

Building evidence for conservation globally

# Journal of Threatened Taxa



10.11609/jott.2022.14.9.21751-21902  
[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

26 September 2022 (Online & Print)  
14(9): 21751-21902  
ISSN 0974-7907 (Online)  
ISSN 0974-7893 (Print)

Open Access





ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher  
**Wildlife Information Liaison Development Society**  
[www.wild.zooreach.org](http://www.wild.zooreach.org)

Host  
**Zoo Outreach Organization**  
[www.zooreach.org](http://www.zooreach.org)

No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road, Saravanampatti,  
Coimbatore, Tamil Nadu 641035, India  
Ph: +91 9385339863 | [www.threatenedtaxa.org](http://www.threatenedtaxa.org)  
Email: [sanjay@threatenedtaxa.org](mailto:sanjay@threatenedtaxa.org)

#### EDITORS

##### Founder & Chief Editor

**Dr. Sanjay Molur**

Wildlife Information Liaison Development (WILD) Society & Zoo Outreach Organization (ZOO),  
12 Thiruvannamalai Nagar, Saravanampatti, Coimbatore, Tamil Nadu 641035, India

##### Deputy Chief Editor

**Dr. Neelesh Dahanukar**

Noida, Uttar Pradesh, India

##### Managing Editor

**Mr. B. Ravichandran**, WILD/ZOO, Coimbatore, India

##### Associate Editors

**Dr. Mandar Paingankar**, Government Science College Gadchiroli, Maharashtra 442605, India

**Dr. Ulrike Streicher**, Wildlife Veterinarian, Eugene, Oregon, USA

**Ms. Priyanka Iyer**, ZOO/WILD, Coimbatore, Tamil Nadu 641035, India

**Dr. B.A. Daniel**, ZOO/WILD, Coimbatore, Tamil Nadu 641035, India

##### Editorial Board

**Dr. Russel Mittermeier**

Executive Vice Chair, Conservation International, Arlington, Virginia 22202, USA

**Prof. Mewa Singh Ph.D., FASc, FNA, FNAsc, FNAPsy**

Ramanna Fellow and Life-Long Distinguished Professor, Biopsychology Laboratory, and  
Institute of Excellence, University of Mysore, Mysuru, Karnataka 570006, India; Honorary  
Professor, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore; and Adjunct  
Professor, National Institute of Advanced Studies, Bangalore

**Stephen D. Nash**

Scientific Illustrator, Conservation International, Dept. of Anatomical Sciences, Health Sciences  
Center, T-8, Room 045, Stony Brook University, Stony Brook, NY 11794-8081, USA

**Dr. Fred Pluthero**

Toronto, Canada

**Dr. Priya Davidar**

Sigur Nature Trust, Chadapatti, Mavinahalla PO, Nilgiris, Tamil Nadu 643223, India

**Dr. Martin Fisher**

Senior Associate Professor, Battcock Centre for Experimental Astrophysics, Cavendish  
Laboratory, JJ Thomson Avenue, Cambridge CB3 0HE, UK

**Dr. John Fellowes**

Honorary Assistant Professor, The Kadoorie Institute, 8/F, T.T. Tsui Building, The University of  
Hong Kong, Pokfulam Road, Hong Kong

**Prof. Dr. Mirco Solé**

Universidade Estadual de Santa Cruz, Departamento de Ciências Biológicas, Vice-coordenador  
do Programa de Pós-Graduação em Zoologia, Rodovia Ilhéus/Itabuna, Km 16 (45662-000)  
Salobrinho, Ilhéus - Bahia - Brasil

**Dr. Rajeev Raghavan**

Professor of Taxonomy, Kerala University of Fisheries & Ocean Studies, Kochi, Kerala, India

##### English Editors

**Mrs. Mira Bhojwani**, Pune, India

**Dr. Fred Pluthero**, Toronto, Canada

**Mr. P. Ilangoan**, Chennai, India

##### Web Development

**Mrs. Latha G. Ravikumar**, ZOO/WILD, Coimbatore, India

##### Typesetting

**Mrs. Radhika**, ZOO, Coimbatore, India

**Mrs. Geetha**, ZOO, Coimbatore India

#### Fundraising/Communications

**Mrs. Payal B. Molur**, Coimbatore, India

#### Subject Editors 2019–2021

##### Fungi

Dr. B. Shivaraju, Bengaluru, Karnataka, India

Dr. R.K. Verma, Tropical Forest Research Institute, Jabalpur, India

Dr. Vatsavaya S. Raju, Kakatiya University, Warangal, Andhra Pradesh, India

Dr. M. Krishnappa, Jnana Sahyadri, Kuvempu University, Shimoga, Karnataka, India

Dr. K.R. Sridhar, Mangalore University, Mangalagangothri, Mangalore, Karnataka, India

Dr. Gunjan Biswas, Vidyasagar University, Midnapore, West Bengal, India

##### Plants

Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India

Dr. N.P. Balakrishnan, Ret. Joint Director, BSI, Coimbatore, India

Dr. Shonil Bhagwat, Open University and University of Oxford, UK

Prof. D.J. Bhat, Retd. Professor, Goa University, Goa, India

Dr. Ferdinando Boero, Università del Salento, Lecce, Italy

Dr. Dale R. Calder, Royal Ontario Museum, Toronto, Ontario, Canada

Dr. Cleofas Cervancia, Univ. of Philippines Los Baños College Laguna, Philippines

Dr. F.B. Vincent Florens, University of Mauritius, Mauritius

Dr. Merlin Franco, Curtin University, Malaysia

Dr. V. Irudayaraj, St. Xavier's College, Palayamkottai, Tamil Nadu, India

Dr. B.S. Kholia, Botanical Survey of India, Gangtok, Sikkim, India

Dr. Pankaj Kumar, Kadoorie Farm and Botanic Garden Corporation, Hong Kong S.A.R., China

Dr. V. Sampath Kumar, Botanical Survey of India, Howrah, West Bengal, India

Dr. A.J. Solomon Raju, Andhra University, Visakhapatnam, India

Dr. Vijayasankar Raman, University of Mississippi, USA

Dr. B. Ravi Prasad Rao, Sri Krishnadevaraya University, Anantpur, India

Dr. K. Ravikumar, FRLHT, Bengaluru, Karnataka, India

Dr. Aparna Watve, Pune, Maharashtra, India

Dr. Qiang Liu, Xishuangbanna Tropical Botanical Garden, Yunnan, China

Dr. Noor Azhar Mohamed Shazili, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia

Dr. M.K. Vasudeva Rao, Shiv Ranjani Housing Society, Pune, Maharashtra, India

Prof. A.J. Solomon Raju, Andhra University, Visakhapatnam, India

Dr. Mandar Datar, Agharkar Research Institute, Pune, Maharashtra, India

Dr. M.K. Janarthnam, Goa University, Goa, India

Dr. K. Karthigeyan, Botanical Survey of India, India

Dr. Errol Vela, University of Montpellier, Montpellier, France

Dr. P. Lakshminarasimhan, Botanical Survey of India, Howrah, India

Dr. Larry R. Noblick, Montgomery Botanical Center, Miami, USA

Dr. K. Haridasan, Pallavur, Palakkad District, Kerala, India

Dr. Analinda Manila-Fajard, University of the Philippines Los Banos, Laguna, Philippines

Dr. P.A. Sinu, Central University of Kerala, Kasaragod, Kerala, India

Dr. Afroz Alam, Banasthali Vidyapith (accredited A grade by NAAC), Rajasthan, India

Dr. K.P. Rajesh, Zamorin's Guruvayurappan College, GA College PO, Kozhikode, Kerala, India

Dr. David E. Boufford, Harvard University Herbaria, Cambridge, MA 02138-2020, USA

Dr. Ritesh Kumar Choudhary, Agharkar Research Institute, Pune, Maharashtra, India

Dr. Navendu Page, Wildlife Institute of India, Chandrabani, Dehradun, Uttarakhand, India

Dr. Kannan C.S. Warrior, Institute of Forest Genetics and Tree Breeding, Tamil Nadu, India

#### Invertebrates

Dr. R.K. Avasthi, Rohtak University, Haryana, India

Dr. D.B. Bastawade, Maharashtra, India

Dr. Partha Pratim Bhattacharjee, Tripura University, Suryamaninagar, India

Dr. Kailash Chandra, Zoological Survey of India, Jabalpur, Madhya Pradesh, India

Dr. Ansie Dippenaar-Schoeman, University of Pretoria, Queenswood, South Africa

Dr. Rory Dow, National Museum of Natural History Naturalis, The Netherlands

Dr. Brian Fisher, California Academy of Sciences, USA

Dr. Richard Gallon, Llandudno, North Wales, LL30 1UP

Dr. Hemant V. Ghate, Modern College, Pune, India

Dr. M. Monwar Hossain, Jahangirnagar University, Dhaka, Bangladesh

Mr. Jatishwor Singh Irungbam, Biology Centre CAS, Branišovská, Czech Republic.

Dr. Ian J. Kitching, Natural History Museum, Cromwell Road, UK

For Focus, Scope, Aims, and Policies, visit [https://threatenedtaxa.org/index.php/JoTT/aims\\_scope](https://threatenedtaxa.org/index.php/JoTT/aims_scope)

For Article Submission Guidelines, visit <https://threatenedtaxa.org/index.php/JoTT/about/submissions>

For Policies against Scientific Misconduct, visit [https://threatenedtaxa.org/index.php/JoTT/policies\\_various](https://threatenedtaxa.org/index.php/JoTT/policies_various)

continued on the back inside cover

Cover: *Pipistrellus tenuis* recorded during the small mammalian fauna study, Manipur, India. © Uttam Saikia.



## Land snails of Guwahati, Assam, India

Girindra Kalita

H.No. 124, Jyotinagar, P.O. Bamunimaidan, Guwahati 781021, India.  
[ginin\\_05@yahoo.co.in](mailto:ginin_05@yahoo.co.in)

**Abstract:** Assam is located in the Indo-Burma global biodiversity hotspot, and contains many animals and plants that have not been investigated scientifically. Increasing urbanization and destruction of forest cover have created threats to the survival of many species, hence scientific investigation is important to support conservation efforts. I undertook this study to evaluate the status of land snails in Guwahati, the capital city of Assam, a fast-growing city 216 km<sup>2</sup> in area where shrinkage of natural forest cover has become a matter of great concern. A total of 12 species were recorded: *Cyclophorus pearsoni* (Benson, 1851), *C. zebrinus* (Benson, 1836), *Pterocyclus parvus* (Pearson, 1833), *Endothyrella affinis* (Gude, 1897), *Cryptaustenia silcharensis* (Godwin-Austen, 1907), *Macrochlamys atricolor* (Godwin-Austen, 1875), *M. hengdanensis* Godwin-Austen, 1899, *Sitala rimicola* (Benson, 1859), *Bradybaena cestus* (Benson, 1836), *Lissachatina fulica* (Bowdich, 1822), *Allopeas gracile* (Hutton, 1834), and *Rishetia hastula* (Benson, 1860). I have provided a detailed discussion of our findings.

**Keywords:** Diversity, Gastropoda, invertebrates, Mollusca, northeastern India, terrestrial mollusc.

**Editor:** Basudev Tripathy, Zoological Survey of India, Kolkata, India.

**Date of publication:** 26 September 2022 (online & print)

**Citation:** Kalita, G. (2022). Land snails of Guwahati, Assam, India. *Journal of Threatened Taxa* 14(9): 21845–21852. <https://doi.org/10.11609/jott.8019.14.9.21845-21852>

**Copyright:** © Kalita 2022. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use, reproduction, and distribution of this article in any medium by providing adequate credit to the author(s) and the source of publication.

**Funding:** The project was partially funded by the University Grants Commission vide letter No. F.5-429/2011-12 (MRP/NERO) 14975, Dated 16/03/2012.

**Competing interests:** The author declares no competing interests.

**Author details:** DR. GIRINDRA KALITA is a retired Associate Professor, Department of Zoology, Guwahati College currently engaging himself in biodiversity study in Assam and has contributed few scientific articles in leading scientific journals like Zoo's Print Journal, Journal of Threatened Taxa, Indian Forester and in Records of the Zoological Survey of India.

**Acknowledgements:** The author is thankful to the University Grants Commission for funding the project (MRP) and also to Zoological Survey of India, Kolkata, W.B. (Department: Mollusca) for their help in identifying some of the samples.

## INTRODUCTION

Globally there are about 24,000 terrestrial mollusc species for which valid descriptions exist (Lydeard et al. 2004). Of these, India harbors 1,487 species under 140 Genera and 32 families (Magare 2015; Sajan et al. 2021). Land snails are found in moist and humid forest habitats where live or decomposed plant matter is available, such as damp walls and stones with algal growth in the crevices (Ramakrishna et al. 2010), domestic organic litter dumping areas, and areas where fungus-rich detritus is abundant. The existence of snails is often ignored due to their camouflaged colour, shape and size, slow movement and avoidance of daylight.

The northeastern region including Assam harbours a rich mixture of Indian and Burmese/Malayan snail groups, resulting in the highest species diversity in India (Mitra et al. 2005; Ramakrishna et al. 2010; Sen et al. 2012). Few studies have assessed their distribution and threats, with most of this information being based on the publications from 'Fauna of British' India volumes published during 1908 and 1914–1921 (Blanford & Godwin Austen 1908; Gude 1914, 1921), plus a few Zoological Survey of India reports (Sen et al. 2012). It is worthy to note that the state boundary of Assam (240,118 km<sup>2</sup>) changed several times during 1960–1970, and many areas previously described as ranges of land snails in Assam are now in Nagaland, Meghalaya, Mizoram, and Arunachal Pradesh. Presently a 78,438 km<sup>2</sup> area including part of Brahmaputra and Barak valley in Assam requires urgent assessment of land snail status.

Increasing urbanization and destruction of forest cover has created threats to the survival of land snails in Assam. Guwahati is a fast urbanizing city, where loss of natural forest cover has become a matter of great concern. The objective of this study was to record the diversity of land snails in Guwahati city (Table 1), where I observed 12 species: *Cyclophorus pearsoni* (Benson, 1851), *C. zebrinus* (Benson, 1836), *Pterocyclus parvus* (Pearson, 1833), *Endothyrella affinis* (Gude, 1897), *Cryptaustenia silcharensis* (Godwin-Austen, 1907), *Macrochlamys atricolor* (Godwin-Austen, 1875), *M. hengdanensis* Godwin-Austen, 1899, *Sitala rimicola* (Benson, 1859), *Bradybaena cestus* (Benson, 1836), *Lissachatina fulica* (Bowdich, 1822), *Allopeas gracile* (Hutton, 1834), and *Rishetia hastula* (Benson, 1860). Morphometric characteristics of dry shells (Table 2) and the soil characteristics of their occurring areas (Table 3) were recorded and studied.

## Description of the study area

Guwahati (26.179 °N & 91.750 °E) is situated on the southern bank of the Brahmaputra in Kamrup Metropolitan district of Assam. A part of the city has also expanded to the northern bank. The city is regarded as the gateway to northeastern India, and is the principal centre of socio-cultural, political, industrial, trade and commerce for the entire region. The total area of the city is ca 216.79 km<sup>2</sup>. Current population is about 9.57 lakhs. The climate of Guwahati is warm-humid with a maximum temperature of 38 °C during summer and minimum of 10 °C during winter. The tropical monsoon climate of the city receives about 1,600 mm annual rainfall with maximum during the months of May to August. The southern and eastern sides of the city are surrounded by hills while, the central part of the city also has some small hillocks. Apart from the hilly tracts, swamps, marshes and small water bodies also cover the city. There are five reserved forest areas in the city and two wildlife sanctuaries namely, Amchang wildlife sanctuary and Deepor Beel Bird Sanctuary. The hills and hillocks, reserved forests and wildlife sanctuaries are home to many terrestrial wild animals.

Mollusc species in the present study were recorded from several hills: Kamakhya pahar, Kharghuli pahar, Nabagraha pahar and Basistha pahar in main Guwahati city, and Agiathuri pahar of northern Guwahati. Some of the residential areas with garden campus, public park, and nurseries were also considered for the study.

## METHODS

A total of 10 sites were selected for the study. All the sites were marked with the help of a global positioning system marking device. The selected areas were searched in the months of March to September 2012 considering the ecological prerequisite of rain for land molluscs (Mitra et al. 2005). Places examined included stone pits and undersurface of stones, shady humid areas, under leaves of shrubs and herbs, tree-trunk, forest litters and vegetable garbage were carefully examined to collect the sample. Both the dry shells and living samples were collected during that time. Collected samples were then transferred to the departmental laboratory of Guwahati College for further investigations. Photographs were taken with the help of a digital camera. Majority of the species were identified following Mitra et al. (2005). Species status of some snails was also verified following Páll-Gergely (2015) and Budha (2017). The diversity of species and evenness was calculated using Shannon-Weiner diversity index (Shannon & Weaver 1949).

Table 1. Name of the recorded species with families, GPS location and total numbers of shell/specimen from different study sites.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
<b>Name of the Site</b>	Kamakhya hill	Kharghuli areas	Basistha hill	Agiathuri hill	Nabagraha hill	Nehru park	Ulubari Nursery	Urban residential campus-1	Urban residential campus-2	Uttar Guwahati village area
<b>Geographical (GPS) location</b>	N 26.3333° E 91.8233°	N 26.2055° E 91.9508°	N 26.2597° E 91.0300°	N 26.3122° E 91.1811°	N 26.2769° E 91.0230°	N 26.2625° E 91.9680°	N 26.1877° E 91.8153°	N 26.2136° E 91.8830°	N 26.2405° E 91.8588°	N 26.4364° E 91.7000°
<b>Habitat pattern</b>	Natural forest, temples, human habitat	Natural forest, human habitat	Natural forest, temples	Natural forest	Natural forest, temples, human habitat	Public park, planned vegetations	Commercial nursery	Human habitat with kitchen litters	Human habitat with kitchen litters	Swampy habitat, village residence, damp soil
Name of the species with family	Total numbers of shell/specimen recorded in 100 m <sup>2</sup> area of each site									
Family: Cyclophoridae										
<i>Cyclophorus pearsoni</i>	17	5	79	52	4	0	0	0	0	0
<i>Cyclophorus zebrinus</i>	3	0	19	10	0	0	0	0	0	0
<i>Pterocyclus parvus</i>	0	0	0	215	0	0	0	0	0	32
Family: Plectopylididae										
<i>Endothyrella affinis</i>	0	0	5	0	0	0	0	0	0	0
Family: Ariophantidae										
<i>Cryptaustenia silcharensis</i>	3	42	1	3	12	0	0	0	0	0
<i>Macrochlamys atricolor</i>	36	13	7	19	17	46	77	92	44	36
<i>Macrochlamys hengdanensis</i>	0	0	5	22	0	1	0	0	0	4
<i>Sitala rimicola</i>	36	88	0	9	78	0	0	0	0	0
Family: Bradybaenidae										
<i>Bradybaena cestus</i>	0	0	0	0	0	0	0	0	0	8
Family: Achatinidae										
<i>Lissachatina fulica</i>	83	74	56	34	66	82	22	78	103	51
Family: Subulinidae										
<i>Rishetia hastula</i>	0	0	0	15	0	0	0	0	0	2
<i>Allopeas gracile</i>	12	3	26	11	18	7	18	3	4	25
Species Richness (S)	7	6	8	10	6	4	3	3	3	7
Shanon diversity (H)	1.514	1.353	1.546	1.805	1.417	0.861	0.878	0.765	0.716	1.617
Species evenness (J)	0.778	0.755	0.743	0.784	0.791	0.621	0.799	0.697	0.652	0.831

## RESULT AND DISCUSSION

The occurrence of 12 snail species within ca. 216.79 km<sup>2</sup> thickly urbanized areas of a metropolitan city in Assam is considered significant. It appears that the diversity of land snails in hilly areas of Guwahati is relatively higher than in public parks, commercial nurseries, and residential campuses. *Macrochlamys atricolor* (Godwin-Austen), *Lissachatina fulica* (Bowdich), *Allopeas gracile* (Hutton),

and *Rishetia hastula* (Benson) (Image 1–4) were recorded from public parks, commercial nurseries, and residential campuses. *Pterocyclus parvus* (Benson), *Cyclophorus zebrinus* Benson, *Macrochlamys hengdanensis* (Godwin-Austen), *Cryptaustenia silcharensis* (Godwin-Austen), *Sitala rimicola* (Benson), *Cyclophorus pearsoni* Benson, and *Endothyrella affinis* Gude (Image 5–11) were recorded from natural forest habitats of hill areas. Two samples of *Bradybaena cestus* (Benson) (Image 12) were



recorded from a village residential campus of northern Guwahati, near a swampy habitat clinging over *Scirpus grossus* L. *Pterocyclus parvus*, *Cyclophorus pearsoni*, and *Rishetia hastula* was comparatively more abundant in the hills of northern Guwahati than in southern bank hills of the River Brahmaputra.

The morphometric measurements of the shells were found to be within already reported ranges (Mitra et al. 2005) (Image 13A–L). Species richness (S), Shannon diversity (H), and species evenness (J) of land molluscs in the studied areas of Guwahati is depicted in Figure 1. The species diversity index (H) fluctuated from 0.7164 to 1.8048 in the studied areas. The highest diversity was recorded in Agiathuri hills, where 10 of 12 recorded species were observed. The highest species evenness (J) was recorded as 0.83 in a village residential area of

northern Guwahati near the Agiathuri hill.

Habitat loss and fragmentation as a result of anthropogenic activities is the root cause of low species diversity and community structure of land molluscs (Sen et al. 2012), which may also be influenced by factors like soil pH and moisture content (Bhattacharyya 1977; Clements et al. 2008). Among the recorded species only two, *Lissachatina fulica* and *Macrochlamys atricolor*, can be considered widely distributed. *Lissachatina fulica* is a general phytophagous mollusc found invading almost all types of garden vegetation, while *Macrochlamys atricolor* is chiefly found within kitchen wastes in damp places. It is discernible that the population of *L. fulica* is decreasing in the city, consistent with the findings of Bhattacharyya (1977). The record of low species diversity of snails in public parks, commercial nurseries, and

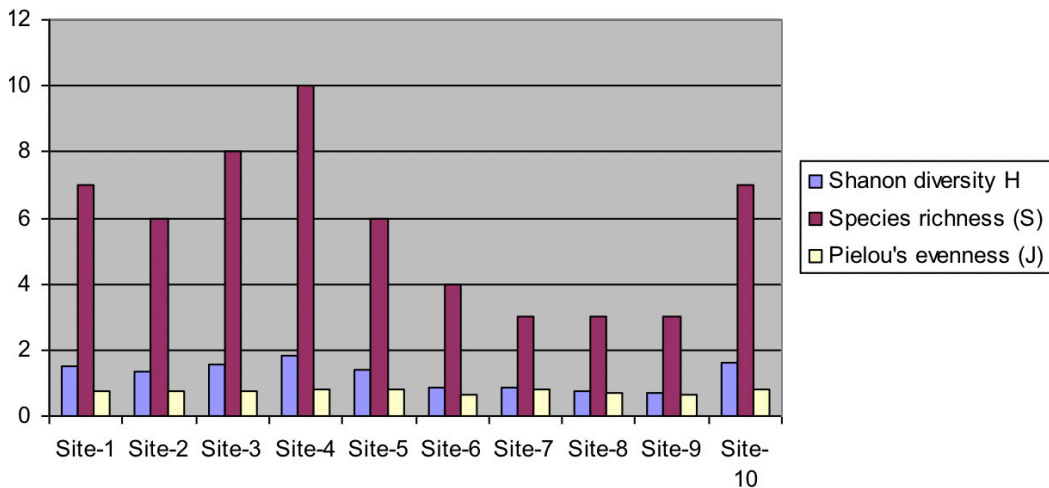


Figure 1. The species richness (S), Shannon diversity (H), and species evenness (J) of land molluscs in studied areas of Guwahati.

Table 2. Observed morphometry of the studied snails.

Name of the snail	Average length/ height of the shell (mm)	Average diameter of the shell (mm)	Average dry shell weight (g)
<i>Cyclophorus pearsoni</i>	30.0	31.0	6.560
<i>Cyclophorus zebrinus</i>	9.0	11.0	0.100
<i>Pterocyclus parvus</i>	4.0	12.0	0.155
<i>Endothyrella affinis</i>	4.0	7.0	0.045
<i>Cryptoaustenia silcharensis</i>	3.5	6.0	0.030
<i>Macrochlamys atricolor</i>	8.0	15.0	0.105
<i>Macrochlamys hengdanensis</i>	4.0	0.65	0.040
<i>Sitala rimicola</i>	7.0	7.0	0.025
<i>Bradybaena cestus</i>	8.0	12.0	0.125
<i>Lissachatina fulica</i>	65.8	34.1	8.79
<i>Rishetia hastula</i>	25.0	6.0	0.165
<i>Allopeas gracile</i>	14.2	3.7	0.075



Image 1. *Macrochlamys atricolor*. © Girindra Kalita



Image 2. *Lissachatina fulica*. © Girindra Kalita



Image 3. *Allopeas gracile*. © Girindra Kalita



Image 4. *Rishetia hastula*. © Girindra Kalita



Image 5. *Pterocyclus parvus*. © Girindra Kalita



Image 6. *Macrochlamys hengdanensis*. © Girindra Kalita



Table 3. Soil characterization of the studied area.

Sites	GPS location	Texture	pH	Organic Carbon (%)	Phosphorous P <sub>2</sub> O <sub>5</sub> (Kg/Hac)	Calcium (CaO) %
1	N 26.3333° E 91.8233°	Silty clay	7.2	0.68	33	0.56
2	N 26.2056° E 91.9508°	Silty clay	7.6	0.76	31.3	0.46
3	N 26.2597° E 91.0300°	Silty clay	7.4	0.9	30	1.56
4	N 26.3122° E 91.1811°	Silty clay	7.5	1.04	32	0.46
5	N 26.2769° E 91.0230°	Sandy	7.6	0.85	34.3	0.9
6	N 26.2625° E 91.9680°	Clay loam	7.1	1.11	29.5	0.82
7	N 26.1877° E 91.8153°	Clay loam	7.4	0.91	38	0.92
8	N 26.2136° E 91.8830°	Clay loam	7.6	0.57	34	0.82
9	N 26.2405° E 91.8588°	Clay loam	7.5	0.92	28	0.36
10	N 26.4364° E 91.7000°	Clay loam	7.7	0.76	31	1.32

residential campuses in Guwahati may be due to the planned maintenance of the area. In managed forests, the abundance and diversity of snails has become low due to the removal of forest litter, and recently developed forest areas have only sparse leaf litter and less rotting logs (Sturm et al. 2006).

The human population of Guwahati has increased considerably in the past few decades, and the population density (population km<sup>-2</sup>) rose from 2558 in 1981 to 3374 in 2001 (Kalita et al. 2011). The rising anthropogenic pressure has resulted in urban sprawl (Thakur & Goswami 1993) that has made the area less humid, with dryness making it less hospitable to land snails. Up to the 1970s, the invasive *L. fulica* and other species like *C. pearsoni*, *M. atricolor*, *S. rimicola*, and *A. gracile* were common, and villagers garlanded cattle with dry shells of *C. pearsoni* which also had traditional medicinal value. During that time it was difficult to protect gardens from the invasion of *L. fulica*, and people frequently used common salt (NaCl) to kill snails. Then as human habitats increased, a combination of loss of forest cover, increasing soil erosion, frequent rain-fed floods with high mud content and increasing temperatures led to the decline of land snail populations in the studied areas. The present government of Assam has taken steps towards protecting the local environment that include conservation of wetlands and hills, implementation of strict municipal laws to stop population sprawl, evictions from forest land, plantation programs to stop soil erosion, and improvement of drainage systems to stop floods. These measures are expected to have positive effects on protecting land snails.

## REFERENCES

- Páll-Gergely, B., P.B. Budha, F. Naggs, T. Backeljau & T. Asami (2015). Review of the genus *Endothyrella* Zilch, 1960 with description of five new species (Gastropoda, Pulmonata, Plectopylidae). *ZooKeys* (529): 1–70. <https://doi.org/10.3897/zookeys.529.6139>
- Bhattacharyya, P.C. (1977). Ecology of *Achatina* (*Lissachatina*) *fulica fulica* (Bowdich) Distribution in Guwahati. unpublished Ph.D. Thesis. Gauhati University, 258 pp.
- Blanford, W.T. & H.H. Godwin-Austen (1908). *The Fauna of British India, including Ceylon and Burma. Mollusca. Testacellidae and Zonitidae*. Taylor and Francis, London, 299 pp.
- Budha, P.B., F. Naggs & T. Backeljau (2017). Conchological differentiation and genital anatomy of Nepalese Glessulinae (Gastropoda, Stylommatophora, Subulinidae), with descriptions of six new species. *ZooKeys* (675): 129–156. <https://doi.org/10.3897/zookeys.675.13252>
- Clements, R., P.K. Ng, X.X. Lu, S. Ambu, M. Schilthuisen & C.J. Bradshaw (2008). Using bio-geographical patterns of endemic land snails to improve conservation planning for limestone karsts. *Journal of Biological Conservation* 141(11): 2751–2764. <https://doi.org/10.1016/j.biocon.2008.08.011>
- Gude, G.K. (1914). *The fauna of British India including Ceylon and Burma (Mollusca-II)*. Today & Tomorrows Printers & Publishers, New Delhi, 520 pp.
- Gude G.K. (1921). *The fauna of British India including Ceylon and Burma (Mollusca-III)*. Today & Tomorrows Printers & Publishers, New Delhi, 386 pp.
- Kalita, G., S.K. Sarmah, A. Bairagee, D. Kakati, P. Baruah, S. Narzary & Rajbanshi (2011). Imperiled wetlands of Guwahati and their conservation. *Journal of Environment and Ecology* 29(1): 217–223.
- Lydeard, C., R.H. Cowie, W.F. Ponder, A.E. Bogan, P. Bouchet, S.A. Clark, K.S. Cummings, T.J. Frest, O. Gargominy, D.G. Herbert, R. Hershler, K.E. Perez, B. Roth, M. Seddon, E.E. Strong & F.G. Thompson (2004). The Global Decline of Nonmarine Mollusks. *BioScience* 54(4): 321–330.
- Magare, S.R. (2015). Species inventory of land molluscs from Satpuda mountains, India. *Indian Journal of Life Science*, special issue A<sup>3</sup>: 77–81.
- Mitra, S.C., A. Dey & Ramakrishna (2005). *Pictorial Handbook Indian Land Snails*. Zoological Survey of India, Kolkata, 344 pp.
- Ramakrishna, S.C. Mitra & A. Dey (2010). *Annotated Checklist of Indian Land Molluscs*. Zoological Survey of India, Kolkata, 359 pp.





Image 7. *Cyclophorus zebrinus*. © Girindra Kalita



Image 8. *Cyclophorus pearsoni*. © Girindra Kalita



Image 9. *Cryptoaustenia silcharensis*. © Girindra Kalita



Image 10. *Sitala rimicola*. © Girindra Kalita



Image 11. *Endothyrella affinis*. © Girindra Kalita



Image 12. *Bradybaenia cestus*. © Girindra Kalita





Image 13A–L. A—*M. atricolor* (H 8.0 mm, D 15.0 mm, W 0.105 g) | B—*L. fulica* (L 65.8 mm, D 34.1 mm, W 8.79 g) | C—*A. gracile* (L 14.2 mm, D 3.7 mm, W 0.075 g) | D—*R. hastula* (L 25.0 mm, D 6.0 mm, W 0.165 g) | E—*P. parvus* (H 4.0 mm, D 12.0 mm, W 0.155 g) | F—*M. hengdanensis* (H 4.0 mm, D 0.65 mm, W 0.040 g) | G—*C. zebrinus* (H 9.0 mm, D 11.0 mm, W 0.100 g) | H—*C. pearsoni* (H 30.0 mm, D 31.0 mm, W 6.560 g) | I—*C. silcharensis* (H 3.5 mm, D 6.0 mm, W 0.030 g) | J—*S. remicola* (H 7.0 mm, D 7.0 mm, W 0.025 g) | K—*E. affinis* (H 4.0 mm, D 7.0 mm, W 0.045 g) | L—*B. cestus* (H 8.0 mm, D 12.0 mm, W 0.125 g).

(H—average shell height | L—average shell length | D—average shell diameter | W—average shell weight). © Girindra Kalita.

- Sajan, S.K., S. Das, B. Tripathy & T. Biswas (2021). Malacofaunal inventory in Chintamani Kar Bird Sanctuary, West Bengal, India. *Journal of Threatened Taxa* 13(2): 17807–17826. <https://doi.org/10.11609/jott.4456.13.2.17807-17826>
- Sen, S., G. Ravikanth & N.A. Aravind (2012). Land snails (Mollusca: Gastropoda) of India: status, threats and conservation strategies. *Journal of Threatened Taxa* 4(11): 3029–3037. <https://doi.org/10.11609/jott.02722.3029-37>
- Shannon, C.E. & W. Weaver (1949). *The Mathematical Theory of Communication*. University of Illinois Press, 117 pp.

- Sturm, C.F., T.A. Pearce & A. Valdés (eds.) (2006). *The Mollusks: A Guide to Their Study, Collection, and Preservation*. American Malacological Society. Published by Universal publishers, Boca Raton, Florida, USA, 445 pp.
- Thakur, A. & D.C. Goswami (1993). Urban sprawl and land suitability analysis: A case study of Guwahati City and its environs. *Proceedings of National Symposium on Remote Sensing Applications for Resource Management with special emphasis on North Eastern Region, Guwahati*, 194–201 pp.

Dr. George Mathew, Kerala Forest Research Institute, Peechi, India  
 Dr. John Noyes, Natural History Museum, London, UK  
 Dr. Albert G. Orr, Griffith University, Nathan, Australia  
 Dr. Sameer Padhye, Katholieke Universiteit Leuven, Belgium  
 Dr. Nancy van der Poorten, Toronto, Canada  
 Dr. Kareen Schnabel, NIWA, Wellington, New Zealand  
 Dr. R.M. Sharma, (Retd.) Scientist, Zoological Survey of India, Pune, India  
 Dr. Manju Siliwal, WILD, Coimbatore, Tamil Nadu, India  
 Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India  
 Dr. K.A. Subramanian, Zoological Survey of India, New Alipore, Kolkata, India  
 Dr. P.M. Sureshan, Zoological Survey of India, Kozhikode, Kerala, India  
 Dr. R. Varatharajan, Manipur University, Imphal, Manipur, India  
 Dr. Eduard Vives, Museu de Ciències Naturals de Barcelona, Terrassa, Spain  
 Dr. James Young, Hong Kong Lepidopterists' Society, Hong Kong  
 Dr. R. Sundararaj, Institute of Wood Science & Technology, Bengaluru, India  
 Dr. M. Nithyanandan, Environmental Department, La Ala Al Kuwait Real Estate. Co. K.S.C., Kuwait  
 Dr. Himender Bharti, Punjabi University, Punjab, India  
 Mr. Purnendu Roy, London, UK  
 Dr. Saito Motoki, The Butterfly Society of Japan, Tokyo, Japan  
 Dr. Sanjay Sondhi, TITLI TRUST, Kalpavriksh, Dehradun, India  
 Dr. Nguyen Thi Phuong Lien, Vietnam Academy of Science and Technology, Hanoi, Vietnam  
 Dr. Nitin Kulkarni, Tropical Research Institute, Jabalpur, India  
 Dr. Robin Wen Jiang Ngiam, National Parks Board, Singapore  
 Dr. Lionel Monod, Natural History Museum of Geneva, Genève, Switzerland.  
 Dr. Asheesh Shivam, Nehru Gram Bharti University, Allahabad, India  
 Dr. Rosana Moreira da Rocha, Universidade Federal do Paraná, Curitiba, Brasil  
 Dr. Kurt R. Arnold, North Dakota State University, Saxony, Germany  
 Dr. James M. Carpenter, American Museum of Natural History, New York, USA  
 Dr. David M. Claborn, Missouri State University, Springfield, USA  
 Dr. Kareen Schnabel, Marine Biologist, Wellington, New Zealand  
 Dr. Amazonas Chagas Júnior, Universidade Federal de Mato Grosso, Cuiabá, Brasil  
 Mr. Monsoon Jyoti Gogoi, Assam University, Silchar, Assam, India  
 Dr. Heo Chong Chin, Universiti Teknologi MARA (UiTM), Selangor, Malaysia  
 Dr. R.J. Shiel, University of Adelaide, SA 5005, Australia  
 Dr. Siddharth Kulkarni, The George Washington University, Washington, USA  
 Dr. Priyadarsanan Dharma Rajan, ATREE, Bengaluru, India  
 Dr. Phil Alderslade, CSIRO Marine And Atmospheric Research, Hobart, Australia  
 Dr. John E.N. Veron, Coral Reef Research, Townsville, Australia  
 Dr. Daniel Whitmore, State Museum of Natural History Stuttgart, Rosenstein, Germany.  
 Dr. Yu-Feng Hsu, National Taiwan Normal University, Taipei City, Taiwan  
 Dr. Keith V. Wolfe, Antioch, California, USA  
 Dr. Siddharth Kulkarni, The Hormiga Lab, The George Washington University, Washington, D.C., USA  
 Dr. Tomas Ditrich, Faculty of Education, University of South Bohemia in Ceske Budejovice, Czech Republic  
 Dr. Mihaly Foldvari, Natural History Museum, University of Oslo, Norway  
 Dr. V.P. Uniyal, Wildlife Institute of India, Dehradun, Uttarakhand 248001, India  
 Dr. John T.D. Caleb, Zoological Survey of India, Kolkata, West Bengal, India  
 Dr. Priyadarsanan Dharma Rajan, Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Bangalore, Karnataka, India

## Fishes

Dr. Neelesh Dahanukar, IISER, Pune, Maharashtra, India  
 Dr. Topiltzin Contreras MacBeath, Universidad Autónoma del estado de Morelos, México  
 Dr. Heok Hee Ng, National University of Singapore, Science Drive, Singapore  
 Dr. Rajeev Raghavan, St. Albert's College, Kochi, Kerala, India  
 Dr. Robert D. Sluka, Chiltern Gateway Project, A Rocha UK, Southall, Middlesex, UK  
 Dr. E. Vivekanandan, Central Marine Fisheries Research Institute, Chennai, India  
 Dr. Davor Zanella, University of Zagreb, Zagreb, Croatia  
 Dr. A. Biju Kumar, University of Kerala, Thiruvananthapuram, Kerala, India  
 Dr. Akhilesh K.V., ICAR-Central Marine Fisheries Research Institute, Mumbai Research Centre, Mumbai, Maharashtra, India  
 Dr. J.A. Johnson, Wildlife Institute of India, Dehradun, Uttarakhand, India  
 Dr. R. Ravinesh, Gujarat Institute of Desert Ecology, Gujarat, India

## Amphibians

Dr. Sushil K. Dutta, Indian Institute of Science, Bengaluru, Karnataka, India  
 Dr. Annemarie Ohler, Muséum national d'Histoire naturelle, Paris, France

## Reptiles

Dr. Gernot Vogel, Heidelberg, Germany  
 Dr. Raju Vyas, Vadodara, Gujarat, India  
 Dr. Pritpal S. Soorae, Environment Agency, Abu Dhabi, UAE.  
 Prof. Dr. Wayne J. Fuller, Near East University, Mersin, Turkey  
 Prof. Chandrashekhar U. Rivonker, Goa University, Taleigao Plateau, Goa, India  
 Dr. S.R. Ganesh, Chennai Snake Park, Chennai, Tamil Nadu, India  
 Dr. Himansu Sekhar Das, Terrestrial & Marine Biodiversity, Abu Dhabi, UAE

## Birds

Dr. Hem Sagar Baral, Charles Sturt University, NSW Australia  
 Mr. H. Byju, Coimbatore, Tamil Nadu, India  
 Dr. Chris Bowden, Royal Society for the Protection of Birds, Sandy, UK  
 Dr. Priya Davidar, Pondicherry University, Kalapet, Puducherry, India  
 Dr. J.W. Duckworth, IUCN SSC, Bath, UK  
 Dr. Rajah Jayapal, SAGON, Coimbatore, Tamil Nadu, India  
 Dr. Rajiv S. Kalsi, M.L.N. College, Yamuna Nagar, Haryana, India  
 Dr. V. Santharam, Rishi Valley Education Centre, Chittoor Dt., Andhra Pradesh, India  
 Dr. S. Balachandran, Bombay Natural History Society, Mumbai, India  
 Mr. J. Praveen, Bengaluru, India  
 Dr. C. Srinivasulu, Osmania University, Hyderabad, India  
 Dr. K.S. Gopi Sundar, International Crane Foundation, Baraboo, USA  
 Dr. Gombobaatar Sunde, Professor of Ornithology, Ulaanbaatar, Mongolia  
 Prof. Reuven Yosef, International Birding & Research Centre, Eilat, Israel  
 Dr. Taej Mundkur, Wetlands International, Wageningen, The Netherlands  
 Dr. Carol Inskipp, Bishop Auckland Co., Durham, UK  
 Dr. Tim Inskipp, Bishop Auckland Co., Durham, UK  
 Dr. V. Gokula, National College, Tiruchirappalli, Tamil Nadu, India  
 Dr. Arkady Lelej, Russian Academy of Sciences, Vladivostok, Russia  
 Dr. Simon Dowell, Science Director, Chester Zoo, UK  
 Dr. Mário Gabriel Santiago dos Santos, Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, Vila Real, Portugal  
 Dr. Grant Connette, Smithsonian Institution, Royal, VA, USA  
 Dr. M. Zafar-ul Islam, Prince Saud Al Faisal Wildlife Research Center, Taif, Saudi Arabia

## Mammals

Dr. Giovanni Amori, CNR - Institute of Ecosystem Studies, Rome, Italy  
 Dr. Anwaruddin Chowdhury, Guwahati, India  
 Dr. David Mallon, Zoological Society of London, UK  
 Dr. Shomita Mukherjee, SAGON, Coimbatore, Tamil Nadu, India  
 Dr. Angie Appel, Wild Cat Network, Germany  
 Dr. P.O. Nameer, Kerala Agricultural University, Thrissur, Kerala, India  
 Dr. Ian Redmond, UNEP Convention on Migratory Species, Lansdown, UK  
 Dr. Heidi S. Riddle, Riddle's Elephant and Wildlife Sanctuary, Arkansas, USA  
 Dr. Karin Schwartz, George Mason University, Fairfax, Virginia.  
 Dr. Lala A.K. Singh, Bhubaneswar, Orissa, India  
 Dr. Mewa Singh, Mysore University, Mysore, India  
 Dr. Paul Racey, University of Exeter, Devon, UK  
 Dr. Honnavalli N. Kumara, SAGON, Anaikatty P.O., Coimbatore, Tamil Nadu, India  
 Dr. Nishith Dharaia, HNG University, Patan, Gujarat, India  
 Dr. Spartaco Gippoliti, Socio Onorario Società Italiana per la Storia della Fauna "Giuseppe Altobello", Rome, Italy  
 Dr. Justus Joshua, Green Future Foundation, Tiruchirappalli, Tamil Nadu, India  
 Dr. H. Raghuram, The American College, Madurai, Tamil Nadu, India  
 Dr. Paul Bates, Harison Institute, Kent, UK  
 Dr. Jim Sanderson, Small Wild Cat Conservation Foundation, Hartford, USA  
 Dr. Dan Challender, University of Kent, Canterbury, UK  
 Dr. David Mallon, Manchester Metropolitan University, Derbyshire, UK  
 Dr. Brian L. Cypher, California State University-Stanislaus, Bakersfield, CA  
 Dr. S.S. Talmale, Zoological Survey of India, Pune, Maharashtra, India  
 Prof. Karan Bahadur Shah, Budhanilakantha Municipality, Kathmandu, Nepal  
 Dr. Susan Cheyne, Borneo Nature Foundation International, Palangkaraja, Indonesia  
 Dr. Hemanta Kafley, Wildlife Sciences, Tarleton State University, Texas, USA

## Other Disciplines

Dr. Aniruddha Belsare, Columbia MO 65203, USA (Veterinary)  
 Dr. Mandar S. Paingankar, University of Pune, Pune, Maharashtra, India (Molecular)  
 Dr. Jack Tordoff, Critical Ecosystem Partnership Fund, Arlington, USA (Communities)  
 Dr. Ulrike Streicher, University of Oregon, Eugene, USA (Veterinary)  
 Dr. Hari Balasubramanian, EcoAdvisors, Nova Scotia, Canada (Communities)  
 Dr. Rayanna Hellem Santos Bezerra, Universidade Federal de Sergipe, São Cristóvão, Brazil  
 Dr. Jamie R. Wood, Landcare Research, Canterbury, New Zealand  
 Dr. Wendy Collinson-Jonker, Endangered Wildlife Trust, Gauteng, South Africa  
 Dr. Rajeshkumar G. Jani, Anand Agricultural University, Anand, Gujarat, India  
 Dr. O.N. Tiwari, Senior Scientist, ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India  
 Dr. L.D. Singla, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India  
 Dr. Rupika S. Rajakaruna, University of Peradeniya, Peradeniya, Sri Lanka  
 Dr. Bahar Baviskar, Wild-CER, Nagpur, Maharashtra 440013, India

## Reviewers 2019–2021

Due to pausity of space, the list of reviewers for 2018–2020 is available online.

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

**Journal of Threatened Taxa** is indexed/abstracted in Bibliography of Systematic Mycology, Biological Abstracts, BIOSIS Previews, CAB Abstracts, EBSCO, Google Scholar, Index Copernicus, Index Fungorum, JournalSeek, National Academy of Agricultural Sciences, NewJour, OCLC WorldCat, SCOPUS, Stanford University Libraries, Virtual Library of Biology, Zoological Records.

NAAS rating (India) 5.64

Print copies of the Journal are available at cost. Write to:  
 The Managing Editor, JoTT,  
 c/o Wildlife Information Liaison Development Society,  
 No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road,  
 Saravanampatti, Coimbatore, Tamil Nadu 641035, India  
 ravi@threatenedtaxa.org





[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

OPEN ACCESS



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at [www.threatenedtaxa.org](http://www.threatenedtaxa.org). All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

September 2022 | Vol. 14 | No. 9 | Pages: 21751–21902

Date of Publication: 26 September 2022 (Online & Print)

DOI: 10.11609/jott.2022.14.9.21751-21902

## Article

**Diversity, distribution, and abundance status of small mammalian fauna (Chiroptera: Rodentia: Eulipotyphla) of Manipur, India**

– Uttam Saikia & A.B. Meetei, Pp. 21751–21768

## Review

**Conservation of Tiger *Panthera tigris* in Nepal: a review of current efforts and challenges**

– Pramod Ghimire, Pp. 21769–21775

## Communications

**Effects of visitor disturbance on tetrapod vertebrates in the Horton Plains National Park, Sri Lanka**

– D.M.T. Dhananjani & W.A.D. Mahaulpatha, Pp. 21776–21785

**Population density and nesting behaviour of Indian Giant Squirrel *Ratufa indica* (Erxleben, 1777) in Bhimashankar Wildlife Sanctuary, Western Ghats of Maharashtra, India**

– Ganesh Rathod, Erach Bharucha & Kranti Yardi, Pp. 21786–21796

**First camera-trap confirmation of Tibetan Brown Bear *Ursus arctos pruinosus* Blyth, 1854 (Mammalia: Carnivora: Ursidae) with a review of its distribution and status in Nepal**

– Madhu Chetri, Pp. 21797–21804

**Age estimation of Tiger *Panthera tigris* (Linnaeus, 1758) and Lion *Panthera leo* (Linnaeus, 1758) (Mammalia: Carnivora: Felidae): applicability of cementum annuli analysis method**

– Vipin, Chandra Prakash Sharma, Vinita Sharma, Surendra Prakash Goyal, Heather Stevens & Sandeep Kumar Gupta, Pp. 21805–21810

**Hematological value of captive Asian Elephants *Elephas maximus* around Chitwan National Park, Sauraha, Nepal**

– Roshan Ghimire, Sagar Regmi, Rakshya Shrestha, Amir Sadaula & Janardan Dev Joshi, Pp. 21811–21817

**Foraging strata and dietary preferences of fifteen species of babblers in Sarawak, Malaysia**

– Jayasilan Mohd-Azlan, Attiqah Fadzilah Sopian, Andrew Alek Tuen & Chong Leong Puan, Pp. 21818–21825

**Effects of wind farm on land bird composition at Kachchh District, Gujarat, India**

– Selvaraj Ramesh Kumar, P.R. Arun & A. Mohamed Samsoor Ali, Pp. 21826–21835

**New records of odonates from Trongsa and Zhemgang, central Bhutan with a checklist of Jigme Singye Wangchuck National Park**

– Mer Man Gurung, Cheten Dorji, Abir Man Sinchuri, Sanjit K. Rai, Karma C. Dendup & Vincent J. Kalkman, Pp. 21836–21844

**Land snails of Guwahati, Assam, India**

– Girindra Kalita, Pp. 21845–21852

**Morphology characterization and phytochemical overview of the Moluccan Ironwood *Intsia bijuga* (Colebr.) Kuntze, a living collection of Purwodadi Botanic Garden, Indonesia**

– Melisnawati H. Angio, Elga Renjana & Elok Rifqi Firdiana, Pp. 21853–21861

**Woody plant wealth of Therikadu Reserve Forest, Tuticorin, India: a checklist**

– V. Muneeswaran & M. Udayakumar, Pp. 21862–21869

**Invasive alien plant species of Hassan District, Karnataka, India**

– G.M. Prashanth Kumar & Shiddamallayya Nagayya, Pp. 21870–21890

## Notes

**First photographic evidence of the Binturong *Arctictis binturong* (Raffles, 1821) from Nepal**

– Madhu Chetri, Purna Bahadur Ale, Tulasi Prasad Dahal & Karan Bahadur Shah, Pp. 21891–21894

**First record of *Chlorophorus jucundus* (Perroud, 1855) (Coleoptera: Cerambycidae: Cerambycinae) from Maharashtra, India**

– Yogesh K. Mane & Sunil M. Gaikwad, Pp. 21895–21897

**First record of the swallowtail moth *Epiplema adamantina* Inoue, 1998 (Lepidoptera: Uraniidae: Epipleminae) from western Himalaya, India**

– Lekhendra & Arun Pratap Singh, Pp. 21898–21899

**Visceral tetrathyridiosis *Mesocestoides* sp. (Cestoda: Cyclophyllidae) in a wild Barn Owl *Tyto alba* - a first report and new host record**

– P.G. Vimalraj & A. Latchumikanthan, Pp. 21900–21902

Publisher & Host

