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Research Papers

Bio-Assessment of Sone River in Bhojpur Area of Bihar

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ABSTRACT

The present paper deals with the status of river water of sone at three places namely Babura (S_1), Koelwar (S_2) and Bahiara (S_3) in Bhojpur area in terms of Saprobic Index and Sequential Diversity Index (SQI). This system of indexing water quality has long been used traditionally in water management in Europe. The macro-invertebrate benthic fauna exhibit a huge range of diversity in river-bed and are highly sensitive to the changes in water quality. They have been extensively used to monitor the water quality in rivers and can complement physico-chemical surveys. The domestic discharges from the point sources and agricultural run-off from non-point sources contains both organic and inorganic toxic components. Thus, by reviewing the saprobic score level and Sequential Diversity score level, reliable management measures can be adopted to maintain the water quality and bio-diversity of the river at these places.

Keywords: - BOD (Biological Oxygen Demand), Saprobic Index, Sequential Diversity Score, Benthic Fauna, Biodiversity Index.

INTRODUCTION: -

Bio indicators and biotic indices are being used extensively by Europeans to assess water quality of water bodies for last 100 years. These indices have also been proved to be one of the best modern method for the biological assessment of rivers in India as well. These methods include sampling of organisms, identification, classification by species forming the Saprobic Index and diversity indices and these, link the use of indicator organisms and diversity measurements. Various kinds of indices are used for qualitative and quantitative analysis like Shannon diversity Index (H'), evennesses Index (J), Species richness Index (s), Saprobic Index and Bio-Diversity Index. In this study, two kinds of indices, Saprobic Index and sequentially Bio-Diversity Index, have been used to assess the benthic macro-invertibrate fauna in the river bed of sone. The study of physico-chemical nature of river water does not give a complete picture of water body habitats including its fauna. But, the approach to measure the abundance, diversity and health of different kinds of animals, can be analyzed to come up with an indication of almost a complete picture of water quality. The agricultural run-off and domestic effluent discharges in the river sone, are inducing characteristic and well documented changes in the flora and fauna in the rivers. Particularly, changes brought about by these in the macro-invertebrate community i.e the studies of aquatic insects (may flies, stone flies and others) together with crustaceans (shrimps), molluca (snails and bivalves), worms etc. are drastic and easily distinguishable. The changes are most probably due to varying sensitivities of different components of the community to the stresses caused by pollution. It appears to be evident that community diversity declines in the presence of pollution and the sensitive species are progressively replaced by more tolerant form as pollution increases. Ideally, all components

of aquatic biota should be utilized but in practice macro-invertebrate community analysis is found to be satisfactory for water quality monitoring purposes. A diversity of species indicates a healthy ecosystem and when, this is maintained overtime, it indicates that these species are not being harmed by the effluents of domestic discharges or agricultural run off. But decline in the no. of species would indicate that some input was having a negative effect on survivability. Having determined the relative proportion of various components in a sample, water quality can be inferred by saprobic and diversity scores as per the water quality criteria of central pollution control board. (CPCB) New Delhi. An advantage of biological sampling vs. chemical sampling is that it looks at indicators of conditions which are present in the river over the period of time rather than just at the moment when water samples are collected so as to give it a water quality value (WQV) (Kumari et. al 2006). The CPCB Delhi established that inclusion of bio-monitoring apart from physico-chemical parameters would enhance the water quality evaluation in a cost effective manner. The macro-invertebrates benthic fauna of a river have been considered as the most suitable biological parameters for the water quality evaluation. The present study deals with the ecological bio-assessment of water quality of river sone in Bhojpur area. River Sone is the largest of the Ganges's southern tributaries. The sone originates near Amarkantak in Madhya Pradesh just east of the headwater of the Narmada River and flows north-north west through Madhya Pradesh before turning sharply eastward where it encounters Kaimur range. It enters in Bhojpur in Dehri and joins the Ganges just above Patna in Maner.

MATERIAL & METHODS:-

The methods of Biological water quality assessment involves the following steps – Sampling, Collection, Sorting of organisms, taxonomic identification of organisms, counting individual organisms and the calculation of indices there from.

Three sampling locations were selected-

I. S_1 near village Babura.
II. S_2 at Koelwar.
III. S_3 at village Bahiara.

These were selected based on various human activities practiced in and around river water. The benthoses including macro invertebrates were collected by dip nets according to the method of bio-monitoring criteria of CPCB (1999),: Biological oxygen demand (BOD) was also estimated according to the method of APHA, (1998). Sampling point S_1 is located near the drainage site of village Babura where domestic effluents of the villagemen are dumped into the river. This point show the status of the river Sone due to domestic discharges of the near by populations. Sampling point S_2 is located near the famous Koelwar Bridge in Koelwar, which is marked by a no. of human activities. Sand raising is the common human activity along with the huge domestic effluents going into the river from nearly dense population at this site. Similarly, sampling point S_3 is located near village Bahiara giving a picture of the river in lees polluted condition, where the river has a little discharge of domestic effluent from near by small village population. Sampling was conducted from March 26, 2011 to Jan 24, 2012. The community of macro-invertebrates was sampled with standard sieve by dragging the sieve downstream in order to collect the animals and sediment mixed with water. The organisms collected were analyzed and ranked according to various taxonomic categories and therefrom the Saprobic and Diversity Scores were calculated by the method of CPCB, (1999). In the laboratory, the samples were rinsed with water and the animals were stored in 70% ethanol.

Table I : Bio-Assessment of river sone

Sampling Site	Saprobic Score	Biodiversity Score	Biological water quality	Biological water class	BOD (mg/l)
S_1	4.8 ±0.1	0.85 ±0.02	Moderate	C	4.7 ±3.41
S_2	5.13 ±0.55	0.59 ±0.02	Moderate	C	1.91 ±1.1
S_3	4.9 ±0.12	0.73 ±0.11	Moderate	C	2.4 ±0.98

DISCUSSION: -

Pollution in an aquatic ecosystem affects the BOD of the ecosystem directly and thus brings a negative effect on the diversity of species in the ecosystem. The diversity indices drops after more sensitive species begin dying out. (Docampo and de Bikuna 1994, Spellberg 1991) Domestic and industrial effluents are discharged in the river from point and agricultural run off from non-point sources which contain both organic and inorganic toxic components (Eliss et. al. 1986). Although transient in nature, the complex and toxic composition as well as high intensity discharge would have a marked effect on the macro-invertebrate species present especially in the vicinity of the discharge. This would result in a lower biological index in the receiving water of the river, providing a better picture than obtained by chemical sampling regime at the point of time. Those intermittent effects may be properly evaluated by applying the biotic indices. Then by reviewing the score level, it can be adopted for reliable management purposes. Macro invertebrate benthic fauna exhibits a wide variation in response to pollutants and have been extensively monitored in various rivers to evaluate water quality and complement physicochemical surveys. (Hawkes (1979) shutes, 1985).

It has been reported by many of the workers especially Kumari et. al. (2006) that pollution in most of the rivers in Northern Bihar is organic ; which may either be due to domestic effluent discharge or due to industrial effluents discharge. Since, BOD is an index of organic pollution, in the present study BOD is measured at all these three sampling points. BOD of river at S_1 has been found to be 4.70 ± 3.41 at S_2 is 1.9 ± 1.1 and at S_3 2.4 ± 0.98 mg/l. It is interesting that the saprobic index at S_2 has been found to be 5.13 ± 0.6 and diversity index is 0.59 ± 0.02, where as saprobic index and diversity score at S 2 is 4.8 ± 0.1 and 0.85 respectively. At S_3,the saprobic score is 4.9 ± 0.12 and diversity score 0.73 ± 0.11 (Table I) considering higher saprobic score as an index of water quality, it can be concluded that the water quality is moderately polluted at all these three sampling points but relatively S_2 is better than S_1 and S_3 based on observed values.

SIGNIFICANCE :-

This article has got potential significance in national and international arena of environmental Science. As environmental issues have become prime importance in today's world, it will create a sense of strong public awareness, which may constitute a step for restoring the flora, fauna and bio-diversity of the river and its surrounding area. This will also help the local and state government to bring proper policies in this regard. As also quoted in the abstract this article will also help to bring reliable management measures for the local people to maintain the water quality and biodiversity of the river.

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