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Threats and Traditions: Citizen Science Insights into Striped Hyena (*Hyaena hyaena)* Conservation in Saudi Arabia

ABSTRACT

The striped hyena (*Hyaena hyaena*) in Saudi Arabia faces mounting threats from habitat degradation, wildlife-vehicle collisions, retaliatory killings, and entrenched cultural stigmas. This study examined public perceptions, traditional beliefs, and conservation attitudes toward the species in Al Qawba, Bisha Province, a region of ecological significance in the Asir Region. Using a cross-sectional mixed-methods approach, data were gathered through qualitative interviews and a structured questionnaire completed by 151 participants from diverse social backgrounds, including Bedouins, farmers, and urban residents. Fieldwork also documented a recent hyena road fatality. Results revealed widespread awareness of hyenas, yet dominant perceptions were largely negative, often associating the animals with personal danger or livestock loss. Despite this, most acknowledged the species' ecological role as scavengers and recyclers of nutrients. Cultural narratives were universally cited, portraying hyenas as supernatural beings or sources of traditional medicine, contributing to poaching and retaliatory killings. Major threats identified included habitat destruction, overhunting, and road infrastructure, reflecting global patterns of carnivore-human conflict amid habitat fragmentation. Encouragingly, most respondents were aware of conservation programs and supported community-led efforts. Preferred interventions included public education, local engagement, and the establishment of protected areas. Regression analysis indicated that higher education and professional background significantly predicted conservation support. This study underscores the urgency of a culturally informed conservation strategy for striped hyenas in Saudi Arabia. Key recommendations include countering harmful myths through targeted outreach, reinforcing anti-poaching laws, restoring degraded habitats, and introducing road mitigation infrastructure to reduce mortality.

KEYWORDS: Human-wildlife conflict; cultural beliefs; community conservation; Asir region; *Hyaena hyaena*

INTRODUCTION

The striped hyena (*Hyaena hyaena*) is a medium-sized carnivore with a broad but fragmented distribution across parts of North Africa, the Middle East, and South Asia (Abi-Said & Dloniak, 2015). Extant populations occur in Egypt, Iraq, Palestine, Jordan, Lebanon, Oman, the Syrian Arab Republic, and Yemen (Abi-Said et al., 2007; Albaba, 2016; Al Sheikhly, 2015; Aidek et al., 2025; Eid et al., 2020). Its status remains uncertain in Kuwait and Qatar (Abi-Said & Dloniak, 2015), while in the United Arab Emirates, the species is assessed as Regionally Extinct (RE) on the UAE National Red List (assessment year 2018; published 2019).

In neighboring Jordan, research using camera traps in the Dana Biosphere Reserve has estimated small population sizes, with nine individuals identified in 2010 and ten in 2012, which indicates higher visitation to waterholes during the hottest summer months (Attum et al., 2017). Other studies in eastern Jordan have documented den sites containing thousands of bone fragments, revealing scavenging behavior targeting livestock such as camels (*Camelus dromedarius*), sheep/goats (*Ovis*/*Capra*), and donkeys (*Equus asinus*) as well as wild fauna including gazelles (*Gazella* spp.) (Kuhn, 2005). Across the Arabian Peninsula, *H. hyaena* is largely absent from the Rub' al Khali and Nafud deserts, with most contemporary records occurring in valleys, open landscapes, and volcanic fields near agricultural areas (Khayat et al., 2024).

Within Saudi Arabia, historical and contemporary records confirm its occurrence from the northern Harrat al-Harrah Protected Area, where tracks and hairs have been found in mountainous areas (Seddon et al., 1997), to the central Najd, the western mountains, and the southwestern highlands of Asir. The species has been recorded in Madinah Province and identified as the second most persecuted carnivore in the country, with persecution including the widespread practice of hanging hyenas on trees or road signs (Aloufi & Amr, 2018; Aloufi & Amr, 2024). Such pressures reflect a broader regional pattern of human–predator conflict that has dramatically reduced populations of larger carnivores, including the striped hyena. Saudi Arabia's rich biodiversity and deep-rooted cultural traditions create a complex backdrop for its conservation (Alam & Khan, 2015; Al Ahmari et al., 2024). As natural sanitizers, striped hyenas contribute to environmental health by consuming carrion, accelerating decomposition, and reducing the spread of pathogens (Jaffa, 2020).

Despite this ecological significance, the species faces mounting threats from habitat loss, retaliatory killings, and cultural stigmas (Attum et al., 2017; Bhandari et al., 2022), exacerbated by rapid urbanization, agricultural expansion, and infrastructure development that fragment habitats and intensify human–wildlife conflict (Eid & Handal, 2018; Alatawi, 2022; Al Ahmari et al., 2024; Eid & Azam, 2025). These threats, combined with traditional uses of hyena body parts in medicine and ritual practices (Aloufi & Eid, 2016; Alqahtani, 2022; Khayat et al., 2024), underscore the urgent need for culturally informed, regionally coordinated conservation strategies across the Arabian Peninsula.

Complementing these national records, beyond our focal region, the striped hyena is documented widely across Saudi Arabia, including Tabuk, the Najd/central plateau, and the southwestern highlands of the Asir–Sarawat range (Aloufi & Amr, 2018; Cunningham et al., 2009; Al Ahmari et al., 2024). Camera-trap syntheses indicate it is among the most frequently recorded carnivores, while direct killing and trade remain leading threats (Al Ahmari et al., 2024; Aloufi & Eid, 2014). In Al-Jouf, a record from the early 1980s likely represents a dispersing individual from northern populations (Mallon & Budd, 2011). Regionally, the species occurs across Jordan, with persecution and habitat loss highlighted as key pressures, and is also confirmed from Oman and Yemen, where threats broadly mirror those elsewhere in Arabia (Eid et al., 2020; Mallon & Budd, 2011).

Culturally, hyenas are frequently demonized and perceived as pests or threats to livestock, with longstanding beliefs in their supernatural powers driving their persecution and use in traditional practices (Jaffa, 2020; Osborne, 2013). A study from the Tabuk region in northwestern Saudi Arabia documented that hyena flesh, often cooked with its fat, was traditionally used to treat various ailments, including rickets in children, joint and muscle pain, physical exhaustion, and muscle fatigue, and was also consumed as a sexual tonic (Aloufi &

Eid, 2016). Similar uses have been reported globally, where various hyena body parts, such as the liver and penis, are incorporated into folk medicine or employed as protective talismans (Jaffa, 2020). These culturally embedded practices highlight the multifaceted role of traditional beliefs, both as a threat to wildlife and as a potential entry point for fostering conservation awareness.

Conservation-focused surveys are practical tools for gauging public attitudes toward conservation programs and policies (Kleiven et al., 2004; McFarlane et al., 2006; Pratt et al., 2004). Examples include studies on landowners' perceptions of conservation initiatives (Winter et al., 2005), individual attitudes toward biodiversity conservation (Karanth et al., 2008), and community views on particular species or management strategies (Bandara & Tisdell, 2003; Caro et al., 2003; McFarlane et al., 2006; Soto et al., 2001). Addressing a knowledge gap, this study explores individual perceptions of the striped hyena in Al Qawba, Bisha Province, an ecologically significant region of Saudi Arabia that is affected by human activities.

MATERIALS AND METHODS

Study Area

Fieldwork was conducted in Al Qawba, within Bisha Province of the Asir Region in southwestern Saudi Arabia, focusing on localities such as Badia Al-Jamaʿa and a road junction between Al Qawba and Halba, approximately 100 km from Bisha city (Figure 1). The area comprises a heterogeneous mosaic of valleys, hills, and agricultural fields, providing diverse wildlife habitats. Bisha is notably productive agriculturally, especially for date palms, and is served by a well-developed road network that enhances connectivity with nearby urban centers. The study sites are located within the Imam Faisal bin Turki Royal Reserve and encompass several wadis and physiographic provinces, the largest being Wadi Bisha. Geologically, the region forms part of the Arabian Shield, where predominantly exposed Precambrian crystalline rocks are partly overlain by Tertiary volcanic units, themselves constituting a segment of the Afro-Arabian Shield. Climatically, Bisha is arid; recent observations (2000–2023) indicate mean monthly air temperatures from 3 °C in January to 41 °C in August (annual mean ≈ 24 °C), mean relative yearly humidity of ~30%, and annual precipitation of 105–125 mm, consistent with long-term aridity in the region (Saudi National Center for Meteorology, 2024).

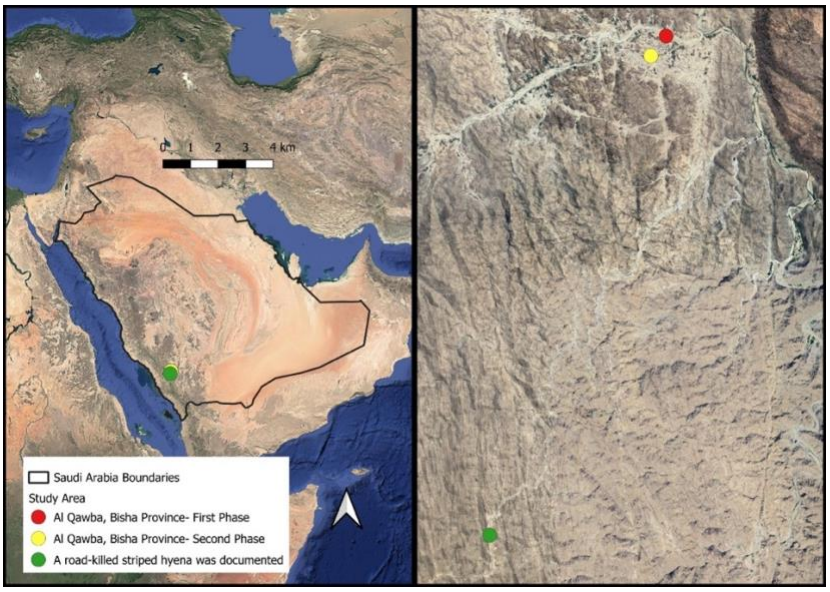

Figure 1. Study area indicating the location of the documented striped hyena road fatality

Study Design and Data Collection

Study Design

This study employed a descriptive cross-sectional mixed-methods design to investigate public perceptions, cultural beliefs, and conservation attitudes related to the striped hyena (*Hyaena hyaena*) in Al Qawba, Bisha Province. The research was implemented in two sequential phases: a qualitative exploratory phase followed by a quantitative survey phase.

Qualitative Phase

The first phase involved qualitative, exploratory interviews with local residents to document myths, traditional knowledge, and cultural narratives surrounding the species. Field observations were also conducted on two occasions between January and March 2024. These observations served as illustrative evidence complementing community-reported threats. One documented wildlife–vehicle collision (WVC) involving a striped hyena was recorded on February 21, 2024. This single event does not quantify the extent of the threat but provides visual and situational context. Fieldwork employed nonintrusive methods, such as remote photography, to minimize disturbance to wildlife.

Quantitative Phase

Insights from the qualitative phase informed the development of a structured questionnaire. The survey targeted 151 participants between January and March 2024, selected using random sampling to ensure balanced representation across farmers, researchers, Bedouins, employees, and employers from urban, rural, and nomadic settings. Data were gathered through face-to-face interviews and, where applicable, paper-based questionnaires distributed in local markets. The questionnaire comprised six sections: (1) demographic characteristics (age, gender, education, occupation, residence); (2) awareness and perceptions of predatory wildlife, particularly the striped hyena; (3) environmental threats (e.g., habitat loss, overhunting, climate change); (4) cultural and social beliefs (e.g., myths, traditional practices); (5) perceptions of conservation efforts and policy; and (6) open-ended recommendations. Question types included multiple-choice, multiple-answer, and open-ended formats to elicit structured data and nuanced personal views. The complete questionnaire is provided as Supplementary Material (Appendix S1).

Data Analysis

Quantitative data were processed using Microsoft Excel to generate descriptive statistics. SPSS Version 27 was used to analyze quantitative data (percentages, means). A binary logistic regression analysis was conducted to identify predictors of conservation support (coded as 1 for support and 0 for no support), with education level, occupation, age, and gender as independent variables. Qualitative responses underwent thematic analysis, with themes such as human–wildlife conflict and cultural myths identified through manual coding by two independent researchers to ensure inter-coder reliability.

Ethical Considerations

No formal ethics committee approval number was issued, as such approval was not required under institutional regulations for non-invasive, interview-based research. All participants provided informed consent before participation, and no personal or identifiable data were collected. The relevant Saudi authorities secured all necessary permits and approvals for field activities.

Results

Demographic Profile of Respondents

The study included 151 participants: 95 males (62.91%) and 56 females (37.09%), aged 20–50 years. The largest age group was 31–40 years (82 participants; 54.30%), followed by 20–30 years (38; 25.17%) and 41–50 years (31; 20.53%). Educational attainment varied, with 67 participants (44.37%) having no formal education, 29 (19.21%) completing primary education, 13 (8.61%) completing secondary education, and 42 (27.81%) holding higher education qualifications. Occupational backgrounds included 23 researchers (15.23%), 16 farmers (10.60%), 46 employees (30.46%), five business owners (3.31%), and 61 Bedouins (40.40%). Urban residents comprised 74 participants (49.00%), rural residents 16 (10.60%), and nomadic Bedouins 61 (40.40%).

Awareness and Perceptions of Striped Hyenas

Most respondents (143; 94.70%) had seen a striped hyena in the wild, often during nocturnal encounters near water sources or agricultural fields, and typically in connection with concerns about livestock predation. Perceptions were dominated by risk framing: 94/151 (62.3%) viewed hyenas as threats to livestock or humans, 43/151 (28.5%) described them as ecologically valuable, and 14/151 (9.3%) held neutral views. Recognition depended on item format: in response to a closed-ended statement describing scavenging and nutrient-recycling services, 98/151 (64.9%) agreed that hyenas play an ecological role, whereas 53/151 (35.1%) disagreed. In open-ended responses, participants most often mentioned carcass removal and bone-breaking as benefits.

Perceived Threats to Striped Hyenas

Participants identified the main threats as habitat destruction (146; 96.70%), overhunting (144; 95.36%), road collisions (142; 94.04%), food shortages (94; 62.25%), climate change (21; 13.91%), and water scarcity (2; 1.32%). Almost all respondents (143; 94.70%) reported a decline in wildlife populations, attributing it to urbanization, desertification, and overhunting, with declines noted in hyenas, Arabian wolves, and gazelles (Figure 2).

Cultural Beliefs and Practices

Hyenas were overwhelmingly perceived as dangerous pests (143; 94.70%), with only 3 (1.99%) considering them sacred/respected and 5 (3.31%) remaining neutral. All participants (100%) acknowledged cultural myths, including beliefs in magical powers (Hyenas are connected to witchcraft), medicinal uses (Hyena eyes for improved vision), and supernatural omens (Their howl is an omen of death). Hunting for body parts (A trade exists for hyena body parts used in traditional remedies) and retaliatory killings (Farmers poison hyenas) were widely reported. A summary of qualitative themes, the proportion of participants mentioning each, and example quotes is provided in Table 1.

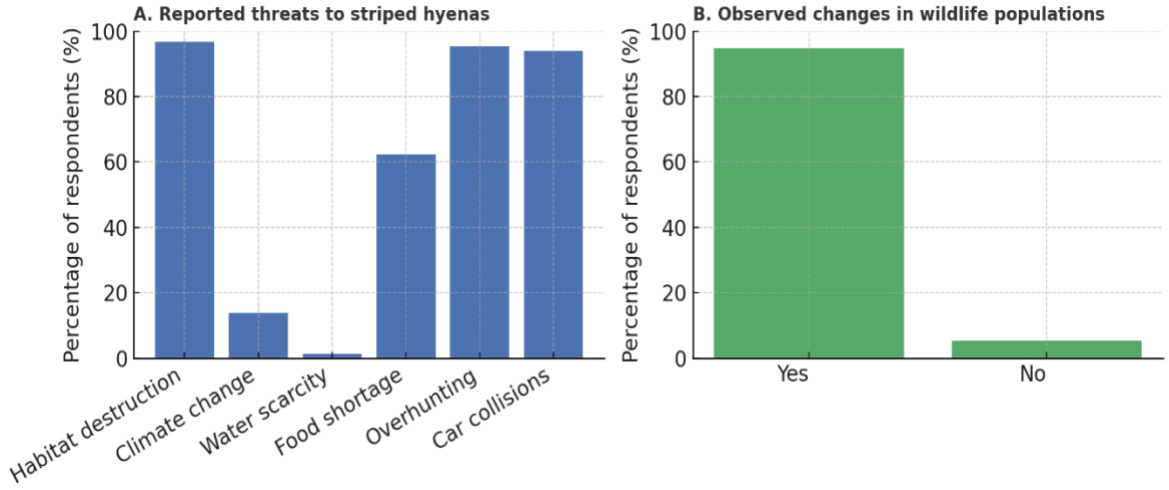

Figure 2. Reported threats to striped hyenas in Al Qawba, Saudi Arabia. (A) Most respondents cited habitat destruction (96.7%), overhunting (95.4%), and road mortality (94.0%) as major threats. (B) Nearly all (94.7%) reported declines in wildlife, primarily attributed to urbanization, desertification, and overhunting.

Table 1: Qualitative themes on striped hyena perceptions and threats in Al Qawba, Saudi Arabia, with corresponding participant frequencies and illustrative quotes

Theme	% of Participants Mentioning	Example Quote
Hyenas as livestock threats	62.25%	They kill our goats and sometimes even calves at night.
Hyenas are ecologically important.	64.90%	They clean the environment by eating dead animals.
Magical/supernatural beliefs	100%	Their howl is an omen of death.
Traditional medicine use	48.34%	The fat can be used for joint pain relief.
Road mortality concern	94.04%	I saw one dead on the road near Halba last winter.

Awareness of Conservation Programs and Preferred Interventions

Awareness of conservation programs was high (144; 95.36%), with 7 participants (4.64%) unaware. Opinions on government conservation efforts were mixed: 103 (68.21%) supported them, 39 (25.83%) did not, and 9 (5.96%) were unsure. Preferred strategies included public awareness campaigns (125; 82.78%), community involvement (106; 70.20%), establishing reserves (84; 55.63%), and stricter hunting regulations (25; 16.56%).

All participants (100%) supported community-led initiatives. Open-ended suggestions included educational campaigns, stronger anti-poaching laws, increased reserves, and habitat restoration (Figure 3).

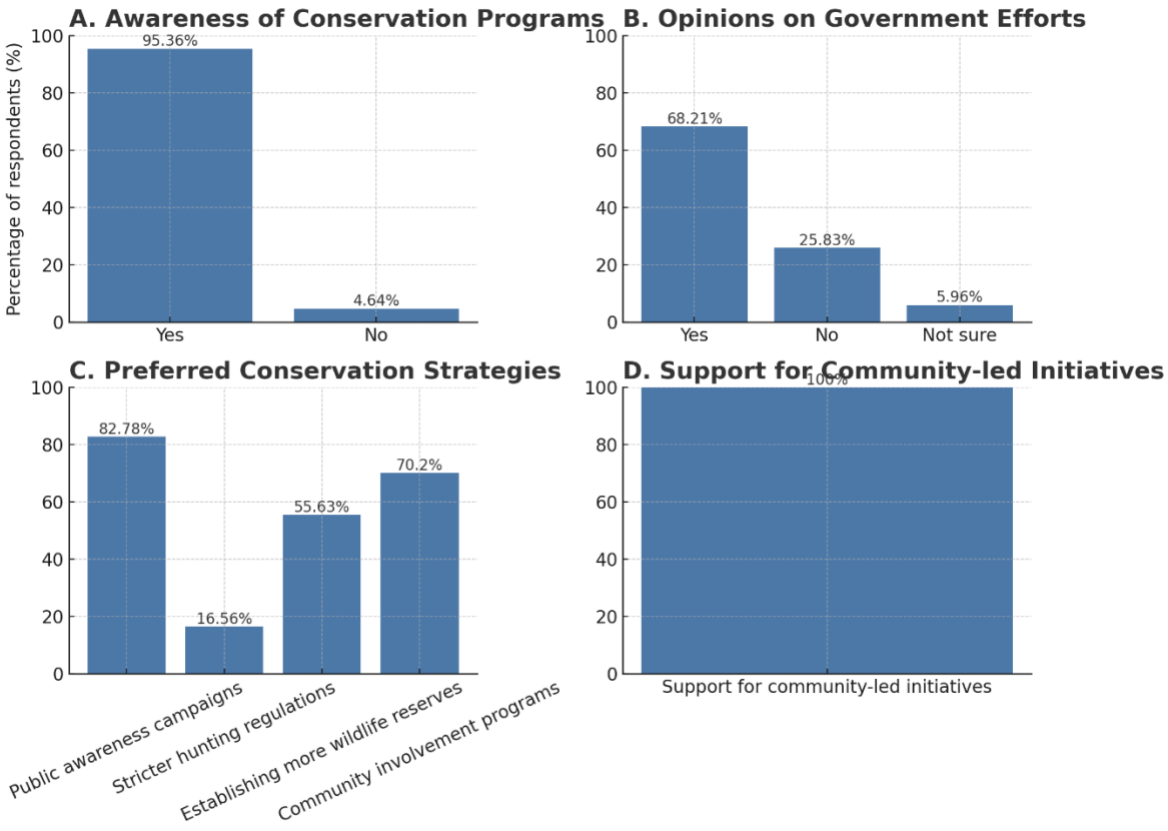

Figure 3: Community responses on striped hyena conservation in Al Qawba, Saudi Arabia. (A) Awareness of conservation programs. (B) Opinions on government efforts. (C) Preferred conservation strategies. (D) Support for community-led initiatives is presented in a single-column bar chart for improved clarity and readability.

Predictors of Conservation Support

Binary logistic regression analysis revealed that education level ($\beta = 0.41$, $p = 0.003$) and occupation ($\beta = 0.36$, $p = 0.012$) significantly predicted conservation support, while age and gender were not significant ($p > 0.05$). The model explained 38% of the variance in conservation support ($R^2 = 0.38$, $p < 0.01$). Participants with higher education and those employed in research or education were more likely to support community-led conservation initiatives compared to farmers and nomadic groups.

Field Observation

Fieldwork corroborated community-reported threats through illustrative evidence, including a single documented wildlife–vehicle collision (WVC) involving a striped hyena on February 21, 2024, at 6 a.m. in Badia Al-Jama'a. The carcass was found intact in the center of the road, suggesting a nocturnal collision

(Figure 4). While this single record does not quantify the extent of road mortality, it provides visual and situational context for the threat posed by the expansion of road infrastructure.

Figure 4: Photo of a striped hyena killed by a vehicle

Climate Change and Regional Comparisons

Only 21 respondents (13.91%) cited climate change as a threat, yet its potential impacts in arid regions are significant. Projected changes in precipitation seasonality and temperature extremes could exacerbate habitat fragmentation, prey scarcity, and water shortages, leading to range contractions or shifts.

DISCUSSION

Our findings confirm the continued presence of the striped hyena (*Hyaena hyaena*) in the Bisha district (Alqahtani, 2022) and situate that persistence within a landscape of persistent human–carnivore conflict. Nearly all respondents (94.7%) reported direct encounters with hyenas. Nevertheless, perceptions were predominantly risk-oriented: most participants viewed the species as a threat to livestock or personal safety, and qualitative narratives emphasized predation incidents and nocturnal proximity to farms. These perceptions translate into concrete conflict behaviors, most notably carcass poisoning and retaliatory killing, which have already been documented elsewhere on the Arabian Peninsula and are reflected in our interview material from Al Qawba (Cunningham et al., 2009; Eid et al., 2020; Eid & Handal, 2018). As natural scavengers

and nutrient recyclers, hyenas provide sanitary ecosystem services; however, that role is often discounted where immediate costs to pastoral livelihoods are salient. Consequently, the conservation challenge in Bisha is not simply biological but social, requiring attention to attitudes, incentives, and the cultural frames within which hyenas are interpreted (Treves & Karanth, 2003; Dickman, 2010).

Beyond attitudes, respondents consistently identified proximate stressors that are well known to erode carnivore viability: habitat destruction (96.7%), overhunting (95.4%), and road mortality (94.0%). These align with global evidence that land conversion and linear infrastructure fragment habitats, isolate populations, and increase mortality risk (Foley et al., 2005; Laurance et al., 2014). The hyena-wildlife vehicle collision we documented along the Al Qawba–Halba road in February 2024 provides a concrete, local illustration of these risks. In fragmented drylands, roads, farms, and water points become focal features that concentrate animal movement at predictable sites, increasing encounter probabilities with people and vehicles.

Cultural beliefs amplify these dynamics. Every participant (100%) acknowledged myths or traditional uses, ranging from witchcraft associations to medicinal applications of body parts, mirroring patterns reported from other parts of Arabia and the broader region (Aloufi & Eid, 2016). Such beliefs motivate persecution and trade, but they also offer entry points for dialogue when addressed respectfully in locally grounded outreach (Dickman, 2010). Notably, despite negative narratives, support for conservation was unexpectedly strong: 100% favored community-led initiatives, and 95.4% were aware of existing programs. Our regression results indicate that education and occupation significantly predict support for conservation, suggesting that tailored messaging toward less-engaged groups (e.g., some farmers and nomadic communities) could yield measurable gains. The unanimity of "support" should be interpreted cautiously; some fraction may reflect social desirability in interviewer-administered surveys (Krumpal, 2013). However, when combined with the qualitative data, it nonetheless represents a real foundation for co-designed action.

Climate change is likely to intensify these existing pressures. Regionally downscaled projections for Saudi Arabia indicate robust warming through mid- to late-century under high-emission pathways, with variable precipitation responses, including increases in parts of the southwest, against a background of chronically high evaporative demand (Tarawneh & Chowdhury, 2018; Saudi Arabia NC4, 2022). In arid systems, higher temperatures and elevated evapotranspiration shorten the persistence of surface water, reduce primary productivity and prey availability, and drive carnivores toward perennial or human-managed water sources, farms, and road corridors. These mechanisms are consistent with field evidence from Jordan, where hyena visits to artificial waterholes increased during the hottest months and after rainfall events (Attum et al., 2017). For Saudi Arabia specifically, species-distribution models suggest that more seasonal precipitation regimes and temperature extremes will reduce habitat suitability in the western mountains and arid steppe, prompting range shifts or contractions and further concentrating movements in human-dominated valleys (Khayat et al., 2024). In practical terms, even modest climatic shifts will likely magnify the very threats respondents already identified, poisoning, overhunting, and road kills, by increasing encounter frequency at a small number of predictable locations (roads, farms, and water points).

Taken together, these results suggest the need for an integrated, culturally sensitive program that combines conflict mitigation with targeted infrastructure and habitat measures. Priority actions emerging from our data

and the broader literature include: (i) co-developed outreach that directly addresses witchcraft- and medicine-related beliefs while highlighting sanitary ecosystem services; (ii) rapid anti-poisoning response protocols and safe carcass-disposal guidance; (iii) livestock-protection support (e.g., nocturnal corralling, improved enclosures, guardian animals) co-delivered with local leaders; (iv) site-specific road-kill mitigation on the Al Qawba–Halba corridor (hotspot speed management, signage, fencing-plus-crossings at wadis and farm approaches); and (v) water-point management that minimizes risky congregation (temporal access rules, placement away from high-speed roads). Because the study area lies within the Imam Faisal bin Turki Royal Reserve (IFBTRR), these actions can be anchored institutionally: the Reserve can convene community committees, coordinate monitoring (including telemetry and camera traps at water points and road segments), and pilot conflict-mitigation micro-grants in partnership with local municipalities.

Finally, the study highlights tractable research priorities that would sharpen management. Longitudinal monitoring is necessary to track hyena abundance and the incidence of conflict. Telemetry and camera-trap arrays can quantify movement patterns around roads and water points. Before–and–after evaluations should assess the efficacy of outreach and road-mitigation pilots. Expanding geographic comparisons within Saudi Arabia and across neighboring countries will also help identify context-specific versus general solutions. Anchored in IFBTRR and aligned with national biodiversity objectives, such a program would convert strong local willingness into durable coexistence while preserving the ecological function of an often-misunderstood carnivore.

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CONFLICT OF INTERESET STATEMENT

We declare that we have no conflict of interest.

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