

TAHER GHADIRIAN^{1*}, HOSSEIN AKBARI², MOHAMMADREZA BESMELI³, ARASH GHODDOUSI⁴, AMIRHOSSEIN KH. HAMIDI¹ AND MORTEZA E. DEHKORDI⁵

Sand cat in Iran - present status, distribution and conservation challenges

For studying the distribution, ecology and threats of the smallest felid species in Iran, the sand cat *Felis margarita*, we gathered all published and unpublished data from across the country and categorised them into hard fact C1 and anecdotal data C2. Based on 46 presence points (C1 = 26 and C2 = 20) from 6 out of 31 provinces, sand cat distribution in Iran is limited to the desert habitats in the centre, east and south-east of the country. Sand dunes with Saxaul trees are the main habitats for sand cat in Iran, as well as arid flat plains with little plant distribution. Potential prey species are desert rodents, reptiles, hare and probably some bird species. Killing by shepherd dogs and trapping by locals in houbara bustard snares are the major threats to survival of this elusive cat in Iran. Desert safaris and road accident may become a potential threat to the existence of sand cats in fragile desert habitats. For better conservation actions, more fine-scale distribution studies especially in eastern and south-eastern parts of the country, diet, estimate of home range size and density of sand cats in Iran are required.

The sand cat is a small cat, with size and build smaller than the wildcat *Felis silvestris* (Sliwa 2013). It is the only felid found primarily in true deserts and has a wide but apparently disjunct distribution through the deserts of northern Africa and south-west and central Asia. (Hemmer et al. 1976, Nowell & Jackson 1996). The head is flat and broad, and the ears are broad and set low down on the sides of the head without apical tuft. The legs are short and the tail is long with a black tip. The light yellow fur is soft and dense and there are thin russet-brown stripes par-

ticularly visible on the front legs and the tail (Aulagnir et al 2009, Hunter, 2011, Sliwa 2013; Figs. 1-3).

Based on morphological data, there are four distinct subspecies: Saharan *F. m. margarita*, Arabian *F. m. harrisoni*, central Asian *F. m. thinobia* and Pakistani *F. m. scheffeli* sand cat (Hemmer et al. 1976). *F. m. thinobia* from the sand deserts of Turkmenistan, Uzbekistan, Kazakhstan, and possibly northern Iran and north-eastern Afghanistan (Sliwa 2013) and *F. m. scheffeli* from Pakistan are two possible subspecies present in Iran. How-

ever, this classification needs further validation in the future.

The sand cat is the smallest cat of Iran and there is little information about this cat in the country, and only in recent years, the information about the distribution of this species has been improved.

The main purpose of this study is to review the distribution status of the sand cat in Iran. Additionally, information about the ecology, biology and threats to this species were gathered from across the country and are presented. The present status assessment of sand cat in Iran will hopefully act as a first step for future studies and conservation planning for this elusive cat in Iran.

Methods

In this study, all the effort has been made to gather information available on this species throughout its range in Iran. Interview surveys with Department of Environment DoE staff in sand cat habitats were the main source of information. Additionally, biometry records of sand cat specimens were used. Presence records of sand cat in Iran were then incorporated into a GIS map and potential sand cat habitats and information gaps were identified.

For the sand cat, we mainly relied on data approved by hard facts, because this small felid can be easily confused with other smaller cats, particularly wildcat. Thus, records were attributed to two categories of reliability, namely "confirmed" (category C1), and "anecdotal" (category C2). Confirmation of presence based on hard fact data such as available photos or videos, sand cat carcasses or other remains of the species were approved by the authors. Observations by trained persons (e.g. field biologists, skilled rangers and wildlife photographers) were assigned to category 2.

Status and distribution

Misonne (1959) and Harrington & Dareshuri (1976) suggested the possible presence of sand cat in Iran based on its presence in the neighbouring countries such as Turkmenistan in the north-east (Heptner & Sludskii 1972) and Pakistan in the south-east (Roberts 1997). Lay (1967), who collected a large number of mammal species of Iran in an extensive survey, didn't record any sand cats in Iran. Etemad (1985) based on Weigel (1961) reported this species for the first time for Iran near Tehran (probably Kavir National Park NP). But the first picture of a sand cat in Iran was taken in 1985 in Kavir N. P. (Bayat



Fig. 1. Sand cat in Abbas'abad Wildlife Refuge (Photo Naein DoE).

1985), which is still one of the main habitats of the species in the country. In the past ten years, sand cats have been recorded from several localities in the deserts of central Iran (Ziaie 2008). Also, in the past five years, several photos and video footages of sand cat have been taken by rangers, wildlife photographers and camera traps in the sand cat habitats of Iran.

In this study, we gathered 46 reports of presence for this cat, of which 26 fall within the hard fact C1 category and 20 are from direct observations C2 by experienced people (without hard fact). Most of the direct observations were made in close proximity to hard fact records and generally most of the records are from the central desert of Iran. Based on this information, sand cat distribution in Iran is limited to the desert habitats in the centre, east and south-east of the country (Fig. 4).

Kavir and Touran NPs in Semnan Province, Khaf region in Khorasan Razavi Province, Shaskooh and Mozaffari Protected Areas PAs and Petergan desert in South Khorasan Province, Abbas'abad Wildlife Refuge WR, Anarak and Khur regions in Isfahan Province, Siahkooch NP, Ariz No-Hunting Area and Es-kanbiloo regions in Yazd province and Samsouri desert in Sistan & Baluchistan Province are the areas where sand cats have been recorded by hard fact data so far.

Nowell & Jackson 1996 based on Groves 1990, indicated Moteh WR in Isfahan Province as a sand cat record, but we didn't find any evidence supporting this information. Also, the picture of a small cat from Bakhtegan NP in Fars Province, which was identified as a sand cat (Ziaie 2008), was later identified as a sub-adult wildcat.

Based on the distribution map that is presented in this paper, most of the sand cat records (more than 90%) are located in central and eastern Iran. This does not mean that these areas are more suitable habitats for this species than other desert habitats, but because they have been more studied than others. The observation of three sand cats in one night survey in Samsouri desert in south-eastern Iran (M. Mousavi, pers. comm.) indicates that good potential habitats are in the vast desert habitats around Dasht-e-Lut (Lut desert) in south-eastern Iran (Fig. 2). Other parts of the country that should be investigated are the following desert areas: Iran-Turkmenistan (Turkmen Sahara and Sarakhs region) border in the north-east, the Iran-Pakistan border in the south-east and the Dehloran Desert in the south-west of Iran neighbouring Iraq.

Felis margarita

Names:

گربه شنى Gorbe sheni
sand cat, sand dune cat

IUCN Red List:

Least Concern (2016)

CITES:

Appendix II

Head and body length:

45-57 cm

Tail length:

28-38 cm

Weight:

1.5-3 kg

Iranian Population:

N/A

Habitat in Iran:

Found in deserts and steppes. It is also adapted with very hot and dry areas and sand dunes.



Photo M. R. Besmeli

Body measurements

The mean, maximum and minimum of head and body length, tail length, shoulder height and weight of 17 specimens (carcass or live from 2001 to 2012) from Abbas'abad WR (n = 14) in the centre, Qaen and Khaf regions (n = 2) in the east and Samsouri desert (n = 1) in the south-east of the country are 47.3 cm (39-56 cm), 26.7 cm (21.5-32 cm), 26.5 cm (20-30 cm) and 2.56 kg (1.6-3.1 kg), respectively (Table 1).

Habitat and extension

Sand cats are specialists of sandy deserts, where they are unevenly distributed, localised around sparse vegetation, which can support small rodent prey. They are also found in stony deserts (Nowell & Jackson 1996), but they are absent from areas where

the soil is compact (Heptner & Sludskii 1972). With thickly furred feet, the sand cat is well adapted to the extremes of a desert environment, living in areas far from water, and tolerant to extremes of hot and cold temperatures (Nowell & Jackson 1996, Sunquist & Sunquist 2002, Sliwa 2013), largely because of their fossorial (burrowing) behaviour. In Turkmenistan, it has been described as inhabiting sand dune areas or in saxaul *Haloxylon ammodendron* forests (Ognev 1935) but in Arabia, it has also been found in stony deserts (Harrison & Bates 1991). Sand cats can withstand 40° Celsius in summer (80° C at the surface of the sand) and -25° C in winter in Central Asia (Aulagnir et al. 2009).

In Iran, the species has been seen in desert habitats, from sand dunes with little plant distribution to arid flat plains with



Fig. 2. Sand cat pictured in south-eastern Iran (Photo M. Mousavi)..



Fig. 3. Sand cat picture from Eastern Iran (Photo M. R. Besmeli).

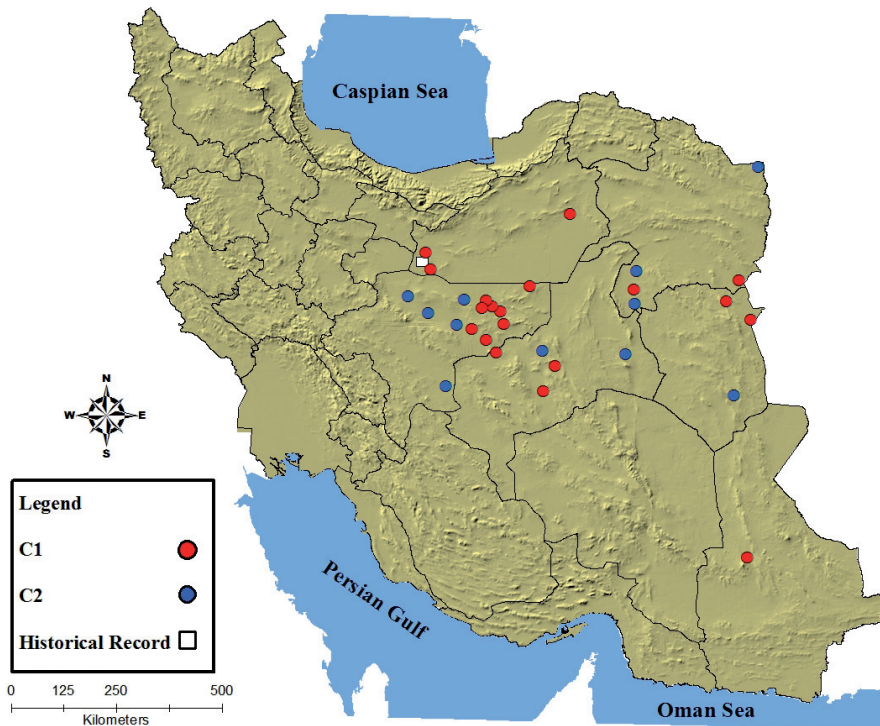


Fig. 4. Distribution of Sand cat in Iran (Historic (30 year ago) and C1 and C2).

vegetation cover consisting of *Artemisia* sp., *Zygophyllum* sp. and *Haloxylon* sp. In Abbas'abad WR, six patches of sand cat distribution have been identified, mainly consisting of sandy plains with abundant Saxaul trees (Farhadinia et al. 2008). However, in Kavir NP, most of its records are in arid flat plains and others in sandy desert, but in Petergan desert, sand cats are observed in sand dunes with Saxaul trees.

Ecology and behaviour characteristics

The sand cat is the only felid to occur exclusively in desert habitats (Macdonald et al. 2010). It is solitary and primarily nocturnal. The sexes come together only for mating. The sand cat is not a good climber or jumper, but an excellent digger. The claws do not fully retract and are rather blunt; possibly due to the sand cat's digging behaviour. It uses this digging ability to dig burrows to escape the heat of the day. The burrows are shared with other individuals, but not simultaneously. Gestation varies between 59-67 days, and in the Sahara the young are born from January to April (Sliwa 2013). The number of kittens is reported to be 2 to 4 per litter. Kittens' eyes open around the 14th day, and they begin to walk at the age of 21 days, and they emerge from the burrow and begin to dig for food when they are five weeks old. They stay with their mother for four months, when they learn to hunt for themselves (Heptner & Sludskii 1972, Nowell & Jackson 1996, Sliwa 2013).

The reproduction of the sand cat is still little studied in Iran. Based on some observations and documents (video and photos) females with cubs have been observed from April to June (Fig. 5). A female with three cubs has been recorded in Naybandan WR (Ziaie 2008) and three kittens about one month old with their mother were found in a burrow in June 2010 in Petergan desert (A. Talebigol, pers. comm.). In Kavir NP rangers have taken photos of a young (but independent) sand cat in spring 2010. The sand cat population was believed to be stable in the past decades; however, its population in Iran has not been studied comprehensively. In central areas, it is known that a relatively good population of sand cats live in Abbas'abad WR and Kavir NP, which need to be further studied in the future.

Prey species

Sand cats cover their scats with sand, making diet studies difficult (Macdonald & Loveridge 2010). The only scats found by Abbadi (1993), contained the remains of Cairo spiny mouse

Acomys cahirinus and gecko *Stenodactylus* spp. Sand-dwelling rodents make up the majority (65–88%) of stomach contents from carcasses collected in Turkmenistan and Uzbekistan in the 1960s (Mallon et al. 2011). Sand cats have also been observed hunting birds and reptiles (Abbadi 1993) and drink water readily, but can survive on metabolic water (Sliwa 2013).

Hotson's Jerboa *Allactaga hotsoni*, Blandford's Jerboa *Jaculus blandfordi*, Cheesman's Gerbil *Gerbillus cheesmani* and Libyan Jird *Meriones libycus* are the main rodents present in the sand cat habitat in Iran. Additionally, hare *Lepus* sp., several reptile species and some bird species, like hoopoe lark *Alaemon alaudipes*, desert lark *Ammomanes deserti* and crested lark *Galerida cristata* share the same habitat and are potential prey.

Harvest and threats

Habitat degradation by human settlement and activity, especially livestock grazing, introduction of feral domestic dogs and cats and killing in traps laid out by inhabitants of oases targeting foxes and jackals are considered as main threats for sand cats (Mallon et al. 2011). The sand cat is not harvested in Iran and is therefore not threatened by exploitation. However, the major threats to survival of sand cats are the persecution by shepherd dogs and to be killed in traps used for capturing houbara bustard *Chlamydotis undulate*. Because herds of livestock present in and around sand cat habitat, this species has been reported to get injured or killed by shepherd dogs. In Petergan desert, sand cats have been observed, trapped and killed by local poachers (A. Talebi-gol, pers. comm.). Also, there is a report of road accident in South Khorasan Province. Sand cat habitat in Iran is located in desert areas with low human activities, thus less habitat destruction can be observed than in other regions. However, an increasing trend in unorganized and unsupervised desert safaris in Iran may become a potential threat to the existence of sand cats in fragile desert habitats.

Table 1. Biometric information on Sand cats from Iran.

	Male			Female		
	Mean	Range	Sample size	Mean	Range	Sample size
Head and body length (cm)	47.7	41-53	7	46.9	39-56	9
Tail length (cm)	28.1	23-32	7	25.5	21-30	9
Shoulder Height (cm)	27.4	23-29	7	26.0	23-30	8
Weight (kg)	2.8	2.5-3.1	6	2.3	1.6-2.6	6

Conservation

The sand cat is globally classified by IUCN as Least Concern LC due to concern over potential low population size and decline (Sliwa et al. 2011) and also vulnerable arid ecosystems are being rapidly degraded by human settlement and activity, especially livestock grazing (Macdonald & Loveridge 2010). Hunting of this species is prohibited in Algeria, Iran, Israel, Kazakhstan, Mauritania, Niger, Pakistan and Tunisia (Nowell & Jackson 1996). The sand cat is included in the CITES Appendix II. The Iranian DoE lists this species as "Endangered" and poaching fine is 100 m Rials (ca. 2500 Euro, 3000 \$). Among 12 known areas for sand cats in Iran (C1), five sites are within NPs, WRs and PAs. To avoid trapping and persecution of sand cats by dogs in their habitat, training of livestock herders is a major activity for conservation of this elusive cat in Iran. Also, for better conservation actions, more fine-scale distribution studies especially in eastern and south-eastern parts of the country are required. Diet and estimation of home range size and density of sand cats in Iran are also interesting fields for research on this species in the future.

Acknowledgements

We sincerely thank Christine and Urs Breitenmoser for providing information for this paper. Our deep gratitude goes to Hamed Moshiri, Saeedeh Baniassadi, Hamed Abolghasemi, Ali Sadr, Amir Talebi-gol (he passed away during a field trip in eastern Iran in January 2014), Naser Baranzehi, Mohammad Anvar Hashemzahi, Faramarz Esfandiari, Ebrahim Ghazanfari, Javad Shokouhi, Seyed Jalal Mousavi and Mohammad Reza Halvani for their contribution in sand cat records and photos. We thank the personnel of DoE, especially Dr. Mohammadi and M. Mousavi for organizing the three-day workshop of "Cats in Iran" in Karaj, Iran.

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Fig. 5. Two sand cat cubs in Petergan desert, Eastern Iran (Photo E. Ghazanfari).

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¹ Persian Wildlife Heritage Foundation, Iran
² Isfahan provincial office of Department of Environment, Iran
³ South Khorasan provincial office of Department of Environment, Iran
⁴ Georg-August-University Göttingen, Germany
⁵ Iranian Cheetah Society, Iran
 * <t.ghadirian@gmail.com>