

Article

Diversity and Conservation of Carnivores in Saudi Arabia

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Abstract: In the present study, we updated the taxonomy and distributional data for 14 carnivore species based on previous records and the recent results of camera trapping (4787 camera nights from 58 locations) and depicted species richness. We then identified threats and the conservation measures that are practiced to ensure the protection of the carnivores of Saudi Arabia. A total of 10 species of carnivores (*Canis aureus*, *Canis lupus*, *Caracal caracal*, *Felis lybica*, *Genetta genetta*, *Hyaena hyaena*, *Ichneumia albicauda*, *Mellivora capensis*, *Vulpes cana*, and *Vulpes vulpes*) were recorded based on camera trapping efforts. The striped hyena was the most recorded species in 13 locations, with the highest number of observations made at Raydah Protected Area, followed by the red fox and the Arabian wolf. Both *Genetta genetta* and *Mellivora capensis* were the least recorded species. *Vulpes vulpes* was the most distributed species and it was recorded from 15 sites. The southwestern corner of Saudi Arabia covering the Asir, Jazan, and Najran Plateaus extending further into the Al Sarawat Mountains hosts the highest number of carnivore species. Major threats affecting carnivores include killing and animal trade. The status of the critically endangered species, *Panthera pardus nimr*, was discussed. Threats and the conservation status based on regional assessment according to the IUCN Red List of the carnivores of Saudi Arabia were documented and highlighted.



Academic Editor: Michael Wink

Received: 24 November 2024

Revised: 17 December 2024

Accepted: 18 December 2024

Published: 25 December 2024

Citation: Al Ahmari, A.; Neyaz, F.; Shuraim, F.; Al Ghamdi, A.R.; Al Boug, A.; Alhlafi, M.; Al Jbour, S.; Angelici, F.M.; Alaamri, S.; Al Masabi, K.; et al. Diversity and Conservation of Carnivores in Saudi Arabia. *Diversity* **2025**, *17*, 6. <https://doi.org/10.3390/d17010006>

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Keywords: carnivora; Saudi Arabia; distribution; threats; conservation

1. Introduction

The vast area of Saudi Arabia with varied habitats has always offered shelters for several species of carnivores. Over the past four decades, several studies have addressed the systematics, distribution, and ecology of the carnivores of Saudi Arabia. In this period, field studies have focused on the distribution and taxonomic status of many carnivores, such as the Arabian wolf, *Canis lupus arabs* Pocock, 1934 [1–3]; Blanford's fox, *Vulpes cana* Blanford, 1877 [4–6]; red fox, *Vulpes vulpes* (Linnaeus, 1758) [7,8]; Rüppell's fox, *Vulpes rueppellii* (Schinz, 1825) [8,9]; caracal, *Caracal caracal* (Schreber, 1776) [10,11]; sand cat, *Felis margarita* Loche, 1858 [12–15]; Arabian leopard, *Panthera pardus nimr* (Hemprich and Ehrenberg, 1833) [16,17]; honey badger, *Mellivora capensis* (Schreber, 1776) [18,19]; white-tailed mongoose, *Ichneumia albicauda* (Cuvier, 1829) [20]; and striped hyena, *Hyaena hyaena* (Linnaeus, 1758) [21]. An update on the distribution of the Asiatic jackal, *Canis aureus* Linnaeus, 1758 was investigated [22]. Other general studies also discussed the status of the carnivores [23–29], with a major revision of the carnivores of the Arabian Peninsula published in 1985 [24].

Threats affecting the carnivores of Saudi Arabia were studied and highlighted, including persecution, illegal trade, killing and poisoning, and habitat destruction [30–34].

The carnivores of Saudi Arabia belong to 6 families (Canidae, Felidae, Hyaenidae, Herpestidae, Mustelidae, and Viverridae), with a total of 14 extant species. The current status of the Arabian leopard remains uncertain [16,17]. Recently, we evaluated the conservation status of the carnivores in the kingdom where conservation measures should be enforced due to the deterioration of the well-being of some species [3,24]. Regionally within the Arabian Peninsula, 16 carnivores have been recorded from Yemen [35], 11 from Oman [36], 12 from the United Arab Emirates [37], and 5 from Kuwait [38].

In the present study, we updated the taxonomy and distributional data for 14 carnivore species based on previous records and recent fieldwork results. We also identified threats and the conservation measures that are currently practiced to ensure the protection of the carnivores in Saudi Arabia.

2. Materials and Methods

2.1. Camera Trapping

A total of 4787 camera trapping nights were conducted from February 2020 to January 2024. Camera traps were placed at 58 locations covering 3 protected areas (Ibex Reserve, Raydah Protected Area, and Farasan), and the southwestern mountains of the Red Sea (Figure 1). They were placed randomly and opportunistically.

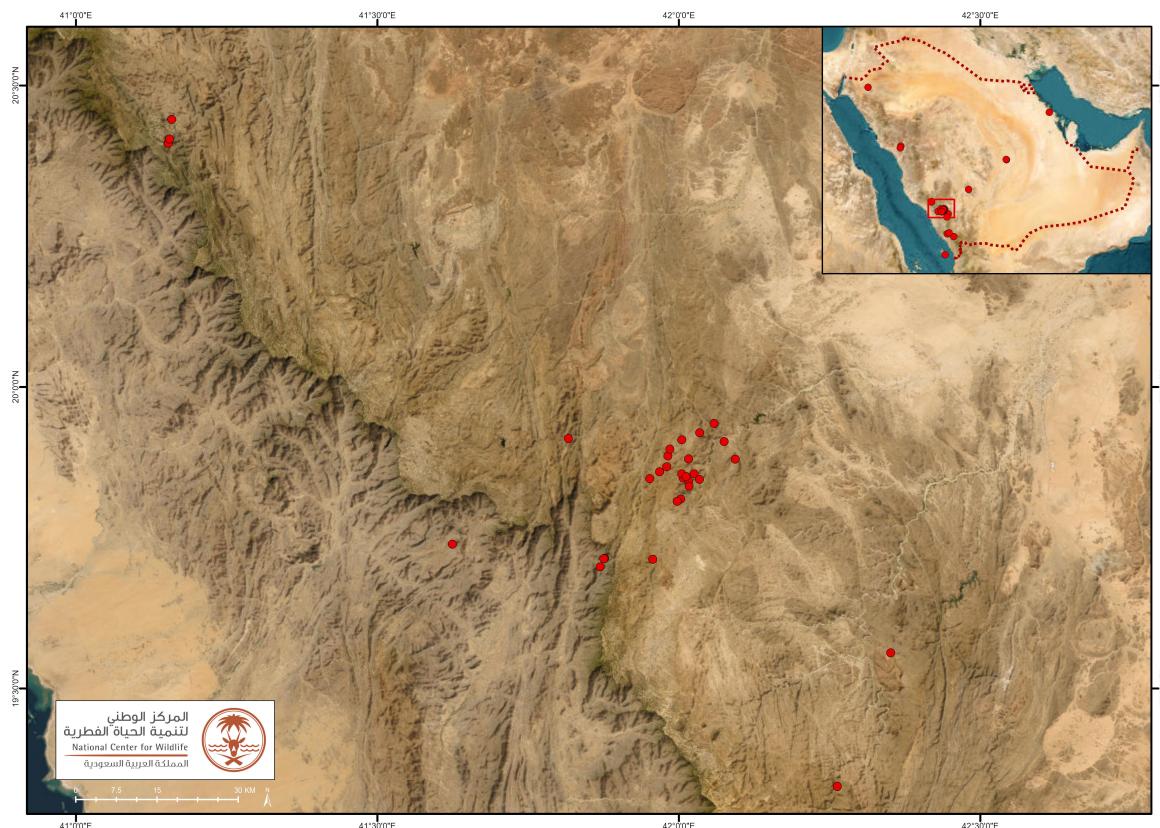


Figure 1. Locations of camera traps used in the study (National Center for Wildlife).

2.2. Distributional Data

Previous records for the carnivores of Saudi Arabia were extracted from published papers, reports, and the mammal collection of the late Prof. Iyad Nader deposited at the NCW. Additionally, personal observations and fieldwork using camera trapping were conducted at different sites in Saudi Arabia by the National Center for Wildlife (NCW) field

biologists. Data on carnivore distribution include 229 localities (Figure 2, Appendix A). Records for each species reported previously are indicated with the reference number in parentheses. Scientific and common names were checked according to the IUCN.

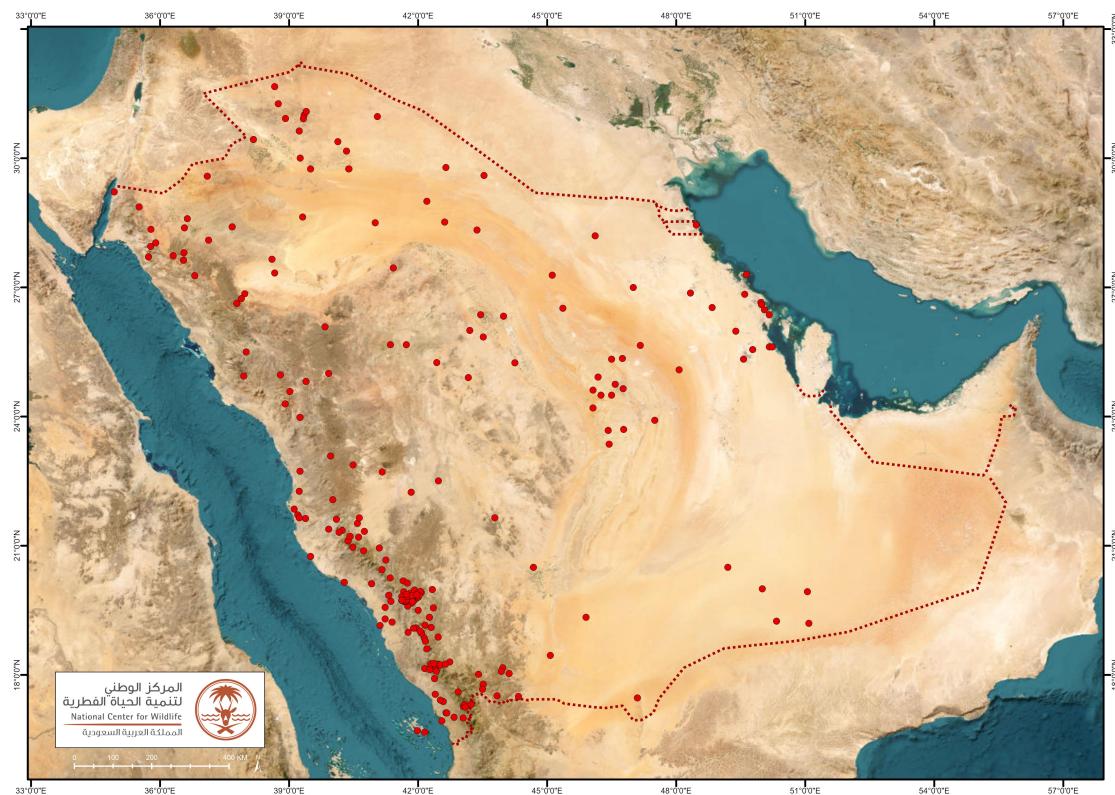


Figure 2. Map of Saudi Arabia showing localities of reported carnivores (NCW).

3. Results

3.1. Camera Trapping

A total of 10 species of carnivores were recorded based on camera trapping efforts (Table 1, Figure 3). The striped hyena was the most recorded species in 13 locations, with the highest number of observations made at the Raydah Protected Area, followed by the red fox and the Arabian wolf (Table 1). Both *Genetta genetta* and *Mellivora capensis* were the least recorded species. *Vulpes vulpes* was the most distributed species and it was recorded from 15 sites.

Table 1. Carnivores recorded by camera traps from Saudi Arabia.

Species	No. of Images	%	No. of Photo Trapping Nights	No. of Sites
<i>Canis aureus</i>	10	0.72	35	2
<i>Canis lupus</i>	73	5.28	631	11
<i>Vulpes cana</i>	11	0.80	69	4
<i>Vulpes vulpes</i>	134	9.68	1841	15
<i>Caracal caracal</i>	27	1.95	159	3
<i>Felis lybica</i>	30	2.16	919	4
<i>Hyaena hyaena</i>	1066	76.96	710	13
<i>Genetta genetta</i>	2	0.14	171	2
<i>Mellivora capensis</i>	3	0.21	87	1
<i>Ichneumia albicauda</i>	29	2.10	165	3
Total	1385	100	4787	58

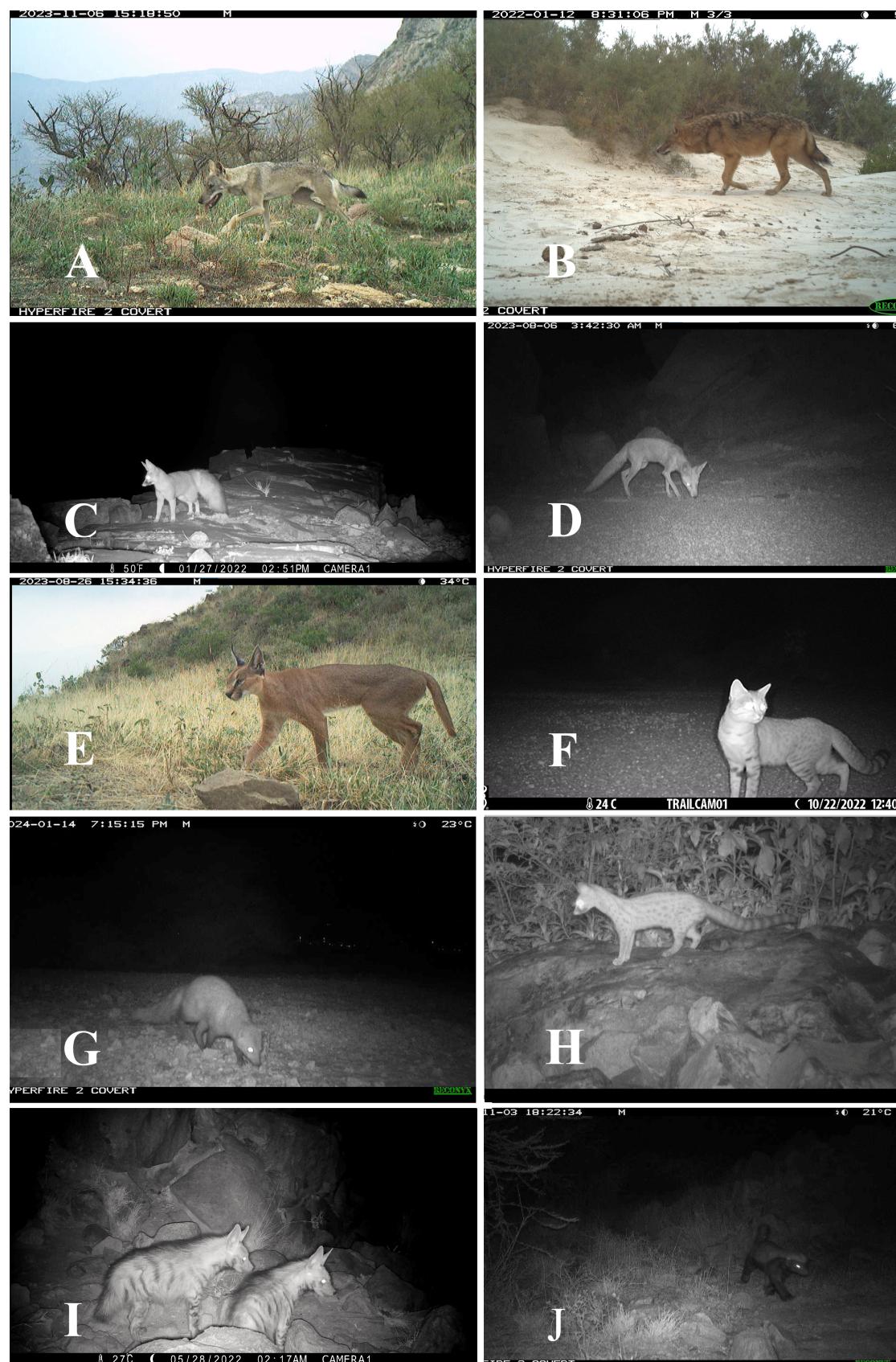


Figure 3. (A) *Canis lupus*. (B) *Canis aureus*. (C) *Vulpes cana*. (D) *Vulpes vulpes*. (E) *Caracal caracal*. (F) *Felis lybica*. (G) *Ichneumia albicauda*. (H) *Genetta genetta*. (I) *Hyaena hyaena*. (J) *Mellivora capensis*. (All photos by NCW).

3.2. Diversity of the Carnivore Fauna of Saudi Arabia

The carnivores of Saudi Arabia consist of 14 species in 6 families (Canidae, Felidae, Herpestidae, Hyaenidae, Mustelidae, and Viverridae) and 10 genera. The family Canidae includes five species, while the families Hyaenidae and Viverridae include one species each (Table 2).

Table 2. Carnivores reported from Saudi Arabia.

	Species	Common Name
Canidae	<i>Canis aureus</i> Linnaeus, 1758	Golden jackal
	<i>Canis lupus</i> Linnaeus, 1758	Arabian wolf
	<i>Vulpes cana</i> Blanford, 1877	Blanford's fox
	<i>Vulpes rueppellii</i> (Schinz, 1825)	Rüpell's or sand fox
	<i>Vulpes vulpes</i> (Linnaeus, 1758)	Red fox
Felidae	<i>Caracal caracal</i> (Schreber, 1776)	Caracal
	<i>Felis lybica</i> Forster, 1780	African wildcat
	<i>Felis margarita</i> Loche, 1858	Sand cat
	<i>Panthera pardus nimr</i> (Hemprich and Ehrenberg, 1833)	Arabian leopard
Herpestidae	<i>Herpestes edwardsii</i> (E. Geoffroy, 1818)	Indian grey mongoose
	<i>Ichneumia albicauda</i> (Cuvier, 1829)	White-tailed mongoose
Hyaenidae	<i>Hyaena hyaena</i> (Linnaeus, 1758)	Striped hyena
Mustelidae	<i>Mellivora capensis</i> (Schreber, 1776)	Honey badger
Viverridae	<i>Genetta genetta</i> (Linnaeus, 1758)	Common genet

Family Canidae

Canis lupus Linnaeus, 1758. Figures 3A and 4A

Common name: Arabian wolf.

Previous Records: Hijla, Taif-Abha, Wadi Khumra [1], Al Khunfa, Al Jandalayah, At Taysiyah, At Tubaiq, Ballasmar, Haram of Makkah, Harrat Al Harrah, Harrat Khaybar/Wadi Hadiyah, Harrat Uwayrid, Himma Al-Azahirah, Himma Al-Fawqa', Himma Al Humayd, Ibex Reserve, Farasan Islands, Jabal Aja, Jabal Batharah/Wadi Turabah, Jabal Uthrub/Al-Balas, Jibal Qaraqir, Jabal Shada, Mahazat As Sayd, Majama' Al Hadb, Nafud Al Urayq, Raydah, Saja/Umm Ar Rimth, Wadi Iya, Wadi Lajb/Jabal Al Qahar, Wadi Tarj/Jabal Jandaf [3], Asir [5], Al Dalham, Al Majmah, Artawiyah, Ayn Dar, Bani Sa'ad, between Al Muzahmiya and Dharma, between Al Khobar and Dammam, Fuleji-Jiddah, Haql, Harrat Khaybar, Khawr Khafji, Jabal Sawdah, Jabal Warjan, Makkah bypass, Shigri, Taif-Abha, Wadi Hanaq, Wadi Hanifah, Wadi Khumra, Wadi Qust, Wadi Sanakhah, Wadi Shuqub, Wadi Turbah, Zaymah [24], Al Namas [25], Ain Al Akhdher, Al Bedeaa, Al Desah, Al Khere-tah, Al Khonfah, Al Sero, Al Zetah, At-Tubayq, Bajdah, Demaj, E of Geal, Gumailah, Haqel, Harat Al Rahah, Jabal Al Lawz, Jabal Shar, Magna, Sharma road, Taima Al Hamra farms, Taima Al Ktaeb, Wadi Dham [28], Bisha [29], Al Namas, Jebal Al Fiqrnah [34], Asir, Hejaz, Hofuf, Nafud, Riyadh [36], Harrat [39], Jeddah [40], Wadi as Sirhan [41], Buraida [42], Ibex Reserve [43].

Recent records: Al Bashayer, Al Far'ah, Aqbat Al Khashaba, Bellahmar, Al Foaha, Jabal Gaimran, Jabal Radwa, Jebal Al Saro, Luga, Rijal Alma'a, Shwas, Tabuk, Tanomah, Tbalah, Wadi Al Khitan, Wadi Qanonah, Wadi Shara, Wadi Tarj, Yadamah.

Remarks: The Arabian wolf occurs in the mountainous areas of the southwest and the rocky landscape of northern Saudi Arabia. Cunningham and Wronski [3] presented a distribution map for the Arabian wolf based on previously unpublished reports. The

distribution of this species covers vast areas, including rocky areas, wadi beds, open deserts, and around human settlements.

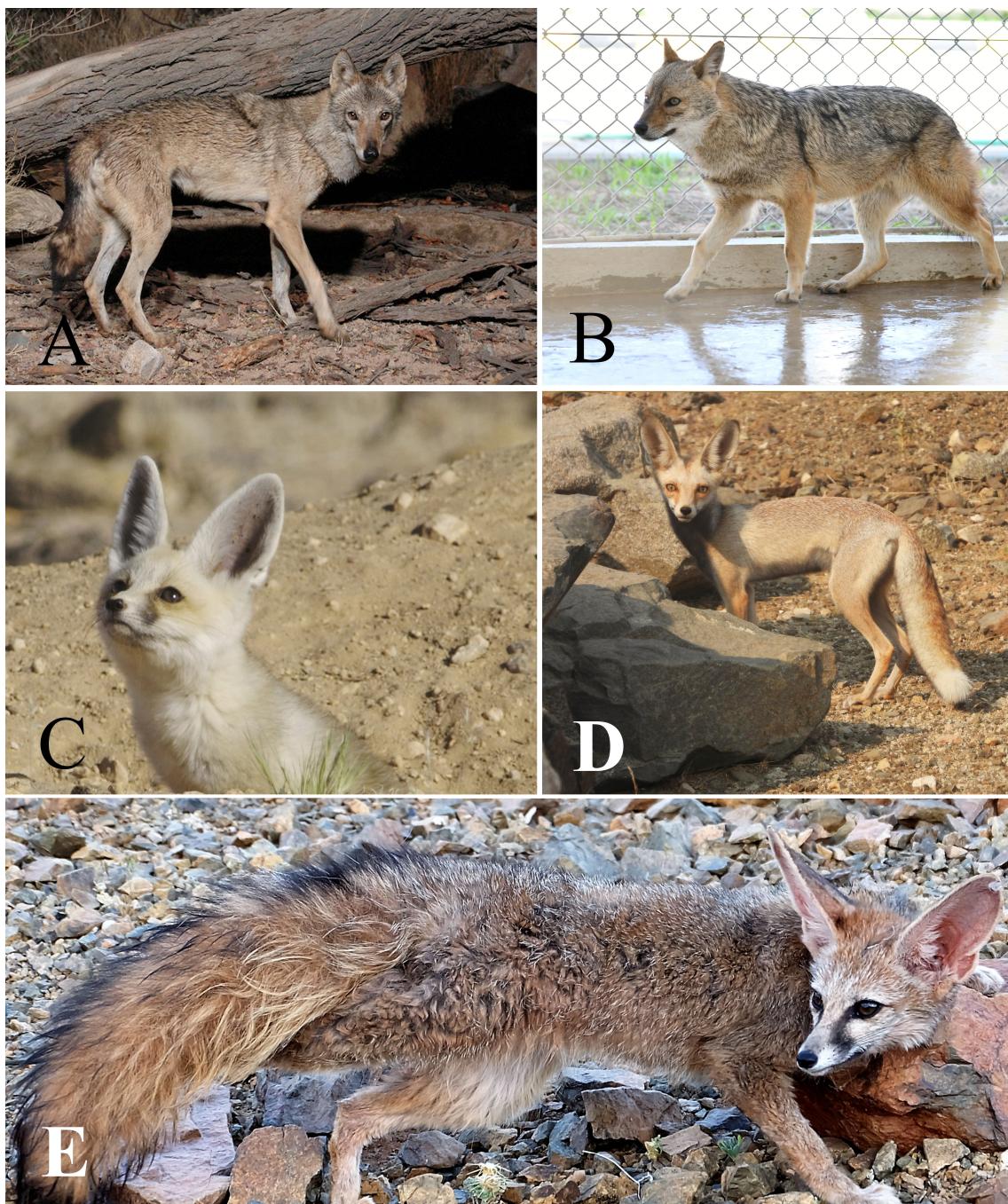


Figure 4. (A) *Canis lupus* (NCW). (B) *Canis aureus* (NCW). (C) *Vulpes rueppellii* (NCW). (D) *Vulpes vulpes* (NCW). (E) *Vulpes cana* (Photo by A. Aloufi).

Wolves feed on a variety of food items, including small mammals, wild ungulates, large lizards, and domestic animals [1]. At Al Namas, it was found to predate a calf. Camera trapping revealed two individuals together. Pups are usually born in the spring or early summer in very cold places, such as the tundra. Females give birth to six to eight puppies, with a gestation period of 2–2.5 months.

Two subspecies were reported from Saudi Arabia; *Canis lupus arabs* Pocock, 1934 and *Canis lupus pallipes* Sykes, 1831. Bray et al. [44] provided genetic evidence that wolves of Saudi Arabia are variable in terms of their genetics and are more closely related to

the Eurasian wolf *Canis lupus* group than to the Indian wolf *Canis lupus pallipes*. The Saudi Arabian wolf population should be considered as *Canis lupus arabs*. In any case, the taxonomic and phylogenetic position of the Arabian wolf requires further genetic and molecular research.

***Canis aureus* Linnaeus, 1758. Figures 3A and 4B**

Common name: Golden jackal.

Previous records: Abo Ali Island, Al Jubail, Al Asfar Lake, Domat Al Jandal, Qa' Sharorah, Tabarjal [22], Hofuf, Laija, Jabal Qarah, Safwa [24], Abo Ali Island, Dauhat Ad-Dafi, Ras Al-Abkhara [45].

Recent records: No found.

Remarks: The Golden Jackal is a nocturnal species and often feeds on carrions and food wastes. It prefers areas with open waterbodies, surrounded by reeds and other aquatic vegetation such as *Phragmites australis* [22]. Its distribution in Saudi Arabia is confined to areas with open pools such as Al Asfar Lake and Domat Al Jandal. One pair was observed during the afternoon at Abo Ali Island [22].

Very little is known about its biology in Saudi Arabia. Mating starts in October and continues till December and pups are born in late winter and early spring. It feeds basically on birds, small mammals, reptiles, amphibians, and large insects [24].

***Vulpes cana* Blanford, 1877. Figures 3C and 4E**

Common name: Blandford's fox.

Previous Records: Ibex Reserve [5,43], Al Namas [25], Bajdah [28], Bisha [29], Biljurshi, Jabal Shada [36], Al Namas, At-Tubaiq Reserve, Jebal Al Fiqrat [46].

Recent records: Aqabat Shareegah, Haid Al Naqa', Jebal Al Saro, Jabel Bathrah, Majama' Al Hadb, Wadi Tarj.

Remarks: This species occurs along the arid mountainous habitats of Saudi Arabia. It has also been recorded in sandstone deserts around the Tabuk area, steep, rocky slopes, and canyons and cliffs along the Red Sea mountains [28,36]. In Bajdah, it occurs along with other mammals, including the rock hyrax, the Nubian ibex, the striped hyena, the red fox and the Arabian wolf [6]. Al-Khalili [4] gave a general account of its habitat selection and behavior.

Gestation lasts for about two months, with a litter size of one to three [47]. This species feeds on invertebrates and fruits, and lizards and rodents seem to be other potential diets. This species is active at night and mostly solitary. The home range was estimated between 0.5 and 2.0 km² [47]. In Saudi Arabia, camera traps showed that peak activity started after 19:00 h with the highest peak at around 05:00 h [6]. In the United Arab Emirates, the diet for this species consists of small invertebrates and fruits [48].

***Vulpes rueppellii* (Schinz, 1825). Figure 4C**

Common name: Rüppell's sand fox.

Previous records: Mahazat as-Sayd [9], Irq Abu Fakr, Rub Al Khali, Sakaka, Zilfi-Buraydah [24], Bisha [29], Riyadh [31], Khafs, Riyadh [40], Ain Sala, Hibaka qa amyat, Najran [36], Nafud Al Sirr, Riyadh, Rub Al Khali, Wadi Dawasir [42], Ibex Reserve [43], Badanah, Rafha [49], Khurais [50].

Recent records: Al Salhaniyah.

Remarks: The Rüppell's sand fox inhabits extreme desertic conditions with soft sand and stony deserts as well. It seems to be common in Mahazat as-Sayd where sand and moderate rocky hills are dominant, with relatively rich vegetation cover of desert plants [8].

Details on the reproduction, diet, and home range for this species in Mahazat as-Sayd Protected Area are reported [8]. The diet consists of desert rodents (*Meriones crassus*, *Gerbillus cheesmani*, and *G. nanus*), birds, reptiles, beetles, other invertebrates, seeds, and

plant materials. The number of cubs per litter ranges from 2 to 6, with a mean of 3.3 [8]. Rüppell's sand fox is strictly a crepuscular/nocturnal animal.

***Vulpes vulpes* (Linnaeus, 1758). Figures 3D and 4D**

Common name: Red fox.

Previous records: Thummamah, Riyadh [7], Mahazat as-Sayd Protected Area [8], Al Jubah, Sakaka, At Tawil [23], Al Aqiq, Amq, Al Baha, Al Uqayr, An Nimas, Ayn Dar, Azaiba, Biljurshi, Bisha, Hakimah, Harrat Kishb, Fayfa, Jafura, Jabal Buwayb, Jabal As Sinfra, Jabal Tuwaiq, Khasab, Makkah, Mikhwah, Qurum, Riyadh, Rumah, Sabya, Samran, Shoiba, Taif-Abha, Wadi Ad Dilla, Wadi Dhi Khul, Wadi Khumrah, Wadi Maraba, Wadi Mardum, Wadi Shakub, Wadi Tabalah, Wadi Turabah [24], An Nimas [25,43], Al Qelebah, Al Sero, Al Zetah, At-Tubayq Reserve Bajdah, Demaj, El Zawiah, Haqel, Shegry, S Tabuk, Tadco farms, Wadi Al Akhdher [28], Bisha [29], Asir, Abha, Dhahran, Harrat Al Harrah, S Hejaz, Jiddah, Kharj, Najran, Nejd, Riyadh, Taif [36], Hofuf, NE Saudi Arabia [42], Ibex Reserve [43], Urq Bin Ma'rd [51], Sakaka [52].

Recent records: Al Jubail, Al Qawba, Bellahmar, Jabal Gaimran, Jebal Al Fiqrab, Jebal Al Saro, Jabel Bathrah, Jabal Radwa, Nofoud Al Uraiq, Riyadh, Tanomah, Wadi Nama'an, Wadi Tarj, Wadi Tibalah.

Remarks: The red fox has a wide range of habitats, including extreme deserts, mountains, sand and gravel deserts, and coastal regions [24]. It also invades urban areas looking for food in the garbage. In the current study, it is considered by far the most common carnivore in Saudi Arabia.

It mates during early winter, giving birth in early spring. It is mainly nocturnal but can be observed during the daytime as well. It feeds on small rodents and birds, lizards, snakes, scorpions, insects, vegetables, and fruits [8]. A home range of 27.3 km² was estimated for one female in Mahazat as-Sayd Protected Area [8].

This species is also persecuted and hunted in many parts of the country. The species population of Saudi Arabia is considered as *Vulpes vulpes arabica* Thomas, 1902.

Family Hyaenidae

***Hyaena hyaena* (Linnaeus, 1758). Figures 3I and 5A**

Common name: Striped hyena

Previous records: Al Harrah, Aljubeh, Alwidyan, An Nafud, Khaw's village, Laija [23], Bani Sar, Biljurshi, Jabal Ayn Dar, Jabal Burrayman, Jabal Lidam, Jabal Qidam, Makkah, Masane, Namrah, Taif Shafa, Talhah, Wadi Qust, Wadi Turabah [24], Al Namas [25,43], Abu Rakah, Alagan, Al Desah, Bajdah, El Bedeaa, E Geal, Gumailah, Haqel, Harat Alrahah, Wadi Al Ghabreah [28], Bisha [29], Asir [34], Al Hasa, Al Medinah, Asir, Hejaz, Tubyeq [36], Hesam (W Tabuk), Jebel Al Lawz, Jebel Hijaz, Jebel Mayen, S Taif across the southwest and in northwest along the Tabuk [53], Turaif [54].

Recent records: Abha, Al Hada, Al Salhaniyah, Al Mosabba'ah, Al Ruddf, Bellasmar, Jebal Al Diqnah, Jabal Gaimran, Jebal Al Saro, Raydah PA, Rijal Alma'a, Shbalah, Tanomah, Wadi Al Hafya, Wadi Khaytan, Wadi Tibalh, Yadamah.

Remarks: The distribution of the striped hyena in Saudi Arabia is the most common in the western mountains, with scattered localities in the heart of the Arabian Peninsula. Rocky terrain rich in caves is quite common in the Hijaz Mountains extending southward to Asir. The striped hyena seeks refuge in remote areas away from human settlements. It is known in the northeast near Hail and Arar where underground caves are abundant. It avoids open sand deserts.

They breed at any time of the year. Gestation lasts for 3 months. A lactating female was observed in March. The activity period extends after 6 p.m. in winter to 3 a.m. in summer. It was found along with the caracal and the Arabian wolf. At Al Baha, the striped hyena feeds on carrion of camels, donkeys, sheep, and cattle. In a cave in Umm Jirsan,

northwest Saudi Arabia, Stewart et al. [21] found tens of thousands of dried old bones from more than 40 animal species (among which were horses, donkeys, wolves, foxes, sheep, camels, goats, gazelles, and hyenas).

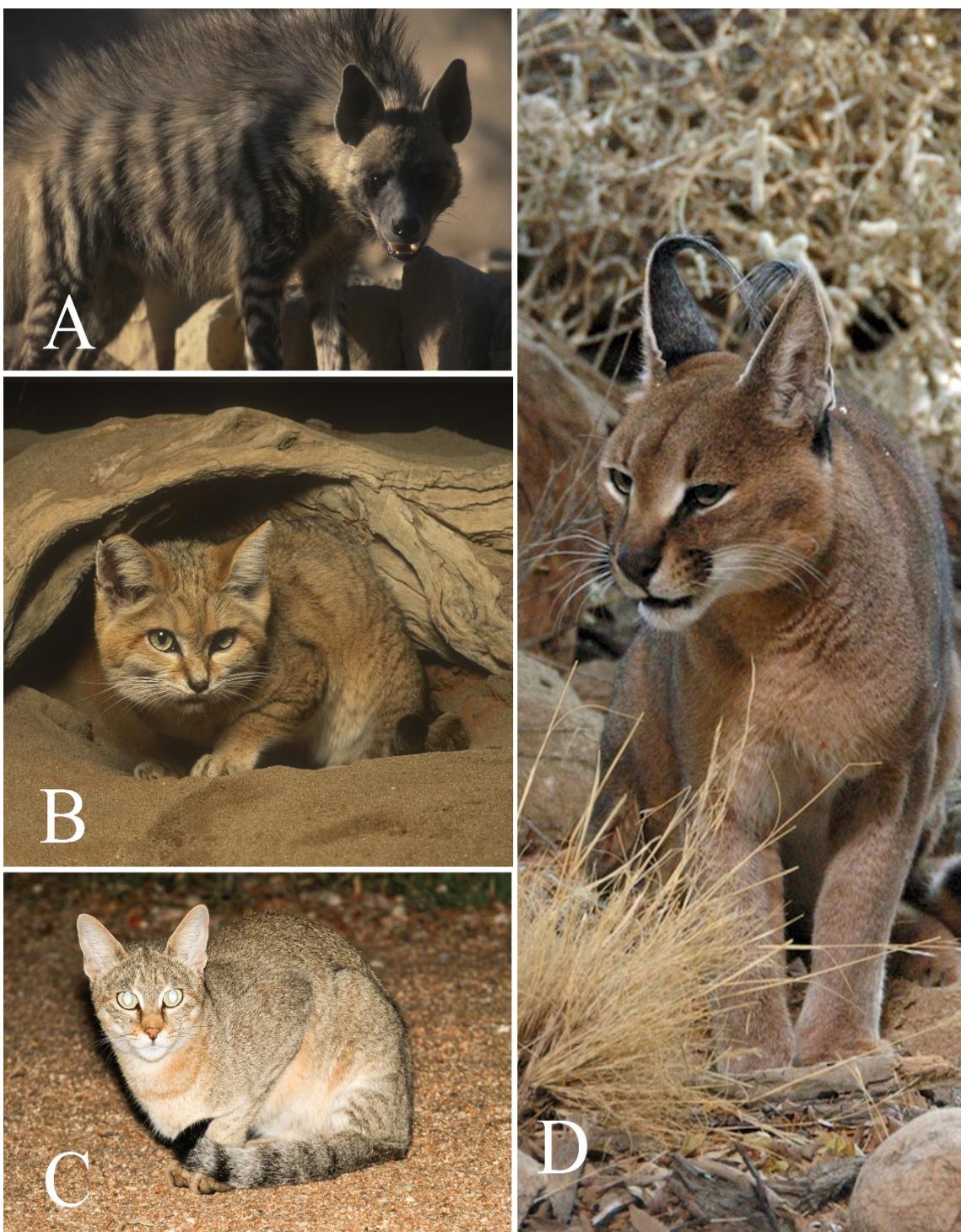


Figure 5. (A) *Hyaena hyaena* (NCW archives). (B) *Felis margarita* (NCW archives) . (C) *Felis lybica* (NCW archives). (D) *Caracal caracal* (NCW archives).

The striped hyena is widely distributed in the Middle East where two subspecies occur: *Hyaena hyaena syriaca* Matschie, 1900, known in Jordan, Palestine, and Syria, and *Hyaena hyaena sultana* Pocock, 1934, in the Arabian Peninsula [36].

Family Felidae

***Caracal caracal* (Schreber, 1776). Figures 3E and 5D**

Common name: Caracal.

Previous records: Abha, Abha-Jizan road, Khamis Mushayt [10], Harrat Al Harrah [11], Wadi Khaytan, between Malik and Abyam [24], Makman Shamma [26], Bisha [29], Qaim [40].

Recent records: Al Awamer, Al Fowaha, Al Namas, Bellahmar, Bellasmar, Jabal Gaimran, Jebal Al Daqnah, Jebal Al Saro, Janab Shokor, Mahayel Aseer, Raydah, Rijal Alma'a, Shwas, Tanomah, Tharban, Wadi Turbah, Yadamah.

Remarks: In Saudi Arabia, the caracal is common in the southwestern mountains where pairs were documented by camera traps. It was found along with the striped hyena and the African wildcat. In Harrat Al Harrah, a radio-tracked male home range was from 270 to 1116 km² [11]. The species was observed in several locations in Al Namas with camera traps, whereas two individuals, a female and a juvenile, were seen in one frame in a rocky area. The species is active during the day and nighttime.

Both sexes become sexually mature by the time they are one year old. Breeding takes place throughout the year. The gestation lasts about two to three months, following which a litter consisting of one to six kittens is born. The caracal feeds primarily on birds, small mammals, gazelles, lizards, and snakes [36]. Van Heezik and Seddon [11] found that the caracal in the Harrat al Harrah Protected Area fed mainly on the Libyan jird, *Meriones libycus*, and was also observed to scavenge on dead Arabian sand gazelle, *Gazella marica*, and feed on the killed steppe eagle, *Aquila nipalensis*.

***Felis margarita* (Loche, 1858). Figure 5B**

Common name: Sand cat.

Previous records: Mahazat as Sayd [8,55,56], Saja/Umm Ar-Rimth, Mahazat as Sayd Reserve [12], Uruq Bani Ma'arid [15], Ashayrah [24], Harrat al-Harrah [26,57], Al Zetah, Haqel, Rowafah [28], Sharri [58], Bisha [29]. Saja/Umm Ar-Rimth protected area [32], between Sarrar and Al Uwaynah, Rumah [36], Riyadh [59], Turif [54].

Recent records: Ibex Reserve, Meegowa, Nofoud Al Uraiq.

Remarks: The sand cat inhabits escarpment plateaus, sand dunes, and interdunal gravel valleys in Uruq Bani Ma'arid [15]. It was found along with Rueppell's fox in the sand dune habitats. Similarly, it was found in sandy areas in the deserts of Tabuk [28].

Young individuals were observed in May, June, and August. This species is strictly nocturnal and more active during the hot season [15]. The gestation period lasts between 59 and 67 days [60]. Rodents and the young of *Lepus capensis* were reported as the main prey of this cat [61]. The cat was active for a total of 7.3 and 6.4 hours per day during summer and winter, respectively [15]. Its activity pattern overlapped with that of *V. rueppellii* and *V. vulpes* [15]. Fagbo et al. [58] found that a sand cat collected from Sharri village near Qaseem was affected by rabies.

***Felis lybica* (Forster, 1780). Figures 3F and 5C**

Common name: African wildcat.

Previous records: Thumamah [7], Bisha [29], Asir, At Taysiyah, Bani Malik, Bani Sar, Biljurshi, Buradah, Harrat Al Harrah, Hejaz, Luga, Makkah, Makkah-Taif Road, Umm Al Quran, Wadi Dhib, Wadi Nissah, Wadi Hizwah, Wadi Samara, N Jeddah [36], Rub al Khali [62].

Recent records: Al Baha, Al Fowaha, Al Namas, Jebal Al Daqnah, Jabal Al Fiqr, Jebal Al Saro, Majama' Al Hadb, Sabat Al Jarah, Nofoud Al Uraiq, Shwas, Wadi Khytan.

Remarks: The African wildcat occurs in rocky areas, scrub deserts, dunes, and plains from the sea level to 2300 m a.s.l. There are no detailed studies on the wildcat in Arabia except for a radio-tracking study of two animals in the UAE [63,64]. A wildcat was found resting in the hollow of a Ghaf tree *Prosopis cinerea* [65].

It is presumed to be a generalist feeder, preying on rodents, small birds, reptiles, eggs, etc. The stomach of one wildcat examined on the Batinah coast, Oman, contained coleoptera, orthoptera, lizards, mammal fur, and a date stone, with the insect remains perhaps a response to the scarcity of rodents during a period of drought [36]. Females give birth to up to 5 kittens and the gestation period lasts 56–60 days.

Panthera pardus nimr (Hemprich and Ehrenberg, 1833) Figure 6A

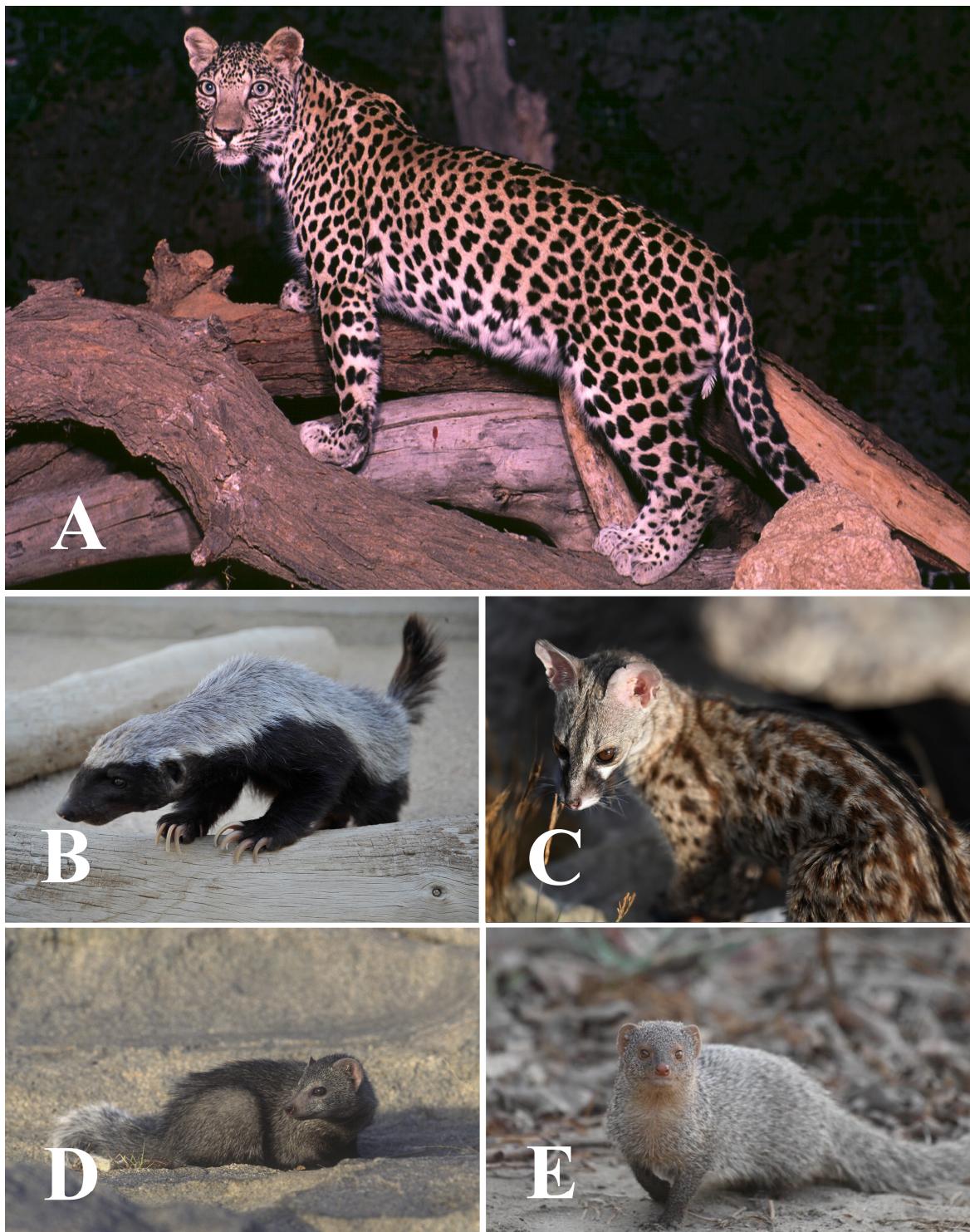


Figure 6. (A) *Panthera pardus nimr* (NCW). (B) *Mellivora capensis* (NCW). (C) *Genetta genetta* (NCW). (D) *Ichneumia albicauda* (NCW). (E) *Herpestes edwardsii* (Photo by M. Al Zayer).

Common name: Arabian leopard.

Previous records: Hijaz in the north and the Asir in the south, Sarawat Mountains, Wadi Hiswa [16], El-Taiyabah [17], Tabuk [28], Al Namas, Bani Saad, Al Fiqrah mountain, Wadi Nauman [33], Hail [66].

Remarks: Leopards were found along remote and rugged mountainous areas in Saudi Arabia. Higher elevations of its distribution range are vegetated with juniper, with the slopes being broken by dry wadis where leopards have been reported [16]. In the Asir Mountains, leopards live along the steep escarpment, parallel to the Red Sea coast, which drops from 2400 m to around 600 m a.s.l. [16]. Arabian leopard scat analyses have revealed the presence of the Arabian gazelle, *Gazella arabica*, Nubian ibex, *Capra nubiana*, cape hare, *Lepus capensis*, rock hyrax, *Procavia capensis*, some bird species, Indian crested porcupine, *Hystrix indica*, Ethiopian hedgehog, *Paraechinus aethiopicus*, small rodents, and insects [67].

In 2017, the National Action Plan for the Arabian Leopard estimated the population of the Arabian leopard around 50 individuals at various sites in the Asir and Hijaz Mountains [68], including Jabal Shada, Raydah, Jazan, and a site on the border with Yemen [69]. However, extensive camera trapping carried out by the National Center for Wildlife since 2010 did not record any leopard presence within Saudi Arabia. These efforts included a follow-up survey conducted after the discovery of the poisoned leopard carcass in Wadi Nauman in 2014, which failed to detect any leopards in that area [69]. During late 2020 and 2021, intensive surveys of 13 sites with 82,075 camera trapping nights, which were considered most likely to support extant leopard populations, were undertaken by the NGO Panthera, in partnership with the Royal Commission for AlUla and with support from the National Center for Wildlife. No leopards were found, and the existing 2021 National Action Plan was updated for the Arabian leopard. It seems unlikely that any functional leopard populations remain in Saudi Arabia, although it is likely that individual leopards may occasionally disperse northward into the kingdom from Yemen [70]. Also, a strategy for the conservation of the leopard in the Arabian Peninsula was drafted [71].

Uphyrkina et al. [72] recognized at least nine discrete populations of *Panthera pardus* across its distribution in Asia and Africa. They stated that the Arabian subspecies, *Panthera pardus nimr* is distinct from other populations. More historical records on the distribution of this subspecies were given by Spalton and Al Hikmani [73]. Based on an analysis of historic and current distribution, *P. p. nimr* has lost as much as 98% of its historic range in the Arabian Peninsula [74].

Family Mustelidae

Mellivora capensis (Schreber, 1776) Figures 3J and 6B

Common name: Honey badger.

Previous records: Mahazat As-Sayd Protected Area [19], Ar Rass, Ayn Dar, Hakimah, Qatif, Makkah By-Pass, Wadi Baysh [24], Makman Shamma [26], Taima [28], Bisha [29], Northern and Central Saudi Arabia; Summan [75], Jafura Desert [76], Badanah [77], Turaiif [54].

Recent records: Al Namas, Al Fowha, Al Jawf. Al Majardah, Al Hareeq, Al Huda, Al Fowha, Biljarashi, Hwalt Al Khabeerah, Jabal Gaimran. Its presence was confirmed near the Al-Hair Lakes in 2022 (observation by F.M.A.), about 45 km south of Riyadh.

Remarks: The Honey badger occurs in most habitats (wadis, mountains, sandy-gravel desert, and plateau) in the Arabian Peninsula except for extensive sand dunes. It has been recorded at 2000 m a.s.l. in Abha, southwestern Saudi Arabia. The honey badger was killing captive Asian houbara bustards, *Chlamydotis macqueenii*, in Saudi Arabia [19]. Three individuals were recorded by camera traps in a wadi bed in Al Namas. They were mostly active during the nighttime, with few sightings in the early morning hours. Females give birth to 1–2 newborns with a gestation period that lasts for 8–9 weeks.

Family Viverridae

Genetta genetta (Linnaeus, 1758). Figures 3H and 6C

Common name: Common genet.

Previous records: Biljurshi, Wadi Alayb, Wadi Khaytan [12], Bisha [29], S Asir [36], Al Jowa, N Jizan, Wadi Samara [78], An Namas [79].

Recent records: Al Baha, Al Bashayer, Al Thahara, Al Sawda, Aqabat Shareegah, Bellahmar, Jebal Al Fiqrat, Jabal Shada, Raydah, Tanomah.

Remarks: The common genet inhabits groves, riparian areas, forests, rocky areas, and scrublands [80]. In Saudi Arabia, it occurs in mountainous areas in the southwest, with dense forests, such as in Bisha [29], and permanent water bodies. Also, it is found around the coastal areas near Jazan. It also invades human habitations and sometimes attacks chickens and other small birds.

The biology of this species is summarized from the species account given by Larivière and Calzada [80]. The common genet is an opportunistic carnivore: it feeds on small mammals, birds and their eggs, reptiles, amphibians, fish, insects, and fruits. Mating occurs from January to September, peaking in February and March. The gestation lasts for 10–11 weeks with a litter size between 1 and 4. This species is nocturnal, with the highest activity from sunset to sunrise.

Family Herpestidae

Ichneumia albicauda (G. Cuvier, 1829) Figures 3G and 6D

Common name: White-tailed mongoose.

Previous records: Abu Arish, Al Aradh, Ad adrb, Al Lith, Bani Malik, Hakimah, Wadi Turabah, Sukh Abyan, between Sabya and Sukh Abyan [24], Bisha [29], Jabal Shada [36], Tawlah [78], Al Aradh, Hakimah [81], Farasan al Kebir [82,83].

Recent records: Al Namas, Al Awamer, Al Baha, Ashouq, Sabt Al Alalaya, Sarat Abeeidah, Wadi Al Osher.

Remarks: The white-tailed mongoose can be found in wooded wadis, coastal plains, plantations, gardens, and even urban areas. This species seems to be common in Bisha where 12 individuals were trapped in the mountains and valleys around Bisha [29]. In Farasan Island, the white-tailed mongoose has an adverse effect on the breeding of the osprey, *Pandion haliaetus* [82], and Kentish plover, *Charadrius alexandrinus* [83].

Details on the biology of this species in Yemen were investigated [84]. It feeds on insects, rodents, reptiles (lizards and snakes), toads, worms, and fruit. Females give birth to two young, and reproduction occurs during February–May.

Herpestes edwardsii (E. Geoffroy, 1818) Figure 6E

Common name: Indian grey mongoose.

Previous records: Al Qatif [12], Uqair [40], Al Qatif [78], Sayhat [85].

Recent records: No found.

Remarks: The Indian grey mongoose was probably introduced to Kuwait and eastern Saudi Arabia. It occurs mainly near the Saudi coasts on the Arabian Gulf. It was found in oases and agricultural areas in Al Qatif [12,85]. Very little is known about its habitat use and distribution in eastern Saudi Arabia.

No data are available on this species in Saudi Arabia. Elsewhere, it was found to feed on rodents, birds, reptiles, a variety of arthropods, and plant materials [86]. Females give birth to 2–3 young, with a gestation period of up to two months.

No information is available on the threats that may affect the Indian grey mongoose in Saudi Arabia.

3.3. Zoogeographical Affinities of the Carnivores of Saudi Arabia

The zoogeography of the mammals of the Arabian Peninsula was presented by Delany [87]. His discussion was based on the distributional data before 1989 (Table 3). Recent studies have expanded the known range for several species that now allow us to discuss in detail the zoogeographic affinities of the carnivores in Saudi Arabia.

Table 3. Zoogeographic affinities of the carnivores of Saudi Arabia.

Species	Present Study	Delany [87]
<i>Canis aureus</i>	Pal–Or	Afr–Pal–Or
<i>Canis lupus</i>	Pal	Pal
<i>Vulpes cana</i>	Pal–Or	Not listed
<i>Vulpes rueppellii</i>	Afr–Pal–Or	Afr–Pal
<i>Vulpes vulpes</i>	Afr–Pal–Or	Pal–Afr–Or
<i>Caracal caracal</i>	Afr–Pal–Or	Afr–Pal–Or
<i>Felis lybica</i> *	Afr–Pal–Or	Afr–Pal–Or
<i>Felis margarita</i>	Afr–Pal–Or	Afr–Pal
<i>Panthera pardus</i>	Afr–Pal–Or	Afr–Pal–Or
<i>Herpestes edwardsii</i>	Pal–Or	Not listed
<i>Ichneumia albicauda</i>	Afr	Afr
<i>Hyaena hyaena</i>	Afr–Pal–Or	Afr–Pal–Or
<i>Mellivora capensis</i>	Afr–Pal–Or	Af
<i>Genetta genetta</i>	Afr–Pal	Afr

* Listed as *Felis silvestris* by Delany [87]. Afr = Afrotropical, Pal = Palaearctic, Or = Oriental

Eight species, *C. caracal*, *F. lybica*, *F. margarita*, *H. hyaena*, *M. capensis*, *P. pardus*, *V. rueppellii*, and *V. vulpes*, representing 57% of the carnivores of Saudi Arabia, have a wide range of distribution throughout the Afrotropical–Palaearctic–Oriental range. One species, i.e., *G. genetta* has the Afrotropical–Palaearctic range (7%), and one species, i.e., *I. albicauda*, is strictly Afrotropical (7%), while three species (21%), *C. aureus*, *H. edwardsii*, and *V. cana*, have Oriental–Palearctic affinities. *Canis lupus* is the only Palaearctic species (7%).

3.4. Species Richness of Carnivores in Saudi Arabia

Figure 7 shows the species richness of the carnivores across Saudi Arabia. The southwestern corner of Saudi Arabia, covering Asir, Jazan, and Najran Plateaus extending further into the Al Sarawat Mountains, hosts the highest number of carnivore species. This includes one Afrotropical species, *I. albicauda*, and species of other affinities, such as *C. lupus*, *C. caracal*, *F. lybica*, *H. hyaena*, *M. capensis*, *V. cana*, *V. vulpes*, and the critically endangered *Panthera pardus*. This area represents the Afromontane element characterized by rich vegetation cover, suitable habitats for carnivores, and abundance of prey of large- to medium- to small-sized animals, such as the Arabian gazelle, *Gazella arabica*, Nubian ibex, *Capra nubiana*, rock hyrax, *Procavia capensis*, Arabian hare, *Lepus capensis*, and rodents.

The Red Sea Mountains also host a number of carnivores. Both *C. lupus* and *H. hyaena* are common species, in addition to the widespread *V. vulpes*. The Blandford's fox, *V. cana*, is associated with both sandstone mountains in the northwest and along the Red Sea Mountains.

At least two species inhabit sand deserts across the country, i.e., the sand cat, *F. margarita*, and Rüppell's sand fox, *V. rueppellii*. Both species are highly adaptable to living in sand dunes.

In eastern Saudi Arabia where salt marches are common, two species of special interest, the Indian grey mongoose, *H. edwardsii*, with very few records, and the golden jackal, *C. aureus*, are commonly reported.

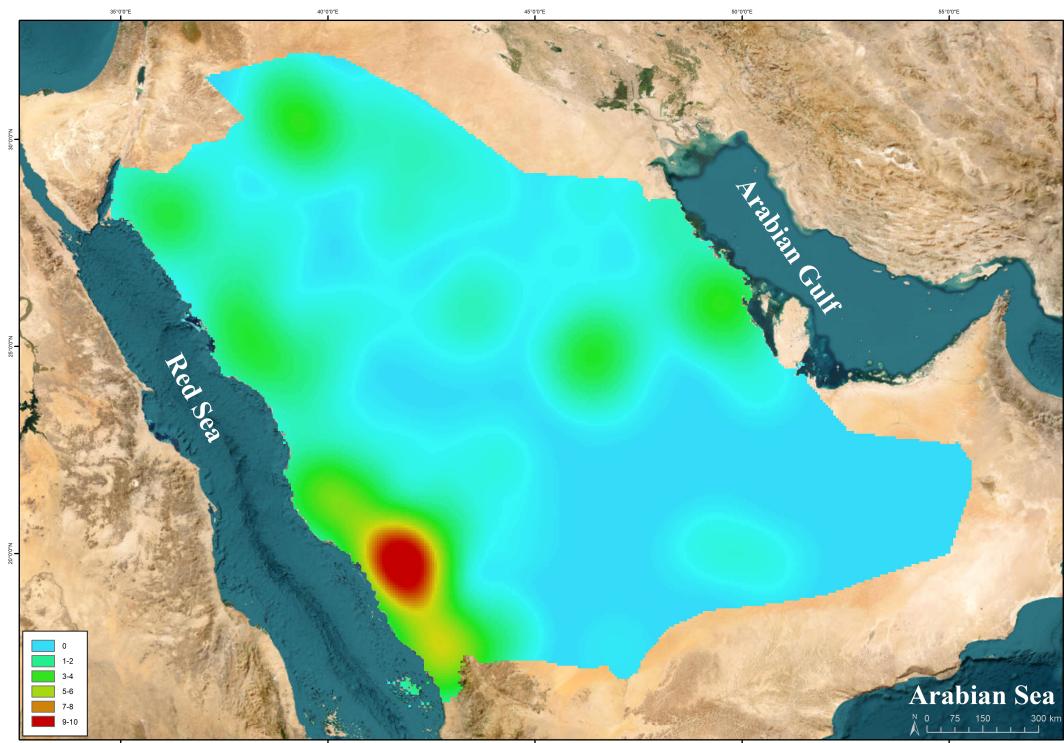


Figure 7. Heat map showing carnivore species richness in Saudi Arabia (NCW).

3.5. Conservation of Carnivores in Saudi Arabia

Most carnivores in Saudi Arabia are protected under the Executive Regulations for Hunting of Wildlife, Article N. M/165 for the year 2020 issued by the Ministry of Environment, Water and Agriculture. Penalties are very severe, varying from as low as SAR 50,000 (USD 13,300) for the killing of the common genet to as high as SAR 400,000 (USD 106,670) for the Arabian leopard. Only the two species of mongooses are not listed.

Confiscated animals by the Environmental Security Special Force are sent to sheltering facilities around the kingdom. Ten species of local carnivores were confiscated and are kept in five sheltering facilities (Table 4). The striped hyena is the most confiscated animal, followed by the Arabian wolf and caracal. At present, all these species are held awaiting rewilding and, subsequently, if deemed suitable, they will be released into fit habitats.

Table 4. Number of confiscated carnivores held at five sheltering facilities in Saudi Arabia.

Common Name	Scientific Name	Holding Centers				
		1	2	3	4	5
Asiatic jackal	<i>Canis aureus</i>	0	0	4	0	0
Arabian wolf	<i>Canis lupus</i>	40	6	0	0	3
Rüppell's sand fox	<i>Vulpes rueppellii</i>	0	0	0	0	3
Honey badger	<i>Mellivora capensis</i>	1	0	0	0	2
White-tailed mongoose	<i>Ichneumia albicauda</i>	2	0	0	0	1
Common genet	<i>Genetta genetta</i>	1	0	0	0	0
Striped hyena	<i>Hyaena hyaena</i>	20	25	0	0	5
African wildcat	<i>Felis lybica</i>	1	0	0	0	2
Sand cat	<i>Felis margarita</i>	1	0	0	0	3
Caracal	<i>Caracal caracal</i>	0	0	0	16	6
Total		66	31	4	16	25

1. The sheltering center in Thumamah. 2. The sheltering center in Jeddah. 3. King Khaled Wildlife Research Center. 4. Prince Saud al-Faisal Center for Wildlife Research at at-Taif. 5. Riyadh Zoo.

Table 5 summarizes the conservation status of the carnivores of Saudi Arabia according to global, regional, and national IUCN assessments [88]. Recently, we assessed the conservation status of the mammals of Saudi Arabia at the local scales according to the IUCN criteria. The Arabian leopard, *P. pardus nimr*, was listed under the critically endangered category. The effective population size is clearly below 250 mature individuals; in fact, the population is declining, and the distribution is severely fragmented, with no subpopulation larger than 50 mature individuals. The species has not been recorded in Saudi Arabia since 2014.

Table 5. Conservation status of carnivores of Saudi Arabia according to the global, regional, and national levels.

Species	Global IUCN Status	Regional IUCN Status	Proposed National IUCN Status
<i>Canis aureus</i>	LC	NT	VU
<i>Canis lupus</i>	LC	NT	EN
<i>Vulpes cana</i>	LC	VU	VU
<i>Vulpes rueppellii</i>	LC	LC	LC
<i>Vulpes vulpes</i>	LC	LC	LC
<i>Caracal caracal</i>	LC	LC	NT
<i>Felis lybica</i>	LC	NT	LC
<i>Felis margarita</i>	LC	NT	LC
<i>Panthera pardus</i>	VU	CR	CR
<i>Herpestes edwardsii</i>	LC	DD	DD
<i>Ichneumia albicauda</i>	LC	LC	LC
<i>Hyaena hyaena</i>	NT	EN	EN
<i>Mellivora capensis</i>	LC	NT	NT
<i>Genetta genetta</i>	LC	LC	LC

Camera traps placed in 13 sites from its historical range and scat DNA analysis failed to document the presence of the leopard [89]. This study concluded that there are no surviving, sustainable populations of Arabian leopards in Saudi Arabia, but, perhaps, individual animals may be present. Both *Canis lupus* and *Hyaena hyaena* are listed as endangered. Although both species have a wide distribution range across Saudi Arabia, they are under severe threats (hunted, poisoned, and killed) causing continued decline in their populations, while the Asiatic jackal, *C. aureus*, and Blanford's fox, *V. cana*, are listed as vulnerable. The Blanford's fox prefers rugged terrain, especially in the southwestern Asir range [90]. The Asiatic jackal has a confined and fragmented distribution in Saudi Arabia. The honey badger, *M. capensis*, and the caracal, *C. caracal* are listed as near threatened. This is mainly due to extensive hunting, killing, and habitat degradation.

3.6. Threats Affecting Wild Carnivores in Saudi Arabia

Unfortunately, large carnivores, especially the Arabian wolf and the striped hyena, are persecuted in many different forms. They are shot when encountered and their carcasses are hung on trees or road signs near villages (Figures 8 and 9). Shepherds claim that wolves predate their sheep and immediately kill them. The use of 'tree hanging' to display killed carnivores, especially wolves and hyenas, is a common practice in Saudi Arabia [3].

Wolves are one of the most persecuted animals in Saudi Arabia. They are hunted, shot, and hung at village intersections. Aloufi and Amr [28] documented that 30 individuals were killed and hung by locals in the Tabuk Province.

Habitat loss and degradation of natural habitats in addition to indiscriminate killing and poaching are major threats affecting the well-being of the Asiatic jackal. Locals do not differentiate between wolves and jackals. A roadkill animal was found dead on the

highway near Tarabjal. The Rüppell's sand fox [24] is also persecuted and was observed hung near Riyadh [31], as is the red fox.



Figure 8. Tree-hung wolves (NCW).

Aloufi and Amr [28] documented that nine hyenas were killed and hung by locals in the Tabuk Province. They are killed by rifle poaching, traps, or poisoning. In addition, habitat alteration, desertification, and urban expansion have their toll on the species' survivorship. Also, the meat of the striped hyena is consumed by some locals. This species is under severe threat and should be protected.

The caracal is presumed to have a wide distribution range in Saudi Arabia. However, its population size is not known without estimates and may be declining, with various forms of threats emerging. This carnivore is trapped and illegally kept on private farms or collections. Fourteen animals have been confiscated in the last two years.

The Arabian leopard has been subjected to extensive poaching over the past 50 years causing a severe decline in its population [91]. Two young leopards were poisoned in Aqabat Tella', 15 km north of Al Namas in 2007. One leopard was killed and hung in Al Kur, 5 km below Jabal Al Hada, Taif, in 2014 (Figure 10). A values-based management plan was developed to re-establish the return of this magnificent species [91].

Local markets offer several carnivores for sale. The Arabian wolf and the sand cat were offered for sale at the Tabuk pet market [30]. The common genet and the white-tailed mongoose were for sale at the Riyadh pet market in 2023 (observation by F.M.A.)

Forty-nine wolves and fifty hyaenas were confiscated from private farms or collections. Some locals keep wolves in enclosures that lack proper space and living conditions. We came across some private farms holding different species of carnivores as "pets or show animals". In addition, the NCW is currently engaged in captive breeding programs for the caracal and other canids.



Figure 9. Tree-hung striped hyenas (NCW).



Figure 10. (A) Two poisoned leopards in Aqabat Tell'a, Al Namas, in 2007. (B) A killed leopard in Al Kur, 5 km below Jabal Al Hada, Taif, in 2014.

4. Discussion

The carnivore fauna of Saudi Arabia is considered relatively rich compared with neighboring countries with 14 known species. It constitutes about 20% of the terrestrial mammals of Saudi Arabia. Twenty-one extant species of carnivores have been recorded from Iraq [92], sixteen from Jordan [93], two from Bahrain [94], five from Kuwait [38], seven from Qatar [95], twelve from the United Arab Emirates [37], twelve from Oman [36] and sixteen from Yemen [35,96].

The carnivores of Saudi Arabia are under severe threats and require more protection through law enforcement all over the country. Habitat loss and degradation are among the major threats causing decline of carnivores in Saudi Arabia and the Arabian Peninsula [53]. Agricultural and pastoralism expansion in desert and mountain habitats have caused retraction of the home range of large carnivores, thus leading to conflict between humans and wildlife [53]. Some selected species have been proposed for captive breeding programs in facilities within operated protected areas. This will ensure breeding animals that will be subsequently released within the protected areas network that will cover 30% of the total area of Saudi Arabia by the year 2030.

Hunting and persecution of wild carnivores were the main reason for the extinction of the cheetah, *Acinonyx jubatus*, in Saudi Arabia [97]. This species was distributed in the northern parts of Saudi Arabia. Four cheetahs were killed in the early 1950s by the ARAMCO workers near the Saudi–Iraqi–Jordanian borders [98]. It was last seen in Hail in 1973 where two animals were killed [97]. By now, the cheetah is considered an extinct species in Saudi Arabia: in 2022, 5 mummified, over 50 skulls, and skeletal remains of cheetahs were found in underground caves in Luga, Ara'r Governorate. The caves varied in size, from small to very large, with extensive alleys and tunnels. Studies to determine the ages and genetic profiles of the collected materials were undertaken by the NCW. By now, the whole genome of two Arabian leopards has been sequenced and compared with other populations [99].

Furthermore, the magnitude of animal trade in local carnivores requires more attention in order to accommodate confiscated animals in sheltering units, along with rewilding and rehabilitation programs. Threats affecting carnivores should be quantified to secure more conservation efforts. Public awareness is very important for educating the public on the importance of these animals in preserving the natural ecosystems of the country.

The present study revealed the urgent need to conduct further studies on the biology of all carnivores in the country to understand their breeding biology, food preference, diseases, habitat preferences, and genetic profiles. This last approach is absolutely fundamental to better define the phylogenetic and taxonomic realities of some Saudi taxa.

Author Contributions: Conceptualization, A.A.B., F.M.A. and Z.S.A.; methodology and data collection, A.A.A., A.R.A.G., F.S., F.N., S.A., S.A.J., K.A.M. and M.A. and result analysis, F.M.A., F.N., S.A.J. and Z.S.A.; writing, A.A.A., A.A.B., F.M.A., S.A.J. and Z.S.A. All authors have read and agreed to the published version of the manuscript.

Funding: This study was supported by the National Center for Wildlife (NCW), Kingdom of Saudi Arabia.

Data Availability Statement: Data are presented in the study.

Acknowledgments: Our thanks are extended to Mohammed Al Dughaim, Wildlife Shelter Unit at Al Thumamah (NCW), for providing data on confiscated carnivores; Mohammad Al Nashiri from the GIS unit (NCW) for map preparation; Mengjing Wei (NCW) for her editorial help; and Mohammed Al Zayer for providing images. Authors wish to express their gratitude to Mohammed Quran, CEO of NCW, for his continuous support and guidance.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Locality	N	E	Locality	N	E
90 km North Jizan	16°56'00"	42°33'00"	Jabal Qidam	26°32'00"	48°50'00"
Abha	18°14'00"	42°31'00"	Jabal Radwa	24°56'29"	37°56'42"
Abu Arish	17°7'00"	42°40'00"	Jabal Shada	19°50'52"	41°18'57"

Locality	N	E	Locality	N	E
Abu Rakah	27°16'16"	36°47'80"	Jabal Tahfa	24°54'04"	43°09'54"
Ad Darb	17°25'00"	42°31'00"	Jabal Tuwaiq	24°30'00"	46°30'00"
Ain Sala	19°56'00"	51°3'00"	Jabal Uthrub	19°46'31"	41°42'57"
Al Ahsa	25°33'16"	49°46'36"	Jabal Wergan	23°59'00"	39°15'00"
Al Aqiq	20°11'00"	41°39'00"	Jabal Aja	27°26'59"	41°25'20"
Al Ardhi	18°58'07"	42°4'50"	Jafura	25°37'00"	50°10'00"
Al Awamer	19°42'26"	41°42'23"	Janab Shukur	19°54'00"	41°49'00"
Al Baha	19°35'54"	41°45'40"	Jebal Al Amud	31°00'00"	39°21'00"
Al Bashayer	19°42'54"	41°53'24"	Jeddah	21°51'00"	39°07'00"
Al Bashir	19°42'57"	41°52'36"	Jibal Zallaqah	31°16'00"	38°45'00"
Al Dalham	18°01'00"	43°24'00"	Khafji	28°27'00"	48°28'00"
Al Disah	27°37'57"	36°32'30"	Khafs	25°20'00"	46°30'00"
Al Figarh	24°58'15"	38°48'03"	Khamis Mushayt	18°18'00"	42°44'00"
Al Fouha	19°46'45"	41°58'10"	Kharj	23°55'00"	47°30'00"
Al Huda	21°23'05"	39°55'18"	Khawa	29°45'00"	40°23'00"
Al Hariq	23°40'35"	46°25'08"	Khurais	25°05'00"	48°04'00"
Al Jandaliyah	27°17'00"	45°7'00"	Laija	29°45'00"	39°30'00"
Al Jawf	13°00'13.47"	39°15'29.34"	Luga	29°46'75"	42°38'52"
Al Jowa	17°00'00"	43°3'00"	Mahazat as Sayd	22°14'41"	41°50'24"
Al Jubail	26°50'29"	49°35'30"	Majami Alhadb	21°38'53"	43°47'03"
Al Khunfah	28°38'00"	39°19'00"	Makkah	25°40'08"	41°21'17"
Al Lith	20°09'00"	40°17'00"	Makkah-Taif Road	21°21'30"	40°14'00"
Al Madinah	24°49'7"	39°23'44"	Malik and Abyam	17°16'00"	43°03'00"
Al Majardah	19°05'3.2"	41°53'41"	Masane	18°10'00"	43°58'00"
Al Majmaah	22°04'00"	40°1'00"	Meda' in Salih	26°51'00"	37°58'00"
Al Makwah	19°42'30"	41°22'02"	Mikhwah	19°18'00"	41°14'0"
Al Mosabbah	19°48'33"	42°00'29"	Muhayil Asir	18°09'00"	42°09'00"
Al Muzaylif	19°33'59"	41°13'48"	N Jeddah	21°43'00"	39°12'00"
Al Namas	19°09'07"	42°9'26"	Naam	23°42'06"	46°46'30"
Al Qassim	25°40'08"	41°43'28"	Nafud	28°30'00"	41°00'00"
Al Qatif	26°36'00"	49°59'00"	Nafud Al Sirr	25°15'00"	44°15'00"
Al Qawba	19°33'33"	42°21'05"	Nafud Al Urayq	25°15'10"	42°25'59"
Al Qelebah	28°24'17"	37°40'41"	Najran	17°30'00"	44°20'00"
Al Qunfida	19°09'00"	41°7'00"	Namrah	19°45'00"	41°40'00"
Al Ruddf	21°13'11"	40°24'49"	NE of Jeddah	21°38'00"	39°23'00"
Al Sadrah	19°42'37"	41°42'44"	Qaim	21°20'00"	40°45'00"
Al Salhaniyah	22°52'36"	40°29'18"	Rafha	29°36'00"	43°32'00"
Al Sarhan	18°16'00"	42°22'00"	Raydah	18°12'18"	42°24'34"
Al Soudah	18°15'29"	42°17'28"	Rijal Alma'	18°07'14"	42°16'15"
Al Uqayr	25°37'00"	50°14'00"	Riyadh	24°39'00"	46°46'00"
Al Zaharh	19°01'15"	42°2'52"	Rowafah	27°44'27"	36°18'14"
Al Zetah	28°52'23"	35°30'50"	Rub' Al Khali	20°00'00"	50°00'00"
Alagan	28°23'00"	36°33'58"	Rumah	25°39'00"	47°10'00"
Alhafya	19°42'54"	41°52'31"	Sabt Al Alayah	19°05'34"	41°56'51"
Aqabat Khashaba	19°43'59"	41°48'07"	Sabt Al Jarah	19°13'33"	41°23'39"
Aqabat Shareegah	19°42'06"	41°52'10"	Sabya	17°07'00"	42°39'00"
Ar Rass	25°51'00"	43°31'00"	Safwa	26°39'00"	49°58'00"
Arasha	19°44'00"	41°37'00"	Saihat	26°29'00"	50°03'00"
Artawiyah	26°31'00"	45°22'00"	SajaUmm Ar Rimth	22°30'23"	42°28'20"
Ash Shuwayhitayah	30°23'00"	40°08'00"	Sakaka	30°10'00"	40°20'00"
Ashayrah	21°39'00"	40°38'00"	Samran	23°05'00"	39°58'00"
Asir	19°30'00"	42°00'00"	Sarrar AL Uwaynah	26°52'00"	48°20'00"
At Taysiyah	28°20'00"	43°22'00"	Shabalh	19°58'13"	41°55'6"

Locality	N	E	Locality	N	E
At Tubayg	29°35'00"	37°06'00"	Shafa/Taif	21°07'00"	40°22'00"
Ayn Dar	25°59'00"	49°23'00"	Shamran	19°48'32"	41°55'23"
Badanah	30°58'00"	41°03'00"	Sharawrah	17°28'00"	47°06'00"
Bajdah	28°20'51"	35°47'16"	Shawas	19°52'08"	41°58'29"
Ballahmar	18°36'07"	42°12'03"	Shigry	28°02'00"	35°54'00"
Ballasmar	18°46'58"	42°10'08"	Shoiba	20°45'00"	39°30'00"
Bani Malik	17°19'00"	43°14'00"	Southern Asir	19°30'00"	42°00'00"
Bani Mazen	18°05'14"	42°25'10"	Southern Hejaz	25°30'00"	38°00'00"
Bani Saad	20°52'58"	40°43'58"	Sukh Abyan	17°19'00"	43°5'00"
Bani Sar	20°08'00"	41°45'00"	Summan	27°00'00"	47°00'00"
Bede'a	27°48'11"	36°33'15"	Tabarjal	30°26'17"	38°10'20"
Biljurashi	19°49'28"	41°37'25"	Tabuk	27°39'06"	38°36'00"
Bisha	19°59'00"	42°20'00"	Taif	21°31'12"	40°35'19"
Buraydah	26°20'00"	43°59'00"	Taif -Abha	21°12'00"	40°37'00"
Dammam	26°22'00"	50°10'00"	Talhah	17°47'00"	43°31'00"
Dhahran	17°40'00"	43°30'00"	Tanomah	18°51'51"	42°8'18.7"
Dharma	24°30'00"	46°15'00"	Tawlah	20°15'00"	41°21'00"
Djezirat Abu Ali	27°18'00"	49°38'00"	Tayma	27°20'11"	38°39'47"
El Taiyabah	24°35'00"	39°01'00"	Tharban	18°59'27"	41°45'52"
El zawiah	28°23'00"	36°33'58"	The Ibex reserve	23°21'41"	46°26'30"
Farasan Al Kebir	16°42'20"	41°58'59"	Turabah	28°31'00"	42°37'00"
Farasan Islands	16°40'00"	42°09'00"	Turaif	31°39'57"	38°39'48"
Fayfa	17°15'00"	43°06'00"	Umm Al Quran	19°12'00"	51°5'00"
Geal	28°23'00"	36°33'58"	Uruq Bani M' arid	19°20'13"	45°54'14"
Gumailah	28°23'00"	36°33'58"	Wadi Ad Dawasir	20°30'00"	44°41'00"
Hafar al batin	28°12'00"	46°07'00"	Wadi Ad Dilla	17°55'00"	42°23'00"
Haid Alnagah	19°50'8"	42°01'00"	Wadi Al Akhdher	28°05'50"	37°07'42"
Hail	29°00'00"	42°12'00"	Wadi Al Ashr	19°42'17"	41°40'47"
Hakimah	17°01'00"	42°50'00"	Wadi Al ayb	20°07'00"	40°55'00"
Haqel	29°13'07"	34°56'02"	Wadi Al Dilfah	19°56'00"	41°40'00"
Harrat Al Harrah	31°05'00"	39°24'00"	Wadi Al ghabreah	27°42'36"	35°44'2"
Harrat Khaybar	26°05'00"	39°50'00"	Wadi Baysh	17°23'00"	42°35'00"
Harrat Kishb	22°43'00"	41°10'00"	Wadi Dhi Khul	17°31'00"	43°50'00"
Harrat Uwayrid	26°37'50"	37°47'01"	Wadi Dhib	24°37'00"	46°04'00"
Haswa	28°35'38"	36°38'02"	Wadi Hadiyah	24°59'59"	39°55'03"
Hawalat Al Khabira	19°42'58"	41°42'21"	Wadi Hanaq	22°44'00'	39°15'00"
Hawalh	19°44'28"	41°43'24"	wadi Hanifah	24°45'00"	46°35'00"
Hejaz	25°30'00"	38°00'00"	Wadi Hiswa	18°15'00"	42°28'00"
Hibaka qa amyat	19°15'00"	50°20'00"	wadi hizwah	18°05'00"	43°56'00"
Hijla	18°15'00"	42°38'00"	Wadi Iya	18°52'37"	42°28'00"
Himma Al Azahirah	19°49'45"	41°44'44"	Wadi Khaytan	19°43'59"	41°37'32"
Himma Al Fawqa	19°50'29"	41°51'27"	Wadi Khumra	24°55'00"	46°11'00"
Himma Al Humayd	19°52'14"	41°43'31"	WadiMakmanShamma	30°38'00"	39°14'00"
Hofuf	25°20'00"	49°34'00"	Wadi Mardum	22°16'00"	39°14'00"
Jabal Al Amad	30°55'00"	39°20'00"	Wadi Nauman	21°18'46"	40°09'39"
Jabal Al Dagna	19°44'22"	41°37'26"	Wadi Nissah	24°12'00"	46°04'00"
Jabal Al Fiqrnah	24°17'38"	38°54'31"	Wadi Qanuna	19°39'43"	41°50'32"
Jabal Al Qahar/Wadi Lajb	17°36'17"	42°55'51"	Wadi Qust	20°57'00"	41°6'00"
Jabal Al Saro	19°51'33"	41°58'5"	Wadi Samra	17°33'00"	42°24'00"
Jabal Al Soudah	18°16'00"	42°22'00"	Wadi Sanakhah	18°02'00"	44°7'00"
Jabal Amer	20°58'00"	40°29'00"	Wadi Shuqub	20°40'00"	41°15'00"

Locality	N	E	Locality	N	E
Jabal As Sinfah	27°57'00"	35°47'00"	Wadi Shuraa	19°47'23"	41°47'40"
Jabal Ayn Dar	25°59'00"	49°23'00"	Wadi Sirhan	30°55'14"	38°54'56"
Jabal Batharah	20°26'40"	41°09'29"	Wadi Tabalah	19°54'35"	42°4'30.46"
Jabal Burrayman	21°39'00"	39°14'00"	Wadi Tarj	19°20'10"	42°15'45"
Jabal Buwayb	25°21'00"	46°45'00"	Wadi Thah	19°56'22"	42°3'29"
Jabal Jandaf	19°06'20"	42°18'04"	Wadi Turabah	20°29'49"	49°12'00"
Jabal Lidam	26°22'00"	43°27'00"	Yadamah	18°27'00"	45°4'30"
Jabal Qaraqir	26°44'31"	37°53'27"	Zaymah	21°37'00"	40°06'00"
			Zilfi	26°00'00"	43°12'00"

References

1. Nader, I.A.; Büttiker, W. Mammals of Saudi Arabia. Mammalia: Fam. Canidae. Records of the Arabian wolf, *Canis lupus arabs* Pocock, 1934, from Saudi Arabia. *Fauna Saudi Arab.* **1980**, *2*, 405–411.
2. Wronski, T.; Macasero, W. Evidence for the persistence of Arabian wolf (*Canis lupus pallipes*) in the Ibex Reserve, Saudi Arabia and its preferred prey species. *Zool. Middle East* **2008**, *45*, 11–18. [[CrossRef](#)]
3. Cunningham, P.L.; Wronski, T. Arabian wolf distribution update from Saudi Arabia. *Canid News* **2010**, *13*, 1–6.
4. Al-khalili, A.D. Ecological review and the distribution of Blanford's fox *Vulpes cana* Blanford, 1877 (Mammalia: Carnivora: Canidae). *Fauna Saudi Arab.* **1993**, *13*, 390–396.
5. Cunningham, P.L.; Wronski, T. Blandford's fox confirmed at At Tubaiq Protected Area (northern Saudi Arabia) and the Ibex Reserve (central Saudi Arabia). *Canid News* **2009**, *12*, 1–7.
6. Aloufi, A.; Eid, E. Distribution and morphometric measurements of Blanford's Fox *Vulpes cana* (Mammalia: Carnivora: Canidae) of the Kingdom of Saudi Arabia. *J. Threat. Taxa JOTT* **2019**, *11*, 13557–13562. [[CrossRef](#)]
7. Macdonald, D.W.; Courtenay, O.; Forbes, S.; Mathews, F. The red fox (*Vulpes vulpes*) in Saudi Arabia: Loose-knit groupings in the absence of territoriality. *J. Zool.* **1999**, *249*, 383–391. [[CrossRef](#)]
8. Lenain, D.M.; Olfermann, E.; Warrington, S. Ecology, diet and behaviour of two fox species in a large, fenced protected area in central Saudi Arabia. *J. Arid Environ.* **2004**, *57*, 45–60. [[CrossRef](#)]
9. Williams, J.B.; Lenain, D.; Ostrowski, S.; Tielemans, B.I.; Seddon, P.J. Energy expenditure and water flux of Rüppell's foxes in Saudi Arabia. *Physiol. Biochem. Zool.* **2002**, *75*, 479–488. [[CrossRef](#)] [[PubMed](#)]
10. Nader, I.A. A second record of the caracal lynx *Caracal caracal schmitzi* (Matschie, 1912) for Saudi Arabia (Mammalia: Carnivora). *Mammalia* **1984**, *48*, 148–150. [[CrossRef](#)]
11. van Heezik, Y.M.; Seddon, P.J. Range size and habitat use of an adult male caracal in northern Saudi Arabia. *J. Arid Environ.* **1998**, *40*, 109–112. [[CrossRef](#)]
12. Strauss, M.; Shobrak, M.; Sher Shah, M. First trapping results from a new sand cat study in Saudi Arabia. *Cat News* **2007**, *47*, 20–21.
13. Banfield, L.M.; al Qahtani, H.; Mallon, D. *Arabian Sand Cat Felis margarita harrisoni Status Review and Conservation Strategy*; Al Ain Zoo: Abu Dhabi, United Arab Emirates, 2014.
14. Zafar ul-Islam, M.; Al Qahtani, H.; Aldosari, M. Arabian sand cats in the 'Uruq Bani Ma'arid reserve, empty quarter of Saudi Arabia. *Cat News* **2018**, *67*.
15. Amin, R.; Wacher, T.; Bruce, T.; Barichievy, C. The status and ecology of the sand cat in the Uruq Bani Ma'arid Protected Area, Empty Quarter of Saudi Arabia. *Mammalia* **2021**, *85*, 220–226. [[CrossRef](#)]
16. Judas, J.; Paillat, P.; Khoja, A.; Boug, A. Status of the Arabian leopard in Saudi Arabia. *Cat News* **2006**, *1*, 11–19.
17. Al-Johany, A.M.H. Distribution and conservation of the Arabian leopard *Panthera pardus nimr* in Saudi Arabia. *J. Arid Environ.* **2007**, *68*, 20–30. [[CrossRef](#)]
18. Nader, I.A. First record of the marbled polecat *Vormela peregusna* (Güldenstaedt, 1770) for Saudi Arabia (Mammalia: Carnivora: Mustelidae). *Fauna Saudi Arab.* **1991**, *12*, 416–419.
19. Zafar-ul Islam, M.; Basheer, M.; Rahman, W.; Boug, A. The honey badger, *Mellivora capensis*, killing captive Asian houbara bustards, *Chlamydotis macqueenii*, in Saudi Arabia. *Zool. Middle East* **2010**, *50*, 127–129. [[CrossRef](#)]
20. Simmons, D.J. A new location for the White-tailed mongoose, *Ichneumia albicauda* (Cuvier, 1829), Farasan Kabir Island, Red Sea, Saudi Arabia. *Small Carniv. Conserv.* **1995**, *13*, 3–5.
21. Stewart, M.; Andrieux, E.; Clark-Wilson, R.; Vanwezer, N.; Blinkhorn, J.; Armitage, S.J.; al Omari, A.; Zahrani, B.; Alqahtani, M.; Al-Shanti, M.; et al. Taphonomy of an excavated striped hyena (*Hyaena hyaena*) den in Arabia: Implications for paleoecology and prehistory. *Archaeol. Anthropol. Sci.* **2021**, *13*, 139. [[CrossRef](#)]
22. Al Atawi, T.T.; Al Ghamdi, A.-R.; Shuraim, F.; Al Boug, A.; Amr, Z. Updates on the distribution of the Golden Jackal, *Canis aureus* Linnaeus, 1758, in Saudi Arabia. *Lynx New Series* **2023**, *54*, 5–10. [[CrossRef](#)]

23. Green, A.A. Status of large mammals of northern Saudi Arabia. *Mammalia* **1986**, *50*, 483–494. [CrossRef]
24. Gasparetti, J.; Harrison, D.L.; Büttiker, W. The carnivores of Arabia. *Fauna Saudi Arab.* **1985**, *7*, 397–461.
25. Nader, I.A. Distribution and status of five predators in Saudi Arabia. *J. Wild. Res.* **1996**, *1*, 210–214.
26. Seddon, P.J.; van Heezik, Y.; Nader, I.N. Mammals of the Harrat al-Harrah Protected Area, Saudi Arabia. *Zool. Middle East* **1997**, *14*, 137–146. [CrossRef]
27. Harrison, D.L. The large mammals in Arabia. *Oryx* **2009**, *9*, 357–363. [CrossRef]
28. Aloufi, A.A.; Amr, Z.S. Carnivores of Tabuk Province, Saudi Arabia. *Lynx* **2018**, *49*, 77–90. [CrossRef]
29. Alqahtani, A.R.M. A survey of carnivora diversity in Bisha district, southwestern Saudi Arabia. *Egypt. Acad. J. Biol. Sci.* **2022**, *14*, 295–307. [CrossRef]
30. Aloufi, A.; Eid, E. Conservation perspectives of illegal animal trade at markets in Tabuk, Saudi Arabia. *TRAFFIC Bull.* **2014**, *26*, 77–80.
31. Cunningham, P.L. Persecution of Rüppell’s fox in central Saudi Arabia. *Canid News* **2009**, *12*, 1–5.
32. Sher Shah, M.; Cunningham, P. Fences as a threat to Sand Cats, *Felis margarita* Loche, 1858, in Saudi Arabia. *Zool. Middle East* **2008**, *44*, 104–106. [CrossRef]
33. Zafar-ul Islam, M.; Boug, A.; As-Shehri, A.; Al Jaid, M. Poisoning of endangered Arabian leopard in Saudi Arabia and its conservation efforts. *Cat News* **2014**, *60*, 16–17.
34. Cunningham, P.L.; Wronski, T.; Al Aqeel, K. Predators persecuted in the Asir Region, western Saudi Arabia. *Wildl. Middle East News* **2009**, *4*, 6.
35. Al-Jumaily, M.M. Review of the mammals of the Republic of Yemen. *Fauna Arab.* **1998**, *17*, 477–499.
36. Harrison, D.L.; Bates, P.J.J. *The Mammals of Arabia*, 2nd ed.; Harrison Zoological Museum Publication: Kent, UK, 1991; 354p.
37. Cunningham, P.L. Checklist and status of the terrestrial mammals from the United Arab Emirates. *Zool. Middle East* **2004**, *33*, 7–20. [CrossRef]
38. Abu Baker, M.A.; Buhadi, Y.A.; Alenezi, A.; Amr, Z.S. *Mammals of the State of Kuwait*; IUCN: Gland, Switzerland; Environment Public Authority: Kuwait, Kuwait, 2022.
39. Doughty, C.M. *Travels in Arabia Deserta*; University Press: Cambridge, UK, 1888; 674p.
40. Morrison-Scott, T.C.S. Some Arabian mammals collected by Mr. H. St. J.B.; Philby, C.I.E. *Novit. Zool.* **1939**, *41*, 181–211.
41. Bromage, T.N. *Wolves in the Middle East*; Field: London, UK, 1954; 703p.
42. Harrison, D.L. *The Mammals of Arabia, Vol. II. Carnivora, Hyracoidea, Artiodactyla*; Ernest Benn Limited: London, UK, 1968; pp. 195–381.
43. Bruce, T.; Al-Hazzah, Q.S.; Al-Othman, O.S.; Al-Khairi, M.H.; Wronski, T.; Wacher, T.; Davey, K.; Amin, R. *Mammal Diversity Survey in the Ibex Reserve, Saudi Arabia*; Final Report 2016; Zoological Society of London: London, UK, 2016.
44. Bray, T.C.; Mohammed, O.S.; Butynski, T.M.; Wronski, T.; Sandouka, M.A.; Alagaili, A.N. Genetic variation and subspecific status of the grey wolf (*Canis lupus*) in Saudi Arabia. *Mamm. Biol.* **2014**, *79*, 409–413. [CrossRef]
45. Kock, D.; Nader, I. Terrestrial mammals of the Jubail Marine Wildlife Sanctuary. In *Marine Wildlife Sanctuary for the Arabian Gulf: Environmental Research and Conservation Following the 1991 Gulf War Oil Spill*; Krupp, F., Abuzinada, A.H., Nader, I.A.A., Eds.; Senckenbergische Naturforschende Gesellschaft: Frankfurt, Germany, 1996; pp. 421–437.
46. Jackson, R.; Boug, A.; Islam, M.Z.; Shehri, A. Camera-Trapping Manual for the Arabian Leopard. NWRC and SWC Report. 2010. Available online: <https://www.zlibrary.to/dl/camera-trap-manual-for-arabian-leopard-pdf-nwrcgovsa> (accessed on 16 December 2024).
47. Geffen, E. *Vulpes cana*. *Mamm. Species* **1994**, *462*, 1–4. [CrossRef]
48. Cunningham, P.L.; Howarth, B. Notes on the distribution and diet of Blanford’s Fox, *Vulpes cana* Blanford, 1877 from the United Arab Emirates. *Zool. Middle East* **2002**, *27*, 21–28. [CrossRef]
49. Lewis, R.E.; Lewis, J.H.; Harrison, D.L. On a collection of mammals from northern Saudi Arabia. *Proc. Zool. Soc.* **1965**, *144*, 61–74. [CrossRef]
50. Lipscombe-Vincett, B.A. *Animal Life in Saudi Arabia*; Privately Printed: Mishawaka, IN, USA, 1982; 252p.
51. Wacher, T.; Attum, O. Preliminary investigations into presence and distribution of small carnivores in the Empty Quarter of Saudi Arabia through the use of a camera trap. *Mammalia* **2006**, *69*, 81–84. [CrossRef]
52. Mohamed, W.F. On the Occurrence of Arabian Red Fox *Vulpes vulpes arabica* (Thomas, 1902) in Sakaka, Northern Saudi Arabia. *Pak. J. Zool.* **2016**, *48*, 1979–1982.
53. Mallon, D.; Budd, K. *Regional Red List Status of Carnivores in the Arabian Peninsula*; IUCN, Gland & Environment and Protected Areas Authority: Sharjah, United Arab Emirates, 2011; 49p.
54. Paray, B.A.; Al-Sadoon, M.K. A survey of mammal diversity in the Turaiif province, Kingdom of Saudi Arabia. *Saudi J. Biol. Sci.* **2018**, *25*, 604–608. [CrossRef] [PubMed]
55. Lenain, D.M.; Warrington, S. Is translocation an effective tool to remove predatory foxes from a desert protected area? *J. Arid Environ.* **2001**, *48*, 205–209. [CrossRef]

56. Ostrowski, S.; van Vuuren, M.; Lenain, D.M.; Durand, A. A serological survey of wild felids from central west Saudi Arabia. *J. Wildl. Dis.* **2003**, *39*, 696–701. [[CrossRef](#)]
57. Goriup, P.D.; Norton, J.A.; Al-Salamah, M. *Houbara Bustard Field Research Project; Report on activities April–June 1989*; NCWCD Technical Report No.15; National Commission for Wildlife Conservation: Riyadh, Saudi Arabia, 1989; 42p.
58. Fagbo, S.F.; Al-Saigul, A.M.; Ali, A.A.; Elshamary, E.; Selim, A.A.; Tatwany, H.; Alfadel, Y.; Stegeman, A.; Assiri, A.; Rupprecht, C.E. Rabies in a Sand Cat (*Felis margarita*) in Saudi Arabia: One health implications. *J. Wildl. Dis.* **2021**, *57*, 977–979. [[CrossRef](#)] [[PubMed](#)]
59. Morsy, T.A.; Al-Dakhil, M.A.; El-Bahrawy, A.F. Natural Leishmania infection in sand cats captured in Riyadh district, Saudi Arabia. *J. Egypt. Soc. Parasitol.* **1999**, *29*, 69–74. [[PubMed](#)]
60. Mellen, J. Reproductive Behavior of Small Captive cats (*Felis* sp.). Ph.D. Thesis, University of California, Davis, CA, USA, 1989.
61. Sliwa, A. Felis margarita Sand cat. In *Mammals of Africa, Volume V: Carnivores, Pangolins, Equids and Rhinoceroses*; Kingdon, J., Hoffman, M., Eds.; Bloomsbury Publishing: London, UK, 2013.
62. Philby, H.S.J.B. *The Empty Quarter*; Constable & Co., Pub.: London, UK, 1933; 576p.
63. Phelan, P.; Sliwa, A. Range size and den use of Gordon's wildcats in the Emirate of Sharjah, United Arab Emirates. *Cat News* **2006**, *44*, 16–17.
64. Phelan, P.; Sliwa, A. Range size and den use of Gordon's wildcats *Felis silvestris gordoni* in the Emirate of Sharjah, United Arab Emirates. *J. Arid Environ.* **2005**, *60*, 15–25. [[CrossRef](#)]
65. Tourenq, C.; Coleman, L. The cat and the tree: A desert tale. *Cat News* **2011**, *56*, 20–21.
66. Carruthers, D. Big game of Syria, Palestine and Sinai. *Field Lond.* **1909**, *114*, 1135–1136.
67. Palomares, F.; Islam, M.Z.; Boug, A. *Non-Invasive Sampling of the Arabian Leopard in Saudi Arabia Using Molecular Analysis of Faeces*; Saudi Wildlife Authority/National Wildlife Research Center: Taif, Saudi Arabia; Ilia State University: Tbilisi, Georgia, 2014; 120p.
68. Islam, M.Z.; Boug, A. National strategy and action plan for Arabian Leopard in the Kingdom of Saudi Arabia. *Cat News* **2017**, *66*, 14–17.
69. Zafar-ul Islam, M.; Boug, A.; Judas, J.; As-Shehri, A. Conservation challenges for the Arabian Leopard (*Panthera pardus nimr*) in the Western Highlands of Arabia. *Biodiversity* **2018**, *19*, 1–10. [[CrossRef](#)]
70. Zafar-ul Islam, M.; Gavashelishvili, A.; Kokiashvili, L.; al Boug, A.; as Shehri, A. Modeling the distribution and movement intensity of the Arabian Leopard *Panthera pardus nimr* (Mammalia: Felidae). *Zool. Middle East* **2021**, *67*, 106–118. [[CrossRef](#)]
71. Breitenmoser, U.; Breitenmoser-Würsten, C.; Mallon, D.; Edmonds, J.A. *Strategy for the Conservation of the Leopard in the Arabian Peninsula*; IUCN/SSC Cat Specialist Group, Environment & Protected Areas Authority: Sharjah, United Arab Emirates, 2010.
72. Uphyrkina, O.; Johnson, W.E.; Quigley, H.; Miquelle, D.; Marker, L.; Bush, M.; O'Brien, S.J. Phylogenetics, genome diversity and origin of modern leopard, *Panthera pardus*. *Mol. Ecol.* **2001**, *10*, 2617–2633. [[CrossRef](#)]
73. Spalton, J.A.; Al Hikmani, H.M. The leopard in the Arabian Peninsula—Distribution and subspecies status. *Cat News* **2006**, *1*, 4–8.
74. Jacobson, A.P.; Gerngross, P.; Lemeris, J.R., Jr.; Schoonover, R.F.; Anco, C.; Breitenmoser-Würsten, C.; Durant, S.M.; Farhadinia, M.S.; Henschel, P.; Kamler, J.F.; et al. Leopard (*Panthera pardus*) status, distribution, and the research efforts across its range. *PeerJ* **2016**, *4*, e1974. [[CrossRef](#)] [[PubMed](#)]
75. Dickson, H.R.P. *The Arab of the Desert*; George Allen & Unwin: London, UK, 1949; 664p.
76. Cheesman, R.E.; Hinton, M.A. LXII.—On the mammals collected in the desert of Central Arabia by Major RE Cheesman. *Ann. Mag. Nat. Hist.* **1924**, *14*, 548–558. [[CrossRef](#)]
77. Lewis, R.E.; Atallah, S.I. A note on the occurrence of *Mellivora capensis* ssp. in northern Saudi Arabia (Mellivorinae: Mustellidae). *Z. Säugetierkd.* **1966**, *31*, 390–392.
78. Nader, I. The present status of the viverrids of the Arabian Peninsula (Mammalia: Carnivora: Viverridae). *Senck. Biol.* **1979**, *59*, 311–316.
79. Barnes, D. Reportage of the genet, *Genetta genetta*. *J. Saudi Arab. Nat. Hist. Soc.* **1983**, *2*, 38–42.
80. Larivière, S.; Calzada, J. *Genetta genetta*. *Mamm. Species* **2001**, *680*, 1–6. [[CrossRef](#)]
81. Nader, I.A.; Al Shaer, A.R.; Faden, Y.M.O. First record of white-tailed mongoose *Ichneumia albicauda* (G. Cuvier, 1829) from Saudi Arabia. *Bull. Fac. Sci. Riyadh Univ.* **1975**, *7*, 231–233.
82. Fisher, P.R. Ecology and behaviour of Osprey *Pandion haliaetus* of Farasan Islands, Red Sea, Saudi Arabia. Ph.D. Thesis, Manchester Metropolitan University, Manchester, UK, 2001.
83. Alrashidi, M.; Kosztolányi, A.; Shobrak, M.; Székely, T. Breeding ecology of the Kentish Plover, *Charadrius alexandrinus*, in the Farasan Islands, Saudi Arabia. *Zool. Middle East* **2011**, *53*, 15–24. [[CrossRef](#)]
84. Al-Safadi, M.M. On the biology and ecology of the White-tailed and Bushy-tailed Mongoose (*Ichneumia albicauda* and *Bdeogale crassicauda*) in Yemen. *Zool. Middle East* **1995**, *11*, 5–13. [[CrossRef](#)]
85. Harrison, D.L. *The Mammals of Arabia*. Vol. III. *Lagomorpha-Rodentia*; Ernest Benn Ltd.: London, UK, 1972; pp. 385–670.

86. Akrim, F.; Mahmood, T.; Nadeem, M.S.; Qasim, S.; Andleeb, S.; Fatima, H. Distribution, dietary breadth and niche overlap between two sympatric mongoose species inhabiting Pir Lasura National Park, Azad Jammu and Kashmir, Pakistan. *Pak. J. Zool.* **2019**, *51*, 1497–1507. [[CrossRef](#)]
87. Delany, M.J. The zoogeography of the mammal fauna of southern Arabia. *Mamm. Rev.* **1989**, *19*, 133–152. [[CrossRef](#)]
88. Mallon, D.P.; Hilton-Taylor, C.; Amori, G.; Baldwin, R.; Bradshaw, P.L.; Budd, K. *The Conservation Status and Distribution of the Mammals of the Arabian Peninsula*; IUCN: Gland, Switzerland; Environment and Protected Areas Authority: Sharjah, United Arab Emirates, 2023; 152p.
89. Dunford, C.E.; Faure, J.P.B.; Ross, M.D.; Spalton, J.A.; Drouilly, M.; Pryce-Fitchen, K.J.P.; De Bruin, R.; Botha, A.; Alshehri, A.; Le Roex, N.; et al. Searching for spots: A comprehensive survey for the Arabian Leopard *Panthera pardus nimr* in Saudi Arabia. *Oryx* **2024**, *58*, 351–362. [[CrossRef](#)]
90. Faure, J.P.B.; Drouilly, M.; Botha, A.E.; Ross, M.D.; Spalton, J.A.; AlHlafi, M.; Dunford, C.E.; Mills, D.R.; De Bruin, R.; Gallacher, E.; et al. Blanford’s fox (*Vulpes cana*) habitat suitability in Saudi Arabia: Insights from camera trapping and ensemble species distribution modelling. *J. Arid Environ.* **2024**, *221*, 105136. [[CrossRef](#)]
91. Zafarul Islam, M.; Smith, M.; al Boug, A. The decline of the Arabian Leopard *Panthera pardus nimr* in Saudi Arabia: A values-based plan for future management. *Biodivers. Conserv.* **2024**, *33*, 1393–1411. [[CrossRef](#)]
92. Al-Sheikhly, O.F.; Haba, M.K.; Barbanera, F.; Csorba, G.; Harrison, D.L. Checklist of the mammals of Iraq (Chordata: Mammalia). *Bonn Zool. Bull.* **2015**, *64*, 33–58.
93. Amr, Z.S. *The Mammals of Jordan*, 2nd ed.; Al Rai Press: Amman, Jordan, 2012.
94. Al-Khalili, A.D. New records and a review of the mammalian fauna of the State of Bahrain, Arabian Gulf. *J. Arid Environ.* **1990**, *19*, 95–103. [[CrossRef](#)]
95. Gillespie, F. *Mammals of Qatar*; Bloomsbury Qatar Foundation Publishing: Ar Rayyan, Qatar, 2014.
96. Mensoor, M. The mammals of Yemen (Chordata: Mammalia). *Preprints* **2023**, 2023010181. [[CrossRef](#)]
97. Nader, I. Rare and endangered mammals in Saudi Arabia. In *Proceedings of the First Symposium Wildlife Conservation and Development in Saudi Arabia, Riyadh, Saudi Arabia, February 1987*; Abu-Zinada, A.H., Goriup, P.D., Nader, I.A., Eds.; National Commission for Wildlife Conservation & Development: Riyadh, Saudi Arabia, 1989; pp. 220–233.
98. Hatt, R.T. *The Mammals of Iraq*; Miscellaneous Publications Museum of Zoology University of Michigan: Ann Arbor, MI, USA, 1959; Volume 106, pp. 1–113.
99. Mochales-Riaño, G.; Fontseré, C.; de Manuel, M.; Talavera, A.; Burriel-Carranza, B.; Tejero-Cicuéndez, H.; AlGethami, R.H.M.; Shobrak, M.; Tomas Marques-Bonet, T.; Carranza, S. Genomics reveals introgression and purging of deleterious mutations in the Arabian leopard (*Panthera pardus nimr*). *iScience* **2023**, *26*, 107481. [[CrossRef](#)]

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