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First Record of Amphibian Diversity from Shikari Devi Wildlife Sanctuary, Himachal Pradesh, India

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ABSTRACT

The present research paper deals with the amphibian diversity of Shikari Devi Wildlife Sanctuary located in the Mandi district of Himachal Pradesh state, India. The objective of the study includes evaluating species diversity, IUCN status, population trends, and elevation from sea level. A total of 4 amphibian species belonging to 2 families have been recorded from the sanctuary for the first time. According to IUCN, 4 species were included under the Least Concern (LC) category. The population trends and elevation from sea level are also discussed.

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INTRODUCTION

The Himalayas, being the youngest mountain range with its intricate topography and fertile soil composition, support a diverse range of plant and animal life. The Himalayan region in India harbours around 30% of the country's total fauna species (Chandra *et al.* 2016, 2017a). This region, encompassing around 500,000 square km in the Indian subcontinent, constitutes 16.2% of India's total land area and has been recognized as a biodiversity hotspot (Mittermeier *et al.* 2004).

The country is home to a diverse population of amphibians with 384 species including 306 anuran, 1 species of salamanders and 35 species of gymnophiona. 75 species of amphibians are threatened in India (Dinesh *et al.* 2011, 2015). Himalayas can be categorized into central, eastern and western Himalayas. Himachal Pradesh, a land of valleys and mountains is a part of the western Himalayas encompassing 32 Wildlife Sanctuaries and 5 National Parks which is about 18% of the total state area (Chandra *et al.* 2018 Kumar *et al.* 2017, Bargali *et al.* 2021). National parks and Wildlife Sanctuaries play a crucial role in promoting biodiversity by offering a stable climate, ecosystem services, and protection from human activities (DeFries *et al.* 2007).

Amphibians, an ancient and diverse group of

vertebrates, possess resilience as they have weathered the last four global mass extinction events and are found across the globe (Alroy 2015). Amphibians are poikilothermal (cold-blooded) and ectothermic, meaning their body temperature fluctuates with their surroundings (Nowakowski *et al.* 2017). The term Amphibians denotes biphasic lifestyles, acting as crucial connectors for the exchange of energy and nutrients between terrestrial and aquatic ecosystems (Finlay and Vredenburg 2007). They feature glandular respiratory skin to maintain moisture through secretions, and tadpole larvae are in a distinct larval stage in their life cycle (Negi and Banyal 2016). In Himachal Pradesh, Mehta (2005) recorded 17 species representing 4 families from different parts of the state. Indu and Avtar (2016) observed 16 species comprising 11 genera and 5 families in the state. Deuti *et al.* (2021) have identified 16 amphibian species from 5 different families in the state among these families, Dicroglossinae is the most widespread and diverse, with Bufonidae coming in second in terms of prevalence and diversity.

As compared to other vertebrates the herpetological studies are very restricted in Himachal Pradesh. Herpetological studies in Himachal Pradesh are based on the work of Acharji and Kripalani (1951), Tilak and Mehta (1977, 1983), Mehta *et al.* (1975), Saikia *et al.* (2007), Indu and Avtar (2016), Negi and Banyal (2016), Santra *et al.* (2019) and Deuti *et al.* (2021).

Study area

Shikari Devi Wildlife Sanctuary, nested in the middle Himalayan range, is a hilly region characterized by steep terrain and present between 31º27’ 03” to 31º32’16” N latitude and 77º05’36” to 77º13’41” E longitude (Fig. 1). It is drained by the Beas River, which flows through Mandi City. The sanctuary’s geological composition includes shales, mica, schists, and quartzite. Its climate exhibits distinct seasons winter (October to March), summer (April to June), and Monsoon (July to September). Snowfall is seen in winter, and the climate varies from cold to hot, with temperatures reaching up to 35ºC in June and dropping to around -10ºC in December and January.

SDWLS covers an area of about 29.94 km^2 (WIIENVIS 2023) and is subdivided into six beats namely, Bharmeri, Fatehpur, Raigarh, Behand, Reunsi and Keolinal. SDWLS is a deciduous temperate forest sanctuary that houses endangered medicinal plants,

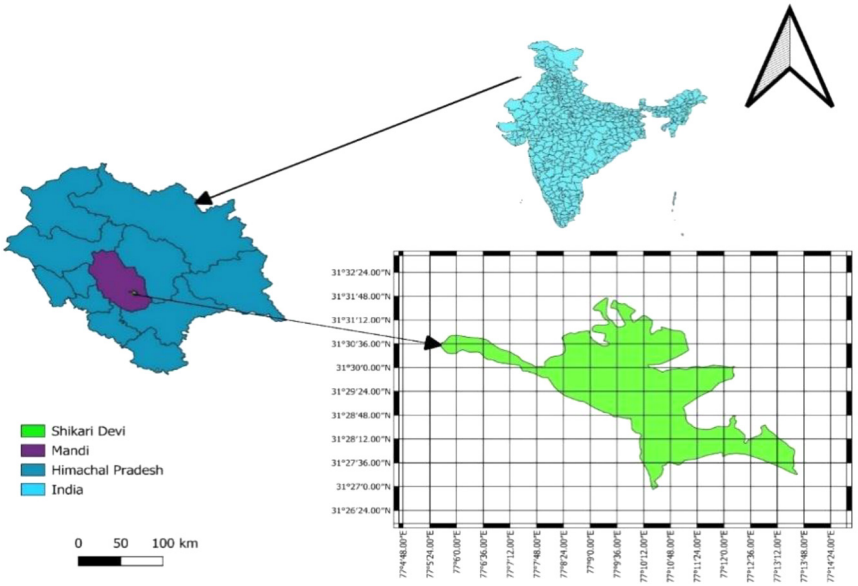

Fig. 1. Map of Shikari Devi Wildlife Sanctuary, Mandi, Himachal Pradesh.

Table 1. Status of Amphibians observed in Shikari Devi Wildlife Sanctuary, Mandi. Abbreviations: IUCN: International Union for Conservation of Nature and Natural Resources (LC: Least Concern, VL: Vulnerable) Pop. Trend: Population Trend (↓: Decreasing population) M a.s.l: Meters above sea level.

Sl. No.	Order	Family	Scientific name	Common name	Conservation Status (IUCN)	Pop. Trend	No. of Individual	Elevation M a.s.l
1	Anura	Bufonidae (Gray)	*Duttaphrynus Himalayanus* (Gunther 1864)	Himalayan toad	LC	↓	7	2500
2	Anura	Bufonidae (Gray)	*Duttaphrynus stomaticus* (Lutken 1862)	Marbled toad	LC	–	5	2300
3	Anura	Dicroglo-ssinae	*Nanorana vicina* (Stoliczka 1872)	Himalayan Paa frog	LC	↓	4	1800
4	Anura	Dicroglo-ssinae	*Nanorana liebigi* (Gunther 1860)	Spiny-armed frog	LC	↓	4	1800

including *Angelica glauca*, *Polygonum verticillatum*, *Rododendron campanulatum* and *Taxus wallichiana,* all classified as threatened by Red Data Book. It offers a prime habitat for various wildlife, such as leopard cats, leopards, black bears, monal and koklash pheasants, along with some reptiles, amphibians, and fish species (Bodh *et al.* 2018, Verma and Kapoor 2019).

MATERIALS AND METHODS

The survey was conducted from February 2023 to September 2023 in different beats of Shikari Devi Wildlife Sanctuary. It was conducted during day and night hours and the breeding calls help in the detection of amphibians during the night time. Adaptive cluster sampling, audio surveys method, and visual encounter surveys (Vasudevan *et al.* 2001) were used to locate diverse amphibian species. In the adaptive sampling approach, areas of adequate size were selected for detailed examination. The survey methods involved thorough investigations and careful visual assessments of amphibians in various potential habitats, such as tree holes, temporary water pools, and beneath shrubs and grasses.

Amphibian identification relied on morphological characteristics. The identification and nomenclature of the species was based on Smith (1943), Daniels (2005), Indu and Avtar (2016), and Deuti (2021) , Table 1. The previous records of identified species and their geographical distribution pattern were taken into consideration. Photographs and videography for identification were made in HD digital format using the Nikon Coolpix –P1000 camera. The elevation of the amphibian's location above sea level was determined by using GPS (Global Positioning System).

RESULTS AND DISCUSSION

During the study, 4 species of amphibians were identified belonging to 2 families Table 1. These four species are *Duttaphrynus himalayanus*, *Duttaphrynus stomaticus, Nanorana vicina,* and *Nanorana liebigi*. *Duttaphrynus himalayanus* exhibited a higher abundance in the area as compared to the other four species. *Duttaphrynus himalayanus* species are attracted to the flying insects at a street light.

Deodar and pine trees are dominated in Shikari Devi Wildlife Sanctuary. The sanctuary is home to a variety of Himalayan fauna, including Black bears, Jungle cats, and common leopards. Throughout the study period, the average temperature ranged from 15ºC to 35ºC. The sanctuary appeared lush and green, with ample water resources that flowed into the Beas River. Maximum sighting of amphibians was done

from Fatehpur and Keolinal beat of the sanctuary likely due to the abundance of water resources in these areas.

According to IUCN status, four species of frog (*Duttaphrynus himalayanus, Duttaphrynus stomaticus, Nanorana vicina* and *Nanorana liebigi*) fall under the least concern category indicating they are not currently at risk. Furthermore, according to the IUCN Red List, the global population trend of *Duttaphrynus himalayanus, Nanorana vicina* and *Nanorana liebigi* was on the decline phase, while *Duttaphrynus stomaticus* had stable population trends.

Himalayan Toad was the dominant species as 7 individuals were encountered during the study period. Marbled Toad was with 5 individuals. Himalayan Paa frog and Spiny-armed Frog were with 4 numbers.

In terms of Elevation, GPS is used to record the altitude above sea level (Table 1). Himalayan toad was observed at the highest elevation, at 2500 m.a.s.l. Himalayan Paa frog and Spiny-armed Frogs were located at an elevation of 1800 meters and Marbled Toad was found at an elevation of 2300 meters above sea level.

4 species of amphibians belonging to 2 families are recorded in the sanctuary. Negi and Banyal (2016) recorded six species of herpetofauna including one species of amphibians and five species of reptiles in Rakchham Chhitkul Wildlife Sanctuary of HP. Harsh weather conditions have led to a reduction in number of amphibian species. In the sanctuary, anthropogenic activities were observed like the demand for fodder, hunting, water for livestock, and the continuous influx of devotees' vehicles visiting the Shikari Devi temple in the sanctuary throughout the year except winters. These activities have the potential to disrupt the habitat utilization pattern and exacerbate the decrease in amphibians. Not just limited to this sanctuary, herpetofauna species worldwide are currently encountering multiple threats, such as fragmentation, loss and degradation of habitat (Bohm *et al.* 2013, Lesbarreres *et al.* 2014). These species are dealing with difficulties including water pollution, proliferation of diseases, harsh climate change and invasive species.

CONCLUSION

This is the first attempt to compile information about the amphibian faunal diversity of the sanctuary. Based on the present findings, it can be concluded that the Shikari Devi Wildlife Sanctuary is an important sanctuary for conserving unique Himalayan amphibian species and possesses fair amphibian diversity. Hopefully, this study will provide the baseline data for future studies about various ecological aspects of amphibian diversity in the sanctuary.

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