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Study of seasonal variations and diversity indices of freshwater and terrestrial gastropods of Jalgaon district (M.S.) India

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ABSTRACT

Preliminary studies were performed to understand the seasonal variations of snails (Gastropods), as they play a significant role in the ecosystem by renewing and recycling organic matter. Molluscan animals are bio-indicators useful in bio-monitoring studies. During the present study samples of aquatic invertebrates were collected by the simple net method and terrestrial invertebrates by the simple handpicking method. Changes in the diversity indices of Gastropods were studied for three seasons- Monsoon, Winter and Summer; from June 2021 to May 2022. Diversity indices Shanno Weiner Index (H), Simpson's Index (1-D), Simpson's Dominance Index (D), Evenness Index (E), Simpson's Reciprocal Index (1/D), Gini-Simpson Equitability, Species Richness (R) and Berger Parker Index were calculated for seasonal variations of Gastropods. During the present study total of 11 species were recorded. Those belonged to 8 different families, four were terrestrial and four were aquatic.

Figures : 02 References : 12 Tables : 02
KEY WORDS : Diversity indices, Freshwater Gastropods, Molluscan diversity, Seasonal variation, Terrestrial Gastropods.

Introduction

Biodiversity acts as a backbone for the survival of various life forms present on the earth. The existence of a variety of plants, animals, and microorganisms makes an ecosystem. A wide range of gastropod species diversity is found all over the world except Antarctica. Phylum Mollusca is the second largest phylum on the earth. Molluscan animals have a very hard shell which is made up of calcium carbonate. The mantle cavity has gills which helps in gaseous exchange. In prosobranchs generally, the shells are spirally coiled, either right or left-handed spiral. Inside the shell, visceral mass gets protected. The head and muscular foot extend out through the shell.

Every changing climatic condition may affect the distribution of various species in a particular area. Diversity indices are the mathematical measures to know species diversity in a particular community. Diversity indices give information about the composition of the community and species richness. Relative abundances of various species have to be taken into consideration. Various measures/indices of biodiversity are developed and compared with each other [5]. This variation in the distribution of animals in a certain region can be studied with the help of diversity indices. Wetlands have rich biodiversity and high productivity so they act as biodiversity conservation hotspots. This has been taken into consideration as a preventive measure [6]. The present study of gastropod diversity from three stations in Jalgaon District is intended to generate data on the distribution and density of various gastropods.

Material and Method

The present study was carried out from June 2021 to May 2022 in three different sites. The study area comes under the Jalgaon district, Maharashtra, which is the northeast Khandesh region located at Tapti River (21°05' 60.00") N latitude and (72°40' 59.99") E longitude. Hatnur Dam and Waghur Dam are situated near Bhusawal, District Jalgaon, located at (21.0738°N) latitude and (75.9457°E) longitude. Dam water is used

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TABLE -1: Checklist of Molluscs recorded from sites 1, 2 and 3

Class- Gastropoda	Superfamily	Family	S. No.	Scientific name
Order- Mesogastropoda	Cerithioidea	Thiaridae	1	*Melanoides tuberculata*
			2	*Mieniplotia scabra*
	Viviparoidea	Viviparidae	3	*Idopoma dissimilis*
			4	*Filopalludina bengalensis*
Order- Bassomatophora	Lymnaeoidea	Physidae	5	*Physa acuta*
		Lymnaeidae	6	*Radix auricularia*
Order- Stylomattophora	Pupilloidea	Partulidae	7	*Partula sp.*
	Achatinoidea	Achatinidae	8	*Glessula sp.*
	Helicoidea	Camaenidae	9	*Chloritis species*
	Helicarionoidea	Ariophantidae	10	*Macrochlamys indica*
		Ariophantidae	11	*Ariophanta interrupta*

for domestic, fishery, hydroelectric power generation, and agricultural use. Waghur dam is located on the Waghur River near the Varadsim and Kandari village, Bhusawal, and located at (20.9180° N) latitude and (75.7067° E) longitude. The average annual rainfall ranges between 77 cm to 80 cm. The average temperature of the year was 10 to 12°C minimum and 41 to 46°C maximum (Fig. 1). The Molluscan species were collected by the simple hand-picking method. While handpicking gloves were worn as a precautionary measure to avoid any possible parasitic infection. Help from local fishermen was also sought for the collection of samples. Collected samples were then put into boiling water, and live animals after boiling treatment were extracted from the shell with the help of bent-tipped forceps. Cleaned shells were sundried and placed inside the bottle and labelled with the site number and date of collection. Animals were identified with the help of freshwater Molluscs of India[12]

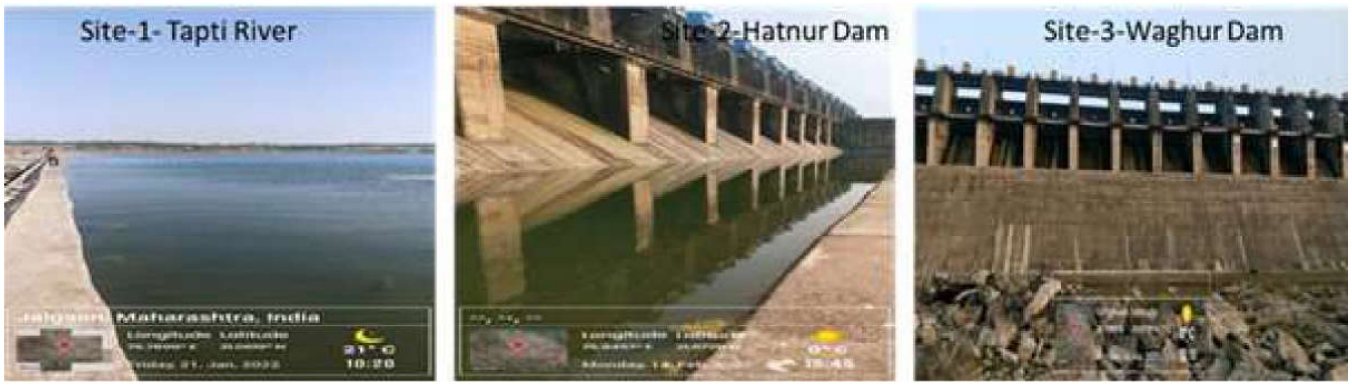

Fig. 1 : Sampling stations

TABLE-2: Variation of Indices in Molluscs, during various seasons from sites -1, 2 and 3.

	Index	(S)	(N)	(H)	(D)	(1-D)	(1/D)	(Nmax/N)	S-1/ln N	E_H
Tapi	Summer	09	975	2.194	0.8892	0.1108	9.022	0.1231	1.162	0.998
River-	Monsoon	11	652	2.352	0.9017	0.0983	10.17	0.1457	1.543	0.980
Site-1	Winter	11	1265	2.379	0.9064	0.0935	10.69	0.1679	1.116	0.981
Hatnur	Summer	08	523	2.065	0.8729	0.1271	9.022	0.1231	1.118	0.992
Dam	Monsoon	10	580	2.25	0.891	0.109	9.17	0.1552	1.414	0.977
Site-2	Winter	10	945	2.292	0.8989	0.1011	9.894	0.127	1.314	0.995
Waghur	Summer	07	430	1.901	0.8454	0.1546	6.468	0.2326	0.989	0.976
dam	Monsoon	08	530	2.049	0.8692	0.1308	7.642	0.1679	1.116	0.985
Site-3	Winter	08	812	2.057	0.8702	0.1298	7.704	0.1847	1.045	0.989

and the Book of Indian Freshwater Molluscs[9]. Some experts also helped the identification of Molluscs.

Qualitative and quantitative estimation of molluscan fauna were carried out using the quadrate method [1]. At least four quadrate 1x1m were sampled from each site and the averages of these were considered as density and species richness per m^2 for that area.

Indices were studies- Shannon-Weiner Index: H= -" Pi (Ln Pi), Simpson's Dominance Index: D = " n (n-1) / N(N1), Simpson's Index of Diversity: D1 = 1-D, Simpson's Reciprocal Index: D2 = 1/D, Simpson's Evenness: E = D2 / S, Equitability Index: E_H = (H / Hmax; Hmax= InS) Margalef's Richness Index: D = (S -1)/ln N and Berger Parker Dominance index: d = Nmax / N. Where, Nmax is the number of individuals in the most abundant species, S = Number of species, N = Total number of individuals of all species, Pi = A/T where A is number of each species in the sample, T = Total number of individuals of all species in the sample and n = Total number of individuals of particular species and In = Natural Logarithm

Results and Discussion

A total of 6,711 different samples of molluscan animals were collected from 3 different sampling stations- Sampling site- 1 (Tapi River), site- 2 (Hatnur Dam) and site- 3 (Waghur Dam). A total of 11 different species of Gastropods were found during this study. These Gastropods were of two different types- Freshwater Gastropods and Terrestrial Gastropods. Eleven species belonged to 8 different families and 3 different orders. Two orders belonged to freshwater gastropods- Mesogastropoda (4 different species- *Melanoides tuberculata*, *Idopoma dissimilis*, *Mieniplotia scabra* and *Filopalludina bengalensis*) and Bassomatophora (2 different species- *Physa acuta and Radix Auricularia*) and a single order of terrestrial gastropods- Stylommattophora (5 different species- *Chloritis sp., Macrochlamys indica, Partula sp., Glessula sp*. and *Ariophanta interrupta*) were recorded. Similar observations were made earlier[1].

During the present investigation, seasonal variations were studied (Table- 1). During the summer season, at the sampling site 1 total of Nine species were found. while during the monsoon and winter seasons, a total of 11 species were found. At sample site-2 total of 8 species were found during the summer season while 10 species were recorded during the monsoon and winter seasons. At sampling, a total of 7 species were found during the summer season while 8 species were recorded during the monsoon and winter seasons respectively. Similar observations were made by earlier workers[1, 4].

During monsoon season, order Stylamattophora

Fig. 2 : Diversity of Molluscan Species at Tapti River, Hatnur Dam and Waghur Dam

was dominant (75.5%) followed by *Macrochamys chloritis* sp. dominant (17.2%) and Order Mesogastropoda (19.5%) and Bassomatophora (5.0%). During the winter season order Mesogastropoda was dominant (48.3%) over the order Stylomattophora (38.9%) and Bassomastophora (12.8%). In the summer season, only two orders were noticed- Mesogastrophora (66.9%) and Bassomatophora (33.1%) and were followed by *Filopalludina bengalensis,* which were dominant throughout the summer season. The highest density of gastropods was recorded during the winter season at all the study sites (Table- 2). Similar results were recorded earlier [2,10].

The species richness and molluscan diversity indices were calculated by different diversity indices which showed variations among the Mollusca at various sites (Table-2).

During the present study, minor fluctuations were observed for all three study sites. Various indices for all three sites were: Simpson's Dominance Index (D) was, Site-1 at 0.8892 to 0.9064 and site-2 and site-3 are showing the ranges 0.8454 to 0.8989. Values of Simpson's Index of diversity (1-D) from site- varied from 0.1108 in the summer season, 0.0983 in the monsoon season, and 0.0935 in the winter season. Site 2 was 0.1271 in the summer season, 0.109 in the monsoon season, and in the winter season 0.1298 respectively. Site 3 was 0.1546, 0.1308, and 0.1298 in the summer, monsoon, and winter seasons respectively. Simpson's reciprocal index (I/D) was highest in the winter season at 10.69, 9.894, and 7.704 from all three sites-1, 2, and 3 respectively, while was least at 9.022, 9.022, and 6.468 in the summer season from all three sites- 1, 2, and 3 respectively. Shannon-Weiner Index (H) varied from a minimum of 1.901 in the summer season from site 3 and a maximum of 2.379 in the winter season from site 1. Berger and Parker's Dominance Index (Nmax/ N) ranged between a minimum of 0.1231in the summer season and a maximum of 0.1679 in the winter season from site 1. Site 2 showed a minimum of 0.1231 and a maximum of 0.1552 in the summer and monsoon seasons respectively. At site-3 ranged between minimum to maximum 0.1679 to 0.2326 in the monsoon and winter seasons. Margalef's Richness Index (S-1/In N) ranged between 0.989 minimum to 1.543 maximum from all three sites. The equitability index ranged between a minimum of 0.977 to 0.998 maximum from all three sites. The present investigation resembles some earlier workers studied from different areas.

Conclusion

Total 11 freshwater and land Molluscan species representing 3 orders, 8 families were from the three different sites. The present investigation is based on the species richness, diversity distribution, and status of the Molluscan population of these three regions. Mollusca diversity depended upon the seasonal abundance of all the species also considerable differences were observed within the study localities.

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