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Study of Freshwater Zooplanktons in Nira River Around Akluj Dist. Solapur Maharashtra State, India

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ABSTRACT

Present investigation has been conducted with special reference to its zooplankton diversity in relation physico-chemical characteristics. 105 (One hundred and five) zooplankton species were identified from Samrat Ashok Sagar which consisted of Rotifera 43 species (41%), Cladocera 25 species (24%), Protozoa 20 species (19%), Copepoda 12 species (11%) and Ostracoda 5 species (5%). The investigation on physico-chemical characteristics at different sites revealed its alkaline nature, suitable for aquaculture practices. Significant site variations have been recorded due to the interference of sewage and agricultural wastes. Among all the zooplankton groups, Rotifera recorded dominance. Maximum diversity of zooplankton population was recorded at macrophytic sites during summer season.

Keywords: Freshwater Zooplanktons; Copepoda; Ostracoda; Daphnia; Rotifera

Introduction

Zooplankton study is important as it could provide ways to predict the productivity of fresh water aquatic system (Borgmann et al. [1]). In deciphering trophic status and biomonitoring of aquatic habitats, zooplankters play a vital role (Krishnamurthy, et al., 1979). The biodiversity and distribution of zooplankton in aquatic ecosystem depend mainly on the physico- chemical properties of water. Pollution of water bodies by different sources results in drastic change in zooplankton populations, and thereby affects the production potential of the ecosystem (Singh and Mahajan, 1987; Harikrishnan and Azis, 1989). Zooplankton communities are highly sensitive to environmental variation. Hence, they are effective tools in environmental biomonitoring of an aquatic system. Changes in the zooplankton species composition have been used as indication of increased eutrophication of fresh waters (Wanganeo and Wanganeo, 2006). Some species flourish in highly eutrophic waters while others are very sensitive to organic or chemical wastes (El-Enany, 2009). In India, several important con-tributions on zooplankton and their diversity, density, ecological importance has been made in different parts of the country such as Ganapati (1949); Gulati (1964); Khan and Rao (1981); Subla, et al. (1984); Patil and Goudar (1989); Wanganeo and Wanganeo (2006); Ramachandra, et al. (2006); Raina, et al. (2009) Chakrapani, et al. (1996); Das, et al. (1996) Dadhick and Sexena (1999); Dhanapathi (2000); Sharma (2009) and Kumar, et al. (2011). But, information regarding the zooplankton diversity has not been thoroughly investigated in Madhya Pradesh and especially in Bhopal district. Thus, the present work aimed to assess the biodiversity of Zooplankton and their Relation to the physico-chemical parameters of Samrat Ashok Sagar which is mainly used for irrigation purposes, commercial fishing practices and recreation.

Materials and Methods

Physico-chemical analysis of water samples were carried out following the standard methods as described by Adoni [2] (1985) and APHA (2000) [3]. For enumeration of zooplankton population surface water samples (100 liters) were filtered with the help of plankton net made of bolting silk of mesh size of 20 µm and concentrated samples were preserved with 5% formaldehyde solution in 100 ml plastic vials. The concentrated samples were examined under the inverted microscope (Metzer made) and identification of plankton was done fol-

lowing the taxonomic references of Needham and Needham (1962), Pennak (1978), Victor and Fernando (1979), Michel and Sharma (1988), Edmondson (1992), Battish (1992) [4], Reddy (1994), Sharma (1999) and Dhanapathi (2003). Around Akluj Akluj is a one of the major water bodies of Central India, situated 25 km away from Bhopal city towards the north east side (Figure 1). The water body (popularly known as Halali reservoir) is spread on three districts of Madhya Pradesh namely Bhopal, Raisen and Vidisha. Most part of Samrat Ashok Sagar lies in Bhopal and Raisen district while the dam is constructed in Vidisha district. Presently, Samrat Ashok Sagar is used for irrigation and aquaculture practices (Table 1). Present work has been conducted on four sampling sites of Samrat Ashok Sagar for the estimation of its zooplankton diversity as well as its physico-chemical properties. Site 1 was fixed at the deepest point of reservoir, site 2 was near Dam, site 3 was near Bhainsakheri village and site 4 was fixed at the confluence of Patra canal. Most of the sampling sites were infested with macrophytic vegetation except site 1.

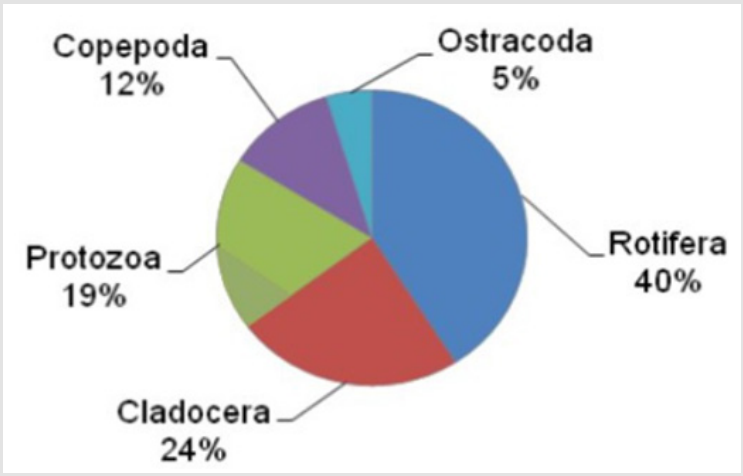

Figure1: Class wise percentage composition of zooplankton in Samrat Ashok Sagar.

Table 1: Important features of Nira River.

Location	Bhopal, Raisen and Vidisha District of M.P.
Year of construction	1973
River system	Halali River
Type of Dam	Earthen dam
Longitude	77° 26′ 45.06» E
Latitude	23º 16′ 17.10» N
Elevation (m)	465
Full Reservoir Level (m)	458.4
Dead Storage Level (m)	448.95
Catchment area (km)	699
Water spread area FRL (ha)	7,712
Maximum depth (m)	29.5
Sources of water	River channels, rainwater, domestic sewage
	Irrigation, potable water, aquaculture,
Main use of water recreation,	washing and bathing

Results and Discussion

Physico-Chemical Analysis

Physico-chemical characteristics of Nira River are given in Table 2. Significant variations in the physico-chemical properties of Samrat Ashok Sagar at different sites have been recorded which is due to the various pollution loads from the incoming channels. The temperature of both air and water is an important factor influencing all aquatic flora and fauna and chemical solutes. Nearby Samrat Ashok Sagar air temperature ranged between 26 to 33°C (Table 2 & Figure 1). Minimum air temperature was recorded at site-1 during post monsoon season and maximum at site 3 during summer period. Water temperature ranged between 23 to 29°C (Table 2). Air temperature recorded higher values as compared to the water temperature which is mainly governed by the local climatic conditions of the aquatic system. Higher air temperature as com-pared to surface water temperature has also been noticed by Bhatnagar (1982) [5], Wanganeo (1998), Ayoade et al. [6] and Wanganeo, et al. (2011). Transparency values ranged between 34 cm to 80 cm and recorded minimum value at site 2 and maximum at site 1 during post monsoon, respectively (Table 2). High transparency at central site was due to the higher depth and absence of algal blooms. Comparatively, low Transparency at site 3 was due to

the presence of algae, boating activity near shore which disturbed the mud water interface and increases turbidity of water. The type and concentration of suspended particles such as silt, clay, fine particles of organic and inorganic matter, soluble organic compounds, plankton and other microscopic organisms control the transparency of the water (Chapman, 1992). Lee, et al. (1981) reported transparency value of <170 cm as indicator of higher trophic status of water body which also confirmed by Wanganeo, et al. (2011) and Kumar, et al. (2010, 2011, 2012). Maximum depth of 18.8 m was recorded at central site during post monsoon while other sites are shallow because of their placement near shore of Samrat Ashok Sagar in shallow region (Table 2). Higher depths control the growth of aquatic vegetation and help to maintain the trophic levels of water body. pH value in Samrat Ashok Sagar ranged between 7 to 8.5 units indicating its alkaline Biological analysis.

Table 2: Physico-chemical characteristics of Nira River.

Parameter	Site-1(Central site)		Site-2(Dam site)		Site-3(Bhainsakheri)		Site-4(Patra Confluence)	
	Summer	P. Monsoon	Summer	P. Monsoon	Summer	P. Monsoon	Summer	P. Monsoon
Air temperature (°C)	30	26	32	28.4	33	27	32	28
Water temperature (°C)	28	23	29.0	28.4	28.6	25	27.2	25.2
Secchi transparency(cm)	50	54	50	25.3	46	34	44	36.00
Depth(m)	14.8	18.8	1	60	1.2	1.3	1.1	1.2
pH(units)	8.1	8.5	7.2	1	8.2	8.5	7	7.3
TDS (ppm)	260	210	320	7.8	250	200	540	520
Conductivity(sg/cm)	340	300	580	270	380	340	780	740
Dissolved oxygen(mg/l)	7.2	6.4	3.8	540	5.4	8.4	4.16	5.7
Total alkalinity(mg/l)	140	120.0	136	4.5	144	156	136.00	146.00
Chloride(mg/l)	48	38.6	48.5	144	50.4	44.4	76.96	67.9
Total hardness(mg/l)	218	206	252	60	274	254	276	260
Calcium hardness(mg/l)	124	92.00	132	240	164	146.00	160.00	152
Mg contents(mg/l)	22.84	27.7	29	118	26.73	26.54	28.18	26.24
Nitrate(mg/l)	0.33	0.31	0.75	29.6	0.64	0.52	1.67	1.52
Nitrite(mg/l)	0.064	0.03	0.18	0.67	0.12	0.08	0.22	0.24
Orthophosphate(mg/l)	0.22	0.28	0.26	0.22	0.24	0.22	0.34	0.3
Ammonia(mg/l)	0.02	0.01	0.034	0.05	0.034	0.03	0.05	0.03
Sodium(mg/l)	4.4	4.8	6.4	5.2	6.6	4.8	12.2	9.4
Potassium(mg/l)	1.4	1.2	1.4	1.6	1.34	1.4	2.34	1.8

Biological Analysis

A total of 105 zooplankton species were identified in Nira River Reservoir (Table 3). Out of these 4.3 as well as density of zooplankton population was observed at site 3 which was located near Bhainsakheri village of Bhopal district. Also, the site was situated in agricultural land where dense aquatic vegetation was observed during monsoon to winter season when water level is high in the reservoir. After site 3, site 2 was the most populated followed by sites 4 and 1. Various authors reported that the aquatic vegetation supports a greater diversity of planktonic fauna because they offer a larger variety of microhabitats (Edmondson, 1944; Wallace, 1977, 1980; Wanganeo, 1980; Duggan, et al., 1998). In the present study, a positive impact of temperature on the growth of zooplankton population has been noticed. Temperature has been considered as one of the primary factors to cause the abundance of zooplankton in freshwaters particularly in shallow waters where bottom exhibit considerable variations in temperature, especially with the progression of the warm season (Mecombie, 1953; Das, 1956; Bamforth, 1958; Moitra and Bhattacharya, 1965, Ahangar et al. [7]). Tripathi and Tiwari (2006) also reported highest zooplankton population in summer season. It was also observed that seasonal occurrence and distribution of zooplankton diversity at different locations of Samrat Ashok Sagar is influenced by various physico-chemical characteristics which indicates various activities and different land use patterns at different sites. Site 4 has been recognized as highly polluted site due to the sewage interference from Patra sewage canal which covers almost 75% area of Bhopal city. Samrat Ashok Sagar is mainly used for aquaculture practices. Hence,

study of zooplankton population in this water body has great importance as they also used to estimate the fishery potential of any aquatic body. Also, the occurrence and abundance of zooplankton may be regarded as a major indicator of the entire environmental status of any water body [8-15].

Table3: Zooplankton composition of Samrat Ashok Sagar, Madhya Pradesh.

Name of the Taxa	Site-1(Central site)		Site-2(Dam site)		Site-3(Bhainsakheri)		Site-4(Patra Confluence)	
Rotifera	Summer	P. Monsoon	Summer	P. Monsoon	Summer	P. Monsoon	Summer	P. Monsoon
	March	September	March	September	March	September	March	September
Anuraeopsis fissa			+	+	D	+	+	+
Anuraeopsis sp.	+	+	+		+			
Asplanchna brightwelli			D		D		+	
Asplanchna sp.	+				+	D		+
Brachionus angularis	D	D	+	+	D	D	+	+
Brachionus bidentata		+	+		+	+		
Brachionus calyciflorus	D		D	D	D	D	+	+
Brachionus caudatus	+				+			
Brachionus diversicornis			+	+	+	+	D	D
Brachionus falcatus					+			
Brachionus forficula	D	+			+	+	+	+
Brachionus patulus					+			
Brachionus plicatilis			+					+
Brachionus quadridentata			+	+	D			
Copepoda								
Cyclops sp.			+		D	+	+	+
Cyclops vicinus	+	+	D	+	D	D	+	
Diaptomus nudus			+	+	+	+		
Diaptomus sp.					+	+	+	+
Eucyclops sp.	+	+	+	+	D			
Heliodiaptomus contortus					+	+		
Mesocyclops leuckarti	+		D	D	D	D	+	+
Mesocyclops sp.			+	+	+		+	
Nauplius larvae	+	+	D	D	D	D	+	+
Thermocyclops crassus	+	+	+	+	D	+		
Thermocyclops hylinus			+		+			
Thermocyclops sp.			+	+		+		
Total	5	4	10	8	11	9	6	4
Ostracoda								
Cypricercus sp.						+		
Cypris sp.					D	+		+
Eucypris sp.			+	+	+			
Stenocypris sp.			+		+	+	+	+
Stenocypris malcolmsoni	+	+	+	+	D	D	+	+
Total	1	1	3	2	4	4	2	3

Note: D=Dominant; +=Present

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