



6	Red foxes ( <i>Vulpes vulpes</i> ) are distributed over most of the northern hemisphere above 30°N latitude. Mating season is between December and April, and is influenced by latitude to some degree, occurring earlier in the south (Adlerton, 1994).
12	Golden or Asiatic jackals ( <i>Canis aureus</i> ) breed within February or March in Russia and in Israel through October into February (IUCN, 2002 & UMMZ, 2002).
SOUTH AMERICA	
7	Crab-eating zorros ( <i>Cerdocyon thous</i> ) live in the North (Bolivia, Brazil, Argentina and Uruguay) and along the coast but avoids the Amazonian interior. Breeding is from November through December (Adlerton, 1994).
8	Culpeos ( <i>Pseudalopex culpaeus</i> ) have a range extending down the western side of South America. Estrus occurs from August to October (Alderton, 1994).
9	Maned wolves ( <i>Chrysocyon brachyurus</i> ) live in eastern South America with a range in parts of Bolivia, Brazil, Argentina and Uruguay. Time of mating is from December to June, peaks in May and June (IUCN, 2002).
10	Azara's zorros ( <i>Pseudalopex gymnocercus</i> ) are distributed in south central area of the continent. Breeding occurs in July through October (Alderton, 1994).
11	Grey zorros ( <i>Pseudalopex griseus</i> ) are distributed in Patagonia and the southwest coast of South America. Mating is from August to September (Adlerton, 1994).
AFRICA	
12	Golden or Asiatic jackals ( <i>Canis aureus</i> ) are distributed in the Sahara and east down to the Somali-Masai arid zone. Mating occurs during October or November and is timed so that birth occurs at peak of food abundance (e.g. Thomson's gazelle fawns in the Serengeti, Jan.-Feb.). In Tanzania estrus occasionally occurs in June or July (Alderton, 1994 & IUCN, 2002).
13	Fennec foxes ( <i>Vulpes zerda</i> ) live in central Sahara and breed from February to March (UMMZ, 2002).
14	Ethiopian wolves ( <i>Canis simensis</i> ) live in the mountains of Ethiopia and is a remnant population of wolves who came into Africa from Eurasia during a cooler period in the late Pleistocene (IUCN, 2002). Most mating occur between August and November. The receptive period of females in any given area is synchronized too less than two weeks (UMMZ, 2002 & IUCN, 2002).
B	Basenjis ( <i>Canis lupus familiaris</i> ) are used as a hunting dog. It is the only canid in Africa that lives in the rainforest of central and western Africa. Breeding north of the equator peaks in October or November and south of the equator in April or May (Johannes, 2002).
15	Bat-eared foxes ( <i>Otocyon megalotis</i> ) live in two areas, the Kalahari and NE Africa. North of the equator in Uganda breeding occurs in January. In the Serengeti and Botswana mating occurs June through September. Estrus appears to be seasonally and locally adjusted so that births occur during the rains when peak insect densities exist (Estes, 1991).
15	Black-backed jackals ( <i>Canis mesomelas</i> ) also occur in two areas, Somali-Masai and southwest arid zones. In Natal mating occurs in May or June and July in Botswana (IUCN, 2002).
16	Side-striped jackals ( <i>Canis adustus</i> ) live in woodland habitat to the edge of the equatorial rainforest. Breeding occurs during the rains or just before, June through September in western Uganda and August to January in southern Africa (UMMZ, 2002 & Estes, 1991).
16	African wild dogs ( <i>Lycaon pictus</i> ) live in most habitats except rainforest or desert. In the Serengeti it starts breeding in November. In Kruger National Park in South Africa breeding occurs in April or May (Estes, 1991 & IUCN, 2002).
SOUTH ASIA & AUSTRALIA	
17	Dholes ( <i>Cuon alpinus</i> ) live in the forest areas of the Indian peninsula. It is also in Malaysia, Java, Sumatra, Burma, and northwards into Korea, China, and eastern Russia. Breeding is from September to February in central and northern India, and from September to December in southern India (Adlerton, 1994).
I	Indian Pariahs ( <i>Canis lupus familiaris</i> ) mostly live a feral existence, although some are pets and watch dogs. Breeding is from September to October (Beregovoy, 2001).
Th	Thailand Pariahs ( <i>Canis lupus dingo</i> ) lives mostly by scavenging and survives without human care. Breeding occurs mostly in August through September (Corbett, 1995 & Bergovoy, 2001).
T	Telomians ( <i>Canis lupus dingo</i> ) are used as a watch and hunting dog in Malaysia. Estrus peaks during September through October (Corbett, 1995, Weller, 1970, & Bergovoy, 2001).
D	Australian Dingos ( <i>Canis lupus dingo</i> ) live apart from humans. Mating peaks around March and April (Corbett, 1995).

**TABLE 1** – Description of canid distribution and estrus cycle timing. Map symbols are from Figure 1.

## Methods

Domesticated and wild canids were included only if they have an annual estrus cycle. Canids with unknown or no seasonal estrus cycle were excluded from Table 1. The geographical zones used by Adlerton (1994) to group canids were applied in Table 1. The canid taxonomy used by the UMMZ (2002) website was followed. Timing for Domestic dog breeds' annual estrus is from Beregovoy (2001).

## Discussion

Distribution of canids is worldwide except for the Antarctica (Figure 1). The Holarctic has several canid species that are widely distributed. The Grey wolf and Red fox (Table 1) live above the Tropic of Cancer and breed at the beginning of the year, both also breed later the further north they live. The Golden jackal does not live as far north as the Grey wolf and Red fox (Figure 1), but it also shows a later estrus the further north it lives. Except for the Indian wolf and Golden jackal in Israel, all the canids living in the Holarctic breed from January to April. There is one domestic dog listed (Table 1), the Siberian Laika, whose estrus also occurs within the time frame for wild canids at this latitude.

Moving south into the tropics most canids have their estrus later in the year. North of the equator the annual estrus is within August to December. The Basenji's estrus falls within this period. The Fennec fox is an exception, having its estrus later (Table 1). The Side-striped jackal breeds earlier. South of the equator a mixed pattern emerges. In South America the Crab-eating zorro and Culpeo range extends into the south and they breed late in the year. The Maned wolf breeds in the first half of the year. In Africa and Australia breeding mostly occurs in the southern winter season. The Basenji and the Dingo also breed in the winter season.

## Conclusions

Canids in the Northern Hemisphere tend to breed earlier in the year than canids in the Southern Hemisphere. The Basenjis annual estrus cycle does coincide with other canids living at the same latitude. The only exception is some canids living in South America. The wolf is widely considered to be the ancestor of dogs; and the Ethiopian wolf's annual estrus timing is very close to the Basenjis. Domestic or feral dogs in south Asia living in the tropic forest also match the Basenjis annual cycle.

## Bibliography

- Adlerton, D. 1994. *Foxes, Wolves and Wild Dogs of the World*. New York: Facts on File. 192 pp.
- Beregovoy, V. and J. M. Porter (2001). *Primitive Breeds – Perfect Dogs*. Wheat Ridge: Hoflin Pub. 424 pp.
- Corbett, L. 1995. *The Dingo: in Australia and Asia*. Ithaca: Cornell University Press. viii + 200 pp.
- Estes, R. D. 1991. *The Behavior Guide to African Mammals*. Berkley: University of California Press. xxii + 611 pp.
- IUCN/SSC Canid Specialist Group (2002). *World Conservation Union/Species Survival Commission/Canid Specialist Group*. August 6, 2002. <<http://www.canids.org>>.
- Johannes, J. E. 2002. The Basenji Annual Estrus: African Origins. *The Basenji* 38(10): 10.
- Kerwood Wolf Education Centre Inc., 2002. *Kerwood Wolf Education Centre Inc*. Ontario: Kerwood. <<http://www.kerwoodwolf.com/index.html>>
- Kingdon, J. 2001. *The Kingdon Field Guide to African Mammals*. San Diego: Academic Press. 476 pp.
- University of Michigan Museum of Zoology (UMMZ) 2002. *Animal Diversity Web*. Michigan: The Regents of the University of Michigan. <<http://animaldiversity.ummz.umich.edu>>
- Weller, J. A. 1970. Telomian Dogs: An Aboriginal Breed from Malaysia. *The Basenji* 7(2):6, 8.