

STATUS OF STRIPED HYENA (*Hyaena hyaena* Linnaeus, 1758) AND THEIR CONSERVATION APPROACHES IN RAUTAHAT AND SARLAHI FORESTS, NEPAL

SHIVISH BHANDARI¹ ✉, BISHWANATH RIJAL¹ AND SUJAN KHANAL²

¹ Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal

²Institute of Forestry, Hetauda, Makawanpur, Nepal

shivish.bhandari@yahoo.com |shivish101@gmail.com

ABSTRACT

The striped hyena is one of the least studied large carnivores in Nepal. We evaluated status of Striped hyena (*Hyaena hyaena* Linnaeus, 1758) and their conservation approaches in Rautahat and Sarlahi forests, Nepal. The overall objective of this study was to explore the baseline information on striped hyena and to recommend the future conservation action for striped hyena. Camera trapping, sign transect and questionnaire surveys were used to collect the baseline information on striped hyena. A total of 20 mammalian species including striped hyena were recorded. The striped hyena preferred riverbed than that of mixed forest, Accacia forest, Shorea forest and grassland. Most of the striped hyena sign evidences (36.27 %) were located in riverbed, followed by mixed forest (26.47%), Accacia forest (20.58 %), Shorea forest (15.56 %) and grassland (0.98%). Habitat degradation was one of the major threats to this animal and its prey species.

Keywords: striped hyena, camera trapping, riverbed, conservation

INTRODUCTION

The striped hyena (*Hyaena hyaena* Linnaeus, 1758) belongs to Hyaenidae family (Prater, 1971; Alam *et al.*, 2014), is one of the least known large carnivore species (Hofer & Mills, 1998; Jnawali *et al.*, 2011; Sharma *et al.*, 2011). It is a scavenger in its habit (Kruuk, 1976; Hofer & Mills, 1998; Alam *et al.*, 2014) that plays an important role in energy flow in an ecosystem (Akay *et al.*, 2011). The distribution area of the striped hyenas around the globe extends from tropical and sub-tropical regions of Africa to middle and south Asia (Hofer & Mills, 1998; Leakey *et al.*, 1999; Qarqaz *et al.*, 2004; Wagner, 2006). The striped hyena has been classified on the IUCN Red List as “Near Threatened” and protected by Government of Nepal “National Park and Wildlife Conservation Act (NPWCA) 2029 (1973)” due to retaliatory killings, persecution, depleting prey populations and loss of habitat (Majupuria & Majupuria, 2006; Baral & Shah, 2008; Jnawali *et al.*, 2011).

Densities of Striped hyenas appear to vary greatly across their range and factors driving this variation are poorly understood because of the paucity of rigorous studies (Hofer & Mills, 1998; Qarqaz *et al.*, 2004; Alam *et al.*, 2015). Comparing with the other large carnivores such as tiger, leopard, etc. there is not much known about striped hyenas and its ecology and conservation. The scanning of some literatures reveals that the Striped hyena’s population has been already

extinct from many localities (Kruuk, 1976; Hofer & Mills, 1998; Wagner, 2006; Khorozyan *et al.*, 2011), and that populations are generally declining throughout their geographical range due to persecution, poisoning, and hunting for meat or medicinal purposes (Qarqaz *et al.*, 2004; Alam *et al.*, 2015). This animal mostly prefer open areas or lands covered with short shrubs in their natural distribution areas (Akay *et al.*, 2011). In the Indian subcontinent, they occur in arid and semi-arid ecosystems, as well as in the extremely wet regions of southwestern coast (Prater, 1971; Karanth, 1986). In many parts of distribution ranges, its population has decreased and presently is confined to small patches (Qarqaz *et al.*, 2004; Singh, 2008; Singh *et al.*, 2010). Among other reasons, the habitat deterioration and depletion are the major factors, restricting the population of this species (Qarqaz *et al.*, 2004; Jnawali *et al.*, 2011). In Nepal, the striped hyena is distributed in lowland of southern part of the country including protected areas (Shrestha, 1997; Chalise, 2001; Majupuria & Majupuria, 2006; Baral & Shah, 2008; Jnawali *et al.*, 2011) and few other places with estimation of less than 100 individuals (Hofer & Mills, 1998; Jnawali *et al.*, 2011). However, little is known about its past and present occurrence (Hofer & Mills, 1998; Sharma *et al.*, 2011; Jnawali *et al.*, 2011). Hence, studies on this species are urgently required not only to help its survival, but also to further investigate its ecology and potential habitat for the long-term conservation and survival. The present study demonstrates that extensive field work and current status regarding habitat, threats, conservation initiatives and peoples' tolerance level which may help in predicting the baseline information and lead to conservation of striped hyena in Nepal.

Study area

The study area was located in Rautahat and Sarlahi districts of central tarai, Nepal (fig. 1) covering an area of 300 square kilometers with Shorea (Sal) forest, grassland, Acacia forest, and mixed riverine forest and the altitude range was 110 – 350 masl (meters above sea level). The study sites were connected to the terai Arc Landscape (TAL) area in the west. TAL is a vast landscape and has been initiated since 2001 covering an area of 49,500 sq km, which extends from Bagmati River of Nepal in the east to Yamuna River of India in the west. TAL encompasses 11 Protected Areas and forest corridors stretching along the Indo-Nepal border from Parsa Wildlife Reserve of central Nepal to Rajaji National Park of India (Kanagaraj *et al.*, 2011). In Nepal, TAL encompasses 23,129 sq km of 14 districts including 75 percent of the remaining forests of the lowland Nepal including Churia hills and some protected areas (MFSC, 2006; Kanagaraj *et al.*, 2011).

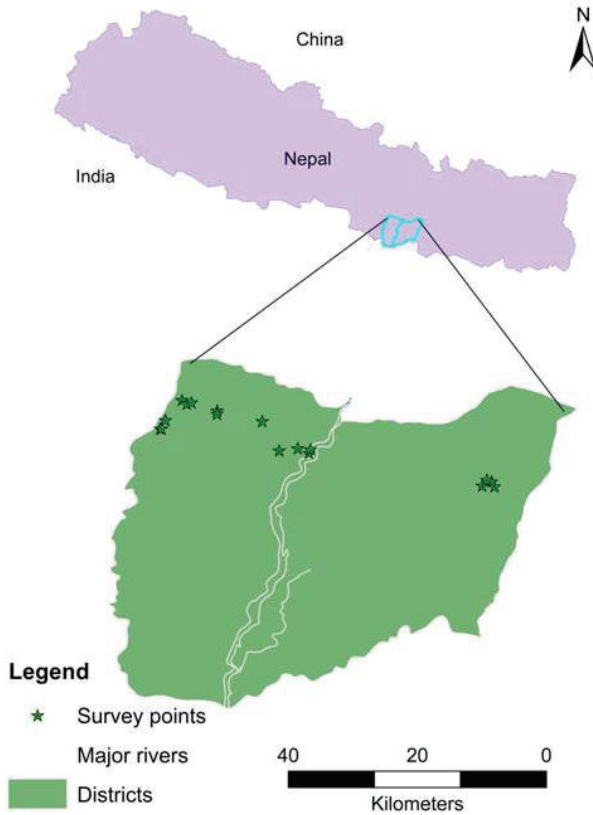


FIG. 1. Location of the study site: the Rautahat and Sarlahi districts of Nepal.

MATERIALS AND METHODS

The study was conducted during September 2015 to November 2015. Sign transect sampling in all possible habitats such as river belt, forest trails, grassland and agriculture land were used to collect information on habitat preference of Striped hyena as well as to explore the mammalian species in the study site. Some relevant field guide and book (Baral & Shah, 2008; Jnawali *et al.*, 2011) on wild mammals of Nepal were used during this study. The camera trap sampling was used for the confirmation of striped hyena population. All camera traps were installed during night time (around 06 PM to 06 AM) only. Four sets of camera trap (STEALTH CAM Digital Scouting Cameras) were installed at 24 stations for over 80 nights.

Questionnaire survey was the first step in documenting the status and distribution of a species (Hofer & Mills, 1998). We used the structured questionnaire sheets from September 2015 to October 2015 to collect information on general status, conflicts, conservation approaches and people's tolerance level towards the striped hyena. During the survey, 50 key peoples (community forest members, graduate students, local club members, etc) were interviewed.

RESULTS AND DISCUSSION

Presence and absence survey: This study demonstrated that large carnivore presence in all the studied habitat types in this human dominated landscape. We recorded 20 species including the striped hyena (fig. 2) through camera trapping, direct observation and sign survey. There were five carnivores named Striped hyena (*hyaena hyaena*), Bengal fox (*Vulpes bengalensis*), Large Indian civet (*Viverra zibetha*), Golden jackal (*Canis aureus*) and Jungle cat (*Felis chaus*) captured by camera trapping in the study site (table 1). Among the 20 species, three species *Elephas maximus* (Asian elephant), *Rhinoceros unicornis* (One horned rhinoceros), and *Hyaena hyaena* (Striped hyena) protected by NPWCA 2029 were recorded, and moreover Asian elephant and one horned rhinoceros were also listed as endangered and vulnerable respectively by IUCN red list category (table 1). The pugmark image of Common leopard (*Panthera pardus*) and Striped hyena (*Hyaena hyaena*) were also captured (fig. 3 & 4).



FIG. 2. Adult Striped hyena captured during camera trap in the study site.

TABLE 1. Some mammalian species and their conservation status found in the study site.

Name of the species	Survey methods	IUCN Status
*Striped hyena, <i>Hyaena hyaena</i> (Linnaeus, 1758)	Camera trapping and sign survey	NT
Rhesus macaque, <i>Macaca mulatta</i> (Zimmermann, 1780)	Direct observation	LC
*Asian elephant, <i>Elephas maximus</i> (Linnaeus, 1758)	Direct observation and sign survey	EN

One-horned rhino, <i>Rhinoceros unicornis</i> (Linnaeus, 1758)	Sign survey	VU
Nilgai, <i>Boselaphus tragocamelus</i> (Pallas, 1766)	Direct observation and sign survey	LC
Barking deer, <i>Muntiacus vaginalis</i> (Boddaert, 1785)	Direct observation	LC
Wild boar, <i>Sus scrofa</i> (Linnaeus, 1758)	Direct observation	LC
Common leopard, <i>Panthera pardus</i> (Schlegel, 1857)	Sign survey	NT
Bengal fox, <i>Vulpes bengalensis</i> (Shaw, 1800)	Camera trapping	LC
Large Indian civet, <i>Viverra zibetha</i> (Linnaeus, 1758)	Camera trapping	NT
Golden jackal, <i>Canis aureus</i> (Linnaeus, 1758)	Camera trapping	LC
Jungle cat, <i>Felis chaus</i> (Schreber, 1777)	Camera trapping	LC
Grey mongoose, <i>Herpestes edwardsii</i> (É. Geoffroy Saint-Hilaire, 1818)	Direct observation	LC
Small Asian mongoose, <i>Herpestes javanicus</i> (É. Geoffroy Saint-Hilaire, 1818)	Direct observation	LC
Terai grey Langur, <i>Semnopithecus hector</i> (Pocock, 1928)	Direct observation	NT
Lesser bandicoot rat, <i>Bandicota bengalensis</i> (Gray, 1835)	Direct observation	LC
Five-striped palm squirrel, <i>Funambulus pennantii</i> (Wroughton, 1905)	Direct observation	LC
Indian hare, <i>Lepus nigricollis</i> (F. Cuvier, 1823)	Direct observation	LC
Common Indian field mouse <i>Mus booduga</i> (Gray, 1837)	Direct observation	LC
Asiatic lesser yellow bat, <i>Scotophilus kuhlii</i> (Leach, 1821)	Direct observation	LC

***NPWCA 2029, protected.**



FIG. 3. Pugmark of Striped hyena in the study site.



FIG. 4. Pugmark of Common leopard.

Habitat preference of Striped hyena

Mainly five major different types of habitats of forest systems (river bed, mixed forest, Accacia forest, Shorea forest and grassland in lowland areas were selected in this study. Evidences of Striped hyena signs (scat, pugmark and kill) i.e. 37 (36.27 %) were located in riverbed, followed by mixed forest i.e. 27 (26.47%), Accacia forest i.e. 21 (20.58 %), Shorea forest i.e. 16 (15.56 %) and grassland i.e. 1 (0.98%). Mostly pugmarks were seen in riverbed followed by mixed forest, Accacia forest and Shorea forest. A total of 13 scats of striped hyena were found in the study site and most of the scats (i.e. 4) were found in the mixed forest followed by riverbed (i.e.3), Accacia forest (i.e.3), Shorea forest (i.e.2) and grassland (i.e.1) (fig. 5).

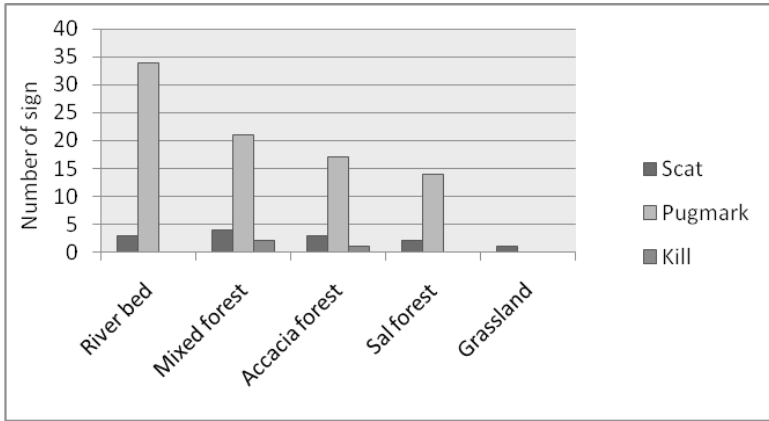


FIG. 5. Sign of Striped hyena in different habitat in Rautahat and Sarlahi.

Local people stated their mixed opinion towards Striped hyena conservation in and around of study site. This did not support to the conservation of striped hyena due to killings of live-stocks was killed by Striped hyena. Most of the people needed to conserve this species in and around the study site if conservation plan includes compensation schemes (fig. 6). The study area provides good habitat for Striped hyena but are under threats due to habitat degradation, poaching, loss of prey species and livestock grazing. The high dependency of the local people on the natural forests especially government managed forests was also a major problem to the survival of the Striped hyena and its prey species.

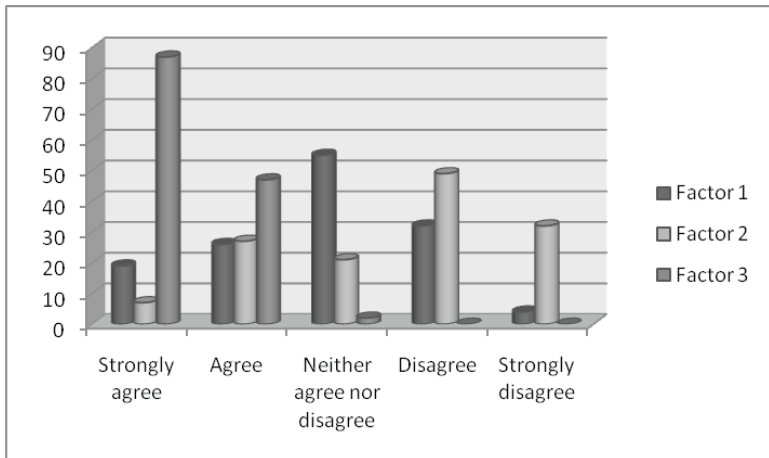


FIG. 6. Tolerance level of local peoples (n= 136), Factor 1: Increasing Striped hyena population is good, Factor 2: I support striped hyena conservation even my livestock has been killed and Factor 3: Striped hyena conservation is needed to conserve outside the protected areas.

Conservation approaches for Striped hyena

We found some local people involved in biodiversity conservation highlighting the importance of biodiversity and wildlife including the striped hyena role for maintaining healthy ecosystem. Scientific management of community managed government forests, regular monitoring and collaboration among forest user groups, district forest office and community forest committee were best program in respect to species and its prey conservation. The advertisement broadcasting from radio stations regarding wildlife and its habitat conservation, fire controlling, hunting etc. are the appropriate way to motivate to local people in the conservation sector. The Government of Nepal has established the Armed Police Force and District Forest Office-Area Sectors in some parts of the forests to control poaching, deforestation and conservation of nature and natural resources.

Carnivores often limit the number of their prey, thereby altering the structure and function of entire ecosystems (Schaller, 1972; Treves & Karanth, 2003). Moreover, species with large spatial requirements, such as top predators, play indispensable roles in the long term maintenance of diversity (Terborgh, 1992). The large home ranges of large carnivores often draw them into recurrent competition with humans, particularly in areas associated with extensive livestock management. Indeed, many large carnivore species are specialized on either natural or domesticated ungulate prey, and some individuals seek and readily kill large livestock when opportunities arise (Meriggi & Lovari, 1996; Polisar *et al.*, 2003; Michalski *et al.*, 2006). The striped hyena, being at the apex of the food chain, influences the ecosystem structure and function despite their low densities in population. They are sensitive to habitat loss and fragmentations because of their large territories, high mortality rates and conflict with people in terms of predation of livestock, and they show a differential response to human induced land-use modifications. There are few populations of Striped hyena in Nepal (Hofer & Mills, 1998; Jnawali *et al.*, 2011) and many tropical, wide ranging carnivorous mammals are now threatened because of the depletion of their prey reserves and anthropogenic pressures that come into conflict with their basic ecological needs (Woodroffe & Ginsberg, 1998; Treves & Karanth, 2003; Chutipong *et al.*, 2014). We investigated the Striped hyena's status in the Rautahat and Sarlahi forests and it needs to be conserving due the low population density and high level of conflicts between human and Striped hyena. Many authors (Sharma *et al.*, 2011; Singh, 2008; Qarqaz *et al.*, 2004) argued that conflicts with Striped hyenas are universal, and people near ubiquitous negative attitude toward carnivores and the conflicts are a major challenge to biodiversity conservation (Woodroffe & Frank, 2005; Woodroffe, 2000). In this context, human–carnivore conflicts pose an urgent challenge to carnivore conservation, especially in recent deforestation frontiers where the requirements of carnivore populations are often at odds with those of human activities. Human–wildlife conflicts present an increasing challenge to conservation, particularly in densely populated parts of low-income countries (McGuinness & Taylor, 2014). The conflicts are difficult to understand and manage because they are influenced by many factors including religious values, cultural and economic values of carnivores and their body parts, and the economic loss imposed by carnivore damage (Dickman, 2010). On consequence, it is important to identify the degree of influence from these factors in order to lay a foundation for designing specific conservation programs and policies (Li *et al.*, 2013).

However, this study was conducted in a human dominated landscape and it was concluded that habitat destruction and lack of conservation awareness program are major problem to the survival of the striped hyena population.

Government programs should be reached to the local people basically on using alternative energy sources, growing food for livestock, stall feeding and alternative livestock breeds and reduce their dependency on forest products, which would be helpful to conserve Striped hyena and other wildlife species. Additionally, local people should be directly involved in development, education and conservation programmes which may improve their perception of wildlife conservation, moreover education programmes about Striped hyena ecology should be implemented, along with training in farming skills. Various ecological aspects regarding population status, distribution pattern, behaviour of Striped hyena etc. are yet to be studied. Further, threats and human-striped hyena conflicts have to be measured and mitigated. Therefore, research and conservation implementation programmes should be conducted. The prevalence of positive attitudes toward its conservation holds potential for the long-term conservation of this least populated species in and outside the protected areas of lowland, Nepal.

ACKNOWLEDGEMENTS

We would like to thank Rufford Small Grant Foundation for funding the study. We are very thankful to Katie Adamson Conservation Fund and Nepal Biodiversity and Research Society (NEBORS) for field equipment support. We are thankful to Dr. Mukesh Kumar Chalise, Mr. Dave Johnson, Mr. Bishnu Thapa, and all correspondents.

REFERENCES

- AKAY, A E; INAC, S; YILDIRIM, I C (2011) Monitoring the local distribution of Striped hyenas (*Hyaena hyaena* L.) in the eastern mediterranean region of Turkey (Hatay) by using GIS and remote sensing technologies. *Environ Monit Assess* 181: 445–455.
- ALAM, M S; KHAN, J A; KUSHWAHA, S P S; AGRAWAL, R; PATHAK, B J; KUMAR, S (2014) Assessment of suitable habitat of near threatened Striped hyena (*Hyaena hyaena* Linnaeus, 1758) using remote sensing and geographic information system. *Asian Journal of Geoinformatics* 14(2): 1–10.
- ALAM, M S; KHAN, J A; PATHAK, B J (2015) Striped hyena (*Hyaena hyaena*) status and factors affecting its distribution in the Gir National Park and Sanctuary, India. *Folia Zool* 64: 32–39.
- BARAL, H S; SHAH, K B (2008) Wild mammals of Nepal. Himalayan Nature, Kathmandu. Nepal; 188 pp.
- CHALISE, M K (2001) Nepal's wildlife (Part -2). Nepal Natural History Society Publication, Kathmandu, Nepal; pp 40–42.
- CHUTIPONG, W; ANTONY, J L; ROBERT, S; TOMMASO, S; GEORGE, A G (2014) Sampling mammalian carnivores in western Thailand: Issues of rarity and detectability. *Raffles Bulletin of Zoology* 62: 521–535.
- DICKMAN, A J (2010) Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Animal Conservation* 13: 458–466.
- HOFER, H; MILLS, G (1998) Population size, threats and conservation status of hyenas. In MILLS, G; HOFER, H (compilers) *Hyenas status, survey and conservation action plan*. IUCN/SSC hyena specialist group. IUCN, Gland, Switzerland and Cambridge, UK; pp 64–79.
- JNAWALI, S R; BARAL, H S; LEE, S; ACHARYA, K P; UPADHYAY, G P; PANDEY, M; SHRESTHA,

- R; JOSHI, D; LAMICHHANE, B R; GRIFFITHS, J; KHATIWADA, A; AMIN, R (2011) The status of Nepal mammals: the national red list series. Department of National Parks and Wildlife Conservation Kathmandu, Nepal.viii+266 pp.
- KANAGARAJ, R; WIEGAND, T; SCHADT, S K; ANWAR, M; GOYAL, S P (2011) Assessing habitat suitability for tiger in the fragmented Terai arc landscape of India and Nepal. *Ecography* 34: 970–981.
- KARANTH, K U (1986) Status of wildlife and habitat conservation in Karnataka. *Journal of the Bombay Natural History Society* 83: 166–179.
- KHOROZYAN, I; MALKHASYAN, A; MURTSKHVALADZE, M (2011) The striped hyaena *Hyaena hyaena* (Hyaenidae, Carnivora) rediscovered in Armenia. *Folia Zool* 60: 253–261.
- KRUUK, H (1976) Feeding and social behavior of the Striped hyena (*Hyaena hyaena*). *E. Afr. Wildl. J* 14: 91–111.
- LEAKEY, L N; MILLEDEGE S A H; LEAKEY, S M; HAYNES, P; KIPTOO, D K; MCGEORGE, A (1999) Diet of striped hyaena in northern Kenya. *African Journal of Ecology* 34: 314–326.
- LI, J; YIN, H; WANG, D; JIAGONG, Z; LU, Z (2013) Human-snow leopard conflicts in the Sanjiangyuan region of the Tibetan plateau. *Biological Conservation* 166: 118–123.
- MAJUPURIA, T K; MAJUPURIA, R K (2006) Wildlife and protected areas of Nepal. Craftsman Press Ltd, Bangkok, Thailand; 549 pp.
- MCGUINNESS, S; TAYLOR, D (2014) Farmers' perceptions and actions to decrease crop raiding by forest-dwelling primates around a Rwandan forest fragment. *Human Dimensions of Wildlife* 19(2): 179–190.
- MERIGGI, A; LOVARI, S (1996) A review of wolf predation in southern Europe: does the wolf prefer wild prey to livestock? *Journal of Applied Ecology* 33: 1561–1571.
- MFSC (2006) Terai Arc Landscape–Nepal annual progress report, Ministry of Forests and Soil Conservation, Nepal; 38 pp.
- MICHALSKI, F; BOULHOSA, R L P; FARIA, A; PERES, C A (2006) Human–wildlife conflicts in a fragmented Amazonian forest landscape: determinants of large felid depredation on livestock. *Animal Conservation* 9: 179–188.
- POLISAR, J; MATIX, I; SCOGNAMILLO, D; FARRELL, L; SUNQUIST, M E; EISENBERG, J F (2003) Jaguars, pumas, their prey base, and cattle ranching: ecological interpretations of a management problem. *Biological Conservation* 109: 297–310.
- PRATER, S H (1971) The book of Indian animals. Bombay Natural History Society, India; 324 pp (3rd edition).
- QARQAZ, M A; BAKER, M A A; AMR, Z S (2004) Status and ecology of the striped hyaena, *Hyaena hyaena*, in Jordan. *Zoology in the Middle East* 34: 87–92.
- SCHALLER, G B (1972) The serengeti lion: a study of predator–prey relations. University of Chicago Press. Chicago, USA; 504 pp.
- SHARMA, G; VIJAY, P; RAJPUROHIT, L S; RAM, C (2011) Ecobehaviour study and status of striped hyena (*Hyaena hyaena* Linnaeus, 1758) in south western Rajasthan, India. *Journal of Evolutionary Biology Research* 3(4): 44–46.

- SHRESTHA, T K (1997) Mammals of Nepal. Shrestha, B, Kathmandu, Nepal; 371 pp.
- SINGH, P (2008) Population density and feeding ecology of the striped hyena (*Hyaena hyaena*) in relation to land use patterns in an arid region of Rajasthan. MS thesis, The Manipal University, Bangalore, India; 48 pp.
- SINGH, P; GOPALSWAMY, A M; KARANTH, K U (2010) Factors influencing densities of Striped hyaenas (*Hyaena hyaena*) in arid regions of India. *Journal of Mammalogy* 91(5): 1152–1159.
- TERBORGH, J (1992) Maintenance of diversity in tropical forests. *Biotropica* 24: 283–292.
- TREVES, A; KARANTH, K U (2003) Human–carnivore conflict and perspectives on carnivore management worldwide. *Conservation Biology* 17: 1491–1499.
- WAGNER, A P (2006) Behavioral ecology of the Striped hyena (*Hyaena hyaena*). PhD dissertation, Bozeman, Montana State University, USA.
- WOODROFFE, R (2000) Predators and people: using human densities to interpret declines of large carnivores. *Animal Conservation* 3: 165–173.
- WOODROFFE, R; FRANK, L G (2005) Lethal control of African lions (*Panthera leo*): local and regional population impacts. *Animal Conservation* 8: 91–98.
- WOODROFFE, R; GINSBURG, J R (1998) Edge effects and the extension of populations inside protected areas. *Science* 280: 2126–2128.