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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., CO_2, 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 6^0C 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 CO_2 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/m^2) in Medical Pond.

Months / Genera	May'07	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan'08	Feb	Mar	Apr
ROTIFERA												
Branchionus bidentatus	52	26	28	68	39	64	62	67	62	69	36	48
B. calyciflorus	39	56	29	62	58	26	64	28	48	52	39	28
Keratella quadrata	38	39	52	52	39	45	29	38	29	48	39	49
K. tropica	60	59	52	64	42	29	25	44	68	58	64	63
Filinia sp.	39	37	28	36	35	54	62	72	45	38	27	27
Notholca	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												
Daphnia sp.	78	97	29	32	54	59	58	92	67	53	48	69
Bosmina sp.	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												
Cyclops sp.	42	29	62	45	54	45	52	61	69	49	55	49
Diaptomus sp.	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												
Cypridopsis	32	51	62	64	39	56	42	29	44	28	27	39
Nauplius	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												
Tubifex	52	49	54	79	87	95	72	87	58	46	45	42
Chaetogaster	42	36	29	48	70	62	72	81	46	39	42	36
Nais	62	64	30	39	61	59	68	79	46	39	42	62
Aelosma niveum	72	62	53	45	38	62	38	39	43	38	52	58
A. quaternarium	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												
Baetis	29	29	58	57	28	62	40	52	61	39	22	54
Caenis	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												
Atoperala	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												
Berosus	30	32	44	38	37	52	48	56	49	38	34	23
Hydaticus	34	22	28	32	46	44	50	55	38	33	29	46
Hydracarina	52	41	42	44	64	66	85	74	63	64	59	35
Hydranchna	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												
Chironomus	239	248	249	260	292	237	258	247	266	257	247	97
Tanypus	49	39	39	37	39	45	47	52	51	48	34	86
Pentaneura	28	26	32	36	38	29	34	39	37	29	27	65
Culicoides	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 zoo-benthic 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/m^2 to 320 No/m^2. 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/m^2 to174 No/m^2 (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/m^2 to 320 No/m^2 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/m^2 and minimum at 207 No/m^2 (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/m^2) in December 2007 and minimum (345 No/m^2) in August 2007.

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