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Species diversity of zooplankton and physico-chemical parameters of Narangi Sarangi dam of Vaijapur, dist. Aurangabad, Maharashtra

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Abstract
Zooplankton plays an important role in aquatic ecosystem. They are assisting the economically in fish culture. The zooplankton diversity in Narangi Sarangi Dam of Vaijapur Dist. Aurangabad Maharashtra, India was observed along with the physico-chemical characteristics for the period of from January, 2017 to December 2017. In this dm there is culture of food fishes viz., *Catla catla, Labeo rohita and Cirrahuns mirigala, Ctinopharyangdon idella, Hipopthalamix molitrix, clarius batrachus, heteropnestus fossilis Tilapia mosambica, Cchanna Sp.* Etc. During the study period, we collected 35 species from 12 genera (Rotifers- 06, Cladocerans-03, Copapodes-2, and Ostracodes-1) of zooplanktons. The Rotifera was dominated accompanied by using Copepoda, Cladocera and Ostracoda species. Quantitative and qualitative analysis was made for distribution of the species. The physico-chemical parameters such as water temperature, pH, salinity, Total Dissolved Solid (TDS) and Dissolve Oxygen (DO) were analyzed throughout the study period. The connection among zooplankton and physico-chemical parameter together with the diversity indices had been calculated, because the productivity of zooplankton turned into unique, it could be continuously implemented for aquaculture.

Keywords: species diversity, zooplanktons Narangi Sarangi dam

Introduction
The zooplankton is fundamental character inside the significance of an aquatic ecosystem and plays a key function in the energy transfer. Freshwater zooplankton plays an essential role in ponds, lakes and reservoirs atmosphere and food chain. Zooplankton feed on phytoplankton. They're answerable for eating millions of little algae which can otherwise develop to an out-of-manipulate state. The insufficient understanding of plankton and their dynamics is a main handicap for the better knowledge of the life system of sparkling water bodies. Aquatic surroundings are suffering from numerous health stressors that significantly expend biodiversity. In destiny, the loss of biodiversity and its consequences are expected to be more in aquatic Atmosphere than terrestrial surroundings. Zooplankton species have special varieties of existence histories stimulated by seasonal variations of biotic elements, feeding ecology and predation strain. The zooplankton community is composed of both primary consumers (feeds upon phytoplankton) and secondary consumers (which feed upon the other zooplankton). They offer a right away hyperlink between number one producers and higher tropic tiers inclusive of fish. Almost all fish rely on zooplankton for meals all through their larval stages, and some fish retain to devour zooplankton for their complete lives. The distribution and diversity of zooplankton in aquatic surroundings rely specially on the physico-chemical properties of water.

The physico-chemical parameters and nutrient fame of water body play an vital position in governing the production of plankton which is the natural food of many species of fishes, specially zooplankton represent crucial food supply of many omnivorous and carnivorous fishes and additionally aid the necessary quantity of protein for the speedy growth of larval carp fishes. They respond speedy to aquatic environmental adjustments (i.e. water quality, together with pH, shade, odor and many others.) for their life cycle, and are consequently used as indicators of universal fitness or circumstance in their habitats. Zooplanktons acts as indictors of water quality and may be used to assess over all lake health. The qualitative and quantitative abundance of zooplankton in a lake are of remarkable importance for successful aquaculture management, as they vary from one geographical region to every other and lake to lake in the equal geographical region even inside similar ecological situations.

Literature on ecology of zooplankton populace from specific parts of india is to be had from the investigation. The research becomes to be had as the seasonal variations in variety of zooplankton in a perennial freshwater lake and Reservoir of the Tamil Nadu, India [1, 2, 3]. The researcher worked on seasonal variant of plankton and their dating with physico-chemical parameters of water from in Krishna Sager Lake, Burdwan, West Bengal [4]. The sizeable research on water great of a few water bodies of Kolhapur district were achieved at some stage in last few decades [5]. Research on water quality and zooplankton diversity executed from Kham River of Aurangabad [6] and Ambe Ghosale Lake of Thane City of Maharashtra [7].

In the present study freshwater zooplankton biodiversity from Narangi Sarangi Dam of Vaijapur Dist. Aurangabad (MS) India was studied on monthly basis for the period of one year.

Materials and Methods

Study Area

The zooplankton diversity from Narangi Sarangi Dam of Vaijapur Dist. Aurangabad (MS) India was observed along with the physico-chemical characteristics for the period of 12 months from January to December, 2017.

Collection and preservation of samples

In the present study water samples were collected at fortnight interval from collection sites from January, 2017 to December, 2017. The water samples were collected during morning hours from 7.00am to 9.00am. Water samples were gathered from the study area in smooth plastic cans of 1 liter capacity. The outcomes such as turbidity and temperature were recorded at the sampling sites whereas the others were recorded in the laboratory. The parameters found have been colour, pH, temperature, DO and Alkalinity. The shade of water was observed visually. Zooplanktons were preserved with 5% of neutral buffer (10 ml) formalin solution. The plankton samples varied each qualitative, in addition to quantitative analysis in the study period. The diverse physico-chemical parameters had been analyzed by way of following the standard protocols [8, 9]. Fortnightly data obtained were compiled to get the Statistical analysis and diversity indices. The statistical analysis was done by using software programmed for total zooplankton numbers of individual species, diversity indices namely; Shannon's diversity index (H'), species evenness and species richness were calculated.

Analysis of Physico-chemical and Biological Parameters

The seasonal wise physico-chemical parameters viz. air and water temperature, pH, salinity, dissolved oxygen and total dissolved solids were estimated by using "µP Based Water & Soil Analysis Kit". The freshwater zooplankton species were studied under microscope and identification was made referring the standard protocols [10, 11]. Plankton counting was made by drop method. Quantitative analysis was made by using a plankton-counting chamber and observed under Stereoscopic Microscope (Magnus). 1 ml of sample was taken with a wide mouthed pipette and poured into the counting cell. After allowing for settle some time they were counted. At least 5 such counting was made for each sample of the plankton. The average values were taken. Total number of plankton present in 1 liter of water sample was calculated [12, 13]

Statistical analysis and diversity indices

The statistical analysis were done using software programmed for total zooplankton numbers of individual species, diversity indices namely; Shannon's diversity index (H'), species evenness and species richness was calculated by PAST, 2017.

Diversity Indices

Zooplankton diversity index is a quantitative measure that will increase when the range of sorts into which a fixed of entities has been increases. Diversity index, taking into consideration the number of individuals in addition to range of taxa, the range indices are utilized in ecology. In the present study Shannon-Wiener Index (H'), Hill's diversity numbers, Evenness and Margalef's richness index are calculated.

Result and Discussion

Physical Parameters (Table 1)

Temperature (°C)

The high atmospheric temperature was recorded 40 °C in month of May and the low atmospheric temperature was recorded 15.5 °C in December month, maximum water temperature 26 °C was recorded in the month of May and minimum 23 °C in January month at study area.

Table 1: Physico-chemical parameters of Narangi Sarangi Dam of Vaijapur Dist. Aurangabad (MS) India from January to December-2017

	Months											
Parameters	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Air-T (^{0}C)	18.5	20	23	33	40	35	28.5	30	32	36	24	15.5
Water-T (^{0}C)	23	24	25	25.5	26	25.5	24	24	24.5	24.5	24	23.5
pH	8.2	8.35	7.55	7.8	7.9	7.65	8.2	7.6	8.3	8.1	7.5	8.1
Salinity (mg/L)	0.815	0.852	0.785	0.89	0.79	0.81	0.842	0.865	0.752	0.725	0.794	0.705
DO (mg/L)	6.8	5.9	8.3	7.7	8.5	8.4	6.9	7.5	7.2	7.4	6.8	6.5
TDS (mg/L)	0.658	0.635	0.725	0.795	0.83	0.745	0.746	0.76	0.638	0.649	0.768	0.642

Salinity (mg/l)

The maximum salinity was recorded 0.865 (mg/l) in the month August and minimum was recorded 0.725 (mg/l) in the month of October.

pH

The maximum pH was recorded 8.3 in the month September and minimum was recorded 7.5 in the month of November.

Dissolved oxygen (mg/l)

The maximum dissolved oxygen was recorded 8.5 mg/l in the month May and minimum was recorded 5.9 mg/l in the month of February.

Diversity of Zooplanktons (Table 2)

Rotifer Diversity

In the study period total, 19 species of Rotifera belonging to 8 genera were recorded during the period of January, 2017 to December 2017 (Table 3). The population density of Rotifers was ranged between 480 and 795 (ind./L). A maximum density of 795 (ind./L) was noticed in the month of May and minimum of 480 (ind./L) in June. The species dominance was found high (0.0682) during January and low (0.0568) in March. The Shannon diversity index (H) was found to be high (2.906) in March and low (2.767) in January. Simpson's diversity index was maximum (0.9432) during March and minimum (0.9346) in December. The high species evenness

(0.9532) was found during September and low evenness (0.8837) was recorded in January. The Margalef's species richness (R1) was found maximum (2.916) in November and minimum (2.615) in January 2017.

Table 2: Diversity Indices of Zooplankton from Narangi Sarangi Dam of Vaijapur Dist. Aurangabad (MS) India from January to December-2017

	January	February	March	April	May	June	July	August	September	October	November	December
Rotifera												
Individuals	665	682	691	696	795	705	675	652	663	658	480	638
Dominance_D	0.06826	0.06108	0.05684	0.06182	0.06068	0.05977	0.06003	0.0646	0.05789	0.05889	0.06279	0.06541
Simpson_1-D	0.9317	0.9389	0.9432	0.9382	0.9393	0.9402	0.94	0.9354	0.9421	0.9411	0.9372	0.9346
Shannon_H	2.767	2.866	2.906	2.847	2.865	2.876	2.873	2.831	2.897	2.887	2.857	2.803
Evenness_e^H/S	0.8837	0.9249	0.962	0.9074	0.9239	0.9337	0.931	0.8927	0.9532	0.9441	0.9165	0.9163
Margalef	2.615	2.759	2.753	2.75	2.695	2.745	2.763	2.778	2.771	2.774	2.916	2.632
Cladocera												
Individuals	410	437	512	562	640	554	624	561	466	615	320	383
Dominance_D	0.09275	0.08408	0.08572	0.08355	0.08729	0.08479	0.08351	0.08864	0.08424	0.07972	0.09641	0.09344
Simpson_1-D	0.9072	0.9159	0.9143	0.9165	0.9127	0.9152	0.9165	0.9114	0.9158	0.9203	0.9036	0.9066
Shannon_H	2.47	2.519	2.509	2.52	2.499	2.516	2.523	2.483	2.518	2.546	2.439	2.457
Evenness_e^H/S	0.9091	0.9549	0.9459	0.9558	0.9364	0.9519	0.9588	0.9212	0.9543	0.9811	0.8815	0.8978
Margalef	1.995	1.974	1.924	1.895	1.857	1.9	1.864	1.896	1.953	1.869	2.08	2.017
Copepoda												
Individuals	683	724	727	759	880	649	560	525	506	440	533	638
Dominance_D	0.09497	0.08577	0.08483	0.08357	0.08143	0.08815	0.08971	0.08421	0.08431	0.08783	0.08121	0.08187
Simpson_1-D	0.905	0.9142	0.9152	0.9164	0.9186	0.9119	0.9103	0.9158	0.9157	0.9122	0.9188	0.9181
Shannon_H	2.442	2.51	2.515	2.517	2.535	2.487	2.473	2.519	2.516	2.492	2.536	2.531
Evenness_e^H/S	0.8846	0.947	0.9511	0.9537	0.9706	0.9249	0.9119	0.9553	0.9521	0.9295	0.9717	0.9667
Margalef	1.839	1.822	1.821	1.809	1.77	1.853	1.896	1.916	1.927	1.971	1.911	1.858
Ostracoda												
Individuals	214	412	414	453	460	421	326	276	394	406	140	347
Dominance_D	0.1791	0.1602	0.1466	0.1436	0.1483	0.1548	0.164	0.1561	0.151	0.1647	0.1481	0.1474
Simpson_1-D	0.8209	0.8398	0.8534	0.8564	0.8517	0.8452	0.836	0.8439	0.849	0.8353	0.8519	0.8526
Shannon_H	1.827	1.881	1.932	1.943	1.928	1.905	1.87	1.894	1.916	1.872	1.929	1.929
Evenness_e^H/S	0.8883	0.9369	0.9861	0.9975	0.982	0.9596	0.9268	0.9494	0.9702	0.9288	0.983	0.9835
Margalef	1.118	0.9965	0.9957	0.9811	0.9786	0.9929	1.037	1.068	1.004	0.9989	1.214	1.026

Cladocera Diversity

Total 13 species of Cladocera belonging to 7 genera was recorded (Table 3) during the study period. The recorded population density was ranged between 320-640 (org/L). A maximum cladocera population (640 org/L) was recorded in May and minimum population (320 org/L) was recorded in November. The species dominance was found high (0.09641) during November and low (0.07972) in October. The Shannon diversity index (H) was found to be high (2.518) in September and low (2.439) in April. Simpson's diversity index was maximum (0.9165) during March and minimum (0.9036) in November. The high species evenness (0.9811) was found during October and low evenness (0.8815) was recorded in November. The Margalef species richness (R1) was found maximum (2.080) in November and minimum (1.857) in May 2017.

Copepod Diversity

Total 13 species of Copepods belonging to 7 genera was recorded (Table 3); the recorded population density was ranged from 440-880 (org/L). A maximum copepod population (880 org/L) was recorded in May and minimum population (440 org/L) was recorded in October. The species dominance was found high (0.09497) during January and low (0.08121) in November. The Shannon diversity index (H) was found to be high (2.536) in November and low (2.442) in January. Simpson's diversity index was maximum (0.9188) during November and minimum (0.905) in January. The high species evenness (0.9717) was found during November and low evenness (0.8846) was recorded in January. The Margalef species richness (R1) was found maximum (1.971) in October and minimum (1.770) in May 2017.

Table 3: List of Zooplanktons collected from Narangi Sarangi Dam of Vaijapur Dist. Aurangabad (MS) India from January to December-2017

Sr. No.		Genus	Name of the Species
	Rotifera (19)	*Anuraeopsis* Lauterborn, 1900	
1			*Anuraeopsis fissa* Gosse, 1851
2			*Anuraeopsis navicula* Rousselet, 1892
		Asplanchna Gosse, 1850	
1			*Asplanchna brightwelli* Gosse, 1850
2			*Asplanchna intermedia* Hudson, 1886
		Brachionus Pallas, 1776	
1			*Brachionus bidentata* Anderson, 1889
2			*Brachionus budapestinesis* Daday, 1885
3			*Brachionus calyciflorus* Pallas, 1776

4			*Brachionus caudatus personatus* Ahlstrom,1940
5			*Brachionus diversicornis* Daday, 1883
6			*Brachionus falcatus* Zacharias, 1898
7			*Brachionus forficulaf* Sudzuki, 1995
8			*Brachionus quadridentatus* Hermann, 1783
9			*Brachionus rubens* Ehrenberg, 1838
		Keratella Vincent, 1822	
1			*Keratella cochlearis* Gosse, 1851
2			*Keratella tropica* Apstein, 1907
		Notholca Gosse, 1886	
1			*Notholca lebis* Gosse, 1887
		Lecane Nitzsch, 1827	
1			*Lecane papuana* Murray, 1913
		Filinia Vincent, 1824	
1			*Filinia longiseta* Ehrenberg, 1834
		Polyarthra Burckhardt, 1900	
1			*Polyarthra major* Burckhardt, 1900
	Cladocera (13)	*Diaphanosoma* Fischer, 1850	
1			*Diaphanosoma sarsi* Richard, 1895
2			*Diaphanosoma excisum* Sars, 1885
		Daphnia Muller, 1785	
1			*Daphnia carinata* King, 1853
2			*Daphnia magna* Straus, 1820
		Ceriodaphnia Dana, 1853	
1			*Ceriodaphnia cornuta* Sars, 1853
2			*Ceriodaphnia reticulata* Jurine, 1820
		Kurzia Daday, 1898	
1			*Kurzia longirostris Daday, 1898*
		Moina Baird, 1850	
1			*Moina brachiata* Jurine, 1820
2			*Moina flagellate* Hudendroff, 1876
3			*Moina micrura* Kurz, 1874
4			*Moina macrocopa* Straus, 1820.
		Moinodaphnia Herrick, 1887	
1			*Moinodaphnia macleayi* King, 1853
		Leydigo Fischer, 1854	
1			*Leydigo acanthocercoids* Fischer, 1854
	Copepoda (13)	*Heliodiaptomus* Kiefer,1932	
1			*Heliodiaptomus viduus* Gurney, 1916
		Neodiaptomus Kiefer, 1932	
1			*Neodiaptomus lindbergi* Brehm, 1951
2			*Neodiaptomus schmakeri* Poppe & Richard, 1892
		Sinodiaptomus Kiefer, 1937	
1			*Sinodiaptomus indicus* Sewell, 1934
		Eucyclops Claus, 1893	
1			*Eucyclops speratus* Lilljeborg, 1901
		Mesocyclops Claus, 1893	
1			*Mesocyclops aspericornis* Daday, 1906
2			*Mesocyclops hyalinus* Rehberg, 1880
3			*Mesocyclops leuckarti* Claus, 1857
		Thermocyclops Kiefer, 1927	
1			*Thermocyclops hyalinus* Rehberg, 1880
		Paracyclop Fischer, 1853	
1			*Paracyclop fermbrialis* Fischer, 1853
		Apocyclops Lindberg, 1942	
1			*Apocyclops dengizicus* Lepeschkin, 1900
		Cletocamptus Schmankevitch, 1875	
1			*Cletocamptus albuquerquensis* Herrick, 1895
		Paracyclop Fischer, 1853	
1			*Paracyclop fermbrialis* Fischer, 1853
	Ostracoda (7)	*Cypris* Muller, 1776	
1			*Cypris protubera* Muller, 1776
		Strandesia Stuhlmann, 1888	
1			*Strandesia elongate* Stuhlmann, 1888
		Cyprinous Brady, 1886	
1			*Cyprinotus nudus* Brady, 1885

		Heterocypris Claus, 1892	
1			*Heterocypris dentatomarginatus* Baird, 1859
		Hemicypris Sars, 1903	
1			*Hemicypris anomala* Furtos, 1993
2			*Candonocypris dentatus*
		Cypretta Vavra, 1895	
1			*Cypretta fontinalis*

Ostracoda Diversity

In present study 7 species of Ostracoda were recorded from 6 genera (Table 3), the recorded population density was ranged from 140-460 (org/L). A maximum copepod population (460 org/L) was recorded in May and minimum population (140 org/L) was recorded in November. The species dominance was found high (0.1791) during January and low (0.1436) in April. The Shannon diversity index (H) was found to be high (1.943) in April and low (1.827) in January. Simpson's diversity index was maximum (0.8564) during April and minimum (0.8209) in January. The high species evenness (0.9975) was found during April and low evenness (0.8883) was recorded in January. The Margalef species richness (R1) was found maximum (1.214) in November and minimum (0.9786) in May 2017.

In the study air and water temperature had been recorded maximum in summer and minimal in winter season (Table 1). The located variation in water temperature may be because of the clean sky except excessive air temperature [14]. Water temperature influences the plankton of surrounding air temperature. All metabolic and physiological activity and life processes consisting of feeding, reproduction, movement and distribution of aquatic organism are substantially stimulated by water temperature. The pH values various from 7.5-8.35 all through the study period it was maximum in September 2017 minimal in November-2017 (Table 1). Aquatic organisms are tormented by pH because maximum of their metabolic activities are on pH based [15]. The physico-chemical parameters including temperature and pH values ranging have been alkaline nature. Salinity acts as essential ecological thing controlling the plankton population of freshwater in addition to brackish water species, which appeared or disappeared relying upon the salinity situation. It's far the maximum fluctuating parameter inside the freshwater environment and exerts distinct ecological and physiological effect depending on the interplay with temperature, oxygen and ionic compounds [16]. The recorded salinity in the present study became most in August and minimum in October.

Dissolved Oxygen plays an important role in water quality assessment and reflects the physical and biological process of water. Maximum amount of Dissolved Oxygen is an indication of healthy system in a water body [17]. The present study showed that the water in all study sites possessed a high DO content and is sufficient to maintain aquatic life form. The maximum dissolved oxygen was recorded in the month of May-2017 and minimum in month of February-2017. The total dissolved solids (TDS) in water were minimum in the month of February-2017 and maximum in the month of May-2017. An important consideration when there is a predominance of smaller species in lakes is the possible relation to suspended material in the water column due to the constant influence of the wind. Reports show the presence of sediments in suspension in natural ecosystems can influence the structure of the zooplankton community by favoring Rotifers [18]. Several species of Rotifers tolerate a high concentration of suspended material because their corona and mastax structures are highly efficient at identifying and selecting the material that will be ingested through the sensorial bristles of the mouth, avoiding inorganic particles.

Conclusion

The present study reports that the, the diversity of zooplankton is depends on the physico-chemical parameters triumphing within the supporting environmental conditions. The study also indicates that temperature plays an important role in the distribution of zooplanktons in a fresh water habitat. Subsequently measures need to be taken to decrease the freshwater pollution by minimizing or preventing human interruptions and activities. It's far understood that the Narangi Sarangi Dam of Vaijapur Dist. Aurangabad (MS) India are good for healthy aquaculture practices.

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