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SHORT COMMUNICATION

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Rarest of the rare: People's awareness and perceptions about the woolly flying squirrel in Uttarakhand Himalaya, Northern India

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Abstract

The Western woolly flying squirrel (*Eupetaurus cinereus*) was rediscovered after seven decades of presumed extinction and remains one of the least studied mammalian species. This study was conducted in the Uttarkashi district of Uttarakhand, India, and aimed to assess local communities' awareness of the species and their potential role in its conservation. From August 2023 to January 2024, we conducted surveys in four villages, interviewing 65 individuals from Pahadi and Nepali communities. Results revealed limited familiarity with the squirrel, highlighting the need for targeted conservation education. Despite extensive camera trap surveys, conclusive evidence of the species' presence was not found, prompting concerns about its population status in the study area. Our findings show the importance of further research and community engagement for effective conservation. This study emphasises the need to align conservation efforts with community involvement for sustainable outcomes.

KEYWORDS

awareness, camera trap, elusive, flying squirrel, least studied, rediscovered, Uttarkashi

Plain language summary

The Western woolly flying squirrel (*Eupetaurus cinereus*), once presumed extinct, was rediscovered after seven decades and remains one of the least studied mammals. The species was recorded in Uttarkashi district, Uttarakhand, India, in 2019. Our study aimed to assess local awareness of the squirrel in Uttarkashi. We conducted interviews with residents from four villages in the district between August 2023 and January 2024. Our findings revealed that local people have limited familiarity with the squirrel, suggesting the need for targeted education regarding the species and its conservation. We also conducted camera trap surveys to document the species from the region. However, despite these efforts, we failed to record any sightings, raising concerns about the population status of the squirrel in the study area. We recommend further research and community engagement to work towards the effective conservation of the species. This study emphasises the importance of aligning conservation efforts with community involvement.

1 | INTRODUCTION

The Western woolly flying squirrel (*Eupetaurus cinereus*) holds a paradoxical distinction: listed as 'Endangered' by the IUCN (Krishna & Ferguson, 2021; Pal et al., 2019; Sheikh & Molur, 2005), it remained presumed extinct for seven decades until its dramatic rediscovery in 1994 (Zahler, 1996). Despite its endangered status, knowledge of its current distribution remains frustratingly limited. This scarcity stems from the species' inherent rarity, with information gleaned primarily from museum specimens and sporadic sightings in isolated locations such as Diamer (Dinets, 2011; Zahler & Woods, 1997), Fairy Meadow Valley (Dinets, 2011), Shounthar Valley (Qamar et al., 2012) and even Gilgit city (Din et al., 2015). The Western woolly flying squirrel (hereafter referred to as Western WFS) was the sole species under the genus *Eupetaurus* until 2021, when a genetic study revealed the presence of two additional species, *Eupetaurus nivamons* and *Eupetaurus tibetensis*, from Yunnan and Xizang (Tibet), respectively (Jackson et al., 2022; Jamtsho et al., 2022).

In India, the earliest record of the Western WFS mentions its presence in Sikkim (Agrawal & Chakraborty, 1970). However, the validity of this sighting remains questionable due to a lack of supporting evidence and the subsequent absence of observations in the area (Zahler, 2010). Despite Zahler's (2010) recommendation to discount its presence in India, Northern India (specifically Kashmir) was included in its possible distribution (Koprowski et al., 2016). For decades, the species remained unrecorded in India until its first confirmed sighting in 2018 within the Harsil Valley of Uttarakhand's Bhagirathi Basin (Pal et al., 2019, 2020). The life of the Western WFS is shrouded in mystery. Except for a few observations on its dietary habits and ecology (Zahler, 2003), little is known about the species. This limited understanding, even concerning its distribution range, hinders effective conservation efforts.

This paper explores the insights of local communities concerning the Western WFS in the Uttarkashi region, where the species was previously captured on camera. The study aims to sensitise local communities and recognise them as key stakeholders in the conservation of this enigmatic animal. The research was part of the project 'Search for the Rocky Glider: Assessing the distribution of *Eupetaurus cinereus* in the Uttarakhand Himalaya, India', supported by the Mohamed bin Zayed Species Conservation Fund.

Practitioner points

- Local communities know little about the Western woolly flying squirrel (Western WFS), so conservation awareness programmes are needed.
- Camera traps failed to capture the Western WFS, but this does not confirm its absence. Habitat changes due to climate change might be contributing to its scarcity.
- Further research is needed to understand the Western WFS population status, habitat requirements and the impacts of climate change.

2 | MATERIALS AND METHODS

The study was conducted between August 2023 and January 2024 in Uttarkashi district, located in the northern part of the Indian state of Uttarakhand. The research focused on four villages: Agoda, Gangnani, Dharali and Mukhba, all situated within the buffer zone of Gangotri National Park. Specifically, Agoda is in the buffer of the Barahat Range of the Uttarkashi Forest Division. The selection of these villages was based on the recorded presence of the WFS in the Bhagirathi basin (Pal et al., 2019, 2020).

During the study period, a total of 65 individuals from the Pahadi and Nepali communities residing near the fringe areas of the Western WFS habitat were interviewed. These participants included villagers, herders (Bakarwhals), mountaineering and hiking tour operators, trekking guides and people who work as manual labourers (see Table S1). The selection criteria focused on individuals who regularly venture to high altitudes as part of their work or daily life, including those who venture out at night, given the nocturnal nature of the Western WFS. The interviews were conducted using a semistructured questionnaire (Supporting Information S1: Appendix S1) designed to gather information on the respondents' socioeconomics, knowledge and awareness of the Western WFS, as well as their personal observations of the species. In addition to the interviews, we conducted camera trap surveys for 10 months (April 2023 to January 2024) to document the presence of the Western WFS in the region. We deployed 15 camera traps (10 Browning Strike Force Pro DCL and 5 Cuddeback C1) at elevations above 3200 m above sea level (msl), covering a total of 3975 camera trap nights. These traps were placed at the base of Srikant, a peak in the Harsil area of Uttarkashi, in potential habitats where the Western WFS had been recorded earlier by Pal et al. (2019). The camera traps were set at a height of about 1.5–2 ft from the ground and were secured using rocks and wooden sticks.

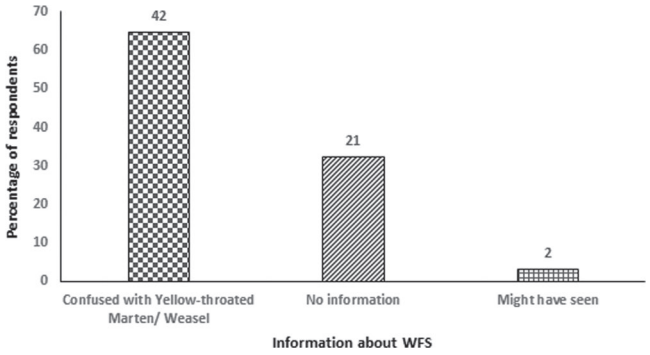

FIGURE 1 Representation of awareness of the Western WFS among respondents (on the top of the bars is the '*n*' value).

3 | RESULTS AND DISCUSSION

3.1 | What do people know about the Western WFS?

The findings revealed a concerning lack of awareness about the Western WFS among the surveyed individuals. A majority of respondents (96%) indicated no prior knowledge of the species. When shown an image of the Western WFS, a significant number of participants ($n = 42$; 65%) misidentified it as other, more familiar animals, primarily the Yellow-throated Marten and Mountain Weasel (Figure 1). This confusion likely arises from the similar body size shared by these species and the higher prevalence of the Marten and Weasel in the region. Two respondents from Dharali, a tour operator and a mountaineer, mentioned that they might have seen the species at high altitudes during their treks, but they were uncertain about their observations.

3.2 | Limited local awareness and the need for education

The limited knowledge of the Western WFS among local communities highlights the need for targeted conservation education initiatives. Such programs should aim to raise awareness about this species' unique characteristics and endangered status that differentiate it from similar animals. By engaging local communities in conservation efforts, we can foster a sense of stewardship towards this critically endangered inhabitant of the Himalayas.

3.3 | Uncaptured on camera traps and potential habitat threats

Despite deploying camera traps exclusively to track the Western WFS for a period of 10 months (April 2023 to January 2024) in areas with previous sightings, the species eluded capture during our study (Pal et al., 2019, 2020). Research suggests the species prefers rocky terrain interspersed with coniferous trees and even utilises open, treeless areas within sensitive ecosystems (Pal et al., 2019; Zahler & Karim, 1999). This raises concern, as climate change in these high-altitude environments is altering the very fabric of the landscape, and this could impact the squirrel's habitat suitability. While further investigation is essential, the lack of captures in our camera trap study does not necessarily confirm its absence in the area or population decline. However, it is a cause for concern, especially considering the potential impacts of climate change on the WFS's habitat. Therefore, continued research and conservation efforts are urgently needed to better understand and mitigate these potential threats.

3.4 | Follow-up steps for the conservation of the WFS

Further research should focus on evaluating the status of WFS populations, with a particular focus on identifying large populations that can be studied and monitored. This includes investigating the species' specific ecological requirements, potential dispersal limitations and the impact of climate change on its habitat suitability. Additionally, engaging local communities through targeted conservation education programs is crucial. Raising awareness about the species' unique characteristics and endangered status while also educating locals on how to differentiate it from similar animals can foster a sense of stewardship and encourage their participation in conservation efforts.

Studies suggest a potential overlap between the regions where *Shilajit* is found in the Himalayas and the WFS distribution (Pal et al., 2019; Qamar et al., 2012; Zahler & Karim, 1999). *Shilajit* is a complex, naturally occurring substance found in the high mountain ranges of Asia. It originates as a humic material and is composed of organic matter, including plant and animal debris, along with inorganic minerals. The specific composition of *Shilajit* varies depending on geographic location and environmental factors, such as temperature. While *Shilajit* is uncommon in the study area, personal observations by Pal et al. (2019) suggest its presence in locations where a WFS was detected. This potential spatial overlap warrants further investigation. We propose deploying camera traps in additional *Shilajit*-containing areas throughout the Indian Himalayas to assess the distribution and potential resource utilisation of the WFS. This noninvasive method offers a valuable tool for further research.

Unlocking the secrets of the WFS requires a coordinated, multidisciplinary approach, combining ecological research, community engagement and conservation action. By deepening our understanding of its current status, ecological niche and the threats it faces, we can develop effective strategies to ensure its survival amidst a changing climate. Such efforts will not only contribute to the

preservation of a unique species but also safeguard the integrity of the fragile Himalayan ecosystem, of which it is an integral part.

3.5 | Limitations of the present study

Our research relied on a relatively small sample of 65 individuals, potentially limiting the generalisability of findings to the broader community. Additionally, the entire study spanned 10 months, which may not have been sufficient to capture seasonal variations in sightings or community perspectives. Furthermore, we deployed only 15 camera traps, which might have limited our ability to comprehensively survey the potential habitat of the Western WFS. Given the limited resources available, securing a larger number of camera traps proved challenging. Recognising these limitations encourages further research with larger sample sizes, longer durations and increased camera trap deployment to comprehensively understand the dynamics surrounding the Western WFS and the community engagement involved in its conservation. By explicitly addressing these limitations, we acknowledge the need for continued investigation and highlight the valuable foundation laid by this initial study.

4 | CONCLUSION

This study underscores the critical need for a multidisciplinary approach to Western WFS conservation, combining ecological research, community engagement and effective action. Understanding its current status, ecological niche, and threats remains crucial for ensuring its survival in the face of a changing climate. This approach would help preserve this unique species while also protecting the integrity of the fragile Himalayan ecosystem.

AUTHOR CONTRIBUTIONS

Hiranmoy Chetia: Formal analysis; funding acquisition; investigation; methodology; project administration; software; writing—original draft. **Murali K. Chatakonda**: Conceptualisation; supervision; writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data are not publicly available due to their containing information that could compromise the privacy of research participants.

ETHICS STATEMENT

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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