

## Short Note

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## Resting sites of opossums (*Didelphimorphia*, *Didelphidae*) in Atlantic Forest fragments

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**Abstract:** We report the type and pattern of use of resting sites used by 14 radio-tracked opossums. *Philander frenatus* rested in natural structures but also on spherical structures of dry leaves, probably built by them. *Caluromys philander* and *Marmosa paraguayana* rested at forest canopy preventing nest type identification. More than half of the resting site locations of each radio-tracked individual were in a single resting site. The repeated use of resting sites in the study area might be a strategy to stay close to resources and a protection against adverse weather conditions, predators and/or competitors.

**Keywords:** *Caluromys philander*; *Marmosa paraguayana*; nests; *Philander frenatus*; sleeping sites.

Knowledge of resting sites' types and pattern of use could help understand several aspects of an animal's ecology (Smith et al. 2007). The choice of where to rest and the pattern of use of resting sites should be affected primarily by the availability of suitable sites, predation pressure, food resources distribution, or home range defense (e.g. Day and Elwood 1999, Smith et al. 2007). Mammals resting sites have been recorded mainly for large sized

species such as primates (e.g. Smith et al. 2007) and carnivores (e.g. Baghli and Verhagen 2005). Non-volant small mammals – the most diverse group of mammals – are nocturnal and thus difficult to locate visually, but some resting sites have been recorded using spool and line devices (e.g. Briani et al. 2001) and radiotelemetry (e.g. Moraes and Chiarello 2005). Here, we describe the type and pattern of use of resting sites by the opossums *Caluromys philander* (Linnaeus 1758), *Marmosa paraguayana* Tate, 1931 and *Philander frenatus* (Olfers 1818) in Atlantic Forest fragments.

This study was conducted in a fragmented landscape within Poço das Antas Biological Reserve (22°30'–22°33' S, 42°15'–42°19' W), Rio de Janeiro, Brazil, which consists of eight forest fragments surrounded by a matrix composed mostly of grasses and bracken. Adult individuals were captured and fitted with radio-collar transmitters at two of the fragments. Between May 2001 and September 2004, animal locations were obtained by a variation of the “homing-in on the animal” technique – locations were recorded when the signal was loud enough to be heard with the antenna disconnected from the receptor (Lira et al. 2007). The first location of each individual was obtained before it left its resting site (usually at sunset) and subsequent locations were obtained until the end of its activity when it entered the resting site (usually at sunrise). Occasionally, diurnal locations were obtained; all these were resting site locations.

Four *Caluromys philander* (*Cp*), eight *Philander frenatus* (*Pf*) and four *Marmosa paraguayana* (*Mp*) were fitted with transmitters and monitored for 2–8 months (Lira et al. 2007). Fifty resting sites used by 14 individuals were recorded. The number of resting sites used by an individual varied from two to six (Table 1) and was not influenced by its total number of locations (linear regression:  $R^2=0.25$ ;  $F=3.85$ ;  $p=0.07$ ).

Resting sites used by *Philander frenatus* individuals included underground burrows, tree cavities, tangles of lianas and palm crowns (Table 1, Figure 1). In the latter two nest types, dried leaves accumulated forming natural shelters. Unlike studies that described nest sharing, suggesting that opossums are more social than previously believed

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**Table 1:** Total number of locations (and number of locations at resting sites) of *Caluromys philander* (Cp), *Philander frenatus* (Pf) and *Marmosa paraguayana* (Mp) individuals in Atlantic Forest fragments at Poço das Antas Biological Reserve, Brazil; for each individual, the type (when identified) and number of locations obtained in each resting site are also provided.

Individuals	Number of locations	Locations at each resting site					
		1	2	3	4	5	6
Cp-M02	117 (25)	17	4	2	1	1	–
Cp-F01	49 (13)	7	3	1	1	1	–
Cp-F02	59 (12)	8	2	1	1	–	–
Pf-M01	46 (18)	8 <sup>UB</sup>	5 <sup>TC</sup>	2 <sup>UB</sup>	1 <sup>UB</sup>	1	1
Pf-M02	9 (3)	1 <sup>TL</sup>	1	1	–	–	–
Pf-M03	38 (15)	10 <sup>TC</sup>	3 <sup>TC</sup>	1	1	–	–
Pf-M04	8 (3)	1 <sup>TC</sup>	1 <sup>PC</sup>	1	–	–	–
Pf-F01	7 (4)	2 <sup>TC</sup>	1 <sup>TL</sup>	1	–	–	–
Pf-F02	22 (10)	3 <sup>TL</sup>	3 <sup>NDL</sup>	2 <sup>NDL</sup>	1 <sup>TL</sup>	1	–
Pf-F03	13 (6)	3 <sup>TC</sup>	1 <sup>TL</sup>	1 <sup>TL</sup>	1	–	–
Pf-F04	6 (3)	2 <sup>NDL</sup>	1 <sup>NDL</sup>	–	–	–	–
Mp-M01	49 (11)	5	3	3	–	–	–
Mp-F01	18 (5)	3	2 <sup>PC</sup>	–	–	–	–
Mp-F02	40 (5)	3	2	–	–	–	–

Resting site type: NDL, nest of dry leaves; PC, palm crown; TL, tangles of lianas; TC, tree cavity; UB, underground burrow.

(Galliez et al. 2009, Astúa et al. 2015), simultaneous use of resting sites by radio-tracked individuals was not observed in this study. However, two *P. frenatus* individuals used the same tree cavity in different occasions – 7 months apart from each other – suggesting that resting sites with some specific characteristics are preferred by animals.

Additionally, we observed in eight different occasions two females, *Pf-F02* and *Pf-F04*, resting inside spherical structures (~20 cm diameter) of interlaced dry leaves 1 m above the ground, which suggests that *Philander frenatus* individuals build their own resting sites (Table 1). Nest building has been already described for the brown four-eyed opossum *Metachirus nudicaudatus* Desmarest, 1817 (Moraes 2004, Loretto et al. 2005) and also for rodents (Briani et al. 2001, Shibata et al. 2004, Alvarenga and Talamoni 2005). Additionally, the behavior of gathering and carrying nesting material in curling tails was documented in captivity for *Monodelphis domestica* Wagner, 1842 (Unger 1982) and *Didelphis virginiana* Kerr, 1792 (McManus 1970) and in the field with camera traps for *Caluromys philander* (Daloz et al. 2012), *Didelphis marsupialis* Linnaeus, 1758 and *M. nudicaudatus* (Delgado-V et al. 2014).

Our results suggest that individuals of *Philander frenatus* rest frequently in the understory; only *Pf-M01* used underground burrows (Table 1). Indeed, Miles et al. (1981) have already described the preference of *P. frenatus* for resting in hollow trees and tree forks located at 8–10 m



**Figure 1:** Resting sites used by *Philander frenatus* individuals in Atlantic Forest fragments at Poço das Antas Biological Reserve, Rio de Janeiro state, Brazil. (A) A male, *Pf-M01*, leaving an underground burrow; (B) a tree cavity used by the female *Pf-F03*.

above ground. This is an interesting finding as this marsupial – despite its arboreal ability (Delciellos and Vieira 2006) – use preferentially the ground (Passamani 1995, Cunha and Vieira 2002) as has also been observed in our study area (Viveiros de Castro and Fernandez 2004). Cunha and Vieira (2002) suggested that the use of understory by *P. frenatus* could be related to competition with and occasional predation by *Didelphis aurita* Wied-Neuwied, 1826, a species that occurs in our studied forest fragments (Viveiros de Castro and Fernandez 2004).

As *Caluromys philander* and *Marmosa paraguayana* were always resting at the forest canopy or high in the understory, resting site types could not be identified in most cases. An exception was a female *M. paraguayana* (*Mp-F01*) that was located resting at the crown of an adult individual of the palm *Astrocaryum aculeatissimum*, approximately 3 m high (Table 1). A preference of *M. paraguayana* for nesting in *A. aculeatissimum* was described by Moraes and Chiarello (2005) who found 70.7% of the resting sites of *M. paraguayana* individuals in this palm species at an Atlantic Forest fragment (União Biological Reserve) which is 30 km away from our study area.

Repeated use of resting sites was observed for all three species (Table 1). More than half of the resting site locations of nine out of the 14 radio-tracked individuals were in a single resting site. According with Aquino and Encarnación (1986) and Smith et al. (2007), the repeated use of resting sites could be a strategy to stay close to resources, protection against adverse weather conditions, predators and/or competitors, territorial defense or caring of young. In our study, the repeated use of resting sites was observed not only in females but also in males and this behavior occurred throughout the year, not only during the reproductive period – which, for opossums, normally coincide with the period of higher food availability, the warm-wet season (Barros et al. 2015). Additionally, although there is evidence for site fidelity in opossums, as far as we know there is no evidence of opossums actively defending an area and we have also not observed any agonistic encounter during our study. Therefore, we believe that the repeated use of resting sites in our study area might be a strategy to stay close to resources and a protection against adverse weather conditions, predators and/or competitors.

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