JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 06, ISSUE 03, 2019

Macro-zoobenthos as Indicators of Pollution in River Lidder at different Sites

Wajid Majeed Khanday[1], Dr. Priti Ranjan Pahari[2], Umar amin[3]

ABSTRACT

Macro-zoobenthos comprise of an important group of aqua fauna because of their contribution to ecosystem stability, besides acting as potential bioindicators of trophic status. Being efficient energy converters, they constitute an important link in the aquatic food web. In view of importance of such an aquatic bioresource, on one hand, and scarcity of information about them, on the other, the present study aimed at working out the species composition, distribution pattern and abundance of macro-zoobenthos in relation to several physico-chemical parameters of the river Lidder. For present study three sites were selected in river Lidder at **Site 1: - Pahalgam Site 2: - Batkote Site 3: - Bumzoo** in most densely populated areas with different types of anthropogenic activities adding different types of affluent to the river and also areas with least human interference. Benthic organisms are often good indicators, insects mostly sensitive to water pollution are the Ephemeropterans (may-flies), Plecopterans (stone- fly) and Trichopterans (caddis-fly). The sparse distribution, low numerical abundance and low species diversity in present study is therefore, indicate that this streamhave been severely disturbed.

Keywords: Macro-zoobenthos, Lidder stream, Bioindicators.

INTRODUCTION

Macrozoobenthos being diverse in nature, react strongly and often indicate the human influences in aquatic ecosystem. They act as a useful tool for biological monitoring of freshwater ecosystems as they have broad range of sensitivities to change in both water quality and habitats (Hallewell, 1986; Abel, 1989). Macro-zoobenthos form the basis of the trophic level and any ill-effect caused by pollution in the community structure can in turn affect trophic relationships. Macrozoobenthic invertebrates convert low quality low energy detritus into high-quality high-energy food for larger consumers in complex food webs (Hynes, 1970; Jimoh et al., 2011). Different species comprises distinct functional groups that provide ecological integrity. In some cases, these functional groups may be represented by only a few species, so that any loss of species diversity could be detrimental to continued ecosystem functioning. Thus, it is increasingly becoming important to protect

ISSN- 2394-5125 VOL 06, ISSUE 03, 2019

macrozoobenthic communities owing to their immense importance in their natural habitats. The present study is focussed on lidder stream which is one of the major sources for commercial purposes in surrounding areas, is an attempt to assess the water quality of the stream with special reference to the diversity and community structure of macroinvertebrates.

Macro-zoobenthos can be used as a biological parameter in determining the condition of the water because it is permanent and has a high sensitivity to environmental changes [23]. Changes in water quality and substrate affect the abundance and diversity of macro-zoobenthos. This abundance and diversity depend on their tolerance and sensitivity to the environmental changes that consist of biotics and abiotics. Good quality waters usually have high species diversity and vice versa in poor or polluted waters usually have low species diversity [22]. The objective of this research is to determine the pollution status of river Lidder, based on diversity index of macro-zoobenthos. The result of this study can be used as basic information to make guidance of river management of river Lidder, therefore the ecological function of river lidder as water resources could be sustainable.

MATERIALS AND METHODS

STUDY AREA: Present study was carried out at different sampling sites located nearby Lidder valley, Anantnag (J&K) India in order to record the physicochemical parameters of water quality of Lidder stream. The following sites were selected for the present study:

Site 1: - Pahalgam

Site 2: - Batkote

Site 3: - Bumzoo

MACRO-ZOOBENTHOS SAMPLING: A D-net (Cuffney et al., 1993) with 0.5 mm mesh is used for sampling macro-zoobenthos. Using a D - frame net (500 micro meter mesh), macro-zoobenthos were collected on monthly basis at productive spots in each station. To dislodge the macro-zoobenthos, 2-feet by 2-feet of sampling area was thoroughly stirred up with feet for 3 minutes. All the dislodged organisms were carried by the water into the net. Then the net was removed from the stream with a forward scooping motion to prevent any of the organisms it contained to wash away; after which the contents of the net were poured into a white basin big tray with water. Any fish, amphibian or reptile caught was immediately returned to the stream. The macro-zoobenthos were picked from white basin tray with the

ISSN- 2394-5125 VOL 06, ISSUE 03, 2019

help of forceps and kept in separate sampling bottles. The abundance of these organisms was calculated as number per square meter by applying the following formula:

N= O/A. S x 10,000 (Welch, 1948)

Where, N = No. of macrozoobenthic organisms/m^2.

O = No. of organisms counted.

A = Area of sampler in square meter.

S = No. of samples taken at each station.

RESULTS

Physico-chemical Parameters: Of all the abiotic parameters affecting the water quality, temperature is an important regulatory factor which influences mixing and stratification patterns. During the present study, all the parameters have been found to follow more or less similar trend. The air and water temperature recorded higher values in summer (9^0C for air and 7^0C for water) and lower values in winter (3^0C for air and 2^0C for water). Likewise, pH, total alkalinity, dissolved oxygen, BOD and Total Phosphorus recorded maxima in summer (7.8, 95mg/l, 10.10mg/l, 15.80mg/l, 57µg/l) and minima in winter (7.1, 62mg/l, 9.6mg/l, 10.10mg/l, 38µg/l). But conductivity recorded higher values in spring (146µS/cm) and lower values in winter (90 µS/cm).

Macro-zoobenthos: During the present study, a total of 17 taxa of benthic organisms (Table 2) were recorded from all the three sampling sites viz., Arthopoda (Insecta - 15, Crustacea - 1 and unidentified - 1). Thus, benthos comprised of 16 species of insects and 1 Crustacea of phylum. Perusal of table 3 Arthropoda reveals that the species rich class Insecta is in itself an assemblage of different forms belonging to 6 different orders (Ephemeroptera - 4, Diptera - 6, Trichoptera - 2, Plecoptera - 1, Coleoptera - 2 and Malacostraca -1). The five most common species found at all the sites during the period of present study included Chironomous sp., Baetisrhodani, Baetiella sp., Tipula sp., and Diamesinae sp. and the 8 rare ones (Tabanus sp., Simulium sp., Hydropsygche sp., Dytiscus sp., Perlidae sp., Gammarus sp., Lamprima sp. And unidentified Pupa) found only at one site. Certain forms like Athrix sp., Ecdgnorus sp., Epeorus sp. and Limniphillus sp. were recorded only from two sites. Amongst the 17 taxa, the greatest number was noted for site 1 (12 taxa), followed by site III (9 taxa) and then site II

(7 taxa). In general, the highest numbers of taxonomic forms were encountered from sites having relatively higher flow velocity as at site I.

Table 3: Monthly Variation of Various Physio-chemical Parameters of Lidder Stream at Three Study Stations

Parameters	Pahalgam (Site 1)						Batkote (Site 2)						Bumzoo (Site 3)					
	Dec.	Jan.	Feb.	Mar.	Apr.	May	Dec.	Jan.	Feb.	Mar.	Apr.	May	Dec.	Jan.	Feb.	Mar.	Apr.	May
Air Temperature (°C)	5.0	2.0	6.0	5.0	6.0	8.0	6.0	2.0	5.0	7.0	8.0	9.0	5.0	4.0	7.0	8.0	9.0	9.0
Water Temperature (°C)	4.0	2.0	5.0	7.0	6.0	7.0	5.0	3.0	5.0	6.0	5.0	9.0	5.0	3.0	5.0	8.0	7.0	9.0
pH	7.1	7.16	7.6	7.35	7.36	7.4	7.2	7.48	7.6	7.5	7.52	7.65	7.5	7.9	7.8	7.7	7.8	7.8
Electrical Conductivity (µS/cm)	80	90	120	130	146	149	120	130	128	112	116	120	90	96	98	116	112	122
Total Alkalinity (mg/l)	80	88	82	80	92	95	62	62	70	75	87	80	70	75	66	99	78	79
Dissolved oxygen (mg/l)	10.5	10.4	7.8	7.8	6.8	6.5	10.3	10.2	8.2	7.7	7.0	7.4	9.7	9.6	8.6	8.2	9.6	8.0
BOD (mg/l)	11	11	12.6	14.6	15.0	15.0	10.5	11	12	14.0	14.6	14.6	10.1	11	14.0	14.6	14.0	14.2
Chloride(mg/l)	16	18	24	34	25	36	15	20	30	24	24	34	20	22	20	32	37	42
Total phosphorus (µg/l)	35	38	52	54	56	52	40	46	48	50	52	47	40	44	49	52	52	57
Free CO_2(mg/l)	3.0	4.0	6.0	8.0	9.0	9.0	4.0	5.0	5.0	7.0	8.0	10.0	4.0	5.0	6.0	9.0	8.0	9.0

Table 1: variation in physio-chemical parameters due to Anthropogenic activities at various sites mentioned above in table.

TABLE 2: Distributional Pattern of Benthic Fauna in Lidder Stream at Three Study Stations

Species/Taxa	Chandanwari						Main Pahalgam						Yened Pahalgam					
	Dec.	Jan.	Feb.	Mar.	Apr.	May	Dec.	Jan.	Feb.	Mar.	Apr.	May	Dec.	Jan.	Feb.	Mar.	Apr.	May
Baetiella sp.	3	2	2	0	3	4	2	2	0	4	3	3	0	0	2	3	4	3
Baetis sp.	3	3	4	0	3	4	0	2	0	3	3	4	0	0	2	3	3	2
Ecdyourus sp.	1	1	2	2	3	3	0	0	0	0	0	0	1	1	3	3	2	2
Epeorus sp.	0	0	2	3	2	4	0	0	0	0	0	0	1	1	2	2	3	3
Tipula sp.	5	6	8	0	0	0	1	2	2	3	6	5	2	2	4	6	5	6

ISSN- 2394-5125 VOL 06, ISSUE 03, 2019

Chironomus sp.	0	0	4	3	3	4	0	0	0	3	3	2	0	0	0	0	3	4
Athrix sp.	2	2	3	4	4	5	0	0	0	0	0	0	0	1	0	1	2	1
Diamesinae sp.	3	5	6	4	4	5	6	9	20	30	5	4	4	5	5	9	7	6
Limnephilus sp.	0	1	2	4	3	3	3	4	5	3	2	3	0	0	0	0	0	0
Lamprima sp.	0	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hydropsyche sp.	0	0	0	0	0	0	0	0	1	2	1	1	0	0	0	0	0	0
Dytiscus sp.	0	0	0	0	0	0	0	2	0	3	2	1	0	0	0	0	0	0
Perlodidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1
Gammarus sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	1	1
Tabanus sp.	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0

- TABLE 2: Total of 17 taxa of benthic organisms were recorded from all the three sampling sites viz., Arthopoda (Insecta - 15, Crustacea - 1 and unidentified - 1). Thus, benthos comprised of 16 species of insects and 1 Crustacea of phylum Arthropoda.

TABLE 3: Macrobenthic Invertebrate Diversity of Lidder Stream

Group /Orders	**Chandanwari**						**Main Pahalgam**						**Yened Pahalgam**						**TOTAL**
	Dec	Jan	Feb	Mar	Apr	May	Dec	Jan	Feb	Mar	Apr	May	Dec	Jan	Feb	Mar	Apr	May	
Ephemeroptera	7	6	10	5	11	13	2	4	0	7	6	7	2	2	9	11	12	10	124
Diptera	10	13	21	10	13	16	7	11	22	36	14	11	6	8	9	16	17	17	257
Trichoptera	0	1	2	4	3	3	3	4	6	5	3	4	0	0	0	0	0	0	38
Coleoptera	0	0	2	1	0	1	0	2	0	3	2	0	0	0	0	0	0	0	11
Plecoptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	5
Malacostraca	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	1	1	7
Pupa (Unidentified)	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	7

- TABLE 3: Arthropoda reveals that the species rich class Insecta is in itself an assemblage of different forms belonging to 6 different orders (Ephemeroptera, Diptera, Trichoptera, Plecoptera, Coleoptera and Malacostraca).

CONCLUSIONS

In all the three selected sites, water temperature was always found to be less than air temperature and followed the trend of air temperature. A positive significant correlation between air and water temperature was observed. High values of pH were recorded in all the selected sites throughout the course of study, which might be related to enhanced photosynthesis carried out by phytoplankton and macrophytes, wherein CO_2 is removed, and hence pH is raised. High values of dissolved oxygen content in December and January could be related to increased oxygen retention capacity of water and reduction in respiratory consumption of oxygen due to reduced metabolic rate, while lower values during April and May might be due to death and decomposition of organic matter, increasing water temperature leading to decrease in oxygen retention capacity of water and increase in the respiratory consumption of oxygen due to increased metabolic rate. High values of hardness recorded throughout the study period in all the three selected sites might be due anthropogenic activities in and around this water body in addition of incoming sewage. High values of calcium recorded in all the three selected sites could be attributed to heavy input of sewage from surrounding area and weathering of calcareous materials. Higher values of chloride during may in all selected sites might be due to the higher rate of evaporation and organic pollution of animal origin, whereas lower values during Feb. and Mar. could be related to reduction in siltation or allochthonous import of chloride along with rain water from catchment area. Higher values of TSS during April and May in all selected sites might be due to eroded soil particles, surface runoff, high rate of evaporation and sedimentation. Benthic fauna of this stream comprised of Ephemeroptera, Diptera, Coleoptera, Malacostraca, Trichopterans and unidentified group. Class insect formed the first most abundant group of benthic fauna and was represented by Baetiella, Baetis rhodani, Ecdyourus, Epeorus, Tipula, Tabanus, Chironomus, Simulium, Athrix, Diamesinae, Limnephilus and Lamprima. Trichopterans showed low frequency across selected sites. This clearly indicated that they are sensitive to pollution. It can be further concluded that these insects can live in polluted water which can be related to the availability of food and oxygen in this stream in addition to other factors. Benthic forms are an important component of food chains and energy flow pathways. Benthic community constitutes an important part of animal production and is tightly integrated into the structure and functioning of these habitats (e.g., organic matter processing, nutrient retention, food resources for vertebrates, such as amphibians, fish). Benthic organisms are often good indicators; insects mostly sensitive to water pollution are the Ephemeropterans (mayflies), Plecopterans (stonefly) and Trichopterans (caddisfly). The sparse distribution, low numerical abundance and low species diversity in present study is therefore, indicate that this stream have been severely disturbed.

REFERENCES

1. Brehm, V. 1936. Yale north Indian Expedition. Report on cladocera. Mem. conn. Acad. Arts. Sci. 10: 283 –197.
2. Brehm, V. and Woltereck, R. 1939. Die DaphinidenDeryale North India Expedition. Inst. Rev. Hydrobiol. Leipzig 38: 1 – 19.
3. Bisht, R.S and Das, S.M.1980. Certain aspect of habitate ecology of aquatic entomofauna in two cold water Kumaon lakes. Indian J. Ecol. 7 (2): 57 – 68
4. Bhat, F.A. and Yousuf, A.R. 2004. Limnological features of some lotic system of Kashmir In: Bioresources concerns and Conservation (eds. Azra N. Kamili and

A.R.Yousuf) Centre of Research for Development, University of Kashmir.

5. CSIR 1974. Analytical Guide (Laboratory Techniques) CSIR, Pretoria, South Africa.
6. Drews, F. 1875. The Jumoo and Kashmir Territories London
7. Edmondson, W.T. & Hutchinson, G.E. 1934. Yele North Indian SExpedition. Report On Rotatoria. Mem.Conn. Acad. Arts and Sci. 16: 153 – 185.
8. Edmondson, W.T. 1959. Freshwater biology John Wiley, N.Y.
9. Engblom, E. and Lingdell, P.E. 1999. Analysis of benthic invertebrates. pp. 39 –77. In: River Jhelum,Kashmir Valley. Impacts on the aquatic environment (LeennartNyman ed.) Swedmar Publications, Swedan.
10. A.P.H.A., 1985, standard methods of the examination of waste and wastewater. 16th edu. American Public Health Association, Washington, D. C.
11. Adoni, A. D., 1985, work book on Limnology. Pratibha publishers, C-10, Gour Nagar, Sagar, India.
12. Arimoro, F.O., Ikomi, R.B. and Efemuna, E., 2007, macroinvertebrate community patterns and diversity in relation to water quality status of river Ase, Niger Delta, Nigeria. Journal of fisheries and Aquatic Science. 2(5), 337-344.
13. Barquin, J. and Death, R.G., 2011, downstream changes in spring-fed stream invertebrate communities: the effect of increased temperature range. J. Limnol., 70(1), 134-146
14. Brinkhurst, R.O., 1965, the biology of tubificidae with special refrence to pollution biological problems in water pollution. Third seminar. (1962) U.S Deptt. Of Health, Education and welfare. 57-64pp.
15. Chopra, A.K., Madhwal, B.P. and Singh, H.R., 1993, relationship between abiotic variables and benthic fauna of river Yamuna in Garhwal Himalaya. Indian. J. Ecol., 20 (1), 53-58.
16. Edema, C.U., Ayeni, J.O. and Aruoture, A., 2002, some observations on the zooplankton and macrobenthos of the Okhuo River, Nigeria. J. Aqua. Sci., 17, 145-149
17. Edokpayi, C.A., Olowoporoku, A.O. and Uwadiae, R.E., 2010, the hydrochemistry and macrobenthic fauna characteristics of an urban draining creek. International Journal of Biodiversity and Conservation. 2(8), 196-203.
18. Edokpayi, C.A. and Osimen, E.C., 2001, hydrobiological studies on Ibiekuma River at Ekpoma, Southern Nigeria, After Impoundment: the fauna characteristics. Afr J.

ISSN- 2394-5125 VOL 06, ISSUE 03, 2019

Sc & Tech., 2(1), 72 – 81.

19. Government of India, (2008). National Urban Sanitation Policy. Nirman Bhawan, New Delhi 110 011, India: Ministry of Urban Development Government of India.
20. Irfan, R., & Shakil Ahmad, R. (September 2012). Impact of anthropogenic activities on water quality of Lidder River in Kashmir Himalayas. Springer Science+Business Media Dordrecht 2012
21. Fachrul M F 2007 Sampling Method Bioecology (Jakarta: Bumi Aksara)
22. Pratiwi R and Astuti O 2012 Journal of Marine Science 17 (1) 8- 14
23. Balkhi, M.H. and A.Yousuf. 1992. Community structure of crustacuian plankton in relation to trophic conditions. Int. J. Ecol. Environ. 18: 155 – 168.