

Study of Physico-Chemical Parameters with Relation of Zooplankton Density of Ranakpur and Mithri Dam, Pali District, Rajasthan

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Abstract: This study is related with relation of physico – chemical parameters and zooplankton density in two different dams of Pali district. In this result the parameters like temperature, pH, TDS, calcium, magnesium, sulphate, chloride and fluoride was found in permissible limit where electrical conductivity of water and Biological oxygen demand was found slightly more than permissible limit. Depth of visibility was found completely in different range in both the dam water. Site 'A' water was very clear while site 'B' water was very turbid due to silt and mud at bottom. In zooplankton density only 3 groups was found. It include Rotifera, cladocera and Copepoda. In site 'A' copepod density was greater than rotifer whereas in site 'B' rotifera density was higher in all three group. Number of cladoceran specially *Daphnia* shown great density in site 'B' water.

Keywords: physico – chemical parameter, zooplankton, density of plankton, producers, aquatic ecosystem

1. Introduction

Zooplankton are smallest microorganism which cannot be seen by naked eyes. They are an important component for secondary production in an aquatic ecosystem and constitute an important link between primary producers (phytoplankton) and higher consumer like carnivore fish in aquatic food chain (Pradhan 2014). They are free living organism which drift in water. Zooplankton form a base (after phytoplankton) in aquatic ecosystem. Biodiversity of an aquatic system depends on number of zooplankton. Zooplankton are tiny organism so their density affected by physico – chemical parameter of water. Aquatic ecosystem are affected by too many anthropogenic activities like domestic waste release, sewage, industrial waste and agriculture waste. Proper functioning of any aquatic system depends on a great extent on the physico – chemical parameters (Sharmila and Rajeswari 2015)

Study of zooplankton for a long time is a very interesting subject. From last two decades too much attention paid for the study of zooplankton as well for study to know their biology, ecology and other factors, because their importance in various emerging concepts in environmental impact assessment, bio indicator of pollution and bio monitoring.

2. Material and Methods

Sadri bundh- The Sadri bundh was constructed in the year 1907. The dam lies on the Maghai river Subbasin of Luni River. The location of the reservoir is on general low lands. The dam is masonry dam of a length of 226 m and 28.48m height from the bed level of the main nallah to the crest of the dam.

Location:-

Latitude- 25.8°N

Longitude – 73.28°E

Total catchment area- 59.83km²

Village- Sadri

Panchayat Samiti- Desuri

Mithri dam: - Mithri dam was constructed in the year 1969-70 on the river mithri in the Tehsil Bali of Pali district. It is located of six km away from Padarla village of Bali-Pindwara road and 17 km from Bali town a Tehsil head quarter. Catchment area is hilly and lies on the western slopes of Aravali hills.

The main dam is an earthen embankment having length of 815m with 15.7m height.

Basin of this dam is Luni River and during rainy season these streams cannot be crossed.

Latitude- 24.04°N

Longitude- 73.16°E

Village- Sewadi

Panchayat Samiti- Bali

Total catchment area- 76.2km

3. Methodology

This study was conducted from April 2021 to April 2022 with periodic occurrence (Interval of 3 months for plankton collection and monthly samples collected for testing of physico chemical parameters). For this investigation sample were collected from both reservoir Ranakpur dam and Mithri dam of Pali district, Rajasthan, India. Collections of plankton and parameters were organized at morning time. Surface water samples were collected by using plastic bottles. Water samples were collected separately in bottles of 1 liter and immediately brought to the laboratory for the analysis of various physico – chemical parameters.

Some physical parameters like temperature of water and concentration of hydrogen ion (pH) of water were recorded in the field itself with normal (laboratory) thermometer and digital pH meter respectively. Depth of visibility of water

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was measured by using Secchi disc of 20cm diameter. Chemical parameters like TDS, alkalinity, chloride, fluoride, magnesium, calcium, sulphate, BOD, EC etc. were determined in the laboratory by standard method as per the standard methods of APHA (2005).

For plankton collection total 30 liter water filtered by plankton net number 12 N bolting silk cloth. Plankton were transferred into air tight plastic bottle of 100 ml. Add 20 ml of 5% formeldihyde into sample to preserve the plankton and keep the sample at low temperature. Maintain the concentration of sample (100 ml), take 1 ml of sample in Sedgewick Rafter plankton counting slide and count the plankton of each chamber under the light microscope.

4. Result

Physico – chemical parameters

- Water temperature** –The minimum and maximum value of water temperature was recorded at site ‘A’ in February (winter) as 17.5⁰C and July (summer) 32⁰C.
- pH**– Concentration of hydrogen ion is observed as low as 7.60 in April (2021) and high as 9.2 in July month at site ‘B’.
- Turbidity/ Depth of visibility** – Excess of silt increase turbidity of any water body. The depth of visibility values fluctuated from 23.85 to 95 cm as minimum and maximum value at site ‘B’.
- TDS** – TDS concentration help to check the hardness of water. The TDS concentration in dam during the research period varied from 229 to 285 ppm as minimal and maximum value at site ‘A’.
- Alkalinity** - The result of this parameter was recorded as minimum in month April as 80 ppm and highest in June month as 110 ppm at site ‘A’.
- Calcium** -Calcium is the fifth most plentiful natural element. Minimum value experiential of calcium was 24 mg/l in the month of July at site ‘A’ and maximum value of calcium was experiential as 64 mg/l in June at site ‘B’.
- Magnesium** – Magnesium content experiential minimum value in the month of November and January is 8.64 mg/l at both sites and the maximum value experiential of 31.68 mg/l in the month of December at site ‘A’.
- Sulphate** -The value of this parameter oscillated from 54 mg/l to 86 mg/l as minimum and maximum in the month of January and December at site ‘A’ and site ‘B’ respectively.
- Fluoride** – The value of fluoride found repeated between 0.30 to 0.50 ppm at both sites many times.
- Chloride** – The value of this parameter was minimum in the month of May as 51.1 mg/l at site ‘A’ and highest in the month of April (2022) as 84 mg/l at site ‘B’.
- Electrical conductivity** – The conductivity of water measure by its capability to pass electric flow. EC value observed as minimum in the month of July with the range of 454 us/cm at site ‘A’ and maximum value experiential in the month of June with the range of 728 us/cm at site ‘B’.
- Biological Oxygen Demand**–Minimum value of BOD indicates the clearness of water or show the presence of a toxic or non-degradable pollutant in water. In this 13

months duration the lowest value of BOD was experiential in September month with range of 2.50 ppm at site ‘A’ and highest in April (2021) with the range of 12 ppm at site ‘B’.

Plankton result -

- Rotifera** - A total number of 17 Rotifera species spread over 5 families are observed from the collection of samples from Ranakpur dam of Sadri block and Mithridam of Bali block, Palidistrict, Rajasthan. Following species are observed as Rotifers are - *Brachionus angularis angularis*, *B. calyciflorus*, *B. caudatus*, *B. diversicornis*, *B. falacatus*, *B. forficula*, *B. quadridentatus*, *Keretellacochlearis*, *K. tropica*, *K. tropicalheterospina*, *Platyiasquadridentatus*, *Filinia longiseta*, *F. opoliensis*, *F. terminalis*, *Conochilus hippocerpis*, *C. arboreus*, *Hexarthramira*.
- Cladocera** – Out of 35 species 10 species recorded as cladoceren plankton which belongs to 4 different families from both sites. Species are included - *Bosminiacoregoni*, *B. deitersi*, *B. longirostris*, *Diphanosomasarsi*, *Daphnia lumholtzi*, *D. carinata*, *Moinabrachiata*, *M. macrocopa*, *Chydorusphaericus*, *C. globosus*.
- Copepoda** - Copepods are less in diversity at both sites but numbers of copepod are greater than cladocerns plankton. Only 9 species of copepods which belongs to 2 families of order – Calanoida are recorded at both sites. Following species are observed like - *Heliodiaptomus sp.*, *Rhinediaptomus indicus*, *Phyllodiaptomus anne*, *Cletocampus albuquervensis*, *Cyclopoidnauplius*, *Mesocyclops shyalinus*, *Mesocyclops leukartileuckarti*, *Paracyclops poppi*, *Zoea larva*.

Following tables represent the data of parameters and plankton density

Table 1: Zooplankton qualitative Analysis

Sr. No.	Zooplankton	Site ‘A’	Site ‘B’
A	Rotifera		
	<i>Branchionus sp.</i>	6	7
	<i>Conochilus sp.</i>	2	2
	<i>Filinia sp.</i>	3	3
	<i>Hexarthramira</i>	1	1
	<i>Keretella sp.</i>	2	1
	<i>Platyias sp.</i>	1	3
	Total	15	17
B	Cladocera		
	<i>Bosminia sp.</i>	3	3
	<i>Chydorus sp.</i>	2	2
	<i>Daphnia sp.</i>	2	2
	<i>Diphanosomasarsi</i>	1	1
	<i>Moina sp.</i>	2	2
Total	10	10	
C	Copepoda		
	<i>Cyclops sp.</i>	3	3
	<i>Cletocampus sp.</i>	1	1
	<i>Diaptomus sp.</i>	2	2
	<i>Nauplius larva</i>	1	1
	<i>Zoea larva</i>	1	1
	Total	8	8
Grand Total	33	35	

Table 2: Comparative Quantitative Analysis of Zooplankton

Sr. No	Zooplankton	4/4	5/4	4/7	5/7	4/10	5/10	4/1	5/1	4/4	5/4
A	Rotifera										
	<i>Branchionus sp.</i>	20	37	24	34	27	37	20	40	17	44
	<i>Conochilus sp.</i>	10	4	-	7	7	-	4	7	-	7
	<i>Filinia sp.</i>	-	-	10	10	10	17	7	10	4	14
	<i>Hexarthramira</i>	10	7	-	-	4	-	4	7	-	7
	<i>Keretella sp.</i>	30	47	24	37	27	50	14	44	17	50
	<i>Platytas sp.</i>	7	4	-	-	-	7	4	4	-	-
Total	77	99	58	88	75	111	53	112	38	122	
B	Cladocera										
	<i>Bosminia sp.</i>	14	14	10	14	-	4	14	17	7	10
	<i>Chydorus sp.</i>	4	-	-	-	7	10	-	4	7	4
	<i>Dephnia sp.</i>	24	24	17	20	14	24	10	20	10	24
	<i>Diphanosoma</i>	4	4	7	4	4	7	10	-	4	-
	<i>Moina sp.</i>	10	7	-	-	7	-	4	10	7	7
	Total	56	49	34	38	32	45	38	51	35	45
C	Copepoda										
	<i>Cyclops sp.</i>	47	27	54	20	57	17	50	17	40	14
	<i>Cletocamptus</i>	7	-	10	4	10	10	4	-	7	4
	<i>Diaptomus sp.</i>	10	-	7	7	7	-	-	4	4	-
	<i>Nauplius larva</i>	27	14	20	10	17	14	14	10	20	7
	<i>Zoea larva</i>	17	7	24	10	24	7	20	7	17	14
	Total	108	48	115	51	115	48	88	38	88	39
Grand Total	241	196	207	177	222	204	179	201	161	206	

Table 1: Selected water quality parameters of Ranakpur Dam (Month wise):

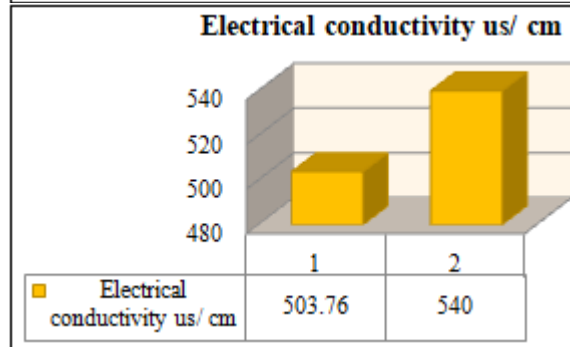
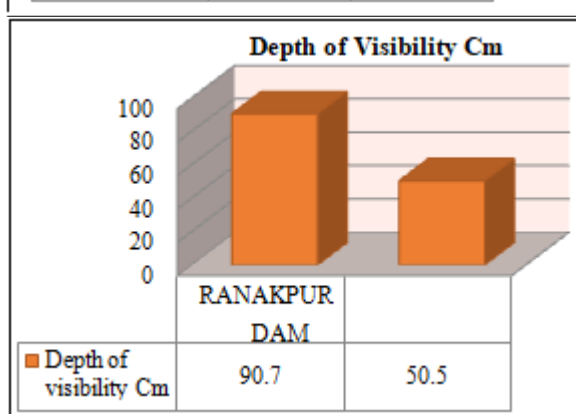
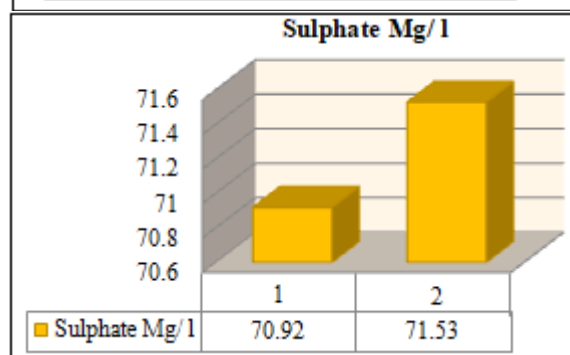
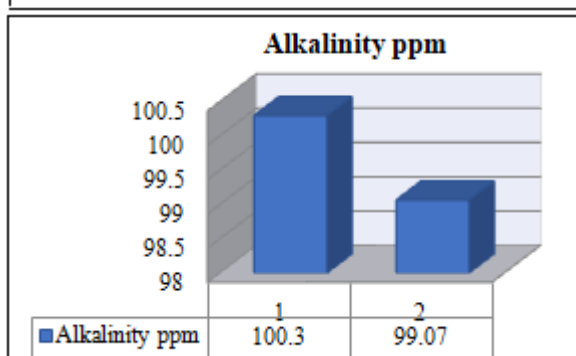
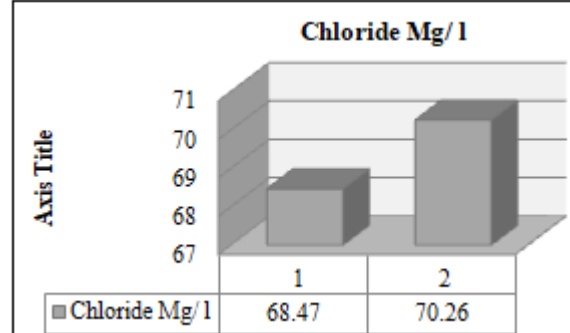
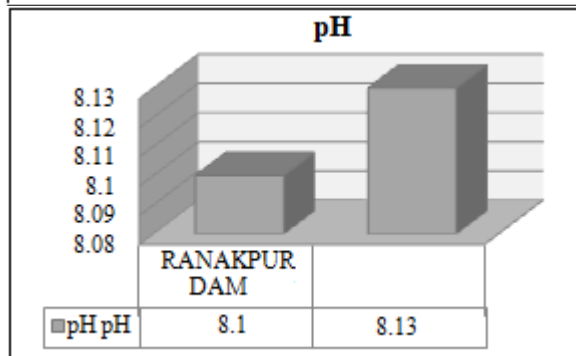
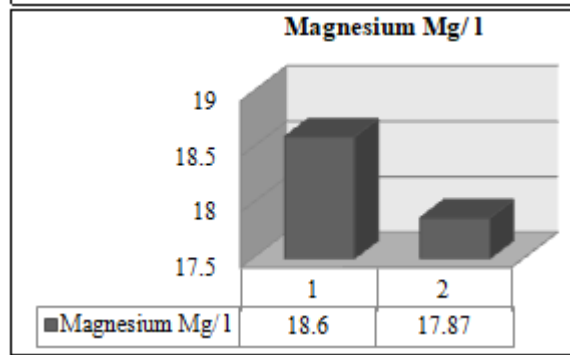
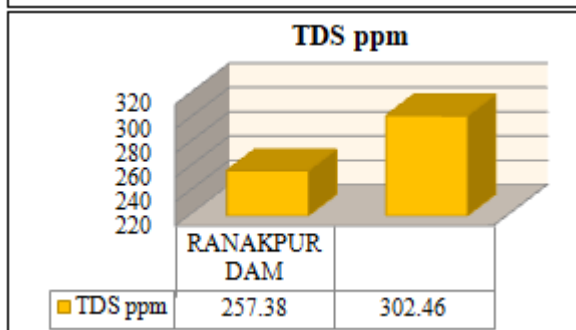
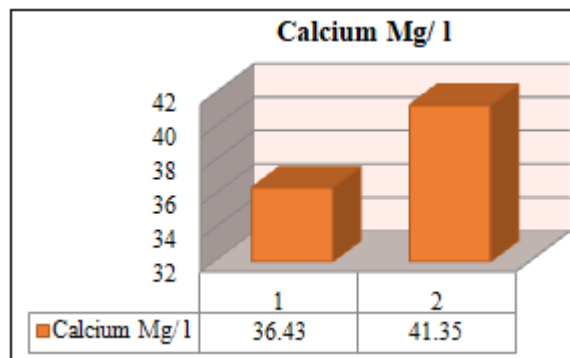
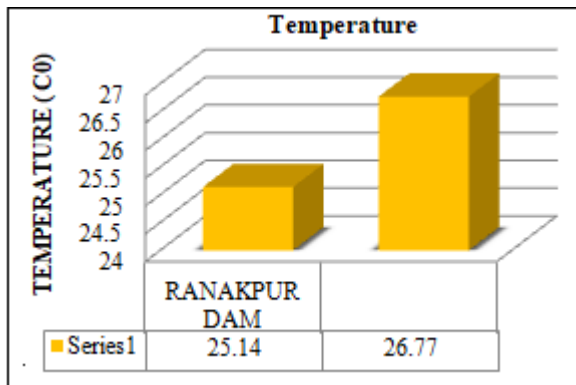
S.No.	Parameters	April	May	June	July	August	September	October	November	December	January	February	March	April
1	Temperature (C ⁰)	24 ⁰	29 ⁰	31 ⁰	32 ⁰	27 ⁰	29 ⁰	30 ⁰	23.4 ⁰	20 ⁰	19 ⁰	17.5 ⁰	20.5 ⁰	24.5 ⁰
2	Ph	7.70	8.5	8.3	8.3	8.10	8.00	8.00	8.20	8.10	8.00	7.90	8.10	8.20
3	Depth of visibility (cm)	151	81	63.75	72.75	75.5	66.2	67	63	67.7	73.3	155.1	160	83
4	TDS (ppm)	249	239	244	229	250	240	239	268	273	276	275	279	285
5	Alkalinity (ppm)	80	108	108	110	108	102	96	106	104	100	92	94	96
6	Calcium (mg/l)	41.60	40	56	24	32	28.80	40	35.20	33.60	41.60	33.60	32	35.20
7	Magnesium (mg/l)	18.24	17.28	24	24.96	24	19.20	14.40	17.28	31.68	8.64	14.40	14.40	13.44
8	Sulphate (mg/l)	56	54	72	66	68	66	64	76	72	84	80	82	82
9	Fluoride (ppm)	0.30	0.30	0.40	0.40	0.30	0.30	0.30	0.30	0.40	0.30	0.40	0.40	0.30
10	Chloride (mg/l)	51.12	51.1	70	60	60	62	60	80	76	80	78	80	82
11	Electrical conductivity (us/cm)	507	463	478	454	462	475	475	529	518	552	528	549	559
12	BOD (ppm)	8.00	7.00	10	6.00	3.00	2.50	3.00	5.00	3.80	5.00	3.60	3.00	4.50

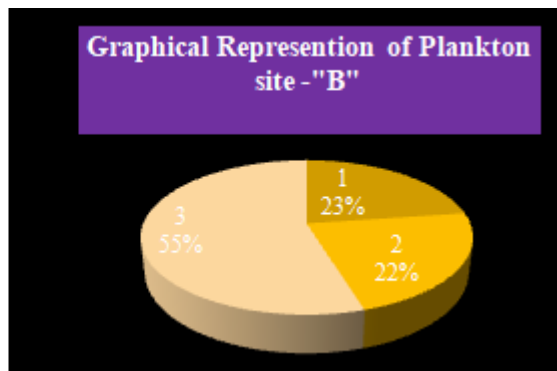
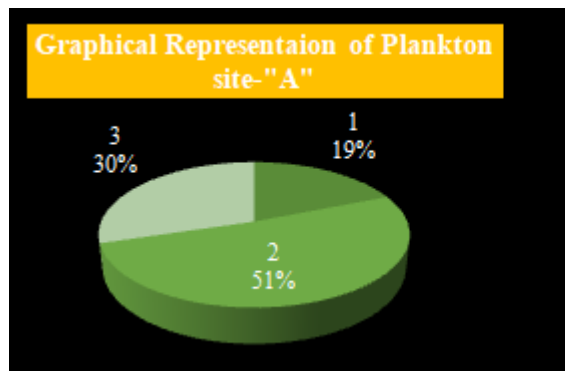
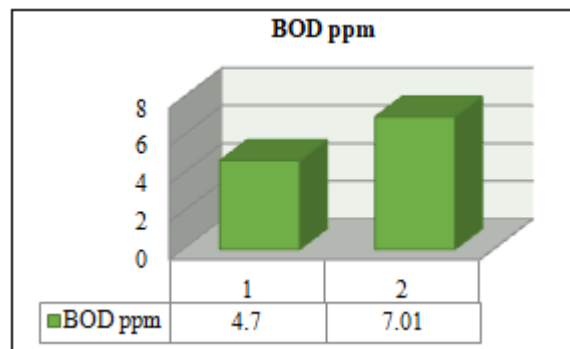
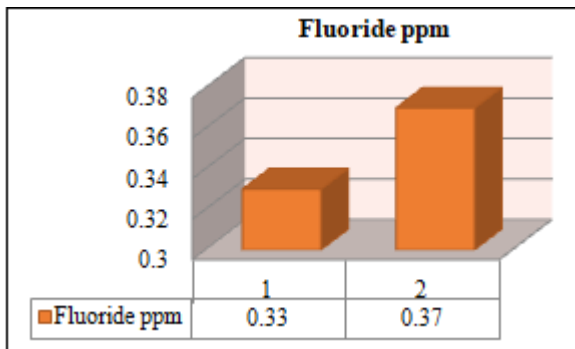
Table 2: Selected water quality parameters of Mithri Dam (Month wise):

S. No.	Parameters	April	May	June	July	August	September	October	November	December	January	February	March	April
1	Temperature (C ⁰)	27 ⁰	29 ⁰	31 ⁰	31 ⁰	28 ⁰	31 ⁰	31.6 ⁰	24 ⁰	22 ⁰	20.5 ⁰	19.50	24 ⁰	29.5 ⁰
2	pH	7.60	8.3	9.2	7.90	8.00	8.20	8.00	8.00	8.10	8.00	8.10	8.00	8.30
3	Depth of visibility (cm)	57.75	42.25	26.75	23.85	25.1	36.1	59.6	56.45	69.5	41.9	95	65.5	56.75
4	TDS (ppm)	309	324	399	348	356	372	231	248	250	256	256	280	303
5	Alkalinity (ppm)	90	102	120	90	92	112	98	98	98	102	96	92	98
6	Calcium (mg/l)	49.60	51.2	64	36.80	38.40	43.20	25.60	33.60	52.80	33.60	32.0	33.60	43.20
7	Magnesium (mg/l)	22.08	24.0	28.80	21.12	22.08	24	18.24	8.64	12.48	8.64	13.44	13.44	15.36
8	Sulphate (mg/l)	60	64	78	74	74	74	60	62	70	74	72	82	86
9	Fluoride (ppm)	0.40	0.50	0.50	0.50	0.40	0.40	0.30	0.30	0.30	0.30	0.30	0.30	0.40
10	Chloride (mg/l)	56.80	59.64	66	72	74	72	62	65	68	78	76	80	84
11	Electrical conductivity (us/cm)	621	650	728	685	698	725	460	488	475	552	492	549	595
12	BOD (ppm)	12	10	18	10	7	5	3.00	3.20	3.00	3.00	3.00	7.00	7.00

Graphical representation of physico – chemical parameters and zooplankton density

1. Ranakpur Dam
2. Mithri Dam





[1] Cladocera

[2] Copepoda

[3] Rotifera

5. Discussion and Conclusion

Study of physico – chemical parameters of Ranakpur Dam (site A), and Mithri dam (site B) was carried out by taking some important parameters like turbidity, temperature, pH, chloride, fluoride, calcium, magnesium, BOD, EC etc for the period of 13 months from April 2021 to April 2022. In the present study most of the parameters are in permissible limits of raw drinking water as per WHO and BSI. For zooplankton Ranakpur dam showed the higher density of plankton comparatively Mithri dam. Out of 35 species 33 species were recorded in Ranakpur dam with reference in Mithri dam all 35 species were recorded. At site ‘A’ the results shows that the copepods are greater in number especially *Cyclops*, *Nauplius* and *Zoea* in relation to their density. Copepod shows less diversity comparatively Cladocera and Rotifers. Rotifers have great diversity with 15 species on site ‘A’, whereas cladocera has diversity of 10 species with moderate density. On site ‘B’ Rotifers shows great density with diversity. Total rotifers species are 17 on site ‘B’ with highest number (density) of all over plankton. Number of Cladocera and Copepods species are same on both sites. Cladocera has moderate density on Site ‘B’ as like site ‘A’.

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