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Assessment of Planktonic Diversity of Makroda Reservoir of Guna District, Madhya Pradesh, India.

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ABSTRACT

The current study investigates the species richness, density, variety and abundance of planktonic population (Phytoplankton and Zooplankton) in the Makroda reservoir.Total 37 genera and 49 species of phytoplankton from four taxonomic assemblages (Chlorophyceae, Bacillariophyceae, Cyanophyceae, and Dinophyceae) were identified in Makroda Lake. The Bacillariophyceae were abundant in both qualitative and quantitative terms in Makroda Reservoir. Summer had the highest species richness, while winter had the lowest. The diversity analysis found 17 genera belonging to zooplankton categories such as Rotifera, Cladocera, Copepoda, and Ostracoda. Among Rotifers, Brachionus and Lecane prevailed in all stations in the water bodies studied during the research period. Zooplankton were most visible in the winter, while Copepods are really visible during the monsoon season while Ostracods were also most commonly seen during the winter season. The seasonal fluctuation were observed in the entire diversity of planktonic population of Makroda reservoir at all the seasons.

INTRODUCTION

Makroda reservoir is a medium-sized water body located around 25 kilometers from the Guna District headquarters and approximately 255 kilometers from Bhopal. It is built over the Negri River, a tributary of the Parvati River. It is located at latitude 24o43'30"N and longitude 77o16'00"E. Planktons are microscopic organisms that live in aquatic environments, both salty and fresh water. Phytoplankton are the major producers of the aquatic food chain. Zooplankton are the principal consumers of every aquatic environment and play an important role in the movement of food from the primary to secondary levels as well as the conservation of detritus matter into consumable animal food. This study has also been taken out to understand the better overall aquatic life system of the Makroda Reservoir water in order to assess its feasibility for upstream aquaculture.

MATERIALS AND METHODS

<u>Sample Collection and Analysis:</u> Phytoplankton samples were collected in a 1-litre plastic container and placed in an ice-filled cooler box for analysis. Sample preparation includes placing a 10ml sample into a counting chamber and allowing it to settle overnight or for at least 6 hours.

For the planktonic investigation, 50 litres of surface water were filtered through a plankton net constructed of bolting silk fabric no. 20. Extreme care was taken to ensure that the water had not been disturbed during the sample selection. The phytoplankton samples are kept in lugol's solution. The Sedgwick rafter cell has been used for quantitative research. An inverted optical microscope is used for identification, as well as the findings have been displayed as a proportion of the valuable algal group.

The Sedgwick rafter cell formula for analysing the sample is

$$\text{Cells/L} = (\text{Cells counted/Slide volume}) \times (1/\text{Concentration factor}) \times (1000/\text{L})$$

For zooplanktonic analysis, the collected samples were preserved in formalin once at concentration approximately 4%. For the variety of zooplankton, a water sample from the surface layer was filtered through a nylon net with a mesh size of 25 mm. A 100-liter sample of water was filtered through a nylon cloth with a mesh size of 25 mm to determine the density of zooplankton. Microscopic inspection of preserved zooplankton samples obtained with compound microscope and Sedgwick rafter cell was used for quantitative research. The qualitative identification of phytoplankton and zooplankton were carried out by standard procedure prescribed by several workers such as Adoni, 1985; Dang *et al.*, 2015; Edmondson, 1959; Needham and Needham, 1941; Palmer, 1980; Prescott, 1954.

Fig.- 01 Sampling Collection in Makroda Reservoir

RESULTS AND DISCUSSION

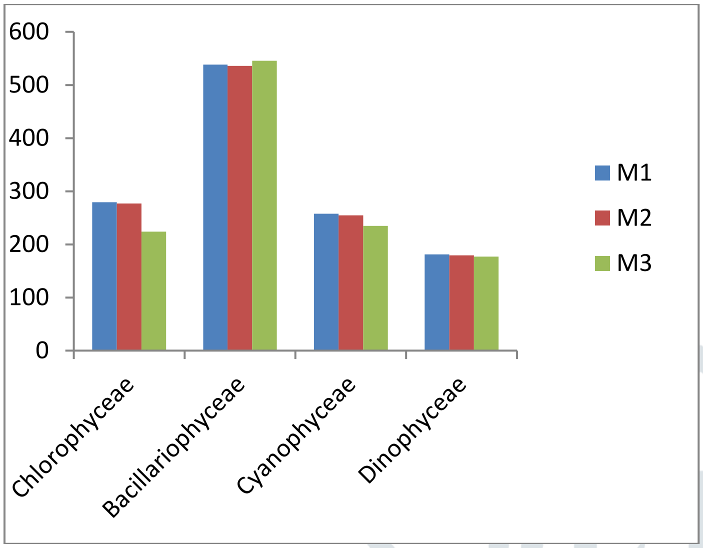
Phytoplankton

During in this research work, 37 genera and 49 species of phytoplankton from four taxonomic assemblages were identified in Makroda reservoir such as Chlorophyceae, Bacillariophyceae, Cyanophyceae and Dinophyceae. During the investigation, eight Cyanophyceae genera were found at the three sites M1, M2, and M3 with the mean biennial percentage of Cyanophyceae species richness was 20.3, 19.74, and 18.92 percent, respectively. 24 Bacillariophyceae (Diatoms) species from 16 genera also identified and their annual percentage diversity at M1, M2, and M3 reached 43.05, 45.42, and 47.88 %, respectively.

During the investigation, eight Cyanophyceae genera were also recorded at the three sites M1, M2, and M3 with mean biennial percentage of Cyanophyceae species richness was 20.3, 19.74, and 18.92 percent, respectively. Dinophyceae species richness is minimal in Makroda Reservoir, for only four varieties from different genera identified. The annual percentage of Dihophyceae biodiversity was 9.72, 8.34, and 8% at M1, M2, and M3, respectively.

The Phytoplanktonic density and their annual changes (no./lit) (average value of three stations) in Makroda Reservoir water from November 2018 to October 2019 are Bacillariophyceae (40.81 to 42.02 percent) > Chlorophyceae (26.94 to 27.82 percent) > Cyanophyceae (19.22 to 20.35 percent) > Dinophyceae (40.81 to 42.02 percent) (8.62 to 8.77 percent).The overall phytoplankton species richness varied seasonally at all locations. In the monsoon, the diversity of species was 25.8±1.1, 28±0.7, and 30±1.3 at M1, M2, and M3, respectively; in the post-monsoon, it must have been 21±0.9, 22.17±1.1, and 24.67±1; while in the winter, that was 19.2±1.8, 20.7 ±0.9 and 22.3 ±1.1. Summer had the highest species richness M3 (37.5±0.4 no. species), followed by M2 and M1 (32.17 ±1.16 and 30.17 ±1.32 species, respectively. The density at the three stations decreased in the monsoon 1917±227.7 ind./L, 2354±299.7 ind./L, and 2475± 311 ind./L at M1, M2, and M3, respectively, and was lowest in the post-monsoon with 1745±91ind./L, 1864±115 ind./L, and 2003±120 ind./L at three stations, respectively, but began increasing in winter with 3099±225.

The organization of phytoplankton communities in reservoir is determined by the interaction that exists between the physical, chemical, and biological characteristics present in the water body. The growth of phytoplankton may be greatly influenced due to elements such as nutrient availability, energy accessibility as well as the composition and quantity of zooplanktons.



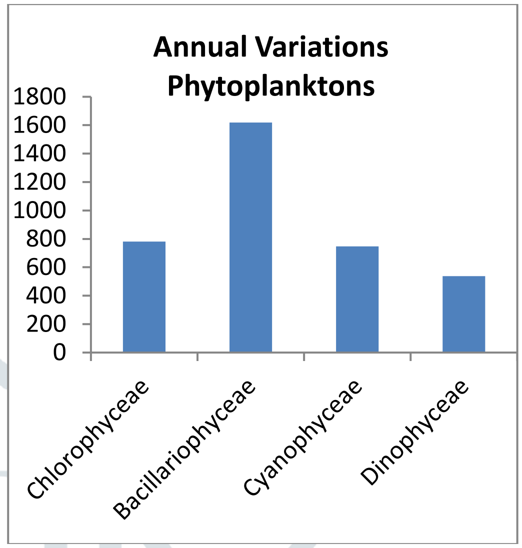


Fig- 02- Annual variations in phytoplanktons (no./lit) (average value of three stations) of water of Makroda Lake, Guna Nov2018-Oct 2019

Zooplanktons

The seasonal fluctuations were observed in zooplanktonic population, which is further separated into four groups: Rotifer, Cladocera, Copepod and Ostracoda. A total of 44 zooplankton species from 26 genera were found in the reservoir's surface water. Nine of these genera belonged to Rotifera (24 species), ten to Cladocera (11 species), four to Copepod (6 species) and three Ostracoda (3 species). Rotifera (35.27 to 36.82 percent) > Cladocera (31.97 to 33.20 percent) > Copepodes (24.53 to 26.17 percent) > Ostracoda (4.9 to 5.5 percent) was the sequence of abundance of several zooplankton groups in decreasing order.

Rotifera was the most prevalent of the four zooplankton species, contributing for 36.29 % of the average density . The percentage density of Rotifera at M1, M2, and M3 was 31.97 %, 33.20 %, and 33.14 %, respectively. Cladocera was the second most abundant group of zooplankton investigated contributing for 32.77 percent of the average density. Cladocera percentage densities were 31.97 percent at M1, 33.20 percent at M2, and 33.14 percent at M3.

Copepoda was the third quantitative component in total zooplankton dominance with annually average density of 25.55 %. Copepod percentage density ranged from 26.17 percent at M1 to 25.95 percent at M2 and 24.53 percent at M3.The density of ostracoda was minimal at all three Makroda areas, contributing for the lowest component of overall zooplankton densitywith annual percentage density of 5.29 %. In all three locations, overall percentage density ranged from 4.90 % to 5.50 % and 5.49 %, respectively.

The abundance of total zooplankton varies significantly in every season. Summer had the highest density of total zooplankton. The density of total zooplankton reduced during the monsoon was 2607 118 nos./L, 2333 138.4 ind./L, and 2173 133.3 Ind./L at M3, M2, and M1 respectively and then reduced further in the post-monsoon to 1327 68.05 ind./L, 1567 90.28 ind./L, and 1620 88.09 ind./L at M1, M2 and M3. During the winter, density at M1, M2, M3 was increased to 1447 137.6 ind./L, 1667 174.9 ind./L, and 1787 187.8 ind./L.

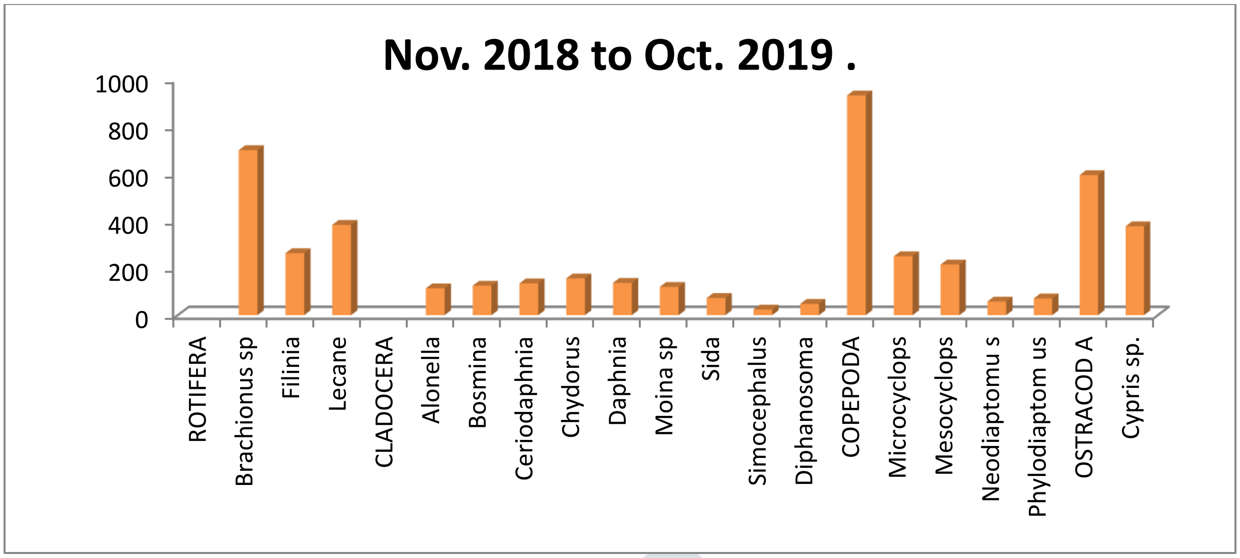


Fig. – 03- Total Genera wise population density of various zooplankton groups with their during Nov. 2018 to Oct. 2019

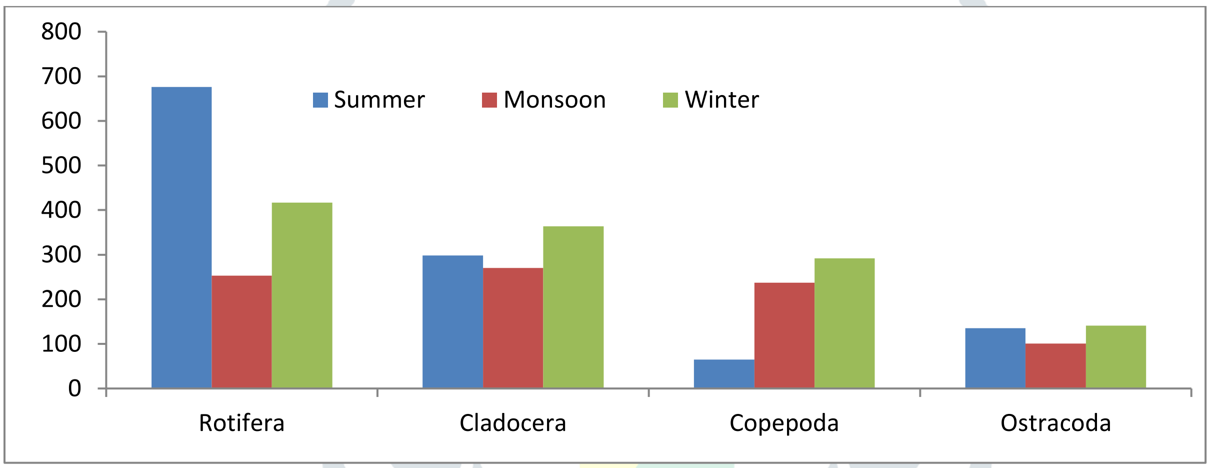


Fig.- 04-Total Group wise seasonal population density (No/L) of Zooplankton during Nov. 2018 to Oct. 2019

The above findings were also confirmed by the work of several researchers who also done their valuable research work in different fields such as ,Yeole *et al.* [2008], Kumar *et al.* [2011], Singh [2012], Tiwari [2015], Manickam *et al.*[2018] Mishra and Yadav (2019) etc.

According to the current findings, phytoplankton are vital ingredients of freshwaters, contributing considerably to the succession and dynamics of zooplankton and fish. The community structure, dominance and seasonality of phytoplankton are very varied and depend on nutritional status, water level, underlying substrate morphometry and other regional characteristics. Phytoplantkton are the base of an ecosystem's nutrient cycle. These perform an essential role in determining the efficiency among biological organisms and abiotic elements. Phytoplankton and Zooplankton can also be used as indicators of water quality, including pollution. They are useful bio-indicators due to their short life cycles and fast responsiveness to environmental changes. The quality and quantity of planktons varies according to depth, place, time, and season of collection, which are all affected by biological and climatic variables.

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