BVG Trust

J. Sci. Trans. Environ. Technov. 2017, 11(1) : 54-57

Scientific Transactions in Environment and Technovation

Sampling protocol for terrestrial molluscs in the high altitude landscape of the Indian Himalayas

https://doi.org/10.56343/STET.116.011.001.010
http://stetjournals.com

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Abstract

The terrestrial gastropod species richness in the Himalayan region of India tends to be high. But, due to vast altitudinal elevation range, it is often difficult to assess the diversity, species composition and habitat requirements in detail within a restricted time windows. Hence, a detailed sampling and monitoring protocol would help in the enumeration of the terrestrial molluscs. Sampling techniques, equipment, field data collection methodology and analysis of data along with field safety methods have been elaborated in details.

Key words : Snail, Protocol, Monitoring, Himalayas, Diversity, India.

Received : September 2015 Revised and Accepted : September 2017

INTRODUCTION

The land snails (terrestrial gastropods) are one of the successful and diverse animal groups and act as an essential component of the forest' ecosystem as well as serve as a bioenergetics to the system (Seddon, 1998; Mitra *et al.,* 2004). The terrestrial gastropods are the ubiquitous component of terrestrial ecosystem, which are influenced by various environmental factors and even some are with specific habitat preference (Nekola, 2003). They play a vital role in the ecosystem services including nutrients recycling and assists in the detoxification of forest soils through calcium sequestration (Emberton *et al.,* 1996, Barker and Mayhill 1999; Mitra *et al*., 2004). Land snails play a significant role in balancing the food chain in such ecosystem. Although, pioneer malacologists who worked in India especially on the taxonomy, and systematic, information on ecological aspects of terrestrial mollusc in India is scanty. The reason could be due to inadequate standard sampling protocol and field methodology for data collection. Hence it becomes necessary to generate the sampling protocol for monitoring and to understand the species diversity, richness and ecology of the taxa for formulating as well as developing suitable conservation and management strategy. Based on the detail information about sampling protocol, field survey technique, collection procedure and monitoring protocol of terrestrial gastropods in the Indian Himalayan region has been elaborated. Collecting methods, preservation and fixation technique, field equipment, field datasheets and details of the environmental factors required to be collected from the field are also discussed.

SAMPLING DESIGN

The field work associated with the collection and transport of samples will account for a substantial proportion of the total cost of a monitoring programme. Therefore, sampling protocol and field methodology should be designed in advance in a planned manner for carrying out the field survey. The sampling should be carried out with respect to altitudinal variation, especially along the high altitude areas of Himalaya. The sampling need to be carried out at every 300 m elevation of a particular ecotone area, since there is a change in the vegetation at every 500 m altitude in Himalaya (Mani, 1968). At least 20x20 m plots of four (4) sampling points at every 300 m need to be selected for molluscan diversity study. Similarly, vegetation sampling should be carried out on the same 20x20 m plot, where there is a canopy cover, 5x5 m meter plot for shrub cover and 1x1 m quadrate plotfor grasses and for ground soil cover. For disturbance sampling, logging, loping, cutting, fire and grazing pressure need to be identified in every plot (Fig.1)

In the Indian Himalayan context, the field samplings are also requi1red to be carried out seasonally, covering at leastthree main seasons *viz*. pre-monsoon (March to June), monsoon (August to November) and post-monsoon (late November to January). Every grid need to be sampled during dayand night in each season with one replicate sampling and with four samples for each gradient for each season.

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P - ISSN 0973 - 9157
E - ISSN 2393 - 9249

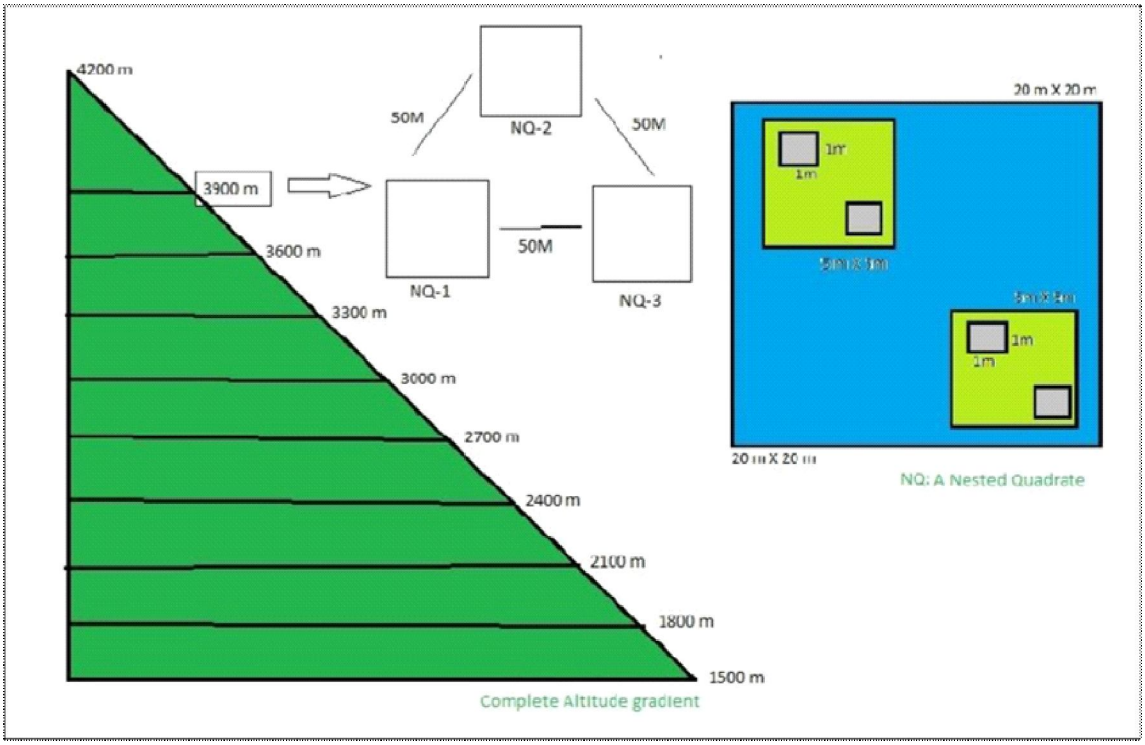

Fig 1. The complete sketch diagram of altitudinal wise nested quadrate sampling plots

SURVEY DATA COLLECTION, MONITORING AND ANALYSIS

Quadrate plot sampling

An active visual search in the 20x 20 m quadrate plot should be made at every 300 m elevation gradient. The field survey team should haveeyes for search of mollusc / snailson the rock surface, rotten bark, bushes, log, and lime stone areas within the sampling plot, since these are possible habitats for land mollusca.

Gunnysack trapping Methods

The gunnysack trapping can be aneffective method for collection of snails, including slugs, especially when large numbers of samples are required for multiple study (Krull andMapes,1974). The gunnysack should be wet and folded 2-3 times and placed on each 20x 20 m plotfor one or two days. This sort of arrangement provides air circulation, cooling and moist environment for the snails.

Leaf litter and soil sampling

Leaf litter and soil samplings are the most effective methods for the minute land molluscs. Since, snails require moisture for survival, there is possibility of more number of snails inside the soil and leaf litter. Therefore, field survey team should collect the soil and litter from 1x 1 m sampling plotfrom the field for a proper assessment of population in the area (Lee, 1993;Emberton *et al.,*1996). The advantage of this field method is that, good number of mollusca can be collected with minimum time investment in the field. Also, leaf litter and soil sampling allows quantitative sampling, either by area of the substrate sampled, or by volume of the material, and often resulted in good collection and diversity of species (Emberton *et al.,* 1996).

Environmental Data

The environmental data is equally important for the assessment of population and diversity. Hence the molluscs should be invariably collected from the field. The abiotic factors*viz*, ambient temperature, humidity, wind speed, and weather condition should also be recorded before and after the sampling. It is mandatory to record all the data carefully, so that it could be correlated with the diversity and distribution of land mollusca of the area.

Vegetation Sampling

The vegetation sampling should be carried out after the collection of molluscs from the sampling plot is over. In the vegetation sampling, field survey team should measure the tree height, girth in field on the same 20 m x 20 m plot. For shrub 5-m x 5-m plot should

be sampled and shrub height and girth volume should be measured, whereas,for grasses / weed / herb 1-m x 1-m plotshould be sampled. It is essential to collect disturbance data *viz*. human activities, livestock, grazing, cutting, logging, loping, fire and presence of tourist / other visitors in the sampling area so as to understand the impact of these factors on to the biodiversity of the area.

Collection

The collection of molluscs should be made as picking either by hand or by forceps. However, spotting of the smaller or minute forms and collection of them individually, is not always easy and possible, and therefore, suitable shady places with sufficient moisture are to be selected and fallen leaves / litters, to be searched to locate the land mollusca. For live specimen, the search should be focused on to the fallen leaves, bricks, stones, wooden logs, etc. Minute shells should be handled with fine forceps or brushes and should immediately be put inside the corked tubes. While collecting the live specimen, a collector should also pay attention to dry shells, complete with all body parts, since live species are always not possible to be located. Collection of empty shells always advantageous, because shells of all stages of growth are available, if properly eyed for. Shells of different stages of growth are essential for studying the variation of shell characters in relation to age. Post monsoon period is the most suitable time for shell collections because many snails get drowned during heavy monsoon showers and the shells left behind are in fresh conditions. Slopes with vegetation, banks of river, streams along the base of walls, and around the base of large trees are the most likely places of occurrence of snails.

Fixation and Preservation

Land snails are usually narcotised by asphyxiation. Live specimens are put inside a glass bottle or a jar completely filled with water and, lid tightly closed. A few drops of laboratory based ethanol may be added at intervals to expedite the process. It usuallytakes 15-20 hours. Any specimen dying and lying at the bottom should be removed. The specimens thus narcotised should be thoroughly washed to remove mucous and then treated with ascending grade of ethanol (20%, 40%, 60%, and 70%) and should be finally preserved at 70% ethanol.

Data Analysis

The Shannon-Weiner Index of species richness is to be used for each site during different seasons for calculation of molluscan richness in the area. Similarly, Sorenson's Index (Sorenson,1948) is useful to assess the similarity in species composition between the different habitats. Other statistical methods *viz.*Simpson and Hills, Chao1 and Jacknife2 are popular methods for field data analysis. All the analyses are required to be carried out by using standard soft-wares *viz*. PASTand SPSS. The Canonical Correlation Analysis (CCA) could be employed for correlating the environmental data with species distribution.

GENERAL CONSIDERATION

In the Indian Himalayas, although many large species of land snails exist, the vast majority of land snail species are minute, less than one centimetre in greatest dimension, some being only one millimetre in size, and hence a detailed survey should be focused with eyes for smaller organisms, and estimations should be made with reference to density and species richness of land snails.

LIST OF KEY EQUIPMENTS

The following equipments should be carried during the field visit and vegetation sampling.

a) Toposheet (atleast 1:50,000 scale)
b) GPS (Global Positioning System)
c) Datasheet (Mollusca / Vegetation) [see Model Datasheet in Appendix-I&II]
d) Environment
e) al meter
f) LUX meter
g) Clinometer
h) Densiometer
i) Soil pH meter
j) Digital moisture meter
k) Measuring tape (1, 30, 50 meter)
l) Digital Weighing Machine
m) Herbarium sheets
n) Torch
o) Collecting Tube / Jar
p) Stationary Utensils (Pen / Pencil / Eraser / Permanent Marker)
q) Soil Collection Bag
r) First Aid Box
s) Alcohol
t) Forceps
u) Fine scale brush
v) Sieves

SAFETY ISSUE AND CONSIDERATION

The team undertaking the field surveys should take proper care and responsibility for safeguarding those including volunteers who may be assisting the team as well as the field equipments. All personnel involved

in the field work must be mentally and physically fit for the field surveys. It is mandatory for all team leaders / scientists / students / volunteers to carry the first aid box and necessary medicines along with sampling kit. Proper hygiene should be followed after handling of the species during field work, for a successful field data collection of land snails.

ACKNOWLEDGEMENTS

We are thankful to the Ministry of Environment, Forest and Climate Change (MoEFF&CC), Government of India, for the financial support for the Himalayan Biodiversity Project being implemented at ZSI. We are also thankful to the G.B. Pant National Institute of Himalayan Environment and Sustainable Development, Dehradun, State Forest Departments of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, West Bengal, Sikkim and Arunachal Pradesh for field logistics. The present work is an outcome of the on-going Long Term Himalayan Biodiversity Monitoring Programme implemented and executed through ZSI.

REFERENCES

Barker, G. M. and Mayhill, P. C. 1999.Patterns of diversity and habitat relationships in terrestrial mollusc communities of the Pukeamaru Ecological District, north-eastern New Zealand. *J. Biogeogr.,* 26(2): 215-238. https://doi.org/10.1046/j.1365-2699.1999.00267.x

Emberton, K. C., Pearce, T. A. and Randalana, R. 1996. Quantitatively sampling land-snail species richness in Madagascan rainforests. *Malacologia*, 38:203-212.

Lee, H. G. 1993. Toward an improved strategy for landsnailcollecting. *AmericanConch.,* 21: 12.

Mani, M. S. 1968. Ecology and Biogeography of High Altitude Insects. W. Junk, *TheHague*, 528 pp. https://doi.org/10.1007/978-94-017-1339-9

Mitra, S. C. and Dey, A. and Ramakrishna. 2004.*Pictorial Handbook: Indian Land Snails*(selected Species): 1-344 (Published – Director, Zool.Surv. India. Kolkata)

Nikola, J. C. 2003. Large scale terrestrial gastropod community composition patterns in the Great Lakes region of North America. *Divers. Distrib.,* 9(1): 55-71. https://doi.org/10.1046/j.1472-4642.2003.00165.x

Seddon, M. 2000. Molluscan biodiversity and the impact of large dams. Contributing Paper for Thematic Review II.1: Dams, ecosystem functions and environmental restoration for the World Commision on Dam's final report: "Dams and Development: A New Framework for Decision-Making." http://www.dams.org/.

Sorenson, T. 1948.A method of establishing groups of equal amplitude in plant sociology based on similarity of species content. Kongelige Danske Videnskabernes Selskab, 5: 4-7.

Krull, W. H. and Mapes, C. R. 1997. Trapping small land snails. In: Jacobson MK (ed.) How to Studyand Collect Shells, 4th Ed. American Malacological Union, Wrightsville Beach, North Carolina. pp 69.