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Canine Life History



Lisa J. Wallis
Department of Ethology, Eötvös Loránd
University (ELTE), Budapest, Hungary

Definition

Canine life history describes the reproduction, growth, and survival patterns for species in the mammalian Canidae, a family within the Carnivora order with multiple species, including dogs, wolves, foxes, jackals, coyotes, and other dog-like mammals.

Introduction

The family Canidae belongs to the suborder Caniformia, and its name comes from the Latin *canis* meaning “dog.” The dog-like caniforms emerged within the Carnivoramorpha 43 million years before present (Flynn and Wesley-Hunt 2005). Three subfamilies existed, but two became extinct, Hesperocyoninae (about 39.74–15 Mya) and Borophaginae (about 34–2 Mya), and the third, Caninae (about 34–0 Mya), is the only surviving subfamily. Using DNA analysis the surviving members of the Canidae family have been divided into a basal Caninae group (containing the gray fox and island fox) and two tribes, the Canini (true dogs) and Vulpini (true foxes)

(Lindblad-Toh et al. 2005). Canidae are the most geographically widespread family of Carnivora and are found on every continent except Antarctica. For example, the red fox and the gray wolf have the most extensive range of all land mammals. Canids live in a wide range of habitats including deserts, mountains, forests, and grasslands. Canidae today include a diverse group of around 36 species ranging in size from the fennec fox (*Vulpes zerda*) measuring only 18 cm at the shoulder and the maned wolf (*Chrysocyon brachyurus*) at over 90 cm (Sillero-Zubiri et al. 2004). One particular canid, the domestic dog (*Canis familiaris*), was the earliest known domesticated animal and remains today one of the most widely kept domestic animals around the world.

Characteristics

The body shape of all canids (in particular jackals, coyotes and wolves) is relatively similar with long muzzles, upright ears, long legs and lithe bodies adapted for chasing prey, with the exception of the bush dog (*Speothos venaticus*), raccoon dog (*Nyctereutes procyonoides*) and some domestic breeds of dog (*Canis familiaris*) (Castelló and Sillero-Zubiri 2018; Miklósi 2014). The length of the muzzle, ears, and tail can also vary significantly between species; however, the gray wolf shows the typical basal form of the family. All canids walk on their toes showing typical digitigrade qualities enabling them to move quickly and

quietly. The cushioned pads on the soles of the feet and the tip of the nose are naked. The soles consist of a three-lobed central pad and a single pad behind the tip of each toe. There are five toes on the fore feet, but the pollex (thumb) does not reach the ground. The African hunting dog is the exception to this rule, as it has only four toes. The hind feet of all canids have four toes (but some domestic dogs have a fifth vestigial toe called a dewclaw) (Mivart 1890).

Male canids possess a bone called the baculum, which supports the penis, and a structure called the bulbus glandis at the base of the penis helps to create a copulatory tie during mating. The copulatory tie is a characteristic of mating in most Canids; during mating the bulbus glandis becomes engorged with blood and locked in the contracted vagina of the female. The two animals can remain attached by their genitals for 15 min or more, during which time ejaculation takes place (Castelló and Sillero-Zubiri 2018). All young are born blind, and their eyes open a few weeks after birth.

Most canids have 42 teeth, which are adapted for cutting, crushing, grinding, and slicing and reflect their dietary habits including hypercarnivory and a more omnivorous diet. All except the bush dog (*Speothos venaticus*), dhole (*Cuon alpinus*), and bat-eared fox (*Otocyon megalotis*) have the same dental formula of three incisors, one canine, four upper premolars, and two molars in the upper jaw, and the same in the lower jaw, apart from the presence of an additional molar (Mivart 1890).

Lifespan

The lifespan of canid species ranges from 3 to 15 years in the wild, but most species can live substantially longer in captivity (please refer to “Lifespan” section of Table 1). Mortality rates in the wild can be high due to natural sources of mortality, interspecies competition, persecution by humans (hunting and trapping for fur, meat, sport, or to be captured and kept as tourist attractions), road kills, and pathogens and parasites. Many canids come into conflict with man due to

their tendency to prey on domestic livestock and wild game (Sillero-Zubiri et al. 2004).

Foraging Behavior

Canids employ several types of foraging strategies, which are dependent on the habitat and prey species available. Most species are generalist hunters and foragers and consume a wide range of food items including mammals, birds, fish, amphibians, reptiles, insects, plants, fruit, and seeds (please refer to the “Food” section of Table 1). Part of the Canidae’s success is due to their ability to adapt to local ecological factors. Some more specialist hunters and foragers have also evolved to exploit particular niche environments. The majority of canid species are carnivores or omnivores, with the exception of the bat-eared fox (*Otocyon megalotis*, insectivorous), Blandford’s fox (*Vulpes cana*, insectivorous and frugivorous), and pale fox (*Vulpes pallida*, herbivorous) (Sillero-Zubiri et al. 2004). Many species are solitary hunters/foragers, due to the small size of their prey; however, the larger more carnivorous species are dependent on bigger prey for sustenance and are therefore reliant on cooperative hunting efforts (please refer to the “Foraging behavior” section of Table 1). The activity patterns of each species are dependent on their prey species and, in more urban areas, human disturbance. Most species are nocturnal, crepuscular, or diurnal (Sillero-Zubiri et al. 2004).

Social Behavior

Nearly all canid species are social animals and live together in small family groups, which consist of the breeding male and female and their current offspring. In addition, most are territorial, or have a home range, and either sleep in the open, using a den only to raise young, or are more dependent on dens on a daily basis. Territories and home ranges are maintained through driving out conspecific intruders, scent marking, and vocalizations. Some canids are solitary species and come together only to breed; others live in larger social

Canine Life History. Table 1 Information on the 36 extant species of canids listed alphabetically by scientific name. Here we include the African golden wolf (*Canis anthus*), the red wolf (*Canis rufus*), the domestic free-ranging dog (*Canis familiaris*), and the Dingo (*Canis dingo*) as distinct species, rather than subspecies. The data provides descriptions of general aspects of life history including the species scientific name, English common name, shoulder height (in mm) and weight (in kilograms (where possible divided by sex (M = male, F = female))), the current distribution of the species, the habitat types they are found in, what food they typically eat, the foraging behavior used to obtain their food, information about their social behavior, lifespan, breeding strategy, gestation length (in days), litter size (mean and range), IUCN status and population trend (taken from <https://newredlist.iucnredlist.org/>), and finally a list of sources (please see abbreviation key at the end of the table)

Scientific name Common name N of subspecies	Shoulder height/ weight	Distribution	Habitat	Food	Foraging behavior	Social behavior	Lifespan	Breeding strategy	Gestation length	Litter size	IUCN status/pop. trend	Source abbrev
<i>Atelesynus microtis</i> Short-eared dog	356 mm 9–10 kg	Amazon rainforest region of S. America	Rainforest – Amazonian lowlands. Often found near water	Carnivore: fish, insects, small rodents, fruits, and frogs	Generalist. Hunts alone or in pairs. Diurnal and nocturnal	Mainly solitary, males tend not to have overlapping territories	1–11 years captive (wild no data)	Unknown	Unknown	2 (1–3)	Near threatened Decreasing	1
<i>Canis anthus</i> African golden wolf 6 subspecies	400 mm 7–15 kg	North and northeastern Africa	Desert-adapted canid, but is common in plains and steppe areas, including ones lacking abundant water	Omnivorous: wild fruit, mammals, reptiles, birds, invertebrates, carrion, and sometimes lambs, sheep, goats, cattle, and human refuge. Thought to be more predatory than jackals	More active in the daytime than jackals. Pairs often successfully hunt gazelle faunas. Observed to hunt ungulates 4–5 times their body weight	Social organization is peaceful and flexible and centers around a home burrow. Frequently groom each other, have a high vocal repertoire, and have greater facial movement than jackals	8 years on average in the wild, but one individual 14 years (Serengeti)	Monogamous and territorial, yearlings may remain and assist in raising pups. The breeding pair suppresses sexual and territorial behavior of the grown pups	63	(1–9)	Not yet evaluated	1, 2
<i>Canis adustus</i> Side-striped jackal	M – 448 mm F – 437 mm M – 9.4 kg F – 8.3 kg	East and Southern Africa	Game areas, farmland, towns, wooded habitats, bush, grassland, marshes, and montane (<2,700 m)	Omnivorous: wild fruit, small mammals, birds, invertebrates, cattle cake, grass, and carrion	Forages singly and opportunisticly. Mostly nocturnal	Solitary, pairs, or family groups of up to seven individuals	10–12 years captive (much shorter in wild)	Monogamous. Cooperative rearing of young, alloparental care likely	60	5 (4–6)	Least concern Stable	1
<i>Canis aureus</i> Golden jackal 7 subspecies	450–500 mm M – 8.8 kg F – 7.3 kg	Southeast Europe, Southwest, South, and regions of Southeast Asia	Semidesert, short to medium grasslands and savannahs, forested, mangrove, agricultural, rural, and semi- urban	Omnivorous: wild fruit, mammals, reptiles, birds, invertebrates, carrion, and human garbage	Hunts singly, in pairs, and rarely packs. Mostly nocturnal but can be diurnal	Breeding pair and sometimes offspring from previous years (4–5 individuals). Home range sizes can vary between 1 and 20 km ² . Social	8 years on average in the wild	Monogamous. Cooperative rearing. Territorial	63	(1–8)	Least concern Increasing	1

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Canine Life History, Table 1 (continued)

Scientific name Common name N of subspecies	Shoulder height/ weight	Distribution	Habitat	Food	Foraging behavior	Social behavior interactions are common	Lifespan	Breeding strategy	Gestation length	Litter size	IUCN status/pop. trend	Source abbrev
<i>Canis latrans</i> Coyote 19 subspecies	530–610 mm M – 8–20 kg F – 7–18 kg	United States and Alaska, Canada (except the far northeastern regions), Mexico, and into Central America	Habitat generalist: all available habitats including prairie, forest, desert, mountain, and tropical ecosystems	Generalist carnivore: large ungulates and livestock, fruit and insects, birds, reptiles, amphibians, crustaceans. Scavenge human-made food resources and carrion	Hunts alone, but when hunting large prey, in pairs or small groups. Age, wind, habitat, and snow conditions influence their ability to hunt small mammals. Often crepuscular	Lives in family packs containing a reproductive female. Pair bonds may persist for years. In populations where elk/deer are available, large packs (<10 individuals) may form. Dominance hierarchy within each pack	Maximum age reported in wild is 15.5 years and 21 years in captivity	Mainly monogamous. Cooperative breeders. Females that fail to mate sometimes assist their sisters or mothers with their pups. Only defends territory during denning season	63	6 (1–9)	Least concern Increasing	1, 3, 4
<i>Canis lupus</i> Gray wolf 38 listed subspecies (some now extinct)	800–850 mm European 38.5 kg North American 36 kg, F weight 2–4 kg less than M	Canada, Alaska, and Northern United States, Europe, and Asia from about 75°N to 12°N	Habitat generalist: all northern habitats where there is suitable food, densities being highest where prey biomass is highest	Carnivore: majority of food is large ungulates (moose, caribou, deer, elk, wild boar, etc.). Will also eat small mammals, eggs, insects, reptiles, amphibians, livestock, carrion, and garbage	Generalist hunter. Winter: hunt in packs. Summer: hunt singly, in pairs, or in small groups	Packs consisting of mated pair and offspring. Family of 5–11 wolves (2 adults, 3–6 juveniles, and 1–3 yearlings). Packs of up to 42 individuals recorded. Distinct male and female age- graded hierarchies	On average 6 years. Maximum up to 13 years in the wild and 20 years in captivity	Monogamous cooperative breeders with alloparental care. Territorial. Alpha female suppresses reproduction of subordinates	63	6 (1–11)	Least concern Stable	1, 5
<i>Canis dingo</i> Dingo	M – 590 mm F – 560 mm M – 15.8 kg F – 14.1 kg	Australia	Habitat generalist: tropical alpine moorlands, forested peaks, arid hot deserts, tropical wetlands, and forests	Generalist carnivore: mammals (71 species), birds (53 species), vegetation (seeds), reptiles (23 species), insects, fish, crabs, and frogs	Changes: group size and hunting strategy in order to maximize hunting success. Mostly nocturnal	Small socially integrated groups or stable packs of 3–12 dingos, usually related. Older breeding pair. Distinct male and female hierarchies. Defend	7–8 years in wild (up to 13 years in captivity)	Cooperative hunting and rearing of young (males and yearlings). Alpha female suppresses reproduction of subordinates	61–69 days	5 (1–10)	Vulnerable Decreasing	1

<p><i>Canis familiaris</i> Domestic dog > 339 recognized breeds (FCI)</p>	<p>63–1067 mm 0.113 kg–155.6 kg Some breeds exhibit sexual dimorphism, with males larger than females</p>	<p>Worldwide. Free-ranging dogs make up 75–80% of the global dog population</p>	<p>Feral, stray, free-ranging village/ community dogs (rural or urban), working, pet, and companion dogs living in human homes and properties</p>	<p>Generalist carnivore: can adapt to a wide- ranging diet including vegetables, berries, and grains. Primarily scavengers of human waste and animal carcasses. Also consumes birds, reptiles, small- to medium-sized mammals, amphibians, and livestock</p>	<p>Free-ranging dogs forage singly and opportunistically predominantly on human refuse. But hunting by dogs can have severe impacts on endemic wildlife species in some environments</p>	<p>territories during breeding</p>	<p>Free-ranging dogs can live in stable packs formed by multiple individuals of both sexes, with an age-graded dominance hierarchy (agonistic and affiliative). Males tend to dominate females of a similar age. An age-graded hierarchy is also found in pet dogs living in packs and multi-dog households</p>	<p>Median – 10–13 years, oldest recorded 26 years</p>	<p>Most free- ranging dogs exhibit a promiscuous mating system. Monogamy, polygyny, and polyandry also occur. High- ranking individuals have greater reproductive success. Females disperse from the pack to give birth alone</p>	<p>63 days</p>	<p>Mean 6 (1–24)</p>	<p>NA</p>	<p>1, 6, 7, 8</p>
<p><i>Canis mesomelas</i> Black-backed jackal 2 subspecies</p>	<p>380–480 mm M – 8.1 (5.9–12) F – 7.4 (6.2–9.9)</p>	<p>Two separate populations, one in East Africa and the other in Southern Africa</p>	<p>Habitat generalist: arid coastal desert, montane grassland, arid savannah and scrubland, open savannah, woodland savannah mosaics, and farmland</p>	<p>Generalist carnivore: fish, insects, small- to medium- sized mammals, reptiles, birds, plants, fruits, frogs, carrion, and human refuge</p>	<p>Pairs and small foraging groups, packs are formed in order to hunt larger prey. Cooperative hunting increases success rate</p>	<p>Territories are spatially and temporally relatively stable. Intruders are aggressively expelled by territory holders. Very vocal species. Home range size varies between 1 and 25 km²</p>	<p>Up to 7 to 10 years in the wild</p>	<p>Monogamous cooperative breeders and hunters, territorial. Dominants prevent subordinates from mating through harassment</p>	<p>60</p>	<p>(1–6)</p>	<p>Least concern Stable</p>	<p>1</p>	
<p><i>Canis rufus</i> Red wolf</p>	<p>M – 699 mm F – 662 mm M – 28.5 kg F – 24.3 kg</p>	<p>Exist only in a reintroduced population in eastern North Carolina, USA</p>	<p>Habitat generalists: coastal prairie marshes, historically river forests, and swamps</p>	<p>Carnivore: mammals including nutria, rabbits, rodents, white- tailed deer, and raccoon</p>	<p>Forage individually and hunt in groups. Mostly nocturnal with crepuscular peaks of activity</p>	<p>Extended family units or packs. Dominant breeding pair and offspring up to 12 individuals. Territorial: home range size varies from 46 to 226 km²</p>	<p>In absence of human- induced mortality up to 13 years</p>	<p>Monogamous with both parents providing care to pups. Den attendance by yearlings and adult pack members is common</p>	<p>61–63</p>	<p>(1–10)</p>	<p>Critically endangered Decreasing (wild pop. nonviable without help)</p>	<p>1</p>	

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Canine Life History, Table 1 (continued)

Scientific name Common name N of subspecies	Shoulder height/ weight	Distribution	Habitat	Food	Foraging behavior	Social behavior	Lifespan	Breeding strategy	Gestation length	Litter size	IUCN status/pop. trend	Source abbrev
<i>Canis simensis</i> Ethiopian wolf 2 subspecies	530–620 mm M – 14.2–19.3 kg F – 11.2–14.15 kg	Six isolated mountain ranges of the Ethiopian highlands (altitudes of 3,000–4,500 m)	Habitat specialist: Afroalpine grasslands and heathlands, prefer open areas with short herbaceous and grassland communities where rodents are most abundant	Specialist carnivore: feed almost exclusively upon diurnal rodents and occasionally on antelopes, hares, goshings, eggs, carrion, and scdge leaves	Preeminently a solitary rodent hunter but also a facultative cooperative hunter. Synchronize their activity with diurnal rodents	Lives in family groups containing up to 20 individuals older than 1 year (average pack size is 6). Each pack has a well- established hierarchy	In the wild 8–10 years; one known male in Bale lived 12 years	Monogamous cooperative breeders, dominant females suppress breeding of subordinates. Territorial: interact aggressively and vocally with other packs	60–62	(2–7)	Endangered Decreasing	1, 9
<i>Cerdocyon thous</i> Crab-eating fox 5 subspecies	368 mm 5.7 kg (4.5–8.5 kg)	Central part of South America	Marshland, savannah, cerrado, caatinga, chaco-cerrado- caatinga transitions, scrubland, woodlands, semi- deciduous, gallery, Atlantic, Araucaria, and montane forest	Omnivorous: fruit, vertebrates, insects, amphibians, crustaceans, birds, carrion, cultivated fruits, domestic fowl, and refuse	Opportunistic predator: nocturnal and crepuscular. Hunt individually but most commonly as pairs	Social groups comprise a breeding pair and 1–5 offspring (older than 1 year). Territorial during dry season	Oldest recorded individual 9.2 years in the wild	Monogamous. Both parents rear the young	56	2.6 (1–3)	Least concern Stable	1
<i>Chrysocyon brachyurus</i> Maned wolf	900 mm 25 kg	Central South America: Argentina, Bolivia, Brazil, Paraguay, Peru, and Uruguay	Lowland grasslands and scrublands woodland with an open canopy (cerrado), wet fields, agricultural and pasture land	Omnivorous: fruits and small- to medium-sized vertebrates, birds, reptiles, and arthropods. 50% of the diet comprising plant material and 50% animal matter	Solitary hunters/ foragers, but pairs have been observed to hunt together. Nocturnal and crepuscular. 8 consecutive hours	Pairs may defend a shared territory of approximately 30 km ² , although outside of mating, the individuals may meet seldom	In captivity, manned wolves may live up to 16 years. Lifespan in wild unknown	Facultatively monogamous. Both parents have been observed to regurgitate food for the young	60–65	3 (1–7)	Near threatened Unknown	1, 10, 11
<i>Cuon alpinus</i> Dhole	430–560 mm M – 15–21 kg F – 10–17 kg	Central and eastern Asia	Tropical dry and moist deciduous	Generalist carnivore. Hunt mainly	Communal hunters. Depending on	More social than gray wolves. Usually live in	7–8 years in the wild;	Cooperative breeders. Dominant male	60–63	5 (4–12)	Endangered Decreasing	1

3 possible subspecies			forest, evergreen and semievergreen forests, dry thorn forests, grassland-scrub-forest mosaics, and alpine steppe	vertebrate prey, preference for medium to large ungulates, insects, birds, reptiles, fruit, and vegetation	prey, will also hunt alone or in pairs. Primarily crepuscular but can hunt at any time of the day or night	clans of 5–10 individuals but groups of as many as 18. Strong hierarchical structure established by pushing and holding, aggression is rarely observed	16 years in captivity	and female are usually the sole breeders. Hold territories – but pups from one clan often join another without trouble once they mature sexually				
<i>Lycalopex culpaeus</i> Culpeo 6 subspecies	South America: Argentina, Bolivia, Chile, Colombia, Ecuador, and Peru	380–400 mm M – 3.4–13.8 kg F – 3.9–10 kg	Rugged and mountain terrain up to the tree line, deep valleys, open deserts, scrubby pampas, sclerophyllous matorral, broad-leaved temperate southern beech forest	Generalist carnivore: wild ungulates, rodents and lagomorphs, domestic sheep, small mammals, insects, lizards, birds, fruits, and berries	Opportunistic predator. Solitary foragers. Influenced by the nocturnal and diurnal activity of main prey	Solitary. Inter- and intra-sexually non-overlapping home ranges. High variability in home range sizes depending on availability	Oldest caught wild individual was 11 years old	Males and females come together only to breed	58	5.2 (3–8)	Least concern Stable	1
<i>Lycalopex fulvipes</i> Darwin's fox	Two populations: Chilóe Island and mainland Chile	>300 mm M – 3.26 kg F – 2.91 kg	Forest obligate species: southern temperate rainforests. Coastal sand dunes, evergreen/broadleaf forest, and dairy cow pastures	Omnivorous: insects, small mammals, reptiles, birds, amphibians, shell fish, seeds, and berries, sometimes carrion	Opportunistic scavenger, solitary hunters	Solitary carnivores when not breeding. Will congregate at a food source such as carcasses. Not territorial, since home ranges overlap	>7 years possible	Males spend more time with pups than females during weaning. Pairs may share their home range with offspring from previous years	Unknown	(2–3)	Endangered Decreasing	1
<i>Lycalopex griseus</i> Chilla 4 subspecies	Southern part of South America (Argentina and Chile)	Unknown M – 4 kg F – 3.3 kg	Steppes, "pampas" (grasslands), "matorral" (scrublands), and forests	Omnivorous generalists: mammals (especially rodents), arthropods, birds, reptiles, fruit, lizards, and carrion	Selective or opportunistic solitary hunters. However, hunting groups of up to 5 individuals are reported	Male and female of the pair maintain an exclusive home range year-round, which does not overlap with home neighboring pairs	Unknown in wild. Up to 5 years in captivity	Breeding monogamous pair, occasional polygyny, sometimes with additional female helpers. Males disperse	53–58	(4–6)	Least concern Stable	1

(continued)

Canine Life History, Table 1 (continued)

Scientific name Common name N of subspecies	Shoulder height/ weight	Distribution	Habitat	Food	Foraging behavior	Social behavior	Lifespan	Breeding strategy	Gestation length	Litter size	IUCN status/pop. trend	Source abbrev
<i>Lycalopex gymnocercus</i> Pampas fox 5 subspecies	380 mm M – 4.6–5.9 kg F – 4.2–4.7 kg	Southern Cone of South America	Open habitats, tall grass plains, ridges, scrub lands, coastal sand dunes, open woodlands, grazed pastures, and croplands	Omnivorous: wild and domestic vertebrates (particularly rodents and birds), fruit, insects, carrion, and garbage	Generalist, solitary, and opportunistic carnivore foraging both during the day and during night	Mostly solitary, comes together to mate and raise young	Few individuals live more than a few years in the wild. 14 years in captivity	Forms monogamous pairs: both guard the den, and males provide food to pups and females	55–60	3.4 (1–8)	Least concern Stable	I
<i>Lycalopex sechurae</i> Sechuran fox	Unknown 3.6 kg (2.6–4.2)	Limited range in the coastal zones of northwestern Peru and southwestern Ecuador	Sandy deserts with low plant density to agricultural lands and dry forests	Omnivorous: vertebrate prey or carrion, seeds, seed pods, insects, fruits, and rodents. Can be vegetarian and survive with limited access to water	Generalist, solitary, and opportunistic omnivore foraging primarily nocturnally	Groups larger than three individuals are rare, and usually only observed in cases where food sources are concentrated. Spends day/light hours in den	Unknown; generation length, 3 years	Most likely comes together only to breed	Unknown	Unknown	Near threatened Unknown	I
<i>Lycalopex vetulus</i> Hoary fox	Unknown M – 3.3 kg (2.5–4) F – 3.4 kg (3.0–3.6)	Brazil	Open cerrado habitats, livestock pastures, and areas of agriculture	Omnivorous: insects (ground- dwelling harvester termites), small mammals, grasshoppers, birds, and reptiles	Forage as individuals or in loosely knit pairs. Mainly nocturnal	Families share largely overlapping home ranges of around 4.6 km ² . They spend up to 35% of their activity period in close proximity	Unknown in wild. Up to 8 years in captivity	Monogamous. Both parents care for the offspring; there is currently no evidence of helpers	53–60	(4–5)	Least concern Unknown	I
<i>Lycalopex pictus</i> African wild dog 5 subspecies	600–750 mm M – 28 kg F – 24 kg	Southern Africa, southern part of East Africa, Central Africa, and North-east Africa	Short-grass plains, semidesert, bushy savannahs, and upland forest. Current distribution is limited primarily by human activities and	Carnivores: medium-sized antelopes (Impala, Kudu, gazelle, wildebeest, dik- dik, steenbok, duiker), warthog, hares, rodents, birds, lizards, and eggs	Pack hunter of medium-sized antelopes. Hunting success varies with prey type, vegetation cover, and pack size but tends to be very successful (>60%)	Lives in permanent packs of 2–27 adults and yearling pups. Intensely social spending most of their time in close contact. Packs may fluctuate rapidly in numbers. Males and females have	6–10 years in the wild. 15 years in captivity	Obligate cooperative breeders. Large home ranges are defended aggressively against neighboring packs. Dominants suppress reproduction in subordinates.	71–73	8 (2–21)	Endangered Decreasing	I

<i>Nyctereutes procyonoides</i> Raccoon dog 6 subspecies	380 mm 4–6 kg Weight fluctuates according to season	Indigenous to East Asia. Introduced and now widespread in northern and eastern Europe	the availability of prey Deciduous/evergreen/mixed forests, heaths, farmlands, and urban areas. Introduced habitat: moist forests and shores of rivers/lakes	Omnivorous: small rodents, frogs, invertebrates, birds, eggs, plants, grains, berries and fruit, carrion, fish, and crustaceans	Opportunistic generalist foragers. Mainly nocturnal, forage in pairs. Decrease food intake before entering hibernation	separate dominance hierarchies Form permanent pair bonds. Both male and female defend the home range against individuals of the same sex. The home range size varies according to the abundance of food	Maximum lifespan in wild 7–8 years. Record in captivity, 13 years	All pack members are involved in caring for the pups Mono gamous; both parents care for the young	61–70	4–9 (2–16)	Least concern Stable	1
<i>Otocyon megalotis</i> Bat-eared fox 2 subspecies	300–370 mm 4 kg	<i>O. m. virgatus</i> , Ethiopia and Southern Sudan to Tanzania; <i>O. m. megalotis</i> , southern part of Africa	Short-grass plains, open scrub vegetation, shrub lands, open arid savannah, open grassland, and woodland boundaries	Predominantly insectivorous: termites and beetles, seasonal fruit, small mammals, birds, eggs, and reptiles	Foraging techniques depend on prey type. Uses its large ears to locate prey. Foraging peaks at the height of insect activity	In Southern Africa, live in monogamous pairs with cubs. In Eastern Africa, live in stable family groups consisting of a male and up to three closely related females with cubs	Recorded up to 9 years in the wild and 13 years in captivity	Predominantly monogamous but also observed in polygynous groups. The male spends more time close to the cubs than females, as maternal investment during lactation is high	60–75	(1–6)	Least concern Stable	1, 12, 13
<i>Speothos venaticus</i> Bush dog	200–300 mm 5–8 kg	Eastern Central America and northern South America, south to Paraguay, and north-eastern Argentina	Habitat generalists. Occur near water sources. Lowland forested habitats including primary and gallery forest and seasonally flooded forest	Primarily carnivorous: large rodents, mammals, lizards, snakes, and possibly ground-nesting birds	Hunting parties consist of at least 2 individuals. Mostly diurnal	Considered the most social of the small canids living in family groups consisting of a breeding pair and their offspring, ranging from 2 to 12 individuals. Home range of 3.8 to 10 km ²	Around 10 years in the wild, 13 years in captivity	Mono gamous. Males exhibit a high degree of parental care. Dominant females suppress the estrus of daughters	67	3.8 (1–6)	Near threatened Decreasing	1
<i>Urocyon cinereogentens</i> Gray fox 16 subspecies	300–380 mm M – 4.0 kg (3.4–5.5) F – 3.3 kg (2.0–3.9)	Central and eastern Canada, Oregon, Nevada, Utah, and Colorado in the United States south to	Deciduous/pine forests, old fields, scrubby woodlands, mixed agricultural/woodland/	Omnivorous: rabbits, rodents, insects, birds, fruits and nuts, and carrion	Solitary hunters. More active at night than during the day. Increase their home ranges during late autumn and	Basic social unit is the mated pair and their offspring of the year. Dens are used any time of the year but	4–5 years in wild. However, individuals of 14–15 years are	Mono gamous, occasionally polygynous. Pups accompany adults on foraging	53–60	3.8 (1–10)	Least concern Stable	1

(continued)

Canine Life History, Table 1 (continued)

Scientific name Common name N of subspecies	Shoulder height/ weight	Distribution	Habitat	Food	Foraging behavior	Social behavior	Lifespan	Breeding strategy	Gestation length	Litter size	IUCN status/pop. trend	Source abbrev
<i>Urocyon littoralis</i> Island fox 6 subspecies	120–150 mm M – 2.0 kg (1.4–2.5) F – 1.8 kg (1.5–2.3)	Venezuela and Colombia	chaparral/ riparian landscapes, shrub and thick brush habitats, semiarid areas, and urban areas	Omnivorous: rodents, birds, lizards, insects, snails, molluscs, carriion, and fruits	winter in response to changes in food resource availability and distribution	mostly during breeding season. Tree dens may be located 30 f. above the ground. Home range size ranges from 0.8 to 27.6 km ²	occasionally reported	expeditions at 3 months. Family group remains together until the autumn, when young males disperse and females stay within proximity of the den	50–63	2.5 (1–5)	Near threatened Increasing	1
<i>Vulpes bengalensis</i> Indian fox	Unknown M – 2.7–4.1 kg F > 1.8 kg	Restricted to six of the California Channel Islands off the coast of southern California, USA	Habitat generalist: beaches, sand dunes, bluffs, grasslands, sage scrub, cactus scrub, chaparral, oak/riparian woodlands, pine forests, marshes, and developed areas	Omnivorous: arthropods, rodents, reptiles, fruits, and birds	Solitary foraging generalist. Adult foxes may also forage together on occasion. Nocturnal and diurnal activity. Skilled climbers	Breeding pairs that occupy discrete territories mean home range sizes of 0.16–3.39 km ² . Not uncommon for offspring to remain in natal range	Up to 10 years of age in the wild	Usually monogamous but extra-pair fertilization has been recorded. Dependent young accompany adults on forays	50–60	2.7 (2–4)	Least concern Decreasing	1, 14
<i>Vulpes cana</i> Blanford's fox	200–250 mm 0.8–1.5	Middle East and Central Asia	Semiarid, flat to undulating terrain, scrub and grassland habitats, thorn or dry deciduous forests, plains, and open scrub forest	Insectivorous and frugivorous: invertebrates,	Solitary opportunistic foragers. Crepuscular and nocturnal	Basic social unit of a breeding pair formed through pair bonds that may last for several years. Hide in dens during day. Larger aggregations may exist when grown pups remain in natal group	In captivity, the lifespan is about 6 to 8 years	Monoamous but extra-pair copulations are known to occur. Both parents bring food to the pups and guard the den	50–60	2 (1–4)	Least concern Stable	1

Canine Life History, Table 1 (continued)

Scientific name Common name N of subspecies	Shoulder height/ weight	Distribution	Habitat	Food	Foraging behavior	Social behavior	Lifespan	Breeding strategy	Gestation length	Litter size availability (2–25)	IUCN status/pop. trend	Source abbrev
<i>Vulpes macrotis</i> Kit fox 8 subspecies	300 mm M – 2.29 kg (1.7–2.7) F – 1.9 kg (1.6–2.2)	Western North America	Arid and semiarid regions encompassing desert scrub, chaparral, halophytic, and grassland communities	Omnivorous: rodents, leopards, and insects, birds, reptiles, fruit, and carrion	Mostly forage solitarily. They are mainly active by night and occasionally exhibit crepuscular activity	Not strongly territorial and home ranges may overlap, although core areas generally are used exclusively by one family group. Home range size 2.5–11.6 km ²	>7 years of age in the wild	Primarily monogamous with occasional polygyny. Young from previous litters (females), may delay dispersal and assist with raising the current litter	49–55	4 (1–9)	Least concern Decreasing	1
<i>Vulpes pallida</i> Pale fox 5 subspecies	<350 mm 2.0–3.6 kg	Sahel of Africa, bordering the Sahara to the north	Very dry sandy and stony marginal sub- Saharan desert and semidesert areas, and moister Guinean savannah areas	Herbivorous: berries, wild fruit such as melons, and vegetable matter. They also feed on small rodents, ground-nesting birds, small reptiles, and invertebrates	Forages solitarily. Has the ability to retain water from its food and can go almost completely without drinking	Lives in small family groups consisting of breeding pair and their young. They dig extensive dens and rest there during the day	Thought to be 6 years in the wild	Thought to be monogamous	51–53	(3–4)	Least concern Unknown	1, 18
<i>Vulpes rueppellii</i> Rüppell's fox 6 subspecies	300 mm 1.62 kg (1.1–2.3) 1.48 kg (1.1–1.8)	North Africa (Morocco to Egypt and Somalia)	Sand and stone deserts, sparse to very sparse vegetation cover, dominated by small brushes	Omnivores: high invertebrate content, as well as rodents, lizards, snakes, birds, and wild fruits, plants, and human garbage. Sometimes prey on livestock	Opportunistic solitary foragers. Either crepuscular or nocturnal, sheltering during the day in dens	Extended families are possible, as sightings of family groups (3–15) are common. Cohabitation of the same den occurs only during the breeding season. Territories of mated pairs overlap but are separate from	7 years in wild, up to 12 years in captivity	Form monogamous pairs in the mating season	52–53	3 (1–6)	Least concern Stable	1, 19

<i>Vulpes velox</i> Swift fox	300 mm 2.24 kg (2-2.5) 1.97 kg (1.6-2.3)	Western grasslands of North America. Reintroduced to Canada (Alberta, Saskatchewan, Montana)	Short-grass and mixed-grass prairies and croplands	Omnivore: mammals (rabbits/rodents), also birds, eggs, insects, plants, fruits, seeds, and carrion	Solitary opportunistic foragers. Nocturnal and crepuscular. Known to run up to 60 km/h (40 mph)	neighboring pairs Females maintain territories, but males emigrate if the resident female is killed/removed. Heavily dependent on the den as shelter from predators	Up to 8 years in the wild	Monogamous, but multiple breeding strategies have been observed. Additional females sometimes help in raising pups	51	2.4-5.7	Least concern Stable	1, 20, 21
<i>Vulpes vulpes</i> Red fox 45 subspecies	Large geographical variation in size 350-500 mm M - 6.3 (4.4-7.6) F - 5.3 (3.6-6.5)	Only canid present on five continents (83 countries)	Urban, rural, city centers, scrub, woodland, agricultural land, moorland, mountainous, grassland/semidesert, boreal forests, and Arctic tundra. Appear to be closely associated with people in many habitats	Opportunistic omnivores: invertebrates, small mammals, birds, fruit, and plant material. Also, scavenge carcasses (deer and sheep), bird food, and garbage	Mainly nocturnal and crepuscular. Can be diurnal where they are undisturbed. Solitary foragers/hunters: may forage in close proximity where resources are clumped	Transient individuals and family groups (usually a mated pair with/without offspring but occasionally one male with 2-5 related vixens sharing a territory). Social group density is one family per km ² in farmland but may vary between 0.2 and 5 families/km ² in the suburbs	In wild, typically do not live beyond 5 years, in captivity as long as 15 years	Largely monogamous, polygyny also reported. Both parents and sometimes other females care for the young. Only dominant female breeds and suppresses reproduction in subordinates	49-58	5 (3-12) varies with food availability	Least concern Stable	1, 22, 23
<i>Vulpes zerda</i> Fennec fox	180-220 mm 1.5 kg (1.3-1.7) 1.4 kg (1-1.9)	Northern Africa to northern Sinai	Arid desert environments	Omnivore: insects, small rodents, lizards, eggs, small birds, various fruits, and some tubers	Hunt alone as solitary hunting group of mated pair and their offspring (up to 10). Young of the previous year may remain in the family. Play and affiliative behavior are common	Unknown in the wild, up to 14 years in captivity	Monogamous, mate for life. Males are aggressive/protective of the female after mating and provision her during pregnancy/lactation	50-52	(1-5)	Least concern Stable	1	

Source: 1, Sillero-Zubiri et al. (2004); 2, Koeplfi et al. (2015); 3, Bekoff (1977); 4, Hennessy et al. (2012); 5, Mech and Boitani (2003); 6, Bonanni et al. (2017); 7, Cafazzo et al. (2014); 8, Kubinyi et al. (2018); 9, IUCN (2011); 10, De Melo et al. (2009); 11, Dietz (1984); 12, Lamprrecht (1979); 13, Wright et al. (2010); 14, Vanaak and Gompert (2007); 15, Harris et al. (2008); 16, Liu et al. (2007); 17, Wang et al. (2008); 18, Stuart and Stuart (1997); 19, Lindsay and Macdonald (1986); 20, Kamler et al. (2004); 21, Kitchen et al. (2006); 22, Harris and Valden (2008); 23, Hunter (2011)

groups called “packs,” which have the advantage of enabling them to tackle larger prey when hunting with more individuals (Sillero-Zubiri et al. 2004). Typically, the older, more experienced individuals lead the pack, and in most cases, a hierarchy is formed, and the dominant male and female are usually the only pack members to breed (Bonanni et al. 2017; Cafazzo et al. 2014; Kubinyi and Wallis 2018; Sillero-Zubiri et al. 2004). Surprisingly, for some species, detailed information about their social behavior is lacking (e.g., the short-eared dog (*Atelocynus microtis*), Sechuran fox (*Lycalopex sechurae*), and pale fox (*Vulpes pallida*); please refer to the “Social behavior” section of Table 1). For other species, captive animals have provided some insight into their social systems (Sillero-Zubiri et al. 2004).

Breeding Strategies

The majority of canid species are monogamous, having only one mate at a time, but polygyny has also been observed in some species (the chilla (*Lycalopex griseus*), bat-eared fox (*Otocyon megalotis*), gray fox (*Urocyon cinereoargenteus*), island fox (*Urocyon littoralis*), kit fox (*Vulpes macrotis*), and red fox (*Vulpes vulpes*); please refer to the “Breeding strategy” section of Table 1) (Sillero-Zubiri et al. 2004). Many are also said to mate for life, but actual data regarding this phenomenon is lacking in most species. Polygyny is likely to occur when ecological conditions are favorable, in years with high food abundance.

Reproduction

Canids are unusual among mammals as a whole as they exhibit several reproductive traits that are uncommon. As stated previously they are typically monogamous, in almost all cases, both the male and female have been observed to provide care to the offspring, and they have reproductive cycles with lengthy proestral and dioestral phases and have a copulatory tie during mating (Castelló and Sillero-Zubiri 2018). Some species even

retain adult offspring within the social group, which provide alloparental care to raise the next generation of offspring. The breeding pair typically suppresses mating in their adult offspring through behavioral means. In females that ovulate but fail to conceive, pseudopregnancy frequently occurs, which helps to ensure maternal behavior of subordinate females. Canids are rare among mammals in that they have monoestrus cycles: a single ovulatory period followed by pregnancy (if fertilization occurs) or by prolonged diestrus phase and then anestrus (Asa et al. 2003). Most canids breed seasonally, with species in temperate latitudes responding to changes in photoperiod, and those in equatorial regions, to seasonal changes in rainfall and/or food availability. Therefore, most have only one seasonal cycle per year; however, African wild dogs (*Lycyaon pictus*), fennec foxes (*Vulpes zerda*), crab-eating foxes (*Cerdocyon thous*), bat-eared foxes (*Otocyon megalotis*), and bush dogs (*Speothos venaticus*) have been observed to sometimes have a second cycle per year in the wild and/or captivity (Sillero-Zubiri et al. 2004). The inter-estrus intervals range from 8 to 10 months, which is similar to the mean interval of most breeds of domestic dog. These nonseasonal monoestrus cycles may be due to changes in photoperiod caused by living in captivity or because the first litter was lost (Valdespino et al. 2002). In terms of gestation period, small-sized canids typically require 50 days on average and larger canids around 60 days (please refer to the column titled “Gestation length” in Table 1). Litter size appears to be highly variable within and between canid species. Arctic foxes and African wild dogs have the greatest range in litter size, and Asa et al. (2003) suggested variability in litter size might be related to ecological variability (food availability and climate). Prolactin hormone levels peak in male and female canids during the spring; usually the time pups are born, which may facilitate paternal behavior (however, prolactin levels have so far only been measured in wolves, dogs, red foxes, and arctic foxes). More research is necessary on life history and reproductive traits of small canids in particular, as data is still lacking (Asa et al. 2003).

The young are usually born in a den dug by the female in order to provide warmth and protection. They are small, blind, and helpless and thus require an extended period of care (Mivart 1890). When the young eventually begin to eat solid food, both parents, and often other pack members, may bring food back to the den and/or regurgitate food for them. They may also accompany them on short foraging trips around the den. Young canids may require 5 months to over a year before they are ready to leave their natal group, and in some species, they will remain in the pack as non-breeding helpers. Typically, small canids tend to reach puberty earlier than larger canid species (Asa et al. 2003).

Cross-References

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