

Research Article

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Effect of climatic conditions on the variety of terrestrial snails (Gastropoda: Mollusca) in Maharashtra's Karanjali region

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Keywords

Terrestrial snails,
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Abstract

Snails were shelled animals which belong to the mollusc family. Snails are most diverse group of mollusks, including over 50,000 species distributed over freshwater, saltwater, and terrestrial environments. Molluscs are indeed the second most prevalent and successful invertebrate group after just insects (Abbot, 1989, Bouchet, 1991)[1, 2]. For over 500 million years, it has been here. Today's estimates vary from 80,000 to 135,000 species of mollusks (Boss, 1973)[13]. Marine species contribute for 31,000–100,000, terrestrial species for 14,000–35,000, and freshwater species for around 5,000. (Abbott, 1989; Seddon 2000) [1 &3].

Introduction

Mollusks are both ecological and bio-indicators, and they play a crucial role in the maintenance of aquatic ecosystems by recycling nutrients and surviving as food for certain aquatic animals. Some freshwater mollusks are edible and serve an important part in the aquatic ecosystem. They also provide food for other animals, including as fish, birds, and mammals, as well as humans. It is vital to investigate the current state of various biota at an era of global biodiversity reduction. For the best result, we start from August to October 2019, examining the biodiversity in our three study areas of Maharashtra. The presence of several species was common in Low temp and soil rich

with organic material were chosen by the species. They were found from the superficial area of the soil at a depth of 3-5 cm during the Monsoon. They are also seen in moist, humus-rich soils in larger numbers. Invertebrate species occur in our study area, and terrestrial snail diversity is widespread. Snails have such a delicate body and a hard shell. This shell is primarily composed of calcium and other minerals that have cemented into a well-formed shell after the snail has consumed them. A strong ligament and other soft tissues attach the soft-bodied animal to a shell permanently. Snails use their shells to protect themselves from threats and the elements. Although several species of aquatic habitats evolved from land habitats to freshwater, the

majority of fresh-water snail species originated in saltwater environments. Snails are typically dominant in freshwater ecosystems, supplying food for a variety of other creatures and grazing on large volumes of vegetation and trash (debris). They're essential for river ecosystems to operate properly. Their strange common names, such as banded mystery snail, apple snail, pagoda slits snail, knob mud snail, rough horn snail, interrupted rock snail, and many more, conceal their importance as a food source for other aquatic species and water quality indicators. Despite their diversity, terrestrial mollusks were previously overlooked. The majority of land snails are found in leaf litter and soil in tropical rain forests (Emberton, 1996) [4], and their biomass is of enormous ecological importance.

Material and Methods

Maharashtra is globally known for its diverse flora and fauna, it has a typical monsoon climate with hot, rainy, and cold weather seasons. Tropical conditions prevail all over the state, and even the hill stations are not that cold. Dew, frost, hail can also happen. The climate of Savalghat is changed according to the weather such as in

summer the temperature rises between 35°C to 42°C, in the winter season its drops up to 5°C to 8°C. The forest with tropical includes teak and Acacia and others. The changes in weather and topographic situations affect diverse biota. (Giri et al., 2022) [5]. The present study was conducted in three different area i.e. Savatri River(S1) which is located between 20.254128° N, 73.583565° E, Gawanpada dam(S2) 20.264663 ° N, 73.577632 ° E, and Savalghat forest(S3) 20.256563 ° N, 73.609633° E. Because of their fragile body, snails appear to be highly temperature sensitive. Snails go into a state of dormancy, or aestivation, during the hot summer months. This is merely a coping mechanism for adverse environmental conditions, primarily dry weather and a drop in temperature (Cunha et al., 2009) [14]. Because of the wet ground, many species are most active right after rain. They hide in damp locations, such as under the barks of trees, fallen logs, rocks, and artificial structures, to help preserve body moisture in drier environments (White et al., 2011) [15]. Snails have largely omnivore or herbivorous diets, and some species are regarded severe agricultural pests, such as for crops, when they are abundant (Nixon, 2012)[16].

Table 1. Data illustration for number of species in year 2019

Sr.No.	Species	Family	Site		
			Savatri River(S1)	Gawanpada dam (S2)	Savalghat forest(S3)
1	<i>Achatina fulica</i>	Achatinidae (Bowdich, 1822)	7	14	21
2	<i>Achatina immaculate</i>	Achatinidae (Lamarck, 1822)	4	6	18
3	<i>Achatina iredalei</i>	Achatinidae Preston, 1910	12	6	14
4	<i>Achatina nykaensis</i>	(Bourguignat, 1889)	8	12	17
5	<i>Achatina reticulate</i>	(L. Pfeiffer, 1845)	6	5	12
6	<i>Achatina varicose</i>	(L. Pfeiffer, 1861)	4	2	14
7	<i>Achatina zanzibarica</i>	(Bourguignat 1879)	5	8	24
8	<i>Achatina marginata</i>	(Swainson, 1821)	6	5	13
9	<i>Achatina ventricosa</i>	(A. Gould, 1850)	6	9	15
Total			58	67	148

Table 2. Data illustration for Number of species in the year 2019 by using A.Shannon index-, Taxa_S, Dominance_D, Simpson_1-D, Shannon_H, Evenness_e H/S, Brillouin. Menhinick, Margalef, Equitability_J, Fisher_alpha, Berger-Parker and Chao-1 respectively.

	S1	S2	S3
Taxa_S	9	9	9
Individuals	58	67	148
Dominance_D	0.1254	0.1361	0.1169
Simpson_1-D	0.8746	0.8639	0.8831
Shannon_H	2.139	2.083	2.172
Evenness_e^H/S	0.9431	0.892	0.9754
Brillouin	1.904	1.876	2.055
Menhinick	1.182	1.1	0.7398
Margalef	1.97	1.903	1.601
Equitability_J	0.9733	0.948	0.9887
Fisher_alpha	2.982	2.798	2.11
Berger-Parker	0.2069	0.209	0.1622
Chao-1	9	9	9

Species identification:-

We identified snail species by looking at photographs and using (Timothy) (Kerney, 1979)[6]'s land snail identification guide.

Statistical Analysis:-

For statistical data analysis, we use PAST 4.03 software.

Diversity Index

A.Shannon index:-

H the variety of species was calculated by using the Shannon index which combines the no. of species within a location virtual plenty of individually species [7, 8, 9, 10]. The statistics were studied to understand & variety in the Shannon Index, which combines the number of species within a site with the comparative plenty of individually species.

$$H = -\sum_{i=1}^R p_i \ln p_i$$

Here pi is the proportion of the ith species in the community and their evenness in abundance (or

equitability) are the two parameters that define H .

B. Pielou’s Evenness index:-

(Equitability) or J . The species evenness is the comparative profusion or proportion of individuals among the species. Evenness of species reveals how their relative abundance is distributed in a particular sample or site [11, 12].

$$J = H / \ln S$$

Here, S is the number of species present in the site. The value of J ranges from 0 to 1.

C. Sørensen’s similarity Index:

$$= 2c / (S1 + S2)$$

Where, S1 = the total no. of species noted in the 1stcivic, S2 = the total no. of species noted in the 2nd civic, and c = the no. of species common to both communities. Sørensen’s index21 is a simple measure of bet diversity, ranging from a value of 0 if no species overlap between the communities to a value of 1 when the same species are initiate in both communities.

The observation and identification were done by used the literature [7, 8, and 9].

D. Bray Curtis similarity Index.

Measurable data was rummage-sale to calculate percent resemblance, using Bray Curtis resemblance index [8]. Dendrograms were set to comprehend site-wise trends.

Table:-3.Data illustration Bray Curtis similarity and distance indices.

	A. fulica	A. Immaculate	A. iredalei	A. nykaensis	A. reticulate	A. varicose	A. zanzibarica	A. marginata	A. ventricosa
A. fulica	1	0.8	0.7297 2973	0.9113 9241	0.7076 9231	0.6451 6129	0.860 75949	0.7272 7273	0.833 33333
A. immaculate	0.8	1	0.8	0.8307 6923	0.8235 2941	0.8333 3333	0.8615 3846	0.8461 5385	0.862 06897
A. iredalei	0.7297 2973	0.8	1	0.811 5942	0.8363 6364	0.7692 3077	0.7246 3768	0.8571 4286	0.8387 0968
A. nykaensis	0.9113 9241	0.8307 6923	0.811 5942	1	0.7666 6667	0.7017 5439	0.8108 1081	0.7868 8525	0.8955 2239
A. reticulate	0.7076 9231	0.8235 2941	0.8363 6364	0.7666 6667	1	0.837 2093	0.7333 3333	0.978 7234	0.8679 2453
A. varicose	0.6451 6129	0.8333 3333	0.76923 077	0.7017 5439	0.837 2093	1	0.701 75439	0.8636 3636	0.8
A. zanzibarica	0.8607 5949	0.8615 3846	0.7246 3768	0.8108 1081	0.7333 3333	0.7017 5439	1	0.7540 9836	0.835 8209
A. marginata	0.7272 7273	0.8461 5385	0.85714 286	0.7868 8525	0.978 7234	0.8636 3636	0.7540 9836	1	0.8888 8889
A. ventricosa	0.8333 3333	0.8620 6897	0.8387 0968	0.8955 2239	0.8679 2453	0.8	0.835 8209	0.8888 8889	1

E. Index of Berger-Parker:

Berger-Parker index is the most significant method. The grouping of several species in a given area tells the most dominant species proportion.

= $[n_{max}/N]$ is the procedure for determining the index. Where n_{max} indicates the frequency of the dominant species, and N shows the total number of species.

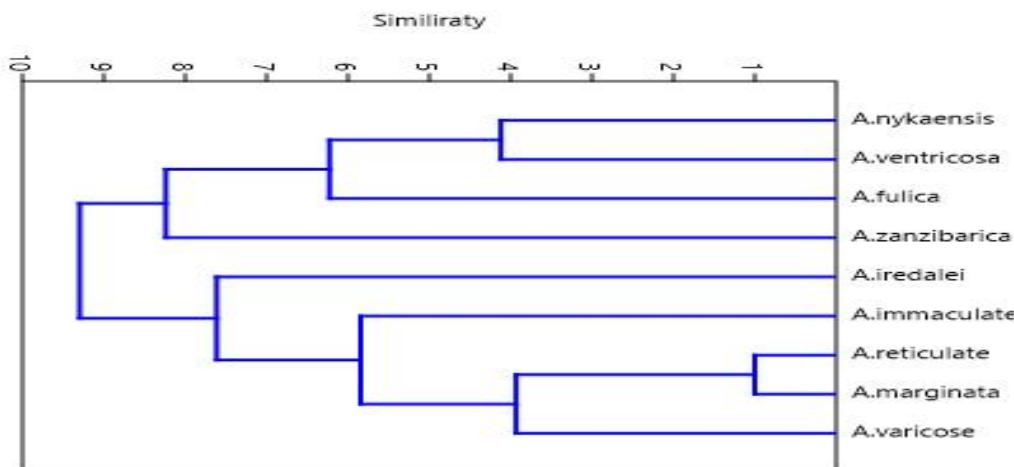


Figure 1:- Bray Curtis similarity index of the Molluscan species.

Results and Discussion

We recorded total of 09 species of snails in our study area. Most of the snails prefer low temperature i.e. 25° C to 30° C and soil rich in organic carbon. In rainy season they occurred from soil surface to a depth of around 4-6 cm. They were observed to be more in moist and humus rich soil. They were fed on leaves, vegetables, plant litter, soft grasses and fruits. Specimens were also predated by the frogs and toads, reptiles and birds. In study area, the overpopulation, highly grazing, highly, exploitation of expected resources and deforestation causes obliteration of numerous normal locales, chiefly of invertebrates. Finally, founded on the findings, it is determined that the variety of snails is described by short-term interactions within a habitat and species of creatures. The study area has a healthy environmental and demographic setting that supports a diverse range of species. The results of these regions' snail fauna are divided into three species. Human and environmental actions can help to treat the wildlife. As a consequence of the dynamic ecological position of the mollusk, it is vital to take measures to preserve its diversity. From the above data, it can be inferred that the density of species in site 1 Savitri River is less than of sites 2 and 3 which are relatively studied. Site 1 is more nutritious than site i.e. Gawanpada but there is human intervention that is present and disturbs the diversity of snails. But in site three Savalghat forest as shown in Tables 1 and 2 the data shows that the maximum number of species richness is more than the site 1st and 2nd. In site S3 the species diversity of snail is maxed than both S1 & S2 max vegetation, favorable climatic condition, less human interference, good shelter, maximum richness in humidity and moisture, free from more predators, max sunlight which result in more herbs for snail. According to the data, in table 2 the Shannon H result for the sites Savatri River (S1), Gawanpada dam (S2) & Savalghat forest (S3) is 2.139, 2.083, and 0.8831 respectively. The Evenness_{e^H/S} shows for Savatri River (S1), Gawanpada dam (S2) & Savalghat forest (S3) is 0.9431, 0.892 and 0.9754.

The Equitability_J shows for the sites Savatri River (S1), Gawanpada dam (S2) & Savalghat forest (S3) is 0.9733, 0.948, and 0.9887. The Fisher_{alpha} shows for Savatri River (S1), Gawanpada dam (S2) & Savalghat forest (S3) is 2.982, 2.798, and 2.11 respectively.

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