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## Status, Distribution, and Threats of Striped Hyena (*Hyaena hyaena* Linnaeus, 1758) in Nepal: A Review

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### ABSTRACT

Striped hyena (*Hyaena hyaena*) is a member of the Hyaenidae family distributed globally from Africa to Central Tanzania, the Arabian Peninsula, Turkey, Central Asia, and the Indian subcontinent including Nepal. Only a few documented studies have been carried out at a national as well as international level regarding their habit, habitat, threats, and conservation measures. Various open access works of literature including articles, reports, and books published from 1941 to 2021 were assessed through Google scholar and Research gate for this study. We searched, refined, and selected 42 pieces of literature for the study purpose. We found that striped hyenas were recorded from five national parks of lowland Terai regions and they were recorded in six districts lying outside the protected area in Central and Western Terai as well as the hilly region of Nepal. Habitat degradation, decreased prey population, retaliatory killing by poisoning, poaching and road kills are found to be the major threats to these endangered scavengers that require immediate conservation initiatives. We believe that this manuscript can fulfill the knowledge gap on this species and suggests conservation initiatives, which could be a landmark for conducting further research and conservation of striped hyenas.

### INTRODUCTION

Striped Hyena (*Hyaena hyaena*), known as *Hudaar* in Nepali, is one of the endangered mammal species and is the only species found in Nepal belonging to family Hyaenidae and this family consists of other three members namely Aardwolf (*Proteles cristata*), Brown hyena (*Hyaena brunnea*) and Spotted hyena (*Crocuta crocuta*) (Hofer & Mills, 1998; Jnawali et al., 2011; Bhandari & Bhusal, 2017). It has been listed as 'Near Threatened' category by the International Union for Conservation of Nature (IUCN) Red List category, nationally assessed as 'endangered species', Appendix-I of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and legally protected under National Park and Wildlife Conservation Act 1973 (Abisaid & Dloniak, 2015; Bhandari & Bhusal, 2017). The total estimated population of striped hyenas all over the world is less than 10,000 individuals (Abi-Said & Abi-Said, 2007) while in Nepal, its estimated

population is less than 100 individuals (Hofer & Mills, 1998; Jnawali et al., 2011).

Globally, the distribution of striped hyena extends from Africa to Central Tanzania, Arabian Peninsula, Turkey, Central Asia, and the Indian subcontinent which extends up to Nepal (Hofer & Mills, 1998; Jnawali et al., 2011). They are widely distributed in arid and semi-arid regions with open habitats or little thorn bushes and are found to neglect the higher altitudes but they are recorded up to 3300 m in Pakistan (Robert, 1977; Hofer, 1998; Wagner 2006; Alam et al., 2014). In Nepal, they have spread in lowland from central to western Terai and in the western hilly region with an altitude of 100 m to 1750 m both within and outside the protected areas (Shrestha, 1997; Chalise, 2001; Majupuria & Majupuria, 2006; Bhandari & Bhusal, 2017).

The striped hyena is a middle-sized predator with pointed ears, pale brown and males are slightly larger than the female (Pocock, 1941). They have a

black-colored tail with white underfur and are slightly longer and bushy than that of spotted hyena (Heptner & Sludskii 1992; Frembgen, 1998). Primarily, striped hyena is a nocturnal scavenger feeding on ungulate carcasses, bones, ligaments, and cartilages but can switch between scavenging and predating as per need so they are termed as 'opportunistic predator' (Heptner & Sludskii 1992; Yirga et al., 2014). They have a life span of 10-12 years in the wild with no apparent seasonal pattern of reproduction, their gestation period is 90–91 days usually springing 1-6 cubs born per litter (Wagner, 2006). Striped hyena's pack is led by a matriarch, although she participates very little in the actual hunting and females are found to have maintained smaller territory which can be easily defendable while males occupy larger territory (Jarman, 1974; Sandell, 1989). They lack sexual dimorphism and are monogamous where males establish a den and help females in raising and feeding offspring (Heptner & Sludskii, 1992; Tichon et al., 2020).

The main factors which result in the decline of striped hyena include retaliatory killing as they are accused of a grave thief in the middle east and also suspected to damage the agriculture and their livestock in Israel, change of the agricultural and livestock practices and decrease in the sources of carcasses due to the low number of other large carnivores and prey species (Hofer & Mills, 1998; Wagner, 2006). The striped hyena also became the victim of poisoning from 1918 to 1948 and also from 1950 to 1970 (Hofer & Mills, 1998). Three-striped hyenas were found dead with their sexual organ removed in Iran (Tourani et al., 2012) as their labial folds are believed to be used in a magical process in southern and western Asia (Frembgen, 1998). The threats are increasing with the increasing urbanization, desertification, and environmental degradation resulting decrease in habitat and population (Bhandari et al., 2021).

Striped hyena plays a vital role to maintain forest and grassland ecosystem as an opportunistic predator, as a scavenger by clearing carcasses and by ingestion of plants and flowers which helps in remodeling of vegetation directly or indirectly (Singh, 2008; Bhandari et al., 2021; Djamali et al., 2020). The conservation activities in Nepal are more skewed towards the flagship mammals and other non-flagship mammals are given less importance (Katuwal et al., 2018). Still, only a few

pieces of research are carried out at the national as well as international level regarding their habit, habitat, threats, and conservation measures (Bhandari & Bhusal, 2017). This review is carried out to compile comprehensive and updated information about the status, distribution, and threats of striped hyenas in Nepal. Thus, we believe this manuscript could help to assemble the information regarding this species initiative that could be a landmark for conducting further research on the striped hyena.

## MATERIALS AND METHODS

The method applied was a desk study where all the required information for the manuscript was obtained by evaluating different scholarly works, journals, academic papers, books, and reports on the striped hyena over 80 years from 1941 to 2021 in Nepal to get detailed information about them in Nepal. Similarly, other studies from their whole home range were also used to get additional information. For this purpose, two search engines, Google Scholar and Research gate were used. Similarly, other reports were also used to gain additional information. Keywords like '*Striped Hyena in Nepal*', '*Threats to Hyaena*' '*Hyaena hyaena*', '*Hyaenidae*', '*Scavenger*', '*Endangered mammals of Nepal*', etc. were used to search the pieces of literature. Altogether 52 pieces of secondary information were downloaded from two search engines.

The downloaded pieces of literature were then screened to remove the duplicates. The literature regarding the population status, distributions, and threats of striped hyena were included in the study. The screened pieces of literature were then reviewed multiple times by all the authors to extract the information as per our objectives and literature, which did not meet our objectives, was excluded. Forty-two pieces of literature that include research papers, reports, and books were used for the study purposes. The obtained information was compiled and reviewed multiple times to draft the manuscript. Arc GIS 10.0 was used to prepare the distribution Map.

## RESULTS AND DISCUSSION

### Population status

The worldwide population size of striped hyenas was estimated to be about 5000 to 14000

individuals in 1998 (Hofer & Mills, 1998). Abi-Said & Abi-Said (2007) reported the estimated population of striped hyenas globally to be less than 10,000 individuals. A report by Abi Said & Dloniak (2015) documented that the population status of striped hyenas is decreasing with an estimated population of matured individuals to be between 5000 and 9999. Out of this global population, around 1000 to 3000 individuals of striped hyena (around 18-20% of the global population) is estimated to be found in India (south to Nilgiri hills, Gujarat, the lowland of Jammu and Kashmir, east to west Bengal) (Kruuk, 1976; Hofer & Mills, 1998; Qarqaz et al., 2004; Sharma et al., 2015). Similarly, Hofer & Mills (1998) estimated nearly more than half of the global striped hyena population (2450-7850 individuals) to be found in Africa (North and East-Africa).

In the context of Nepal, the exact population status of striped hyenas is yet to be explored and documented. However, Hofer & Mills (1998) estimated the population to be 10-50 individuals and Jnawali et al. (2011) estimated the population to be less than 100 individuals. Besides, many cases regarding sightings of striped hyena and human-hyena encounters are frequently reported in Nepal. Khanal et al. (2017) reported that a den of striped hyena was found in the Kalapani community forest of Deukhuri valley in Dang district in 2012. The den found was located at an altitude of 282 m from sea level and was recorded as the first confirmed den of striped hyena in Nepal and in 2017, striped hyenas residing in that den were confirmed to be breeding which was found out through camera trapping (Khanal et al., 2017). Exact population data is lacking because no particular research has been carried out for the population study and only guessed estimated data is available (Jnawali et al., 2011). Nocturnal habit, solitary behavior, and difficult terrain habitat of striped hyena make it difficult to conduct surveys and research on its actual population status (Abisaid & Dloniak, 2015). Similarly, most of the research and conservation activities are confined to flagship species in Nepal (Thapa et al., 2014).

#### **Distribution of Striped hyena**

Regarding the distribution of striped hyena in Nepal (Figure 1), Shrestha (1997) reported their occurrence from Terai to Hilly region, from an altitude of 100 m to 1750 m inside and outside the

protected areas which also resembles the findings of Chalise (2001), Majupuria & Majupuria (2006) and Bhandari & Bhusal (2017). All these protected areas lie in the lowland Terai region of Nepal and they are Parsa National Park (PNP), Chitwan National Park (CNP), Banke National Park (BaNP), Bardiya National Park (BNP), and Shuklaphanta National Park (ShNP) (Heinen, 1994; Jnawali et al., 2011; Bhandari & Chalise, 2016; Adhikari et al., 2018; Bhandari et al., 2018;), while outside the protected areas, the species was recorded in Central Terai districts that include Sarlahi and Rautahat (Bhandari et al., 2018) and western part of Terai in Dang district as well as districts in hilly regions namely Kalikot and Jajarkot of Western Nepal (Khanal and Baniya, 2018; Bhandari & Bhusal, 2017). In research conducted in 11 Terai districts of Nepal, from Bagmati in central Nepal to Mechi in the east, striped hyena presence was confirmed in the western part of the study area i.e., Sarlahi and Rautahat (Allendorf et al., 2020). Arid and semi-arid environments and human presence shape the distribution of striped hyenas in the southeast lowlands of Nepal (Bhandari et al., 2021). The distribution of striped hyena is normally found in human-dominated areas where water availability is within 10 km (Khanal et al., 2017) though it possesses a high risk of exposure to human as the food and water is easily available nearby human settlement (Singh et al., 2010; Bhandari et al., 2021).

Kruuk (1976) and Wagner (2006) found that striped hyenas were habituated to arid and semi-arid environments. Alam et al. (2014) reconfirmed the habitual ecology of striped hyenas. Furthermore, a detailed report by Priya (2008) and Akay et al. (2011) suggested striped hyena survive naturally in the tropical region and open areas with short shrubs and scarce trees. In the context of Nepal, Allendorf et al. (2020) reported striped hyena presence in dry areas of Terai; Sarlahi, Rautahat which matches with the fact that striped hyenas live in the drier areas. In Nepal, higher striped hyena frequencies were reported in areas with low canopy volume (grasslands and riverbeds) which were close to human settlement areas as food and water was easily available there while lower striped hyena frequencies were reported in thick and dense forest areas (*Shorea robusta*, *Acacia* spp. and riverine mixed forest) and difficult landscape (200 to 400

m.s.l) as the area was rough and less dense which facilitates safe refuge availability for striped hyena (Bhandari et al., 2021).

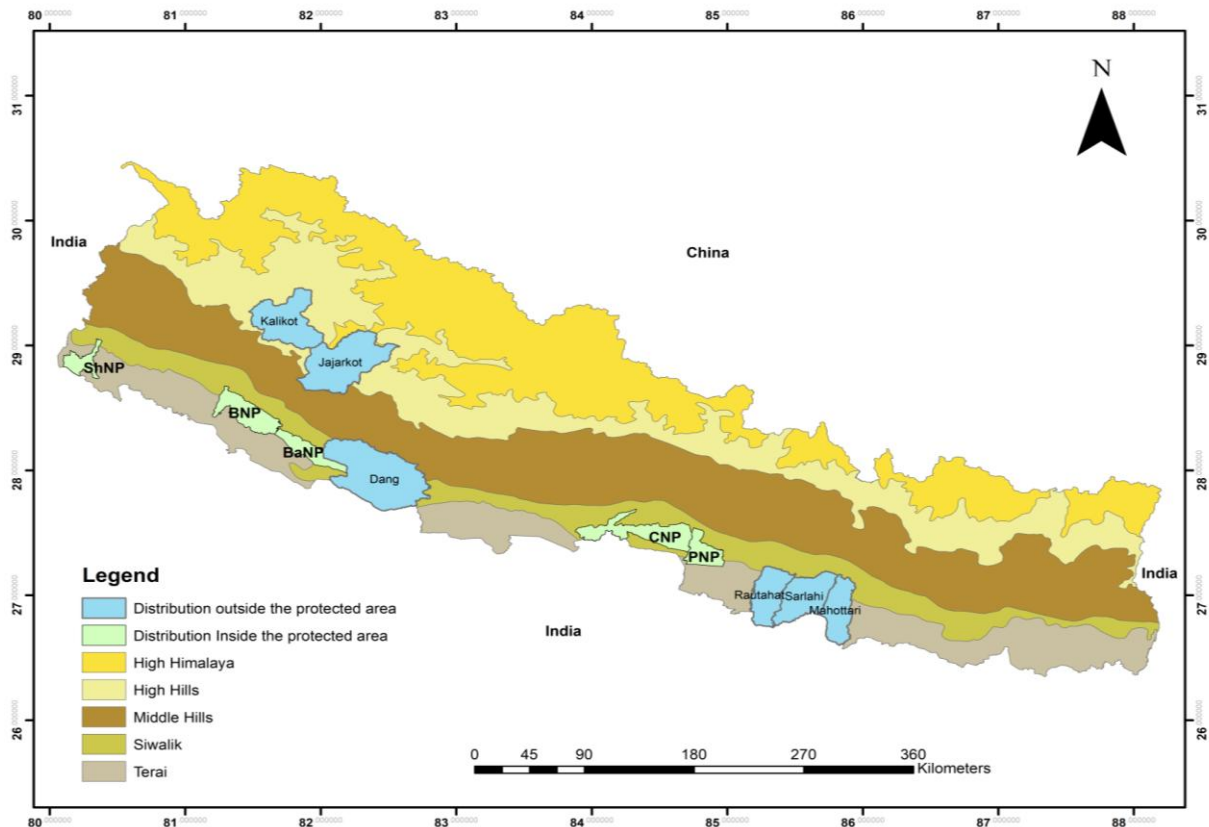


Figure 1. Map showing distributional records of striped hyena in Nepal

### Threats to Striped hyena

The detailed study of the literature reveals that the population of striped hyenas is gradually decreasing and is on the verge of extinction (Alam et al., 2015). Decrease in food stocks and prey species along with competition with another carnivore for habitat are documented as the global driving factor in the decrease and declination of striped hyena population (Wagner, 2006; Alam, 2011). In many countries of the world, various developmental activities like road construction, urbanization, industrialization, and other activities in human-dominated areas along with encroachment and desertification have triggered the conflict of striped hyena with people (Carter et al., 2013; Joshi et al., 2016; Bhandari et al., 2020). Similarly, hunting and poaching of striped hyenas for skin, traditional medicine, and displaying as an entertainment item is another driving factor for their declination and population reduction (Abisaid & Dloniak, 2015).

In Nepal, striped hyena exists patchily in hills and Terai region but its number and habitat are

gradually decreasing because of human-induced activities like deforestation, degradation, and urbanization (Hofer & Mills, 1998; Abi-Said & Dloniak, 2015; Creel et al., 2018; Bhandari et al., 2021). Decrease in prey species of striped hyena because of low plant diversity along with land-use change is challenging the survival and existence of striped hyena in Nepal (Bhandari et al., 2021). Similarly, the major threats are attributed to habitat degradation, human hyena conflict, and other activities of illegal hunting, poisoning, and poaching in Nepal (Adhikari et al., 2018; Bhandari & Bhusal, 2017). The local people, mostly in the hilly region (Jajarkot and Kalikot) are found to be less aware of conserving the striped hyena due to the loss they have been facing from the striped hyenas preying on their livestock (Bhandari & Bhusal, 2017). In between 2015-2016, 4 striped hyenas in Jajarkot and 2 in Kalikot were reported to be retaliatorily killed in conflict with the human while 2 striped hyenas were poisoned by locals in Mahottari (Bhandari & Bhusal, 2017). Meanwhile in May 2017, on East-West Highway near Nijgad, h,

a mature male striped hyena was found dead (Adhikari et al., 2018). These cases of striped hyena deaths are serious threats that need to be addressed very soon.

In this regard, it is of utmost need to conduct more research and exploration on understanding the population dynamics, behavior, habitat selection, availability of prey, and ecological niche of striped hyena in the context of Nepal. Along with these, further investigations are required on increasing threats and mortality rate, as well as evaluations are necessary on present strategies including designing efficient conservation approaches for the conservation and existence of striped hyenas in Nepal (Bhandari & Bhusal, 2017; Bhandari et al., 2021). Most importantly, human-hyena conflict, poisoning, and poaching along with environmental degradation have to be reduced and a positive attitude should be lightened to the people (Bhandari et al., 2021) with various programs that can create awareness on the conservation of the species. Additionally, the government should establish compensation and relief programs for loss of life and livestock from striped hyena to reduce the human-hyena conflicts.

## CONCLUSION

The striped hyena is a charismatic mammal, scavenger, and opportunistic predator. In Nepal, they are mostly found in the dry, semi-arid areas nearby human settlements in Terai and Hilly region lying within or outside protected areas. This study found the distribution of striped hyena in five National Parks BNP, BaNP, ShNP, CNP, and PNP of lowland Terai region as well as located in six districts lying outside the protected area in Central Terai (Sarlahi, Mahottari, and Rautahat) and Western Terai (Dang) and Hilly region (Kalikot and Jajarkot) of Nepal. Retaliatory killing by poisoning, habitat destruction, road kills, and depletion of their prey species are the main threats of the striped hyena in Nepal. The exact population of striped hyenas in Nepal is still unknown which directly shows the need for more targeted surveys and research to understand their distribution and present population dynamics in Nepal. Thus, the effective awareness and education campaigns, compensation and insurance policy to mitigate human-hyena conflict, wildlife crossing structures in highways and proper habitat management of the species with

the integrated efforts of government, NGOs, INGOs, and people could only secure the existence of striped hyenas in Nepal

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