

The Grey Fox *Canis griseus* (Gray) in Chilean Patagonia (Southern Chile)

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ABSTRACT

*During May 1982 a total of 2235 km² of land was surveyed in Southern Chile to estimate grey fox *Canis griseus* density. An area of 28 310 km² was judged to be potential habitat for populations in the continental area including Riesco Island. The total number of grey foxes was estimated as 65 835, that is 1 fox per 43 ha.*

Despite the generally good habitat conditions and the lack of both disturbance and pollution, there is no certainty that the relatively good population level can be maintained in the future due to illegal hunting. An adequate management programme could counter this threat, not only for this species but for all wildlife in the area.

INTRODUCTION

Although a little is known of the biology, distribution and feeding habits of the grey fox *Canis griseus* in Chile (Osgood, 1943; Miller & Rottmann, 1976; Yáñez & Jaksić, 1978; Jaksić *et al.*, 1981), there are no data on its population density in Southern Chile. These data are necessary to resolve

several questions related to conservation, in particular the consequences of predation upon sheep and lagomorphs and competition with the red fox *Canis culpaeus*, which inhabits the forest area and the more closed vegetation sites throughout the region. Since these species are allopatric in this habitat, they show several similarities in diet preferences. This fact could permit competition and the allopatry exhibited could be the result of competitive exclusion (Jaksić *et al.*, 1980, 1981).

Due to the high price of the grey fox fur on the international market, and the need for information as a basis for an adequate management programme, a field survey was undertaken as the first step of a project concerned with the conservation of the fauna of Chilean Patagonia.

The area considered as potential habitat for the species was defined using biogeographic information for the Magallanes region (Cekalovic, 1974) together with a cartographic interpretation of different types of environments. All areas of exploited forestry and natural virgin forest and hills (red fox habitats) were excluded. The total area judged to be grey fox habitat encompassed 28 310 km².

MATERIAL AND METHODS

Field work was carried out during May 1982 and the study area was a sector of Region XII of Chile 'Magallanes and Antártica Chilena', between 51° and 53° S and 72° 30' and 69° 45' W. A sampling area was defined consisting of a 5 km wide strip along the roads of the study area. The length of the transect was 447 km, giving a total area of 2235 km². The study area was divided into seven sites which were surveyed at night between 1800 h and midnight (Fig. 1).

Description of sites

Site 1 corresponds to a littoral strip on the eastern section of Riesco Island. The area is characterized by the 'coirón' steppe (*Festuca gracillima* and *F. pallescens*) and by a low bush of *Lepidophyllum cupressiforme* and *Berberis buxifolia*. Some small areas of 'ñirre forest' *Nothofagus antarctica* are found in the area.

Site 2 (Río Verde—Cabo de Mar) is a flat area with no more than 5% slope in some places. The predominant flora is *F. pallescens*, *L. cupressiforme* and *B. buxifolia*.

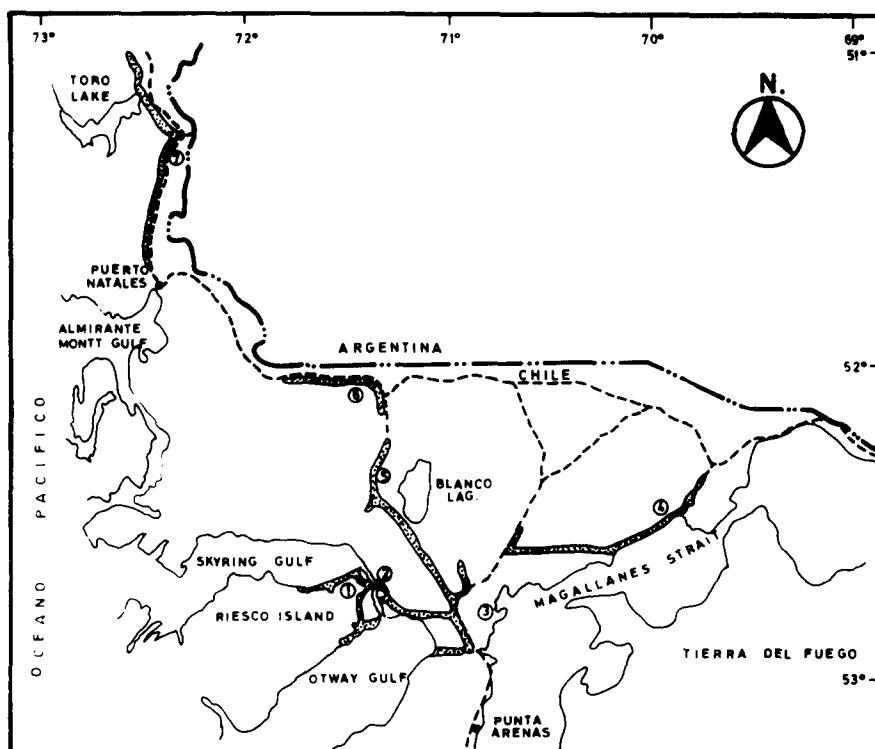


Fig. 1. Study area.

Site 3 (Kon Aiken—Cabeza de Mar) is similar to site 2. No more than 8% slope was detected. *F. gracillima* and *F. pallescens* are predominant. In several places *Chilotrachium diffusum* and *B. buxifolia* are present.

Site 4 (Oasy Harbour—Punta Delgada) is similar to sites 2 and 3; some areas with bush steppe of *Verbena tridens* are present on low hills.

Site 5 (Laguna Blanca—Cabeza de Mar) is gently undulating, mainly 'coirón' steppe and natural grasses. The same plant species are present.

Site 6 (Monte Alto—Morro Chico): coirón steppe is predominant, followed by small forests of *N. antarctica* and *N. pumilio*.

Site 7 (Torres del Paine—Puerto Natales); magellanic steppe, with slight slope. Shrubs predominate on hills. *Festuca* spp. and annual Graminea are present in the flat area.

Transects were conducted in a four-wheel-drive vehicle equipped with six halogen lamps which effectively illuminated a strip of 75 m on each side of the road. Some tracks were repeated and figures averaged. We

surveyed a total of 767 km. The foxes were counted, recording each flashing of the eyes that reflected the light of the lamps. Frequently, it was possible to see the specimens directly when they were near the road. Due to the homogeneity of the sites there were no problems in observing foxes—vegetation is mostly low, corresponding to the Patagonian steppe, and appears as open patches throughout. However, each observation was confirmed using binoculars 7×50 and 20×50 . In addition, 20 survey stations of 50 ha each distributed within the seven sites were searched for fox scats. Observations of specimens of grey fox during diurnal surveys (when collecting the scats) confirm that there are no red foxes on these sites. Data were analysed using: (1) a simple extrapolation of number of foxes per ha; (2) the Robson & Whitlock (1964) index; and (3) Frye's strip census (Overton, 1953). Results are expressed as number of hectares per fox unless otherwise indicated.

RESULTS

One hundred and sixty-five specimens of grey fox were observed during the study. Each sector exhibited different figures, as shown in Table 1. The average by simple extrapolation was 1 fox 75 ha^{-1} . When calculating the

TABLE 1
Grey Fox Density Ratio Estimated in Seven Sites of the Chilean Patagonia. XII Region, Chile, 1982.

Site	No. of ha per fox		
	Simple estimate	Robson & Whitlock estimate	Frye estimate
1. Riesco Island	48	23	26
2. Río Verde—Cabo de Mar	150	75	45
3. Kon Aiken—Cabeza de Mar	50	28	30
4. Oasy Harbour—Punta Delgada	72	58	40
5. Lagunda Blanca—Cabeza de Mar	71	65	44
6. Monte Alto—Morro Chico	33	—	19 ^a
7. Torres del Paine—Puerto Natales	110	105	76
$\bar{x} \pm 1 \text{ SD}$	76 ± 41	59 ± 30	43 ± 18

^a Single observation.

TABLE 2
 Estimated Population of Grey Fox in the Chilean Patagonia. XII Region Chile, 1982.
 (Comparison of three methods.)

<i>Method</i>	<i>No. of ha fox⁻¹</i>	<i>CL^a</i>	<i>Population</i>	<i>Rank</i>
Simple estimate	76	± 38	37 250	24 833–74 500
Robson & Whitlock estimate	59	± 31	47 983	31 456–101 107
Frye estimate	43	± 19	65 837	45 661–117 958

Kruskal–Wallis test: $H = 2.98$ $P > 0.05$ (NS)

^a 95% Confidence limits

absolute number using the Robson and Whitlock non-parametric index, the average figure was 1 fox 59 ha⁻¹. The range fluctuated between 1 fox 23 ha⁻¹ and 1 105 ha⁻¹. According to this index, Riesco Island showed the greatest density of foxes, i.e., 4.3 specimens 100 ha⁻¹, while the remaining sites exhibited numbers from 1 to 3.5 fox 100 ha⁻¹. Estimating with Frye's index, an average of 1 fox 43 ha⁻¹ was obtained when considering the mean of the figures from replicate transects.

There are no significant differences between the simple estimation, the Robson and Whitlock index and Frye's strip census ($P > 0.05$, Kruskal–Wallis test). The total density estimation given by each index is shown in Table 2. Figures fluctuated from 37 250 to 65 837 specimens for the whole area, depending on the method used.

Finally, a statistically significant correlation value between estimated figures and density of scats per site was found ($r = 0.988$; $P < 0.05$).

DISCUSSION

According to Pisano (1975), the magellanic ecosystems are fragile and susceptible to damage. Several factors underlie this environmental fragility: the substrata are geologically recent, the selective effect of recurrent climatic changes, especially during the postpleistocene, results in a simple ecosystem with low biotic diversity. Furthermore, there is a climatic aridification process and a slow development of soil. These factors make the ecosystem susceptible to any external disturbance.

In Chilean Patagonia, effects of the destruction and burning of forest, forest exploitation, extensive sheep grazing and oil extraction are all

apparent. Forest destruction has affected the habitat of some endangered species such as the southern huemul *Hippocamelus bisulcus* and guanaco *Lama guanicoe*. The endemic fauna is further imperilled by the introduction of exotic species such as rabbit *Oryctolagus cuniculus*, hare *Lepus europaeus*, beaver *Castor canadensis* and muskrat *Ondatra zibethicus*, all of which are competitors with local herbivores.

The grey fox in Chilean Patagonia has been hunted for years because it is considered a major predator of sheep. The habitat of this species in Patagonia extends from Río Negro in Argentina to the Magallanes Strait in Chile (Cabrera & Yepes, 1940; Osgood, 1943; Cabrera, 1961). In 1950, it was introduced into Tierra del Fuego to control a rabbit plague, where its population flourished (Jaksić & Yáñez, 1983).

Few studies have been made on this carnivore. The feeding habits were investigated in Neuquén, Argentina, by Crespo & De Carlo (1963) and in Central Chile by Yáñez & Jaksić (1978) and Jaksić *et al.* (1980). The predator-prey relationship among the grey fox and different rodent species, mainly *Chinchilla lanigera*, was studied in Northern Chile recently (details to be published). According to these studies the grey fox appears to feed principally on rodents, while its predation on sheep is minimal.

The combined effects of illegal capture and human disturbance (farming, livestock, forest exploitation, fire, camping) collectively threaten the species. This animal is protected by law and hunting permission is obtained after much difficulty. The authorities request a population census conducted by a specialist before permitting any capture. This type of measure is new and its results are yet unknown.

In the present study, grey foxes and their signs were seen at all sites surveyed. Density differed between sectors. Riesco Island (site 1) exhibited the greatest density within 2.6 and 6.6 specimens 100 ha⁻¹. Only the eastern section of the island and, more exactly, its littoral strip, was surveyed. The western section comprises mountain vegetation communities represented by the Patagonian cloud forest and tundra, which are habitats for red fox. The grey fox habitat was characterized by the 'coirón' steppe chaparral and shrub with some little groups of 'ñirre' forest. This area is used for sheep farming. To obtain more land for the flocks, the forest has been frequently burnt and destroyed. Paradoxically, this fact has been advantageous to the grey fox, which needs open habitats to survive.

On the other hand illegal hunting in this area is high, as farmers see the

fox as a serious predator of their sheep flocks. Atalah *et al.* (1980) discussed the role of the grey fox in Tierra del Fuego and found that sheep are an important element in the fox diet. However, other work has demonstrated that sheep are not a preferred prey and, moreover, that fox predation is exerting control over endemic rodents such as *Octodon degus* and *Abrocoma bennetti* (Yáñez & Jaksic, 1978). It is possible that foxes, as opportunistic feeders (Jaksic *et al.*, 1980), may eat sheep carrion.

The remaining sites exhibited lower densities than Riesco Island, with sites 6 and 3 following in importance. Site 6 is an area of low hills with wide prairies which corresponds to the coirón steppe. Site 3 is gently undulating, with mainly coirón steppe and natural grasses. Both represent typical vegetation formations suitable for grey fox habitat. Both have a low human population density of 1.2 person km⁻² (Instituto Nacional de Estadísticas, Chile, 1974). This suggests that foxes are not more frequent near the roads where there is little traffic, and consequently there are fewer carcasses on which to scavenge.

Since the whole area is suitable habitat for the grey fox, areas with low densities, such as sites 2, 4, 5 and 7, should be given special consideration. Perhaps treating them as areas in which human access is restricted would be the best management. In the near future it will be necessary to improve our knowledge of the biotic communities of these sites, including an accurate study of the rodent species, especially in those areas favoured by the fox.

In conclusion, there are few factors which directly affect the grey fox population in Chilean Patagonia. Although we lack figures, illegal hunting seems to be the most important. The loss of forest and the increase of steppe favour this species because the biotope is extended. This phenomenon could result in a substantial increase in illegal hunting if the grey fox becomes more numerous in the near future.

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