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Research Report

Home range and activity of two sympatric fox species in the Bolivian Dry Chaco

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Abstract

Two fox species inhabit the Kaa Iya del Gran Chaco National Park in Bolivia: the crab eating fox *Cerdocyon thous* and the pampas fox *Pseudalopex gymnocercus*. We present the results of a study of the spatial ecology of these two species in Kaa Iya. In a series of bi-monthly systematic camera trap surveys, we set between 21 and 32 camera traps at different research camps over a four-year period (2001-2005). We recorded 215 photos of crab-eating foxes and 206 photos of pampas foxes. We captured three pampas foxes and four crab-eating foxes and fitted them with radio telemetry collars. Activity patterns of foxes (obtained from camera trap photos) were similar for both species: the activity peak was between 18:00 and 23:00h, with less activity between 10:00 and 17:00h. Home ranges of crab-eating foxes were between 155 and 293ha and for pampas foxes between 73 and 183ha. Female home ranges for both species were smaller than for males and only in one individual we observed a seasonal home range shift.

Introduction

The Gran Chaco is the third most extensive ecosystem in South America, covering more than one million km². Canids are widely represented by two species, crab-eating fox and pampas fox, with the bush dog *Speothos venaticus* recently reported for the first time in the Kaa-Iya del Gran Chaco National Park, and the maned wolf *Chrysocyon brachyurus* in Copo National Park (Argentina). Even though both fox species inhabit a wide variety of Chaco habitats frequently in sympatry, the pampas fox is found more frequently in drier areas from southern Bolivia to central Argentina, while the crab-eating fox is more generalist, distributed in diverse environments below 2,000m (except Amazonia), and is scarce and even absent in the drier areas of Chaco (Eisenberg and Redford 1999, Emmons and Feer 1999). This paper compares home ranges and activity patterns of these two species in the Kaa-Iya National Park.

Methods

Study area

We studied crab-eating foxes at Tucavaca field camp (18º 31′ S 60º 48′ W) where the dominant vegetation is transitional Chaco-Chiquitano dry forest with a continuous canopy 8-12m high and a mean annual precipitation of 800mm. We studied pampas foxes at Guanacos field camp (20º 15′ S 62º 26′ W), where the vegetation is a herbaceous/scrub pampa with a mean annual precipitation of 400mm. Both sites are within the 34,400km² Kaa-Iya del Gran Chaco National Park.

Sampling components

For this study, we applied two indirect methods:

Camera Traps: In a series of two-month systematic camera trap surveys specifically targeting jaguars *Panthera onca*, we set between 24 and 32 pairs of camera traps at several different sites over a four-year period (2001-2005), with a total of 15,234 trap nights. We set camera traps on roads or trails, with camera stations separated by roughly 2km. We programmed camera traps to take pictures all day and in every picture the hour and date were marked in order to confirm the time when the animal was active.

Radio-tracking: We set 12 Tomahawk™ traps on roads or trails during seven months at Tucavaca camp and two months at Guanacos camp. We baited the traps with live chicken and human food scraps, and visited them in early morning and late afternoon to check if a carnivore had been captured, and to feed and water the chicken. We anesthetized captured foxes with Telazol™ (5mg/kg), supplemented with Ketamine™ if the animal was not completely relaxed. We took samples of blood and parasites, as well as biological measurements (Appendix 1), and fitted a radio-collar (Model M2140, ATS, Insanti, MN). We placed the animals back in the traps for complete recovery and then released them. Veterinary data are presented elsewhere (Fiorello 2004). We radio-tracked the animals from roads and trails marked every 100m (fixed points) using a Communications Specialists Inc. R-1000 telemetry receiver and a directional antenna. When animals were detected, we recorded the position by triangulation according to conventional methods (Rabinowitz 2003). We analyzed the triangulations with the Locate II programme (Pacer, Inc.) to estimate each location of each fox, and we calculated the home range with the ArcView program (ESRI, Inc.) using the Minimum Convex Polygon (Mohr, 1947) with 95% of the data points (White and Garrot 1990).

Results

Camera traps: We obtained 215 pictures of crab-eating foxes and 206 pictures of pampas foxes with hour/date data. Activity patterns were very similar for both species: foxes can be active both night and day, with an activity peak for both species between 18:00 and 23:00h, and reduced activity between 10:00 and 17:00h, the hottest period of the day (Figure 1).

Some mammals that lack distinctive coat spots can be identified at the individual level. For example Trolle et al. (2006) used tail features, distinct colouration on legs and face, and body structure, spots in the legs or scars to distinguish maned wolves in the first application of the procedure in canids. However, the procedure is more difficult with smaller animals as poorer quality photos are obtained, and with presumed larger numbers of individuals to distinguish per site. Therefore, we did not attempt to identify individual foxes, and were unable to estimate population density for these species from the camera trapping records and the application of capture-recapture methodologies.

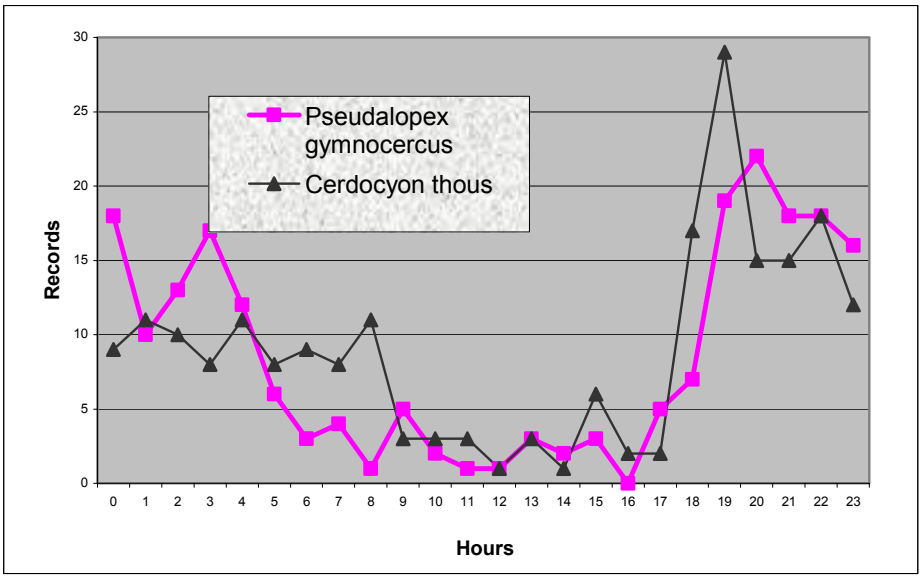

Figure 1. Fox activity in the Kaa-Iya del Gran Chaco National Park based on camera trap records (*P. gymnocercus* n=206, *C. thous* n=215).

Radio-tracking: At Tucavaca camp we accumulated 99 days of capture effort (1,391 trap nights). We captured five crab-eating foxes, two males and three females (all adults, except a subadult female, determined by her size and dental wear), for a capture rate of one fox/278 trap nights. Unfortunately, shortly after capture, the subadult female disappeared and another lost her collar, so we obtained sufficient data from only one female and two males. In addition to foxes, we captured five ocelots *Leopardus pardalis* and fitted them with radio-collars (Maffei and Noss in press). We tracked foxes for at least one year.

The two male crab-eating foxes used home ranges of 263 and 207ha respectively, and occupied the same home range over this period. In contrast, during the first five months of dry season (June-October), the female "Victoria", occupied 64ha, sharing 40% of her area with a male "Jorge"; she then disappeared for two months; finally she reappeared 5km north of her previous home range, using a range of 91ha over a 13-month period, and sharing 65% of this range with the second radio-collared male "Carmelo" (Figure 2).

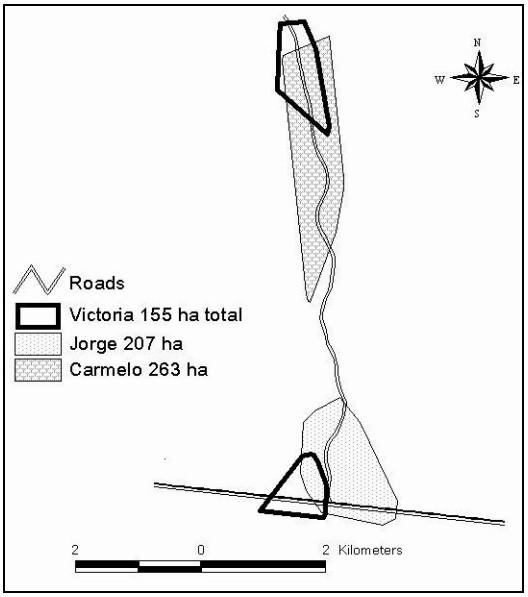

Figure 2. Home ranges of crab-eating foxes at Tucavaca field camp, Kaa-Iya del Gran Chaco National Park.

At Guanacos Camp, we set 16 traps during 20 days (320 trap nights). We captured four pampas foxes, three females and one male, that were subsequently radio-tracked between seven and 11 months each. The capture rate at

Guanacos was much higher than at Tucavaca, reaching one fox for every 80 trap nights. All animals stayed within the same area and none shifted its home range. Home ranges were small, between 73 and 183ha. There was an almost complete overlap among the ranges of two females "Yuliana" and "Tatiana" and the male "Tuicha". The home range of the third female "Iyarasi" overlapped only slightly with the male and one other female (Figure 3).

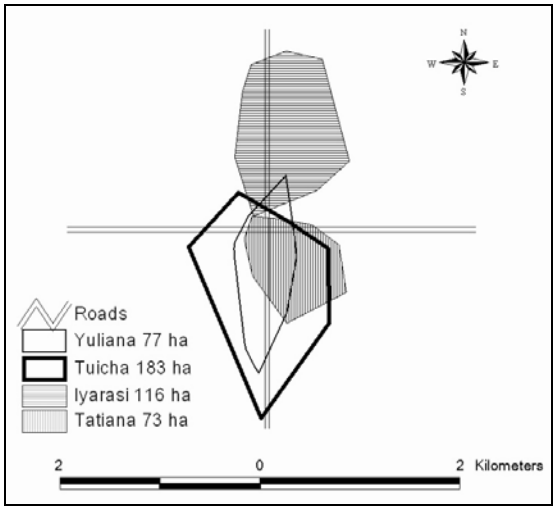

Figure 3. Home ranges of pampas foxes at Guanacos field camp, Kaa-Iya del Gran Chaco National Park.

Discussion

Crab-eating foxes have been reported to be mainly nocturnal or strictly nocturnal (Sunquist 1989, Macdonald and Courtenay 1996). In this study, and for both species, we confirm that foxes tend to be nocturnal, but with significant diurnal activity as well: 24% and 15% of the photographs of crab-eating and pampas fox respectively were taken during daylight hours.

At five sites within the Kaa-Iya National Park (Cuéllar et al. 2004, this study) and one site in Chiquitano dry forest, the San Miguelito ranch (Arispe et al. 2004), where we conducted camera trap surveys between 2001 and 2005, we observed pampas foxes more frequently in relatively open and dry habitats, and crab-eating foxes more frequently in habitats with higher canopy and more humid conditions - higher rainfall or riverine forest (Appendix 2). Also, Hurtado (1999) in Lomerio (a region near San Miguelito Ranch, with 1,100mm annual rainfall), reported the presence of crab-eating foxes in the area, but no pampas foxes. Besides rainfall and type of forest, Cordero and Nassar (1999) suggested that the patchy combination of habitats (forest, grasslands, savannah, etc.) can be beneficial to crab-eating foxes, as happens in San Miguelito and Lomerio.

Capture rates were higher at Guanacos than Tucavaca (even though the trapping area at Guanacos [1.3km²] was smaller than at Tucavaca [2km²]), probably because at Tucavaca foxes have larger home ranges and maybe lower densities, so in a given area there are fewer crab-eating foxes than pampas foxes). In a similar study at Cerro Cortado field camp (also within the Kaa-Iya National Park), C. Fiorello trapped carnivores during 748 trap nights and captured four foxes (three pampas and one crab eating fox), with a capture rate of one fox per 187 trap nights, an intermediate rate between the two recorded in this study.

Home ranges were very different between the two species. Crab-eating foxes had an average home range of 208ha, while for pampas foxes the average was nearly half, at 112ha. Results for crab-eating foxes are similar to those from another area of Chiquitano dry forest (Maffei and Taber, 2003) where three radio-tracked animals occupied an average area of 216ha. However, other studies in other habitats reported smaller areas, for example 34 to 100ha for 11 animals radio-tracked in the Venezuelan Llanos (Sunquist et al. 1989), or larger areas, for example an average of 532ha for 21 animals radio-tracked in the Brazilian Amazon (Macdonald and Courtenay 1995). The latter study reported that crab-eating foxes are territorial and have minimal range overlap. In this study, given the low number of radio-tracked animals, we could not confirm this assertion. Pampas foxes in Kaa-Iya had home ranges smaller than in the somewhat wetter Argentine pampas (500-800mm) where Luengos (2003) reported home ranges of 250ha for males and 304ha for females according to 100% MCP.

At Tucavaca field camp we carried out a parallel study radio-tracking five ocelots and found no spatial or temporal segregation between this species and crab-eating foxes. Ocelots are also principally nocturnal (Maffei and Noss in press), had home ranges that overlapped significantly with fox home ranges, and we also photographed both species at the same camera trap locations. With camera traps, we also recorded Geoffroy's cats *Leopardus geoffroyi* and jaguarundis *Puma yagouaroundi*, that are sympatric with both species of foxes.

In addition to the observations of several medium-sized carnivores sharing spatial-temporal habitats, we conclude that crab-eating foxes are more abundant in wetter and relatively closed habitats, whereas pampas foxes are more abundant on drier and relatively open habitats (Appendix 2). Camera trap records were useful for describing relative abundance among species and across sites as well as activity patterns: cumulative activity patterns were similar for both species, with an activity peak between 18:00-23:00h and reduced activity from 10:00-17:00h. Telemetry in contrast was useful for estimating individual home ranges, suggesting that the slightly larger crab-eating foxes utilize more extensive territories than do pampas foxes even though the former tend to occupy more productive environments. The two methods, camera traps and radio-telemetry respectively, provided complementary information on two sympatric fox species.

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Appendices

Appendix 1. Biological measurements of captured foxes at Kaa Iya National Park.
Ct= *Cerdocyon thous*, Pg= *Pseudalopex gymnocerus.*

Animal	*Species*	*Sex*	*Body**	*Tail**	*Foreleg**	*Ear**	*Weight***
Jorge	Ct	Male	67	33	14	7	6.50
Victoria	Ct	Female	70	31	7	13	5.00
Carmelo	Ct	Male	57	30	12	6	3.50
Tina	Ct	Female	67	30	13	7	4.75
Lisa	Ct	Female	60	33	13	7	5.00
Juliana	Pg	Female	58	38	13	8	3.50
Tatiana	Pg	Female	57	39	13	8	3.50
Tuicha	Pg	Male	63	39	13	8	5.25
Iyarasi	Pg	Female	57	35	12	7	3.50

*Expressed in millimeters
**Expressed in kilograms

Appendix 2. Captures per 1,000 trap nights at five research camps in the Kaa-Iya del Gran Chaco National Park and at San Miguelito Ranch.

Camp	*Precipitation (mm/year)*	*Forest type*	*C. thous*	*P. gymnocercus*
Guanacos	400	Chaco grassland	0	68
Cerro Cortado	500	Chaco dry forest	0 (but present)	12
Ravelo	700	Chaco-Chiquitano transitional forest	13	<1
Estación Isoso	750	Chaco transitional forest	15	1
Tucavaca	800	Chaco-Chiquitano transitional forest	17	0 (but present)
San Miguelito	1300	Chiquitano dry forest	158	0 (but present)