

## South Asia – South of the Himalaya (Oriental)

### 8.1 Dhole

***Cuon alpinus*** (Pallas, 1811)

Endangered – EN: C2a(i) (2004)

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#### Other names

**English:** Asiatic wild dog, Indian wild dog, red dog; **French:** chien sauvage d'Asie, cuon d'Asie; **German:** der alpenwolf, rotwolf; **Spanish:** perro salvaje Asiatico; **Indigenous names:** Assamese: kuang-kukur, rang kukur; Bahasa Indonesia: adjag or ajag, anjing hutan; Bahasa Malaysia: srigala, Bengali: ban-kutta, ban-kukur; Bhutanese: phara, phou; Burmese: tan-kwe; Buryat: zurbi; Chinese: tsai-lang; Gujarati: kutra; Gurkhali: ban-kukur; Hindi: adivi-kuta, son-kuta, sona-kuta, rasa-kuta, jungli kuta; Javanese: asu alas; Kachin: kyi-kwa-lam; Kashmiri: jungli-kuta, ram-hun, ban-kuta, bhansa; Kazakh: chue; Kirgizian: chue, nyar; Kannada: kadu nai, korku, bun-seeta; Khmer: chikai prey [wild dog]; Ladakh: farra; Lao: ma nai [big dog]; Tibetan: farra; Manipuri: huithou; Lepcha: sa-tun; Malayalam/Tamil: chen nai; Marathi: kolsun; Mongolian: dshergul; Nepali: bwaso; Oriya: balia kukura; Russian: krasnyi volk [red wolf], dikaya sobaka [wild dog], chikalka; Telegu: resu kukka; Thai: maa nay; Telegu: resu kukka; Tungus: dzergil; Vietnamese: cho soi lua.

#### Taxonomy

*Canis alpinus* Pallas, 1811:34. Type locality: near Udskoi Ostrog, Uda R., Amur region, former USSR.

The genus *Cuon* is post-Pleistocene in origin, and related more closely to the extant jackals than to wolves (Thenius 1954). Simpson (1945) placed the dhole in the subfamily Simocyoninae of the family Canidae, together with the African wild dog (*Lycaon pictus*) and the bush dog (*Speothos venaticus*) of South America on the basis of shared anatomical features, most notably the reduction

of the role of the crushing post-carnassial molars. Many have questioned Simpson's classification arguing that similarities in dentition are due to convergent evolution because of a highly predatory diet (Thenius 1954).

Clutton-Brock *et al.* (1976) provided further support for Thenius's view by analysing morphological, ecological and behavioural characteristics across 39 canid species. Their study found that *Cuon* was more similar to *Canis*, *Dusicyon* and even *Alopex*, than to *Speothos* or *Lycaon*. However, *Cuon* resembled *Speothos* and *Lycaon* only when skull and dental characters were considered. According to Kleiman (1972) and Lorenz (1975), *Cuon*, *Lycaon* and *Speothos* appear more closely related to other canid genera than to each other. Further evidence of the taxonomic distinctiveness between *Speothos*, *Cuon* and *Lycaon* comes from analysis of sequences from mitochondrial genes (Wayne *et al.* 1997); both *Lycaon* and *Cuon* were classified as *Canis*-like canids and *Speothos* within a clade with another South American canid, the maned wolf (*Chrysocyon brachyurus*).

Chromosome number: 2n=78 (Aristov and Baryshnikov 2001).

#### Description

Dholes are large canids (typically 12–20kg) (Table 8.1.1), usually having a reddish or brown coat and a darker, bushy tail (sometimes with a white tip). Sexual dimorphism is not very distinct with no quantitative anatomical differences known. The ears are triangular with rounded tips (about half the length of the face). The pinnae are usually whitish-fawn on the inside and reddish-brown on the outside. The muzzle is brown, relatively short, and slightly convex in profile. The nose is black and the eyes slightly hooded with amber irises. The dorsal and lateral pelage is red to brown and the foreneck, chest and undersides are often whitish or light ginger coloured. In the south and south-west of the dhole's range, the fur is shorter and rusty-red coloured. In the north and north-

**Table 8.1.1. Body measurements for the dhole.**

	Cohen (1978)	Phu Khieo Wildlife Sanctuary, Thailand (L. Grassman unpubl.).	Kanha, India (L. Durbin unpubl.).
HB	880–1,130mm	male: 970mm (880–1,050) n=3	1,355mm n=1
T	410–500mm	male: 340mm (320–360) n=3	421mm n=1
WT male	15–20kg	16.0kg (15.0–17.0) n=3	15.5kg, n=1
WT female	10–13kg		



Two-year-old male dhole.  
Bandipur National Park,  
Karnataka State, India, 1996.

Krupakar Senani

east, the fur is longer, brownish-red or yellowish-brown. The legs are notably shorter in some alpine regions and the coat is a yellowish-grey colour in Himalayan regions. In Thailand, the coat is more uniform brown lacking the lighter throat and chest. The coat is occasionally grizzled (Duckworth *et al.* 1998). The toes are red, brown and/or white; the hairless fore-toe pads (on all feet) are joined at the base (near the main pad) unlike most domestic dogs. Dentition is unique within the Canidae having one fewer lower molar tooth (3/3-1/1-4/4-2/2), with the heel of the lower carnassial  $M_1$  crested and with a single cusp (all other canids within the range of *Cuon* have two cusps). There are usually six or seven pairs of mammae, rather than the five pairs typical for *Canis* (Burton 1940).

**Subspecies** Mivart (1890) distinguished two species of *Cuon*, the southern dhole (*C. javanicus*) and the northern dhole (*C. alpinus*), on the bases of body size and the second upper and lower molars. Ellerman and Morrison-Scott (1951), however, recognised 10 subspecies, later revised to nine (Ellerman and Morrison-Scott 1966) or 11, according to Ginsberg and Macdonald (1990), which are given below. The validity of many of these forms is doubtful.

- *C. a. alpinus* (east of eastern Sayans, East Russia). Thick tawny red coat greyish neck and ochre muzzle.
- *C. a. lepturus* (south of Yangze River, China). Uniform red coat with thick underfur.
- *C. a. dukhunensis* (south of the Ganges, India). Reddish coat, short hair on the paws and black whiskers.
- *C. a. adjustus* (North Myanmar and north-east India). Reddish brown coat.
- *C. a. primaevus* (Himalayan Nepal, Sikkim and Bhutan). Longer redder coat than *C. a. dukhunensis*, long hair on paws.

- *C. a. laniger* (Kashmir and southern Tibet). Full, yellowish-grey coat, tail not black but same colour as body.
- *C. a. hesperius* (East Russia and China). Long yellow-tinted coat, white underside and pale whiskers.
- *C. a. fumosus* (West Szechuan, China and Mongolia). Luxuriant yellowish-red coat, dark back and grey neck.
- *C. a. infuscus* (South Myanmar, Malaysia, Thailand, Laos, Cambodia and Vietnam). Relatively uniform brown coat.
- *C. a. sumatrensis* (Sumatra, Indonesia). Short red coat and dark whiskers.
- *C. a. javanicus* (Java, Indonesia). Short, bright red coat.

**Similar species** Dingo (*Canis lupus dingo*): Tail less bushy and when held upright often bends forward towards the head; penis more visible from side and ears pointed; proportionally longer jaw relative to head length.

Golden jackal (*Canis aureus*): Notably smaller (*c.* 2/3 size of dhole), with proportionally shorter tail to body; coat yellowish-brown and always grizzled; face thin and ears pointed; distinctive fast trotting gait.

Grey wolf (*Canis lupus*): Notably larger; distinctive greyish coat; ears pointed; penis more visible from side; proportionally longer jaw relative to head length.

### Distribution

**Historical distribution** Most of South, East, and Southeast Asia. Extending from the Tian-Shan and Altai mountains and the Maritime Province of the former USSR southwards through Mongolia, Korea, China, Tibet, Nepal, India, and south-eastwards into Myanmar and Indochina (Cambodia, Vietnam, and Laos), Thailand, the Malaysian peninsula, and the Indonesian islands of Sumatra and Java.

**Current distribution**

*Central and eastern Asia:* There have been no confirmed, recent reports of dholes from Russia, Mongolia, Kazakhstan, Kyrgyzstan (where they were found formerly in the Tian-Shan area), or Tajikistan (where they were found formerly in the eastern Pamir area) (A. Poyarkov and N. Ovsyanikov *in litt.* D. Miquelle pers. comm.). There is a recent report of a dhole that was captured in Jiangxi district, south China (C. Bellamy pers. comm.). Dholes were once present in parts of western China in the Tian-Shan Range, but the species' current status in this area is unclear. The species is still found in Tibet today, particularly in areas bordering the Ladakh region of India (R. Wangchuk pers. comm.), and the Tibet Forestry Bureau has reported that dholes are still “common” in parts of south-east Tibet (S. Chan, *in litt.*). Dholes occurred in northern Korea (Won Chang Man and Smith 1999) and a few small populations may still exist. There have been no records from Pakistan, but the species occurred on the alpine steppes of Ladakh, Kashmir, and India (Johnsingh 1985) that extend into the region termed Pakistan-occupied Kashmir by India.

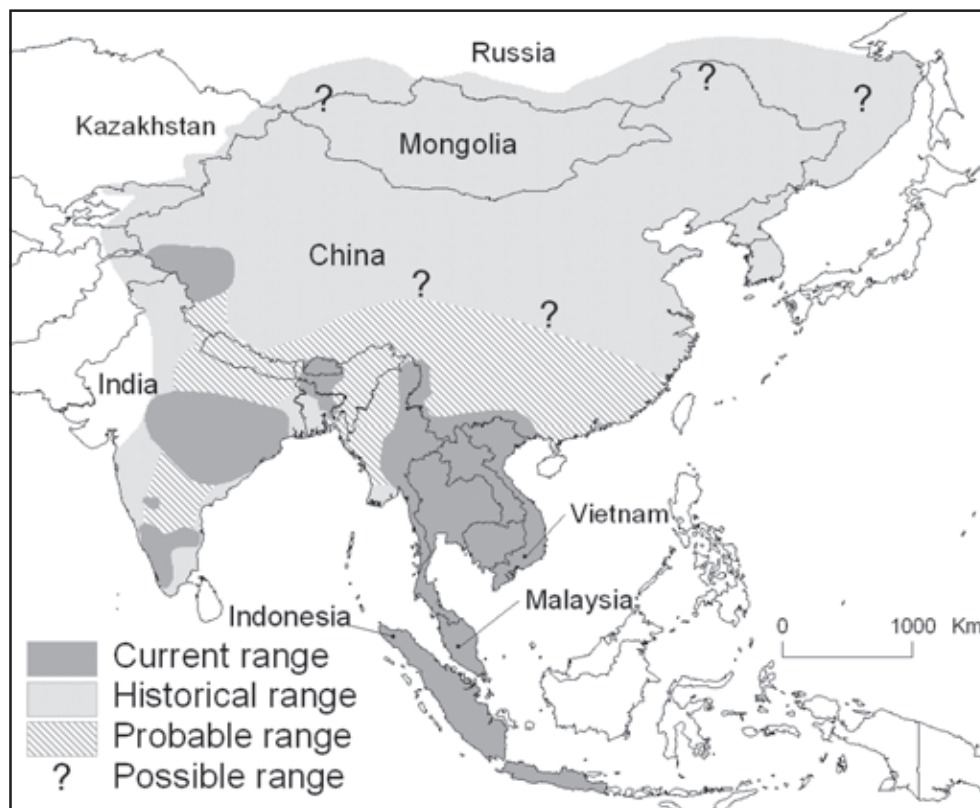
*India:* Dholes are still found throughout much of India south of the river Ganges, and especially in the Central Indian Highlands and the Western and Eastern Ghats of the southern states. They are also found throughout north-east India, in the states of Arunachal Pradesh, Assam,

Meghalaya, and West Bengal (A. Venkataraman, A.J.T. Johnsingh and L. Durbin pers. comm.). In the Himalaya and north-western India, the status of dholes seems more precarious with a much more fragmented distribution. Dholes reportedly still occur in the Ladakh area of Kashmir, which is contiguous with the Tibetan highlands in China (R. Wangchuk pers. comm.).

*Nepal* Formerly recorded in the Terai region of the Indo-gangetic plain, including the Royal Chitawan National Park in Nepal, but there have been few recent reports. There is an unconfirmed report of dholes in Dhorpatan Hunting Reserve in the late 1990s (R.C. Kandel pers. comm.).

*Bhutan:* There have been recent press reports that dholes have recovered from a government-initiated mass poisoning campaign in the 1970s, and there have apparently been numerous recent incidents of dholes killing livestock in the lower Kheng region. Two recent, independent, eyewitness reports identify dholes in six protected areas in Bhutan (S. Wangchuk pers. comm.; T. Wangchuk pers. comm.). In some regions, dhole predation on wild boar (*Sus scrofa*) may be viewed in a positive light by local people (T. Wangchuk pers. comm.).

*Bangladesh:* Dholes were thought to occur in the forested tracts of the Chittagong and Sylhet Districts (Johnsingh 1985). It is not certain whether any remain in Bangladesh.



**Figure 8.1.1. Current distribution of the dhole.**

*Myanmar:* In Myanmar, dholes were recorded by camera trapping at 11 of 15 survey areas scattered across the country, only four of which were protected. Dholes and/or leopards have apparently replaced tigers as the top predator in these areas (Myanmar Forest Department 2003).

*Indochina (Laos, Cambodia, Vietnam) and Thailand:* Dholes probably ranged over all or almost all of Laos, Cambodia, Vietnam, and Thailand, although reliable site-specific information is scarce. Present distribution is highly fragmented, and large parts, particularly of Vietnam and Thailand are without any regular occurrence of dholes, although they persist in a number of protected areas (Duckworth *et al.* 1999; Waltson 2001; M. Baltzer and R. Shore *in litt.*; A. Lynam pers. comm.).

*Indonesia and Malaysia:* Their historical range probably included all or most of the Malaysian peninsula and the Indonesian islands of Sumatra and Java, but reliable information is scarce. Current distribution is poorly known but is thought to be highly fragmented. On the Malaysian peninsula, dholes are known to occur in four sites in northern and central areas of the peninsula (from recent camera-trap surveys; J.B. Abdul pers. comm.). On Java, dholes appear to be most common in the protected areas at the eastern and western ends of the island. On Sumatra, very little is known, but dholes are known to occur in major protected areas in the southern, central, and northern parts of the island (e.g., from camera trapping; D. Martyr pers. comm.).

**Range countries** Bangladesh (?), Bhutan, Cambodia, China (including Tibet), India, Indonesia (Sumatra and Java), Kazakhstan (Ex?), Kyrgyzstan (Ex?), North Korea (?), South Korea (?), Laos, Malaysian peninsula, Mongolia (?), Myanmar, Nepal (?), Pakistan (?), Russia (?), Tajikistan (Ex?), Thailand, and Vietnam (Johnsingh 1985; Sosnovskii 1967; A. Poyarkov and N. Ovsyanikov *in litt.*; D. Miquelle pers. comm.).

### **Relative abundance**

The only information on dhole abundance comes from a few protected areas in southern and central India. These estimates have not been obtained through systematic sample-based survey methods, but are based on estimates of the number of packs within the protected areas (derived using known home range areas and knowledge of mean pack sizes).

**Estimated populations/relative abundance and population trends** Reported densities of dholes in protected areas include: Bandipur Project Tiger Reserve (Karnataka, southern India), 0.13 dholes/km<sup>2</sup> (A. Venkataraman and V. Narendra Babu unpubl.); Mudumalai Sanctuary (Tamil Nadu, southern India), 0.095 dholes/km<sup>2</sup> (A. Venkataraman

and V. Narendra Babu unpubl.); Pench National Park (Madhya Pradesh, central India), 0.3 dholes/km<sup>2</sup> (B.B. Acharya and A.J.T. Johnsingh unpubl.).

In the Mudumalai Sanctuary, dhole numbers have been monitored for the last 13 years, and there are indications that overall numbers are stable though substantial annual variations do occur. However, in parts of the adjoining Bandipur National Park, a significant decline in numbers has been observed in the years 2002 to 2003 (A. Venkataraman, pers. obs.). The reason for this decline is unknown. A.J.T. Johnsingh (pers. comm.) noted a decline of dholes during the 1970s in the Mundanthurai Plateau area of the Kalakad-Mundanthurai Project Tiger Reserve in southern India. There has been a recent increase in the number of dhole packs seen.

In general dholes are thought to be abundant in protected areas in southern and central India, including Bandipur and Nagarhole National Parks (Karnataka), Periyar Project Tiger Reserve (Kerala), Kanha National Park (Madhya Pradesh), and Melghat and Tadoba Project Tiger Reserves (Maharashtra). Abundance is relatively lower in West Bengal, Assam and Arunachal Pradesh. In the rest of north-east India (Nagaland, Mizoram), dholes are currently extinct or close to extinction.

No remotely comparable information on density is available for any part of Southeast Asia, and there are no empirical data on trends in this region.

### **Habitat**

The dhole is found in a wide variety of vegetation types, including: primary, secondary and degraded forms of tropical dry and moist deciduous forest; evergreen and semi-evergreen forests; dry thorn forests; grassland–scrub–forest mosaics; and alpine steppe (above 3,000m a.s.l.). They are not recorded from desert regions.

In India, tropical dry and moist deciduous forest may represent optimal habitats, based on the regions thought to hold the largest dhole populations. Ungulate biomass, particularly that of cervid species, is highest in these vegetation types when compared to others in the same region (A. Venkataraman and V. Narendra Babu unpubl.). In India, tropical dry and moist deciduous forests are subject to seasonal monsoon climates.

Important factors that may influence habitat selection include the availability of medium to large ungulate prey species, water, the presence of other large carnivore species, human population levels, and suitability of breeding sites (proximity to water, presence of suitable boulder structures, and sufficient prey).

### **Food and foraging behaviour**

**Food** The main prey of dholes varies throughout their range. Beetles, rodents, and birds have all been recorded among dhole prey items (e.g., Adams 1949; Davidar 1975); and dholes also occasionally consume grass and other

plants like most other carnivores (A.J.T. Johnsingh pers. comm.). However, dholes hunt mainly vertebrate prey, with a preference for medium to large ungulates. Studies of prey selection by sympatric carnivores in Nagarahole, in southern India, showed that dholes prefer medium-sized prey between 31kg and 175kg in weight (Karanth and Sunquist 1995, 2000). The average weight of prey killed by dholes was 43kg in Nagarahole. In Bandipur, prey weighing less than 50kg were most preferred (Johnsingh 1992). In Mudumalai Sanctuary, India, Venkataraman *et al.* (1995) reported the occurrence of prey remains in scats for two packs: chital remains comprised 70% and 41%, sambar (*Cervus unicolor*) 22% and 23%, cattle 4% and 15%, and lagomorphs 3% and 20%, for the two packs, respectively. In parts of Russia, the main prey species were reported to be reindeer (*Rangifer rangifer*), wild sheep (*Ovis spp.*), and wild goats (*Capra spp.*) (Sosnovski 1967). In Alas Purwo National Park in East Java, Indonesia, banteng (*Bos javanicus*) were frequently eaten by dholes during a study in the mid- to late-1990s (Hedges and Tyson 1996). Elsewhere on Java, dholes seem to take Javan rusa (*Cervus timorensis*) and red muntjac (*Muntiacus muntjac*) in preference to banteng (Hedges and Tyson 1996). In Khao Yai, Thailand, prey occurrence in scats comprised: sambar, 63%; red muntjac, 18%; East Asian porcupine (*Hystrix brachyura*), 5%; insects, 3%; birds, 3%; reptiles, 3% and vegetation, 5% (S. Austin unpubl.).

In Kanha National Park, India, dholes have been seen to return to scavenge on prey remains several days after the prey was killed (L. Durbin pers. obs.). Dholes were also occasionally observed to eat carrion (elephant (*Elephas maximus*) and gaur (*Bos gaurus*) carcasses), in Mudumalai Sanctuary (A. Venkataraman and R. Arumugam unpubl.) and have been seen feeding on a red muntjac carcass originally killed by a python in Thailand (Nettelbeck 1995). It has, however, been suggested that such scavenging only occurs during periods of prey scarcity, particularly during the dry season.

Dholes will occasionally eat vegetation and invertebrate prey. Grass is ingested, but may serve an anti-helminthic function rather than a nutritional one (L. Durbin unpubl.). Prater (1971) also writes “*In the South Indian hill ranges dholes are said to feed greedily on the fallen fruits of bael and black wood trees*”. Cohen (1977) found vegetable matter in only 25% of scats; Johnsingh (1983) found grass to be a major component in only 7% of scats.

**Foraging behaviour** Dholes are communal hunters, occasionally forming packs of over 30 animals (Fox 1984), but are more often found in hunting groups of fewer than 10 animals. Depending on prey availability, dholes may also hunt alone or in pairs, taking smaller prey such as infant deer or hares (Cohen 1977; Venkataraman *et al.* 1995). The dhole is primarily a crepuscular forager but can hunt at any time of the day or night (Johnsingh 1982; L.

Durbin, S. Hedges, and M. Tyson pers. obs.). In central India, dholes rarely run their prey to exhaustion and most chases extend for less than a few hundred metres (L. Durbin pers. obs.). This is generally the case when dholes hunt deer and banteng in East Java, but occasionally dholes chase banteng until the latter appear exhausted (S. Hedges and M. Tyson pers. obs.). During hunts, some dholes may lie in ambush while others drive prey towards them. Dholes often drive deer into water, where they surround them and swim out to capture them. It is common for certain individuals to take particular roles in the hunt, such as leading the chase or taking the first grab at the prey. Pack members communicate their whereabouts with whistles and yelps, and cooperate in bringing down and killing the prey. They eat quickly (e.g., up to 1kg per dog in 4 minutes; Johnsingh 1983), with relatively little aggression, except when dealing with small prey. Usually one or more dholes take turns as sentinel (who possibly look out for leopards and tigers that could prey on dholes or appropriate their kills or humans who scavenge kills in some areas) when feeding on large prey (L. Durbin, pers. obs.). Dholes hunt successfully both in open meadows and in denser forest. They prefer to kill their own prey, but sometimes steal the kills of other species, or scavenge from old kills.

**Damage to livestock or game** Dholes generally prefer to kill wild prey species and ignore domestic livestock (Venkataraman *et al.* 1995; L. Durbin pers. obs.). Sometimes they resort to stock predation (e.g., domestic cattle or goats) when their natural prey is diminished (Venkataraman *et al.* 1995; L. Durbin, S. Hedges and M. Tyson pers. obs.). Dholes sometimes prey on threatened species; for example, it was feared that the banteng population of Alas Purwo National Park in Java was being driven to local extinction by dhole predation (Hedges and Tyson 1996). It was the dholes that finally “disappeared” when banteng numbers reached a level that, apparently, could no longer sustain them. Possibly, these dholes turned to cattle predation and suffered retributive human persecution (S. Hedges and M. Tyson unpubl.). In Kanha, central India, dholes prey on a rare, endemic subspecies of swamp deer (*Cervus duvauceli branderi*). The two species seem to coexist, as chital, which constitute the dholes’ principal prey, are numerous in Kanha (L. Durbin pers. obs.).

### Adaptations

The presence of only a single crested cusp (two in other canids) on the lower carnassial  $M_1$  may enhance the shearing capacity of the teeth and hence the speed at which prey can be consumed. This may improve the dholes’ ability to compete with kleptoparasites.

Dholes have the capacity to hold large quantities of meat in their stomachs (c. 3kg). Like African wild dogs, they can also regurgitate small quantities at will, thus allowing the transportation of food to pack-mates and

neonates. This is an adaptation to communal breeding, providing food for the pups, the mother, and other adult helpers that remain at the den.

### **Social behaviour**

Dholes usually live in packs of 5–10 individuals, but groups of as many as 18 (Alas Purwo, Java, Indonesia; Hedges and Tyson 1996), 24 (Kanha, India; L. Durbin unpubl.), and 25 (Mudumalai Sanctuary, India; Venkataraman *et al.* 1995) have been recorded on a regular basis. These group sizes included juvenile animals. Group size and composition may vary under different environmental conditions, but most of the current data are from India. Packs studied by Johnsingh (1983), Venkataraman *et al.* (1995), and L. Durbin (unpubl.), contained significantly more males than females, perhaps a reflection of female-biased dispersal (Venkataraman 1998).

Pack members regularly play together, engaging in mock-fights, rolling, and allo-grooming. Social rank is established by pushing and holding, but rarely by aggressive biting (M. Boer pers. comm., L. Durbin unpubl.). Groups have a strong hierarchical structure, with a dominant male and female who are the main, or sole, breeders.

Pack members over-mark each other's faeces and urine, producing latrines throughout the group's range. Latrines may serve intra-group communicative functions (e.g., relaying information about hierarchical or sexual status) as well as territorial ones. The ranges (or at least core areas) of neighbouring packs are often quite separate (Johnsingh 1982; Venkataraman *et al.* 1995; L. Durbin unpubl.), though interactions between groups can be either friendly or hostile.

In Bandipur, India, Johnsingh (1983) reports a home range size of 40km<sup>2</sup> and Venkataraman *et al.* (1995) found ranges of 54 and 83km<sup>2</sup> in Mudumalai. Durbin *et al.* (pers. comm.) radio-tracked an adult male within a breeding pack (12 adults; 12 pups) in Kanha, India, and during the three month tracking period, when adults were tending pups at den sites, the pack used a range of 55km<sup>2</sup>. In a more recent study in Thailand, three adult male dholes were captured, radio-collared, and tracked for one to ten months in Phu Khieo Wildlife Sanctuary, Thailand, between March 2000 and June 2002. A total of 101 radio-locations were recorded for two animals and used to calculate home range sizes. The overall home range sizes of two of the males were 12.0km<sup>2</sup> and 49.5km<sup>2</sup> respectively, while the third male could not be tracked after radio-collaring. The dholes did not utilise the habitat within their ranges in a uniform manner; instead, open forest/grassland was used proportionately more than closed forest (L. Grassman *in litt.*).

Dholes have a broad and unusual vocal repertoire that includes whines, mews, and squeaks (Fox 1984). Growls, growl-barks, chattering calls, and screams are used as alarms to alert other pack-mates to danger (Johnsingh 1982). This large range of alarm calls may have evolved to

alert pack-mates to danger from humans or other predators (e.g. leopard, tiger). Such calls could also act as a threat to intimidate adversaries. A repetitive whistle-like contact call may allow dispersed pack members to identify one another and to re-group (Durbin 1998). Maintaining group cohesion in this way is likely to be highly adaptive in areas with other large predators. Whistle calls travel well at ground level due to their frequency and structure and allow easy location of the source (L. Durbin unpubl.).

### **Reproduction and denning behaviour**

Dholes give birth once a year and have a gestation period of about nine weeks (Sosnovskii 1967). Mating occurs between November and April (dry season) in India, with a peak during December and January (Davidar 1973; L. Durbin pers. obs; but see Venkataraman 1998; Johnsingh 1982). In East Java, dholes are thought to mate mainly during January and May (i.e., end of the wet season) (S. Hedges and M. Tyson pers. obs.). Females exhibit seasonal polyoestrus with a cycle of 4–6 weeks (M. Boer pers. comm.). The dominant pair engages in vigorous play and marking, culminating in a copulatory tie (Davidar 1973; Paulraj *et al.* 1992). It is usually only the dominant female that breeds, but exceptions have been noted. Johnsingh (1979) has observed lone females breeding outside the group, with limited or no success in rearing their litters. By contrast, three females have been seen suckling within a single group (Davidar 1974). Whether this represents plural breeding or “wet nursing” is uncertain. Subordinate males sometimes show sexual interest in the alpha female and may contribute to the paternity of the litter (Venkataraman 1998; M. Boer pers. comm.).

Litter sizes vary dramatically, even within the same pack in different years (e.g., up to 8, and 5–10, for two packs in Mudumalai; Venkataraman *et al.* 1995). The largest litter size recorded is 12, with only one lactating female in the group (Kanha, India; L. Durbin *et al.* unpubl.).

In captivity, newborn pups can weigh 200–350g, although by the age of 10 days their body weight can double, and they have a total body length of about 340mm (Sosnovskii 1967). Pups suckle from the mother until they are about three weeks old, when they start to receive regurgitated meat from other pack members. Pups are weaned by about 6–7 weeks (L. Durbin *et al.* unpubl.), although, in captivity, weaning has been recorded at 8–9 weeks (M. Boer pers. comm.). In their early weeks, the pups are quarrelsome, but with age they become more vigilant and less aggressive, noticeably so by around eight weeks (L. Durbin *et al.* unpubl.). All adults take part in guarding, feeding, grooming, and playing with the pups. By about three months, the pups accompany the adults during hunts (Johnsingh 1982); however, the pack may not be fully mobile until about eight months (Venkataraman 1998). Dholes reach adult size by about 15 months. Venkataraman (1998) states that female dholes breed for

the first time at three years. This is probably due to behavioural, as well as physiological, constraints. In captivity, dholes of both sexes can reproduce at two years of age (M. Boeer pers. comm.).

Den types range from earthen burrows to rocky caverns. Johnsingh (1982) and Fox (1984) provide more information on dhole den sites.

### Competition

A number of instances have been recorded where dholes were killed and eaten by tigers and leopards (Venkataraman 1995). However, Venkataraman (1995) reported that injuries or deaths as a result of interactions between dholes and leopards or tigers were rare. Interactions are usually limited to intimidation and harassment, presumably to reduce competition resulting from use of common hunting grounds. In Nagarahole National Park, southern India, Karanth and Sunquist (1992) found dhole hairs in leopard scats, evidence that dholes are occasionally eaten by leopards. However, the effect of intra-guild competition on dhole densities is unknown.

In some areas humans scavenge dhole kill; for example, Kurumba tribes of the Nilgiris in southern India (Venkataraman 1999), and among at least one Mon Khmer speaking tribal group in Laos (Chamberlain 2003).

### Mortality and pathogens

**Natural sources of mortality** Most observed injuries to dholes are probably inflicted by prey animals, but dholes have been wounded and killed by leopards and tigers (e.g., Connell 1944; Venkataraman 1998).

**Persecution** Dholes are persecuted throughout their range. In India, bounties were paid for carcasses until the Wildlife Act of 1972, when dholes were given legal protection. Perhaps the most common reason for persecution is the fear of stock predation. Methods of persecution include poisoning of carcasses, snaring, shooting, and clubbing of animals at den sites. In India, farmers can be compensated if there is proof that their stock has been killed by wild animals outside core protected areas. Despite this, stock predation is a common reason for dhole persecution by local people in India, e.g., Arunachal Pradesh (N. Babu pers. comm.). In India, British colonial hunters also shot and poisoned dholes because they saw them as a threat to the wild ungulate populations. Today, human persecution still occurs, but levels vary regionally depending on the enforcement of wildlife laws, levels of stock predation, and cultural beliefs. Across Laos, Cambodia, and Vietnam, levels of hunting are very high, sufficient to reduce almost all species of mammal larger than a hare to very low densities, except in the largest wildernesses, and to cause widespread local extinction of most species of large carnivores and ungulates. There is little if any evidence of dholes being specifically

hunted anywhere in these three countries, but because many hunting techniques are essentially non-selective (e.g., snaring), dholes are affected. Any dholes moving out of wilderness areas into human-settled areas are at risk of being killed, either as a result of indiscriminate snaring or as presumed stock predators.

**Hunting and trapping for fur** Not thought to be a significant mortality factor at present. Skins have been reported as curios (Duckworth *et al.* 1999). In the countries of the former USSR, dholes were not hunted for fur to any great extent because they occurred at too low densities (A. Poyarkov and N. Ovsyanikov *in litt.*). However, in the mid-19th century, dhole pelts were valuable in Ussuryisk Krai, and at the beginning of the 20th century, in Manchzhuriya, prices for dhole pelts were high (Geptner *et al.* 1967).

**Road kills** In India, many roads cut through dhole habitat and injuries and death by traffic are possibly significant causes of dhole mortality.

**Pathogens and parasites** When dholes are in contact with other species, especially other canids, they are at risk of contracting and transmitting infectious diseases. Dholes may occasionally present human health risks. Their faeces contain infectious pathogens such as *Toxocara canis*. Dholes have also been known to suffer from rabies (Morris 1942), canine distemper (Davidar 1975; M. Boeer pers. comm.), mange (Morris 1937; L. Durbin pers. obs.), trypanosomiasis (S.K. Ray pers. comm.), canine parvovirus (seroprevalences found in Chennai and Hopenhagen zoos, M. Boeer pers. comm.), and endoparasites such as cestodes and roundworms. In the 1940s, a rabies epidemic in the Billigirirangan Hills, India, resulted in villagers being bitten by rabid dholes and subsequently dying (Morris 1942).

**Longevity** Dholes can live to at least 16 years in captivity (Sosnovskii 1967), but this is uncommon in the wild. Venkataraman (1998) found that older dholes often “disappeared” from packs when 7–8 years old.

### Historical perspective

No information.

### Conservation Status

#### Threats

**Depletion of the dhole's prey base.** Across almost all of Cambodia, Laos, and Vietnam, as well as within protected areas, ungulates occur at levels well below natural. All species of ungulate except muntjacs (*Muntiacus* spp.), pigs (*Sus* spp.) and in some areas southern serow (*Naemorhedus sumatraensis*) are ecologically or fully extinct across extensive parts of the region. Only a few of the largest wildernesses support nearly intact species assemblages and even in these, the larger species (*Bos* spp., *Cervus* spp., hog

deer *Axis porcinus*) are very rare. This situation will likely hinder any possibility of recovery by the region's dhole populations, even if the other issues could be addressed. While not as depressed as in Indochina, prey levels in Indonesia also exist at levels much below carrying capacity (because of illegal hunting and habitat degradation). In protected areas in southern and central India, where dhole numbers are stable, prey densities are high. In north-east India, prey densities are very low in protected areas with dholes.

*Habitat loss and transformation.* Currently, extensive areas of natural or semi-natural vegetation remain in Laos and Cambodia, some areas encompassing many hundreds of square kilometres of potential dhole habitat. However, habitat conversion and fragmentation are proceeding apace. In Vietnam, very few natural areas of over 50km<sup>2</sup> remain. Habitat loss and fragmentation is a major threat to protected areas in Indonesia, particularly those on Sumatra. Habitat loss and degradation are also serious threats to dholes in South Asia, and the disappearance of dholes from many of the forested tracts in India has been attributed in large part to loss of habitat.

*Persecution by cattle graziers through poisoning, shooting, trapping, and killing of pups at dens.* This certainly occurs in Indochina, although it is unclear how often. In Indonesia, too, it is a threat but again its significance is unknown. In India, such persecution can play a serious role in limiting local populations. Dholes living outside or on the edge of core protected areas are particularly vulnerable to human kleptoparasitism, snaring (non-selective) and direct persecution. For example, during a radio-tracking study in 2000, in the buffer zone of Kanha Tiger Reserve, central India, at least 16 out of 24 dholes in one pack died from a sudden strychnine poisoning (L. Durbin pers. obs). In southern India, such persecution is moderate to low, and often occurs indirectly when cattle graziers and others inadvertently go close to dhole dens and disturb adults and pups, disrupting breeding and rearing (A. Venkataraman pers. obs.). "By-catch" in snares and other traps is probably a significant threat to dholes across Indochina at least.

*Competition with other species including feral domestic dogs for prey species.* Apparently, free-living dogs have been seen and/or camera trapped in many parts of Indochina, but there is no evidence for existence of large populations. Undoubtedly, the main competitor for prey species in Indochina is people. There is no evidence that feral dogs are significant competitors with dholes in Indonesia. In many parts of their range, dholes are sympatric with tigers and leopards and so the potential for significant interspecific competition for prey exists, especially if the prey populations are reduced as a result of hunting by people.

*Disease and pathogens.* Particularly those transmitted by feral and/or domestic dogs, e.g., mange, canine distemper, parvovirus and rabies. The significance of

disease is unclear in Indochina, but diseases are a significant threat in South Asia, and probably in parts of Indonesia.

**Commercial use** There is no widespread exploitation for fur or other purposes, though medicinal use should be investigated in China.

#### **Occurrence in protected areas**

- *Bhutan:* Reliable reports of dholes in Thrumshingla National Park, Royal Manas National Park, Jigme Dorji National Park, Jigme Singye Wangchuck National Park, Bumdeling Wildlife Sanctuary, Toorsa Strict Nature Reserve, and Phiposs Wildlife Sanctuary (CSG Dhole Database 2003; Sanjay pers. comm., T. Wangchuk pers. comm.).
- *Cambodia:* Reliable reports of dholes in The Trapeang Thom and Russei Thom areas of Preah Vihear Province; Virachey NP in Ratanakiri Province; the Koh Nhek area of Mondulakiri Province; Lomphat WS in Ratanakiri Province; Kulen Promtep WS in Preah Vihear Province; the Chhep area in Preah Vihear Province; Phnom Samkos WS in Pursat Province; and in the Central Cardamoms (Prek Tatai area) in Koh Kong Province. The last two listed are unconfirmed, since they are based on footprints only (Long *et al.* 2000). The other reports are primarily from the camera-trap surveys conducted by the Wildlife Conservation Society's Cambodia Program and WWF Cambodia.
- *China:* Reliable reports of dholes from two protected areas in the 1990s (Taohongling NR and Li Shan NR) and unconfirmed reports from at least five other sites (CSG Dhole Database 2003). There is also a report of a dhole trapped near Poyang Lake Nature Reserve in Jiangxi province, South China, and currently being held in captivity (C. Bellamy pers. comm.).
- *India:* Reliable reports of dholes from at least 38 protected areas in India (15 in southern India, 11 in central India, 6 in western India, and 6 in northern India; CSG Dhole Database 2003).
- *Indonesia:* Dholes are known to occur, or to have occurred recently (in the 1990s) on Java: Alas Purwo National Park, Baluran National Park, and Ujung Kulon National Park. There are unconfirmed reports from at least six other protected areas on the island. Sumatra: dholes are known to have occurred recently (in the 1990s), in Bukit Barisan Selatan National Park, Kerinci-Seblat National Park, and Gunung Leuser National Park. Outside of these areas information is sparse (CSG Dhole Database 2003). In Way Kambas National Park, Sumatra, dholes were previously listed; however, a three-year camera trapping study failed to record any dholes (R. Tilson pers. comm.).
- *Laos:* Dholes have been recorded from eight declared or proposed national protected areas and there are unconfirmed reports from another 11 areas. Four of the

five existing or proposed protected areas without records or reports are those least well surveyed. The fifth, Xe Bang-Nouan, was surveyed with a very rigorous approach to village-interview derived data and species were only listed as reported where a dated, site-located, claim was discussed in detail with the original observer. The species may well have occurred into the 1990s in all declared or proposed national protected areas in Laos. There is no more recent information from most areas (CSG Dhole Database 2003).

- *Malaysian peninsula*: Dholes were photographed recently (using camera traps; e.g., J.B. Abdul, pers. comm.) in the following protected areas, Taman Negara (national park), Cameron Highlands Wildlife Sanctuary, Ulu Lepar Forest Reserve, and Krau Wildlife Reserve (CSG Dhole Database 2003).
- *Myanmar*: There are recent reliable records from eight areas in Myanmar, including the Alaungdaw Kathapa National Park, Mamanyaing Reserve Forest, and the Southern Rakhine Yoma Elephant Range.
- *Thailand*: There are confirmed reports of dholes in three protected areas from 1999 or 2000 (Khao Yai NP, Phu Khieo WS, Thapraya NP) and unconfirmed reports from seven other sites (CSG Dhole Database 2003).
- *Vietnam*: Dholes were thought to occur in Vu Quang NR, Pu Mat NR, Ngoc Linh (Quang Nam) NR, and Phong Nha NR in the 1990s, there were unconfirmed reports from 18 other sites (CSG Dhole Database 2003).

#### **Protection status** CITES – Appendix II (2003)

**Current legal protection** In Cambodia, the current wildlife decrees give the dhole protection from all hunting. A new forestry law is under preparation, and a proposal to list the species as a fully protected species is under discussion. In India, the dhole is protected under Schedule 2 of the Wildlife Act of 1972 (permission is required to kill any individual unless in self defence or if an individual is a man killer). The creation of Project Tiger Reserves in India has provided some protection for populations of the *C. a. dukhunensis* subspecies (A.J.T. Johnsingh pers. comm., L. Durbin pers. obs.). In the Russian Federation, dholes received the status of “protected animal” in 1974 (A. Poyarkov and N. Ovsyanikov *in litt.*); however, the poisoning of grey wolves may inadvertently affect any remnant dhole populations (V. Puzanskii pers. comm.). In Vietnam, the dhole is protected by Decree 18/HDBT (17/01/1992) and the amendment Decree 48/2002/ND-DP (22/04/2002) under category IIB, which limits extraction and utilisation. However, the levels of extraction or utilisation are not quantified (B. Long *in litt.* 2003).

**Conservation measures taken** None specifically focused on dholes have been reported for most range

states. In India, Project Tiger could potentially maintain dhole prey bases in areas where tigers and dholes coexist. There do not appear to be any specific measures for dhole conservation in Indochina, although the declaration of relatively large protected area networks in Cambodia, Laos, and Vietnam will, when these areas become functional realities on the ground, form a suitable conservation system for the species in at least Cambodia and Laos.

#### **Occurrence in captivity**

There are at least 110 dholes in captivity, and the sex ratio is approximately even. Except for some captive populations in India heterozygosity appears to be good, but there is little chance of breeding the putative subspecies as animals from diverse geographical origins have been widely interbred (M. Boer pers. comm.). Dholes are known to breed in Beijing, Winnipeg, Dresden, Novosibirsk, Chennai (Madras), Hodenhagen, Safari Park Beekse Bergen, Magdeburg, and Howletts (M. Boer pers. comm.). To our knowledge there have been no attempts to reintroduce the species, and at present there is no evidence that this would be justified.

#### **Current or planned research projects**

L. Durbin, B.B. Acharya, A.J. Durbin, and A.J.T. Johnsingh (Centre for Ecology and Hydrology, UK and Wildlife Institute of India) undertook an ecological study of dholes in Kanha Tiger Reserve, central India, between May 1998 and March 2000. Radio-telemetry data were restricted to a three-month period for a male in a large breeding pack.

L.I. Grassman (Texas A and M University, USA) carried out a ten-month radio-telemetry study of a pack-living male dhole in Phu Khieo Wildlife Sanctuary, Thailand, between March 2000 and June 2002.

S. Hedges and M.J. Tyson (Wildlife Conservation Society, Indonesia) studied the impact of predation by dholes, leopards, and human poachers on the ungulate prey base in Baluran and Alas Purwo National Parks in East Java, Indonesia, from September 1991 to January 1999. There are plans to begin a radio-telemetry study of dholes in East Java.

M. Boer (Hodenhagen Safari Park, Germany) is involved in studies of reproductive biology and behaviour of a pack of dholes in a large enclosure at Hodenhagen Safari Park, from 1995 to present.

C. Sommer (Philipps-University of Marburg, Germany) is carrying out a comparative study of dhole, African wild dog, and grey wolf in captivity, with special emphasis on dominance hierarchy, communication, individual distances, and mating behaviour.

A. Iyengar, S. Hedges, A. Venkataraman, V. Narendra Babu, and P.A. Morin (Laboratory of Conservation Genetics, Max Planck Institute for Evolutionary

Anthropology, Germany, the Indian Institute of Science, and the Wildlife Conservation Society) are studying the conservation genetics of dholes.

A. Venkataraman and V. Narendra Babu (Asian Nature Conservation Foundation, Bangalore, India) are currently undertaking a conservation assessment of dholes in southern and central India.

A.J.T. Johnsingh, K. Sankar, and B. B. Acharya (Wildlife Institute of India) are conducting a radio-telemetry study of dholes in Pench, central India.

### 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.



Hira Punjabi