

# Correlations of Zooplankton Population with Some Physico-chemical Parameters of Chandani Dam, Maharashtra (India).

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**Key words :-** *Correlation Coefficient (r) Zooplankton population, , Physico-chemical Factors, Chandani Dam, Maharashtra.*

**Abstract :** Present paper deals with study of monthly variations in the zooplankton population and their correlations with some physicochemical characteristics of Chandani Dam in Osmanabad district, Maharashtra during June 2018 to May 2019. Parameters like, Water temperature, transparency, Sp. Conductivity, pH, TDS, dissolved oxygen, carbon dioxide, alkalinity, hardness, Chlorides etc. have been studied. The diversity and population dynamics of zooplankton is under the control of numerous physico-chemical factors. The population of zooplankton fluctuates along with the physicochemical factors. A study revealed that 20 genera of zooplanktons belonging to 4 groups viz. Rotifera, Cladocera, Copepoda and Ostracoda were observed. Highest zooplankton populations were recorded in the month of December and January. The present investigation showed positive correlations with parameters like DO, CO<sub>2</sub>, transparency, conductivity whereas water temperature, TDS, pH, Chlorides, alkalinity showed negative correlations with zooplankton population.

## **Introduction:**

Freshwater ecosystems are highly diversified and having with wide range of physicochemical conditions, which greatly influences the aquatic life. The quality of water is described by its physical, chemical and microbial characteristics. The Zooplankton is an important group of micro-organisms which indicates the trophic status of water body. Some of them are also acting as bio-indicators of organic and inorganic pollution of water body. The diversity and population dynamics of the zooplankton in fresh water ecosystem is controlled by several physico-chemical factors such as water temperature, pH, DO, free CO<sub>2</sub>, alkalinity, chlorides etc. The occurrence and abundance of zooplankton in the water body depends on its productivity which in turn is influenced by the physicochemical parameters and level of nutrients. Seasonal changes in physicochemical conditions in aquatic bodies influences the plankton dynamics, Bhowmick et.al. (1993). The seasonal fluctuations of zooplankton in relation to physico-chemical factors and their correlations have been studied by many workers in India including Tonapi (1980). Trivedy and Goel (1988)Kulshekhara et.al (1989), Adholia (1991), Chandrashekhara and Kodarkar (1996), Asif Khan et. al. (1996), Sayestehfer, Salaskar and Yeragi (2003), Surve P. R. et. al.(2004), Lendhe and Yeragi (2004), etc.

The Present paper deals with study of monthly variations in the zooplankton population and their correlations with some physicochemical characteristics of Chandani

Dam which is an earthfill dam on Chandani river which is the basin of Krishna and located near Paranda, Osmanabad district, in the state of Maharashtra (India). It lies between latitude 18.2543° N and Longitude 75.5327° E. Irrigation is the main purpose of this dam.

### Materials and Methods:

During present study water samples were collected for one year from June 2018 to May 2019 of each month between 9.30 to 11.30 am. Physicochemical parameters like water temperature, pH, transparency etc. were recorded at the sampling site. Other physico-chemical parameters were analysed in the laboratory as per standard methods for examinations of water suggested by APHA (1989), Trivedy (1984), Kodarkar (1998).

For qualitative and quantitative studies of zooplankton 100 lit. of surface water was passed through a conical plankton net with mesh size of 120 $\mu$ . The collected samples were preserved in 4 % formalin solution. These samples were observed and identified under research microscope by using suitable keys, standard texts and monographs given by Tonapi (1980), APHA (1989), Battish (1992) and Dhanpathi (2000). The Zooplanktons were counted with the help of Sedgwick Rafter Cell by taking one ml of diluted sample and the observation was represented number of organisms per liter of each genus were calculated. Correlation co-efficient (r) is computed with the help of computer.

### Results and discussion:-

Water contains dissolved and suspended constituents in varying proportion. They often have different physical and chemical properties along with the biological variation. The physico-chemical environment of the water bodies found to be the limiting factors for controlling diversity and density of zooplanktons and other microorganisms. The present study helped to understand the effect of different physico-chemical parameters and their interactions among themselves in deciding the final biotic and abiotic environment of the water body.

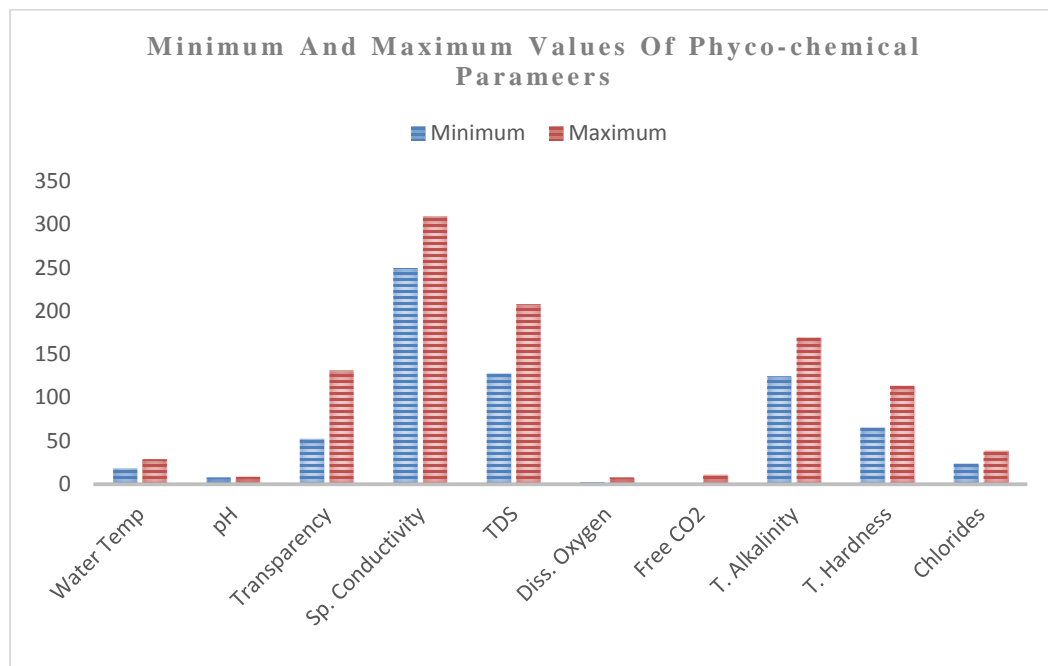
The monthly variations of physico-chemical characteristics are given in table 1. Temperature accelerates the chemical reactions in water and also influences aquatic life and concentration of gases such as O<sub>2</sub>, CO<sub>2</sub> etc. In the present study temperature was observed between 18.6<sup>0</sup>C to 28.9<sup>0</sup>C. The minimum temperature was recorded in the month of Dec.2018 and maximum in May 2019. According to Welch (1952) smaller water bodies react quickly with the change in the atmospheric temperature. The pH was alkaline in the present study. It was ranged between 8 to 8.7. Its values found to be increased in summer and decreased in winter and monsoon. Maximum values in summer may be due to increased photosynthesis of the algal bloom. Temperature brings out changes in pH. Singhal (1986) has obtained a direct relationship between water temperature and pH. The present study showed pH range favorable for aquatic life. The transparency ranged between 53 cm to 131.5cm. It was observed minimum during the monsoon and maximum during the winter season. Transparency decrease in monsoon is due to sewage discharge with rain water from the surrounding area. **Chavan**, et.al (2005). The specific conductivity of present water bodies ranges between 250  $\mu$  Mhos / cm to 310  $\mu$  Mhos / cm. Its maximum values were observed during summer season. The higher values of conductivity during summer might be due to evaporation of water resulting in increased concentration of salts. Rise in conductivity is due

to increased TDS. Nalina and Puttaiah (2006). The range of TDS reported was 128 to 208 mg/lit. TDS values were observed maximum during the summer season followed by

Season	Monsoon				Winter				Summer			
	Jun. 2018	Jul. 2018	Aug. 2018	Sept. 2018	Oct. 2018	Nov. 2018	Dec. 2018	Jan. 2019	Feb. 2019	Mar. 2019	Apr. 2019	May 2019
Water Temp	28.7	25.2	23.7	21.8	20.6	18.9	<b>18.6</b>	20.3	23.6	24.5	26.8	28.9
pH	8.1	8.2	8.2	8.3	8.2	8.3	<b>8</b>	8.2	8.3	8.4	8.6	<b>8.7</b>
Transparency	96.5	<b>53</b>	66.5	93.4	110	117	129	<b>131.5</b>	130	124	115	110
Sp. Conductivity	271	262	274	274	269	263	<b>250</b>	258	291	286	293	<b>310</b>
TDS	192	166	156	158	148	<b>128</b>	146	166	172	178	192	<b>208</b>
Diss. Oxygen	3.6	6.6	6.4	7	7.2	7.3	<b>7.8</b>	5.8	5.4	4.4	4.8	<b>2.5</b>
Free CO <sub>2</sub>	3.9	3.74	3.52	5.06	6.28	<b>11</b>	6.6	6.8	4.4	3.4	2.2	0
T. Alkalinity	170	155	150	145	145	<b>125</b>	135	145	150	155	160	<b>170</b>
T. Hardness	86	84	70	78	<b>66</b>	80	84	90	92	<b>114</b>	106	98
Chlorides	34.08	26.4	26.48	25.80	<b>24.14</b>	25.56	28.4	31.4	33.48	34.66	36.26	<b>38.99</b>
Phosphate	0.30	0.36	<b>0.42</b>	0.36	0.36	0.34	0.34	0.34	0.24	0.30	<b>0.12</b>	<b>0.12</b>
Nitrates	0.22	0.30	<b>0.34</b>	0.30	0.22	0.34	0.26	0.18	0.22	0.08	<b>0.14</b>	<b>0.14</b>

monsoon and winter. High values of TDS in summer might be due to evaporation of water resulting in increased concentration of salts **Lendhe, R.S. & S.G. Yeragi (2004)**

**Table 1. Monthly values of Physico-chemical parameters of Chandani Dam during June 2018 to May 2019**



Dissolved oxygen in water is the most important abiotic factor to indicate water quality. Dissolved oxygen levels in natural waters depend on the physical, chemical and biological activities in the water body. The importance of DO in aquatic ecosystem bringing out various biochemical reactions and its effects on metabolic activities of organisms. In the present investigation DO ranged between 2.5 mg/lit to 7.8 mg/lit. Peak values of DO were observed in winter followed by monsoon and summer. Maximum values of DO were observed in the month of Dec.2009 and minimum in May 2010. Mishra and Yadav (1978) have discussed seasonal averages and fluctuations in dissolved oxygen. High values of DO in winter would be due to low temperature of water. The low DO in summer was because of high temperature. Trivedy and Goel (1988). It showed inverse relationship with the temperature. Sreenivasan (1974). The free CO<sub>2</sub> is directly proportional to bicarbonates. During present study the free CO<sub>2</sub> values ranged between nil to 11 mg/lit. The maximum CO<sub>2</sub> was recorded in the month of November 2018 and nil in the month of May 2019. The absence of free CO<sub>2</sub> might be due to its utilization in photosynthetic activity. Sreenivasan (1974). The inhibition of CO<sub>2</sub> may be because of the formation of appreciable amount of carbonates in water. The alkalinity ranged from 125 mg/ lit. to 170 mg/lit. The alkalinity values of present water body generally remains higher than 100 mg/lit. indicates that the water body seems to have moderately contaminated and may be due to high photosynthetic activity of the phytoplankton, domestic sewage input, agricultural runoff and water temperature. Kulshekhara et al. (1989). The hardness of water is the sum of concentration of alkaline earth metal cations present in it. In the present investigation hardness was ranged 66 mg/ lit to 114 mg/ lit. The hardness was observed maximum in summer and it may be due to presence of high concentration of carbonates and bicarbonates. Similar results were observed by Lendhe & Yeragi (2004). The Chlorides ranged between 24.14 mg/ lit to 38.99 mg/ lit. High values of chlorides were recorded during summer months and it may be due to increased organic decomposition of animal origin. Yeole and Patil (2005). or it may be due to loss of water by evaporation. Wagh Nitin (1995). In natural water phosphates are present in small quantities. The values of phosphates were observed slightly more in monsoon season. Chavan R.J. (2002). The nitrates were recorded high during monsoon due to addition of domestic sewage and mixing of agricultural runoff.

Various physicochemical factors play an important role in the distribution and abundance of various aquatic organisms. Tonapi (1980). The seasonal variations in water quality parameters such as light, pH, inorganic and organic constituents play an important role in determining the nature and pattern of fluctuations in population densities of zooplankton. Relation between various physico-chemical parameters and zooplankton diversity has been studied by many workers. Tonapi (1980). **Singhal, R.N.**, Swamjeet & Davies (1986) : Kulshekhara et.al (1989) Sayestehfer A.(1990), Adholia (1991) Dhanpathi (2000), Chavan R.J. (2002). Salaskar and Yeragi (2003), Surve P. R. et. al. (2004), Lendhe and Yeragi (2004), etc.

A diverse collection of zooplankton revealed that the presence of 20 genera of zooplanktons belonging to four major groups viz. Rotifera, Cladocera, Copepoda

and Ostracoda. Among the total zooplanktonic organisms group Cladocera was observed most diversified including eight genera viz. *Alonella*, *Bosmina*, *Ceriodaphnia*, *Chydorous*, *Daphnia*, *Moina*, *Sida*, *Diphanosoma*. Copepoda is second most diversified genera representing six species viz. *Cyclops*, *Microcyclops*, *Mesocyclops*, *Neodiaptomus*, *Phyllodiaptomus* and *Sinodiatomus*. Four genera observed from group Rotifera were *Brachionus*, *Filinia*, *Lecane* and *Tripleuchlanis*. *Cypris* and *Stenocypris* were observed belonging to the group Ostracoda. Maximum zooplankton diversity was observed during the winter and minimum during summer months.

Group wise seasonal population density (No./L) of zooplankton is listed in Table 2 and the correlation coefficient ('r' value) between physico-chemical parameter and zooplankton population for all possible correlation is computed and listed in Table -3.

Maximum population density (No. /L) of zooplankton group was recorded in the winter season (39%) followed by monsoon (32%) and summer season (29%). During study period among four groups, Rotifers recorded dominantly having with 1456 (32%) numbers, followed by Copepods 1395 (31%) Cladocera 1209 (26%) and Ostracods 507 (11%) number of genera.

The temperature play an important role in the productivity of water. It also plays a conspicuous role in the diversity and biomass of zooplankton in tropical shallow fresh water bodies.(Dhanpathi 2000). Temperature effects on the metabolic activities and proliferation of zooplankton. Shukla et.al. (1991). Maximum number of zooplanktons were recorded during winter in the present study and they showed negative correlation ( $r = -0.9382$ ) with temperature. George (1962) reported that the temperature regulates the production of Zooplankton. He observed higher production of zooplankton during the period of low temperature and low production when the temperature was considerably high. Salaskar (2003) also observed negative correlation of zooplankton population with temperature. The pH is considered to be the most important factor regulating the plankton abundance. In present investigations the pH of the water showed alkaline range. The pH had negative correlation ( $r = -0.7268$ ) with zooplankton. Lendhe and Yeragi (2004) observed negative correlation between pH and zooplankton in water of Kharbhav lake of district Thane. In the present investigation maximum transparency was observed late winter and early summer months. Some workers consider transparency as limiting factor in plankton population. The transparency had a positive correlation ( $r = 0.2689$ ) with zooplankton. Salaskar and Yeragi (2003) also observed positive correlation between transparency and zooplankton. Conductivity (-0.8085) and TDS (-0.8582) showed significant negative correlation with zooplanktons. **Salaskar, P.B., Yeragi S.G. (2003)** also observed same results in Powai lake, Mumbai.

**Table 2. Group wise population dynamics ( density) of zooplanktons during June 2018 to May 2019.**

Zooplankton component	Monsoon Season				Winter season				Summer				Total
	Jun. 2018	Jul. 2018	Aug. 2018	Sept. 2018	Oct. 2018	Nov. 2018	Dec. 2018	Jan. 2019	Feb. 2019	Mar. 2019	Apr. 2019	May 2019	
Rotifera	96	80	70	101	143	159	164	173	144	110	109	107	1456

<b>Cladocra</b>	86	100	118	115	110	121	133	126	98	78	68	56	1209
<b>Copepoda</b>	118	136	145	125	116	103	110	88	116	118	123	97	1395
<b>Ostracoda</b>	32	48	52	46	49	53	58	64	45	32	16	12	507
<b>Total</b>	332	364	385	387	418	436	465	451	403	338	316	272	4567
<b>Seasonal Density</b>	1468				1770				1329				

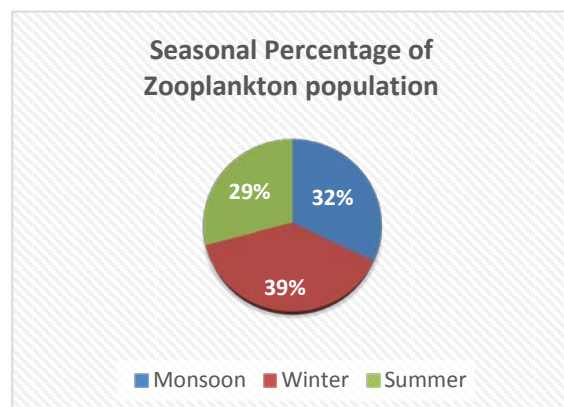
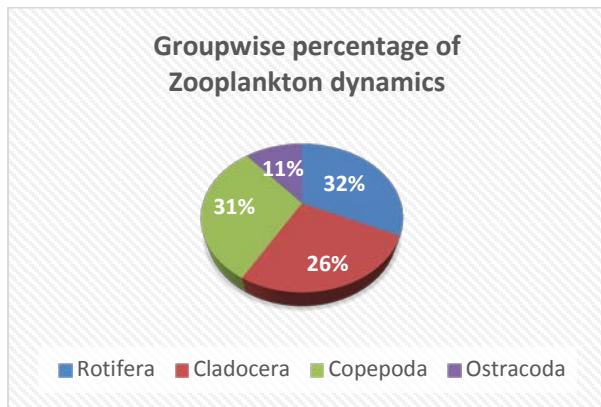


Table -3. Showing correlation coefficient between zooplankton population and Physico-chemical parameters.

Sr. No.	Parameters	Correlation coefficient ('r' Value)
1	Zooplankton and temperature	-0.9382
2	Zooplankton and pH	-0.7268
3	Zooplankton and transparency	0.2689
4	Zooplankton and conductivity	-0.8085
5	Zooplankton and TDS	-0.8582
6	Zooplankton and dissolved oxygen	0.8388
7	Zooplankton and carbon dioxide	0.8416
8	Zooplankton and alkalinity	-0.8716
9	Zooplankton and total hardness	-0.5276
10	Zooplankton and Chlorides	-0.6867
11	Zooplankton and Phosphates	0.6648
12	Zooplankton and Nitrates	0.4995

Dissolved oxygen is most vital parameter which influences the zooplankton population. It showed significant positive correlation ( $r = 0.8388$ ) with zooplankton population. Similar results were reported by **Dhanapathi M.V.S.S.** (2000), Salaskar and Yeragi (2003), Surve et.al.(2004). An inverse relationship between zooplankton and DO was reported by Asif Khan et. al (1986). Free carbon dioxide is also another important parameter. Maximum values of carbon dioxide were observed in winter season when temperature was minimum. The zooplankton showed positive correlation ( $r = 0.8416$ ) with free  $CO_2$ . Surve et. al (2004) recorded positive correlation between zooplankton and  $CO_2$ .



In the present investigation zooplankton population showed negative correlation with alkalinity ( $r = -0.8716$ ), Surve et. al observed positive correlation between zooplankton and alkalinity. While it showed negative correlation with total hardness ( $r = -0.5276$ ) and chlorides ( $r = -0.6867$ ). The nutrients like phosphates and nitrates play an important role in the biological activities. The nutrient level of the water body seemed to be poor. In the present investigation zooplankton population had positive correlation with phosphates ( $r = 0.6648$ ) and nitrates ( $r = 0.4995$ ). Salaskar et.al (2003) observed negative correlation with nitrates.

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