Journal of Research & Development, Vol. 5 (2005)
ISSN 0972-5407

Ecology of Macrozoobenthos in Rambiara Stream, Kashmir

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ABSTRACT

The present paper deals with the qualitative and quantitative analysis of macrozoobenthic community in Rambiara stream, an important left bank tributary of river Jhelum. The slightly alkaline water (pH, 7.8 – 8.3), having temperature ≤ 18°C contained mainly bicarbonates of calcium and magnesium. Nutrient content was generally low; however, the increasing trend was recorded towards summer. The macrozoobenthos was contributed by twelve taxa of which annelids (03 taxa) and molluscs (03 taxa) were the dominant component. Shannon – Weiner diversity index, Margalef's species richness and evenness pattern indicated richer zoobenthic diversity during the winter period.

Key Words: Rambiara Stream, Kashmir, Ecology, Macrozoobenthos

INTRODUCTION

The Rambiara Nalla, an important left bank tributary of the River Jhelum, rises in Rupri peak, the Bhagsar Lake, Pir Panjal and Naba passes. After flowing for about 60 km it joins River Jhelum at Nyayun near Sangam (Anantnag). A hydro-biological study of this lotic system was undertaken during 2002 – 2004 during the tenure of an Integrated Ecological Research Project sponsored by G. B. Pant Institute of Himalayan Ecology and Development. The data collected during this study on the ecology of macrozoobenthos in the stream are presented in the present communication.

MATERIALS AND METHODS

The samples were collected near Littar Bridge some 4 km upstream of the mouth of the stream. The bottom texture at the sampling site was sandy and clay type. The average width of the stream was 10m and the average depth 60cm. The water samples were collected from December 2002 to November 2003 by dipping one liter polyethylene bottles about 10cm below the surface of water, generally between 10.00 and 15.00 hrs. Temperature, pH, conductivity, depth, speed and transparency were recorded on the spot, while analysis of the other parameters was done in the laboratory within 24 hours in accordance with EPA (1976), Mackereth *et al* (1978) and APHA (1995). For the collection of macrozoobenthos the bottom sediment samples were collected with the help of Ekman's dredge having an area of 15.5 × 15.5cm and sieved through 0.5mm mesh. The organisms were sorted out manually using forceps and preserved in 4% formalin for detailed examination in the

laboratory. Identification of the various taxa was done with the help of standard taxonomical works of Edmondson (1959), Pennak (1978) and Engblom and Lingdell (1999) and later on fluctuations in species diversity and population density were determined by using Shannon Weiner (1963) and Margalef's (1957) indices.

RESULTS AND DISCUSSION

The data on the various physico – chemical characteristics of the stream are presented in Table 1. Water temperature in the stream fluctuated from 7°C to 18°C and as such the stream falls under the category of cold waters. The conductivity and pH varied in the range of 202µS to 351µS and 7.8 to 8.3 respectively. The alkalinity of water was mainly due to the presence of bicarbonates of calcium and magnesium. The nutrient level in the water was low. While Nitrate-nitrogen fluctuated in the range of 112µg/l to 220µg/l, the range showed by Ammonia-nitrogen and Nitrite-nitrogen was 28µg/l to 68µg/l and 8µg/l - 19µg/l respectively. The total phosphorus and ortho-phosphate phosphorus recorded a range of 55µg/l - 87µg/l and 5µg/l - 15µg/l respectively. Almost all the physico-chemical parameters showed an increasing trend from winter to summer months.

A total of 12 taxa of macrozoobenthos belonging to three main groups, viz., Arthropoda, Annelida and Mollusca were identified from the benthic samples of Rambiara stream during the study period of one year (Table 2). The mean annual density of zoobenthos was recorded as 130 ind./m^2, with a range of 75 ind./m^2 (November) - 169 ind./m^2 (August). Insecta was represented by Diptera, Ephemeroptera and Trichoptera. The annual mean density of Insecta fluctuated from 25 ind./m^2 in November to 49 ind./m^2 in August, with the overall mean annual density of 36 ind./m^2. *Monodiamessa* and *Chironomus* were the dominant insect taxa, recording the maximum density of 19 ind. /m^2 (July) and 28 ind./m^2 (June) respectively. While Ephemeropteran larvae were more common during the colder months than the warmer ones, the Trichopterans were completely absent from March through August/September. *Gammarus pulex* (Amphipoda) recorded an annual mean density of 19 ind./m^2, with the minimum and maximum density of 14 ind./m^2 (March) and 28 ind. /m^2 (October) respectively.

Annelida contributed a considerable proportion of the zoobenthos and was represented by *Tubifex*, *Limnodrilus* and *Erpobdella*. The annual mean density of these taxa was recorded as 23 ind./m^2, 19 ind./m^2 and 10 ind./m^2 respectively. The maximum density of annelids was recorded in August (76 ind./m^2) and the minimum (24 ind./m^2) in November. Mollusca was represented by *Lymnaea auricula, Corbicula* sp and *Lymnaea columella*. The annual mean density of these taxa was recorded as 8, 14 and 4 ind./m^2 respectively.

The distribution, abundance and diversity of macrozoobenthos is affected by inter and intra-specific competition as well as tolerance capacity of organisms to changing physico – chemical parameters of water. The important factors which regulate the occurrence and distribution of

Table 1: Some important physico-chemical parameters of Rambiara stream during 2002 - 2003

S NO	PARAMETERS	Dec	Jan	Feb	Mar	April	May	June	Jul	Aug	Sep	Oct	Nov
1	Air Temp °C	8	11	10	18	20	22	25	30	25	20	15	9
2	Water Temp °C	7	7	7	11	12	13	16	18	15	12	10	6
3	Depth cm	35	35	45	85	90	90	90	80	70	60	45	35
4	Transp. cm	20	20	25	35	35	35	30	30	30	25	20	20
5	Velocity cm/s	23	25	20	65	70	65	70	70	60	60	50	22
6	Conductivity uS	302	291	202	290	310	321	351	302	297	281	260	307
7	pH	8.2	8.2	8.3	8.2	8.1	8.1	8	7.8	7.9	7.7	7.8	8.1
8	CO2 mg/l	11	10	8	9	11	11	12	12	8	11	12	8
9	Alkalinity mg/l	170	146	176	140	130	160	172	180	174	162	165	168
10	DO mg/l	8.7	8.3	9.1	8.2	8.3	8.1	8.6	8.7	9.1	9.3	9.6	8.8
11	Chloride mg/l	13	12	12	12	20	12	20	13	14	12	12	11
12	Hardness mg/l	140	120	132	120	130	142	165	171	140	136	140	162
13	Ca mg/l	42	32	32	28	32	42	48	53	38	31	30	34
14	Mg mg/l	9	10	13	12	12	8	11	10	11	14	16	18
15	Nitrite-N ug/l	13	15	18	12	15	16	19	12	8	8	10	14
16	Nitrate-N ug/l	198	220	180	188	190	112	220	190	180	180	191	202
17	Ammonia-N ug/l	50	60	52	55	52	62	68	50	46	32	28	38
18	Ortho-P ug/l	7	8	8	10	15	11	9	10	10	6	5	8
19	Total-P ug/l	65	75	75	80	87	72	65	72	80	68	55	70

Table 2: Population density (individuals/m²) of various zoobenthic invertebrates in Rambiara Stream

Class/Order/Taxa	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sep.	Oct.	Nov.	Mean	S. D
INSECTA														
Diptera														
Monodiamessa sp.	10	8	12	15	16	18	13	19	21	14	11	8	14	4.22385
Chironomus sp.	6	8	11	14	20	26	28	21	26	16	12	6	16	7.94107
Ephemeroptera														
Baetis larva	8	4	7	3	2	1	2	3	2	4	3	5	4	2.10339
Trichoptera														
Hydropsyche sp.	6	4	3	0	0	0	0	0	0	3	2	4	4	1.36626
Nectopsyche sp.	3	2	0	0	0	0	0	0	0	0	0	2	3	0.57735
Total	33	26	33	32	38	45	43	43	49	37	28	25	41	
AMPHIPODA														
Gammarus pulex	12	13	16	11	18	22	16	23	18	26	28	19	19	5.40202
ANNELIDA														
Tubifex larva	22	18	23	26	30	31	22	25	30	22	12	9	23	6.85565
Limnodrillus sp.	8	10	12	14	20	22	30	26	28	21	18	12	19	7.30452
Erpobdella sp.	7	7	6	6	12	12	16	13	18	11	8	3	10	4.48144
Total	37	35	41	46	62	65	68	64	76	54	38	24	52	
MOLLUSCA														
Lymnaea auricula	8	5	4	6	7	10	12	13	10	8	7	4	8	2.94906
Lymnaea columella	3	2	3	4	5	3	6	2	4	3	0	0	4	1.78164
Corbicula sp.	12	16	12	14	18	21	18	22	12	10	8	3	14	5.50757
Total	23	23	19	24	30	34	36	37	26	21	15	7	25	
Total (I+A+A+M)	105	97	109	113	148	166	163	167	169	138	109	75	130	

Table 3: Seasonal variations in the values of diversity indices of zoobenthos

	Winter	Spring	Summer	Autumn
Shannon-Weiner diversity index	3.355	3.061	3.101	3.237
Equitability index	0.936	0.921	0.933	0.903
Margalef's index	6.746	5.847	6.035	6.81

stream dwelling invertebrates include speed, temperature and dissolved substances (Macan, 1980; Cairns *et al*, 1971; King, 1983). The dominance of typical pollution tolerant species like *Chironomus, Monodiamessa, Tubifex, Limnodrilus, Erpobdella, Lymnaea* and *Corbicula* in the stream during warmer period of the year seems to be related with increased anthropogenic pressure due to agricultural activities in the catchment area. This is supported by the relatively higher values of inorganic nitrogen, total phosphorus, total hardness and chloride concentration in the stream during this period (Oliver 1971, Milbrink 1980, Bazzanti, 1983). During the winter months presence of ephemeropterans and trichopterans together with pollution tolerant molluscs and annelids and dipterans resulted in fairly good diversity of the benthic fauna (H = 3.355), which increased the homogeneity (E = 0.936) in the system (Table 3) during this season. From the foregoing observations, it may be concluded that the Rambiara stream is subjected to sewage and agricultural runoff from its catchment, especially in summer season.

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