

CHARACTERISTICS OF DEFECATION SITES OF THE GEOFFROY'S CAT *Leopardus geoffroyi*

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ABSTRACT: Little is known about the use of feces in scent marking by small wildcats. We analyzed the characteristics of 357 Geoffroy's cat, *Leopardus geoffroyi*, defecation sites in five protected areas of Argentina. Defecation sites were mainly found in trees (47.6%) or on the ground (38.1%), and the frequency of occurrence of the types of sites differed between areas. Almost half (47.3%) of defecation sites were latrines, with 6.1 ± 3.6 (mean \pm SD) feces each. Geoffroy's cats were flexible in the choice of defecation sites, but mainly deposited feces in latrines located in conspicuous sites. These results suggest that Geoffroy's cats use feces in olfactory/visual communication.

RESUMEN: Características de los sitios de defecación del gato montés *Leopardus geoffroyi*. Se sabe muy poco sobre el uso de las heces en la marcación territorial por pequeños felinos silvestres. Analizamos las características de 357 sitios de defecación del gato montés, *Leopardus geoffroyi*, en cinco áreas protegidas de Argentina. La mayoría de ellos fueron encontrados en árboles (47.6%) o en el suelo (38.1%), variando la frecuencia de ocurrencia de los tipos de sitios de defecación entre áreas. El 47.3% fueron letrinas, con 6.1 ± 3.6 (media \pm DS) heces cada una. El gato montés presentó flexibilidad en la elección de los sitios de defecación. Sin embargo, utilizó principalmente letrinas ubicadas en lugares conspicuos. Estos resultados sugieren que el gato montés utiliza las heces en la comunicación olfativa/visual.

Palabras clave. Carnívoros. Félidos. Letrinas. Marcación odorífera.

Key words. Carnivores. Felids. Latrines. Scent marking.

The use of feces in territorial scent marking is relatively common in carnivores (Kruuk, 1992; Sliwa, 1996; Marassi and Biancardi, 2002; Barja et al., 2005), and it has been reported for small wild felids in captivity (Mellen, 1993). Felids employ olfaction and vision in communication, and urine is the chemical scent most commonly reported for wild cats (Kleiman and Eisenberg, 1973). However,

scats also constitute a chemical scent and are habitually deposited in nonrandom and conspicuous locations (Sunquist and Sunquist, 2002). Little is known about the use of feces in wildcats, and our understanding of chemical communication by wild felids is still poor. This is also true for the Geoffroy's cat (*Leopardus geoffroyi*) despite its wide distribution in the Southern Cone of South America

(Nowell and Jackson, 1996). Some data on the defecation sites of this small cat have been reported from a few areas (Johnson and Franklin, 1991; Lucherini et al., 2000; Ciuccio et al., 2005; Bisceglia et al., 2008), but no specific description of the characteristics of these sites has been published. Our objective was to analyze the characteristics of Geoffroy's cat defecation sites in a range of habitats.

Data were collected in five protected areas of Argentina (Fig. 1). Los Alerces National Park (LANP) is a national protected area of 263 000 ha located in Chubut Province, south-eastern Argentina (42°53' S and 71°37' W), within the Southern Temperate Forest ecoregion. The climate is cool and humid. Laguna de Chasicó Reserve (CLR) protects a lake in southwestern Buenos Aires Province (38°37' S and 62°56' W). Fieldwork was carried out in three privately-owned ranches, covering a total of about 1000 ha, close to the lake. Sandy dunes, covered by sparse bushes and low woodland are the main habitats of this area, but a large portion of the natural

scrublands have been logged and replaced by cattle pastures. The climate is dry temperate. Ernesto Tornquist Provincial Park (ETPP) has an area of 6700 ha and is located in the central part of the Ventana Mountain System (38°03' S and 62°56' W), south-western Buenos Aires Province. Mountain grassland with sparse shrubs is the dominant vegetation. The weather is temperate. Laguna Guatraché Provincial Reserve (GLR) occupies 8500 ha, and is located in southeastern La Pampa province (37°46' S and 63°32' W). Climate and vegetation are similar to CLR, but sandy soils are absent. Campos del Tuyú Wildlife Reserve (CdTR) covers about 3000 ha of Pampas wetlands on the northeastern coast of Buenos Aires Province (36°20' S and 56°50' W). Marshes, saline meadows, which are flooded after heavy rainfalls, and grasslands are the main habitats, but small patches of woodland also occur. The climate is temperate and humid or sub humid.

The areas were surveyed on foot, and felid feces were identified from those of other car-

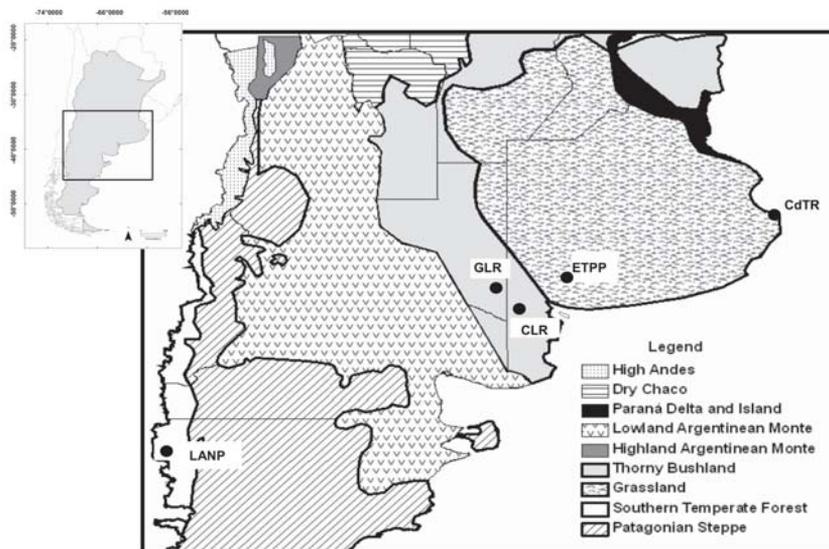


Fig. 1. Map showing the ecoregions of central Argentina and the locations of study areas. We adopted here the ecoregion classification proposed by Burkart et al. (1999). CdTR = Campos del Tuyú Wildlife Reserve; CLR = Laguna de Chasicó Reserve; ETPP = Ernesto Tornquist Provincial Park; GLR = Laguna Guatraché Provincial Reserve; and LANP = Los Alerces National Park.

nivores based on their shape, smell, and general aspect. At all defecation sites we recorded the number of feces found and their respective estimated age class (fresh, old, very old), as well as the type of site. Types of sites were grouped in the following categories: burrows in rocks or in the ground and small holes in the ground, standing or fallen trees/tree branches, and ground, including feces found along trails or on top of small bushes and grasses. We defined a latrine as a defecation site with >2 feces of different ages, indicating its re-use over time (Gorman and Trowbridge, 1989; Begg et al., 2003).

Extensive fieldwork proved that the Geoffroy's cat is the only small cat at CdTR (Vuillermoz and Sapoznikow, 1998; Manfredi et al., 2006) and ETPP (Manfredi, 2006). At LANP the kodkod (*L. guigna*) is sympatric with the Geoffroy's cat, but apparently is found at much lower population densities (Lucherini and Luengos Vidal, 2003). Camera trapping showed that the pampas cat (*L. colocolo*) occurs at CLR, but photo trapping rates and DNA-based identification of scats indicate that this species is much rarer than the Geoffroy's cat in this area (Manfredi and Lucherini unpubl. data). Finally, although the presence of the pampas cat at GLR cannot be excluded, we had no data confirming it.

We recorded 1274 feces from 357 defecation sites (Table 1). Almost half (47.6%; $n = 170$) of all defecation sites (51.3% of the fe-

Table 1

Number of defecation sites, estimated number of feces, mean \pm SD of the number of feces per defecation site and, in parenthesis, the maximum number of feces/site for the Geoffroy's cat at five protected areas of Argentina.

Area	# defecation sites	# feces	# feces/site
LANP	33	115	3.5 \pm 2.9 (11)
CLR	25	62	2.3 \pm 1.4 (6)
ETPP	71	319	4.8 \pm 5.4 (21)
GLR	116	427	3.7 \pm 2.9 (20)
CdTR	112	351	3.1 \pm 3 (13)

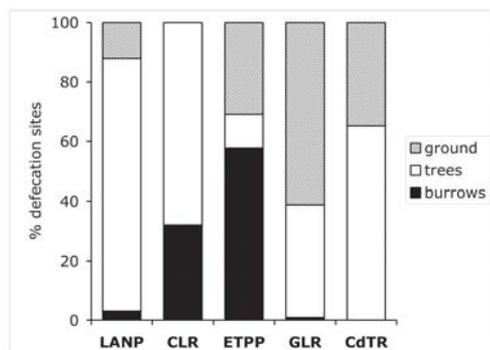


Fig. 2. Percent occurrence of categories of defecation sites used by Geoffroy's cats in five protected areas in Argentina. Acronyms as in Fig. 1.

cal samples; $n = 653$) were found in trees, 38.1% ($n = 136$) were on the ground, mainly along trails, and the remainder in burrows (Fig. 2). However, the frequencies of occurrence of the types of sites varied significantly among the different areas (chi-square test: $\chi^2 = 190.8$; $df = 8$; $P < 0.001$; Fig. 2). At LANP, CLR and, especially, CdTR, trees (*Nothofagus* sp., 80% of the cases, $n = 28$; *Prosopis caldenia*, 100%, $n = 17$; *Celtis tala*, 100%, $n = 73$, respectively) were the most common defecation sites, whereas feces were mainly found on grass tussocks and along trails at GLR, and at ETPP, an area where large trees are rare, most defecation sites were in natural rocky shelters (Fig. 2). Although GLR and CLR are found in the same ecoregion (Argentine Monte), at CLR, defecation sites were recorded on *P. caldenia* trees and in holes in the ground, while most sites were located along trails at GLR, and a smaller proportion on *P. caldenia* trees (Fig. 2), possibly because in this area where scrubland is denser than at CLR, cats used trails more intensely. Most of the trees used as defecation sites were large, mature specimens with wide platforms among their branches. This is also true for the few trees (all of them *Salix humboldtiana*) where cat scats were found at ETPP. The majority of feces were found in latrines, which represented 47.3% ($n = 169$) of the defecation sites (mean number of feces/site \pm SD: 6.1 ± 3.6), with 54.2% ($n = 690$) of feces in large (>5 feces)

and 27.1% (n = 345) in small (3-5 feces) latrines.

Both olfactory and visual communications are widespread in felids (Macdonald, 1985; Mellen, 1993), but their use has not been studied in the Geoffroy's cat in the wild. At CdTR, based on the selection shown by radiotagged cats, Manfredi et al. (2006) hypothesized that wood patches were important "communication centres", where information in the form of scent marks deposited in large latrines was exchanged among individuals. Our results are congruent with this conclusion and, in general, with the hypothesis that feces play a role in the scent marking behaviour of Geoffroy's cats. If feces are used as marks in olfactory/visual communication, they should be deposited in a way that enhances their persistence and facilitates their detection by conspecifics (Barja and List, 2006). Therefore we would expect feces to be deposited in conspicuous, non-random sites, and defecation sites to be re-used over time. Our data are clearly in agreement with both expectations. Irrespective of the habitat, Geoffroy's cats mainly use latrines as defecation sites. These latrines do not appear to be located randomly, but rather in conspicuous sites, such as big trees, large and visible rocky shelters, and isolated grass tussocks, which may represent advantageous points for territory marking and/or the exchange of chemical signals. By definition, latrines are re-used sites, but we were able to record the regular use of some defecation sites for at least five years at CdTR and four years at ETPP. Although we could not prove that feces were specifically used in territorial marking/defence, we argue that such long-term use is also suggestive of a marked selection by Geoffroy's cats and of the importance of defecation sites.

Interestingly, we confirmed that Geoffroy's cats tend to use trees of only one species in each area as defecation sites, as was noted by Johnson and Franklin (1991) for southern Patagonia. However, our data also indicate that the Geoffroy's cat is flexible in its choice of defecation sites, most likely in response to the characteristics of the areas where it lives, and

in accordance to the adaptability already reported for its foraging behaviour (Manfredi et al., 2004) and space use (Manfredi et al., 2006).

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