

DIVERSITY OF FRESH WATER ZOOPLANKTON OF DHUTI DAM, BALAGHAT DISTRICT, MADHYA PRADESH

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ABSTRACT

Zooplankton are a diverse group of heterotrophic organisms and one of the most important ecological parameters in water quality assessment because they help in disposal of sewage and act as natural purifiers of water. Present study was carried out to assess seasonal variation in zooplankton diversity at Dhuti Dam, Balaghat District, Madhya Pradesh. Zooplankton samples were collected for the period of one year from July 2020 to July 2021 from selected sampling sites of Dhuti Dam and zooplankton community structure was assessed. The sample were observed in laboratory under light microscope and identified using standard references books and various standard research journals. The diversity of various types of zooplankton was studied and the result revealed that the zooplankton was represented by various genera viz., rotifera, cladocera, copepoda and protozoa. Out of these 4 species belonged to Protozoa, 12 species belonged to Rotifera, 5 species belonged to Cladocera and 4 species belonged to group Copepoda. Rotifera was found to be the most dominant group, followed by Cladocera, Copepoda and Protozoa. Seasonally, Rotifera and Protozoa were found to be maximum during summer and minimum during monsoon. In case of Cladocera and Copepods, maximum numbers were found in summer and least in winter.

Keywords: Dhuti Dam, Zooplankton, Seasonal variation, Rotifera, Cladocera, Copepoda, Protozoa.\

INTRODUCTION

Plankton is simply a heterogeneous group of tiny organisms (phytoplankton and zooplankton) adapted to suspended life style in a water body. The tiny organisms that remain suspended in water bodies were first recognized in 1845 by John Miller. The term plankton is attributed to the oceanographer Victor Hensen (1887). The word plankton comes from the Roman words for wanderer, meaning a tiny organism adrift in the water.

The availability and versatility of the zooplankton community play the major role in the management of aquaculture. Their abundance depends on the availability of phytoplankton and bacterial plankton as a food. They feed on phytoplankton's which directly provide food source for larval vertebrates as well as related to the growth of larger organisms and fish. They play an important role in the conservation of energy from primary to secondary level Sharma and Uchchariya (2018). Therefore, they are found at an upper trophic level after phytoplankton in the energy flow and serve as the main food for fish. Protozoa, rotifers, Cladocera, copepods and ostracods and their egg and larval forms constitute the main zooplankton groups. Zooplankton most significant part is fresh water ecosystem. A mainly function while a primary and secondary relations in the food series. Species from a significant group as a good number of them provide for upon the primary producers and zooplanktons and make themselves offered to advanced organisms in food series. These supplies while in food for fishes, positive dissemination their concentrated growth and help in the development of fish culture Prajapati *et al.*, (2019).

Zooplankton organisms are critical components of the water food chain and significantly contribute to aquatic productivity in a freshwater environment. They play a major role in studying the fauna biodiversity of aquatic ecosystems. The zooplankton population play an important role transferring energy from primary

to secondary trophic stages. The freshwater zooplankton organism is very keen to alterations in water conditions, such as DO, pH and nutrient load.

Present work was done to assess the diversity of zooplankton of Dhuti Dam of Balaghat district, Madhya Pradesh. Present study was carried out keeping in view of above information and scarcity of literature from Madhya Pradesh. Though few works on Zooplankton diversity was reported from Chaibasa, West Singhbhum (Sinha and Singh, 2016) and Bokaro (Saba and Sadhu, 2016) of Madhya Pradesh but much more study is required from freshwater bodies of different parts of Madhya Pradesh to establish a well-documented knowledge in area of zooplankton diversity from Jharkhand. Thus, the present study was an attempt for reporting Zooplankton diversity of Dhuti Dam from Balaghat District of Madhya Pradesh.

MATERIALS AND METHODS

Dhuti Dam, officially the Dhuti Weir, is a diversion head work over Wainganga River near Lamta in Balaghat district of the Indian state of Madhya Pradesh. The dam was built in 1923. The usefulness of the Dhuti dam and its importance for crop irrigation at the Balaghat station, located on the Wainganga River in Madhya Pradesh, India. It is one of the oldest earthen dams in India, sealed with lime mortar. Floods have affected the cultivated area and water demand in the Balaghat district area for the past few years. There are two canals on the sides of the dam. The canal on the eastern side provides irrigation to Balaghat.

For the zooplanktonic samples, about 50 litres of water was filtered through a bolting silk net (No. 25) with 64 microns up to a 100 ml sample was taken from the net after washing plankton attached to it. The samples were collected in separate pre-labelled bottles and fixed by adding in 4% (1 ml) formalin and Lugol's iodine solution (1 ml). The identification of zooplankton was done to maximum extent possible after following the text books, research publication and reference materials such as Edmondson (1965a), Koste (1978), Battish (1992), Sharma (1992), Dhanapathi (2000) and APHA (2012).

RESULTS AND DISCUSSION

Zooplanktons are fundamental components of aquatic food chain and contribute significantly to aquatic productivity in freshwater environment. They play an important role to study the faunal biodiversity of aquatic ecosystems. Zooplankton community always acts as a key component which transfers the energy from primary to secondary level in an aquatic ecosystem and it helps to regulate the productivity of the water body. Freshwater zooplanktons are highly sensitive for the changes of water condition such as dissolved oxygen, pH and nutrient loading.

Reported zooplanktons are divided into four groups such as Protozoa, Rotifers, Cladocera and Copepods. All these groups of zooplankton are identified. Monthly and seasonal variations were studied. The Dhuti Dam had moderate diversity of zooplankton with species 25 belongs to four taxonomic groups viz., Rotifera (12 species), Cladocera (05 species), Copepoda (4 Species) and Protozoa (4 species) (Table 1). The population density order observed as rotifers > cladocerans > copepods = protozoa (Figure 1). The seasonal variation was maximum in summer season and minimum in rainy season. Details of the identified zooplankton genera and species have been presented (Table 1,2,3 and Fig.1).

Among all the zooplanktons, recorded in Dhuti Dam, rotifera was the most dominant group (Fig. 1). The group was represented by *Brachionus angularis*, *B. forficula*, *B. falcatus*, *B. calyciflorus*, *B. caudatus*, *B. diversicornis*, *Keratella tropica*, *K. tecta* and *K. cochlearis*. Rotifers were found to be dominant throughout the study. Rotifers represented 47.51% of all zooplanktons recorded from the Dhuti Dam. The total number of rotifers was recorded at four Stations during July 2020 to July 2021 was 3683 cells/lit. Seasonally, the number was highest during summer, followed by monsoon and lowest during winter (Table 1, 2, Fig.1). Sharma and Uchchariya (2018) recorded 11 species of rotifers from Pagara dam of Morena district with maximum number of species in summer. Singh, *et al.*, (2019) also observed rotifera as the most dominant zooplankton in A Fresh Water Pond (Raja Bandh) of Jamtara, Jharkhand, India. The dominance of rotifers was attributed to their short development rate and fish predation on large zooplanktons. Rajshekhar *et al.* (2010) recorded 24 species of zooplanktons in a fresh water reservoir of Gulberbarga district, Karnataka.

Rotifer was the dominant group throughout their study period. Highest count was recorded during summer. Similarly, Rajkumar (2012) observed 23 species of zooplanktons. In his observation, he found number of rotifers to be highest during summer followed by monsoon and lowest during in winter. Akhtar *et al.*, (2023) recorded 24 species of zooplanktons in a fresh water of Anchar Lake, Kashmir. Rotifer was the dominant group throughout their study period. Highest count was recorded during summer.

Table 1: Abundance of Zooplankton species of Dhuti Dam Dhuti Dam from July 2020 to July 2021

| ORDER | SPECIES | SITES | | | |
|-----------------------------|---------------------------------|----------------------|---|---|---|
| | | A | B | C | D |
| Protozoa | <i>Arcella sp</i> | + | + | + | - |
| | <i>Centropyxis aculeate</i> | + | + | - | + |
| | <i>Centropyxis spinosa</i> | + | + | + | + |
| | <i>Diffugia lebes</i> | + | - | + | + |
| Rotifera | <i>Asplanchna brightwelli</i> | - | + | + | + |
| | <i>Brachionus angularis</i> | + | + | - | + |
| | <i>Brachionus falcatus</i> | + | - | + | + |
| | <i>Brachionus forficula</i> | + | + | - | + |
| | <i>Brachionus diversicornis</i> | + | + | + | - |
| | <i>Brachionus caudatus</i> | - | + | + | + |
| | <i>Brachionus calyciflorus</i> | + | + | + | + |
| | <i>Keratella cochlearis</i> | - | + | + | + |
| | <i>Keratella tropica</i> | + | + | + | + |
| | <i>Keratella tecta</i> | + | - | + | + |
| | <i>Lecane luna</i> | - | + | + | + |
| | <i>Mytiline ventralis</i> | + | - | + | - |
| | Cladocera | <i>Alona guttata</i> | - | + | + |
| <i>Bosmina longirostris</i> | | + | + | - | + |
| <i>Chydorus sphaericus</i> | | + | - | + | + |
| <i>Daphnia pulex</i> | | - | + | + | + |
| <i>Moina brachiata</i> | | + | + | + | - |
| Copepoda | <i>Diaptomus sp.</i> | + | - | + | + |
| | <i>Mesocyclops sp.</i> | - | + | + | + |
| | <i>Nauplius sp.</i> | + | - | + | + |
| | <i>Thermocyclops crassus</i> | - | - | + | + |

Table 2: Group wise seasonal variation in zooplanktons composition in Dhuti Dam from July 2020 to July 2021

| Season | protozoa | Rotifera | Cladocera | Copepoda |
|--------|----------|----------|-----------|----------|
| Summer | 907 | 2483 | 827 | 725 |
| Rainy | 316 | 843 | 86 | 247 |
| Winter | 434 | 357 | 334 | 193 |
| Total | 1657 | 3683 | 1247 | 1165 |

Table 3: Group wise seasonal variation in zooplanktons at four sites in Dhuti Dam from July 2020 to July 2021

| Group | Summer | % | Rainy | % | Winter | % |
|-----------|--------|---|-------|---|--------|---|
| Protozoa | 907 | | 316 | | 434 | |
| Rotifera | 2483 | | 843 | | 357 | |
| Cladocera | 827 | | 86 | | 334 | |
| Copepoda | 725 | | 247 | | 193 | |
| Total | 4942 | | 1492 | | 1318 | |

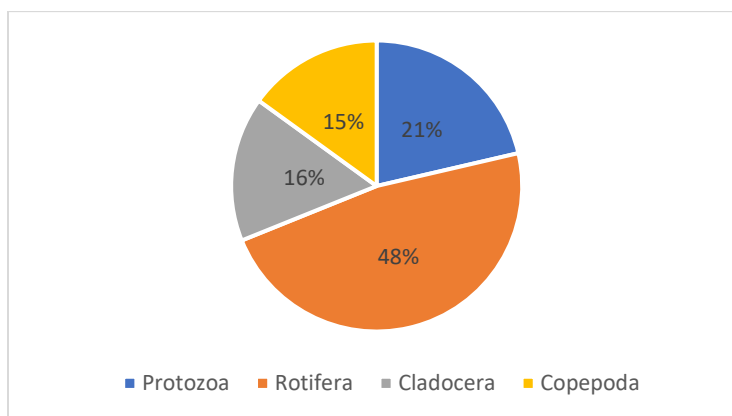


Figure 1: Annual variation in zooplankton at Dhuti Dam from June 2023 to June 2024

Cladocera was second dominant group of zooplankton in Dhuti dam. Five species of cladocerans namely *Alona guttata*, *Bosmina longirostris*, *Chydorus sphaericus*, *Daphnia pulex*, and *Moina brachiata* were observed. The maximum number of Cladocera was reported in summer season and minimum in rainy season. Among all five species of cladocerans *Daphnia pulex* were observed throughout the year. The occurrence of found all the year *Alona guttata*, *Bosmina longirostris*, *Chydorus sphaericus* except December and January during winter. The abundance of *Alonella sp.* were decreased during rainy days and not observed in winter while *Moina brachiata* population decreased in winter and lowest observed in rainy days. The data (Table 1) showed the diversity of cladocerans during different months of the year. Similar seasonal fluctuations in Cladocera in different water bodies have been reported earlier by Kedar *et al.*, (2008) and Yogesh (2020). Sharma and Diwan (1993) studied plankton dynamics of Yeshwant Sagar reservoir in which the Cladocera showed maximum density in June. Cladocerans are a crucial group among zooplanktons and form the most useful nutritive group of crustaceans. Cladocerans feed on small zooplanktons, bacteria planktons and algae. They are highly responsive to pollutants and even react against the low concentration of contaminants.

In the present study, Copepods were represented by *Diaptomus sp.*, *Mesocyclops sp.*, *Nauplius sp.* and *Thermocyclops crassus*. Copepoda was the second largest group of zooplanktons representing 13 % of the total population of zooplanktons. In the present observation the group Copepoda were observed during throughout the study period, but maximum Copepoda population density in summer season and minimum in rainy season. This pattern of seasonal fluctuation of copepods has also been observed by Mahor (2011) in Tighra reservoir of Gwalior. Kaur *et al.*, (2018) also reported that the temperature was most important factor that affects the copepods density and diversity. Their production increased with increase in temperature. This may be due to the fact that the higher temperature increased the biochemical & biological activities and increased the production of microorganisms

The group Protozoa was mainly represented by *Arcella sp*, *Centropyxis aculeate*, *Centropyxis spinosa* and *Diffflugia lebes* in our study. The number of Protozoa found during the study period was 1651 cells/lit. In the present observation the group protozoa were observed during throughout the study period, but maximum protozoa population density observed in summer season and minimum in rainy season. Protozoa represented 21.37 % of the total population of zooplanktons, recorded at the Dhuti Dam. According to Kedar *et al.*, (2008) protozoa also show seasonal fluctuation the maximum population of protozoa was also recorded in summer and minimum in monsoon that can be correlated with water cover.

CONCLUSION

Zooplankton diversity in water of Dhuti Dam showed that mainly four group's viz., Rotifera, cladocera, copepoda and protozoa. Among rotifers, *Brachionus angularis*, *B. forficula*, *B. falcatus*, *B. calyciflorus*, *B. caudatus*, *B. diversicornis*, *Keratella tropica*, *K. tecta* and *K. cochlearis* were recorded. Among cladocerans *Alona guttata*, *Bosmina longirostris*, *Chydorus sphaericus*, *Daphnia pulex* and *Moina brachiata* and in copepods *Diaptomus sp.*, *Mesocyclops sp.*, *Nauplius sp.* and *Thermocyclops crassus* were found. Only four species of protozoa were observed namely *Arcella sp*, *Centropyxis aculeate*, *Centropyxis spinosa* and *Diffflugia lebes*. The objective of this investigation was to know the zooplankton diversity in a fresh water Dam Balaghat District, Madhya Pradesh and to develop our knowledge about the fact that the diversity of a fresh water Dam is endowed with a great harbor of different fauna, especially the zooplankton as they are playing a vital role in the stability and integrity of aquatic ecosystem. This study revealed diversity of zooplankton in one Dam so for develop much stronger information advance study is needed for any scientific utilization. Also, a depth information and knowledge are needed to analyse its community and dynamics.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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