

Protection status CITES – not listed.

The species is classed as Lower Risk: Near Threatened in Morocco (including Western Sahara) (Cuzin 1996).

Current legal protection In Saudi Arabia, there is currently no effective legislation for the protection of native carnivores (P. Seddon pers. comm.). It is not illegal to shoot, poison or trap mammalian carnivores. Hunting laws (Decree No. 457 and Decrees M/22, No.128) restrict such activities within the National Commission for Wildlife and Conservation Development protected areas network. Some of the areas encompass and protect carnivore populations, although none to date have been established with the protection of Rüppell's foxes listed as the main objective.

In Israel, the species is fully protected by law, and no hunting, trapping or trading is allowed. In Morocco, according to the annual hunting decree, Rüppell's foxes and red foxes may be hunted during the whole year, as they are considered as pests. There is no information for other countries.

Conservation measures taken None known.

Occurrence in captivity

Rüppell's foxes are held in captivity. According to the International Zoo Yearbook (1992), only two cases of successful breeding occurred in zoos (Nikolaev, Ukraine and Tel Aviv, Israel). Attempts to breed Rüppell's foxes have not been very successful (Ginsberg and Macdonald 1990), although they have been successfully bred in the Hai Bar Breeding Centre, Eilat, Israel (E. Geffen pers. comm.). According to ISIS data, 2 males, 4 females and 1 unsexed animal are kept in zoos, without any recent reproduction noted. One female is kept in Rabat Zoo, Morocco.

Current or planned research projects

J.B. Williams (Ohio State University, Columbus, USA) and D.M. Lenain and S. Ostrowski (National Wildlife Research Center, Taif, Saudi Arabia) are investigating metabolic response and water turnover of Rüppell's foxes in an arid environment in Saudi Arabia.

S. Ostrowski and D.M. Lenain (National Wildlife Research Centre, Taif, Saudi Arabia) and M. van Vuren (University of Pretoria, South Africa) are undertaking research into seroprevalence of canine diseases in the Rüppell's fox population at Mahazat as-Sayd, Saudi Arabia.

R. Hefner and E. Geffen (Tel Aviv University, Israel) are studying habitat use of Rüppell's foxes in Israel.

Gaps in knowledge

The status and ecology of North African populations remains largely unknown. Monitoring of populations in

well-established protected areas throughout the species' range is encouraged. There is scope for detailed study of competition between Rüppell's and red foxes.

Core literature

Lenain 2000; Lindsay and Macdonald 1986; Kowalski 1988; Olfermann 1996.

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7.4 Fennec fox

Vulpes zerda (Zimmermann, 1780)

Data Deficient (2004)

C.S. Asa, C. Valdespino and F. Cuzin

Other names

Arabic: Fenek: rhorchi, gorchi, arhorchi, aqorchi (Maghreb); **English:** fennec; **French:** fennec; **German:** fenek, wüstenfuchs; **Spanish:** fenec; **Indigenous names:** Tuareg: akori, akorhal, eresker, ahuneski.

Taxonomy

Canis zerda Zimmermann, 1780. Geogr. Gesch. Mensch. Vierf. Thiere 2: 247. Type locality: "Es bewohnt die Soara und andere Theile von Nordafrika hinter des Atlas, der Ritter Bruce behautet, man Fände es auch in tripolitanischen." [Sahara].

Placed in the genus *Fennecus* by Stains (1975), Coetzee (1977) and Nowak (1999). Wozencraft (1993) included *Fennecus* in the genus *Vulpes*, an arrangement in agreement with many other authorities (e.g., Clutton-Brock *et al.* 1976; Geffen *et al.* 1992e) and followed here. Note that two previously described races, *saarensis* Skjöldbrand, 1777 and *zaarensis* Gray, 1843 are synonyms.

Chromosome number: 2n=64 (Ewer 1973).

Description

The fennec fox is the smallest canid, with extremely large ears that give it the greatest ear to body ratio in the family (Table 7.4.1). The muzzle and legs are slender and delicate. Pelage is typically sandy or cream-coloured, although it may have a light fawn, red or grey cast; underparts are paler. The large ears are darker on the back and white or nearly so inside; ear edges are white. Eyes are large and dark, with dark streaks extending from the inner eye down and outward to either side of the muzzle. Upper parts of limbs reportedly coloured reddish-sand in individuals from North Africa, whereas those from further south are nearly white in these areas. The coat is very thick and long; dense fur on the feet extends to cover the pads. The tail is also well furred with a darker tip and a slightly darker spot

Table 7.4.1. Body measurements for the fennec fox.

	Saint Louis Zoo, St. Louis, MO, USA	West Africa, Sudan, and northern Africa (Rosevear 1974) (gender not reported)	Egypt (Osborn and Helmy 1980) (gender not reported)
HB male	392mm (390–395) n=2	362mm (333–395) n=9	368mm (337–387) n=46
HB female	382mm (345–395) n=5		
T male	232mm (225–240) n=2	169mm (125–187) n=9	206mm (186–230) n=46
T female	241mm (230–250) n=5		
HF male	105mm (100–110) n=2	93mm (90–98) n=9	103mm (93–111) n=46
HF female	98mm (92–100) n=5		
E male	100mm (100) n=1	91mm (86–97) n=9	96mm (88–104) n=46
E female	93mm (90–95) n=5		
WT male	1.5kg (1.3–1.7) n=2		1.1kg (0.8–1.15) n=9
WT female	1.4kg (1.0–1.9) n=5		



Six year-old female fennec fox. St Louis Zoo, Missouri, USA, 2001.

Chuck Dresner

covering the caudal gland. Females have three pairs of mammae. It has a vulpine skull, but with very large tympanic bullae (Clutton-Brock *et al.* 1976). The canines are small and narrow. The dental formula is 3/3-1/1-4/4-2/3=42.

Subspecies Monotypic (Coetzee 1977).

Similar species Rüppell's fox (*Vulpes rueppellii*): larger; upper parts silvery grey. Pale fox (*V. pallida*): larger; upper parts pale sandy fawn suffused with black hairs (Dorst and Dandelot 1970).

Current distribution

Widespread in the sandy deserts and semi-deserts of northern Africa to northern Sinai (Figure 7.4.1) (Saleh and Basuony 1998).

Historical distribution Morocco, Algeria, Tunisia, Libya, and Egypt south to the Sudan.

Current distribution They are common throughout the Sahara (Harrison and Bates 1991) and may occur to north Sahelian areas in the south to 14°N (Dragesco-Joffé 1993; Granjon *et al.* 1995). References to fennec fox sightings in the United Arab Emirates were based on an animal in the Al Ain zoo (Al-Robbae 1982), which was, in fact, a Rüppell's fox (Gasperetti *et al.* 1985). Thesiger (1949) reported fennec fox tracks in the region of Abu Dhabi but whether the tracks were accurately identified is uncertain. The only documented regression concerns northern Moroccan Sahara, where the fennec foxes disappeared during the 1960s from four localities, which were restricted sandy areas close to permanent human settlements (F. Cuzin pers. obs.).

Range countries Algeria, Chad, Egypt, Libya, Mali, Mauritania, Morocco (including Western Sahara), Niger, Sudan, and Tunisia (Hufnagl 1972; De Smet 1988; Bel Hadj Kacem *et al.* 1994; Granjon *et al.* 1995; Poilecot 1996; Saleh and Basuony 1998).

Relative abundance

Current statistics are not available, but the population is assumed to be adequate based on the observations that the fennec fox is still commonly trapped and sold commercially in northern Africa. In southern Morocco, fennec foxes were commonly seen in all sandy areas away from permanent human settlements (F. Cuzin pers. obs.).

Estimated populations/relative abundance and population trends There is no detailed information on its abundance or status.

Habitat

Fennec foxes subsist in arid desert environments, preferring this substrate for burrowing. Stable sand dunes are believed to be ideal habitat (Dorst and Dandelot 1970; Coetzee 1977), although they also live in very sparsely vegetated sand dunes near the Atlantic coast (F. Cuzin pers. obs.). Annual rainfall is less than 100mm per year on the northern fringe of the fennec fox's distribution. On the southern fringe, it may be found up to the Sahelian areas that receive as much as 300mm rainfall per year. In the Sahara, sparse vegetation is usually dominated by *Aristida* spp., and *Ephedra alata* in large sand dunes. In small sand dunes, it is dominated by *Panicum turgidum*, *Zygophyllum* spp., and sometimes by trees like *Acacia* spp. and *Capparis decidua* (F. Cuzin pers. obs.). The fennec fox is claimed to be the only carnivore of the Sahara living completely away from water sources (Dekeyser and Derivot 1959, in Noll-Banholzer 1979).

Food and foraging behaviour

Food Fennec foxes are omnivorous and are reported to consume insects, small rodents (e.g., *Jaculus jaculus*, *Gerbillus* spp. and *Meriones* spp.), lizards (e.g., *Acanthodactylus* spp.), geckos (e.g., *Stenodactylus* spp.), skinks (e.g., *Scincus albifasciatus*), eggs, small birds (e.g., larks and sandgrouse), various fruits and some tubers (Dragesco-Joffé 1993; F. Cuzin pers. obs.). Captive fennec foxes have also been reported to capture and kill an adult rabbit (Gauthier-Pilters 1962).

Foraging behaviour Fennec foxes hunt alone (Coetzee 1977), probably because solitary hunting of small prey is more efficient. They have not been seen using the "mouse jump" hunting strategy typical of most fox species (Ewer 1973), but reportedly dig to find insects and small vertebrates. However, like other foxes, they do cache food by burying. Fennec foxes are very opportunistic and commonly visit temporary human settlements during the night in search of food (Dragesco-Joffé 1993; F. Cuzin pers. obs.).

Damage to livestock or game In Niger, some individuals have been reported raiding poultry coops (Dragesco-Joffé 1993).

Adaptations

The fennec fox is well adapted to desert living. They are primarily nocturnal, although crepuscular activity is also reported (Gauthier-Pilters 1967). In southern Morocco, animals were commonly active in winter until around mid-morning (F. Cuzin pers. obs.). The pale, dense fur presumably serves to protect against cold nights, whereas the well-furred feet facilitate walking on hot, sandy substrates. The exceptionally large ears likely help in heat dissipation, but may also aid in locating insects and small



Figure 6.3.1. Current distribution of the fennec fox.

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vertebrates (Ewer 1973). Nocturnal activity patterns, the use of burrows during the day, and the moisture content of their prey probably contribute to their ability to go without drinking water (Schmidt-Nielsen 1964; Dragesco-Joffé 1993; F. Cuzin pers. obs.). In addition, their kidneys filter extremely high concentrations of urea with little water loss (Gasperetti *et al.* 1985).

Social behaviour

Fennec foxes are thought to be moderately social, but this evidence is based mainly on captive animals. The basic social unit is believed to be a mated pair and their offspring, and, like some other canids, the young of the previous year may remain in the family even when a new litter is born (Gauthier-Pilters 1967). Play behaviour is common, even among adults, although males show more aggression and urine-marking around the time of oestrus. Captive fennec foxes engage in high levels of affiliative behaviour, and typically rest in contact with each other. In captivity, fennec foxes often bury faeces by pushing loose substrate with their noses or hind feet (Gauthier-Pilters 1962).

Reproduction and denning behaviour

First mating is reported at nine months (Bekoff *et al.* 1981) to one year (Gauthier-Pilters 1967). In the wild, fennec foxes mate in January and February and give birth in March and April (Gauthier-Pilters 1967). In captivity, births can occur year round, but most litters are born between March and July (Bauman 2002). Data from captivity are more extensive than those from the wild, but, because captive animals are maintained in a broad range of environmental conditions, inter-oestrous intervals vary considerably. Individual differences are also likely to contribute to this variability. Fennec foxes most commonly give birth once annually, but more than one litter per year is possible under some conditions (Koenig 1970; Valdespino *et al.* 2002).

The fennec fox monoestrous cycle is characterised by a pro-oestrous phase of about six days and a one- to two-day oestrus (Gauthier-Pilters 1967; Koenig 1970; Valdespino *et al.* 2002). There is no sanguineous discharge in association with oestrus or pro-oestrus. In non-fertile cycles, ovulation is followed by an approximately 50-day di-oestrous period, also called pseudopregnancy because it is equivalent in hormonal pattern and duration to gestation (Asa and Valdespino 1998; Valdespino 2000). Most remarkable is the exceptionally long copulatory tie of as long as 2 hrs 45 min (Valdespino 2000; Valdespino *et al.* 2002). The male becomes very aggressive and protective of the female after mating, and he provisions her during pregnancy and lactation (Sowards 1981).

Gestation is 50–52 days (Petter 1957; Volf 1957; Saint Giron 1962; Koenig 1970); however, Gangloff (1972) reported 62- and 63-day gestations for two fennec foxes at the Strasbourg Zoo. Litter size ranges from 1–4 (Petter

1957; Gauthier-Pilters 1967; Koenig 1970; Gangloff 1972; Bauman 2002), and weaning takes place at 61–70 days (Koenig 1970).

Dens are always dug in sand, in open areas or places sheltered by plants such as *Aristida pungens*, and *Calligonum comosum* (Dragesco-Joffé 1993; F. Cuzin pers. obs.). Dens may be huge and labyrinthine, especially in the most compacted soils, covering up to 120m², with as many as 15 different entrances (Dragesco-Joffé 1993). Bueler (1973) reports that dens may be close together or even interconnected. In soft sand, dens are usually small and simple, with just one entrance and one tunnel leading to a chamber (Dragesco-Joffé 1993; Cuzin 1996).

Competition

The fennec fox is partly sympatric with, and thus may face competition from, Rüppell's fox (Lindsay and Macdonald 1986), although direct observations have not been made. In southern Morocco, encounters between these species are rare, as Rüppell's fox rarely goes into large sandy areas (F. Cuzin pers. obs.). At its southern limit, the fennec fox is sympatric with the pale fox (Dragesco-Joffé 1993).

Mortality and pathogens

Natural sources of mortality In the wild, jackals, striped hyaenas (*Hyaena hyaena*) and domestic dogs are reported to prey on fennec foxes (Gauthier-Pilters 1967), though this is anecdotal and possibly questionable. The capture of fennec foxes is likely very difficult, as they are fast and able to change direction very quickly. Nomads consider them very difficult to capture, even for the saluki, a local greyhound-like dog (Monteil 1951; Dragesco-Joffé 1993). However, the eagle owl may prey on young fennec foxes (Dragesco-Joffé 1993). There is significant mortality of neonates in captivity, generally attributed to the sensitivity of the parents to disturbance (Petter 1957; Volf 1957; Gangloff 1972).

Persecution Young foxes are captured in their burrow by humans for photographic exhibition, to be sold to tourists (F. Cuzin pers. obs.), or to locals to be raised for meat (Schmidt-Nielsen 1964). In southern Morocco, however, fennec fox meat is not eaten because it is considered foul smelling (F. Cuzin pers. obs.).

Hunting and trapping for fur Fennec foxes are commonly trapped for sale to the pet trade and for fur by the indigenous people of northern Africa.

Road kills Because roads are rare in large sandy areas, only one mortality has been recorded in southern Morocco (F. Cuzin pers. obs.).

Pathogens and parasite Fennec foxes are presumed to be susceptible to pathogens and parasites that affect

domestic dogs. There is some evidence that modified-live canine distemper vaccine may induce canine distemper in fennec foxes (Montali *et al.* 1994), but the newer sub-unit vaccines should not (R. Junge pers. comm.).

Longevity Lifespan in the wild is unknown. In captivity, the recorded maximum longevity is 14 years for males and 13 years for females (Bauman 2002).

Historical perspective

None.

Conservation status

Threats The primary threat appears to be trapping for commercial use. In sandy areas commonly visited by tourists, the fennec fox is well known, but because it is otherwise difficult to see, it is trapped for exhibition or sale to tourists (F. Cuzin pers. obs.). Though restricted to marginal areas, new permanent human settlements such as those in southern Morocco have resulted in the disappearance of fennec foxes in these areas (F. Cuzin pers. obs.).

Commercial use See Mortality and pathogens.

Occurrence in protected areas

- *Algeria*: Ahaggar and Tasili n’Ajjjer National Parks;
- *Egypt*: Bir El Abd Conservation Area;
- *Libya*: Nefhusa National Park, Zellaf Nature Reserve;
- *Mauritania*: Banc d’Arguin and Diawling National Parks;
- *Niger*: Aïr and Tenere National Reserve;
- *Tunisia*: Sidi Toui National Park.

Protection status CITES – Appendix II (2000)

Listed as Lower Risk: Least Concern (Cuzin 1996) in Morocco, which probably reflects their threat status across their range.

Current legal protection Legally protected in Morocco (including Western Sahara).

Conservation measures taken No specific measures taken.

Occurrence in captivity

Historically, the North American Regional Studbook (Bauman 2002) lists some 839 individuals that have been held in the North American region between 1900 and 2001. At the end of 2001, there were 131 individuals in 51 institutions. The Australian Regional Studbook lists 81 historically, with only 12 in the captive population at present. Although fennec foxes occur in European zoos, there is no studbook or management plan. Fennec foxes are also kept as pets and bred privately, but these records are not available.

Current or planned research projects

None known.

Gaps in knowledge

While studies of captive animals have gone some way towards improving our knowledge of this enigmatic species (particularly as regards reproduction), much remains unknown of their basic ecology and behaviour in the wild. Work on captive populations is encouraged, but an in-depth study of the species, with particular emphasis on habitat use and population dynamics in the wild, is overdue.

Core literature

Bauman 2002; Gangloff 1972; Gautier-Pilters 1962, 1967; Petter 1957; Valdespino 2000; Valdespino *et al.* 2002.

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