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Gaps in knowledge

Data on distribution, status, relative abundance and population trends in Southeast Asia, and data on relative abundance and population trends in India, are essential. Furthermore, the possible existence of remnant populations of dholes in central and north-east Asia (i.e., Korea, China, Mongolia, Russia, Kazakhstan, Kyrgyzstan and Tajikistan) needs to be investigated. Additional research on threats emerges as an immediate area requiring additional research, particularly regarding the role of disease in dhole population dynamics, the significance of road kills and the ability of dhole to persist on small prey items (e.g., lagomorphs, rats and mice) in areas where populations of large (or indeed of all) ungulates have been reduced to negligible levels.

Core literature

Burton 1940; Cohen 1978; Davidar 1975; Durbin 1998; Fox 1984; Johnsingh 1982, 1985; Venkataraman 1995, 1998; Venkataraman and Johnsingh 2004; Venkataraman *et al.* 1995.

Reviewers: Arati Iyengar, A.J.T. Johnsingh. **Editors:** Claudio Sillero-Zubiri, Michael Hoffmann.

8.2 Indian fox *Vulpes bengalensis* (Shaw, 1800) Least Concern (2004)

A.J.T. Johnsingh and Y.V. Jhala

Other names

English: Bengal fox; **Indigenous names:** Hindi: lomri (India); Tamil: kulla naree (India); Telugu: gunta nakka (India); Kanada: kanka nari, sanna nari (India); Marathi: kokri (India); Nepali: phiamro (Nepal); Gujarati and Kutchi: lokdi (India).

Taxonomy

Canis bengalensis Shaw, 1800. Gen. Zool. Syst. Nat. Hist., 1(2), Mammalia, p. 330. Type locality: “Bengal” [India, c. 22°00'N, 86°00'E].

Chromosome number not known.

Description

Medium-sized fox with typical vulpine appearance, though smaller than any of the subspecies of the red fox *V. vulpes* (Table 8.2.1). The species' ears are proportional, with darker brown hair on the back. The nose and lips are black, and the eyes have dark tear marks. The muzzle is pointed with tan to black hair around the upper part and near the eyes. The pelage is grey, varying between yellowish grey to silver grey, and lacking the rusty red hair that is typical of the red fox. The dorsal region is darker, while the underside is a paler cream to dirty white. The winter coat can be quite luxuriant. The limbs are slender with some rufous on them, and the tail is more than half the body length. The tip of the tail is black. The tail is carried trailing during normal travel, it is kept horizontal when the fox is running, and it is raised to almost vertical when the fox makes sudden turns. Females have three pairs of mammae. The dental formula is 3/3-1/1-4/4-2/3=42.

Subspecies Monotypic.

Table 8.2.1. Body measurements for the Indian fox from Bombay Natural History Society museum specimens (Y. Jhala unpubl.).

HB male	500mm (390–575) n=6
HB female	472mm (460–480) n=3
T male	289mm (247–320) n=5
T female	276mm (245–312) n=3
HF male	118mm (110–125) n=5
HF female	114mm (112–116) n=3
E male	71mm (68–73) n=4
E female	75mm (72–79) n=3
WT male	2.7–3.2kg
WT female	>1.8kg

Adult Indian fox, sex unknown. Ahmednagar, Maharashtra, India, 2002.



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Similar species Desert fox (*Vulpes vulpes pusilla*) sympatric in western Indian and Pakistan, larger and taller at the shoulders, and with white-tipped tail.

Current distribution

The Indian fox is endemic to the Indian subcontinent (Figure 8.2.1). It ranges from the foothills of the Himalaya in Nepal to the southern tip of the Indian peninsula. In the northern part of the Indian subcontinent, the species' range extends from Sindh province of Pakistan to north Bengal in India.

Range countries India, Nepal, and Pakistan (Prater 1971; Roberts 1977; Shrestha 1997).

Relative abundance

Nowhere in its range is the Indian fox abundant. Densities seem to track rodent abundance in the Bhal area of Gujarat (Y.V. Jhala unpubl.), which fluctuates widely between years in the species' prime habitat (arid and semi-arid zones of India) (Prakash 1975; Tripathi *et al.* 1992). Occurrence of the Indian fox in Langtan National Park and Shey Wildlife Reserve in Nepal was reported by Shrestha (1997); however, this has not been confirmed and is considered unlikely.

Estimated populations/relative abundance and population trends Densities of breeding pairs range from 0.15–0.1/km² during periods of peak rodent abundance (1995 to 1996) to 0.01/km² during periods of low rodent abundance (1999 to 2000) (Y.V. Jhala unpubl.). In more diverse and stable prey systems (e.g., the Kutch), fox densities are more constant (0.04–0.06/km² over the past five years) (Y.V. Jhala unpubl.). Fox densities also range from 1.62/km² in protected grassland plots (Rollapadu

Wildlife Sanctuary, Andhra Pradesh) to 0.37/km² in unprotected areas; in this area populations declined five-fold due to an epidemic in 1995 (Manakadan and Rahmani 2000). Due to loss of short grassland-scrub habitat to intensive agriculture, industry and development projects the Indian fox population is on the decline. However, there is no available estimate on the rate of these declines.

Habitat

The Indian fox prefers semi-arid, flat to undulating terrain, scrub and grassland habitats where it is easy to hunt and dig dens. It avoids dense forests, steep terrain, tall grasslands, and true deserts. The species is relatively abundant in the biogeographic zones 3, 4, and 6 of India, in which rainfall is low, and the vegetation is typically scrub, thorn or dry deciduous forests, or short grasslands (Rodgers *et al.* 2000). In the Indian peninsula, the species is restricted to the plains and open scrub forest.

Food and foraging behaviour

Food Indian foxes are omnivorous, opportunistic feeders and generally consume any food that they can handle. Their diet consists mainly of insects (e.g., crickets, winged termites, grasshoppers, ants, beetle grubs, spiders), small rodents, including soft-furred field rats (*Millardia meltada*), field mice (*Mus booduga*), and Indian gerbils (*Tatera indica*), and birds and their eggs, including Indian mynah (*Acridotheres tristis*), ashy-crowned finch lark (*Eremopterix grisea*) and grey partridge (*Francolinus ponticerianus*). Other prey species include ground lizards, rat snakes (*Ptyas mucuosus*), hedgehogs (*Paraechinus nudiventris*), and hares (*Lepus nigricollis*) (Johnsingh 1978; Rahmani 1989; Manakadan and Rahmani 2000). Shepherds have also seen Indian foxes eating the freshly voided pellets of sheep (Johnsingh 1978). Amongst vegetable matter, the Indian fox has been reported to feed on fruits of ber (*Ziziphus* spp.), neem (*Azadirachta indica*), mango (*Mangifera indica*), jambu (*Syzigium cumini*), banyan (*Ficus bengalensis*), melons, fruits and the shoots and pods of *Cicer arietum* (Mivart 1890; Prater 1971; Mitchell 1977; Roberts 1977; Johnsingh 1978; Manakadan and Rahmani 2000). The scats of pups are almost exclusively composed of rodent hair (Johnsingh 1978; Manakadan and Rahmani 2000).

Foraging behaviour In most parts of its range Indian foxes are crepuscular and nocturnal. Therefore, individuals usually wait for darkness before starting their evening hunt. However, if the temperature is mild, as on rainy days, they may also hunt at mid-day. While the basic social unit consists of a breeding pair, foraging is normally done singly (Johnsingh 1978).

Damage to livestock and game There have been no reports of the Indian fox raiding poultry or attacking sheep.

Figure 8.2.1. Current distribution of the Indian fox.



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Adaptations

The Indian fox, being a specialist of hot, arid, short grass- scrub habitats, has large external ears for an animal of its size (probably an adaptation for thermoregulation).

Social behaviour

The basic social unit of the Indian fox is the breeding pair, formed through pair bonds that may last for several years. Larger aggregations may exist when grown pups remain in the natal group for longer than normal (Johnsingh 1978). Other observations suggest that the Indian fox may be more social at times. Johnsingh (1978) reported observing two lactating females suckling pups in a single den during one year. Four adult-sized foxes were also observed resting together on two occasions and once emerging from a single den in Rollapadu (Manakadan and Rahmani 2000).

The common vocalisation of the Indian fox is a chattering cry that seems to have a major role in maintaining territoriality and may also be used as an alarm call. Besides this, foxes also growl, whimper, whine and make a sound which could be called a growl-bark (Johnsingh 1978). Scent marking by scats and urine may serve as a “book keeper” (Henry 1977) to indicate if an area has been hunted recently.

Reproduction and denning behaviour

The Indian fox breeds from December to January in Bhal and Kutch (Y.V. Jhala unpubl.). During the breeding season, the male vocalises intensively, sometimes through the night but mostly during the early part of the night and morning. The gestation period of Indian foxes is 50–53 days (Jerdon 1984; Sheldon 1992), with parturition occurring between January and March (Acharjyo and Misra 1976; Johnsingh 1978). Litter size is 2–4 (Roberts 1977; Sheldon 1992), and averaged 2.7 in the Bhal area (Y.V. Jhala unpubl.). Responsibility for post-natal care of the pups is shared by both sexes. Both parents bring food to the pups and guard the den. The presence of helpers has not been observed in the species (Y.V. Jhala unpubl.). Rarely is the den left unguarded in the first two months after the pups are born since the parents take turns foraging. Post-natal care lasts approximately 4–5 months, after which young disperse, usually at the onset of the monsoon in north-western India, when food is plentiful (June/July) (Y.V. Jhala unpubl.).

Den use by the Indian fox is primarily restricted to the pup-rearing period (Johnsingh 1978; Manakadan and Rahmani 2000). Dens are excavated in open habitat, never in dense vegetation (Manakadan and Rahmani 2000). Indian foxes will usually excavate their own dens but occasionally they will appropriate and enlarge gerbil holes (Manakadan and Rahmani 2000). The species exhibits great site fidelity with sites being reused by breeding pairs year after year (Johnsingh 1978; Y.V. Jhala pers. obs.).

Dens consist of a mosaic of tunnels in various stages of excavation leading to a small chamber about 0.5–1.0m below the surface where the pups are born. The number of holes in a den complex is usually between two and seven (although as many as 43 have been recorded) (Manakadan and Rahmani 2000). The holes and tunnels of a well-used den site in the Bhal area of Gujarat covered an area 10 x 8m (Y.V. Jhala unpubl.). Pups are rarely moved between dens during the denning period (Manakadan and Rahmani 2000; Y.V. Jhala pers. obs.), although, once pups become more mobile, Indian foxes may use any of the numerous dens excavated within the territory of the parents (Manakadan and Rahmani 2000).

Competition

Grey wolves (*Canis lupus pallipes*) have been observed to appropriate fox holes and enlarge them to make their dens in the Bhal and Kutch areas (Jhala 1991). Wolves and jackals (*C. aureus*) were both recorded to appropriate fox holes in Rollapadu (Manakadan and Rahmani 2000). On one occasion wolf pups and fox pups shared the same den site in Velavadar National Park (Y.V. Jhala unpubl.).

Mortality and pathogens

Natural sources of mortality Wolves and feral dogs do predate on the Indian fox, but such events are not a threat to the population.

Persecution In the study area of Tamil Nadu, humans are a major mortality factor for the fox, especially nomadic tribals, *Nari kuravas*, and their dogs. Occasionally, the tribals visit the area where they use their ability to mimic fox calls to easily net and kill foxes for flesh, teeth, claws and skin. They also use handmade, animal fat-covered, country bombs to kill foxes (Johnsingh 1978). In Rollapadu, the fox is hunted by certain castes of people using smoke, nets and dogs at dens (Manakadan and Rahmani 2000). Further mortality is caused by the local ‘hunters’ who do not hesitate to shoot or attempt to kill foxes with their dogs. In Tamil Nadu people often block fox dens with stones (Johnsingh 1978). In Gujarat and Rajasthan, a major stronghold for the species, humans rarely persecute foxes, though the *waghri* and *koli* tribes kill and eat foxes occasionally.

Hunting and trapping for fur There is no organised fur trade, since the pelt is of poor quality. Illegal hunting of hare (*Lepus nigricollis*) by the use of dogs sometimes results in the killing of the Indian fox. In such cases the pelt is taken and kept due to local beliefs that the pelt brings good luck (A.J.T. Johnsingh pers. comm.).

Road kills Indian foxes are often killed by fast moving traffic and the development of major highways, in the semi-arid tracts, are likely to become barriers to dispersal.

Pathogens and parasites The Indian fox is susceptible to infectious diseases. There has been no local authenticated report of the Indian fox suffering from or transmitting rabies. In Rollapadu Wildlife Sanctuary, a disease epidemic which could have been caused by either rabies or distemper resulted in a five-fold variation in population density within a period of three years (Manakadan and Rahmani 2000). Mass mortality in certain years has also been observed in the Bhal and Kutch areas of Gujarat and in Rollapadu (Y.V. Jhala pers. obs., Manakadan and Rahmani 2000). The cause of this mortality was not ascertained, but it may have been caused by distemper that was prevalent amongst dogs, wolves and jackals in the Bhal area during that time (Y.V. Jhala unpubl.).

Longevity In captivity, the Indian fox lives 6–8 years (Y.V. Jhala pers. obs.).

Historical perspective

The Indian fox features in several animal short stories of the ancient Jataka texts and the Panchatantra. The fox is depicted as a clever and sometimes cunning creature in these tales.

Conservation status

Threats Although the Indian fox is widespread, it occurs at low densities throughout its range, and populations can undergo major fluctuations due to prey availability. It is also quite sensitive to human modifications of its habitat. With expanding human populations and continued development of grasslands and “wastelands” for agricultural and industrial uses, the habitat of the Indian fox is continuously being depleted. The combination of above factors along with disease and/or natural mortality could potentially cause local extinctions. In certain states like Gujarat, Maharashtra, and Rajasthan the Indian fox habitat is widespread with minimal threats while in other states like Karnataka and Tamil Nadu the specialised habitats of the Indian fox are limited and on the decrease. In such areas the survival of the Indian fox is under serious threat.

Commercial use There are no known commercial uses for the Indian fox, although there is limited localised trade for skin, tail, teeth and claws (for medicinal and charm purposes). There is no trade or potential for trade of the Indian fox.

Occurrence in protected areas

- *India*: the Indian fox occurs in a number of protected areas in Rajasthan (16), Gujarat (9), Maharashtra (5), Madhya Pradesh (17), Andhra Pradesh (10) and over 25 protected areas in other states;
- *Nepal*: it is reported to occur in Royal Bardia National Park, Royal Chitwan National Park, Royal Shukla Phanta Wildlife Reserve and in Kosi Tappu Wildlife Reserve (Majupuri and Kumar 1998).

Protection status CITES – not listed.

Current legal protection The Indian Wildlife Protection Act (1972 as amended up to 1991) prohibits hunting of all wildlife and lists the Indian fox in Schedule II. It is not on any special category for protection in the wildlife legislation of Nepal.

Conservation measures taken There have been no conservation efforts targeted specifically for the species.

Occurrence in captivity

The Indian fox is held in captivity in several zoos in India, where the species breeds well. In 2001, there were 15 males, 14 females, and 11 unsexed individuals in several zoos (Central Zoo Authority pers. comm.).

Current or planned research projects

Y.V. Jhala (Wildlife Institute of India) is studying the food habits distribution and densities of the Indian fox in the Bhal and Kutch areas of Gujarat, India.

Gaps in knowledge

A status survey is needed to identify areas throughout the species' range that have large, relatively secure fox populations. In some of these areas, an in-depth, long-term study is needed on population dynamics of the Indian fox. This would help elucidate the fox's relationship with prey population cycles and disease outbreaks. Research is also needed on ranging patterns, territoriality, and behaviour of this poorly studied species.

Core literature

Johnsingh 1978; Manakadan and Rahmani 2000.

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