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### COMMUNICATION

#### REDISCOVERY OF CARACAL *CARACAL CARACAL* (SCHREBER, 1776) (MAMMALIA: CARNIVORA: FELIDAE) IN ABU DHABI EMIRATE, UAE

Robert Gubiani, Rashed Al Zaabi, Justin Chuvén & Pritpal Sooraa

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## Rediscovery of Caracal *Caracal caracal* (Schreber, 1776) (Mammalia: Carnivora: Felidae) in Abu Dhabi Emirate, UAE

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**Abstract:** We present evidence confirming the presence of Caracal *Caracal caracal* in Abu Dhabi Emirate. Camera trap deployment into areas likely to harbour elusive species revealed the presence of at least one male individual with 37 records in 683 camera trap days over a seven-month period. These records represent the first confirmed presence of Caracal in Abu Dhabi Emirate since 1965. Both diurnal and nocturnal records highlighted varied activity patterns of this generally elusive species. Foraging activity occurred primarily during low luminosity levels associated with the new moon. The evidence obtained proves the presence of Arabian Caracal in a location long suspected of providing suitable habitat for this species.

**Keywords:** Camera trap, Jabal Hafit, moon phase, small wild cat, United Arab Emirates.

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**Author contribution:** Robert Gubiani—field sampling and camera deployment, data collection, data analysis, image preparation, manuscript drafting. Rashed Al Zaabi—supervision, manuscript drafting. Justin Chuvén—field sampling, data collection, image preparation, manuscript drafting. Pritpal Soorae—supervision, manuscript drafting.

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## INTRODUCTION

Globally, the Caracal *Caracal caracal* is classified as Least Concern (AvGAN et al. 2016). Given the lack of recent records in the United Arab Emirates (UAE), however, it is considered 'Extinct in the Wild' in the recent Abu Dhabi Red List Assessment (unpublished 2020) and Critically Endangered in the UAE (Mallon et al. 2019). While the Caracal is listed as Least Concern in the Arabian Peninsula (Mallon 2011; Mallon & Budd 2011), it is listed as Endangered in Jordan (Amr 2000) and Oman (Fisher 1999), and as Critically Endangered in Pakistan (Sheikh & Molur 2004), and Morocco (Cuzin 2003). It already vanished in Kuwait (Cowan 2013), parts of Turkmenistan (Lukarevsky 2001) and is thought to be on the verge of extinction in many parts of northern Africa (Cuzin 2003); however, while the Caracal shows signs of population declines and range loss in parts of Asia and northern Africa, it is common and stable in central and southern Africa (Thorn et al. 2011). Although its global range is extensive, the population within the Arabian peninsula is difficult to determine and thought to be declining (Cunningham 2008; Mallon & Budd 2011). Available information about its distribution in the Arabian peninsula is based on opportunistic sightings (Thalen 1975; Gasperetti et al. 1985; Harrison & Bates 1991). It is considered rare in the UAE (Gasperetti et al. 1985; Harrison & Bates 1991; Mallon & Budd 2011). Oman may be an exception as some population expansion was observed in areas devoid of Leopard *Panthera pardus* (Spalton et al. 2014). This is concerning as the local population is considered to be a distinct subspecies, *Caracal caracal schmitzi* (Kitchener et al. 2017).

In Arabia, the Caracal has an average body length of 1–1.2 m and a weight of 8–15 kg (Harrison & Bates 1991). Some aspects of its ecology were studied in Israel (Weisbein & Mendelsohn 1990), southern Africa (Avenant & Nel 1998; Avenant & Nel 2002a; Bothma et al. 2004; Marker & Dickman 2005), Turkey (Giannatos et al. 2006; Ilemine & Gürkan 2010), and India (Mukherjee et al. 2004; Singh et al. 2014). It is predominantly nocturnal, solitary and extremely secretive making field observations rare (Van Heezik & Seddon 1998). The paucity of information on this species limits active conservation measures until surveys are conducted to find out where it is present and in which density (Schaller 1976).

In the 1990s, the diet of a radio-collared individual was studied in Saudi Arabia that was observed while scavenging on ungulate and raptor carcasses (Van Heezik & Seddon 1998). Scat analysis showed a high density of

rodent bones consisting mainly of Libyan Jird *Meriones libycus* (Van Heezik & Seddon 1998). Stuart & Stuart (2002) reported Caracal scat found in northern Oman and adjacent parts of the UAE that contained remains of ungulates, bird feathers and a spider (Stuart & Stuart 2002). It is considered to be diverse in its selection of prey that is up to 2 to 2.5 times its own size (Van Heezik & Seddon 1998; Avenant & Nel 1998; Sunquist & Sunquist 2002; Avenant & Nel 2002a; Livingston 2009). It preys on small domestic livestock to varying degrees (Stuart 1982; Stuart & Hickman 1991; Bothma et al. 2004; Melville & Bothma 2006), but this has yet to be reported as a major occurrence in the middle-east region.

Historically, the Caracal has not been reported to occur far into the hyper-arid regions such as those present in the Empty Quarter; instead, it prefers mountain ranges and hilly steppe (Van Heezik & Seddon 1998). Within the UAE, most sightings have historically occurred in the mountainous northern emirates (Gasperetti et al. 1985; Mallon & Budd 2011), although sightings were infrequently reported in sandy desert areas between Dubai and Al Ain (Harrison & Bates 1991; Stuart & Stuart 2007). The last known individual in the United Arab Emirates was photographed in September 1983 in Al Rams located in the north (Gasperetti et al. 1985). Previous surveys on Jabal Hafit failed to identify the presence of any individuals, however, it was suspected that the Caracal might have occurred in the area, albeit in very low numbers (Harrison & Bates 1991). As with most carnivore species in the region, persecution by farmers (Harrison & Bates 1991) and the general public continues to put additional pressure on existing populations that are likely to be naturally already low in density (Melville & Bothma 2006).

## STUDY AREA

Our study area of 27km<sup>2</sup> was located in Jabal Hafit National Park. This protected area in eastern UAE was established in 2017 to conserve the biodiversity of Jabal Hafit (Mubarak 2018) (Figure 1). Jabal Hafit is a 25km long and 5km wide foothill of the Al Hajar Mountains that stretch from the eastern UAE through northern Oman (Hansman & Ring 2018). The city of Al Ain is located northeast of Jabal Hafit; in the east, the 30km wide Al Jawwa plain separates it from Al Hajar Mountains; in the south, it terminates in Oman (Zaineldeen & Fowler 2014). The permanently fenced border between the UAE and Oman divides Jabal Hafit into two portions, the smaller of which is located within UAE (S. Tubati



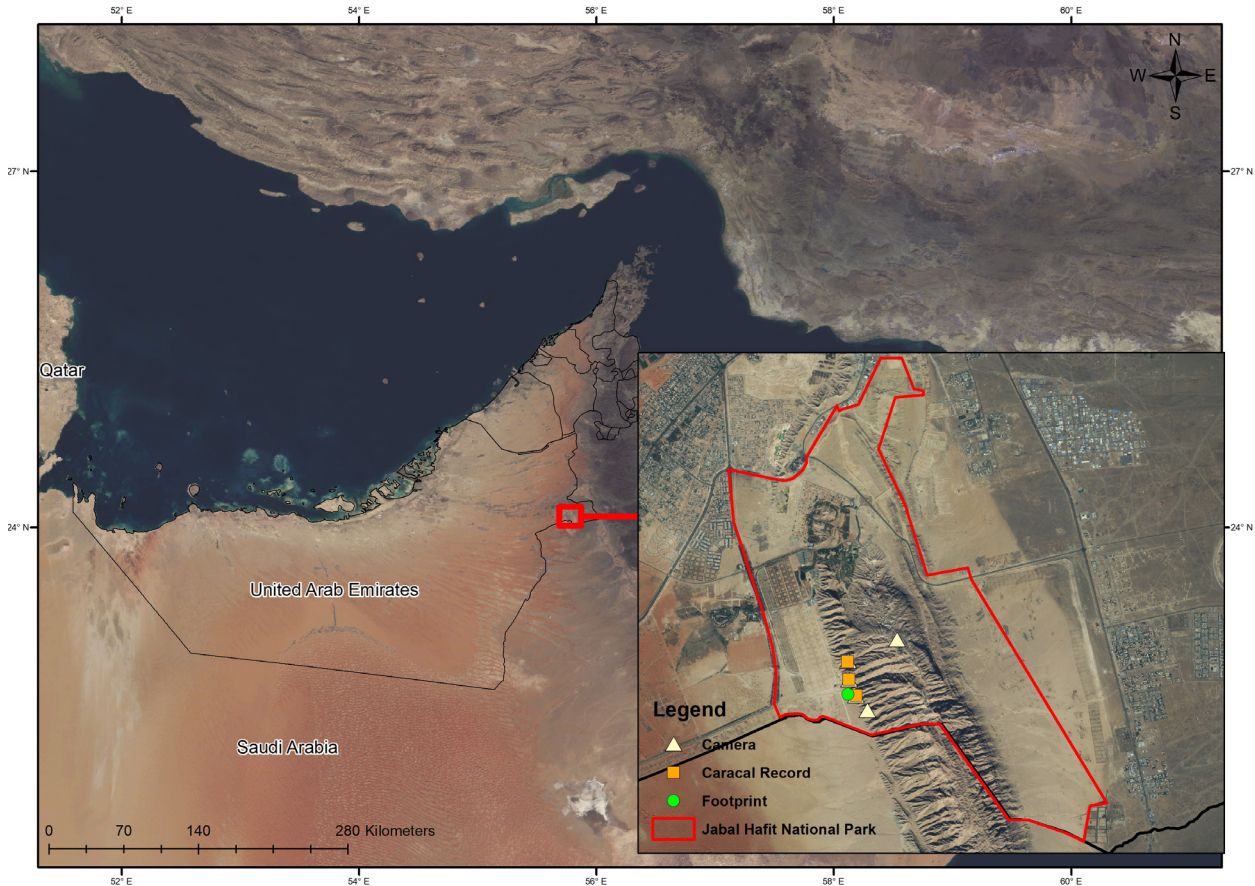


Figure 1. Map of the study area in Abu Dhabi Emirate.

pers. comm. 01 October 2020). Jabal Hafit National Park is surrounded by residential and industrial areas in the west and north and farmland in the east, which transitions into a residential and mixed used landscape (R. Gubiani pers. obs. 2020). The main thoroughfare to the top of Jabal Hafit National Park is a sealed road providing access to a hotel, viewing area and private residences all extending off this main road.

Home range of this individual is extremely difficult to presume. Elsewhere in Caracal range countries, home ranges varied from 418km<sup>2</sup> (Norton & Lawson 1985) to 15.2km<sup>2</sup> (Bothma et al. 1997), 26.9km<sup>2</sup> (Avenant & Nel 1998), and 308.4 km<sup>2</sup> in the southern Kalahari (Bothma & LeRiche 1994) to 1,116km<sup>2</sup> in northern Saudi Arabia (Van Heezik & Seddon 1998). Giannatos et al. (2006) estimated Caracal density to be 1.73 individuals per 100km<sup>2</sup> in southwestern Turkey, assumingly a result of limited prey and development activities in the surroundings of the survey area. The limited size of suitable habitat in Jabal Hafit National Park increases the likelihood that the Caracal may be traversing the border fence and utilising the rest of the mountain

within Oman, which is significantly larger and relatively undeveloped in comparison.

The climate in the region is classified as bi-seasonal Mediterranean type characterised by limited rainfall and high temperatures (Aspinall & Hellyer 2004). Winter temperatures drop to 4°C at night and soar to 49°C by day in the peak summer season in July (National Center of Meteorology 2020). Precipitation varies on an annual basis with heavy downpours during the peak winter season with a mean of 10.7mm in January and close to no rainfall in summer with a mean of 0.6mm (National Center of Meteorology 2020).

Due to Jabal Hafit's elevation of 1,240m and unique climatic conditions, it hosts about 160 of the roughly 390 floral species currently known to occur within Abu Dhabi Emirate (Aspinall & Hellyer 2004). Predatory species recorded historically on Jabal Hafit include Blanford's Fox *Vulpes cana*, African Wildcat *Felis lybica* (Harrison & Bates 1991), Striped Hyaena *Hyaena hyaena*, Arabian Wolf *Canis lupus arabs* (Aspinall & Hellyer 2004) and Leopard (Edmonds et al. 2006). Industrial development and urban expansion has caused large tracts of natural

habitat to be lost or modified that is deemed no longer suitable for a number of endemic species (Al Dhaheiri et al. 2018).

## MATERIAL AND METHODS

We used five Bushnell TrophyCam HD camera traps that were active for 24 hours per day. We mounted them either on camera tripods, metal stakes or on trees in a north or south orientation to eliminate misfires due to direct exposure to sunlight. We placed them in funnel points or areas with high resource density. In areas lacking obvious funnel points, we placed them in patches of vegetation or on elevated points. Such locations have in the past shown to be more likely to carry scent from baiting products, and to be used for scent marking by carnivores. Camera traps were placed in five locations. The distance between locations varied from 600m to 1.26km.

Batteries were changed every three months, however misfires due to wind or non-target species such as humans resulted in some periods of camera inaction. Only periods when photographs were recorded were included in this analysis.

In order to increase the likelihood of recording wildlife, bait was placed approximately one metre directly in front of the deployed camera trap and replenished every three months. Although many types of artificial lures are available internationally, very few dedicated lure products are available locally. Therefore, we used cat food with chicken flavour as it had proven successful with similar trapping programmes aimed at Sand Cat *Felis margarita* and Rüppell's Fox *Vulpes rueppellii*. Additionally, bait was used in areas that were exposed to increase the visual stimulus as well as enhancing scent dispersal into lower lying areas within the survey area.

Activity of recorded wildlife was determined by the time stamp on each obtained photograph. The influence of moon phase on foraging activity was determined by the division of lunar cycle into ten moon exposure increments namely phase 1 (0%–10%), phase 2 (10.1%–20%), phase 3 (20.1%–30%), phase 4 (40.1%–50%) and so forth. The percentage of lunar presence was determined using the time stamp recorded by the camera trap and then determined by using the database of the Moonpage (2020) website. It should be noted that moon phase does not take cloud cover into consideration as no dedicated weather station currently exists on Jabal Hafit.

## RESULTS

During our study, we obtained 37 photographs of Caracal after a survey effort of 683 camera trap days, or one photograph of a Caracal per 18.45 camera trap days. Of the five camera traps deployed, four recorded a Caracal. Diurnal records were also obtained by camera traps located 300m south and 250m north from the initial location. Our camera traps also recorded Nubian Ibex *Capra nubiana*, Arabian Tahr *Arabitragus jayakari*, Red Fox *Vulpes vulpes*, feral Domestic Cat *Felis catus*, feral Domestic Goat *Capra hircus*, Rock Hyrax *Procapra capensis*, Egyptian Spiny Mouse *Acomys cahirinus* and *Rattus*. Avifauna species recorded included Eurasian Collared Dove *Streptopelia decaocto*, Rock Dove *Columba livia*, Laughing Dove *Spilopelia senegalensis*, Grey Francolin *Francolinus pondicerianus*, Eurasian Hoopoe *Upupa epops*, and Arabian Partridge *Alectoris melanocephala*.

A preference for early moon phases was clearly evident with 62% (n=23) of records during phase 1 and 11% (n=4) occurring in phase 2, constituting 63% of all records obtained (Figure 3). Record totals of 3, 2, and 2 were obtained in phases 5, 3, and 6 whereas only single records occurred in phases 7, 9, and 10. No records were obtained during moon exposure phase 30.1%–40% and 70.1%–80%. Regression analysis indicated that these results were not statistically significant.

## DISCUSSION

Our record of a Caracal in Jabal Hafit National Park represents the first confirmed record of this species in the United Arab Emirate since 1983. Gasperetti et al. (1985) reported a photograph taken in the vicinity of Al Rams in the Emirate of Ras Al Khaimah in September 1983, but we did not find any other authenticated record in the country. Stuart & Stuart (2007) reported one scat sample found between the cities of Ras Al Khaimah and Dibbah in June 1995, which they attributed to Caracal, but without indicating their method of identifying scat to a species.

We obtained the first record on 7 July 2018 (Image 1). A short video confirmed its presence on 3 January and 9 January 2019 (Image 2). A footprint (Image 3) was also identified as well as additional diurnal photographs (Image 4) with a final record on 25 February 2019. Our repeated records of a Caracal over nine months indicate that it may be resident in Jabal Hafit National

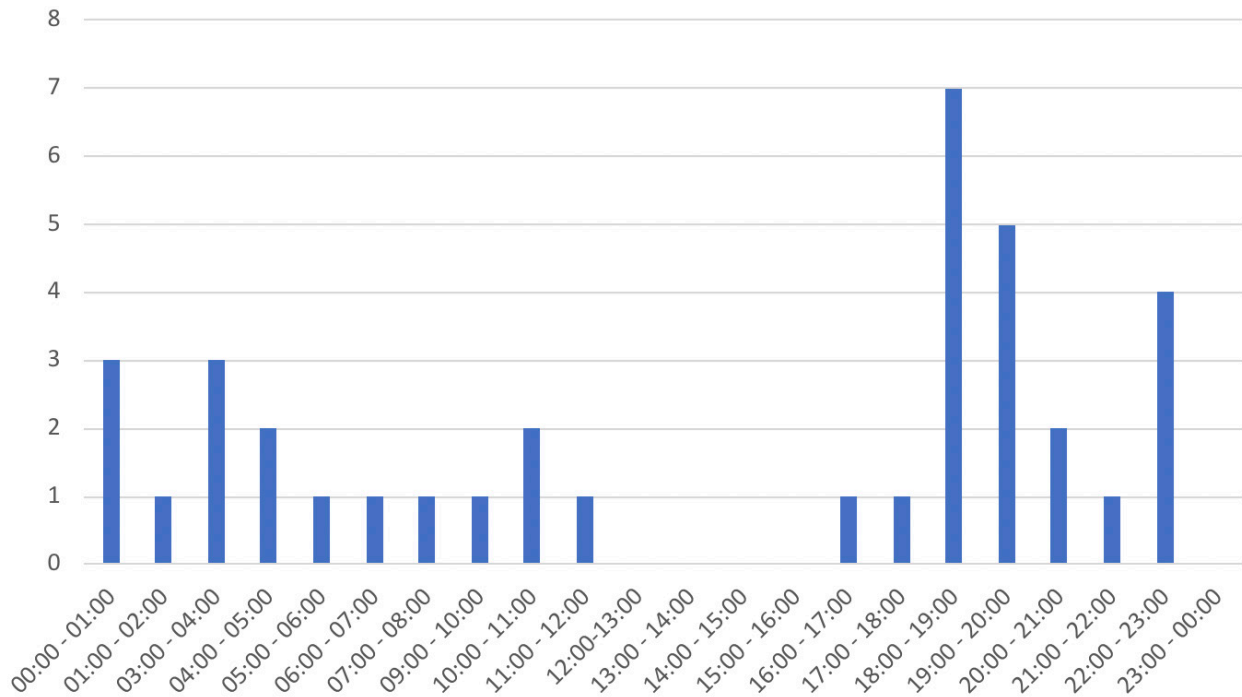


Figure 2. Hourly activity of the Caracal.

Park. All our camera trap photographs show a solitary individual of the same size. We, therefore, assume that the same individual was repeatedly recorded. Definitive identification of the number of individuals is difficult as we did not identify any scars, marks or deformities.

Activity of the recorded individual/s showed a preference for nocturnal activity with 29 of 37 records (78%) obtained between 18.01 and 06.00 h (Figure 2). The remaining records were obtained during the day at 06.01–12.00 h ( $n=6$ ) and in the afternoon at 12.01–18.00 h ( $n=2$ ). Further analysis of activity in hourly time slots demonstrated that the highest activity periods occurred at 18.00–23.00 h with peak record acquisition between 18.00–19.00 h ( $n=7$ ) (Figure 2). No record was obtained in the midday to early evening period.

Peak activity records occurred between 18.00 and 23.00 h, which differs greatly from results of studies conducted by Singh et al. (2014) who noted peak activity at 01.00–04.00 h with early night activity only constituting less than 5%. Similarly, camera trapping surveys in Turkey showed that Caracal were active foremost between 06.00 and 08.00 h (Ilemin & Gürkan 2010) with a slight increase at dusk. Temperature is known to influence Caracal foraging behaviour, which was seen to align with increased activity from primary food sources (Hassan-Beigi 2015). Activity records during our study do not appear to show any influence

by temperature or activity of prey species. The majority of activity periods differs from peak activity of Arabian Partridge and Rock Hyrax. Primary activity of these species decreases during the increased hunting period of the Caracal.

Moon phase and lunar activity of carnivores is well-studied and documented (Harmsen et al. 2011; Penteriani et al. 2011, 2013; Huck et al. 2016; Pratas-Santiago et al. 2017). Previous studies highlighted that Caracal activity pattern can be influenced greatly by the activity pattern of its prey (Nowell & Jackson 1996; Sunquist & Sunquist 2002; Singh et al. 2014; Hassan-Beigi 2015). This appears not to be the case with this individual/s as our records indicate little overlap with prey activity during the same periods. All records of Blanford's Fox ( $n=4$ ) and Egyptian Spiny Mouse ( $n=10$ ) in our study area occurred from moon phase 3 onwards. Caracal are known to prey on smaller carnivores (Livingston 2009), which could provide some explanation as to why Blanford's Fox avoided peak Caracal hunting periods. Further data, however, will be needed to assess activity patterns and temporal avoidance between the two predators. Rodents constitute large parts of the Caracal's diet (Ghoddousi et al. 2009; Livingston 2009), but the moon phase behaviour of Egyptian Spiny Mouse cannot be definitively linked to the arrival of a new meso-predator in the landscape. Although this limited data



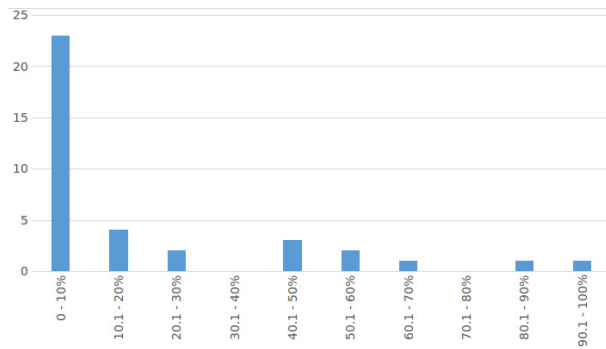


Figure 3. Moon phase activity of the Caracal.

does not definitively prove increased foraging activities as a result of the presence of the Caracal, it does provide some insight into preferred activity periods of smaller mammals present on Jabal Hafit based on moon phase and warrants further investigation.

Currently, the information about dietary needs of many species of small wild cats is scarce, especially Caracal (Livingston 2009). The Caracal is considered to be a generalist predator often taking advantage of localised resources (Van Heezik & Seddon 1998; Avenant & Nel 2002a; Moqanaki et al. 2016). The Caracal is able to kill prey weighing 2–3 times its own size such as gazelles *Gazella* (Moqanaki et al. 2016). The reduction of these ungulates as a result of hunting and land degradation may be the reason for the Caracal to prey occasionally on small domestic livestock and poultry (Stuart & Stuart 2007; Zafar-ul et al. 2018). Predation on escaped livestock was recorded in South Africa, but is considered to be seasonal in nature and limited in extent (Avenant & Nel 2002a). Remains of domestic goat and sheep were also found in Caracal scat in Oman and northern UAE (Stuart & Stuart 2007). On Jabal Hafit, Arabian Tahr is present in small numbers, estimated at less than 15 individuals (J. Chuvén pers. comm. 12 December 2019). Whether they constitute prey for the Caracal in Jabal Hafit remains unknown. We observed four feral goats, which escaped from local farms, but we did not come across any incidence that the Caracal preyed on livestock.

The Caracal in Jabal Hafit was recorded in areas where Rock Hyrax and Egyptian Spiny Mouse were observed. Rodents such as Libyan Jird and Egyptian Spiny Mouse were found in Caracal scat in Iran (Ghoddousi et al. 2009). Van Heezik & Seddon (1998) noted that a collared individual selected areas with high rodent abundance during the day. Rodents are deemed to be an important part of the Caracal diet particularly in arid environments (Avenant & Nel 2002b; Mukherjee et al. 2004; Seddon



Image 1. First nocturnal record of the Caracal in Jabal Hafit National Park on 7 July 2018. © Environment Agency Abu Dhabi.



Image 2. First diurnal record of the Caracal on 3 January 2019 in Jabal Hafit National Park. © Environment Agency Abu Dhabi.

et al. 2007; Farhadinia et al. 2007; Ghoddousi et al. 2009; Livingston 2009). Although Arabian Jird *Meriones arimalius* and Cheesman's Gerbil *Gerbillus cheesmani* were recorded in the vicinity of Jabal Hafit, only Egyptian Spiny Mouse and *Rattus* are confirmed to occur on the mountain (Cunningham 2008). The recent release of approximately 10,000 Arabian Partridge is likely to be a more easily accessible food source for the recorded Caracal. Furthermore, the high level of development around and on Jabal Hafit will likely result in increased levels of House Mouse *Mus musculus* and *Rattus*, which could constitute a prey base for the Caracal. Given the dramatic increase in prey sources within the Abu Dhabi portion of Jabal Hafit, this raises the possibility



**Image 3.** Caracal footprint in Jabal Hafit National Park. © Environment Agency Abu Dhabi.

of predators moving back and forth across the border with Oman to take advantage of this increase in prey abundance. Van Heezik & Seddon (1998) proposed that the Caracal might have a broader diet and larger home range than expected due to low prey abundance. Home range size of the Caracal in Saudi Arabia reduced significantly during periods of increased biomass (Van Heezik & Seddon 1998).

The use of camera trapping rates as an index for abundance has been widely debated (Rovero & Marshall 2009; De Bonde et al. 2010; Hobbs & Brehme 2017), however, the probability of encounters between camera traps and individuals would increase if abundance of target individuals increases (Rovero & Marshall 2009). Limited access to protected areas and the scarcity of confirmed records make it difficult to identify further potential areas harbouring this species. In view of the limited knowledge and precarious state of the Caracal within parts of the Arabian Peninsula, it is important that any new information, particularly sightings and observed behaviour is reported. The identification of the Caracal in Abu Dhabi Emirate is important in terms of species abundance as it highlights the possibility of elusive and rare species occurring in protected areas



**Image 4.** Second diurnal record of the Caracal in Jabal Hafit National Park on 8 February 2019. © Environment Agency Abu Dhabi.

within the Emirate. The preservation of Jabal Hafit National Park and its natural habitat is of paramount importance. Continued monitoring of the behaviour and movement of the Caracal in this area is essential to devise conservation measures and determine corridors that connect Jabal Hafit National Park with other areas suitable for the Caracal in the UAE.

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