

Benthic Fauna and its Ecology of River Ganga from Rishikesh to Haridwar (Uttaranchal) India

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Abstract

Benthic Fauna of river Ganga in relation to physico-chemical characteristics of water has been investigated. A total of 10 groups of benthic fauna were collected. Ephemeroptera was found as dominant during the course of study. Benthos were found maximum in winter months. The physico-chemical characteristics of river Ganga were found almost in limits.

Key words: *Benthos, Ecology, Physico-chemical, Ganga*

Introduction

Due to unpropotional growth of population and industries , the quality and purity of Ganga water has deteriorated considerably. The religious importance of the Ganga may exceed than that of any other river in the world. It has been revered from the earliest times , and Hindus regard it today as the holiest of all rivers.

At Rishikesh-Haridwar, the Ganga cuts across the Shivalik hills and for the first time enters the plains. The discharge of domestic and industrial sewage, makes water unpotable and also severely affects the bio-productivity of the aquatic system. These discharge consists of large number of chemicals and heavy metals these waste materials react with each other as a result , the water pollutes and may become toxic and effects the macrobenthic diversity of river.

The aquatic fauna are the natural indicators of water quality .Today no proper information is provided regarding the macro-invertebrates of river Ganga at Rishikesh-Haridwar. In the present study an attempt has been made to collect information regarding the macrobenthic diversity of river Ganga.

Materials and Methods

For limnological study of river Ganga the water samples were collected fortnightly from different sampling stations for a period of one year.

Various physico-chemical parameters were analyzed following the standards methods of APHA (1998), Trivedi and Goel (1986), Mathur (1982) and Khanna and Bhutiani (2004). While the benthos were identified with the help of Day (1878), Hutchinson (1957), Needham and Needham (1972).

Results and Discussion

The results of the present study are given in table 1-3 and figure 1 and 2. In the present study the minimum ($11.25^{\circ}\text{C} \pm 0.35$) and maximum ($20.00^{\circ}\text{C} \pm 0.00$), temperature was observed in the month of January and September respectively. The water temperature showed an upward trend from January to April followed by a downward trend from May onwards. Similar trend was also reported by Khanna (1993), Khanna and Chugh (2004), Badola and Singh (1981).

Temperature showed an inverse relationship with dissolved oxygen through out the year, this is due to maximum photosynthesis when temperature was minimum. Maximum ($11.15 \text{ mg/l} \pm 0.07$) DO was observed in January and minimum ($7.60 \text{ mg/l} \pm 0.14$) in July. From May onwards there is decrease in DO due to increased turbidity which retarded the photosynthesis in aquatic flora. Maximum ($485.00 \text{ J.T.U} \pm 162.63$) turbidity was observed in July and minimum ($0.00 \text{ J.T.U} \pm 0.00$) in the month of January, February and March. Singh *et al.* (1982), Khanna and Chugh (2004) reported similar results.

The value of BOD was observed maximum ($3.85 \text{ mg/l} \pm 0.70$) in July and minimum ($1.95 \text{ mg/l} \pm 0.07$) in February. A negative relationship has been observed between BOD and DO contents. Similar pattern was observed by Verma *et al.* (1984).

According to Ray *et al.* (1966) and Khanna (1993) maximum free CO_2 have been observed in rainy season in Ganga river. Maximum ($4.65 \text{ mg/l} \pm 0.07$) and minimum ($1.15 \text{ mg/l} \pm 0.07$) value of free CO_2 had been reported in the month of July and January respectively. Quadri and Shah (1984) reported similar observations.

The maximum ($2.10 \text{ m/s} \pm 0.00$) and minimum ($0.35 \text{ m/s} \pm 0.00$) value of velocity was observed in the month of August and March respectively. The velocity started increasing from May onwards due to melting of snow at the place of origin of river. Again beyond September velocity starts decreasing. Similar results were given by Khanna (1993). In the present investigation residues were maximum ($3048.00 \text{ mg/l} \pm 62.67$) in July and minimum ($129.50 \text{ mg/l} \pm 23.33$) in February this was due to maximum velocity in rainy season. Similar conditions were reported by David (1956) and Verma and Shukla (1969).

Transparency was maximum ($170.10 \text{ cm} \pm 2.69$) and minimum ($2.00 \text{ cm} \pm 1.27$) in the month of February and August. Badola and Singh (1981), Chugh (2000) reported similar pattern.

During the course of study the pH was observed slightly alkaline. Maximum (8.06 ± 0.06) and minimum (7.63 ± 0.01) value of pH was recorded in February and July respectively. Similar observations were reported by Sangu and Sharma (1985) and Bhutiani (2004). The highest concentration ($97.50 \text{ mg/l} \pm 6.36$) and lowest concentration ($44.00 \text{ mg/l} \pm 1.41$) of alkalinity was observed in the months of January and August respectively. Holden and Green (1960), Abden (1948 a), Khanna and Chugh (2004) gave similar findings.

The value of total nitrogen was observed maximum ($0.63 \text{ mg/l} \pm 0.07$) in August and minimum ($0.10 \text{ mg/l} \pm 0.01$) in January. Swarup and Singh (1979) observed similar results. Khanna (1993) observed minimum value of total nitrogen in rainy season.

The total percentage of Benthic fauna in river Ganga was observed as Ephemeroptera (30.52%), Lepidoptera (25.07%), Odonata (2.03%), Zygoptera (0.08%), Tricoptera (12.64%), Hemiptera (1.05%), Coleoptera (2.24%), Diptera (45.21%), Gastropoda (0.25%) and Annelida (0.17%).

In the present investigation Ephemeroptera was found as dominating. The Benthic Fauna of river Ganga were attached by increased turbidity which reduces the benthos as also

reported by Das and Pathani (1978).

The index of similarity of Benthic fauna during different months was found to be very close to 1.0 in most of cases except in the month of July and August.

The results indicates that Benthos were maximum in January and February i.e. winter months which was due to low temperature, high dissolve oxygen , low velocity and transparency of water along with other suitable conditions . Similar findings have been reported by Khanna (1993) in river Ganga.

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Table 1: Monthly Variation in Physical parameters of river Ganga

Months	Temperature (°C)	Turbidity (JTU)	Velocity (m/sec)	Transparency (cm)	Total Residue (mg/ l)
September	20.00±0.00	375.00 ±21.21	1.78±0.11	6.70±1.56	1019.50±419.31
October	18.75±0.35	75.00±7.07	1.03±0.46	67.50±10.61	193.50±98.29
November	15.00 ± 0.00	57.50±3.54	0.65±0.00	97.50±17.68	172.50±10.61
December	11.75 ±0.35	32.50±3.54	0.55 ± 0.14	127.75± 3.89	160.00± 0.00
January	11.25± 0.35	0.00± 0.00	0.40± 0.07	152.62± 3.32	198.50± 3.54
February	13.25 ± 1.06	0.00± 0.00	0.37± 0.00	170.10± 2.69	129.50± 23.33
March	15.50 ± 0.71	0.00± 0.00	0.35± 0.00	158.00± 3.54	170.00± 14.14
April	19.75 ± 0.35	27.50± 3.54	0.60 ±0.00	134.30± 10.04	179.00± 4.24
May	19.25 ± 0.35	92.50± 10.61	1.10± 0.00	16.00± 0.00	204.00± 8.49
June	19.00 ±0.00	200.00± 42.43	1.16± 0.08	11.00± 4.24	752.00± 565.69
July	18.00 ±0.00	485.00± 162.63	1.98± 0.11	3.00± 0.71	3048.00± 862.67
August	18.75 ±0.35	450.00± 0.00	2.10± 0.00	2.00± 1.27	1740.50± 741.76
Annual Average	16.69 ±3.20	12.08± 151.63	1.00± 0.63	78.87± 68.37	663.88± 898.76

Table 2: Monthly variations in Chemical parameters of river Ganga

Months	pH	D.O (mg/l)	BOD (mg/l)	Free CO ₂ (mg/l)	Alkalinity (mg/l)	Total Nitrogen (mg/l)
September	7.78±0.04	8.35± 0.07	2.75± 0.07	2.01±0.00	57.50± 3.54	0.40± 0.00
October	7.78± 0.04	9.05± 0.78	2.70± 0.14	1.85± 0.07	65.50± 4.95	0.38± 0.30
November	7.87± 0.06	9.65± 0.21	2.33± 0.00	1.60± 0.00	80.50± 2.21	0.30 ±0.01
December	7.83± 0.00	10.25± 0.35	2.40± 0.14	1.40± 0.00	75.50± 0.71	0.23± 0.04
January	8.04± 0.04	11.15± 0.07	2.20± 0.06	1.15± 0.07	97.50± 6.36	0.10± 0.01
February	8.06±0.06	11.10± 0.01	1.95± 0.07	0.75±0.21	87.50± 3.54	0.19± 0.01
March	7.93± 0.04	10.00± 0.71	2.15± 0.07	1.70± 0.14	89.50± 0.71	0.45± 0.07
April	7.99± 0.20	9.00± 0.71	2.45± 0.07	2.55± 0.07	92.50 ±3.54	0.50± 0.14
May	7.80± 0.00	8.75± 0.07	2.66± 0.14	3.10± 0.00	67.00 ±2.83	0.45± 0.07
June	7.73± 0.04	8.35± 0.21	3.15 ±0.35	3.45± 0.07	52.50± 0.71	0.60± 0.00
July	7.63± 0.01	7.60± 0.14	3.85± 0.7	4.65± 0.07	46.50± 2.21	0.35± 0.07
August	7.71± 0.01	7.80 ±0.14	3.55± 0.07	3.65± 0.07	44.00± 1.41	0.63± 0.07
Annual Average	7.85 ±0.14	2.69± 1.50	2.33± 0.56	2.33 ±1.77	71.33± 18.56	0.36± 0.14

Table 3: Benthic Fauna in the river Ganga

Months	Ephemeroptera	Lepidoptera	Odonata	Zygoptera	Tricoptera	Hemiptera	Coleoptera	Diptera	Gastropoda	Annelida	Average
Sept.	30	2	-	-	3	1	-	13	-	1	5.00 ± 9.63
Oct.	57	8	1	-	18	2	1	50	-	-	13.7 ± 21.77
Nov.	70	12	3	-	32	1	3	96	-	-	21.70 ± 34.31
Dec.	91	17	3	-	44	3	6	150	-	-	31.40 ± 50.77
Jan.	120	30	3	1	97	3	11	180	2	-	44.70 ± 64.35
Feb.	145	21	9	1	50	5	15	275	2	-	52.30 ± 89.80
Mar.	85	15	6	-	30	2	9	148	1	-	21.60 ± 49.01
April	50	9	3	-	15	3	5	102	1	-	18.80 ± 32.86
May	37	5	6	-	6	1	2	47	-	-	10.40 ± 16.99
June	29	1	2	-	4	2	1	17	-	-	5.60 ± 9.67
July	5	-	-	-	-	1	-	6	-	1	1.30 ± 2.26
Aug	3	-	-	-	-	1	-	2	-	2	0.80 ± 1.14
Annual	60.16	10.00	3.00	0.16	24.91	2.08	4.41	90.50	0.41	0.33	19.50
Average	± 43.98	± 9.40	± 2.79	± 0.38	± 28.49	± 1.24	± 4.94	± 84.73	± 0.66	± 0.65	± 16.95
Total Percentage	30.52	25.07	2.03	0.08	12.64	1.05	2.24	45.21	0.25	.17	

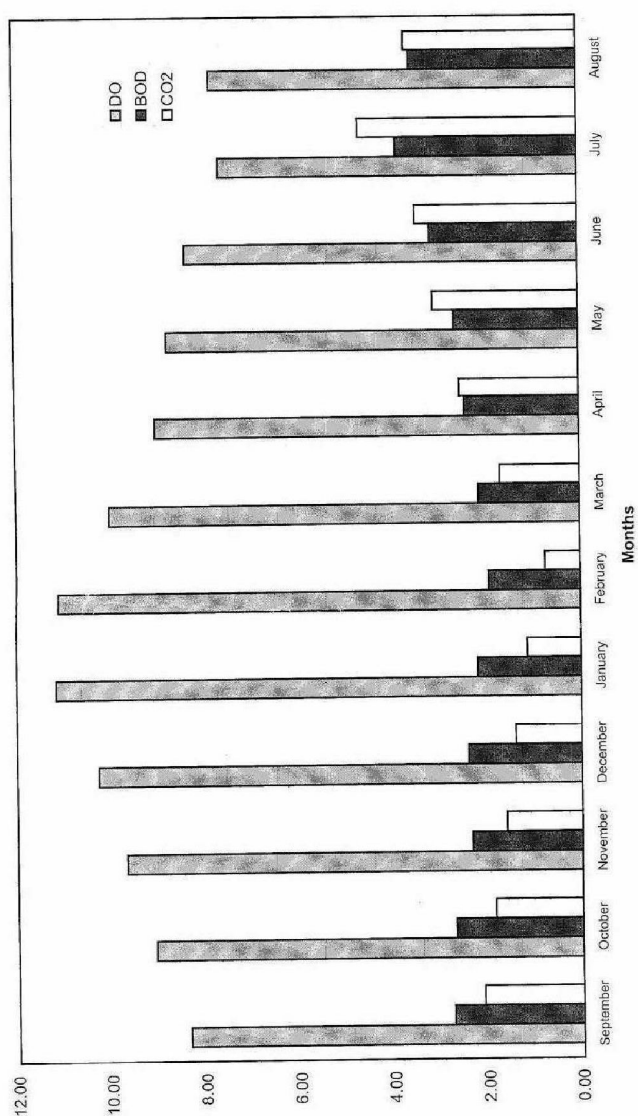


Fig. 1: Comparative study of free CO₂, Dissolved Oxygen and BOD

