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Diversity of Zooplankton With Reference to Physicochemical Parameter of River Wainganga, Near Bramhapuri, Dist: Chandrapur.

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ABSTRACT
The present investigation was aim to study the diversity of zooplankton with respect to some physicochemical parameters of river Wainganga near Bramhapuri, Dist: Chandrapur. During the present study the water and zooplankton sample were collected from four different sampling site of the river. The zooplankton sample were qualitatively and quantitatively estimated and water sample analyzed with the various physicochemical parameters such as Temperature, pH, TDS, Conductivity, DO, Free Co_2, Sulphate, Nitrate, Phosphate, BOD, COD. The different zooplankton species were recorded and consisted of Rotifera, Cladocera, Copepoda and Ostracoda. Occurrence of these species diversity with respect to physicochemical parameters is discussed.

Key Words: Wainganga River, Zooplankton, Physicochemical Parameter, Bramhapuri.

INTRODUCTION

Fresh water is a natural resource having fundamental importance. It is well established fact, that, life originated in water and like air, water is one of the most important and precious among natural resources and a regular and plentiful supply of clean water is essential for the survival and health of all living organisms. The important physical and chemical properties that contribute in natural waters make up the basic way through various combinations and intensities, upon which the occurrence, the distribution and the success of aquatic organisms depend.

In addition, the organisms exert influence on one another. Therefore, the conditions within an environment are to a great extent mutually dependent and in nature this factor are always operating in presence of one another.

The physico-chemical properties of the environment directly affect the life inhabiting it. Variations in these parameters often create the adverse environment to organisms, shortening their growth and affecting in the physiological processes, which reduce their ability to compete with other populations within the environment, ultimately changing the community structure.

The biosphere constitutes a vital life support system for man. Its existence in a healthy and functional state is essential for the existence of human race. It is the complex collection of innumerable organisms- the biodiversity- which makes our lives both pleasant and possible.

METHODOLOGY

Analysis of water Quality Parameters:
Water samples were collected in polythene bottles (two liters) once in a month, from the four selected sites of River Wainganga for analyzing the water quality parameters for a period of 24 months, from June 2005 to May 2007. The analysis of temperature, pH and Dissolved oxygen was done near the collection sites, and remaining parameters were analysed in the laboratory. The samples were preserved by refrigeration at 4^0C, which is most generally accepted method. For analyzing the various parameters, methods given in APHA [1].

Zooplankton:
Zooplankton collection was done by filtering 100 Litters of water samples through Plankton net number 25 made up of Nylon bolting silk cloth having mesh size approximately 64 μ, at monthly intervals, during the period of investigation. The zooplankton samples were collected in 50 ml bottle and preserved in 4 % formalin. Qualitatively zooplankters were identified upto species under Labomade Microscope model DG Pro. 2 attached to computer and Photographed, using pertinent literature.

RESULTS AND DISCUSSION

Physicochemical Parameters:
Temperature:
Water temperature plays an important role in influencing the productivity, occurrence and abundance of phytoplankton. Temperature is also helpful in determining the saturated values of solids and gases that can be dissolved in water. In the present study, minimum temperature was 21.4 ^{0}C at site A during winter whereas maximum 26.53^o C at site D during summer. The low water temperature in the winter might be due to high water levels and lower solar radiation whereas maximum in the summer might be due to low water level, greater solar radiation and clear atmosphere. Similar results were reported by Arvind Kumar And Singh [2] in the Mayurakshi River, Jharkhand and Sawane, *et al.*,[3] in the Irai River, Chandrapur.

Conductivity:
The conductivity is a numerical expression of the ability of a water sample to carry an electric current which in turn, depends on the total concentration of the ionized substances dissolved in the water and the temperature at which the measurement is made. The minimum conductivity value 61.34 µmhos/cm was recorded at site A during winter might be due to the less human interferences without any appreciable source of pollution thus, resulting in less ionic concentration and maximum of 110 µmhos/cm was recorded at site C during summer might be due to increased concentration of dissolved solids, usually due to less flow of water, increased evaporation and also input of paper mill effluents and sewage at this site. Similar results were reported by Bobdey [4] in the river Wainganga, Pauni, Dist: Bhandara and Dahegaonkar [5] in the three lotic ecosystems, Chandrapur.

Total Dissolved Solids (TDS):
Dissolved solids denotes the various types of minerals present in the water in dissolved forms, this may also includes organic substances in the dissolved forms as in the case of polluted water. Maximum value of TDS 179.50 mg/L was recorded at site C during summer might be due to receiving large quantity of domestic sewage and paper mill effluents whereas minimum

116.50 mg/L was recorded at site A during winter might be due to no any remarkable stress of pollutants thereby showing low TDS. Dahegaonkar [5] reported high TDS during summer due to receiving of large quantity of domestic and industrial effluents whereas lower TDS during winter might be due to no sedimentation in the rivers Wardha, Erai and Zarpat at Chandrapur.

Hydrogen Ion Concentration (pH):

In the present study, the pH value from all the sampling sites were slightly alkaline throughout the study period which ranges from 7.31 to 8.55. Prakash *et al.*[6] recorded the pH ranging from 6.90 to 8.80 in the river Cauveri. The maximum values of pH were recorded during monsoon at all the sites especially at site C and D, this may be due to the receipt of sewage from nearby villages containing more carbonates and bicarbonates and also effluents from nearby paper mill.

Dissolved Oxygen (DO):

Higher DO values were observed in the winter season and lower in the monsoon season at all the sites. Winter maxima might be due to the clear zone, fall in temperature, increased in the solubility of oxygen, slightly more photosynthetic activities and high aeration rate whereas monsoon minima might be due to the increased organic matter from surface and agricultural runoff. Arvind Kumar And Singh [2] recorded high DO values in the winter might be due to solubility of dissolved oxygen increased with reduction in the Water temperature.

Free Carbon-dioxide (Free CO2):

Carbon dioxide is an end product of both aerobic and anaerobic bacterial oxidation; therefore, its concentration is not limited by the amount of dissolved oxygen. In the present study, maximum Free CO2 7.34 mg/L was recorded during summer at site D whereas minimum value 2.48 mg/L in the monsoon at site A. Summer maxima might be due to higher rate of decomposition of organic matter by microorganism with consequent increase in free CO2 and higher respiratory activities by benthos and microbes. Monsoon minima might be due to dilution effects as large quantity of water in the flooded river dilutes the decomposed organic matter to greater extent. This finding is in conformity with Bobdey [4] in the Wainganga river at Pauni.

Sulphate:

In the present study, the concentration of sulphate was minimum 5.34 mg/L at site A during winter whereas maximum 13.95 mg/L at site C during monsoon. The maximum value at site C during monsoon might be due to domestic sewage from nearby villages, surface runoff and paper mill effluents whereas minimum value at site A during winter might be due to not having any appreciable load of organic input by domestic as well as other sources. Kulshreshtha, *et al.* [7] reported maximum sulphate in the monsoon season which believed to be due to rain water bringing in high in put of sulphate from surrounding catchment area in Manasarovar reservoir, Bhopal, (MP).

Phosphate:

Maximum values 0.33 mg/L, 0.27 mg/L of Phosphate at site C and Site D during monsoon might be due to rain water bringing in high input of Phosphate from bank of river containing ashes of funeral pyres, nutrient soil deposited from catchment areas, agricultural runoff and paper mill effluents. Winter minima 0.035 mg/L at site A might be due to utilization of Phosphate by aquatic plants and assimilation of Phosphate by phytoplankton. Similar results were recorded by Chanu And Devi [8] in the Iril river at Manipur.

Biochemical Oxygen Demand (BOD):

Biochemical oxygen demand is an important parameter that indicates water pollution by oxidisable organic matter. The main sources of organic pollution are untreated domestic sewage, agricultural runoff and certain industrial effluents. In the present study, minimum value of BOD was observed 1.38 mg/L at site A during winter whereas maximum value 6.51 mg/L was observed at site C during monsoon. The maximum BOD at site C in the monsoon might be due to domestic sewage, surface runoff and paper mill effluents. At site A, there is no receipt of any appreciable load of pollutants that gives low value at this site. Kataria *et al.* [9] and Shivanikar *et al.*, [10] recorded maximum BOD in the monsoon and maximum in the summer in the Halali river, Bhopal and Godavari river, Nanded respectively.

Chemical Oxygen Demand (COD):

Chemical oxygen demand may be define as, the amount of oxygen required by the organic matter present in the water for its oxidation by strong chemical oxidant. The minimum value 3.63 mg/L of COD was observed at site A during summer whereas maximum value 9.89 mg/L of COD was observed at site C during winter. Winter maxima might be due to release of domestic sewage, paper mill effluents and other anthropogenic activities increase the chemical load. Summer minima might be due to evaporative loss of water, drying of river basin. Similar report was given by Chugh [11] in the Godavari river, Hardwar.

Zooplankton Diversity:

The total number of zooplankton, monthly and seasonal average of zooplankton Ind/Lit are recorded. The total number of zooplankton varied from 45 to 117 Ind/lit at Site A, 46 to 144 Ind/Lit at Site B, 48 to 119 Ind/Lit at Site C, 61 to 165 Ind/Lit at Site D during the present investigation. The zooplankton consisted of Rotifers, Ostracods, Cladocerans and Copepods at all four sampling sites. The quantitative relationship amongst different groups of zooplankton at sampling site A, site B and site C as Rotifera > Copepoda > Cladocera > Ostracoda, and at sampling site D it was Copepoda > Rotifera > Cladocera > Ostracoda.

Rotifera:

In all sampling sites as far as seasonal variation is concerned the rotiferans dominated in the winter season in the present study. Biswas and Konar, [12] reported maximum number of rotifers in winter season from river Ganga at Hatidah (Bihar). Sawane *et al.* [13] reported number of rotifers in winter season from river Erai at Chandrapur. Edmondson, [14] have observed that, the high population of rotifers in the winter season could be attributed with the favorable temperature and availability of abundance of food material in the form of bacteria, nanoplankton and suspended detritus. In the present study, five species of *Brachionus* were observed. Hutchinson, [15] have observed that, the *Brachionus* species are very common in temperate and tropical waters, which indicates alkaline nature of river water.

Ostracoda:

The Ostracoda at all the four sampling sites dominated during summer in the present study. The environmental factors such as dissolved oxygen, temperature and sediments composition seems influence the distribution of Ostracods in the river Cauvery. Mezquita,[16] reported that, the abundance of Ostracods was more in summer when the water temperature was rising in Mediterranean rivers. The Ostracods population was found minimum in the winter and monsoon season and might be due to dilution effects of flooded river. Ostracods abundance also depends on the availability of food as observed by Joy and Clark [17].

Cladocera:

In the present study, the Cladocerans were more in the winter season at sampling sites A, B and D and in the summer at sampling site C. The Cladoceran component of zooplankton plays an important role in the benthic tropodynamics. Most of the Cladoceran species are primary consumer and feed on microscopic algae and fine particulate matter in the detritus thus, influencing cycling of matter and energy in the benthos. There is also an influence of some physico-chemical factors on the seasonality of Cladocera. The maximum population of Cladoceran in the winter might be due to favorable temperature and availability of abundant food in the form of nanoplankton and suspended detritus. Biswas and Konar, [12] recorded 6 species of Cladocerans and reported that, the Cladocera was the dominant group in the summer at one site and it was highest in the season.

Copepoda:

In the present study, Copepods were maximum during summer season at all the sampling sites. The inverse relationship between high population of Rotifers and Cladocera and low population of Copepoda during winter season may be due to the feeding pressure of native fish. The Copepoda diversity was represented by 4 species. Among the four sampling sites; increased number of Diaptomus species observed at site A and increased number of

Cyclop species was observed at site C and D which receive the domestic sewage and industrial effluents. Kulshreshtha et al,[18], kumar and Singh, [19] and Arvind Kumar, [20] observed that, the Cyclops increase with an increase in nutrients.

Table 1: Seasonal Variation in Physicochemical Parameters During Present Study.

Parameters	Season	Sampling Sites			
		Site A	Site B	Site C	Site D
Temp	M	24.48	24.66	24.87	25.01
	W	21.4	21.56	21.78	22
	S	25.92	26.1	26.31	26.53
Cond	M	69.88	78	105	100
	W	61.34	66.25	108.50	97.25
	S	71.94	80.50	110	105.75
TDS	M	127.5	142.25	164.75	143.25
	W	116.5	121	138.75	124.75
	S	131	147	179.5	157.75
pH	M	7.75	7.92	8.55	8.47
	W	7.33	7.75	7.71	7.68
	S	7.31	7.44	7.86	7.97
DO	M	6.14	5.53	5.19	5.33
	W	8.34	8.56	7.64	7.71
	S	6.22	5.83	6.22	6.67
Free Co_2	M	2.48	3.49	3.98	4.19
	W	4.98	4.44	5.89	6.61
	S	5.54	6.74	7.14	7.34
Sulphate	M	11.2	13.26	13.95	10.41
	W	5.34	7.16	7.76	6.57
	S	7.31	7.53	8.44	7.17
Phosphate	M	0.06	0.19	0.33	0.27
	W	0.035	0.10	0.26	0.22
	S	0.053	0.10	0.11	0.09
Nitrate	M	0.76	1.04	1.26	0.77
	W	0.41	0.43	0.63	0.52
	S	0.25	0.35	0.40	0.35
BOD	M	2.18	2.90	6.51	2.92
	W	1.38	1.61	5.49	2.25
	S	2.14	2.30	5.78	2.47
COD	M	4.40	5.12	5.55	5.34
	W	5.57	5.67	9.89	9.24
	S	3.63	3.79	4.98	4.50

All Values are expressed in mg/L except pH and Conductivity. **M:** Monsoon; **W:** Winter; **S:** Summer.

Table 2: Total Number of Zooplankton Ind/Lit during present study.

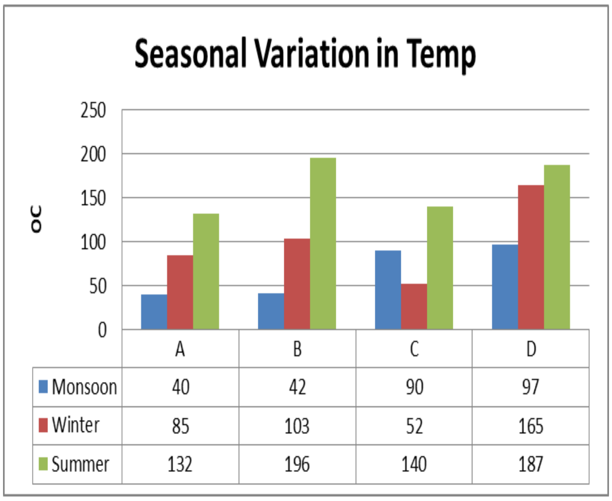
Site A																
Monthly													**Seasonal**			
Zooplankton	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**M**	**W**	**S**	**Total**
Rotifera	13	0	0	24	32	36	54	35	33	33	14	10	37	157	90	284
Ostracoda	10	0	0	18	10	0	0	0	10	15	20	11	28	10	56	94
Cladocera	2	0	0	16	27	47	44	26	24	13	6	4	18	144	47	209
Copepoda	20	0	0	20	21	23	19	22	31	31	36	34	40	85	132	257
Total	45	0	0	78	90	106	117	83	98	92	76	59	123	396	325	844
Site B																
Monthly													**Seasonal**			
Zooplankton	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**M**	**W**	**S**	**Total**
Rotifera	18	0	0	56	57	63	72	62	47	25	14	12	74	254	98	426
Ostracoda	12	0	0	15	7	6	0	0	8	10	15	9	27	13	42	82
Cladocera	4	0	0	16	36	43	54	46	27	13	6	1	20	179	47	246
Copepoda	12	0	0	30	44	30	15	14	35	63	59	39	42	103	196	341
Total	46	0	0	117	144	142	141	122	117	111	94	61	163	549	383	1095
Site C																
Monthly													**Seasonal**			
Zooplankton	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**M**	**W**	**S**	**Total**
Rotifera	17	0	0	26	46	42	52	17	18	25	25	29	43	157	97	297
Ostracoda	28	0	0	35	10	15	5	0	2	17	19	22	63	30	60	153
Cladocera	19	0	0	22	25	33	21	17	33	34	30	31	41	96	128	265
Copepoda	54	0	0	36	18	8	12	14	28	35	45	32	90	52	140	282
Total	118	0	0	119	99	98	90	48	81	111	119	114	237	335	425	997
Site D																
Monthly													**Seasonal**			
Zooplankton	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**M**	**W**	**S**	**Tota l**
Rotifera	6	0	0	12	36	41	44	24	15	31	29	21	18	145	96	259
Ostracoda	28	0	0	38	5	4	6	6	17	30	25	18	66	21	90	177
Cladocera	3	0	0	8	13	33	29	20	18	39	43	22	11	95	122	228
Copepoda	33	0	0	64	67	53	34	11	28	46	68	45	97	165	187	449
Total	70	0	0	122	121	131	113	61	78	146	165	106	192	426	495	1113

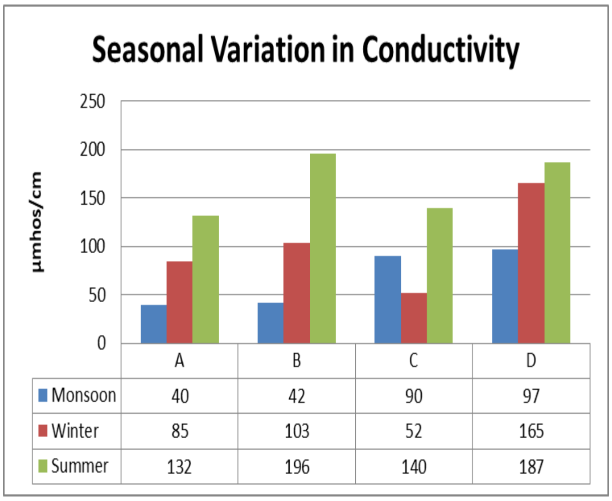
M: Monsoon; **W:** Winter; **S:** Summer

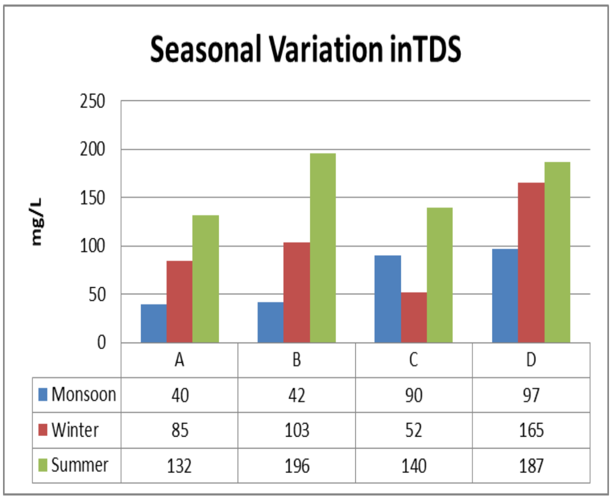
Table 3: Diversity of Zooplankton at Sampling Sites

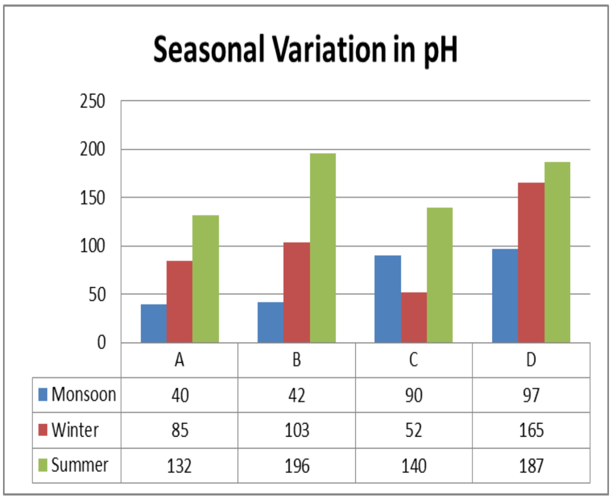
	Zooplankton	A	B	C	D			A	B	C	D
	ROTIFERA										
A	**Family : Brachionidae**					**D**	**Family : Macrothricidae**				
1	Brachionus calyciflorus	+	+	+	+	11	Macrothrix goeldii	+	-	-	+
2	Brachionus diversicornis	+	+	+	+	12	Macrothrix laticornis	+	-	-	+
3	Brachionus quandridentatus	+	+	+	+	13	Echinisca triserialis	+	-	-	+
4	Brachionus caudatus	+	+	-	+	14	Echinisca odiosa	+	-	-	-
5	Brachionus falcatus	+	+	+	+	**E**	**Family : Chydoridae**				
6	Plationus patulus	+	+	-	-	15	Chydorus sphaearicus	+	+	+	+
7	Keratella tropica	+	+	+	+	16	Pluroxus aduncus	+	-	-	-
B	**Family : Lecanidae**					17	Alonella spp.	+	-	-	-

8	Lecane decipiens	+	+	+	+
9	Lecane cornuta	+	+	+	+
10	Lecane ohioensis	+	+	-	-
11	Lecane monostyla	+	+	-	-
C	**Family : Trichocercidae**				
12	Trichocerca spp.	+	+	+	+
D	**Family : Asplanchnidae**				
13	Asplanchna brightwelli	+	+	+	+
E	**Family : Trochosphaeridae**				
14	Horaella brehmi	+	+	-	-
F	**Family : Testudinellidae**				
15	Testudinella spp.	+	-	-	-
	OSTRACODA				
1	Cypris spp.	+	+	+	+
	CLADOCERA				
A	**Family : Sididae**				
1	Diaphanosoma sarsi	+	+	+	+
2	Diaphanosoma excisum	+	+	+	-
3	Diaphanosoma senegal	+	+	+	+
B	**Family : Daphnidae**				
4	Ceridaphnia cornuta	+	+	+	+
5	Ceridaphnia quadrangula	+	+	+	+
6	Ceridaphnia laticaudata	+	+	-	-
7	Ceriodaphnia pulchella	+	+	-	+
8	Simocephalus spp.	+	-	-	+
C	**Family : Moinidae**				
9	Moina micrura	+	+	+	+
10	Bosmina longirostris	+	+	+	+
18	Alona rectangula rectangula	+	+	+	+
19	Alona rectangula richardi	+	+	+	+
20	Alona davidi punctata	+	+	-	-
	COPEPODA				
1	Mesocyclop spp.	+	+	+	+
2	Eucyclop spp.	+	+	+	+
3	Cyclop spp.	+	+	+	+
4	Diaptomus spp.	+	+	+	+






Seasonal Variation inTDS
mg/L
250
200
150
100
50
0
A B C D
Monsoon 40 42 90 97
Winter 85 103 52 165
Summer 132 196 140 187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250
200
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100
50
0
A B C D
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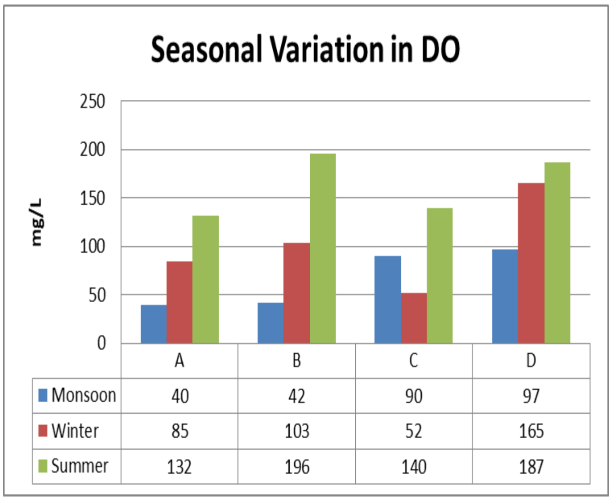
Winter 85 103 52 165
Summer 132 196 140 187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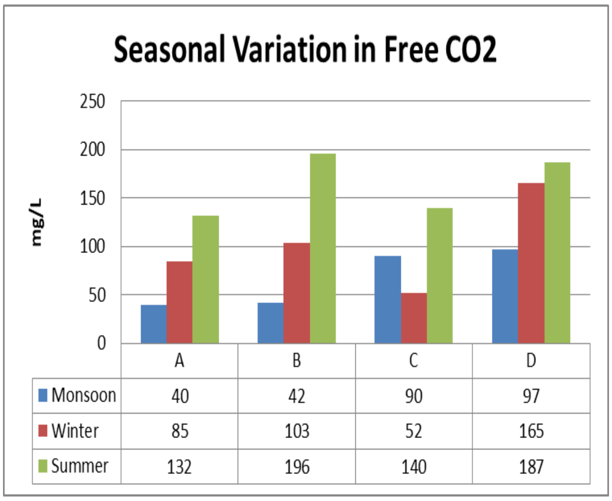
mg/L
250
200
150
100
50
0
A B C D
Monsoon 40 42 90 97
Winter 85 103 52 165
Summer 132 196 140 187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mg/L
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150
100
50
0
A B C D
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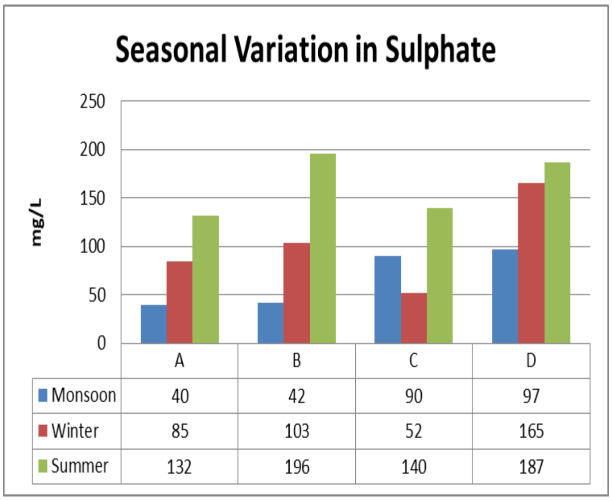
Winter 85 103 52 165
Summer 132 196 140 187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mg/L
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200
150
100
50
0
A B C D
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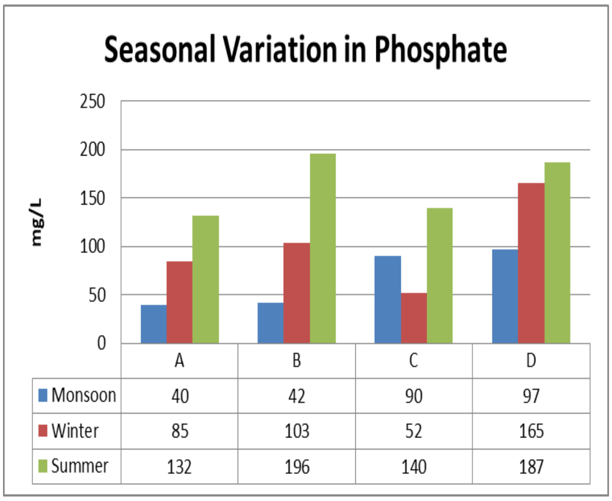
Winter 85 103 52 165
Summer 132 196 140 187


Seasonal Variation in Phosphate
mg/L
250
200
150
100
50
0
A B C D
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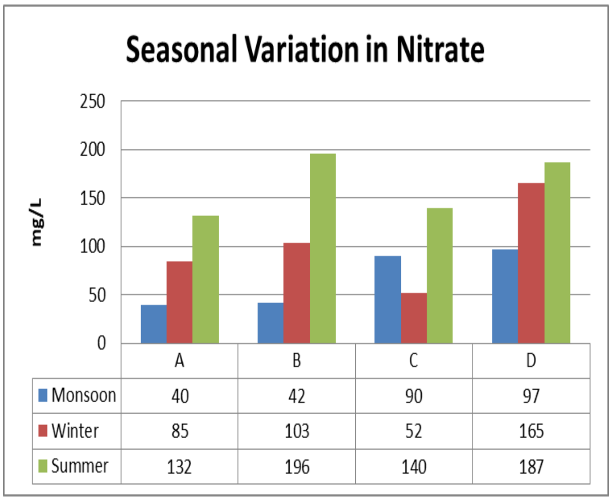
Winter 85 103 52 165
Summer 132 196 140 187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mg/L
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150
100
50
0
A B C D
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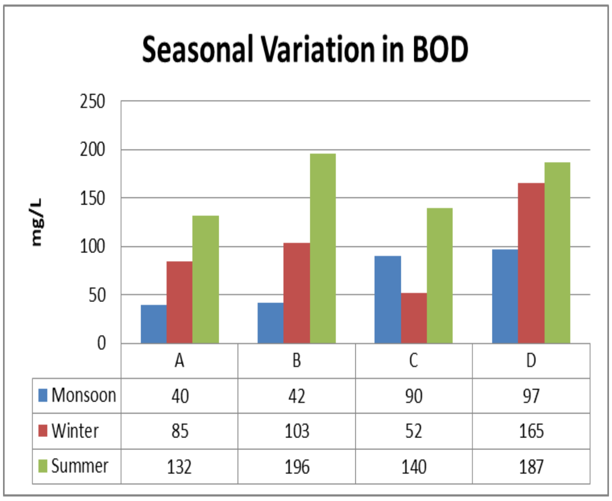
Winter 85 103 52 165
Summer 132 196 140 187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mg/L
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150
100
50
0
A B C D
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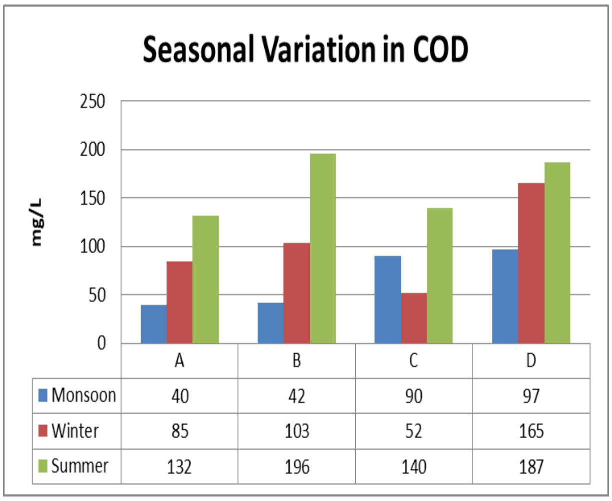
Winter 85 103 52 165
Summer 132 196 140 187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mg/L
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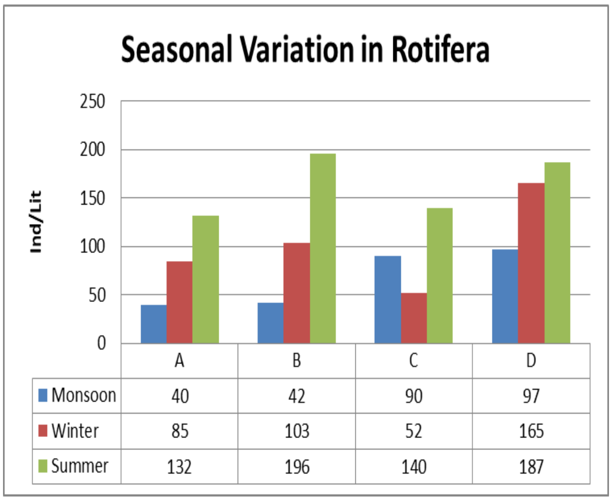
200
150
100
50
0
A B C D
Monsoon 40 42 90 97
Winter 85 103 52 165
Summer 132 196 140 187


Seasonal Variation in Rotifera
Ind/Lit
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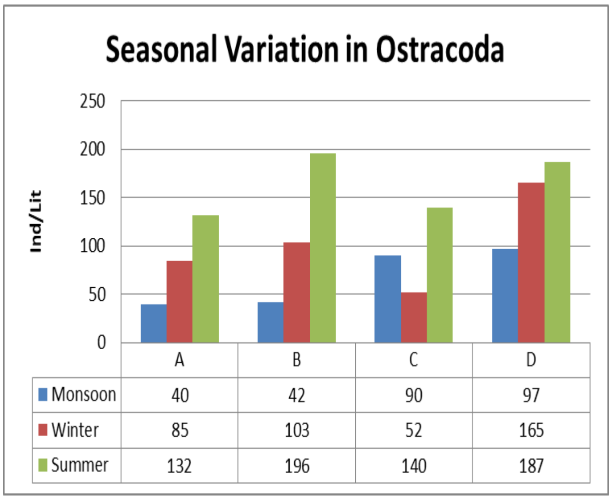
200
150
100
50
0
A B C D
Monsoon 40 42 90 97
Winter 85 103 52 165
Summer 132 196 140 187


Seasonal Variation in Ostracoda
Ind/Lit
250
200
150
100
50
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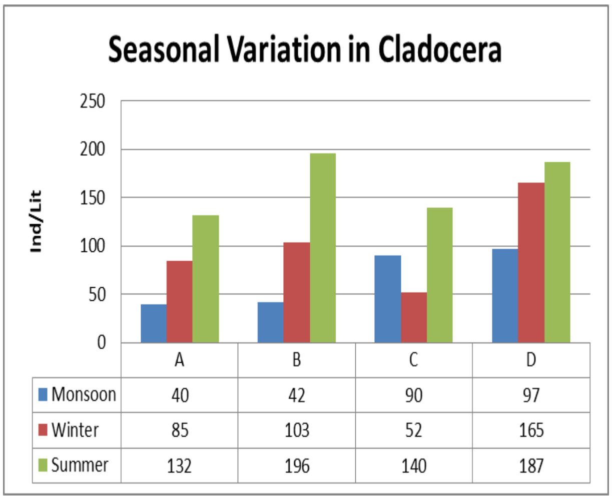
A B C D
Monsoon 40 42 90 97
Winter 85 103 52 165
Summer 132 196 140 187


Seasonal Variation in Cladocera
Ind/Lit
250
200
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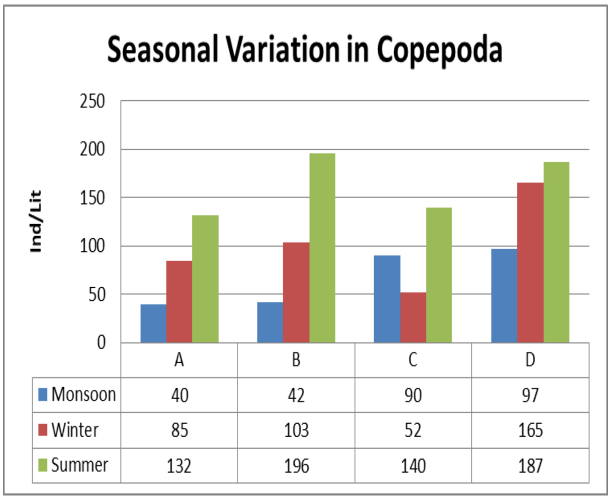
A B C D
Monsoon 40 42 90 97
Winter 85 103 52 165
Summer 132 196 140 187



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