IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"A Study On Seasonal Variation Density Of Phytoplankton And Zooplankton In Beedpura Pond In Maan River Of Dhar District, Madhya Pradesh, India"

ALONE MAHENDRA KUMAR

DEPARTMENT OF ZOOLOGY

GOVT. COLLEGE, RAU, INDORE, MADHYA PRADESH

ABSTRACT:

Phytoplankton are microscopic single-celled organisms that form the base of the marine food chain. Zooplankton refers to a diverse group of small, drifting animals that inhabit the ocean, freshwater bodies, and even some terrestrial environments. The present study was carried out at Manawar Taluka of Dhar District of M.P. state in Central India.

In phytoplankton density three groups were examined viz., cyanophyceae, euglenophyceae and bacillariophyceae, in which the cyanophyceae has anabaena, Oscillatoria and Microcystis showed highest relative abundance followed by bacillariophyceae with Cyclotella and Navicula and lowest was euglenophyceae with euglena and zygena. Three groups of zooplankton named rotifers, copepods and cladocerans. In which copepods showed maximum relative abundance among the groups in Beedpura Pond.

Keywords: Food web, phytoplankton, zooplankton, relative abundance etc.

INTRODUCTION:

Phytoplankton are microscopic, plant-like organisms that live in bodies of water such as oceans, lakes, and rivers. They are extremely important to the health and balance of marine ecosystems, as they form the basis of the food chain for many aquatic animals. These tiny organisms are classified as autotrophs, meaning they can produce their own food through the process of photosynthesis. They use sunlight, carbon dioxide, and nutrients from the water to create energy in the form of organic compounds. This energy is then passed on to other organisms that consume phytoplankton, including fish, crustaceans, and even some whales. Not only do phytoplankton play a crucial role in the marine food web, but they also help regulate the Earth's climate by

absorbing large amounts of carbon dioxide and producing oxygen through photosynthesis. Unfortunately, due to pollution and climate change, phytoplankton populations are declining at an alarming rate, which could have devastating effects on the entire ocean ecosystem. Therefore, it is crucial to protect and conserve these tiny but mighty organisms for the health of our planet's oceans.

Zooplankton are small, often microscopic, animals that live in aquatic environments. They are a crucial part of the food chain, as they are primary consumers that feed on phytoplankton and other organic matter. These tiny creatures play a vital role in maintaining the health and balance of marine and freshwater ecosystems. Zooplankton are incredibly diverse, with over 10,000 known species. They come in various shapes and sizes, ranging from the size of a pinhead to being barely visible to the naked eye. Some species of zooplankton have unique adaptations, such as transparent bodies or bioluminescence, which help them survive in their environment. These organisms are found in all types of aquatic habitats, from the open ocean to freshwater lakes and rivers. They are essential for nutrient cycling and provide a food source for larger animals, such as fish and whales. Unfortunately, zooplankton populations are facing threats from climate change, pollution, and overfishing, which can have a cascading effect on the entire food chain. As such, it is crucial to understand and protect these tiny but mighty creatures to maintain the health and balance of our oceans and waterways.

Seasonal fluctuations of the phytoplankton and zooplankton population are a well-known phenomenon and zooplankton exhibits a bimodal oscillation with a spring and autumn in the temperate lakes and reservoirs (Wetzel, 2001). This fluctuation is greatly influenced by the variation in the temperature along with many other factors. Among several factors temperature seems to exhibit the greatest influence on the periodicity of zooplankton (Byars, 1960; Battish and Kumari, 1986; Prasad and Singh, 2003). Water temperature between 10 - 29 °C are suitable for zooplankton development (Kaushik et al, 1992). However, in shallow, tropical, perennial and seasonal ponds such as a regular food cycle can be seen. Thus in any aquatic ecosystem zooplankton not only take part in transferring food from primary to secondary level but also switch over conversion of detritus matter in to edible animal food.

METHODOLOGY:

(i) Topography of the study area:

The present study was carried out at Manawar Taluka of Dhar District of M.P. state in Central India. The district has an area 8-153 km. It is bounded by Ratlam to North Ujjain, north east Indore to the east Khargone (West Nimar), Barwani to the south east and Jhabua to the west. The Vindhya range run east and west side through the district. The northern part of the district lies on the Malwa Plateau. The north western portion of the district lies in the water shade of the Mahi river and its tributaries. The portion of the south side of the ridge of the Vindhyas lies in the water shade of the Narmada river which run to Manawar Tehsil.

Manawar is away from the Agra-Bombay high way No. 3 and its nearest railway station and airport is Indore which is 130 km from Manawar. It is situated at 20, 23°40'' north latitude and 74°,50°27' south altitude and it has an average elevation of 180 meters (590 feet) and time zone is IST (UTC+5:30). Manawar is a tribal area. It had a population of 25,460 as of 2001 India Census. Manawar has a river named Man and surrounded by many cesspool and small pond. Beedpura (Manawar) has one medium sized pond which receives rain water and run off water from the fields. It doesn't receive any domestic effluents. Besides this pond, some temporary breeding ground of *Anopheles* mosquitoes were also searched during rainy seasons. It is dried after few months.

(ii) Collection of sample:

Sampling period – only in 2nd week of every month around 10.00 am Sampling was started since Dec., 2008 to Nov. 2009 and Dec., 2009 to Nov. 2010 in both the years.

Sampling – The net was used for the sampling of Zooplankton that is made up of 50 ml glass tube by a nylon mono filament and 75 µm mesh conical net has 0.25 mouth diameter from the sampling point.

Counting – For zooplankton counting, the Sedgwick rafter cell was used which is 50 mm long, 20 mm wide and 1 mm deep. Before filling the SR cell with sample, the cover glasses were diagonally placed across the cell and then sample were transferred with a large big bore pipette so that no air bubbles in the cell cover were formed. The S-R cell was let standard for at least 15 minutes to settle plankton. Then plankton on bottom of the S-R cell was counted, enumerated by compound microscope. By moving the mechanical stage, the entire bottom of the slide area was examined carefully. Organisms lying between two parallel cross hairs were counted as they passed on vertical line.

Number of plankton (Phyto and Zooplankton) in the S-R cell was derived using following formula (APHA, 1998).

$$\text{No species / } \mu = \frac{C \times 1000\ mm^3}{L \times D \times W \times 5}$$

Here, C = Number of organism counted

L = length of each strips (S-R cell length) in mm.

S= Number of Strips counted (mm)

D = Depth of each strips (mm).

W = Width of each strip (mm).

S = Number of strips.

Biological analysis and identification of the zooplankton was studied under microscope and identified with the help of standard reference (Adoni et al, 1985; Agarkar et al, 1994).

The present work was aimed to study the zooplanktons seasonal distribution and diversity in Beedpura pond at Manawar during two years period that is 2021-22 and 2022-23.

RESULT AND DISCUSSION:

During the tenure of one year of research period phytoplankton and zooplanktonic seasonal density was recorded in the year of 2022-23 in Beedpura Pond.

In phytoplankton density three groups were examined viz., cyanophyceae, euglenophyceae and bacillariophyceae, in which the cyanophyceae has anabaena, Oscillatoria and Microcystis showed highest relative abundance followed by bacillariophyceae with Cyclotella and Navicula and lowest was euglenophyceae with euglena and zygena.

The group of phytoplankton named cyanophyceae seasonal variation of anabaena, Oscillatoria and Microcystis was 197, 143 and 321 cells/litre in winter season followed by 415, 645 and 180 cells/litre in summer season and 804, 290 and 300 cells/litre in winter season respectively.

Seasonal variation of species named Cyclotella and Navicula of bacillariophyceae was recorded 320 and 206 cells/litre in winter season 106 and 190 cells/litre in summer season and 120 and 125 cells/litre in rainy season respectively.

In euglenophyceae two species viz., euglena and zygena were identified, the seasonal variation of these two species was 110 and 70 cells/litre in winter season and 20 and 18 cells/litre in summer season and 60 and 30 cells/litre in rainy seasons recorded respectively during the tenure of one year of research period.

Among zooplanktons, three groups were observed which was dominated by Cladocerans which was represented by 4 species, followed by 3 species of rotifers and 2 of copepods. Nauplius was dominating genera in copepods whereas Moina was dominated among Cladocerans and Branchionus among rotifers.

The study also revealed that maximum genera were occurred during winter season than summer and monsoon season, which were also reported by Abdus et al (1995) and Kumar et al (2001). The smaller number of genera of zooplankton might be attributed due to less nutrient in breeding habitat, consequently less productivity in the breeding ponds.

The other probable reason for the reduction in the number of genera may be due to predation and variation in the pH of water. Jhingran (1982) also reported that in winter months ponds breeding habitat are found rich in zooplanktons. It may be due to biotic interaction operating through feeding pressure rather than water quality. It seems to affect the zooplankton diversity and density because, the fish found in the breeding ponds play an

important role in the harvesting species of copepods and cladocerans. Rotifers were higher in winter which can be linked in favorable temperature and availability of abundant food in the form of bacteria and other microorganism, present in the pond. This view was supported by Baker (1979) and later on Majagi and Vijaykumar (2009).

During the study period cladocerans were found to be most dominating group in the Beedpura pond at Manawar. However, this does not coincide with the reports of Kedar et al (2008) who have reported that in fresh water lake rotifers were the most dominating group among zooplanktons. Koushik and Sharma (1994) and Singh (2000) have also mentioned the similar views in a fresh water pond. They have clearly mentioned that rotifers richness and its biodiversity have a direct relationship with the temperature of the reservoir.

Three groups of zooplankton were identified during the tenure of one year of research period named rotifers, copepods and cladocerans. In which copepods showed maximum relative abundance among the groups in Beedpura Pond.

Seasonal variation of copepods species named nauplius and Eucyclops in Beedpura pond was 607 and 480 cells/litre in winter season, 770 and 622 in summer and 50 and 80 in rainy seasons respectively.

Rotifers seasonal variation of species named branchionus, Keratela and Asplanchana was 120, 125 and 09 cells/litre in winter season 110, 103 and 20 cells/litre in summer and 105, 109 and 256 cells/litre in rainy season respectively.

Seasonal variation of cladocerans species named daphnia, moina, alona and Chidonus species was 110, 100, 05 and 09 cells/litre in winter season, 00, 10, 30 and 64 cells/litre in summer season and 75, 100, 20 and 11 cells/litre in rainy seasons in Beedpura pond during 2022-23 study period.

As per above examination it can be concluded that the relative abundance, seasonal density and dominance of planktonic group cyanophyceae indicates that -Cyanophyceae, disparate other phytoplankton, responded inversely to environmental factors. In small water bodies like pond cyanophyceae were directly associated with pH, NO_3, NH_4 etc. Pond cyanophyceae relative abundance and density is most preferred macro-phytic dominance compared to other water bodies. Field ponds have higher density, abundance and lower diversity as compared to other aquatic resources.

Copepods are ecologically important biotic components of an aquatic ecosystem that links in the food chain or web linking microscopic organism to large fishes. They also have great potential to control mechanism for parasitic disease like malaria by consuming the larvae of mosquitoes and other aquatic insects and also, they act as intermediate host of many animal and human parasite.

The copepod represents the single most important group of animal plankton. Small fishes feed on them and are in turn eaten by bigger fishes, seabirds, seals and whales. We, too, depend on fishes nourished by aquatic plankton.

PHYTOPLANKTONIC SEASONAL DESNSITY

Table 1. Showing relative abundance of the phytoplankton of the Beedpura pond.

Class	Genus	Relative abundance
Cyanophyceae or Myxophyceae	*Anabaena* *Oscillatoria* *Microcystis*	++++ ++++ ++++
Euglenophyceae	*Euglena sp.* *Zygnaea sp.*	++ ++
bacillariophyceae	*Cyclotela* *Navicula*	+++ +++

Table 2. Showing seasonal variation of phytoplankton (Bacillariophyceae) in the Beedpura pond 2021-22.

Months	***Cyclotella* Cells/litre**	***Navicula* cells/litre**	Total
Nov - Feb	320	206	526
Mar - June	106	190	296
Jul – Oct.	120	125	245

Table 3. Showing seasonal variation of phytoplankton (Bacillariophyceae) in the Beedpura pond in 2022-23.

	***Cyclotella* ells/litre**	***Navicula* cells / litre**	Total
Nov - Feb	300	200	500
Mar - June	102	189	291
Jul – Oct.	126	125	251

Table 4. Showing seasonal variation of phytoplankton (Euglenoidae) in the Beedpura pond 2021-22.

Months	***Euglena* Cells/litre**	***Zygnema* cells/litre**	Total
Nov - Feb	110	70	180
Mar - June	20	18	38
Jul – Oct.	60	30	90

Table 5. Showing seasonal variation of phytoplankton (Euglenoidae) in the Beedpura pond during 2022-23.

Months	***Euglena* Cells/litre**	***Zygnema* cells/litre**	Total
Nov - Feb	107	68	175
Mar - June	18	16	34
Jul – Oct.	55	25	70

Table 6. Seasonal variation of phytoplankton (Myxophyceae) in Cells/litre in the Beedpura pond during 2021-22.

Months	***Anabaena***	***Oscillatoria***	**Microcystis**	Total
Nov - Feb	197	143	321	661
Mar - June	415	645	180	1240
Jul – Oct.	804	290	300	1394

Table 7. Seasonal variation of phytoplankton (Myxophyceae) in the Beedpura pond during 2022-23.

Months	***Anabaena***	***Oscillatoria***	**Microcystis**	Total
Nov - Feb	199	144	322	665
Mar - June	419	670	181	1270
Jul – Oct.	854	290	303	1447

ZOOPLANKTONIC SEASONAL DENSITY

Table 8. Showing relative abundance of the zooplankton of the Beedpura pond.

Class	**Genus**	**Relative abundance**
Rotifers	*Branchionus*	+++
	Keratela	+++
	Asplanchana	+
Copepods	*Nauplius*	++++
	Eucylops	++++
Cladocerans	*Daphnia*	++
	Moina	++
	Alona	+
	Chidonus	+

Table 9. Showing seasonal variation of zooplankton (Rotifers) in the Beedpura pond 2021-22.

Months	*Brachionus*	*Keratela*	*Asplanchana*	*Total*
Nov - Feb	120	125	09	384
Mar - June	110	103	20	263
Jul – Oct.	105	109	25	269

Table 10. Showing seasonal variation of zooplankton (Rotifers) in the Beedpura pond during 2022-23.

Months	*Brachionus*	*Keratela*	*Asplanchana*	*Total*
Nov - Feb	103	100	07	320
Mar - June	90	40	20	160
Jul – Oct.	20	35	06	76

Table 11. Showing seasonal variation of zooplankton (Copepods) in Beedpura pond during 2021-22.

Months	*Nauplius*	*Eucyclops*	Total
Nov - Feb	607	480	1087
Mar - June	770	622	1392
Jul – Oct.	50	80	130

Table 12. Showing seasonal variation of zooplankton (Copepods) in Beedpura pond during 2022-23.

Months	*Nauplius*	*Eucyclops*	Total
Nov - Feb	250	130	380
Mar - June	790	660	1450
Jul – Oct.	70	120	190

Table 13. Showing seasonal variation of zooplankton (Cladocerans) in the Beedpura pond during 2021-22.

Months	*Daphnia sp.*	*Moina sp.*	*Alona sp.*	*Chidonus*	Total
Nov - Feb	110	100	05	09	224
Mar - June	Nil	10	30	64	104
Jul – Oct.	75	100	20	11	107

Table 14. Showing seasonal variation of zooplankton (Cladocerans) in the Beedpura pond during 2022-23.

Months	*Daphnia sp.*	*Moina sp.*	*Alona sp.*	*Chidonus*	Total
Nov - Feb	60	57	Nil	03	120
Mar - June	Nil	03	07	06	16
Jul – Oct.	40	105	15	10	170

REFERENCES:

Abdus, S. and K. Altaff (1995). Qualitative and quantitative analysis of zooplankton population of tropical pond during summer and rainy season. J. Eco. Biol., 7 (4) : 269-275.

Adoni, A.D. (1985). Work Book on Limnology (Ed), Department of Environment, Govt. of India, Bandana Printing Service, New Delhi.

Agarkar, M.S.; Goswami, H.K.; Kaushik S.; Mishra, S.M.; Bajpai, A.K. and U. S. Sharma (1994). Biology, conservation and management of Bhojwtland, upper lake ecosystem in Bhopal. Bionature, 14 : 25-273.

Baker, S.L. (1979). Specific status of Keratella cochlearis (Gosse) and K. Ahlastrar (Rotifera : Brachionidae) : Ecological considerations, Can. J. Zool., 7 (9) : 1719-1722.

Battish, S.K. and P. Kumari (1986). Effect of physicochemical factors on the seasonal abundance of cladocera inn typical pond at village of Raqba, Ludhiana. Ecology, 13 (1), 146.151.

Byars, J. A. (1960). A fresh water pond in New Zealand. Australian J. of Marine and Freshwater Res., 11 : 222-240.

Jhingran, V.G. (1982). Fish and Fisheries of India. New Delhi; Hindustan.

Kaushik, S. and D.N. Sharma (1994). Physicochemical characteristics and zooplankton population of a perennial lake, Malsya Sarovar, Gwaloir, J. Environ. Ecol., 1 : 429 - 434.

Kaushik, S.; Agarkar, M.S. and D.N. Saxena (1992). Distribution of phytoplankton in riverine waters in Chambal area (M.P.). Bionature,12:1-7.

Kedar, G.T.; Patil, G.P. and S.M. Yeole (2008). Effect of physicochemical factors on the seasonal abundance of zooplankton population in Rishi Lake. Proc. Of Tall 2007 : The 12th World Lake Conference, pp. 88-91.

Kumar, K.S. (2001). Studies on the freshwater copepods and cladocerans of Dharmapuri district Tamil Nadu. J. Aqua. Biol., 16 (1 & 2) : 5-10.

Majagi, S. and K. Vijaykumar (2009). Ecology and abundance of zooplankton in Karanja reservoir. Environ. Monit. Assess. 152 : 451-458.

Prasad, B. and R. B. Singh (2003). Composition, abundance and distribution of phytoplankton and zoobenthos in a tropical water body. Nat. Environ. & Poll. Tech., 2 (3) : 255-258.

Singh, D.N. (2000). Seasonal variation of zooplankton in a tropical lake. Geobios, 27 : 92-100.

Wetzel, R. G. (2001). Limnology: lakes and Reservoir ecosystem (3rd Edn.), Burlington : Academic pp. 1006.