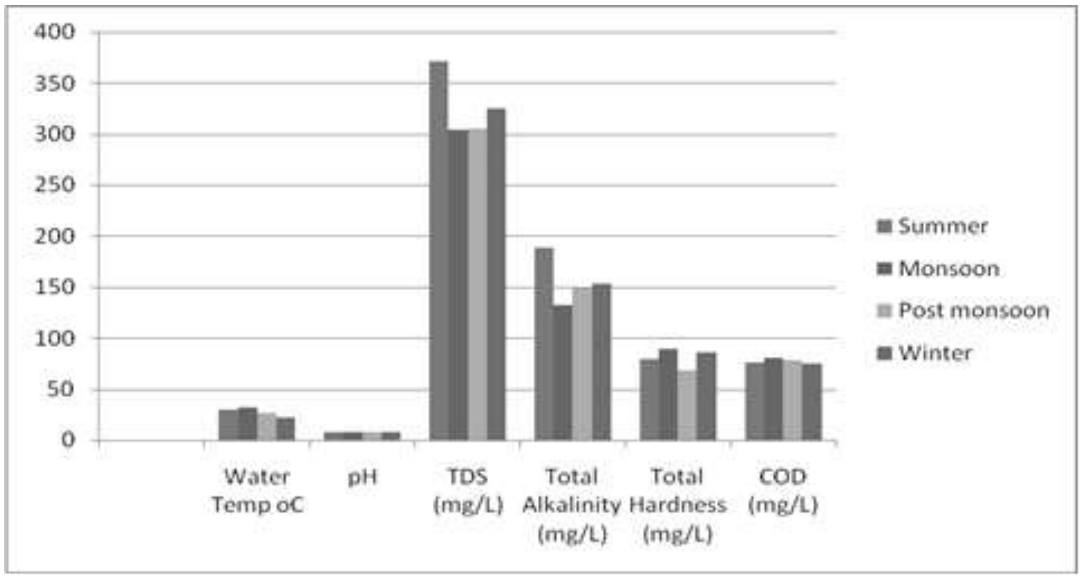
Fig 1. Map of Rabindra Sarobar

Sample Collection and Analysis: The present investigation was conducted for a period of one year from May 2013 to April 2014. The samples were collected in the morning. Water samples were collected from 10 different sites of the lake. Water samples were collected by using one litre wide mouth plastic containers. Water quality parameters were analysed as per methods of AHPA (1998). For qualitative and quantative estimation of zooplankton, 50 litres of water samples were filtered using the 125µ mesh size plankton net and preserved in 4% formalin. Literatures were used for taxonomic position and identification of zooplankton (Battish, 1981 and Altaff, 2004). A Sedgewick rafter counting cell was used for numerical analysis and density was expressed as number of individuals per litre. The average data of the collected samples were recorded month wise, which were then represented as four seasons, i.e. summer (March-May), monsoon (June-August), post-monsoon (Sept.-Nov.) and winter (Dec.-Feb.)

Parameter	Summer	Monsoon	Post monsoon	Winter
Water Temp ^{o}C	29.60	31.80	26.80	21.60
pH	7.82	7.38	7.49	7.58
TDS (mg/L)	371.00	304.00	305.00	325.00

Total Alkalinity (mg/L)	188.70	132.00	149.00	153.70
Total Hardness (mg/L)	79.30	89.40	68.40	86.30
DO (mg/L)	6.35	6.91	5.29	7.38
BOD (mg/L)	3.38	4.40	2.86	1.91
COD (mg/L)	76.30	80.80	78.60	74.50
Phosphate (mg/L)	0.72	0.96	1.12	0.69
Total N (mg/L)	3.75	1.83	2.29	1.60
Sulphate (mg/L)	11.21	15.70	8.51	8.06

Table 1 Seasonal variation of physico-chemical parameters of lake water



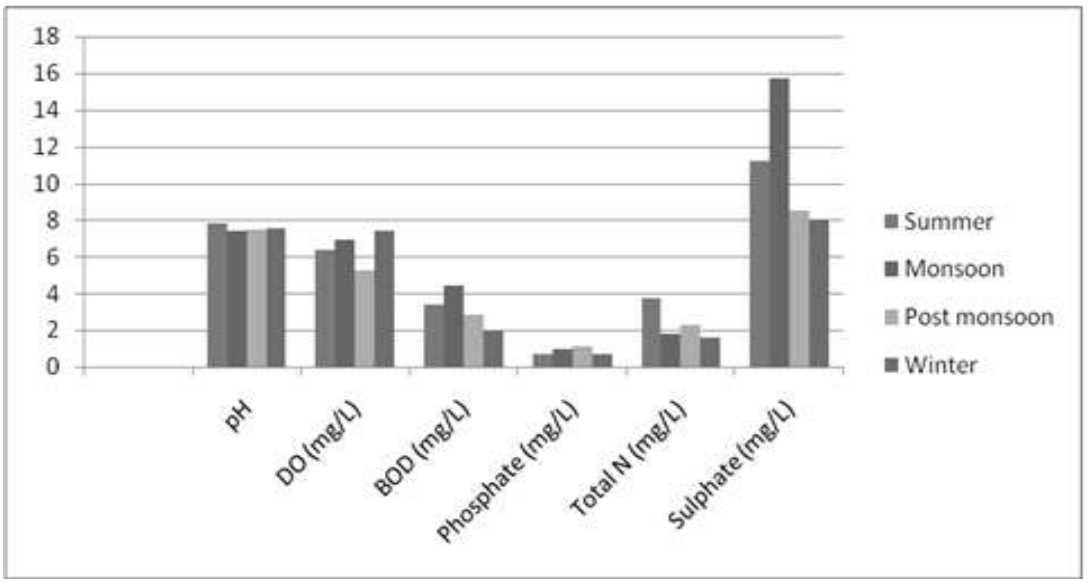


Fig 2.1 & 2.2 — Seasonal average variation of physio-chemical parameters of lake water.

ROTIFERA	CALDOCERA
1. *Brachionus calyciflorus*	1. *Diaphanosoma sarsi*
2. *Brachionus quadridentatus*	2. *Simocephalus exspinosus*
3. *Brachionus caudaters*	3.*Scapholebris kingi*
4. *Brachionus fulcatus*	4. *Ceriodaphnia cornuta*
5. *Brachionus forficula*	5. *Moina* sp.
6. *Brachionus diversicornis*	6. *Oxyurella singlensis*
7. *Brachionus patulus*	7. *Alona dhilloni*
8. *Keratella tropica*	8. *Chydorus sphaericus*
9. *Mytilina ventralis*	9. *Dunhevedia crassa*
10. *Euchlanis dialata*	10. *Pleuroxus denticulatus*
11. *Lepadella patella*	OSTRACODA
12. *Monostyla quadridenta*	1. *Cypris* sp.
13. *Monostyla decipiens*	COPEODA
14. *Asplanchna* sp.	1. *Heliopdiaptomus videms*
15. *Polyarthra sp.*	2. *Phyllodiaptomus* sp.
16. *Testudinella mucronata*	3. *Mesocyclops leuckarti*
17. *Filinia terminalis*	4. Nuaplii

Table 2 Zooplankton species recorded in Rabindra Sarobar

Groups	Summer	Monsoon	Post monsoon	Winter
ROTIFERA	23	40	8	14
CLADOCERA	184	514	299	41
OSTRACODA	15	46	24	2
COPEPODA	226	902	821	217
GROUP TOTAL	448	1502	1152	274

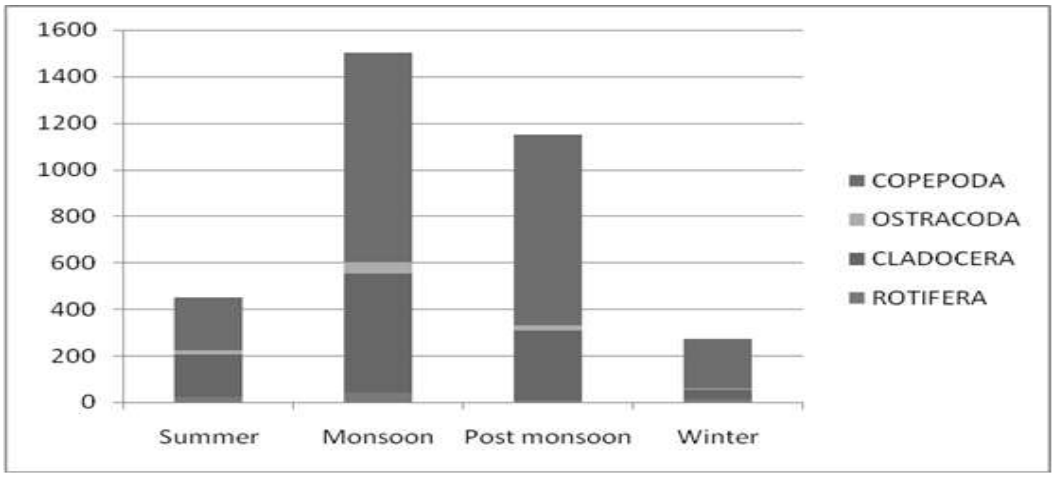


Table 3 & Fig 3. Seasonal variation of population (mean no. /L) of different groups of zooplankton in Rabindra Sarobar.

Result and Discussion: In the present investigation, seasonal variation of the physico-chemical parameters of Rabindra Sarobar has been represented in Table 1 and illustrated in Fig. 2.1 & 2.2 the maximum water temperature was recorded in monsoon (31.8^{o}C) and last in winter (21.6^{o}C). Temperature influences the physical, chemical and biological conditions of a lake and is responsible for the release of nutrients in the lake through organic decomposition (Kumar, 1994). Highest pH value was obtained in summer (7.82) and lowest in monsoon (7.38), which confirms the alkaline nature of the lake water. Alkalinity is associated with the presence of carbonates and bicarbonates in water. Decrease of pH in monsoon may be due to dilution effect of rainwater (Goel *et. al*., 1980). Total dissolved solids wre highest in summer (371mg/L) and least in monsoon (304mg/L). Water loss due to evaporation may increase particle concentration and dilution by rainwater in monsoon may decrease their value (Pathak and Sastree, 1993). Total alkalinity was maximum in summer (188.70 mg/L) and least in monsoon (132 mg/L). Total hardness was highest in monsoon (89.40 mg/L) and lowest in post-monsoon (68.40 mg/L). This may be due to high surface runoff from the catchment area (Patralekh, 1994). Do was maximum in winter (7.38 mg/L) and minimum in post-monsoon (5.29 mg/L) but was moderate in summer and monsoon months. High range of DO in winter may be due to better oxygen holding capacity of water at lower temperature (Gupta and Sharma, 1994). Both BOD and COD showed similar trends with highest value in monsoon and least value in winter. Fairly high values of BOD and COD can be attributed to unchecked disposal of organic matter and surface runoff during monsoon. Lower values in winter indicated lower decomposition rate and lower planktonic growth (Saha, 2000). The occurrence of nutrients like phosphate, total nitrogen and sulphate chiefly depend on biological processes. Total N was highest in summer (3.75 mg/L) and least in winter (1.60 mg/L). This may be attributed to high decomposition rate at high temperature (Ramkrishna, 2014). Phosphate showed higher ranges in monsoon and post-monsoon and was low in winter. Lower concentration in winter may be due to low bacterial decomposition at low temperature and rapid utilization by autotrophs (Patralekh, 1994).

A total of 31 species of zooplankton were identified from Rabindra Sarobar (Table 2), belonging to 4 major groups viz., Rotifera, Cladocera, Ostracoda and Copepoda. Rotifera showed highest species diversity as 17 species were recorded followed by Cladocera (10species), Copepoda (3 species) and Ostracoda (1 species). Similar results were obtained by Das *et.al.* (2005) and Thirupathaiah *et. al.* (2012). Total zooplankton population varied from 274 -1502 /L. Highest density was recorded in monsoon and least in winter. The seasonal average values of zooplankton abundance is represented in Fig 3. In terms of density copepods were most dominant and their population ranged from 217-902/L . The maximum population was encountered during monsoon and post-monsoon season. Cladocerans also showed the same trend with maximum abundance in monsoon (514/L) and minimum in winter (41/L). Rotifera and Ostracoda showed low density. Summer and monsoon months recorded higher population of rotifers. Similar observations were noted by Singh (2000) and Ramkrishna (2014) indicating the influence of temperature on rotifer density.

In monsoon high temperature and high level of total hardness, DO, BOD, COD, phosphate and sulphate may have a positive relationship with the abundance of Cladocera, Copepoda and total zooplankton population. Baker (1979) and Dhembare (2011) had noted that water temperature and DO play an important role in controlling the diversity and density of Cladocera. High Copepoda population in Rabindra Sarobar may be due to richness of organic matter as commented by Somani and Pejavar (2004) in Lake Masunda. Low water temperature, low levels of BOD, COD, phosphate,

total N and sulphate in winter months maybe unfavourable for zooplankton density as least density was recorded in winter.

In conclusion, Copepoda appeared to be the most dominant community throughout the study period. Rotifera exhibited high species richness and diversity. Overall zooplankton diversity and abundance in Rabindra Sarobar indicate that the lake water is rich in nutrients and is moderately healthy. The lake may become polluted and eutrophic if it is not managed properly.

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