WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Study of Zooplankton Abundance and Species Diversity in Pakki Pond of Purnea District of Bihar (India)

Vikas Kumar[1], Radha Keot Sah[2]

[1]Post Graduate Dept of Zoology, Purnea Univ. Purnea
Email: vk10876@gmail.com
[2]Assistant Professor, Post Graduate Dept of Zoology, Purnea Univ. Purnea
Email: radhasah0101@gmail.com

ABSTRACT:

From April 2022 to March 2023, the current study was carried out in the Pakki pond of Purnea distric, Bihar. Utilizing a conventional methodology, zooplanktonic diversity and abundance were assessed. The main goal of this investigation was to learn more about the zooplankton diversity in the marsh as a whole. Zooplankton nets were used to collect water samples, which were then transported to the lab for further examination after being preserved on the spot with formalin (an aqueous solution of formaldehyde) and 5% neutral buffer (10 ml). There were 21 species of zooplankton total, divided into four different classes (rotifer, cladocera, copepod, and ostracoda), with rotifera being the most prevalent. There are 21 genera in all, of which 10 belong to the family Rotifera, 6 to the cladocera, 3 to the copepoda, and 2 to the ostracoda. To analyze the species diversity, the Shannon-Weaver index was used.

Keywords: Pond, Species, Shannon-Wiener, Species richness Zooplankton

INTRODUCTION

Millions of living organisms depend directly or indirectly on small wetlands like ponds, rivers, lakes, swamps, etc. for their survival. Human civilization began on the banks of enormous rivers. But because to population growth and anthropogenic stressors, the majority of wetlands have already deteriorated and will continue to do so (Brraich and Saini, 2015).The development of human civilization is directly influenced by freshwater bodies. According to Tiwari and Ali (1987), Tiwari and Mishra (1986), Reddy and Venkateswar (1987), and Khulab (1989), the quality of freshwater supplies is deteriorating at an alarming rate and has now become a global issue.

The tolerance, abundance, variety, and dominance of plankton communities in the habitat are all influenced by environmental changes, and they respond quickly to these changes (Mathivanan and Jayakumar, 1995). Plankton are very sensitive to environmental changes.

Because they are heterotrophic creatures, zooplankton play a significant role in the cycling of organic matter in aquatic ecosystems and are the most significant trophic link in the food chain (Patra et al.). Additionally, because to some species' capacity to recognize deterioration in water quality brought on by pollution or eutrophication, their diversity has been more well-known in recent years. The monitoring of zooplankton as biological indicators may serve as an early warning system when pollution impacts the food chain (Mahajan 1981).

The species composition, geographic distribution, and abundance of zooplankton in any body of water are influenced by the chemical and physical characteristics of the water. The relationship between lake trophic condition and zooplankton grazing capacity was examined by Baruah et al. (1993), Alfred and Thapa (1996), and Salaskar and Yeragi (2003).

Although there is a dearth of information on freshwater zooplankton in India, there are numerous research on seasonal change of zooplankton in temperate freshwaters.Few studies on the abundance of zooplankton populations in various wetlands types have been conducted (Sinha et al. 1994; Das 2002; Khan 2003; and Nandi and Das 2003). There had previously been substantial limnological research on freshwater ponds in Purnea described by Nasar (1977), Nasar and Dutta-Munshi (1974), and Sinha and Sinha (1983). As a result, the current study's objective is to evaluate the Shajangi Pond in Purnea, Bihar's zooplankton community's species diversity index.

MATERIALS AND METHODS

Study Area

Throughout the months of April 2022 and March 2023, the zooplankton biodiversity in the Purnea district's Pakki Pond was examined seasonally.

Collection and Preservation of Sample

Plankton and water samples from several pond locations were collected over the course of a year's worth of sampling (one year). In the first week of every month, from 6 to 8 a.m., samples were collected on a monthly basis.For quantitative analysis, zooplankton was collected by filtering 100 liters of water through a 150-meter-long plankton net made of bolting silk. Plankton samples were put into polyethylene vials (90 ml) and stored with formalin (aqueous formaldehyde solution) and 5% neutral buffer (10 ml).Standard techniques were used to identify the different species of freshwater zooplankton after microscopical examination (Edmondson, 1959; Battissh, 1992; Murgan, 1998 & Altaf, 2004).To tally the plankton, the drop method was employed.

According to Santhanam et al., the total number of plankton in a litre of water sample was calculated using the formula N = n v / V. Where V is the volume of concentrated plankton (ml), N is the total number of plankton per liter of filtered water, n is the average number of plankton in a 1 ml sample, and N is the liter of filtered water as a whole.

Calculation of Plankton Diversity Index

The most extensively used index for estimating the species

diversity is Shannon - Weaver index (Shannon and

Weaver, 1949) given by formula

H' = - S (ni / N) log 2 (ni / N), where

H' = Shannon – Weaver index

ni = Importance value of each species (number of

individuals)

N = Total of importance value

RESULTS AND DISCUSSION

The peak period for zooplankton density, from June to August, was measured to be between 356 and 1335 Unit/L. The population of rotifers ranged between 102 and 520 unit/l, with the maximum numbers occurring from April to December 2022.

Sl. No.	Group/Class	Species	Total Number
1	Rotifera	Asplanchnaintermedia	4265
		Brachionuscalyciflorus	
		Brachionuscaudatuspersonatus	
		Brachionusbidentata	
		Keratellacochlearis	
		Keratellatropica	
		Filinialongiseta	
		Lecanecurvicornis	
		L. donneri	
		Testudinellamucronata	
2	Cladocera	Alonaquadrangularis	3896
		Ceriodaphniacornuta	
		Ceriodaphniareticulata	
		Daphnia carinata	
		Moinbrachiataa	
		Moina flagellate	
3	Copepoda	Eucyclopsspp	1440
		Mesocyclopsaspericornis	
		Neodiaptomusschmakeri	
4	Ostracoda	Cyprisprotubera	727
		Cyprinotusnudus	

Table 1: List of Recorded Zooplankton species during Study in Pakki Pond, Purnea and its abundance in temporary water habitat.

Clasess Month ↓	Rotifera	Cladocera	Copepoda	Ostracoda	Total	
	n/l	n/l	n/l	n/l	n/l	%
April 2022	335	241	208	92	876	8.54
May	425	245	204	88	962	9.0
June	520	468	168	71	1227	11.97
July	500	635	112	73	1320	12.88
August	501	598	78	65	1242	12.11
September	465	437	71	53	1026	10.01
October	355	296	87	43	781	7.62
November	307	184	101	69	661	6.45
December	352	178	52	77	659	6.43
January 2023	110	101	97	45	353	3.44
February	102	204	117	42	465	4.53
March	233	239	158	46	676	6.59
Total	4205 (41.03%)	3826 (37.33%)	1453 (14.17%)	764 (7.4%)		

Table 2: Month wise list of abundance of Zooplankton species (unit per litre) during Study in Pakki Pond, Purnea, Bihar.

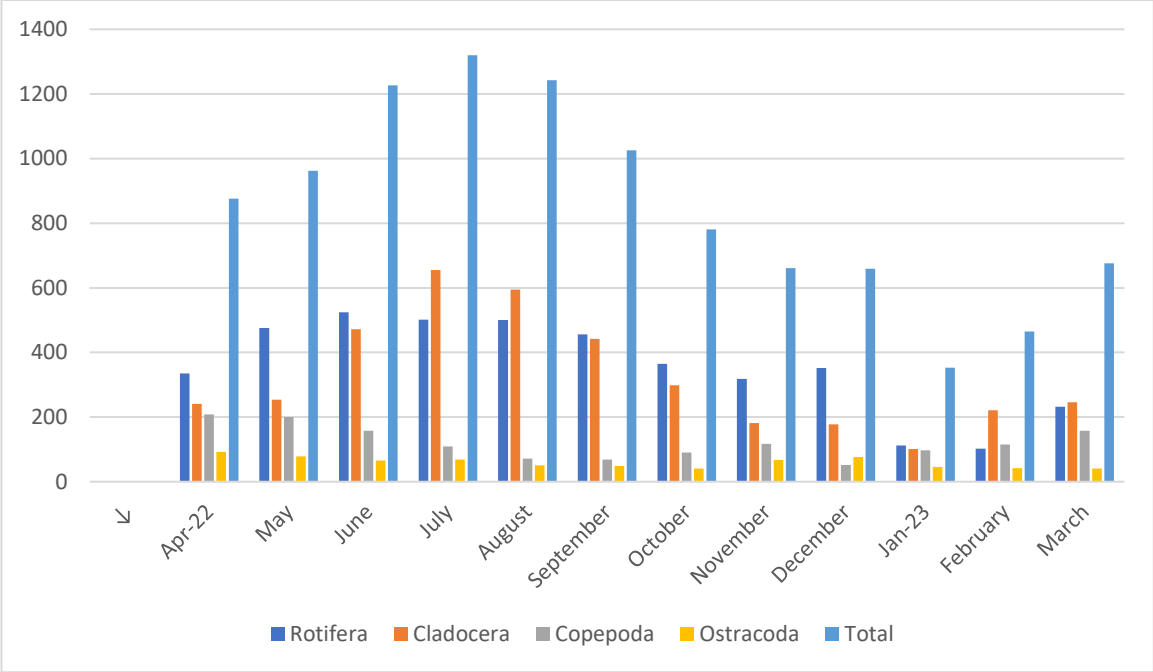

Fig 1: Graphical Representation ofMonth wise No of abundance of Zooplankton species (unit per litre) in Pakki pond of Purnea, Bihar.

INDICES	Rotifera	Cladocera	Copepoda	Ostracoda
Shannon's diversity index(H)	2.36	2.29	2.38	2.41
Species Evenness	0.94	0.91	0.97	0.96

Table 3: Table Shows Shannon's diversity index (H) and species evenness of Zooplanktons of Pakki pond of Purnea, Bihar.

The populations of Copepoda range from 52 to 208, whereas those of Cladocera range from 101 to 635 unit/l (Tab - 2), showing that Cladocera are quantitatively more prevalent than other zooplankton families in this pond. The number of rotifer-cladocera populations increased over the summer (April–June), and their densities ranged from 255–635 unit/l. Population patterns for rotifera, cladocera, and ostracoda in November and December all exhibited a decline in numbers.

Maximum Rotifera occupancy was 41.03% of the plankton population. Six species of Cladocera made up a second-highest percentage of the plankton population—37.33%. Ostracoda, which had two genera, accounted for at least 7.4% of the plankton population.

The Rotifera, Cladocera, Copepoda, and Ostracoda had Shannon's diversity indexes of 2.36, 2.39, 2.38, and 2.41, respectively, while the species evenness values were 0.94, 0.91, 0.97, and 0.96, respectively.

Zooplankton plays a crucial role in the transformation of plant food into animal food as well as serving as a source of food for higher organisms, especially in freshwater ecosystems. The surrounding environment has an impact on the accessibility and adaptation of zooplanktons in a wetland. Temperature, light, and pH are the three main factors that have a significant impact on zooplankton population in wetlands (Karuthapandi et al., 2012).

In the zooplankton community's four groups (Rotifera, Cladocera, Copepoda, and Ostracoda), rotifers showed a greater species abundance, which is comparable to the study of Karuthapandi et al., 2012. Most rotifers were present throughout the summer and monsoon seasons (July to September). In a perennial freshwater lake and reservoir in the Dharmapuri District of Tamil Nadu, India, 13 species of rotifera were found by Shivakumar and Altaff in 2004, Manickam et al. in 2012, and Manickam in 2014. The populations of these species peaked in the summer and declined during the monsoon. Water fleas are a member of the Cladocera genus, which is present in almost all freshwater habitats. These are an essential component of the aquatic food chain because they offer young and adult fishes, as well as prawn larvae, a nourishing diet.

According to Korovhinsky (1996), there are more than 600 species of freshwater cladocerans in the world.The cladocera population in this study had the second-highest population density (3896). In the earlier study, the highest population of cladocera was found in the summer, which can be attributed to the favorable temperature and the availability of favorable food, such as bacteria, nanoplankton, and suspended detritus. In contrast, during the monsoon, factors like water temperature, dissolved oxygen, turbidity, and transparency play a significant role in controlling cladocera diversity and density (Edmondson, 1996).

Copepoda are an essential component of the aquatic food chain. Between small and large organisms, as well as bacteria, algae, and protozoa, they are in the intermediate trophic level.

On the other (Manickam et al. 2015), plankton predators.Three species of copepods were found at Shahjangi Pond in Purnea, Bihar, India, as part of the current study. In this study, the copepoda population came in third in terms of the total number of individuals (1440), and their numbers peaked in the summer (158–203 units/l). According to Karmaker 2021's research, during the summer, rising temperatures caused more water to evaporate, which was followed by rich nutrients and an increase in the amount of zooplankton in the lake. However, during the monsoon due to pond dilution brought on by rains, zooplankton abundance decreased.

Ostracoda, also referred to as "mussel shrimp" or "seed shrimps," are tiny crustaceans. They inhabit a variety of aquatic environments, such as lakes, pools, streams, and particularly small, weedy, or algae-filled regions (Manickam et al. 2015). The population of the two ostracod species that were discovered in the current study peaked in the summer. The current study shows that water temperature might favourably boost zooplankton population variety because of the strong positive correlation between temperature and plankton density.

CONCLUSION

From the above study, the conclusion is that the Rotifers occupy a large space of the Zooplankton community in the Pakki pond of Purnea district of Bihar followed by Cladocera whereas Ostracoda is present in minimal quantity in this pond.

REFERENCES

- Alfred JRB, Thapa MP, 1996. Limnological investigations on Ward's Lake - A wetland in Shillong, Meghalaya, W. E. India. Rec. Zool. Surv. India. Occa. 169:1-125.
- Barraich OS and Sunil SK, 2015. Phytoplankton Abundance and Species Diversity in Ranjit Sagar Wetland, Punjab (India), Curr. World Environ., 10(1), 215-221.
- Baruah A, Singh DK, Sinha AK, Sharma UP, 1993. Plankton variability of a tropical wetland, Kawar Lake (Begusarai), Bihar. J. Freshwat. Biol. 5 (1): 27 -32.
- Das SK, 2002. Primary production and zooplankton biodiversity in brakish water shrimp culture pond. J. Ecobio. 14(4): 267 – 271.
- Datta NC, Mandal N and Bandyopadhyay BK, 1987. Seasonal abundance of Rotifer in a perennial freshwater pond in Calcutta. J. Environ. Biol., 8(1): 63-71.
- Edmondson WT, 1965. Reproductive rate of planktonic rotifers as related to food and temperature. Ecological Monographs; 35: 61–111.
- Karmakar S, 2021. Phytoplankton and Zooplankton Diversity and Water Quality Assessment of Three Ponds in Hooghly District (West Bengal, India), Research Square: 2: 1 22.
- Karuthapandi M, Innocent BX and Siddiqi SZ, 2012. Zooplankton in a temporary freshwater pond habitat, in Attapur, Hyderabad Andhra Pradesh, India, International Journal of Advanced Life Sciences (IJALS), Vol. 1.
- Khan RA, 2003. Faunal Diversity of Zooplankton in Freshwater wetlands of Southern W. B. Zool. Surv. India. Rec. 204: 1 –107.
- Korovhinsky NM, 1996. How many species of Cladocera are there? Hydrobiologia; 321: 191-204.
- Mahajan CL, 1981. Zooplankton as indicators for assessment of water pollution. In WHO sponsored workshop on Biological Indicators and Indices of Environmental Pollution. Cent. Bd. Prev. cont. Poll. / Osmania University, Hyderabad, India. 138 - 148.

- Manickam N, Bhavan PS, Santhanam P, Chitrarasu P, Jawahar AA, 2012. Zooplankton diversity in a perennial freshwater lake. Diversity and Physiological Processes: Ed. Desai PV, Roy Goa R, University. ISBN: 978-81 -908791 -3-2: 25-37.
- Manickam N, Bhavan PS, Santhanam P, Muralisankar T, Srinivasan V, Radhakrishnan S, Vijayadevan K, Chitrarasu P and Jawahar AA, 2014. Seasonal Variations of Zooplankton Diversity in a Perennial of Reservoir at Thoppaiyar, Dharmapuri District, South India. Austin Journal of Aquaculture and Marine Biologyand 1(1): 1-7.
- Mathivanan V and Jayakumar S, 1995. The studies on plankton fluctuation in a reservoir of Annamalainagar. Proceedings of the national symposium on recent trends in Indian wild liferesearch, AVC College, MayiladuthuraiTamilnadu, India.
- Nandi NC, Das SR, 2003. Diversity and population density of macrozoobenthos and zooplankton of south 24-Parganas district, West Bengal. J. Aquacult. Bio. 18 (1): 41 - 46.
- Nasar SAK, 1977. Investigations on the seasonal periodicity of zooplankton in a freshwater pond in Bhagalpur, India. ActaHydrochem. Hydrobiol., 5: 577-584.
- Patra A, Santra KB & Manna CK, 2011. Ecology and diversity of zooplankton in relation to physico-chemical characteristics of water of SantragachiJheel, West Bengal, India, Journal of Wetlands Ecology, (5): 20-39.
- Salaskar PB, Yeragi SG, 2003. Seasonal fluctuations of plankton population correlated with physico-chemical factors in Powai Lake, Mumbai, Maharastra. J. Aquat. Biol. 18(1): 19 - 22.
- Sanatham R, Velayutham P and Jegatheesan G, 1989. A Manual of Fresh water Ecology. Daya Publishing House Delhi: 1-109.
- Shilong, Meghalaya, W. E. India. Rec. Zool. Surv. India. Occa. Pap. 169: 1 - 125.
- Sinha RK, Sharma G, 2003. Faunal diversity of the river Sarda, Uttar Pradesh, India. J. Ecophysio. Occupl. Hlth. 3(1 - 2): 103 – 116.
- Sivakumar K and Altaff, 2004. Ecological indices of freshwater copepods and Cladocerans from Dharmapuri District, Tamilnadu, India. Zoo's Print Journal; 19 (5): 1466-1468.
- Tiwari TN and Ali MJ, 1987. Environ. Prot., 7, 347-351.
- Tiwari TN and Mishra M, 1986. Life Sci. Adv., 5, 130-137.