ECOLOGICAL STUDIES ON BENTHIC COMMUNITY OF KALGADDI STREAM IN UTTARAKHAND, INDIA

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ABSTRACT

The benthic fauna forms an important tropic level in the lotic water bodies being major food for most of the fish species. Some important physico-chemical parameters which affect the density and diversity of Macro-Zoobenthos were to be water temperature, velocity of water current, pH, total hardness, Dissolved oxygen and CO_2. The average water temperature of the stream fluctuated from a minimum of 10^0C (January) to 21.5^0C (June). During the present study a negative correlation was obtained between water temperature and Macro-Zoobenthic density. A significant positive correlation was obtained between all other parameters with Macro-Zoobenthos, considered at the 1% level of significance.

Key word: Kalagaddi stream, Macro-Zoobenthos, Physic-chemical parameters.

INTRODUCTION:

Kalgaddi stream is an important tributary of Western Nayar which is its turn confluence with river Ganga at Vyasghat (437 masl). Due to specific water quality and primary Productivity, the benthic life in Kalgaddi stream is conducive and forms a good source of fish food. The stream originated from a dense forest of oak. This stream is of great importance in Pauri Garhwal district as it forms an abode for many hill stream fishes.

The term benthos is designated to all the bottom dwelling aquatic organisms that live on or attached with the sediments at the bottom of the river body and are differentiate into phytobenthos (plant nature) and zoobenthos (animal nature). The term Macro-Zoobenthos is used for large benthic animals which can be identified through naked eyes. The Macro-Zoobenthos occupy a very important place in the tropic level of Kalgaddi Stream as they form a major part of the food of Carni-Omnivore fishes. The stream Macro-Zoobenthos have been studied by various workers using different techniques (Minshall and Minshall, 1972; Doeg and lake, 1981; Wright et.al., 1984; Boon, 1988, Dobriyal et.al., 1992; Kumar et.al., 1998, Balodi, et al., 2004, etc.)

A review of literature indicated that considerable work has been done on the benthic biota of the Garhwal hill streams. The present study is conducted to achieve the objective of correlating Macro-Zoobenthos diversity with the habitat ecology of the Kalgaddi stream.

MATERIALS AND METHODS:

Macro-zoobenthos study was carried out in the Kalgaddi stream during 2012-13 near Kalgaddi village. The analysis of physico-chemical parameters were made by using standard methodology (Welch, 1948 and APHA, 1995). The Macro-Zoobenthos were collected for the quanti-qualitative study from one meter square area of the stream at the depth of 15cm. Benthos 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 (APHA, 1995; Needham and Needham, 1972; Ward and Whipple, 1992). The routine calculations were made with the help of scientific calculator and the statistical analyses were carried out by using Microsoft Excel.

RESULTS AND DISCUSSION:

The density diversity data of Macro-Zoobenthos is shown in the Table 1, and monthly variation in the average values of physic-chemical parameters of Kalgaddi stream is presented in Fig 1. The correlation of macro-Zoobenthos with certain abiotic factors is presented in Table 2.

The benthic fauna forms an important position in the hill streams being major food items for most of the fish species. The hill streams generally have a moderate to fast current velocity which doesn't allow plankton to stay. Thus the bottom dwelling insects and Periphytic vegetation is the main food for fish fauna. Some important physico-chemical parameters which affect the density and diversity of Macro-Zoobenthos were observed as water temperature, velocity of water current, pH, total hardness, Dissolved oxygen and CO_2. The average water temperature of the stream fluctuated from a minimum of 10^0C (January) to 21.5^0C (June). During the present study a negative correlation (Table 2) of Macro-Zoobanthos with water temperature and velocity of water current was obtained. The study indicated that the growth of vegetation and detritus standing stock is the main reason for the high density of Zoobenthos in winter (Balodi et al., 2004). Another important reason of benthic abundance in winter is the substratum stability and minimal human interference.

The dissolved oxygen concentration was observed maximum in January (11.2ppm) and minimum in June (9.8ppm) and shows a positive correlation with the Macro-Zoobenthic density. The pH was observed to be lowest in monsoon and highest in winter. It shows a positive correlation with Macro-Zoobenthic density. The pH is also influenced by (DO) level (Hynes, 1970). The aquatic organisms prefer pH between 6.7 to 8.4 (Sunder and Subla, 1986). Other parameters also showed a positive correlation in between and with the Macro-zoobenthic community of the stream.

During the present investigation the abundance of Macro-Zoobenthos was recorded during winter followed in decreasing order by Summer, Autumn and Monsoon season. During the present study about 28 genera belonging to different orders were observed and presented in the Table 2. Present study corroborates with Pandey et al. (1983) and Kumar (1991) which concluded that the higher dissolved oxygen values along with low temperature and high alkalinity during winter favoured the algal growth resulting in rich benthic density. Quantitatively it was observed that major share of Macro-Zoobenthic concentration was made by the *Ephemeroptera* with 7 genera and showed a positive correlation with the studied ecological parameters. Wells (1991) opined that the presence of Macro-zoobenthic group like *Plecoptera, Ephemeroptera, Trichoptera, Odonata and Coleoptera* are indicative of non-polluted water. It means the Kalagaddi stream water is not polluted till date and fit for the aquatic fauna inhabited.

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Table -1Quanti-qualitative data of Macro-Zoobenthic community (Units/m^2) in Kalgaddi stream from Garhwal Himalaya (2012-2013).

Benthic Groups	October 2012	November 2012	December 2012	January 2013	February 2013	March 2013	April 2012	May 2013	June 2013	July 2013	August 2013	September 2013
Ephemeroptera												
Caenis	15	26	37	40	29	29	27	26	23	0	0	10
Cinygma	12	18	26	25	24	24	22	28	24	0	0	16
Cinygmula	14	17	24	27	26	27	21	21	28	0	0	11
Ephemerella	14	16	21	24	22	20	19	18	18	0	0	9
Ecdyonurus	16	18	23	23	28	27	26	25	21	0	0	12
Ephemera	12	19	25	29	22	22	21	21	19	0	0	8
Baetis	37	41	51	55	49	46	44	41	40	0	0	33
Trichoptera												
Rhyachophila	4	6	7	9	8	6	5	6	4	0	0	2
Agapatus	0	4	3	7	4	2	3	2	0	0	0	0
Hydropsyche	41	66	79	98	92	81	71	58	53	0	0	31
Chimarra	8	11	23	31	29	21	17	19	12	0	0	2
Glassosoma	2	4	5	6	8	3	3	3	0	0	0	0
Leptocella	7	8	15	18	16	12	14	15	11	0	0	4
Philiopotamid	38	69	81	91	85	78	73	61	42	0	0	29
Plecoptera												
Neoparla	13	12	14	15	14	11	4	8	6	0	0	10
Perla	5	8	10	10	8	6	4	3	0	0	0	4
Coleoptera												
Potamonectus	4	6	7	8	6	5	4	2	0	0	0	10
Psephenus	12	16	19	24	21	19	17	14	14	0	0	4
Hydroporus	5	4	6	8	7	5	3	0	0	0	0	4
Hydrophilus	0	3	2	4	3	2	0	0	0	0	0	0
Lepidoptera												
Aulocodes	3	4	4	7	5	4	3	0	0	0	0	0
Turbelleria												
Polycelis	8	11	12	16	14	11	10	10	8	0	0	4
Total (Sum±SD)	**270±11.804**	**387±18.43**	**494±22.11**	**575±25.43**	**520±23.81**	**461±22.04**	**411±20.4**	**381±17.55**	**323±15.47**	**0**	**0**	**203±9.933**

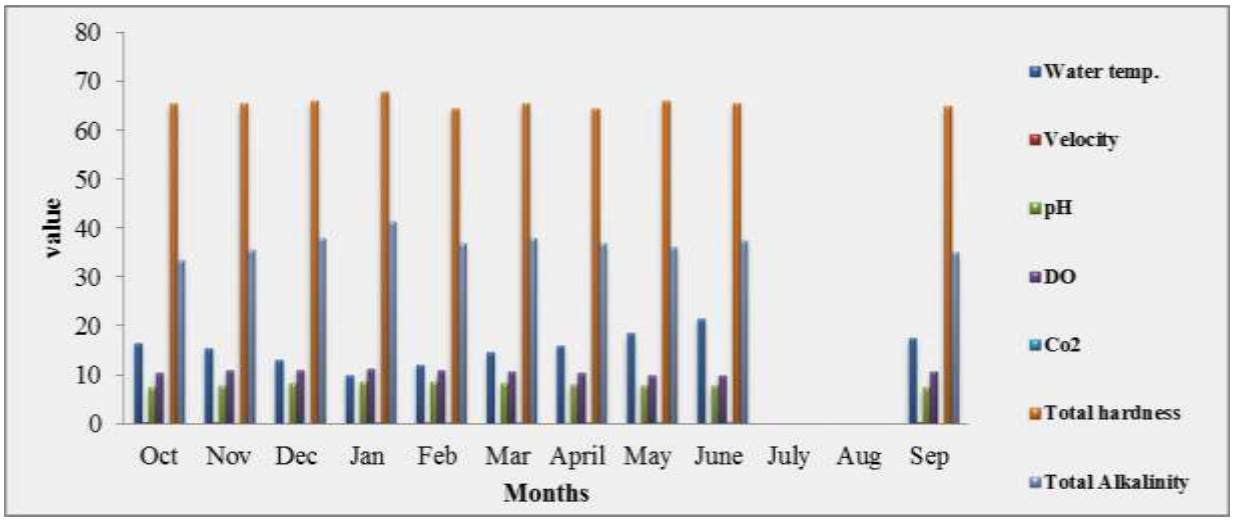

Fig -1 Monthly variation in physico-chemical parameters of Kalgaddi stream

Table-2 Coefficient of correlation between Macro-Zoobenthos and physico-chemical parameters

	Benthic	Water temp.	Velocity	pH	DO	Co_2	Total hardness	Total Alkalinity
Benthic	1							
Water temp.	0.550012	1						
Velocity	0.648541	0.839	1					
pH	0.885968*	0.855	0.898285	1				
DO	0.8604*	0.85	0.933092	0.99	1			
Co_2	0.681008	0.54	0.221361	0.6	0.52	1		
Total hardness	0.840293*	0.888	0.925032	0.99	1	0.56	1	
Total Alkalinity	0.884449*	0.853	0.888774	1	0.99	0.61	0.993328	1

*Correlation Coefficient (r) is significant at the 0.001 level (2-tailed).

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