

Macro-Zoobenthic Study in Relationship to Physico-Chemical Parameters of Khoh River in Uttarakhand, India



Zoology

KEYWORDS: Macro-Zoobenthos, Physico-chemical parameters, Khoh river

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ABSTRACT

The benthic community structure and species diversity were studied at Khoh river during January 2014 to December 2014 at a selected site (Amsour) in Khoh river. Collection of Macro-Zoobenthos was made by using forcep and brush from one meter square area. The collected samples were preserved in 5% formalin on the spot, and then bring in the laboratory for further study. Some important physico-chemical parameters were also analysed which effect the benthic community. Macro-Zoobenthic groups inhabited the river were the (mayfly nymphs) *Ephemeropter* 43 % then *Trichoptera* 36.96 %, *Colieoptera* 5.63 %, *Diptera* 4.7 %, *Plecoptera* 2.29 %, *Odoneta* 1.07 % were reported. Some unknown genera also reported about 4.09 % respectively. Co-coefficient of correlation was also performed to check the relationship between the Macro-Zoobenthos and ecology of the river.

Introduction

Geographically the Khoh tributary is situated between 78.30°E to 78.40°E and 29.45°N to 29.55°N in the eastern region of Garhwal Himalaya in Pauri district of Uttarakhand. Aquatic ecosystem harbors a vast diversity of fishes, invertebrates and vertebrates. Varieties of the organisms are found in these lentic and lotic environment such as fishes, plenty of benthic and planktonic organisms. Freshwater is essential to human health; agriculture, natural ecosystem and industry. Rapid growth of population, increasing living standard is urban areas and industrialization have resulted in greater demands of quality water. Water covers about 71% of earth surface. The quality of aquatic life depends on the water quality and freshwater bodies utilize successfully for fish production (Mahor, 2010) it is very important to study physico-chemical factors, which influence the biological productivity of water body. Benthic ecology is an important aspect of both lentic and lotic environments as it chiefly relates to the food of the fishes. Present investigation was carried out first time to study Macro-Zoobenthic community in Khoh river at Amsour (625 masl) in relation to physico-chemical parameters. Although several literature exists on the hydrobiology of the rivers and lakes of Garhwal and Kumaun Himalayas, Bhatt et al., (1884); Dobriyal et al., (1992); Kumar et al., (1998); Balodi, et al., (2004); Madan (2013); Negi and Mangain (2013); Balodi (2015). There is no report yet on the hydrobiology of Khoh River. This work aims to study the physico-chemistry of water and their effect on the benthic community of the river water.

Material and Methods

Monthly collections of Macro-Zoobenthos were made from one meter square area of the stream at the depth of 15cm from January 2014 to December 2014 at Amsour in Khohriver. Macro-Zoobenthos were carefully picked up with the help of brush, forcep, and needles and were preserved in 70% alcohol or sometime in 5% formalin solution for further study. Identification of sample was made by using several keys and monographs (Needham and Needham, 1972; Ward and Whipple, 1992). The water samples were collected as per standard methods APHA (1995) monthly. The Physical parameters like air and water temperature, pH were measured immediately by using digital pen type thermometer and digital pH meter by dipping them in the water for five minutes respectively. Air temperature was measure by lifting thermometer in the air for five minutes. Water velocity is measured by using floating block (m/s) method. The other chemical parameters like dissolved oxygen, free carbon dioxide, alkalinity etc. were measured by Trivedy and Goel. (1986). The investigation period was one year and correlation was studied between the physico-chemical parameters and Macro-Zoobenthos.

Result and Discussion

The data obtained from the present study is shown in the Table 1 and correlation between the Macro-Zoobenthic density and physico-chemical parameters were presented in the Table 2. In present study the pH is alkaline throughout the year and show positive correlation with the Macro-Zoobenthic community. The pH is also influenced by DO levels (Hynes, 1970) similar trend was recorded in our study. The water temperature ranges from 15.2 °C in February and maximum 29.8 °C in June, except *Odonata* ($r=0.84$) genera a negative correlation was obtained between water temperature and Macro-Zoobenthic density ($r=-0.78$ to -0.89). It seems that the benthic abundance in winter in Khoh is the substratum stability and minimum human interference. The Khoh River flowing with an average ranges from 0.28 m/sec (May 2014) to 0.58 m/sec (July 2014). During entire a negative correlation was obtained between water velocity and Macro-Zoobenthic density ($r=-0.6$ to -0.82) similar result by Balodi et al., 2004. It is obvious that high velocity of the water washes the bottom biota along with flash. The dissolve oxygen is higher in the winter months as compared to the monsoon and shows a seasonal variation from 9 mg/l in June and maximum 11.8 mg/l in January. A highly positive correlation was obtained between DO and benthos ($r=0.79$ to 0.95) at 0.05 level of significance (Table 2). In contrary the value of free CO_2 was recorded in winter 0 in January and highest in July (0.7 mg/l), but these values are negatively correlated with the benthos. Bhatt et al., (1984), Negi (1990) also observed a highest DO and lowest CO_2 . Low solubility of oxygen at high temperature might be one cause for low percentage of DO in summer. Total alkalinity fluctuates from 38 mg/l in July and maximum in 54 mg/l in Dec-January.

Quantitative analyses were made and the percentage composition of different Macro-Zoobenthic group/m² was analysed (Fig. 1) which indicated that the major Macro-Zoobenthic groups inhabited the river were the (mayfly nymphs) *Ephemeropter* 43 % then *Trichoptera* 36.96 %, *Colieoptera* 5.63 %, *Diptera* 4.7 %, *Plecoptera* 2.29 %, *odoneta* 1.07 % were reported. Some unknown genera also reported about 4.09 % respectively. It was observed that mayflies were more at the spots throughout the year indicate that the periphyton growth and characteristic substratum that probably enable more diverse dwelling habitat.

Qualitatively study also indicated that the *Ephemeroptera* had a highest density of 378 individual/m² in January and lowest 71 individual/m² in September. The *Trichoptera* was maximum 320 individual/m² in January and lowest 64 individual/m² in September. The *Diptera* were maximum in January 57 in January and minimum 7 individual/m² in June while absent in September. *Plecoptera* was maximum in 36 in January and minimum 3 indi-

vidual were observed in the month of September and *Odoneta* were absent in May and September month and was maximum in 14 individual/m² in January and minimum in 3 individual/m² October. From this data is clearly defined that the abundance of the benthic community in the winter month was due to the favorable substratum and lowest velocity of water, less human interference. And absent the in rainy season (September and October) we record that the Macro-Zoobenthic community was vanished due to the fast flood during the moon.Wells (1991) defined that Macro-Zoobenthic group like *Plecoptera*, *Ephemeroptera*,

Trichoptera, *Odonata* and *Coleoptera* are indicative of non-polluted water. It means the Khoh water is not polluted till date and fit for the aquatic fauna inhabited.

Acknowledgement

Author is thankful to Prof. A.K Dobriyal, HOD Zoology & Biotechnology, H.N.B Garhwal University, Pauri Campus for providing necessary laboratory facilities. Assistance rendered by Mr.Sudesh Kumar research Scholar of the Department is thankfully acknowledged.

Table 1 Data on density of Macro-zoo benthic community and Physico-chemical parameters

Physico-chemical Parameter	January	February	March	April	May	June	July	August	September	October	November	December
pH	8	8.1	8	7.9	7.6	7.2	7.3	7.3	7.5	7.7	7.8	7.7
Air temp. °C	20	23	23	33	32	32	26	27	29	28	26	20
Water Temp. C°	17	15	21	22	23	30	29	26	23	22	20	18
Water current (m/s)	0.3	0.3	0.3	0.3	0.3	0.3	0.6	0.5	0.4	0.4	0.3	0.3
DO (mg/L)	12	11	10	9.4	9.2	9	9.1	9	9.8	10	10	11
Co ₂ (mg/L)	0	0.2	0.3	0.3	0.4	0.6	0.7	0.5	0.4	0.4	0.2	0.2
T. Alkalinity (mg/l)	54	52	53	52	47	40	38	42	50	52	53	54
Macro-Zoobenthic Density												
Ephemeropter	378	302	241	208	167	139	0	0	71	158	242	311
Trichoptera	320	275	252	203	156	98	0	0	64	108	168	254
Diptera	57	49	32	21	16	7	0	0	Nil	9	24	31
Colieoptera	62	44	29	17	11	8	0	0	9	22	38	49
Plecoptera	36	28	25	22	17	16	0	0	3	19	25	29
Odonata	14	8	6	4	4	Nil	0	0	Nil	2	6	11
Other	33	30	24	20	14	9	0	0	8	17	26	29

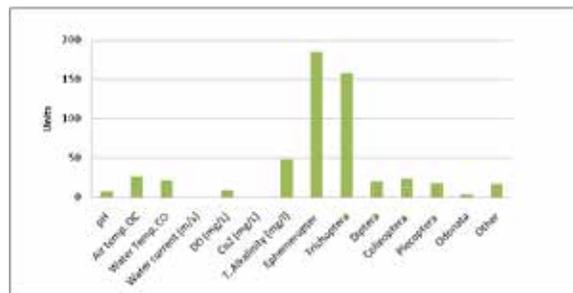


Fig 1 Variation in physico-chemical and Macro-Zoobenthic community in Khoh river

Table 2 Correlation between the Macro-Zoobenthic group and physico-chemical parameters of Khoh River

	pH	Air temp. °C	Water Temp. C°	Water current (m/s)	DO (mg/l)	Co ₂ (mg/l)	Total alkalinity (mg/l)	Ephemeropter	Trichoptera	Diptera	Colieoptera	Plecoptera	Odonata	Other
pH	1													
Air temp. °C	-0.45	1												
Water Temp. C°	-0.89	0.597	1											
Water current (m/s)	-0.64	-0.04	0.553	1										
DO (mg/l)	0.791	-0.79	-0.89	-0.43	1									
Co ₂ (mg/l)	-0.85	0.545	0.931	0.626	-0.88	1								

	pH	Air temp. °C	Water Temp. C°	Water current (m/s)	DO (mg/l)	Co ₂ (mg/l)	Total alkalinity (mg/l)	Ephemeropter	Trichoptera	Diptera	Colieoptera	Plecoptera	Odonata	Other
To alkalinity (mg/l)	0.867	-0.41	-0.89	-0.68	0.75	-0.9	1							
Ephemeropter	0.822*	-0.53	-0.84*	-0.78	0.85*	-0.9	0.796	1						
Trichoptera	0.873*	-0.5	-0.83*	-0.78	0.82*	0.88	0.79	0.976*	1					
Diptera	0.852*	-0.63	-0.84*	-0.6	0.89*	0.87	0.685	0.934*	0.948*	1				
Colieoptera	0.777	-0.73	-0.87*	-0.56	0.95*	-0.92	0.785	0.945*	0.892*	0.92	1			
Plecoptera	0.805	-0.46	-0.78	-0.82	0.79*	-0.85*	0.768	0.985*	0.954*	0.90*	0.907*	1		
Odonata	0.751	-0.71	0.84*	-0.54	0.88*	-0.90*	0.72	0.928*	0.909*	0.93*	0.956*	0.88*	1	
others	0.881*	-0.55	-0.89	-0.76	0.88*	-0.92*	0.86*	0.983*	0.959*	0.92*	0.949*	0.97*	0.91*	1

*Correlation Coefficient (r) is significant at the 0.05 level (2-tailed).

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