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The composition and diversity of net zooplankton species in a tropical water body (Bhoj Wetland) of Bhopal, India

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The aim of the present study was to determine the species diversity and abundance of net zooplankton in samples collected from Bhoj wetland, Bhopal, India. A total of 82 species of zooplankton were identified, among them, 66 species were recorded during the first year (2008-09) and 70 species were documented during the second year (2009-10) of the study period. In the first year, Rotifera recorded the highest number of species (53%) followed by Cladocera (29%), which in turn was followed by Copepoda (8%), Protozoa (6%) and Ostracoda (5%) in the second year of study, Rotifera recorded the highest number of species (47%) followed by Cladocera (37%), which in turn was followed by Protozoa (7%), Copepoda (6%) and Ostracoda (3%). Cumulative 24 months density in the present study ranged from 760 to 11050 Ind.l^{-1}, with an overall mean of 3307 Ind.l^{-1}. A major peak of 11050 Ind.l^{-1} was observed in June 2009, with 47 and 43% contribution from Copepoda and Rotifera. Among Copepoda, *Cyclops* sp. and nauplii were major contributors to this peak while amongst Rotifera, *Brachionus caudatus* and *Keratella tropica* were dominant contributors. Cladocera was comparatively less represented group, being chiefly represented by *Diaphanosoma* sp. Shannon-index ranged between 0.96 and 2.75 during the two years of study period.

Key words: Zooplankton, diversity, Cyclops, Brachionus, Keratella, Shannon-Wiener index, Bhoj wetland.

INTRODUCTION

Tropical wetlands have played an important role for humankind in all continents (Junk, 2002). These are characterized by a large number of ecological niches and harbour a significant percentage of world's biological diversity. Wetlands are among the most productive ecosystems in the world, comparable to rainforests and coral reefs (Thomas and Deviprasad, 2007). Zooplankton are microscopic organisms which do not have the power of locomotion and move at the mercy of the water movements. Zooplankton community is cosmopolitan in nature and they inhabit all freshwater habitats of the world. Zooplankton diversity and density refers to variety within the community (Jalilzadeh et al., 2008). These are often an important link in the transformation of energy

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from producers to consumers due to their large density, drifting nature, high group or species diversity and different tolerance to the stress. Zooplankton plays an important role in lake ecosystem, as grazers that control algal and bacterial populations, as a food source for higher trophic levels and in the excretion of dissolved nutrients. The organization of biological communities in aquatic ecosystems is closely dependent on the variations of physical and chemical conditions linked to natural and anthropogenic factors (Pourriot and Meybeck, 1995). The zooplankton communities, very sensitive to environmental modifications, are important indicators for evaluating the ecological status of these ecosystems (Magadza, 1994). They do not only form an integral part of the lentic community but also contribute significantly, the biological productivity of the fresh water ecosystem (Wetzel, 2001). The presence and the relative predominance of various copepod species have been used to characterize the eutrophication level of aquatic ecosystems (Park and Marshall, 2000; Bonecker et al., 2001). Herbivorous zooplankton is recognized as the main agent for the top-down control of phytoplankton, and the grazing pressure exerted by cladocerans and copepods on algae and cyanobacteria is sometimes an important controlling factor of harmful algal blooms (Boon et al., 1994).

The objectives of this study are i) to study the seasonal fluctuations of zooplankton abundance of the Bhoj wetland, ii) to understand the impact of pollution on zooplankton community in the Bhoj wetland. In this investigation, the data of zooplankton density and diversity in a tropical wetland system (Bhoj wetland) was studied for two years.

Study area

Bhopal, the capital city of the state of Madhya Pradesh, India is famous for its numerous lakes. Of these, the most important are the Upper and Lower Lakes, which have commonly been designated as Bhoj Wetland. The Bhoj Wetland is a wetland of international importance. The Upper Lake basin comprises of a submergence area of about 31.0 sq km and a catchment area of 361 sq km., whereas the Lower Lake basin comprises of a submergence area of 0.9 sq km and catchment area of 9.6 sq km. While Lower Lake is surrounded on all sides by dense urban settlements, only about 40% of the fringe area of Upper Lake has dense human settlement and the rest is sparsely populated having cropping as the major land use. The Upper Lake spread over longitude 77°18’00” to 77°24’00” E and latitude 23°13’00” to 23°16’00” N, whereas the considerably smaller Lower Lake is spread over 77°24’00” to 77°26’00” E and latitude 23°14’30” to 23°15’30” N. The Upper Lake was created in the 11th century by constructing an earthen dam across Kolans River, the main feeding channel of the lake with the objective of supplying potable water to the city dwellers. The wetland also supports a wide variety of flora and fauna. Several species of phyto and zooplankton, macrophytes, aquatic insects, amphibians, fishes and birds (resident as well as migratory) are found in these wetlands. Considering its ecological importance, Ramsar site was declared by the Government of India in 2002. Increase in anthropogenic activities in the catchment during the second half of the last century resulted in environmental degradation of the lakes.

Investigations on the ecology of Bhoj wetland of Madhya Pradesh indicate that this man-made wetland is under severe degradation pressure. Siltation, solid waste disposal and weed infestation, dumping of agricultural waste, hospital waste disposal and idol immersion in the wetland during the festival season pollutes the wetland ecosystem beyond the tolerable limits of any aquatic system Figure 1.

MATERIALS AND METHODS

Water samples were collected on monthly basis for a period of two year. For the present study nine sampling points in the wetland were selected and each point, taking into account the human activities such as washing, bathing, fishing, boating, the outlets, inlets, morphometric features and growth of aquatic vegetation etc., and other important factors were considered during the selection of the sampling sites. Some of the features of the sampling sites are as follows: Station I (Kamla Park) is situated on eastern end of the wetland. It is subjected to maximum anthropogenic pressure. The Idol immersion activity at this site has been reduced after developing Prempura Ghat particularly for immersion activity. Station II (Gandhi Medical College) is situated close to the inlet of Shaheed Nagar Nallah adjacent to Gandhi Medical College. Station III (Koh e Fiza) has an intake point for water supply in this area. This station is also the site of Tazia immersion. Station IV (Van Vihar) represents the area that comes under protected forest (Van Vihar). The station is comparatively free from human intervention and other anthropogenic activities. Station V (Yatch Club) is the boating station, where maximum human interaction takes place. Tourists start their motor and paddle boats from this station, and a crowd of tourists can be observed from morning till evening at this station. Station VI (Bairagarh), a station of Bhoj wetland is situated near Bairagarh where substantial inflow of domestic sewage can be seen. The area has become shallow due to high density of free floating, emergent and submerged macrophytes. Station VII (Sehore side) has a lot of agricultural land surrounds this station in Bhoj Wetland. Most of the catchment area consists of agricultural land. Because of this all the fertilizers, pesticides and agricultural residues used in the fields find their way as run off into the wetland waters. Station VIII (Prempura Ghat) is the idol immersion station. During the Hindu religious festivals, lots of idols are immersed in water. Station IX (Nehru Nagar) is highly influenced by anthropogenic and cattle activities. The run-off from the catchment area adds nutrients to the wetland. The region is covered with high density of emergent/submerged macrophytes. The run-off from the catchment area also adds considerable quantities of nutrients to the wetland.

The water samples have been collected in one liter polyethylene canes of the surface waters by the boat between 8 am to 12 pm from the selected sites of the Bhoj wetland. For the quantitative analysis of zooplankton, water was collected from the surface with minimal disturbance and filtered through a No. 25 bolting silk cloth, net of mesh size 63 µm. Ten liters of water were filtered and concentrated to 100 ml and were preserved by adding 2 ml of 4% formalin simultaneously. The quantitative analysis of zooplankton was done by using Sedgwick-Rafter cell with dimensions of 50 x 20 x 1 mm, following the method given in APHA (2000). 1 ml of concentrated sample was taken in a Sedgwick-Rafter counting cell and the entire contents were counted. The identification of aquatic biota (zooplankton) have been done following the standard works and methods of Edmonson (1959), Needham and Needham (1962), Pennak (1978), Victor and Fernando (1979), Michael and Sharma (1988), Battish (1992) and Sharma (1999). The results have been expressed as individuals/l (Wanganeo and Wanganeo, 2006).

Number of zooplankton "n" = $\frac{C \times 1000\ mm^2}{A \times D \times E}$

C = Number of organisms recorded; A = area of field of microscope; D = depth of field (SRC depth) in mm; E = number of fields counted.

Number of zooplankton/l = $\frac{\text{n x Vol. of concentrate (ml)}}{\text{Vol. (litres) of water filtered}}$

Shannon diversity index

This index is an index applied to biological systems derived from a mathematical formula used in communication area by Shannon in 1948.

$H' = -\Sigma [(n_i / N) \times (\ln n_i / N)]$

H': Shannon Diversity Index; n_i: Number of individuals belonging to i species; N: total number of individuals.

RESULTS AND DISCUSSION

Zooplankton are the central trophic link between primary producers and higher trophic levels. The freshwater zooplankton comprises Cladocera, Rotifera, Copepoda, Ostracoda and Protozoa. Most of them depend to a large extent, on various bacterioplankton and phytoplankton for food. Many of the larger forms feed on smaller zooplankton, forming secondary consumers. Some of them are detritivore feeders, browsing and feeding on the substrate attached organic matter. Many of these organisms are also fish food organisms and are consumed by the other aquatic macrofauna.

In the two years of the study period, a total of 82 species of zooplankton were identified, among them, 66 species were recorded during the 1st year (2008-09) of study, while 70 species of Zooplankton were documented during the 2nd year (2009-10) of study period. At all the nine stations total 66 species were identified, group Rotifera recorded the highest number of species (53%) followed by Cladocera (29%), which in turn was followed by Copepoda (8%), Protozoa (6%) and Ostracoda, 5% (Table 1 and Figure 1 and 2).

Similarly in the second year of study at all the nine stations a total of 70 species were identified, group Rotifera recorded the highest number of species (47%) followed by Cladocera (37%), which in turn was followed by Protozoa (7%), Copepoda (6%) and Ostracoda (3%) (Table 1 and Figure 3).

Table 1. Qualitative enumeration of zooplankton species, 2008-09.

Group	First year (2008-09)	Second year (2009-10)
	Number of species (%)	Number of Species (%)
Rotifera	35 (53%)	33 (47%)
Cladocera	19 (29%)	26 (37%)
Copepoda	5 (8%)	4 (6%)
Ostracoda	3 (5%)	2 (3%)
Protozoa	4 (6%)	5 (7%)
Total	66	70

The relative abundance was maximum (3.83%) for *Bosmina* sp. and minimum (0.01%) for *Chydorus ventricosue, Diaphanosoma excisum, Diaphanosoma sarsi, Sida crystalline*in Cladocera while the maximum (8.43%) for *Brachionus caudatus* and minimum (0.01%) for *Ploesoma* sp. *Triploceros limnias* in Rotifera; maximum (32.20%) for *Cyclops* sp. and minimum (0.03%) for *Mesocyclops* sp. in Copepoda and Ostracoda and protozoa are least groups (Table 2).

Furthermore, the frequency of occurrence was maximum (42.15 and 47.38%) in the month of October during the first and second year and minimum (8.54 and 5.94%) in the month of November 2008 and September 2009 from the group Cladocera. Similarly in the Rotifera group, frequency of occurrence was maximum (39.51 and 47.49%) in December 2008 and September 2009 and minimum (14.05% and 3.13%) in October 2008 and January 2010 during first and second year of study. While in Copepoda, it was maximum (66.54 and 81.04%) in the March 2008 and January 2009 and minimum (36.47% and 29.65%) in the January 2009 and October 2009. Nevertheless, the frequency of the occurrence in Ostracoda and Protozoa (each of these groups were represented by least species density) was maximum having 2.26 and 3.73% respectively (Table 3 and Figure 4).

In the present study, the zooplanktonic mean density during 1st year was 2484 $Ind.l^{-1}$ which increased to 4130 $Ind.l^{-1}$ in the 2nd year (Table 3). There was variation in zooplankton density during two years which may be attributed to low water volume caused by drought conditions in the second year. The maximum population density recorded in the 2nd year also reflected a positive relationship with temperature, nitrate and phosphate concentrations. Similar observations were recorded by Paliwal (2005). The maximum population density of zooplankton in the 2nd year may also be attributed to greater availability of food viz., phytoplankton. The factors like temperature, dissolved oxygen play an important role

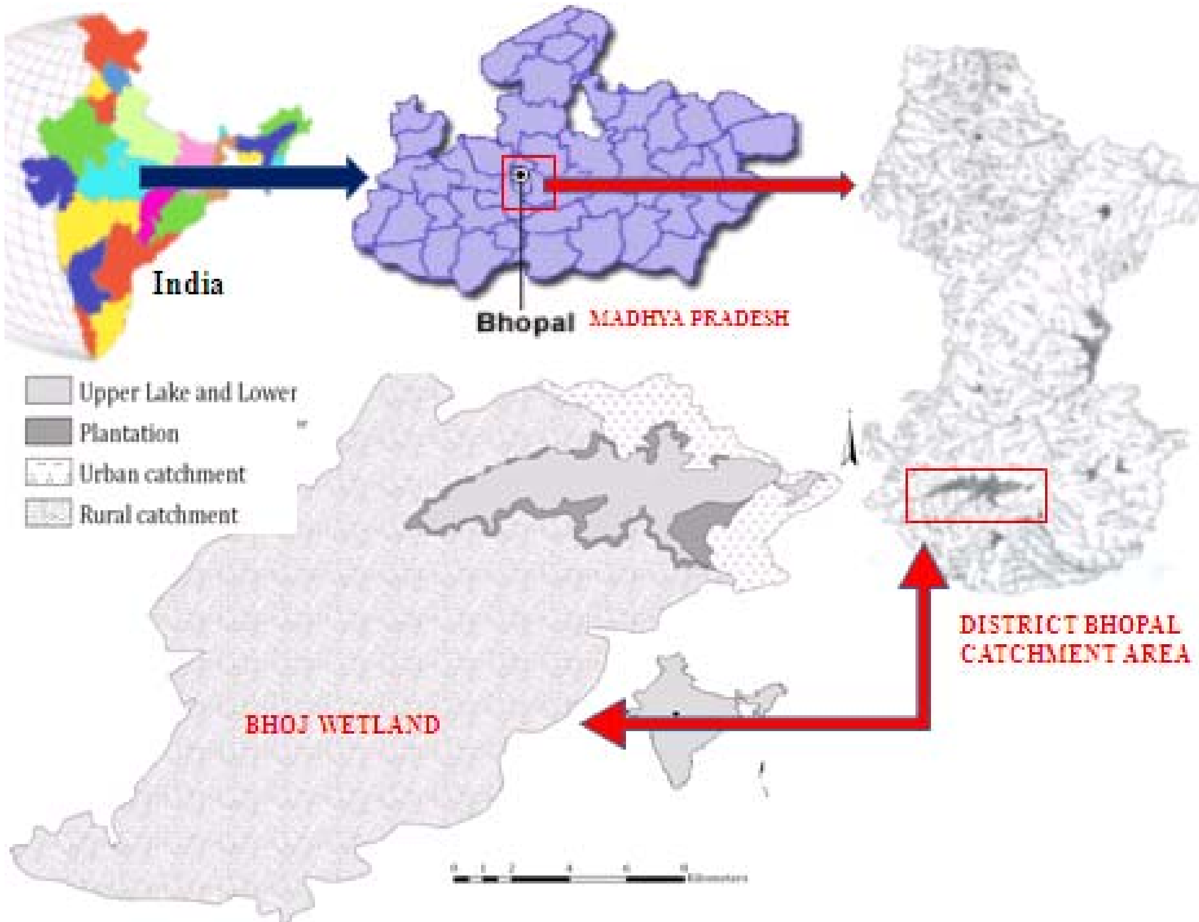

Figure 1. Map of India indicating location of Madhya Pradesh state and also indicating location of study area (Bhoj wetland), Bhopal (Source MPCST 2009).

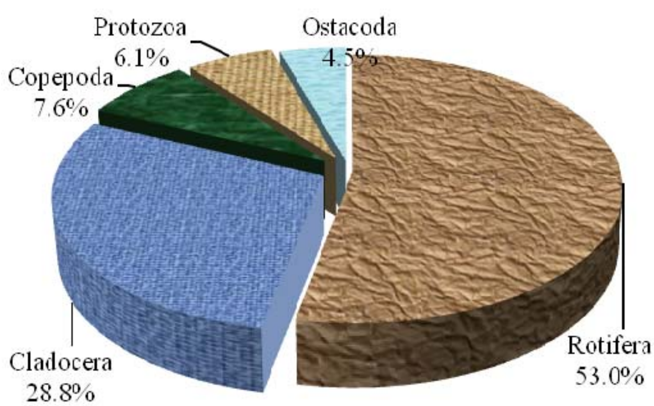

Figure 2. Group wise percent contribution of zooplankton (2008-09).

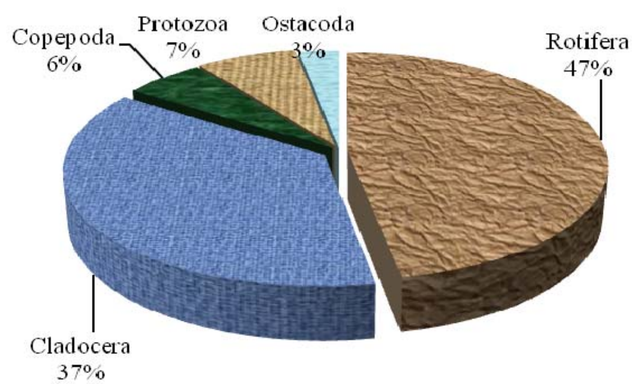

Figure 3. Group wise percent contribution during 2009-10.

in controlling the diversity and density of zooplankton (Edmondson, 1965; Baker, 1979).

According to Kurbatova (2005) and Tanner et al. (2005), pH more than 8 means highly productive nature of a water body, in the present study, the average pH recorded was 8.3 units, indicating water highly productive for zooplankton population. Cumulative station (24

Table 2. Net zooplankton species recorded from the surface water of the Bhoj wetland from February 2008 to January 2010.

Groups with species	Number of individuals	Relative frequency (% by number)	Groups with species	Number of individuals	Relative frequency (% by number)
Cladocera (28 species)		**16.75**	*Mytilina* sp.	70	0.09
Alona sp.	400	0.50	*Philodina* sp.	20	0.03
Alonella sp.	260	0.33	*Platyias* sp.	90	0.11
Alonella dentifera	20	0.03	*Ploesoma* sp.	10	0.01
Bosmina sp.	3040	3.83	*Polyarthra* sp.	1020	1.28
Bosmina longirostris	200	0.25	*Rotaria* sp.	60	0.08
Bosminopsis deitersi	30	0.04	*Scaridium* sp.	80	0.10
Ceriodaphnia sp.	700	0.88	*Synchaeta* sp.	40	0.05
Chydorus (space) sp	1950	2.45	*Tetramastixapoliensis*	60	0.08
Chydorus sphaericus	390	0.49	*Trichocerca* sp.	710	0.89
Chydorus ventricosue	10	0.01	*Trichocercalongiseta*	140	0.18
Conochiloides sp.	40	0.05	*Trichotria* sp.	20	0.03
Daphnia sp.	130	0.16	*Triploceros limnias*	10	0.01
Diaphanosoma sp.	910	1.15	*Trochosphaera* sp.	20	0.03
Diaphanosoma brachyurum	110	0.14	**Copepoda (5 species)**		**51.23**
Diaphanosoma excisum	10	0.01	*Cyclopoid copepod*	40	0.05
Diaphanosoma sarsi	10	0.01	*Cyclops* sp.	25590	32.20
Leydgia sp.	280	0.35	*Diaptomus* sp.	1010	1.27
Macrothrix sp.	80	0.10	*Mesocyclops* sp.	20	0.03
Moina sp.	1010	1.27	Nauplius larvae	14050	17.68
Moina macrocopa	140	0.18	**Ostracoda (3 species)**		**0.33**
Moina micrura	70	0.09	*Cyprinotus* sp.	60	0.08
Moinadaphnia sp.	1310	1.65	*Cypris* sp.	140	0.18
Pleuroxus aduncus	180	0.23	*Stenocypris* sp.	60	0.08
Scapholebris sp.	40	0.05	**Protozoa (8 species)**		**0.99**
Sida sp.	70	0.09	*Actinophyrus* sp.	20	0.03
Sida crystallina	10	0.01	*Arcella* sp.	20	0.03
Simocephalus sp	1780	2.24	*Centropyxix* sp.	590	0.74
Streblocerus sp.	130	0.16	*Climacostomum* sp.	10	0.01
Rotifera (38 species)		**30.69**	*Coleps* sp.	80	0.10
Asplanchna sp.	200	0.25	*Colpidium* sp.	30	0.04
Asplanchnopsis sp.	60	0.08	*Oxytricha* sp.	30	0.04
Ascomorpha sp.	40	0.05	*Verticella* sp.	10	0.01
Brachionus angularis	1110	1.40	*Filinia* sp.	890	1.12
Brachionus angulosum	50	0.06	*Gastropus* sp.	110	0.14
Brachionus calyciflorus	1960	2.47	*Harringia* sp.	70	0.09
Brachionus caudatus	6700	8.43	*Hexarthra* sp.	130	0.16
Brachionus falcatus	2290	2.88	*Keratella* sp.	120	0.15
Brachionus forficula	400	0.50	*Keratella cochlearis*	1560	1.96
Brachionus quadridentata	180	0.23	*Keratella tropica*	4000	5.03
Brach. urceus	40	0.05	*Lecane* sp.	1010	1.27
Cephalodella sp.	70	0.09	*Lepodella* sp.	170	0.21
Colurella sp.	40	0.05	*Monostyla* sp.	780	0.98
Conochilus sp.	60	0.08	**Total**	**79460**	**100.00 %**

months) density in the present study ranged from 760 to 11050 Ind. l^{-1}, with an overall mean of 3307 Ind.l^{-1} (Table 3). A major peak of 11050 Ind. l^{-1} was observed in June 2009, with 47 and 43% contribution from Copepoda and Rotifera, respectively. Among Copepoda, *Cyclops* sp. and nauplii were major contributors to this peak while

Table 3. The net zooplankton assemblages across different months in surface water of the Bhoj wetland (frequency of occurrence (%)).

Month	Frequency of occurrence (%) Cladocera	Frequency of occurrence (%) Rotifera	Frequency of occurrence (%) Copepoda	Frequency of occurrence (%) Ostracoda	Frequency of occurrence (%) Protozoa	Net zooplankton
Feb. '08	27.61	29.10	40.30	1.49	1.49	1340
Mar	16.92	15.77	66.54	0.38	0.38	2600
Apr	9.21	33.89	56.07	0.84	0.00	2390
May	32.36	19.24	47.52	0.87	0.00	3430
Jun	17.62	26.64	54.92	0.41	0.41	2440
Jul	15.74	29.70	54.57	0.00	0.00	3940
Aug	18.42	25.00	56.58	0.00	0.00	760
Sep	33.71	26.97	38.20	0.00	1.12	890
Oct	42.15	14.05	41.32	0.83	1.65	1210
Nov	8.54	35.68	55.28	0.50	0.00	1990
Dec	12.65	39.51	45.37	0.62	1.85	3240
Jan. '09	24.37	37.81	36.74	0.36	0.72	5580
Feb	8.48	29.70	60.91	0.15	0.76	6600
Mar	10.48	37.90	50.97	0.00	0.65	6200
Apr	14.00	33.00	50.00	0.00	3.00	2000
May	17.65	42.41	38.70	0.31	0.93	3230
Jun	9.59	42.53	47.15	0.18	0.54	11050
Jul	17.22	38.28	44.50	0.00	0.00	2090
Aug	8.55	30.38	58.70	0.88	1.47	3390
Sep	5.94	47.49	46.58	0.00	0.00	2190
Oct	47.38	21.80	29.65	0.29	0.87	3440
Nov	29.32	24.06	42.86	2.26	1.50	1330
Dec	32.84	29.85	33.58	0.00	3.73	1340
Jan. '10	12.99	3.13	81.04	0.00	2.84	6700

amongst Rotifera, *Brachionus caudatus* and *Keratella tropica* were dominant contributors.

The two minor peaks of 6600 and 6700 Ind.l^{-1} were recorded in February 2009 and January 2010, respectively. Among Copepoda, *Cyclops* sp. alone contributed significantly to the February 2009 and January 2010 peaks, to the tune of 61 and 81%, respectively (Table 3 and Figure 4).

On monthly basis, maximum zooplankton density was observed in summer and winter months during both years. Winter peak months in both years were mainly represented by Copepoda, summer peak was represented by Copepoda. In summer months, low flow of water brings stability to the ecosystem and more availability of food due to production and decomposition of organic matter.

The high density of zooplankton recorded in summer months may be related to high phytoplankton density during this period. It was documented that nutrient availability influence the abundance of Rotifera and Copepoda (particularly *Cyclops* sp.) (Kumar et al., 2004). The net zooplankton abundance increased during summer, probably corresponding to the water quality, decaying vegetation, increased levels of organic matter in the sediment and higher

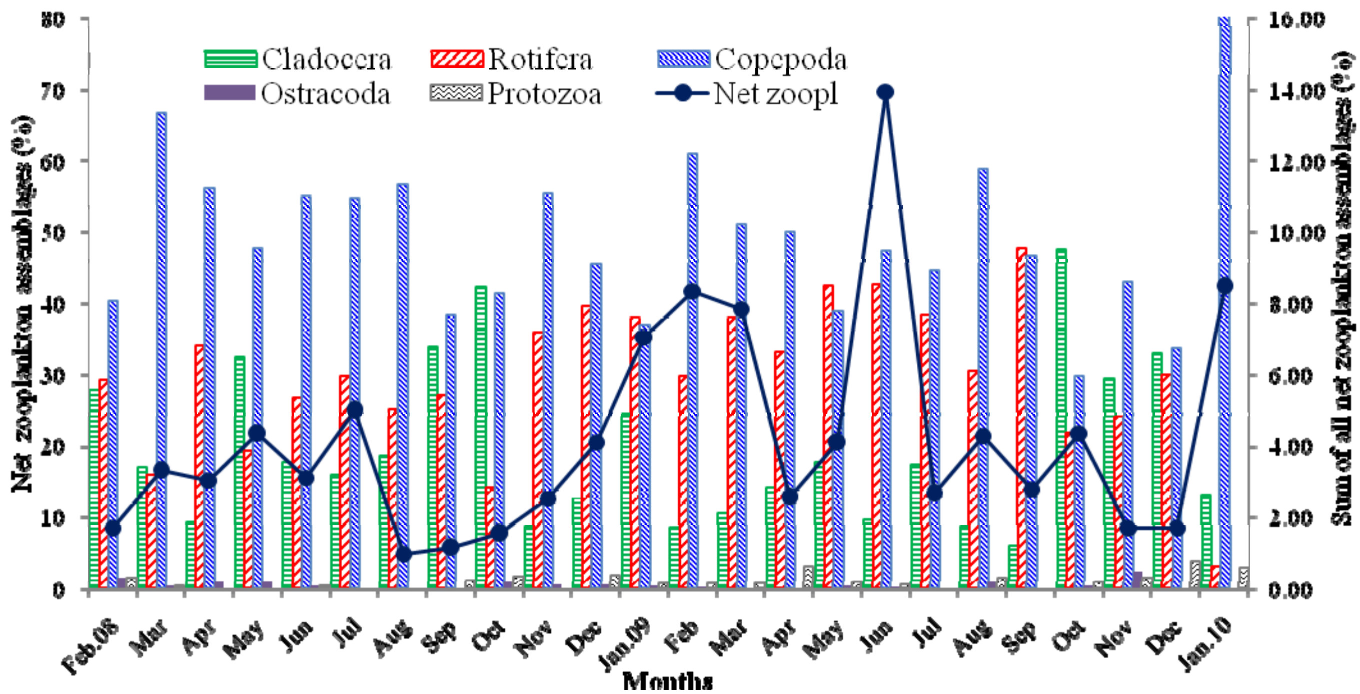

Figure 4. Net zooplankton abundance across different months in surface water of the Bhoj wetland (frequency of occurrence (%)).

abundance of bacteria in the wetlands (Coman et al., 2003; Chattopadhyay and Barik, 2009). Copepods develop better in warm periods (Dar and Dar, 2009). Copepoda population dominated numerically in the zooplankton populations in Dal Lake, Kashmir (Zutshi and Vass, 1982). The dominance of Copepods in flood-plain lakes of Kashmir has already been established by Khan (2002). The significant density of Copepoda nauplii in Bhoj wetland was recorded during the summer months, indicating the role of high temperature in promoting the egg production and development. This is in agreement with the work of Makino and Ban (2000), in Lake Toya who reported that higher water temperature causes more rapid development and higher egg production while increased food density results in larger body size and higher egg production.

During the present investigation, the summer population of total zooplankton fell significantly in monsoon season (July to September) as was also observed (Sadguru et al., 2002 and Pandey et al., 2004). Sudden reduction in the zooplankton population density during the rainy season as noticed in the present findings could also be due to fall of temperature and dilution in concentration of minerals and salts in wetland water (Chakraborty, 2004; Dutta et al., 2010 and Okogwu et al., 2010). The population in winter as a result of favorable environmental conditions, including temperature, dissolved oxygen and the availability of abundant food in the form of bacteria, nanoplankton and suspended detritus as reported by Edmondson (1965) and Baker (1979).

In the present study, it has been observed that Copepoda followed by Rotifera were well represented groups quantitatively throughout the study period. Cladocera was comparatively less represented group being chiefly represented by *Diaphanosoma* sp. Cladocera which followed Rotifera was represented by *Diaphanosoma* sp. Jana and Pal (1984) reported the abundance of *Diaphanosoma excisum* in water bodies having high organic content. Therefore, presence of *Diaphanosoma* sp. at all the stations in the present study can also be considered as an indication of increased organic content in the water, from sewage and other agricultural effluents.

Copepoda during the entire period was mainly represented by *Cyclops* sp. and nauplii. This was attributed to alkaline nature of waters. Verma et al. (1984) and Ahmad et al. (2011) observed that *Cyclops* sp. and nauplii were sensitive to pollution (organic matter) and increase with an increase in nutrients. Copepods (density, species composition) were directly related to nitrogen and phosphorus and showed tolerance to different physico-chemical characteristics (Kulshreshta et al., 1992). Syuhei (1994) stated that individual growth rate of Copepoda may also depend on temperature conditions. The occurrence of nauplii throughout the study period in the present wetland indicated extended reproductive phase of the cyclopoid, which is in agreement with the reports of Sharma (2011) and Sharma and Sharma (2011). Brachionides (*Brachionus* sp.) and *Keratella* spp. were the most dominant genera in

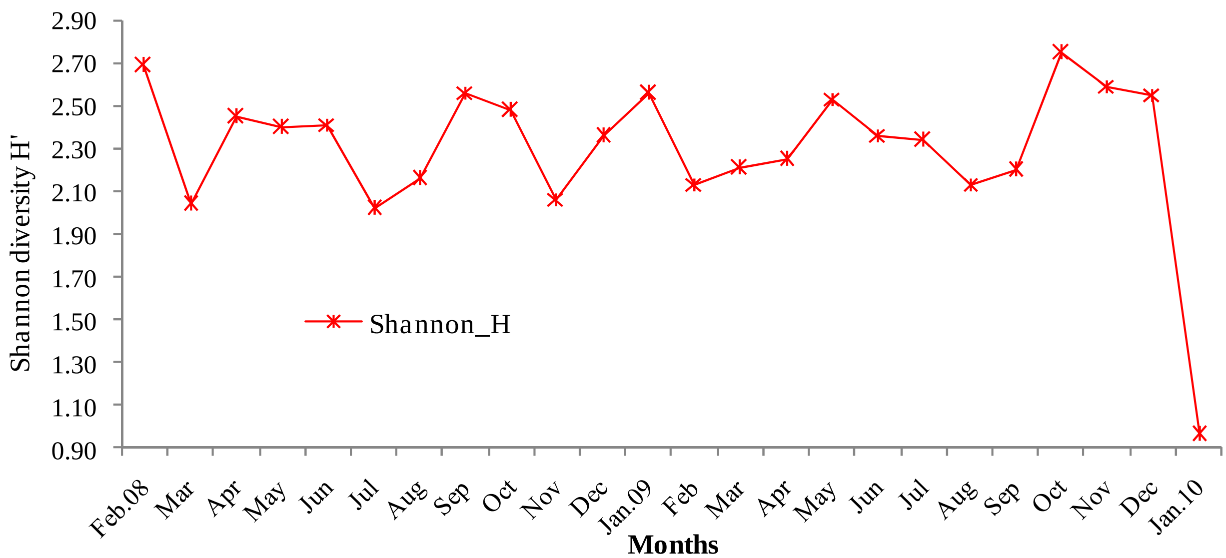

Figure 5. Shannon-Weiner diversity index of net zooplankton species during 2008-10.

the present study. Abundance of such species is considered as biological indicator for eutrophication (Nogueira, 2001). Mulani et al. (2009) reported *Brachionus* spp. to be present in typical tropical conditions while Sampaio et al. (2002) reported *Brachionus* spp. to be indicator of eutrophication.

Diversity of net zooplankton species

The diversity indices are all based on two assumptions: (a) stable communities have a high diversity value and unstable ones have a low diversity, and (b) stability in diversity is an index of environmental integrity and wellbeing (Magurran, 1988). As a consequence, the diversity value decreases with environmental degradation. Shannon-Weaver Index is a combination of the number of species and the evenness of distribution of individuals among taxa. It may function as a sensitive indicator for pollution (Klemm et al., 1990). In the present investigation, Shannon-Wiener diversity index ranged between 0.96 and 2.75 during the two years of study (Figure 5). The above trend can be attributed to the surrounding disturbances in the riparian zone and also increasing anthropogenic interaction in the wetland. Bhoj wetland can be classified as less diverse as Shannon-Wiener index (H') is > 2; it also indicates poor quality in the water body. McDonald (2003) stated that the value of the index ranging from 1.5 to 3.4 has low diversity and species richness while value above 3.5 has high diversity and species richness. The present study shows that limnological processes affecting net zooplankton species diversity operated almost equally throughout the surface waters of the water body and across all seasons.

Zooplankton assessment is an important indicator of aquatic community structuring and water conditions. Zooplankton is directly or indirectly influenced by seasonal variation of complex limnological factors. The annual quantitative study of zooplankton population depends on the succession, appearance and disappearance of component species. Periods of quantitative increase and decrease of individuals do not coincide with seasonal minima and maxima of the total zooplankton. Three main zooplankton groups were identified in the study (Rotifers, Cladocera and Copepoda) which constitute the zooplankton population and contributed significantly to secondary production of the wetland. Some species increases slowly and more or less uniformly to the maximum while others show an almost starting burst of development from an apparent absence to a numerical dominance of the whole net zooplankton within a very short period of time.

The nature of wetland is closely related to the fluctuations of the zooplankton density. The analysis of species richness and diversity indices revealed clearly the status of the water body. The rapid modification of the planktonic communities in response to environmental stress confirms the strong instability of tropical shallow water ecosystems and reinforces the interest of their ecological monitoring, particularly, as for Bhoj wetland; they have multipurpose and potentially conflicting uses (drinking water, irrigation and fishing).

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