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Study of freshwater zooplanktons in Nira River around Akluj

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Abstract

Present investigation has been conducted on Nira river around Akluj with special reference to its zooplankton diversity in relation physico-chemical characteristics. 105 (One hundred and five) zooplankton species were identified from Nira river Akluj 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; Environmental role of Zooplanktons; Bio-Indicator; Seasonal variations of Zooplanktons; Location of Zooplanktons

1. Introduction

Zooplankton study is important as it could provide ways to predict the productivity of fresh water aquatic system (Borgmann et al., 1984; Morgan et al., 1978). In deciphering trophic status and biomonitoring of aquatic habitats, zooplanktoners 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 contributions 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 Maharashtra and especially in Solapur district. Thus, the present work aimed to assess the biodiversity of Zooplankton and their Relation to the physico-chemical parameters of Nira river Akluj which is mainly used for irrigation purposes, commercial fishing practices and recreation.

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2. Materials and methods

Physico-chemical analysis of water samples were carried out following the standard methods as described by Adoni (1985) and APHA (2000). 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 following the taxonomic references of Needham and Needham (1962), Pennak (1978), Victor and Fernando (1979), Michel and Sharma (1988), Edmondson (1992), Battish (1992), Reddy (1994), Sharma (1999) and Dhanapathi (2003).

2.1 Around akluj

Akluj is a one of the major water body of Central India, situated Near the Akluj city (Figure 1). The water body (popularly known as Ujani reservoir) is spread on three districts of Solapur, Pune and Satara. Most part of Nira River lies in Akluj and Solapur district while the dam is constructed in Pune district. Presently, Nira River In Akluj is used for irrigation and aquaculture practices (Table 1). Present work has been conducted on four sampling sites of Nira River 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 Akluj Village, site 3 was near Ujane dam and site 4 was fixed at the confluence of Akalaai Mandir. Most of the sampling sites were infested with macrophytic vegetation except site 1.

3. Results and discussion

3.1 Physico-chemical analysis

Physico-chemical characteristics of Nira River are given in Table 2. Significant variations in the physico-chemical properties of Nira River Akluj 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 Nira River air temperature ranged between 26 to 33°C (Table 2 and Figure 2) 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 Table 2 an 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 compared to surface water temperature has also been noticed by Bhatnagar (1982), Wanganeo (1998), Ayoade et al. (2006) and Wanganeo et al. (2011).

Table 1 Important features of Nira River

Location	Nira River Akluj
Year of construction	1973
River system	Nira River
Type of Dam	Ujane dam
Longitude	77° 26' 45.06" E
Latitude	23° 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, rain water, domestic sewage
Main use of water	Irrigation, potable water, aquaculture, recreation, washing and bathing

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.

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	28.40	33	27	32	28
Water temperature (°C)	28	23	29.0	25.3	28.6	25	27.2	25.2
Secchi transparency (cm)	50	54	50	60	46	34	44	36.00
Depth (m)	14.8	18.80	1	1	1.2	1.3	1.1	1.20
pH (units)	8.1	8.5	7.2	7.8	8.2	8.5	7	7.3
TDS (ppm)	260	210	320	270	250	200	540	520
Conductivity (µs/cm)	340	300	580	540	380	340	780	740
Dissolved oxygen (mg/l)	7.2	6.4	3.8	4.50	5.4	8.40	4.16	5.70
Total alkalinity (mg/l)	140	120.0	136	144	144	156	136.00	146.00
Chloride (mg/l)	48	38.6	48.5	60	50.4	44.4	76.96	67.90
Total hardness (mg/l)	218	206	252	240	274	254	276	260
Calcium hardness (mg/l)	124	92.00	132	118	164	146	160.00	152.00
Mg contents (mg/l)	22.84	27.70	29	29.60	26.73	26.24	28.18	26.24
Nitrate (mg/l)	0.33	0.31	0.75	0.67	0.64	0.52	1.67	1.52
Nitrite (mg/l)	0.064	0.03	0.18	0.22	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	0.30
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

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 Nira River in Akluj in shallow region (Table 2 and Figure 4). Higher depths control the growth of aquatic vegetation and help to maintain the trophic levels of water body. pH value in Nira River in Akluj ranged between 7 to 8.5 units indicating its alkaline biological analysis.

3.2 Biological analysis

A total of 105 zooplankton species were identified in Nira River Reservoir (Table 3). Out of these 4.3

Table 3 Seasonal variation of Zooplanktons

Name of the Taxa	Site-1 (Central site)		Site-2 (Dam site)		Site-3 (Bhainsakheri)		Site-4 (Patra Confluence)	
	S	PM	S	PM	S	PM	S	PM
Rotifera	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	M		P	M				
Cyclops sp.			+		D	+	+	+
Cyclops vicinus	+	+	D	+	D	D	+	
Diaptomus nudus			+	+	+	+		

Table 3. Contd.

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: S=Summer, PM=Post monsoon, D= Dominant, +=Present.

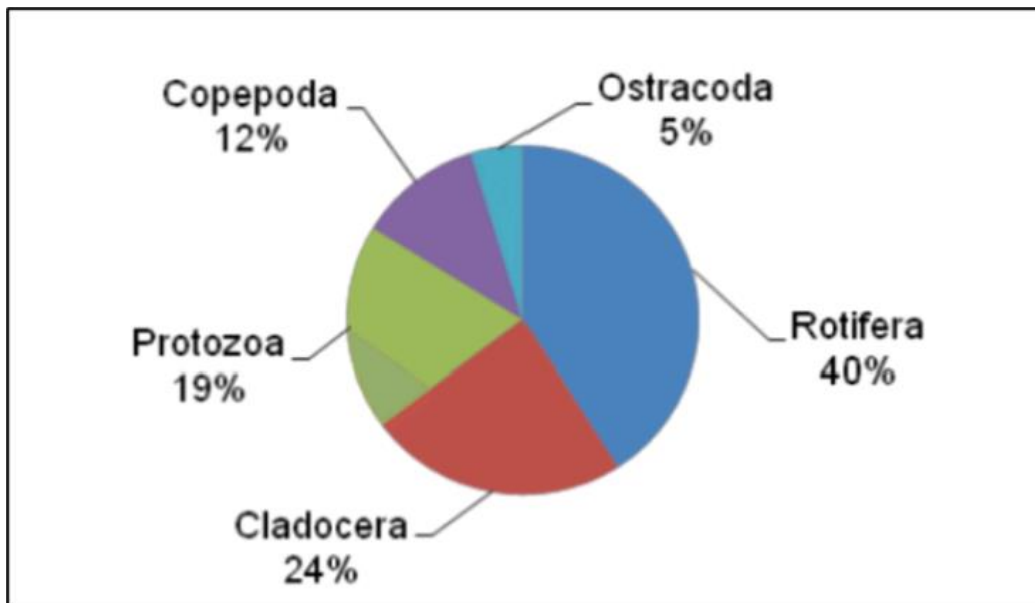


Figure 1 Class wise percentage composition of zooplankton in Ujane dam

As well as density of zooplankton population was observed at site 3 which was located near Ujane dam of Pune 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., 2012). 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 Ujane dam 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 Akalaai Mandir. Nira River in Akluj 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.

4. Conclusion

Author should provide an appropriate conclusion to the article. Write conclusion as single para. Conclusion should be concise, informative and can be started with summarizing outcome of the study in 1-2 sentence and ended with one line stating: how this study will benefit to the society and way forward.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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