Search for the Rocky Glider: Assessing the distribution of *Eupetaurus cinereus* in the Uttarakhand Himalaya, India

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Technical Research Report

Search for the Rocky Glider: Assessing the distribution of *Eupetaurus cinereus* in the Uttarakhand Himalaya, India

صندوق محمد بن زايد
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Preface

The work reported in this final technical report is the outcome of the study conducted between April 2023-April 2024 under the project titled “Search for the Rocky Glider: Assessing the distribution of *Eupetaurus cinereus* in the Uttarakhand Himalaya, India” funded by the MBZ Species Conservation Fund. The present study was conducted in the district of Uttarkashi in the state of Indian state of Uttarakhand.

This report explains the distribution, threats and the need for a targeted conservation plan for the species.

The entire study is recorded in this report is divided into eight chapters. *Chapter-1*:Introduction provide general information about the Woolly Flying Squirrel *Chapter-2*:Study area, study area. *Chapter-3*:Objective and Methods and it explains about the objectives of the study and methods that were used for carrying out the objectives. *Chapter-4*:Results, this section explains about the results of all the objectives. *Chapter-5*:Discussion explains about the discussion on the results of the objectives. *Chapter-6*: provides Conclusion amd recommendations of the project

The results obtained during this study have been meticulously analysed and the implications have recorded in relation to the animal category under the study for its conservation and habitat management.

Abstract

The project entitled “Search for the Rocky Glider: Assessing the distribution of *Eupetaurus cinereus* in the Uttarakhand Himalaya, India” funded by the MBZ Species Conservation Fund was sanctioned to me in the year 2022. The present study was carried out in the Himalayan region of the Uttarkashi district of the Indian state of Uttarakhand.

The Woolly Flying Squirrel (*Eupetaurus cinereus*) was rediscovered after seven decades of presumed extinction, and it is also one of the least-studied mammalian species. Based on the survey which lasted from April 2023-April 2024, data collection was conducted in the Himalayan region of Uttarkashi. Data on the presence and distribution of the species was collected with the help of Camera Trap (CT) Surveys and information about the species within the local communities was collected through questionnaire surveys. Despite the efforts, we failed to record the species during the CT surveys and find conclusive evidence about the presence of the species, prompting concerns about the status of its populations in the study area. Results from the questionnaire surveys revealed limited familiarity with the squirrel among the local people, suggesting the need for targeted conservation education. We also conducted local awareness programmes for the local communities to disseminate the information regarding Woolly Flying Squirrel. Further research and community engagement are crucial for effective conservation.

Chapter 1: Introduction

The Woolly Flying Squirrel (*Eupetaurus cinereus*) embodies a fascinating paradox. Classified as "Endangered" by the IUCN (Sheikh & Molur, 2005; Pal et al. 2019; Krishna & Ferguson 2021), it was remarkably presumed extinct for a period of approximately seven decades before a dramatic rediscovery in 1994 (Zahler, 1996). This precarious conservation status highlights the potential vulnerability of the species, yet our understanding of its current distribution remains frustratingly limited.

The scarcity of information regarding the WFS's distribution stems primarily from its inherent rarity. Existing knowledge is largely based on museum specimens and sporadic sightings in geographically isolated locations. These locations include Diamer (Zahler & Woods, 1997; Dinets, 2011), Fairy Meadow Valley (Dinets, 2011), Shounthar Valley (Qamar et al. 2012), and even the urban environment of Gilgit city (Din et al. 2015). This fragmented data paints an incomplete picture of the WFS's true distribution and habitat preferences.

Taxonomic classification within the *Eupetaurus* genus has also undergone recent revisions. Until 2021, the WFS was considered the sole member of the genus. However, advancements in genetic analysis led to the identification of two additional species: *Eupetaurus nivamons* and *Eupetaurus tibetensis*, found in Yunnan and Xizang (Tibet) respectively (Jackson et al. 2022; Jamtsho et al. 2022). This taxonomic update necessitates a re-evaluation of historical records and the development of robust species identification protocols for future surveys.

In the context of India, the earliest record of the WFS dates back to 1970, with a reported sighting in Sikkim (Agrawal & Chakraborty, 1970). However, the validity of this observation remains questionable due to the lack of supporting evidence and the absence of subsequent sightings in the area (Zahler, 2010). Despite initial scepticism regarding the WFS's presence in India, the species was included within the possible distribution range for Northern India, specifically Kashmir (Koprowski et al. 2016). For a significant period, there were no confirmed records of the WFS in India until its rediscovery in 2018 within the Harsil Valley of Uttarakhand's Bhagirathi Basin (Pal et al. 2019, 2020). This confirmed sighting provided the first concrete evidence of the WFS's presence in India after a substantial gap.

Our understanding of the WFS's life history remains shrouded in mystery. Beyond a few observations on its diet and ecology (Zahler 2003), much about its behaviour, habitat preferences, and population dynamics remains unknown. This limited knowledge base poses a significant challenge for developing effective conservation strategies. The lack of robust data on the WFS's distribution range further complicates conservation efforts, as it hinders the identification and protection of critical habitat areas.

The present study aimed to shed light on the many unknowns surrounding the Woolly Flying Squirrel in the Uttarakhand Himalayas. This involved field surveys and camera trapping to map the species' presence and distribution and identify potential habitats. We also evaluated the threats the WFS may faces, such as habitat loss and hunting. We also evaluated the information regarding the WFS among the local communities of the study area. Recognizing the importance of local involvement, the study implemented awareness programs to educate communities about the WFS and foster a sense of stewardship towards its conservation.

Chapter 2: Study Area

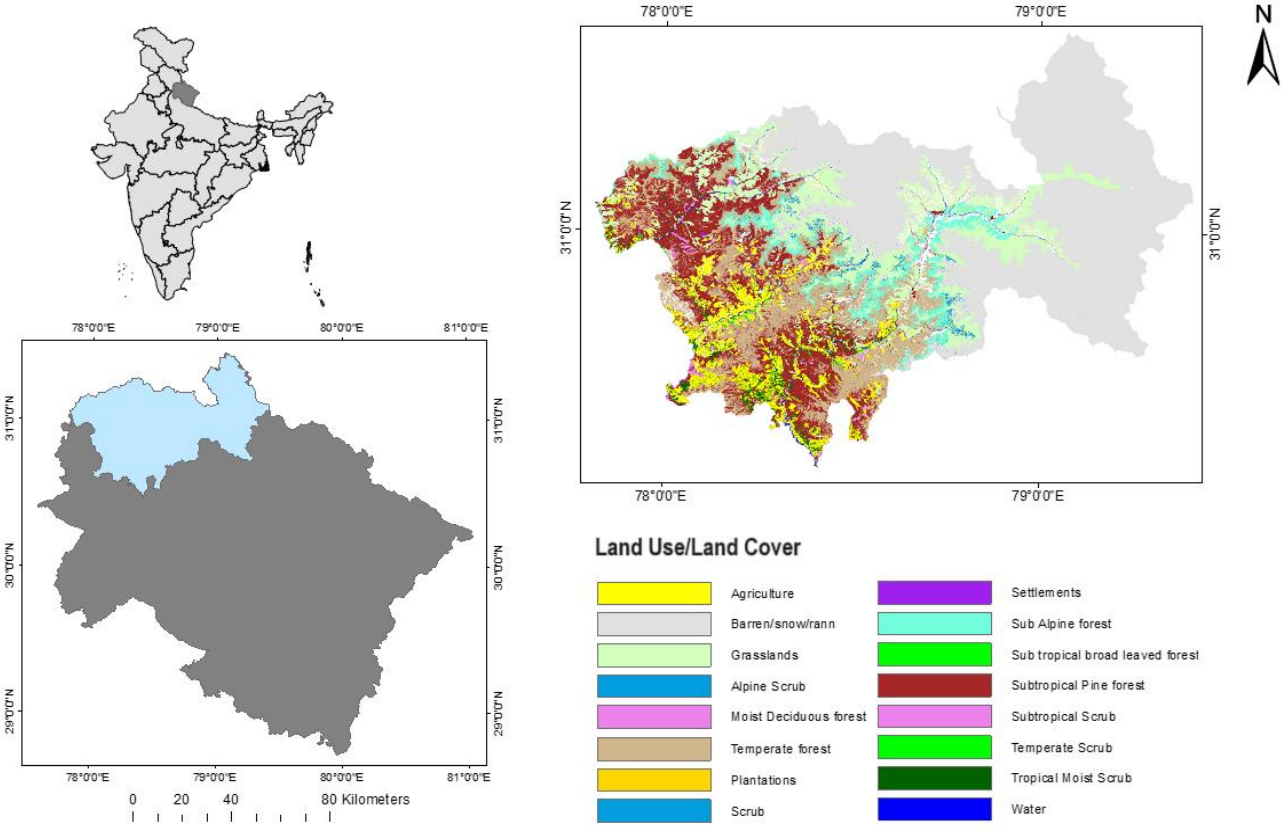

Figure 1. Location of Uttarkashi district in India along with Land Use and Land Cover

The district of Uttarkashi is located in the northern part of the state of Uttarakhand of India which lies on the southern slope of the Himalaya range. The climate and vegetation of the region vary greatly with elevation, from glaciers at the highest elevations to subtropical forests at the lower elevations. The highest elevations are covered by ice and bare rock. Below them, between 3,000 and 5,000 metres (9,800 and 16,400 ft) are the western Himalayan alpine shrub and meadows. The temperate western Himalayan sub-alpine conifer forests grow just below the tree line. At 3,000 to 2,600 metres (9,800 to 8,500 ft) elevation, they transition to the temperate western Himalayan broadleaf forests, which lie in a belt from 2,600 to 1,500 metres (8,500 to 4,900 ft) elevation. Below 1,500 metres (4,900 ft) elevation lie the Himalayan subtropical pine forests.

Image Plate: Potential habitats of WFS

Chapter 3: Objectives and Methods

Objective 1- To assess the distribution of the species in the study area.

Methods: Field surveys were conducted in areas with suitable habitat characteristics. We also employed camera trapping techniques, strategically placing 15 cameras to capture images and videos of the WFS.

Image: Camera traps placed at the potential habitats of WFS

Objective 2- To assess the threats to the species in the study area.

Methods: Data was collected through interviews with local communities and relevant stakeholders. We used a semi-structured questionnaire (Appendix 1) and interviewed a total of 65 respondents who regularly venture to the high altitudes. The respondents were selected through snowball sampling. This approach helped identify potential threats such as hunting and habitat loss. Since this is a sensitive topic, the respondents were kept anonymous.

Objective 3- To formulate conservation plans for the species in the study area.

Methods: While formulating a detailed conservation plan for the WFS within the study area will be a future endeavour based on this study's findings, the groundwork for fostering community engagement has already begun. To understand local perceptions and knowledge regarding the WFS, semi-structured interviews were conducted with 65 individuals residing near the fringes of the WFS habitat in four villages: Agoda, Gangnani, Dharali, and Mukhba (Table 1). These villages are located within the buffer zone of Gangotri National Park, with Agoda situated specifically in the buffer of the Barahat Range of the Uttarkashi Forest Division. Participants were purposefully chosen from various community groups with regular interactions in high-altitude areas, such as villagers, herders, tour operators, trekking guides, and manual labourers.

This selection aimed to target individuals with a higher likelihood of encountering the WFS due to their high-altitude activities. As WFS is a nocturnal species, we interviewed those people who also ventures at night. This was also one of the criteria that we kept in our mind. A standardized, semi-structured questionnaire (Appendix 2) guided the interviews, focusing on the respondents' socioeconomics, existing knowledge about the WFS, and personal experiences (if any) with the species. The insights gleaned from these interviews will be instrumental in developing a comprehensive conservation plan that prioritizes areas for protection, proposes mitigation strategies for identified threats, and outlines strategies for promoting community engagement in WFS conservation efforts. This collaborative approach is vital for ensuring the long-term survival of the WFS within the Uttarakhand Himalayas.

Table 1: Number of people interviewed in the villages with their respective occupations

Village	Occupation	No. of persons interviewed
Dharali	Villager	13
	Bakarwhal (herders)	0
	Tour Operator	2
	Tour Guide	3
	Labourer	7
Mukhba	Villager	5
	Bakarwhal (herders)	0
	Tour Operator	0
	Tour Guide	2
	Labourer	5
Gangnani	Villager	6
	Bakarwhal (herders)	5
	Tour Operator	0
	Tour Guide	0
	Labourer	2
Agoda	Villager	5
	Bakarwhal (herders)	3
	Tour Operator	1
	Tour Guide	3
	Labourer	3
Total		65

Legend: Bakarwhal is a nomadic shepherd community in Northern India. Their livelihood revolves around raising herds of sheep and goats and moving from place to place, following seasonal changes.

Chapter 4: Results

Objective 1- To assess the distribution of the species in the study area.

Field surveys conducted in suitable habitat areas identified WFS presence in locations with documented historical sightings (Pal et al., 2018, 2020). However, deploying camera traps strategically across these areas for a ten-month period (April 2023 to January 2024) yielded a single confirmed WFS detection (Figure 2). Unfortunately, the image quality was compromised due to camera malfunction caused by snowfall (Zoomed image in Figure 3). While this detection confirms WFS presence within the study area, the limited number of captures highlights the inherent challenges associated with studying this elusive and rare mammal. Further research efforts are necessary to refine our understanding of WFS distribution patterns and population density within the study region.

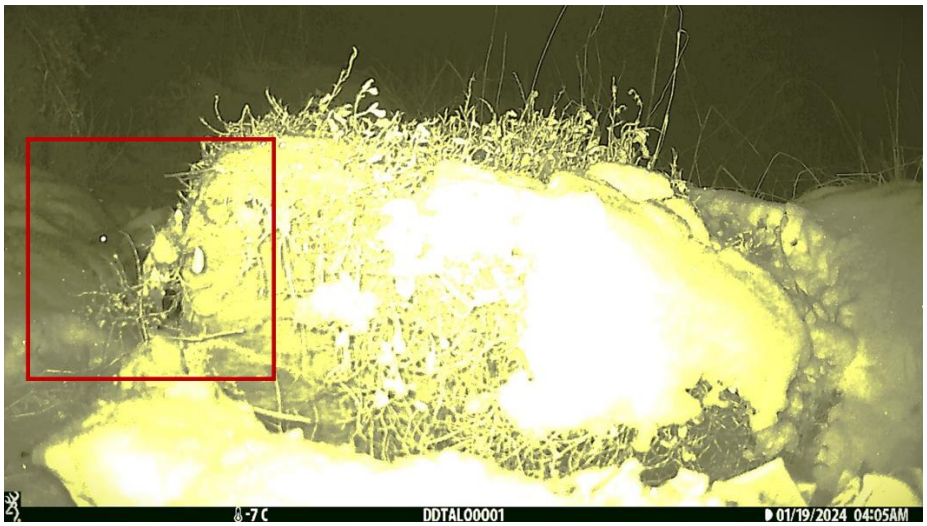

Figure 2: A hazy camera trap image of WFS

Figure 3: Zoomed-out image of Figure 2, which shows the head of the WFS

Objective 2- To assess the threats to the species in the study area.

Our study documented the prevalence of occasional hunting in the region. All the respondents reported engaging in or witnessing hunting practices. Further analysis is necessary to fully understand the motivations behind hunting. While some respondents (77%) expressed positive attitudes towards hunting, the data suggests this positivity may reflect cultural acceptance, reliance on wild meat for subsistence, or economic benefits from harvesting specific species

Our findings on hunted species provide more concrete data (Figure 5). Respondents primarily reported hunting larger mammals, including the Himalayan tahr (*Hemitragus jemlahicus*) (15, 23.08%), Himalayan goral (*Naemorhedus goral*) (13, 20%), Sambar (*Rusa unicolor*) (8, 12%), and Himalayan Musk deer (*Moschus leucogaster*) (6, 9.23%).

However, 12.31%, acknowledged hunting smaller animals, primarily porcupines (*Hystrix indica*) for meat. Interestingly, a portion (23.08%) reported killing pikas (*Ochotona roylei*), not for consumption, but to protect their apple trees from these herbivores. It's important to acknowledge the potential for under-reporting of hunting practices, particularly for species with social stigmas or legal restrictions. Future research employing larger sample sizes and

potentially anonymous surveys could provide a more comprehensive understanding of hunting dynamics, especially regarding smaller mammals like the WFS in its distributional range.

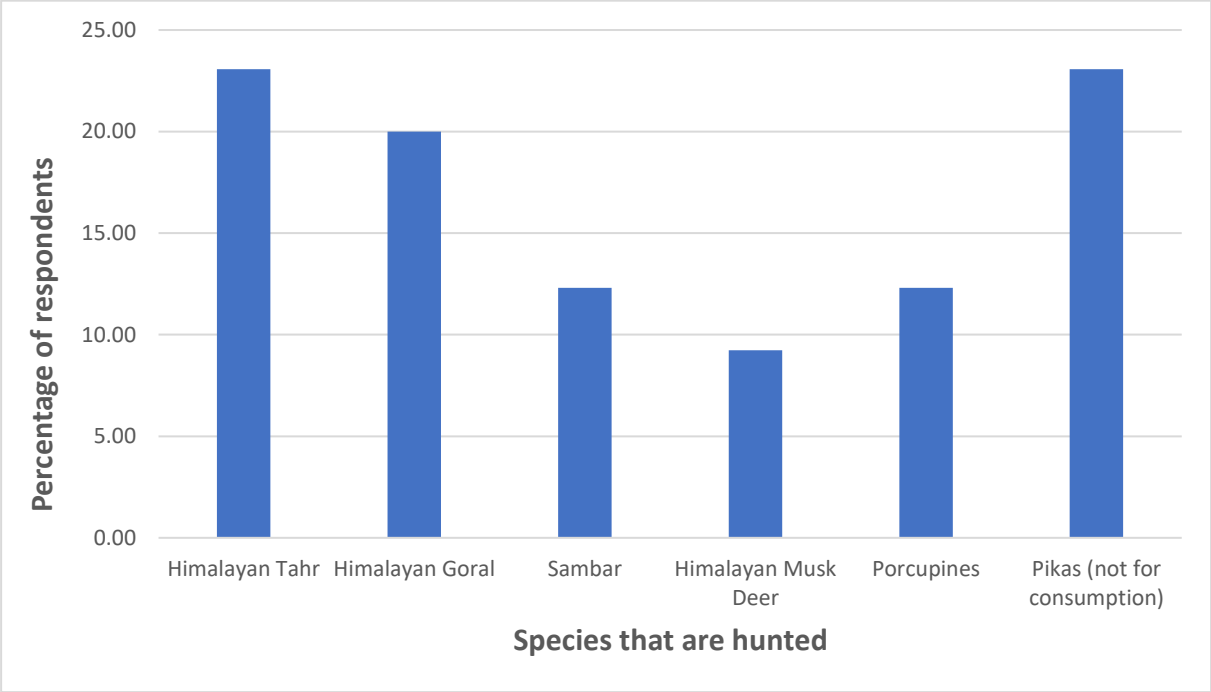

Figure 5: Hunting practices in the study area

We also documented that the potential WFS habitats are frequently subject to seasonal grazing by domestic animals and the concerning practice of illegal medicinal plant harvesting.

Objective 3- To formulate conservation plans for the species in the study area.

The findings of the questionnaire survey to assess the knowledge gap regarding the information of WFS revealed a concerning lack of information about the Western WFS among the surveyed individuals. Most respondents (96%) displayed no prior knowledge of the species. When presented with an image of the Western WFS, many participants (65%) mistook it for other, more familiar animals, primarily the Yellow-throated Marten and Mountain Weasel (Figure 6). This confusion likely stems from the similar body size shared by these species, coupled with the higher prevalence of the Marten and Weasel in the region. Two respondents (both from Dharali), a tour operator and a mountaineer, informed us that they might have seen the species in the high altitudes during their treks but also seemed unsure about it.

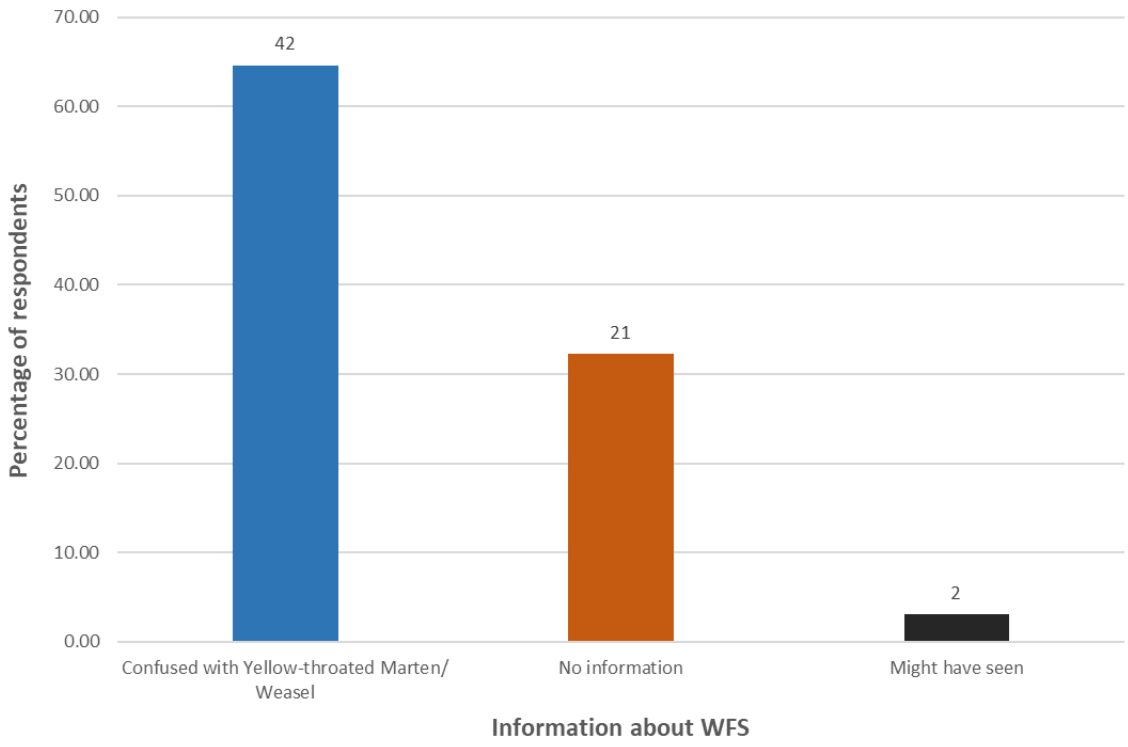

Figure 6: Peoples' information about WFS

To address the issue, awareness campaigns were initiated to educate local communities about the significance of the WFS. Pamphlets and stickers containing information and illustrations of the WFS were distributed within the villages. These informational materials explained the WFS's role in the ecosystem, highlighting the challenges it faces due to human activities, and encouraged responsible practices within the WFS habitat. The awareness campaign aimed to foster a sense of stewardship among local residents and encourage their participation in future conservation efforts.

Image: A sticker for awareness to save the WFS

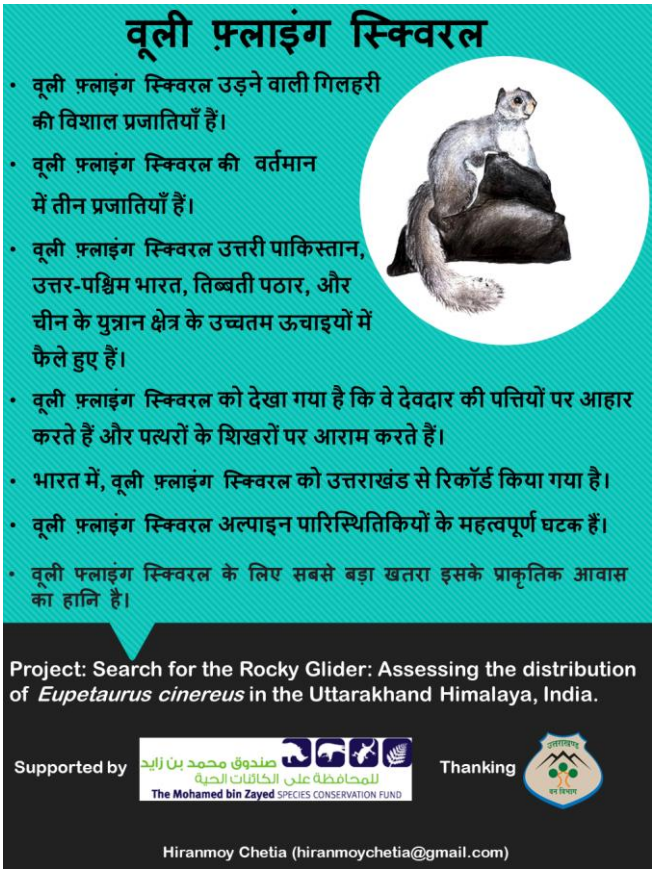

Image: Pamphlet in Hindi language with information on WFS

Image: Pamphlets at doors of a community hall

Image: Sticker on a signboard of Forest Department

Image plate: Distribution of pamphlets to raise awareness

Chapter 5: Discussion

This study aimed to investigate the distribution of the Woolly Flying Squirrel (WFS) within the Uttarakhand Himalayas, assess potential threats to its population, and initiate groundwork for future conservation planning. Here, we discuss the key findings from each objective and their implications for WFS conservation.

Distribution and Detectability Challenges

Field surveys conducted in suitable habitat areas identified potential WFS presence in locations with documented historical sightings (Pal et al. 2019, 2020). However, despite deploying camera traps strategically across these areas for ten months (April 2023 to January 2024), only one confirmed WFS detection was obtained (Figure 2). The image quality was compromised due to camera malfunction caused by snowfall (Zoomed image in Figure 3). While this confirms WFS presence within the study area, the limited capture rate underscores the difficulty of studying this elusive and rare mammal. Several factors, such as nocturnal and cliff-dwelling habits, might have contributed to this challenge. Further research efforts employing refined camera trap placement strategies, extended survey durations potentially focused on peak activity seasons, and weatherproof camera housings are necessary to refine our understanding of WFS distribution patterns and population densities within the study region.

Significance: While the single confirmed detection limits our ability to definitively establish population density, it provides the concrete evidence of WFS presence within this specific region of the Uttarakhand Himalayas. This finding significantly expands our knowledge of the WFS's geographic range and highlights the potential importance of this area for its conservation. Further research employing the refined methodologies discussed above will be crucial for delineating WFS distribution patterns and population estimates across the broader Western Himalayas.

Threats to the WFS Population

Our study documented the prevalence of occasional hunting in the region. All respondents reported engaging in or witnessing hunting practices, although further analysis is needed to fully understand the motivations behind it. While a significant portion (77%) expressed positive

attitudes towards hunting, this may reflect cultural acceptance, reliance on wild meat for subsistence, or economic benefits from harvesting specific species. The reported hunted species primarily included larger mammals like Himalayan tahr and goral (Figure 5), aligning with previous research (Kumar et al. 2021; Lohani et al. 2022). However, hunting of smaller animals, including porcupines for meat and pikas to protect crops, was also reported. Under-reporting, particularly for species with social stigmas or legal restrictions, is a potential limitation. Future research with larger sample sizes and potentially anonymous surveys could provide a more comprehensive picture of hunting dynamics, especially regarding smaller mammals like the WFS within its distributional range.

Community Engagement and Conservation Planning

The questionnaire survey revealed a concerning lack of knowledge about the WFS among the surveyed individuals. Most respondents displayed no prior knowledge of the species, and when presented with an image, many mistook it for other animals (Figure 6). This highlights the need for fostering community awareness and understanding of the WFS's ecological significance. To address this gap, we initiated awareness campaigns through informative pamphlets and stickers distributed within local villages. These materials aimed to educate residents about the WFS, the threats it faces, and responsible practices within its habitat. The campaign's goal is to foster a sense of stewardship among local communities and encourage their participation in future conservation efforts.

Further action:

This study provides valuable insights into the challenges and opportunities for WFS conservation within the Uttarakhand Himalayas. While the limited camera trap data necessitates further research to establish robust distribution patterns and population estimates, the confirmed presence underscores the importance of the region for this rare mammal. Understanding the full extent of the WFS's distribution across the Western Himalayas through surveys in other high-altitude states is crucial to identify potential threats and inform broader conservation planning. Additionally, in-depth studies on habitat quality, human-wildlife interactions, and the impact of practices like seasonal grazing and medicinal plant harvesting are needed to develop effective mitigation strategies.

Furthermore, fostering long-term WFS conservation hinges on continued community engagement. Building upon the initial awareness campaigns, future efforts should explore collaborative initiatives like citizen science programs to involve local residents in monitoring activities. Ultimately, a multi-pronged approach that integrates scientific research, community engagement, and effective mitigation strategies will be critical for ensuring the long-term survival of the Woolly Flying Squirrel in the Uttarakhand Himalayas.

Limitations: This study represents a preliminary investigation into WFS distribution and potential threats within the Uttarakhand Himalayas. The reliance on a single confirmed camera trap detection and a relatively small sample size for the community survey necessitates further research to draw more definitive conclusions. Additionally, a more comprehensive understanding of potential threats requires a deeper analysis of factors like habitat quality and the ecological impact of specific human activities.

Chapter 6: Conclusion and Recommendations

This study investigated the distribution of the Woolly Flying Squirrel (WFS) within the Uttarakhand Himalayas, assessed potential threats to its population, and initiated groundwork for future conservation planning. While limitations inherent to studying this elusive mammal necessitate further research, the findings provide valuable insights for WFS conservation in the region.

Key Findings:

a) A single confirmed camera trap detection, alongside documented historical sightings, confirms WFS presence within the study area.
b) The limited capture rate highlights the challenges associated with studying this nocturnal and cliff-dwelling mammal.
c) Community surveys revealed a significant lack of awareness about the WFS among local residents.
d) Hunting practices, though primarily focused on larger mammals, pose a potential threat to the WFS population.
e) Seasonal grazing and medicinal plant harvesting within potential WFS habitats require further investigation to assess their ecological impact.

Significance:

This study expands our knowledge of the WFS's geographic range and underscores the potential importance of the Uttarakhand Himalayas for its conservation. The findings emphasize the need for a multi-pronged approach that integrates scientific research, community engagement, and effective mitigation strategies.

Recommendations:

a) Conduct follow-up surveys employing refined camera trap placement strategies, extended durations encompassing peak activity seasons, and weatherproof camera housings to establish robust distribution patterns and population estimates.

b) Expand surveys to other high-altitude states across the Western Himalayas to delineate the full extent of the WFS's geographic range.
c) Conduct in-depth studies on habitat quality, human-wildlife interactions, and the ecological impact of practices like seasonal grazing and medicinal plant harvesting to develop targeted mitigation strategies.
d) Build upon the initial awareness campaigns by implementing long-term community engagement initiatives, such as citizen science programs, to foster a sense of stewardship among local residents and encourage their participation in conservation efforts.

By implementing these recommendations, we can move forward with a comprehensive plan to ensure the long-term survival of the Woolly Flying Squirrel within the Uttarakhand Himalayas and its broader range across the Western Himalayas.

Constraints during the Project

This study encountered several challenges due to the irregular weather patterns experienced throughout the ten-month field research period (April 2023 to January 2024). These unforeseen weather events impacted various aspects of the project and highlight considerations for future research endeavors in the region.

Impact on Camera Trap Deployment: The erratic weather conditions, including unexpected snowfall, posed logistical challenges for camera trap deployment and maintenance. In some instances, snowfall compromised camera functionality, resulting in a malfunction that reduced the overall number of usable captures, as exemplified by the compromised image quality of the single confirmed WFS detection (Figure 2). Future research efforts should consider incorporating weatherproof camera housings to mitigate the impact of such conditions and ensure data collection continuity.

Potential Influence on WFS Activity: The irregular weather patterns might have influenced the activity patterns of the WFS. Fluctuations in temperature and precipitation could have impacted food availability or led to periods of increased nocturnal activity to avoid harsh weather. This, in turn, may have reduced the likelihood of WFS encountering camera traps, potentially contributing to the limited capture rate. Future studies could explore correlations between weather patterns and WFS activity to refine camera trap placement strategies and survey durations to better align with periods of peak activity.

Difficulties with Field Surveys: The unpredictable weather made field work more challenging and occasionally hazardous. Heavy snowfall or treacherous conditions could impede researchers' ability to access certain areas or lengthen survey times. While these challenges were overcome during this study, future research should prioritize to incorporate real-time weather monitoring to ensure researcher safety and optimize data collection efforts.

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Appendices

Appendix 1

Title: Questionnaire for documenting hunting practices

Participant Information

Name (Optional):
Age:
Gender:
Occupation:

1. Have you ever heard of hunting in the region?

   Yes
   No

2. Have you ever participated in hunting?

   Yes
   No

   If yes, what animals have you hunted?

3. What was the primary reason for hunting these animals?

4. What are the tools or equipment that you use for hunting?

5. Are there any regulations or restrictions on hunting in your area that you are aware of?

Appendix 2

Title: Woolly Gliding Squirrel Information Questionnaire

1. Participant Information

Name (Optional):

Age:

Gender:

Occupation:

Affiliation (e.g., local community, forest staff, conservation organization):

2. Knowledge and Awareness

A. Have you heard of the Woolly Gliding Squirrel before?

Yes

No

B. If yes, how did you first learn about the Woolly Gliding Squirrel?

C. How familiar are you with the Woolly Gliding Squirrel? (1 = Not familiar, 5 = Very familiar)

1

2

3

4

5

D. Do you know of any local or indigenous names for the Woolly Gliding Squirrel?

3. Observations and Encounters

A. Have you ever encountered a Woolly Gliding Squirrel in the wild?

Yes

No

B. If yes, please describe the encounter (location, date, behaviour, etc.).

4. Conservation and Threats

A. In your opinion, what are the main threats to Woolly Gliding Squirrel populations in your area?

B. Are there any conservation efforts or initiatives in your community or region to protect the Woolly Gliding Squirrel?

C. Do you think more should be done to protect the Woolly Gliding Squirrel and its habitat?

Yes

No

Not sure

5. Sighting and Habitat Information

A. If you have observed the Woolly Gliding Squirrel, please provide details about the location and habitat (e.g., type of forest, elevation, nearby water sources).

B. Have you noticed any changes in the Woolly Gliding Squirrel's habitat or population in recent years? Please describe.

6. Additional Comments

A. Are there any traditional stories, beliefs, or cultural significance associated with the Woolly Gliding Squirrel in your community?

B. Is there any additional information, stories, or concerns you would like to share regarding the Woolly Gliding Squirrel?

Publications from the Project

This project successfully yielded two publications:

1. Chetia H., and Chatakonda M. K. (2024). Rarest of the Rare: People's Awareness and Perceptions about the Woolly Flying Squirrel in Uttarakhand Himalaya, Northern India. *Integrative Conservation*. (Accepted)

2. Chetia H., Gupta J., and Chatakonda M. K. (2024). First Photographic Record of Red Giant Gliding Squirrel *Petaurista petaurista* Pallas, 1766 (Mammalia: Rodentia: Sciuridae) from Sattal, Uttarakhand, India. *Journal of Threatened Taxa*. (Under Review)

Photo plates

Photos of some important wildlife from the study area:

Himalayan Red Fox
(*Vulpes vulpes montana*)

Himalayan tahr
(*Hemitragus jemlahicus*)

Mountain weasel
(*Mustela altaica*)

Muntjak/Barking deer
(*Muntiacus muntjak*)

Sambar deer
(*Rusa unicolor*)

Red Giant Gliding Squirrel
(*Petaurista petaurista*)