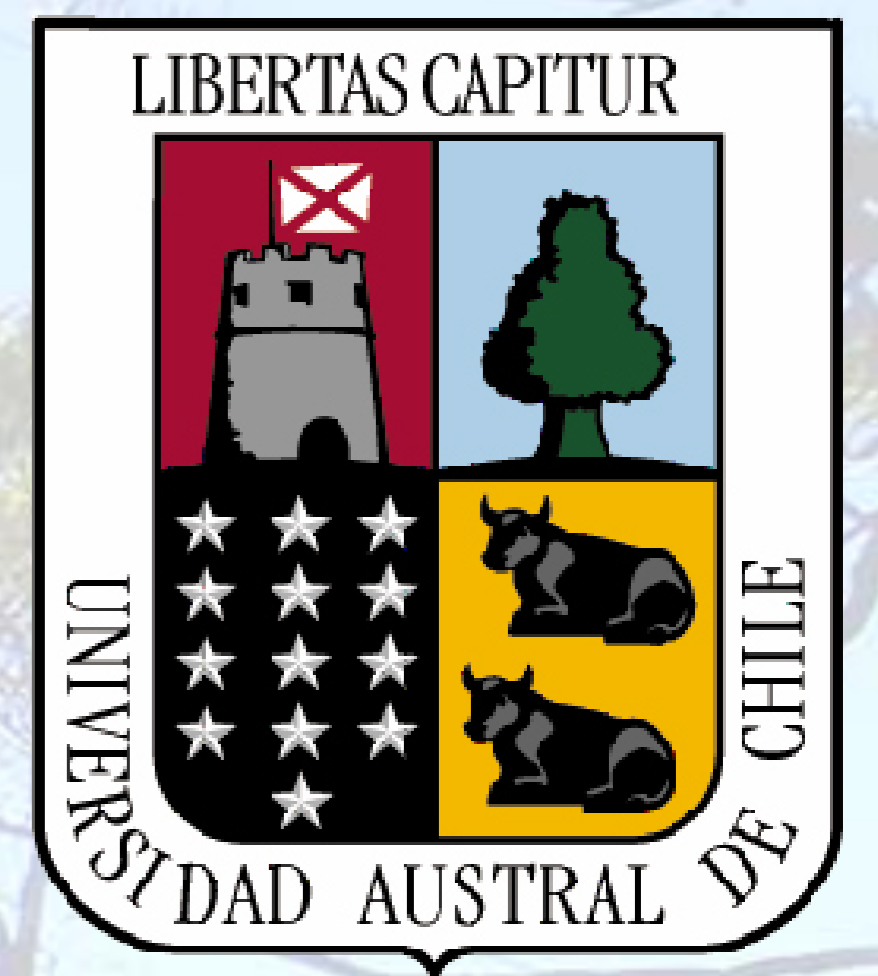


# COPROLOGICAL SURVEY OF ENDOPARASITES OF DARWIN FOX (*Pseudalopex fulvipes*) AND KODKOD (*Leopardus guigna*) IN CHILOÉ ISLAND IN SOUTHERN CHILE



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## Introduction and objectives

Parasites have the potential to reduce reproductive success and survival at individual level and can have a significant impact on the population dynamics in wildlife. In despite of this, knowledge of parasitism in endangered species is scarce. Parasites can affect differentially to species depending on their habitat requirement. The goal of this study was to determine the species of endoparasites affecting two sympatric carnivore species of conservation concern in southern Chile in a pristine environment, the Darwin's fox (*P. fulvipes*) and kodkod (*L. guigna*) through coprologic tests and compare these results to explore differences in richness, diversity and abundance as well as prevalence of infection.

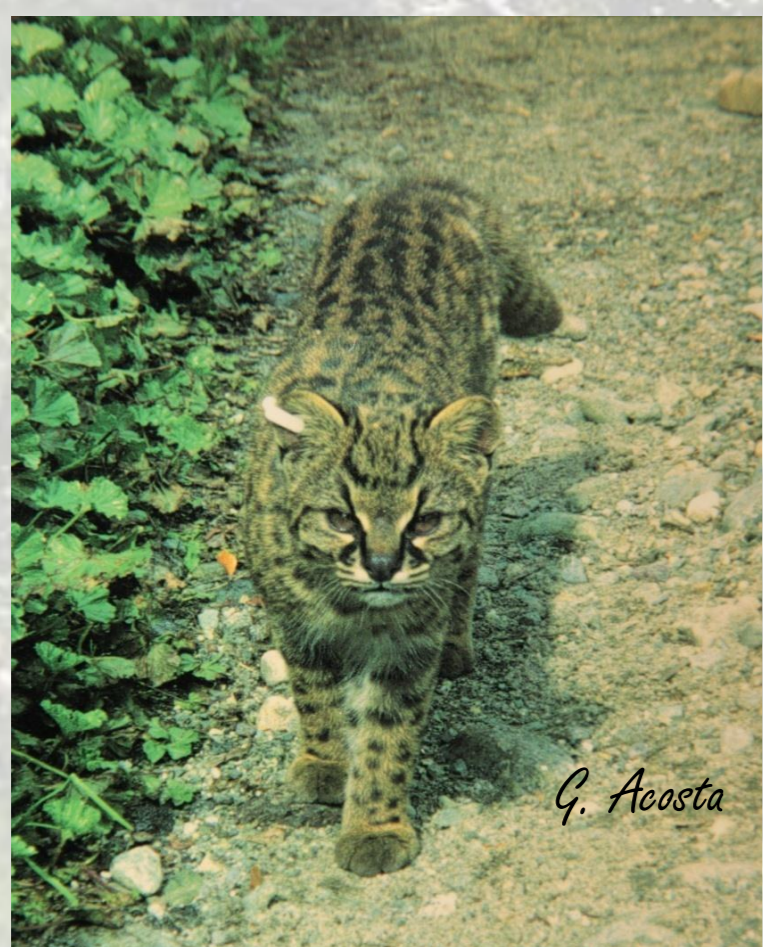


Fig. 1 According to IUCN, the kodkod (*Leopardus guigna*) in the left is considered vulnerable and Darwin fox (*Pseudalopex fulvipes*) in the right critically endangered. Both with a decreasing population.

## Material and methods

From January to February 2011, fecal samples of wild carnivores inhabiting the Tantauco private park (43° 5' N, 73° 6' W) in the Chiloé Island in southern Chile were collected and deposited in 70% ethanol. Faeces were visually assigned to each species depending on the presence of seeds. When seeds were present fecal samples were named as coming from Darwin's fox and in its absence from kodkod. Confirmation of carnivore species was done by PCR, extraction and sequencing mitochondrial DNA. Flotation-sedimentation technique was used to assess coprevalence of gastrointestinal parasites of both species. Each fecal sample was explored at 10x zoom and parasite richness and egg abundance was assessed. Abundance was explored by counting the number of eggs per field (epf) classifying them from 0 to 4; where 0 was negative, 1 very low (1-2 epf), 2 low (3-10 hpf), 3 medium (11-20 hpf) and 4 high (>20 hpf). Shanon-Wiener biodiversity index was determined and GLM analyses with Poisson errors were used to assess the effect of carnivore species on parasite richness and parasite abundance index. Chi-square and Fisher test were used to compare the frequency of parasites between carnivore species. Statistical analyses were carried out in R.

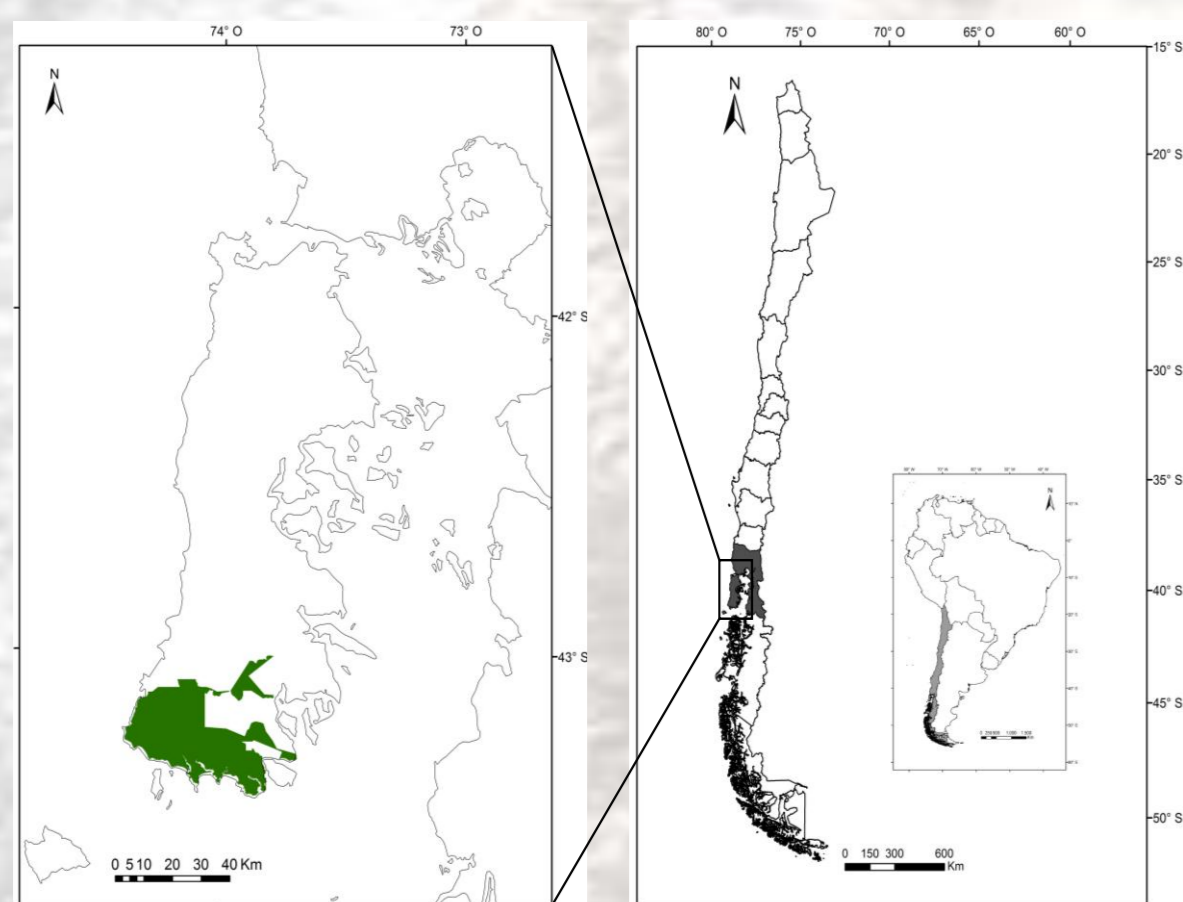


Fig. 2 Study area in the Tantauco private park (in green) in Chiloé island at the Los Lagos region where fecal samples were collected.



Fig. 3 Fecal samples taken from the field. To the left Darwin's fox feces and to the right kodkod's feces.

## Results

Overall, 94 fecal samples were collected. Of them only 74 (79%) could be classified as Darwin fox (n=43) or kodkod (n=31) by mitochondrial DNA analyses, giving a 70% of success of the morphological criteria for classifying fecal samples. Therefore, only genetically classified samples were used for statistical analyses.

Table 1. Prevalence of parasitism in kodkod and Darwin fox. Chi-square and Fisher analyses were used to test for differences between species.

	DARWIN FOX (n=43)		KODKOD (n=31)		p
	n	Prevalence	n	Prevalence	
<b>N° positive samples</b>	24	56 %	29	94 %	< 0.05
<b>NEMATODES</b>					
<i>Toxocara sp.</i>	9	38 %	19	66 %	NS
<i>Toxascaris leonina</i>	1	4 %	1	3 %	NS
<i>Aspiculuris sp.</i>	2	8 %	3	10 %	NS
<i>Trichuris sp.</i>	0	0 %	1	3 %	NS
<i>Capillaria sp.</i>	4	17 %	5	17 %	NS
<b>CESTODES</b>					
<i>Spirometra sp.</i>	0	0 %	9	31 %	< 0.05
<i>Taenia sp.</i>	4	17 %	0	0 %	< 0.05
<b>TREMATODES</b>					
Unknown	5	21 %	21	72 %	< 0.05
<b>PROTOZOA</b>					
Coccidias	13	54 %	9	31 %	NS

Statistical significant differences were found when comparing the overall prevalence of parasitism and *Spirometra sp.*, *Taenia sp.*, and trematodes between kodkod and Darwin's fox (Table 1). Although similar biodiversity index of Shannon-Wiener was obtained for both species (Darwin's fox: 3.0 and kodkod 3.2), a higher parasite richness and eggs abundance was found in kodkod (Fig. 4).

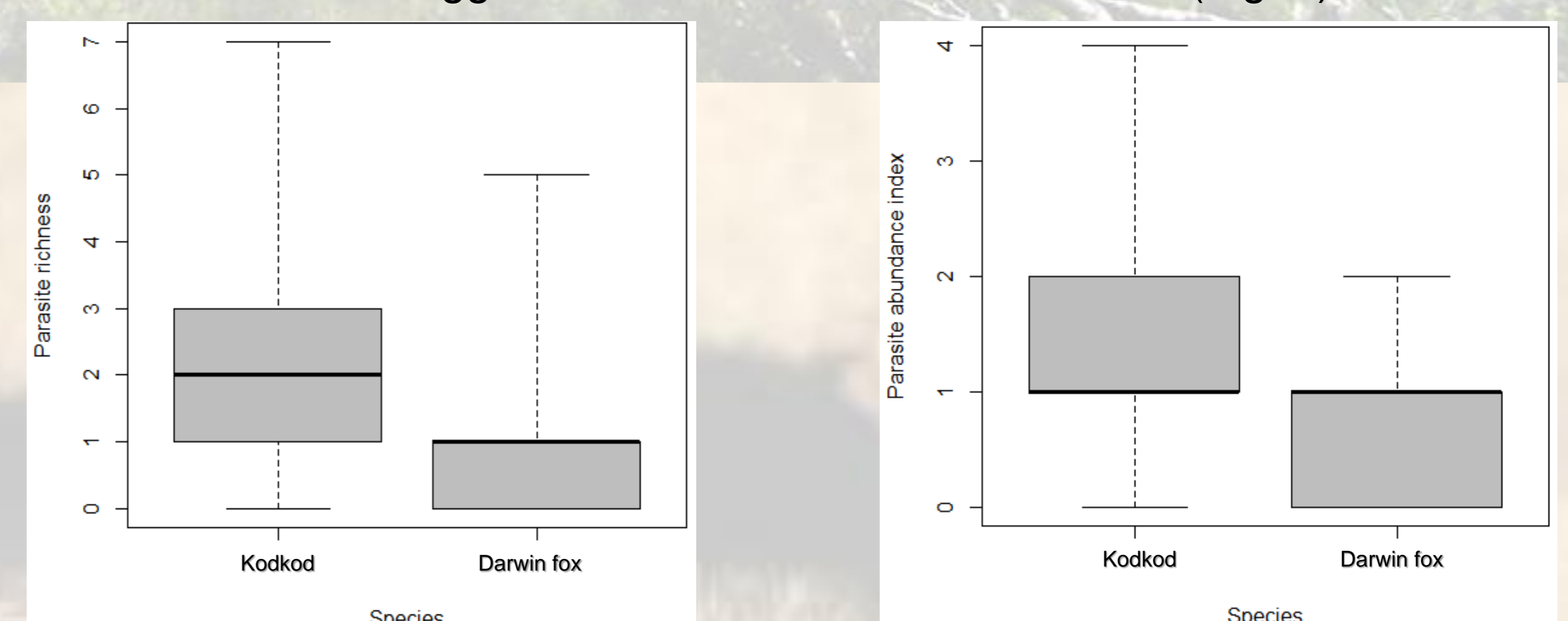


Fig. 4 Comparison of parasite richness and parasite abundance index between *L. guigna* and *P. fulvipes*. Significant differences were found between both measures indicating that kodkod has a higher parasite richness (GLM, d.f.=72, p<0.0001) and eggs (GLM, d.f.=72, p<0.001) than the Darwin fox.

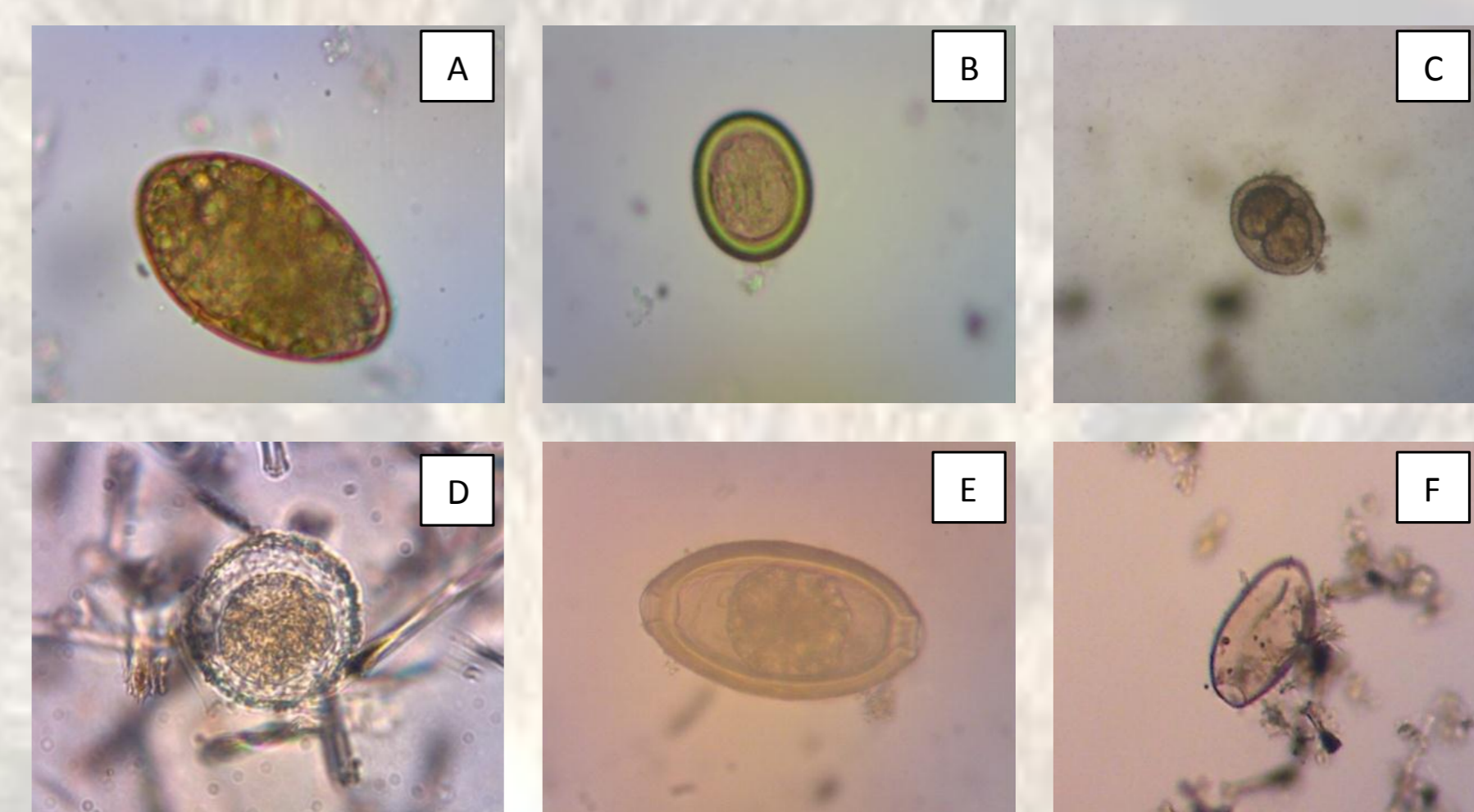


Fig. 5 Pictures of parasites eggs found in *L. fulvipes* y *L. guigna* (40x). A: *Spirometra sp.*, B: *Taenia sp.*, C: *Toxocara sp.*, D: *Toxascaris leonina*, E: *Capillaria sp.*, F: Trematodo.

## Conclusions

1. Gastrointestinal parasitism of free-ranging kodkod and Darwin's fox shows differences in the Chiloé Island in southern Chile.
2. In despite of the sympatry of kodkod and Darwin fox in Chiloé Island they differ in prevalence of gastrointestinal parasitism, parasite richness and abundance, but not in biodiversity. This could be a result of differences in prey selection, habitat use and/or a combination of them. Kodkod is depicted as to predate more in small mammals than Darwin fox, which is described as a seed consumer.
3. Further studies are recommended to explore the consequences of differences in parasitism in these rare and endangered species.



## ACKNOWLEDGEMENTS

