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Seasonal variation of benthic community in Medical Pond of Aligarh

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Abstract

Study of fresh water bodies of Aligarh was carried out to determine seasonal variation in macro zoo-benthic community of Medical Pond that receives water from domestic discharge and from rainwater which accumulates during rainy season. Physicochemical parameters like water temperature, dissolved oxygen, pH, T.D.S., carbonate, and conductivity were analyzed with the help of method given by Trivedy and Goel.

Keywords: Seasonal variation in benthos; zoo benthos; derelict water bodies.

Introduction

The term benthos is derived from two Greek words 'Ben' meaning "The collection of organisms living in or on the sea or lakes" and 'Thos' "the bottom of sea or lakes". The maxima of benthic assemblages during winter could be accounted for low water temperature, good oxygen content coupled with low water level in the system having least disturbance due to dry spells. The monthly distribution of benthic community also depends upon various physicochemical parameters (e.g., temperature, pH, D.O.). All benthos forms an important part of food chain, especially for fish. Many invertebrates feed on algae and bacteria, which are on the lower end of the food chain. Some eat leaves and organic matter that enter the water because of their abundance in aquatic food chain. Thus, benthos plays a critical role in the natural flow of energy and nutrients. As benthic invertebrates die, they decay leaving behind nutrients that are reused by aquatic plants and other animals in the food chain.

Materials and Methods

The present study was carried out in Medical College Pond which is a sewage fed pond, situated on the back side of the Medical College residential complex at a distance of about 2 km from the Department of Zoology. It covers a surface area of about 0.71 hectares, having a depth of 1-2 meters in different seasons. The pond receives rainwater from the surrounding area along the shoreline.

Physicochemical factors, namely temperature, hardness, T.D.S., pH, D.O., CO₂, alkalinity and conductivity were analyzed with the help of method given by Trivedy and Goel (1984). For benthos analysis, bottom mud

sample was collected with the help of mud scrapper. Separation was done with the help of sieves having different mesh sizes according to APHA (1998). Identification was done with the help of keys given in APHA (1998) and Edmondson (1959), counting was done with the help of Sadgwick rafter cell. The major groups (zoobenthos) in Medical Pond belong to Insecta (Ephemeroptera, Diptera, Plecoptera and Coleoptera), Cladocera, Copepoda, Ostracoda, Oligochaetes and Rotifera.

Results and Discussion

The data on chemical and physical features of water are presented in Table 1, composition of zoobenthos and its relative abundance are recorded in the Table 2, and monthly percent composition of zoobenthos is given in Table 3. In Medical Pond, transparency ranged from 15.0 cm to 19.5 cm showing minimum in November 2007 and maximum in September 2008 (Table 1). Temperature is the most important factor in aquatic environment since it regulates various physicochemical as well as biological activities (Kumar et al., 1996). It varies according to ambient air temperature showing minimum temperature difference 6°C during February 2008. It shows positive correlation with zoobenthos.

pH is generally considered as an index for suitability of environment and is one of the most important factors affecting productivity of water body (Welch, 1952). Free carbon dioxide was never recorded throughout the study period from May 2007 to April 2008. Complete absence of CO₂ might be due to the fact that Medical Pond showed minimum hardness (153 mg/l) in March 2008 and maximum (423 mg/l) in April 2008 during study period. Total Dissolved

Solids (T.D.S.) has been proved as a very useful parameter in determining the productivity of inland waters (Rawson, 1951; Hutchinson, 1975; Wetzel, 1975). The value of T.D.S. ranged from

minimum 184 mg/l in October to maximum 400 mg/l during April 2008. It is directly related to productivity (Rawson, 1951; Haque, 1991).

Table 1a: Monthly variation in different physicochemical parameters in Medical Pond.

Month	pH	Water temp	Air temp	Transparency (cm)	D.O.	Free CO ₂	Hardness mg/l
May	8.3	32	35	18	1.8	absent	235
Jun	8.1	35	30	17.5	1.6	-	312.8
Jul	8.0	37	34	18	3.4	-	225
Aug	9.0	32	35	19	4.7	-	245
Sep	9.6	33	34	19.5	2.4	-	198
Oct	9.2	29	27	16.0	3.6	-	212
Nov	9.2	24	22	15.0	6.8	-	240
Dec	9.0	19	20	16.0	9.4	-	230
Jan	9.3	15	17	15.5	9.2	-	245
Feb	8.5	20	27	15.4	8.7	-	162
Mar	8.5	26	24	15.7	4.7	-	153
Apr	8.7	26	24	19.2	5.2	-	423

Table 1b: Monthly variation in different physicochemical parameters in Medical Pond.

Month	Carbonate HCO ₃ ⁻	Bicarbonate HCO ₃ ⁻	Total alkalinity	T.D.S.	Ca ⁺⁺	Mg ⁺⁺	Hydroxide Mg/l	Conductivity
May	80	45	125	230	60.5	42.5	-	2168
Jun	60	60	120	291	98.5	16.37	-	2050
Jul	56	46	102	212	70.8	7.55	-	2200
Aug	72	58	130	197	80.2	11.64	-	2340
Sep	40	64	104	202	82.5	10.28	-	2398
Oct	188	110	298	184	67.8	11.9	-	2458
Nov	78	227	305	230	91.0	4.09	-	2598
Dec	94	103	197	198	44.08	22.36	-	2652
Jan	56	102	158	319	52.8	24.3	-	2698
Feb	140	32	172	312	60.12	42.9	-	2525
Mar	56	112	168	350	61.3	13.8	-	2528
Apr	144	36	180	400	140	40.86	-	2496

Table 2: Distribution and abundance of zoobenthos (No/m²) in Medical Pond.

Months Genera	May'07	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan'08	Feb	Mar	Apr
ROTIFERA												
<i>Branchionus bidentatus</i>	52	26	28	68	39	64	62	67	62	69	36	48
<i>B. calyciflorus</i>	39	56	29	62	58	26	64	28	48	52	39	28
<i>Keratella quadrata</i>	38	39	52	52	39	45	29	38	29	48	39	49
<i>K. tropica</i>	60	59	52	64	42	29	25	44	68	58	64	63
<i>Filinia sp.</i>	39	37	28	36	35	54	62	72	45	38	27	27
<i>Notholca</i>	28	29	22	38	26	29	29	34	29	39	36	29
Total	256	240	211	320	239	247	267	283	281	304	241	241
CLADOCERA												
<i>Daphnia sp.</i>	78	97	29	32	54	59	58	92	67	53	48	69
<i>Bosmina sp.</i>	29	28	54	39	29	39	42	38	29	27	42	38
Total	107	125	83	71	83	98	100	130	96	80	90	107
COPEPODA												
<i>Cyclops sp.</i>	42	29	62	45	54	45	52	61	69	49	55	49
<i>Diaptomus sp.</i>	52	49	45	45	56	34	58	34	65	45	29	39
Total	94	78	107	90	110	79	110	95	134	94	84	88
OSTRACODA												
<i>Cypridopsis</i>	32	51	62	64	39	56	42	29	44	28	27	39
<i>Nauplius</i>	24	25	19	22	17	32	26	21	34	18	14	49
Eggs	45	42	65	46	45	56	62	65	54	59	46	43
Total	101	119	146	132	101	144	130	115	132	105	320	131
OLIGOCHAETA												
<i>Tubifex</i>	52	49	54	79	87	95	72	87	58	46	45	42
<i>Chaetogaster</i>	42	36	29	48	70	62	72	81	46	39	42	36
<i>Nais</i>	62	64	30	39	61	59	68	79	46	39	42	62
<i>Aelosma niveum</i>	72	62	53	45	38	62	38	39	43	38	52	58
<i>A. quaternarium</i>	28	32	41	28	53	39	49	54	38	29	51	38
Total	256	243	207	239	309	317	299	340	233	211	257	236

EPHEMEROPTERA

<i>Baetis</i>	29	29	58	57	28	62	40	52	61	39	22	54
<i>Caenis</i>	38	49	55	37	38	60	77	66	52	38	32	49
Total	67	78	113	94	66	112	117	118	113	77	54	103

PLECOPTERA

<i>Atoperala</i>	40	38	39	29	21	28	19	42	38	36	21	34
Total	40	38	39	29	21	28	19	42	38	36	21	34

COLEOPTERA

<i>Berosus</i>	30	32	44	38	37	52	48	56	49	38	34	23
<i>Hydaticus</i>	34	22	28	32	46	44	50	55	38	33	29	46
<i>Hydracarina</i>	52	41	42	44	64	66	85	74	63	64	59	35
<i>Hydranchna</i>	28	26	19	17	24	26	36	38	29	19	17	34
Total	144	121	133	131	171	188	219	223	179	154	139	138

DIPTERA

<i>Chironomus</i>	239	248	249	260	292	237	258	247	266	257	247	97
<i>Tanytus</i>	49	39	39	37	39	45	47	52	51	48	34	86
<i>Pentaneura</i>	28	26	32	36	38	29	34	39	37	29	27	65
<i>Culicoides</i>	29	35	37	35	46	48	72	66	52	49	47	50
Total	345	348	357	368	415	359	411	403	406	383	355	308
Grand Total	1410	1390	1396	1474	1515	1582	1671	1750	1612	1444	1561	1386

Table 3: Monthly percent composition of different groups of zoobenthos in Medical Pond.

Genera	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Rotifera	18.1	17.2	15.1	21.7	15.7	15.6	15.9	16.1	17.4	21.0	15.4	18.3
Cladocera	7.5	8.9	5.9	4.8	5.4	6.1	5.9	7.4	5.9	5.5	5.7	8.2
Copepoda	6.6	5.6	7.6	6.1	7.2	4.9	6.5	5.4	8.3	6.5	5.3	7.2
Ostracod	7.1	8.5	10.4	8.9	6.6	9.1	7.7	6.5	8.1	7.2	20.4	8.0
Oligochaets	18.1	17.4	14.8	16.2	20.3	20.0	17.8	19.4	14.4	14.6	16.4	18.2
Ephemeroptera	4.7	5.6	8.0	6.3	4.3	7.7	7.0	6.7	4.7	5.3	3.4	4.5
Coleoptera	2.8	2.7	2.7	1.9	1.3	1.7	2.5	2.4	2.3	2.4	2.5	1.5
Plecoptera	10.2	8.7	9.5	8.8	11.2	11.8	13.0	12.7	11.1	10.6	8.9	8.9
Diptera	24.4	25.0	25.5	24.9	27.3	22.6	24.5	23.0	25.1	26.5	22.7	24.7

The benthic community plays an important role in the economy of natural waters. Study of qualitative and quantitative macro zoobenthic organisms is important criteria for evaluation leading to water quality designation according to saprobiant system. Level of species richness was found depend upon abiotic factors like temperature, hardness, pH, dissolved oxygen, chloride and phosphorus. However, the importance of habitat types, pollution, biotic factors and anthropogenic cannot be ruled out. They are sensitive to watershed condition and exhibit sufficient stability in assemblage structure over time to make them useful as long-term monitors of stream health and indicator of water quality. Hynes (1960) reported that the density of benthos in a water body is a useful index of water quality although density may fluctuate widely with change in the seasons.

In the present study, the seasonal distribution of benthic diatoms supported the peak period of phytobenthic productivity. Colijin and Venekamp (1977) also observed significant positive correlation between algal biomass and microphytobenthic productivity in EMS-Dollard estuary. Benthic community may also reflect eutrophication depending upon how quickly they respond to the eutrophication depending upon how quickly they respond to eutrophication. The population of macrobenthos was highly stable in both the ponds on account of feebly changing ecological condition. The major groups of zoobenthos in Lal Diggi Pond (Aligarh) belong to Insecta (Ephemeroptera, Diptera, Plecoptera and Coleoptera), Cladocera, Copepoda, Ostracoda, Oligochaetes and Rotifera. The total number of rotifers recorded in this pond was found to vary from 211 No/m² to 320 No/m². The group is represented by only four genera namely, *Brachionus*, *Filinia*, *Keratella* and *Notholca*. Among them, *Brachionus* was recorded as dominant genus.

Cladocera: It comprises a group of primitive and usually microscopic crustaceans to which the general name of 'entomostracan' was formerly applied. The member of this group is also commonly termed as 'water fleas' because of their characteristic 'jerk' swimming action of locomotion (Dodson and Frey, 1991).

Copepods: They are very ancient arthropods and the diminutive relatives of crabs and shrimps. In terms of their diversity and abundance, they are also often called as 'water fleas' in common with many other small

crustaceans (Reddy, 2001). The total number of Copepods recorded in this pond was found to vary from 78 No/m² to 174 No/m² (Table 2).

Ostracods: Ostracods, commonly known as seed shrimps, form another important group of benthic community. They inhabit all types of substrate in both standing and running waters, including rooted vegetation, debris, mud, sand and rubble. The total number of ostracods varied from 101 No/m² to 320 No/m² in Medical Pond (Table 2).

Oligochaetes: In the present investigation too, the seasonal fluctuations in the abundance of oligochaetes were not so much pronounced. Maximum number of Oligochaetes were observed at 340 No/m² and minimum at 207 No/m² (Table 2).

Insecta: Out of the total insects present in the benthos, dipterans contributed major share in the samples collected from the Lal Diggi Pond, showing maximum value (415 No/m²) in December 2007 and minimum (345 No/m²) in August 2007.

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