

Sub-Saharan Africa (Ethiopian)

6.1 Side-striped jackal

Canis adustus Sundevall, 1847

Least Concern (2004)

R.P.D. Atkinson and A.J. Loveridge

Other names

Afrikaans: witwasjakkals; **French:** le chacal à flancs rayés; **German:** streifenschakal; **Indigenous names:** Amharic: Bale-gone Mesmer Kebero (Ethiopia); Karamojong: Oloo (Uganda); Kikinga: Ngwe (Tanzania); Kinyakyusa: Akambwe, Imbira (Tanzania); Kinyiha: Habila (Tanzania); Kiswahili: Bweha, Bweha Miraba (East Africa); Luganda: Akabowa, Ekihe (Uganda); Lugbara: Bowa (Uganda); Lwo: Too (Sudan); Madi: Uba (Uganda); Ndebele: kanka (South Africa, Zimbabwe); Runyankole: Emuha (Uganda); Runyoro: Eboa (Uganda); Sebei: Bleyit (Uganda); Shona: Gava (Zimbabwe, South Africa).

Taxonomy

Canis adustus Sundevall, 1847. Ofv. K. Svenska Vet.-Akad. Forhandl. Stockholm 1846, 3:121 [1847]. Type locality: “Caffraria Interiore”; fixed by Sclater (1900) as “Magaliesberg” [South Africa].

Description

Medium-sized canid (Table 6.1.1), overall grey to buff-grey in colour, with a white side stripe blazed on the flanks, and a diagnostic white tip to the tail. Head is grey-buffy, ears dark buffy. The back is grey, darker than the underside, and the flanks are marked by the indistinct white stripes running from elbow to hip with black lower margins. The boldness of markings, in particular the side

Table 6.1.1. Body measurements for the side-striped jackal from Zimbabwe (Smithers 1983)

TL male	1,082mm (960–1,165) n=50
TL female	1,075mm (1,000–1,170) n=50
T male	361mm (305–390) n=50
T female	354mm (310–410) n=50
HF male	172mm (160–192) n=50
HF female	168mm (153–178) n=50
E male	88mm (80–97) n=50
E female	86mm (80–95) n=50
SH male	448mm (420–490) n=9
SH female	437mm (420–460) n=6
WT male	9.4kg (7.3–12.0) n=50
WT female	8.3kg (7.3–10.0) n=50



Side-striped jackal, age and sex unknown. Nairobi National Park, Kenya, 1993.

Chris and Tilde Stuart

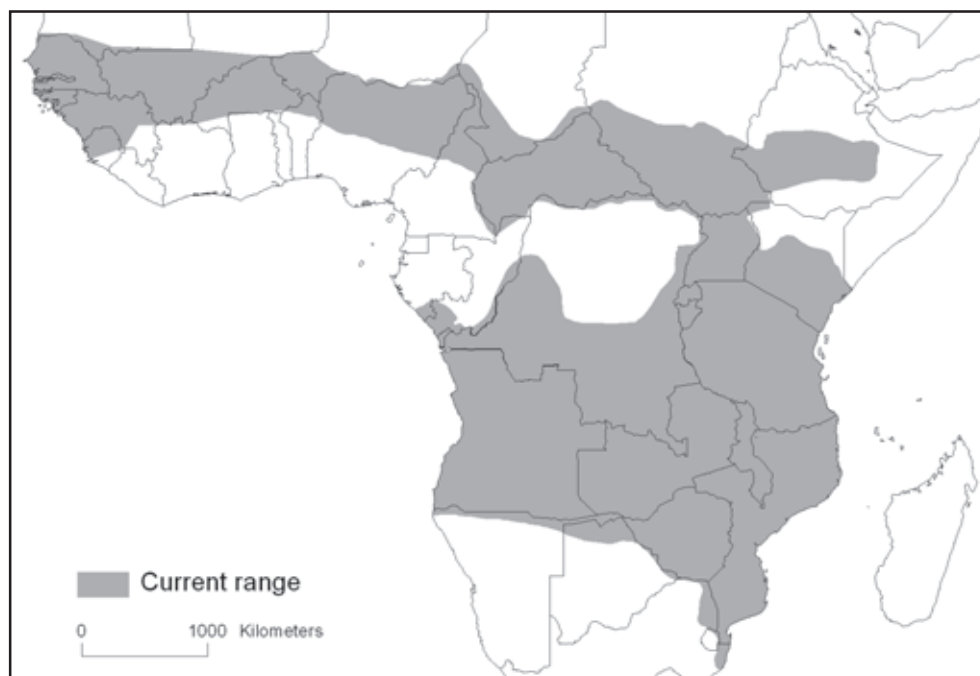


Figure 6.1.1. Current distribution of the side-striped jackal.

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stripes, varies greatly between individuals; those of juveniles are less well defined than those of adults. The legs are often tinged rufous, and the predominantly black tail nearly always bears the distinctive white tip, which Kingdon (1977) suggests may be a “badge” of the species’ nocturnal status. The female has two pairs of inguinal teats.

Skull similar to that of the black-backed jackal (*Canis mesomelas*), but flatter, with a longer and narrower rostrum and having a distinct sagittal crest and zygomatic arches of lighter build. As a result of the elongation of the rostrum, the third upper premolar lies almost in line with the others and not at an angle as in the black-backed jackal (Skinner and Smithers 1990). The dental formula is 3/3-1/1-4/4-2/3=42.

Subspecies Allen (1939) listed seven subspecies from the continent, Coetzee (1977) five, and Kingdon (1997) recognises only three. Many authorities have pointed out that, as with the black-backed jackal, subspecies are hard to distinguish, and the differences may be a consequence of individual variation (Kingdon 1997).

Similar species Black-backed jackal (*C. mesomelas*): usually smaller size, characterised by a prominent dark saddle and black-tipped tail, as well as reddish flanks and limbs (see skull differences noted above); lacks white-tipped tail characteristic of the side-striped jackal.

Golden jackal (*C. aureus*): golden coat colour, and cream-coloured underparts; lacks white-tipped tail.

Current distribution

The side-striped jackal occurs in West, Central and southern Africa (excluding the southernmost part) (Figure

6.1.1), being replaced in the arid south-west and north-west of the continent by the black-backed jackal and in North Africa by the golden jackal. This species probably occurs extensively in the areas shown.

Range countries Angola, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Democratic Republic of Congo, Ethiopia, Gabon, Gambia, Ghana, Kenya, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo (probably in north), Uganda, Zambia, Zimbabwe (Ansell 1960; Rosevear 1974; Coetzee 1977; Kingdon 1977; Skinner and Smithers 1990; Grubb *et al.* 1998).

Relative abundance

Regional estimates of abundance are not available, but from work undertaken in two diverse habitats in Zimbabwe, it seems reasonable to assume the species is common and to estimate a total population in excess of three million. It is likely that the population is at least stable. This species’ dietary flexibility and ability to co-exist with humans on the periphery of settlements and towns suggests that populations are only vulnerable in cases of extreme habitat modification or intense disease epidemics.

Estimated populations/relative abundance and population trends Jackal densities are estimated at around 1/km² in highveld commercial farmland in Zimbabwe (Rhodes *et al.* 1998), where rural density is probably highest. Density estimates from western Zimbabwe were between 0.5–0.8 individuals per km². In Senegal’s Sahel

jackal density was estimated at 0.07 per km² (Sillero-Zubiri *et al.* 1997).

Habitat

Side-striped jackals occupy a range of habitats, from game areas through farmland to towns within the broad-leaved savannah zones, including wooded habitats, bush, grassland, abandoned cultivation, marshes and montane habitats up to 2,700m (Kingdon 1977, 1997; Estes 1991). The species tends to avoid very open savannah (although Rowe-Rowe (1992) mentions they occur in open grassland in north-eastern KwaZulu-Natal), thickly wooded areas and arid zones (Stuart and Stuart 1988; Skinner and Smithers 1990; Kingdon 1997), but Kingdon (1997) states that it enters the equatorial forest belt in the wake of human settlement. Side-striped jackals frequently occur near rural dwellings and farm buildings (Skinner and Smithers 1990; Kingdon 1997), and penetrate peri-urban and urban areas (Liebenburg 1990; Skinner and Smithers 1990). In Botswana, Smithers (1971) recorded them where mean annual rainfall was 400–700mm, and many authors note that the species occurs in well-watered areas (e.g., Kingdon 1977; Skinner and Smithers 1990). Where side-striped jackals occur sympatrically with golden and black-backed jackals, they may avoid competition by ecological segregation (Fuller *et al.* 1989). In such areas of sympatry, side-striped jackals usually occupy areas of denser vegetation, while black-backed and golden jackals dominate in the more open areas (Loveridge 1999; Loveridge and Macdonald 2003).

Food and foraging behaviour

Food: The side-striped jackal is omnivorous, and their diet is very responsive to both seasonal and local variation in food availability. On commercial farmland in the Zimbabwe highveld, they eat mainly wild fruit (30%) and small- (<1kg) to medium-sized (>1kg) mammals (27% and 23%, respectively), with the remainder of their diet comprising birds, invertebrates, cattle cake, grass and carrion (Atkinson *et al.* 2002a). In wildlife areas of western Zimbabwe, side-striped jackals feed largely on invertebrates during the wet season and small mammals up to the size of a springhare (*Pedetes capensis*) during the dry months of the year. This species scavenges extensively from safari camp rubbish dumps and occasionally from large carnivore kills (although they are out-competed for this resource by black-backed jackals) (Loveridge and Macdonald 2002, 2003). In the Ngorongoro Crater, Estes (1991) recorded the species competing with black-backed jackals to catch Grant's gazelle (*Gazella granti*) fawns. Certain fruits may be taken almost exclusively when in season (Smithers and Wilson 1979; Atkinson *et al.* 2002a). The species appears less predatory than other jackals, although Estes (1991) states that they may be just as predatory as other jackals when prey is highly available.

Foraging behaviour The species forages solitarily, although in western Zimbabwe family groups have been observed feeding together on abundant resources, and Estes (1991) mentions that as many as 12 have been counted at kills or scavenging offal outside towns. Atkinson *et al.* (2002b) described jackals foraging opportunistically, exploiting food-rich habitats by random walks with fractal characteristics. They are primarily nocturnal, and, where persecuted, retain extreme flexibility in their foraging strategies (Atkinson 1997a). The species has an amazing ability to find food where none seems obvious to the human observer. A pair studied in the Zimbabwe highveld remained permanently in their territory after a bush fire had apparently destroyed all available food and somehow survived (Atkinson 1997b).

Damage to livestock or game There is very little evidence for extensive predation on domestic stock (Shortridge 1934; Roberts 1951; Smithers 1971; Coetzee 1977; Smithers and Wilson 1979; Rowe-Rowe 1992), or game larger than a baby antelope (Kingdon 1977, 1997; Estes 1991). They have never been recorded running anything down, and it may be pertinent that one was seen to enter a pen to eat ducks' mash, without attempting to harm the birds themselves (Kingdon 1977).

Adaptations

The species is unspecialised and well adapted anatomically and behaviourally for opportunism. The dentition appears well suited to an omnivorous diet (Skinner and Smithers 1990). The canines are long, curved and sharp-pointed, with a sharp ridge on their posterior surfaces. The upper outer incisors are canine-like, the carnassial shear well adapted for slicing, while the first and second upper molars are broad and developed for crushing. The side-striped jackal has relatively smaller carnassials than the more carnivorous black-backed jackal (Skinner and Smithers 1990), and is certainly less adapted for total carnivory than, for example, the African wild dog (*Lycaon pictus*), which has carnassials wholly adapted for shearing.

Social behaviour

Side-striped jackals occur solitarily, in pairs and in family groups of up to seven individuals (although see Foraging behaviour above). The basis of the family unit is the mated pair, which has been known to be stable over several years. In game areas of western Zimbabwe, home ranges varied seasonally from 0.2km² (hot dry season) to 1.2km² (cold dry season), whereas in highveld farmland, they were seasonally stable and in excess of 4.0km² (a third of the yearly total range). Sub-adults disperse from the natal territory, up to 12km in highveld farmland and 20km in game areas of western Zimbabwe. In highveld farmland, territories are configured to encompass sufficient patches of grassland, where resources are most available, and the

structure of the habitat mosaic appears an important factor. Home ranges overlap by about 20% in highveld farmland and 33% in game areas. The residents use the core territory almost exclusively (Atkinson 1997a).

The species has a wide repertoire of sounds, including an explosive bark (“bwaal”), growls, yaps, cackles, whines, screams, a croaking distress call, and a hooting howl (Estes 1991; Kingdon 1997). Calling occurs all year round, but is especially common between pair members during the mating period. Jackals from neighbouring territories sometimes answer each other. Captive pups have been heard calling at eight weeks, but may start earlier (Atkinson 1997a).

Reproduction and denning behaviour

Mating is most common during June and July in Zimbabwe, and the gestation period is about 60 days. Litters of 4–6 pups (Skinner and Smithers 1990) are born from August to November, coinciding with the onset of the rainy season. Pup mortality is thought to be high, and, since up to 12 fetuses have been found in pregnant females (Wolhuter, quoted in Shortridge 1934), some reabsorption may occur (Kingdon 1977).

Abandoned aardvark holes or excavated termitaria are common den sites (Skinner and Smithers 1990), with the den chamber occurring 0.75–1.0m below the surface and 2–3m from the entrance. The same pair may use such dens in consecutive years (Kingdon 1977). After weaning, both parents assist in rearing the young, returning at 2–3-hour intervals through the night to feed the pups on food that probably is regurgitated (Moehlman 1979). The pups are aggressive towards each other, as evidenced by the degree of wounding seen.

Year-old offspring remain in (or occasionally return to) the parental territory while additional offspring are raised. It appears likely that alloparental care of young occurs in this species, as has been observed in other jackal species (Moehlman 1989), and that side-striped jackals may be more social than has been previously suspected (Loveridge and Macdonald 2001).

Competition

Side-striped jackals compete for food with a wide variety of other animals, including other canids, mustelids, viverrids, felids, primates and humans. Many of these competitors are more specialised, and the side-striped jackal’s survival is due to its own flexibility. An interesting case of inter-specific, intra-generic and intra-guild competition has been documented in wildlife areas of western Zimbabwe. Here black-backed and side-striped jackals occur in sympatry. Diet does not differ significantly between the species, but there are marked differences in habitat use. Black-backed jackals use open grassland, while side-stripes use woodland and scrub areas. Interestingly, and in an unusual and perhaps unique circumstance where a larger mammalian carnivore is

displaced by a smaller one, black-backed jackals (7–9kg) aggressively displace the larger side-striped jackal (10–12kg) (Loveridge and Macdonald 2003).

Mortality and pathogens

Natural sources of mortality Leopards (*Panthera pardus*) are the only regular predator of the side-striped jackal, although they may fall prey to other large carnivores. As noted above, pup mortality is thought to be high.

Persecution In areas of high human population density, snaring may be the commonest cause of death in adult side-striped jackals, and may account for as much as a third of adult deaths in such areas (Atkinson 1997a).

Hunting and trapping for fur None known.

Road kills In towns and suburbs, they may be run over by vehicles (Kingdon 1977).

Pathogens and parasites They are vulnerable to rabies (Bingham and Foggin 1993), distemper, tick fever (Kingdon 1977) and mange, for all of which they are known or suspected reservoirs and vectors for domestic dog infection. Computer simulations (Rhodes *et al.* 1998) suggest rabies can only persist in side-striped jackal populations where the density is very high (such as around towns), and that most rabies occurrence in side-striped jackals is a result of spill-over from domestic dogs living on communally owned land. Side-striped jackals can contract the disease from domestic dogs, other jackal species and conspecifics and may spread it to domestic stock. Intra-specific infection is more likely during periods of the year when aggressive encounters are more common such as during the mating season, and after weaning when young disperse and may interact with other jackals (Loveridge and Macdonald 2001). The spread of rabies may be more restricted in stable populations than in those disturbed by culling regimes. Rabies in jackals is probably best controlled by oral vaccination (Rhodes *et al.* 1998).

Longevity As with the black-backed jackal, longevity has been given as 10–12 years (Haltenorth and Diller 1980), but is likely to be much shorter in the wild.

Historical perspective

Jackals of unspecified species play an important role in African folklore (for example, see Elliott 1939, 1947, 1957).

Conservation status

Threats Side-striped jackals are persecuted for their role in rabies transmission and their putative role as stock killers. It is unlikely that this persecution has an effect on the overall population, but indiscriminate culling through

poisoning could affect local abundance. Side-striped jackals appear well capable of exploiting urban and suburban habitats, a factor which may help to ensure their persistent occurrence.

Commercial use There appears to be little or no trade in jackal products.

Occurrence in protected areas The side-striped jackal occurs in many protected areas across its range, including Niokola-Koba National Park (NP) in Senegal, Comoe NP in Ivory Coast, Queen Elizabeth NP in Uganda, Serengeti NP in Tanzania, Hwange NP in Zimbabwe, and Kruger NP in South Africa.

Protection status CITES – not listed.

Current legal protection Jackals have no legal protection outside protected areas.

Conservation measures taken None.

Occurrence in captivity

The species has been kept and bred in zoos, but it is not a common zoo exhibit and there are none currently listed on ISIS. Captive animals have been used in experiments testing rabies vaccine efficacy (Bingham *et al.* 1995).

Current or planned research projects

Although there are no current projects specifically focusing on this species, the side-striped jackal will likely become part of larger carnivore guild studies that are increasingly being conducted around the continent.

Gaps in knowledge

For many years the only major studies on the species' ecology remained those of Kingdon (1977) and Smithers and Wilson (1979), with additional observations by other authors. In the last five years, studies conducted in Zimbabwe by the authors have gone some way to increasing our understanding of this jackal species, particularly as concerns their role in rabies transmission. However, in comparison with the better-known black-backed jackal, the side-striped jackal has a much wider distribution, such that there are large parts of their range for which no information on populations or status is available.

Core literature

Atkinson 1997a,b; Atkinson *et al.* 2002a,b; Kingdon 1977; Loveridge 1999; Loveridge and Macdonald 2001, 2002, 2003; Moehlman 1979, 1989; Skinner and Smithers 1990.

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6.2 Golden jackal *Canis aureus* Linnaeus, 1758 Least Concern (2004)

Y.V. Jhala and P.D. Moehlman

Other names

English: Asiatic Jackal, Common Jackal; **Albanian:** Cakalli; **Arabic:** Ibn Awee; **Croatian:** Èagalj; **Czech:** Šakal Obecný; **Danish and Swedish:** Sjakal; **Dutch:** Jakhals; **Estonian:** Šaakal; **Finnish:** Sakaali; **Faeroese:** Sjakalur; **French:** Chacal Doré, Chacal Commun; **German:** Goldschakal; **Greek:** Tóáëää; **Hungarian:** Aranysakál; **Italian:** Sciacallo Dorato; **Latvian:** Zeltainais Ģakālis; **Maltese:** Xakall; **Norwegian:** Gullsjakal; **Polish:** Szakal Zlocisty; **Portuguese:** Chacal-dourado; **Romanian:** Șakal; **Slovakian:** Šakal Obyčajný; **Slovenian:** Šakal; **Spanish:** Chacal; **Turkish:** Çakal; **Indigenous names:** Amharic: Tera Kebero (Ethiopia); Fulani: Sundu; Hausa: Dila; Hindi: Giddhad; Kanada: Nuree; Kiswahili: Bweha wa Mbugani, Bweha Dhahabu (Tanzania); Marathi (India): Kolha; Nepali (Nepal), Bengali, Gujarati and Kutchi (India): Shiyal; Singhelese: Nariya; Songhai: Nzongo; Tamil (India): Peria Naree; Wolof: Tili.

Taxonomy

Canis aureus Linnaeus, 1758. Syst. Nat., 10th edn. 1: 40 Type locality: “oriente”; restricted by Thomas (1911) to “Benna Mountains, Laristan, Southern Persia” [Iran, c. 27°30'N, 55°15'E].

Chromosome number: 2n=78 (Wurster-Hill and Benirschke 1968).

Description

Medium-sized canid, considered the most typical representative of the genus *Canis* (Clutton-Brock *et al.* 1976). There is approximately 12% difference in body weight between sexes (Moehlman and Hofer 1997) (Table 6.2.1). Basic coat colour is golden but varies from pale creamy yellow to a dark tawny hue on a seasonal basis. The pelage on the back is often a mixture of black, brown, and white hairs, such that they can appear to have a dark saddle similar to the black-backed jackal (*Canis*

Table 6.2.1. Body measurements for the golden jackal from Gujarat, India (Y. Jhala unpubl.).

HB male	793mm (760–840) n=6
HB female	760mm (740–800) n=3
T male	220mm (200–240) n=6
T female	205mm (200–210) n=3
E male	76mm (68–90) n=6
E female	80mm (75–85) n=3
WT male	8.8kg (7.6–9.8) n=6
WT female	7.3kg (6.5–7.8) n=4



Golden jackal, age and sex unknown. Bandipur National Park, Karnataka State, India, 1997.

Krupakar Senani



Figure 6.2.1. Current distribution of the golden jackal.

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mesomelas). Jackals inhabiting rocky, mountainous terrain may have a greyer coat shade (Sheldon 1992). The belly and underparts are a lighter pale ginger to cream. Unique lighter markings on the throat and chest make it possible to differentiate individuals in a population (Macdonald 1979a; Moehlman 1983). Melanistic and piebald forms are sometimes reported (Jerdon 1874; Muller-Using 1975). The tail is bushy with a tan to black tip. Legs relatively long, and feet slender with small pads. Females have four pairs of mammae (Sheldon 1992).

The skull of the golden jackal is more similar to that of the coyote (*C. latrans*) and the grey wolf (*C. lupus*), than that of the black-backed jackal, side-striped jackal (*C. adustus*), and Ethiopian wolf (*C. simensis*) (Clutton-Brock *et al.* 1976). The dental formula is $3/3-1/1-4/4-2/3=42$.

Moehlman and Hofer (1997) give mean body mass for females as 5.8kg, and for males 6.6kg.

Subspecies As many as 12 subspecies are distinguished across the range (Ellerman and Morisson-Scott 1951; Coetzee 1977). However, there is much variation and

populations need to be re-evaluated using modern molecular techniques.

Similar species Black-backed jackal (*C. mesomelas*): Distinguished by the reddish flanks and limbs, the shape of its skull, the position and angle of its ears, and usually the prominent dark saddle (the dark saddle is sometimes apparent in the golden jackal though usually not as prominent).

Side-striped jackal (*C. adustus*): Typically with relatively longer legs, a pale side stripe and a white-tipped tail.

Distribution

The golden jackal is widespread in North Africa and north-east Africa, occurring from Senegal on the west coast of Africa to Egypt in the east, in a range that includes Morocco, Algeria, and Libya in the north to Nigeria, Chad and Tanzania in the south. They have expanded their range from the Arabian Peninsula into western Europe to Austria and Bulgaria (Genov and Wassiley 1989; Sheldon 1992), and eastwards into Turkey, Syria,

Iraq, Iran, Central Asia, the entire Indian subcontinent, then east and south to Sri Lanka, Myanmar, Thailand and parts of Indo-China.

Range countries Afghanistan, Albania, Algeria, Austria, Bahrain, Bhutan, Bosnia, Bulgaria, Central African Republic, Chad, Croatia, Djibouti, Egypt, Eritrea, Ethiopia, Greece, India, Iran, Iraq, Israel, Italy, Jordan, Kenya, Kuwait, Lebanon, Libya, Mali, Mauritania, Morocco (including Western Sahara), Myanmar, Nepal, Niger, Nigeria, Oman, Pakistan, Qatar, Saudi Arabia, Senegal, Sri Lanka, Somalia, Sudan, Syria, Tanzania, Thailand, Tunisia, Turkey, Turkmenistan, United Arab Emirates, Vietnam, Yemen, and Yugoslavia (Rosevear 1974; Kingdon 1977; Roberts 1977; Prater 1980).

Relative abundance

The golden jackal is fairly common throughout its range. High densities are observed in areas with abundant food and cover. In several parts of India, high densities of low-quality cattle are maintained. Due to religious beliefs, most people do not consume beef, and cattle carcasses are freely available for scavenging.

Estimated populations/relative abundance and population trends In India, jackal populations achieve high densities in pastoral areas such as Kutch, Maharashtra, Rajasthan, and Haryana. Based on intensive observations on breeding pack units and radio-collared individuals, jackal densities in the semi-arid Velavadar National Park were estimated between one and two jackals per km² (Y. Jhala *et al.* unpubl.); see Sharma (1998) for densities quoted for the Thar Desert in India. On the African continent, in the Serengeti National Park, densities can range as high as four adults per km² (Moehlman 1983, 1986, 1989).

Based on known density estimates for parts of India and considering that about 19% (i.e., about 637,000 km²) of the geographical area of India has forest cover with jackal populations (and that jackals are also found outside forested habitats), a minimum population estimate of over 80,000 golden jackals would not be unreasonable for the Indian sub-continent. Population estimates for Africa are not available.

Habitat

Due to their tolerance of dry habitats and their omnivorous diet, the golden jackal can live in a wide variety of habitats. These range from the Sahel Desert to the evergreen forests of Myanmar and Thailand. They occupy semi-desert, short to medium grasslands and savannahs in Africa; and forested, mangrove, agricultural, rural and semi-urban habitats in India and Bangladesh (Clutton-Brock *et al.* 1976; Poche *et al.* 1987; Y. Jhala pers. obs.). Golden jackals are opportunistic and will venture into human

habitation at night to feed on garbage. Jackals have been recorded at elevations of 3,800m in the Bale Mountains of Ethiopia (Sillero-Zubiri 1996) and are well established around hill stations at 2,000m in India (Prater 1980).

Food and foraging behaviour

Food Golden jackals are omnivorous and opportunistic foragers, and their diet varies according to season and habitat. In East Africa, although they consume invertebrates and fruit, over 60% of their diet comprises rodents, lizards, snakes, birds (from quail to flamingos), hares, and Thomson's gazelle (*Gazella thomsoni*) (Wyman 1967; Moehlman 1983, 1986, 1989). In Bharatpur, India, over 60% of the diet comprised rodents, birds and fruit (Sankar 1988), while in Kanha, Schaller (1967) found that over 80% of the diet consisted of rodents, reptiles and fruit. In Sariska Tiger Reserve, India, scat analysis (n=136) revealed that their diet comprised mainly mammals (45% occurrence, of which 36% was rodents), vegetable matter (20%), birds (19%), and reptiles and invertebrates (8% each) (Mukherjee 1998). Great quantities of vegetable matter occur in the diet of jackals and, during the fruiting season in India, they feed intensively on the fruits of *Ziziphus* sp., *Carissa carvanda*, *Syzgium cuminii*, and pods of *Prosopis juliflora* and *Cassia fistula* (Kotwal *et al.* 1991; Y. Jhala pers. obs.).

Foraging behaviour Single jackals typically hunt smaller prey like rodents, hares and birds. They use their hearing to locate rodents in the grass and then pounce on them by leaping in the air; they also dig out gerbils (*Tatera indica*) from their burrows. They have been observed to hunt young, old, and infirm ungulates that are sometimes 4–5 times their body weight (Van Lawick and Van Lawick-Goodall 1970; Eisenberg and Lockhart 1972; Kotwal *et al.* 1991; Y. Jhala pers. obs.). During calving peaks of blackbuck (*Antelope cervicapra*), in Velavadar National Park, India, jackals were observed searching for hiding calves throughout the day with searches intensifying during the early morning and late evening (Y. Jhala pers. obs.). Although single jackals were observed hunting (n=4) and killing blackbuck calves (n=1), jackal packs (2–4 jackals) were more successful (n=4), as has been observed for predation on African antelope fawns (Wyman 1967; Kruuk 1972; Rosevear 1974). Indeed, cooperative hunting permits them to harvest much larger prey in areas where it is available, and cooperative hunting of langurs (*Presbytis pileata* and *P. entellus*) has been reported (Newton 1985; Stanford 1989). Aggregations of between five and 18 jackals have been sighted scavenging on carcasses of large ungulates (Y. Jhala pers. obs.), and Macdonald (1979a) reports similar aggregations on clumped food resources in Israel.

In Velavadar National Park, India, hundreds of harriers (*Circus macrourus* and *C. pygargus*) roost communally in the grasslands during the course of winter migration.

Jackals were observed to stalk close to roosting harriers and then rush at them attempting to catch one before the harriers could take off and gain height. In several areas of India and Bangladesh, jackals subsist primarily by scavenging on carrion and garbage (Poche *et al.* 1987; Y. Jhala pers. obs.). They have the habit of caching extra food by burying it (Kingdon 1977).

Damage to livestock or game Golden jackals cause damage to melon, peanut, grape, coffee, maize and sugarcane crops; they sometimes take to killing lambs, kids, weak sheep, goats and poultry (Jerdon 1874; Kingdon 1977; Prater 1980; Poche *et al.* 1987).

Adaptations

Jackals are generalists, adapting to local abundance of food resources. This adaptability permits them to occupy a wide variety of habitats and utilise a variety of food resources. A lithe body with long legs allows jackals to trot for large distances in search of food. They are reported to have the ability to forego water (Kingdon 1977), and jackals have been observed on Pirotan Island in the Gulf of Kutch, India, where there is no fresh water (Y. Jhala pers. obs.). Jackals can commute between this island and the mainland by traversing through mangroves and small islands that are exposed during extreme low tides.

Social behaviour

The social organisation of golden jackals is extremely flexible depending on the availability and distribution of food resources (Macdonald 1979a; Moehlman 1983, 1986, 1989; Fuller *et al.* 1989; Moehlman and Hofer 1997; and see Food and foraging behaviour). The basic social unit is the breeding pair, which is sometimes accompanied by its current litter of pups and/or by offspring from former litters (Moehlman 1983, 1986, 1989). In Tanzania, golden jackals usually form long-term pair bonds, and both members mark and defend their territories, hunt together, share food, and cooperatively rear the young (Moehlman 1983, 1986, 1989). Of a total of 270 recorded jackal sightings in the Bhal and Kutch areas of Gujarat, India, 35% consisted of two individuals, 14% of three, 20% of more than three, and the rest of single individuals (Y. Jhala unpubl.). Moehlman and Hofer (1997) give average group size as 2.5 in the Serengeti, Tanzania, while average pack size in Velavadar National Park, India, was 3.0 ($n=7$) (Y. Jhala unpubl.).

Scent marking by urination and defecation is common around denning areas and on intensively used trails. Such scent flag posts are considered to play an important role in territorial defence (Rosevear 1974). Although Moehlman (1983) reports maintenance of year-round exclusive territories in Tanzania, aggregations in Israel (Macdonald 1979a) and India (Y. Jhala pers. obs.) point towards the flexibility of social organisation depending on available

food resources. Recent data obtained by telemetry from the Bhal area of India suggest that most breeding pairs are spaced well apart and likely maintain a core territory around their dens (Y. Jhala unpubl.). Feeding ranges of several jackals in the Bhal overlapped, as also reported by Van Lawick and Van Lawick-Goodall (1970). Jackals were observed to range over large distances in search of food and suitable habitat, and linear forays of 12–15 km in a single night were not uncommon (A. Aiyadurai and Y. Jhala unpubl.). Non-breeding members of a pack may stay near a distant food source like a carcass for several days prior to returning to their original range. Recorded home range sizes vary from 1.1–20 km² (Van Lawick and Van Lawick-Goodall 1970; Kingdon 1977; Poche *et al.* 1987; Y. Jhala unpubl.), depending on the distribution and abundance of food resources.

Affiliative behaviours like greeting ceremonies, grooming, and group vocalisations are common in jackal social interactions (Van Lawick and Van Lawick-Goodall 1970; Golani and Keller 1975). Vocalisation consists of a complex howl repertoire beginning with 2–3 simple, low-pitch howls and culminating in a high-pitched staccato of calls. Jackals are easily induced to howl and a single howl evokes responses from several jackals in the vicinity. Golden jackals often emit a warning call that is very different from that of their normal howling repertoire in the presence of large carnivores like tigers, hyaenas and wolves (Jerdon 1874; Y. Jhala pers. obs.). In India, howling is more frequent between December and April, a time when pair bonds are being established and breeding occurs, perhaps suggesting a role in territory delineation and defence (Jaeger *et al.* 1996).

Reproduction and denning behaviour

Reproductive activity commences from February to March in India and Turkmenistan, and from October to March in Israel (Golani and Keller 1975; Ginsberg and Macdonald 1990). In Tanzania, mating typically occurs from October to December with pups being born from December to March (Moehlman 1983, 1986, 1989). As with other canids, mating results in a copulatory tie that lasts for several minutes (Golani and Mendelssohn 1971; Golani and Keller 1975). Timing of births coincides with abundance of food supply; for example, the beginning of the monsoon season in northern and central India, and the calving of Thomson's gazelle in the Serengeti (Moehlman 1983; Ginsberg and Macdonald 1990). Females are typically monoestrus, but there is evidence in Tanzania of multiple litters (P. Moehlman pers. obs.). Gestation lasts about 63 days (Sheldon 1992). Moehlman and Hofer (1997) give mean litter size as 5.7 (range=1–8) in Tanzania, while in the Bhal area in India, average litter size was 3.6 (range=2–5; $n=11$) (Y. Jhala unpubl.). In Tanzania, Wyman (1967) reported an average of two pups emerging from the den at three weeks of age. Pups are born blind and their eyes open at

approximately nine days and their teeth erupt at 11 days after birth (Moehlman and Hofer 1997). Lactation usually lasts for 8–10 weeks.

In India, den excavations begin in late April to May, with dens primarily located in natural and man-made embankments, usually in scrub habitat. Rivulets, gullies, road, and check-dam embankments are prime denning habitats (Soni *et al.* 1995; Y. Jhala pers. obs.), although drainage pipes and culverts have served as dens on several occasions in the Bhal. Dens may have 1–3 openings and typically are about 2–3m long and 0.5–1.0m deep. Young pups could be moved between 2–4 dens prior to joining their parents. In Tanzania, both parents and ‘helpers’ (offspring from previous litters) provision and guard the new pups. The male also feeds his mate during her pregnancy, and both the male and the ‘helpers’ provision the female during the period of lactation (Moehlman 1983, 1986, 1989; Moehlman and Hofer 1997). The ‘helpers’ are full siblings to the young pups that they are provisioning and guarding, and the presence of ‘helpers’ results in a higher pup survival (Moehlman 1986).

Competition

The existence of three sympatric species of jackals (golden, black-backed and side-striped) in East Africa is explained in part by resource partitioning and the high relative diversity of prey and predators in Africa (Fuller *et al.* 1989; Wayne *et al.* 1989).

Golden jackals have been observed to appropriate the dens of Bengal foxes (*Vulpus bengalensis*) and porcupines (*Hystrix indica*), and also to use abandoned grey wolf (*Canis lupus*) dens (Y. Jhala pers. obs.). Jackals often scavenge off the kills of larger predators like lion (*Panthera leo*), tiger (*P. tigris*), leopard (*P. pardus*), spotted hyaena (*Crocuta crocuta*), dhole (*Cuon alpinus*) and grey wolf (Jerdon 1874; Schaller 1967; Van Lawick and Van Lawick-Goodall 1970; Kruuk 1972; Moehlman 1986; Jhala 1994). Jackals have been observed following grey wolves on a hunt and scavenging off wolf kills without evoking any hostile reactions from wolves (Jhala 1991, 1994).

Mortality and pathogens

Natural sources of mortality In Kutch, India, jackals are predated by striped hyaenas (*Hyaena hyaena*), and one hyaena maternity den had three jackal carcasses (Y. Jhala unpubl.). Spotted hyenas also have been observed to kill and feed on golden jackals (Kruuk 1972; Kingdon 1977), and the same probably holds true of other large carnivores. Singh (1983) reports that pythons (*Python morulus*) were a major predator of jackals in Corbett National Park, India. Jackals are often chased and sometimes killed by feral dogs when they approach human habitation.

Persecution In India, pastoralists occasionally use poison to kill predators like wolves and leopards that predate on

livestock, and jackals are killed by scavenging such poisoned kills (Y. Jhala unpubl.).

Hunting and trapping for fur Some tribal communities like the *kolis*, *vaghris* in Gujarat and *Rajasthan* and *nari kuravas* in Tamil Nadu do kill and eat jackals. This occasional hunting currently does not pose a threat to jackal populations in these states of India. However, there is a threat from organised poaching for skins and tails which are sometimes marketed.

Road kills Besides dogs, jackals are the most common road kills on rural roads in India. The incidence of road kills increases during the breeding season from February to March (Y. Jhala pers. obs.).

Pathogens and parasites Since golden jackals live in close proximity to human habitation, they often come into contact with feral dog populations. Jackals in India are often infected with diseases like rabies and distemper, and rabid jackals frequently attack domestic livestock, dogs and humans (Y. Jhala unpubl.). Skin diseases like mange and ectoparasites like ticks and fleas are common in jackals in areas where they occur at high densities. In Tanzania, golden jackals had positive seriological test results to canine parvovirus, canine herpesvirus, canine coronavirus and canine adenovirus (W.B. Karesh pers. comm.).

Longevity The maximum life span recorded in the Serengeti was 14 years (Moehlman and Hofer 1997).

Historical perspective

The jackal features in mythological and cultural accounts of several civilisations spanning Africa, India and Europe. The ancient Egyptians worshipped the jackal-headed god Anubis, and the Greek gods Hermes and Cerberus probably derived their origins from the golden jackal. In India, jackals feature in ancient texts like the *Jatakas* and *Panchtatra* that abound with animal stories. The jackal normally is portrayed as an intelligent or wily creature in these stories. Some tribes in India believe that a horn-like growth appears on the heads of some jackals called *shiyal shingi*; the possession of this organ is believed to bring good fortune. Coffee beans that have passed through the gut of a jackal are believed to have an added flavour, and these are collected and marketed in certain parts of southern India (Jerdon 1874; A.J.T. Johnsingh pers. comm.)

Conservation status

Threats Over its entire range except in protected areas like National Parks and Sanctuaries, the jackal population may be declining. Traditional land use practices, like livestock rearing and dry farming that were conducive to the survival of jackals and other wildlife, are being steadily replaced by industrialisation and intensive agriculture;

wilderness areas and rural landscapes are being rapidly urbanised. Jackal populations adapt to some extent to this change and may persist for a while, but eventually disappear from such areas like other wildlife. There are no other known threats, except for local policies of extirpation and poisoning (for example, Israel).

Commercial use There is no significant trade in jackal products, although skins and tails are occasionally sold.

Occurrence in protected areas Golden jackals are present in all protected areas of India except for those in the high elevation regions of the Himalaya. In East Africa, they occur in the Serengeti-Masai Mara-Ngorongoro complex, as well as numerous other conservation units. Thus they have a wide coverage in terms of protected populations.

Protection status CITES – Appendix II (in India).

Current legal protection Jackals feature on Schedule III of the Wildlife Protection Act (1972) of India and are afforded the least legal protection (mainly to control trade of pelts and tails). However, no hunting of any wildlife is permitted under the current legal system in India. The golden jackal could be considered as a “species requiring no immediate protection” with caution and knowledge that populations throughout its range are likely declining.

Conservation measures taken Besides being represented in a wide array of protected areas covering several landscapes, no species-specific conservation efforts have been undertaken.

Occurrence in captivity

Almost all zoos in India have golden jackals. In March 2000, there were 67 males, 72 females, and 54 unsexed individuals in Indian zoos (Central Zoo Authority India pers. comm.).

Current or planned research projects

P. Moehlman (Tanzania Wildlife Research Institute) is conducting ongoing, long-term studies in the Serengeti, Tanzania.

Y. Jhala (Wildlife Institute of India) is continuing with ongoing studies on wolves, jackals, and striped hyaenas in Bhil and Kutch areas of Gujarat, India.

M. Jaeger (Department of ESPM, University of California at Berkley, USA) is investigating crop damage, densities and ranging patterns of golden jackals in Bangladesh.

Gaps in knowledge

Little quantitative information is available on jackal densities, habitat use, and ranging patterns in relation to

food availability. Information on dispersal, survival and mortality factors of adults, pups and dispersing individuals is needed. Jackal ecology needs to be studied in forested ecosystems of Southeast Asia where a different set of factors are likely to operate affecting food availability, ranging patterns and survival. Aspects of canid diseases in relation to population dynamics of jackals and transmission need to be better understood.

Core literature

Fuller *et al.* 1989; Macdonald 1979a; Moehlman 1983, 1986, 1989; Moehlman and Hofer 1997.

Reviewers: Asir J.T. Johnsingh. **Editors:** Michael Hoffmann, Claudio Sillero-Zubiri.

6.3 Black-backed jackal ***Canis mesomelas* Schreber, 1775** **Least Concern (2004)**

A.J. Loveridge and J.A.J. Nel

Other names

English: silver-backed jackal; **Afrikaans:** rooijakkals; **French:** chacal à chabraque; **German:** schabrakenschakal; **Indigenous names:** Amharic: tikur-jerba kebero (Ethiopia, Eritrea); Shona: hungubwe, gava (Zimbabwe); Ndebele: ikhanka (Zimbabwe); Zulu: mpungutshe, kanka (South Africa); Siswati: mpungutje; Shangaan: impungutshe (South Africa); Tswana: phokojwe (Botswana, South Africa); Venda: phungubwe (South Africa); Sotho: phokobje, phokojoe (South Africa); Herero/Ovambo: ombánji (Namibia); Nama/Damara: Girib, Gireb (Namibia); Kiswahili: bweha nyekunda (East Africa).

Taxonomy

Canis mesomelas von Schreber, 1775. Die Säugethiere 2(14): pl. 95; text 1776, 3(21): 370. Type locality: “Vorgebirge der guten Hofnung” [“Cape of Good Hope”, South Africa].

Chromosome number: 2n=78 (Wayne 1993).

Description

The black-backed jackal is somewhat fox-like in appearance, with a long, pointed muzzle. Diagnostic features include the dark saddle, black, bushy tail and reddish flanks and limbs; males are slightly larger and heavier than females (Table 6.3.1). The ears are large, erect, pointed and constantly mobile. The overall body colour is rufous brown, the colour gaining its greatest intensity on the ears, rump and flanks. A black stripe midway up each flank slopes obliquely from behind the shoulder to the top of the rump; the dark saddle is broadest at the shoulders and tapers to a narrow point at the base



Black-backed jackal, age and sex unknown. Etosha National Park, Namibia.

Chris and Tilde Stuart

Table 6.3.1. Body measurements for the black-backed jackal from the former Cape Province, South Africa (Stuart 1981).

HB male	785mm (690–900) n=65
HB female	745mm (650–850) n=42
T male	326mm (270–395) n=70
T female	316mm (260–381) n=45
HF male	160mm (130–185) n=66
HF female	156mm (140–180) n=43
E male	109mm (90–132) n=68
E female	104mm (80–120) n=41
WT male	8.1kg (5.9–12.0) n=59
WT female	7.4kg (6.2–9.9) n=42

of the tail. Anterior to this stripe, just behind the shoulder is a small vertical stripe, diffuse in some individuals. Above the side markings, the back is marbled black and white giving an overall silver appearance in mature animals (hence their alternative name of silver-backed jackal). Juveniles and subadults have similar markings but these are drabber and only gain their full intensity at around two years of age. In the drier west and Namib coast in southern Africa the winter coat is a deep reddish brown (especially in males). The bushy tail is dark brown to black with a distinctive black subcaudal marking. The markings, especially the side and shoulder stripes, are unique to each individual and can be used for identification purposes. Hair on the face is 10–15mm, lengthening to 30–40mm on the rump. Guard hairs on the saddle in the shoulder region are c. 60mm decreasing to 40mm at the base of the tail; on the tail they reach 70mm.

Skull elongated, braincase pear-shaped, rostrum narrow, supra-occipital crest well developed, bullae

rounded, zygomatic arches broad and well developed, and post-orbital bars incomplete. Dental formula is $3/3-1/1-4/4-2/3=42$. Outer upper incisors larger, more pointed and caniniform than others. Upper canines long, curved and pointed, with a sharp ridge on their posterior faces (Skinner and Smithers 1990).

In southern Africa black-backed jackals differ in size in different areas. Recorded mean mass of males from different regions include: 8.4kg (n=123) for KwaZulu-Natal (Rowe-Rowe 1978), 8.2kg (n=12) in the former Transvaal (Rautenbach 1982), and 9.7kg (n=7) for the Skeleton Coast of Namibia (Stutterheim *in litt.*). Average weight in East Africa is 8.5kg (Kingdon 1977).

Subspecies As many as six (Allen 1939) subspecies have been recognised. Coetzee (1977) listed five, while Meester *et al.* (1986) assigned all southern African material to the nominate subspecies, mentioning the two remaining subspecies from East Africa. However, considering the regional variation in the species, Kingdon's (1997) recognition of only two, geographically isolated subspecies is followed here.

- *C. m. mesomelas* (southern Africa)
- *C. m. schmidtii* (East Africa).

Similar species Both side-striped jackals (*Canis adustus*) and golden jackals (*Canis aureus*) occur in sympatry with the black-backed jackal in parts of East Africa, and the side-striped jackal occurs in sympatry with this species in parts of Zimbabwe, Botswana and South Africa. Both the side-striped jackal and golden jackal typically lack the prominent dark saddle, although this is sometimes apparent in the golden jackal. They also lack the reddish flanks and limbs. The side-striped jackal has a whitish

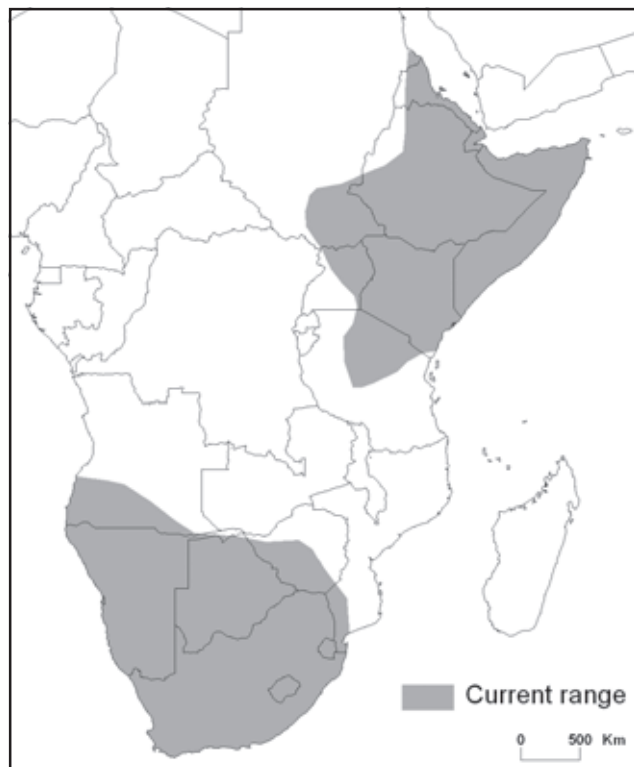
stripe along the flanks and a characteristic white-tipped tail, while the golden jackal is sand-coloured and has cream-coloured underparts.

Distribution

Current distribution The black-backed jackal has a disjunct distribution range, and is found in two separate populations, one in East Africa, and the other in southern Africa (Figure 6.3.1). Ansell (1960) notes that this species is entirely absent from Zambia and it is absent through much of central and equatorial Africa. The disjunct distribution of this species is similar to that of other endemic African species adapted to dry conditions (e.g., aardwolf *Proteles cristatus*, bat-eared fox *Otocyon megalotis*, dik-dik *Madoqua kirkii*). The two black-backed jackal ranges are separated by as much as 1,000km and their discontinuous distribution suggests that regions of dry *Acacia* bush and savannah, the preferred habitat of this species, once connected south-west Africa and the Horn of Africa.

Historical distribution Fossils of black-backed jackals have been found in deposits in South Africa dating to at least two million years ago (Hendey 1974), but fossil remains have never been found north of Ethiopia suggesting that they have always been restricted to sub-Saharan Africa.

Figure 6.3.1. Current distribution of the black-backed jackal.



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Range countries Angola, Botswana, Djibouti, Eritrea, Ethiopia, Kenya, Lesotho, Mozambique, Namibia, Somalia, South Africa, Sudan, Swaziland, Tanzania, Uganda, Zimbabwe (Coetsee 1977; Kingdon 1977; Skinner and Smithers 1990).

Relative abundance

Regional estimates of abundance are not available. However, black-backed jackals are generally widespread, and, in Namibia and South Africa, they are common in protected areas where suitable habitat occurs. They occur in many livestock producing areas, where they are considered vermin, but despite strenuous control measures in many farming areas of southern Africa this species is still relatively abundant.

Estimated populations/relative abundance and population trends

In the Drakensberg Mountains of South Africa, Rowe-Rowe (1982) found densities of 1 jackal/2.5–2.9km², while J.A.J. Nel *et al.* (unpubl.) recorded linear densities along the Namib Desert Coast of Namibia that varied from 0.1–0.53 jackal/km² along food-scarce beaches along the Skeleton Coast, to 7.0–9.0/km² at the food-rich seal rookery at Cape Cross, reaching a maximum of 16.0–32.0/km² along the centre of the seal rookery.

Habitat

Black-backed jackals are found in a wide variety of habitats including arid coastal desert (Dreyer and Nel 1990), montane grassland (Rowe-Rowe 1982), arid savannah and scrubland (Skinner and Smithers 1990), open savannah (Wyman 1967; Kingdon 1977; Lamprecht 1978; Moehlman 1983; Fuller *et al.* 1989; Estes 1991), woodland savannah mosaics (Smithers 1971; Loveridge and Macdonald 2002) and farmland. In general, black-backed jackals show a preference for open habitats tending to avoid dense vegetation (Pienaar 1969). In KwaZulu-Natal, they are recorded from sea level to more than 3,000m a.s.l. in the Drakensberg, and in localities receiving more than 2,000mm of rainfall (Rowe-Rowe 1982, 1992). Where more than one jackal species occur in sympatry the habitat is partitioned. The trend is for black-backed jackals to use either the open grassland (when sympatric with side-striped jackal; Loveridge and Macdonald 2000) or wooded savannah (when sympatric with golden and side-striped jackals; Fuller *et al.* 1989). In western Zimbabwe habitat partitioning was mediated by aggressive encounters in which black-backed jackals displaced side-striped jackals from grassland habitats (Loveridge and Macdonald 2002).

Food and foraging behaviour

Food Black-backed jackals are generalist feeders. Diet varies according to food availability (Skinner and Smithers 1990; Loveridge and Macdonald 2003), and, when occurring in sympatry with other carnivores sharing the

same prey base, food resources are partitioned (Bothma *et al.* 1984). Dietary items typically include small- to medium-sized mammals (e.g., murids, springhares, young ungulates), reptiles, birds and birds' eggs, carrion and human refuse (Roberts 1922; Stuart 1976, 1981; Kingdon 1977, 1997; Ferguson 1980; Rowe-Rowe 1983; Dreyer and Nel 1990; Skinner and Smithers 1990; Kok 1996), as well as invertebrates and plants (Bothma 1971b), beached marine mammals, seals, fish and mussels on coasts (Nel and Loutit 1986; Avery *et al.* 1987; Oosthuizen *et al.* 1997). Invertebrates, such as termites and insects, are commonly eaten (Kingdon 1997; Loveridge 1999).

Foraging behaviour Pairs and small foraging groups are often seen foraging together. Groups of between 8 and 10 aggregate at large carcasses of herbivores, and more than 80 have been recorded at seal colonies on the Namib Desert coast (Oosthuizen *et al.* 1997). Such aggregations are accompanied by aggressive behaviour between territorial individuals. However, in the south-western Kalahari, where antelope carcasses are uncommon, groups of up to 15 pairs feed in succession without much overt aggression (J.A.J. Nel unpubl.). Mated black-backed jackal pairs will often cooperate in the capture of prey resulting in a higher success rate (Lamprecht 1978; Loveridge 1999). In Botswana, McKenzie (1990) found that, on occasion, they form 'packs' in order to hunt adult impala (*Aepyceros melampus*), and other authors have recorded them taking adult antelope (Van Lawick and van Lawick-Goodall 1970; Sleicher 1973; Lamprecht 1978). On the Namib Desert coast they patrol beaches for beached marine refuse and move along sheltered paths in-between food-rich patches; the top of coastal hummocks are used as feeding sites (Dreyer and Nel 1990). In this environment, they frequently occur in association with brown hyaenas (*Parahyaena brunnea*), following from a distance in the hope of securing the odd food item. The large, mobile ears are used to locate invertebrate and small mammalian prey. A leap, followed by an accurate pounce is employed to capture prey located in this fashion, after the manner of a red fox (*Vulpes vulpes*). They are largely nocturnal, but activity periods may extend well into daylight hours in areas where they are free from persecution.

Damage to livestock or game This species will prey on livestock (especially juvenile goats and sheep) and is thus considered vermin in many livestock producing regions (Van der Merwe 1953). However, such predation is usually localised and not extensive (Shortridge 1934; Roberts 1951; Smithers 1971; Rowe-Rowe 1975; Lawson 1989). In certain areas losses of up to 3.9% can result, or up to 18% on specific farms, which entail a high economic loss to farmers (Brand 1993). Where controlled herding is practiced, e.g., southern Namibia, losses amount to only 0.3–0.5% (Brown 1988).

Adaptations

Black-backed jackals are relatively unspecialised canids and well suited for an opportunistic lifestyle in a wide variety of habitats. They have a well-developed carnassial shear with a longer premolar cutting blade than other jackal species, an indication of a greater tendency towards carnivory (Van Valkenburgh 1991; Van Valkenburgh and Koepfli 1993). Examination of kidney structure suggests that this species is well adapted to water deprivation (Loveridge 1999) which may explain its presence in the drier parts of the African continent. Black-backed jackals are wary of unfamiliar objects and young follow the example of adults by avoiding poisoned baits (coyote getters) in control operations (Brand 1993; Brand and Nel 1996); here, as well as during foraging and selecting prey, social learning seems to play a role (Nel 1999).

Social behaviour

The monogamous mated pair is the basis of social structure in this species. The pair bond appears to be life-long in most cases, and if one member of a pair dies the other often will lose its territory (Moehlman 1978, 1979; Estes 1991). Black-backed jackals are territorial using faeces and urine to demarcate their territorial boundaries (Kingdon 1977; Ferguson *et al.* 1983; Skinner and Smithers 1990). Territories are spatially and temporally relatively stable, and intruders are aggressively expelled by territory holders. In Hwange National Park, Zimbabwe, a mated pair of black-backed jackals held the same territory for at least four years (Loveridge 1999). Water sources are shared with intruders but these perform submissive behaviour to territory holders, and even their pups (J.A.J. Nel unpubl.). Density and group size is dependent on food biomass and dispersion (J.A.J. Nel *et al.* unpubl.).

Recorded home range sizes vary across the range of the species. In South Africa, home range size averaged 18.2km², (n=14) in the Giants Castle Game Reserve in the KwaZulu-Natal Drakensberg (Rowe-Rowe 1982). In the more arid south-western Kalahari, ranges were smaller, with adult ranges varying from 2.6–5.2km², (mean 4.3km², n=7) and subadult ranges from 4.0–8.8km², (mean 6.3km², n=4) (Ferguson *et al.* 1983). In Zimbabwe, home ranges were largest in the cold, dry season (ca 1.0km² and 1.3km², n=3 and 6 respectively) and smaller in the hot dry season (ca 0.3km² and 0.6km², n=4) (Loveridge and Macdonald 2001), while in the Rift Valley in Kenya, home ranges varied between 0.7–3.5km², with a mean of 1.8km² (Fuller *et al.* 1989). Interestingly, at Cape Cross Seal Reserve on the Namibian coast, average home range size varied from 7.1–24.9km² (n=4). Here jackals did not defend their ranges and were not territorial (Hiscocks and Perrin 1988), whereas in all other cases ranges were defended and mutually exclusive for pairs.

The black-backed jackal is a very vocal species. A high-pitched, whining howl is used to communicate with group

members and is often used to call the group together in the early evening; this may also function in territorial advertisement (Moehlman 1983; Estes 1991). Howling often stimulates the same behaviour in adjacent territories or in nearby individuals. A three- to five-syllable alarm call, consisting of an explosive yelp followed by a series of shorter high-pitched yelps, is used when disturbed and may be frantic and prolonged when mobbing leopard (*Panthera pardus*). A low-pitched, gruff bark is used to warn pups of intruders near the den, and whines are used to call to pups. Kingdon (1997) notes the use of a 'clattering distress call' and a loud yelp when alarmed. Interestingly, black-backed jackals are much less vocal where they occur alongside the golden jackal, which is the only jackal species heard to howl in East Africa (Kingdon 1977, 1997).

Reproduction and denning behaviour

Mating in this species is accompanied by increased vocalisation and territoriality in both sexes (Bernard and Stuart 1992; Loveridge and Macdonald 2001). The dominant individuals within the territory prevent same sex subordinates from mating by constant harassment. As with other canids, there is a copulatory tie after mating. In southern Africa mating generally occurs from late May to August and, following a gestation period of about 60 days, births occur from around July to October (Stuart 1981; Bernard and Stuart 1992). However, in the KwaZulu-Natal Drakensberg, Rowe-Rowe (1978) recorded a peak in births in July. Bernard and Stuart (1992) suggested that summer births are timed to coincide with the reproductive season of important prey like vlei rat (*Otomys irroratus*) and four-striped grass mouse (*Rhabdomys pumilio*), and winter births with an increase in the availability of ungulate carcasses at the end of winter.

Litter size is typically between one and six, and pups are born in modified termitaria or other convenient burrows, often with multiple entrances. The same den sites may be used from year to year. Pups first emerge from the den at three weeks, are weaned at 8–9 weeks, and are completely independent of the den at 14 weeks (Moehlman 1978).

Alloparental care, where young from previous years may remain within the territory to act as 'helpers', is well documented for this species (Moehlman 1978). Alloparents feed pups by regurgitation and guard them when the parents are foraging. One 'helper' may increase the average number of pups surviving per mated pair from one to three, and two 'helpers' further increases survival to four pups (Moehlman 1979, 1983).

Pups reach sexual maturity at about 11 months (Ferguson *et al.* 1983), and even at this early age they can disperse distances of more than 100km (Bothma 1971c).

Competition

Black-backed jackals compete to a small degree with many small carnivores, but this species' generalist habits

ensure that such competition is rarely intense and food resources are partitioned (Bothma *et al.* 1984). They also compete for carrion with other scavengers, particularly hyaenas, lion and vultures. Wyman (1967) found that this species was much more common than golden jackals at large carnivore kills in the Ngorongoro crater, Tanzania, despite being less numerous in the area, while Estes (1991) notes that black-backed jackals are more likely to attempt to feed on lion and hyaena kills than other jackal species. Competition for resources with side-striped jackals has been recorded in western Zimbabwe. In this case black-backed jackals aggressively displaced side-striped jackals from prime grassland habitat, despite being around 3kg smaller. Indeed, black-backed jackals are reputed to be more aggressive than other species of jackal (Kingdon 1977; Skinner and Smithers 1990; Estes 1991) and Estes (1991) mentions that pups of this species become 'quarrelsome and unsociable' and are more likely to emigrate than golden jackal pups.

Mortality and pathogens

Natural sources of mortality Natural predators include leopard (Turnbull-Kemp 1967; A. Loveridge pers. obs) and spotted hyaena (*Crocuta crocuta*) which may prey on unprotected pups (Van Lawick and van Lawick-Goodall 1970). Estes (1967) observed 11 jackals taken by a leopard over the course of three weeks, and they may be a favourite prey item of leopard in some areas (Kingdon 1977). Interestingly, a golden jackal was seen killing a litter of four black-backed jackal pups (about 5–6 weeks old) while the adults were away hunting (O. Newman and A. Barrett pers. comm.). Other predators include birds of prey; Van Lawick and van Lawick-Goodall (1970) observed a martial eagle (*Polemaetus bellicosus*) fly away carrying a subadult black-backed jackal.

Persecution Snaring and road accidents may be the commonest cause of jackal mortality in areas of high human density.

Hunting and trapping for fur Hunting and trapping for skins occurs in some areas of southern Africa but is not a widespread industry.

Road kills see Persecution.

Pathogens and parasites Black-backed jackals succumb to diseases of domestic dogs, such as babesiosis and distemper (Kingdon 1977; Van Heerden 1980). Jackals are significant vectors of rabies in central southern Africa (Foggin 1988; Bingham and Foggin 1993). In some areas rabies control is undertaken by culling of wildlife, especially jackals, and is thus a major cause of mortality. Recent work suggests that culling is ineffective and rabies is less prevalent in areas where jackal populations are stable,

such as national parks. Oral vaccination is the most effective method of rabies control.

Longevity Haltenorth and Diller (1980) give longevity as 10–12 years in the wild, although Rowe-Rowe (1992) states that few appear to live beyond seven years.

Historical perspective

Black-backed jackal livestock predation resulted in the formation of ‘hunting clubs’ in many farming districts of South Africa in the early to middle part of the last century (Van der Merwe 1954). Despite strenuous control measures (use of dogs, poison, shooting and gassing) this species was never eradicated and continues to occur in these areas today. Jackals appear regularly in African folklore, especially as an allegorical vehicle for greed or cunning.

Conservation status

Threats No major threats, but black-backed jackals are persecuted for their role as livestock killers and as rabies vectors. Population control efforts appear largely ineffective and probably only succeed in producing a temporary reduction in local numbers.

Commercial use There is no significant trade in jackal products, although body parts are used in traditional African medicine.

Occurrence in protected areas

- *Angola*: Iona National park;
- *Botswana*: Kgalagadi Transfrontier Park, Central Kalahari Game Reserve, Moremi Game Reserve, Chobe National Park;
- *Ethiopia*: Awash National Park, Mago National Park, Nechisar National Park, Omo National Park;
- *Kenya*: Masai Mara;
- *Lesotho*: Sehlabathebe National Park;
- *Mozambique*: Gorongosa National Park;
- *Namibia*: Skeleton Coast National Park, Namib-Naukluft National Park, Etosha National Park, Waterberg National Park;
- *Somalia*: unknown;
- *South Africa*: Augrabies Falls National Park; Kgalagadi Transfrontier Park, Karoo National Park, Kruger National Park, Ukahlamba-Drakensberg Park, Hluhluwe-Umfolozi Game Reserve, Suikerbosrand Nature Reserve, Tankwa Karoo National Park, Mountain Zebra National Park, Namaqua National Park;
- *Tanzania*: Serengeti National Park, Selous Nature Reserve;
- *Uganda*: Kidepo National Park, Queen Elizabeth National Park;
- *Zimbabwe*: Hwange National Park.

Protection status CITES – not listed.

Current legal protection Black-backed jackals have no legal protection outside protected areas

Conservation measures taken None.

Occurrence in captivity

Black-backed jackals have been maintained in captivity for use in experiments testing rabies vaccine (Bingham *et al.* 1995).

Current or planned research projects

S. Kaunda (Wildlife Conservation Research Unit, University of Oxford, United Kingdom) is currently undertaking ecological work on this species in Botswana.

S. Gowtage-Sequeira (Zoological Society London, United Kingdom) is studying the transmission of canid pathogens such as rabies and canine distemper between carnivores (black-backed jackals and brown hyaenas) on the Namibian coast.

M.J. Somers (Department of Zoology, University of Transkei, South Africa) is studying the ecology and intraguild relations among small carnivores along the Transkei Wild coast.

Other projects include ongoing monitoring by P. Moehlman in the Serengeti, an ecological study by L. Frank as part of the Laikipia Predator Project in Kenya, investigations into problem-animal control by R. Harrison-White in South Africa, and veterinary-related work by J. Bingham and C. Foggin.

Gaps in knowledge

A large amount of research focusing on the behaviour and ecology of this species has been undertaken, particularly in the last 25 years. In the last decade, however, the emphasis has generally shifted to the role that the animal plays as a vector of rabies, and as a problem animal. The study of Loveridge (1999) may provide a model for future research, whereby funds and efforts are directed towards better understanding their role, for example, in disease transmission and livestock predation, and ecological, behavioural and other data are gathered concurrently. In many settled areas this species, together with the caracal (*Caracal caracal*), represent the top predators in many ecosystems, yet their roles are poorly understood.

Core literature

Ferguson 1980; Lamprecht 1978; Loveridge and Macdonald 2001, 2002; Moehlman 1983, 1987; Rowe-Rowe 1982; Skinner and Smithers 1990.

Reviewers: Patricia D. Moehlman, J. du P. Bothma.

Editors: Michael Hoffmann, Claudio Sillero-Zubiri.

6.4 Ethiopian wolf

Canis simensis Rüppell, 1835

Endangered – EN: C2a(i), D (2004)

C. Sillero-Zubiri and J. Marino

Other names

English: Simien fox, Simien jackal; **French:** loup d'Abyssinie; **German:** Aethiopienfuchs; **Italian:** volpe rossa; **Spanish:** lobo Etiope; **Indigenous names:** Amharic: ky kebero; Oromo: jedalla farda (Ethiopia).

Taxonomy

Canis simensis Rüppell, 1835. Neue Wirbelt. Fauna Abyssin. Gehörig. Säugeth., 1:39, pl. 14. Type locality: "...in den Bergen von Simen..." [Ethiopia, mountains of Simen, c. 13°15'N, 38°00'E].

Gray (1868) placed this species in a separate genus *Simenia*. Clutton-Brock *et al.* (1976) noted that *C. simensis* is the most distinct species in the genus *Canis*, and suggested close affinity with the side-striped jackal (*C. adustus*) and *Dusicyon* spp. The Ethiopian wolf has also been called the Simien or Simenian fox, but is not closely linked to the *Vulpes* group (Clutton-Brock *et al.* 1976), and Simien or Ethiopian jackal, suggesting a close relationship with jackals (Rook and Azzaroli-Puccetti 1997). Other vernacular names used include Abyssinian wolf and red fox, denoting the difficulty faced by naturalists in cataloguing this species correctly.

Phylogenetic analysis using mitochondrial DNA sequencing suggested that *C. simensis* is more closely related to the grey wolf (*C. lupus*) and the coyote (*C. latrans*) than to any African canid (Gottelli *et al.* 1994), and that the species may have evolved from a grey wolf-like ancestor crossing to northern Africa from Eurasia as recently as 100,000 years ago (Gottelli *et al.* 2004). There

are fossils of wolf-like canids from the late Pleistocene in Eurasia (Kurtén 1968), but unfortunately no fossil record of *C. simensis*.

Microsatellite and mitochondrial DNA variability in *C. simensis* was small relative to other canid species (Gottelli *et al.* 1994, 2004), suggesting small population sizes may have characterised its recent evolution.

Chromosome number not known.

Description

A medium-sized canid with a reddish coat, distinctive white markings, long legs and an elongated muzzle, resembling a coyote in conformation and size. Males are significantly larger (20%) than females in terms of body mass (Table 6.4.1). The face, ears and upper parts of the muzzle are red. Ears broad, pointed, and directed forward; the pinnae are thickly fringed with long white hairs growing inward from the edge. Palate, gums, and naked borders of the lips entirely black. Characteristic facial markings include a white ascending crescent below the eyes, and a small white spot on the cheeks. The throat, chest, and

Table 6.4.1. Body measurements of the Ethiopian wolf from Bale Mountains (Sillero-Zubiri and Gottelli 1994).

HB male	963mm (928–1012) n=18
HB female	919mm (841–960) n=8
T male	311mm (290–396) n=18
T female	287mm (270–297) n=8
HF male	199mm (193–209) n=18
HF female	187mm (178–198) n=8
E male	108mm (100–119) n=18
E female	104mm (95–110) n=8
WT male	16.2kg (14.2–19.3) n=18
WT female	12.8kg (11.2–14.2) n=8



Ethiopian wolf, Bale Mountains National Park, Ethiopia, 1999.

Claudio Sillero-Zubiri

underparts are white, the ventral part of the neck with a distinctive white band. Pelage is soft and short, ochre to rusty red, with a dense whitish to pale ginger underfur. Boundary between the red coat and the white markings is sharp and well defined. The contrast of white markings against the red coat increases with age and social rank in both sexes; the female's coat is generally paler than the male's. The long, slender legs are reddish outside, with inner aspect white. Front feet have five toes, hind feet with four. The area around the anus is white. There is a short rufous-coloured stripe down the back of the tail, becoming a black stripe leading to a thick brush of black-tipped guard hairs.

The skull is very flat in profile, with only a shallow angle between frontals and nasals. The neuro-cranium is low and narrow, thick, and almost cylindrical. Its width is 30% of the total skull length. Facial length is 58% of the total skull length. The inter-parietal crest is slightly developed, and the coronal ridge is linear. Teeth small and widely spaced, especially the premolars. The dental formula is $3/3-1/1-4/4-2/3=42$; $m3$ occasionally absent. Sharply pointed canines average 19mm in length (14–22mm); carnassials ($P4$ and $m1$) are relatively small (Sillero-Zubiri and Gottelli 1994).

Subspecies Coetzee (1977) recognised two subspecies:

- *C. s. simensis* (north-west of the Rift Valley). Nasal bones consistently shorter than those from the southern race (Yalden *et al.* 1980).
- *C. s. citernii* (south-east of the Rift Valley). Redder coat.

A recent study identified differences in the cranio-morphology of wolves on both sides of the Rift Valley (Dalton 2001), but mtDNA analysis from a larger sample of individuals do not support the subspecies criteria of reciprocal monophyly of the northern and southern clades (Gottelli *et al.* 2004).

Similar species Golden jackal (*Canis aureus*): smaller in size, relatively shorter legs, and lack the distinctive reddish coat, white underparts, and throat, chest, and tail markings.

Distribution

Endemic to the Ethiopian highlands, above the tree line at about 3,200m (Figure 6.4.1).

Historical distribution There are no recent records of the species at altitudes below 3,000m, although specimens were collected at 2,500m from Gojjam and north-western Shoa at the beginning of the century (references in Yalden *et al.* 1980). Reported in the Simien Mountains since the species was first described in 1835, but scattered and irregular sightings suggest numbers have been declining. Reported on the Gojjam plateau until early this century (Powell-Cotton 1902; Maydon 1932). South of the Rift

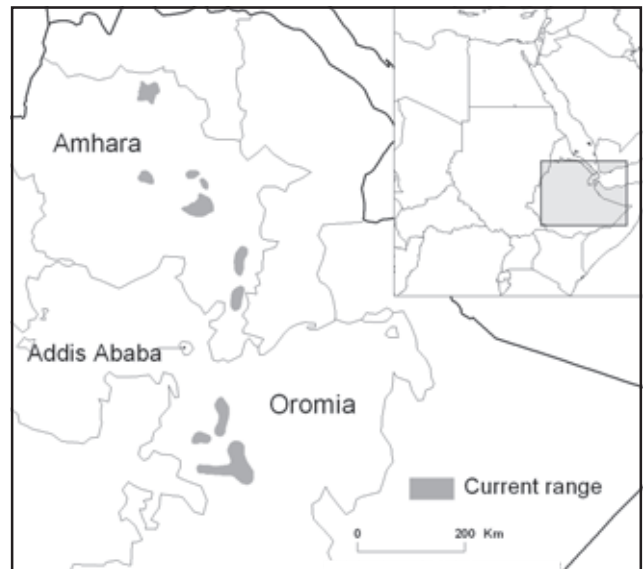


Figure 6.4.1. Current distribution of the Ethiopian wolf.

Valley, wolves have been reported in the Arsi Mountains since the turn of the century, and, more recently (1959), in the Bale Mountains. Reports of small populations in North Sidamo (Haltenorth and Diller 1980) may be in error. There is no evidence that the Ethiopian wolf ever occurred in Eritrea (Coetzee 1977).

Current distribution Confined to seven isolated mountain ranges of the Ethiopian highlands, at altitudes of 3,000–4,500m (Gottelli and Sillero-Zubiri 1992; Marino 2003). In the northern highlands wolves are restricted to land above 3,500–3,800m by increasing agricultural pressure (Yalden *et al.* 1980; Marino 2003). Wolf populations occur north of the Rift Valley in the Simien Mountains, Mount Guna, North Wollo and South Wollo highlands, and Menz. Recently extinct in Gosh Meda (North Shoa), and absent from Mt Choke, Gojjam, for a few decades. South-east of the Rift Valley there are populations in the Arsi Mountains (Mt Kaka, Mt Chilalo and Galama range) and in the Bale Mountains, including the Somkaru-Korduro range (Marino 2003).

Range countries: Ethiopia (Marino 2003).

Relative abundance

More than half of the species' population live in the Bale Mountains, where wolf density is high for a social carnivore of its size, and is positively correlated with density of rodent prey and negatively with vegetation height (Sillero-Zubiri and Gottelli 1995a). Highest wolf densities are found in short Afroalpine herbaceous communities (1.0–1.2 adults/km²); lower densities are found in *Helichrysum* dwarf-scrub (0.2/km²), and in ericaceous heathlands and barren peaks (0.1/km²). Wolves are also present at low

density (0.1–0.2/km²) in montane grasslands at lower altitudes.

Elsewhere, overall density is relatively lower. In Menz, wolf density was estimated at 0.2 animals per km² using transect data (Ashenafi 2001). Comparison of census transect data from recent comprehensive surveys (Marino 2003) indicates comparatively higher abundance in North Wollo (0.20 ± 0.20 sightings per km), intermediate in Arsi and Guna (0.10 ± 0.11 and 0.10 ± 0.14, respectively), and lower in South Wollo and Simien (0.08 ± 0.13 and 0.06 ± 0.11, respectively). These results were supported by counts of wolf signs (diggings and droppings) and interview results.

Estimated populations/relative abundance and population trends The most reliable population estimates are those from Bale and Menz where research has been more intense (Table 6.4.2.). The size of the populations in other mountain ranges was derived from field maps of current habitat distribution and extrapolations of wolf densities to the areas of ‘optimal’ and ‘good’ habitat in each isolated range (Marino 2003).

Table 6.4.2. The status of Ethiopian wolves in various montane regions of Ethiopia (Trend: I=increasing, S=stable, D=declining, Ex=extinct, ?=unknown).		
Region	Population/Abundance	Trend
Simien	40–54	D
Guna	7–10	?
North Wollo	19–23	I
South Wollo	16–19	D
Gojjam	–	Ex
Menz	17–23	S
Gosh Meda	–	Ex
Arsi	93–108	S-D
Bale	250	I

Time series of count data from the Bale Mountains, spanning over 17 years, evidenced marked variation in wolf abundance in association with disease epizootics that affected high-density populations in the early 1990s (Marino 2004). Population numbers returned to previous levels revealing resilience to catastrophes, but at the lower extreme of densities the population rate of increase was inversely density-dependent; delays in the formation of new breeding units appeared to limit the capacity for immediate recovery (Marino 2004).

Habitat

A very localised endemic species, confined to isolated pockets of Afroalpine grasslands and heathlands where they prey on Afroalpine rodents. Suitable habitats extend from above the tree-line at about 3,200m up to 4,500m, with some wolves present in montane grasslands at 3,000m. However, subsistence agriculture extends up to 3,500–

3,800m in many areas, restricting wolves to higher ranges (Marino 2003). Rainfall at high altitude varies between 1,000 and 2,000mm/year, with one pronounced dry period from December to February/March.

Wolves utilise all Afroalpine habitats, but prefer open areas with short herbaceous and grassland communities where rodents are most abundant, along flat or gently sloping areas with deep soils and poor drainage in parts. Prime habitats in the Bale Mountains are characterised by short herbs (*Alchemilla* spp.) and grasses and low vegetation cover, a community maintained in continuous succession as a result of molerat (*Tachyoryctes macrocephalus*) burrowing activity. Other good habitats include tussock grasslands (*Festuca* spp., *Agrostis* spp.), high-altitude scrubs dominated by *Helichrysum* spp. and short grasslands in shallow soils. In northern parts of the range, plant communities characterised by a matrix of ‘guassa’ tussock grasses (*Festuca* spp.), ‘cherenfi’ bushes (*Euryops pinifolius*) and giant lobelias (*Lobelia rhynchopetalum*) sustain high rodent abundance and are preferred by wolves. Ericaceous moorlands (*Erica* and *Phyllipia* spp.) at 3,200–3,600m are of marginal value, with open moorlands having patches of herbs and grasses which are relatively good habitat.

Food and foraging behaviour

Food Ethiopian wolves feed almost exclusively upon diurnal rodents of the high-altitude Afroalpine grassland community. In the Bale Mountains, diurnal rodents accounted for 96% of all prey occurrences in faeces, with 87% belonging to three Bale endemic species, the giant molerat (300–930g), Blick’s grass rat (*Arvicanthis blicki*), and the black-clawed brush-furred rat (*Lophuromys melanonyx*) (Sillero-Zubiri and Gottelli 1995b). Other prey species include typical vlei rat (*Otomys typus*), yellow-spotted brush-furred rat (*Lophuromys flavopunctatus*), Starck’s hare (*Lepus starcki*), and goslings and eggs. Occasionally, wolves were observed feeding on rock hyrax (*Procavia capensis*), and young of common duiker (*Sylvicapra grimmia*), reedbeak (*Redunca redunca*) and mountain nyala (*Tragelaphus buxtoni*) (Sillero-Zubiri and Gottelli 1995b; Malcolm 1997; C. Sillero-Zubiri pers. obs.). Leaves of sedge (*Carex monostachya*) are occasionally ingested, probably to assist digestion or control parasites.

Where the giant molerat is absent, it is replaced in the wolf diet by the smaller East African molerat, *Tachyoryctes splendens* (i.e., Gaysay montane grassland in Bale – Malcolm 1997, and Menz – Ashenafi 2001). Similarly, in northern Ethiopia *Arvicanthis abyssinicus* and *Lophuromys flavopunctatus* replace their respective endemic relatives from Bale *A. blicki* and *L. melanonyx*. Elsewhere, *O. typus*, a rare prey item in Bale and Menz, was identified as the commonest prey in droppings collected in other five populations (Marino 2004). This study confirmed that

wolves are specialised hunters of diurnal rodents all throughout their distribution, with some degree of dietary variation along climatic-induced gradients.

Foraging behaviour Although the Ethiopian wolf is a pre-eminent, solitary rodent hunter it is also a facultative, cooperative hunter. Occasionally, small packs have been seen chasing young antelopes, lambs, and hares and making a kill. Ethiopian wolves will take carrion or feed on carcasses; in fact, a sheep carcass is the most successful bait for attracting wolves (C. Sillero-Zubiri pers. obs.). The local name '*jedalla farda*' – the horse's jackal – refers to the wolves' habit of following mares and cows about to give birth so they can eat the afterbirth. In areas of grazing in Bale, wolves were often seen foraging among herds of cattle, a tactic that may aid in ambushing rodents out of their holes, by using the herd as a mobile hide.

In Bale, wolves are mostly diurnal. Peaks of foraging activity suggest that they synchronise their activity with that of rodents above the ground (Sillero-Zubiri *et al.* 1995). There is little nocturnal activity, with wolves seldom moving far from their evening resting site. They may become more crepuscular and nocturnal where human interference is severe (e.g., Simien: Brown 1964; Somkaro and Kaka Mountains: C. Sillero-Zubiri pers. obs.).

Rich food patches are carefully explored by wolves, which walk slowly, pausing frequently to investigate holes or to localise the rodents by means of their excellent hearing. Once the prey is located, the wolf moves stealthily towards it, taking short steps, and freezing, sometimes with its belly pressed flat to the ground. The quarry is grabbed with the mouth after a short dash. A stalk can last from seconds to up to one hour, especially in the case of a giant molerat. Occasionally, wolves run in zig-zags across rat colonies picking up the rodents in passing. Digging prey out is common and is the most favoured technique to catch giant molerats, with the effort expended varying from a few scratches at a rat hole to the total destruction of a set of burrows leaving mounds of earth one metre high. Sometimes, digging serves to reach a nest of grass rats. Kills are often cached and later retrieved.

Damage to livestock or game Until recently, wolves in Bale were unmolested by humans and did not appear to be regarded as a threat to sheep and goats, which are sometimes left unattended during the day (Gottelli and Sillero-Zubiri 1992). Only two instances of predation upon lambs were recorded during 1,800 hours of observation (Sillero-Zubiri and Gottelli 1994). Losses to wolves in the southern highlands were dismissed by herders as unimportant when compared to damage by spotted hyaenas (*Crocuta crocuta*) or jackals. Elsewhere, wolves have been persecuted in the past due to their reputation as predators of sheep and goats. Livestock predation is reported as important in some heavily populated areas of

Wollo and Simien (Marino 2003) but livestock remains were uncommon in droppings collected from across the highlands (Marino 2004).

Adaptations

The legs are strikingly long and slender, seemingly suitable for coursing in open country. The muzzle is long, and the small, well-spaced teeth suggest morphological adaptation to feeding on rodents. They have an unusually good sense of smell, and bolt more readily at the scent rather than the sight of man.

The guard hairs are short and the underfur is thick, providing protection at temperatures as low as -15°C. Ethiopian wolves do not use dens to rest at night, and during the breeding season only pups and nursing females use the den. Wolves sleep in the open, alone or in groups, curled up, with nose beneath the tail. Several animals may sleep close together. During the cold nights in the dry season, a 'bed' is carefully prepared from a pile of vegetation debris, the product of giant molerat activity. During the day they take frequent naps, usually resting on their sides. Occasionally, they seek shelter from the rain under overhanging rocks and behind boulders.

Social behaviour

Ethiopian wolves live in packs, discrete and cohesive social units that share and defend an exclusive territory. Packs of 3–13 adults (mean=6) congregate for social greetings and border patrols at dawn, noon and evenings, and rest together at night, but break up to forage individually in the morning and early afternoon (Sillero-Zubiri and Gottelli 1995a).

Annual home ranges of eight packs monitored for four years averaged 6.0 km², with some overlap in home ranges. Home ranges in an area of lower prey biomass averaged 13.4 km² (n=4) (Sillero-Zubiri and Gottelli 1995a). Overlap and aggressive encounters between packs were highest during the mating season. Dispersal movements are tightly constrained by the scarcity of suitable habitat. Males do not disperse and are recruited into multi-male philopatric packs; some females disperse at two years of age and become 'floaters', occupying narrow ranges between pack territories until a breeding vacancy becomes available (Sillero-Zubiri *et al.* 1996a). Breeding females are typically replaced after death by a resident daughter. Pack adult sex ratio is biased toward males 1.8:1 (n=59), with small family groups closer to 1:1 (Sillero-Zubiri and Gottelli 1995a).

Scent marking of territory boundaries, via urine posts, scratching, and faeces (deposited on conspicuous sites like mounds, rocks and bushes), and vocalisations, are common and function in advertising and maintaining territories (Sillero-Zubiri and Macdonald 1998). All pack members, independent of social rank, regularly scent-mark objects along territory boundaries with raised-leg urinations and

scratches. Aggressive interactions with neighbouring packs are common, highly vocal and always end with the smaller group fleeing from the larger (Sillero-Zubiri and Macdonald 1998).

Calls can be grouped into two categories: alarm calls, given at the scent or sight of man, dogs, or unfamiliar wolves; and greeting calls, given at the reunion of pack members and to advertise pack size, composition and position (Sillero-Zubiri and Gottelli 1994). Alarm calls start with a 'huff' (rapid expulsion of air through mouth and nose), followed by a quick succession of high-pitched 'yelps' (a series of 4–5 'yeahp-yeahp-yeahp-yeahp') and 'barks'. 'Yelps' and 'barks' can also be given as contact calls, and often attract nearby pack mates. Greeting calls include a 'growl' of threat, a high-frequency 'whine' of submission, and intense 'group yip-howls'. A lone howl and a group howl are long-distance calls used to contact separate pack members and can be heard up to 5km away. Howling by one pack of wolves may stimulate howling in adjacent packs. Communal calls muster pack members before a border patrol.

Reproduction and denning behaviour

The only detailed information available on the reproductive habits of these animals comes from four years of observations of nine wild packs in the Bale Mountains (Sillero-Zubiri 1994; Sillero-Zubiri *et al.* 2004).

Pre-copulatory behaviour by the dominant female includes an increase in the scent-marking rate, play soliciting, food-begging towards the dominant male, and agonistic behaviour towards subordinate females. The receptive period is synchronised in sympatric females to less than two weeks (Sillero-Zubiri *et al.* 1998). Courtship may take place between adult members of a pack or with members of neighbouring packs. After a brief courtship, which primarily involves the dominant male permanently accompanying the female, wolves copulate over a period of three to five days. Copulation involves a copulatory tie lasting up to 15 minutes. Other males may stand by a tied pair with no signs of aggression. Mate preference is shown, with the female discouraging attempts from all but the pack's dominant male, by either defensive snarls or moving away; the female is receptive to any visiting male from neighbouring packs. Sillero-Zubiri *et al.* (1996a) found that up to 70% of matings (n=30) involved males from outside the pack.

The dominant female of each pack gives birth once a year between October and January (Sillero-Zubiri *et al.* 1998). Only about 60% of females breed successfully each year. During breeding and pregnancy, the female coat turns pale yellow and becomes woolly, and the tail turns brownish, and loses much of its hair. Gestation lasts 60–62 days (based on the time from last day of mating to parturition). Pups are born in a den dug by the female in open ground, under a boulder or inside a rocky crevice.

Neonates are born with their eyes closed and the natal coat is charcoal grey with a buff patch in chest and inguinal regions. Two to seven pups emerge from the den after three weeks. At this time, the dark natal coat begins to be replaced by the pelage typical of the species. Pups are regularly moved between dens, up to 1,300m apart. In eight out of 18 natal dens watched, a subordinate female assisted the mother in suckling the pups. At least 50% of extra nursing females showed signs of pregnancy and may have lost or deserted their own offspring before joining the dominant female's den (Sillero-Zubiri 1994; Sillero-Zubiri *et al.* 2004). Five and six placental scars were counted in the uteri of two females.

Development of the young comprises three stages: (1) early nesting (week 1 to week 4), when the young are entirely dependent on milk; (2) mixed nutritional dependency (week 5 to week 10), when milk is supplemented by solid foods regurgitated by all pack members until pups are completely weaned; and (3) post-weaning dependency (week 10 to six months), when the pups subsist almost entirely on solid foods supplied by helpers. Adults have been observed providing food to juveniles up to one year old. Juveniles will join adults in patrols as early as six months of age, but will not urinate with a raised leg posture until 11 months, if male, or 18 months, if female. Yearlings attain 80–90% of adult body mass, and full adult appearance is reached at two years. Both sexes become sexually mature during their second year.

Competition

The high densities and diversity of raptors (12 recorded species in Bale), many of which have been observed to feed on small mammals, are likely to pose the greatest competitive threat to the wolves (although they tend to clepto-parasitise eagles's kills—Sillero-Zubiri and Gottelli 1995a). In addition, free-ranging domestic dogs, golden jackals and servals (*Leptailurus serval*) may also feed upon the same prey species. There is interference competition with domestic dogs and spotted hyaenas (*Crocuta crocuta*) that will actively chase away wolves from large carcasses. Honey badgers (*Mellivora capensis*) are also possible competitors for food and burrows (Sillero-Zubiri 1996).

Mortality and pathogens

Natural sources of mortality There are no known predators, but unattended young might be taken by spotted hyaenas or the Verreaux eagle (*Aquila verreauxi*). Attacks of the tawny eagle (*Aquila rapax*) directed at small pups result in swift defence by guarding adults. Other causes of mortality include starvation of juveniles between weaning and one year of age. The sex ratio (see above) indicates that female mortality is higher than that of males. This is most likely associated with their dispersal as subadults.

Persecution During periods of political instability in the recent past, guns were more available and killings more frequent. In many regions, people living close to wolves believe numbers are recovering through successive years of good breeding and less persecution. The degree of conflict due to predation determines the negative attitude to wolves in some regions where persecution may persist (Marino 2003).

Hunting and trapping for fur There are no reports of exploitation for furs, although some opportunistic use may occur. For instance, in parts of Wollo wolf skins were seen used as saddle pads (C. Sillero-Zubiri pers. obs.). In the past, sport hunters occasionally killed wolves, but no hunting is currently permitted.

Road kills On the Sanetti Plateau in Bale, an all-weather road runs across 40km of prime wolf habitat and is used on average by 26 vehicles (mostly trucks) every day. At least four wolves have been killed by vehicles since 1988 (C. Sillero-Zubiri pers. obs.). Two other animals have been shot from the road and another two were left with permanent limps from collisions with vehicles. Similar accidents may occur on other roads across wolf habitat such as the Mehal Meda road in Menz, and the road to Ticho in Arsi.

Pathogens and parasites Rabies is the most dangerous and widespread disease to affect Ethiopian wolves, and is the main cause of mortality in Bale (Sillero-Zubiri *et al.* 1996b). The disease killed whole wolf packs in 1990 and 1991 and accounted for a major population decline with losses of up to 75% (Sillero-Zubiri *et al.* 1996b; Laurenson *et al.* 1998). A rabies epizootic was reported in late 2003 and has accounted for similar mortality levels, although the full impact of it has yet to be assessed fully (S. Williams pers. comm.). In other regions, rabies cases have been reported in domestic dogs, livestock, people and one Ethiopian wolf (Sillero-Zubiri *et al.* 2000; Marino 2003). The level of rabies awareness amongst people, and the frequency of the reports, suggests high incidence across the highlands.

In Bale dogs travel regularly with their owners in and out of wolf range, and are in contact with many other dogs which are attracted to garbage and carrion in villages, and they may provide the vehicle for pathogens such as rabies or distemper to reach their wild relatives (Laurenson *et al.* 1998). The risk of transmission, however, will depend on the probability of contact between wolves and dogs, which varies with grazing regimes in high-altitude pastures, dog husbandry and the spatial distribution of wolf habitat in relationship to settlements. Long-term population monitoring data from Bale, indicated that high wolf densities may be the most important factor in determining the vulnerability of a local population to epizootics,

independently of the abundances of sympatric dogs, people and livestock within the wolf range (Marino 2004). A population viability model indicates that disease-induced population fluctuations and extinction risks can be markedly reduced with the vaccination against rabies of a relatively small proportion of wolves (Haydon *et al.* 2002).

Ethiopian wolves are exceptionally free of ectoparasites, perhaps because of the cold mountain climate; none were found on any of 67 animals handled. Nematodes and trematodes were present in faeces and in the gut of several carcasses, one of which was identified as *Taenia pisiformis* (M. Anwar pers. comm.).

Longevity In the wild 8–10 years; one known male in Bale lived 12 years (C. Sillero-Zubiri pers. obs.).

Historical perspective

There is little evidence of wolves playing a significant role in Ethiopian culture, and they seldom feature in folklore. Nonetheless, the wolf has been recognised by Ethiopian people, with the earliest mention in literature dating back to the 13th century (Sillero-Zubiri and Macdonald 1997). More recently, the government has used the wolf as a national symbol, and it has featured in two stamp series. No known traditional uses, although wolf livers may be used as a medicament in north Ethiopia (Staheli 1975, in Sillero-Zubiri and Macdonald 1997).

The Bale Mountains National Park was established in 1970 partly on the recommendation of British naturalist Leslie Brown to protect Ethiopian wolves (Brown 1964).

Conservation status

The species is more restricted now than in the past (Yalden *et al.* 1980). With probably only 500 individuals surviving, this distinctive carnivore is considered the rarest canid in the world and one of the rarest African carnivores. Recent exhaustive surveys, however, have confirmed the persistence of seven isolated populations, two previously undescribed (Marino 2003).

Threats Continuous loss of habitat due to high-altitude subsistence agriculture represents the major threat. Sixty percent of all land above 3,200m has been converted into farmland, and all populations below 3,700m are particularly vulnerable to further habitat loss, especially if the areas are small and of relatively flat relief (Marino 2003). Habitat loss is exacerbated by overgrazing of highland pastures by domestic livestock, and in some areas habitat is threatened by proposed development of commercial sheep farms and roads. Human persecution triggered by political instability in the past is currently less severe and is associated with conflicts over livestock losses (Marino 2003). Recent population decline in Bale is mostly due to disease epizootics, with road kills and

shooting as secondary threats. Rabies is a potential threat to all populations. Most of these threats are exacerbated by the wolves' specialisation to life in the Afroalpine ecosystem.

In Bale the Ethiopian wolf hybridises with domestic dogs. Gottelli *et al.* (1994) used mitochondrial DNA restriction fragments and micro-satellite alleles to conclude that hybridisation was relatively common in western Bale as a result of crosses between female wolves and male domestic dogs. Hybrids have shorter muzzles, heavier-built bodies and different coat patterns. Although hybrids are confined to the Web Valley in western Bale they may threaten the genetic integrity of the wolf population. Following hybridisation, a population may be affected by outbreeding depression or reduction in fitness, although to date this does not seem to have taken place in Bale. To date there is no indication of hybridisation taking place outside western Bale.

Commercial use There is no exploitation for furs or other purposes.

Occurrence in protected areas Simien Mountains National Park; Bale Mountains National Park; Hunting blocks in Arsi; Denkoro State Forest in South Wollo; Guassa Community Management in North Shoa.

Protection status CITES – not listed.

Current legal protection Full official protection under Ethiopia's Wildlife Conservation Regulations of 1974, Schedule VI. Killing a wolf carries a sentence of up to two years.

Conservation measures taken A number of important steps have been taken in the interests of conserving this endemic species, including: 1) a dog vaccination campaign in Bale, currently extended to Wollo; 2) sterilisation programme for domestic dogs and hybrids in Bale; 3) vaccination of wolves in parts of Bale affected by rabies; 4) community and school education programme in Bale and Wollo; 5) strengthening the capacity of the Bale Mountains National Park – funding patrolling, maintenance of infrastructure, etc.; 6) surveys to determine the persistence and status of all populations of wolves; 7) monitoring of all wolf populations; 8) Ethiopian Wolf Conservation Strategy Workshop, Bale Mountains, November 1999, with representatives of national, regional and local governments and international scientists (Sillero-Zubiri *et al.* 2000); and 9) establishment of the Ethiopian Wolf Conservation Committee within Ethiopia as a national steering committee for dealing with conservation issues.

In 1983, the Wildlife Conservation Society set up the Bale Mountains Research Project, which publicised the wolf's plight and started a regular monitoring programme

for the species. A detailed four-year field study followed (Sillero-Zubiri 1994). Based on its findings, the IUCN Canid Specialist Group produced an action plan for the Ethiopian wolf (Sillero-Zubiri and Macdonald 1997), providing a detailed strategy for the conservation and management of remaining wolf populations. This plan advocated immediate action on three fronts – education, wolf population monitoring, and rabies control in domestic dogs – to conserve the Afroalpine ecosystem and its top predator. As a result, the Ethiopian Wolf Conservation Programme (EWCP) was established in 1995 by Oxford University with support from the Born Free Foundation, UK. Its overall aim is to protect the Afroalpine ecosystem and many of its rare highland endemic plants and animals through better management in Bale and the establishment of other conservation areas in Menz and Wollo. The EWCP currently monitors the demography of Bale and selected populations in South and North Wollo, supports park patrols within the wolf range, undertakes domestic dog control and the removal of dog-wolf hybrids. Additionally, the EWCP carries out a community conservation education campaign that targets people living inside the wolf's range and is aimed at improving dog husbandry and combating disease in the park and surroundings. A large-scale dog vaccination programme (targeting up to 3,000 dogs a year) seeks to reduce the occurrence of rabies and distemper within the Ethiopian wolf range and is backed up by further epidemiological and demographic studies. The EWCP is also active elsewhere in Ethiopia, with representatives surveying and monitoring all wolf ranges and implementing education campaigns about the plight of the species. Zelealem Tefera Ashenafi set up the Guassa Biodiversity Project in 1996, looking at the relationships between pastoralists and wildlife in the highlands of Menz.

Occurrence in captivity

There are no animals in captivity. Recent attempts to establish captive populations were abandoned due to lack of permission from the Ethiopian government.

Current or planned research projects

S. Williams (Wildlife Conservation Research Unit, University of Oxford, UK) and Ethiopian Wolf Conservation Programme staff currently monitor the demography of the Bale and Wollo populations. Data collected include pack demographic structures, home ranges and pup survival.

J. Marino (Wildlife Conservation Research Unit, University of Oxford, UK) is studying the effect of habitat heterogeneity and fragmentation on the ecology of Ethiopian wolves at various spatial scales and levels of organisation.

L. Tallents and D. Randall (Wildlife Conservation Research Unit, University of Oxford, UK) have begun

graduate studies on foraging ecology and reproductive strategies.

K. Laurenson and D. Knobel (Centre for Tropical Veterinary Medicine, University of Edinburgh, UK) are testing a combination of vaccination trial and field techniques to investigate the dynamics of canid pathogens, particularly rabies, in domestic and wild carnivore species.

Anteneh Shimelis and Ermias A. Beyene (Addis Ababa University), S. Williams (Wildlife Conservation Research Unit, University of Oxford), S. Thirgood (Frankfurt Zoological Society, Tanzania) are studying predator-prey interactions in Bale, assessing whether rodent populations are regulated by competition (with domestic livestock) or by predation (by wolves and raptors).

Gaps in knowledge

Although the behavioural ecology of the species is well known, this has been focused in the optimal habitats in the Bale Mountains. Additional information on dispersal distance and survival would be useful. Investigation into the role of the species in the epidemiology of canid-related diseases is necessary. Studies on wolf-prey relationships and prey availability in the high risk populations of northern Ethiopia are also urgently needed.

Core literature

Gottelli and Sillero-Zubiri 1992; Gottelli *et al.* 1994, 2004; Haydon *et al.* 2002; Laurenson *et al.* 1998; Marino 2003, 2004; Sillero-Zubiri 1994; Sillero-Zubiri and Gottelli 1994, 1995a,b; Sillero-Zubiri *et al.* 1996a,b, 2000, 2004a; Sillero-Zubiri and Macdonald 1997.

Reviewers: Neville Ash, M. Karen Laurenson, James R. Malcolm, Zelealem Tefera Ashenafi, Stuart Williams.
Editor: Michael Hoffmann.

6.5 African wild dog

***Lycaon pictus* (Temminck, 1820)**

Endangered – EN: C2a(i) (2004)

R. Woodroffe, J.W. McNutt and M.G.L. Mills

Other names

English: Cape hunting dog, painted hunting dog; **French:** lycaon, cynhyène, loup-peint; **Italian:** licaone; **German:** hyänenhund; **Spanish:** licaon; **Indigenous names:** Afrikaans: wildehond (Namibia, South Africa); Amharic: takula (Ethiopia); Ateso: apeete; isiNdebele: iganyana iketsi leKapa (South Africa); isiXhosa: ixhwili (South Africa); isiZulu: inkentshane (South Africa); Kalenjin: suyo (Kenya); Kibena: liduma; Kibungu: eminze; Kichagga: kite kya nigereni; Kihehe: ligwami; Kijita: omusege; Kikamba: nzui; Kikukuyu: muthige; Kikuyu: muthige

(Kenya); Limeru: mbawa; Kiliangulu: eeyeyi; Kimarangoli: imbwa; Kinyaturu: mbughi; Kinyiha: inpumpi; Kinyiramba: mulula; Kisukuma: mhuge; Kiswahili: mbwa mwitu; Kitaita: Kikwau; Kizigua: mauzi; Lozi: liakanyani; Luo: sudhe, prude; Maasai: osuyiani (Kenya, Tanzania); Mandingue: juruto (Mali, Senegal); Nama and Damara: !Gaub (Namibia); Samburu: Suyian (Kenya); Sebei: kulwe, suyondet; Sepedi: lehlalerwa, letaya (South Africa); Sesotho: lekanyane, mokoto, tlaierwa (Lesotho, South Africa); Setswana: leteane, letlhalerwa, lekanyana (Botswana, South Africa); Shona: mhumhi (Zimbabwe); siSwati: budzatja, inkentjane (Swaziland, South Africa); Tshivenda: dalerwa; Woloof and Pulaar: saafandu (Senegal); Xitsonga: hlolwa (Mozambique, South Africa); Yei: umenzi (Botswana).

Taxonomy

Hyaena picta Temminck, 1820. Ann. Gen. Sci. Phys. 3: 54. Type locality: “à la côte de Mosambique” [coastal Mozambique].

The genus *Lycaon* is monotypic and was formerly placed in its own subfamily, the Simoncyoninae. While this subfamily division is no longer recognised (Wozencraft 1989), recent molecular studies have supported the separation of this species in its own genus (Girman *et al.* 1993). Wild dogs have been grouped with dhole (*Cuon alpinus*) and bush dogs (*Speothos venaticus*), but morphological similarities among these species are no longer considered to indicate common ancestry, and they are now considered close to the base of the wolf-like canids (Girman *et al.* 1993).

Genetic and morphological studies carried out by Girman *et al.* (1993) initially suggested the existence of separate subspecies in eastern and southern Africa. However, no geographical boundaries separated these proposed subspecies, and dogs sampled from the intermediate area showed a mixture of southern and eastern haplotypes, indication of a cline rather than distinct subspecies (Girman and Wayne 1997).

Chromosome number: 2n = 78 (Chiarelli 1975).

Description

A large, but lightly built canid, with long, slim legs and large, rounded ears (Table 6.5.1). The coloration of the pelage is distinctive but highly variable, with a combination of irregular black, yellow-brown and white blotches on the back, sides, and legs. Wild dogs in north-east Africa tend to be predominantly black with small white and yellow patches, while dogs in southern Africa are more brightly coloured with a mix of brown, black and white. Each animal's pelage coloration is unique, and this can be used to identify individual animals. Coloration of the head and tail is more consistent: almost all dogs have a yellow-brown head with a black ‘mask’, black ears, and a black line following the sagittal crest, and a white tip to

Table 6.5.1. Body measurements for the African wild dog.

	Kruger National Park, South Africa (M.G.L. Mills unpubl.).	Laikipia and Samburu Districts, Kenya (R. Woodroffe unpubl.).
HB male	1,229mm (1,060–1,385) n=16	962mm (845–1,068) n=5
HB female	1,265mm (1,090–1,410) n=15	990mm (930–1,045) n=4
T male	354mm (320–420) n=15	345mm (328–380) n=5
T female	326mm (310–370) n=13	328mm (320–333) n=4
HF male	250mm (230–260) n=13	245mm (225–318) n=5
HF female	241mm (230–250) n=14	224mm (215–229) n=3
E male	135mm (125–148) n=15	128mm (110–145) n=5
E female	130mm (125–135) n=15	129mm (120–136) n=4
WT male	28.0kg (25.5–34.5) n=12	21.0kg, n=1
WT female	24.0kg (19.0–26.5) n=12	18.0kg, n=1

the tail. The length of the pelage varies regionally, but hair is generally very short on the limbs and body but longer on the neck, sometimes giving a shaggy appearance at the throat. There are four digits on each foot, all with claws; and in most individuals, the pads of the second and third toes are partially fused. Females have six to eight pairs of mammae. Males are slightly heavier than

females, and are easily recognised by the conspicuous penis sheath.

The dental formula is $3/3-1/1-4/4-2/3=42$. In common with *Cuon* and *Speothos*, departure from the typical form of dentition within the Canidae is found in the lower carnassial where the inner cusp of the talonid is missing so that instead of forming a basin, this part of the tooth forms a subsidiary blade. This suggests a highly predacious diet, with corresponding diminished importance of vegetable matter (Ewer 1973).

Subspecies No subspecies are currently recognised (Girman and Wayne 1997; Girman *et al.* 2001).

Similar species Wild dogs are occasionally confused with feral dogs and striped hyaenas (*Hyaena hyaena*), and even side-striped jackals (*Canis adustus*) and bat-eared foxes (*Otocyon megalotis*), but are morphologically distinct from all.

Distribution

Historical distribution Historical data indicate that wild dogs were formerly distributed throughout sub-Saharan Africa, from desert (Lhotse 1946) to mountain summits (Thesiger 1970), and probably were absent only from lowland rainforest and the driest desert (Schaller 1972).

Current distribution Wild dogs have disappeared from much of their former range – 25 of 39 former range states no longer support populations (Fanshawe *et al.* 1997). The species is virtually eradicated from West Africa, and greatly reduced in central Africa and north-east Africa.



Male African wild dog, age unknown. Moremi Wildlife Reserve, Okavango Delta, Botswana, 1990.

Chris and Tilde Stuart

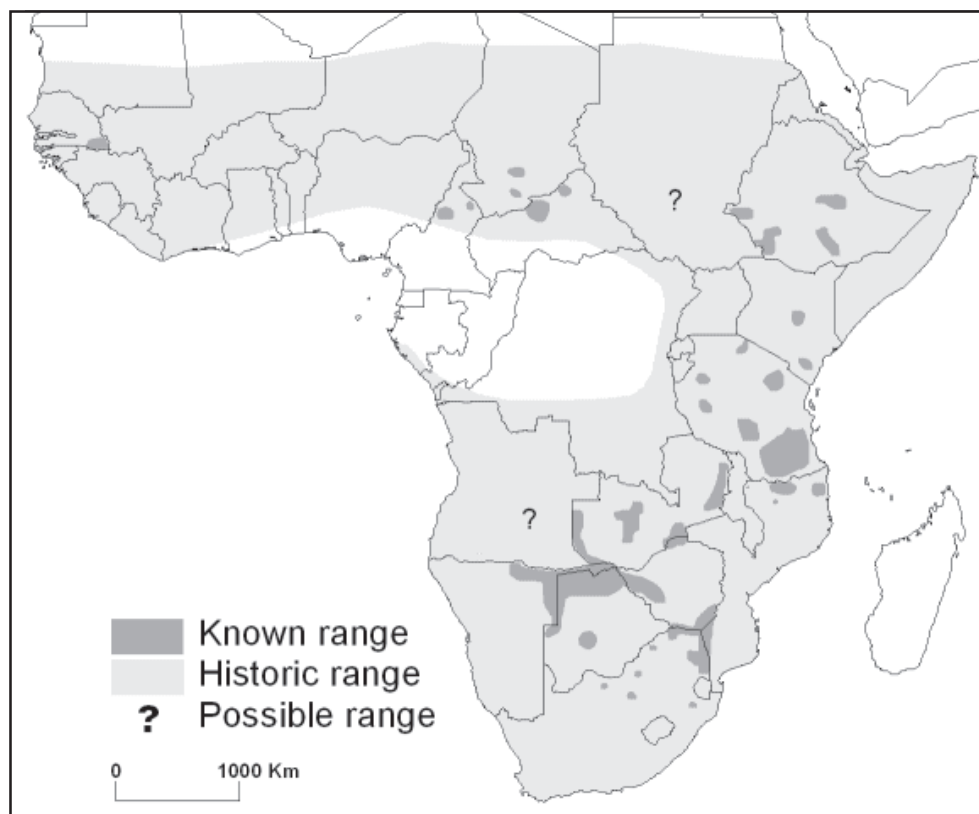


Figure 6.5.1. Current distribution of the African wild dog.

The largest populations remain in southern Africa (especially northern Botswana, western Zimbabwe, eastern Namibia, and Kruger National Park, South Africa) and the southern part of East Africa (especially Tanzania and northern Mozambique). Details of current distribution and status are in Woodroffe *et al.* (1997).

Range countries Angola (?), Botswana, Cameroon, Central African Republic, Chad, Ethiopia, Kenya, Mozambique, Namibia, Senegal, South Africa, Sudan, Swaziland (vagrant), Tanzania, Zambia, Zimbabwe. (Fanshawe *et al.* 1997). Wild dogs are known to be, or presumed to be, extinct or near-extinct in Benin, Burkina Faso, Burundi, Democratic Republic of Congo, Eritrea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Malawi, Mali, Niger, Nigeria, Rwanda, Sierra Leone, Togo and Uganda (Woodroffe *et al.* 1997). The situation in Angola is unknown, but it is possible that packs still occur there.

Relative abundance

Wild dogs are rarely seen, even where they are relatively common, and it appears that populations have always existed at very low densities. Population densities in well-studied areas are given below (Table 6.5.2), which Ginsberg and Woodroffe (1997a) used to estimate the size of remaining populations at between 3,000–5,500 free-ranging wild dogs in Africa.

Table 6.5.2. Population densities of wild dogs in various study areas across Africa (updated from Woodroffe *et al.* 1997).

Study site	Population density (adults/100km ²)
Aitong, near Maasai Mara, Kenya	2.6–4.6
Okavango Delta, Botswana	3.5
North-central Botswana	0.5
Hluhluwe-Umfolozi Park, South Africa	3.3
Hwange National Park, Zimbabwe	1.5
Zambezi Valley Complex	2.0
Kruger National Park, South Africa	0.8–2.0
Selous Game Reserve, Tanzania	4
Serengeti National Park, Tanzania 1967–1979	1.5
Serengeti National Park, Tanzania 1985–1991	0.67

Estimated populations/relative abundance and population trends

The following estimated sizes and trends of national wild dog populations in Africa are updated from Woodroffe *et al.* (1997) (Table 6.5.3). Figures for protected and unprotected areas are approximate, since few wild dog populations are confined entirely to protected areas. For this reason, populations given for protected areas are almost universally over-estimated, with concomitant under-estimates for numbers outside protected areas.

Table 6.5.3. The status of wild dogs in range states across Africa (I=increasing, S=stable, D=declining).

Country	In and around protected areas		Outside protected areas		Total
	Population	Trend	Population	Trend	
Botswana	500	S	300		800
Cameroon	50	D?			50
Central African Republic	150	?			150
Chad	70	?			70
Ethiopia	200	?	200	?	400
Kenya	100	S?	250	I	350
Mozambique	200	?			200
Namibia	100	S	300	S?	400
Senegal	20	?			20
Somalia	0	?	20	?	20
South Africa	300	S	110	I?	410
Sudan			50	?	50
Tanzania	1,300	S?	500	S?	1,800
Zambia	430	?	?	–	430
Zimbabwe	400	SD?	200	I	600
Grand total					5,750

Habitat

Wild dogs are generalist predators, occupying a range of habitats including short-grass plains, semi-desert, bushy savannahs and upland forest. While early studies in the Serengeti National Park, Tanzania, led to a belief that wild dogs were primarily an open plains species, more recent data indicate that they reach their highest densities in thicker bush (e.g., Selous Game Reserve, Tanzania; Mana Pools National Park, Zimbabwe; and northern Botswana). Several relict populations occupy dense upland forest (e.g., Haremma Forest, Ethiopia: Malcolm and Sillero-Zubiri 2001; Ngare Ndare Forest, Kenya). Wild dogs have been recorded in desert (Lhotse 1946), although they appear unable to establish themselves in the southern Kalahari (M.G.L. Mills unpubl.), and montane habitats (Thesiger 1970; Malcolm and Sillero-Zubiri 2001), although not in lowland forest. It appears that their current distribution is limited primarily by human activities and the availability of prey, rather than by the loss of a specific habitat type.

Food and foraging behaviour

Food Wild dogs mostly hunt medium-sized antelope. Whereas they weigh 20–30kg, their prey average around 50kg, and may be as large as 200kg. In most areas their

principal prey are impala (*Aepyceros melampus*), kudu (*Tragelaphus strepsiceros*), Thomson's gazelle (*Gazella thomsonii*) and wildebeest (*Connochaetes taurinus*) (Table 6.5.4). They will give chase of larger species, such as eland (*Tragelaphus oryx*) and buffalo (*Syncerus caffer*), but rarely kill such prey. Small antelope, such as dik-dik (*Madoqua* spp.), steenbok (*Raphicerus campestris*) and duiker (tribe *Cephalophini*) are important in some areas, and warthogs (*Phacochoerus* spp.) are also taken in some populations. Wild dogs also take very small prey such as hares, lizards and even eggs, but these make a very small contribution to their diet.

Foraging behaviour Wild dogs hunt in packs. Hunts are almost always preceded by a “social rally” which is believed to coordinate the pack in preparation for hunting. Once prey sight the dogs, they may flee, or stand and defend themselves alone or as a herd. During chases, wild dogs can run at speeds of up to 60km/h, and are specially adapted to deal with the heat stress that this involves (Taylor *et al.* 1971). After one dog has made the first grab, other pack members may help to drag the quarry to the ground. Once the quarry has been captured, the animal is killed by disembowelling. In some hunts, one pack member may restrain the head of the prey by biting its nose and holding on while others make the kill. Hunts can appear to be highly coordinated events, but in many areas packs tend to split during hunts with individual dogs often chasing and bringing down the prey alone, then leaving it to find and bring the rest of the pack to the kill.

Hunting success is high in comparison with other large carnivore species (e.g., in Serengeti, 70% of 133 wild dog hunts ended in a kill, compared with 23% of 523 lion hunts; Schaller 1972). As a result of social hunting, each pack member has a higher foraging success (measured as kg killed per km chased) than it would if it hunted alone (Creel and Creel 1995). Members of larger packs are also able to specialise on more profitable prey species (e.g., wildebeest; Creel and Creel 2002), and are better able to defend their kills against scavenging hyaenas (Fanshawe and FitzGibbon 1993). Wild dogs themselves very rarely scavenge (Mills and Biggs 1993).

Damage to livestock or game Wild dogs do take livestock in some areas, but this is a fairly rare occurrence. In and around the Maasai Mara National Reserve, Kenya, wild dogs ignored livestock, and Samburu and Maasai herders

Table 6.5.4. Diet of wild dogs in three selected study areas. ‘n’ indicates the number of kills recorded in each area.

Study area	n	impala	kudu	reedbuck	Thomson's			Reference
					gazelle	wildebeest	warthog	
Kruger NP South Africa	78	69%	15%	15%	–	–	–	Mills and Biggs (1993)
Aitong, Kenya	60	17%	–	–	67%	8%	2%	Fuller and Kat (1990)
Selous GR, Tanzania	347	54%	–	–		29%	9%	Creel and Creel (2002)

interviewed in northern Kenya indicated that wild dogs rarely caused problems (R. Woodroffe unpubl.). A study of wild dog depredation on commercially raised livestock in Zimbabwe found that the dogs took fewer cattle than the farmers believed (26 cattle from a herd of >3,000, over a two year period, cf. 52 losses attributed to wild dogs; Rasmussen 1999). Wild dogs hunting in livestock areas outside Selous Game Reserve, Tanzania, were never observed to kill livestock in six years of observation (Creel and Creel 2002). Nevertheless wild dogs can become a severe problem for sheep and goats, with multiple animals being killed in a single attack (R Woodroffe unpubl.).

The impact of wild dogs on wild ungulates is likely to be small in intact ecosystems, where dogs are uncommon in comparison with other predators (e.g., lions *Panthera leo*, spotted hyaenas *Crocuta crocuta*) taking essentially the same prey (Mills and Biggs 1993; Creel and Creel 1996). However, historically, wild dogs have been perceived to have a serious impact on game species (e.g., Bere 1955) and are still reviled by game farmers who consider them a major competitor, taking prey that could have been sold to commercial hunters or purchasers of live game (P. Lindsey unpubl.).

Social behaviour

Wild dogs are intensely social animals, spending almost all of their time in close association with each other (e.g., McCreery 2000). Packs are dynamic and may fluctuate rapidly in numbers. They may be as small as a pair, or number as many as 30 adults and yearlings – average pack compositions for various study sites are summarised in Table 6.5.5. Packs are usually formed when small same-sex subgroups (usually litter-mates) leave their natal groups and join sub-groups of the opposite sex (McNutt 1996a; McCreery and Robbins 2001). Occasionally, new packs

form by fission from larger groups, with males and females emigrating together. In newly formed packs, the females are typically closely related to one another, but not to the males, and the males are closely related to one another, but not to the females. Young born into such packs may remain there, or disperse as yearlings or young adults to form new packs. Because wild dogs are obligate social breeders, the pack, rather than the individual, should be considered the basic unit within the population.

Wild dogs have large home ranges (Table 6.5.6), which they defend infrequently but aggressively against neighbouring packs. Ranges are much larger than would be expected on the basis of their body size. Packs are confined to relatively small areas (50–200km²) when they are feeding young pups at a den, but outside the denning period they range widely. As a result, wild dogs' large home ranges translate into very low population densities (Table 6.5.2). The home ranges of neighbouring wild dog packs overlap considerably, but wild dogs can, nevertheless, be considered territorial: packs rarely enter other packs' core areas and these areas are defended aggressively as well as by scent-marking. Even wild dog packs that inhabit protected areas may travel extensively outside the reserve borders where they encounter human activity and threats such as roads, snares and livestock and game farmers likely to persecute them. Wild dogs dispersing away from their natal packs may range even more widely. Dispersing wild dogs have been tracked over hundreds of kilometres (Fuller *et al.* 1992a), a characteristic that could account for the occasional reports of single wild dogs, or single-sex groups from countries such as Uganda, Democratic Republic of Congo and Swaziland, where there have been no resident wild dog populations for several decades.

Wild dogs have a complex communication system, including a number of unique vocalisations (Robbins

Table 6.5.5. Pack compositions of wild dogs in various study sites across Africa. Data updated from Woodroffe *et al.* (1997), with unpublished data from Botswana and Kruger.

Study site	Sample (pack-years)	Adults	Yearlings	Pups
Hwange National Park, Zimbabwe	1989–1990 1992–2000	5 13	7.8 3.9	3.2 2.0
Kruger National Park, South Africa	76	4.0	2.2	4.5
Masai Mara National Reserve, Kenya	6	4.2	4.0	8.8
Northern Botswana	75	6.6	4.4	9.9
Selous Game Reserve, Tanzania	39	8.9	4.3	7.9
Serengeti National Park, Tanzania	7	6.6	6.0	11.2

Table 6.5.6. Home ranges of wild dogs in various study sites across Africa (updated from Woodroffe *et al.* 1997).

Study site	No. packs	Home-range size in km ² (range)
Aitong, near Masai Mara, Kenya	1	659
Hwange National Park, Zimbabwe	4	423 (260–633)
Kruger National Park, South Africa	20	553 (150–1,110)
Moremi Game Reserve, Botswana	9	617 (375–1,050)
Selous Game Reserve, Tanzania	11	433 (SE±66)
Serengeti National Park, Tanzania	5	1318 (620–2,460)

2000), as well as olfactory communication both within and between packs (van Heerden 1981; M. Parker unpubl.).

Reproduction and denning behaviour

A pack consists of any group of wild dogs with a potentially reproductive pair. In a pack larger than two adults, the reproductive pair consists of the dominant male and the dominant female (Frame *et al.* 1979; Malcolm and Marten 1982). In most wild dog packs, the dominant female is the mother of all the pups, although two or even three females may breed on some occasions. Similarly, the dominant male fathers most (but not necessarily all) of the pups (Girman *et al.* 1997). Dominant males are usually no more assiduous in caring for pups than are other males in the pack (Malcolm and Marten 1982). In fact, all pack members are involved in caring for the pups. Such additional care is vital if pups are to survive; because very small packs (<4 members) rarely manage to raise any pups (J.W. McNutt unpubl.). Cooperative care may even extend to caring for adopted pups (McNutt 1996b).

Births are seasonal, and gestation lasts 71–73 days (J.W. McNutt unpubl.). Wild dogs have very large litters for their body size, averaging 10–11 and occasionally as many as 21 (Fuller *et al.* 1992b). Pup sex ratios are male-biased in some populations (Fuller *et al.* 1992b; J.W. McNutt unpubl.). The pups, each weighing approximately 300–350g, are born in an underground den which they use for the first three months of life. Such dens are often those of aardvark (*Orycteropus afer*), sometimes modified by warthog or spotted hyaenas. The mother is confined to the den during early lactation, and is reliant on other pack members to provision her during this time. Wild dogs feed the mother and pups (from four weeks of age) by regurgitating solid pieces of meat. Some pack members also “baby-sit” the pups and chase predators off while the remainder of the pack is away hunting. Pups are generally fully weaned by eight weeks but continue to use a den for refuge until 12–16 weeks of age. Wild dogs reach sexual maturity in their second year of life, but social suppression of reproduction in subordinates of both sexes means that few animals breed at this age (Creel *et al.* 1997). Few animals breed at any age due to reproductive suppression. However, it is common for two-year old females and less frequent for two-year old males to reproduce.

Competition

Competition with larger predators has a major impact on wild dogs’ behaviour and population biology (Creel and Creel 1996; Mills and Gorman 1997). Lions, in particular, are a major cause of natural mortality (Table 6.5.7, 6.5.8), and wild dogs tend to move away if they detect the presence of lions (Creel and Creel 1996). Spotted hyaenas also occasionally kill dogs of all ages (J.W. McNutt pers. obs.). They also steal kills from wild dogs, particularly in open areas where such kills are easily located (Fanshawe

and FitzGibbon 1993). While the loss of kills to hyaenas is much less common in more closed bush, wild dogs’ high metabolic rate means that prey loss to competitors has the potential to seriously impact their energy balance (Gorman *et al.* 1998). Leopards (*Panthera pardus*) have also been recorded to kill pups (M.G.L. Mills unpubl.).

Competition with larger carnivores might help to explain wild dogs’ wide-ranging behaviour. While larger predators tend to occur at higher densities where prey are more abundant, wild dogs (like cheetahs, *Acinonyx jubatus*) tend to avoid these areas. Because they range in areas of comparatively low prey densities requiring greater travel times during hunting, they are effectively forced to occupy larger home ranges. This wide-ranging behaviour, coupled perhaps with their preference for areas of reduced predator density, explains why wild dogs inhabiting isolated reserves are so exposed to human activity on and around reserve borders.

Mortality and pathogens

Wild dogs experience high mortality in comparison with other large carnivore species. Annual adult mortality varies between populations, with averages ranging from 20–57% (summarised in Creel and Creel 2002). Similarly, pup mortality during the first year of life is relatively high, and averages around 50% in most populations. There is some evidence to suggest that pup survival is higher in large packs where there are more helpers to assist with their care.

Natural sources of mortality The principal cause of natural mortality is predation by lions (Tables 6.5.7, 6.5.8), although hyaenas, crocodiles and leopards also kill wild dogs in some areas.

Persecution While pups die almost exclusively from “natural” causes (Table 6.5.8), more than half of the mortality recorded among adults is caused directly by human activity, even in some of the largest and best-protected areas (Table 6.5.7). Wild dogs using protected areas often range outside the borders and into areas used by people. Here they encounter high-speed vehicles, guns, snares and poisons, as well as domestic dogs, which represent reservoirs of potentially lethal diseases.

Hunting and trapping for fur There is no known trade in the fur of wild dogs and virtually no commercial hunting or trapping. Quotas for commercial hunting have been issued in the past in Cameroon, but the full quota has not been taken (Breuer 2003).

Road kills Road kills are an important cause of mortality for both adults and pups (Tables 6.5.7, 6.5.8), partly because wild dogs use roads to travel and may also rest on them.

Table 6.5.7. Causes of adult mortality in free-ranging populations of African wild dogs. Figures show the percentages of deaths attributed to each cause. Numbers in brackets give the total number of known deaths recorded in that study site. Updated from Woodroffe *et al.* (1997), using unpublished data provided by G. Rasmussen, S. Creel and K. McCreery and R. Robbins.

	Kruger NP, South Africa	Northern Botswana	South-western Zimbabwe	Selous GR, Tanzania	Zambia	Total
Natural causes						
Predators						
Lions	26% (19)	47% (15)	4% (85)	20% (10)	0% (36)	10% (165)
Spotted hyaenas	0% (19)	7% (15)	2% (85)	0% (10)	0% (36)	2% (165)
Unknown/others	11% (19)	7% (15)	1% (85)	0% (10)	3% (36)	3% (165)
Other wild dogs	16% (19)	0% (15)	0% (85)	40% (10)	0% (36)	4% (165)
Disease	0% (19)	0% (15)	0% (85)	0% (10)	22% (36)	5% (165)
Accident	0% (19)	33% (15)	2% (85)	0% (10)	0% (36)	4% (165)
Subtotal natural	53% (19)	94% (15)	12% (116)	60% (10)	25% (36)	27% (196)
Human causes						
Road kill	5% (19)	0% (15)	19% (116)	0% (10)	22% (36)	16% (196)
Snared	21% (19)	0% (15)	42% (116)	40% (10)	6% (36)	30% (196)
Shot	21% (19)	0% (15)	27% (116)	0% (10)	14% (36)	20% (196)
Poisoned	0% (19)	0% (15)	0% (116)	0% (10)	33% (36)	6% (196)
Unknown	0% (19)	7% (15)	0% (116)	0% (10)	0% (36)	0.5% (196)
Subtotal human	47% (19)	7% (15)	88% (116)	40% (10)	75% (36)	73% (196)

Table 6.5.8. Causes of pup mortality in free-ranging populations of African wild dogs. Figures show the percentages of deaths attributed to each cause. Numbers in brackets give the total number of known deaths recorded in that study site. Updated from Woodroffe *et al.* (1997), with unpublished data from S. Creel and G. Rasmussen.

	Kruger NP, South Africa	Selous GR, Tanzania	South-western Zimbabwe	Total
Natural causes				
Predators				
Lions	37% (38)	6% (36)	14% (22)	20% (96)
Spotted hyaenas	0% (38)	6% (36)	18% (22)	6% (96)
Monitor lizard	0% (38)	6% (36)	0% (22)	2% (96)
Other wild dogs	50% (38)	77% (36)	5% (22)	50% (96)
Disease	8% (38)	6% (36)	0% (22)	5% (96)
Subtotal natural	95% (38)	100% (36)	37% (22)	83% (96)
Human causes				
Road kill	0% (38)	0% (36)	27% (22)	6% (96)
Snared	5% (38)	0% (36)	9% (22)	3% (96)
Shot	0% (38)	0% (36)	27% (22)	6% (96)
Unknown	0% (38)	0% (36)	0% (22)	0% (96)
Subtotal human	5% (38)	0% (36)	63% (22)	16% (96)

Pathogens and parasites The impact of disease is almost certainly under-estimated in Tables 6.5.6 and 6.5.7 (disease outbreaks tend to be episodic, while these data come from stable populations unaffected by epizootics at the time of study), and is likely to be particularly severe in small populations. Rabies is known to have contributed to the extinction of the wild dog population in the Serengeti ecosystem on the Kenya-Tanzania border in 1990 to 1991, and is suspected to have caused the deaths of several packs in northern Botswana in 1995 and 1996. Canine distemper has also caused at least one whole-pack death in Botswana, although the impact of distemper appears smaller than

that of rabies, with several populations showing evidence of non-fatal exposure. An unidentified *Toxoplasma* sp. was implicated in the deaths of 23 out of 24 pups from two litters at a den in the Kruger National Park (M.G.L. Mills pers. obs).

Longevity: In Hwange National Park, Zimbabwe, a male dog lived up to 11 years (G. Rasmussen pers. comm.). In Kruger National Park and northern Botswana, no wild dog has survived more than 10 years, and most dogs studied in Selous Game Reserve, Tanzania, lived six years or less (Creel and Creel 2002).

Historical perspective

Wild dogs play only a small role in traditional cultures, in comparison with other predators such as lions and hyaenas. They are valued in some areas as their kills are a source of meat; various body parts may also be considered to have medicinal and magical powers. In colonial times, wild dogs were almost universally reviled, with a reputation as ugly, cruel and bloodthirsty killers. Game managers' attitudes to them are exemplified by Bere's (1955) observation that they "...hunt in packs, killing wantonly far more than they need for food, and by methods of the utmost cruelty... When the Uganda national parks were established it was considered necessary, as it had often been elsewhere, to shoot wild dogs in order to give the antelope opportunity to develop their optimum numbers...". Such persecution in the name of "game" management and conservation continued as national parks' policy in some areas well into the 1970s, and unofficially this attitude still persists in a few areas.

Conservation status

Threats As described above, the principal threats to wild dogs are conflict with human activities and infectious disease. Both of these are mediated by habitat fragmentation, which increases contact between wild dogs, people and domestic dogs. The important role played by human-induced mortality has two long-term implications. First, it makes it likely that, outside protected areas, wild dogs may well be unable to co-exist with the increasing human population unless better protection and local education programmes are implemented. This will be a serious problem for wild dog populations outside protected areas. Second, wild dog ranging behaviour leads to a very substantial "edge effect", even in large reserves. Simple geometry dictates that a reserve of 5,000km² contains no point more than 40km from its borders – a distance well within the range of distances travelled by a pack of wild dogs in their usual ranging behaviour. Thus, from a wild dog's perspective, a reserve of this size (fairly large by most standards) would be all edge. As human populations rise around reserve borders, the risks to wild dogs venturing outside are also likely to increase. Under these conditions, only the very largest unfenced reserves will be able to provide any level of protection for wild dogs. In South Africa, proper fencing around quite small reserves has proved effective in keeping dogs confined to the reserve (although fencing has costs, as well as benefits, in conservation terms).

Even in large, well-protected reserves, or in stable populations remaining largely independent of protected areas (as in northern Botswana), wild dogs live at low population densities. Predation by lions, and perhaps competition with hyaenas, contribute to keeping wild dog numbers below the level that their prey base could support. Such low population density brings its own problems. The

largest areas contain only relatively small wild dog populations; for example, the Selous Game Reserve, with an area of 43,000km² (about the size of Switzerland), contains about 800 wild dogs. Most reserves, and probably most wild dog populations, are smaller. For example, the wild dog population in Niokolo-Koba National Park and buffer zones (about 25,000km², larger than the state of Israel) is likely to be not more than 50–100 dogs. Such small populations are vulnerable to extinction. "Catastrophic" events such as outbreaks of epidemic disease may drive them to extinction when larger populations have a greater probability of recovery – such an event seems to have led to the extinction of the small wild dog population in the Serengeti ecosystem on the Kenya-Tanzania border. Problems of small population size will be exacerbated if, as seems likely, small populations occur in small reserves or habitat patches. As discussed above, animals inhabiting such areas suffer a strong "edge effect". Thus, small populations might be expected to suffer disproportionately high mortality as a result of their contact with humans and human activity.

Commercial use There are no commercial uses for wild dogs, other than non-consumptive ecotourism.

Occurrence in protected areas The occurrence of wild dogs in protected areas is described in detail in Fanshawe *et al.* (1997). The largest populations inside protected areas occur in:

- *Tanzania*: Selous Game Reserve and Ruaha National Park;
- *South Africa*: Kruger National Park;
- *Botswana*: Chobe National Park and Moremi Wildlife Reserve;
- *Zimbabwe*: Hwange National Park.

Protection status CITES – not listed.

Current legal protection Wild dogs are legally protected across much of their range. However, this protection is rarely enforced and wild dogs are extinct in several countries despite stringent legal protection (Table 6.5.9). Outside reserves, legal protection may have questionable value when it concerns a species that comes into conflict with people, often in remote areas with poor infrastructure. Under such circumstances, legal protection may serve only to alienate people from conservation activities.

Conservation measures taken The establishment of very large protected areas (e.g., Selous Game Reserve, Kruger National Park), as well as conservancies on private and communal land, has ensured wild dogs' persistence in parts of eastern and southern Africa, and maintenance of such areas remains the highest priority for wild dog conservation. Attempts are underway to re-establish wild

Table 6.5.9. The status of wild dog populations and their degree of protection across range states. The columns marked "Date" give, respectively, the date of the most recent information on which the population estimate is based, and the date of the protective legislation. Most of the information about the protected status of wild dogs was provided by the Environmental Law Centre, Bonn, Germany.

Country	Status of wild dogs	Date	Degree of protection	Date
Algeria	rare?	1989	?	–
Angola	rare?	1987	total?	1957
Benin	extinct?	1987	?	–
Botswana	present	1996	partial	1979
Burkina Faso	extinct?	1987	partial	1989
Cameroon	present	1992	partial?	?
Central African Republic	present	1987	total	1984
Chad	rare	1987	?	–
Congo	extinct	1992	total	1984
Côte d'Ivoire	rare?	1987	noxious	1965
Dem. Rep. Congo	extinct?	1987	partial	1982
Eritrea	extinct?	1992	?	–
Ethiopia	present	1995	total	1972
Gabon	extinct	1987	?	–
Ghana	extinct?	1987	partial	1971
Guinea	rare	1996	total	1990
Kenya	present	1996	partial	1976
Malawi	rare	1991	partial	?
Mali	extinct?	1989	?	–
Mozambique	rare	1996	total	1978
Namibia	present	1996	total	?
Niger	extinct?	1987	total?	?
Nigeria	extinct?	1991	total	1985
Rwanda	extinct	1987	total	1974
Senegal	present	1996	partial	1986
Sierra Leone	rare?	1996	?	–
Somalia	rare?	1994	total	1969
South Africa	present	1996	specialty protected	?
Sudan	rare	1995	total?	?
Swaziland	extinct?	1992	?	–
Tanzania	present	1996	total	1974
Togo	rare?	1987	partial	1968
Uganda	rare?	1996	?	–
Zambia	present	1994	total	1970
Zimbabwe	present	1992	partial	1990

dogs in a network of very small reserves in South Africa, but this approach will demand intensive management in perpetuity and need not, at present, be used as a model for wild dog conservation elsewhere.

Conservation priorities include: (i) to maintain and expand connectivity of habitat available to wild dogs, particularly in northern Botswana/eastern Namibia/western Zimbabwe, South Africa/western Mozambique/south-east Zimbabwe, northern South Africa/south-east Botswana/south-west Zimbabwe and southern Tanzania/northern Mozambique; (ii) to work with local people to reduce deliberate killing of wild dogs in and around these areas, and also in smaller populations in Senegal,

Cameroon and Kenya; (iii) to establish effective techniques for protecting small wild dog populations from serious infections such as rabies and distemper; (iv) to carry out surveys to establish the status of other potentially important populations, particularly in Algeria, Angola, Central African Republic, Ethiopia, Mozambique and Sudan, and (v) to continue long-term monitoring of 'sentinel' populations to identify emerging threats. Re-establishment of extinct populations through reintroduction currently has a low priority in most areas, although natural recolonisations should be encouraged.

Occurrence in captivity

There are more than 300 wild dogs in captivity in 55 zoos, as listed on ISIS and as many as 200 additional animals occur in zoos and private collections, particularly in South Africa. With the exception of a small number of animals held in the Mkomazi Game Reserve, Tanzania, all of the dogs held in captivity are of southern African origin. Successful breeding is patchy; some institutions have been extremely successful at breeding wild dogs in captivity, while others have failed. Juvenile mortality is high in most collections.

Early attempts to reintroduce captive-bred animals to the wild were hampered by the dogs' poor hunting skills and naive attitudes to larger predators. However, recent reintroductions have overcome this problem by mixing captive-bred dogs with wild-caught animals and releasing them together. This approach has been very valuable in re-establishing packs in several fenced reserves in South Africa, but is not considered a priority in other parts of Africa at present. Nevertheless, captive populations have important roles to play in developing conservation strategies for wild populations, through research (e.g., testing of vaccination protocols), outreach and education.

Current or planned research projects

J.W. McNutt (University of Montana, USA) runs the Botswana Wild Dog Research Project, a long-term monitoring study of wild dog ecology and behaviour in the Okavango Delta.

R. Woodroffe (University of California, Davis, USA), principal investigator of the Samburu-Laikipia Wild Dog Project, is studying the conflicts between people and wild dogs outside protected areas in northern Kenya.

M. Rainey (African Wildlife Foundation, Nairobi, Kenya) is currently monitoring wild dogs in the Kajiado District, Kenya.

M.G.L. Mills (South Africa National Parks and Endangered Wildlife Trust, South Africa) is continuing with long-term ecological monitoring of wild dogs in the Kruger National Park.

P. Lindsey (Mammal Research Institute, University of Pretoria, South Africa) has recently concluded a bio-economic analysis of wild dog conservation in South Africa.

D. Knobel (Mammal Research Institute, University of Pretoria, South Africa and Centre for Tropical Veterinary Medicine, University of Edinburgh, UK) is investigating the development of a bait and baiting system for the delivery of oral rabies vaccine to free-ranging wild dogs.

H. Davies (Wildlife Conservation Research Unit, University of Oxford, UK and Endangered Wildlife Trust, South Africa) is the principal investigator of the De Beers Venetia Reserve Wild Dog Project, which involves the study of the biology of a reintroduced wild dog pack and the value of the species to ecotourism in a small reserve.

A. Visee (George Adamson Wildlife Preservation Trust, Tanzania) is studying infectious disease and safety/effectiveness of vaccination, as well as husbandry, of captive wild dogs in Mkomazi, Tanzania.

K. Leigh (University of Sydney, Australia) is the principal investigator of the Lower Zambezi African Wild Dog Conservation Project, a study of the threats to wild dogs in Lower Zambezi National Park aimed at generating conservation recommendations for the Zambia Wildlife Authority.

G. Rasmussen (Wildlife Conservation Research Unit, University of Oxford, UK) runs Painted Dog Conservation, a long-running project aimed at monitoring and protecting wild dogs outside protected areas in Hwange and elsewhere in Zimbabwe.

J. Chambers (Lowveld Wild Dog Project, Save Valley, Zimbabwe) is involved in the ecological monitoring of wild dogs in south-eastern Zimbabwe.

K. McCreery and R. Robbins (African Wild Dog Conservancy, Olympia, Washington, USA) have recently surveyed wild dog populations in East Kenya.

R. Lines (Namibia Nature Foundation, Windhoek, Namibia) is studying wild dog livestock conflict in Namibia.

C. Sillero-Zubiri and J.-M. Andre (Wildlife Conservation Research Unit, University of Oxford, UK) are surveying wild dogs in and around protected areas of central and northern Mozambique.

The Wild Dog Advisory Group of South Africa is overseeing the strategic reintroduction of wild dogs in a network of fenced reserves across South Africa and conducting detailed monitoring of dogs in Hluhluwe-Umfolozi Park, Pilansberg National Park, Marekele National Park and Madikwe Game Reserve.

Other long- and short-term projects have been carried out in Tanzania (Selous Game Reserve, S. and N. Creel; Serengeti National Park, L. and H. Frame, J. Malcolm, H. van Lawick, J. Fanshawe, R. Burrows), Kenya (P. Kat, T. Fuller), Zimbabwe (Hwange National Park, J. Ginsberg) and Senegal (Niokola-Koba National Park, C. Sillero-Zubiri). Restricted surveys have recently been carried out in Cameroon (T. Breuer), Mozambique (C. Sillero-Zubiri), Tanzania (Ruaha Game Reserve, Mikumi National Park, S. and N. Creel) and Nigeria (S. Baggett).

Gaps in knowledge

Several pieces of information are needed to enable more effective conservation of African wild dogs. These include: (1) establishing which techniques will be most effective and sustainable for protecting wild dogs from disease, including whether vaccinating wild dogs against rabies and distemper can ever be safe and effective, and whether other methods (including control or vaccination of domestic dogs) can reduce the risks to wild dogs; (2) determining the true impact of wild dogs on livestock under different conditions of husbandry, and the effectiveness of techniques to reduce this; (3) establishing the true impact of wild dogs on managed wild game and the effectiveness of techniques to resolve conflicts with game ranchers; (4) surveys of wild dog distribution and status are also required, particularly in Algeria, Angola, Cameroon, Central African Republic, Ethiopia, Mozambique and Sudan; (5) genetic research would be valuable to establish the distinctiveness of wild dog populations remaining in west, central and north-east Africa; and (6) the reasons for and degree of fluctuation in packs and populations need to be better understood. In addition, several aspects of wild dogs' basic biology require further study, particularly: (1) mechanisms of ranging and dispersal; (2) causes of increased mortality among dispersers; (3) reasons for large home range; (4) mechanisms of sex-ratio biasing; (5) paternity; and (6) communication.

Core literature

Creel and Creel 1995, 1996, 2002; Frame *et al.* 1979; Fuller and Kat 1990; Fuller *et al.* 1992a,b; Girman *et al.* 1997, 2001; Malcolm and Marten 1982; McNutt 1996a,b; Mills and Gorman 1997; Woodroffe and Ginsberg 1999a; Woodroffe *et al.* 1997.

Reviewers: Scott Creel, Joshua Ginsberg, Kim McCreery, Gregory Rasmussen, Robert Robbins. **Editors:** Claudio Sillero-Zubiri, Michael Hoffmann.

6.6 Bat-eared fox *Otocyon megalotis* (Desmarest, 1822) Least Concern (2004)

J.A.J. Nel and B. Maas

Other names

Afrikaans: bakoovos, bakoorkakkals, draaijakkals; **French:** l'otocyon; **German:** löffelhund; **Indigenous names:** ||K'au||en and !Kung San (Bushmen): !u (Botswana and Namibia); Amharic: joro-kib kebero (Ethiopia); Swahili: bwega masigio; Karamojong: ameguru; Kichagga: kipara; Kigogo: nchenjeji; Kikomo: mchutu; Kinyaturu: bii; Kiramba: bili (Kenya, Tanzania); Herero: okata-ká-ha; Nama: bergdamara; Hei||kum San (Bushmen): ||ab;

Ovambo: ombúü (Namibia); Northern Sotho: mo-tlhose; Tswana: motlósi; Zulu: udlamhloshwana (South Africa).

Taxonomy

Canis megalotis Desmarest, 1822. Mammalogie, in Encyclop. Meth., 2 (suppl): 538. Type locality: “le Cap de Bonne-Espérance” [South Africa, western Cape Province, Cape of Good Hope].

Included by some authors, e.g., Simpson (1945) and Ellerman *et al.* (1953), in a separate subfamily, the *Otocyoninae*, on account of its aberrant dentition; more recently (Clutton-Brock *et al.* 1976 and subsequent authors) this species is regarded as having affinities with the vulpine line.

Chromosome number: 2n=72 (Wayne *et al.* 1987).

Description

A small, slight canid with slim legs, a long bushy tail and conspicuously large ears. Males (4.1kg) are heavier than females (3.9kg) (average for both sexes 3.9kg) (see Gittleman 1989), although, in Botswana, females weigh marginally more than males (Table 6.6.1). The back of the ears, front part of the snout, face mask, front and lower part of the back legs, and the mid-dorsal part of the tail are black. A whitish band extends from across the forehead to below and up the first three-quarters of the frontal rim of the ears. Some animals have a broad, dark mid-dorsal band. Beige- to honey-coloured fur covers the lower jaw from behind the muzzle and extends across the throat, chest and under parts. Fur coloration is paler in older individuals. Body and tail fur are thick and soft on upper parts with a black base and white tip, giving a grizzled or grey appearance; sides appear more buff. Underfur on the

Table 6.6.1. Body measurements for the bat-eared fox from Botswana (Smithers 1971).		
HB male	529mm	(462–607) n=25
HB female	536mm	(467–607) n=29
T male	298mm	(230–340) n=25
T female	303mm	(278–340) n=29
HF male	149mm	(140–161) n=25
HF female	150mm	(139–165) n=29
E male	124mm	(119–137) n=25
E female	124mm	(114–134) n=29
WT male	4.0kg	(3.4–4.9) n=22
WT female	4.1kg	(3.2–5.4) n=29

upper body is about 30mm long, while the dense overcoat of guard hairs measures about 55mm. A sprinkling of tactile hairs (up to 65mm) occurs amongst the guard hairs (Skinner and Smithers 1990). Bat-eared foxes are unique amongst living eutherians (odontocetes excepted) in having four to five functional lower molars, and unique amongst modern canids in having three to four upper molars (Guilday 1962). The milk dentition is typically canid, with unreduced carnassials. In adults, the carnassial shear is lost and molars become the most bunodont, verging on zalambdodont, of any canid (see Kieser 1995). Supernumerary molars yield a dentition of 3/3-1/1-4/4-3-4/4-5=46-50, the largest number for any non-marsupial land mammal.

Subspecies Two subspecies are recognised (Coetzee 1977):

- *O. m. megalotis* (southern Africa)
- *O. m. virgatus* (East Africa)



Bat-eared fox. Robertson Karoo, Western Cape Province, South Africa.

Chris and Tilde Stuart

Similar species Cape fox (*Vulpes chama*): somewhat smaller; silver-grey upper parts, under parts off-white to pale fawn; head and back of ears reddish fawn; no black on back; tail more bushy, only tip black.

Current distribution

The bat-eared fox has a disjunct distribution range, occurring across the arid and semi-arid regions of eastern and southern Africa in two discrete populations (representing each of the known subspecies) separated by about 1,000km (Figure 6.6.1). *Otocyon m. virgatus* ranges from southern Sudan, Ethiopia and Somalia down through Uganda and Kenya to south-western Tanzania; *O. m. megalotis* occurs from Angola through Namibia and Botswana to Mozambique and South Africa (Coetzee 1977; Kingdon 1977; Skinner and Smithers 1990). The two ranges were probably connected during the Pleistocene (Coe and Skinner 1993). This disjunct distribution is similar to that of the aardwolf (*Proteles cristatus*) and black-backed jackal (*Canis mesomelas*).

Range extensions in southern Africa in recent years (e.g., Stuart 1981; Marais and Griffin 1993) have been linked to changing rainfall patterns (MacDonald 1982).

Range countries Angola, Botswana, Ethiopia, Kenya, Mozambique, Namibia, Somalia, South Africa, Sudan, Tanzania, Uganda, Zimbabwe (Smithers 1971; Smithers

and Lobão-Tello 1976; Coetzee 1977; Kingdon 1977; Smithers and Wilson 1979; Skinner and Smithers 1990).

Relative abundance

The species is common in conservation areas in southern and eastern Africa, becoming uncommon in arid areas and on farms in South Africa where they are occasionally persecuted. Within a circumscribed habitat, numbers can fluctuate from abundant to rare depending on rainfall, food availability (Waser 1980; Nel *et al.* 1984), breeding stage and disease (Maas 1993a, b; Nel 1993).

Estimated populations/relative abundance and population trends

In the south-western Kalahari, bat-eared fox numbers can vary over time: regular counts along a 21km stretch of dry riverbed, with an area of c.10km², were of 7–140 individuals, i.e., 0.7–14/km² (Nel *et al.* 1984; Nel 1996). In the Limpopo province, South Africa, Berry (1978) found densities of 5.7 foxes/km², and in the nearby Mashatu Game Reserve, Botswana, densities of 9.2 foxes/km² in the breeding season, and 2.3 foxes/km² at other times. At the Tussen-die-Riviere Game Reserve, Free State province, South Africa, Mackie (1988) recorded densities that varied from 0.3–0.5 foxes/km² over a three-year period, while Kuntzsch (1992) found densities that ranged from 1.1–2.0 foxes/km² on two farms in the central Karoo of the Northern Cape province. Hendrichs (1972) recorded a density of 0.3–1.0 foxes/km² in the Serengeti.

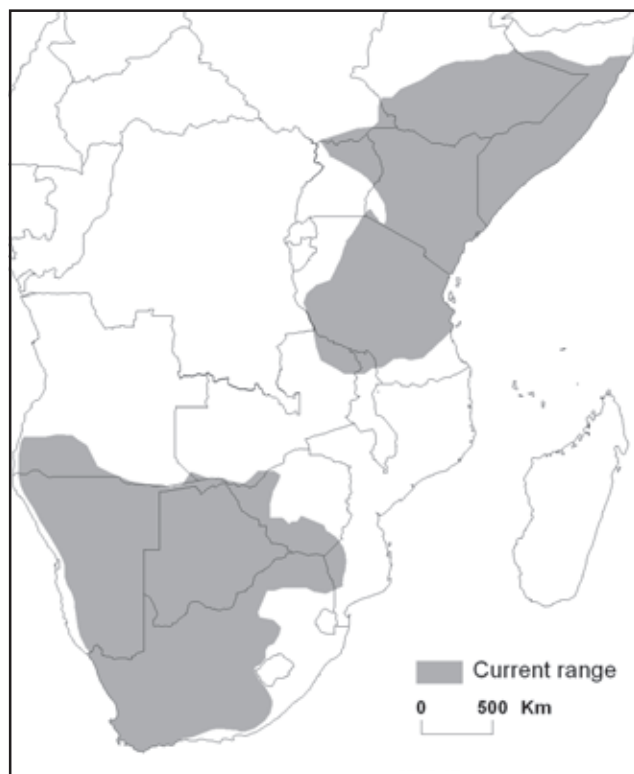
Habitat

In southern Africa, the prime habitat is mainly short-grass plains and areas with bare ground (Mackie and Nel 1989), but they are also found in open scrub vegetation and arid, semi-arid or winter rainfall (fynbos or Cape macchia) shrub lands, and open arid savannah. The range of both subspecies overlaps almost completely with that of *Hodotermes* and *Microhodotermes*, termite genera prevailing in the diet (Mackie and Nel 1989; Maas 1993a). In the Serengeti, they are common in open grassland and woodland boundaries but not short-grass plains (Lamprecht 1979; Malcolm 1986); harvester termite (*H. mossambicus*) foraging holes and dung from migratory ungulates are more abundant in areas occupied by bat-eared foxes, while grass is shorter and individual plants are more widely spaced (Maas 1993a).

Food and foraging behaviour

Food In the Serengeti's woodland boundary, and the open grasslands of southern and East Africa, insects are the primary food sources, with harvester termite and beetles predominating, and supplemented by smaller numbers of orthopterans, beetle larvae and ants (Shortridge 1934; Berry 1978; Nel 1978; Lamprecht 1979; Waser 1980; Stuart 1981; Malcolm 1986; Mackie 1988;

Figure 6.6.1. Current distribution of the bat-eared fox.



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Skinner and Smithers 1990; Maas 1993a). In open shrub savannah in Botswana other taxa such as arachnids can be more common, while fruit is taken seasonally (Nel 1978; Skinner and Smithers 1990) but can be important in open shrub vegetation with scattered trees (Skinner and Smithers 1990; Kuntzsch and Nel 1992). Small mammals, birds, eggs and reptiles are eaten sporadically in southern Africa (Nel 1978; Skinner and Smithers 1990) but rarely in eastern Africa (Lamprecht 1979; Maas 1993a).

Seasonal changes in the proportion of particular taxa occur (Nel 1978; Nel and Mackie 1990; Maas 1993a). In the Serengeti dung beetles are the main source of food during the rainy season when termite activity is reduced (Waser 1980; Maas 1993a). When both are scarce, beetle larvae are often dug up from the ground (Maas 1993a). *Hodotermes mossambicus* is patchily distributed throughout the Serengeti and may constitute a limiting resource in this part of the species' range (Maas 1993a). Harvester termites and dung beetles are more abundant in areas inhabited by clusters of bat-eared fox families, and local differences in *H. mossambicus* density are inversely related to territory size (Maas 1993a). *Hodotermes* foraging-hole density is positively related to a variety of demographic and reproductive variables, such as litter size and female recruitment rate (Maas 1993a). Although the animals' water requirements may be met by the high water content of their insect prey or, in southern Africa, berries during the summer (Nel 1978; Kuntzsch and Nel 1992), water constitutes a critical resource during lactation (Maas 1993a).

Foraging Foraging techniques depend on prey type (Maas 1993a), but food is often located by walking slowly, nose close to the ground and ears cocked forward. Prey is detected mostly by sound; sight and olfaction play a lesser role (Nel 1978). Changes in daily and seasonal *H. mossambicus* availability directly affect bat-eared fox activity patterns. In eastern Africa nocturnal foraging is the rule (Lamprecht 1979; Malcolm 1986; Maas 1993a). In southern Africa nocturnal foraging during summer gradually changes to an almost exclusively diurnal pattern in winter, mirroring activity changes of *H. mossambicus* (Nel 1990). By day, foraging peaks at the height of insect activity (Koop and Velimirov 1982; Nel 1990). Foraging and feeding rate is higher when feeding on termite patches, than on more dispersed insects (e.g., beetle larvae or grasshoppers) (Nel 1990).

In the Serengeti groups frequently patrol known *Hodotermes* patches in their territory after leaving the den in the evening (Maas 1993a). When feeding on termite patches, group members feed closely together, but when feeding on beetles, beetle larvae or grasshoppers group members can forage up to 200m apart (Nel 1978; Maas 1993a). Group members call each other to rich food patches with a low whistle. In the hard-capped soils of the

Karoo shrubland and inter-dune, excavations made during foraging by bat-eared foxes, aardvark (*Orycteropus afer*), porcupines (*Hystrix africaeaustralis*) and Cape foxes (*Vulpes chama*) act as microsites, which foster germination of plant seedlings (Dean and Milton 1991). See also Reproductive and denning behaviour.

Damage to livestock or game There is no evidence for predation on livestock or game (e.g., Kok 1996). However, in South Africa bat-eared foxes are sometimes mistaken for livestock predators when seen feeding on fly larvae in lamb carcasses.

Adaptations

Bat-eared foxes are adapted to their predominantly insectivorous diet with a variety of morphological, demographic and behavioural characteristics. Morphologically, the animals' huge ears, used to detect insect prey, are the most conspicuous morphological adaptation and may also serve a thermoregulatory function (Maas 1993b). Insectivory has also affected the number and shape of the animals' teeth (see above). A modification in the insertion point of the digastric muscle facilitates very rapid chewing (Gaspard 1964; cited in Malcolm 1986).

In southern Africa nocturnal foraging during the hot summer changes to a diurnal pattern in winter, when subzero night temperatures are common (Nel 1990). Group members can huddle in dens by night or in the early morning to escape the cold, or seek shade to escape the worst heat, or in the open, facing multiple directions, to ease predator detection. In southern Africa, an eight-week moult takes place between August and September and again between January and February (Smithers 1971).

Male parental care, allo-suckling and, in some areas, communal breeding occurs because insect prey has a high renewal rate, the cost of food sharing is low and dispersal risk high amidst limited breeding territories (Maas 1993a; see also Reynolds 1977; and see Reproductive and denning behaviour).

Social behaviour

Bat-eared foxes in southern Africa live in monogamous pairs with cubs (Nel *et al.* 1984), while those in eastern Africa live in stable family groups consisting of a male and up to three closely related females with cubs (Maas 1993a). Group size varies with time of year, with a mean of 2.72 (range=1–10; n=623) for *O. m. megalotis* (Nel *et al.* 1984); in the Serengeti, average adult group size is 2.44 (± 0.1 ; n=18), and group size prior to dispersal of pups is 6.0 (± 0.4 ; n=18) (Maas 1993a). Additional females in extended family groups are philopatric daughters, sometimes from several generations, which form a hierarchy based on age. All females in such 'super families' breed (Maas 1993a, see also Reproductive and denning behaviour).

Groups forage as a unit, and have home ranges from less than 1km² to more than 3km². In southern Africa home ranges overlap widely (Nel 1978; Mackie and Nel 1989). However, in East Africa they can either overlap (Malcolm 1986) or, as in the Serengeti, where they cluster around harvester termite colonies, be defended as territories that are patrolled and urine-marked during part of the year (Lamprecht 1979; Maas 1993a). Group size determines the outcome during territorial conflict (Maas 1993a, 1993b). Territory inheritance is not uncommon in the Serengeti and neighbouring groups can be closely related, with animals visiting each other from time to time (Maas 1993a).

Bat-eared foxes engage in frequent and extended allogrooming sessions, which serve to strengthen group cohesion (Maas 1993a). In the south-western Kalahari, it increases markedly (as does urine-marking) during courtship, when huddling, playing and mutual chasing. Vigorous and extended social play is very common in this species, not only in cubs but also adults even after the young have left (B. Maas unpubl.).

Communication is primarily visual, with a variety of ear and tail positions, emphasised by dark markings, used for displays (Nel and Bester 1983; B. Maas pers. obs.). The unique inverted U position of the tail is indicative of a range of states of arousal including fear, play and alarm (Nel and Bester 1983). Vocalisations are mostly soft and sparingly used (Lamprecht 1979; Nel and Bester 1983), except when the animals are highly alarmed or excited during play (Maas 1993a).

Reproductive and denning behaviour

Bat-eared foxes become sexually mature at 8–9 months of age. Pair-bonding and mating takes place from July to September with up to 10 copulations per day for several days (Rosenberg 1971), and with a copulatory tie lasting c. 4 minutes, followed by peculiar post-copulatory play (Le Clus 1971). Bat-eared foxes have one litter per year, with births occurring from October to December (Nel *et al.* 1984; Maas 1993a), following a gestation period of 60–75 days. Litter size ranges from 1–6, and in the Serengeti averages 2.56 (n=90). Neonates weigh from 99–142g.

Dens are excavated by breeding adults or adapted from disused dens of other mammals (e.g., springhare *Pedetes* spp., aardvark, and even termite mounds and warthog holes *Phacochoerus* spp.; Lamprecht 1979; Maas 1993a). Dens may have several entrances and chambers and tunnels up to 3m long (Smithers 1971; Berry 1978), and are used for protection against predators and the elements (e.g., flooding, temperature extremes), particularly by the newborn cubs. Small cubs nurse inside the den, later outside and first emerge for brief periods when they are 8–12 days old. Cubs are sometimes moved between dens (Maas 1993a; Pauw 2000, see above), and in the Serengeti, bat-eared foxes utilise ‘foraging dens’ for

the protection of cubs in different parts of the territory (Maas 1993a). Dens are carefully maintained throughout the year, often for generations (Maas 1993a). Breeding dens can be clustered: in the south-western Kalahari six dens were found in a 0.5km² section of the riverbed in 1976 (J.A.J. Nel unpubl.), and each was occupied by an adult pair and 2–3 cubs (16 in total). Two further dens were nearby.

The male spends more time close to the cubs than females, grooming, guarding and playing with them and defending them against predators. Maternal investment during lactation is high in bat-eared foxes compared with other canids, but due to an insectivorous diet mothers and/or cubs cannot be provisioned directly in the conventional sense (Maas 1993a; but see Pauw 2000). The high level of male parental care, however, enables females to maximise their foraging time, which limits nutritional intake in small, dispersed food items. The disparity in care between the sexes becomes less prominent after weaning (10–15 weeks; Berry 1978; Maas 1993a), which in the south-western Kalahari occurs after the first rains and subsequent flush of insects.

Young cubs are initiated into foraging by the male (Nel 1978), and in the Serengeti parents facilitate better access to different *H. mossambicus* patches for small and vulnerable cubs by regularly guiding the cubs from the breeding den to ‘nocturnal feeding dens’ (Maas 1993a). Social learning by cubs seems to be involved (Nel 1999). The nuclear family group persists until the following June when cubs disperse and the pair – which mates for life (Maas 1993a) – reaffirm their pair bond (Nel 1984).

In East Africa (Serengeti), polygyny, communal breeding and indiscriminate allo-suckling is common. In extended family groups (‘super families’; see Social behaviour), where there is more than one breeding female, nursing effort per cub is higher in daughters than in alpha females (Maas 1993a). The number of cubs to emerge from the den in ‘super families’ is inversely related to the number of breeding females. Cubs raised per ‘super family’ average 3.6 in the Serengeti (n=48), in contrast to the normal 2.56 (see above), but is subject to annual variation potentially linked to food availability (Maas 1993a). Because of the benefits, particularly amongst related females, of sharing both males and insect prey, additional breeding females spread the energetic costs associated with reproduction (Maas 1993a).

Although communal breeding is rare in southern Africa (Nel *et al.* 1984; Pauw 2000), family groups can also coalesce, with up to 10 non-suckling juveniles and three adults (J.A.J. Nel unpubl.).

Competition

In southern Africa bat-eared foxes are sympatric with other carnivores (e.g., suricates *Suricata suricatta*, yellow mongoose *Cynictis penicillata*, black-backed jackal *Canis*

mesomelas and Cape fox *Vulpes chama*) that also feed on insects and therefore scramble (and even interference) competition cannot be ruled out. However, in most cases, although there is dietary overlap, rank order of particular prey in the diet of these sympatric carnivores differs (Bothma *et al.* 1984; MacDonald and Nel 1986; Kok and Nel 1992; Kok 1996; Nel and Kok 1999). Bat-eared foxes attack and mob and can displace Cape foxes, aardvarks, aardwolves, and black-backed jackals and even hyenas, especially if the latter approach a den with cubs.

Mortality and pathogens

Natural sources of mortality During droughts, or in the absence of suitable breeding territories (Maas 1993a), lack of food can cause starvation, or decrease ability to avoid predators. Predators include spotted hyaena (*Crocuta crocuta*), martial eagle (*Polemaetus bellicosus*), spotted eagle owl (*Bubo africanus*), Verreaux's eagle owl (*Bubo lacteus*), rock pythons (*Python sebae*) (Maas 1993a), cheetah (*Acinonyx jubatus*), wild dog (*Lycaon pictus*) (Rasmussen 1996), and leopard (*Panthera pardus*) (Bothma and Le Riche 1982; J.A.J. Nel pers. obs.). Pups also fall prey to black-backed jackal (*Canis mesomelas*) (Pauw 2000; J.A.J. Nel and B. Maas pers. obs.).

Persecution In southern Africa persecution is limited to farms where these foxes are sometimes erroneously regarded as predators of young lambs (see Kok 1996).

Hunting and trapping for fur Limited to indigenous peoples in southern Africa, especially Botswana, where hunting and trapping for fur in the colder months can be severe. Treated skins (often as blankets) are known as "macloutsi". Individuals and sometimes families are also captured for food in Botswana (see Sheldon 1992; B. Maas pers. obs.). Surprisingly, bat-eared foxes are sold as trophy animals in South Africa, but the extent of this trade is unknown.

Road kills In South Africa, Namibia and Tanzania, road kills can be numerous; often pairs and some young are run over together.

Pathogens and parasites Rabies (Maas 1993b; Nel 1993; Thomson and Meredith 1993) and canine distemper (Roelke-Parker *et al.* 1996; E.A.N. Le Riche pers. comm.) can cause drastic declines in populations. In East Africa, both diseases have been linked to reservoirs in domestic dogs (Cleaveland and Dye 1995; Carpenter *et al.* 1998). In the Serengeti, 90.4% of mortality was caused by disease (3.2% each by predation and road accidents (n=94)). Trichinellosis has been found in one Serengeti bat-eared fox, but any effect on mortality is unknown (Pozio *et al.* 1997). Canine parvovirus (CPV-2b) has also been isolated from a bat-eared fox (Steinel *et al.* 2001).

Longevity Recorded up to 13 years in captivity, but probably shorter in the wild.

Historical perspective

In southern Africa, especially Botswana, treated skins (macloutsi) are commonly used for making karosses (skin blankets).

Conservation status

Threats: In southern Africa the primary threats are hunting for skins or, because they are perceived as being predators of small livestock. Populations fluctuate due to disease or drought.

Commercial use Very limited, but winter pelts are valued and sold as blankets. They are also sold as hunting trophies in South Africa.

Occurrence in protected areas

- **Botswana:** Kgalagadi Transfrontier Park, Central Kalahari Game Reserve, Chobe National Park;
- **Ethiopia:** Abiata-Shalla Lakes National Park, Awash National Park, Mago National Park, Nachisar National Park, Omo National Park;
- **Kenya:** Maasai Mara;
- **Namibia:** Etosha National Park, Namib-Naukluft National Park, Fish River Canyon National Park;
- **South Africa:** Augrabies Falls National Park, Kgalagadi Transfrontier Park, Karoo National Park, Richtersveld National Park, Namaqua National Park, West Coast National Park, Mountain Zebra National Park, Goegap Nature Reserve, Bloemhof Nature Reserve, Soetdoring Nature Reserve, Willem Pretorius Nature Reserve, Tussen-die-Riviere Nature Reserve;
- **Tanzania:** Serengeti National Park;
- **Uganda:** Kidepo National Park;
- **Zimbabwe:** Hwange National Park.

Protection status CITES – not listed.

Current legal protection None known.

Conservation measures taken None known. Species widespread and mostly common.

Occurrence in captivity

Records from the International Species Information System (ISIS) indicate bat-eared foxes are kept in captivity in North America, Europe, South Africa and Asia, although never in large numbers. There are no management programmes or studbooks for the species in any of these regions. Importations have occurred throughout the history of the captive population despite successful captive breeding since 1970. Bat-eared foxes can coexist well with

other species and are frequently seen in African plains exhibits at zoos.

In South Africa an unknown number are being kept as pets, while they are also kept at a small number of international zoos. South African zoos keeping bat-eared foxes include Congo, Bester Birds, Hartbeespoort Dam, World of Birds, Bloemfontein Zoological Gardens, Johannesburg Zoological Gardens, Emerald, and Monkey Den.

Current or planned research projects

H. Wright (Warwick University, UK) is studying the behavioural ecology of monogamy in the bat-eared fox in Kenya.

N. Jordan (Department of Zoology, Cambridge University, UK) is planning a research project in the south-western Kalahari.

Gaps in knowledge

There is a conspicuous lack of information about both abundance and population trends in this species across its range. In southern Africa, little is known about dispersal of young and the formation of new breeding pairs. The causal factors for differences in home range size in different localities, group size and changes in density as a function of food availability are poorly known. In the Serengeti, behavioural evidence on group and pair formation and the existence of 'super families', consisting of one male and up to three closely-related breeding females, raises interesting questions about regular inbreeding between males and their daughters from several generations (see Maas 1993a).

Core literature

Lamprecht 1979; Maas 1993a,b; Maas and Macdonald 2004; Mackie 1988; Mackie and Nel 1989; Malcolm 1986; Nel 1978, 1990, 1993; Nel *et al.* 1984.

Reviewers: James R. Malcolm, Patricia D. Moehlman.

Editors: Michael Hoffmann, Claudio Sillero-Zubiri.

6.7 Cape fox

Vulpes chama (A. Smith, 1833)

Least Concern (2004)

C. Stuart and T. Stuart

Other names

Afrikaans: silwervos, silwerjakkals, draaijakkals; **English:** silver fox, silver jackal; **French:** le renard du Cap; **German:** Kapfuchs; **Spanish:** zorro chama, zorro del Cabo; **Indigenous languages:** Xhosa: uGqeleba (South Africa); Heikum San: !khamalirib; Herero: ombánji-ururápa (Namibia); Ovambo: ombánji-kalulúng, karurúnga

(Namibia); Tswana: leSie, thósê, thlósê, khanína (Botswana, South Africa).

Taxonomy

Canis chama A. Smith, 1833. S. Afr. Quart. J. 2: 89. Type locality: "Namaqualand and the country on both sides of the Orange river", determined by Shortridge (1942: 41) as "Port Nolloth, Little Namaqualand" [South Africa, c. 29°15'N, 16°52'E].

Chromosome number not known.

Description

The smallest canid and only true fox occurring in southern Africa, the Cape fox has a slender build and a black-tipped bushy tail. Males are approximately 5% larger than females (Table 6.7.1). The overall coloration of the upperparts is grizzled silver-grey, with the lower limbs, head and back of the long ears reddish-brown to pale tawny-brown. There is some freckling of white hairs on the face with the greatest concentration being on the cheeks; the fronts of the ears are also fringed with white hairs. A narrow dark patch above and between the eyes and at the tip of the muzzle may be present. The upper chest is fawny-red, with the underparts coloured off-white to pale fawn, often with a reddish-brown tinge. The upper region of the front legs is reddish-yellow, paler as one descends to the paws, with a dark brown patch on the backs of the thighs of the hind legs. Overall, the body pelage is soft, with a dense underfur of wavy hairs (averaging about 25mm in length) overlaid by a thick guard coat, with individual hairs averaging 45mm in length; the latter are predominantly black in colour but with light-coloured bases and banded silver. Slightly longer black tactile hairs are scattered through the body coat. During the moulting period, from October to December, much of the guard coat is lost, giving the foxes a rather dull and 'naked' appearance. The upper surfaces of the paws are pale fawn to reddish, with the claws of the front feet being sharp, curved and averaging 15mm around the curve. There is pronounced hair growth between the foot-pads. The tail is very bushy with individual

Table 6.7.1. Body measurements for the Cape fox from the former Cape Province, South Africa (Stuart 1981).

HB male	554mm (450–610) n=21
HB female	553mm (510–620) n=15
T male	348mm (300–406) n=25
T female	338mm (250–390) n=17
HF male	131mm (123–140) n=20
HF female	126mm (115–140) n=17
E male	98mm (90–110) n=22
E female	97mm (87–105) n=17
WT male	2.8kg (2.0–4.2) n=17
WT female	2.5kg (2.0–4.0) n=11



Cape fox, age and sex unknown. Anakanirab, Central Namib-Naukluft Park, Namibia, 1993.

Chris and Tilde Stuart

hairs reaching 55mm in length. The tail hairs have buffy-white bases and are broadly black or dark brown towards the tips. From a distance, the overall impression is of a black to very dark-brown tail, although close at hand the tail has a paler appearance. Females have one pair of inguinal and two pairs of abdominal mammae. The skull is narrow and elongated (average total length is 115mm), with a narrow rostrum and a rather weak zygomatic arch. The bullae are large in relation to the size of the skull. The canines are long, slender and strongly curved and the two upper molars are broad as an adaptation to crushing. The dental formula is $3/3-1/1-4/4-2/3=42$.

Subspecies Monotypic (Meester *et al.* 1986).

Similar species Bat-eared fox (*Otocyon megalotis*): distinguishable on grounds of coloration and the conspicuously large ears.

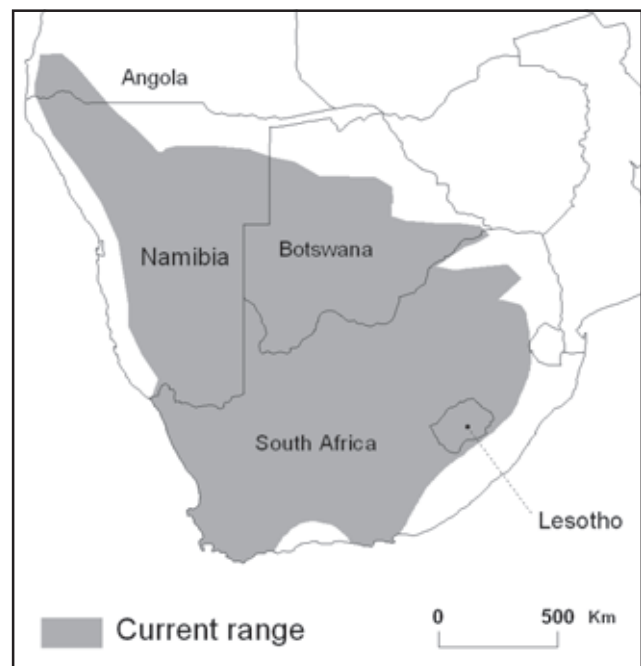
Current distribution

The species is widespread in the central and western regions of Southern Africa (Figure 6.7.1), reaching to about 15°N in south-western Angola (Crawford-Cabral 1989). It occupies mainly arid and semi-arid areas, but in parts, such as the fynbos biome of South Africa's Western Cape province, the species enters areas receiving higher precipitation and denser vegetation. The species has expanded its range over recent decades to the south-west where it reaches the Atlantic and Indian Ocean coastlines (Stuart 1981). Expansion through South Africa's Eastern Cape province has been documented (Coetzee 1979). Status in Swaziland is uncertain, but they may occur in the south-west (Monadjem 1998), as the species occurs in adjacent regions of north-western KwaZulu-Natal (Rowe-Rowe

1992); possible occurrence in Lesotho (Lynch 1994). Previous records of its occurrence in western Zimbabwe (Roberts 1951; Coetzee 1977) and Mozambique (Travassos Dias 1968) have not been substantiated, and it is considered unlikely that these records are valid.

Range countries Angola, Botswana, Lesotho (?), Namibia, South Africa, Swaziland (?) (Shortridge 1934; Smithers 1971; Crawford-Cabral 1989; Skinner and Smithers 1990; Lynch 1994; Monadjem 1998).

Figure 6.7.1. Current distribution of the Cape fox.



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Relative abundance

Generally common to fairly abundant across much of its range, although problem animal control activities have resulted in population reductions in some areas. Estimates are only available for South Africa's Free State province where an average density of 0.3 foxes per km² was estimated with a total population of 31,000 individuals (Bester 1982). Annual offtake resulting from problem animal control programmes averaged roughly 16% up to 1985, with no obvious declines in overall populations (Bester 1982). Range and numbers have increased in the south-west and east of South Africa (Coetzee 1979; Stuart 1981). Estimated population sizes or numbers are not available, but it is thought that populations are currently stable across their entire range.

Habitat

They mainly associate with open country, including grassland, grassland with scattered thickets, and lightly wooded areas, particularly in the dry Karoo regions, the Kalahari and the fringes of the Namib Desert. They also penetrate moderately dense vegetation in lowland fynbos in the Western Cape, as well as extensive agricultural lands where they lie up in surviving pockets of natural vegetation during the day and forage on arable and cultivated fields at night (Stuart 1981). Along the eastern flank of the Namib Desert, Namibia, they occupy rock outcroppings and inselbergs, ranging out onto bare gravel plains at night (Stuart 1975). In Botswana, they have been recorded from *Acacia*-scrubland, short grassland and especially on the fringes of shallow seasonal pans, as well as cleared and overgrazed areas (Smithers 1971; Skinner and Smithers 1990). In the central Karoo of South Africa, they occupy the plains as well as the low rocky ridges and isolated rock outcroppings. In the Free State, Lynch (1975) found that they were most abundant in areas receiving less than 500mm of rainfall, although in KwaZulu-Natal they have been recorded between 1,000 and 1,500m above sea level, where rainfall is roughly 720–760mm (Rowe-Rowe 1992).

Food and foraging behaviour

Food The Cape fox takes a wide range of food items, including small rodents (murids), hares, reptiles, birds, invertebrates and some wild fruits (Bothma 1966a, 1971d; Smithers 1971; Lynch 1975; Stuart 1981; Bester 1982; Kok 1996). A sample of the contents of 57 stomachs collected across much of western and central South Africa (former Cape Province) showed that rodents were by far the most important mammal prey items; beetles (larvae and adults) and grasshoppers comprised the majority of invertebrate intake (Stuart 1981). Other dietary studies, involving stomach analysis of specimens obtained from Botswana (n=23, Smithers 1971), Free State (n=58, Lynch 1975; n=192, Bester 1982), the former Transvaal province (n=66, Bothma 1971d) and South Africa in general (n=37, Bothma

1966a) have revealed similar trends. Birds and reptiles are occasionally included in the diet but these do not appear to be important. The largest wild prey species recorded include hares (*Lepus* spp.) and springhares (*Pedetes capensis*) (Lynch 1975). Prey utilisation seems to reflect prey availability and seasonal variation in prey use occurs (Bester 1982). They will also scavenge and occasionally include young lambs and goats in their diet (Stuart 1981; Bester 1982).

Foraging behaviour Although the Cape fox lives in monogamous pairs, foraging is a solitary activity (Bester 1982). However, occasionally they may gather in loose groupings to forage at an abundant food source (Stuart 1981). Foraging is an almost exclusively nocturnal activity, with peaks shortly after sundown and just before dawn. Much prey is obtained by rapid digging with the front paws, often preceded by intensive listening bouts. Caching of prey is common (Le Clus 1971; Bester 1982; C. Stuart and T. Stuart pers. obs.).

Damage to livestock or game Predation on domestic livestock, especially lambs up to the age of three weeks, has been well documented (Stuart 1981; Bester 1982). However, it is not always clear to what extent scavenging is involved, and at least in some areas damage levels are exaggerated. In our experience, lambs killed by the Cape fox are seldom older than four days. Although some authors (Roberts 1951; Bothma 1966) found no evidence of stock killing by Cape foxes, this may have been influenced by their particular study areas. The seasons when samples were taken could also have influenced their conclusions, as the majority of sheep farmers follow fixed lambing times. The highest incidence of lamb losses to the Cape fox has been documented from the Free State, where Bester (1982) recorded that they may take 4.5% of the lamb crop.

Adaptations

Large pinnae and enlarged bullae and auditory meatus suggest enhanced detection of prey as well as predators. Nocturnal activity could serve to reduce predation, especially by the larger diurnal raptors (as has been hypothesised for Blanford's fox, *Vulpes cana*; Geffen and Macdonald 1993).

Social behaviour

The ecology of the Cape fox is poorly known and much of what is known comes from the study undertaken by Bester (1982) in the Free State. Cape foxes live in monogamous pairs. They appear to have overlapping home ranges, especially in areas where food is abundant, although the defended territory is believed to be a limited area around the den in which the female has her litter (Skinner and Smithers 1990). Home ranges ranged in size from 1.0–4.6km² (Bester 1982) and are likely to vary according to rainfall and food abundance.

The main vocal communication consists of a high-pitched howl, ending with a sharp bark. The vixen may bark when a potential predator approaches a den occupied by pups (Smithers 1983). Facial expressions and tail positions play an important role in visual communication (Le Clus 1971; Bester 1982).

Reproduction and denning behaviour

Breeding appears to be non-seasonal in some areas, and strongly seasonal in others (Stuart and Stuart 2001). The majority of births take place in spring and summer, with births recorded in August and September in South Africa's west (Stuart 1981), and August to October, with a peak in September, in the Free State (Bester 1982). In captivity, at the National Zoological Gardens in Pretoria, births were recorded from mid-September to mid-October (Brand 1963). In the Kalahari, breeding apparently extends throughout the spring and summer months. In the Western and Northern Cape provinces, juveniles and subadults have been collected during November and December (Stuart 1981).

Gestation lasts about 52 days (Brand 1963) and litter size in the Free State (2.9; range=1–6; n=16) and Kalahari (2.8; range=2–4; n=5) is similar. Young are born in burrows which are dug in sandy soil, or otherwise the adults enlarge those dug by species such as the springhare or armadillo (*Orycteropus afer*). They have also been known to use crevices, cavities amongst boulder tumbles and, occasionally, dense vegetation (Stuart 1981; Bester 1982). Although both parents feed the pups, the vixen is the main provider; no helpers are found at dens. Both parents will defend the pups against potential predators (Bester 1982). Their habit of abandoning one den for another could avoid accumulation of parasites and confuse potential predators (Bester 1982). Bester (1982) established that pups first begin to hunt at about 16 weeks and are independent of the mother and disperse at the age of about five months.

Communal denning has been recorded in the southern Kalahari (M.G.L. Mills pers. comm.), and Bester (1982) found one litter consisting of eight pups in the Free State, perhaps evidence of a similar situation.

Competition

Although poorly known, it is likely that the black-backed jackal (*Canis mesomelas*) is a competitor, and an occasional predator. It is likely that other predators, such as the caracal (*Caracal caracal*), are also competitors. Where Cape foxes coexist with possible competitors, such as black-backed jackal, some separation in prey use is evident (Bothma *et al.* 1984; Kok 1996). Over much of its range, large predators have been eradicated or greatly reduced in numbers.

Mortality and pathogens

Natural sources of mortality C. Stuart and T. Stuart (pers. obs.) recorded two instances of predation by black-

backed jackal, and Mills (1984) observed a single case of predation by a leopard (*Panthera pardus*) in the Kalahari.

Persecution This fox suffers direct and indirect mortality from problem animal control activities, particularly in South Africa and southern Namibia. In the past fairly accurate figures were kept by hunting clubs and associations of most problem animals killed during control operations. However, in recent years, most of these hunting clubs have been disbanded and control measures, by and large, have been left to individual farmers. This has resulted in a paucity of records and data that can only be quoted from the 1960s and 1970s. In the former Cape Province of South Africa, from 1966 to 1970 and 1974 to 1976, more than 6,000 Cape foxes were killed by registered hunters/hunting clubs in the districts to the south of the Orange River. During this same period, in six hunting districts in the Eastern Cape province, records show that more than 20% of all animals killed were Cape foxes (Stuart 1981). In the Free State in 1974, 4,000 Cape foxes were killed during organised control operations and an average of 2,000–3,000 animals were taken in each subsequent year (Bester 1978). The Cape fox is often indirectly killed as a 'by-catch' of efforts aimed at the black-backed jackal and the caracal. The main control methods employed are leg-hold traps, dog packs and poison.

Hunting and trapping for fur Although the occasional pelt may be seen for sale in South African and Namibian curio shops, numbers entering the trade are very small. In Botswana, the pelts of this fox and other species are used in the making of traditional blankets (kaross) but no figures are available. The availability of mass-manufactured blankets has probably greatly reduced demand for animal pelts. Fur trapping poses no threat to this fox anywhere within its range.

Road kills Although occasionally seen as a road kill, the incidence of road traffic death is very low, particularly when compared with that for the bat-eared fox. Bat-eared foxes tend to stand more easily for oncoming lights, whereas Cape foxes usually turn and move.

Pathogens and parasites They are susceptible to rabies but not to the same extent as some other mammalian carnivores. The following parasites have been collected from this fox in the former Cape province: Order Siphonaptera, *Ctenocephalides connatus* and *Echidnophaga gallinacea*; Order Acarina, *Haemaphysalis leachi* and *Rhipicephalus capensis*; Order Eucestoda, *Taenia endothoracicus*, *Joyeuxiella* sp. and *Mesocostoides* sp. (Stuart 1981). In general, the role of disease and parasites as mortality factors in the Cape fox is largely unknown.

Longevity Unknown, but unlikely to be more than about seven years in the wild.

Historical perspective

Pelts were used for the production of traditional blankets, especially by the Tswana people, along with those of species such as the bat-eared fox. However, their usage has greatly diminished.

Conservation status

Threats Habitat loss/changes are not a major factor influencing the conservation status of the Cape fox. In fact, in Western Cape province and elsewhere, changing agricultural practices have resulted in range extensions for this species, as well as for the bat-eared fox (Stuart 1981). Expansion of semi-arid karroid vegetation during the process of desertification, especially eastwards, has also resulted in range extensions of this canid. Heavy direct and indirect problem animal control measures do not seem to have had a major impact on populations of the Cape fox, even though they have resulted in declines in some areas. The illegal but widespread and indiscriminate use of agricultural poisons on commercial farms poses the greatest threat (C. Stuart and T. Stuart pers. obs.).

Commercial use The trade in Cape fox pelts is negligible and this situation is unlikely to change.

Occurrence in protected areas

- *Botswana*: Central Kalahari Game Reserve, Kgaligadi Transfrontier Park (shared with South Africa);
- *Namibia*: Etosha National Park, Damaraland Wilderness Reserve, Namib-Naukluft Park, Fish River Canyon Park, Skeleton Coast National Park;
- *South Africa*: Addo National Park, Augrabies Falls National Park, Bontebok National Park, Cape Peninsula National Park, Golden Gate Highlands National Park, Karoo National Park, Kgaligadi Transfrontier Park, Mountain Zebra National Park, Richtersveld National Park, West Coast National Park.

The Cape fox occurs in many provincial and private nature reserves, as well as on game ranches in all South

African provinces, although the species has a much more restricted range in Limpopo Province and KwaZulu-Natal (Stuart 1981; Rautenbach 1982; Lynch 1975; Rowe-Rowe 1992). In Swaziland, the species may occur in Nhlangano Nature Reserve in the south-west, and pups have been successfully reared in Milwane Game Reserve (Monadjem 1998).

Protection status CITES – not listed.

Current legal protection Although treated as a problem animal across most of its range, it is partially protected in several South African provinces, as it does not appear on the official lists of problem species. However, no permit is required from any authority to kill this fox in problem animal control operations. No protection measures are currently enforced and at the present time, this is not necessary.

Conservation measures taken None.

Occurrence in captivity

None known.

Current or planned research projects

There are no formal research projects being undertaken or planned on the Cape fox anywhere within its range.

Gaps in knowledge

Although the Cape fox has been extensively studied in South Africa's Free State province (Lynch 1975; Bester 1982; Kok 1996), there is little information for elsewhere within its range. Aspects such as diet and reproduction are quite well known but little information is available on aspects of social ecology and behaviour in the wild. Some investigation into the role, if any, this species plays in disease transmission is necessary.

Core literature

Bester 1982; Lynch 1975; Stuart 1981.

Reviewers: M.G.L. Mills, Jan A.J. Nel, Gustav Peters.

Editors: Michael Hoffmann, Claudio Sillero-Zubiri.