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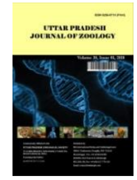

A PRELIMINARY ASSESSMENT OF ZOOPLANKTON WITH REFERENCE TO BIOCHEMICAL OXYGEN DEMAND (BOD) IN FRESH WATER BODIES OF DHING TOWN (ASSAM)

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

In the present study, initially the identification of Zooplanktons (Rotifers, Cladocerans & Copepods) was carried out at the level of Genus, using standard keys and manual. Samples were collected following standard methods from five major freshwater bodies of Dhing area. Quantitative enumeration of the identified genera under the three groups-Rotifera, Cladocera, and Copepoda were done and studied in relation to the water quality (BOD) of the freshwater bodies. A total of 14 genera were recorded, of which 5 genera belonged to Rotifers, 6 genera to Cladocerans and 3 genera to Copepods. The rotifer population showed positive correlation to degrading water quality (increasing BOD) while cladoceran & copepod population showed negative correlation with rising BOD.

Keywords: Zooplankton; rotifer; cladocera; copepoda; water quality.

1. INTRODUCTION

Zooplanktons, zoon meaning animal and planktos meaning wanders, are weak swimmers, floating or drifting along with water currents, thus limited by locomotion. Their size generally exceeds not more than a few millimetres.

They engross a key position in the ecological pyramids of the freshwater ecosystem. The makeup of zooplanktons in each freshwater body is different. They are a vital component of grazing food chain in aquatic ecosystems and play a role in cycling organic matter of aquatic ecosystems [1]. The zooplankton community is inclusive of both primary consumers (feeding on phytoplanktons) & secondary consumers (feeding on other zooplanktons. They serve as a direct connection between primary producers and higher trophic levels, such as fish. During their larval stages, nearly all fishes rely on zooplankton for nourishment,

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and some fishes eat zooplanktons throughout their lives [2].

Zooplanktons are indicative of the aquatic health of a water body owing to their short life cycle and fast response to changes in the aquatic environment, mostly water quality (eutrophication). Changes in nutrient input and eventual nutrient pollution are reflected by the zooplankton community and the study of such patterns is useful in studying the environmental status of a water body [3].

Rotifera, Cladocera, and Copepoda are three major groups of zooplanktons. Rotatoria (Rotifers) are found majorly in fresh water (except few marine species). The most distinguishing character of Rotifers is the presence of Corona: a rotating wheel of cilia in the anterior end. They are considered to be the most important soft bodied invertebrates. Rotifers exhibit an astounding spectrum of morphological changes and adaptations as a group, however, the vast majority share a few key characteristics [4].

Cladocerans, known as "water fleas," tend to reside in deep water and are an important source of food for fish. They play an important role in the food chain and energy transformation. The majority of members of the cladocera order are between 0.2 and 3.0 mm in length [5,6].

Although marine in origin, Copepods are found in all aquatic ecosystems. Their size usually range from 0.5-2mm in length [7]. They are a key link between producers and higher consumers in being a predator to phytoplanktons, while a prey for fish themselves [8].

2. MATERIALS AND METHODS

2.1 Study Area (Sampling Sites)

Dhing town is inclusive of Nagaon district, Assam, India. Following fresh water bodies of Dhing area have been selected as sample sites, as given below:

2.1.1 Site I: Talibor lake (Fish rearing site)

Coordinates: 26.4594030ºN , 92.4837899ºE

The Talibor lake is the most important and large freshwater lake in Dhing town. It has an area of 1sq.kilometeres. The lake has been separated into two parts due to a bridge constructed above it along with dumping of garbage down the bridge, separating one fourth of the lake from the main body. The major three-fourth of the lake is now used for rearing of commercial fishes, and has a notable diversity of aquatic animals. This part of the lake has been used as SITE-I for our sample collection.

2.1.2 Site II: Talibor lake (Non-rearing site)

Coordinates: 26.4572604ºN, 92.4833376ºE

The one fourth part of Talibor lake , cut off from the main body has been used as SITE- II for sample collection. Here no rearing is carried out and is rather an un-cleaned water body. Most of the garbage and waste is dumped in this part of the lake. Algal bloom has been noted, and eutrophication is possibly occurring.

2.1.3 Site III: Brahmaputra tributary (No.3 Rangrai)

Coordinates: 26.4946695ºN, 92.4269683ºE

The No.3 part of Rangrai station of the Brahmaputra touches the end most periphery of Dhing town. This site has been used as SITE-III for sample collection.

2.1.4 Site IV&V

Additionally we have included two fresh water ponds in Dhing for our study.

- Bhetapukhuri (Site IV)&
- Singhimari pond (Site V)

2.2 Sampling Methods

Samples of zooplankton were collected by filtering 50 litres of surface water from each of the five sample sites. A plankton net of 60-65 µm mesh size was used for filtering purpose. Sample preservation was done in 4% formalin solution [9].

2.3 Laboratory Methods

Collected samples were concentrated to a volume of 100mL. 1 mL subsamples were used for examination. A Sedgewick Rafter (SR) counting cell of dimensions: 50 mm (length)x20 mm(width) x1 mm(depth) and 1mL holding capacity was used for numerical counting of zooplankton. Prior to sample loading, the coverslip was crosswise placed across the cell. With the help of a pipette, samples were carefully loaded from one corner, without the formation of any air bubble. The following formula was used to obtain the numerical count of the observed genera:

$$\textbf{No. /L=} \frac{\text{n x 1000 mm3}}{\text{L x W x D x S}} \text{ x 1000x Correction factor}$$

Where,

n = Number of Zooplanktons(of the genera) counted;
L = length of each(1 of 1000) strip (mm)
D =depth of chamber(mm)
W=width of each strip(mm)
S = number of strips counted.

The identification of the Zooplankton genera was carried by referring to standard books and independent works [10-12]. The physico-chemical parameters: temperature, pH, dissolved oxygen(DO) & biological oxygen demand (BOD) were measured in accordance to APHA (1976) [13].

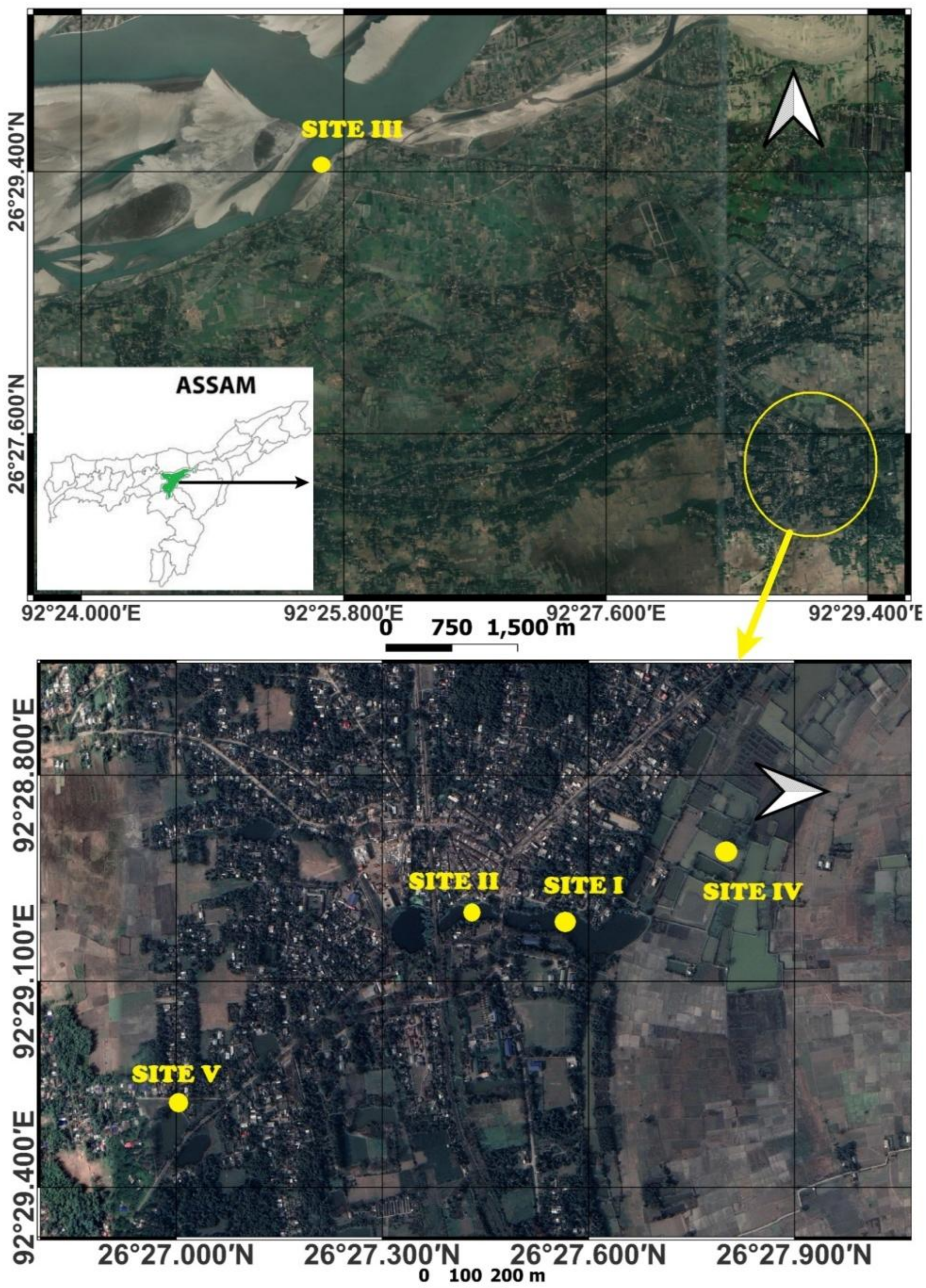

Fig. 1. Map of sample sites in Dhing, Nagaon, Assam

3. RESULTS

In the study, a total of 14 genera were recorded, of which there were 5 genera of Rotifers, namely- *Keratella, Brachionus, Asplanchna, Filinia and Euchlanis;* 6genera of Cladocera, namely- Daphnia, Ceriodaphnia, Moina, Moinodaphnia, Bosmina&Diaphanosoma; and 3 genera of Copepods, namely- Cyclops, Mesocyclops&Diaptomus. The results of quantitative analysis(Numbers per L of sample) are tabled below.

ROTIFERA

Table 1. Total number of Rotifers at the different sites

Genera	Site-I Talibor rearing part	Site-II Talibor polluted part	Site-III (Brahmaputra)	Site-IV (Bheta Pukhuri)	Site V (Singhi Mari pond)
Keratella	360	468	330	375	387
Branchionus	1003	1652	767	1151	1321
Asplanchna	97	192	92	131	150
Filinia	166	255	170	173	199
Euchlanis	137	172	104	139	155
TOTAL	1763	2739	1463	1969	2212

CLADOCERA

Table 2. Total number of Cladocerans at the different sites

Genera	Site-I (Talibor rearing part)	Site-II (Talibor polluted part)	Site-III Brahmaputra)	Site-IV (Bheta Pukhuri	Site V (Singhi Mari pond)
Daphnia	439	218	670	334	300
Ceriodaphnia	190	134	304	164	165
Moina	246	121	438	197	178
Moinodaphnia	215	167	345	192	179
Bosmina	132	109	229	119	108
Diaphanosoma	155	117	225	136	120
TOTAL	1377	866	2211	1142	1050

COPEPODA

Table 3. Total number of Copepods at the different sites

Genera	Site-I (Talibor rearing part)	Site-II (Talibor polluted part)	Site-III (Brahmaputra)	Site-IV (Bheta Pukhuri	Site V (Singhi Mari pond
Cyclops	350	246	450	289	266
Mesocyclops	245	104	276	182	150
Diaptomus	159	112	250	139	124
TOTAL	754	462	976	610	540

Table 4. Parameters of water quality at different sites

SITE	BOD (mg/L)	DO (mg/L)	pH	TEMPERATURE (degree Celsius)
I	5.2	5.1	6.9	26
II	9	2.5	6.1	27
III	4.5	6	7.8	23.5
IV	7	3.4	6.4	25.4
V	8.3	3.0	6.5	27.5

GRAPHICAL ANALYSIS

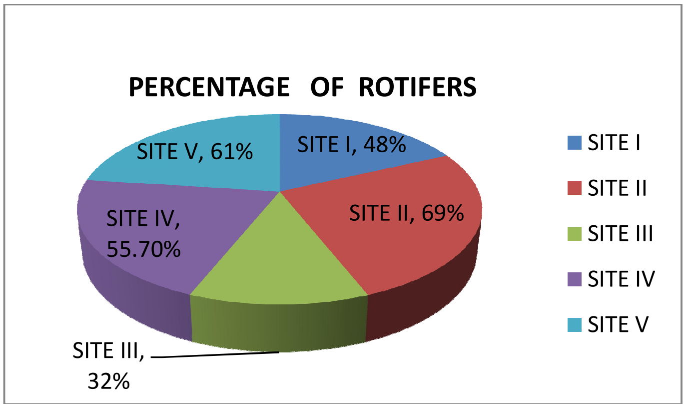

Fig. 2. Pie diagram showing the percentage composition of Rotifers at different sites

The percentage of Rotifers in the Zooplankton population follows the order:

SITEII >	**SITE V >**	**SITE IV >**	**SITE I >**	**SITE III**
(BOD=9)	(BOD=8.3)	(BOD=7)	(BOD=5.2)	(BOD=4.5)

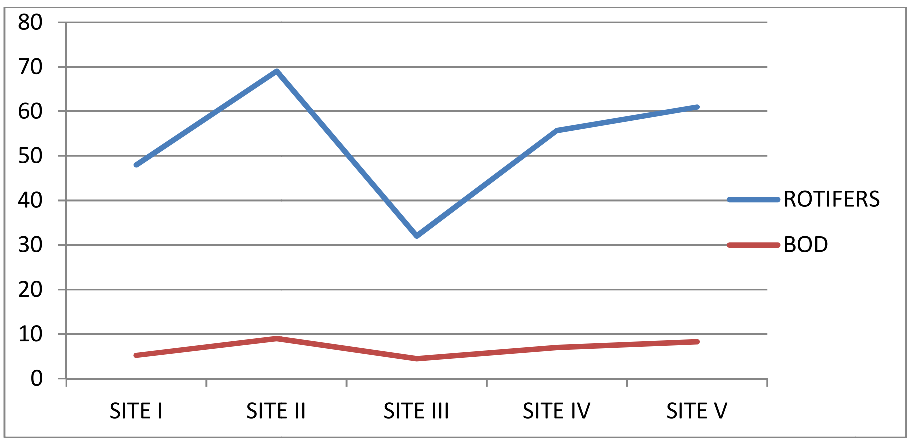

Fig. 3. Graph showing positive correlation of rotifer population to BOD

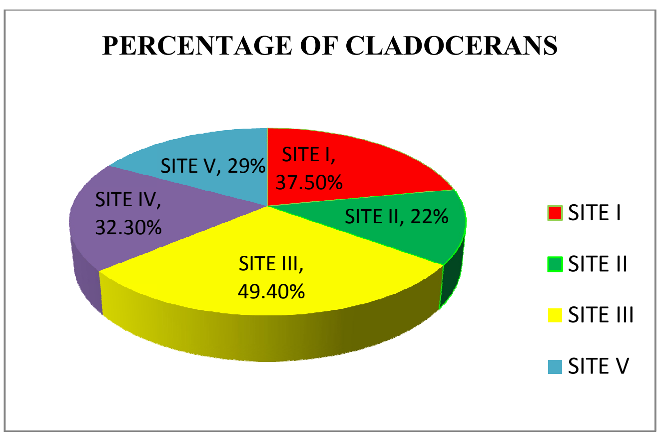

Fig. 4. Pie diagram showing percentage composition of Cladocerans at different sites

The percentage of Cladocerans in the Zooplankton population follow the order:

SITE III >	**SITE I >**	**SITE IV >**	**SITE V>**	**SITE II**
(BOD=4.5)	(BOD=5.2)	(BOD=7)	(BOD=8.3)	(BOD=9)

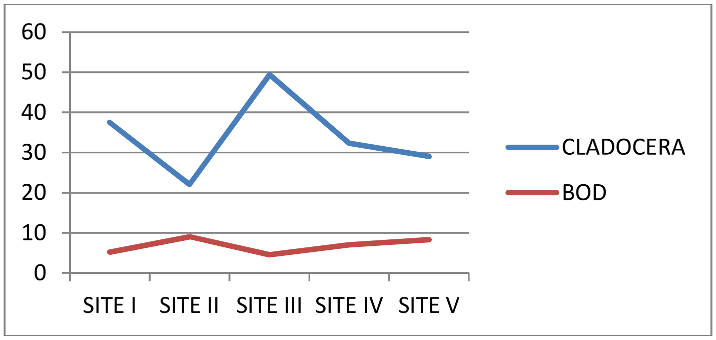

Fig. 5. Graph showing negative correlation between cladoceran population and BOD

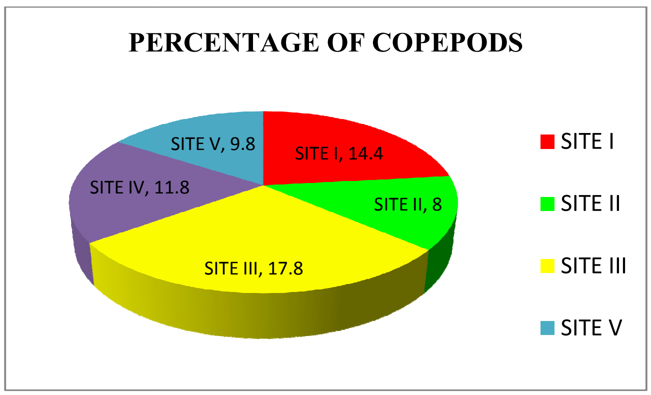

Fig. 6. Pie diagram showing percentage composition of Copepods at different sites

The percentage of Copepods in the Zooplankton population follow the order:

SITE III >	**SITE I >**	**SITE IV >**	**SITE V >**	**SITE II**
(BOD=4.5)	(BOD=5.2)	(BOD=7)	(BOD=8.3)	(BOD=9)

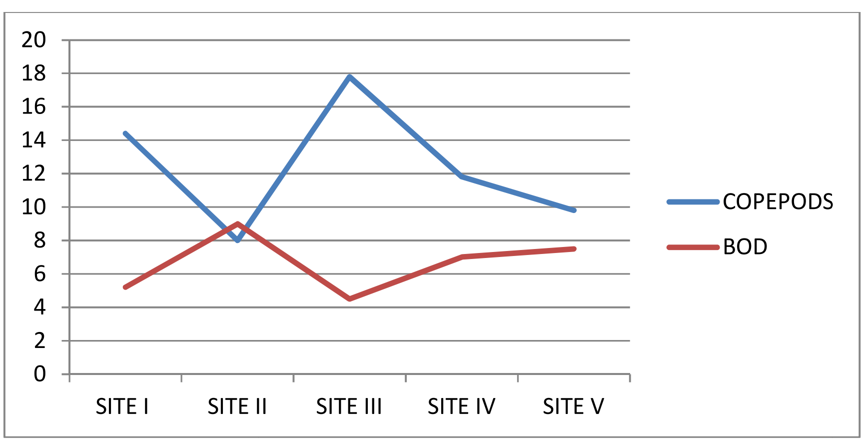

Fig. 7. Graph showing negative correlation between copepod population and BOD

4. DISCUSSION

It is seen that the quantitative analysis of the Zooplankton populations when studied in relation to the BOD of the five sites, we can observe that the zooplankton population can be used as an indicator or relative measure of nutrient pollution and eutrophication [14].

From the above study, we may conclude that eutrophic state (higher BOD) is favourable for rotifiers. Thus rotifers are good indicators of eutrophic condition. Whereas, Cladoceran and Copepod populations show negative trend with eutrophication.

The basic reason behind this is possibly that rotifers have a smaller size than cladocerans and copepods. Hence in higher BOD water bodies (with more organic matter and lower visibility) rotifers are comparatively less visible to predators. The large size of Cladocerans and Copepods decreases their abundance due to fish predation, in comparision to Rotifers.

Thus, we can use an analysis of the Zooplankton community to analyse water quality and promote aquatic health**.**

5. CONCLUSION

A vital element of the ecology of any area, zooplanktons occupy a key basal position in the food web and are economically much significant than people realize. Irresponsible human activities have done much damage to the zooplankton community. Hence, the present study was done to assess the water quality and the zooplankton diversity and patterns in the major freshwaters of Dhing area, which show signs of nutrient pollution. It is henceforth the responsibility of the people to promote healthy aquatic environment and support the zooplankton diversity in the area.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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