Commercial use Not exploited for fur or any other products.

Occurrence in protected areas *Brazil:* Parque Nacional de Chapada dos Guimarães, Parque Nacional da Serra da Capivara, Parque Nacional da Serra da Canastra, Parque Nacional de Emas, Parque Nacional Grande Sertão Veredas, Estação Ecológica de Águas Emendadas, Parque Nacional de Brasília, Refúgio de Vida Silvestre da Fazenda Nhumirim e RPPN do Rio Negro, Parque Estadual da Serra do Lageado, Parque Estadual de Santa Bárbara, Santuário de Vida Silvestre do São Miguel, Fazenda São Miguel.

Protection status CITES – not listed.
Listed as "Vulnerable" by the Canid Conservation Assessment and Management Plan (CAMP) 1993 meeting in São Paulo; "Vulnerable" in individual state faunal status accounts, but not listed in the Brazilian official list of threatened mammals (Fonseca *et al*. 1994).

Current legal protection Hunting and trade in wildlife is generally forbidden in Brazil. There is no specific hunting legislation for hoary foxes.

Conservation measures taken Nothing proposed. No cultural protection reported.

Occurrence in captivity
Specimens in Brazilian zoos at the time of writing include: Brasilia (1); São Paulo (1); Ribeirão Preto (1); Belo Horizonte (5); Teresina (1). High mortality rates due to starvation amongst captive cubs are reported. There are no current plans to reintroduce hoary foxes into the wild.

Current or planned research projects
J. Dalponte (Universidade de Brasília, Brazil) is currently studying the ecology and behaviour of the hoary fox in Mato Grosso, Brazil.

Gaps in knowledge
Areas for further research include focusing on aspects of behavioural ecology, population status, geographical range, the potential role of disease in population regulation, and their status as potential reservoirs of veterinary (e.g., scabies, distemper) and public health (e.g., leishmaniasis, rabies) pathogens.

Core literature
Costa and Courtenay 2003; Dalponte 1997, 2003; Juarez and Marinho-Filho 2002; Silveira 1999.

Reviewers: Louise Emmons, Jader Soares Marinho-Filho.
Editors: Claudio Sillero-Zubiri, Michael Hoffmann.

3.10 Bush dog
Speothos venaticus (Lund, 1842)
Vulnerable – VU: C2a(i) (2004)

G.L. Zuercher, M. Swarner, L. Silveira and O. Carrillo

Other names
English: vinegar dog, savannah dog; **Dutch:** boshond, busdagoe (Suriname); **French**: chiens des buissons, zorro; **German**: waldhund; **Italian:** speoto, itticione; **Portuguese:** cachorro-do-mata, cachorro-do-mato-vinagre, cachorro-do-mato-cotó, cachorro-pitoco (Brazil); **Spanish:** zorrito vinagre (Argentina); zorro/perro vinagre, perro/perrito de monte (Bolivia/Ecuador/Venezuela); perrito venadero, umba (Colombia); perro de la selva, pero selvático, perro de agua, Guanfando (Ecuador – origin undetermined); **Indigenous languages:** Cubeo: maca tawimi, Huitoto: itón+maido, Shuku: puinave, Yucuna: huerateyaniminami (Colombia); Achuar: tuwen'k, patukam yawa, Chachi: pikucha, Huaorani: babeguinta, Quichua: sacha alcu, Secoya: airo jo'ya, masioco yai (Ecuador); Aché: mbetapa, Guarani: jagua yvyguy (Paraguay); Amarakaeri: dumba cuhua, cuan cuan, Shibipo: hueshes (Peru).

Taxonomy
Cynogale venatica Lund, 1842. K. Dansk. Vid. Selsk. Naturv. Math. Afhandl. 9:67. Type locality: "Lagoa Santa" [Minas Gerais, Brazil, *c.* 19°39'S, 43°44'W].

The bush dog is accepted as the sole extant representative of the monotypic genus *Speothos*. *Speothos pacivorus* Lund, 1839, an extinct species, is known only from fossil deposits discovered at the Lagoa Santa caves in Minas Gerais, Brazil, and may not have existed past the Holocene (Berta 1984). This is the same site for the type locality specimen of *S. venaticus*. The two species are distinguished by several dental features, including the presence of a metaconule and hypocone on M_1, a large, double-rooted M_2, as well as the larger size of *S. pacivorus* (Berta 1987). A third species, *S. major* (Lund 1843), is now considered synonymous with *S. venaticus* (Berta 1984).

The taxonomic relationship of bush dogs to other canids remains debatable. The presence of a unicuspid M_1 talonid led to the inclusion of the bush dog in the subfamily Simocyoninae, along with two other species that share this characteristic, the African wild dog (*Lycaon pictus*), and dhole (*Cuon alpinus*). Berta (1984, 1987) suggested bush dogs are most closely related to small-eared dogs (*Atelocynus microtis*), and members of the *Cerdocyon* clade (one of four monophyletic groups of South American canids). This group includes the raccoon dog (*Nyctereutes procyonoides*). Berta (1987) suggests a single ancestor for this group, ranging over Eurasia and North America, with isolation of the raccoon dog occurring when the Bering Land Bridge disappeared. Recent molecular analyses,

Adult male (front) and female (behind) bush dog. Oklahoma City Zoo, USA.

Gerald L. Zuercher

based on mitochondrial DNA, suggest bush dogs and maned wolves (*Chrysocyon brachyurus*) constitute a monophyletic group distinct from other South American canids (Wayne *et al*. 1997).

Chromosome number: 2n=74 (Schreiber and Dmoch 1994).

Description

The bush dog is characterised by an elongate body, a short and sometimes stubby tail, broad face with short muzzle, small rounded ears, brown eyes, and short legs (Table 3.10.1). Head and neck are generally reddish/tan or tawny, gradually darkening to black or dark brown hindquarters and legs. The underside is also dark and some individuals may show a pale white throat (i.e., Bolivia) or chest patch. Coat patterns can, however, be highly variable, ranging from almost all black to very light blonde. Feet are partially webbed and tracks are nearly identical to those of the domestic dog. Bush dogs are one of three canid species with trenchant heel dentition, a unicuspid talonid on the lower carnassial molar that increases the cutting blade length. Dental formula is 3/3-1/1-4/4-2/2=40.

Table 3.10.1. Body measurements for the bush dog from Paraguay (Van Humbeck and Perez 1998; Nowak 1999).

HB	630mm (575–750)
T	140mm (125–150)
E	30mm
SH	200mm (200–300)
WT	5–8kg

Subspecies Three subspecies are recognised (Cabrera 1961).

— *S. v. panamensis* (Panama)
— *S. v. venaticus* (Argentina, Bolivia, northern and central Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Venezuela).
— *S. v. wingei* (south-eastern Brazil).

Similar species Short-eared fox (*Atelocynus microtis*): distinguished by a grizzled, blackish/grey coat, erect pointed ears, longer legs, and a bushy tail long enough to touch the ground. Tayra (*Eira barbara*): longer bushy tail and a yellow throat and head patch.

Current distribution

This species occurs from extreme eastern Central America and northern South America, south to Paraguay and north-eastern Argentina (Figure 3.10.1). Isolated populations may also still occur in Ecuador (Tirira 2001) and Colombia, west of the Andes. However, historical distribution may have extended as far north as Costa Rica (De la Rosa and Nocke 2000), where the species may still survive in suitable habitat.

Range countries Argentina, Bolivia, Brazil, Colombia, Costa Rica (?), Ecuador, French Guiana, Guyana, Panama, Paraguay, Peru, Suriname, Venezuela (Fonseca and Redford 1984; Defler 1986; Strahl *et al*. 1992; Aquino and Puertas 1997; Silveira *et al*. 1998; De la Rosa and Nocke 2000; Barnett *et al*. 2001; Tirira 2001; Zuercher and Villalba 2002).

Figure 3.10.1. Current distribution of the bush dog.

Relative abundance

Although there is currently no information available regarding the species' density, it is important to note that, despite its large distributional range and occurrence in a variety of habitats (i.e., cerrado and rainforest), the species has never been reported as abundant. Thus, it seems to be naturally rare throughout its range, independent of human disturbance.

Habitat

Bush dogs are reported to be a habitat generalist by indigenous peoples, within the context of occurring generally near water sources, particularly small streams, and near available prey populations, especially *Agouti paca* (O. Carrillo and M. Swarner pers. obs.). Bush dogs have been observed in lowland (below 1,500m a.s.l.) forested habitats including primary and gallery forest (Defler 1986), semi-deciduous forest, and seasonally flooded forest (Aquino and Puertas 1997). Observations have also been recorded from cerrado habitat in Brazil (Silveira *et al.* 1998; C. Brady pers. comm.) and Paraguay (Zuercher and Villalba 2002) and pampas (wet savannah) edge/riparian areas (Strahl *et al.* 1992; Emmons 1998). In some cases, they have been observed as far as 5,700m from forest habitat (Silveira *et al.* 1998). The species is also occasionally reported from secondary forest, ranchland (M. Swarner pers. obs.) and fragmented cerrado ranchland (L. Silveira and A. Jácomo pers. comm.).

Food and foraging behaviour

Food Primarily carnivorous, bush dogs are most commonly observed hunting large rodents such as paca (*Agouti paca*) and agouti (*Dasyprocta* spp.) (53.1% and 28.1%, respectively, of reported sightings in central western Amazonia; Peres 1991). Their diet may also include small mammals (i.e., rats, *Oryzomys* spp. and *Proechimys* spp., rabbits, *Sylvilagus brasiliensis*, opossums, *Didelphis* spp. and nine-banded armadillo *Dasypus novemcinctus*; Van Humbeck and Perez 1998; Zuercher and Villalba 2002). Other prey items include teju lizards (M. Swarner pers. obs.), snakes, and possibly ground-nesting birds. Local people report that bush dogs can take prey considerably larger than themselves such as capybaras (*Hydrochaeris hydrochaeris*), and rheas (*Rhea americana*), as well as deer (*Mazama* spp.), and possibly even tapir (*Tapirus terrestris*) (R. Wallace pers. comm.) by hunting in packs (Deutsch 1983; Peres 1991; Strahl *et al.* 1992). Their diet is reported to vary seasonally.

Foraging behaviour Peres (1991) reported 92% of observed bush dog hunting parties consisted of at least two individuals (mean=4.5; range=2–8). Local people describe a variety of cooperative hunting strategies employed by bush dogs (M. Swarner unpubl.). For example, in Bolivia, they are commonly reported to hunt *Mazama* deer by attacking the legs until the animal tires and falls. Olfaction may play a large role when foraging. When hunting burrowing animals, some individuals reportedly enter the prey's burrow while other pack members wait at possible escape routes. Once flushed, prey is pursued with seemingly relentless endurance by the pack, even into deep water. Solitary hunting has been observed (Deutsch 1983).

Damage to livestock or game In Bolivia and Ecuador, bush dogs are considered predators of chickens (M. Swarner pers. obs.).

Adaptations

Modified carnassial teeth suggest an exclusively carnivorous diet. Webbed feet suggest swimming capability and imply that large rivers do not represent barriers to distribution (Strahl *et al.* 1992). Small compact body may be an adaptation to pursue burrowing prey and navigate through dense forest. Stocky, muscular neck may aid in prey capture or extraction from burrows. Dark coat colour is a reported general adaptation to humid, forest environments. Nomadic behaviour may reflect responses to changing densities of favoured prey species as well as avoidance of competitors and/or predators.

Social behaviour

Although solitary individuals have been observed, the bush dog is considered the most social of the small canids (Ginsberg and Macdonald 1990; Sheldon 1992), reportedly living in groups ranging from 2–12 individuals with most observed groups comprising 2–6 members (M. Swarner unpubl.; L. Silveira pers. obs.). Captive bush dogs, too, are compulsively social, rarely spending more than a few minutes from companions (Macdonald 1996). Strahl *et al.* (1992) state that the bush dog is probably a cooperative species, and report observations by indigenous hunters and colonists in Venezuela of bush dogs hunting in groups of up to six individuals. The ability of a pack to subdue larger prey appears to be a primary benefit of sociality for bush dogs (Kleiman 1972; Drüwa 1983).

Drüwa (1983) suggests a monogamous pair-bond is likely with multiple years' offspring living with the pair at any given time. A mostly diurnal species, the pair and any family members spend the night in a den (Kleiman 1972; I. Porton pers. comm.). Males exhibit a high degree of parental care that includes food supplementation to females prior to birth and throughout nursing (I. Porton pers. comm.). Silveira *et al.* (1998) estimate the home range as between 4.56 and 4.72km^2; this estimate is derived from a canid home range regression based on body mass by Gittleman and Harvey (1982).

Porton (1983) suggests urine marking is important in formation and maintenance of pair-bonds. Indigenous people report a strong smell associated with bush dogs (Swarner unpubl.), lending further evidence that urine is

a particularly effective communication medium for this species. Sex-specific urine-marking behaviour characterises bush dogs. Males extrude the penis and move laterally, creating a spray rather than a stream (Kleiman 1972). Females drag the ano-genital region over a surface or display either a forelimb handstand or a squat. The raised posture of the female allows urine to be deposited approximately 150mm higher than the spray of the male (Kleiman 1972).

Adult bush dog vocalisations have been classified into six categories: (1) whines; (2) repetitive whines; (3) pulsed vocalisation; (4) screams; (5) barks; and (6) growls (Brady 1981). Infant vocalisations include whines, grunts, growls, and barks and are thought to either elicit care or reduce aggression. Habitat and social organisation are thought to influence the physical structure of bush dog vocalisations. The elaborate set of close-range vocalisations assists in communicating subtle changes in mood as well as changes in location (Kleiman 1972; Brady 1981). The use of this close-contact call has been noted in a bush dog group travelling through tall grass during the day in Colombia (Defler 1986). Bush dogs also have a vocalisation similar to the short-distance vocalisation (Brady 1981) but at a different frequency. This particular vocalisation has been reported from Paraguay during the early morning (K. DeMatteo pers. comm.) and night (Beccaceci 1994).

Reproduction and denning behaviour

Free-ranging bush dogs have an unknown mating season, although pups have been found in the wet season (M. Swarner pers. obs.). The majority of information regarding bush dog reproduction comes from captive studies. Captive females have two oestrous cycles per year (Kleiman 1972), demonstrating the species' physiological potential. Oestrus is aseasonal and likely influenced by social factors (Porton *et al*. 1987). Dominant females appear to suppress the oestrus of daughters (Porton *et al*. 1987; Macdonald 1996). Gestation is 67 days, and mean litter size is 3.8 (range=1–6). Lactation lasts approximately eight weeks. Bush dogs are believed to be sexually mature by one year.

Competition

No direct measures of competition are available. However, there is a high degree of overlap in the reported diets of bush dogs and many other Neotropical carnivore species and humans. This potential competition with humans for food resources may partially explain the absence of bush dogs near human settlements. Den-site competition is unlikely as the species is considered very nomadic and often reported to use pre-existing burrows of paca or armadillos. Direct interactions with sympatric carnivore species are unknown.

Mortality and pathogens

Natural sources of mortality Indigenous peoples in Paraguay, Bolivia, and Ecuador report finding bush dogs killed by jaguars and puma.

Persecution Bush dogs are occasionally killed in Bolivia and Ecuador for depredation of chickens (M. Swarner pers. obs.).

Road kills No substantial data exist to quantify bush dog susceptibility to automobile collisions. However, in Brazil, bush dogs have been found as road kills (L. Silveira, pers. obs.).

Hunting and trapping for fur The bush dog is not currently, nor was it historically, valued for its pelt. Local people report that they were an extremely rare by-catch during the pre-1978 spotted-cat skin trade.

Pathogens and parasites Known disease-causing organisms and parasites of bush dogs include bacteria (*Escherichia coli, Proteus vulgaris, Staphylococcus aureus, S. epidermis, Klebsiella* sp., *Shigella* sp.), protozoans (*Giardia* sp.), fungi (*Candida* sp.) (Van Humbeck and Perez 1998), nematodes (*Lagochilascaris* sp.) and cestodes (*Echinococcus* sp.) (Volcán and Medrano 1991). Captive individuals also have shown susceptibility to parvovirus (Janssen *et al*. 1982) and vaccine-induced canine distemper virus (McInnes *et al*. 1992).

Longevity A captive bush dog reportedly lived for more than 13 years (Jones, in Nowak 1999), but is likely to be around 10 years in the wild.

Historical perspective

Indigenous people have occasionally kept bush dogs as pets and hunting dogs, emphasising their superior hunting abilities when pursuing burrowing prey, especially paca and armadillos (M. Swarner unpubl.). However, other informants report that bush dogs are difficult or impossible to domesticate because of the fierceness, all-meat diet, or susceptibility to domestic dog diseases.

Some lowland Quichua of eastern Ecuador report that bush dogs have owners like any domestic dog (M. Swarner pers. obs.). The "owners" are referred to as *sacha runa* (forest people or spirits) and use them as hunting dogs. Due to this belief, some Quichua are reluctant to capture or kill bush dogs because it would be equivalent to stealing or killing a neighbour's hunting dog.

Many indigenous peoples consider the bush dog to be one of the best hunters in the forest, sometimes singing songs to their own dogs in hopes of passing on the bush dog's skills (Descola 1996). Human hunters often report killing prey pursued by bush dogs whenever encountered and taking it for themselves, even following the bush dog's high-pitched hunting barks in the hope of a stealing opportunity (M. Swarner unpubl.).

Conservation status

Threats Only serious perceived threat is from habitat conversion and human encroachment.

Commercial use None known.

Occurrence in protected areas

— *Argentina:* Iguazu National Park and Urugua-í Provincial Park;
— *Bolivia:* Carrasco National Park, Amboro National Park, Rios Blancos and Negros Reserve, Beni Biosphere Biological Station and Reserve and Madidi National Park, and Noel-Kempff Mercado National Park;
— *Brazil:* Emas National Park, Iguaçu National Park, Cantão State Park, Tocantins State and Serra das Araras State Park, Mato Grosso, IGBE's Ecological Reserve, Gurupi Biological Reserve, Amazonia National Park, Rio Trombetas Biological Reserve, Tapirapé Biological/Tapirapé-Aquiri National Forest, and Mirador State Park; *Colombia:* Tuparro National Park;
— *Ecuador:* Sumaco-Napo Galeras National Park (Centro de Datos para la Conservación del Ecuador), Yasuni National Park, Cotocachi-Cayapas Ecological Reserve, and Cuyabeno Faunistic Reserve;
— *Guyana:* Kaieteur National Park;
— *Paraguay:* Reserva Biosfera del Bosque Mbaracayú, San Rafael National Park, Reserva Privada Golondrina, Reserva Natural Privada Morombi, Reserva Natural Privada Ypeti, and Reserva Natural Privada Ka'I rague;
— *Peru:* Tamshiyacu-Tahuayo Communal Reserve, and National Reserve of Pacaya-Samiria, Biabo Cordillera Azul Reserve, Centro Río Amigos, and Bahauja-Sonene National Park and Tambopata Candamo Reserve;
— *Venezuela:* Canaima National Park.

Protection status CITES – Appendix I (2000).
Declared "Vulnerable" in Argentina (Beccaceci, in Ginsberg and Macdonald 1990).

Current legal protection Hunting is prohibited in Colombia (Law Number 848:1973), Ecuador (Law Number 74:1981), French Guiana (Law Number JO19860625:1986), Panama (Law Number 2-80:1980), Paraguay (Law Number 18796:1975) and Peru (Law Number 5056:1970). Hunting and trade is regulated in Argentina (Law Number 22.421:1981), Bolivia (Law Number 12301:1975), Brazil (Law Number 5197:191967), and Venezuela (Law Number 276:1970). There is no Information for Guyana and Suriname.

Conservation measures taken None known.

Occurrence in captivity

Bush dogs do occur in captivity and are breeding successfully. No known attempts at reintroduction.

Current or planned research projects

G. Zuercher (Kansas Cooperative Fish and Wildlife Research Unit, Kansas State University and Sunset Zoological Park, Manhattan, Kansas, USA), with additional support by Sedgwick County Zoo (Wichita, Kansas), and the American Zoo and Aquarium Association, is investigating the ecological role of the bush dog as part of a greater mammalian carnivore community within the Interior Atlantic Forest of eastern Paraguay.

L. Silveira (Pró Carnívoros, São Paulo, Brazil), A. Jácomo (Pró Carnívoros), and C. Brady (Memphis Zoo, Memphis, Tennessee, USA) are exploring the distribution and conservation of bush dogs within the Brazilian cerrado biome, where conservation units of confirmed bush dog presence are being examined, and potential corridor sites are being identified. The project is sponsored by Pró Carnívoros and Memphis Zoo (Memphis, Tennessee, USA).

M. Swarner (University of Maryland, College Park, Maryland, USA) undertook an inventory of indigenous knowledge of bush dogs throughout western Amazonia between July 2000 and August 2001 (a study supported by the Thomas J. Watson Foundation).

K. DeMatteo (St. Louis Zoo and St. Louis University, St. Louis, Missouri, USA) is continuing an ongoing captive study to investigate the reproductive physiology of female bush dogs and the role of social stimulation in ovulation.

Gaps in knowledge

The distribution of bush dogs should be re-evaluated. There are no population estimates or demographic data for bush dogs in any of their range countries. Our understanding of dietary habits is based mostly on anecdotal information and does not address seasonal or geographic variation. Habitat associations are not clearly understood – the species was once thought to be dependent on forests but is now regularly observed in open habitats. The impact of disease, both historically and currently, is unclear (this is especially true for diseases introduced by domestic animals). Accepted ideas of behaviour and social structure, obtained from captive animals, have not yet been verified in wild populations. Interspecific relationships with sympatric carnivores need to be further evaluated.

Core literature

Aquino and Puertas 1997; Brady 1981; Drüwa 1983; Kleiman 1972; Macdonald 1996; Porton 1983; Silveira *et al*. 1998; Strahl *et al*. 1992; Van Humbeck and Perez 1998.

Reviewers: Melissa Rodden; Karen DeMatteo. **Editors:** Michael Hoffmann, Claudio Sillero-Zubiri.