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A Study of Relationship Between Zooplanktonic Community & Physico Chemical Parameters of Water at Malsisar Dam in Jhunjhunun District of Rajasthan (India)

Jitendra Kumar[1], Leena Sharan[2], Pooja Kumari[3]

[1,2,3]Laboratory of Environmental Biology, P.G. Department of Zoology Govt. Dungar College Bikaner 334001 Rajasthan, India

ABSTRACT:

The purpose of this study was to investigate the presence of microalgae in an open artificial pond that served as a kind of freshwater environment. Scientists were able to positively identify one hundred different kinds of phytoplanktons at the Malsisar Dam, which is located in Jhunjhunun, Rajasthan. Sampling was conducted monthly from JANUARY 2024 to OCTOBER 2024 to assess species composition, abundance, and seasonal variations in relation to physicochemical parameters . A total of 39 zooplankton species were identified, belonging to four major groups: Rotifera (08 species), Protozoa (06 species), Arthropoda (24 species), and Annelida (01 species). Arthropoda dominated the community (55% of total abundance), followed by crustacea (41.66%), Insecta (20.83%), Copepoda (16.66%), Brachiopoda (8.33%), Ostracoda (8.33%) and Cladocera (4.16%). Additionally, variations in physicochemical parameters including as temperature, Sodium((Na^{+}), potassium(K^{+}), calcium(Ca^{++}), magnesium(Mg^{++}), chloride (Cl^{-}) , phosphate (Po_4^{-2}), bicarbonate (Hco_3^{-2}), nitrate (No_3^{-}), turbidity, alkalinity and hardness were monitored during the course of this research. It is impossible to find a resource on our planet that is more precious than water. Without water, it would be impossible for there to be life on earth. Since the beginning of time, municipalities have depended on ponds as a source of drinking water for their communities. for this reason, the objective of this study is to determine the salinity of the water that is contained inside the ponds that are located at the Malsisar Dam in Jhunjhunun, Rajasthan. The physicochemical characteristics of a body of water are what determine the quality of the water in that body. An examination of the seasonal variation in physicochemical parameters was carried out in the current study via the use of statistical analysis and graphical depiction. When compared to zooplankton populations, phytoplankton species were found to be more diverse and to have a better degree of success. Regarding the various physicochemical properties, the water in the Malsisar dam exhibited a wide range of variations across all three seasons, as shown by the findings. as a consequence of this, the elimination of water pollution calls for quick and essential action towards the implementation of a quality management procedure.

Keywords: Zooplankton, Malsisar Dam, Physico-chemical Parameters, Seasonal Variation , Jhunjhunun.

INTRODUCTION:

The construction of dams is an essential component of modern civilization. Dams are constructed for a wide variety of purposes, including flood control, electricity generating, drinking water supply, and irrigation, and their construction costs continue to rise. The damming of a river results in the formation of an artificial body of water known as a reservoir, which is also often referred to as a man-made lake.

This water body is the Malsisar Dam, which can be found in the Jhunjhunun district of Rajasthan. Dams and reservoirs, such as Malsisar, are not only necessary for human consumption, agriculture, and industry in regions where water scarcity is a continuous concern, but they also play a vital role in the preservation of the local biodiversity. Malsisar is an example of such a reservoir. It is vital to do study on the ecological health of these bodies of water, particularly with regard to the planktonic community, in order to get a more in-depth understanding of the water bodies' capability for sustainability and resilience. In aquatic ecosystems, the base of the food chain is comprised of plankton, which are comprised of microscopic organisms that are suspended in the water column. The term "zooplankton" originates from the Greek word "zoon," which means "animal." Zooplankton include protozoans or metazoans, such as crabs and other creatures, that consume other plankton. There are several eggs and larvae of bigger nektonic species that are included in this collection. These animals include fish, crabs, and annelids. Fungi and creatures that resemble fungi are included in the category of mycoplankton. Mycoplankton, like bacterioplankton, play an important role in the process of remineralization and the cycling of nutrients. Zooplankton are microscopic aquatic organisms that form a critical link in freshwater food webs, transferring energy from primary producers (phytoplankton) to higher trophic levels, such as fish. Their diversity and abundance are influenced by environmental factors, including temperature, pH, dissolved oxygen (DO), and nutrient availability, making them valuable bioindicators of ecosystem health. In semi-arid regions like Rajasthan, where water bodies are subject to extreme climatic conditions and anthropogenic pressures, understanding zooplankton dynamics is essential for ecological monitoring and management.

Malsisar Dam, located in Jhunjhunun District (27.88°N, 75.28°E), is a man-made reservoir constructed for irrigation and domestic water supply in a region characterized by low rainfall (average 450 mm annually) and high evaporation rates. Despite its utilitarian purpose, the dam supports a diverse aquatic ecosystem, yet it remains understudied compared to larger Rajasthan lakes like Pichhola or Fatehsagar. This study aims to fill this knowledge gap by documenting the zooplanktonic diversity of Malsisar Dam, assessing seasonal variations, and exploring the influence of physicochemical parameters.

Rajasthan’s water bodies exhibit unique ecological characteristics due to their arid setting, with zooplankton communities often dominated by resilient groups like Rotifera, which thrive in fluctuating conditions. Previous studies in the region (e.g., Sharma et al., 2007) have reported high rotifer abundance in eutrophic systems, suggesting that Malsisar Dam may follow similar patterns. However, localized factors such as agricultural runoff, seasonal water level changes, and sediment dynamics could shape its zooplankton assemblage differently.

Fig.-1 Malsisar dam

Fig-2. Masisar dam during Sampling

OBJECTIVES:

1. Characterize the seasonal variations in physico-chemical parameters of Malsisar Dam water.
2. Document the composition, density, and diversity of the zooplanktonic community across seasons.
3. Investigate the statistical relationships between zooplankton populations and key water quality variables.

MATERIAL AND METHODS:

The Malsisar dam, which is located in close proximity to the Jhunjhunun area, will serve as the location for the research. During the course of the dam, two research sites will be identified, and at regular intervals of one month, samples of water and biota will be collected from these study stations. A sample of water will be obtained from the littoral section of the body of water and placed in polythene bottles that have been appropriately labeled. The plankton net will be used for the collection of zooplankton. The use of formaldehyde and Lugol's solution as preservatives is going to be implemented. In order to conduct a chemical analysis of water, we shall conform to the standard analytical procedures that have been defined by the APHA – AWWA WPCF (1981). Na, K, Ca, and Mg are going to be investigated among the cations. The first two cations will be determined using flame photometry, and then two titrametrically among anions, bicarbonates, carbonates, chloride, and sulfates will be determined through titrametric analysis. Physical and chemical parameters, such as temperature, pH, total dissolved solids, dissolved oxygen, electrical conductivity, alkalinity, salinity, and hardness of the medium, will also be recorded in addition to ionic components. Through the use of a microscope, zooplankton will be recognized and counted. These will be identified in accordance with Edniondson (1966), Michael (1973), Needham & Needham (1978), and Tonapi (1980). The population density of both species of plankton will be determined when the number one has been reached. In order to verify that there is a link between the ionic components and other parameters and the planktonic composition and population dynamics, a statistical analysis of the data will be performed, specifically with the application of correlation.

RESULTS AND DISCUSSION:

Table -1 provides data on physico-chemical parameters of water of Malsisar dam . Minimum water temperature was noted during January (23.5 ^{o} C) and maximum during May (29.2 ^{o}C). The pond water wa alkaline with pH ranging between 7.5 to 8.3 . the electrical conductance of water ranged

from 172.80 micro mhos/cm. to 372.42 micro mhos/cm. it was constantly low during monsoon season and high in summer season . the dissolved oxygen content varied between 6.92 mg./lit. to 8.78 mg./lit. that is high during January month and low during march month. the Total Dissolved Solid (TDS) ranged from 78.14 to 125.34 during study.

during this study also assess some cations and anions from January 2024 to October 2024 , they are following-

Sr. No.	Elecrolytes	Maximum Range with month (mgm./lit)	Minimum Range with month (mgm./lit)
01.	Sodium (Na^+)	5.80 (September)	2.48 (January)
02.	Pottasium (K^+)	0.91 (May)	0.48 (June)
03.	Calcium (Ca^+)	68.0 (April)	41.0 (March)
04.	Mgnissium (Mg^{++})	22.0 (May)	8.9 (July)
05.	Chloride (Cl^-)	118.30 (July)	58.30 (September)
06.	Nitrate (NO_3^-)	9.0 (October)	4.48 (June)
07.	Bicarbonate (HCo_3^-)	312 (October)	206 (January)

ZOOPLANKTON COMMUNITY:

Table 2 represents the abundance and distribution of zooplankton is guarded by a variety of ecological factors. However limnological parameters are extremely variable from time to time. In such conditions it is rather difficult to draw specific illusions about their individual effects of these parameters on population densities of zooplankton. But it can be expressed in general that the fluctuation patterns of physico- chemical conditions of water effects the distribution of zooplanktons. The zooplanktons, which are the most important trophic link, are the organisms that connect the upper trophic levels and the primary producers to one another. There are many different kinds of algae that are included in the category of freshwater zooplankton rotifers, copepods, ostracods, arthropoda , annelida and protozoa. An extensive number of different types of zooplankton may be found in the Malsisar Dam, which is located in the Jhunjhunun region of Rajasthan, as shown by the results of the contemporary study. A total of 39 zooplankton species were identified, belonging to four major groups: Rotifera (08 species), Protozoa (06 species), Arthropoda (24 species), and Annelida (01 species). Arthropoda dominated the community (55% of total abundance), followed by crustacea (41.66%), Insecta (20.83%), Copepoda (16.66%), Brachiopoda (8.33%), Ostracoda (8.33%) and Cladocera (4.16%).

Table- 1: Physico-chemical parameters of water of Malsisar dam, jhunjhunun during January-2024 to October-2024

Sr. No.	Vriable	Jan. 2024	Feb. 2024	Mar. 2024	Apr. 2024	May 2024	June 2024	July 2024	Aug. 2024	Sep. 2024	Oct. 2024

1.	**Depth** (ft.)	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20
2.	**Transperancy** (cm.)	45.72	45.50	41.33	40.30	38.31	37.40	40.50	39.50	44.31	45.30
3.	**Atmospheric Temperature** (^{0}C)	25.5	29.1	37.0	36.5	37.5	38.2	34.2	30.0	31.2	29.5
4.	**Water Temperature** (^{0}C)	23.5	23.7	24.8	28.5	29.2	26.5	25.3	27.5	28.2	26.5
5.	**pH of water**	8.4	8.1	7.9	7.5	8.3	8.0	8.1	8.0	8.0	8.1
6.	**EC** (micro mhos/cm.)	264.54	263.77	371.42	372.42	371.59	371.66	174.30	176.57	172.80	189.40
7.	**TDS**	93.57	95.60	102.55	120.50	125.34	101.59	116.90	79.44	78.14	90.17
8.	**Dissolved Oxygen** (mg/l)	8.78	8.01	6.92	7.13	7.39	7.46	7.58	7.38	7.46	8.03
9.	**Alkalinity** (mg/l)	224	216	198	192	219	207	217	201	200	209
10.	**Total Hardness** (mg/l)	154.78	157.40	161.42	169.23	172.54	170.56	172.11	178.31	112.40	140.20
11.	**Sodium** (mg/l)	2.48	3.10	3.68	4.10	3.80	5.60	4.80	4.53	5.80	3.46
12.	**Potassium** (mg/l)	0.86	0.61	0.68	0.86	0.91	0.48	0.56	0.82	0.91	0.77
13.	**Calcium** (mg/l)	66	51	41	68	56	44	49	51	67	61
14.	**Magnisium** (mg/l)	17.3	16.2	18.0	19.7	22.0	14.7	8.9	13.7	14.0	16.8
15.	**Chloride** (mg/l)	67.0	89.0	98.30	112.1	113.67	99.30	118.30	68.30	58.30	110.80
16.	**Nitrate** (mg/l)	7.31	9.0	8.50	7.47	6.46	4.48	6.58	6.0	8.50	9.0
17.	**Phosphate** (mg/l)	0.0001	0.0001	0.0004	0.0002	0.0001	0.0007	0.0004	0.0002	0.0004	0.0001
18.	**Bicarbonate** (mg/l)	206	246	248	286	301	304	208	209	296	312

Table-2 - Abundance of Zooplankton species (No./Lit.) of Malsisar dam, Jhunjhunun From January-2024 to October-2024

Sr.no.	GROUPS	SPECIES	Jan. 2024	Feb. 2024	Mar. 2024	Apr.2024	May 2024	June 2024	July 2024	Aug2024	Sep. 2024	Oct. 2024
A.	PROTOZOA	*Paramicium caudatum*	01	05	02	01	01	04	05	08	36	09
		Vorticella campanulla	01	04	00	02	01	01	01	12	18	08
		Oxytricha ovalis	00	01	00	00	00	01	01	02	01	05
		Trachelius ovum	00	02	03	00	00	02	02	01	00	01
		Lacrymaria olor	00	01	00	01	01	00	02	00	01	00
		Ophryoglena flava	00	00	00	00	01	00	00	01	00	01
B.	ROTIFERS	*Brachionus calcyflorus*	01	01	01	01	01	00	00	01	01	02
		Brachionus forficula	01	01	01	00	00	00	02	00	01	03
		Kertella tropica	00	00	00	00	00	00	00	00	00	00
		Notholca spp.	00	01	00	00	00	00	04	00	00	02
		Lacane spp.	00	00	01	00	00	00	00	00	00	01
		Monostylla bulla	00	00	00	00	00	00	00	00	01	00
		Scaridium longicaudum	00	01	00	00	01	00	00	00	00	01

C.	**ANNELIDA**	***Tubifex (benthos)***	**01**	**01**	**00**	**00**	**00**	**00**	**02**	**01**	**02**	**03**
D.	**ARTHROPODA 1.INSECTA**											
		Chironomous	**00**	**00**	**01**	**00**	**12**	**22**	**28**	**02**	**01**	**00**
		Agabus	**00**	**00**	**00**	**00**	**04**	**06**	**04**	**01**	**00**	**00**
		Cullicoids	**00**	**00**	**00**	**00**	**05**	**02**	**00**	**00**	**00**	**04**
		Stone fly	**00**	**00**	**00**	**00**	**09**	**09**	**12**	**03**	**01**	**00**
		Tendipes	**00**	**00**	**00**	**00**	**06**	**02**	**00**	**00**	**00**	**01**
	2.CRUSTACEA	***Straptocephalous dicotomus***	**00**	**00**	**00**	**00**	**00**	**01**	**02**	**01**	**01**	**01**
		Trios longicaudatous	**00**	**00**	**00**	**00**	**00**	**00**	**02**	**00**	**00**	**01**
		Daphnia carinata	**00**	**00**	**00**	**00**	**00**	**04**	**04**	**01**	**01**	**04**
		Nuplius larva	**00**	**00**	**01**	**01**	**01**	**03**	**07**	**02**	**01**	**06**
		Ostracoda	**00**	**00**	**00**	**00**	**00**	**00**	**02**	**00**	**00**	**00**
		Heliodiapotomus viddus	**00**	**00**	**04**	**00**	**03**	**00**	**01**	**00**	**02**	**00**
		Phyllodiaptomus annae	**00**	**01**	**00**	**00**	**00**	**00**	**01**	**00**	**05**	**04**
		heterocypris	**01**	**00**	**00**	**00**	**01**	**01**	**01**	**00**	**00**	**00**
		Mesocyclops lukert	**00**	**01**	**00**	**00**	**00**	**00**	**01**	**02**	**00**	**02**
		Mesocyclops hyalinus	**00**	**00**	**00**	**03**	**00**	**00**	**01**	**00**	**00**	**01**
	3.BRANCHIOPODA	***Ceriodaphnia reticulate***	**00**	**06**	**04**	**01**	**00**	**00**	**00**	**04**	**01**	**00**
		eubranchiopus	**00**	**02**	**03**	**01**	**00**	**00**	**00**	**02**	**03**	**00**
		Cypris	**01**	**00**	**00**	**08**	**05**	**01**	**00**	**00**	**00**	**04**

	4.OSTRACODA	***Eucypris spp.***	**00**	**00**	**00**	**10**	**01**	**01**	**00**	**00**	**01**	**02**
	5.CLADOCERA	***Daphnia spp.***	**24**	**01**	**00**	**00**	**00**	**00**	**01**	**03**	**01**	**12**
	6.COPEPOD	***Cyclops varicans***	**04**	**03**	**01**	**00**	**00**	**05**	**31**	**18**	**36**	**22**
		Diptomus	**02**	**04**	**00**	**00**	**00**	**04**	**12**	**05**	**10**	**04**
		Eucyclops	**00**	**00**	**00**	**00**	**00**	**02**	**02**	**06**	**09**	**00**
		Mesocyclops leukarti	**00**	**01**	**00**	**00**	**00**	**05**	**04**	**09**	**03**	**00**
	TOTAL NUMBER OF ZOOPLANKTONS		**37**	**37**	**22**	**29**	**53**	**76**	**129**	**84**	**137**	**100**

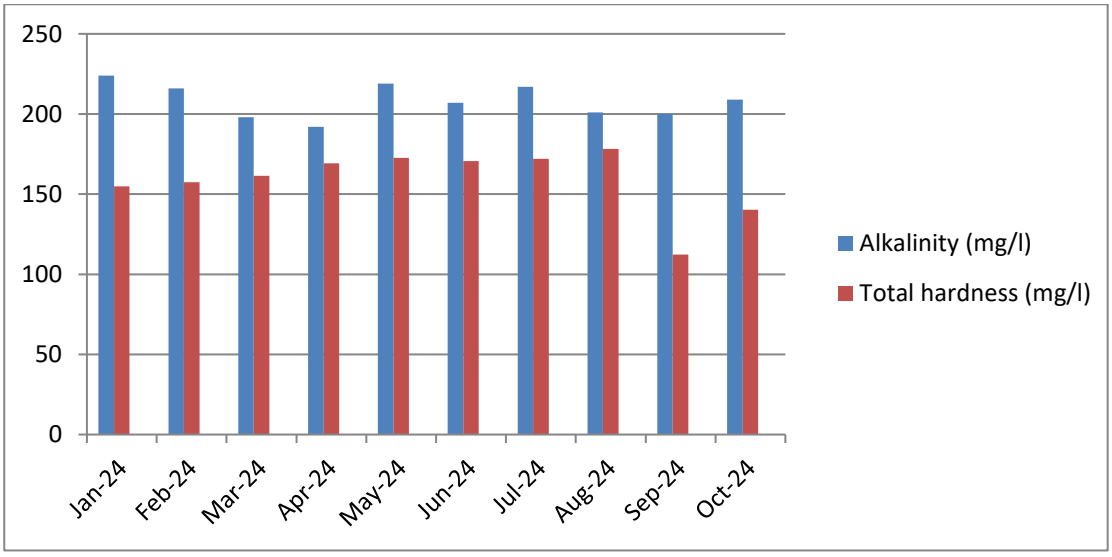

Fig. 3 : Monthly variation in Alkalinity and Total Hardness

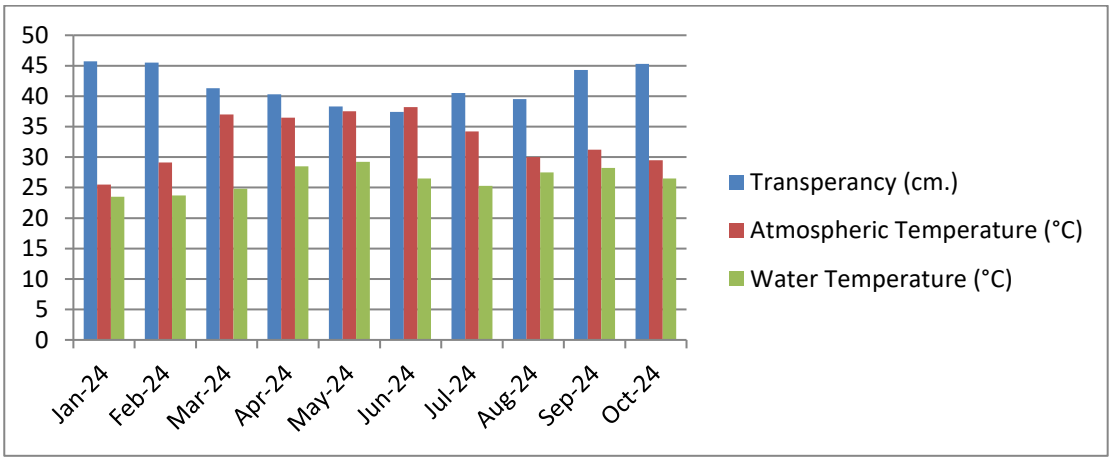

Fig. 4 : Monthly variation in Transperancy and Temperature

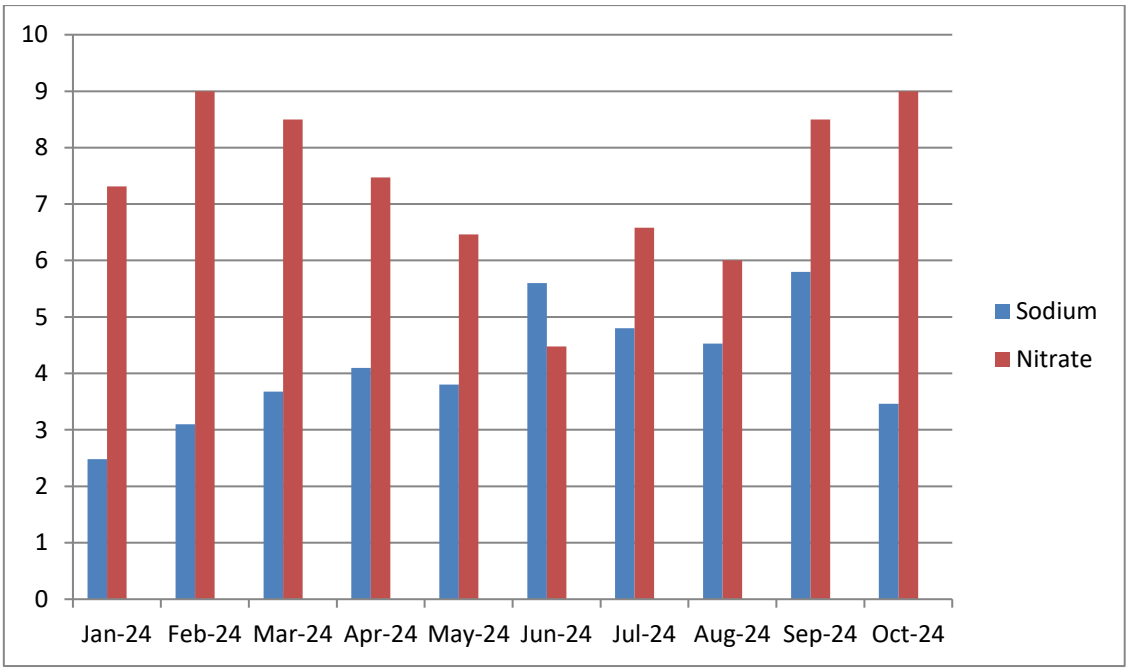

Fig. 5 : Monthly variation in Sodium and Nitrate concentration of water

CONCLUSION:

This study illuminates the intricate relationship between the zooplanktonic community and physico-chemical parameters of water at Malsisar Dam, Jhunjhunu District, Rajasthan, revealing the dam's ecological dynamics in a semi-arid context. The monthly analysis from January 2024 to October 2024 demonstrates that zooplankton composition and abundance are strongly governed by environmental variables such as temperature, dissolved oxygen, and nutrient concentrations. study on Malsisar dam exhibit Arthropods and Rotifers are important group of Zooplanktons which is Dominated throughout the study period can be considerd as a valuable component of fresh water ecosystem. Rotifera's dominance in warmer, nutrient-rich summer waters, contrasted with the prevalence of Cladocera and Copepoda in oxygen-rich post-monsoon and winter periods, underscores the adaptability of these organisms to fluctuating conditions. Statistical correlations and multivariate analyses further confirm that these physico-chemical factors are not merely background variables but active drivers of zooplankton ecology, shaping community structure and biodiversity. The findings carry significant implications for Malsisar Dam's management. As a critical water resource in an arid region, the dam's health is reflected in its zooplankton, which signal shifts in water quality that could affect higher trophic levels and human uses like drinking , irrigation and fisheries.

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