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Full Length Research Paper

Correlation between Benthic Macro invertebrates and Physicochemical Parameters in the Narmada River Nimar Area Madhya Pradesh, India

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ABSTRACT

River Narmada is one of the 13 prominent rivers of India, which covers 98,797 sq km of total water-shed area. Narmada is considered to be the lifeline of Madhya Pradesh and most important west flowing river of India. The monitoring of water quality of Narmada River was carried out for One year August 2011 to July 2012. Barwani sampling stations were selected at downstream of Narmada River. The main objectives of practice on direct mixing of domestic sewage in to the river and Regular monitoring of physic-chemical as well as biological parameters of the Narmada river. The water samples collected were analyzed, as per standard methods parameters such as pH, Turbidity were measured in-situ. Raised values of physico-chemical parameters indicate the pollution of riverine ecosystem due to domestic wastes, municipal sewage, industrial effluent from Security Paper Mill (SPM) and agricultural run-off that influence the water quality directly or indirectly. Statistical analysis carried out through correlation method and also evaluates Average values. Macro invertebrates are an important component of river ecosystems and are a link in the transfer of material and energy from producers to top level consumers and also act as excellent bioindicators. Therefore, the collection of certain benthic macro-invertebrates species particularly in polluted and non-polluted parts of a river indicated that they could be used as potential bio indicators for river pollution.

Introduction

Macro-invertebrates are most frequently used in bio-monitoring studies because the responses of macro-invertebrates to organic and inorganic pollution have been extensively documented (Thorne., Williams., 1997 ; Kazanci., Dugal., 2000 . They have sensitive life stages that respond to stress and integrate effects of both short-term and long-term environmental stressors (EPA., 1998) and they are important areas for maintaining biodiversity (Meyer et al., 2007; Richardson., Danehy., 2007). The study of benthic macro-invertebrates provides a method to determine the water quality of a stream based on collection and identification of stream-bottom (benthic) macro-invertebrates. This study has been done to water quality assessment using benthic macro-invertebrates. Benthic study in Malwa region of Madhya Pradesh is scare except that of Govindan K., Kashinathan R., Desai BN., 1976 , Rao KS et al., 1985 , Sunny A., DiwanAP.,1991 Sharma S.,and Barkale S 2016 , Sharma S et al., 2007 ,Khichi Y and Sharma S., 2017.The main purpose of this study is to assess the water quality of Narmada river and to suggest the conservative measures to increase the quality of the river.

Materials and Methods

Description of Study Area

The Narmada river is considered as the life line of Madhya Pradesh. The catchment area of the river exists in the States of Madhya Pradesh (86.18%), Gujarat (11.6%), Maharashtra (1.5%), and Chattisgarh (0.72%). During its course, the river drops from an elevation of 1051 m to sea level, and flows through narrow gorges in the head reaches. The basin is bounded on the north by the Vindhya ranges, on the east by the Maikal range, on the south by the Satpura ranges and on the west by the Arabian Sea. Deep black soil covers the major portion of the basin. The river has 41 tributaries, of which 22 are on the left bank and 19 are on the right bank. The Barna, Tawa, Kolar, and Sukta dams have been constructed on the tributaries. The

Bargi is constructed on the mainstream, while the Indirasagar, Omkareshwar, Maheshwar and Sardar Sarovar dams are under construction.

Sampling stations Barwani

Barwani, also known as Siddh Nagar, is an important city and a municipality in Barwani district in the state of Madhya Pradesh, India. The place is also famous for chool giri, Jain pilgrimage center of Bawangaja. The town is situated near the left bank of the Narmada river. Latitude (DMS) 22° 10', 60"N and Longitude (DMS) 74° 54', 0 " E.



Map. 1: Map of Narmada river showing sampling stations

Physico chemical analysis of water

The water samples were collected from the sampling station Barwani, for the period of 12 months from August 2011 to July 2012. In the analysis of the Physico-chemical properties of water, standard methods prescribed in limnological literature were used Odum (1971), Wetzel (1975) and Wantzen, K.M. (2008). Parameters like Temperature, pH and Turbidity were determined at the site, while other parameters like Biochemical oxygen demand, Chloride, Alkalinity, total Solids were determined in the laboratory. The Physico- Chemical parameters of water were determined as per standard methods of APHA (2005), Welch (1998), Golterman (1991).

Results and Discussion

Water Temperature

The oxidation of organic matter is highly influenced by the temperature of water. Temperature of river water depends upon the season, climatic zone, where river is flowing, time of sampling and also upon the temperature of the effluents, which are being added in the river. Temperature fluctuation during August 2011 to July 2012 was as follows fig no.1.

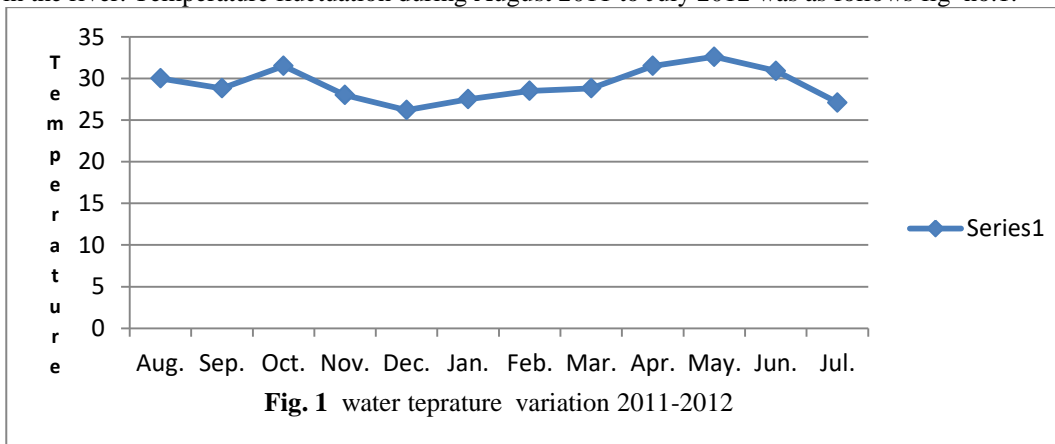


Fig. 1 water teprature variation 2011-2012

The minimum water temperature was 26.2°C in December2012 and the maximum was reported 32.6°C in May 2012 at Barwani. The same observation were also reported by R.Bhutaiani et al (2016), Sharma et al (2011) and Shraddha et al (2008) in Narmada river, while studying the hydrological parameters of Narmada river at Hoshangabad recorded water temperature between 27.6°C to 38.4°C.

pH Range

pH is an important parameter which is important in evaluation the acid base balance of water. Natural waters generally have been found to range from 5.5 to 8.6 because of the presence of bicarbonates and carbonates of alkaline earth metals. Drinking water with a pH range from 6.5 to 8.3 has been necessary. During August 2011 to July 2012 the pH was fluctuated as follows fig no.2

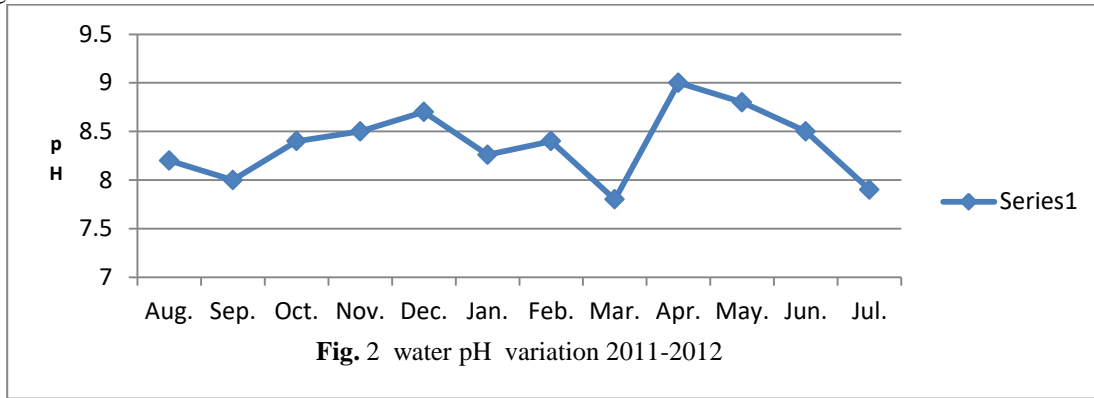


Fig. 2 water pH variation 2011-2012

The minimum in March 2012 and the maximum in May 2012 at Barwani. Sharma et al (2011) observed pH fluctuation between 7.6 to 9.9 in Hoshangabad area of Narmada river. Prasanna and Ranjan (2010) observed pH value between 7.5 to 8.5 in Dharma estuary.

Transparency.

Transparency of the surface water is often an important limiting factor in the development and distribution of plant and animal life in fresh waters. This is most important significance of transparency monitoring and therefore it has been an indication of effectiveness of filtration of water supplies (Hauser 2001). During August 2011 to July 2012 transparency was fluctuated as follows fig no. 3.

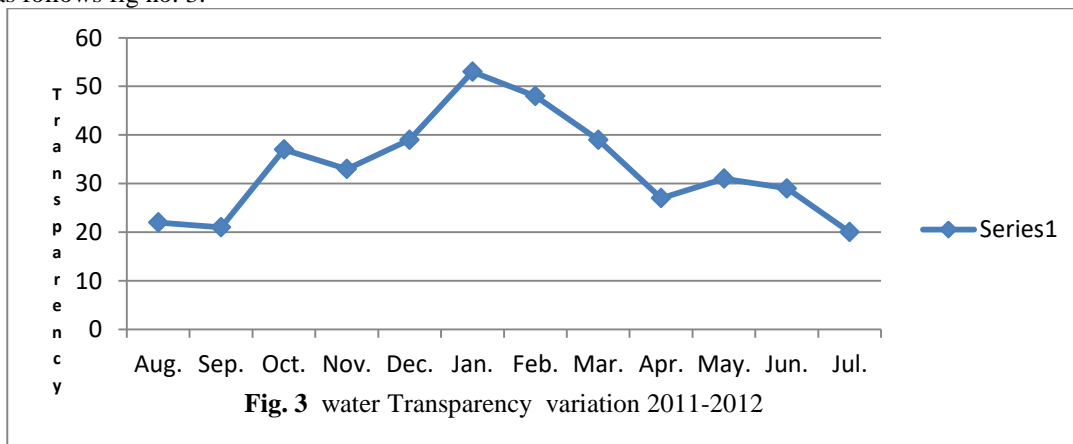


Fig. 3 water Transparency variation 2011-2012

The minimum in July 2012 and maximum in January 2012 at Barwani. These observations were also supported by Prasanna and Panda (2010), Shraddha et al (2008) Tiwari, M and Dwivedi, A(2016) and Trivedi et al (2009).

Total dissolved solid

The total solids are the total amount of chemical substance present in the water. The total dissolved solids and total suspended solids together make the total solids in the water. The presence of solids in water vary greatly at different times and affect the density of water and there by the quality of aquatic environment. During August 2011 to July 2012 the value of total solids varied as follows fig no. 4.

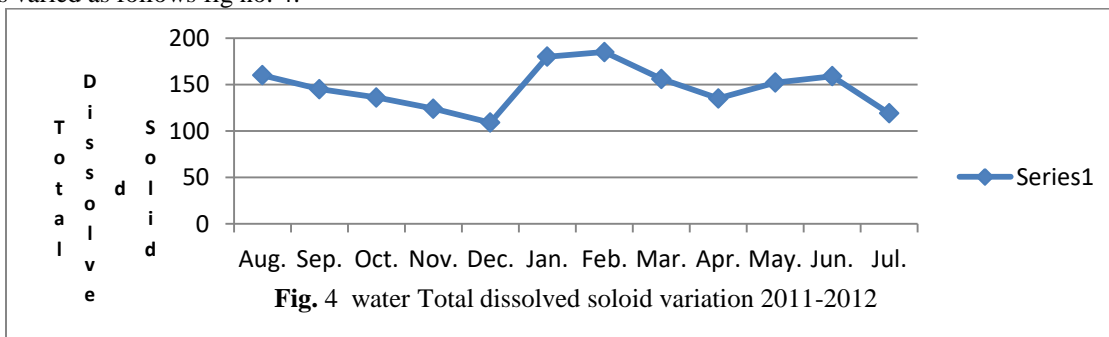


Fig. 4 water Total dissolved solid variation 2011-2012

The minimum value was recorded in December 2011 and maximum in February 2012 at Barwani . Nduka et al (2008) also recorded total solids between 100 to 220 mg/l in Niger delta of Nigeria and Khanna, D.R, and Rawat, S., Bhutiani ,R.,(2014).

Alkalinity

Alkalinity measures the buffering capacity of water and content of CO₂ in its various forms are involved in this carbonate-bicarbonate carbonic acid buffering system. In the present study the value of Alkalinity varied as follows fig no. 5.

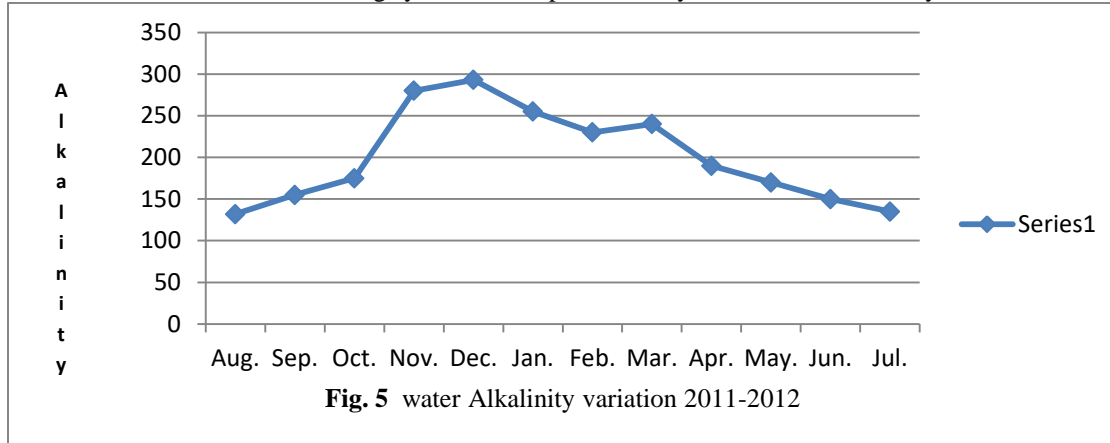


Fig. 5 water Alkalinity variation 2011-2012

The minimum value in August 2011 and maximum in December 2011 at Barwani. Trivedi et al (2009) recorded alkalinity value between 13 to 246mg/l in Ganga river India. Singh et al (2010) observed alkalinity value between 54 to 168mg/l while studying on Manipur river.

Biochemical Oxygen Demand

Biochemical oxygen demand is the amount of oxygen utilized by microorganism in stabilizing the organic matter in aerobic condition. DO measurement forms the basis of BOD analysis. It gives an indication of load of biodegradable organic material present in the water body. During the present study the BOD was fluctuated as follows fig no. 6.

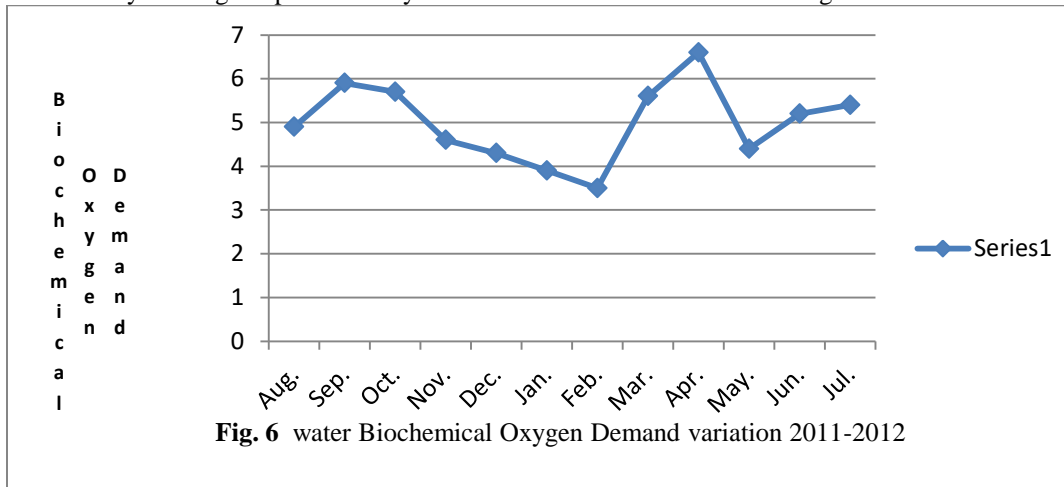


Fig. 6 water Biochemical Oxygen Demand variation 2011-2012

The minimum BOD was recorded February 2012 and maximum in April 2012 at Barwani. Same observations were also recorded by Nnaji et al (2010) Katakwar, M (2014) and Mary et al (2008).

Conclusion

Bio monitoring is good tool for the assessment of water body. It needs no chemicals means ecofriendly, cost effective and moderately accurate. And this study also helps in studying aquatic macro- invertebrates. Macroinvertebrates serve several important functions within the aquatic environment: They provide a valuable "cleaning" service by scavenging dead or decaying bacteria, plants, and animals, which helps recycle nutrients back into the system. They are an important food for fish, birds, amphibians and reptiles. As well as they have good bioindicators.

Recommendations

1. A continuous monitoring of the physico-chemical, biological, and microbiological parameters of this river is needed for in-situ conservation of aquatic biodiversity.
2. A definite impact on the water mass for increase in the development of submerged saprophytes and aquatic weeds which promote eutrophication must be prevented by taking advance precaution in this record.

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