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PRELIMINARY DATA ON OCCURRENCE OF ZOOPLANKTONS OF FRESH WATER LENTIC ECOSYSTEM - A CASE STUDY OF DAKOR SACRED WETLAND, CENTRAL GUJARAT, INDIA

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Abstract

The aim of the present study was to depict the preliminary data on occurrence of zooplanktons of Dakor Sacred Wetland (DSW) Central Gujarat, India. The samples of zooplanktons were collected from three permanent sampling stations for one year (June 2012 to May 2013) at 15 days interval. The zooplankton population was represented by a total of 36 genera and 39 species dispersed amongst Ciliophora (16 species), followed by Zooflagellata, Rhizopoda and Rotifera (6 species), Cladocera (3 species) while Copepoda and Ostracoda (1 species). Species such as *Thecamoeba verrucosa* Ehrenberg, *Placus luciae* Kahl, *Spasmostoma viride* Kahl, *Cyclops sp.*, *Daphnia lumholtzi* G.O. Sars, were found abundant in all the study sites, while some chunk of species were classified as rare 43.5% (n=17) and the remaining were recorded as common.

Key words: Zooplanktons, Occurrence, Freshwater lentic ecosystem, Sacred wetland, Central Gujarat, India

Introduction

Inland wetlands have played a vital role for humankind in all the continents of the world (Junk, 2002). Wetlands are characterized by a large number of ecological niches which harbour a significant percentage of world's biological diversity and are amongst the most productive ecosystems in the world comparable to rainforests and coral reefs (Thomas and Deviprasad, 2007). Zooplanktons are the intermediate linkage between phytoplankton and fish, and plays a key role in cycling of organic materials in an aquatic ecosystem (Jalilzadeh *et.al.*, 2008). Discharge of waste and surface run-off causes deleterious effect on flora and fauna and other aquatic organisms (Sah *et al.*, 2000).

Due to their short life span, the zooplankton community often exhibits quick and dramatic changes in response to the changes in the hydro-chemical regime of the aquatic

habitat (Dar *et al.*, 2004). Zooplanktons not only form an integral part of the lentic community but also contribute to the biological productivity of the freshwater ecosystem (Wetzel, 2001). Trivedi *et al.* (2003) disclosed that places of low zooplankton population usually have rapidly multiplied phytoplankton population. Hakanson (2003) attributed this to food availability and avoidance of predators. Zooplanktons are globally recognized as pollution indicator organisms in the aquatic environment (Sunkad *et al.*, 2004).

In Gujarat, although some information is available on the zooplankton community of marine ecosystem, studies are sparse and restricted to mere short-term taxonomic observation of lentic ecosystem without any ground-truth quantitative analysis. Several studies have been carried out on different aspects of lentic ecosystems. The floral and faunal diversity of aquatic ecosystem and the major industrial development pressures posed by mangroves and coastal ecosystems of Gujarat were observed by Oswin (2004). Kumar *et al.* (2005, 2008) explored physico-chemical characteristics of water and sediments, and diversity of macrophytes. Temporal and spatial variations with reference to community composition of zooplankton had been studied by Soni (2007) for two community reservoirs (Pariyej and Kanewal Community Reservoirs), Central Gujarat, for a yearlong study period. Influence of water quality on composition and seasonal abundance of phytoplankton community in Thol Wetland of Gujarat was studied by Nirmal Kumar and Verma (2011). Rawal and Pandit (2011) evaluated the quality of surface water devastating due to rapid industrialization, population growth and urbanization of Ahmedabad city by weighted arithmetic index method.

In the present investigation, zooplankton diversity and density at Dakor Sacred Wetland (DSW), District Anand, Central Gujarat, India, was derived for one year (June 2012 to May 2013), at three selected study sites.

Material and Methods

Description of Study Area

Dakor Sacred Wetland (DSW), District Anand, Central Gujarat, India, is located at 22.75° N 73.15° E and has an average elevation of 49 meters above MSL; temperature ranges from lowest 12 °C to highest 34 °C (World Weather Online, 2008) According to 2001 census, the human population of Dakor is around 23,784 More than 70-80 lakhs devotees visit Dakor every year and on the day of “*Falgun Purinma*”, 10-15 lakhs devotees visit Dakor (Census

Commission of India, 2004). It is the most worshiped temple of Deity Lord Krishna and has also become source of attraction for the people from all over the world (Figure 1).



Figure 1. Holistic View of Dakor Sacred Wetland (DSW), Central Gujarat, India

Sampling

Collections of zooplanktons were carried out at three permanent sampling stations at fortnight intervals over one year from June 2012 to May 2013 which covers three consecutive seasons. Nylon plankton net with 20 μ mesh-size of conical shape and reducing cone having filtering area three times larger than the area of the mouth with the bottle at its end was used to collect zooplankton (Downing *et al.*, 1984). The plankton net was towed in open water area of each site in three directions such as horizontally, vertically and obliquely. Collected samples were transferred into the air tight plastic bottles, and were labelled and preserved immediately 4% formaldehyde. Zooplankton samples were identified with an aid of a light compound binocular microscope (Almicro) (Rajashekhar *et al.*, 2009). Later, the collected samples were brought to the laboratory and carefully studied under compound binocular microscope (Almicro) and were identified up to genus using published keys from various monographs and books (Tonapi 1980; Pennak 1994; Edmondson 1998; and Battish 2000.) Then all the samples were preserved in plankton laboratory for comparative studies of other samples as a future reference. The occurrence status of all the taxa were calculated on the basis of method depicted by Reckendorfer *et al.* (1999), considering the number of samples in which a given taxon occurred in relation to the total number of samples collected. For this, the following categories were determined: Abundant (A): > 80%; Common (C): \leq 70%, and Rare (R): <10%.

Results and Discussion

The population structure of Zooplanktons of DSW was represented by a total of 39 species belongs to 36 Genera and comprising of 7 Classes. Of which, 15 genera (41.66%) were represented by Ciliophora, followed by Zooflagellata and Rhizopoda [6 (16.66%) species each], 5 (13.88%) species of Rotifera, while Copepoda and Ostracoda representing with 1 (2.77%) species each (Table 1).

The supremacy of zooplanktons was reflected by the occurrence of members of Class Ciliophora 16 species (41.02%), followed by 6 species (15.38%) of Zooflagellata and Rhizopoda, Cladocera 3 species (7.69%) and only 1 species (2.56%) of Copepoda and Ostracoda (Figure 2). These results clearly depict the importance and dominance of Ciliophora, Zooflagellata and Rhizopoda in the aquatic ecosystem of DSW (Howaida *et al.*, 2007).

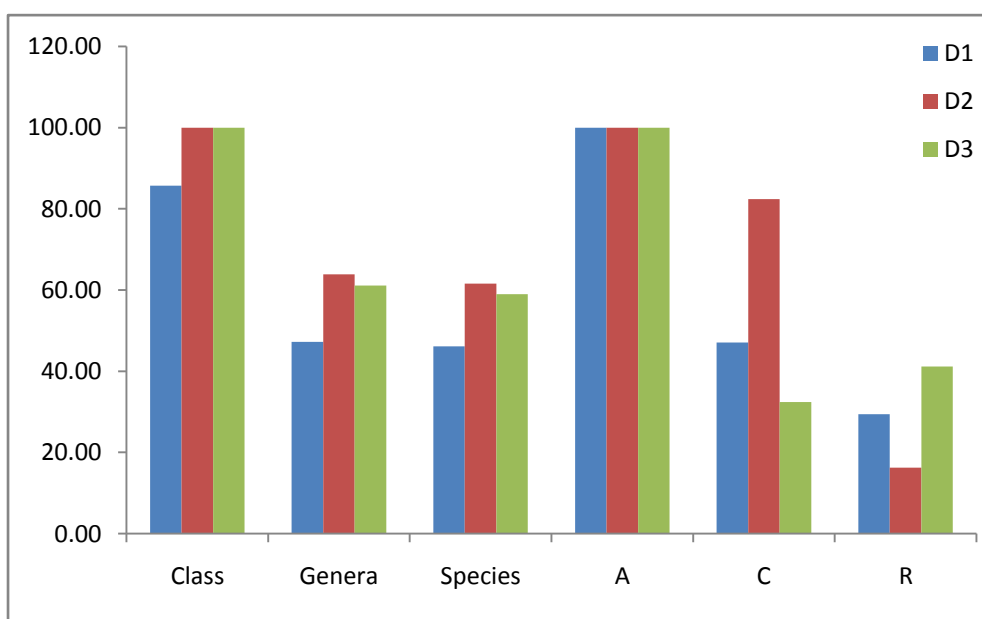


Figure 2. Percent Distribution of Zooplanktons at DSW

Table 1. Zooplanktons recorded at DSW

Class	Genera	Species	Genus: Species
Zooflagellata	6	6	1.00
Rhizopoda	6	6	1.00
Ciliophora	15	16	1.07
Rotifera	5	6	1.20
Copepoda	1	1	1.00

Cladocera	2	3	1.50
Ostracoda	1	1	1.00
Total (7 Classes)	36	39	1:5.14:5.42 (Class: Genera: Species)

Among the recorded 39 species, the most abundant species belonging to class Ciliophora are *Placus luciae* Kahl and *Spasmostoma viride* Kahl which exhibited its occurrence throughout the study period at all the study stations, whereas the common species among them were *Aspidisca costata* Dujardin Stein, *Campanella umbellaria* Linnaeus, *Coleps hirtus* Muller, *Paramecium aurelia* Ehr., *Perispira ovum* Stein, *Stentor coeruleus* Ehrenberg; while the other species of the same class were noted rarely. The supremacy of Ciliophora members amongst other classes of zooplanktons substantiates the previous work (Nirmal Kumar *et al.*, 2005; Nirmal Kumar and Shailendra, 2008; Nirmal Kumar *et al.*, 2011).

Of the listed classes, Zooflagellata, Rhizopoda and Rotifera formed the second most dominant group of zooplanktons represented by 6 species. Amongst the recorded species, the dominant taxa are *Thecamoeba verrucosa* Ehrenberg among Rhizopoda class. On the contrary, species such as *Actinomonas mirabilis* Kent, *Bodo caudatus* Dujardin, *Bodopsis*

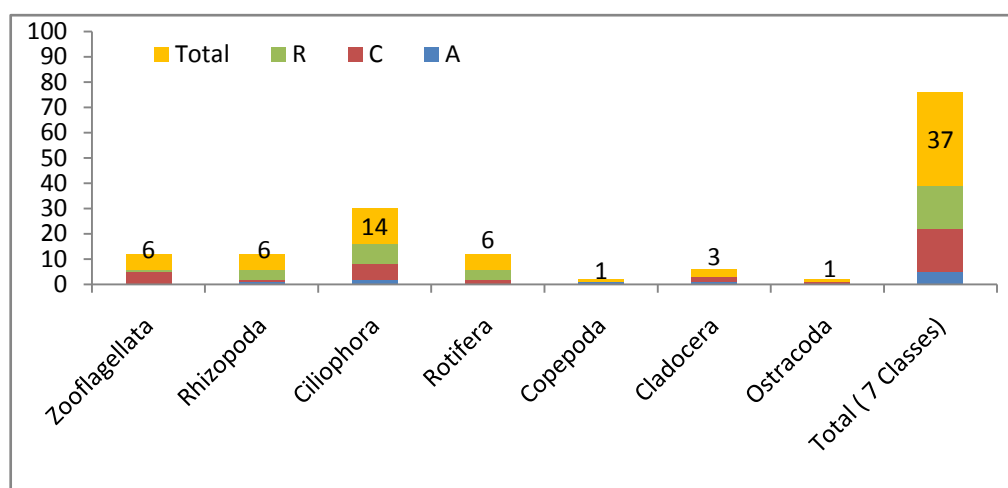


Figure 3. Occurrence and Status of reported Families at Sampling Stations of DSW

godboldi Lackey, *Mastigamoeba replans* Stokes, *Trimastigamoeba* Whitmore, *Chydorus ciliatus* Poggenpol, *Pedipartia gracilis* Myers and *Diffugia oblongata* Ehrenberg were observed as common, and the remaining of the species were reported as sporadic (Figure 3).

Of the documented species (03) of Cladocera *Daphnia lumholtzi* G.O. Sars dominated the other members of the class, whereas *Oxyurella singalensis* Daday and *Oxyurella tenuicaudis* Daday were the species found as common. During the present investigation, it was surprising that the majority of the species was classified as infrequent as these organisms were observed only during one or two months throughout the study area. Contrastingly, Copepoda and Ostracoda was represented by only single species viz. *Cyclops sp.* and *Cypris pubera* O.F. Muller, respectively, which could be a resultant impact of negligible extent of pollution at DSW.

The reported taxa (36 genera, 39 species) of zooplanktons at DSW can be depicted by a ratio 1:5.14:5.42 (Class: Genera: Species) (Table 1), noticeably indicates remarkably the peak species richness (15 Genera, 16 Species) of zooplanktons taxa belonging to Class Ciliophora, with a ratio 1:07 (Genera: Species), followed Zooflagellata and Rhizopoda members (6 Genera, 6 Species) with a Genera: Species ratio (1:1). Besides, class Rotifera was ruled with 5 genera and 6 species (Genera: Species ratio - 1:20), while least recorded taxa were represented by members of Classes Cladocera with 2 genera 3 species (1:50), while Copepoda and Ostracoda with 1 genera and species each (Genera: Species ratio - 1:1).

Table 2. Status of Zooplanktons at Sampling Stations (DSW)

Status	D1	D2	D3	Total
A	5	5	5	5
C	8	14	12	17
R	5	6	7	17

* D1, D2, D3: Sampling Stations:

A: Abundant, C: Common, R: Rare

Table 2 denotes the site-wise description of reported Classes, genera and species of zooplanktons along with their status at DSW. Sites D2 and D3 showed the existence of all the documented classes of zooplankton (04). Highest numbers of genera (23) of zooplanktons were recorded in water of Site 2 and least number of genera (17) was observed at Site 1, whereas the water of Site 3 exhibited the intermediate number of zooplanktons genera (22).

Similarly, in congruence with the observed genera, the maximum was number of species was noticed at Site 2, following Site 3 and the least species richness was reported at Site 1. With respect to the status, five species of zooplanktons were found abundant in the

water of all the sampling stations, whereas 14 species were classified as common at Site 2, following 12 at Site 3 and the least (8) at Site 1. During the study period, some zooplanktons species appeared only for one or two months and thus were categorized as rare species. Highest number (07) of such species was seen at Site 3, preceded by Site 2 (06) and the least (05) at Site 1.

Conclusion

The present investigation clearly revealed that a total of 36 genera and 39 species were recorded at Dakor Sacred Wetland (DSW) throughout the tenure of the research work. The ratio of Class: Genera: Species revealed that for each class, 5 genera and 5 species of zooplanktons were present. Class Ciliophora occurred as the most dominant (41.66%), followed by Zooflagellata and Rhizopoda 6 (15.38%), Rotifera 5 (12.82%), while Copepoda and Ostracoda representing each with 1 (2.56%) (Table1). The site-wise approach at DSW showed the prolific occurrence of all seven (07) classes of zooplanktons at Sites 2 and 3, whereas Site 1 was recorded with only six (06) classes. The steep gradient of zooplanktons species were observed at all the study sites (Site 1, 2 and 3) reflected by the persistence of member of class Ciliophora. On the contrary, no members of class Ostracoda were noted in the water of Sites 1 (Annexure 1).

Annexure 1. List of Zooplankton species collected from June 2012 to May 2013 at three selected study sites at Dakor Sacred Wetland DSW, Central Gujarat, India

Class	Species	D1	D2	D3	Status
Zooflagellata	<i>Actinomonas mirabilis</i> Kent	+		+	C
	<i>Bodo caudatus</i> Dujardin		+	+	C
	<i>Bodopsis godboldi</i> Lackey	+	+		C
	<i>Mastigamoeba replans</i> Stokes		+	+	C
	<i>Phyllomitus amylophagus</i> Klebs	+			R
	<i>Trimastigamoeba</i> Whitmore	+	+		C
	Species	4	4	3	
Rhizopoda	<i>Actinophrys sol</i> Ehr.			+	R
	<i>Amoeba proteus</i> L.	+			R
	<i>Arcella megastoma</i> Penard			+	R
	<i>Diffflugia oblongata</i> Ehrenberg	+	+		C

	<i>Pyxidicula scutella</i> Playfair		+		R
	<i>Thecamooeba verrucosa</i> Ehrenberg	+	+	+	A
	Species	3	3	3	
Ciliophora	<i>Aspidisca costata</i> Dujardin Stein		+	+	C
	<i>Campanella umbellaria</i> Linnaeus	+	+		C
	<i>Chilodonella uncinata</i> Ehrenberg	+			R
	<i>Chilophrya utahensis</i> (Pack) Kahl		+		R
	<i>Coleps hirtus</i> Muller	+		+	C
	<i>Glaucoma scintillans</i> Ehrenberg	+			R
	<i>Keronopsis muscorum</i> Kahl			+	R
	<i>Paramecium aurelia</i> Ehr.		+	+	C
	<i>P. bursaria</i> Ehr.		+		R
	<i>Perispira ovum</i> Stein		+	+	C
	<i>Placus luciae</i> Kahl	+	+	+	A
	<i>Podophrya bengalensis</i> Ghosh			+	R
	<i>Spasmostoma viride</i> Kahl	+	+	+	A
	<i>Stentor coeruleus</i> Ehrenberg		+	+	C
	<i>Trachelophyllum apiculatum</i> Perty		+		R
	<i>Vorticella campanula</i> Ehr.		+		R
	Species	6	11	9	
Rotifera	<i>Brachionus caudatus</i> Pallas		+		R
	<i>Chydorus bicornutus</i> Auktor Doolittlecornutus	+			R
	<i>C. ciliatus</i> Poggenpol	+		+	C
	<i>Mytilina ventralis</i> Ehrenberg			+	R
	<i>Pedipartia gracilis</i> Myers	+	+		C
	<i>Rotaria vulgaris</i> Schrank			+	R
	Species	3	2	3	
Copepoda	<i>Cyclops sp.</i>	+	+	+	A
	Species	1	1	1	
Cladocera	<i>Daphnia lumholtzi</i> G.O. Sars	+	+	+	A
	<i>Oxyurella singalensis</i> Daday			+	C
	<i>O. tenuicaudis</i> Daday		+	+	C

	Species	1	2	3	
Ostracoda	<i>Cypris pubera</i> O.F. Muller		+	+	C
	Species	0	1	1	
	Total Species	18	24	23	

* D1, D2, D3: Sampling Stations

A: Abundant, C: Common, R: Rare

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