



40 **zoo**reach  
Zoo Outreach Organisation  
Years

Open Access

Building evidence for conservation globally  
**Journal of  
Threatened  
Taxa**

10.11609/jott.2026.18.2.28262-28454  
[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

26 February 2026 (Online & Print)  
18(2): 28262-28454  
ISSN 0974-7907 (Online)  
ISSN 0974-7893 (Print)



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

Publisher  
**Wildlife Information Liaison Development Society**  
www.wild.zooreach.org

Host  
**Zoo Outreach Organization**  
www.zooreach.org

Srivari Illam, No. 61, Karthik Nagar, 10th Street, Saravanampatti, Coimbatore, Tamil Nadu 641035, India  
Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, 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),  
Coimbatore, Tamil Nadu 641006, India

##### Assistant Editor

**Dr. Chaithra Shree J.**, WILD/ZOO, Coimbatore, Tamil Nadu 641006, India

##### Managing Editor

**Mr. B. Ravichandran**, WILD/ZOO, Coimbatore, Tamil Nadu 641006, 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 641006, India

##### Board of Editors

**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, Mavinhalla PO, Nilgiris, Tamil Nadu 643223, India

**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

##### Copy Editors

**Ms. Usha Madgunaki**, Zooreach, Coimbatore, India

**Ms. Trisa Bhattacharjee**, Zooreach, Coimbatore, India

**Ms. Paloma Noronha**, Daman & Diu, India

##### Web Development

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

##### Typesetting

**Mrs. Radhika**, Zooreach, Coimbatore, India

**Mrs. Geetha**, Zooreach, Coimbatore, India

#### Fundraising/Communications

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

#### Subject Editors 2021–2023

##### 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

**Dr. Kiran Ramchandra Ranadive**, Annasaheb Magar Mahavidyalaya, Maharashtra, 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**, Department of Plant and Soil Science, Texas Tech University, Lubbock, Texas, USA.

**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. Janarthanam**, Goa University, Goa, India

**Dr. K. Karthigeeyan**, 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 Baños, 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. A.G. Pandurangan**, Thiruvananthapuram, Kerala, India

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

**Dr. Kannan C.S. Warriar**, 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

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: Digital illustration of *Impatiens chamchumroonii* in Krita by Dupati Poojitha.



## Activity budgets of a zoo-housed Mishmi Takin *Budorcas taxicolor taxicolor* (Mammalia: Artiodactyla: Bovidae) herd

Nabanita Ghosh<sup>1</sup> , Pranita Gupta<sup>2</sup> , Joy Dey<sup>3</sup> & Basavaraj S. Holeyachi<sup>4</sup>

<sup>1-4</sup> Padmaja Naidu Himalayan Zoological Park, Darjeeling, West Bengal 734101, India.

<sup>1</sup>ghosh.nabanita1695@gmail.com (corresponding author), <sup>2</sup>pranita.gupta.subba@gmail.com, <sup>3</sup>joydarjeeling@yahoo.co.in, <sup>4</sup>basavifs@gmail.com

**Abstract:** The Himalayan Caprine *Budorcas taxicolor taxicolor*, generally known as the Mishmi Takin, is a globally 'Vulnerable' species per IUCN Red List and categorised under Schedule I of the Wildlife (Protection) Act, 1972. Information on their behaviour is limited, and this study was undertaken at Padmaja Naidu Himalayan Zoological Park, Darjeeling, to investigate the activity budgets of a herd of seven Mishmi Takin in captivity, with emphasis on reproductive and maternal behaviours. Ethograms developed based on a literature review and preliminary observations were used to observe animals for one year. Data analysis was conducted using descriptive statistics. It was observed that the takins spend the majority of their time feeding, standing, ruminating, resting or in locomotion. Reproductive behaviours comprised less than 1% of the activity budget. The study provides preliminary data on the behaviour of the Mishmi Takin in captivity, and could be utilised by zoo management to strategize animal enrichment and welfare.

**Keywords:** Behaviour, captivity, feeding, Himalayan Caprine, locomotion, observations, Padmaja Naidu Himalayan Zoological Park, ruminating, seasonality, zoo management.

**Editor:** Tiger Sangay, Ugyen Wangchuck Institute for Forestry Research and Training, Bumthang, Bhutan. **Date of publication:** 26 February 2026 (online & print)

**Citation:** Ghosh, N., P. Gupta, J. Dey & B.S. Holeyachi (2026). Activity budgets of a zoo-housed Mishmi Takin *Budorcas taxicolor taxicolor* (Mammalia: Artiodactyla: Bovidae) herd. *Journal of Threatened Taxa* 18(2): 28406–28412. <https://doi.org/10.11609/jott.9576.18.2.28406-28412>

**Copyright:** © Ghosh et al. 2026. 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 funded by West Bengal Zoo Authority. The grant number is 104/WBZA/T-18(j)/21-22 dated 15.06.2021.

**Competing interests:** The authors declare no competing interests.

**Author details:** NABANITA GHOSH, project fellow for the project. Affiliated to Padmaja Naidu Himalayan Zoological Park while working on the project. PRANITA GUPTA is the current zoo biologist in Padmaja Naidu Himalayan Zoological Park, Darjeeling. She is in charge of writing new projects and supervising them, overlooking animal records and education outreach. Joy Dey is the zoo veterinarian in charge of animal health. Basavaraj S. Holeyachi is the ex-director and one of the supervisors of this project.

**Author contributions:** NG: methodology, data collection, data analysis, manuscript writing and editing. PG: manuscript editing. JD: partial supervision. BSH: supervision.

**Acknowledgements:** I would like to acknowledge Barkha Subba (ex-zoo biologist) for the initial conceptualization of the project, Prishka Pariyar (ex-project fellow) for collecting the ad-libitum data and making the ethogram, zookeepers for their guidance during observations and data collections, Bedan Chettri (ex-assistant librarian) for providing study and reference material from the library and Shiwangi Rai (ex-project fellow) for helping with sampling the study.



## INTRODUCTION

The Mishmi Takin *Budorcas taxicolor taxicolor*, is a large Himalayan even-toed member of the Bovidae, with three recognized subspecies: Bhutan Takin *B. t. whitei*, Grey or Sichuan Takin *B. t. tibetana*, and Golden or Shaanxi Takin *B. t. bedfordi* (Neas & Hoffmann 1987; Sharma et al. 2015). Elongated in structure with lunate horns, adult males weigh up to 350 kg and females up to 280 kg (Neas & Hoffman 1987). These generalist herbivores are primarily browsers, foraging on a wide variety of plants (Schaller et al. 1986). They occur in mountainous terrain and move in herds that typically migrate to higher elevations during summer (Schaller et al. 1986; Adkin et al. 2012). Breeding is observed in July–August, when they often inhabit higher altitudes (Allen 1940; Schaller et al. 1986; Zeng et al. 2008); the gestation period ranges 7–8 months (Neas & Hoffmann 1987).

The IUCN Red List categorizes the Takin as ‘Vulnerable’, and Wildlife (Protection) Act, 1972, identifies it as a Schedule I animal (Song et al. 2008; Sharma et al. 2015). In India, it is found in the remote hills of Mishmi in Arunachal Pradesh, most of which is not legally protected (Sharma et al. 2015). Information about its behaviour is scant in the literature, owing to the inaccessible, uneven, and rugged terrain takins occupy. Observational studies in zoo research programs have provided insights into animal habits and behaviour (Mench et al. 1997), and this study was an attempt to generate baseline behavioural data for a captive herd of Mishmi Takin at PNHZP. The activity budgets were specifically prepared based on observations made during the active daylight period, spanning from early morning to early evening hours for each herd member. Subsequently, the influence of seasonal variation were quantitatively evaluated on these activities. Reproductive behaviour of the group and maternal care of a pregnant female takin were also investigated as part of the research objective. This study hopes to provide data that can be utilised by zoo management to support effective animal welfare and maintain viable captive breeding populations.

## METHODS

Observations of captive Mishmi Takins took place at the Padmaja Naidu Himalayan Zoological Park (PNHZP), Darjeeling, India (27.050 °N, 88.261 °E) from March 2022 to May 2023. The animals were housed in three

enclosures of similar design and area. All the enclosures were outdoor yards comprising a separate feeding and drinking area, makeshift wooden platforms and in-built shelters for extreme weather conditions (Figure 1). Takin feed comprised fodder from the forest and supplementary feed from the zoo animal feed section. Supplementary feed provided to the takins, to meet the nutritional requirements, included a mixture of crushed maize, crushed wheat, gram, barley, pulses, turmeric, salt, and molasses (during winters) and was fed daily during morning hours (0900 h) by the zookeepers. The takins were fed fodder twice a day, typically around 0930 h in the morning and 1500 h in the afternoon. It comprised of a variety of plants like *Cyathea chinensis* Copel., *Artemisia vulgaris* L., *Rhaphidophora glauca* (Wall.) Schott, *Selaginella pennata* (D. Don), *Tradescantia fluminensis* Vell, *Saurauia napaulensis* DC., *Hedychium gardnerianum*, *Piper suipigua* Buch.-Ham. ex D. Don, *Pouzolzia sanguinea* (Blume) Merr., *Acer laevigatum* Wall., *Maesa chisia* D. Don, and *Leucosceptrum canum* Sm.

Initially, Male 1, Male 3, Female 1, and Female 3 were housed together. Male 2 was housed alone. Female 2 and Female 4 were housed together. After three months, Male 1 was housed with Female 2 and Female 4. Male 3, Female 1 and Female 3 were shifted to Male 2’s enclosure. Female 3 and Female 4 were transferred to a different zoo six months after the initiation of the observation period (Table 1). The decision to shift the takins and reduce the enclosures occupied from three to two was a zoo management decision pertaining to logistics.

One-hundred-and-eight hours of preliminary observations were conducted on the captive herd of seven takins in March–April 2022 (Table 1). The ad libitum data from these observations, along with data provided in the literature was used to curate an ethogram for behavioural observations (Powell et al. 2012). A total of 37 behaviours were listed under five different categories, namely active, inactive, social affiliative, social aggression, and reproductive (Table 2).

To assess activity budgets, daily behavioural observations were collected on members of the captive herd using the instantaneous scan sampling method (Altman 1974). Hourly observations at 10-minute intervals were done by the observer from an elevated position. Observations were made 5–6 days per week, for 2–3 hours each day between 0700–1700 h. For the first three months, observations of the third enclosure were performed by a zookeeper after conducting an observer reliability test (Crockett 1996).

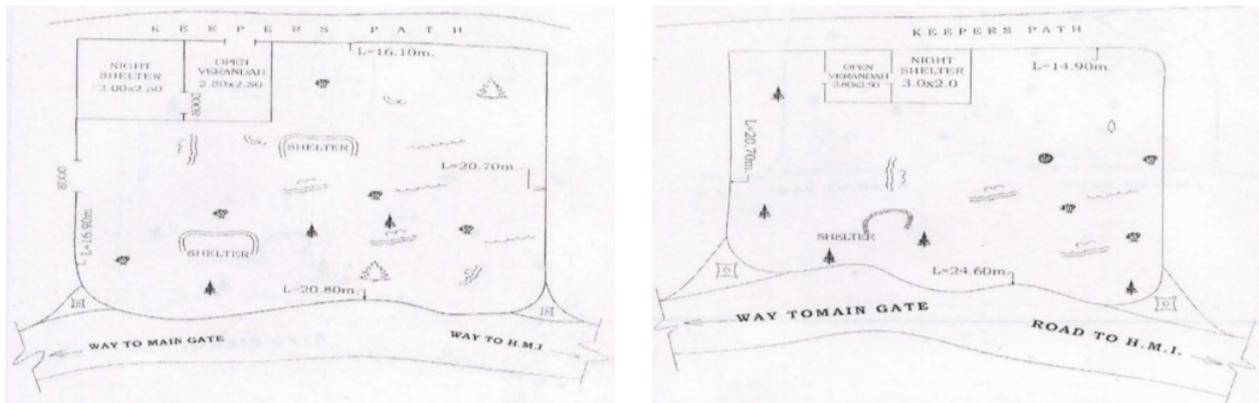


Figure 1. Takin enclosures at the Padmaja Naidu Himalayan Zoological Park.

Table 1. Mishmi Takin individuals housed at the Padmaja Naidu Himalayan Zoological Park.

	Animal	House name	Sex	Date of birth	Age as of 2023 (in years)	Stage	Dam	Sire	Date of acquisition
1.	Male 1	Danny	Male	19.iii.2016	7	Adult			20.i.2019
2.	Male 2	Rock	Male	11.ii.2016	7	Adult			20.i.2019
3.	Female 1	Claire	Female	18.iii.2016	7	Adult			20.i.2019
4.	Female 2	Ramona	Female	16.iii.2017	6	Adult			20.i.2019
5.	Female 3	Lucky	Female	29.iii.2020	3	Sub-adult	Claire	Danny	
6.	Female 4	Diana	Female	07.ii.2021	2	Calf	Ramona	Rock	
7.	Male 3	Canny	Male	25.i.2022	1	Calf	Claire	Danny	
8.	Female 5	Donna	Female	25.v.2023	0.5	Calf	Ramona	Danny	

The activity budgets of five takins (three males and two females) ranging 1–7 years old have been reported in this study. Female 2 got pregnant during the observation period and gave birth at the end of the observation period. Two female sub-adult takins (Females 3 & 4) were transferred to another zoo in the sixth month of the study period; hence, they couldn't be assessed further.

A total of 400 hours of behavioural data were collected in June 2022–May 2023, and subsequently categorised according to individual takins and seasons. Descriptive statistics were utilised to prepare activity budgets, which were represented graphically. The time that the members were out of sight has been excluded while calculating the time budgets, as the activities during that duration were not visible to the observer. The normality of the data was tested using the Shapiro-Wilk test. To examine potential differences between pregnant and non-pregnant females, the activity patterns of two adult females were compared using the Wilcoxon rank-sum test. For males, the Kruskal-Wallis test was applied to investigate potential age-related differences,

with post-hoc comparisons conducted by Bonferroni's method. Additionally, seasonal variations in activity patterns were assessed for the herd across four seasons: monsoon (June, July, August), autumn (September, October), winter (November, December, January), and summer-spring (March, April, May) using the Kruskal-Wallis test. February was excluded from the analysis to accommodate hormonal analysis conducted as part of the same study. Preliminary maternal care observations were made using ad libitum notes following Female 2's parturition in the last week of May 2023. Data compilation, sorting, and statistical analyses were done in MS Excel and R.

## RESULTS

The overall activity budgets (Figure 2) of the zoo-housed Mishmi Takins showed that they spent 54.6% of their time in active behaviour, 42.2% in inactive behaviour, 2.4% in social affiliation, and 0.3% being socially aggressive and 0.3% of reproductive acts. Active

**Table 2. Ethogram for behaviour observation of Mishmi Takin.**

Behavior	Description
<b>Inactive</b>	
Ruminating	Movement of the mouth similar to chewing
Standing rest	Standing with its head lowered, facing the ground, or positioned straight
Sternal rest	Lying on the stomach, with head lowered or near ground level
Lateral rest	Completely resting on one side of its body, with head resting on the ground or on its back
Alert position	Being attentive with eyes open and fixated on the source
Bipedal stand	Standing on its hind limbs with forelimbs resting on the enclosure wall
<b>Active</b>	
Locomotion	Movement for a minimum of two steps
Foraging	Searching and sniffing foliage in the enclosure
Feeding	Actual consumption of food items and drinking water
Maintenance	Scratching the body with the hoof, licking the fur, rubbing the body against an erect object in the enclosure, shaking the head or entire body, self-nibbling, slowly rubbing the horns on an object without any force
Object manipulation	Investigates and moves around an object in the enclosure
<b>Social aggression</b>	
Head down	Displaying a lower head while drawing their rear legs forward, and arching their back
Head bud	Intertwining horns with force
Object horning	Thrashing vegetation, gouging large tree trunks with horns, and aggressively horning and manipulating inanimate objects inside the enclosures
Head shake	Shaking its head in the direction of another individual aggressively
Dominance posture	Standing rest position
Chasing	Pursuing another individual at a rapid pace
Submissive	Moving away from a charging individual
<b>Social affiliation</b>	
Social play	Juveniles running, jumping and head-butting each other
Contact with conspecifics	Face sniffing, nuzzling, licking and nudging
Snorting	Expelling air through the nose when threatened
Bellow	Sound coming from an open mouth as the call is produced deep in the throat
Maternal care	Suckling and protecting the calf
Facilitate nursing	Giving a call to the calf for nursing and allowing it to suckle
Allo-parenting	Non-maternal infant care, such as licking, protecting, nuzzling, and guiding by other members of the herd
<b>Reproductive</b>	
Flehmen	Sniffing the anogenital area, or urine, with head upright and nostrils flared
Mounting	Males attempting to mount females by throwing their forelegs onto the back of the females
Copulating	Occurs while mounting and is identified by agitated movements of the hind region
Following conspecific	Following the conspecific, especially after scent sampling
<b>Others</b>	Yawning, sneezing, defecating, and urinating
<b>Out of sight</b>	An animal cannot be observed from the data collector's location

behaviours entailed feeding (79.8%), locomotion (14%), maintenance (3.6%), and foraging (2.6%). Inactive behaviours included standing (43.14%), ruminating (31.2%), resting in sternal position (21.67%), resting in lateral position (1.52%), bipedal stands (0.96%), and alert (0.74%). In social aggression, there were 10 instances of head butt, six instances of chasing, one act of dominance and three acts of submission. Social affiliative behaviours included eight instances of social play, six instances of contact with conspecific, 18 instances of maternal care and two instances of female nursing. Vocalisations that were also included in social affiliation included 145 bellows and four snorts by the individuals. Reproductive behaviour included five instances of scent sampling, two instances of mounting and 15 instances of following.

Since feeding, resting, ruminating, and locomotion occupied the majority of the behaviours displayed, they were assessed further to examine whether these activities were affected by changing weather conditions (Figures 3 & 4). In the overall activity budget for the herd, feeding ( $\chi^2 = 17.85$ ,  $df = 3$ ,  $p < 0.01$ ) and resting ( $\chi^2 = 9.9$ ,  $df = 3$ ,  $p = 0.01$ ) showed a statistically significant difference across the four seasons. On assessing the time budgets of the members, comparatively, monsoons saw the highest percentage of time spent in feeding (females: 49% & males: 55%), followed by winters (females: 46.64% & males: 47.95%). This trend took a dip in autumn (females: 44% & males: 37%) and was the lowest in spring-summer (females: 40.97% & males: 39.42%). Herd members rested the highest percentage of time in spring-summer (females: 32.5% & males: 36%), followed by autumn (females: 30% & males: 31.7%). Monsoon saw a dip in resting (females: 26% & males: 31.4%), as did winters (females: 26% & males: 26.7%).

Wilcoxon rank-sum tests were conducted to compare the activity patterns (in percentage) between Female 1 and Female 2. Significant differences were observed in resting ( $W = 0$ ,  $p = 0.029$ ) and locomotion ( $W = 16$ ,  $p = 0.029$ ), indicating that the two females differed in the percentage of time spent on these activities. On examining their activity patterns, it was found that time utilised in resting was higher in Female 2 (33%) compared to Female 1 (24%), and time spent in locomotion was higher in Female 1 (14%) compared to Female 2 (6.6%). However, no significant differences were found for feeding ( $W = 15$ ,  $p = 0.057$ ) or ruminating ( $W = 6$ ,  $p = 0.68$ ).

For males, there were no significant differences among the three individuals except for locomotion patterns. The Kruskal-Wallis test revealed a statistically

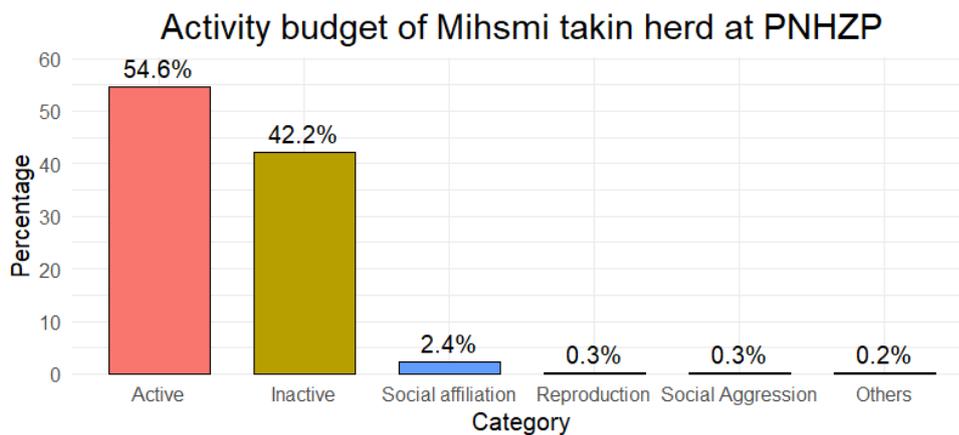


Figure 2. Activity budget of Mishmi Takin herd at the Padmaja Naidu Himalayan Zoological Park for one year.

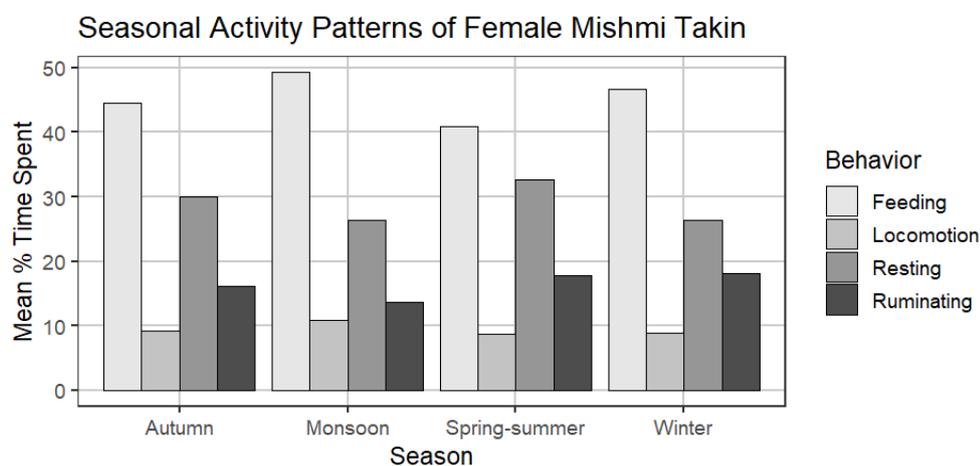


Figure 3. Selected behaviours for female takins at the Padmaja Naidu Himalayan Zoological Park.

significant difference in locomotion percentages among the three males ( $\chi^2 = 6.5$ ,  $df = 2$ ,  $p = 0.03$ ). However, post-hoc pairwise comparisons using Dunn's test with Bonferroni adjustment found no statistically significant differences between any pairs of males (all adjusted  $p$ -values  $> 0.05$ ). These results suggest that, while there maybe trends in locomotion activity in males, no specific pairwise differences were statistically robust after correcting for multiple comparisons.

Female 2 gave birth in the last week of May. After birthing, the mother immediately started licking the infant and kept guard. It sniffed the newborn takin from time to time. The infant stood up after almost 45 min and started suckling. It would spend time either sleeping or suckling. The mother was always in close vicinity of the newborn. These behaviours were prominent for 3–4 days after the takin's birth and began declining after a week.

## DISCUSSION

The activity budgets of the captive herd of Mishmi Takin were assessed in this study at PNHZP. The study covers active daylight time observations. The individuals spent most of their time feeding, ruminating, resting and in locomotion. The effect of different seasons was also assessed and it was seen that feeding peaked during monsoons in both female and male members and females spent more time feeding as compared to males. This is in accordance with the findings of its wild counterpart, the Golden Takin, that spent 60–80% of their time feeding, resting and walking (Zeng & Song 2001) as well as its family group member, Bison *Bison bison*, in which lying, standing and feeding dominated 87.9% of the time budgets (Robitaille & Prescott 1993). Seasonal variations in feeding patterns can be attributed to availability of quality forage at different altitudes. Powell et al. (2013)

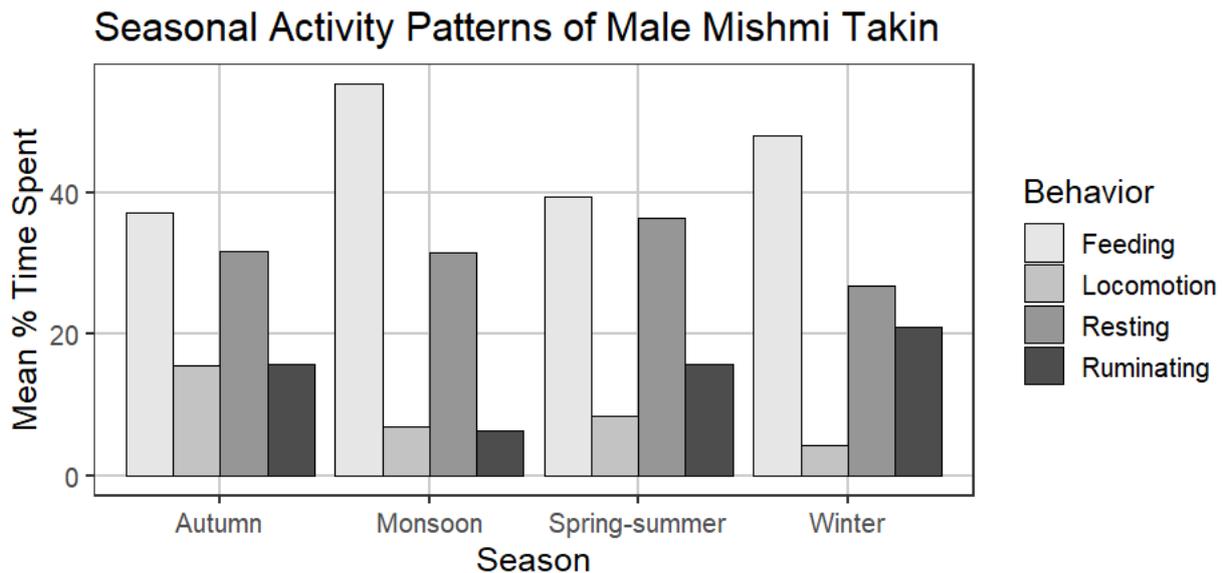


Figure 4. Selected behaviours for male takins at the Padmaja Naidu Himalayan Zoological Park.

reported that the captive takin herd in The Wilds in Cumberland, Ohio, spent 35% of their time feeding with females, comparatively spending more time than males in winter. Studies on activity budgets of the Bovidae family member, the Common Bushbuck *Tragelaphus scriptus decula*, revealed that they spent most of their time feeding, which was comparatively higher during the wet seasons as compared to the dry seasons (Bayih & Yihune 2018). Previous research on seasonal feeding patterns of another bovid family member, Bison *Bison bison*, has reported that diet quality and preferences peak from June to September in colder or wetter regions due to high abundance of quality forage (Craine 2021). In females, it was observed that the pregnant female (Female 2) spent comparatively more time resting than the non-pregnant female (Female 1). This could be attributed to a prepartum behavioural change, including increased transition from lying to standing or vice versa, among other tendencies such as seeking isolation, which facilitates a calm parturition and creates an optimal environment for birthing (Rørvang et al. 2018; Nervard et al. 2022).

Reproductive behaviour displayed by the takin herd in PNHZP constituted 0.3% of the annual activity budget, reflecting the limited temporal occurrence of reproductive activities outside the breeding season. Takins are seasonal breeders (Yoshida et al. 2024). The lack of display of reproductive behaviours could be attributed to the fact that these acts are only prominent during the breeding season. During the study period, 22 instances of such behaviours were recorded,

reflecting findings by Adkin et al. (2012), who observed that reproductive behaviours accounted for 0.01% to 1.1% of the time budget during a 2.5-year study of Sichuan Takin at Lincoln Park Zoo, Chicago. Flehmen is a common behaviour observed in bovids, such as Bison, characterised by lip curling while sniffing the vulva or urine of a female. Mounting in bovids, including Bison, is often the initial step of the copulatory sequence, typically followed by soft panting. However, this sequence is rarely completed as females often step away when the act begins (Estes 1974). In the observations conducted at PNHZP, these behaviours were exclusively performed by Male 1 and occasionally by Male 2. None of the females exhibited such behaviours during the study period.

Social aggression in the herd accounted for a small portion of the activity budget (0.3%), with only 20 instances recorded over a one-year period between Male 1 and adult female (Female 1) or juvenile male (Male 3). The low counts of aggression could be attributed to the captive conditions that are exceedingly different from wild conditions. Additionally, the placement of the two adult males into different enclosures could also lead to less aggressive counts. Aggressive behaviours are typically observed in bulls or bison during periods of male-male competition, often as part of dominance establishment. Serious fights are highly frequent, with passive avoidance frequently substituting physical confrontations, particularly during the rut (Estes 1974). In the current study, social affiliation, including vocalisations, made up 2.4% of the takins' activity budget. Similarly, in the study of the captive takin

herd at The Wilds, social behaviours were observed to constitute a very small percentage of the activity budget (<6%) (Powell et al. 2013).

This study at PNHZP had several limitations. Observations of the study sample were limited to behaviour in captive conditions. The sample size decreased from seven to five midway through the observation period due to the transfer of two sub-adult females. Additionally, the members were housed in separate enclosures, which prevented the exploration of collective herd behaviour, such as social hierarchical dynamics. The lactating and non-lactating females were also kept in separate enclosures, resulting in comparisons being divided by space and time. Furthermore, the maternal behaviour described in this study was based on ad libitum observation, limiting the depth of behavioural analysis. Future studies could focus on a more systematic investigation of mother-infant interactions to better understand this aspect of takin behaviour. The results of this study provide a preliminary understanding of the activity budgets of takins in captivity. Future research could further explore aspects such as diet preferences, enclosure utilisation, and social dynamics to create a more comprehensive framework for enrichment and welfare planning.

## REFERENCES

- Adkin, A., D. Bernier & R.M. Santymire (2012). Characterizing the behavior and reproductive biology of zoo-housed Sichuan Takin *Budorcas taxicolor tibetana* using non-invasive techniques. *Theriogenology* 78(3): 483–494. <https://doi.org/10.1016/j.theriogenology.2012.02.006>
- Allen, G.M. (1940). The mammals of China and Mongolia. *American Museum of Natural History, New York* 2: 621–1350.
- Altmann, J. (1974). Observational study of behaviour: sampling methods. *Behaviour* 49: 227–67. <https://doi.org/10.1163/156853974X00534>
- Bayih, W. & M. Yihune (2018). Population status, feeding ecology and activity pattern of Common Bushbuck *Tragelaphus scriptus decula* in Sekele Mariam Forest, West Gojjam, Ethiopia. *Journal of Ecology and The Natural Environment* 10(5): 69–79. <https://doi.org/10.5897/JENE2018.0689>
- Crockett, C.M. (1996). Data collection in the zoo setting, emphasizing behavior, pp. 545–546. In: Kleiman, D. (ed.). *Wild Mammals in Captivity*. University of Chicago Press, Chicago.
- Craine, J.M. (2021). Seasonal patterns of bison diet across climate gradients in North America. *Scientific Reports* 11(1): 6829. <https://doi.org/10.1038/s41598-021-86260-9>
- Estes, R.D. (1974). Social organization of the African Bovidae. The behaviour of ungulates and its relation to management 1: 166–205.
- Lovari, S. & M. Apollonio (1994). On the rutting of the Himalayan Goral *Nemorhaedus goral*. *Journal of Ethology* 12: 25–34. <https://doi.org/10.1007/BF02350077>
- Mench, J.A. & G.J. Mason (1997). Behavior, pp. 127–142. In: Appleby, M.C. & B.O. Hughes (eds.). *Animal Welfare*. CAB International, Wallingford, CT.
- Neas, J.F. & R.S. Hoffmann (1987). *Budorcas taxicolor*. *Mammalian Species* No. 277. pp.1–7. <https://doi.org/10.2307/3503907>
- Nevard, R.P., S.D. Pant, J.C. Broster, S.T. Norman & C.P. Stephen (2022). Maternal behavior in beef cattle: The physiology, assessment and future directions—a review. *Veterinary Sciences* 10(1): 10. <https://doi.org/10.3390/vetsci10010010>
- Powell, D., B. Speeg, S. Li, E. Blumer & W. McShea (2013). An ethogram and activity budget of captive Sichuan Takin *Budorcas taxicolor tibetana* with comparisons to other Bovidae. *Mammalia* 77(4): 391–401. <https://doi.org/10.1515/mammalia-2012-0076>
- Robitaille, J.F. & J. Prescott (1993). Use of space and activity budgets in relation to age and social status in a captive herd of American Bison, *Bison bison*. *Zoo biology* 12(4): 367–379. <https://doi.org/10.1002/zoo.1430120407>
- Rørvang, M.V., B.L. Nielsen, M.S. Herskin & M.B. Jensen (2018). Prepartum maternal behaviour of domesticated cattle: a comparison with managed, feral, and wild ungulates. *Frontiers in Veterinary Science* 5: 45. <https://doi.org/10.3389/fvets.2018.00045>
- Reinhardt, V. (1985). Courtship behaviors among Musk-Ox males kept in confinement. *Zoo Biology* 4: 295–300. <https://doi.org/10.1002/zoo.1430040311>
- Song, Y.L., A.T. Smith & J. MacKinnon (2008). *Budorcas taxicolor*. The IUCN Red List of Threatened Species 2008: e.T3160A9643719. <https://doi.org/10.2305/IUCN.UK.2008.RLTS.T3160A9643719.en>. Accessed on 12 February 2026.
- Schaller, G.B., W. Pan Teng, Z. Qin, X.H. Wang & Shen'Heming (1986). Feeding behavior of Sichuan Takin *Budorcas taxicolor*. *Mammalia* 50: 311–322. <https://doi.org/10.1515/mamm.1986.50.3.311>
- Sharma, D., T. Wangchuk, G.S. Rawat & A.J.T. Johnsingh (2015). Takin, *Budorcas taxicolor*. In: Johnsingh, A.J.T. & N. Manjrekar (eds.). *Mammals of South Asia, Vol. 2*; Chapter 5. Orient BlackSwan, 766 pp.
- Yoshida, T., Y. Shimokawa, M. Ohta, M. Takayanagi & S. Kusuda (2024). Reproductive seasonality, estrous cycle, pregnancy, and the recurrence of postpartum estrus based on long-term profiles of fecal sex steroid hormone metabolites regarding zoo-housed female Golden Takins *Budorcas taxicolor bedfordi*. *Animals* 14(4): 571. <https://doi.org/10.3390/ani14040571>
- Zeng, Z.G., A.K. Skidmore, Y.L. Song, T.J. Wang & H.S. Gong (2008). Seasonal altitudinal movements of golden takin in the Qinling Mountains of China. *Journal Wildlife Management* 72: 611–617. <https://doi.org/10.2193/2007-197>
- Zeng Z. G., & Y.L. Song (2001). Daily activity rhythm and time budget of golden takin in spring and summer. *Acta Theriologica Sinica* 21(7): 13.



Mr. Jatishwor Singh Irungbam, Biology Centre CAS, Branišovská, Czech Republic.  
Dr. Ian J. Kitching, Natural History Museum, Cromwell Road, UK  
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  
Mr. 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. Topiltzin Contreras MacBeath, Universidad Autónoma del estado de Morelos, México  
Dr. Heok Hee Ng, National University of Singapore, Science Drive, Singapore  
Dr. Rajeesh 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 Vyasa, 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, Kalinga Foundation, Agumbe, 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, SACON, 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. P.A. Azeez, Coimbatore, Tamil Nadu, India

#### 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, SACON, 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, SACON, Anaikatty P.O., Coimbatore, Tamil Nadu, India  
Dr. Nishith Dharaiya, 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, Sri S. Ramasamy Naidu Memorial College, Virudhunagar, 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 2021–2023

Due to paucity of space, the list of reviewers for 2021–2023 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,  
3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore,  
Tamil Nadu 641006, India  
ravi@threatenedtaxa.org & ravi@zooreach.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)

February 2026 | Vol. 18 | No. 2 | Pages: 28262–28454

Date of Publication: 26 February 2026 (Online &amp; Print)

DOI: 10.11609/jott.2026.18.2.28262-28454

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

## Articles

**Floristic composition and conservation significance of vascular plants in Kalatop-Khajjiar Wildlife Sanctuary, Himachal Pradesh, India**

– Sumit, Gulshan Kumar, Sumit Singh, Kanwaljeet Singh, Taslima Sheikh, P. Vishal Ahuja & Arvind Kumar, Pp. 28263–28274

**Assessing the tree diversity along the Dudhganga River in Kolhapur District of Maharashtra, India**

– Sachin Chavan & Rajaram Gurav, Pp. 28275–28286

**Flower bud growth, mortality rate, and population structure of *Sapria himalayana* Griffith f. *albavinosa* Banziger & Hansen (Rafflesiaceae) in a subtropical forest, northeastern India**

– K. Shamran Maring & Athokpam Pinokiyo, Pp. 28287–28295

**Comparing three sampling techniques for surveying and monitoring arthropods in Moroccan agroecosystems**

– Hanae El Harche, Pp. 28296–28306

**Community structure of Lepidoptera in Nantu-Boliohuto Wildlife Reserve, Sulawesi, Indonesia**

– Chairunnisah J. Lamangantjo, Marini Susanti Hamidun, Sasmianti & Dewi Wahyuni K. Baderan, Pp. 28307–28316

**Foraging niche segregation among woodpeckers in the oak-pine forest of Kumaon Himalaya, Uttarakhand, India**

– Rafat Jahan, Satish Kumar & Kaleem Ahmed, Pp. 28317–28328

**Local knowledge, attitudes, and perceptions of ecosystem services and disservices provided by the Painted Stork *Mycteria leucocephala* Pennant, 1769 (Aves: Ciconiidae) in northern India: insights for conservation**

– Yashmita-Ulman & Manoj Singh, Pp. 28329–28342

## Communications

**Analysis revealed minuscule DNA sequence data availability for Indian marine macroalgal diversity**

– Digvijay Singh Yadav, Aswin Alichen & Vaibhav A. Mantri, Pp. 28343–28349

**Checklist of rust fungi of the Nuratau Nature Reserve, Uzbekistan**

– I.M. Mustafae, M.M. Iminova, I.Z. Ortiqov, S.A. Teshaboyeva & N.Q. Iskanov, Pp. 28350–28357

**Checklist of moths (Lepidoptera: Heterocera) from the campus of University of North Bengal, Siliguri, India**

– Abhirup Saha, Ratnadeep Sarkar, Rujas Yonle, Subhajit Das, Prapti Das & Dhiraj Saha, Pp. 28358–28369

**Vulture diversity and long-term trends in the Ranikhet region, Kumaon Himalaya, Uttarakhand, India**

– Mirza Altaf Baig, Nazneen Zehra & Jamal Ahmad Khan, Pp. 28370–28377

**Nesting dynamics of Red-wattled Lapwing *Vanellus indicus* Boddaert, 1783 in urban and rural regions of Indore, India**

– Kratika Patidar & Vipul Keerti Sharma, Pp. 28378–28386

**Assessing avian diversity and conservation status in Dhamapur Lake World Heritage Irrigation Structure, Sindhudurg, Maharashtra, India**

– Yogesh Koli, Pravin Sawant & Mayuri Chavan, Pp. 28387–28398

**Population status and habitat use of Indian Grey Wolf *Canis lupus pallipes* in Pench Tiger Reserve, Madhya Pradesh, India**

– Iqra Rabbani & Sharad Kumar, Pp. 28399–28405

**Activity budgets of a zoo-housed Mishmi Takin *Budorcas taxicolor taxicolor* (Mammalia: Artiodactyla: Bovidae) herd**

– Nabanita Ghosh, Pranita Gupta, Joy Dey & Basavaraj S. Holeyachi, Pp. 28406–28412

**Extended distribution of *Nymphoides peltata* (S.G.Gmel.) Kuntze (Menyanthaceae) in Manipur, India**

– Aahen Chanu Waikhom & Bimolkumar Singh Sadokpam, Pp. 28413–28418

## Short Communications

***Impatiens chamchumroonii* (Balsaminaceae), a new record for the flora of Vietnam**

– Cuong Huu Nguyen, Diep Quang Dinh, Dinh Duc Nguyen & Keoudone Souvannakhommane, Pp. 28419–28423

**Occurrence of the wood fern *Arachniodes sledgei* Fraser-Jenk. (Pteridophyta: Dryopteridaceae) in the northern Western Ghats, India**

– Sachin Patil & Jagannath Patil, Pp. 28424–28427

## Notes

**A note on the Petal-less Caper *Maerua apetala* (B. Heyne ex Roth) Jacobs (Capparaceae)**

– Shamsudheen Abdul Kader & Bagavathy Parthipan, Pp. 28428–28429

**Record of *Euploea mulciber* (Cramer, [1777]) (Lepidoptera: Nymphalidae) in Delhi, India: evidence of range extension in a restored urban ecosystem**

– Aisha Sultana, Mohammad Shah Hussain & Balwinder Kaur, Pp. 28430–28432

**Hump-nosed Pit Viper *Hypnale hypnale* feeding on an Allapalli Skink *Eutropis allapallensis* in Karwar, India**

– Nonita Rana, Karthy Shivapushanam, S.J.D. Frank & Govindan Veeraswami Gopi, Pp. 28433–28435

**Sighting of vagrant Red-backed Shrike *Lanius collurio* in the coastal areas of Thoothukudi, Tamil Nadu, India**

– Kishore Muthu, Anand Shibu & Santhanakrishnan Babu, Pp. 28436–28437

**First record of the Diamond Dove *Geopelia cuneata*, an Australian endemic, in Sikhna Jwhlwao National Park, Assam, India**

– Bibhash Sarkar, Bijay Basfore, Leons Mathew Abraham & Anjana Singha Naorem, Pp. 28438–28440

**First photographic record of the Rusty-spotted Cat *Prionailurus rubiginosus* (I. Geoffroy Saint-Hilaire, 1831) (Mammalia: Carnivora: Felidae) in Kuldiha Wildlife Sanctuary, Odisha, India**

– Tarun Singh, Harshvardhan Singh Rathore, N. Abhin, Subhalaxmi Muduli, Yash Deshpande, Vivek Sarkar, Diganta Sovan Chand, Samrat Gowda, Prakash C. Gogineni, Manoj V. Nair, Bivash Pandav & Samrat Mondol, Pp. 28441–28443

**First photographic evidence of the Rusty-spotted Cat *Prionailurus rubiginosus* (I. Geoffroy Saint-Hilaire, 1831) (Mammalia: Carnivora: Felidae) in Kapilash Wildlife Sanctuary, Odisha, India**

– Alok Kumar Naik, Sumit Kumar Kar, Shyama Bharati, Ashit Chakraborty & Ashis Kumar Das, Pp. 28444–28446

**Record of a Tiger *Panthera tigris* (Linnaeus, 1758) (Mammalia: Carnivora: Felidae) in Saptari District of eastern Nepal: implications for conservation and habitat connectivity**

– Gobinda Prasad Pokharel, Chiranjibi Prasad Pokharel, Ashish Gurung, Bishnu Singh Thakuri, Ambika Prasad Khatiwada, Aastha Joshi, Birendra Gautam, Mithilesh Mahato, Naresh Subedi & Madhu Chetri, Pp. 28447–28450

## Book Review

**At the Point of No Return? – Reading Pankaj Sekhsaria's Island on Edge: The Great Nicobar Crisis**

– Himangshu Kalita, Pp. 28451–28454

Publisher &amp; Host



Threatened Taxa