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Activity, habitat use, density, and reproductive biology of the crab-eating fox (*Cerdocyon thous*) and comparison with the pampas fox (*Lycalopex gymnocercus*) in a Restinga area in the southern Brazilian Atlantic Forest

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Abstract

The ecology and reproductive biology of the crab-eating fox (*Cerdocyon thous*) and the pampas fox (*Lycalopex gymnocercus*) were studied in Itapuã State Park, an Atlantic Forest fragment. In this study we describe their activity patterns (diel, lunar, and seasonal), reproductive period, density, spatial distribution, and habitat overlap. The crab-eating fox was more abundant than the pampas fox, occurring in all types of habitats and overlapping with the pampas fox only in the southern portion of the study area, covered by open vegetation. Both canid species presented nocturnal habits and *C. thous* showed no significant differences in activity among lunar phases or else year season. The density of *C. thous* was estimated to be 0.78 ind/km^2. The crab-eating fox reproduced once a year, generating pups during spring (October to December). In comparison with *C. thous* populations from lower-latitude regions the relatively low density and one reproductive event per year that we observed are probably related to a colder climate, shorter photoperiod, and shortage of food resources in the winter, characteristic of southern Brazil.

Keywords: Activity patterns; Canidae; Habitat use; Niche overlap; sympatry

Introduction

The crab-eating fox (*Cerdocyon thous*) is a medium-sized canid that presents a broad distribution in South America (Emmons and Feer 1997; Parera 2002). It is typically generalist, with opportunistic habits, occupying a great variety of habitats from savannas to forests, occurring from sea level to altitudes higher than 2000 m

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(Emmons and Feer 1997; Eisenberg and Redford 1999). In Brazil, this canid can be found in the entire country, with exception of the lower lands in the Amazon region (Langguth 1975). This animal feeds on fruits, small invertebrates, and vertebrates, and occasionally on carrion and garbage (Montgomery and Lubin 1978; Bisbal and Ojasti 1980; Sunquist et al. 1989; Motta-Junior et al. 1994; Facure and Giaretta 1996; Facure and Monteiro-Filho 1996; Macdonald and Courtenay 1996; Nowak 1999; Delgadon 2002; Facure et al. 2003; Bueno and Motta-Junior 2004).

Even though *C. thous* is common and generally abundant in its area of occurrence, the majority of the studies published about this species emphasizes mainly its diet (e. g. Bueno and Motta-Junior 2004; Rocha et al. 2004; Pedó et al. 2006) or else were conducted in central and eastern South America (e.g. Brady 1979; Macdonald and Courtenay 1996; Juarez and Marinho-Filho 2002; Maffei and Taber 2003; Trovati et al. 2007). Besides that, other important ecological aspects, such as daily activity periods and reproductive patterns have been neglected (but see Jácomo et al. 2004; Vieira and Port 2007).

Patterns of activity (both daily and seasonal) and reproductive traits are two key biological aspects of an animal. Timing of activity is decisive in determining encounters between neighbouring territorial species (Halle 2000), in reducing competition between species (e.g. Loveridge and Macdonald 2003), and also in influencing their foraging success (Lockard 1978). This latter affects directly the reproductive success of mammals.

Mammals may allocate energy to reproduction in different ways, depending on environmental and biological factors, which results in different life-history traits. These traits may vary within the same species, influenced by both biological and environmental factors (Cameron and McClure 1988; Boyce 1988). The relationship between life-history traits and environmental factors as well as other biological aspects of *C. thous* (e.g. diel and seasonal activity) have not been adequately investigated in southern South America not only for this canid species but also for the similar-sized pampas fox (*Lycalopex gymnocercus*), sympatric with the crab-eating fox in this region (Vieira and Port 2007). *Lycalopex gymnocercus* is also recognized as generalist in diet, feeding opportunistically on rodents, lagomorphs, birds, reptiles, amphibians, insects, and fruits (Crespo 1971; Varela et al. 2008). However the ecology of *L. gymnocercus* is less known, since only a few studies investigated this species (e.g. Crespo 1971; Garcia and Kittlein 2005; Vieira and Port 2007; Varela et al. 2008).

Both *C. thous* and *L. gymnocercus* are found in Argentina and in southern Brazil, where they occur in several habitat types, including the Restinga formations close to the coast. The term restinga applies to both the sandy plains dating from the Quaternary and the vegetation that covers these plains (Zamith and Scarano 2006). This vegetation is a subtype of the highly threatened Atlantic rain forest of Brazil, one of the 25 biodiversity hotspots in the world for the combination of high species diversity, high number of endemic species, and high level of habitat destruction (Myers et al. 2000). The proximity of the Restinga vegetation to big coastal cities of Brazil has been causing a high destruction of this unique habitat type (Zamith and Scarano 2006).

The occurrence of wild canids in ecological reserves near urban areas is extremely important, since generally these animals occupy high trophic positions in these environments, playing an important ecological role in the community. In addition, due to their well-known role in seed dispersion (Motta-Junior et al. 1994), crab-eating foxes and pampas foxes could be very important in the processes of maintenance and regeneration of natural environments (Howe and Smallwood 1982).

In the present study we investigated activity patterns, habitat use, and reproductive biology of the crab-eating fox in an ecological reserve located close to areas with intensive human activity in a highly threatened ecosystem. Specifically we analyzed activity in different seasons and lunar phases, diel activity, density, and reproductive traits of this canid. We also defined zones of sympatry with the pampas fox, present in the same area.

Material and methods

We conducted the study in the Itapuã State Park (Parque Estadual de Itapuã, hereafter PEI) located in a Restinga vegetation in the State of Rio Grande do Sul, southern Brazil (30°22′S; 51°02′W) (Fig. 1). This vegetation type is a mosaic of plant communities ranging from creeping types to open scrubs and forested formations (Lacerda et al. 1993). The PEI has a total area of 5556.6 ha, with about 30% of that occupied by a lagoon (Fig. 1). Local climate is classified by the Köppen system (1948) as Cfa, described as subtropical humid, and the mean annual rainfall is about 1300 mm. The PEI is one of the unique areas close to Porto Alegre city (>1,400,000 inhabitants) where the natural landscape presents its own characteristics. Due to the physiographic diversity, several ecosystems occur, such as granitic hills, undulated soils, medium to high forest, grassland, beaches, marshes, and lagoons. Vegetation in PEI is characterized by a great diversity of floristic types as a result of species adaptation to variations in the soil condition, determined by differences in the formation of granitic hills and coastal plan. For more detailed information on the study area see Pinent et al. (2003) and Silva et al. (2008).