

ORIGINAL ARTICLE

Zooplankton Diversity and Physicochemical Parameters of
Narsinh Mehta and Sudarshan Pond

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ABSTRACT

A study on diversity of Zooplankton was carried out at two ponds of Junagadh. Samples were collected every month throughout the study period. In this study 19 species of Zooplankton were identified. Species belongs to five groups i.e., Protozoa, Rotifera, Cladocera, Copepoda and Ostracoda of zooplankton communities. From Narsinh Mehta Pond 14 Zooplankton species were recorded and from Sudarshan pond 16 Zooplankton species were recorded. The physico-chemical parameters were considered as major factors for understanding the trophic dynamics of the water body and in study of limnology. Zooplankton community are important because they play important role in trophic dynamics, cycling of nutrients and energy transfer in the aquatic ecosystem. The knowledge about Zooplankton abundance, their species diversity and distribution are important in understanding trophodynamics of water bodies.

Key words: Cladocera, Copepoda, Ostracoda, Rotifera, Zooplankton, Physicochemical parameters.

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INTRODUCTION

Aquatic system is the most diverse ecosystem within the world that has rivers, streams, ponds, lakes, oceans, bays, swamps, marshes and their associated organisms. All these water bodies are the repository of typical biological wealth which are yet to be fully explored [1]. Water is the most vital factor for the existence of all living organisms. Freshwater habitat has played an imperative role for human civilization and massive ecological usefulness for livelihood in all the continents of the world [2]. Due to increasing human population more land area covered in Agriculture and more industries established so, the pressure on the water bodies has increased and with passage of time, humans felt the need to conserve water as water would be insufficient during the dry seasons [3]. Overall process of evaluation physical, chemical and biological nature of water in relation to the natural quality, human effects and intended uses, particularly the uses which may affect human health and health of aquatic ecosystem itself is termed as water quality assessment as described by [4]. Hydrobiology of wetland water provides an idea about physical and chemical properties of water and their relationship with ecosystem diversity [5]. India is facing a serious problem of natural resource scarcity, especially that of water in view of population growth and economic development i.e., Agriculture and industrial application. Therefore, studies related to sustainable development and conservation need to be carried out. A reliable and safe water supply is the basic requirement for development and stability of world [6]. As water supports life on earth and around which the entire fabric of life is woven so Water is prime necessity and an elixir of life; because of most of the biological reaction uses water as medium. It governs the evolution and function of the universe on earth Phytoplankton and zooplankton are the basic component of the aquatic ecosystem [7]. The term plankton describe as microscopic aquatic forms having little or no resistance to currents and living free-floating, swim with mercy of currents and are unable to swim against currents and suspended in natural waters [8] [9] [10]. Planktonic plants known as phytoplankton and planktonic animals known as zooplankton are covered in this section. In freshwater zooplankton comprise principally protozoans, rotifers, cladocerans, and copepods according to [8]. Phytoplankton are important because they're the chief primary producers

of an aquatic environment which fix solar energy by the process of photosynthesis by assimilating carbon dioxide and water to produce carbohydrates [11]. Zooplankton play significant role in Lake food web due to their central position in food webs, can strongly affect water quality, algal densities, fish production, and nutrient and contaminant cycling (<https://www.iisd.org/articles/zooplankton-and-fresh-water>). Additionally, attributable to their crucial role as a food supply for larval and juvenile fish, the dynamics of zooplankton populations have a significant influence on recruitment to fish stocks [12]. The Study of zooplankton is important for perceive the ecological status of the biota of any water reservoir marine, estuary and fresh water [13]. Most of Zooplankton depends to a large extent on various phytoplankton for food in absence of phytoplankton feed on bacterioplankton. Many of the larger forms feed on smaller zooplankton some are detritivore feeder like Ostracods. Zooplankton study is important as it could provide ways to predict the productivity of fresh water aquatic system [14]. Physicochemical property of an aquatic ecosystem is important because fluctuation in the water quality have an influence on the biotic communities.

MATERIAL AND METHODS

STUDY AREA

Junagadh has acquired an important place in tourist map of Gujarat. Junagadh is located at 21.52°N 70.47°E (<https://junagadh.nic.in/about-district/>). Two Pond of Junagadh city selected for study one is Narsinh Mehta Pond and Sudarshan Pond. Narsinh Maheta pond is located near State Transport bus Station. Narsinh Mehta Pond has public park "Shahid Park" and habitat for fishes and various migratory birds. Sudarshan pond is located behind Bhavnath Temple in Girnar hills it provides important water source to wild animals.

SAMPLE COLLECTION

Sample collection points were selected from Narsinh Mehta Pond and Sudarshan Pond. Specific GPS locations were 21°30'45"N 70°27'16"E for Narsinh Mehta Pond and 21°31'30"N 70°30'11"E for Sudarshan Pond. Water samples were collected for physicochemical test. Dissolved oxygen fixations were done at the sampling sites, while other parameters were analyzed in the laboratory. During the study period, total seven Parameters of these collected water Samples were analyzed. These parameters are pH, TS, TDS, TSS, DO, BOD, Total Hardness. Analytical procedures for all water quality parameters were as per APHA [8]. The zooplankton samples were collected from surface water by filtering water through Nylon plankton Net (conical shape), mesh size of 60 µm.

STUDY OF SEASONAL ABUNDANCE OF ZOOPLANKTONS IN WATER OF NARSINH MEHTA POND AND SUDARSHAN POND

Zooplanktons were identified with the help of various zooplankton identification manuals: [15] [16] [17] [18] [19] [20][21][22][23]. The samples were analyzed qualitatively under the Compound microscope and Light microscope for the study of diverse types of zooplanktons [10]. Samples were preserved immediately with the help of formalin in which hardy species were preserved. Members from few other groups like Rotifers etc., preservation, change their morphological features considerably suggesting their observation to be living condition and the qualitative and quantitative analysis of zooplankton was done by using by lackey's drop method [7].



Figure 1 Map of India



Figure 2 Map of Gujarat



Figure 3 Map of Junagadh



Figure 4 Sundarshan Lake



Figure 5 Narsinh Mehta Lake

Selected site location (Source: Google earth retrieved on 29th December 2021)

RESULTS

Table 1 physicochemical parameters of Narsinh Mehta Pond

	pH	TS	TDS	TSS	Hardness	DO	BOD
	mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg /L
Oct 2020	6.5	768	315	453	104	5.3	4.8
Nov 2020	6.93	771	328	443	176	5.8	4.5
Dec 2020	7.24	842	375	467	166	4.5	3.3
Jan 2021	7.72	833	430	403	216	5	3.2
Feb 2021	8.37	828	441	387	212	5.5	4.2
Mar 2021	8.6	840	475	365	190	5	4.5
Mean (X)	7.56	813.66	394	419.66	177.33	5.18	4.08
SD	0.822	34.587	64.844	40.569	40.903	0.4535	0.673

Table 2 Correlation between physicochemical parameters of Narsinh Mehta Pond

parameters	pH	TS	TDS	TSS	Hardness	DO	BOD
pH	0						
TS	0.761	0					
TDS	0.972	0.837	0				
TSS	-0.905	-0.485	-0.885	0			
Hardness	0.770	0.659	0.765	-0.661	0		
DO	-0.138	-0.699	-0.296	-0.123	-0.001	0	
BOD	-0.139	-0.662	-0.283	-0.112	-0.501	0.654	0

Table 3 physicochemical parameters of Sudarshan Pond

	pH mg /L	TS mg /L	TDS mg /L	TSS mg /L	Hardness mg /L	DO mg /L	BOD mg /L
Oct 2020	7.2	598	233	365	138	8.1	1.5
Nov 2020	7.44	635	253	382	196	7.6	1.8
Dec 2020	8.09	614	269	345	204	6.5	2
Jan 2021	8.01	610	297	313	212	6.2	1.3
Feb 2021	8.15	630	307	323	230	6	1.6
Mar 2021	8.34	645	395	250	286	5.5	2.1
Mean(X)	7.87	622	292.33	329.66	211	6.65	1.72
SD	0.447	17.584	57.252	46.671	48.145	0.997	0.306

Table 4 Correlation between physicochemical parameters of Sudarshan Pond

Parameter	pH	TS	TDS	TSS	Hardness	DO	BOD
pH	0						
TS	0.511	0					
TDS	0.816	0.699	0				
TSS	-0.809	-0.481	-0.963	0			
Hardness	0.877	0.822	0.948	-0.853	0		
DO	-0.985	-0.542	-0.874	0.868	-0.908	0	
BOD	0.381	0.628	0.441	-0.305	0.525	-0.298	0

The average pH of Narsinh Mehta Pond and Sudarshan Pond was 7.56 and 7.87, respectively (Table 1, 2). The average TS of Narsinh Mehta Pond and Sudarshan Pond was 813.66 and 622, respectively. The average TDS of Narsinh Mehta Pond and Sudarshan Pond was 394 and 292.33, respectively. The average Hardness of Narsinh Mehta Pond and Sudarshan Pond was 177.33 and 211, respectively. The average DO of Narsinh Mehta Pond and Sudarshan Pond was 5.18 and 6.65, respectively. The average BOD of Narsinh Mehta Pond and Sudarshan Pond was 4.08 and 1.71, respectively (Table 3, 4).

Table 5 List of Zooplankton observed at both sites*

Group	Family	Genus	Species
Protozoa (Georg August Goldfuss, 1818)	Parameciidae (Dujardin, 1840)	<i>Paramecium</i> (Muller, 1773)	<i>Paramecium bursaria</i> (Ehrenberg, 1831) Focke, 1836
	Vorticellidae (Ehrenberg, 1838)	<i>Vorticella</i> (Linnaeus, 1767)	<i>Vorticella campanula</i> (Ehrenberg, 1831)
	Euglenaceae (Dujardin 1841)	<i>Euglena</i> (Ehrenberg, 1830)	<i>Euglena viridis</i> (O.F. Müller) Ehrenberg, 1830
Rotifera (Cuvier, 1817)	Brachionidae (Wesenberg - Lund, 1899)	<i>Brachionus</i> (Pallas, 1766)	<i>Brachionus calyciflorus</i> (Pallas, 1766)
			<i>Brachionus caudatus</i> (Barrois and Daday, 1894) Sub species: <i>Brachionus caudatus aculeatus</i> (Hauer, 1937)
			<i>Brachionus falcatus</i> (Zacharias, 1898)
			<i>Brachionus diversicornis</i> (Daday, 1883)
	Keratella (Bory de St. Vincent, 1822)	<i>Keratella</i> (Bory de St. Vincent, 1822)	<i>Keratella quadrats</i> (Muller, 1786)
			<i>Keratella tropica</i> (Apstein, 1907)
	Synchaetidae (Remane, 1933)	<i>Polyarthra</i> (Ehrenberg, 1834)	<i>Polyarthra vulgaris</i> (Carlin, 1843)
Asplanchnidae (Harring and Myer, 1926)	<i>Asplanchna</i> (Gosse, 1850)	<i>Asplanchna herrickii</i> (De Guerne, 1888)	

	Filiniidae (Bartos, 1959)	<i>Filinia</i> (Bory de St. Vincent, 1824)	<i>Filinia longiseta</i> (Ehrenberg, 1834)
Copepoda (H. Milne Edwards, 1840)	Diaptomidae (Baird, 1850)	<i>Heliodiaptomus</i> (Kiefer, 1932)	<i>Heliodiaptomus viduus</i> (Gurney, 1916)
	Paracalanidae (Giesbrecht, 1893)	<i>Acrocalanus</i> (Giesbrecht, 1888)	<i>Acrocalanus gibber</i> (Giesbrecht, 1888)
	Cyclopidae (Rafinesque, 1815)	<i>Tropocyclops</i> (Kiefer, 1929)	<i>Tropocyclops prasinus prasinus</i> (Fischer, 1860)
Cladocera (S. Str.) Latreille, 1829	Sididae (Baird, 1850)	<i>Diaphanosoma</i> (Fischer, 1850)	<i>Diaphanosoma Senegal</i> (Gauthier, 1951)
	Daphniidae (Straus, 1820)	<i>Ceriodaphnia</i> (Dana, 1853)	<i>Ceriodaphnia sp.</i>
Ostracoda Latreille, 1806	Cyprididae (Baird, 1845)	<i>Stenocypris</i> (Sars, 1889)	<i>Stenocypris major major</i> (Baird, 1859)

*(Source:[24] [25] [26] [27])

Table - 6 Relative abundance of Zooplankton observed in Narsinh Mehta Pond									
Relative abundance of Zooplankton observed in Narsinh Mehta Pond									
Zooplankton species	Abundance in no./ml of Six Months						TOTAL	Mean	% of abundance
	Oct	Nov	Dec	Jan	Feb	Mar			
Protozoa species									
<i>Paramecium bursaria</i>	5	4	6	5	9	14	43	7.17	18.14
<i>Vorticella campanula</i>	5	9	4	7	10	12	47	7.83	19.83
TOTAL PROTOZOA	10	13	10	12	19	26	90	15	37.97
Rotifera species									
<i>Brachionus calyciflorus</i>	2	0	4	5	3	6	20	3.33	8.44
<i>Brachionus caudatus aculeatus</i>	1	0	2	4	3	0	10	1.67	4.22
<i>Keratella tropica</i>	3	2	4	3	5	10	27	4.5	11.39
<i>Polyarthra vulgaris</i>	1	0	0	0	3	2	6	1	2.53
<i>Filinia longiseta</i>	0	2	4	0	3	0	9	1.5	3.8
TOTAL ROTIFERA	7	4	14	12	17	18	72	12	30.38
Copepoda species									
<i>Heliodiaptomus viduus</i>	0	0	1	0	2	3	6	1	2.53
<i>Tropocyclops prasinus prasinus</i>	0	2	0	3	7	5	17	2.83	7.17
<i>Acrocalanus gibber</i>	0	0	2	1	3	0	6	1	2.53
Copepod nauplii	3	4	5	4	10	4	30	5	12.66
TOTAL COPEPODA	3	6	8	8	22	12	59	9.83	24.89
Cladocera species									
<i>Diaphanosoma senegal</i>	0	0	1	0	3	0	4	0.67	1.69
<i>Ceriodaphnia sp.</i>	0	0	0	0	2	1	3	0.5	1.26
TOTAL CLADOCERA	0	0	1	0	5	1	7	1.17	2.95
Ostracoda species									
<i>Stenocypris major major</i>	0	0	0	0	1	8	9	1.5	3.8
TOTAL OSTRACODA	0	0	0	0	1	8	9	1.5	3.8
Total Zooplankton	20	23	33	32	64	65	237	39.5	100

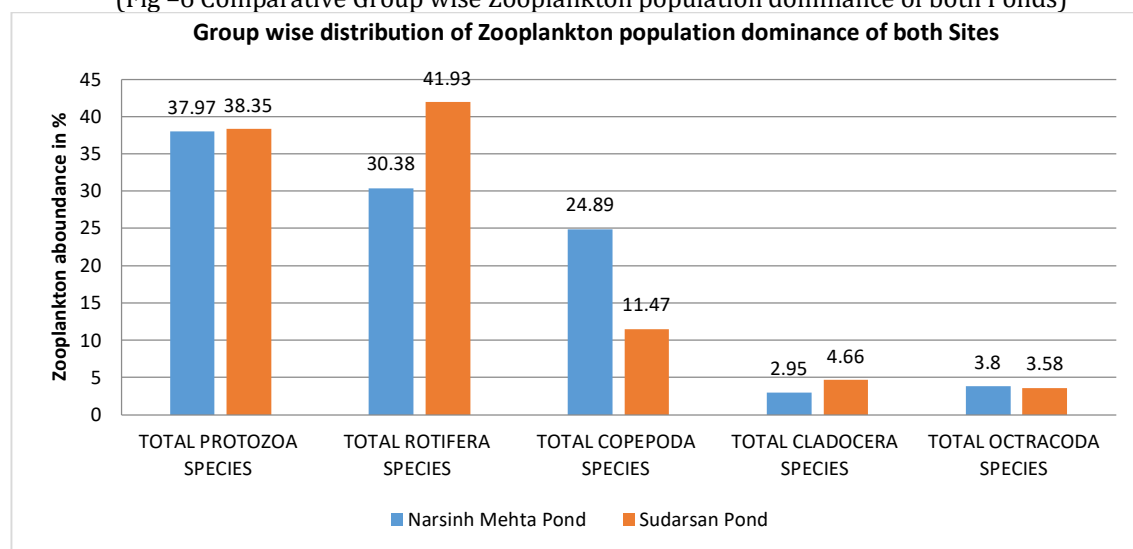
Total 14 species of zooplankton were observed in Narsinh Mehta Pond and total 237 individual were observed among them Protozoa- 90, Rotifera- 72, Copepoda- 59, Cladocera -7, Ostracoda- 9. There was highest 65 individual in March among them highest species were 26 Protozoa, 18 Rotifera, 12 Copepoda, 8 Ostracoda, 1 Cladocera. Lowest 20 individual of the zooplankton were observed in October. The total zooplankton population was dominated by 37.97% protozoa, 30.38% rotifers, copepod 24.89%, cladocera 2.95% and ostracoda 3.8% in Narsinh Mehta Pond. Among the zooplankton protozoa was the dominant group Narsinh Mehta Pond.

In Narsinh Mehta Pond species *Vorticella campanula* (20%) showed highest abundance and lowest abundance showed by 1% of *Ceriodaphnia sp* (Table 6).

Table - 7 Relative abundance of Zooplankton observed in Sudarshan Pond									
Relative abundance of Zooplankton observed in Sudarshan Pond									
Name of Zooplankton Species	Abundance in no./ml of Six Months						TOTAL	Mean	% of abundance
	Oct	Nov	Dec	Jan	Feb	Mar			
Protozoa species									
<i>Paramecium bursaria</i>	6	3	5	6	3	7	30	5	10.75
<i>Vorticella campanula</i>	8	8	6	11	9	14	56	9.33	20.07
<i>Euglena viridis</i>	2	6	0	5	0	8	21	3.5	7.53
TOTAL PROTOZOA	16	17	11	22	12	29	107	17.83	38.35
Rotifera species									
<i>Brachionus calyciflorus</i>	0	2	5	0	6	3	16	2.67	5.73
<i>Brachionus diversicornis</i>	1	0	2	3	5	9	20	3.33	7.17
<i>Brachionus falcatus</i>	2	4	0	5	10	5	26	4.33	9.32
<i>Keratella tropica</i>	4	6	4	0	9	13	36	6	12.90
<i>Keratella quadrats</i>	0	2	3	1	0	2	8	1.33	2.87
<i>Asplanchna herrickii</i>	1	0	0	2	0	3	6	1	2.15
<i>Polyarthra vulgaris</i>	0	0	2	0	3	0	5	0.83	1.79
TOTAL ROTIFERA	8	14	16	11	33	35	117	19.5	41.93
Copepoda species									
<i>Heliodiaptomus viduus</i>	0	0	2	1	0	3	6	1	2.15
<i>Tropocyclops prasinus prasinus</i>	1	1	0	0	3	7	12	2	4.30
<i>Acrocalanus gibber</i>	0	1	2	0	1	3	7	1.17	2.51
Copepod nauplii	0	0	4	0	3	0	7	1.17	2.51
TOTAL COPEPODA	1	2	8	1	7	13	32	5.33	11.47
Cladocera species									
<i>Ceriodaphnia sp.</i>	2	5	0	0	2	4	13	2.17	4.66
TOTAL CLADOCERA	2	5	0	0	2	4	13	2.17	4.66
Ostracoda species									
<i>Stenocypris major major</i>	0	0	0	0	2	8	10	1.67	3.58
TOTAL OSTRACODA	0	0	0	0	2	8	10	1.67	3.58
Total Zooplankton	27	38	35	34	56	89	279	46.5	100

Total 16 species of zooplankton were observed in Sudarshan Pond and total 279 individual were observed among them Protozoa- 107, Rotifera- 117, Copepoda- 32, Cladocera -13, Ostracoda- 10. There were highest 89 individual in March among them highest species were 35 Rotifera, 29 Protozoa, 13 Copepoda, 8 Ostracoda, 4 Cladocera. Lowest 27 individual of the zooplankton were observed in October. The total zooplankton population was dominated by 41.93% rotifers, 38.35% protozoa, 11.47% copepod, 4.66% cladocera and 3.58% ostracoda in Sudarshan Pond. In Sudarshan Pond species *Vorticella campanula* (20%) showed highest abundance and lowest abundance 3% showed by of 2 species of Rotifera (*Asplanchna herrickii*, *Polyarthra vulgaris*) and 1 species of Copepoda (*Heliodiaptomus viduus*) (Table 7).

(Fig –6 Comparative Group wise Zooplankton population dominance of both Ponds)



In

Narsinh Mehta Pond copepod species (24.89%) abundance recorded higher than Sudarshan Pond copepod species (11.47%) whereas in Sudarshan Pond rotifera species (41.93%) abundance recorded higher than Narsinh Mehta Pond rotifera species (30.38%). Maximum abundance recorded by Sudarshan Pond rotifera species (41.93%) whereas minimum abundance recorded by Narsinh Mehta Pond cladocera species (2.95%).

Study revealed the order of zooplankton dominance in terms of species richness in pond water is Protozoa> Rotifera> Copepoda> Cladocera> Ostracoda for Narsinh Mehta Pond and Rotifera> Protozoa> Copepoda> Cladocera> Ostracoda for Sudarshan Pond (Fig 6).

Table - 8 Comparative Zooplankton diversity of Narsinh Mehta Pond and Sudarshan Pond		
Zooplankton Species	Narsinh Mehta Pond	Sudarshan Pond
PROTOZOA SPECIES		
<i>Paramecium bursaria</i> (Ehrenberg, 1831) Focke, 1836	+	-
<i>Vorticella campanula</i> Ehrenberg, 1831	+	+
<i>Euglena viridis</i> (Muller O. F) Ehrenberg, 1830	-	+
ROTIFERA SPECIES		
<i>Brachionus calyciflorus</i> Pallas, 1766	+	+
<i>Brachionus caudatus aculeatus</i> (Hauer, 1937)	+	-
<i>Brachionus diversicornis</i> (Daday, 1883)	-	+
<i>Brachionus falcatus</i> Zacharias, 1898	-	+
<i>Keratella quadrata</i> (Muller, 1786)	-	+
<i>Keratella tropica</i> (Apstein, 1907)	+	+
<i>Polyarthra vulgaris</i> (Carlin, 1843)	+	+
<i>Asplanchna herrickii</i> De Guerne, 1888	-	+
<i>Filinia longiseta</i> (Ehrenberg, 1834)	+	-
COPEPODA SPECIES		
<i>Heliodiaptomus viduus</i> (Gurney, 1916)	+	+
<i>Tropocyclops prasinus prasinus</i> (Fischer, 1860)	+	+
<i>Acrocalanus gibber</i> (Giesbrecht, 1888)	+	+
Copepod nauplii	+	+
CLADOCERA SPECIES		
<i>Diaphanosoma Senegal</i> (Gauthier, 1951)	+	-
<i>Ceriodaphnia sp.</i>	+	+
OCTRACODA SPECIES		
<i>Stenocypris major major</i> (Baird, 1859)	+	+

In all, 11 species of zooplankton were found to be **common** to the both sites out of which one was protozoans, 3 were rotifers, 4 were copepods, 1 were cladocerans, and 1 were ostracods (Table 8).

Table 9: Biodiversity Indices of both Pond.	
Simpson's Index	
Narsinh Mehta Pond Simpson's Index	Sudarshan Pond Simpson's Index
0.1168	0.0966
Shannon's Index (H)	
Narsinh Mehta Pond Shannon's Index	Sudarshan Pond Shannon's Index
2.3226	2.5165
Shannon's equitability	
Narsinh Mehta Pond H equitability	Sudarshan Pond H equitability
0.8801	0.9076

Lower values of Simpson's index and higher Shannon's index values for Total Zooplankton were for Sudarshan Pond therefore in Sudarshan Pond diversity of zooplankton is higher than Narsinh Mehta Pond. Higher the value of Shannon's equitability index for Sudarshan Pond indicate Zooplankton species more

evenly distributed than Narsinh Mehta Pond (Table 9).

DISCUSSION

The highest pH was recorded 8.6 in March and lowest pH was recorded 6.5 in October at Sampling site Narsinh Mehta Pond and highest pH was recorded 8.43 in March and lowest pH was recorded 7.2 in October at Sampling site Sudarshan Pond [28]. studied fluctuation in zooplankton and Physicochemical parameters of some fresh water tank in Maharashtra they found maximum pH value of site A (7.86 ± 0.70) and site C (8.40 ± 0.70) in winter (December) it may be due to higher photosynthetic activity. [29] observed pH was maximum in summer season due to high decomposition activities of biotic i.e., aquatic organism and abiotic i.e. physical and chemical factors, and minimum in monsoon season due to dilution of water by rainfall and water from the other sources. [30] mentioned the higher photosynthetic activity support an increase in pH and anthropogenic activities like washing of cloths with detergents and mixing of sewage also attributed to higher pH. pH was negatively correlated with DO ($r = -1.00$) also recorded by [31].

The highest TDS was recorded 475 in March and lowest TDS was recorded 315 in October at Sampling site Narsinh Mehta Pond and highest TDS was recorded 395 in March and lowest TDS was recorded 233 in October at Sampling site Sudarshan Pond. Higher values of Total dissolved solids were recorded in summer months by [7].

The lowest TSS was recorded 365 in March at Sampling site Narsinh Mehta Pond and lowest TSS was recorded 250 in March at Sampling site Sudarshan Pond. The higher TSS during monsoon reflects the addition of suspended solids from the runoff water, which starts settling down slowly in post-monsoon and results in minimum TSS during winter, the products of decaying vegetation at the surface when starts sinking may increase the TSS as well as TDS [6].

The highest Hardness was recorded 216 in January and lowest Hardness was recorded 104 in October at Sampling site Narsinh Mehta Pond and highest Hardness was recorded 286 in March and lowest Hardness was recorded 138 in October at Sampling site Sudarshan Pond. Natural hardness of water depends upon the geological nature of the catchment area [6]. [32] recorded maximum values of total hardness during summer and minimum values observed in SWM (South West Monsoon), They concluded that higher values during summer are probably due to the regular addition of quantities of sewage detergent and large scale of human use.

The highest BOD was rerecorded 4.8 in October and lowest BOD was recorded 3.2 in January at Sampling site Narsinh Mehta Pond BOD is increased with increased in microorganisms and zooplankton also observed by [33]. [31] also found Maximum value of pH, Total Hardness, and BOD in summer season and TDS and DO maximum value in monsoon and winter respectively. [34] also found maximum DO in march. Zooplankton Diversity

Table 6 and 7 shows the zooplankton diversity at both sampling site.

As per [35] Zooplankton density was highest in winter (39.56%) followed by summer (38.46%) and monsoon (21.97%). Zooplankton density (no/L) recorded maximum in winter and minimum in monsoon. [10] also mentioned that zooplankton density of all the zooplankton components fall of during monsoon the study period can be attributed to the dilution effect. Presence of variety of *Branchionus sp.* and copepods are the indicator of influence of pollutants as well as domestic sewage discharges suggest by them.

According to table 9 Simpson's index (D) values for Total Zooplankton noticed 0.1168 and 0.0966 for Narsinh Mehta Pond and Sudarshan Pond respectively. Value of Simpson's D ranges from 0 to 1; 0 representing infinite diversity and 1 representing no diversity [36]. Shannon's index (H') values for Total Zooplankton 2.3226 and 2.5165 for Narsinh Mehta Pond and Sudarshan Pond respectively, H' is zero if there is only one species in the sample and H' is maximum if all species are evenly distributed [34]. Therefore, in Sudarshan Pond diversity of zooplankton is higher than Narsinh Mehta Pond. Shannon's equitability index values for Total Zooplankton 0.8801 and 0.9076 for Narsinh Mehta Pond and Sudarshan Pond respectively. Equitability assumes a value between 0 and 1 with 1 being complete evenness; higher the value of Sudarshan Pond indicates Zooplankton species more evenly distributed than Narsinh Mehta Pond.

Among the Rotifers, the genus *Brachionus* was found more in numbers 2 species in Narsinh Mehta Pond and 3 species in Sudarshan Pond. Some Similar species of genus *Brachionus* observed by [30] i.e. *Brachionus calyciflorus*, *Brachionus caudatus*, *Brachionus diversicornis*, *Brachionus falcatus*.

[37] also observed some similar species were *B. calyciflorus*, *B. caudatus*, *B. diversicornis*, *K. tropica*, *F. longiseta*, 2 species of *Heliodyptomus* one is *H. viduus*, 2 species of each *Ceriodaphnia* and *Diaphanosoma*. [38] recorded Total 22 species of zooplankton among them 14 species Rotifera, 3 species Copepoda, 4 species Cladocera, and only one species of Ostracoda from municipal waste water contaminated urban pond of the lower Gangatic plain.

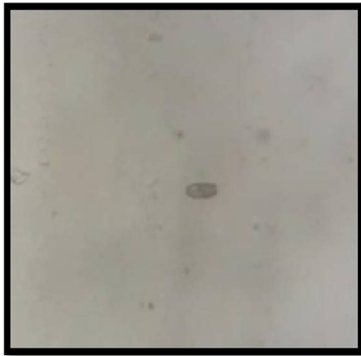
[7] studied Diversity and seasonal abundance of zooplankton in some ponds at Raipur in Chhattisgarh and Recorded 34 species of zooplankton were composed of highest 22 species of Rotifera, 6 species of Protozoa, 3 of Copepoda, 2 species of cladocera and 1 species of Ostracoda. The total zooplankton population was dominated by rotifers 64%, protozoa 18%, copepod 9%, cladocera 6% and Ostracoda 3%.

CONCLUSION

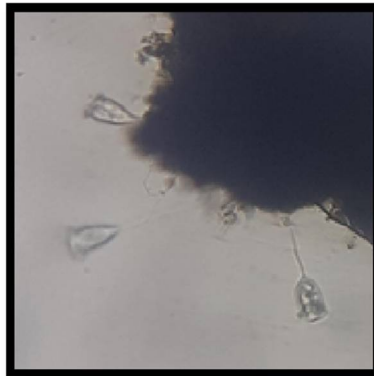
All the aquatic system and their biotic and abiotic factors affect human beings directly or indirectly. All forms of life on the earth depend upon water for their existence; therefore, it becomes prime necessary to preserve from deterioration. The present study was undertaken to understand the physicochemical condition of freshwater wetlands of this region and to study the biodiversity of zooplankton community, their population structure and dynamics, their interrelationship with the abiotic factors and the threats faced by the wetlands in general. Physicochemical parameters values are similar to other fresh water body of country Among the zooplankton protozoa was the dominant group Narsinh Mehta Pond. Among the zooplankton Rotifera was the dominant group in Sudarshan Pond. Species diversity found higher in Sudarshan Pond (16 species) than Narsinh Mehta Pond (14 species). The compositions of zooplanktons of investigated ponds are also similar to the other fresh water bodies of the country.

In all, eleven species of zooplankton were found to be common to the both sites out of which two were protozoans, three were rotifers, four were copepods, one was cladoceran, and one was ostracod.

PROTOZOA SPECIES



1 *Paramecium bursaria*



2 *Vorticella campanula*



3 *Euglena viridis*

ROTIFERA SPECIES



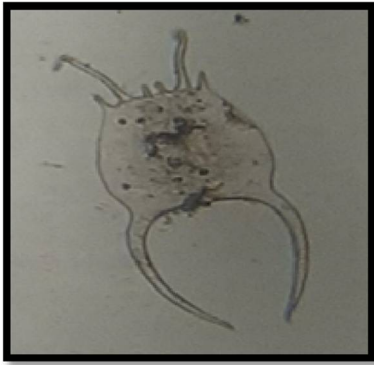
4 *Brachionus calyciflorus*



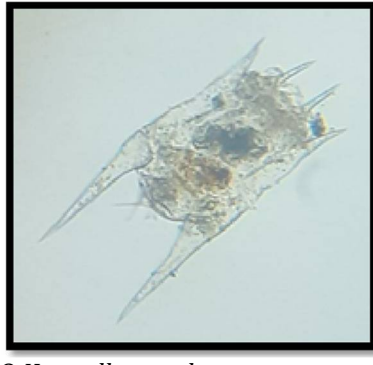
5 *Brachionus caudatus aculeatus f. lateralis*



6 *Brachionus diverdicornis*



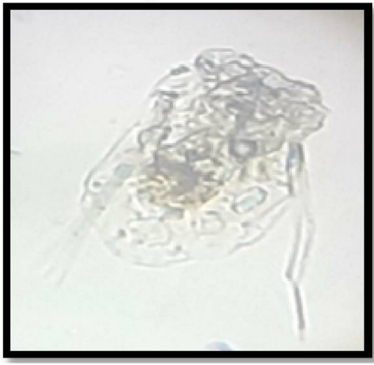
7 *Brachionus falcatus*



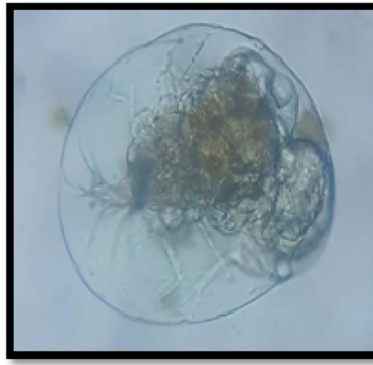
8 *Keratella quadrata*



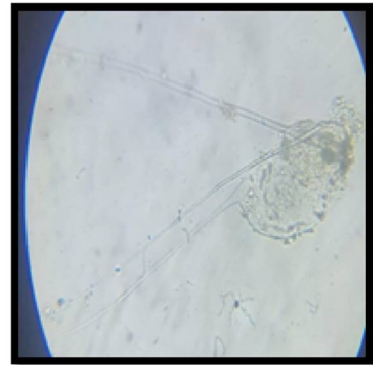
9 *Keratella tropica*



10 *Polyarthra vulgaris*



11 *Asplanchna herrickii*



12 *Filinia longiseta*

COPEPODA SPECIES



13 *Heliodiaptomus viduus*



14 *Tropocyclops prasinus prasinus*

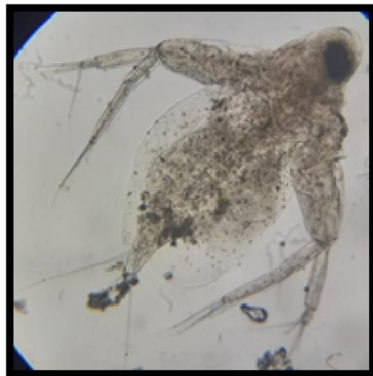


15 *Acrocalanus gibber*

CLADOCERA SPECIES

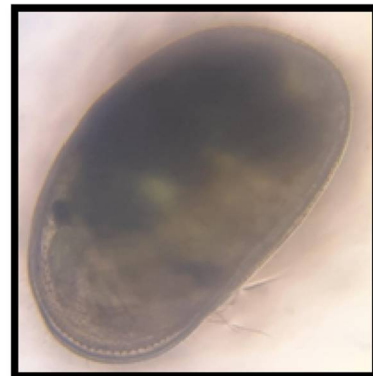


16 *Diaphanosoma senegal*



17 *Ceriodaphnia sp.*

OSTRACODA SPECIES



18 *Stenocypris major major*

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