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Discovery of a Continental Population of the Rare Darwin's Fox, *Dusicyon fulvipes* (Martin, 1837) in Chile

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ABSTRACT

The rare Darwin's fox Dusicyon fulvipes *(Martin, 1837) was thought to be restricted to Chiloé Island in southern Chile, and to be a subspecies of* Dusicyon griseus. *We report the finding of a continental population of* D. fulvipes, *600 km north of its known insular ranges and in sympatry with* D. griseus. *We document for the first time the food habits of Darwin's fox, add new information on its morphometry, and discuss the systematic, zoogeographic and ecological implications of the discovery of the continental population.*

INTRODUCTION

Darwin's fox *Dusicyon fulvipes* (Martin, 1837) is probably the rarest fox in South America (Miller *et al.*, 1983). Charles Darwin secured the first known

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specimen on 6 December 1834 in the southeastern corner of Chiloé Island. He (Darwin, 1962) says of the fox that 'He was so intently absorbed in watching the work of the officers, that I was able, by quietly walking up behind, to knock him on the head with my geological hammer'. This specimen is now in the British Museum of Natural History, with catalogue number 55.12.24.431. Two other specimens from southern Chiloé Island (their pelts only) were subsequently (in 1898 and 1899) collected for, or sent to, Chile's National Museum of Natural History in Santiago, and catalogued with numbers 036 and 049, respectively. A third, a pelt with number 511, is also in the Museum catalogue, but undated.

Two individuals were collected by Osgood in 1922, this time with fish-baited traps, near the mouth of Inio River in Chiloé Island (Osgood, 1943), within 32 km of the spot described by Darwin. These two specimens (one of them catalogued as No. 23815) are deposited in Chicago's Field Museum of Natural History. Osgood measured and compared the two specimens with those of mainland *Dusicyon griseus* and stated that 'in view of its geographical position and its agreement in most general features with *griseus* and subspecies, the conclusion that *fulvipes* is an offshoot of the *griseus* group is certainly the most natural and logical one. However, since its distribution apparently is limited to the southern end of Chiloé Island, its status as a separate species perhaps should not be disturbed'.

Since then, several other individuals have been captured from south-western Chiloé Island (Miller & Rottman, 1976; Pine *et al.*, 1979). At least one of those was placed under public exhibit in Santiago's Zoological Park until its death in February 1977, when it was donated to the National Museum and catalogued with number 552. This is the only specimen in Chile for which the cranium is available.

MORPHOMETRY OF *DUSICYON FULVIPES*

The only morphometric information so far published seems to be that by Osgood (1943) and Pine *et al.* (1979). J. L. Y. has provided data (in mm) on the only complete specimen deposited in Chile's National Museum of Natural History: MNHN 552, a female: Total length = 735; tail = 202; hind foot = 112; ear from crown = 67; greatest length of cranium = 122·2; condylo-basal length = 115·2; facio-cranial ratio = 46·1; zygomatic width = 67·2; least interorbital width = 22·2; median length of nasals = 40·3; width of braincase = 44·5; width of rostrum at base of canines = 22·2; palatal length = 61·1; length of upper carnassial = 11·1; combined length of two upper molars = 13·5. In comparison to Osgood's data, most measurements taken from MNHN 552 fall in the middle of the range,

somewhat closer to female figures. Exceptions are: width of braincase, and least interorbital width (both figures being larger than those reported by Osgood for the male).

TAXONOMIC STATUS OF *DUSICYON FULVIPES*

Dusicyon fulvipes has been considered a different species from *D. griseus* (Martin, 1837), an opinion followed by Osgood (1943) and Cabrera (1958). However, Langguth (1969) concluded that it is a subspecies of *Dusicyon griseus* and this was supported by Clutton-Brock *et al.* (1976), using numerical classification methods, and is now generally accepted (Pine *et al.*, 1979; Corbet & Hill, 1980; Tamayo & Frassinetti, 1980; Honacki *et al.*, 1982). In this paper we report information that may help dispel doubts concerning the specific distinctiveness of *D. fulvipes* and cast some light on its evolution and zoogeography. This is based on the discovery of a population of Darwin's fox in mainland Chile, 600 km north of its known range, in sympatry with the larger *D. griseus*.

SYMPATRY OF *DUSICYON FULVIPES* AND *D. GRISEUS* ON THE CHILEAN MAINLAND

Darwin's fox was first reported in the 1960s in Nahuelbuta National Park (37° 48′ S, 73° 04′ W, 1100–1150 m elevation; 28 km west of Angol) by the Park's Administrator, Mr Leonel Pincheira. In the early 1970s, he found a dead individual (pers. comm.), which is now mounted and under exhibit at the Park's Information Center; later he was able to trap a single individual which he kept in captivity for a while before releasing it. *D. fulvipes* can be distinguished from *D. griseus* by its smaller size, dark brown pelage instead of grey, and because the rufescent areas on its head, ears and legs are a deeper and richer shade (see Osgood, 1943 for a detailed comparison).

On 26 July 1981, Manuel and Juan Carlos Gedda published three photographs of Darwin's fox in Nahuelbuta, along with some anecdotal information, in *Revista del Domingo* of Santiago's leading newspaper *El Mercurio*. However, our attention to Darwin's fox was attracted by the personal observation of J. E. J. that *D. fulvipes* was not only present in the Park, but was sympatric with *D. griseus*. He saw one individual of *D. fulvipes* for the first time (December 1975) in the Pehuenco sector (Information Center) of the Park. At the end of December 1982 and beginning of January 1983 he saw a single individual on 6 consecutive days, both morning and evening. J. E. J. was able to take several photographs (available on request)

as it was attracted to meat left as bait, but it was not known whether the same or different foxes came to the bait each day.

The habitat where these two fox species coexisted was a non-disturbed area of hygrophilous forest on the hills of the coastal range known as 'Cordillera de Nahuelbuta' (Greer, 1965). J. E. J.'s sightings of *fulvipes* were only during the mornings and evenings, whereas those of *griseus* were during the night. Although both species were attracted to the same garbage can close to the Park's camping site, *fulvipes* seemed to be more closely associated with forest and scrub habitats, whereas *griseus* apparently preferred open areas.

FOOD HABITS OF *DUSICYON FULVIPES* IN MAINLAND AND ISLAND SITUATIONS

The only information on the diet of Darwin's fox is that by Miller & Rottman (1976) and Pine *et al.* (1979) on artificially fed captive individuals. A special trip to Nahuelbuta National Park was made in February 1987 by R.G.M. to collect scats of both *D. fulvipes* and *D. griseus*. Although we cannot be absolutely sure, it appeared to us that *fulvipes* scats were smaller, darker, and stronger-smelling than those of *griseus*. While collecting scats R.G.M. saw defecating foxes on three occasions, 2. *D. griseus* and 1 *D. fulvipes*. Some scats attributed to *D. griseus* may in fact belong to *D. fulvipes*, but not *vice-versa*.

Darwin's fox appeared to consume fewer mammals, birds and reptiles, and more insects, than its congener (Table 1). In addition, plant material was five times more frequent in *fulvipes* than in *griseus* scats (32 versus 6%). The contents of 16 scats of Darwin's fox collected by J. J. A. in Chiloé Island (nine from Pidpid: 42° 26′ S, 73° 47′ W; seven from Alcaldeo de Llau-Ilao: 42° 28′ S, 73° 46′ W) during February 1986 demonstrated a higher prevalence of plant material in the island diet than that of the mainland (100 versus 32%). The only animal prey detected were one unidentified bird, one beetle and one cricket. The plant material was made up exclusively of berries and drupes, whose seeds (total = 955) were apportioned as follows: 75% *Amomyrtus luma*; 12% *Drymis winterii*; 6% *Pernettya* sp.; 5% *Nertera depressa*; 1% *Ovidia pillopillo*; and 1% *Berberis* sp. According to Armesto *et al.* (1987), Darwin's fox may be an important dispersal agent for these plant species.

CONCLUSIONS

The coexistence in sympatry of two closely related subspecies is not thought possible. *Dusicyon fulvipes* should, for the time being, be considered

TABLE 1

Mammal, Bird, Reptile and Insect Prey, and Plant Material, Found in Scats of *Dusicyon fulvipes* (Martin, 1837) and *D. griseus* (Gray, 1837), Nahuelbuta National Park, February 1987
Figures in parentheses are the percentages of scats containing prey of each group

Prey taxa	Dusicyon fulvipes		Dusicyon griseus	
	Prey items (%)	*Scats* (%)	*Prey items* (%)	*Scats* (%)
Mammals	22	(65)	54	(100)
Rodentia				
Aconaemys fuscus (Waterhouse, 1842)	0		4	
Akodon longipilis (Waterhouse, 1837)	0		2	
Akodon olivaceus (Waterhouse, 1837)	2		0	
Auliscomys micropus (Waterhouse, 1837)	1		14	
Octodon bridgesi (Waterhouse, 1845)	0		2	
Oryzomys longicaudatus (Bennett, 1842)	1		0	
Phyllotis darwini (Waterhouse, 1837)	1		4	
Unidentified	12		8	
Lagomorpha				
Oryctolagus cuniculus (Linnaeus, 1758)	1		8	
Marsupialia				
Dromiciops australis (Philippi, 1894)	2		12	
Artiodactyla				
Pudu pudu (Molina, 1782)	2		0	
Birds	2	(6)	4	(11)
Passeriformes				
Rhinocryptidae	1		2	
Unidentified	1		0	
Psittaciformes	0		2	
Reptiles	15	(29)	18	(44)
Squamata				
Liolaemus sp.	15		18	
Insects	61	(85)	24	(50)
Coleoptera	22		8	
Hymenoptera	1		0	
Orthoptera	38		16	
Plant material	—	(32)	—	(6)
Total no. of prey items	108		50	
Total no. of scats		34		18

For authorities on species, see full references given in Honacki *et al.* (1982).

a species separate from *D. griseus*. The possibility that *D. fulvipes* is a smaller, melanic form of *D. griseus* should not be discarded, but it seems unlikely that only this size/color morph should be found in Chiloé Island (no *D. griseus* has ever been reported from the island). In order to determine with certainty the distinct specific status of these two foxes, it is necessary to obtain the karyotype of *D. fulvipes*, given that the karyotype of *D. griseus* is known (Gallardo & Formas, 1975).

The disjunct geographical distribution (a 600-km gap) apparently shown by *D. fulvipes* is very puzzling. More collecting is necessary, particularly along the coastal ranges that link the Cordillera de Nahuelbuta and Chiloé Island. If no Darwin's foxes are found along this distributional gap, two possibilities remain. First, that a once widespread Darwin's fox nowadays demonstrates a relict distribution, with intervening populations having become extinct. In this case, lack of gene flow between foxes in Nahuelbuta and in Chiloé might have produced some degree of genetic differentiation perhaps with little loss of shared alleles. Second, that the fox population in Nahuelbuta resulted from the settlement and successful reproduction of captive specimens (perhaps a single pregnant female) which escaped from the periphery of the Park. Although we do not know of the past or present existence of such captive specimens, if this were the case, a genetic founding effect should be clear among Darwin's foxes in Nahuelbuta, with a marked loss of heterozygosity in comparison to Chiloé foxes. As stated above, genetic studies seem to be the best way to resolve the issue of Darwin's fox species identity and origin.

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