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Checklist

Checklist of wild mammals of Shivapuri Nagarjun National Park, Nepal

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Abstract

An updated checklist of mammalian richness is an important tool for biodiversity conservation and management of protected areas. In this study, we present the updated checklist of wild mammals of Shivapuri Nagarjun National Park (SNNP) in the central mid-hill of Nepal based on direct observation, field reports, key informant interviews, and a literature review. A total of 65 species of mammals belonging to eight orders and 22 families were known to occur in the park. Order Rodentia (n=21, 32.30%) and family Muridae (n=14, 21.53%) have the highest record of the number of species. Out of 65 mammal species, 53 species (81.53%) were confirmed for their occurrence either by direct observation and camera trap. Only 12 species were listed based on literature review and personal communication. In SNNP, 1.53% of mammalian species are listed as critically endangered species 9.23% are under vulnerable; 6.15% of the species are listed as endangered in the National Red List. The confirmation for small mammals needs further study for robust taxonomy and we suggest molecular study of species having contradictory taxonomy.

Keywords: Camera trap; Mid hills; Nagarjun Forest; Protected area; Shivapuri Forest

1 | Introduction

A checklist is a crucial tool for the documentation and conservation of biodiversity (Nameer et al. 2015). Understanding the diversity of flora and fauna in a protected area plays a vital role in the management of protected areas (Sirinivasalu et al. 2004). Long-term management of the protected area and species conservation approaches needs proper taxonomic information on the diversity of wildlife in that area (Mace 2004). Currently, 218 species of mammals are reported from Nepal which is equivalent to 4.2% of the world's mammalian fauna (Amin et al. 2018; Adhikari et al. 2018; Sharma et al. 2019; Sharma et al. 2021; Dahal et al. 2022; Lamichhane et al. 2023). Among them, the National Parks and Wildlife Protection Act, 1973 of Nepal includes 27 mammalian species in Schedule I as protected mammals (DNPWC 2013). Similarly, two species of them are categorized as critically endangered in the IUCN Red List of Threatened Species, 13 are endangered, 20 are near threatened and 17 of them are vulnerable. The National Red List of Nepal classified nine of them as critically endangered, 26 as endangered, 14 as vulnerable, one is listed as regionally extinct, seven as near threatened, and 49 species listed as nationally threatened (Amin et al. 2018).

Shivapuri Nagarjun National Park (SNNP) is the only protected area in the mid-hills depicting its crucial role in biodiversity conservation (SNNP 2017), however, the status of wild mammals in this area is poorly known. Several unpublished documents and reports from the SNNP office state that the park hosts more than 30 species of mammals, but an updated species checklist of the wild mammals of the national park has not been systematically compiled. In this regard, this study aims to prepare the first updated and consolidated checklist of the wild mammals in SNNP.

2 | Materials and methods

2.1 | Study area

SNNP lies in the mid hills of Nepal covering parts of Kathmandu, Nuwakot, Sindhupalchok, and Dhading districts (Fig. 1). It has two separate forest patches: Shivapuri Forest and Nagarjun Forest. The Shivapuri Forest lies between 27°43′ and 27°52′ N latitude and 85°13′ and 85°45′ E longitude and while the Nagarjun Forest lies between 27°43′ and 27°46′ N latitude and between 85°13′ and 85°18′ E longitude. The elevation range of SNNP is 960 to 2732 m asl covering a total area of 159 km^2 (SNNP 2017) with a 118.61 km^2 buffer zone. The SNNP occupies nearly 0.19% area of Nepal but it represents 16.4% of the floral species of the country (SNNP 2017, DNPWC 2019). SNNP is one of the Important Bird & Biodiversity Areas (IBAs) out of 27 IBAs of Nepal (BLI 2022). The mean annual temperature of the park varies from 19 °C to 30 °C during autumn and from 2 °C to 17 °C during winter, whereas the climate varies from subtropical to temperate. The annual precipitation is about 1,400 mm which falls mostly (80%) during monsoon months - June to September (Shrestha et al. 1999). Physiographically, the park lies in a transition zone between subtropical and temperate regions. The dominant rocks are metamorphic rocks such as phyllite, limestone and dolomite, gneiss, and ingratiate while the soil types are loamy on the northern aspect and sandy on the southern. Four major forest types that flourish in the area are (i) Lower mixed hardwood forests at 1000–1500 m, (ii) Chir pine forests at 1000–1600 m, (iii) Oak forests at 2300–2700 m, and (iv) Upper mixed hardwood forests at 1500–2700 m (Shapkota & Kafle 2021). The dominant tree species are *Schima wallichii*, *Pinus roxburghii*, *Castanopsis indica*, *Alnus nepalensis*, *Myrica esculenta*, *Quercus semecarpifolia*, *Rhododendron arboreum*, *Juglans regia* and *Taxus wallichiana.*

2.2 | Desk study and literature review

The information on the occurrence and distribution of mammals in the park was collected from official records in the published literature and authentic unpublished data/reports to obtain an updated checklist of the mammals present in the study area. A desk study was carried out at Central Library, Tribhuvan University in September 2022. We also used the keywords Shivapuri Nagarjun National Park and mammals in scholar google, PubMed, and the Google for any publication related to mammals in the study area.

2.3 | Opportunistic records from the forest patrolling and trail walks

Live and dead records of mammalian species were documented opportunistically during patrolling inside the forests and walking through the trails. The observed species and signs were photographed and also

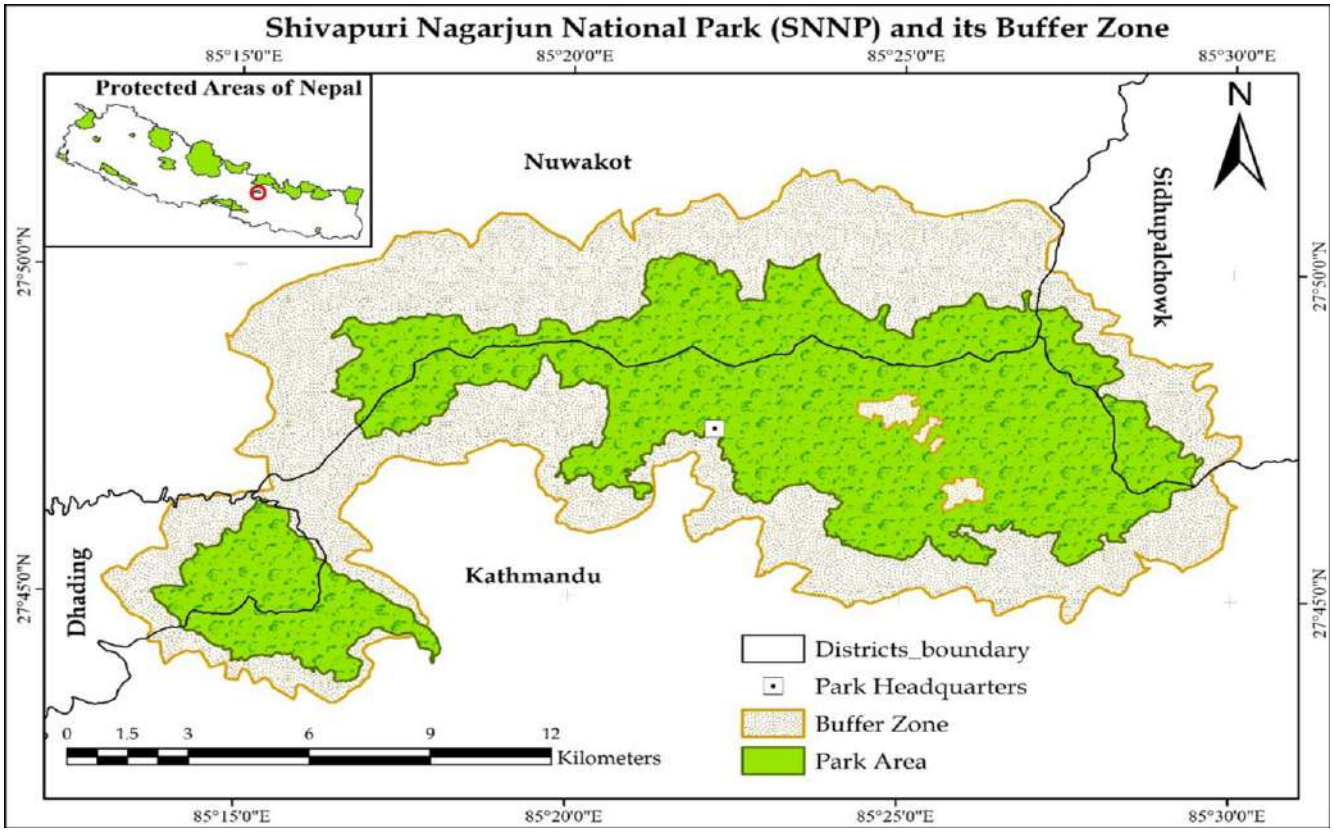

Figure 1. Study area showing SNNP (Source Topographical map, Department of Survey (1994/98), GON & SNNP (DNPWC)

Table 1: Details of walking trails and observation dates

Walking trails	Observation Dates		
	Winter (2021)	Summer (2021)	Spring (2022)
Dadagaon (1840 m) -Bishnudwar (1970 m) -Panimuhan (1655 m) -Nagi Gumba (1990 m) -Tarebhir (1885 m)	9- Feb	9- Aug	4- Apr
Tarebhir (1885 m) -Saur Danda (1940 m)- Bagamati Bridge (1640 m) -Mulkhraka (1905m)	16-Feb	15-Aug	-
Sundarijal Kotthum (1425 m)- Bagmati Riverbank- Mulkharka (1905 m)-Nagmati-Syalmati-Dhap Dam (2085 m).	10-Feb	16-Aug	13-Apr
Sundarijal Dam (1605 m) -Mulkharka (1905m) -Kuikel (1935 m) -Manichur (2130m) -Jhule (2200 m) -Dhap (2085 m)-Chisapani (2175 m).	17-Feb	17-Aug	12-Apr
Chisapani (2175 m) -Okhreni Deurali (2320 m) -Tinchuli (2625 m) -Shivapuri Peak (2732 m) -Baghdwar (2495 m)- Shivapuri Peak (2732 m)	18-Feb	18-Aug	11-Apr
Shivapuri Peak (2732 m)- Baghdwar (2495)- Deurali (2385 m) -Nagi Gumba (1990)- Panimuhan (1655 m)	19-Feb	19-Aug	10-Apr
Dadagaon (1840 m) -Gurje Bhanjyang (1890m) - Suire Chaur (2100 m)-Gurje Bhanjyang- Shivapuri Village Resort (1900m).	11-Feb	10-Aug	7-Apr
Shivapuri Village Resort (1900 m) -Gurje Bhanjyang (1890 m) -Tarakeswar (1825 m) - Bhukampa Danda (2005 m) -Kakani (2080 m).	12-Feb	11-Aug	-
Shivapuri Village Resort- Gurje Bhanjyang- Kakani from Nuwakot side	-	-	8-Apr
Kakani Surroundings	12-Feb	12-Aug	9-Apr
Nagarjun Forests (Ain Danda (1840 m)- Sonagaon (1490 m) -Mudkhu (1525 m).	13-Feb	14-Aug	-
Nagarjun Forests (Fulbari Gate- Jamacho foot trail to Jamacho (2090 m) and back to Fulbari Gate (1360 m)	14-Feb	13-Aug	-
Nagarjun Forests (Fulbari Gate (1360 m)- Raniban (1355 m)- Pachali Bhairab (1410 m)- Labdanda.	15-Feb	12-Aug	5-Apr
Ichangu (Labdanda) to Jamacho	-	-	6-Apr

information on human-wildlife conflict and rescue made to the wild animal from the surrounding settlement areas were noted. The images of the wildlife captured inside the national park by nature guides and tourists were also considered. In addition, the occurrence of mammals was recorded by direct observation during our trail walks (142 km trail walks in winter, 9-19 February 2021; 126 km trail walk in summer, 9-19 August 2021; and 114 km trail walk in spring, 4-13 April 2022) which were purposively conducted for bird monitoring (Table 1). These trails were also used by nature guides and tourists for hiking and office staff for forest patrolling.

2.4 | Camera trapping at Nagarjun Forest targeting larger mammals

The Nagarjun Forest was surveyed using motion sensor camera traps from November 2017 to June 2018 and again from October 2021 to January 2022. A total of 15 Bushnell camera traps were used in 2017 and 2018 and 10 Cuddeback camera traps in 2021–2022 from elevations between 1360 m and 2090 m above mean sea level (Table 2). The 15 km^2 Nagarjun forest block was divided into grids of 1 km×1 km (Figure 1) and camera traps were deployed systematically in the easily accessible areas with indirect signs of wildlife at a height of 30 to 40 cm from the ground. The cameras were installed on the sides of game trails, forest roads, and streambeds without using any bait or lure. Camera traps were mounted on trees or wooden poles. Cameras were set in a hybrid mode that capture 3 photos and video of 10 seconds in length at intervals of 5 seconds when an animal moved in front of the motion sensor cameras. The images of wildlife captured by camera traps were carefully examined, and identified with the help of mammals of Nepal and expert opinions (Baral & Shah 2008).

2.5 | Nets and traps for bats, rats, and other small mammals

Multiple live traps (Sherman trap & tube trap) and nets (Mist netting, harptrapping) were installed at the 14 different locations of 6 sites in SNNP from 30 October to

Table 2: Details on live trapping administered sites and dates

Sites	Locations with elevation in meter	Surveyed dates
Kakani	Ghoyochyat, Kakani, 1910	05 Sept. 2021
	Kakani (Picnic spot), 1961	21 Nov. 2021
	Kharibhanjyang (near school stream), 1680	22 Nov. 2021
	Kharibhanjyang, 1653	22 Nov. 2021
Nagarjun	Raniban, 1334	14 Nov. 2021
	Nagarjun Cave, 1371	15 Nov. 2021
Pani Muhan	Panimuhan Reservoir, 1664	22 Sept. 2021
	Panimuhan Stream, 1801	30 Oct. 2021
Baghdwar	Baghdwar, 2500	31 Oct. 2021
	Baghdwar, 2516	01 Nov. 2021
Bishnudwar	Bishnudwar, 1991	13 Nov. 2021
Sundarijal	Sundarijal (Bagmati River near reservoir), 1606	27 Nov. 2021
	Tunnel below Scout Sundarijal, 1599	28 Nov. 2021
	Sundarijal (Nagmati Bridge) 1583	29 Nov. 2021

30 November 2021 at five localities for 31 days. Moreover, at each location, one harp trap and one to three ecotone monofilament mist nets of various sizes (7 m × 3 m, 6 m × 3 m, or 3 m × 3 m) were deployed to catch the bats above streams, close to cave openings, on the edge or inside the forests. Additionally, 10 Sherman traps (Model: SFA-Small Folding Aluminium), dimensions: 5.2cm × 6.4cm × 16.5 cm (approximately 1.3 cm thick when folded) and weight: 136 gm) were placed randomly around the same location at least 25 meters apart from another baited with peanut butter mixed with oats to catch small mammals like rats, mice, and shrews. Mist nets and harp traps were set up shortly before the period of bat flight emergence at sunset (usually around 17:30 hours) and checked in every 10-20 minutes till midnight before they were shut down. Harp traps were used all night long and monitored in the morning. Sherman traps were set up in the evening at about 18:00 hours, and they were checked the following early morning. Animals caught in traps were held gently by gloved hands each measured, photographed, identified, and then released back into their natural habitat.

3 | Results

In this study, a total of 65 mammal species (Table 3), belonging to eight orders were documented in the SNNP. Order Rodentia had the highest number of species recorded (n=21), whereas Chiroptera has 17, and Carnivora has 12 species. The least number of species recorded was of Lagomorpha (1) and Pholidota (1) (Fig. 2)

The wild mammal species inhabiting the SNNP are from 22 families. Muridae had the highest species number (n=14, 21.53%), it is followed by Rhinolophidae (9, 13.84%), Sciuridae (8, 12.39%), Felidae and Soricidae (4, 6.15%) whereas families, Ursidae, Canidae, Hystricidae, Leporidae, Manidae, Megadermatidae, Miniopteridae, and Suidae has one single species (Fig. 3).

The mammalian species in SNNP are categorized into six categories in the national red list but five categories in IUCN global red list. There are 1.53% of critically endangered species and 9.2% vulnerable in both lists; 6.15% of species are listed as endangered on the National red list but none of the mammals are listed as endangered on IUCN red list (Table 3). Out of 65 mammal species 53 species (81.53%) were either sighted or captured in this survey. For other species, we relied on published journals and photographs.

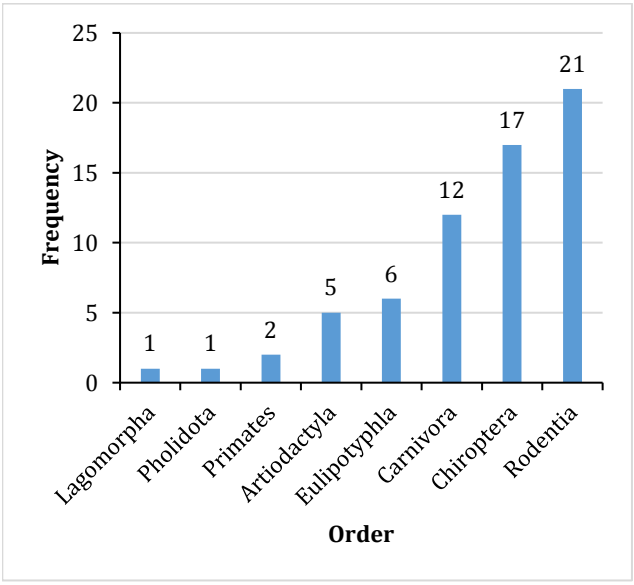

Figure 3. Distribution of mammalian species (according to order) at SNNP

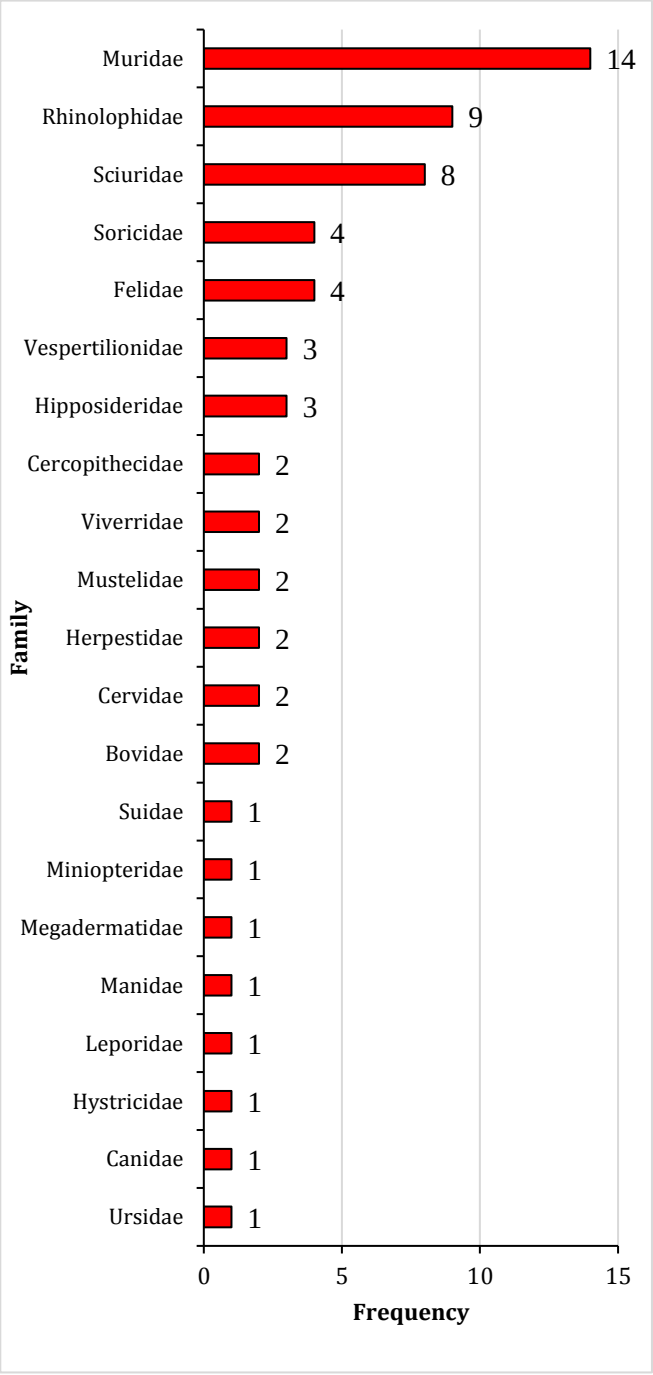

Figure 2. Frequency of the species occurrence (along with family) at SNNP

Table 3: Conservation status of mammals of SNNP: in National Red list and IUCN (global) Red list

Red list	No. of species in National Red List	National red list (%)	No. of Species in IUCN (global) Red list	IUCN Red List (%)
DD	6	9.23	2	3.07
LC	43	66.15	53	81.53
NT	5	7.69	3	4.61
VU	6	9.23	6	9.23
EN	4	6.15	-	-
CR	1	1.53	1	1.53

Note: CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threaten, LC = Least Concern and DD = Data Deficient

4 | Discussion

The recent study conducted by SNNP and Small Mammals Conservation and Research Foundation (SMCRF), Kathmandu recorded 15 species of bats in SNNP with the first record of *Hipposideros cineraceus,* and *H. gentilis.* They further reported that four species *H. cineraceus*, *H. gentilis*, and *M. aurata* have not been recorded from PAs other than SNNP (Thapa et al. 2022b). Koju et al. (2022) recorded the Burmese ferret badger (*Melogale personata*) in a camera trap from Nagarjun Forest. Moreover, the study by SNNP on rodent diversity explored eight species of rodents and two species of shrews (Thapa et al. 2022a).

The checklist of mammals provided in the management plan of SNNP (SNNP 2017) needs to be updated as some species which are not present in Nepal are reported in the list. The presence of Royle's pika (*Ochotona roylii*), Marbled cat (*Pardofelis marmorata*) and Indian pangolin (*Manis crassicaudata*), Grey langur and Eurasian otter (*Lutra lutra*) in SNNP (2017) is questionable. The presence of these mammals in SNNP are reported in Suwal & Verheugt (1995); Shrestha & Basnet (2005); and Jnawali et al. (2011). Our study based on the camera trap, direct obesevation, during forest patrolling and trail walks have not recorded these species. The ecological distribution modelling on grey langur also does not support its presence in SNNP (Khanal et al. 2018). Thus, the presence of these species is questionable and needs further study for confirmation. Reports of Suwal & Verheugt (1995); and Shrestha & Basnet (2005) and Jnawali et al. (2011) might have been misidentified since their study were based on secondary data and sign survey only. Moreover, the information on the record of the Indian crested porcupine (*Hystrix indica*) by Shrestha & Basnet (2005); Pandey (2012); and (Dhital et al. (2020) is mistaken with the crestless porcupine. The photo published by Dhital et al. (2020) is of a crestless porcupine but was named mistakenly an Indian crested porcupine. Even though more than 81% of mammalian species reported in this checklist were either photographed directly or camera trapped. Still, 12 species in this checklist are based on either literature review or personal communication. Thus, further study is necessary for confirmation of their presence in SNNP. We suggest for molecular study on species with contradictory taxonomic information.

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Authors' contributions

Poudyal, L.P. collected data, drafted the manuscript, and supervised the work. Koju, N. P. collected data, conducted fieldwork, and wrote & revised the manuscript, Bista, M. collected data and drafted the manuscript, Thapa, S.; Khadka, S.; Dahal, D.R.; and Pandey, B. P. conducted fieldwork and data collection.

Conflicts of interest

Authors declare no conflict of interest.

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Annex 1. Photo of the mammals listed in the threatened category

Chinese pangolin (*Manis pentadactyla*) recorded in Nagarjun Forest (Photo credit Narayan Koju, 2018)

Leopard (*Panthera pardus)* recorded in Nagarjun Forest (Photo credit Narayan Koju, 2017)

Sambar deer (*Rusa unicolor*) recorded in Nagarjun Forest (Photo credit Narayan Koju, 2017)

A cub of a Himalayan black bear (*Ursus thibetanus)* recorded dead at SNNP Fireline above Panimuhan (Photo credit Bishnu Pandey, 2014)

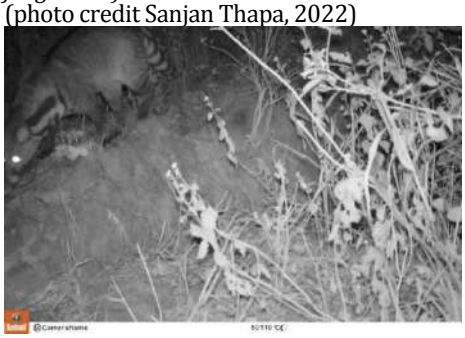
Assamese macaque (*Macaca assamensis)* recorded in Nagarjun Forest (Photo credit Narayan Koju, 2018)

Clouded leopard (*Neofelis nebulosa)* recorded at Kakani area (Photo credit Bishnu Panday, 2010)

Eastern bent-wing bat (*Miniopterus fuliginosus)* recorded in Panimuhan SNNP (photo credit Sanjan Thapa, 2022)

Leopard cat (*Prionailurus bengalensis)* recorded in Nagarjun Forest (Photo credit Narayan Koju, 2017)

Himalayan Goral (*Naemorhedus goral*) recorded in Nagarjun Forest (Photo credit Keshav Dhodari, 2021)



Large Indian civet (*Vivera zibetha)* recorded in Nagarjun Forest (Photo credit Narayan Koju, 2018)

Himalayan serow (*Capricornis sumatraensis thar*) recorded in Sundarijal area (Photo credit Janak Biswakarma, 2023)

Annex 2. Annotated list of mammals recorded in Shivapuri Nagarjun National Park

SN	Scientific Name	Common Name	Order	Family	Method of confirmation	IUCN Red list		CITES	References
						National	Global		
1.	*Muntiacus vaginalis*	Barking deer	Artiodactyla	Cervidae	*, #, Ω, ψ	VU	LC		Suwal & Verheugt 1995, Shrestha & Basnet 2005, Jnawali et al. 2011, Pandey 2012, Katuwal et al. 2018, Dhital et al. 2020
2.	*Capricornis sumatraensis*	Himalayan serow	Artiodactyla	Bovidae	*, #, Ω, ψ	DD	VU	I	Photographed by Mukesh Chalise, at Kakani in 2014, and by SNPP staff at Jhule and Chisapani in 2023
3.	*Naemorhedus goral*	Himalayan goral	Artiodactyla	Bovidae	#, Ω, ψ	NT	NT		Suwal & Verheugt 1995, Shrestha & Basnet 2005
4.	*Rusa unicolor*	Sambar deer	Artiodactyla	Cervidae	*, #, Ω, ψ	VU	VU		Dhital et al. 2020, Koju et al. 2022
5.	*Sus scrofa*	Wild boar	Artiodactyla	Suidae	*, #, Ω, ψ	LC	LC		Suwal & Verheugt 1995, Shrestha & Basnet 2005, Pandey 2012, Katuwal et al. 2018, Dhital et al. 2020
6.	*Felis chaus*	Jungle cat	Carnivora	Felidae	#, Ω, ψ	LC	LC		Suwal & Verheugt 1995, Shrestha & Basnet 2005, Pandey 2012, Katuwal et al. 2018, Dhital et al. 2020, Jnawali et al. 2011
7.	*Ursus thibetanus*	Himalayan black bear	Carnivora	Ursidae	#, Ω, ψ	EN	VU		Suwal & Verheugt 1995, Shrestha & Basnet 2005, Cynthia & Shrestha 2007, Jnawali et al. 2011
8.	*Canis aureus*	Asiatic golden jackal	Carnivora	Canidae	Ω, ψ	LC	LC	III	Suwal & Verheugt 1995, Shrestha & Basnet 2005, Baral & Shah 2008, Jnawali et al. 2011
9.	*Neofelis nebulosa*	Clouded leopard	Carnivora	Felidae	#, Ω, ψ	EN	VU	I	Suwal & Verheugt 1995, Jnawali et al. 2011, Pandey 2012
10.	*Panthera pardus*	Leopard	Carnivora	Felidae	*, #, Ω, ψ	VU	VU		Suwal & Verheugt 1995, Shrestha & Basnet 2005, Jnawali et al. 2011, Pandey 2012, Katuwal et al. 2018, Dhital et al. 2020
11.	*Prionailurus bengalensis*	Leopard cat	Carnivora	Felidae	*, #, Ω, ψ	VU	LC		Pandey 2012, Katuwal et al. 2018, Dhital et al. 2020
12.	*Herpestes auropunctatus*	Small Indian mongoose	Carnivora	Herpestidae	*, #, Ω, ψ	LC	LC		Shrestha & Basnet 2005, Jnawali et al. 2011
13.	*Herpestes urva*	Crab-eating mongoose	Carnivora	Herpestidae	*, Ω	VU	LC		Pandey 2012
14.	*Martes flavigula*	Yellow-throated Marten	Carnivora	Mustelidae	*, #, Ω, ψ	LC	LC		Suwal & Verheugt 1995, Shrestha & Basnet 2005, Pandey 2012, Katuwal et al. 2018, Dhital et al. 2020
15.	*Melogale personata*	Burmese ferret-badger	Carnivora	Mustelidae	#, Ω,	DD	LC		Koju et al. 2021
16.	*Paguma larvata*	Masked Palm Civet	Carnivora	Viverridae	*, #, Ω, ψ	LC	LC		Pandey 2012, Dhital et al. 2020
17.	*Viverra zibetha*	Large Indian civet	Carnivora	Viverridae	*, #, Ω, ψ	NT	LC		Shrestha & Basnet 2005, Jnawali et al. 2011, Pandey 2012, Dhital et al. 2020,
18.	*Rhinolophus affinis*	Intermediate horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	LC	LC		Kock 1996, Csorba et al. 1999, Jnawali et al. 2011, Pearch 2011, Thapa et al. 2021, Thapa et al. 2022 (b)
19.	*Rhinolophus ferrumequinum*	Greater horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	LC	LC		Jnawali et al. 2011, Pearch 2011, Millen & Lim 2018, Thapa et al 2021, Thapa et al. 2022 (b)
20.	*Rhinolophus lepidus*	Blyth's horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	NT	LC		Thapa et al. 2021, Thapa et al. 2022 (b)

21.	*Rhinolophus luctus*	Great woolly horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	LC	LC		Thapa et al. 2021, Thapa et al. 2022 (b)
22.	*Rhinolophus macrotis*	Big-eared horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	LC	LC		Jnawali et al. 2011, Thapa et al. 2021, Thapa et al. 2022 (b)
23.	*Rhinolophus pearsonii*	Pearson's horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	LC	LC		Jnawali et al. 2011, Pearch 2011, Thapa et al. 2021, Thapa et al. 2022 (b)
24.	*Rhinolophus pusillus*	Least horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	LC	LC		Sinha 1973, Bates & Harrison 1997, Jnawali et al. 2011, Thapa et al. 2021, Thapa et al. 2022 (b)
25.	*Rhinolophus sinicus*	Chinese rufous horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	LC	LC		Fry, 1925, Thapa et al. 2021, Thapa et al. 2022 (b), Jnawali et al. 2011
26.	*Rhinolophus rouxii*	Rufous Horseshoe bat	Chiroptera	Rhinolophidae	*, Ω	LC	LC		Jnawali et al. 2011, Thapa et al. 2021,
27.	*Hipposideros armiger*	Great roundleaf bat	Chiroptera	Hipposiderida e	*, Ω	LC	LC		Csorba et al. 1999, Pearch 2011, Jnawali et al. 2011, Millen & Lim 2018, Thapa et al. 2021, Thapa et al. 2022 (b),
28.	*Hipposideros cineraceus*	Ashy roundleaf bat	Chiroptera	Hipposiderida e	*, Ω	DD	LC		Thapa et al. 2022 (b)
29.	*Hipposideros gentilis*	Andersen's Leaf-nosed bat	Chiroptera	Hipposiderida e	*, Ω	NT	LC		Thapa et al. 2022 (b)
30.	*Miniopterus fuliginosus*	Eastern bent-wing bat	Chiroptera	Miniopteridae	*, Ω	LC	VU		Thapa et al. 2022 (b), Pearch 2011 (if M. schreibersii)
31.	*Murina aurata*	Little tube-nosed bat	Chiroptera	Vespertilionid ae	*, Ω	NT	DD		Maeda 1980, Jnawali et al. 2011, Thapa et al. 2021
32.	*Myotis csorbai*	Csorba's mouse-eared bat	Chiroptera	Vespertilionid ae	*, Ω	CR	DD		Pearch 2011, Thapa et al. 2021, Thapa et al. 2022 (b)
33.	*Pipistrellus javanicus*	Java pipistrelle	Chiroptera	Vespertilionid ae	*, Ω	LC	LC		Hinton & Fry 1923, Fry 1925, Jnawali et al. 2011, Thapa et al. 2021, Thapa et al. 2022 (b)
34.	*Lyroderma lyra*	Greater false vampire bat	Chiroptera	Megadermatid ae	*, Ω	LC	LC		Csorba et al. 1999, Jnawali et al. 2011, Thapa et al. 2021
35.	*Soriculus nigrescens*	Himalayan shrew	Eulipotyphla	Soricidae	*, Ω	LC	LC		Fry 1925, Abe 1982, Jnawali et al. 2011, Thapa et al. 2022 (a)
36.	*Suncus murinus*	Asian house shrew	Eulipotyphla	Soricidae	*, Ω	LC	LC		Abe 1982, Pearch 2011, Thapa et al. 2022 (a)
37.	*Episoriculus caudatus*	Hodgson's Brown-toothed Shrew	Eulipotyphla	Soricidae	Ω	LC	LC		Abe 1982, Shrestha & Basnet 2005, Pearch 2011
38.	*Chimarrogale himalayica*	Himalayan water shrew	Eulipotyphla	Soricidae	Ω	EN	LC		Abe 1982
39.	*Crocidura attenuata*	Grey shrew	Eulipotyphla	Soricidae	Ω	LC	LC		Mitchell & Punzo 1976, Pearch 2011
40.	*Suncus etruscus*	Savi's pygmy shrew	Eulipotyphla	Soricidae	Ω	LC	LC		Mitchell & Punzo 1976
41.	*Lepus nigricollis*	Indian hare	Lagomorpha	Leporidae	#, Ω	LC	LC		Hinton & Fry 1923, Fry 1925, Suwal & Verheugt 1995, Shrestha & Basnet 2005, Pandey 2012
42.	*Manis pentadactyla*	Chinese pangolin	Pholidota	Manidae	*, #, Ω, ψ	EN	CR	I	Shrestha & Basnet 2005, Bhandary and Chalise 2014, Dhital et al. 2020
43.	*Macaca assamensis*	Assamese macaque	Primates	Cercopithecid ae	*, #, Ω, ψ	VU	NT		Jnawali et al. 2011, Chalise et al. 2013, Dhital et al. 2020
44.	*Macaca mulatta*	Rhesus macaque	Primates	Cercopithecid ae	*, #, Ω, ψ	LC	LC		Suwal & Verheugt 1995, Jnawali et al. 2011, Shrestha & Basnet 2005, Pandey 2012

45.	*Dremomys lokriah*	Orange-bellied Himalayan squirrel	Rodentia	Sciuridae	*, #, Ω	LC	LC	Hinton & Fry 1923, Fry 1925, Suwal & Verheugt 1995, Shrestha & Basnet 2005, Jnawali et al. 2011, Katuwal et al. 2018, Dhital et al. 2020
46.	*Petaurista petaurista*	Red giant flying squirrel	Rodentia	Sciuridae	*, #, Ω	LC	LC	Thapa et al. 2016, Katuwal et al. 2018
47.	*Petaurista magnificus*	Hodgson's giant flying squirrel	Rodentia	Sciuridae	*, #, Ω	DD	LC	Pearch 2011, Koirala et al. 2016, Thapa et al. 2016
48.	*Petaurista nobilis*	Bhutan giant flying squirrel	Rodentia	Sciuridae	*, Ω	DD	NT	Fry 1925, Thapa et al. 2016
49.	*Hylopetes alboniger*	Particolored flying squirrel	Rodentia	Sciuridae	*, Ω	LC	LC	Hinton & Fry 1923, Ellerman 1961, Jnawali et al. 2011
50.	*Callosciurus pygerythrus*	Hoary-bellied squirrel	Rodentia	Sciuridae	*, Ω	LC	LC	Thapa et al. 2016, Katuwal et al. 2018
51.	*Hystrix brachyura*	Himalayan porcupine	Rodentia	Hystricidae	*, #, Ω, ψ	LC	LC	Camera trap in Nagarjun
52.	*Mus cervicolor*	Fawn-colored mouse	Rodentia	Muridae	*, Ω, ψ	LC	LC	Hinton & Fry 1923, Abe 1982, Suwal & Verheugt 1995, Shrestha & Basnet 2005, Thapa et al. 2022 (a)
53.	*Mus musculus*	House mouse	Rodentia	Muridae	*, Ω, ψ	LC	LC	Suwal & Verheugt 1995, Pearch 2011, Jnawali et al. 2011, Thapa et al. 2022 (a)
54.	*Mus booduga*	Common Indian field mouse	Rodentia	Muridae	Ω	LC	LC	Pearch 2011
55.	*Niviventer eha*	Smoke-bellied rat	Rodentia	Muridae	*, Ω	LC	LC	Thapa et al. 2022 (a)
56.	*Niviventer fulvescens*	Chestnut white-bellied rat	Rodentia	Muridae	*, Ω	DD	LC	Abe 1982, Pearch 2011, Thapa et al. 2022 (a)
57.	*Niviventer niviventer*	White-bellied rat	Rodentia	Muridae	*, Ω	LC	LC	Niethammer & Martens 1975, Abe 1982, Thapa et al. 2022 (a)
58.	*Rattus nitidus*	Himalayan field rat	Rodentia	Muridae	*, Ω	LC	LC	Abe 1982, Jnawali et al. 2011, Pearch 2011, Thapa et al. 2022 (a)
59.	*Rattus pyctoris*	Turkestan rat	Rodentia	Muridae	*, Ω	LC	LC	Hinton & Fry 1923, Jnawali et al. 2011, Thapa et al. 2022 (a)
60.	*Rattus rattus*	Black rat	Rodentia	Muridae	*, Ω	LC	LC	Abe 1982, Suwal & Verheugt 1995, Shrestha & Basnet 2005, Jnawali et al. 2011, Pearch 2011, Thapa et al. 2022 (a)
61.	*Vandeleuria oleracea*	Asiatic long-tailed climbing mouse	Rodentia	Muridae	*	LC	LC	Drishtant Bidari captured photograph inside SNNP in 2020.
62.	*Bandicota indica*	Greater bandicoot rat	Rodentia	Muridae	Ω	LC	LC	Pearch 2011
63.	*Mus terricolor*	Earth-coloured mouse	Rodentia	Muridae	Ω	LC	LC	Pearch 2011
64.	*Rattus tanezumi*	Oriental house rat	Rodentia	Muridae	Ω	LC	LC	Hinton 1922, Hinton & Fry 1923
65.	*Golunda ellioti*	Indian bush rat	Rodentia	Muridae	Ω	LC	LC	Pearch 2011

Note: * Direct observation, # Camera trap, Ω Literature Review, ψ Signs; CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern and DD = Data Deficient

Annex 3. The list of mammals excluded as their presence is not confirmed

SN	Scientific Name	Common Name	Order	Family	IUCN Red list		CITES	References
					National	Global		
1	*Lutra lutra*	Eurasian otter	Carnivora	Mustelidae		NT	I	SNNP 2017
2	*Manis crassicaudata*	Indan pangolin	Pholidota	Manidae				SNNP 2017
3	*Pardofelis marmorata*	Marbled cat	Carnivora	Felidae				SNNP 2017
4	*Hystrix indica*	Crested porcupine	Rodentia	Hystricidae	DD	LC		Shrestha & Basnet 2005, Pandey 2012, Dhital et al. 2020
5	*Ochotona roylei*	Royle's pika	Lagomorpha	Ochotonidae	EN	LC		Suwal & Verheugt 1995, Shrestha & Basnet 2005, SNNP 2017
6	*Semnopithecus schistaceus*	Nepal gray langur	Primates	Cercopithecidae	LC	LC		Suwal & Verheugt 1995, Shrestha & Basnet 2005, Jnawali et al. 2011