

# Biomonitoring as a tool for assessing the water quality of river halali during monsoon season Madhya Pradesh (India)

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## Abstract

Macrozoobenthos comprise an important group of aqua fauna by way of their contribution to ecosystem stability, besides acting as potential bio indicators of trophic status. Rivers provide habitat to many plants and animals consisting of benthic aquatic and terrestrial components which are life line for organisms. Halali River is a tributary of Betwa River which flows through district Bhopal. In the present study two sampling sites were selected viz., Islam Nagar (inlet) and Halali dam (outlet) for assessing the water quality. Samples were collected during monsoon season (September 2016). The aim of the study was to assess the distribution of Macrozoobenthos along with assessment of water quality with the help of Macrozoobenthos. A total of 25 species of macrozoobenthos were observed in Halali River belonging to four phyla viz., phylum Arthropoda, phylum Mollusca, phylum Annelida and phylum Platyhelminthes. In the present study it was found that species of Arthropoda was more dominant. BMWP scores, ASPT scores and presence of species like Chironomus and Tubifex tubifex (pollution indicating species) indicates that the water of Halali River is polluted. The BMWP scores and ASPT scores confirms the findings of the physicochemical parameters.


**Key Words:** Halali, Macrozoobenthos, Bio indicators, BMWP scores, ASPT scores.

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## INTRODUCTION

Benthic macroinvertebrate are aquatic organisms that lie in the bottom of any water body. Macro invertebrate response to environmental change is useful in assessing the impact of municipal, industrial and agricultural waste and impact from other land uses on surface water. The macroinvertebrate are highly popular pollution indicators (Hallawel, 1986). The procedure for assessing the biotic communities of surface water become widely used in recent years as they allow large number of sites to examine at low cost (Rosenberg and Resh,1993). Biomonitoring is the assessment done by studying the

benthic organisms for monitoring and analyzing water quality, so these organisms can be used as a bioindicator to access the water quality. Macrozoobenthos presence or absence can predict the status of physicochemical parameters defining the quality of water of any given water body. Abundance of families of highly intolerant species indicates good water quality and presence of highly tolerant species indicates water belongs to poor quality.

## MATERIAL AND METHODS

Samples were collected from two selected sites of Halali River in the month of September 2016 seasons. Site 1 (Islam Nagar -Inlet) lies on 77°33'1.87"E and 23°30'37.07"N. Site 2<sup>nd</sup> (Halali Dam-Outlet) is located at the Halali dam which lies on 77°33'1.87"E and 23°30'14.54"N.

**Methods:** The sampling was done by using net of mesh size (500 µm) for collecting the macro-invertebrates. Each pick able large boulder or cobble in the sampling area was picked up and the collected organisms were washed neatly by hand. Finally, the substrate with smaller boulders was disturbed 3 – 4 times such that the organisms were collected into the net. The organisms

were carefully picked up from the net and finally preserved immediately in 70% ethanol for further identification. The samples for Biological examination were collected in sterilized and dried non-reactive Borosilicate glass bottles. The samples were collected in

plastic container and analyzed for physicochemical parameters using standard methods suggested by American Public Health Association APHA (1998). The biological assessment was carried out with the help of Identification keys of Needham, Needham and Trivedy.

## RESULTS AND DISCUSSIONS

**Physico chemical parameters:** The present study was carried out in Monsoon season (September 2016). Physico-chemical parameters for water quality were analyzed as per APHA (1998) and ADONI (1985).

**Table 1:** Physicochemical parameters of Monsoon season (September 2016)

Physicochemical parameters	Monsoon	
	Site 1 <sup>st</sup> (Islam nagar)	Site 2 <sup>nd</sup> (Halali Dam)
pH	8.5	8.3
Water temp(0°C)	27.6	25.6
Air temp(0°C)	28.8	28.8
Conductivity(ms/cm)	0.17	0.46
Total dissolved solids(mg/l)	103.7	280.6
Dissolved oxygen(mg/l)	4	6.4
Free Co <sub>2</sub>	16	3
Turbidity(FAU)	117	124
Total alkalinity(mg/l)	50	120
Carbonate alkalinity(mg/l)	0	0
Bicarbonate alkalinity(mg/l)	50	120
Total hardness(mg/l)	40	114
Calcium hardness(mg/l)	33.6	94.5
Magnesium hardness(mg/l)	6.4	19.5
Chloride(mg/l)	9.99	14.99
Nitrate(mg/l)	1.76	2.95
Orthophosphate(mg/l)	1.41	1.99
BOD(mg/l)	2.8	4.8
COD(mg/l)	8	20

In the present investigation the highest pH value of 8.5 recorded at site 1<sup>st</sup> and lowest pH value of 8.3 was recorded at site 2<sup>nd</sup>. Adhikari (2003) also reported the value of pH between 8.3-8.5 which indicates that water body is productive in nature which is favorable for food growth and survival of fishes. Waganeo (1984) reported high pH values towards alkaline side to enhancement of photosynthetic rate. Relatively high value of D.O was recorded in site 2<sup>nd</sup> i.e. at Halali Dam as compared to site 1<sup>st</sup>. During present work fluctuation in hardness may be due to the addition of domestic sewage. The total hardness of the river Halali was 40 mg/l recorded at site 1<sup>st</sup> and 114 mg/l at site 2<sup>nd</sup>. Yousf *et al.*, (2006) seemed to be the hardness of the water influenced by the anthropogenic activities. The water temperature was record with range value of 25.6°C to 27.6°C. A range for water temperature between 19.7°C to 29.5°C in

Halali reservoirs was reported by Das *et al.*, (2008). In the present study the air temp both sites was same 28.8°C. Sandwar and Tiwari (2006) reported air temperature range between 22.7°C to 37.5°C in Ganga River in North Bihar. The highest turbidity recorded at second site 124 FAU and the lowest turbidity recorded at site 1<sup>st</sup> 117 FAU. The conductivity recorded was highest at site 2<sup>nd</sup> 0.46 ms/cm and the lowest as compared at site 1<sup>st</sup> 0.17 ms/cm. Grey (2004) reported the increase conductivity towards downstream was due to increased could be increased urban and agricultural land drainage into the rivers. The highest value of B.O.D was recorded in site 2<sup>nd</sup> 4.8 mg/l and lowest value of B.O.D was recorded in site 1<sup>st</sup> 2.8 mg/l. The C.O.D recorded was highest at site 2<sup>nd</sup> 20 mg/l and the lowest as compared at site 1<sup>st</sup> 8 mg/l i.e. in inlet at Islam nagar.

**Biological data:** In the present survey total 25 generas were observed belonging to 18 families and 10 orders. (Table 2). Identification was done with the help of keys of Trivedy, (1995) and Needham, Needham, (1988). Total number of 8 families were observed at site 1<sup>st</sup> belonging to 6 orders and 10 generas out of which 1 family belongs to Mollusca, 5 families were from phylum Arthropoda,

and 2 families belongs to phylum Annelida. The dominating species was of phylum Arthropoda. At Site 2<sup>nd</sup> number of 13 families were recorded at site 2<sup>nd</sup> under 6 orders and 18 generas out of which 11 families belongs to phylum Arthropoda, 2 families of phylum Mollusca, 2 families of phylum Annelida and 1 family belong to phylum Platyhelminthes.

**Table 2:** Macrozoobenthic invertebrates recorded during Monsoon seasons (September 2016)

S.no.	Taxa	ISLAM NAGAR Site 1 <sup>st</sup> (INLET)	HALALI DAM Site 2 <sup>nd</sup> (OUTLET)
Phylum: Mollusca			
Class: Gastropoda			
Order: Mesogastropoda			
Family: Viviparidae			
1	Bellamyia bengalensis	+	+
2	Bellamyia dissimilis	+	-
3	Campeloma	-	+
Family: Lymnaeidae			
4	Lymnaea	-	+
Phylum: Arthropoda			
Class: Insecta			
Order: Diptera			
Family: Chironomidae			
5	Chironomus sps.	+	-
6	Ablabesmyia	+	-
Order: Hemiptera			
Family: Nepidae			
7	Nepa	-	+
8	Ranatra sps.	-	+
Order: Coleoptera			
Family: Dytiscidae			
9	Acilius	-	+
10	Dytiscus	-	+
Family: Hydrophilidae			
11	Hydrophilus	-	+
12	Berosus spc.	-	+
Family: Haliplidae			
13	Peltodytes	-	+
14	Haliplus	-	+
Family: Elmidae			
15	Riffle bettle	-	+
Family: Gyrinidae			
16	Dineutus	-	+
Order: Hemiptera			
Family: Naucoridae			
17	Pelocoris	+	-
Family: Notonectidae			
18	Notonecta	+	-
Order: Ephemeroptera			
Family: Heptageniidae			
19	Heptagenia	+	+
Family: Caenidae			
20	Caenis	+	+
Phylum: Annelida			
Class: Clitellata			
Order: Oligocheata			

Family: Naididae	21	Tubifex	+	-
Order: Arhynchobdellida				
Family: Hirudinidae	22	Hirudo	+	-
Order: Haplotaxida				
Family: Megascolecidae	23	Pheretima	-	+
Class: Secernentea				
Order: Spirurida				
Family: Onchoceridae	24	Wuchereria	-	+
Phylum: Platyhelminthes				
Class: Rhabditophora				
Order: Tricardida				
Family: Planariidae	25	Planaria	-	+

**Table 3:** BMWP and ASPT scores for site 1<sup>st</sup> and site 2<sup>nd</sup> of Halali River during monsoon season (September 2016)

Sr. No.	Invertebrate Families	Islamnagar Site 1 <sup>st</sup>	Halali dam Site 2 <sup>nd</sup>
01	Heptageniidae	10	10
02	Gyrinidae	-	8
03	Caenidae	7	7
04	Haliplidae	-	7
05	Viviparidae	6	6
06	Elmidae	-	5
07	Nepidae	-	5
08	Hydrophilidae	-	5
09	Dytiscidae	-	5
10	Naucoridae	5	-
11	Notonectidae	5	-
12	Hirididae	3	-
13	Planariidae	-	3
14	Lymnaeidae	-	3
15	Chironomidae	2	-
16	Onchoceridae	-	1
17	Megascolecidae	-	1
18	Naididae	1	-
	<b>Total BMWP SCORE</b>	<b>39</b>	<b>66</b>
	<b>ASPT SCORE</b>	<b>4.8</b>	<b>5.07</b>

**Abbreviation:** BMWP-Biological monitoring working party, ASPT-Average score per taxon.

**Table 4:** The BMWP and ASPT score table (Hawkes, 1998) showing biological quality and water quality

BMWP		ASPT	
BMWP Score	Biological Quality	ASPT Score	Water Quality
Over 130	A. Very good biological quality (natural)	Over 7	Very good (natural)
81 – 130	B. Good biological quality	6.0 – 6.9	Good
51 – 80	C. Fair biological quality	5.0 – 5.9	Fair
11 – 50	D. Poor biological quality	4.0 – 4.9	Poor
0 – 10	E. Very poor biological quality	3.9 or less	Very poor

The BMWP score calculated for site 1<sup>st</sup> was 39 and the ASPT value was 4.8. The BMWP score for site 2<sup>nd</sup> was 66 and ASPT value was 5.07 (Table-3). The obtained score at site 1<sup>st</sup> reveals that water is of poor biological quality and belongs to class D (Table-4). The ASPT scores of site 1<sup>st</sup> reveals that the water is polluted

reveals that the water is polluted and of poor quality. The obtained score of BMWP at Site 2<sup>nd</sup> reveals that water is of fair Quality and belongs to class C and the ASPT reveals that water is of fair biological quality. Thus the result of physico chemical and biological parameters both confirms that in Islam nagar water is polluted and of poor

quality while at Halali dam water is fair biological quality.

## CONCLUSION

The biological study of water of Halali River confirmed that the use of macro invertebrates as bio indicators is a valuable monitoring tool in comparison to the physicochemical analysis in accessing quality of water. The River which carries pollution load and belongs to poor quality get converted into fair quality suggests that the pollutants got settled down in due course of flow of river when the water reaches to the Halali reservoir. The concerned department may take mitigate measures to reduce the pollution in Halali river at Islam Nagar. The need of the hour is to create environmental awareness among the nearby inhabitants regarding quality of water and effect of pollution on Halali River so that the quality of water may reach from fair to good biological quality.

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