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Quantification of zooplanktons from two selected freshwater bodies of Cooch Behar district of West Bengal, India

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ABSTRACT

The District Cooch Behar holds a number of freshwater bodies both of lentic and lotic types having zooplankton communities. A total of sixteen taxa of zooplankton were recorded from the Panishala Beel (one lentic system) encompassing three rotifera, five copepoda, one ostracoda and seven cladocera. On the other hand, a total of thirteen taxa of zooplankton were recorded from the River Ghargharia (one lotic system) that includes five copepoda, one ostracoda, one rotifera and six cladocera. Both the water bodies contains four zooplankton groups and show same kind of group diversity in respect of their zooplankton group. Both the water bodies were dominated by *Cyclops* sp. most probably due to organic pollution and abundant nutrients.

Introduction

Plankton forms an important component of fish food in aquatic environment and as such, the knowledge of their production and abundance is essential for successful management of fishery. Zooplanktons occupy a central position between the autotrophs and other heterotrophs and form an important link in food of a fresh water ecosystem. Zooplankton show their abundance in all types of aquatic bodies with their in the energy transfer at different trophic level (Altaff, 2004). Freshwater zooplankton has notified species diversity as filter feeders, omnivores and predators (Rudescu, 1960; Cole, 1983; Goldman *et al*., 1983; Kalf, 2001). Zooplanktons are important link in the transformation of energy in an aquatic food web because of their drifting nature, large density, high species diversity and tolerance to the stress (Bhat *et al*., 2014). Ecologically, zooplanktons are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of matter (Murugan *et al*., 1998; Dadhick *et al*., 1999; Sinha *et al*., 2002; Park *et al*., 2007). Study of community structure of freshwater zooplankton is significantly potential for assessing aquatic ecosystem. They are not only useful as bio-indicators but also helpful for ameliorating polluted water in an aquatic ecosystem (Jose *et al*., 2012). The study of zooplankton community is important as it provides ways of predicting productivity and it is one of the principle links in the food chain. They have been widely used in assessment of aquatic pollution because of their sensitivity to small changes in environment, short generation time.

Studies on fresh water bodies, natural or man-made have gained much importance in recent years mainly because of their multiple uses. Natural freshwater bodies can be of two types – lotic and lentic. The term lotic represents running water, where the entire body of water moves in a definite direction. These may comprise brooks, streams, rivers and springs which represents the lotic bodies in India.

India has extensive freshwater lentic bodies also, reasonably known in vernacular terms as *Tals*, *Beels*, *Mauns*, *Chauri*, *Pats* and *Jheels* situated all over the country. These natural resources are the integral part of the river complex and as a result of diversions in river or course of strengthens of embankments for flood control.

The District Cooch Behar at the termini of the northern parts of West Bengal with its scenic beauty endeavours a fabric of both lentic and lotic water bodies. Zooplankton communities are present in both types of aquatic systems. Attempts have been made to study the hydro-biological profile of varied water bodies with intent of assessing the quality of water. But, there is little observation on zooplankton from two types of water bodies. Therefore, present study was aimed to quantify the zooplanktons of both the systems from two points of study (one lotic and one lentic) at Cooch Behar District of West Bengal.

Materials and Methods

A. Study Sites: The district of Cooch Behar is geographically a part of the *Himalayan Terai* of West Bengal, India. It lies between the parallels of 25° 57′ 56″ and 26° 32′ 46″ North latitude and the longitude of the eastern most point which beings 89° 52′ 00″ East and the longitude of the western most point beings 88° 45′02″ East.

1. **Site 1 (S1):** First study site is the *Panishala Beel*, which is a natural water body and is an offshoot from river *Torsa* which in course of time got disconnected from the river and persists as an impounding water body, presently known as *'beel'*. This site is named "*Panishala Beel*" (Fig.1c.) and is situated under the administrative jurisdiction of *Panishala gram panchayet* of the district. This study site (26^{o} 27′ 89′′ N, 89^{o} 52′ 53′′ E) is situated adjacent to the Dinhata subdivision of Cooch Behar district but is 12 kilometre away from Cooch Behar town. It is a natural wetland and thus enlists a huge geographical and ecological importance. It receives run-off water from the adjacent land area and in present is mainly used for pisciculture.

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2. Site 2 (S2): The second study site is the river Ghargharia, a tributary of the Torsa river and one of the main resources having a water stretch of 65 km flowing from the area of Uttar Sonapur, Alipurduar district (origin) to Bhelakopa Pratham Khanda, Cooch Behar district (meeting point with Sil Torsa river) and flowing primarily through the Cooch Behar district of West Bengal covering mostly rural areas. A study point (26° 31′ 41″ North latitude and 89° 55′ 41″ East longitude) was considered for the study of zooplankton abundance of this water body.

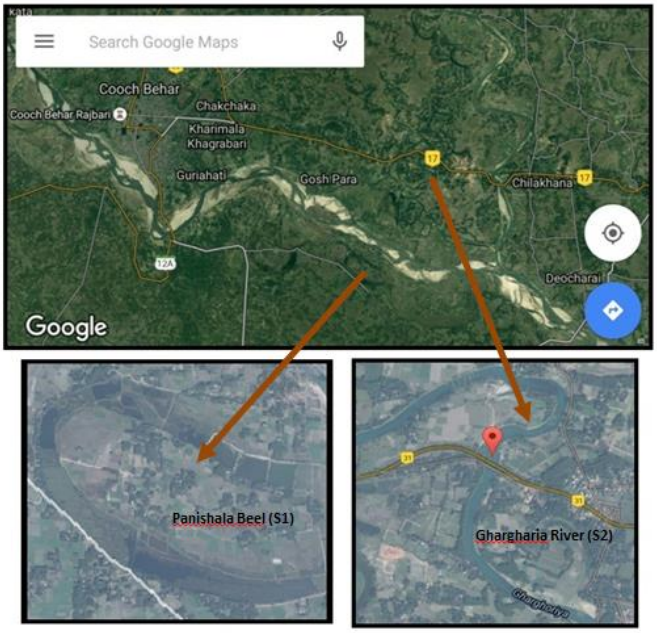

Fig 1. Satellite imagery of the study sites.

B. Zooplankton Study

1. Sample collection: Zooplankton samples were collected from the study sites by filtering 10 litres of the subsurface source water through fine nylon mesh attached to the conical zooplankton net. The content thus collected in the plankton tube that was attached to the lower end of the net. Collection was then transferred to separate polyethylene tubes following sedimentation, from that a subsample of 30 ml was taken. Collected samples were preserved in 4% formalin solution and subsequently 4-5 drops of glycerine were added to the samples to ensure good preservation.

2. Mode of study

a) Quantitative estimation: For quantitative study, the zooplankton count was made by Sedgwick Rafter cell counter under the microscope.

b) Photography of zooplanktons: Zooplanktons were observed with a binocular compound microscope (Olympus, Model No. *CH20i*) and subsequently, the photography were done with the help of a camera.

3. Systematic identification: Systematic identification of collected zooplanktons was done after following the guideline as given by Edmondson (1959) and from the reference of workers like Battish (1992), Sharma (1998, 1999) and Sharma *et al*. (2008).

Results and Discussion

Present investigation reveals that a total of sixteen taxa of zooplankton were recorded from the site-1 of which rotifer, copepoda and ostracoda represents three, five and one taxa respectively. Cladocera was found to numerically abundant group with seven taxa. Whereas site-2 contains a total of thirteen taxa of zooplankton of which copepoda group represents five taxa. Groups like Ostracoda and Rotifera both contains only one taxa. Cladocera was found to be richest of the entire group with six taxa (Table 1).

Verma *et al.* (2013) from Madhya Pradesh had reported 54 genera of plankton from an anthropogenic pond. Kar *et al.* (2013) had registered 26 species of Zooplankton from an oxbow lake of Cachar, Assam. Manickam *et al.* (2014) from Southern parts of India, on the other hand, had observed 55 species of zooplankton. From Satara district of Maharashtra, India, Pawar (2014) had reported 66 species of Zooplankton from freshwater bodies. Grossly 40 genera of zooplankton were reported by Kar *et al.* (2016) from a freshwater wetland of Cachar, Assam. Present observation is in consonance with Das *et al*. (2013) who had enlisted 22 genera of zooplanktons from '*Rasik Beel'* at Cooch Behar district of West Bengal.

Apparently no significant difference in the incidence of zooplankton incidence was noted as both Ghargharia, and Panishala Beel had supported 13 species of plankton. However, in *Panishala Beel* three more taxa of zooplankton were registered. The abundance of *Moina sp*., *Diphanosoma sp.*, *Alona sp.*, *Daphnia sp.*, *Diaptomus sp*., *Heliodiaptomus sp.* and *Mesocyclops sp*. was comparatively higher in S2 site. Contrary to that abundance of *Chydorus sp.*, *Cyclops sp*., *Tropocyclops sp.* and *Brachionus sp.* was numerically more abundant at S1 site (Fig 2). Thus, in respect of each zooplankton species, both the study sites show overall same kind of abundance.

Table 1. List of zooplanktons with their relative abundance value.

Phylum	Subphylum	Class and Order	Zooplankton	Presence or Absence		Abundance (%)	
				S1	S2	S1	S2
Arthropoda	Crustacea	Class-Branchiopoda Order-Cladocera	*Nauplius sp.* (Larva)	+	+	8.26	3.66
			Zoea sp. (Larva)	+	-	2.54	--
			Moina sp.	+	+	3.92	4.24
			Chydorus sp.	+	+	9.56	9.10
			Diphanosoma sp.	+	+	4.3	4.16
			Alona sp.	+	+	4.26	8.52
			Daphnia sp.	+	+	7.6	8.86
		Class-Maxillopoda Order-Copepoda	*Diaptomus sp.*	+	+	2.57	3.17
			Heliodiaptomus sp.	+	+	3.77	8.52
			Cyclops sp.	+	+	23.56	21.40
			Tropocyclops sp.	+	+	12.9	8.24
			Mesocyclops sp.	+	+	2.32	3.16
		Class - Ostracoda	*Cypris sp.*	+	+	2.1	12.85
Rotifera	--	--	*Brachionus sp.*	+	+	9.48	4.12
			Keratella sp.	+	-	2.16	--
			Lacane sp.	+	-	0.7	--

N.B.: "+"= Present, "-"= Absent, "--"= Zero value.

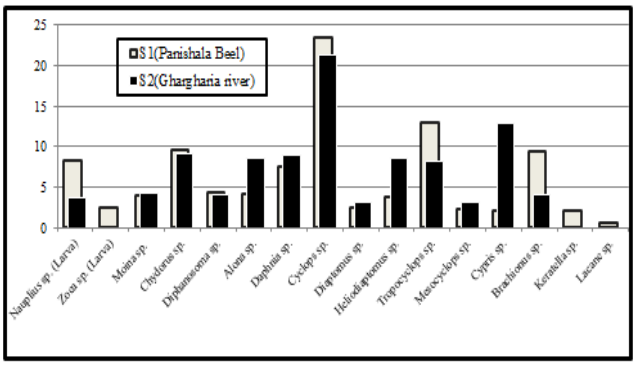

Fig 2. Graphical representation of abundance of each zooplankton species of the study sites.

The abundance (in percentage value) of zooplanktons at both the study sites are also represented here through web diagrams and pie diagrams (Fig 3, 4, 5 and 6).

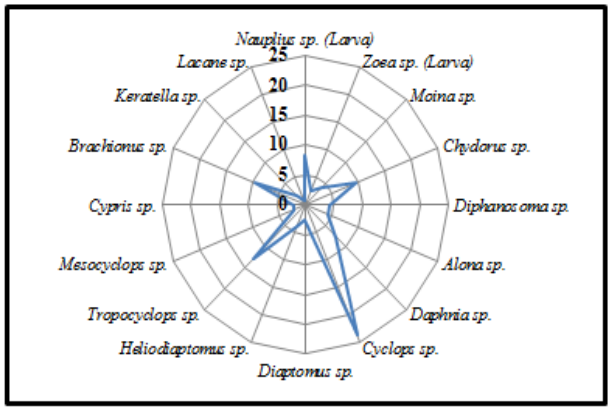

Fig 3. Web map of Zooplankton abundance of the study site 1 (Panishala Beel).

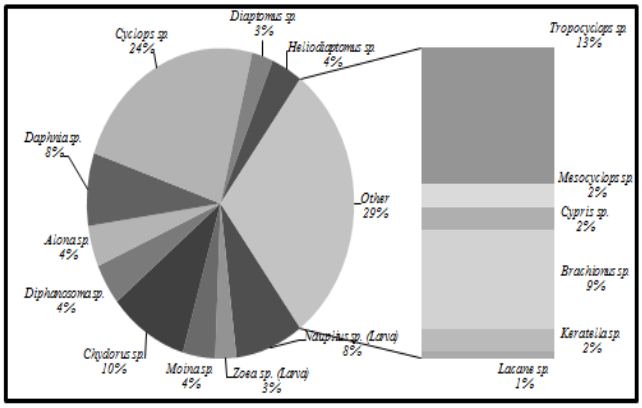

Fig 4. Zooplanktons of the study site 1 (Panishala Beel).

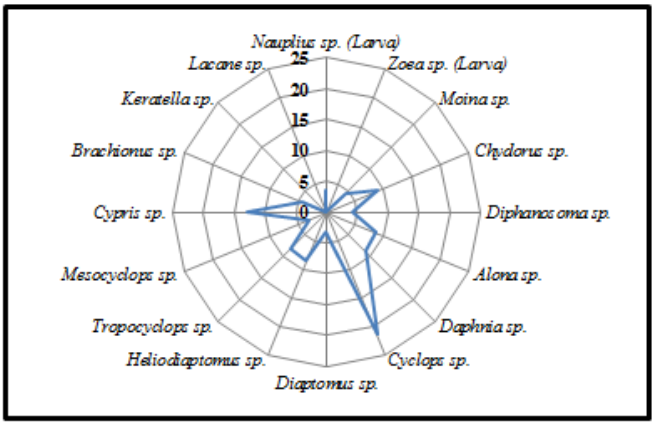

Fig 5. Web map of Zooplankton abundance of the study site 2 (Ghargharia river).

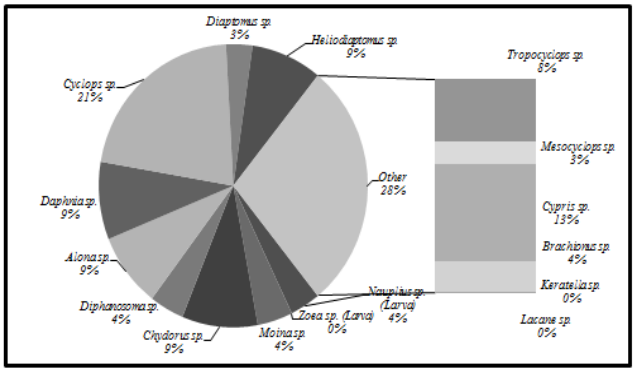

Fig 6. Zooplanktons of the study site 2 (Ghargharia river).

The zooplankton species identified during our present study from site-1 are *Nauplius sp.* (Larva), *Zoea sp.* (Larva), *Moina sp.*, *Chydorus sp.*, *Diaphanosoma sp.*, *Alona sp.*, *Daphnia sp.* belonging to Cladocera group; *Mesocyclops sp.*, *Cyclops sp.*, *Diaptomus sp.* and *Heliodiaptomus sp.*, *Tropocyclops sp.* belonging to Copepoda group; *Cypris sp.* belonging to Ostracoda group and *Brachionus sp.*, *Lecane sp.* and *Keratella sp.* belonging to Rotifera group. Again the zooplankton species identified during our present study from site-2 are *Nauplius sp.* (Larva), *Moina sp.*, *Chydorus sp.*, *Diaphanosoma sp.*, *Alona sp.*, *Daphnia sp.* belonging to Cladocera group; *Mesocyclops sp.*, *Cyclops sp.*, *Diaptomus sp.* and *Heliodiaptomus sp.*, *Tropocyclops sp.* belonging to Copepoda group; *Cypris sp.* belonging to Ostracoda group and *Brachionus sp.* belonging to Rotifera group. Both the water bodies show same kind of group diversity in respect of their zooplankton of each group (Fig 7).

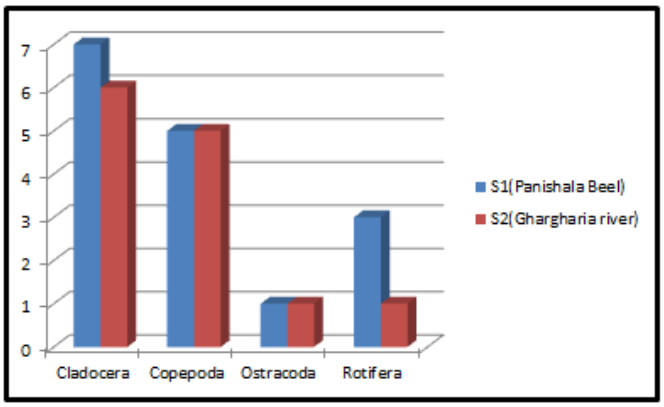

Fig 7. Diagram showing the comparative proportions of zooplankton groups of the study sites.

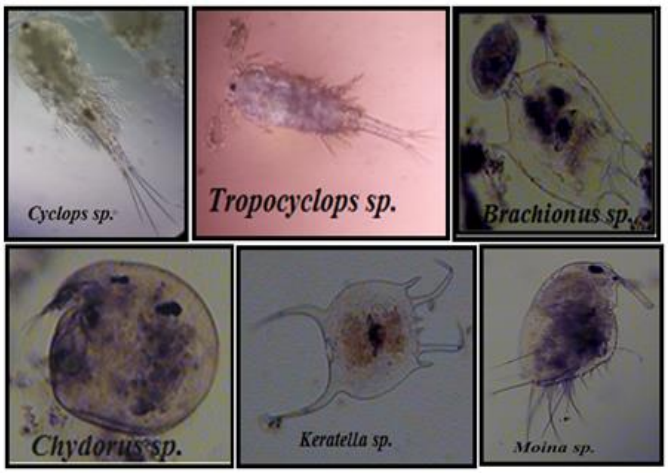

Fig 8. Photographs of some identified zooplankton species.

Beside the all above mentioned facts, in present study it was noted that, both the water bodies are dominated by *Cyclops sp*. Verma *et al*. (1984) and Ahmad *et al.* (2011) observed that *Cyclops sp*. were sensitive to pollution (organic matter) and increase with an increase in nutrients.

Conclusion

The overall view of the present investigation reveals good diversity of zooplankton in both the two types of water bodies at Cooch Behar. In the present investigation, cladocera group of zooplankton was found to dominate the population in the water body over ostracoda, rotifer and copepod. Cladocera is an order of small crustaceans commonly called water fleas. Cladocerans are known to be abundant in water with good littoral vegetation, while ponds and lakes without vegetation have fewer cladoceran species. So, the ecological status of the water bodies was found to be impoverished in terms of species composition. Again, presence of high number of *Cyclops sp*. in the water bodies is an indication of organic pollution and increase of nutrients.

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