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Physical Habitat Assessment of two Pristine And Polluted Streams of Narmada River Basin

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Abstract: *The present survey was conducted to assess the physical habitat assessment of two pristine and polluted streams. The various physicochemical parameters viz., in stream habitat, epifaunal substrate, pool quality, riffle quality, bank stability were measured to evaluate the physical condition of Barna and Jamner stream. The results showed that the Jamner stream is polluted due to anthropogenic pressure.*

Keywords: *Physical habitat assessment, stream,*

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I. Introduction

The generic term habitat is used to describe the local physical, chemical and biological features that provide an environment for the biota (Jowett, 1997). Physical habitat assessment is the evaluation of habitat quality which is directly associated with the ecology of any water body. Physical habitat assessment aims to characterize the physical realm and to explain the physical processes involved in creating spatial heterogeneity and in particular physical features of the streams (Butler, 1995; Dutta and Baruah, 2013). It is reorganization of structure and function of physical habitat which affects the quality of water and its community (Barbour *et al.,*1996*).* Physical habitat characteristics controls the structure and composition of fluvial biological communities and play an important role in determining fluvial ecosystem functioning (Dent *et al.,* 2002; Murray *et al.*, 2008). The methods involved in characterizing river habitats are becoming more important for the success of river restoration projects and understanding the river ecosystem functioning. The high quality physical habitat and riparian habitats provide niche for aquatic organisms to reproduce, to feed, and take refuge from both predators as well as natural high flow events. (Maddock,1999).The present study was conducted in order to assess the physical habitat conditions of Barna and Jamner streams to analyze the prevailing ecological conditions at these water bodies.

II. Materials And Methods

Study area

The present study was conducted on two streams namely Barna and Jamner of Barna basin of Narmada River. These streams join an irrigation reservoir which is built across the Barna stream located at $23^0$5` N and $78^0$7` E near Bari village in Raisen district of Madhya Pradesh known as Barna reservoir. This reservoir is also identified under National Wetland conservation program by Ministry of Environment and Forests (Government of India). Hence the present study is of great importance. The present study aims at assessing the physical habitat conditions of Barna and Jamner streams.

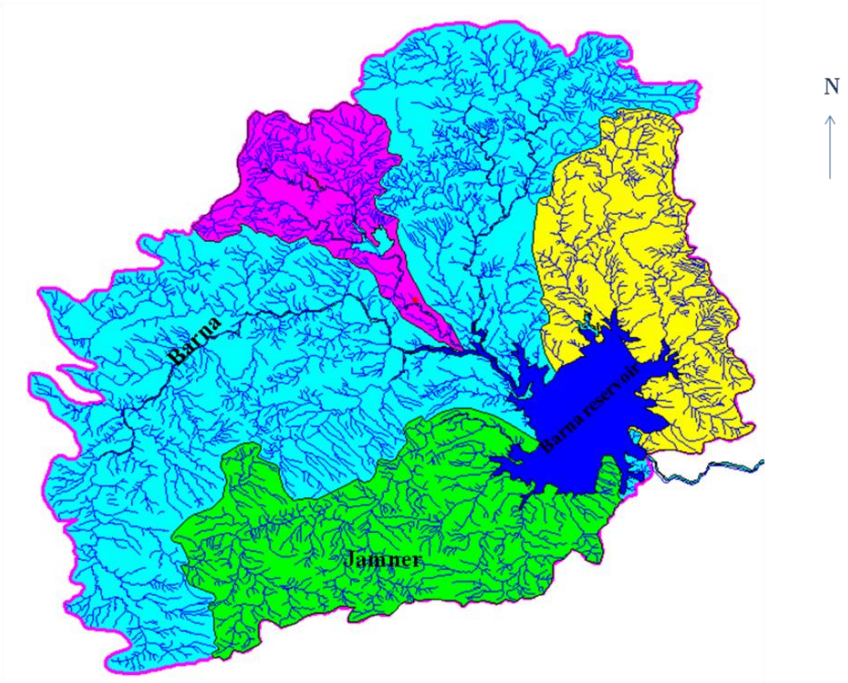

Fig.1 Map Showing Study Area

III. Methodology

The physical habitat conditions were assessed by numeric evaluation. Several parameters such as in stream habitat, epifaunal substrate, embeddedness, pool quality, riffle quality, bank stability, channel flow status, sediment deposition, riparian vegetation were scored based by using scoring system. Each of the parameters was ranked as optimal, suboptimal, marginal or poor. A stream with a high score on this portion of the assessment likely provides a favorable habitat whereas, low score shows anthropogenic pressure. The physical habitat assessment was followed from rapid bioassessment protocol (Barbour *et al.*, 1999).

IV. Results And Discussion

During the present study various physical habitat characters of the Barna and Jamner streams were assessed (Table 1). The in stream habitat quality of Barna stream was found to be in optimal range as adequate amount of cobbles, boulders and submerged logs were present at this station whereas, the in stream habitat quality of Jamner stream was found to be in marginal range as mixture of boulders, cobbles, gravel, submerged logs were present in less amount and although boulders were found scattered in more number throughout the water body.

The epifaunal substrate of Barna stream was found in optimal range. The epifaunal substrate at Barna stream consists of cobbles and pebbles in abundance with well developed riffle and runs. Epifaunal substrate of Jamner stream showed in marginal range. During the study, the availability of substrate favorable for epifaunal colonization was found very little. It was also found frequently disturbed and influenced by humans *i.e.*, having agricultural practices close to stream bank. Here the substrate was comprised of boulders, clay and mud while cobbles and pebbles were not present. The little deposition of sand, gravel was found with bottom almost unaffected at Barna stream which makes it to fall under optimal range for sediment deposition. In Jamner stream, moderate amount of sand, gravel, fine sediment depositions were present and increased amount of bar development had resulted in substantial amount of the bottom affected, hence, it falls under marginal range for sediment deposition. The Barna stream showed optimal range for bank stability. The evidences of soil erosion were very small as no human involvements in degradation of banks were found and it was also found less than 20% banks were affected. In Jamner stream, bank stability showed marginal range. Banks were found moderately unstable due to agricultural activities from one side and human settlements from other side of the bank. No rocks, boulders found near the banks which are susceptible to soil degradation during energetic flow of rainy season.

The vegetative protection was found to be in optimal range in Barna stream. The stream is surrounded by forested area. The vegetative disruption through human interference was little with almost native vegetation unaffected. The vegetative protection of Jamner stream was found to be in marginal range. The forested vegetation was found but the vegetative disruption through human activities was evident.

The riparian vegetation zone width at Barna stream showed in optimal range. The human activities were found to have no impact on the width of natural vegetation along the stream banks. An abundance of trees were found along both sides of the banks. The forests growth in riparian corridor makes the stream more pristine. On the contrary, the riparian vegetative zone width of Jamner stream comes in marginal range due to the influence of human activities *viz.*, agricultural activities and human settlement in riparian zone.

Pool quality at Barna stream was found to be remaining in poor range as some small pools with shallow water were found present. The pool quality of Jamner stream was found in optimal range. The depths of pools were found to be large enough, providing shelter to diversity of organisms. Majority of the pools were large-deep with boulders very enough in quantity in the mid stream. A mixture of mud, clay and sand were present with little emergent vegetation was also found present.The riffle quality at Barna stream showed optimal range. The riffle condition was found good throughout the sampling reach of the stream while the readings of Jamner stream for riffle quality were found in poor range. The occurrence of riffles were very rare in Jamner stream and also very little mixture of cobbles, gravel, boulders were present.

The embeddedness at Barna stream showed optimal range. A mixture of gravel, cobbles and boulders were surrounded by a very little amount of fine sediment whereas, embeddedness at Jamner stream showed in marginal range. The boulders and cobbles were covered by fine sediments besides mud.Channel flow status at Barna stream was found to be in suboptimal range. The water reaches the base of both lower banks with almost no channel substrate exposed. Channel flow status of Jamner stream was also found in suboptimal range. During the study while moving towards the edges of Jamner stream, it was found that a less portion of the channel substrate is exposed. Water reaches almost near the base of both lower banks. However, it may be noted that the rate of flow of Barna stream was found to be more as compared to Jamner stream.

RB=Right bank, **LB**=Left bank

Table 1: Showing variation in physical habitat assessment at Barna and Jamner streams

Parameters	Barna stream	Jamner stream
Instream habitat	17	10
Epifaunal substrate	16	08
Sediment deposition	16	10
Bank stability	6(RB)	05(RB)
	8(LB)	04(LB)
Vegetative protection	7(RB)	04(RB)
	8(LB)	03(LB)
Riparian vegetation	8(RB)	05(RB)
	9(LB)	04(LB)
Pool quality	04	16
Riffle quality	18	04
Embeddedness	17	08
Channel flow status	14	13

V. Conclusion

The primary aim of the study was to evaluate variation associated with the measurement of physical habitat assessment of Barna and Jamner streams. During the study period, disparities among the parameters of physical habiat assessment between two streams were clearly observed. The physical habitat assessment at Barna stream comes under optimal or sub optimal category which shows that it is a pristine stream. On the contrary, in Jamner stream the status of physical habitat comes under marginal or poor condition due to agricultural land use and human interferences which shows that it is a polluted stream. Thus, the study clearly predicted that the physical habitat condition, riparian condition and land use pattern have profound effect in assessing overall ecological health of the water bodies.

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