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# Biomonitoring a biological approach to water quality management

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**ABSTRACT**

The "biological monitoring" has been widely used to assess the environment impact of pollutant discharges. The methodology must be evaluated in terms of false positives and false negatives. A false positive is an indication that an excursion beyond previously established quality control conditions (i.e., unacceptable conditions) has occurred when, in fact, one has not. A false negative is an indication that conditions are acceptable when, in fact, they are not. Statistics must play a more important role in biological monitoring because they are capably of explicit statement of confidence in the biological monitoring results. With appropriate statistical evaluation of the data, professional judgment on whether to initiate immediate action or wait for more confirming data will be more objective and reliable. n order to optimize the usefulness of biological monitoring, the selection of biological monitoring methodology shall not be based on the investigator's favorite organism or group of organisms. Neither can be a convenient methodology adopted by regulatory agencies. The selections must be based on the compatibility of data generated with the decision making process, including the statistical establishment of confidence in the result obtained.

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**Introduction**

Water is one of the most important natural resource around the world (EPA 2001, Voelz et al., 2005). It is a necessity for life and provides a variety of use from drinking water in cities to the irrigation of crops in agricultural areas. Water also provides recreational use as well as habitat for wildlife. Rivers and streams are very important natural. Environment and linked to human lives, animals and vegetation (Hasse and Blodgett 2009).

Biomonitoring is the use of the biological responses to assess changes in environment. Therefore, macro-invertebrates are most frequently used as indicator species. Cairns &Pratt (1993) conclude that biological surveillance of communities, with special emphasis on characterizing taxonomic richness and composition, is perhaps the most sensitive tool now available for quickly and accurately detecting alterations in aquatic ecosystems.

Benthic macro-invertebrates are best indicator for bioassessment (Kumar 2003) which provides a more reliable assessment of long term ecological changes in the condition of a aquatic system. Aquatic macro-invertebrates are organisms that are large enough to be seen with the naked eye, lake of a backbone and inhabit all types of waters including lentic, lotic and muddy habitats (Viklund, 2011). Benthic macro-invertebrates are best indicators for Bio-assessment. The abiotic environment of the water body directly affect in the distribution, population density and diversity of the macro benthic community. Benthic fauna are especially of great significance for fisheries that they themselves act as food of bottom feeder fishes (Sharma *et al.*, 2007). Macro-zoobenthic organisms play an important role in the energy cycle of fresh water bodies. Their value as indicator organism's water quality and occurrence with relation to the sedimental particle size were highlighted in several reports (Kajak 1963), (Brinkhurst 1964), (Ockleman 1964), (Cairns & Dickson 1977), (Edmondson 1971), (Jhingran 1977).

**Review of literature:-**

Bio-indicators are useful to offers the functional efficiency of water treatment plant which is one of important practical consideration (Thomas 1972).Parameters is one of the evaluation of physicochemical used tools in assessing the quality of water. Physicochemical parameters pertain to both physical and chemical properties, changes, and reactions. Different studies have been carried out using physicochemical parameters alone, which proved its efficacy and accuracy (Agarwal and Saxena 2011).

With the acquired knowledge of the possible sources of pollutants found in water systems, many environmental scientists have been interested in assessing and monitoring water qualities, especially on the streams and rivers. Water quality monitoring is the most direct and valid method available to assess water quality and its response to management and other factors (Coffey and Smolen, 1990).There are many different ways to relate benthic macro-invertebrate community structure to water quality with much new analysis system. The benthic macro-invertebrate community has been used as an indicator of water quality (Roback 1974) & (Hellawell 1986).

Benthic macro-invertebrate fauna are those organisms that like on or inside the deposit at the bottom of a water body (Idowu & Ugwumba 2005), Water quality are those physical, chemical and biological factors that influence species, composition, diversity, stability, productions and physiological conditions of indigenous populations of a water body (Boyd 1982).

In recent years, numerous publications have critically reviewed the use of benthic macro-invertebrates as bio-indicator as well as the appropriateness and shortcoming of certain indices. Biological monitoring, the systematic use of biological

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responses to evaluate environmental changes (Rosenberg and Resh 1993), has proven to be a valuable water resource management tool in rivers (Hynes 2007; Bonada *et al.*, 2006; Varunprasath *et al.*, 2010), and particularly for the management of rivers in developing countries.

There are several possible assemblages of organisms available for use in bio-assessment. However, benthic macro-invertebrates, periphyton, and fish are the biological indicators suggested for use by the U.S. EPA in lotic environments (Barbour *et al.*, 1999). Benthic macro-invertebrates are the most commonly used assemblage (De Pauw *et al.*, 1992; Hellawell 1986; Rosenberg and Resh 1993).

Benthic macro-invertebrates are useful us bio-indicators in pollution studies. The use of bio-indicators belonging mostly to profundal benthic communities has so for given good result in studies on the water quality of lakes and reservoirs. However, studies on the benthic fauna of littoral zone seem to be qualitatively and quantitatively merge. Benthic communities have been the best indicators of water quality and organic pollution because of their constant presence and relatively long sedentary habitats, comparatively large size and varying tolerance to stress (Hynes 1962), (Wass 1967), (Mylinsky & Ginsburg 1977), (Reddy & Rao 1991 ), and (Petridis 1993).

Studies on water quality management using macro-invertebrates in evaluating the impacts of specific pollutants in aquatic envirnments have been reported (Ogbeibu, 2001; Hart and Zabbey, 2005; Arimoro and Ikomi, 2007; George *et al.*, 2009; Esenowo and Ugwumba, 2010, Ogidiaka 2012, Sharma *et al.*, 2012).

Aquatic macro-invertebrates organisms that are large enough to be seen with the naked eye, lack of a backbone and inhabit all types of waters including lentic, lotic and muddy habitats (Viklund 2011). Benthic macro-invertebrates assemblages at sub tropical river of jammu, river tawi (Sharma and chowdhary 2011). Benthic macro-invertebrates sensitive to the environmental changes and they are used as bio indicators for pollution and health of a water body (Sarkar 2012). Macro-invertebrates play a critical role in ecosystem balance by facilitating flow of energy and matter through food web and constitute an important trophic level in the aquatic ecosystem (Ramachandra 2009) & (Aweng *et al.*, 2012)

Benthos is an important part of the food chain, especially for fish (Feldman 2006). Many invertebrates feed on algae and bacteria, which are on the lower end of the food chain. Some of them and eat leaves and other organic matter that enters the water. Because of their abundance and position as "middlemen" in the aquatic food chain, benthos plays a critical role in the natural flow of energy and nutrients. As benthic invertebrates die, they decay, leaving behind nutrients that are reused by aquatic plants and other animals in the food chain (Vesna *et al.*, 2012).

Examination of benthic macro-invertebrates in semi-natural, urban and agricultural land use along the highland Ken River in central India reveals a significantly higher density in semi-natural compared with other two landuse. Insects dominate the fauna at semi natural (90%) and urban locations (93%) compared to agriculture sites (48%) where The semi natural location characterized by rocky substrate support high relative abundance of Caenidae and Neoephemeridae. Their abundance decreases at urban locations. Brachycentridae, Chironomidae, Glossocolecidae, Nephthydae, Thiaridae and Corbiculidae increased at urban and agriculture locations characterized by small-sized sediments, suggesting important role for substrate also. Functionally, the collectors dominate the fauna, as all three landuse, especially large tracts of agriculture, are a continuous source of particulate organic matter (POM) in the river (Nautiyal & Mishra 2013).

The benthic macro-invertebrates were studied keeping in view their potential in indicating degree of pollution. The aquatic Dytiscidae (Predaceous diving beetle Cybister spp.), Gyrinidae (Whirling beetles) and aquatic hemipterans, Belostomidae (Giant Water bug), Nepidae (Water scorpion) and others were found in the littoral zone. The presence of dipteran larvae in the lake sediments point out towards the presence of organic pollution in the lake basin. In all 7 species of benthic macro-invertebrates and 9 species of insects were recorded in the lake waters. The molluscan species were recorded from the submerged plants as well as from sediments of the lake basin (Sitre 2013).

**Conclusion:-**

The term "Biological monitoring" has been widely used in this discussion to include almost any type of data gathered to assess the environmental impact of discharges. In our opinion, biological monitoring is limited to a continue collection of data to establish whether explicitly stated quality control condition are being met. If these conditions are not being met, there will be an immediate decision to take corrective action. Purpose of biological monitoring include providing early warnings of hazards, detecting spills, detecting environmental trends or cycles, determining the best and least redundant information for monitoring, and evaluating the environmental effects associated with the introduction of genetically engineered organisms into natural system. One design will not serve each purpose, but if the researchers have clearly defined goals for the monitoring program, powerful designs are possible.

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