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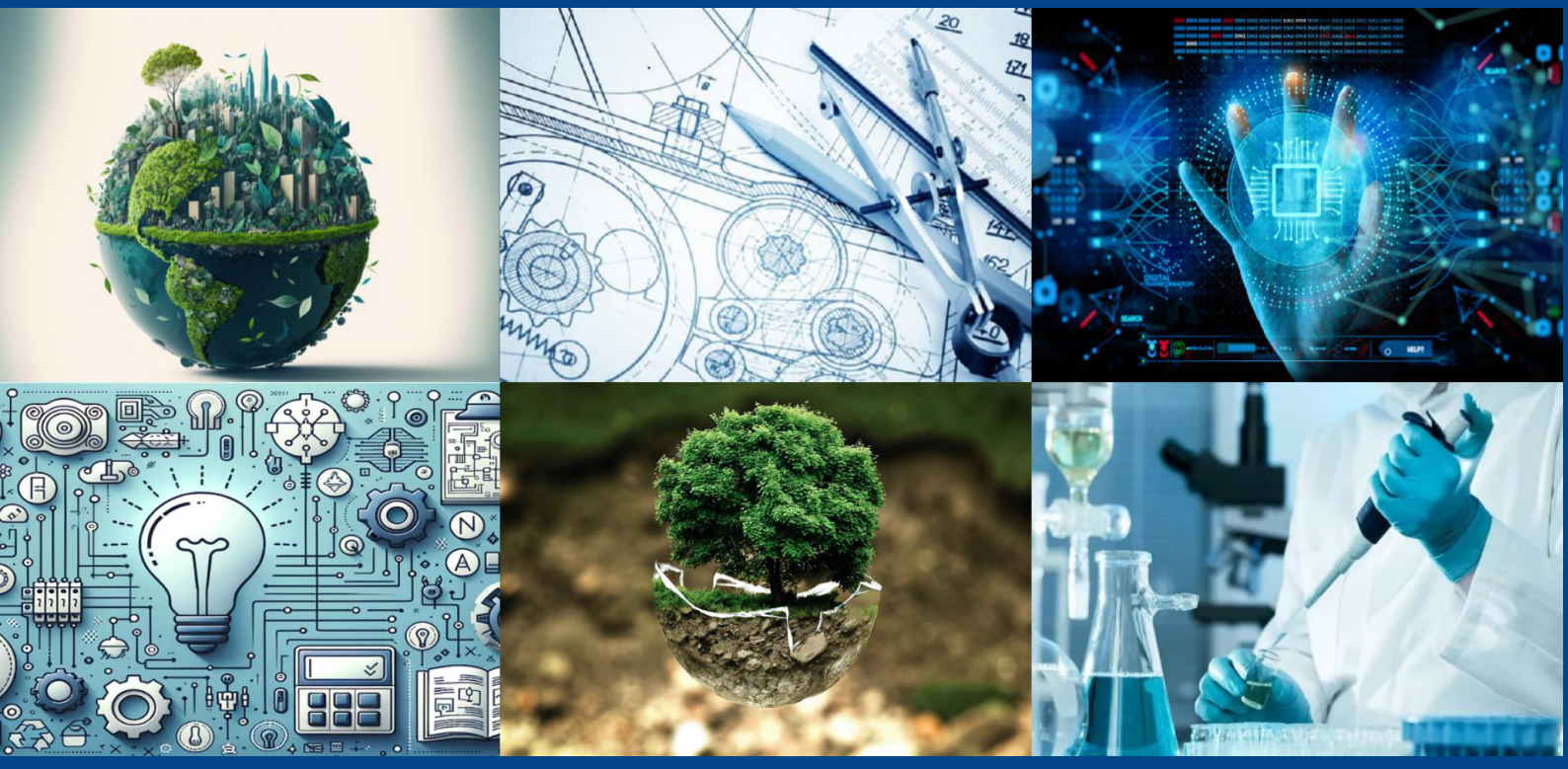

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Study of Selected Zooplankton Diversity and Distribution in Jaju Sagar Dam Neemuch

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ABSTRACT: This study investigates the diversity and distribution of zooplanktons in Jaju Sagar Dam, located in Neemuch, with an emphasis on understanding their ecological roles within the freshwater ecosystem. Zooplanktons, being crucial components of aquatic food webs, were sampled from different locations in the dam over a period of two years to assess species composition, abundance, and seasonal variations. The results indicated significant seasonal fluctuations in zooplankton populations, influenced by environmental factors such as water temperature, pH, dissolved oxygen, and nutrient concentrations. The study also highlighted the dominance of specific zooplankton groups during different phases of the monsoon and post-monsoon seasons. Understanding these patterns is essential for managing the aquatic biodiversity of Jaju Sagar Dam and for assessing the ecological health of the water body. The findings underscore the importance of preserving zooplankton diversity as a key factor in maintaining the ecological balance of freshwater ecosystems.

KEYWORDS: Zooplankton, Biodiversity, Jaju Sagar Dam, Freshwater ecosystem, Seasonal variations, Environmental factors & Ecological health.

I. INTRODUCTION

Freshwater zooplankton are a diverse group of tiny, usually microscopic, animals that drift or swim in the water column of freshwater ecosystems, such as lakes, rivers, and ponds. These minute organisms play a vital role in the aquatic food web, serving as a crucial link between primary producers (phytoplankton) and higher trophic levels (fish, insects, and other invertebrates).

Freshwater zooplankton encompass a wide range of taxonomic groups, including crustaceans (e.g., copepods, cladocerans), rotifers, and protozoa. These organisms exhibit remarkable adaptations to their environment, such as specialized feeding structures, rapid reproduction rates, and complex migration patterns.
As primary consumers, freshwater zooplankton grazing on phytoplankton, regulating their populations and influencing the overall water quality. In turn, zooplankton are preyed upon by larger aquatic animals, transferring energy and nutrients up the food web.

Understanding freshwater zooplankton ecology is essential for managing and conserving freshwater ecosystems, as changes in zooplankton populations can have cascading effects on the entire aquatic food web.Several studies across India have highlighted regional variations in zooplankton diversity and their sensitivity to environmental changes. Ashaari et al. (2024) highlighted the growing role of zooplankton in aquaculture through their review on nutrient and probiotic enrichment, published in the Journal of Applied Animal Research. Their work underscores the significance of zooplankton not only in ecology but also in sustainable aquaculture practices.Sinha and Islam (2003) examined the seasonal variation in zooplankton populations across two lentic water bodies at the Assam State Zoo cum Botanical Garden, Guwahati. Their study highlighted the influence of seasonal changes on zooplankton abundance and diversity, contributing to the understanding of ecological dynamics in managed aquatic systems.

A study by Nanda et al. (2020) on the only natural lake near Itanagar, Arunachal Pradesh, highlighted both the ecological richness and the environmental threats faced by the lake. Using a Foldscope microscope, the study successfully documented 16 zooplankton species and revealed that the physicochemical parameters supported aquatic life, emphasizing the lake's ecological significance. Vaghela et al. (2023) analyzed the phytoplankton and zooplankton communities in the Sabarmati River, linking their distribution to water quality parameters. Similarly, Rani (2023)

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demonstrated how anthropogenic disturbances influence zooplankton composition in the lentic ecosystems of Patna. Mahajan et al. (2024) explored ecological factors shaping zooplankton abundance in the Ravi River, while Chattopadhyay and Panda (2021) reported seasonal fluctuations and Rotifera dominance in Saheb Bandh Lake, West Bengal. In the Godavari River, Yannawar (2022) focused on species identification and their roles in the aquatic food chain. Collectively, these studies underscore the importance of zooplankton as ecological indicators and stress the need for region-specific biodiversity assessments.

II. MATERIAL AND METHOD

Study sites:

Pond Name	Location	Distance	District
Jaju Sagar Dam	Harkiyakhal	150 km from (Udaipur)	Neemuch(mp)

Neemuch is a part of Ujjain division. Rajasthan Morwan dam is 24 km from Neemuch and built on Gambhiri tributary of Chambal river that supply water for irrigation and water supply to nearby Jaju sagar Dam is commonly known as Harkiyakhal reservoir, which is a soul source of drinking water to 26 villages of Neemuch district. The Dam water is treated by Hingoria water treatment plant then sent for chlorination and then supplied to the locality.
Length: 46.03 km
Depth: 35 m
Built in: 1960

One of the main sources of drinking water for the people of Neemuch city is the Sitaram Jaju Sagar Dam, which is situated close to the town of Jiran (17 km from Neemuch) in the Neemuch District (M.P.). It's a man made dam, which was brought into existence through blocking of the water flow from the surrounding nallas, and a dam was built on it in 1961 and now it is commonly known as Jaju Sagar Dam. The dam has a catchment area of 176.12 sq. kms. The dam is a very valuable and sole source of drinking water to the residents of Neemuch. Gross storage capacity of the dam is 276 MCFT (when water level rises up to 21 ft). Present water supply was designed in 1955 for the population of 50,000 up to 1975. The total water demand of the city for domestic use is 7.55 mld. (Million liters per day). The dam has a yield of 12,280 mld for the year of minimum rainfall i.e.14 inches.

Here's a step-by-step guide on how to identify zooplankton using a microscope:

Materials Needed
- Compound microscope (100x to 400x magnification)
- Stereo microscope (optional)
- Zooplankton samples (preserved or live)
- Identification keys and guides
- Glass slides and coverslips

Preparation of Samples
1. *Preservation*: If using live samples, preserve them in a sugar-formalin solution or ethanol to prevent degradation.
2. *Concentration*: Concentrate the zooplankton sample using a plankton net or by centrifugation.
3. *Mounting*: Place a small drop of the concentrated sample onto a glass slide and add a few drops of water or a mounting medium.
4. *Cover slipping*: Gently place a cover slip over the sample to prevent air bubbles and secure it in place.

Microscopic Examination
1. *Low magnification*: Start with low magnification (100x) to observe the overall morphology and movement of the zooplankton.
2. *High magnification*: Switch to higher magnification (200x to 400x) to examine the details of the zooplankton's body structure, such as setae, antennae, and mouthparts.
3. *Illumination*: Adjust the microscope's illumination to optimize the visibility of the zooplankton's features.

Identification

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1. *Consult identification keys*: Use specialized identification keys and guides, such as those provided by the Smithsonian Institution or the World Register of Marine Species, to aid in the identification process.
2. *Observe key characteristics*: Note the presence or absence of distinctive features, such as spines, shell shape, or appendage structure.
3. *Compare with reference images*: Compare your observations with reference images or illustrations to confirm the identification.

Common Zooplankton Groups

1. *Copepods*: Small, usually transparent, crustaceans with a distinctive pair of antennae.
2. *Cladocerans*: Small, usually transparent, crustaceans with a characteristic shell shape.
3. *Rotifers*: Small, usually transparent, animals with a distinctive wheel-like structure (corona) used for feeding and locomotion.
4. Ostracod -freshwater ostracods are a group of small crustacean that belong to the class ostracoda, body elongated and transparent.
5. Protozoan-freshwater zooplankton protozoa are small single cell organisms.

By following these steps and consulting identification keys and guides, you can accurately identify zooplankton using a microscope.

III. RESULTS AND DISCUSSION

Session 2022-23

S.N.	Zooplankton group	Name of z. Species	Monsoon	Winter	Summer	Total		Percentage
01	Rotifera	Branchions	22	12	18	52	88	28.94%
		Keratella	12	12	12	36		
02	Cladocora	Daphnia	16	09	10	35	55	18.09%
		Bosmina	08	06	06	20		
03	Copepods	Cyclops	22	20	20	62	93	30.59%
		Diaptomus	O8	15	08	31		
04	Ostracods	Cypris	08	05	10	23	23	7.5%
05	Protozoa	Euglena	04	02	03	09	45	14.80%
		Amoeba	08	05	05	18		
		Paramecium	08	02	08	18		
Total	-	-	116	88	100	304		

Calculate Zooplankton density.individuals per liter (ind/L) for each season:

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Seasonal Zooplankton Density:
1. *Monsoon*: 116 ind/L
2. *Winter*: 88 ind/L
3. *Summer*: 100 ind/L

Average Zooplankton Density:(2022-23)
To calculate the average density, add the seasonal densities and divide by the number of seasons:

Average density = (116 + 88 + 100) / 3
= 304 / 3
= 101.33 ind/L

During the present study, 10 genera of Zooplankton were recorded from the jaju sagar dam freshwater pond belonging to the 5 groups viz, Rotifera, Cladocera Copepoda, and ostracoda, protozoan Among the recorded genera, 2 belongs to rotifera 2 belongs to Cladocera and 2genera belongs to Copepods, 1 genera belongs group ostracoda and 3 genera belongs to protozoa . Similar observation was made by many researchers throughout the country Kar and Kar (2013) reported 26 species of Zooplankton from an oxbow lake of Cachar, Assam; Tyor et al. (2014) studied Zooplankton diversity in a shallow lake of Gurgaon, Haryana revealing Rotifera with highest diversity followed by Cladocera and then Copepoda showing least diversity; Pawar (2014) reported 66 species of Zooplankton in some freshwater bodies around Satara district of Maharashtra, India. The abundance status of the Zooplankton group recorded from Sat Beel was depicted in Fig 1. The present study revealed that the freshwater body that was investigated comprised various seasons . during 2022-23 Rotifera species Brachionus 52,keratella 36 total number 88 found in different seasons, Cladocera species Daphnia 35 and Bosmina 20 total number 55 found in different seasons Copepod Species Cyclops 62 and Diaptomus 31 total number 93 found. Ostracoda species Cyprus 23 found in different seasons Protozoa Species Euglena 9 ,Amoeba 18, paramecium 18 total number 45 found in different seasons in jaju sagar dam freshwater pond .

Copepods 93 number count where Copepods constituted the most dominating group contributing 30.59% to the total Zooplankton followed by Rotifera 28.94%contributing and Cladocera contributing 18% and Protozoan contributing 14.8% and postcodes Contributing 7.5%. to the total Zooplankton. Different species of Zooplankton showed their abundance according to the favourable conditions. The population density status of the Zooplankton recorded from Sat Beel is depicted in During the study period, among Cladocera, Diaphanosoma sp., Sida sp., Chydorus sp., Ceriodaphnia sp., Bosmina sp., Alona sp. and Moina sp. were recorded throughout the year; among Copepoda, Mesocyclops sp., Neodiaptomus sp. were recorded throughout the year and among Rotifera, Brachionus sp., Plationus sp., Lecane sp., Keratella sp., Anuraeopsis sp., Asplanchna sp., Ascomorpha sp., Testudinella sp., Trichocerca sp. and Scaridium sp. were recorded throughout the year. Present investigation reveals high value of species richness reflecting the suitability of the wetland for the dominant species (Arora and Mehra 2003). In the present study, the study site was characterized by a greater diversity of Zooplankton taxa during monsoon season. During the present study, the Copepods group was reported to be dominant among all other Zooplankton groups.

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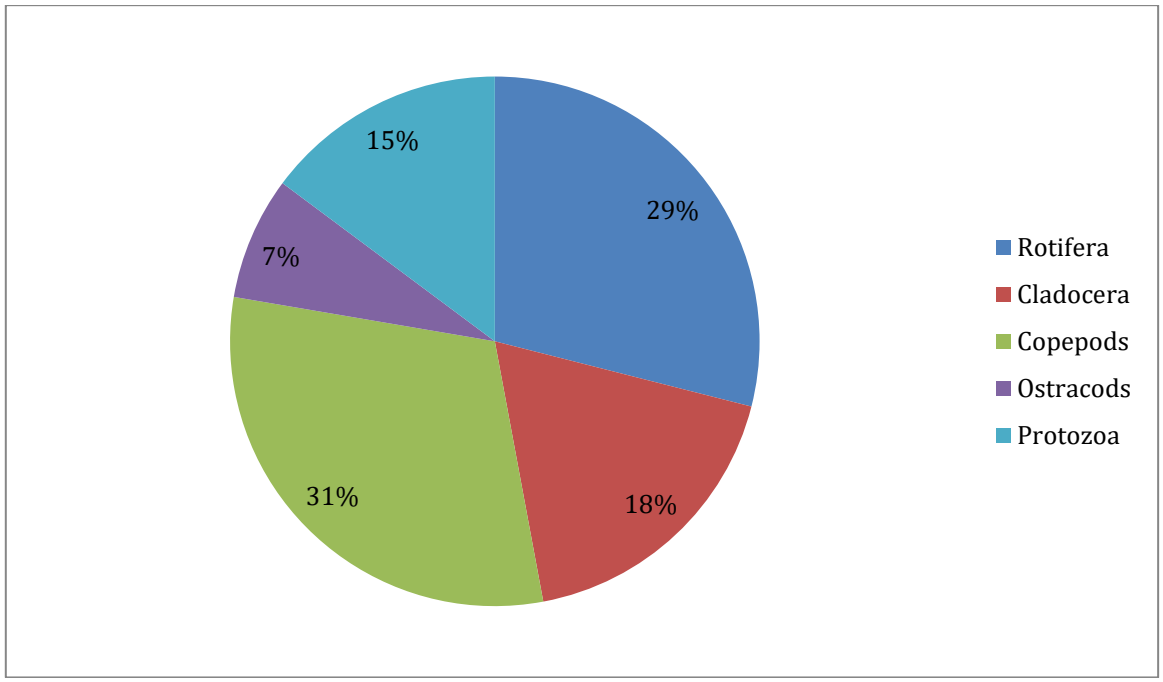
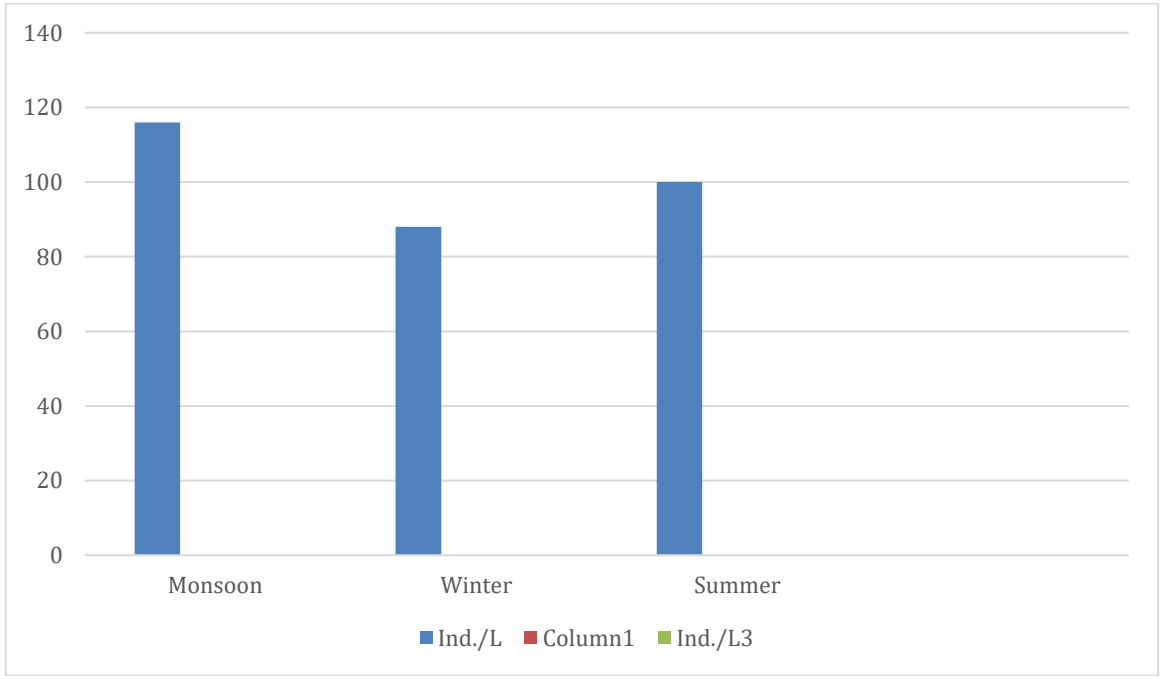
Session-2022-2023



Density Bar graph

Season-2022-2023



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3.1 RESULTS AND DISCUSSION

Session 2023-24

S.N.	Zooplankton group	Name of z. Plankton	Monsoon	Winter	Summer	Total		Percentage
01	Rotifera	Branchions	16	12	16	44	76	23.97%
		Keratella	08	10	14	32		
02	Cladocora	Daphnia	20	10	13	43	61	19.24%
		Bosmina	08	05	05	18		
03	Copepods	Cyclops	26	22	16	64	99	31.23%
		Diaptomus	08	15	12	35		
04	Ostracods	Cypris	12	06	16	34	34	10.7%
05	Protozoa	Euglena	08	02	03	13	47	14.82%
		Amoeba	06	05	02	13		
		Paramecium	08	05	08	21		
Total	-	-	120	92	105	317	-	-

calculate zooplankton density (2023-24)
Seasonal Variations:
1. *Monsoon*: 120 ind/L (highest density)
2. *Summer*: 105 ind/L
3. *Winter*: 92 ind/L (lowest density)

Average Density:
Average density = (120 + 92 + 105) / 3
= 317 / 3
= 105.67 ind/L

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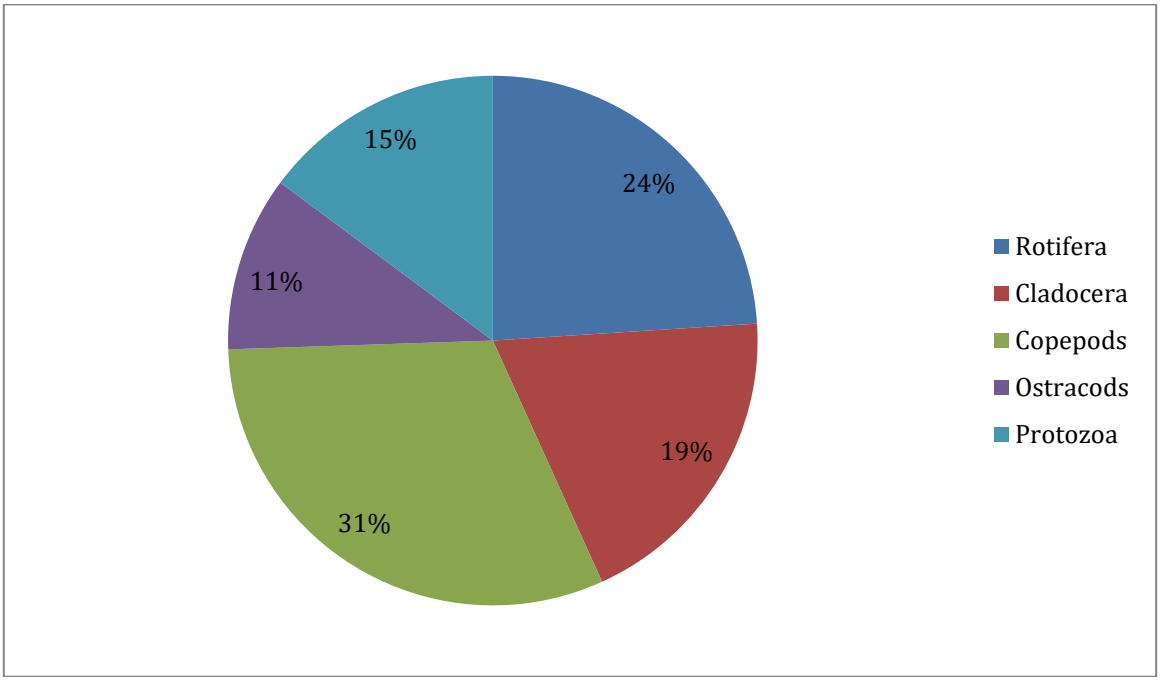
Copepods 99 number count where Copepods constituted the most dominating group contributing 31.24 % to the total Zooplankton followed by Rotifera 23.97%contributing and Cladocera contributing 19.24% and Protozoan contributing 14.82% and postcodes Contributing 10.7%. to the total Zooplankton. Different species of Zooplankton showed their abundance according to the favourable conditions. The population density status of the Zooplankton recorded from Sat Beel is depicted in During the study period, among Cladocera, Diaphanosoma sp., Sida sp., Chydorus sp., Ceriodaphnia sp., Bosmina sp., Alona sp. and Moina sp. were recorded throughout the year; among Copepoda, Mesocyclops sp., Neodiaptomus sp. were recorded throughout the year and among Rotifera, Brachionus sp., Plationus sp., Lecane sp., Keratella sp., Anuraeopsis sp., Asplanchna sp., Ascomorpha sp., Testudinella sp., Trichocerca sp. and Scaridium sp. were recorded throughout the year. Present investigation reveals high value of species richness reflecting the suitability of the wetland for the dominant species (Arora and Mehra 2003). In the present study, the study site was characterized by a greater diversity of Zooplankton taxa during monsoon season. During the present study, the Copepods group was reported to be dominant among all other Zooplankton groups.

Session -2023-2024



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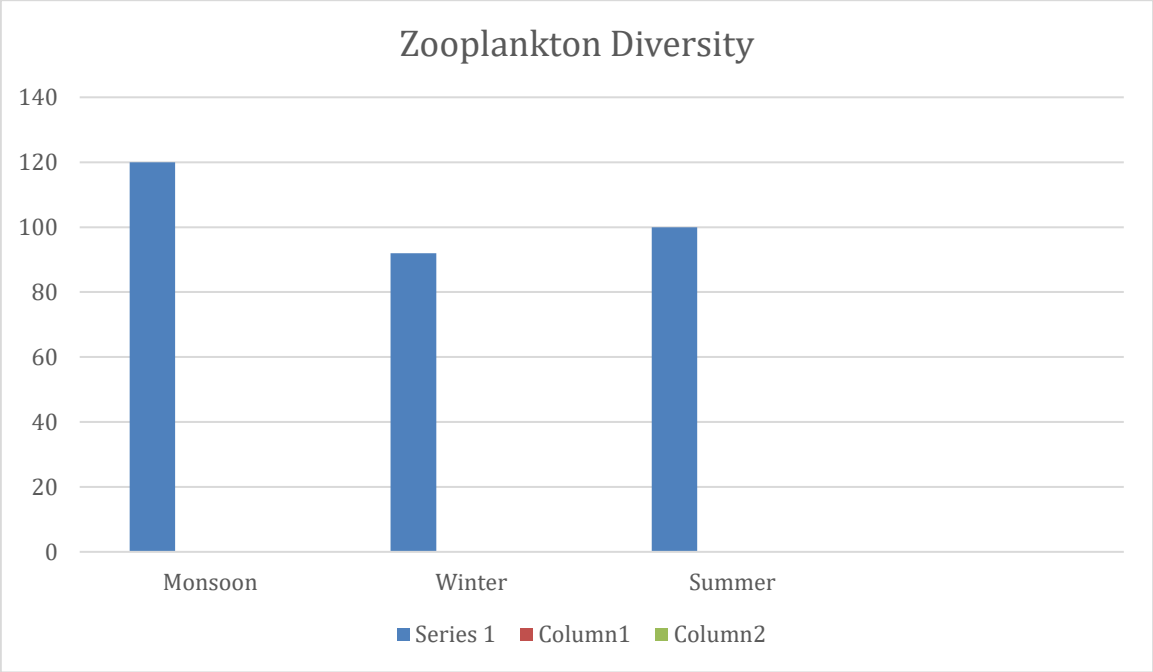
Season- 2023-2024



IV. CONCLUSION

The quantity of zooplankton varies significantly across the monsoon, winter, and summer seasons due to changes in water temperature, nutrient availability, and phytoplankton production. Here's how zooplankton abundance typically fluctuates in different seasons:

1. Summer (Moderate to High Abundance)
Temperature: High
Food Availability: Moderate (phytoplankton growth depends on nutrient levels)
Zooplankton Response:
Some species, like copepods and cladocerans, thrive in warm waters.
High metabolic rates lead to increased reproduction.
However, predation by fish is also high, which can limit population growth.

2. Monsoon (Peak Abundance)
Temperature: Moderate to warm
Food Availability: High (due to nutrient-rich runoff and phytoplankton bloom)
Zooplankton Response:
Heavy rainfall leads to an influx of nutrients, boosting phytoplankton growth.
Zooplankton populations peak during and after monsoon due to abundant food.
Freshwater species like rotifers and cladocerans show high diversity and density.
Some regions may experience fluctuations due to strong water currents and dilution effects.

3. Winter (Lowest Abundance)
Temperature: Low
Food Availability: Low (reduced phytoplankton production due to low sunlight)
Zooplankton Response:
Many species enter diapause (a dormant stage) to survive unfavorable conditions.
Reproduction slows down, leading to the lowest zooplankton density of the year.
Deep-water species may dominate as they migrate to warmer layers.

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