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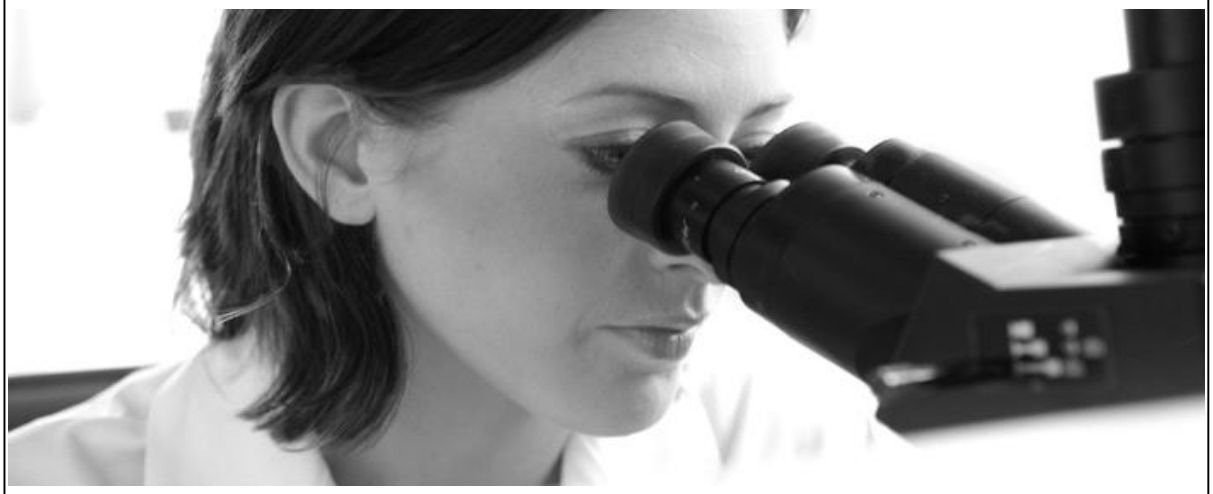

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RESEARCH ARTICLE

PRELIMINARY STUDY OF MOLLUSCAN DIVERSITY IN NARMADA RIVER, JABALPUR REGION (M.P.)

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ABSTRACT

The purpose of this study is to evaluate the diversity of Mollusca in the river Narmada at Jabalpur region (situated in the eastern zone) using diversity and dominance indices. Hence, the samples of Mollusca were obtained from two sites along the river bank, from June 2014 to December 2014. The present study carried out about 9 species of class Gastropoda and 4 species of class Pelecypoda were recorded throughout the study duration. The Shannon's Index of Mollusca was determined (を = -0.839586). The diversity of all stations was compared with each other. The highest diversity was obtained from site I (Simpson index: 0.173115, を: -0.839586) and the lowest diversity was obtained from site II (Simpson index: 0.128353, を: -1.024398) that indicate a good variation.

INTRODUCTION

Biodiversity, the variation among living organisms or ecosystems (UNEP, 1992), is a multi-factorial concept and is known to be heterogeneous in time (Gaston, 2000; Rohde and Muller, 2005; Weir, 2006) and space (Diniz-Filho and Bini, 2005; Buckley and Jetz, 2008). The Narmada is the longest west flowing river in India. It rises from Amarkantak Hill in Shahdol district of Madhya Pradesh in the Maikal hill range and from the head of the Satpura Range it reaches Jabalpur where it passes through the 'Marble Rocks' and enters the Narmada plains.

The Narmada basin lies between east longitudes 72°32' to 81°45' and north latitudes 21°20' to 23°45'. Molluscs are among the most ancient of animals on earth today. The Mollusca is an extraordinarily varied phylum with estimates of 80,000 to 100,000 described species and total diversity possibly as high as 200,000. Molluscs are also among the most successful of all animals, and are second only to arthropods in species richness. The largest molluscan classes i.e., Gastropoda and Bivalvia have repeatedly and successfully colonized continental (''fresh'') waters (Strong *et al*., 2007). Freshwater gastropods are found on every continent except Antarctica and in nearly all aquatic habitats including rivers, lakes, streams, swamps, underground aquifers and springs, as well as temporary ponds, drainage ditches and other ephemeral and seasonal waters. Most live submerged, and many are specialized for particular habitats aquatic vegetation, stones, rocks, wood and other solid surfaces, or soft sediment. Some are amphibious and a few are able to tolerate periods of time out of water (e.g., Ampullariidae); others are capable of prolonged periods of aestivation in soil during dry periods. The tropics have faced massive biodiversity loss due to intensive anthropogenic activities such as changes in land use and degradation of environment.

Natural populations of freshwater gastropods are subjected to severe ecological constraints imposed by large temporal fluctuations of their environment; their success is depending on their physiological capacity to tolerate these fluctuations (Kalyoncu, 2009). Gastropods usually play a dominant role in the ecology of fresh-waters by providing food for many animals and by grazing on vast amounts of algae and detritus (Agudo-Padron, 2011).Recent reports suggest that the tropics are losing biodiversity at an alarming rate (Sodhi, 2008). However, there is very little knowledge on the extent of loss in lesser known groups, especially the invertebrates. In this paper, we highlight the diversity and abundance of snails and the need for their conservation. The aim of this study is the assessment of the environment and the biodiversity of fresh water Mollusca, detection the diversity of species in river Narmada of Jabalpur region.

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MATERIAL AND METHOD

The study site includes river Narmada and its reservoir in Jabalpur city. The studies carried out from June 2014 to December 2014 to calculate diversity indices of Mollusca in two sampling stations namely Bargi dam to Gwarighat and Gwarighat to Bhedaghat. Mollusca were collected from surrounding area and deeper Profundal zone by using Ekman grab and at shallow Profundal zone by using surber sampler following Wetzel (2001) in the reservoir as well as river. All the samples were preserved in field with 5% formalin solution. Organisms were identified by using standard keys, such as Tonapi (1980), Adoni *et al* (1985) and SubbaRao (1993). Shannon-Weiner diversity index (H) was calculated using Shannon-Weiner equation according to Mangurran (1988) and the dominance index that is Simpson index (C) was calculated according to Sklar (1985).

Calculation of Shannon's Species Diversity Index (e)

$H = -\sum (ni/ N) * \log (ni / N)$ **OR** $-\sum Pi * \log Pi$

Where, H = Shannon Index of Diversity.
ni = Number of individual of each species.
N = Total number of individuals in the sample, (i.e., $N = \sum ni$).
Pi = Importance probability for each species, (i.e., Pi = ni / N)

Calculation of Simpson's Index of Dominance (C)

$C = \sum (ni / N)^2$ **OR** $\sum (Pi)^2$

Where, C = Number of individual of each species
ni = Number of individual of each species.
N = Total number of individuals in the sample, (i.e., $N = \sum ni$).
Pi = Importance probability for each species, (i.e., Pi = ni / N)

RESULT

The total density of Mollusca species and the number of appearance of all species during the time of study were explained in (Table 1 and Fig 1), the result show the highest density values in site 2, from Gwarighat to Bhedaghat and lowest in site 1 from Bargi Dam to Gwarighat (Fig. 1).

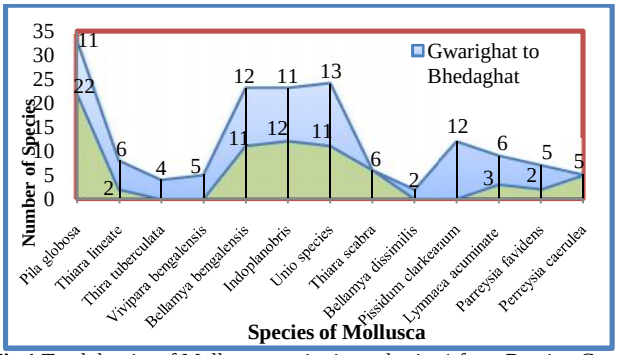

Fig 1 Total density of Mollusca species in study site 1 from Bargi to Gwari and site 2 from Gwarighat to Bhedaghat.

Table 1 and table 2 show the dominance as well as diversity of each Mollusca species in the sites according to the Simpson's dominance index (C) and Shannon-Wiener Diversity Index.

Tab. 1 List of recorded species of Mollusca in Jabalpur Region

S. No.	Name of The Species	Site 1 (Bargi Dam to Gwarighat)		Site 2 (Gwarighat to Bhedaghat)	
		Status	No. of Species seen	Status	No. of Species seen
	Class : Gastropoda				
1	Pila globosa	Present	22	Present	11
2	Thiara lineate	Present	2	Present	6
3	Thiara tuberculata	**Absent**	**0**	Present	4
4	Vivipara bengalensis	**Absent**	**0**	Present	5
5	Bellamya bengalensis	Present	11	Present	12
6	Indoplanobris	Present	12	Present	11
7	Unio species	Present	11	Present	13
8	Thiara scabra	Present	6	**Absent**	**0**
9	Bellamya dissimilis	**Absent**	**0**	Present	2
	Class : Pelecypoda				
10	Pissidum clarkeanum	**Absent**	**0**	Present	5
11	Lymnaea acuminate	Present	3	Present	6
12	Perreysia favidens	Present	2	Present	5
13	Perreysia caerulea	Present	5	**Absent**	**0**

According to the Shannon-Wiener index, the species diversity in River Narmada in middle of Jabalpur was founded to be 0.93 at average. The highest level of diversity was founded at Site 2 (-0.839586) and its lowest was founded at Site 2 (-1.024398).

Simpson Index (C) the result were showed the value of this index ranging between the highest values (0.173115) in Site 1 and lowest values (0.128353) in Site 2, the values of this index were increased the with decrease of the diversity (show negative correlation with the diversity). This was agreed with that of (Al-Nemraw, 2005).

Table 1 Calculation of Shannon's Index of general diversity ($\overline{H}$) and Simpson's Index of dominance (C) for the Mollusca Site 1 Bargi to Gwarighat.

Name of Mollusca	Total no. of Mollusca	Pi = (ni/ N)	LogPi	e=Pi*LogPi	C = $(Pi)^2$
Class: Gastropoda					
Pila globosa	22	0.297297	-0.526809	-0.156618	0.088385
Thiara lineate	2	0.027027	-1.568201	-0.042383	0.000730
Thiara tuberculata	0	0	0	0	0
Vivipara bengalensis	0	0	0	0	0
Bellamya bengalensis	11	0.148648	-0.827839	-0.123057	0.022096
Indoplanobris	12	0.162162	-0.790050	-0.128116	0.026296
Unio species	11	0.148648	-0.827839	-0.123057	0.022069
Thiara scabra	6	0.081081	-1.091080	-0.088465	0.006574
Bellamya dissimilis	0	0	0	0	0
Total	64	-	-	-0.661696	0.166177
Class: Pelecypoda					
Pissidum clarkeanum	0	0	0	0	0
Lymnaea acuminate	3	0.040540	-1.392110	-0.056436	0.001643
Perreysia favidens	2	0.027027	-1.568201	-0.042383	0.000730
Perreysia caerulea	5	0.067567	-1.170261	-0.079071	0.004565
Total	10	-	-	-0.177890	0.006938
Grand Total (N)	74	-	-	-0.839586	0.173115

Shannon's Index ($\overline{H}$) = Pi * Log Pi = -0.839586
Simpson's Index (C) = $(Pi)^2$ = 0.173115

It is obviously seen that the groups of Mollusca are different with the study sites; this may have been related to the changes in the environment, to the industrial or organic pollution (Al-Saad *et al*., 2011). Benthic macro invertebrates are susceptible to the local environmental perturbation, which are also effective integrators of the environmental contamination, this

means, they were responded to all contaminants in the environment not only those were measured in conventional water or sediment quality monitoring program (Karr, 1986).

Table 2 Calculation of Shannon's Index of general diversity (H) and Simpson's Index of dominance (C) for the Mollusca in Site: 2 Gwarighat to Bhedaghat.

Name of Mollusca	Total no. of Mollusca	Pi = (ni/ N)	LogPi	e=Pi*LogPi	C = $(Pi)^2$
Class: Gastropoda					
Pila globosa	11	0.146667	-0.833668	-0.122271	0.021511
Thiara lineate	6	0.080000	-1.096910	-0.087752	0.006400
Thiara tuberculata	4	0.053333	-1.273001	-0.067893	0.002844
Vivipara bengalensis	5	0.066667	-1.176091	-0.078406	0.004444
Bellamya bengalensis	12	0.160000	-0.795880	-0.127340	0.025600
Indoplanobris	11	0.146667	-0.833668	-0.122271	0.021511
Unio species	13	0.173333	-0.761118	-0.131927	0.030044
Thiara scabra	0	0	0	0	0
Bellamya dissimilis	2	0.026667	-1.574031	-0.041974	0.000711
Total	**64**	-	-	**-0.779834**	**0.113065**
Class: Pelecypoda					
Pissidum clarkeanum	5	0.066667	-1.176091	-0.078406	0.004444
Lymnaea acuminate	6	0.080000	-1.096910	-0.087752	0.006400
Perreysia favidens	5	0.066667	-1.176091	-0.078406	0.004444
Perreysia caerulea	0	0	0	0	0
Total	11	-	-	-0.244564	0.051288
Grand Total (N)	75	-	-	-1.024398	0.128353

Shannon's Index (H) = Pi * Log Pi = -1.024398
Simpson's Index (C) = $(Pi)^2$ = 0.128353

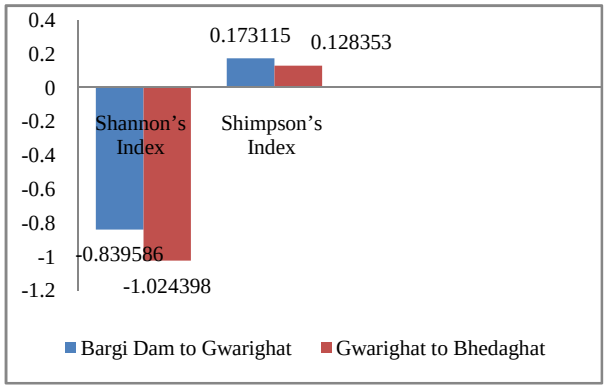

Fig 2 Shannon-Wiener index and Simpson's dominance index of Mollusca species in study sites from Site 1 to site 2 In River Narmada.

CONCLUSION

Serious attention needs to be paid towards protecting remaining forested areas, maintaining and possibly restoring connectivity, especially in the tropical rain forests which support rich snail diversity (Emberton, 1996). We did not find significant differences in the frequency of species occurrences at sites. We do, however, see a moderate trend indicating a decrease in endemic species and an increase of widespread species. Interestingly, many endemic species are very common and relatively unconfined regarding their depth preferences. In contrast, non-endemic species are mostly rare species, typically being restricted to limited areas of the surface layer. However, so far, community disintegration due to widespread species invading river Narmada could not be shown.

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