

## RESEARCH ARTICLE

## Correlation of Molluscan diversity with physico-chemical characteristics of water of Gorewada reservoir, Nagpur, India.

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Manuscript details:	ABSTRACT
<p>Date of publication 18.10.2014</p> <p>Available online on <a href="http://www.ijlsci.in">http://www.ijlsci.in</a></p> <p>ISSN: 2320-964X (Online) ISSN: 2320-7817 (Print)</p> <p><b>Editor: Dr. Arvind Chavhan</b></p> <p><b>Cite this article as:</b> Dorlikar AV, Mohite AS and Charde PN (2014) Correlation of Molluscan diversity with physico-chemical characteristics of water of Gorewada reservoir, Nagpur, India. <i>Int. J. of Life Sciences</i>, Special issue, A2: 197-201.</p> <p><b>Copyright:</b> © Author(s), This is an open access article under the terms of the Creative Commons Attribution-Non-Commercial - No Derives License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.</p>	<p>Aim of the present study is to assess the species diversity of molluscs and impact of physico-chemical parameters on their diversity from Gorewada reservoir on monthly basis. During present investigation, a total of 12 species of molluscs representing 06 orders, 08 families and 10 genera were recorded from the Gorewada reservoir. Gastropods substituted a dominant group of macro-invertebrates present throughout the study period. Ten species of gastropod recorded were <i>Melaniascabra</i>; <i>Melaniastritella</i>; <i>Faunus ater</i>; <i>Viviparous bengalensis</i>; <i>Endolanorbisexustus</i>; <i>Anisusconvexiusculus</i>; <i>Lymnaealuteola</i>; <i>Lymnaeaacuminata</i>; <i>Pilaglobosa</i> and <i>Gabbiastenothyroides</i>. Among the bivalve molluscs only <i>Lamelliden smarginalis</i> and <i>Corbiculastritella</i> were present as macro-invertebrate benthos. The <math>\alpha</math>-diversity indices for molluscan species that are Simpson index, Dominance index, Shannon-Weiner index, Margalef richness index, Menhink index, Equitability Index were also calculated and correlated with physico-chemical parameters that are pH, Water Temp, Transparency, Electrical Conductivity, Dissolved Oxygen, Dissolved CO<sub>2</sub>, Alkalinity, Total Dissolved Solids, Total Hardness, Chloride, Sulphates, Nitrates, Inorganic Phosphorus, B.O.D. and C.O.D.</p> <p><b>Keywords:</b> Gorewada reservoir, Gastropods, physico-chemical parameters, <math>\alpha</math>-diversity indices</p>
	<p><b>INTRODUCTION</b></p> <p>Gorewada reservoir is the precious aquatic ecosystem playing significant role in supplying potable water to Nagpur city as well as sustain a rich aquatic fauna. Among the macro-invertebrates, molluscs are an integral component of aquatic ecosystem and are very sensitive to changes in water quality, making them an excellent indicator species, thus assessing the trophic status of freshwater systems (Choubisa, 1992). In India, till today, 5070 species of molluscs have been recorded of which, 3370 species are from marine habitats (SubbaRao, 1991). There are 1671 species of non marine mollusks living in the wild in India (Ramakrishna and Mitra, 2002).</p> <p>This includes 1488 terrestrial species in 140 genera and 183 freshwater species in 53 genera. (Arvind <i>et al.</i>, 2005). Thus aim of study is to determine the monthly variation in water quality parameters and its impact on the molluscan density and diversity.</p> <p><b>MATERIALS AND METHODS</b></p> <p>Gorewada lake is one of the fresh water and artificial lake situated in the north-west corner of the Nagpur city (79°11' E latitude, 21°11' N, longitude and 303m (M.S.L) altitude).</p>

Collection of molluscan fauna has been made from Gorewada reservoir on monthly basis from the profundal zone by using Ekman dredge. The samples from littoral zone have been collected by scoop net. The samples have been washed and shifted through a grade 40 mesh size sieve. 3 samples were taken from reservoir to minimize the sampling error. The collected organisms were fixed in 5% formalin solution and enumerated group wise and preserved organisms were identified standard keys provided by Ward and Whipple (1959), Tonapi (1980) and Adoniet.al. (1985). Numbers of each species were expressed as organisms/m<sup>2</sup>. Water samples were collected on a monthly basis for a period of six months. The parameters included water temperature, pH, transparency, electrical conductivity, dissolved oxygen, free CO<sub>2</sub>, alkalinity, total dissolved solids, total hardness, chloride, sulphate, nitrate, Inorganic phosphate, biological oxygen demand and chemical oxygen demand. For the estimation of dissolved oxygen and biological oxygen demand, water samples were fixed at the sites. The collection, preservation and analysis of various parameters of water samples from different sampling locations were carried out by following the standard methods (APHA, 2005; Saxena, 1994; Manivasakam, 1982; Trivedy and Goel, 1986). Triplicates of each analysis were performed and mean values were used for calculation. Six indices were used to estimate  $\alpha$ -biodiversity of molluscan species. Species diversity index was calculated based on Simpson (1949) and Shannon-Weiner (1949); richness index was adopted by Margalef (1951) and Menhinic (1964) and equitability Index by Magurran (1988). Dominance index or Simpson's index of diversity was calculated using formula 1- Simpson index.

### Statistical Analysis

The correlation coefficient matrix between each pair of parameters were estimated to identify the highly correlated and interrelated water quality parameters and different  $\alpha$ -diversity molluscan indices. Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS 10.0).

## RESULTS AND DISCUSSION

A total of 12 species of molluscs representing 06 orders, 08 families and 10 genera were recorded from the Gorewada reservoir. The recorded species are represented in Table 1.

Gastropods substituted a dominant group of macro-invertebrates present throughout the study period. Ten species of gastropods representing 04 orders, 06 families and 08 genera were recorded during present study. Among gastropods species, *Melaniascabra*, *Melaniastritella* and *Anisusconvexiusculus* were recorded abundantly during entire study period. The density of order Gastropoda ranged between 33 to 65 organisms/m<sup>2</sup> with maximum density in summer and minimum in winter season (Figure 1). Pelecypods were represented by only two species belonging to 02 orders, 02 families and 02 species. Among pelecypods *Corbiculastritella* was recorded as a most dominant species. Density of Pelecypoda group was recorded and represented by 5 to 13 organisms/m<sup>2</sup> with maximum density in summer and minimum in winter season (Figure 1). Molluscan abundance during summer may be due to increased temperature which may enhance the rate of decomposition of organic matter in the reservoir (Malhotra et al., 1996).

**Table 1: Molluscan fauna recorded in Gorewada reservoir, during January 2008 to June, 2008.**

Class	Order	Family	Genus and species
Gastropoda	Mesogastropoda		<i>Melaniascabra</i>
			<i>M. striatella</i>
			<i>Faunus ater</i>
	Basommatophora	Viviparidae	<i>Viviparous bengalensis</i>
		Planorbidae	<i>Indoplanorbis exustus</i>
			<i>Anisusconvexiusculus</i>
		Lymneidae	<i>Lymnaea acuminata</i>
			<i>Lymnaea luteola</i>
Architaenioglossa	<a href="#">Ampullariidae</a>	<i>Pilaglobosa</i>	
Caenogastropoda	Bithyniidae	<i>Gabbiastenothyroides</i>	
Pelecypoda	Eulamellibranchia	Unionidae	<i>Lamellidens marginalis</i>
	Veneroida	Corbiculidae	<i>Corbiculastritella</i>

**Table 2:** Range of variation, mean and standard deviation, Coefficient of variation, Variance of the physico-chemical characteristics of water of Gorewada reservoir.

S. No	Parameter	Unit	Range of Variation		Mean ± Std. Deviation	Coefficient of Variation	Variance
			Min	Max			
1.	pH	--	7.30	8.10	7.70 ± 0.268	0.034	0.072
2.	Water Temp.	°C	20.2	23.7	21.7 ± 1.31	0.060	1.710
3.	Transparency	Cm.	19.4	32.0	25.0 ± 4.33	0.173	18.782
4.	Electrical Conductivity	μ mho cm <sup>-1</sup>	110	172	136 ± 23.0	0.169	531.2
5.	Dissolved Oxygen	mgL <sup>-1</sup>	7.40	8.40	7.97 ± 0.403	0.050	0.162
6.	Dissolved CO <sub>2</sub>	mgL <sup>-1</sup>	0.0	0.3	0.167 ± 0.103	0.619	0.010
7.	Alkalinity	mgL <sup>-1</sup>	84	178	127 ± 41.9	0.329	1759.46
8.	Total Dissolved Solids	mgL <sup>-1</sup>	222	490	385 ± 102	0.264	10340.26
9.	Total Hardness	mgL <sup>-1</sup>	110	160	134 ± 21.4	0.160	457.86
10.	Chloride	mgL <sup>-1</sup>	22.60	32.80	27.617 ± 3.42	0.123	11.67
11.	Sulphates	mgL <sup>-1</sup>	4.55	14.50	8.66 ± 4.75	0.547	22.52
12.	Nitrates	mgL <sup>-1</sup>	0.65	0.9	0.77 ± 0.104	0.133	0.010
13.	Inorganic Phosphorus	mgL <sup>-1</sup>	1.50	3.40	2.28 ± 0.77	0.340	0.605
14.	B.O.D.	mgL <sup>-1</sup>	2.0	3.1	2.48 ± 0.44	0.177	0.193
15.	C.O.D.	mgL <sup>-1</sup>	6.60	9.80	8.56 ± 1.28	0.148	1.626

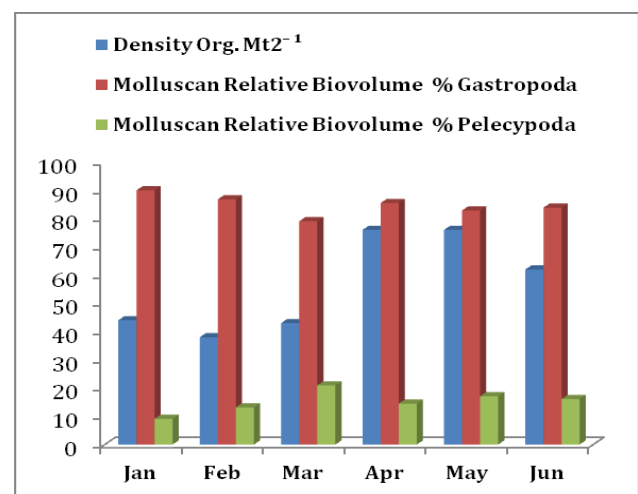
**Table 3.** Correlation coefficient (*r*) between physico-chemical parameters and molluscan abundance in the Gorewada reservoir\*.

Parameters	Gastropoda	Pelecypoda
pH	0.403	0.106
Temp	0.634	0.566
Trans	-0.398	-0.706
Cond	-0.348	-0.292
DO	-0.071	-0.066
CO <sub>2</sub>	0.458	0.571
Alkalinity	0.848	0.782
TDS	0.622	0.913
Hardness	0.988	0.775
Chlorides	0.722	0.682
Sulphates	0.47	0.448
Nitrates	0.267	0.744
In.PO <sub>4</sub>	0.296	0.504
BOD	0.905	0.839
COD	0.843	0.4

\*The values (*r*) ranged above 0.811 and 0.910 are significant at P < 0.05 and P < 0.01, respectively for two tailed test.

The physico-chemical parameters of water, Mean, standard deviation, Coefficient of variation, Variance at Gorewada reservoir have been given in the Table 2. The diversity indices during study period are presented in figure 2. The molluscan fauna in the study area showed great diversity during the study period. Values of Simpson index ranged from 0.12 to

0.2. Dominance index varied from 0.79 to 0.87. Shannon-Weiner index was in between 3.3 to 3.5. Margalef richness index values varied from 2.54 to 3.02. Menhink index was least (1.337) during summer and highest (1.94) during the winter season. Equitability index was minimum during summer (0.93) and highest during winter (0.98) and premonsoon period (0.97). Values of coefficient of correlation (*r*) of molluscan abundance with physico-chemical parameters are shown in Table 3. The values of coefficient of correlation (*r*) indicate that there was a moderate positive correlation between the Gastropods and temperature, TDS and chlorides while significant positive correlation between alkalinity and hardness, BOD and COD at 5% level of significance.



**Fig. 1:** Molluscan Density (Organisms Mt<sup>-2</sup>) and relative biovolume in % .

**Table 4.** Correlation matrix of physico-chemical parameters,  $\alpha$ -diversity indices and equitability indices in theGorewada reservoir,\*The values ( $r$ ) ranged from 0.8114 to 0.9171 and 0.9172 to above are significant at  $P < 0.05$ (2-tailed) and  $P < 0.01$ (2-tailed), respectively.

	$\lambda$	1- $\lambda$	$H'$	R1	R2	E	pH	TEMP	TRA	CON	DO	CO <sub>2</sub>	Alk	TDS	HD	Cl	S	Nit	In.Po <sub>4</sub>	BOD	COD	
$\lambda$	1																					
1- $\lambda$	-0.99	1																				
$H'$	-0.96	0.96	1																			
R1	-0.90	0.91	0.77	1																		
R2	-0.90	0.91	0.77	1	1																	
E	-0.96	0.96	1	0.77	0.77	1																
pH	0.07	-0.08	0.11	-0.40	-0.40	0.11	1															
TEMP	0.29	-0.32	-0.06	-0.66	-0.66	-0.06	0.804	1														
TRA	-0.24	0.29	0.13	0.50	0.50	0.13	-0.14	-0.60	1													
CON	-0.29	0.31	0.27	0.43	0.43	0.27	-0.67	-0.44	0.13	1												
DO	0.16	-0.17	-0.33	0.01	0.01	-0.33	-0.31	-0.502	0.03	-0.28	1											
CO <sub>2</sub>	0.14	-0.17	0.07	-0.49	-0.49	0.07	0.43	0.85	-0.81	0	-0.56	1										
Alk	0.63	-0.66	-0.46	-0.89	-0.89	-0.46	0.69	0.9	-0.60	-0.62	-0.19	0.67	1									
TDS	0.50	-0.54	-0.39	-0.72	-0.72	-0.38	0.24	0.72	-0.90	-0.29	-0.17	0.79	0.79	1								
HD	0.88	-0.88	-0.73	-0.96	-0.96	-0.73	0.41	0.65	-0.34	-0.29	-0.20	0.48	0.83	0.60	1							
Cl	0.71	-0.72	-0.65	-0.77	-0.77	-0.65	0.54	0.56	-0.20	-0.80	0.006	0.17	0.81	0.54	0.71	1						
S	0.29	-0.31	-0.17	-0.53	-0.53	-0.17	0.81	0.76	-0.23	-0.83	-0.27	0.37	0.79	0.50	0.49	0.85	1					
Nit	0.28	-0.32	-0.27	-0.4	-0.4	-0.27	0.10	0.46	-0.63	-0.41	-0.16	0.46	0.55	0.81	0.27	0.58	0.59	1				
In.PO <sub>4</sub>	0.49	-0.50	-0.57	-0.32	-0.32	-0.57	-0.65	-0.24	-0.45	0.34	0.46	0.06	-0.002	0.36	0.21	-0.10	-0.50	0.13	1			
BOD	0.81	-0.81	-0.66	-0.88	-0.88	-0.66	0.25	0.64	-0.43	-0.08	-0.39	0.60	0.76	0.69	0.94	0.60	0.40	0.405	0.29	1		
COD	0.63	-0.63	-0.46	-0.80	-0.80	-0.46	0.73	0.66	-0.16	-0.51	-0.03	0.33	0.78	0.30	0.82	0.63	0.54	-0.06	-0.09	0.61	1	

$\lambda$ : Simpson's index; 1- $\lambda$ : Dominance index;  $H'$ : Shannon-Weiner index; R1: Margalef richness index; R2:Menhink index;E: Equitability index; TEMP:Temperature; TRA:Transparency; CON:Conductivity; DO;Dossolved oxygen; Alk:Alkalinity;TDS: Total dissolved solids; HD:Hardness; Cl:Chlorides; S:Sulphates;Nit:Nitrates;In.PO<sub>4</sub>:Inorganic phosphates; BOD:Biological oxygen demand;COD: Chemical oxygen demand.

The pelecypods showed significant positive correlation between TDS and BOD at 5% level of significance while moderate positive correlation was observed in between pelecypods and temperature, CO<sub>2</sub>, alkalinity, hardness, chlorides, nitrate and inorganic phosphates. A moderate negative correlation exists between pelecypod population with transparency. Correlation matrix of physico-chemical parameters,  $\alpha$ -diversity indices and equitability indices in the Gorewada reservoir is represented in Table 4.

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