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Carnivores of the Madinah Province, Saudi Arabia: Distribution and threats (Carnivora)

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Abstract. Records of carnivores in the Madinah Province, Saudi Arabia, were documented between 2016 and 2024, using camera traps (altogether 415 trapping nights), images from social media platforms, and direct observations. A total of ten species of carnivores representing six families (Canidae, Felidae, Herpestidae, Hyaenidae, Mustelidae, Viverridae) is reported. The red fox (*Vulpes vulpes*) was the most encountered species, followed by the grey wolf (*Canis lupus*). The distribution records of the common genet (*Genetta genetta*) and the white-tailed mongoose (*Ichneumia albicauda*) represent their northernmost range parts in Saudi Arabia. Threats affecting the carnivores of the Madinah Province are discussed.

Keywords. Carnivores, Saudi Arabia, conservation, distribution.

INTRODUCTION

The Madinah Province covers a total area of 153,800 km^2 and represents the third largest province in the Kingdom of Saudi Arabia. It is located in the north-west of the country, with the Red Sea coast about 180 km long. Lava fields constitute around 22.5% of its total area, including Harrat Rahat in the south, Harrat 'Uwayrid in the north, and Harrat Khaybar in the north-east. High mountains such as Jabal Werqaan (2393 m a. s. l.) and Jabal Radhwa (2282 m a. s. l.) are located in the west. In addition, many types of wetlands are present as well as perennial flowing springs like Wadi Khadrah, and springs at Khyber and Wadi Al Fara'a (Fig. 1).

The fauna of carnivores of Saudi Arabia consists of 14 species in six families. The first comprehensive study on the carnivores of Saudi Arabia was published by Gasperetti et al. (1985). Other studies reported on the distribution of the caracal (Nader 1984), Blanford's fox (Al-Khalili 1993), sand and red foxes (Lenain et al. 2004), grey wolf (Cunningham & Wronski 2010), and sand cat (Amin et al. 2021).

The carnivores of the nearby Tabuk Province were studied, addressing main threats and distribution of seven species (Aloufi & Amr 2018). Recently, Dunford et al. (2024) while trying to confirm the presence of the Arabian leopard, documented the occurrence of nine carnivore species along the western part of Saudi Arabia, with no evidence of occurrence of the Arabian leopard. The distribution of the golden jackal in Saudi Arabia was discussed by Al Atawi et al. (2023).

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The present study documents the carnivore fauna of the Madinah Province and discusses threats and conservation issues related to this group.

METHODS

Field trips were carried out to 67 localities across the Madinah Province, Saudi Arabia, in 2016–2024 (Table 1, Fig. 1). The data were obtained by direct observations, exploration of social media platforms especially for killed animals, and using camera traps. The records were supplemented with photographs

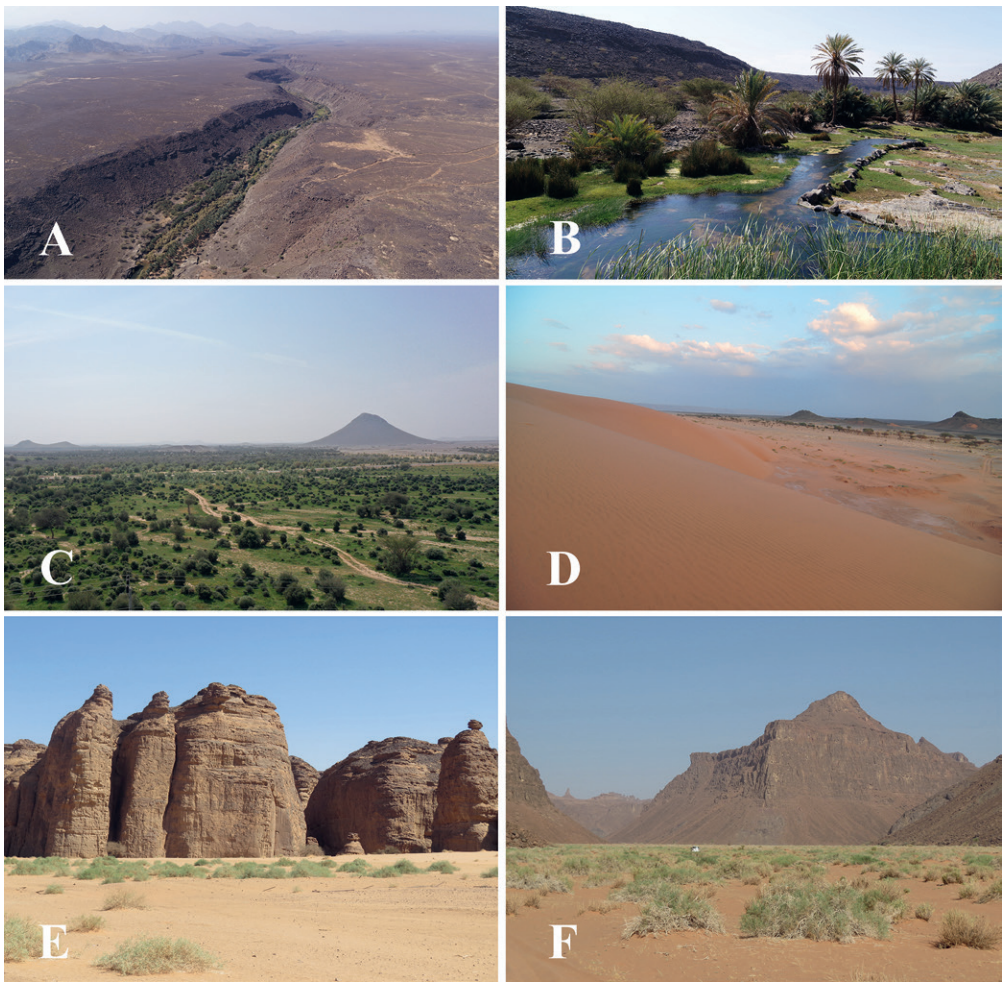

Fig. 1. Examples of natural habitats in the Madinah Province. A – Harrat Rahat, B – Wadi Khadhrah, C – Wadi Al Nagea'a, D – Sand dunes in Al Nefaed, E – Shara'an sandstone desert, F – Wadi Nakhlah in Al Ula.

Table 1. Localities in the Madinah Province from which carnivores were reported, the numbers of localities correspond with the map in Fig. 2

No.	locality	N	E	No.	locality	N	E
1	Abo Dheb'a	23° 12' 40"	39° 32' 20"	35	Far'a Alradadi	24° 18' 10"	39° 15' 31"
2	Ad Dulula	24° 44' 58"	39° 34' 01"	36	Galat Makheet Area	24° 30' 27"	39° 29' 29"
3	Al Agool	24° 31' 43"	39° 46' 11"	37	Hazrah	24° 17' 23"	39° 14' 36"
4	Al Aseel	23° 55' 06"	39° 18' 05"	38	Hedhab Al Rebodh	25° 26' 11"	41° 04' 31"
5	Al Atafeah Village	24° 27' 28"	39° 53' 58"	39	Jabal Al Balasah	23° 40' 03"	39° 02' 43"
6	Al Atef	23° 55' 39"	39° 18' 02"	40	Jabal Al Hefea	24° 32' 17"	39° 28' 15"
7	Al Ayes	24° 51' 33"	38° 14' 44"	41	Jabal Al Senfa	24° 02' 10"	39° 15' 36"
8	Al Baidha	24° 43' 59"	39° 28' 13"	42	Jabal Dummah	23° 51' 48"	41° 03' 14"
9	Al Balga	24° 29' 32"	39° 27' 24"	43	Jabal Hammadah	26° 47' 49"	37° 05' 06"
10	Al Dayer	24° 55' 09"	39° 54' 54"	44	Jabal Sobh	23° 41' 18"	39° 05' 42"
11	Al Fareah	26° 07' 48"	39° 26' 21"	45	Jabal Uhud	24° 30' 59"	39° 36' 56"
12	Al Geder	23° 55' 39"	39° 18' 02"	46	Jabal Um Rugubah	23° 21' 25"	39° 35' 40"
13	Al Ghoson	24° 15' 12"	39° 33' 53"	47	Jabal Wergan	23° 59' 04"	39° 17' 31"
14	Al Hazem	24° 35 '43"	39° 54' 41"	48	Jebal Al Vegarah-Ketaedah		
15	Al Jafjaf	23° 51' 05"	38° 40' 09"			24° 07' 29"	39° 06' 50"
16	Al Jafor	24° 23' 27"	39° 08' 35"	49	Khals	23° 49' 44"	39° 23' 03"
17	Al Jow Village	27° 12' 11"	37° 13' 53"	50	Madakheel	27° 00' 34"	37° 50' 42"
18	Al Jumaemaa	23° 40' 07"	40° 50' 01"	51	Mugeraa	26° 27' 45"	38° 07' 23"
19	Al Juraeseah	23° 34' 15"	40° 49' 35"	52	Oglat Al Saifi	24° 19' 26"	39° 19' 01"
20	Al Medheeq	23° 20' 09"	39° 36' 42"	53	Sabha	25° 10' 56"	40° 49' 34"
21	Al Mulaeleeh	24° 48' 52"	39° 11' 50"	54	Shafa Reem	23° 55' 39"	39° 18' 02"
22	Al Musayjid	24° 04' 52"	39° 06' 31"	55	Shajwa	25° 02' 51"	38° 59' 57"
23	Al Nefaed	26° 11' 45"	39° 35' 47"	56	Shallal	26° 47' 45"	37° 51' 29"
24	Al Rakteen	23° 54' 42"	39° 17' 26"	57	Shebragah	24° 07' 46"	39° 09' 10"
25	Al Sedarh	24° 07' 10"	39° 13' 39"	58	Soarey	23° 43' 36"	39° 31' 29"
26	Al Shalayel	23° 57' 58"	39° 20' 54"	59	Sukhaebrah	24° 35' 00"	40° 58' 40"
27	Al Sumeneah	24° 56' 27"	40° 57' 17"	60	Um Al Shelael	24° 20' 42"	39° 00' 00"
28	Al Umg Village	23° 56' 21"	40° 57' 20"	61	Wadi Al Har	24° 29' 28"	39° 54' 31"
29	Al Vegeer Village	23° 25' 01"	39° 42' 21"	62	Wadi Detheer	24° 59' 00"	40° 03' 00"
30	Al Wasetah-Dagbaj	23° 52' 10"	38° 54' 03"	63	Wadi Hadiyah	25° 31' 59"	38° 04' 54"
31	Al Yaserah Village	23° 18' 37"	39° 35' 47"	64	Wadi Mathaar	23° 41' 02"	39° 04' 51"
32	Azb Al Dhaleel	23° 59' 02"	39° 25' 49"	65	Wadi Mzaber	24° 21' 44"	38° 57' 45"
33	Barq Al Meadi	23° 55' 05"	38° 35' 32"	66	Wadi Reem	23° 52' 27"	39° 21' 25"
34	Faidhat Al Sulimaneah					23° 31' 20"	39° 50' 36"

when possible. Several types of camera trap (Suntek HC-900 Pro, Vikeri Trail Camera, 1520P 20MP Game Camera, Hawkray Trail Camera 20MP 1080P, Meidase P200 Trail Camera, Enkeeo PH730S Trail Camera 1080P) were used for a total of 415 nights between January 2016 and February 2024. Meat and chicken remains were used as a bait.

RESULTS

At 30 camera-trap locations, a total of 415 camera-trap days were carried out, using 16 camera traps. A total of 1815 images were captured, of which 546 included carnivores. Six species of

carnivores were documented in this way. Table 2 shows the number of images recorded for each carnivore species. By far, the red fox (*Vulpes vulpes*) was the most common species and constituted 53.47% of the total number of captured images, followed by the grey wolf (*Canis lupus*) with 23.26%. The common genet (*Genetta genetta*) and the white-tailed mongoose (*Ichneumia albicauda*) were the least camera-trapped carnivores with frequencies of 0.18% and 3.11%, respectively. The other four carnivore species (*Caracal caracal*, *Felis margarita*, *Mellivora capensis*, *Hyaena hyaena*) were never camera-trapped during the entire study. The number of individuals per frame ranged from one to five for *Vulpes vulpes*, with the majority of one individual (97.94 %). A maximum of four *Canis lupus* and five *Vulpes cana* individuals were captured by one frame (Table 2).

Altogether ten species of carnivores belonging to six families (Felidae, Hyaenidae, Viverridae, Herpestidae, Canidae, Mustelidae) were recorded in the Madinah Province, based on the results of camera trapping, direct observations and images obtained from social media.

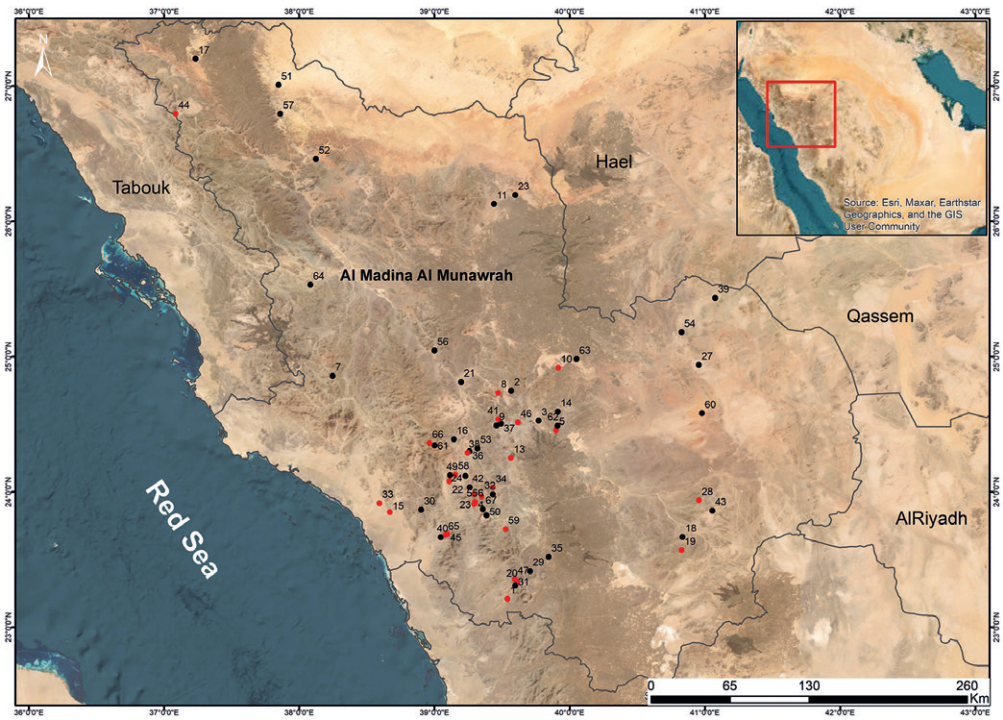

Fig. 2. Map of the Madinah Province showing studied localities; the numbers associated to symbols correspond to the numbers in Table 1. Red circles – locations of camera trap records, black circles – locations of other records.

Table 2. Carnivore species recorded by camera traps in the Madinah Province of Saudi Arabia and conservation status of carnivores of the country according to the IUCN global and regional assessments (Mallon et al. 2023). P = total of photos captured

species	P	%	frequency of the number of individuals					IUCN status	
			1	2	3	4	5	global	regional
Caracal caracal	0	–	–	–	–	–	–	LC	LC
Felis lybica	62	11.36	62	–	–	–	–	NE	NT
Felis margarita	0	–	–	–	–	–	–	LC	VU
Panthera pardus	0	–	–	–	–	–	–	VU	CR
Hyaena hyaena	0	–	–	–	–	–	–	NT	VU
Genetta genetta	1	0.18	1	–	–	–	–	LC	LC
Ichneumia albicauda	17	3.11	17	–	–	–	–	LC	LC
Herpestes edwardsii	0	–	–	–	–	–	–	LC	LC
Canis lupus	127	23.26	121	2	–	4	–	LC	VU
Canis aureus	0	–	–	–	–	–	–	LC	LC
Vulpes vulpes	292	53.48	286	3	–	–	3	LC	LC
Vulpes cana	47	8.61	42	5	–	–	–	LC	VU
Vulpes rueppellii	0	–	–	–	–	–	–	LC	LC
Mellivora capensis	0	–	–	–	–	–	–	LC	NT

F e l i d a e

Caracal caracal (Schreber, 1776)

Records. **Dead**: killed by a hunter, Al Hazem, 26 February 2017 (Fig. 3B); an individual was sold in Friday market, 17 March 2017.

Comments. The caracal has been reported from several localities along the Red Sea mountains extending from as far north as near Al Beda'a reaching Abha, Bishah, to Najran in the south (Nader 1984, Gasperetti et al. 1985, Alqahtani 2022, Dunford et al. 2024), with a single record from Harrat Al Harrah in the north (van Heezik & Seddon 1998). Little is known on its biology in the Arabian Peninsula. In Harrat Al Harrah, a radio-tracked male home range ranged between 270 and 1,116 km^2 (van Heezik & Seddon 1998). Dunford et al. (2024) gave the most updated distribution of the caracal in Saudi Arabia, where the highest number of records was observed in the south-west. Twin caracal kittens with their mother were observed in the Al Namas area in the Asir region, Saudi Arabia (Al Hikmani et al. 2024). In the Madinah Province, one caracal was found killed in 2017. This species is persecuted since shepherds consider it a predator of their livestock.

Felis lybica Forster, 1780

Records. **Dead**: killed by hunters, Jabal Sobh, 17 July 2023; roadkill, Al Vegeer Village, 22 December 2023. – **Observed**: photo by a local, Jabal Al Senfa, 11 December 2020; captured and released by a local, Al Sedarh, 3 November 2022. – **Camera traps**: Al Shalayel, 11 October 2018 (Fig. 4A); Jebal Al Vegarah-Ketaedah, 7 August 2012, 19 April 2023; Soarey, 18 October 2021; Al Geder, 18 November 2023.

Comments. The African wild cat is a common species in mountainous regions of Saudi Arabia. It prefers rocky areas with wadis, and avoids extreme deserts, especially sand dunes. In Saudi Arabia, it was reported from several localities along the Red Sea mountains (Harrison & Bates 1991). Dunford et al. (2024) reported 744 observations of this species by camera traps, it was found in all their studied sites. Four individuals were photographed by camera trap at Al Shalayel, Jebal Al Vegarah-Ketaedah, Soarey, and Al Geder, and other two were observed by locals from Jabal Al Senfa and Al Sedarh.

Felis margarita Loche, 1858

Records. **Observed**: a photo, Al Nefaed, 23 January 2018 (Fig. 3A); captured by locals, Sukhaebrah, 22 April 2018; video, Al Sumeneah, 30 March 2019.

Comments. The sand cat is a species inhabiting sand deserts across Saudi Arabia. It was reported from several localities within protected areas in Saudi Arabia (Seddon et al. 1997, Lenain et al. 2004, Strauss et al. 2007, Sher Shah & Cunningham 2008, Zafar ul-Islam et al. 2018, Amin et al. 2021), and several localities in the provinces of Tabuk (Aloufi & Amr 2018), Turif (Paray & Al-Sadoon 2018), and Bisha (Alqahtani 2022). Amin et al. (2021) gave some details on its daily activity patterns in Uruq Bani Ma'arid, where it becomes active for 7.3 and 6.4 hours per day during summer and winter, respectively. Although it is not directly persecuted, locals trap this cat and sometimes offer it for sale in animal markets.

Hyaenidae

Hyaena hyaena (Linnaeus, 1758)

Records. **Dead**: killed and hanged by locals, Mugeraa, 12 November 2017 (Fig. 5A); two individuals killed by hunters, Jabal Al Balasah, 9 September 2019 (Fig. 5B); killed and hanged by locals, Al Jafor, 13 July 2020.

Comments. The striped hyena has a wide range of distribution covering most habitats except sand deserts of Saudi Arabia. Its distribution extends along the mountains of the Red Sea with scattered records from the north (Gasperetti et al. 1985, Green 1986, Aloufi & Amr 2018, Alqahtani 2022). Dunford et al. (2024) indicated that this species is distributed along the western mountains of Saudi Arabia, however, being more common in the south-west. This carnivore is the second most persecuted animal in the country, and its populations are on the decline. The practice of hanging hyenas on trees or road signs is widespread (Aloufi & Amr 2018). All our records of killed animals and camera trapping efforts failed to document the species, conforming with its rare occurrence and decline.

Viverridae

Genetta genetta (Linnaeus, 1758)

Records. **Dead**: a roadkill, Al Wasetah, Daghbah, 17 December 2023 (Fig. 3D). – **Camera trap**: Jebal Al Vegarah-Ketaedah, 4 October 2016.

Comments. The common genet is an African species known in Yemen and south-western Saudi Arabia. It was reported from several localities in Saudi Arabia in Jazan, Farasan Island, Wadi

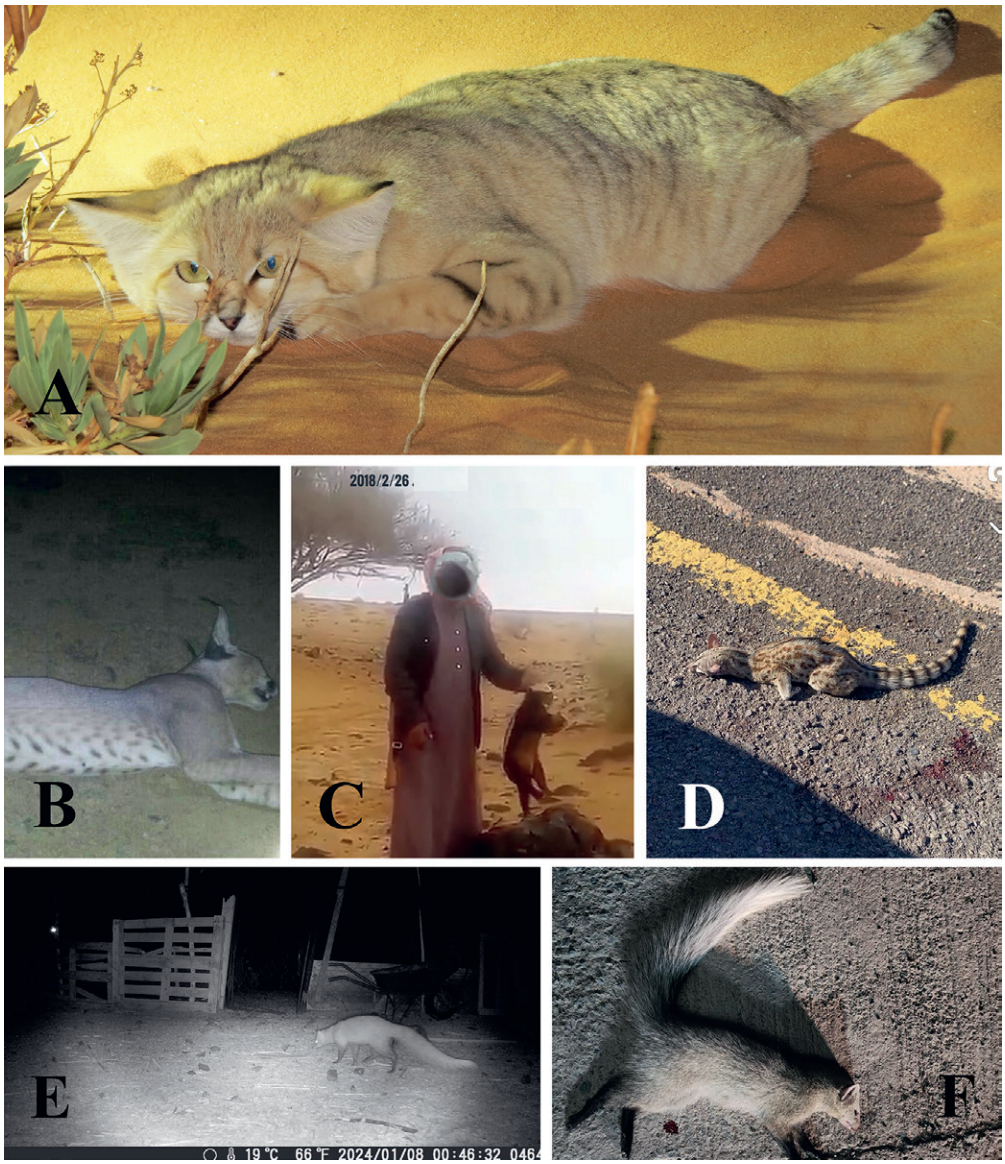

Fig. 3. Records of carnivores in the Madinah Province I. A – sand cat (*Felis margarita*), Al Nefaed, 23 January 2018; B – caracal (*Caracal caracal*), Al Hazem, 26 February 2017 (photo by T. Al Oufi); C – killed honey badger (*Mellivora capensis*), Al Jow village, 26 February 2018 (photo by I. Al Aradi); D – roadkill of the common genet (*Genetta genetta*), Al Wasetah, Daghbah, 17 December 2023 (photo by Y. Eid). E – camera trap photo of the white-tailed mongoose (*Ichneumia albicauda*), from Al Yaserah Village, 8 January 2024. F – roadkill of the white-tailed mongoose (*Ichneumia albicauda*), Al Vegeer Village, 1 December 2023 (photo by O. Al Muraebiti).

Khaytan, Biljarashi, Bisha, and An Namas (Nader 1979, Gasperetti et al. 1985, Alqahtani 2022). Dunford et al. (2024) found that it was the least recorded species within their survey, with 95 camera trap images. The present record expands its distribution further north by about 500 km. Further studies between its most reported northern range and the Madinah Province should be carried out to fill its distributional gap. Al Wasetah is a small village with farmland and date orchards located some 80 km south-west of the Al Madinah Al Munawwara city, and the locals keep chickens in their yards. Upon interviewing, locals indicated the presence of the genet around their farms.

Herpestidae

***Ichneumia albicauda* (Cuvier, 1829)**

Records. **Dead**: a roadkill, Al Vegeer Village, 1 December 2023 (Fig. 3F). – **Observed**: video by locals, Al Yaserah Village, 10 December 2023. – **Camera trap**: Al Yaserah Village, 10 January 2014, 8 January 2024 (Fig. 3E).

Comments. The white-tailed mongoose has a wide range of distribution in south-western Saudi Arabia (Nader et al. 1975, Gasperetti et al. 1985). Other recent records include Farasan al Kebir (Masseti 2010) and Bisha (Alqahtani 2022). The closest localities in the most northern range were reported from Bani Malik near Jeddah (Gasperetti et al. 1985). The Wadi systems between the mountains east of Jeddah provide natural corridors for this species to penetrate further to the north-east. Along these wadis, several villages with agricultural land are common, providing suitable habitats for the white-tailed mongoose. Villagers stated that this animal is rather common and frequently encountered at night. It was documented by video in Wadi Al Fara'a near Al Yaserah Village. This record expands the known distribution range of this species 250 km to the north-east.

Canidae

***Canis lupus* Linnaeus, 1758**

Records. **Dead**: four wolves killed and hanged on a tree, Al Fareah, 20 October 2017; one wolf killed and hanged, Khals, 5 February 2018; one wolf killed by locals, Madakheel, 17 March 2018; one wolf killed by locals, Al Mulaeleeh, 3 April 2019; one wolf killed by locals, Wadi Al Har, 9 September 2018; one wolf killed and hanged on a road sign, Al Hinakiyah, 2 February 2019; 12 wolves killed and hanged on trees, Wadi Hadiyah, 7 February 2019; two wolves killed and hanged, Jabal Dummah, 23 March 2020 (Fig. 5C); one wolf killed and hanged, Al Jumaemaa, 6 June 2021; one wolf killed by locals, Shajwa, 24 July 2021. – **Observed**: one wolf was sold in Friday market, Madinah, 24 March 2017; one wolf captured alive by locals, Shallal, 20 March 2018, a photo by locals, Al Agool, 8 June 2020; a photo of wolf cub by locals, Wadi Reem, 20 September 2020; a video of one wolf captured and released alive by locals, Al Shalayel, 27 October 2020; a photo by locals, Ad Dulula, 6 March 2021; an observed prey (lamb), Sabha, 11 October 2022. – **Camera trap**: Al Shalayel, 5 November 2018, 19 October 2019; Faeiah, 22 October 2020; Al Musayjid, 30 April 2022; Al Dayer, 9 June 2022; two inds., Al Shalayel, 24 June 2022, 6 August 2022; one ind. caught a red fox cub and escaped, Al Umg Village, 23 October 2023; 4 inds., Shafa Reem, 11 November 2023; Barq Al Meadi, 19 November 2023 **(**Fig. 4B); Wadi Mathaar, 10 December 2023; 3 inds., Jebal Al Vegarah-Ketaedah, 25 December 2023.

Comments. The grey wolf has a wide range of distribution across Saudi Arabia, associated mostly with mountainous regions (Nader & Büttiker 1980, Gasperetti et al. 1985, Harrison & Bates

1991, Nader 1996, Cunningham et al. 2010, Aloufi & Amr 2018). Cunningham & Wronski (2010) gave a detailed overview of the distribution of the grey wolf in Saudi Arabia, along with threats affecting this animal. Alatawi (2024) depicted a photo of the "wolf", which is actually of the golden jackal. Dunford et al. (2024) showed that this species is distributed along the western mountains of Saudi Arabia, however, more common in the south-west. We documented 25 killed wolves in various localities in the Madinah Province in 2017–2021. Twenty wolves were documented alive by camera traps over the period 2020–2023. These numbers reflect the decline of the species in the study area.

Vulpes cana Blanford, 1877

Records. **Camera trap**: Jabal Wergan, 16 January 2017 (Fig. 4C); Jabal Hammadah, 20 November 2018; Jebal Al Vegarah-Ketaedah, 20 September 2021, 9 November 2021.

Comments. The Blanford's fox is distributed along the mountains of the Red Sea extending from Bajdah (Aloufi & Amr 2018) and reaching as far An Namas in the south (Nader 1996). Al-Khalili (1993) gave a general account of its habitat selection and behaviour. This fox is

Fig. 4. Records of carnivores in the Madinah Province II (camera trap records). A – African wild cat (*Felis lybica*), Al Shalayel, 11 October 2018 (photo by M. Al Hujaeli). B – grey wolf (*Canis lupus*), Barq Al Meadi, 19 November 2023. C – Blanford's fox (*Vulpes cana*), Jabal Wergan, 16 January 2017 (photo by F. Al Saedi). D – red fox (*Vulpes vulpes*), Al Atef, 18 November 2023.

associated with all types of mountains with sharp edges and cliffs (i.e. sandstone and granite) in the country. Dunford et al. (2024) reported 394 sightings by camera trap for this species. Faure et al. (2024), based on camera trapping in 21 sites, stated that the Blanford's fox is distributed in the south-western Asir Mountains that provide suitable habitats.

The individual that was camera-trapped exhibited a white tail tip. Cunningham & Wronski (2009) observed a black-tipped-tailed Blanford's fox in the Ibex Reserve. Eid et al. (2015) noted white-tipped-tailed foxes in Jordan. Smith et al. (2003) indicated the presence of white-tipped--tailed individuals among populations of *V. cana* in the United Arab Emirates and suggested that this character is a form of genetic variation. Aloufi & Eid (2019) indicated, based on camera trapping, that the peak activity of *V. cana* started after 19:00 with the highest peak at around 5:00.

Vulpes vulpes (Linnaeus, 1758)

Records. **Dead**: a roadkill, Al Ayes, 2 November 2022; one fox killed by locals, Far'a Alradadi, 5 October 2023. – **Observed**: two foxes were sold in Friday market, Madinah, 7 April 2017; a video by locals, Al Balga, 25 February 2019; a fox captured by a shepherd, Galat Makheet Area, 28 February 2019; a photo by locals, Hedhab Al Rebodh, 11 October 2022; a photo, Um Al Shelael, 26 September 2023; a photo, Faidhat Al Sulimaneah, 23 October 2023; a photo by locals, Wadi Detheer, 28 October 2023; five foxes under trees, Oglat Al Saifi, 25 October 023; a photo by locals, Azb Al Dhaleel, 8 November 2023; an adult with three cubs, Oglat Al Saifi, 25 October 2023. – **Camera trap**: Al Shalayel, 11 October 2018, one adult with three cubs, 23.6.2022; Jabal Uhud, 14 November 2018, 12 January 2019; Al Baidha, 17 November 2018; Hazrah, 7 January 2019; Abo Dheb'a, 25 September 2020, 5 November 2020; Faeiah, 5 October 2020, 19 October 2020; Al Medheeq, 13 November 2020; Jebal Al Vegarah-Ketaedah, 7 March 2021; Al Juraeseah, 18 March 2021; Al Ghoson, 4 November 2021; Al Atafeah Village, 12 April 2022; Al Aseel, 22 May 2022; Wadi Mzaber, 26 May 2022; Al Dayer, 2 June 2022; Barq Al Meadi, 11 November 2023; Jebal Al Hefea, 11 November 2023; Al Rakteen, 11 November 2023; Barq Al Meadi, 11 November 2023; Al Jafjaf, 21 November 2023; Al Atef, 18 November 2023 (Fig. 4D); Shafa Reem, 11 November 2023.

Comments. This is by far the most common and widespread carnivore in Saudi Arabia (Aloufi & Amr 2018). It has a wide range of distribution covering almost all types of habitats (Gasperetti et al. 1985). During our study, it was the most frequently recorded species by camera traps and direct observations, with a total of 35 records. Dunford et al. (2024) stated that the red fox was the most frequently camera-trapped species with 4,962 captured images in 14 sites along the western part of Saudi Arabia.

Mustelidae

Mellivora capensis (Schreber, 1776)

Records. **Dead**: one ind. killed by locals, Al Jow village, 26 February 2018 (Fig. 3C); three inds. killed by a beekeeper, Jabal Um Rugubah, 17 November 2023.

Comments. The honey badger seems to be very rare with a single record over the past five years. It was not documented by the camera traps, and our record is based on killed specimens. Its distribution records are scattered all over the country except extensive sand dunes (Gasperetti et al. 1985, Seddon et al. 1997, Zafar-ul Islam et al. 2010, Aloufi & Amr 2018, Paray & Al-Sadoon 2018, Alqahtani 2022). Dunford et al. (2024) reported 290 camera trap captures for this species during their study. This animal is persecuted by the locals and killed since it is considered a predator of chickens.

DISCUSSION

This study documented 10 species of carnivores in the Madinah Province. Most notably, the expansion of the common genet (*Genetta genetta*) by more than 500 km to the north from its currently known range, and range expansion of the white-tailed mongoose (*Ichneumia albicauda*) further to the north-east, about 200 km from its northernmost previously reported records, were recorded.

The number of species captured by camera trapping provides an insight into their natural abundance. The red fox (*Vulpes vulpes*) and the grey wolf (*Canis lupus*) were the most frequently encountered species, while the striped hyena (*Hyaena hyaena*), caracal (*Caracal caracal*), honey badger (*Mellivora capensis*) were not encountered during the entire period of the study, implying that their populations are on the decline to their minimum. Dunford et al. (2024) obtained similar results for the red fox and the grey wolf as we did, however, the other carnivore species were well represented in their record at a varying rate. On the other hand, little known species (e.g. the common genet and the white-tailed mongoose) were documented for the first time in the Al Madina Province by us.

All carnivores in Saudi Arabia are persecuted and are driven to various levels of threats and steady decline in their populations. This is very true for the wolf and the hyena, where the practice of killing and mutilation of these animals is known across the country. Tree hanging to display killed carnivores, especially wolves and hyenas, is practised at a large scale in many

Fig. 5. Records of carnivores in the Madinah Province III (killed individuals). A – hanged striped hyena (*Hyaena hyaena*), Mugeraa, 12 November 2017 (photo by I. Al Aradi). B – two shot striped hyenas (*Hyaena hyaena*), Jabal Al Balasah, 9 September 2019 (photo by Y. Obean). C – two hanged grey wolves (*Canis lupus*), Jabal Dummah, 23 March 2020.

parts of Saudi Arabia, reflecting a serious issue of the human-animal conflict. Aloufi & Amr (2018) documented these practices in the Tabuk Province, and Cunningham et al. (2009) elsewhere. In this regard, it is important to point out that such practices stem from cultural beliefs, as a sign of manhood, or just because of hunting any moving target. Hunting of other large mammals including gazelles and ibexes deprived carnivores of their main source of food, thus they frequented human habitations to prey on domestic animals such as sheep and goats, creating conflict resulting in shooting and killing of the carnivores. It is important to indicate that these practices are not based on religious background, as the islamic teachings forbid killing and mutilating wild animals in general.

Most carnivores and all ungulates in Saudi Arabia are protected under the Executive Regulations for Hunting of Wildlife, Article No. M/165 for the year 2020 issued by the Ministry of Environment, Water and Agriculture. The National Center for Wildlife has the mandate to impose these regulations. Harsh penalties for hunting and killing carnivores ranges from as high as 400,000 SR for the Arabian leopard to as low as 50,000 SR for the common genet. Despite these strict regulations, carnivores are still persecuted and hunted.

It seems that road accidents pose a serious threat to wildlife, and particularly carnivores. In this study, we documented road-killed carnivores such as the white-tailed mongoose, red fox, and common genet. Documentation of the wildlife mortality due to collision on highways and roads in Saudi Arabia is lacking. Images communicated by social media platforms showed many road-killed animals, this issue thus deserves to be recorded.

The most recent evaluation of the mammals of the Arabian Peninsula (Mallon et al. 2023) listed four carnivores as Vulnerable (*Canis lupus*, *Felis margarita*, *Hyaena hyaena*, *Vulpes cana*), two as Near threatened (*Felis lybica*, *Mellivora capensis*) and one as Critically Endangered (*Panthera pardus*), see Table 2.

Further studies should focus on the biology and ecology of some little-known species such as the common genet and the white-tailed mongoose in their northernmost range in Saudi Arabia. Despite the absence of the Arabian leopard in our record that was historically known to occur around the mountains of the Madinah Province (Al-Johany 2007), further studies may reveal the existence of isolated populations in the remote areas of the Madinah Province.

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