Molluscs Diversity and their Correlation with Physico-Chemical Parameters of Susari dam Shahada Taluka District Nandurbar (M.S.) India

Dr. Patil Ravindra D.
Department of Zoology,
Vasantrao Naik Arts, Science and
Commerce College Shahada,
Dist. Nandurbar.
raviyash99@mail.com

Dr. Patil Rajendra D.
Department of Zoology,
Arts, Commerce and Science
College, Navapur,
Dist. Nandurbar
rajendradpatil1964@gmail.com

Abstract:

Molluscan diversity, seasonal variations and their correlation with the physicochemical parameters of Susari dam have been studied during June 2012 to May 2014. A correlation between Molluscs collected by using unit cover method and water samples collected from three points from reservoir have been attempted. The biotic samples and water samples carried to laboratory for qualitative and quantitative evaluation with respect to Molluscan density and species richness while abiotic components of water have been analyzed over three seasons' monsoon, winter and summer. In Susari dam total nine species and seven genera were recorded. Of these nine species eight belongs to class gastropod and one species of class bivalvia The value thus obtained have been used to find out correlation between water parameters and density and species richness of mollusc by keeping molluscs as dependent variables and abiotic factors as independent variables. Maximum density observed in monsoon and minimum in winter. The positive or negative significant or non-significant correlations of Molluscan density and species richness with physicochemical parameters of water that produce cumulative effect are discussed.

Keywords: Mollusc, Diversity, Density, Species richness, Physico-Chemical parameters and Susari Dam.

Introduction:-

Molluscs are highly successful invertebrates in terms of ecology and adaptation and are found nearly in all habitats ranging from deepest ocean trances to the intertidal zone, and freshwater to moist land occupying a wide range of habitats (Dillon and Robert, 2004; Strong *et al.,* 2008). The first molluscs appeared as early as Cambrian period, approximately 500 million years ago. The freshwater Mollusca play an important role in water ecosystem. Phylum Mollusca is the second largest after phylum Arthropod in terms of number of species on the earth. Molluscan is a group of most diverse and dominantly benthic fauna of water bodies performs a key role in the functioning of aquatic ecosystem. Mollusca occur in various habitats and are divided into freshwater, marine and terrestrial forms. The molluscs greatly vary in form, structure, habitats and habits. They are highly adaptive and occupy all possible aquatic and terrestrial habitats, expect aerial, they are mostly free living creatures that creep slowly. (Tonapi, 1980). The Phyla Molluscs constitute dominant group animals belonging to the seven classes namely Aplacophora, Monoplacophora, Polyplacophora, Bivalvia, Gastropoda, Cephalopoda and Scaphopoda. Among these classes, Gastropods, Bivalvia and Cephalopod are considered as major and important ones. Molluscs are extremely important communities among other ecological communities. They constitute the second largest invertebrate and most successful group next only to insects.

Abbott (1989) Bouchet (1992). They prove immensely beneficial both economically and medicinally (Wosu 2003). They have been important to humans as a source of food, jewelry tools and even pets. Freshwater molluscs play significant role in public and veterinary health (Supian and Ikhwanuddin 2002). Their existence is highly necessary

because they constitute food for many aquatic organisms, Subba (2003), Begum and Narayan 2006.

Biodiversity is one of the important lives supporting system on the earth. With reference to Molluscan diversity all over the world, maximum number of species occurs in the marine ecosystem. (31463) followed by terrestrial ecosystem (24503) and freshwater ecosystem (8765). Out of 8765 freshwater species estimated available in the world, 284 species (56) genera are reported from India and adjacent countries. Among 284 species 171 species of molluscs are gastropods (Punithavelu and Raghunathan 2005). In spite of great diversity the freshwater molluscs did not receive much attention till recently. Molluscan communities are good indicators of localized conditions, indicating the water quality. The freshwater ecosystems in India harbor a rich diversity of molluscs, representing 212 species belonging to 21 families of these 164 species were recorded from rivers and streams (Subba Rao, 1993). Authentic data on the status of various species of molluscs is not readily available. Recent surveys have shown that species which were once abundant and easily available are hard to find now in their habitats (Subba Rao, 1989).

As per world conservation monitoring center about 170 species of molluscs have become extinct since 1800 AD. While the 1990 IUCN Red list recorded 425 species of molluscs under the threatened category. Much of the molluscs diversity found in the topical world (Vanmali and Jadhav. 2015). Despite this great diversity, very few studies on molluscs have been carried out. (Emberton 1996) with their biomass, to the diversity is of great ecological significance. An attempt to address the diversity, endemism and geographical distribution patterns of land snail of Western Ghats, has been made by Arvind *et al.,* 2005. Till date 1487 species of land snails belonging to 32 families and 140 genera have been reported in India (Ramakrishna and Mitra 2002). Recently, the checklist of terrestrial gastropods of Karnataka (Mavin Kurve *et al.,* 2004) and land and freshwater molluscs of Maharashtra state have also been published by Patil and Talmale (2005), Magare (2007,2012) and Magare and Valvi (2013). Diversity of freshwater molluscs of Satpuda Mountains of Gujarat is carried by Magare and Valvi. Kulkarni (1973) published an account of land and freshwater molluscs of Marathwada region.

Study area:

Susari dam is the minor irrigation project which is built up in 2006. It is situated on the Susari River, 7 km away from Shahada town. The geographical location of the dam has $21^0 35$ North latitude and $74^0 29'$ East longitude. It is earthen dam which have catchment area of 17.67 meter. The water of the dam is used for drinking, irrigation and pisciculture

Fig. 1: Satellite image and Panoramic view of Susari dam.

Susari dam again *Lymnaea accuminate* appeared most dominant (22.2%) species, while *B. bengalensis*, *Parreysia corugata* and *Gibba orcula* was least abundant (0.0%). (Table-2) The Pearson correlation (Table-3) of different factors with density and species richness of aquatic molluscs revealed significant positive correlation at the level of 0.01 at all the three dam with AT, WT, NO_3^-, PO_4^{-3}, SO_4^{-2} and TSS. While negatively significant with DO, pH and Transparency at the same level. However, in Ranipur dam Molluscan density were positively correlated at AT, CO_2, NO_3^-, PO_4^{-3}, SO_4^{-2} , TDS, TS and WT at 0.01 level, and negatively with WC at 0.01 level and same ratio for species richness. In Londhare dam Molluscan density were positively correlated at AT, TS, TSS, and WT, at 0.01 level, and negatively with DO, pH and Transparency at 0.01 level. In Susari dam Molluscan density were positively correlated at AT, NO_3^-, PO_4^{-3}, SO_4^{-2}, TS, TSS at 0.01 level and WT and Cl^- at 0.05 level. While negatively significant Trans at 0.01 levels and DO, pH at 0.05 levels. And species richness and species density at three water bodies are positively significant correlated at 0.01 level.

Materials and methods:

The molluscs of Susari dam were studied during June 2012 to May 2014. Benthic molluscs were collected monthly from three selected sites of the dam. It is a shallow area with muddy bottom densely covered with macrophytes. For collection of molluscs a unit corer with 10cm height and 8cm radius was inserted 5 to 6 spots at each field station. The soil collected was sieved and the molluscs were collected in a separate sample bottle as described by Micheal (1984). An average of this was considered as a unit for the site per visit. Some sites of the dam, where more macrophytes were present net was directly dipped in the water and swept to collect molluscs with vegetation. The collected molluscs were preserved in 4% formalin and carried to the laboratory for quantitative and qualitative estimation. The collected molluscs were identified as per the key provided by Subba Rao (1989).

To find out correlation of molluscs density with their habitat and physico chemical parameters of water samples were analyzed by using standard methods as per APHA (1998) and Michael (1984). The data for four months were pooled into three seasons, monsoon, winter and summer. The densities of molluscs were calculated on the basis of the volume of the cover used for the collection of soil samples using following formula:

$$\textit{Density} = \text{Number of molluscs} / \text{Volume of the cover}$$

Further, the mean and standard error of mean (SEM) were used for performing one way ANOVA (Fowler J. and Cohen L. 1987) with no post- test for analyzing seasonal variations in density of molluscs across three seasons using graph pad prism version 3.00 for windows (Graph pad Software San Diego California USA). The P value for ANOVA is non-significant if P> 0.05(ns) significant if P< 0.05(*), significantly significant (**) if P< 0.001 and highly significant (***) if P< 0.0001. To find out the relation between the Molluscan density and various abiotic and biotic parameters. Pearson correlation test of statistics was carried out using SPSS 7.5 software for windows. Where ** correlation is significant at the 0.01 level (two tailed) and * correlation is significant at the 0.05 level (two tailed).

Result and discussion:

Molluscan are considered are the most diverse and dominant benthic fauna both from lentic and lotic region which are mainly represented by the two major classes namely Gastropods and Pelecypods. In Susari Dam only nine species and seven genera of aquatic molluscs were recorded. Out of these eight species belongs to class gastropods and one to bivalvia. The gastropod species found were *Lymnaea accuminata, Lymanea luteola, Bellamya bengalenesis (F.) bengalenesis, Bellamya bengalenesis (F.) annandalai, Thiara tuberculata, Indoplanorbis exustus,* and *Tarebia granifera.* The bivalvia species found were *Lamellidens marginalis.*

Density and species richness :-(Table- 1, Fig 2, and 3)

The trend in seasonal variations at Susari dam was not different than Ranipur and Londhare dam with significant seasonal variations for density (P < 0.0001 $F_{2\ 21}$ 31.5) and species richness (P < 0.0001 $F_{2\,21}$ 25.65). Maximum density was recorded in monsoon (1064 ± 35.85 /m^3) and minimum in winter (471.9 ±56.88 /m^3) with maximum species richness again in monsoon (4.87 ± 0.29) and minimum in winter (2.0 ± 0.26) when density and species richness of three water reservoir were compared, overall maximum density and species richness were recorded at Ranipur dam and minimum at Susari dam, while moderate at Londhare dam over three seasons.

Relative abundance of Aquatic molluscs (Table 2):-

The relative abundance of molluscs showed variation in Susari Dam. Susari dam again *Lymnaea accuminate* appeared most dominant (22.2%) species, while *B. bengalensis*, *Parreysia corugata* and *Gibba orcula* was least abundant (0.0%).

The Pearson correlation (Table-3) of different factors with density and species richness of aquatic molluscs revealed significant positive correlation at the level of 0.01 at Susari dam with AT, WT, NO_3^-, PO_4^{-3}, SO_4^{-2} and TSS. While negatively significant with DO, pH and Transparency at the same level. In Susari dam Molluscan density were positively correlated at AT, NO_3^-, PO_4^{-3}, SO_4^{-2}, TS, TSS at 0.01 level and WT and Cl$^-$ at 0.05 level. While negatively significant Trans at 0.01 levels and DO, pH at 0.05 levels. And species richness and species density of Susari water bodies are positively significant correlated at 0.01 level.

Present study was carried out at higher altitude at Susari dam, area in Satpuda mountain range; low species richness of molluscs was observed. Different species of molluscs occur in Lacustrine and Riverine habitats (Subba Rao 1989). Recently Magare (2007) also studies the biodiversity of fresh water molluscs from Satpuda Mountain and Tapi River with reference to vector snails and reported 15 species of molluscs from which 12 species are from Gastropoda and 3 species from pelecypoda. In the Susari water reservoirs, 09 Species of Mollusca recorded. The highest density of Susari dam water reservoirs were observed during the monsoon.

Thus indicates that the high water level, moderate photoperiod and temperature favor the growth of the macrophytes which provide food and shelter, the two basic needs of life and thus probably enhance the breeding performance of molluscs. Monsoon is one of the determinant factor in regulating density and distribution of plant (the macrophytes) as it influences the physical and chemical characteristics of the dam. Freshwater Molluscan species found on every continent and in all aquatic habitats. (Strong *et al.,* 2008) morphological assessment of molluscs became fundamental part of biological research and found suitable technique in the identification of species (Adams, *et al.,* 2004). Freshwater molluscs play a massive role in nature and help in assessment of ecological status of the water bodies.

In the present study of molluscs significant seasonal variation were recorded in density and species richness at Susari dam are dependent on the surrounding area. The seasonality of molluscs may be correlated with temporal variation of biotic and abiotic parameters. Maximum density and species richness of aquatic molluscs were recorded in monsoon. When weather is moderate. When various Physico-chemical parameters are considered with respect to overall Molluscan density and species richness. In present study also the significant positive correlation is established (Table-3) between temperature and density as well as species richness for molluscs at the Susari dam. Further increase in temperature in observed range may favors the growth of molluscs (Ekhande et al.,2010, Patil J.V. 2011) have also shown positive correlation between temperature and Molluscan density. Though a negative correlation between temperature and Molluscan was recorded in some

North Indian lake and ponds (Vasisht, and Bhandal 1979). One of the parameters influenced by rainfall is water cover which was also significantly positively correlated with their density and species richness of the molluscs.

Table: - 1 Seasonal variations in density (no/m³) and species richness (No. of. Species) of Aquatic molluscs at Susari Dam (SD).

Parameters	F value	Monsoon	Winter	Summer
Total Density (RD)	F_{221} 31.5	1064	471.9	664.4
Species Richness(RD)	F_{221} 25.65	4.875	2.0	3.125

Table: 2 Molluscs Species and their relative abundance (%) recorded in the wetlands Susari Dam during Study period June 2012 to May 2014.

Sr. No	Molluscs		Percentage (%)
	Species	**Occurance**	**Susari**
1	*Lymnaea accuminata*	VC	22.2
2	*Lymnaea luteola*	C	17.6
3	*Bellamya bengalensis (F.) bengalensis*	VC	13.5
4	*Bellamya bengalensis (F.) annandalai*	C	0
5	*Thiara tuberculata*	VC	10.9
6	*Indoplanorbis exustus*	VC	9.5
7	*Lamellidens marginalis*	VC	15.9
8	*Gyraulus labiatus*	R	0.9
9	*Parreysia corugata*	R	0
10	*Gabbia orcula*	R	0
11	*Tarebia granifera*	VC	9.5

VC= Very Common, C= Common, R= Rare.

Table: - 3 Pearson correlations: Aquatic molluscs density and species richness with Abiotic and Biotic parameters in Susari Dam (SD) during June 2012 to May 2014.

Pearson Correlation–Physicochemical Parameters and Molluscs of Susri Dam

	MOLDEN	MOLSPR
AT	.546**	.562**
CA	–.367	–.304
CL	.442*	.507*
CO2	.371	.444*
DO	–.385	–.472*
MG	–.376	–.374
MOLDEN	1.000	.921**
MOLSPR	.921**	1.000
NO3	.834**	.864**
PH	–.443*	–.411*
PO4	.932**	.898**
SO4	.961**	.909**
TDS	.298	.380
TH	–.298	–.240
TRAN	–.871**	–.880**
TS	.770**	.811**
TSS	.910**	.889**
WC	.190	.069
WT	.510*	.577**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Fig: 2 Seasonal variations in Density and Species richness of Molluscs at Susari Dam (SD), during the study period June 2012 to May 2014.
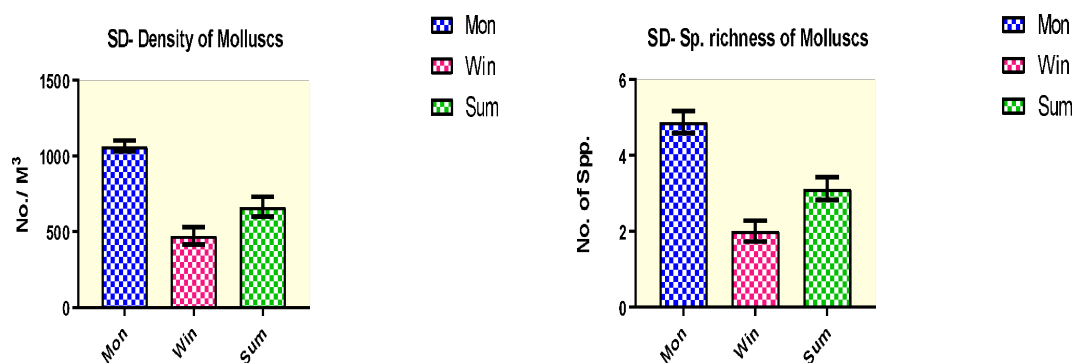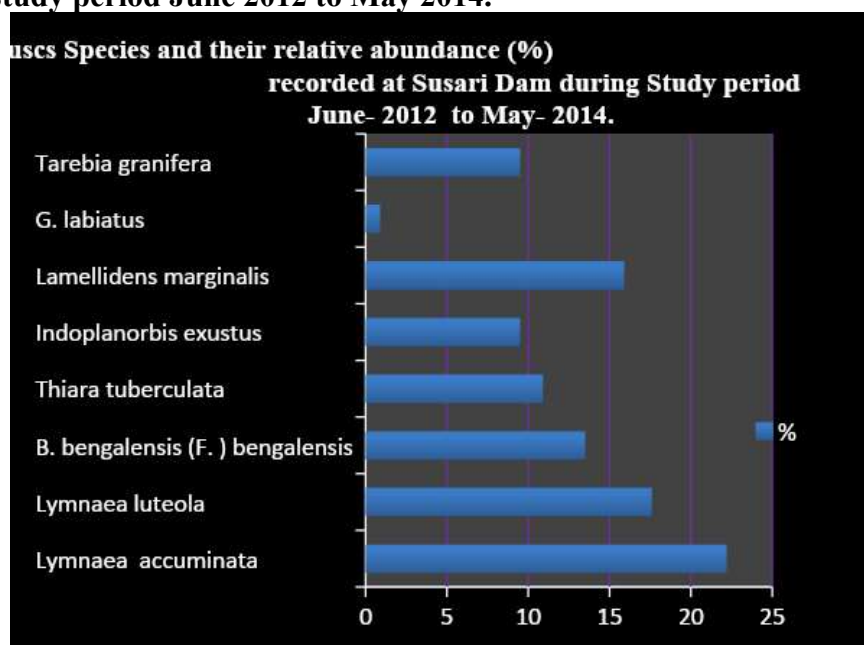

Fig: 3 Molluscs species and their relative abundance (%) recorded at Susari Dam (SD), during the study period June 2012 to May 2014.

Conclusion:

In conclusion it may be said that the Susari dam altogether 09 species of molluscs belonging to 07 genera were recorded. Susari dam are the rain deficient regions of North Maharashtra supports good density and diversity of molluscs.

References:

Abbott, R.T 1989: Compendium of Land shells. American Malcologists, *Burlington, Inc. Melbourne.*

Adams, D, Rohlf, and F. and Slice, D. 2004: Geometric morphometric: Ten years of Progress following the 'revolution'. *The Italian Journal of Zoology*. 71: 5-16.

APHA.1998: American Public Health Association: Standard methods for the examination of water and waste water 20th edition. American water works association water environment federation, Washington D.C.

Arvind, N.A., Rajashekar, K.P. and Madhayastha, N.A. 2005: Species diversity, endemism and distribution of land snails of the Western Ghats, India, *Records of the western Australian Museum, Supplement, 68:31-38.*

Begum and Narayana.J 2006: Animal diversity of four lentic Water bodies in and around Davangare city, Karnataka. *J. Aqua. Bio.* 21(2): 13-18.

Dillon, J.R. and Robert, T. 2004: The Ecology of fresh water Molluscs. *Cambridge University Press, UK.*

Ekhande, A.P., Patil, J.V. and Padate, G.S. 2010: Seasonal variation in molluscs densities, species richness in Yashwant Lake of Toranmal, Maharashtra. *Ecology and fisheries* 3 (2):67-80.

Emberton, K.C.1996: Conservation Priorities for forest- Floor invertebrates of the Southeastern half of Madagascar: Evidence from two land Snails. *Biodiversity and conservation,* 5:729-741.

Fowler, J. and Cohen, L. 1987: Statistics for ornithologists. Second edition, BTO Guide No. 22.

Kulkarni, A.B. (1973): Studies on the freshwater and land Pulmonates of Marathwada region ii Stylommatophora. *Mar.Univ.Jour. S.G. Vol* xii.

Magare S.R. 2012: Biodiversity of Mollusca Biodiversity and Environmental impacts. *NCBEI.IT* (6): 18-22.

Magare, S.R. 2007: Biodiversity of freshwater molluscs from Satpuda mountain and Tapi River with reference to vector snails- *Flora and Fauna*- 13(1): 16-164.

Mavinkurve, R.G; Shanbhag, S.P; and Madhyastha, N.A. 2004: Checklist of land Snails of Karnataka. 2005. *Print-J.* 19: 1684-1686.

Michael, P. 1984: Ecological methods for Field and Laboratory Investigation. *Tata Mc Graw-Hill Publishing Company Limited, New Delhi.*

Patil, S.G. and Talmale, S.S.2005: A Checklist of land and freshwater Mollusca of Maharashtra state, 2005*, Print J.20* (6): 1912-1913.

Punithavelu, V. R. and Raghunathan, M. B. 2005: Taxonomy and diversity of freshwater gastropods. (Mollusca) From southern India. *Pro.Nat. Conf.on Wetland Biodiversity.* 26-27

Ramkrishna, R.T. and Mitra, S.C. 2002: Endemic land molluscs of India. *Occasional Paper,* 196:1-65.

Strong, E.E; Gargominy, O, ponder W.F. and Bounchet. P. 2008: Global diversity of gastropods. (Gastropoda: Mollusca) in freshwater. *Hydrobiologia,* 595: 149-166.

Subba Rao, N.V. 1989: Handbook: Freshwater molluscs of India. *Zoological Survey of India, Calcutta.*

Subba Rao, N.V. and Dey 1989: Freshwater molluscs in Aquaculture: 225-232. *In: Handbook of freshwater molluscs of India. Zoological survey of India, Calcutta. 289.*

Subbha, B.R. 2003: Molluscan Checklist of Ghodaghodi Tal. Area, Kallali District, *our Nature,* 1: 1-2.

Supian, Z., Ikhwanuddin, A. M. 2002: Population dynamics of freshwater Mollusca. (Gastropod; Melanoides tubercuaata) in Crocker Range park, Subha. *ASEAN Rev. Bioiv. Environ. Conserve. (ARBEC):* 1-9.

Tonapi, G. T. 1980: Fresh water animals of India (An Ecological Approach). *Oxford and IBH publishing CO. New Delhi,* 341

Vanmali, H.S. and Jadhav, R.N. 2015: Assessment of Mollusca diversity of Dativare Coast of Vaitama estuary dist. Palghar, Maharashtra (India). Research Invent: *International Journal of Engineering and Science*-5: 1-6.

Vasisht, H.S. and Bhandal, R.S. 1979: Seasonal variations of benthic fauna of some North Indian lakes and ponds. *Indian Journal of Ecology*, 6: 77- 83.

Wosu, L.O. (2003): Commercial Snail Farming in West Africa-guide. *AP.Express Publishers, Hsukka-Nigeria.*