ISSN (Online): 3048-7803
JWLS
Volume 2, Issue 3 (September 2025)

TYPE Research Article

Unveiling the Elusive: Density, Activity Patterns, and Human-Interactions of Striped Hyenas in Kappathagudda Wildlife Sanctuary

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RECEIVED 27 February 2025
ACCEPTED 29 September 2025
PUBLISHED 30 September 2025

CITATION
Amanna, A. & Lyngdoh, S. (2025). Unveiling the Elusive: Density, Activity Patterns, and Human-Interactions of Striped Hyenas in Kappathagudda Wildlife Sanctuary. *Journal of Wildlife Science,* 2(3), 82-90.
https://doi.org/10.63033/JWLS.DOWL1544

FUNDING
Karnataka Forest Department

PUBLISHED BY
Wildlife Institute of India, Dehradun, 248 001 INDIA

Abstract

The striped hyena is a nocturnal and elusive carnivore, making population assessments challenging. We estimated its density, activity patterns, and interactions with wildlife and humans using camera-trap surveys and community interviews. Multi-session spatially explicit capture–recapture (SECR) models with a hazard rate detection function yielded a pooled density of 1.24 individuals/100 km^2 (SE = 0.27, 95% CI: 0.81–1.90) across 1,488 summer and 2,656 winter trap nights. Kernel density estimation confirmed predominantly crepuscular and nocturnal activity, with temporal overlap detected with Indian hare, wild pig, blackbuck, and porcupine. Spatial co-occurrence analyses indicated largely random associations, though some positive associations with langur, leopard, and grey mongoose likely reflected shared habitat use rather than ecological interactions. Interviews with 141 residents revealed frequent encounters but minimal conflict, with livestock predation limited mainly to young goats. Overall, results highlight the hyena's adaptability and scavenging ecology, emphasising the importance of community-based strategies for coexistence and landscape-level conservation planning.

Keywords: Camera-trapping, coexistence, landscape conservation, scavenging ecology, spatially explicit capture–recapture, temporal activity overlap

Introduction

The striped hyena (*Hyaena hyaena*) belongs to one of the smallest families within the order of mammalian carnivores- Hyaenidae (Bothma, 1998; Hadad *et al.*, 2023a; Kruuk, 2008; Solari & Baker, 2007). This family currently comprises only four extant species: striped hyena (*Hyaena hyaena*), aardwolf (*Proteles cristata*), brown hyena (*Hyaena brunnea*), and spotted hyena (*Crocuta crocuta*) (Bhandari *et al.*, 2021a; Koepfli *et al.*, 2006; Mills & Hofer, 1998). The striped hyena is smaller and less aggressive than its more well-known relative, the spotted hyena. It is a medium-sized predator characterised by pointed ears, a prominent dorsal crest of long dark hair, a sloping back, and a coat that varies from buff to grey with black transverse stripes (Neupane *et al.*, 2021). Striped hyenas can be individually identified by their unique patterns of stripes and spots found on various body parts, including the shoulders, flanks, hips, and limbs (Spagnuolo *et al.*, 2022). These distinctive patterns, along with physical markers such as scars or ear notches, facilitate identification. However, the lack of sexual dimorphism makes determining the sex of striped hyenas challenging. The Sstriped hyena is nocturnal and a solitary forager (Singh *et al.*, 2014; Wagner *et al.*, 2008). It is also a facultative scavenger (Leslie, 2016; Mohamed Ahmed *et al.*, 2012; Panda *et al.*, 2022, 2023a), and occasionally predates on small animals (Leakey *et al.*, 1999). As an omnivore (Alam & Khan, 2015; Kruuk, 2008), its diet includes small vertebrates, invertebrates, carcasses, vegetables, fruits, and organic waste, making it highly adaptable to diverse environments.

Globally, striped hyenas are found across a range extending from Africa (as far south as Central Tanzania) to the Arabian Peninsula, Turkey, Central Asia, and the Indian subcontinent, including Nepal (Mills & Hofer, 1998). They are widely found in open habitats (Rieger, 1979), sparse thorny bushes (Mills & Hofer, 1998), riverbeds (Bhandari *et al.*, 2015), grasslands (Bhandari *et al.*, 2021b), deserts, semi-deserts, rocky areas (Qarqaz *et al.*, 2004), dry deciduous forests (Gajera *et al.*, 2009), and arid and semi-arid environments (Panda *et al.*, 2023a). The global population of striped hyenas has suffered a significant decline and is currently listed as Near Threatened on the IUCN Red List (AbiSaid & Dloniak, 2014), with an estimated 5,000 to 9,999 mature individuals remaining. Throughout the species' range, striped hyenas occur at low densities (Wagner, 2006). This study aims to estimate the density of the lesser-known striped hyena using the photographic capture–recapture method (Cutler, 1999) through the SECR method (Harihar *et al.*, 2010; Gupta *et al.*, 2009; Singh *et al.*, 2014), given the species' elusive and shy nature (Hadad *et al.*, 2023b).

The persistence of carnivores in human-dominated landscapes has emerged as one of the greatest conservation challenges of our time (Lamb *et al.*, 2020). The rapid proliferation of human populations and widespread land-use changes are major drivers of wildlife population declines. These factors contribute to habitat fragmentation, alterations in natural landscapes, and restrictions on animal movement, all of which are prevalent concerns in the present study area (Ellis *et al.*, 2013; Tucker *et al.*, 2018). Across much of their range in India, striped hyenas coexist with human populations (Bhandari *et al.*, 2021b; Das, 2022; Panda *et al.*, 2022; Singh *et al.*, 2014; Young *et al.*, 2020), though conflicts have been reported in certain human-dominated landscapes (Akash *et al.*, 2021; Selvaraj & Sha, 2018; Tal, 2024) and in other parts of the world (Dadashi-Jourdehi *et al.*, 2020; Derouiche *et al.*, 2020; Moures-Nouri *et al.*, 2023; Mwebi *et al.*, 2024; Rieger, 1979). This study also aims to examine the interactions of striped hyenas with other wildlife species and human communities. Understanding hyena populations is crucial for assessing their ecological roles, mitigating human–wildlife conflicts, and developing effective conservation strategies.

Material and Methods

Study area

Kappatagudda Wildlife Sanctuary (244.5 km^2), located in Gadag District, Karnataka, comprises hilly and rocky terrain interspersed with dry deciduous forests, scrublands, and grasslands (Figure 1). Elevation ranges from 300 to 1,000 m, with a semi-arid climate and annual rainfall of 450–650 mm. The Tungabhadra River forms its southern boundary. Initially notified as a Conservation Reserve in 2015 and upgraded to a Wildlife Sanctuary in 2019, the area was historically affected by gold and iron ore mining, which left ecological scars despite the absence of current mining activity (Koppar, 2024). The sanctuary also contains human settlements along its periphery, where agriculture and livestock grazing are major livelihoods. These factors shape prey availability, scavenging opportunities, and potential human–hyena interactions.

Data Collection

Camera Trap Survey: A two-phase camera trap survey was conducted in Kappatagudda Wildlife Sanctuary (Maurya *et al.*, 2018; Regmi *et al.*, 2022) . Phase I (01 June – 01 July, 2023) used a 1.4 × 1.4 km grid from a prior sign survey by the Karnataka Forest Department, with 48 stations (96 Cuddeback C1 cameras, two per station) operating for 31 days, yielding 1,488 trap nights and ~94 km^2 coverage. Phase II (15 January – 16 February, 2024) expanded coverage to the entire sanctuary using a 2 × 2 km grid, with 121 Cuddeback and Browning cameras at 83 locations for 32 days, totalling 2,656 trap nights and ~272 km^2 coverage. While the larger grid reduced resolution, adaptive camera placement optimised detection probability and effort distribution; some Phase I sites were resampled and new ones added, reflecting logistical and seasonal considerations of the broader project design. Camera trap effort was calculated based on individual camera locations rather than per grid cell, as deployments were influenced by terrain, accessibility, and signs of animal activity.

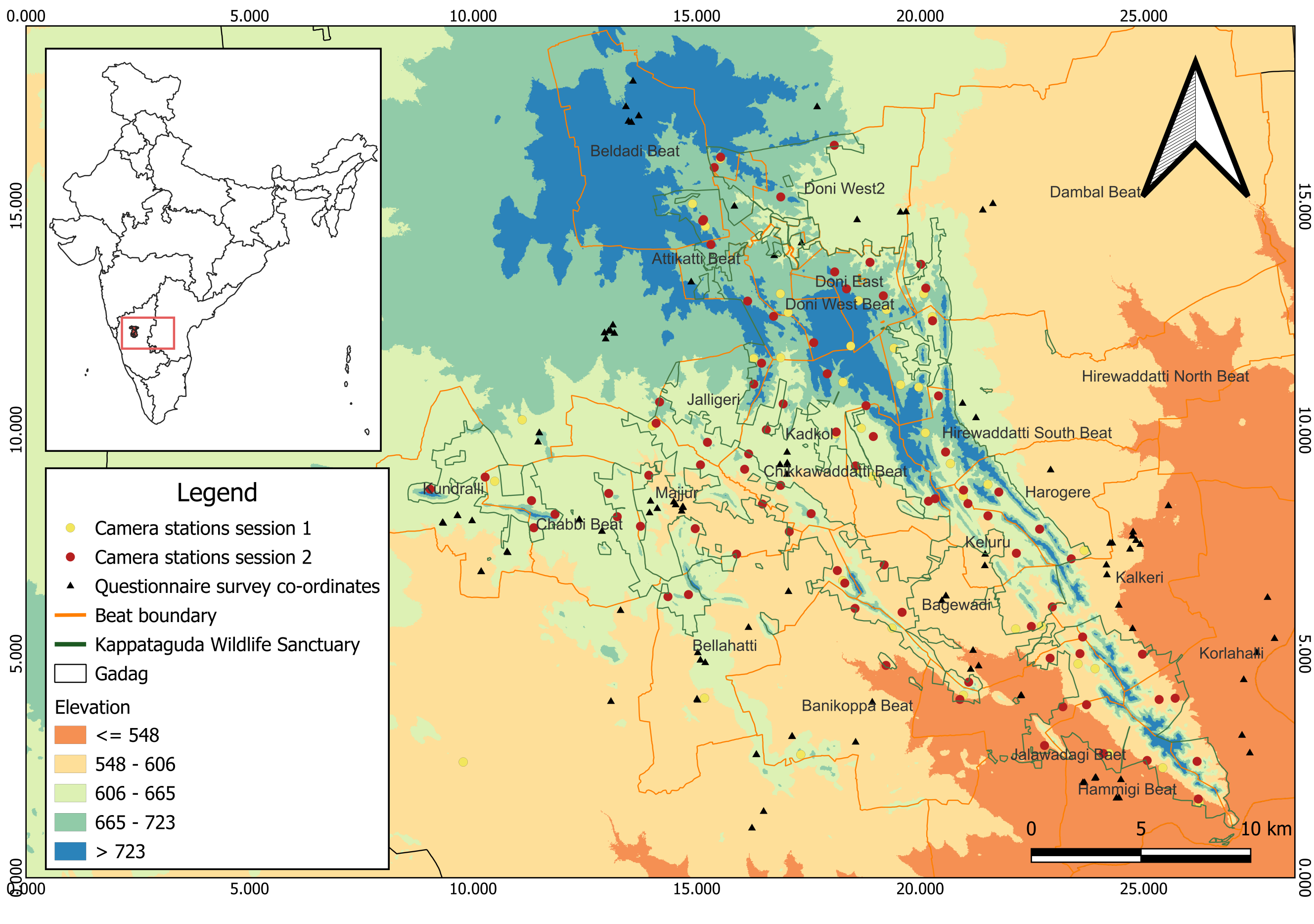

Figure 1. Map of Kappatagudda Wildlife Sanctuary showing research locations, including camera trap stations and questionnaire survey points.

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Human-Hyena Interaction: Human-hyena interactions were assessed through a field-based survey conducted between February and March 2024 in villages surrounding the Kappatagudda Wildlife Sanctuary. A total of 141 semi-structured interviews were conducted across 41 villages located in close proximity to the sanctuary. Village selection was purposive, based on proximity to the sanctuary and likelihood of hyena interactions. The survey targeted a diverse group of respondents, including shepherds, farmers, and labourers, with a particular focus on individuals who had potential hyena encounters. The number of interviews per village varied and was determined based on the availability and willingness of suitable respondents, who were often seasonally mobile and carried the risk of sampling bias. The questionnaire covered a broad range of topics, including demographic information, knowledge and perceptions of striped hyenas, conflict experiences, livestock predation, and economic impacts. A local field assistant familiar with the villages and residents accompanied the surveyor, helping to engage individuals who might otherwise have been reluctant to participate, and facilitating the collection of more inclusive and representative information.

Data analysis

We used multi-session spatially explicit capture–recapture (SECR) models to estimate the density of striped hyenas across both phases of the camera-trap survey. The SECR models were implemented in R using the secr package (Efford, 2010), employing a hazard-rate detection function to estimate hyena density within the study area. Individual identification was based on unique stripe patterns (Figure 2). Two investigators independently identified individuals, and discrepancies were resolved by consensus, and cross-checking ensured consistency. In Phase I, 48 stations were equipped with paired cameras, yielding 17 identified individuals based on higher-quality left-flank images. In Phase II, 83 stations operated with 121 cameras, from which 21 individuals were identified using right-flank images. The two phases were analysed jointly as a multi-session SECR model, with detection probability at the activity centre (g0) and spatial scale of detection (σ) allowed to vary by session, and keeping the mask (buffer = 20km, spacing = 200m) the same for both sessions. We compared models with and without a session effect on density (D ~ session *vs.* D ~ 1), and we fitted three alternative detection functions (Half-normal (HN), Hazard-rate (HR), and Exponential (EX)).Model support was assessed using Akaike's Information Criterion corrected for small sample sizes (AICc). Models were fitted using maximum likelihood with the "secr.fit" function, specifying a count detector type. Diel activity patterns of all species were analysed using the camtrapR package in R (Niedballa *et al.*, 2016). Independent detection records were generated with the "recordTable" function using a ≥30-min threshold, and "activityDensity" to compute smoothed activity curves with kernel density methods (Wang *et al.*, 2015). Temporal overlap between striped hyenas, other carnivores, and potential prey was quantified using overlap coefficients, with uncertainty assessed through bootstrap resampling (999 iterations; "resample" and "bootEst" functions). We assessed spatial relationships between striped hyenas and other species using probabilistic co-occurrence models implemented through the cooccur package in R (Griffith *et al.*, 2016). Habitat overlap was quantified using Pianka's niche overlap index (Tsafack *et al.*, 2021), calculated from species-specific capture histories derived from species-specific capture histories. For this, presence–absence matrices were constructed across camera trap stations (1 = detected, 0 = not detected), treating detections as indicators of site use (Carbone *et al.*, 2002). For data on human-hyena interactions, collected through questionnaire surveys, we used Microsoft Excel for summarisation and analysis. Data were summarised through descriptive statistics (frequencies, percentages, and means) to capture trends in local perceptions and experiences with hyenas. Given the low frequency of conflict incidents and the generally positive perceptions, the analysis was primarily descriptive.

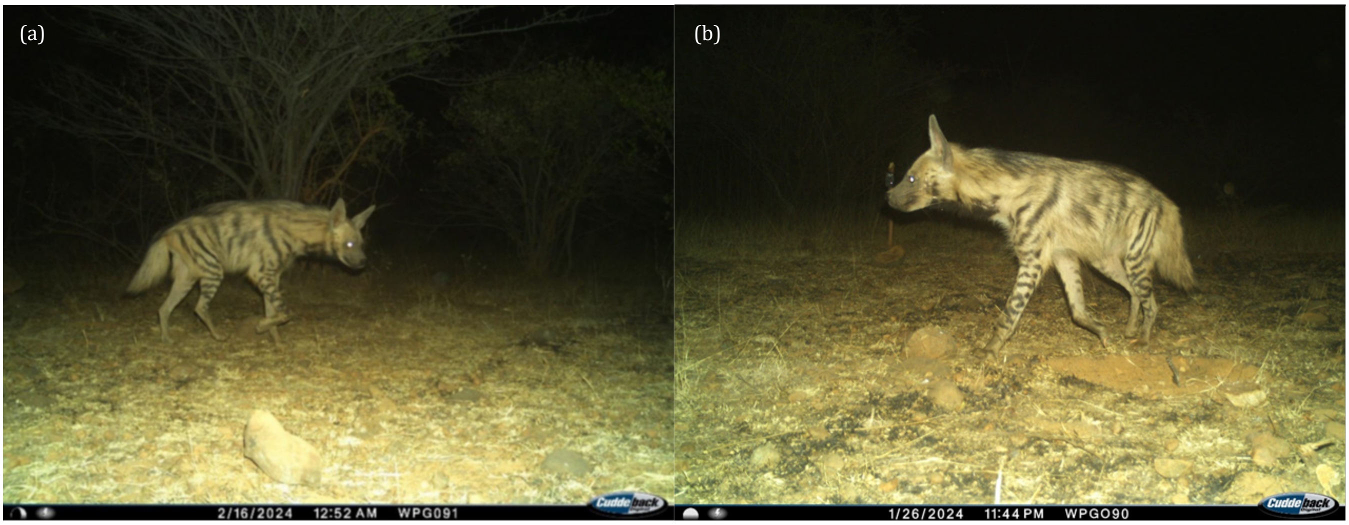

Figure 2. Right (a) and Left (b) Flank of Striped Hyena (Individual No. 10) in Kappatagudda Wildlife Sanctuary, Gadag.

Results

Density estimation

In the first session, 48 trap stations were deployed, resulting in the identification of 17 individual hyenas based on left-flank profiles. Among these, individual SH6S1 recorded the highest number of recaptures (n = 32). In the second session, 83 trap stations were used, and 21 individuals were identified from right-flank profiles, with SH10S2 showing the highest number of recaptures (n = 16). Capture–recapture data were analysed using multi-session spatially explicit capture–recapture (SECR) models with a hazard rate detection function. Model comparisons indicated strong support for the hazard rate model

 https://doi.org/10.63033/JWLS.DOWL1544

over exponential and half-normal alternatives (Table 1). The hazard rate model with session effects on density, $g0$, and σ had the lowest AICc (938.79) and highest support (AIC weight = 0.94). The exponential model received limited support (ΔAICc = 5.45, AICwt = 0.06), while the half-normal was clearly unsupported (ΔAICc = 46.88, AICwt ≈ 0). A subsequent comparison of hazard rate models with either session-specific or constant density showed that the constant density model (D∼1, $g0$∼ session, σ∼session) had slightly greater support (AICc = 937.08, AICwt = 0.58) than the session-specific density model (D∼session, AICc = 938.79, AICwt = 0.42) (Table 2). Under the session-specific model, density was estimated at 1.57 individuals/100 km^2 (SE = 0.40; 95% CI: 0.90–2.73) in Session 1 and 1.03 individuals/100 km^2 (SE = 0.29; 95% CI: 0.60–1.76) in Session 2 (Table 3). When density was held constant across sessions, the pooled estimate was 1.24 individuals/100 km^2 (SE = 0.27) (Table 4). The hazard rate shape parameter (z) was consistent across sessions, estimated at 2.77 (95% CI: 2.25–3.43).

Activity patterns of striped hyena

Striped hyenas exhibited crepuscular and nocturnal activity across both sessions. In Session 1 (n = 160), activity peaked during dawn (05:00–07:00) and dusk (18:00–20:00), while in Session 2 (n = 97), activity was more evenly spread throughout the night with a clear increase between 20:00 and midnight. These results indicate flexible nocturnal foraging behaviour, with consistent reliance on crepuscular hours. It is important to note that activity patterns reflect detections at camera sites rather than complete individual activity cycles. (Figure 3)

Temporal and spatial interaction between striped hyena and other animals

Striped hyenas showed high temporal overlap ($\hat{\Delta}$ > 0.8) with several nocturnal and crepuscular species, including wild pig (n = 196, $\hat{\Delta}$ = 0.83 ± 0.03; 95% CI: 0.77–0.89), black-naped hare (n = 879, $\hat{\Delta}$ = 0.86 ± 0.03; 95% CI: 0.81–0.91), porcupine (n = 825, $\hat{\Delta}$ = 0.80 ± 0.02; 95% CI: 0.76–0.86), and the cathemeral blackbuck (n = 211, $\hat{\Delta}$ = 0.86 ± 0.03; 95% CI: 0.81–0.91). These overlaps likely reflect temporal synchrony rather than direct predation, given the species' scavenging ecology and photographic evidence of carrion feeding. Overlap with diurnal species was low, e.g., grey mongoose (n = 16, $\hat{\Delta}$ = 0.13 ± 0.04; 95% CI: 0.06–0.22), consistent with contrasting diel niches. Among carnivores, overlaps were high with Asian palm civet (n = 12, $\hat{\Delta}$ = 0.75 ± 0.09; 95% CI: 0.56–0.90) and small Indian civet (n = 117, $\hat{\Delta}$ = 0.84 ± 0.03; 95% CI: 0.77–0.90), indicating concurrent nocturnal activity. Overlap estimates may be affected by unequal detections across species. Spatial co-occurrence (Pianka's index) was mostly random, with only langur (n = 46; 0.5045), leopard (n = 11; 0.4385), and grey mongoose (n = 16; 0.7457) showing moderate spatial overlap. Overall, striped hyenas shared space and time with multiple species, but patterns reflect habitat-level overlap and nocturnality rather than niche partitioning or trophic interactions. (Figure 4)

Table 1: Model selection results comparing hazard rate, exponential, and half-normal detection functions for striped hyena multi-session SECR models (Model: D ∼ session, g0 ∼ session, σ ∼ session, z ∼ 1).

Detection function	Parameters (npar)	LogLik	AIC	AICc	ΔAICc	AIC weight
Hazard rate	7	-460.53	935.06	938.79	0.00	0.94
Exponential	6	-464.25	940.51	943.22	5.45	0.06
Half-normal	6	-484.97	981.94	984.65	46.88	0.00

Table 2: Comparison of hazard rate SECR models with constant versus session-specific density for striped hyenas.

Model	Parameters (npar)	LogLik	AIC	AICc	ΔAICc	AIC weight
D ∼ 1, g0 ∼ session, σ ∼ session, z ∼ 1	6	-461.19	934.37	937.08	0.00	0.5849
D ∼ session, g0 ∼ session, σ ∼ session, z ∼ 1	7	-460.53	935.06	938.79	0.69	0.4151

Table 3: Density estimates of Striped Hyena in Kappatagudda Wildlife Sanctuary, Gadag (Model: D ∼ session, g0 ∼ session, σ ∼ session, z ∼ 1, detection function: Hazard rate)

Session	Trap nights	Encounter rate	Number of individual striped hyena	Occasion (days)	Density(D)±SE individuals/ 100 sq. km	95% Confidence limit (individuals /100 sq. km	Detection probability (g0±SE)	Sigma (σ)±SE (in Km)
S1	1488	0.064	17	31	1.57±0.4	0.90±2.7	0.22±0.18	1.2±0.5
S2	2656	0.031	21	32	1.03±0.3	0.60±1.76	0.02±0.007	3.8±0.7

Table 4: Density estimates of Striped Hyena in Kappatagudda Wildlife Sanctuary, Gadag (Model: D ∼ 1, g0 ∼ session, σ ∼ session, z ∼ 1, detection function: Hazard rate)

Session	Density(D)±SE individuals/ 100 sq. km	95% Confidence limit (individuals /100 sq. km	Detection probability (g0±SE)	Sigma (σ)±SE (in Km)
S1	1.24±0.2	0.8±1.9	0.21±0.22	1.3±0.71
S2	1.24±0.2	0.60±1.76	0.02±0.007	3.7±0.77

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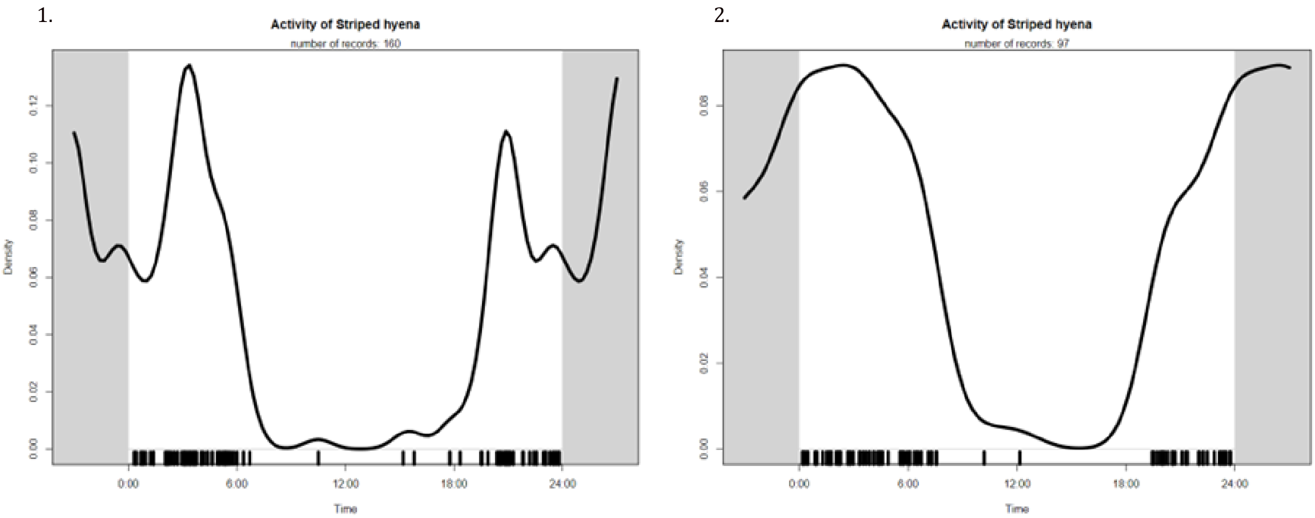

Figure 3. Seasonal Activity Patterns of Striped Hyena in Kappatagudda Wildlife Sanctuary. 1. Summer and 2. Winter.

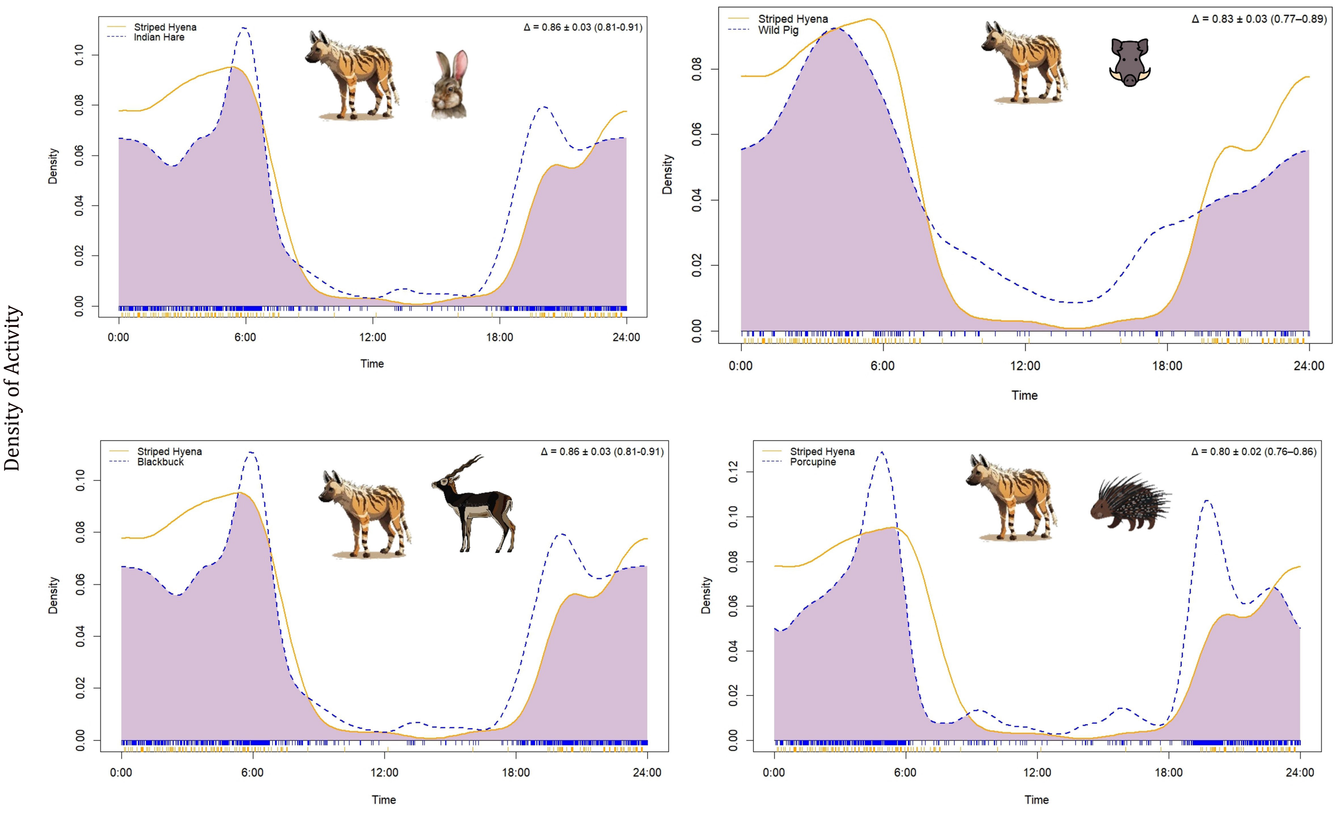

Figure 4. Pairwise temporal overlap between the striped hyena with their potential prey species in Kappatagudda Wildlife Sanctuary, Gadag.

Human-striped hyena interaction

A total of 141 respondents, primarily Kuruba shepherds engaged in livestock rearing and small-scale agriculture, reported frequent encounters with striped hyenas, most often during livestock grazing near forest edges. Households comprised an average of six members, earned on average approximately 1 lakh INR annually, and maintained large herds (≈111 animals/household) grazing about 6.4 km per day. While encounters occurred mainly in forested areas, hyenas were occasionally observed entering villages in search of food. Most encounters took place at night (18:00–06:00), with seasonal peaks in winter (35%) and summer (28%). Reported behaviours included commuting (52%), hunting/feeding (36%), resting (9%), and rare territorial displays (2%). Scavenging, although likely, was not explicitly described in local accounts. Livestock depredation was reported by 35 households, totalling 44 incidents, primarily involving young sheep and goats in Bagewadi and Kalkeri. Losses ranged from 3,000 to 40,000 INR, yet no respondents accessed government compensation schemes. Importantly, 92% of participants could identify hyenas, and misidentification with wolves was considered unlikely, supporting the reliability of reported predation incidents. Community perceptions of hyenas were divided. Approximately half (55.4%) believed populations were increasing, while the rest perceived declines. Views on threat status were mixed, 36% disagreed that hyenas are dangerous, whereas 46% agreed or strongly agreed. Similarly, 39% considered hyenas a livestock threat, while 42% disagreed. Nearly half opposed strict population control, and 48% were neutral regarding hyenas' ecological role, though 30% acknowledged their importance in maintaining ecosystem balance. Overall, respondents expressed low to moderate concern about human–hyena conflict, indicating that while hyenas are a visible component of daily life and occasionally cause livestock losses, they are not perceived as an urgent threat by the majority of the community.

Discussion

Assessing the status of solitary, nocturnal, and elusive species such as the striped hyena presents inherent challenges. We estimated hyena density across two sessions (July and January), with values ranging from 1.03 to 1.57 individuals/100 km^2 and a pooled mean estimate of 1.24 individuals/100 km^2. The hazard rate model for the detection function was strongly supported over exponential and half-normal alternatives, reflecting its flexibility in capturing steep declines in detection with distance and accommodating heterogeneity through the shape parameter (z). Within hazard rate models, the constant-density formulation was marginally favoured over session-specific density, suggesting that true population density remained stable across sessions, with apparent differences more likely driven by variation in detectability and ranging behaviour rather than demographic change over the short interval. The pooled results indicate moderate detectability. and movement ranges are consistent with a wide-ranging carnivore in a semi-arid landscape. Although session-specific models showed variability in detection parameters, we interpret these differences cautiously, as they are likely influenced by a combination of seasonal shifts in ranging behaviour, prey distribution, vegetation cover, reproductive cycles (e.g., post-littering movements), and survey effort (48 traps in Session 1 *vs.* 83 in Session 2). Striped hyena densities across their distribution show considerable regional variation. In Africa and Central Asia, estimates are generally low (0.1–3 individuals/100 km^2) (Hadad *et al.*, 2023c; Hadad *et al.*, 2023d), whereas densities in Israel and India are higher, often exceeding 2–12 individuals/100 km^2 (Athreya *et al.*, 2013; Harihar *et al.*, 2010; Mandal *et al.*, 2017; Gupta *et al.*, 2009; Singh *et al.*, 2010; Singh *et al.*, 2014; Tichon *et al.*, 2016). Within India, densities range from 0.07 individuals/km^2 in Gir (Alam *et al.*, 2015) to 15.1 individuals/100 km^2 in Sariska (Gupta *et al.*, 2009) and 12 individuals/100 km^2 in Sawai Mansingh (Panda *et al.*, 2022), reflecting differences in prey availability, habitat, anthropogenic pressures, and survey effort. Our pooled estimate of 1.24 individuals/100 km^2 falls below most Indian reports, suggesting the study landscape supports a comparatively smaller population, likely constrained by agricultural expansion, livestock grazing, mining, and other human disturbances. Since our study did not focus on collecting detailed environmental data like NDVI, rainfall, or temperature, we were unable to quantitatively assess the influence of seasonal resource variability on hyena detectability or density. Future research integrating environmental variables and individual movement data would be essential to disentangle these effects and improve the understanding of hyena ecology across seasons. Kernel density plots of activity indicate that striped hyenas are primarily nocturnal and crepuscular, though patterns may be influenced by camera placement and reflect activity along foraging routes rather than initial emergence from dens or refuge sites. Activity was largely consistent across sessions, with slight temporal shifts likely reflecting responses to temperature, prey availability, water, and avoidance of human disturbances such as agriculture and livestock movement. High temporal overlap with species such as the Indian hare, wild pig, blackbuck, and porcupine indicates shared nocturnal activity rhythms but does not imply predation. Striped hyenas are primarily scavengers (Panda *et al.*, 2023b), though opportunistic predation on small, vulnerable species such as hares has been documented. In contrast, consumption of porcupines and wild pigs is more often linked to scavenging (Bopanna, 2013; Mandal *et al.*, 2018). In our study, camera traps recorded hyenas feeding on hare, domestic dog, and carrion (Supplementary Figure S1), but without scat or kill-site data, the relative roles of predation and scavenging cannot be distinguished. Accordingly, we view activity overlap as temporal synchrony rather than ecological interaction. Spatial co-occurrence analysis supports this interpretation, with most species showing random associations, with the hyena's role as a facultative scavenger with opportunistic foraging, consistent with its well-established ecology. Future work incorporating dietary or movement data would be required to clarify predation versus scavenging dynamics.

The striped hyena population in Kappatagudda Wildlife Sanctuary (WLS) faces multiple conservation challenges, including historical mining, agricultural expansion, livestock grazing, and human encroachment (~20–25 km^2). More than 20 villages occur within the sanctuary boundary, and additional settlements lie in the surrounding landscape, making human–wildlife interactions inevitable. Before its designation as a sanctuary, 37 villages were located inside the reserve (Sawkar & Hegde, 2013); till now, encroachments for agriculture, livestock grazing, and firewood collection remain extensive. Local livelihoods are primarily dependent on farming and pastoralism, with the Kuruba and Scheduled Tribe (ST) communities forming a large proportion of respondents. High livestock numbers (goats, sheep, cattle, buffalo) graze regularly along the sanctuary edges and sometimes inside, despite the absence of formal grazing permissions. Importantly, carcass dumping within the sanctuary provides a consistent food source for scavengers such as striped hyenas. These socio-economic factors are key drivers of hyena movement, scavenging behaviour, and the nature of human–hyena interactions in the region. Our socio-ecological survey, covering 41 villages, revealed that 35 of 141 respondents (24.8%) reported conflicts with striped hyenas. Most incidents involved livestock depredation (44 cases), with young goats being the most vulnerable, alongside nine domestic dogs and one calf. Some households reported multiple losses. While these conflicts highlight the economic risk to local communities, the frequency of hyena-related incidents was lower than in other regions (Selvaraj & Sha, 2018; Bhandari & Bhusal, 2017), likely reflecting the species' elusive nocturnal habits, reliance on scavenging, and the presence of natural prey. No cases of human injury or fatality were reported, though a few respondents noted opportunistic crop-raiding during the watermelon season.

Despite occasional livestock depredation, retaliation against hyenas appeared minimal. Local attitudes were largely neutral to positive, with many respondents favouring coexistence over lethal responses. This tolerance is rare in many other conflict-prone landscapes, which may be shaped by long-standing traditions of coexistence, non-lethal conflict mitigation practices (torchlights, guard dogs, makeshift fencing), pastoralist lifestyles, and cultural perceptions of hyenas as scavengers rather than dangerous predators. In contrast, hyenas are persecuted in parts of Iran, Nepal, and northern India due to fear, superstition, or perceived threats (Selvaraj & Sha, 2018; Moures- Nouri *et al.*, 2023; Bhandari & Bhusal, 2017). The relative tolerance observed in Kappatagudda is therefore notable and highlights the potential for coexistence. However, mitigation practices remain rudimentary, and there is little awareness among communities about the ecological role of hyenas, underscoring the need for outreach and education. Community reports and camera trap data confirmed the solitary nature of hyenas, with occasional sightings of cubs and dens suggesting the presence of resident, breeding populations. Taken together, frequent sightings, relatively few conflicts, and local tolerance suggest opportunities for sustainable coexistence. Strengthening conflict-reporting systems, revising compensation frameworks to include depredation events inside the sanctuary, and promoting innovative deterrent strategies could reduce economic losses and support conservation goals. Future studies should also integrate genetic sampling, prey availability assessments, and inter-carnivore interactions to build a deeper understanding of hyena ecology in this multi-use landscape. Finally, we note that conflict data were based on respondent recall, which may be subject to memory bias or misattribution. This limitation highlights the importance of long-term, systematic monitoring of both conflict incidents and hyena ecology. Our study provides the first systematic baseline for striped hyenas in Kappatagudda, offering a foundation for future ecological and socio-cultural research, and informing strategies to strengthen human–wildlife coexistence in semi-arid protected areas.

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Acknowledgment

We are thankful to the Director, Dean, and Research Coordinator of the Wildlife Institute of India Dehradun for supporting the study. We are grateful to Dean (Academics), FRI (Deemed to be) University, Dehradun and Course Coordinator for granting me the opportunity to work on this topic through the provision of necessary guidance and facilities. Special appreciation goes to Smt. Dipika Bajpai, IFS, CF, Dharwad Division, our deep gratitude goes to the Gadag Division Forest Department, for their assistance and hospitality during my fieldwork. A special thanks to all the field assistants and family for supporting in the field. We thank Priyanka Justa and Tarun Singh for their help with the data analysis.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY

The data will be provided upon request from the corresponding author

AUTHOR CONTRIBUTIONS

SL conceptualised the study. AA collected data. AA, SL curated data. SL, AA developed the methodology. AA and SL analysed data. AA wrote the original manuscript. SL and AA reviewed and edited the manuscript. SL procured funding, provided resources, and supervised the work.

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