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Vulpes cana.

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Vulpes cana Blanford, 1877

Blanford's Fox

Vulpes cana Blanford, 1877:315. Type locality Gwadar, Baluchistan, Pakistan.

CONTEXT AND CONTENT. Order Carnivora, Family Canidae, Genus *Vulpes* in which there are 12–14 species, depending on the authority accepted (Clutton-Brock et al., 1976; Van Gelder, 1978; Wayne et al., 1989). *V. cana* is monotypic.

DIAGNOSIS. A small fox (ca. 1 kg), similar in body mass to the fennec (*Fennecus zerda*). The tail of the Blanford's fox is bushy and longer ($\bar{x}$ = 32.3 cm), relative to length of body ($\bar{x}$ = 42.6 cm), than in the other Arabian desert foxes (6.8%, 9.8%, and 22.5% longer than that of *Vulpes rueppelli*, *Vulpes vulpes*, and *Fennecus zerda*, respectively—Geffen et al., 1992*a*; Mendelssohn et al., 1987). The length of the hind foot, relative to length of body, is significantly the shortest in *V. cana* (1.8%, 0.8%, and 3.2%, respectively), and the relative ear length is intermediate (2.0% longer than in *Vulpes vulpes* and 2.6% and 5.4% shorter than in *V. rueppelli* and *F. zerda*, respectively—Geffen et al., 1992*a*; Harrison and Bates, 1991). This fox has a slender face and a pointed muzzle with a distinctive black marking extending from the internal angle of the eye to the anteromedial part of the upper lip (Fig. 1). The iris is almost as dark as the pupil (Geffen, 1990). The body and tail are brownish-gray, with a black mid-dorsal band present along the back and tail. A distinctive dorsal black spot is present at the base of the tail, which usually has a black tip, although in some individuals the tip is white. The feet have blackish-naked pads (Geffen et al., 1992*a*; Harrison and Bates, 1991). The skull (mean of greatest length is 94.1 mm) is intermediate in size between *F. zerda* and *V. rueppelli*, with a noticeably slender rostrum. The tympanic bullae are relatively smaller than those of *V. rueppelli*, and the coronoid process of the mandible is relatively more convex (Harrison and Bates, 1991). The baculum of *V. cana* is similar in size to that of *V. rueppelli* (41.5 mm), but it is broader and has an expanded bulbous tip (Harrison and Bates, 1991).

GENERAL CHARACTERS. Blanford's fox is a small fox with a long tail that almost equals its body length. The body is brownish-gray, fading to pale yellow on the belly. The winter coat is soft and woolly with a dense, black underwool. Its dorsal region is sprinkled with white-tipped hair. The summer coat is less dense, the fur is paler colored, and the white-tipped hairs are less apparent. A distinctive mid-dorsal black band extends from the nape of the neck caudally, becoming a mid-dorsal crest throughout the length of the tail. The tail is similar in color to the body. A distinctive dorsal black spot is present at the base of the tail. The tip of the tail usually is black, although in some individuals it is white. The dark mid-dorsal band, which is a distinctive feature of the Israeli specimens, is less evident in specimens from Oman, although the black tail markings are equally developed (Harrison and Bates, 1989). The forefeet and hind feet are dorsally pale yellowish-white, while posteriorly they are dark gray. Unlike the other fox species in the Arabian deserts, the blackish pads of the feet and digits are hairless and the claws are cat-like, curved, sharp, and semi-retractile. The head is orange buff in color, especially in the winter coat. The face is slender with a dark band extending from the upper part of the sharply pointed muzzle to the internal angle of the eyes. The ears are pale brown on both sides with long white hairs along the anteromedial border (Geffen, 1990; Geffen et al., 1992*a*; Harrison and Bates, 1991; Roberts, 1977).

Measurements of specimens from the Afghan–Iranian region (in cm) were: length of body, 40–50; length of tail, 33–41; length of ear, 6.5–7.0 (Novikov, 1962; Roberts, 1977). Two *V. cana* in Oman were: total length, 73.5 and 76.0; length of tail, 35 and 36; length of hind foot, 9.7 and 10.1; length of ear, 7.6 and 8.0 (Harrison and Bates, 1989). Average body mass ($\pm SD$) of nine adult males and six adult females from Ein Gedi (by the Dead Sea), Israel, was 1.18 ± 0.11 and 1.11 ± 0.14 kg, respectively, and the average mass of three adult males and five adult females from Eilat (Gulf of Aqaba), Israel, was 1.05 ± 0.09 and 0.99 ± 0.09 kg, respectively (Geffen et al., 1992*a*). Average measurements ($\pm SD$, cm) of these individual males and females from Ein Gedi and Eilat, respectively, were: length of body, 44.43 ± 1.84 and 42.75 ± 1.86; 41.17 ± 2.36 and 40.10 ± 0.55; length of tail, 33.22 ± 1.82 and 31.50 ± 1.79; 31.00 ± 1.73 and 32.40 ± 0.55; length of hind foot, 9.50 ± 0.37 and 9.53 ± 0.46; 9.17 ± 0.76 and 9.50 ± 0.93; length of forearm, 15.06 ± 0.46 and 14.18 ± 0.63; 14.83 ± 1.89 and 13.94 ± 0.38; length of ear, 8.03 ± 0.27 and 7.82 ± 0.46; 7.73 ± 0.46 and 8.00 ± 0.35. Mediolateral diameter of the forefoot pad averaged ($\pm SD$, cm) 1.34 ± 0.07 and 1.33 ± 0.05 for males and females, respectively, whereas mediolateral diameter of the hind foot pad averaged 1.13 ± 0.08 and 1.12 ± 0.06 for males and females, respectively (Geffen et al., 1992*a*). These characters exhibited minimal sexual dimorphism (0.5–6.0%, depending on the parameter considered—Geffen et al., 1992*a*).

The skull of Blanford's fox is intermediate in size between *F. zerda* and *V. rueppelli* (Fig. 2). The rostrum is slender, and the nasal bones are long and thin. The postorbital processes are well developed and are not deeply concave dorsally. The braincase is relatively narrow and weakly ridged. The palatines are narrow, and the mesopterygoid space also is long and thin. Average cranial measurements ($\pm SD$, mm) for eight specimens from Oman, Israel, and Sinai (Harrison and Bates, 1991; Mendelssohn et al., 1987) are: greatest length of skull, 94.1 ± 3.1; condylobasal length, 87.0 ± 5.1; zygomatic width, 49.1 ± 3.0; width of braincase, 35.8 ± 0.9; interorbital constriction, 16.9 ± 0.8; length of maxillary toothrow, 41.0 ± 2.1; length of mandibular toothrow, 45.1 ± 1.7; length of mandible, 70.2 ± 2.5. Length and width of upper carnassial teeth are ca. 9.1 and 4.5 mm, respectively. Length and width of the lower carnassial teeth are 9.8 and 4.3 mm, respectively. The dental for-

FIG. 1. An adult *Vulpes cana* at Ein Gedi, Israel. Photo courtesy of S. Kaufman.

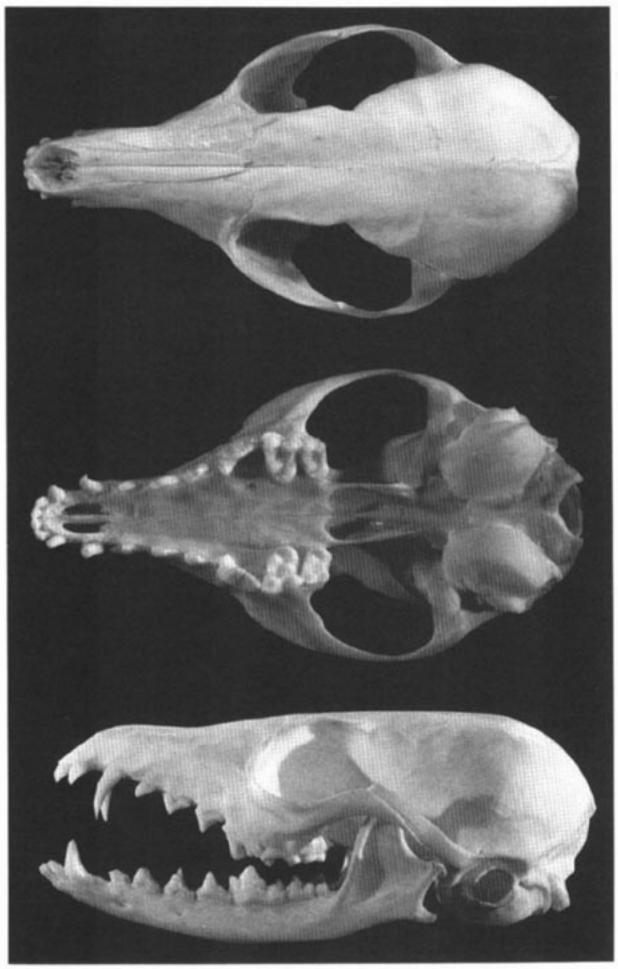

FIG. 2. Dorsal, ventral, and lateral view of the cranium, and dorsal view of the mandible of *Vulpes cana* (photo courtesy of A. Shub, taken from Mendelssohn and Yom-Tov, 1987). Greatest length of skull is 92.7 mm.

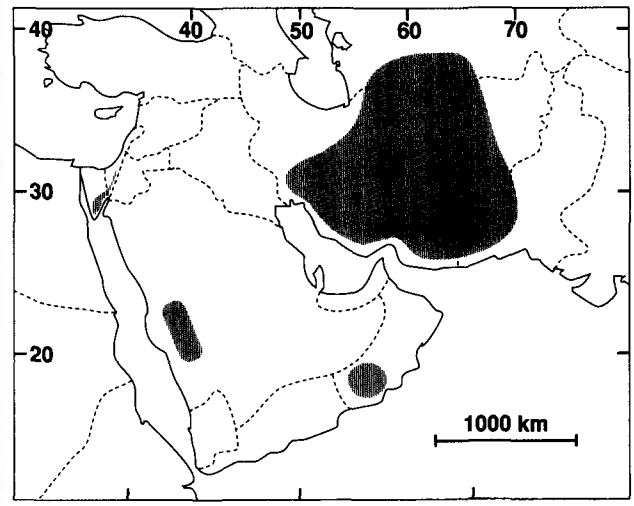

FIG. 3. Distribution of *Vulpes cana* in western Asia and the Middle East (Geffen, 1990; Harrison and Bates, 1991).

mula is i 3/3, c 1/1, p 4/4, m 2/3, total 42 (Harrison and Bates, 1989).

DISTRIBUTION. Previously, Blanford's fox was thought to be confined to mountainous regions in northern Iran (Lay, 1967), Afghanistan (Hassinger, 1973), northwestern Pakistan (Roberts, 1977), and southern Turkmenia (Bobrinskii et al., 1965; Novikov, 1962). Recently, it has been discovered in Oman (Harrison and Bates, 1989), Saudi Arabia (Harrison and Bates, 1991), Sinai, and Israel (Ilany, 1983; Mendelssohn et al., 1987; Fig. 3).

There are no records of the species from the northern Himalayan range (Roberts, 1977). Bobrinskii et al. (1965) reported that *V. cana* in Russia was known from two locations near the border with northern Afghanistan. Ranjitsinh (1984) observed two Blanford's foxes in the Great Rann of Kutch (27°00′N, 70°00′E; India) from a helicopter; however, this identification is questionable. No fossils have been recorded.

FORM AND FUNCTION. Blanford's fox has dense fur with thick underwool during winter. This fox inhabits mountains throughout the Iranian Plateau and Arabian Peninsula where climatic conditions during winter (December–February) are dry and cold. In Israel, density of fur and body mass were highest in winter, whereas the fractional volume of total body water was lowest (Geffen et al., 1992*a*, 1992*d*). These facts suggest that Blanford's foxes lay down increased fat and fur in the winter, possibly to improve insulation (Geffen et al., 1992*a*, 1992*d*).

Most canids are cursorial carnivores, capable of prolonged trotting at moderate speeds (Taylor, 1989) and, in general, locomotion of canids is adapted to long-distance travel over horizontal ground. *V. cana* utilizes both horizontal and vertical ground regularly (Geffen et al., 1992*a*). The only other species that routinely climbs is the gray fox, *Urocyon cinereoargenteus* (Fritzell, 1987). The relatively bushier and longer tail of *V. cana* is probably an important counter balance during climbing, as in many other arboreal mammals (Taylor, 1989). Among canids, Blanford's foxes have an astonishing jumping ability; captive individuals bounced from one wall to another or jumped to the highest ledges (2–3 m) in their cage with remarkable ease, and did so as part of their routine movements (Mendelssohn et al., 1987). In the field, these foxes were observed climbing vertical, crumbling cliffs by a series of jumps up the vertical sections (Geffen et al., 1992*a*). Their naked pads and sharp, curved claws enhance traction on vertical ascents (Geffen et al., 1992*a*; Mendelssohn et al., 1987).

ONTOGENY AND REPRODUCTION. Blanford's foxes live in monogamous pairs (Geffen and Macdonald, 1992). Females are monoestrus and come into heat during January–February (in Israel). Gestation period is ca. 50–60 days, and litter size is one to three. Females have two to six active teats, and the lactation period is 30–45 days. Neonates are born with soft, black fur. Based on repeated measures of body mass of three young born in captivity, a neonate body mass of 29 g was estimated (Geffen, 1990; Mendelssohn et al., 1987). Body mass of subadult is reached in ca. 3–4 months (700–900 g). At ca. 2 months of age the young start to forage, accompanied by one of the parents, and at 3 months of age they start to forage alone. Juveniles have similar markings as the adult, but their coat is darker and more grayish. Sexual maturity is reached at 10–12 months of age (Geffen, 1990).

Young are entirely dependent upon their mother's milk for food until they begin to forage for themselves. Adult Blanford's foxes never have been observed to carry food to the young and only one den was found with remains of prey at the entrance (Geffen and Macdonald, 1992). Observations of Blanford's foxes suggest that food is not regurgitated to the young, as in other small canids. Geffen and Macdonald (1992) had no indication that the male provides food either to the female or to the young, although they observed males grooming and accompanying 2–4-month-old juveniles. Therefore, it appears that the direct contribution to survival of the young by any individual other than the mother, probably is minimal. Offspring often remain on their natal home range until autumn (October–November).

ECOLOGY. Blanford's fox is confined to mountainous regions (Lay, 1967; Roberts, 1977). Hassinger (1973) concluded that Blanford's foxes generally are found below an elevation of 2,000 m in dry montane biotopes. All the records collected at the Persian Plateau are from foothills and mountains in the vicinity of lower plains and basins (Hassinger, 1973; Roberts, 1977). In that region, the habitat of Blanford's foxes comprises the sides of rocky mountains with stony plains and patches of cultivation (Lay, 1967; Roberts, 1977). This

species appears to avoid higher mountain ranges as well as lower, warmer valleys (Roberts, 1977). In the Middle East, Blanford's foxes are confined to mountainous desert ranges, and inhabit steep, rocky slopes, canyons, and cliffs (Harrison and Bates, 1989; Mendelssohn et al., 1987). In Israel, *V. cana* is distributed along the western side of the Rift Valley, and in the central Negev, it was observed in creeks that drain into the Rift Valley (Geffen, 1990). Apparently, *V. cana* can occur on various rock formations as long as its other requirements are met. The distribution of Blanford's fox in the Arabian Desert is not limited by access to water (Geffen et al., 1992*d*). In Israel, Blanford's foxes inhabit the driest and hottest regions. The densest population is found in the Judaean Desert at elevations of 100–350 m below sea level. This is in contrast to Roberts' (1977) remark that the species avoids low, warm valleys in Pakistan.

Blanford's foxes in Israel primarily are insectivorous and frugivorous (Geffen et al., 1992*b*; Ilany, 1983). Invertebrates are the major food with beetles, grasshoppers, ants, and termites eaten most often (Geffen et al., 1992*b*). Plant foods consisted mainly of fruit of two caperbush species, *Capparis cartilaginea* and *Capparis spinosa*. Fruits and plant material of *Phoenix dactylifera, Ochradenus baccatus, Fagonia mollis*, and various species of Gramineae also were eaten. Blanford's foxes in Pakistan are largely frugivorous, feeding on Russian olives (*Eleagnus bortensis*), melons, and grapes (Roberts, 1977). Remains of vertebrates were present in ca. 10% of fecal samples analyzed (Geffen et al., 1992*b*). The diet differed significantly between two sites examined in Israel, but seasonal and individual differences in diet were not detected (Geffen et al., 1992*b*).

Daily energy expenditure of free-ranging Blanford's foxes near the Dead Sea was 0.63–0.65 kJ g^{-1} day^{-1}, with no significant seasonal difference (Geffen et al., 1992*d*). Mean rate of water intake was significantly higher in summer (0.11 ml g^{-1} day^{-1}) than in winter (0.08 ml g^{-1} day^{-1}). They concluded that foxes maintained water and energy balances on a diet of invertebrates and fruits without drinking. Furthermore, this study suggested that Blanford's foxes foraged more for water than for energy because metabolic needs are met before water requirements when feeding on invertebrates. Blanford's foxes in Israel consume more fruit during the hot summer, which compensates for deficiencies in body water (Geffen et al., 1992*b*, 1992*d*). Metabolism of Blanford's foxes during activity was 8.4 times higher than at rest, and daily expenditure of energy averaged 30.1% higher than that of the kit fox (*Vulpes macrotis*—Geffen et al., 1992*d*). These results suggest that activity is more energetically expensive for Blanford's foxes in their mountainous habitat than for other species of desert foxes that inhabit flat terrain (Geffen et al., 1992*d*).

In two populations in Israel, old age or rabies were the primary causes of death (Geffen, 1990). There was one known case of mortality from predation, where the predator was suspected to be a red fox. Potential predators of Blanford's foxes in Israel are leopards (*Panthera pardus*), red foxes (*V. vulpes*), eagle owls (*Bubo bubo*), golden eagles (*Aquila chrysaetus*), and Bonelli's eagles (*Hieraeetus fasciatus*). Life span of Blanford's foxes in these populations was ca. 4–5 years (Geffen, 1990; Ginsberg and Macdonald, 1990). In captivity, individuals reached 6 years of age. Old individuals showed severe tooth wear, absence of some incisors and canines, and often poor body condition. Blanford's foxes appear to be susceptible to rabies. During 1988–1989, 11 dead Blanford's foxes were found in two study populations in Israel, and two fresh carcasses tested positive for rabies (Geffen, 1990).

Blanford's fox is considered one of the rarest predatory mammals in southwestern Asia (Novikov, 1962) and is rare in museum collections (Lay, 1967). In Israel, Blanford's fox appears to be fairly common in the Judaean and Negev deserts. Density in Ein Gedi was estimated at 2 individuals/km^2 and at Eilat was 0.5 individuals/km^2 (Geffen, 1990; Ginsberg and Macdonald, 1990). The status of the species outside Israel is unknown. Most of its range in Israel is within protected areas and nature reserves where its future existence is secure. Blanford's fox is protected by law in Israel, but it is unprotected in the other countries throughout its range and, in some regions, is heavily hunted (Roberts, 1977). The number of exported furs of this species is relatively small compared with other fox species (such as red and Arctic foxes, *Alopex lagopus*—Ginsberg and Macdonald, 1990). Records by the Convention on International Trade in Endangered Species showed that no furs were exported during 1983 and 1985–1986, in 1980 and 1982 seven were exported, and in 1981 ca. 30 skins were exported from Afghanistan. In 1984, 519 skins of the Blanford's fox reportedly were exported, mostly from Canada, which is well beyond the distribution of this species (Ginsberg and Macdonald, 1990).

BEHAVIOR. Blanford's foxes in Israel are strictly nocturnal. Geffen and Macdonald (1993) hypothesized that this activity pattern is an anti-predator response to diurnal raptors. The onset of activity is governed largely by light conditions, and closely follows sunset. Foxes were active ca. 8–9 h/night, independent of duration of darkness. Average distance ($\pm SD$) traveled per night was 9.3 ± 2.7 km, and size of nightly home range averaged 1.1 ± 0.7 km^2 (Geffen and Macdonald, 1992). Significant seasonal or gender differences in duration of activity, nightly distance traveled, or nightly home range were not detected. Climatic conditions at night in the desert of Israel appeared to have little direct effect on the activity of Blanford's foxes, except when conditions were extreme (Geffen and Macdonald, 1993).

Blanford's foxes are almost always solitary foragers (92% of 463 observations—Geffen et al., 1992*b*), only occasionally foraging in pairs. Mated pairs, which shared home ranges, differed significantly in the time of arrival at fruitful food patches and in the pattern of use of their home range (Geffen, 1990; Geffen and Macdonald, 1993). Three types of foraging behavior were observed: 1) unhurried movements back and forth between rocks in a small area (0.01–0.03 km^2), accompanied by sniffing and looking under large stones and occasionally digging a shallow scrape; 2) standing near a bush for a few seconds, alert with ears erect, before circling the bush or pouncing upon prey within, and then walking to another bush to repeat the sequence (on four occasions members of a pair were observed using this type of foraging behavior simultaneously around the same bushes); and 3) short, fast sprint after small terrestrial or low-flying prey (Geffen et al., 1992*b*). Food caching is rare or absent in the Blanford's fox, contrary to other fox species. Food offered to foxes was either consumed on the spot or carried away and eaten (Geffen et al., 1992*b*; Macdonald, 1976).

Estimated size of home ranges of Blanford's foxes in Israel during a year is 0.5–2.0 km^2. Significant seasonal or gender differences in size of home range were not detected (Geffen et al., 1992*c*). Dry creekbed was the most frequently visited habitat in all home ranges. Home ranges at Ein Gedi, Israel, comprised an average ($\pm SD$) of 63.44 ± 3.22% gravel scree, 3.63 ± 2.59% boulder scree, 28.38 ± 4.05% dry creekbed, and 4.54 ± 3.46% stream and spring. Average time ($\pm SD$) spent by foxes at Ein Gedi in gravel scree was 148.8 ± 109.8 min/night, 46.0 ± 63.8 min/night in boulder scree, 359.9 ± 141.9 min/night in dry creekbed, and 13.0 ± 27.9 min/night near a water source (Geffen et al., 1992*c*). Dry creekbed provided abundant prey for the foxes and only sparse cover for their terrestrial predators. Creekbed patches were used in proportion to their size. Both the available area of creekbed in each range and the area of creekbed patches that was used by the foxes were independent of size of home range. However, variance in size of home range was explained by the mean distance between the main denning area and the most frequently used patches of creekbed (Geffen et al., 1992*c*).

Data from 11 radiotracked Blanford's foxes studied over 2 years indicated that they were organized as strictly monogamous pairs in territories of ca. 1.6 km^2 that overlapped minimally (Geffen and Macdonald, 1992). Locations and configurations of home ranges were stable during that study. A shift in location of home range was observed only once following the death of a pair member. Three of five territories contained one, non-breeding yearling female during the mating season, but there was no evidence of polygyny (Geffen and Macdonald, 1992).

Dens used by Blanford's foxes in Israel usually were on a mountain slope and consisted of large rock and boulder piles or screes. Blanford's foxes appeared to use only available natural cavities, and never dug burrows. Dens were used both for rearing young during spring and for day-time harborage throughout the year. During winter and spring, both members of a pair frequently occupied the same den, or adjacent dens at the same site, while during summer and autumn they often denned in separate locations. Frequent changes in location of den from day to day were more common in summer and autumn (Geffen and Macdonald, 1992).

GENETICS. A cladistic analysis of mtDNA restriction-fragment and restriction-site data, and 402 base pairs of cytochrome *b* sequence in fox-like canids revealed that Blanford's fox and the

coexisting desert species, the fennec were consistently associated as sister taxa (Geffen et al., 1992*e*). Furthermore, these two taxa formed a monophyletic clade distinct from the other fox-like canids, and thereby defined a taxonomic grouping that previously has not been recognized. However, based on restriction-site data, the sequence divergence between the fennec fox and Blanford's fox is 8.7%, indicating an ancient divergence as much as $3–4 \times 10^6$ years ago. This divergence is coincident with the appearance of desert regions in the Middle East and northern Africa (Wickens, 1984).

REMARKS. *Vulpes* comes from the Latin *vulpes*, meaning fox. The specific epithet, *cana*, is derived from the Latin *canus*, meaning grayish-white hair (Brown, 1991). Other vernacular names are king fox and Afghan fox (Roberts, 1977).

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LITERATURE CITED

BLANFORD, W. T. 1877. Note on two species of Asiatic bears, the "mamh" of Balúchistán (*Ursus gedrosianus*) and *Ursus pruinosus* of Tibet, and on an apparently undescribed fox (*Vulpes canus*) from Balúchistán. Journal of the Asiatic Society of Bengal, 46:315–322.

BOBRINSKII, N. A., B. A. KUZNETZOV, AND A. P. KUZYAKIN. 1965. Synopsis of the mammals of USSR. Prosveshchenie, Moscow, Russia, 381 pp.

BROWN, R. W. 1991. Composition of scientific words. Smithsonian Institution Press, Washington, D.C., 882 pp.

CLUTTON-BROCK, J., G. B. CORBET, AND M. HILLS. 1976. A review of the family Canidae, with a classification by numerical methods. Bulletin of the British Museum (Natural History), Zoology Series, 29:119–199.

FRITZELL, E. K. 1987. Gray fox and Island gray fox. Pp. 408–420, *in* Wild furbearer management and conservation in North America (M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds.). Ministry of Natural Resources, Ontario, Canada, 1150 pp.

GEFFEN, E. 1990. The behavioural ecology of the Blanford's fox, *Vulpes cana*, in Israel. Ph.D. dissert., University of Oxford, Oxford, United Kingdom, 145 pp.

GEFFEN, E., AND D. W. MACDONALD. 1992. Small size and monogamy: spatial organization of the Blanford's fox, *Vulpes cana*. Animal Behaviour, 44:1123–1130.

———. 1993. Activity and time tabling in the movement patterns of Blanford's foxes, *Vulpes cana*, in Israel. Journal of Mammalogy.

GEFFEN, E., R. HEFNER, D. W. MACDONALD, AND M. UCKO. 1992*a*. Morphological adaptations and seasonal weight changes in the Blanford's fox, *Vulpes cana*. Journal of Arid Environments, 23:287–292.

———. 1992*b*. Diet and foraging behavior of the Blanford's fox, *Vulpes cana*, in Israel. Journal of Mammalogy, 73:395–402.

———. 1992*c*. Habitat selection and home range in the Blanford's fox, *Vulpes cana*: compatibility with the resource dispersion hypothesis. Oecologia (Berlin), 91:75–81.

GEFFEN, E., A. A. DAGAN, M. KAM, R. HEFNER, AND K. A. NAGY. 1992*d*. Daily energy expenditure and water flux of free-living Blanford's foxes (*Vulpes cana*): a small desert carnivore. The Journal of Animal Ecology, 61:611–617.

GEFFEN, E., A. MERCURE, D. J. GIRMAN, D. W. MACDONALD, AND R. K. WAYNE. 1992*e*. Phylogeny of the fox-like canids: analysis of mtDNA restriction fragment, site, and cytochrome *b* sequence data. Journal of Zoology (London), 228:27–39.

GINSBERG, J. R., AND D. W. MACDONALD. 1990. Foxes, wolves, jackals and dogs: an action plan for the conservation of canids. International Union for Conservation of Nature, Gland, Switzerland, 116 pp.

HARRISON, D. L., AND P. J. J. BATES. 1989. Observations on two mammal species new to the Sultanate of Oman, *Vulpes cana* Blanford, 1877 (Carnivora: Canidae) and *Nycteris thebaica* Geoffroy, 1818 (Chiroptera: Nycteridae). Booner Zoologische Beiträge, 40:73–77.

———. 1991. The mammals of Arabia. Harrison Zoological Museum Publication, Sevenoaks, Kent, United Kingdom, 354 pp.

HASSINGER, J. D. 1973. A survey of the mammals of Afghanistan. Fieldiana: Zoology, 60:1–195.

ILANY, G. 1983. Blanford's fox, *Vulpes cana*, Blanford 1877, a new species to Israel. Israel Journal of Zoology, 32:150.

LAY, D. M. 1967. A study of the mammals of Iran. Fieldiana: Zoology, 54:1–282.

MACDONALD, D. W. 1976. Food caching by red foxes and some other carnivores. Zeitschrift für Tierpsychologie, 42:170–185.

MENDELSSOHN, H., AND Y. YOM-TOV. 1987. Mammals. Plants and animals of the land of Israel (A. Alon, ed.). Appendix. Ministry of Defence Publishing, Tel Aviv, Israel, 7:1–111.

MENDELSSOHN, H., Y. YOM-TOV, G. ILANY, AND D. MENINGER. 1987. On the occurrence of Blanford's fox, *Vulpes cana* Blanford, 1877, in Israel and Sinai. Mammalia, 51:459–462.

NOVIKOV, G. A. 1962. Carnivorous mammals of the fauna of the USSR. Israel Program for Scientific Translations, Jerusalem, Israel, 283 pp.

RANJITSINH, M. K. 1984. A possible sighting of Blanford's fox (*Vulpes cana*) in Kutch. The Journal of the Bombay Natural History Society, 82:395–396.

ROBERTS, T. J. 1977. The mammals of Pakistan. Ernest Benn Limited, London, United Kingdom, 361 pp.

TAYLOR, M. E. 1989. Locomotor adaptation by carnivores. Pp. 382–409, *in* Carnivore behavior, ecology and evolution (J. L. Gittleman, ed.). Cornell University Press, Ithaca, New York, 620 pp.

VAN GELDER, R. G. 1978. A review of canid classification. American Museum Novitates, 2646:1–10.

WAYNE, R. K., R. E. BENVENISTE, D. N. JANCZEWSKI, AND S. J. O'BRIEN. 1989. Molecular and biochemical evolution of the carnivora. Pp. 465–494, *in* Carnivore behaviour, ecology and evolution (J. L. Gittleman, ed.). Cornell University Press, Ithaca, New York, 620 pp.

WICKENS, G. E. 1984. Flora. Pp. 67–75, *in* Sahara Desert (J. L. Cloudsley-Thompson, ed.). Pergamon Press, Oxford, United Kingdom, 348 pp.

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