MAMMALIAN SPECIES No. 795, pp. 1–5, 3 figs.

Vulpes bengalensis.

By Matthew E. Gompper and Abi Tamim Vanak

Published 9 August 2006 by the American Society of Mammalogists

Vulpes bengalensis (Shaw, 1800)

Indian Fox

Canis bengalensis Shaw, 1800:330. Type locality "Bengal." Type "probably exported from Calcutta" (Pocock 1936); restricted to "the adjoining area of India [near Calcutta], south of the Ganges" (Pocock 1936:49).

Canis kokree Sykes, 1831:101. Type locality "Dukun, (Deccan), East Indies."

Canis (*Vulpes*) *indicus* Hodgson, 1833:237. Type locality not specified. Restricted to "India" (Pocock 1941:129).

Canis (*Vulpes*) *rufescens* Gray, 1833–1834:plate 6. Type locality not specified. Restricted to "India" (Pocock 1936:49).

Canis chrysurus Gray, 1837:577. Type locality "India." Restricted to "Nepal" (Pocock 1936:49). Type specimen is apparently the same individual as the type of *V. xanthura* (skin is type of *chrysurus*, skull is type of *xanthura*—Pocock 1936).

Vulpes hodgsonii Gray, 1837:578. Type locality "North India, Nepal."

Vulpes xanthura Gray, 1838:68. Type locality not specified. Restricted to "Nepal" (Pocock 1936:49). Type specimen is same individual as type of *V. chrysurus*.

V[*ulpes*]. *bengalensis*: Gray, 1838:68. First use of current name combination.

CONTEXT AND CONTENT. Order Carnivora, suborder Caniformia, family Canidae, subfamily Caninae, genus *Vulpes* (Wilson and Reeder 1993). *V. bengalensis* is monotypic.

DIAGNOSIS. *Vulpes bengalensis* (Fig. 1) is a small fox of the Indian subcontinent, where it overlaps primarily with *V. vulpes*. *V. bengalensis* can be distinguished from *V. vulpes* by the former species having a black-tipped tail, grayish body pelage that lacks mixing of red hairs, brownish or rufous legs, ears that are the same color as nape or darker (but never with a black patch as in *V. vulpes*), and smudges of black hairs around upper part of muzzle in front of eyes (Johnsingh and Jhala 2004; Menon 2003; Pocock 1936, 1941; Prater 1980; Roberts 1997). Dorsal guard hairs of *V. bengalensis* can be differentiated from those of *Canis aureus*, *C. lupus*, *Cuon alpinus*, and *V. vulpes* in India by medullary index, scale structure, counts, and position (Chakraborty and De 2001). Indian fox scats are ca. 25% smaller in diameter than those from sympatric carnivores such as golden jackal (*C. aureus*) and jungle cat (*Felis chaus*—Vanak 2003).

GENERAL CHARACTERS. *Vulpes bengalensis* is a relatively small fox with an elongated muzzle, long, pointed ears, and bushy tail ca. 50–60% length of head and body (Menon 2003; Roberts 1997). Dorsal pelage is grayish and paler ventrally; legs tend to be brownish or rufous. Tail is bushy with prominent black tip. Back of ears is dark brown with black margin. Rhinarium is naked and lips are black, with small black patches of hair on upper part of muzzle in front of eyes (Johnsingh and Jhala 2004; Menon 2003; Prater 1980; Roberts 1997). Extensive variation in coat color may occur between populations and seasonally within populations (Pocock 1936, 1941).

External measurements (in mm; mean and parenthetical range with *n*) of males and females, respectively, from the collections of the Bombay Natural History Museum are: length of head and body, 500 (390–575, 6), 472 (460–480, 3); length of tail, 289 (247–320, 5), 276 (245–312, 3); length of hind foot, 118 (110–125, 5), 114 (112–116, 3); length of ear, 71 (68–73, 4), 75 (72–79, 3—Johnsingh and Jhala 2004). Body masses for males and females are 2.7–3.6 kg and >1.8 kg, respectively (Johnsingh and Jhala 2004; Pocock 1936; Roberts 1997). In Nepal, external measurements (mean ± *SD*, in mm) of 3 males and 2 females, respectively, are: total length, 747.7 ± 30.3, 785.6 ± 32.5; length of tail, 277 12.6, 292.7 ± 6.1; length of hind foot, 122.0 1.3, 114.5 ± 4.7; length of ear, 77.2 ± 4.3, 76.2 ± 0.2 (Mitchell 1977). External measurements (mean ± *SD*, in mm) of 10 males and 7 females collected throughout India and Pakistan are: length of head and body, 526.2 ± 45.3, 514.5 ± 40.6; length of tail, 295.0 ± 24.2, 303.8 ± 28.5; length of hind foot, 116.3 ± 7.4, 115.6 ± 6.0 (*n* = 9 and 6, respectively—Pocock 1936).

Skull of *V. bengalensis* (Fig. 2) has a relatively short, broad muzzle; nasal bones are broad posteriorly. Width above P2 is ca. one-third length of palate, and height of upper canine is less than combined lengths of upper carnassial (P4) and M1; upper carnassial is smaller than M1 (Pocock 1936). Cranial measurements (mean ± *SD*, in mm) of adult males (*n* = 11) and adult females (*n* = 14, except where indicated), respectively, throughout India, Pakistan, and Nepal are: condylobasal length, 111.2 ± 7.4, 106.8 ± 4.1; zygomatic breadth, 64.0 ± 3.5, 59.6 ± 3.4; postorbital width, 20.0 ± 1.1, 19.6 ± 1.1; interorbital width, 21.3 ± 2.0, 19.6 ± 1.4; width of maxillary, 18.1 ± 1.4, 17.0 ± 1.1; length of maxillary toothrow, 50 ± 3.6, 48.1 ± 1.8 (*n* = 13 females); length of mandible, 85.0 ± 6.0, 81.6 ± 4.2 (*n* = 13 females); length of P4, 9.2 ± 0.6, 9.4 ± 0.5; length of m1, 11.0 ± 0.5, 10.7 ± 0.7 (*n* = 13 females—Pocock 1936). Greatest lengths of skull (in mm) for 2 adult females and 1 adult male from Field Museum of Natural History (Chicago, Illinois) are 110.4, 110.7, and 115.8, respectively.

DISTRIBUTION. *Vulpes bengalensis* is endemic to the Indian subcontinent (Fig. 3) from the Himalayan foothills and Terai of Nepal through southern India and from southern and eastern Pakistan to eastern India and southeastern Bangladesh (Chesemore 1970; Johnsingh and Jhala 2004; Khan 1984, 1985; Mitchell 1977; Roberts 1997; Sarker and Sarker 1984; Shrestha 1997). *V. bengalensis* has not been recorded from Afghanistan or Iran or from the Western Ghats, India (Johnsingh and Jhala 2004; Roberts 1997). Populations may be expanding into the Sundarbans, Bangladesh, with decline of mangrove forests (Seidensticker 1987). *V. bengalensis* is rarely abundant within its range, and may be absent from many localities within its range (Vanak 2005).

FOSSIL RECORD. *Prototocyon* (= *Sivacyon*—McKenna and Bell 1997) *curvipalatus*, the type comprised of an associated

FIG. 1. Adult female *Vulpes bengalensis*, Nanaj, Maharashtra, India, February 2006. Photograph by A. T. Vanak.

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of adult female *Vulpes bengalensis* (Field Museum of Natural History, Chicago, Illinois, 83083). Greatest length of cranium is 110.7 mm.

skull and mandible, was 1st described as *Canis* (= *Vulpes*) *curvipalatus* and is considered closely allied to *V. bengalensis* (Bose 1880). The remains were recovered from the early Pleistocene Upper Siwaliks horizon of the Siwalik Hills, India (Colbert 1935; Pilgrim 1932).

FORM AND FUNCTION. Dental formula is i 3/3, c 1/1, p 4/4, m 2/3, total 42 (Johnsingh and Jhala 2004). Tongue has 3 pairs of papillae arranged in converging lines (Sonntag 1923). External brain anatomy of *V. bengalensis* has been described (Lyras and van der Geer 2003).

Dorsal guard hairs are 4–5 cm long and 60 μm in diameter at proximal region, with a gross appearance of black in distal region and yellow in proximal region (Koppikar and Sabnis 1976). Females have 3 pairs of mammae (Johnsingh and Jhala 2004; Pocock 1936, 1941).

Forefeet and hind feet have 4 toes with nonretractable claws, and pads of feet are naked (Pocock 1941; Roberts 1997). Measurements (mean ± *SD*, range, in cm) of 11 paw prints from southern India are: total length, 4.11 ± 0.18, 3.3–5.1; total width, 3.53 ± 0.14, 3.0–4.3; pad width, 1.91 ± 0.13, 1.2–2.5; pad length, 1.89 ± 0.1, 1.5–2.6; pad–toe gap, 0.79 ± 0.18, 0.3–2.3 (Vanak 2003). Mean diameter (± *SE*) of 55 Indian fox scats collected from the Rollapadu (Andhra Pradesh) and Ranebennur (Karnataka) Wildlife Sanctuaries is 14.25 ± 0.31 mm (Vanak 2003).

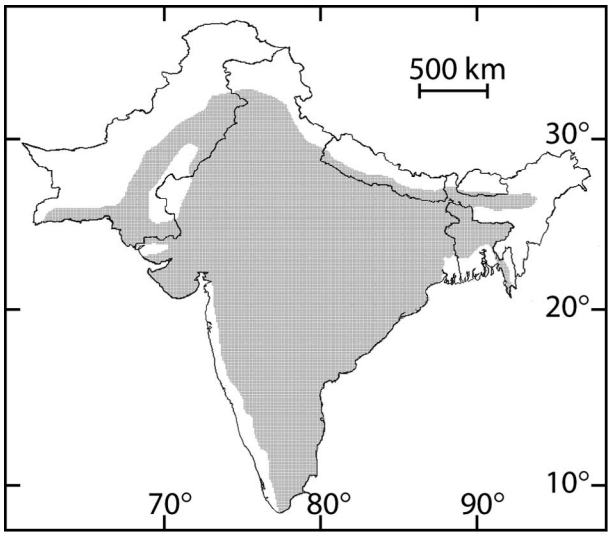

FIG. 3. Geographic distribution of *Vulpes bengalensis*.

ONTOGENY AND REPRODUCTION. Indian foxes form pair bonds that extend beyond the reproductive period. In Gujarat, mating occurs during December–January (Johnsingh and Jhala 2004); elsewhere, mating and parturition is timed to the monsoon season and availability of resources (Johnsingh 1978; Roberts 1997). In Nepal, a female collected in late December had 3 embryos (Mitchell 1977). Mating involves an extended copulatory tie, gestation lasts 50–53 days, and pups are generally born between January and May (Acharjyo and Misra 1976; Johnsingh 1978; Manakadan and Rahmani 2000; Prater 1980). Litter size is 2–4, and averaged 2.7 in Bhal, Gujarat (Johnsingh and Jhala 2004). Four neonates weighed 52–65 g and were 18.5–19 cm in total length; pups are born with eyes closed (Acharjyo and Misra 1976).

Nursing and postnatal care last several months. In Tamil Nadu, young are born in January, and nursing may extend through late April (Johnsingh 1978). In Pakistan, births occur in July–August, coinciding with onset of southwest monsoon (Roberts 1997). In Andhra Pradesh, where den use is restricted to pup-rearing season, scats of pups were found at den sites in April–May; pups remained at den sites until beginning of monsoon after which dens were abandoned (Manakadan and Rahmani 2000). Both parents bring food to pups and guard den. Aggregations of Indian foxes at den sites have been reported when dispersal of grown individuals is delayed, although presence of helpers has not been observed (Johnsingh 1978; Johnsingh and Jhala 2004). Nursing by >1 female has been observed, but relationships of these females to young and to each another were unclear (Johnsingh 1978). Play among pups is common for the first 3 months, and consists of vertical leaps, back-arching, foreleg stabs, submissive displays, and play solicitation; the adult male will occasionally play with young (Johnsingh 1978). In northwestern India, dispersal of young occurs during the onset of the monsoon season when resources are abundant (Johnsingh and Jhala 2004).

ECOLOGY AND BEHAVIOR. *Vulpes bengalensis* prefers semiarid flat to undulating terrain, and is relatively abundant in regions with low rainfall where vegetation is principally short grasslands or scrub, thorn, or dry deciduous forests. Indian foxes avoid dense forests, steep terrain, tall grasslands, and true deserts (Johnsingh and Jhala 2004; Macdonald and Sillero-Zubiri 2004; Prater 1980). In Nepal and northeastern India, *V. bengalensis* occurs up to 1,350–1,500 m (Johnson et al. 1980; Mitchell 1977; Pocock 1936). Indian foxes are relatively tolerant of habitat disturbance and can be found near agricultural fields, human habitations, and irrigation backs (tailings from excavation of irrigation canals—Johnsingh 1978; Manakadan and Rahmani 2000; Prater 1980; Vanak 2003).

Vulpes bengalensis occurs at densities from 0.04–0.06 to 1.63/km² and undergoes fluctuations in local abundance because of altered prey availability and outbreaks of disease (Awasthi et al. 1994; Johnsingh and Jhala 2004; Manakadan and Rahmani 2000). Densities of breeding pairs vary from 0.01 to 0.15/km² as a function

of rodent availability (Johnsingh and Jhala 2004). In the Kutch area of Gujarat, density of breeding pairs was 0.10/km² (Home 2005). Population densities are greatest in semiarid grasslands of peninsular India; in Rollapadu (Andhra Pradesh) and Ranebennur (Karnataka) wildlife sanctuaries, the Indian fox is the most common carnivore and during some years direct sightings are a daily occurrence (Vanak 2005; Vanak and Gompper, in press). In Andhra Pradesh, density of Indian foxes in grazing lands tends to be lower than in adjacent protected areas (Manakadan and Rahmani 2000). The Indian fox is widely distributed in northern and southern highlands of Balochistan, Pakistan (densities of 0.02–0.03/km²) with a more patchy distribution in central highlands and southern lowlands, and absence in northern highlands. Overall density in Balochistan is estimated at 0.008/km² with a province-wide population size of 557 individuals (Mian 2003a, 2003b). Analyses based on body and brain masses indicate that 71–94 km² is the minimum area necessary to support a population of *V. bengalensis* (Smallwood 1999).

The Indian fox is primarily crepuscular and nocturnal; although individuals may occasionally become active during cool periods of daylight, they generally spend the hotter daylight hours under cover or in dens (Johnsingh 1978; Vanak and Gompper, in press). Microhabitat use surveys and den site mapping in Andhra Pradesh suggest a preference for open habitats and lower grass height and avoidance of dense vegetation (Manakadan and Rahmani 2000; Vanak and Gompper, in press). *V. bengalensis* is typically seen in pairs at dens or groups of dens (Manakadan and Rahmani 2000). Three types of den are used: simple, short dens with 2 openings used for brief rest periods, complex dens with multiple openings, and dens under rocks or rock crevices (Johnsingh 1978). Complex multientrance dens are most common, and can be used to survey Indian foxes (Johnsingh 1978; Vanak 2003). Several of the openings may lead to a central sleeping chamber 60–90 cm below ground (Prater 1980). In Tamil Nadu, 8 such dens had 6–23 openings each and were inhabited over extended periods (e.g., >15 years—Johnsingh 1978). A den complex in Andhra Pradesh had 43 openings, and large complexes may cover 80 m² (Johnsingh and Jhala 2004; Manakadan and Rahmani 2000). All holes at a den complex are not used by foxes; 2–7 active holes per den is typical, with other holes sometimes being used by rodents or monitor lizards (*Varanus bengalensis*—Manakadan and Rahmani 2000).

Indian foxes have several vocalizations, including a chattering bark that consists of a sharp yelp repeated 3 or 4 times (Johnsingh and Jhala 2004; Mivart 1890; Prater 1980). Other calls include a growl, whimper, whine, and growl–bark (Johnsingh 1978).

The Indian fox is omnivorous and opportunistic (Home 2005; Johnsingh 1978; Johnsingh and Jhala 2004; Manakadan and Rahmani 2000; Roberts 1997; Vanak 2003). In southern Tamil Nadu, several vertebrate and invertebrate prey species were identified from fecal analyses, indicating a diet in this region of insects, ground-nesting birds, and small mammals (Johnsingh 1978). In Rollapadu, Andhra Pradesh, scat analyses identified rodents, leporids, monitor lizard, *Acoryphya* grasshoppers, and seeds of *Arachis hypogea*, *Cassia fistula*, and *Zizyphus mauritiana*. Scats from pups at Rollapadu contained primarily rodent fur (Manakadan and Rahmani 2000). Of 67 scats from adult foxes in Rollapadu, Andhra Pradesh, and Ranebennur, Karnataka, 85% contained remains of invertebrates, 46% mammals, 16% birds, and 4% reptiles (Vanak 2003). Remains of fruits and seeds (mainly *Z. mauritiana*) occurred in 33% of scats and 34% had undigested plant matter. Among all scats, 13% were composed of 1 food type, 46% of 2 food types, 28% of 3 food types, and 12% of 4 food types (Vanak 2003). Similar dietary patterns occurred in grassland and scrub habitat in the Kutch region of Gujarat, where across habitats and seasons, arthropods were the most important food items, followed by mammals (Home 2005). Arthropods occurred in 77% and 84% of scats collected in grassland and scrub habitats, respectively (Home 2005). Other prey items found in scats from grassland and scrub habitats, respectively, included mammals (46%, 53%), fruits (54%, 23%), reptiles (44%, 26%), and birds (6%, 2%); percent occurrence of fruits and reptiles in scats differed significantly between grassland and scrub, and occurrence of several other food types differed between habitats within particular seasons. Minimum number of scats required to analyze annual food habits of Indian foxes is ca. 100 (Home 2005). Other notable food items recorded in the diet of *V. bengalensis* are centipedes, land crabs, scorpions (*Palamneus*), shoots and pods of *Cicer arietum*, and fruits of *Azadirachta indica*, *Citrullus vulgaris*, *Ficus bengalensis*, *Mangifera indica*, *Melia azedarachta*, and *Syzigium cumini* (Johnsingh and Jhala 2004; Mivart 1890; Pocock 1941; Prakash 1959, 1975; Prater 1980; Roberts 1997). Indian foxes may scavenge kills by wolves (*C. lupus*—Jhala 1993). *Vulpes bengalensis* is a potential predator on eggs and chicks of the endangered great Indian bustard (*Ardeotis nigriceps*), although analyses of fox scats from Rollapadu Wildlife Sanctuary, Andhra Pradash, did not detect presence of bustard remains (Manakadan and Rahmani 2000). Indian foxes may play a role in regulating rodent populations (Advani 1987).

Vulpes bengalensis and *V. vulpes* rarely overlap, or where overlap occurs, they avoid or replace each another (Pocock 1941; Prakash 1994; Roberts 1997). Agonistic interactions between *V. bengalensis* and the common mongoose (*Herpestes edwardsi*) were observed in Tamil Nadu (Johnsingh 1978). Wolves and jackals (*C. aureus*) usurp and enlarge fox dens (Johnsingh and Jhala 2004; Manakadan and Rahmani 2000), and once in Velavadar National Park, Gujarat, Indian fox and wolf pups simultaneously shared a den site (Johnsingh and Jhala 2004).

Lifespan in captivity is 6–8 years (Johnsingh and Jhala 2004). In the wild, disease and predation by larger carnivorous birds, mammals, and reptiles cause mortality (Manakadan and Rahmani 2000). In India, wolves, free-ranging domestic dogs (*Canis familiaris*), and raptors have been reported to chase or kill *V. bengalensis* (Johnsingh and Jhala 2004; Manakadan and Rahmani 2000; Prater 1980). A study of wolf food habits in Gujarat found *V. bengalensis* in 2.3% ($n = 601$) of fecal samples (Jhala 1993). In some areas such as Tamil Nadu and Karnataka, India, anthropogenic mortality is high; humans, assisted by domestic dogs, kill Indian foxes for flesh, teeth, and pelts (Johnsingh 1978; Johnsingh and Jhala 2004; Manakadan and Rahmani 2000; Vanak 2003, 2005). When pursued, Indian foxes will twist, turn, and double back attempting to escape (Prater 1980).

In Rollapadu Wildlife Sanctuary, a population of ca. 40–50 foxes declined in 1 year to ca. 10 animals before recovering (Manakadan and Rahmani 2000; Vanak 2003). A similar decline occurred in areas of Gujarat (Johnsingh and Jhala 2004). Parasites reported for *V. bengalensis* include heartworm (*Dirofilaria immitis*—Rao and Acharjyo 1971, 1993), nematodes (*Subulura numidica*. and *S. vulpis*—Khera 1954), Mallophaga biting lice (*Trichodectes canis*—Mitchell 1977), Anoplura sucking lice (*Linognathus setosus bhatii*—Dutta 1988), fleas (*Ctenocephalides felis felis*, *C. f. orientis*, and *Pulex irritans*—Mitchell 1977), and ticks (*Haemaphysalis heinrichi* and *H. bispinosa*—Hoogstraal and Kim 1985; Mitchell 1977). Anoplura sucking lice (*L. vulpis*) collected from "*V. rüppellii bengalensis*" in Karachi, Pakistan (Cardozo-de-Almeida et al. 1999) were likely from *V. bengalensis*.

GENETICS. Diploid chromosome number of *V. bengalensis* is 60 and includes 10 metacentric and submetacentric autosomes, 48 acrocentric autosomes, a metacentric X, and an acrocentric Y chromosome (Ranjini 1966; Srivastava and Bhatnagar 1967; Wurster and Benirschke 1968). Microchromosomes occur (Bhatnagar 1973).

CONSERVATION. *Vulpes bengalensis* was listed as Least Concern by the International Union for the Conservation of Nature and Natural Resources [IUCN] Red List global rankings in 2004 (Johnsingh and Jhala 2004). In India, *V. bengalensis* is protected as a Schedule II species under the Indian Wildlife (Protection) Act of 1972 (as amended up to 2002—Anonymous 2002), and populations are declining in parts of the country, notably Karnataka and Tamil Nadu, because of loss of short grassland–scrub habitat to agriculture, industry, and development (Johnsingh and Jhala 2004). Numbers have declined in arid western India (Prakash 1994). Although widespread in its distribution, *V. bengalensis* may occur at high densities only in habitats such as the semiarid grasslands of peninsular India, which are highly endangered ecosystems and poorly represented in the protected area network of India; <2% of potential Indian fox habitat falls within protected areas in southern India (Vanak and Irfan-Ullah 2004). Populations in Nepal have decreased (Shrestha 1997). In Bangladesh, although *V. bengalensis* is considered widely distributed and is a 1st-schedule species under the Bangladesh Wildlife (Preservation) (Amendment) Act of 1974 and therefore open to hunting and shooting by an ordinary game hunting permit, viable populations may be uncommon or may

no longer persist, and the species is considered Vulnerable (IUCN Bangladesh 2000; Khan 1984, 1985).

REMARKS. Local vernacular names for *V. bengalensis* include Lokeria, Lokri, Löm, Lomri, and Lúmri (Hindi); Lokeria (Central India); Lukhariya (Bundelkund); Khekar and Khikir (Bihar); Khek-shiyal (Bengali); Kokri (Marathi); Kulla naree (Tamil); Hiyal (Assamese); Kodisilai (Oriya); Lamhui (Manipuri); Kuru naree (Malayalam); Khekri (Gond); Gunta nakka, Konka-nakka, and Poti Nara (Telegu); Chandak-nari, Hakku-nari, Kanka nari, Kempnari, Konk, Konku-nari, and Sanna nari (Kanarese); Lokdi (Gujarati and Kutchi); Fyauroo, Phauroo, and Phiamro (Nepali); and Khek shial (Bangladeshi—Johnsingh and Jhala 2004; Khan 1984; Menon 2003; Pocock 1941; Prater 1980; Vanak 2003).

Vulpes bengalensis is featured in many tales from ancient Jataka texts and Panchatantra (Macdonald and Sillero-Zubiri 2004). In some areas, vocalizations of Indian foxes are taken as omens (Prakash 1994). Capture and ceremonial release of *V. bengalensis* during the Sankaranti religious festival occurs in Karnataka (Vanak 2003).

We thank M. Schulenberg (Field Museum of Natural History, Chicago, Illinois) for assistance with skull examinations.

LITERATURE CITED

Acharjyo, L. N., and R. Misra. 1976. A note on the breeding of the Indian fox *Vulpes bengalensis* in captivity. Journal of the Bombay Natural History Society 73:208.

Advani, R. 1987. Rodent damage to various annual and perennial crops of India and its management. Pp. 108–112 in Eighth Great Plains Wildlife Damage Control Workshop, Rapid City, South Dakota.

Anonymous. 2002. The Indian Wildlife (Protection) Act, 1972 (as amended up to 2002). Government of India, New Delhi.

Awasthi, A. K., S. Sharma, and M. K. Das. 1994. Evaluation and status assessment of Panna National Park (MP). Environment and Ecology 12:685–689.

Bhatnagar, V. S. 1973. Microchromosomes in the somatic cells of *Vulpes bengalensis* Shaw. Chromosome Information Service 15:32.

Bose, P. N. 1880. Undescribed fossil Carnivora from the Siválik Hills in the collection of the British Museum. Quarterly Journal of the Geological Society of London 36:119–136.

Cardozo-de-Almeida, M., P. M. Linardi, and J. Costa. 1999. The type specimens of sucking lice (Anoplura) deposited in the Entomological Collection of Instituto Oswaldo Cruz, Rio de Janeiro, RJ, Brazil. Memórias do Instituto Oswaldo Cruz 94:625–628.

Chakraborty, R., and J. K. De. 2001. Identification of dorsal guard hairs of five Indian species of the family Canidae (Carnivora: Mammalia). Mammalia 65:483–493.

Chesemore, D. L. 1970. Notes on the mammals of southern Nepal. Journal of Mammalogy 51:162–166.

Colbert, E. H. 1935. Siwalik mammals in the American Museum of Natural History. Transactions of the American Philosophical Society, New Series. 26:1–401.

Dutta, S. 1988. Revisionary studies on the Anoplura infesting mammals of U. P. with description of a new subspecies, *Linognathus setosus bhatii*. Bulletin of Entomology (New Delhi) 29:104–111.

Gray, J. E. 1833–1834. Illustrations of Indian zoology; chiefly selected from the collection of Major-General Hardwicke. Volume II. Adolphus Richter and Company, London, England.

Gray, J. E. 1837. Description of some new or little known Mammalia, principally in the British Museum collection. Magazine of Natural History, New Series 1:577–587.

Gray, J. E. 1838. On a new species of paradoxure (*Paradoxurus derbianus*), with remarks on some Mammalia recently purchased by the British Museum, and characters of the new species. Proceedings of the Zoological Society of London 1837:67–68.

Hodgson, B. H. 1833. Description of the wild dog of the Himalaya. Asiatic Researches 18:221–237.

Home, C. 2005. Resource utilization by the Indian fox, *Vulpes bengalensis* in Kutch, Gujarat. M.S. thesis, Saurashtra University, Rajkot, India, 79 pp.

Hoogstraal, H., and K. C. Kim. 1985. Tick and mammal coevolution, with emphasis on *Haemaphysalis*. Pp. 505–568 in Coevolution of parasitic arthropods and mammals (K. C. Kim, ed.). John Wiley and Sons, New York.

IUCN Bangladesh. 2000. Red book of threatened mammals of Bangladesh. IUCN, The World Conservation Union, Dhaka, Bangladesh.

Jhala, Y. V. 1993. Predation on blackbuck by wolves in Velavadar National Park, Gujarat, India. Conservation Biology 7: 874–881.

Johnsingh, A. J. T. 1978. Some aspects of the ecology and behaviour of the Indian fox *Vulpes bengalensis* Shaw. Journal of the Bombay Natural History Society 75:397–405.

Johnsingh, A. J. T., and Y. V. Jhala. 2004. Indian fox (*Vulpes bengalensis*). Pp. 219–222 in Canids: foxes, wolves, jackals and dogs. Status survey and conservation action plan (C. Sillero-Zubiri, M. Huffman, and D. W. Macdonald, eds.). IUCN/SSC Canid Specialist Group, Gland, Switzerland.

Johnson, D. H., S. D. Ripley, and K. Thonglongya. 1980. Mammals from Nepal. Journal of the Bombay Natural History Society 77:56–63.

Khan, M. A. R. 1984. Endangered mammals of Bangladesh. Oryx 18:152–156.

Khan, M. A. R. 1985. Mammals of Bangladesh. A field guide. Nazma Reza, Dhaka, Bangladesh.

Khera, S. 1954. Nematode parasites of some Indian vertebrates. Indian Journal of Helminthology 6(2):27–133.

Koppikar, B. R., and J. H. Sabnis. 1976. Identification of hairs of some Indian mammals. Journal of the Bombay Natural History Society 73:5–20.

Lyras, G. A., and A. A. E. van der Geer. 2003. External brain anatomy in relation to the phylogeny of Caninae (Carnivora: Canidae). Zoological Journal of the Linnaean Society 138: 505–522.

Macdonald, D. W., and C. Sillero-Zubiri. 2004. Dramatis personae. Pp. 3–36 in Biology and conservation of wild canids (D. W. Macdonald and C. Sillero-Zubiri, eds.). Oxford University Press, United Kingdom.

Manakadan, R., and A. R. Rahmani. 2000. Population and ecology of the Indian fox *Vulpes bengalensis* at Rollapadu Wildlife Sanctuary, Andhra Pradesh, India. Journal of the Bombay Natural History Society 97:3–14.

McKenna, M. C., and S. K. Bell. 1997. Classification of mammals above the species level. Columbia University Press, New York.

Menon, V. 2003. A field guide to Indian mammals. Dorling Kindersley, Delhi, India.

Mian, A. 2003a. On biology of houbara bustard (*Chlamydotis macqueenii*) in Balochistan, Pakistan: faunal associations. Online Journal of Biological Sciences 3:535–552.

Mian, A. 2003b. On biology of houbara bustard (*Chlamydotis macqueenii*) in Balochistan, Pakistan: animal populations sharing habitat. Online Journal of Biological Sciences 3:782–796.

Mitchell, R. M. 1977. Accounts of Nepalese mammals and analysis of the host–ectoparasite data by computer techniques. Ph.D. dissertation, Iowa State University, Ames, 558 pp.

Mivart, G., Sr. 1890. Dogs, jackals, wolves, and foxes: a monograph of the Canidae. R. H. Porter, London, England.

Pilgrim, G. E. 1932. The fossil Carnivora of India. Memoirs of the Geological Survey of India, Palaeontologia Indica, New Series 18:1–232, plates I–X.

Pocock, R. I. 1936. The foxes of British India. Journal of the Bombay Natural History Society 39:36–57.

Pocock, R. I. 1941. Fauna of British India, including Ceylon and Burma. Mammalia. Volume II. Carnivora (continued from Volume 1), suborders Aeluroidea (part) and Arctoidea. Taylor and Francis, London, England.

Prakash, I. 1959. Food of some Indian mammals. Journal of Biological Sciences 2:100–109.

Prakash, I. 1975. The population ecology of the rodents of the Rajasthan Desert, India. Pp. 75–116 in Rodents in desert environments (I. Prakash and P. K. Ghosh, eds.). Dr. W. Junk, The Hague, The Netherlands.

Prakash, I. 1994. Mammals of the Thar desert. Scientific Publishers, Jodhpur, India.

Prater, S. H. 1980. The book of Indian animals. Third edition. Bombay Natural History Society, Mumbai, India.

RANJINI, P. V. 1966. Chromosomes of *Vulpes bengalensis* (Shaw). Mammalian Chromosomes Newsletter 22:216.

RAO, A. T., AND L. N. ACHARJYO. 1971. Histopathological changes in some of the organs in heart worm infection in an Indian fox (*Vulpes bengalensis*). Indian Veterinary Journal 48:342–344.

RAO, A. T., AND L. N. ACHARJYO. 1993. Incidence of heart worms in captive wild carnivores. Indian Journal of Parasitology 17: 201–202.

ROBERTS, T. J. 1997. The mammals of Pakistan. Revised Edition. Oxford University Press, Karachi, Pakistan.

SARKER, S. U., AND N. J. SARKER. 1984. Mammals of Bangladesh—their status, distribution and habitat. Tigerpaper 11:8–13.

SEIDENSTICKER, J. 1987. Managing tigers in the Sundarbans: experience and opportunity. Pp. 416–426 in Tigers of the world: the biology, biopolitics, management, and conservation of an endangered species (R. L. Tilson and U. S. Seal, eds.). Noyes Publications, Park Ridge, New Jersey.

SHAW, G. 1800. General zoology or systematic natural history. Volume 1. Part 2. Mammalia. G. Kearsley, London, England.

SHRESTHA, T. K. 1997. Mammals of Nepal (with reference to those of India, Bangladesh, Bhutan, and Pakistan). Bimala Shrestha, Kathmandu, Nepal.

SMALLWOOD, K. S. 1999. Scale domains of abundance amongst species of mammalian Carnivora. Environmental Conservation 16:102–111.

SONNTAG, C. F. 1923. The comparative anatomy of the Mammalia. VIII. Carnivora. Proceedings of the Zoological Society of London 1923:129–153.

SRIVASTAVA, M. D. L., AND V. BHATNAGAR. 1967. The somatic chromosomes of the common Indian fox (*Vulpes bengalensis*). Mammalian Chromosomes Newsletter 8:284.

SYKES, W. H. 1831. Catalogue of the Mammalia of Dukun (Deccan); with observations on the habits, etc., and characters of new species. Proceedings of the Zoological Society of London 1830–1831:99–106.

VANAK, A. T. 2003. Preliminary survey of Indian fox (*Vulpes bengalensis*) distribution in southern India. Wildlife Conservation Society–India Program, Bangalore.

VANAK, A. T. 2005. Distribution and status of the Indian fox (*Vulpes bengalensis*) in southern India. Canid News 8.1 [online]: http://www.canids.org/canidnews/8/Indian_fox_in_southern_India.pdf. Accessed 5 May 2006.

VANAK, A. T., AND M. E. GOMPPER. In press. Effectiveness of non-invasive techniques for surveying activity and habitat use of the Indian fox in southern India. Wildlife Biology.

VANAK, A. T., AND M. IRFAN-ULLAH. 2004. Predicting Indian fox distribution using ecological niche modelling. Abstract. P. 205 in Defenders of Wildlife's Carnivores 2004 Conference, 14–17 November 2004, Santa Fe, New Mexico.

WILSON, D. E., AND D. M. REEDER. 1993. Mammal species of the world. Second edition. Smithsonian Institution, Washington, D.C.

WURSTER, D. H., AND K. BENIRSCHKE. 1968. Comparative cytogenetic studies in the order Carnivora. Chromosoma 24:336–382.

Associate editors of this account were KRISTOFER HELGEN, BETTY MCGUIRE, and PAMELA OWEN. Editor was VIRGINIA HAYSSEN.

M. E. GOMPPER AND A. T. VANAK, DEPARTMENT OF FISHERIES AND WILDLIFE SCIENCES, UNIVERSITY OF MISSOURI, COLUMBIA, MISSOURI 65211.