

Influence of group sizes and food resources in home-range sizes of capybaras from Argentina

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Within a species, home-range size can vary due to intrinsic and extrinsic factors. In this study we test the hypotheses that social group sizes (intrinsic) of capybaras (*Hydrochoerus hydrochaeris*) and food availability in their habitat (extrinsic) affect their home-range sizes. We used the minimum convex polygon method to estimate home-range sizes and core areas (the area in which each group was present during all seasons). Home-range size estimates varied from 11.3 ha to 27.6 ha ($\bar{X} = 19 \text{ ha} \pm 1.89 \text{ SE}$). Core area accounted for a mean 22.5% of the total home-range size. Home ranges measured during autumn and winter were significantly larger than those recorded in spring and summer. The correlation between home-range size and mean number of adults in groups was marginally significant, whereas that between home-range size and the overall average group size was not significant. We observed a significant negative linear correlation between home-range size and estimators of food availability. The evidence that we determined does not allow us to establish any relationship between group size and home-range size, but it lends support to the hypothesis that the abundance of food resources is a major limiting factor in determining home-range size.

Key words: Argentina, capybara, group size, home range, Iberá wetlands, minimum convex polygon method, resources

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Understanding the habitat requirements of a species and the reasons why it selects a particular area in which to live are critical for the effective sustainable management of wildlife populations. The home range is the space used by each individual or social group for basic activities such as feeding, reproduction, parental care, and rest (Burt 1943; Jewell 1966). Home-range size and shape can vary seasonally or irregularly in response to several factors, well exemplified in rodents (Maher and Burger 2011). Thus, intrinsic factors such as sex (Eiris and Barreto 2009), habitat quality (i.e., resource availability and dispersion—Endries and Adler 2005; Fridell and Litvaitis 1991; Hayes et al. 2007), environmental fluctuations such as seasons (Harris and Leitner 2004; Lurz et al. 2000; Quirici et al. 2010; Schradin and Pillay 2006), disturbances (Braun 1985; Schradin and Pillay 2006), changes in population density (Erlinge et al. 1990), predator density

(Hubbs and Boonstra 1998), and body mass and energetics (Harestad and Bunnell 1979; McNab 1963) all influence home-range size and shape, as do changes in these variables through time. Social organization, that is, group structure and size, also can affect a species' use of space (Branch 1993; Burton and Krebs 2003; Herrera and Macdonald 1989; Rayor 1988; Wang et al. 2011).

The capybara (*Hydrochoerus hydrochaeris*) conducts most of its activities on seasonally flooded stretches of land along water bodies or in the water (less than 500 m from the water's edge—Ojasti 1973; Quintana et al. 1998a, 1998b). Water bodies are important for feeding, mating, thermoregulation,



and escape from predators, whereas higher ground is used to rest and feed (Alho et al. 1989; Herrera and Macdonald 1989). During periods of drought, groups of capybaras come together to form aggregates with large numbers of individuals (Herrera and Macdonald 1987; Maldonado-Chaparro and Sánchez-Palomino 2010; Ojasti 1973; Schaller and Crawshaw 1981). Thus, the home range used by capybaras includes a mosaic of environments that meet their ecological requirements (Barreto and Herrera 1998; Herrera and Macdonald 1989); in some cases this home range can be slightly overlapped, constituting a territory (Herrera and Macdonald 1989). Herrera and Macdonald (1989) found that all capybara home ranges they studied included a patch of grass, a section of a water body, and a portion of higher dry land; they also found a correlation between group size and home-range size.

In Argentina, the capybara is a natural resource of great social and economic importance in many areas of its distribution because of its high productivity and quality of its meat and leather (Ojasti 1973, 1991; Quintana et al. 1994). Despite the ecological and socioeconomic importance of this species and numerous attempts to design management plans in South America, there are significant information gaps on various issues of the biology and ecology of capybaras (Bolkovic et al. 2006). Previous studies on home ranges and territorial behavior of capybaras were conducted in habitats with different climate–hydrological conditions such as the Colombian and Venezuelan savannahs (Herrera and Macdonald 1989; Perea and Ruiz 1977), the Paraguayan Chaco (Campos Krauer 2009), the Brazilian Pantanal (Alho and Rondon 1987; Schaller and Crawshaw 1981), and the Amazon rain forest (Soini and Soini 1992). In Argentina, the Iberá wetland system with a subtropical–humid climate constitutes a potentially optimal habitat for this species (Adámoli et al. 1988; Álvarez 2002) and capybaras exhibit their highest abundances in this country (Bolkovic et al. 2006); however, there are currently no ecological studies for this species under such conditions. Thus, the 1st aim of our paper was to analyze capybara home ranges, the levels of overlap between adjacent home ranges, and the seasonal variation and relationships of home range with group size and food availability, in order to generate basic ecological information that will help design and implement sustainable management measures. We also aimed to test 2 hypotheses on the variation on home-range size. Because capybaras' gregariousness appears to be the result of an antipredator strategy (Herrera and Macdonald 1989; Macdonald 1981), and grass is a homogeneously distributed resource, we predicted a positive relationship between social group size and home-range size, and that habitat food availability affected capybara home-range size; in this case we predicted a negative relationship between food availability and capybara home-range size (e.g., see Saïd and Servanti 2005). We also tested the hypothesis that home range constitutes a territory for capybara groups and we predicted a low overlap between home ranges of capybara groups.

MATERIALS AND METHODS

Study area.—Our study was conducted within Guayaibí Park (28°00'S, 57°18'W), a former livestock farm located to the north of the central Iberá wetland system, in Los Campos District (Carnevali 2003), Corrientes Province, Argentina. Guayaibí Park covers an area of about 750 ha, corresponding to a sandy ridge bordered by marshes. The sandy ridge includes 5 rounded, shallow lakes of wind-pseudokarstic origin (Carnevali 2003; Conservation Land Trust 2006; Fig. 1). The landscape is dominated by “paja colorada” grassland, mainly represented by *Andropogon lateralis*, *Axonopus fissifolius*, and *Rhynchospora barrosiana* (Carnevali 2003; Corriale 2010). The rounded, shallow lakes—also called deflation basins—have a well-defined area, and contain water almost permanently. In the ecotone between the terrestrial and aquatic environments, there are 2 transition zones at different heights; during the rainy season (spring–summer, September–March), the upper one is occasionally waterlogged, whereas the lower one is permanently waterlogged. In the low-lying area there are patches of floating soil (“embalsados”) and limnetic areas with aquatic and palustrine vegetation. Some temporary ponds fill with water only during the rainy season (spring–summer) or occasional periods of prolonged or intense rainfalls. The area corresponds to a private ecological reserve under low grazing pressure, where grassland areas are subject to low-intensity fires during autumn and winter (Corriale 2010).

Climate is subtropical–humid, with hydric and thermal seasonality. Rainfall occurs in all seasons but it is heavier in spring (21 September–20 December) and summer (21 December–20 March). Annual average rainfall is approximately 1,700 mm (Neiff and Poi de Neiff 2005). In summer average and maximum temperatures are 27°C and 44°C, respectively, and in winter average temperature is 16°C, with the historical record of minimum temperature over the past 50 years being –2°C.

Home range.—The study area was searched on horseback for capybara groups. Ten capybara groups were randomly selected and seasonally monitored during 1 day from sunrise to sunset over 2 years. We recorded the number of individuals and the position of each group every 30 min using a Bushnell Spacemaster telescope (15–45×60 mm, Bushnell, Overland Park, Kansas) from a 2-m-high platform located 50–300 m from capybara groups. The positions of each group were estimated by measuring the position of the edge individuals (minimum 5) through their distances to the observer and the angle between the line from the observer to the group and the line to the north. Distances were measured with a laser distance Yardage Pro Compact 800 Bushnell, (Bushnell, Overland Park, Kansas) (accuracy ± 1 m), angles were measured with a handheld compass, and the position of the observer was obtained with a satellite positioning device (global positioning system; Garmin Vista HCX E-trex; Garmin, Olathe, Kansas). The number of daily data points for each season varied according to day length, from 0700 to 1815 h in spring, summer, and winter and from 0745 to 1730 h in autumn. At the

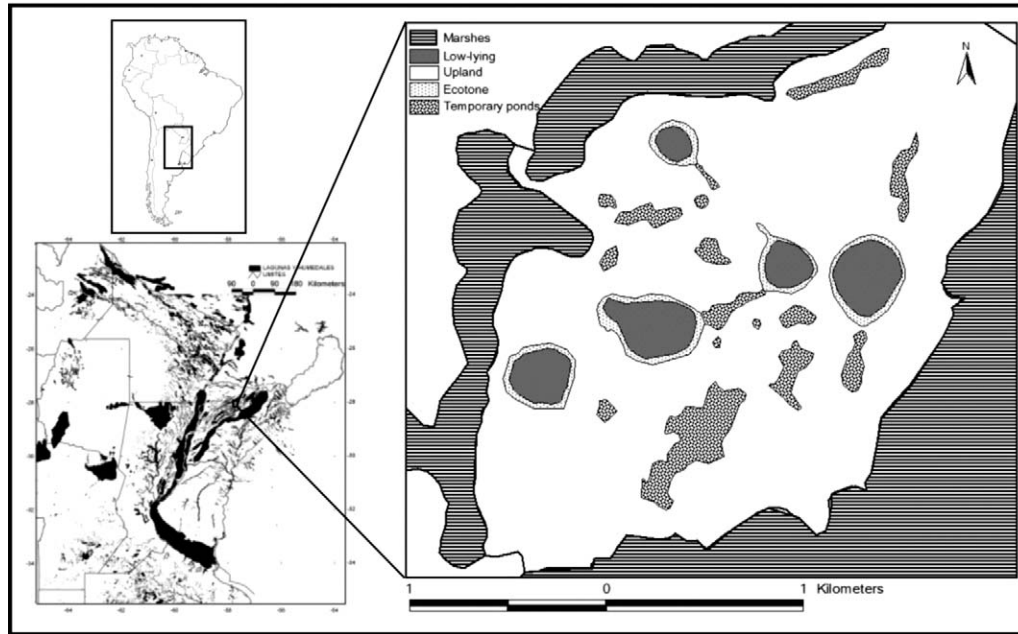


FIG. 1.—Study area. a) Satellite image (Landsat) of Guayaibí Park ($28^{\circ}00'S$, $57^{\circ}18'W$) located to the north of the central Iberá Macrosystem. b) Thematic map of environments based on the interpretation of aerial photographs (1:20,000 scale) and satellite imagery (Landsat), with further field validation.

beginning of each sampling we checked the position and number of groups in each shallow lake. In parallel, in order to corroborate the identification of the groups, we recognized the males by natural markings such as scars in the skin, size and shape of the nasal gland called “morrillo,” and the coloration of the crotch. These natural markings were photographed in order to identify groups at different seasons.

The geographic analysis program Arcview GIS (version 3.3; ESRI, Redlands, California) and the Spatial Analyst extension were used for home-range estimations for each group of capybaras using the minimum convex polygon method (Jenrich and Turner 1969; Mohr 1947; Stickel 1954). We used the minimum convex polygon method because it is objective, it is not limited by assumptions of distribution of observations, and it is commonly used in studies of habitat use, allowing comparisons with other studies (Van Soest 1994). On one hand, we did not test for autocorrelation because the use of this method minimizes the sensitivity of our analyses to dependence of successive data points (Cooper and Randall 2007; Swihart and Slade 1985, 1997). On the other we considered that there was sufficient time between readings to allow the movement of individual capybaras across their area, therefore suggesting that successive data points are not temporally dependent (Harris et al. 1990; Otis and White 1999; Rooney et al. 1998; Santos and Lacey 2011; Swihart and Slade 1997; White and Garrott 1990). Because the minimum convex polygon method is sensitive to outliers, we removed the positions of 3 lone individuals that moved away long distances (100 m or more from other individuals of the same group), considering this behavior as exploratory movements.

Because capybaras are naturally aggregated in social units (Herrera and Macdonald 1987; Ojasti 1973), we considered

each capybara group as the observational unit. Overall home-range area was estimated as the maximum area used by each group throughout the 2 sampling years, whereas the seasonal home-range area was calculated as the area used by each group in each season (each one grouping data from the same season of the 2 successive studied years). We defined a core area as a measure of site fidelity, the area in which each group of capybaras was present during all seasons. We estimated the ecological density as the number of individuals per group within the home range. We also used the geographic analysis program Arcview GIS (version 3.3; ESRI) and the Spatial Analyst extension to estimate the percent overlap of home ranges and core areas.

In order to evaluate the influence of years and seasons in home-range sizes, a general linear mixed model was applied with home-range size as the dependent variable, and the years and seasons as the independent variables. Capybara groups were included as a random factor. To validate the simple model corresponding to such restrictions, we calculated the proportion of variability among home-range sizes accounted for by the various factors. When significant differences were found, Fisher's least significant difference test ($\alpha = 0.05$) was carried out. We used InfoStat software for all statistical analysis (Di Rienzo et al. 2011).

A Spearman rank correlation coefficient (Sokal and Rohlf 1995) was used to detect potential correlations between home-range size and core-area size. The normality and homoscedasticity assumptions were tested using the Shapiro–Wilk W -test and the Levene test for homogeneity of variances, respectively. Data were presented as mean \pm standard error, whereas median and upper and lower quartiles were used if those variables did not show normal distribution.

Group size and home range.—Overall group size was estimated as the statistical mode of the number of individuals per group recorded every 30 min throughout the day (Herrera and Macdonald 1989). At sunset, we estimated the number of adults in each group (using Tasco 8–20 × 50 Zoom binoculars; Tasco, Overland Park, Kansas) by walking around the groups at distances of 1–20 m. Age structure was estimated by eye using the body-size categories described by Ojasti (1973): adults (over 18 months, more than 35 kg), subadults (12–18 months, 22–35 kg), juveniles (4–12 months, 7–22 kg), and infants (less than 4 months, less than 7 kg).

Pearson correlations were conducted to evaluate the relationships between home-range sizes (estimated throughout the study period and for each season) and overall group size, number of adults, number of adult males, and number of adult females.

Home range and food availability.—Simple regressions were calculated to evaluate a possible relationship between home-range size and food availability. Because the capybara is a selective herbivore (Barreto and Herrera 1998; Escobar and González-Jiménez 1976; Ojasti 1973; Quintana 1996; Quintana et al. 1994) that feeds mainly on grasses and forbs of small size (Escobar and González-Jiménez 1976; Quintana et al. 1994, 1998a, 1998b), we assumed that it was appropriate to use the categories grasses, Cyperaceae, graminoids and green plant material cover throughout the study period in our estimations of food availability. A total of 1,200 censuses (150 surveys per season) distributed in different habitats were conducted in randomly selected plots of 1 m². In each plot, the percentage cover of green plant material and the abundance-cover of the vegetation were estimated. The latter was calculated using the modified Braun–Blanquet scale (Mueller-Dombois and Ellenberg 1974). In each habitat type, the variables measured in each census were averaged and we calculated a weighted average of grasses, Cyperaceae, and graminoids considering the representation of each habitat in the study area. These variables were arcsine square-root transformed for the regression analysis. For each season, we used the average home-range sizes of each of the 10 groups selected.

RESULTS

Home range.—A total of 1,840 locations were obtained from 10 groups studied from November 2006 to October 2008 (184 locations per group). For each social group, we recorded at least 5 locations of border individuals in each group. All groups could be found across all location records.

Home-range sizes of 10 capybara groups varied between 11.3 ha and 27.6 ha ($\bar{X} = 19 \pm 1.89$ ha; Table 1), with great overlap between neighboring groups (46.2% of the area occupied by home ranges overlapped; Fig. 2). The average core area was 4.27 ± 0.62 ha, accounting for a mean of $22.5\% \pm 3.3\%$ of the total home-range area and showed a slight overlap of 4.2% (Fig. 3).

TABLE 1.—Total group size (TGS), adult group size (AGS), home range (HR), and core area (CA) of capybaras (*Hydrochoerus hydrochaeris*) in the Esteros del Iberá, Argentina. G: group; ED: ecology density (density within the home range).

G	TGS	AGS	HR (ha)	CA (ha)	ED (individuals/ha)
1	35	18.4	16.93	4.27	2.07
2	33.6	18	27.46	6.81	1.22
3	27.8	14.3	14.63	1.90	1.90
4	35.6	17.9	22.57	4.40	1.58
5	33.3	16.8	27.60	4.82	1.21
6	31.6	14.6	11.30	3.06	2.80
7	29.2	16	23.71	4.84	1.23
8	33.4	17	15.78	1.00	2.12
9	29.3	14.6	12.34	3.61	2.37
10	25.8	14.5	17.27	7.41	1.49
\bar{X}	31.5	16.2	19	4.2	1.8
SD	3.3	1.6	6	1.9	0.5

The fitted general linear mixed model shows that the home-range sizes did not vary significantly between seasons and years (season × year: $F_{3,63} = 1.93$, $P = 0.1341$). There were significant differences in capybara home-range sizes among seasons ($F_{3,63} = 7.59$, $P = 0.0002$), 8.05 ± 4.25 ha in spring, 6.95 ± 3.48 ha in summer, 11.64 ± 4.2 ha in autumn, and 13 ± 5.97 ha in winter. No differences were observed between years ($F_{1,63} = 1.69$, $P = 0.1981$). Home-range sizes recorded during autumn and winter were significantly larger than those registered in spring and summer, whereas no differences were found between autumn and winter and between spring and summer ($P < 0.05$).

Group size and home range.—The correlation analyses between home-range size and mean number of adults in the group approached significance ($R_S = 0.60$, $P = 0.064$), whereas the correlation analyses between home range and overall average group size were not significant ($R_S = 0.36$, $P = 0.305$). Core area also was not correlated with the mean number of adults or the overall average group size ($R_S = 0.16$, $P = 0.664$ and $R_S = -0.15$, $P = 0.688$, respectively). No significant correlations were found between seasonal home ranges and total group sizes or number of adults in the group (Table 2). We did not find any significant association between the home-range size and number of adult males ($R_S = 0.69$, $P = 0.06$) or number of adult females ($R_S = 0.56$, $P = 0.09$).

Home range and food availability.—We found a significant negative linear correlation between home-range size and the arcsine of the square root of the percentage of grass cover ($R^2 = 0.66$, $P = 0.015$), graminoids ($R^2 = 0.67$, $P = 0.013$), and green plant material ($R^2 = 0.71$, $P = 0.009$), whereas no significant correlation was observed with the percentage of Cyperaceae ($R^2 = 0.39$, $P = 0.095$).

DISCUSSION

Factors such as social group sizes and resource availability may affect movements patterns and in consequence the home-range sizes of individuals or social groups (Maher and Burger

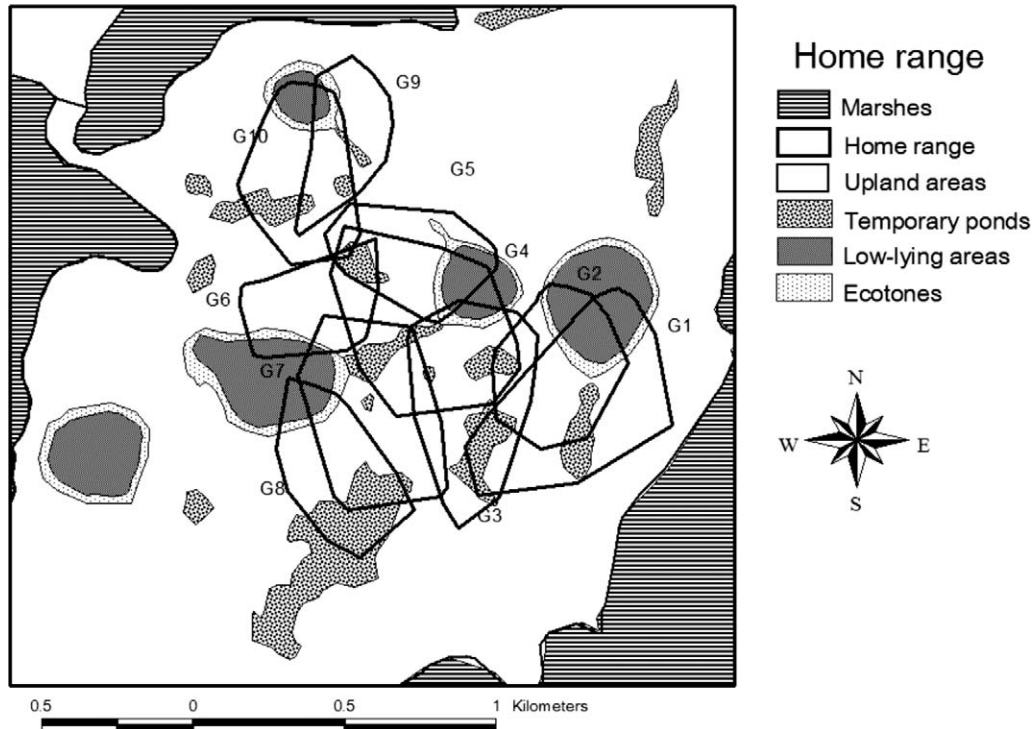


FIG. 2.—Home range of 10 capybara groups in the study area during November (2006) and October (2008) on a sandy ridge of the Esteros del Iberá (Corrientes Province, Argentina).

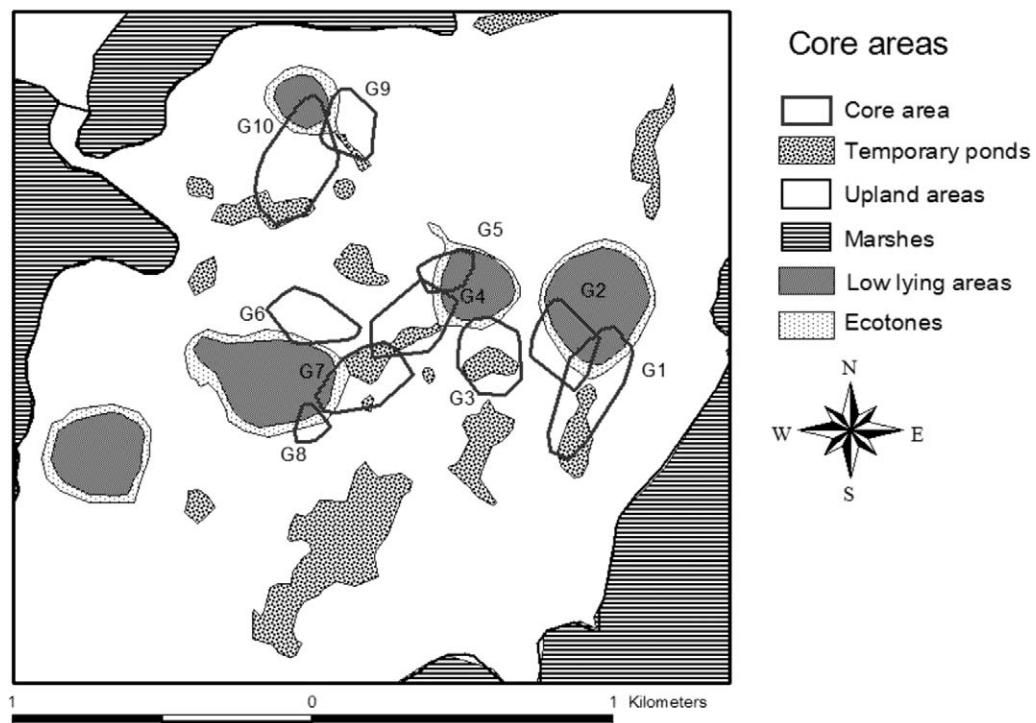


FIG. 3.—Core areas of 10 capybara groups in the study area during November (2006) and October (2008) on a sandy ridge of the Esteros del Iberá (Corrientes Province, Argentina).

TABLE 2.—Correlation results between seasonal home range (SHR) and group sizes during the spring 2006–winter 2008 period in the Esteros del Iberá, Argentina. AGS: adult group size; TGS: total group size; R^2 : regression coefficient; Sp: spring; S: summer; A: autumn; W: winter.

SHR	AGS		TGS	
	R_s	P	R_s	P
Sp 06	0.22	0.539	0.03	0.927
S 07	0.33	0.352	−0.18	0.616
A 07	0.43	0.217	−0.04	0.908
W 07	−0.22	0.538	−0.65	0.053
Sp 07	−0.05	0.889	0.19	0.594
S 08	0.16	0.664	0.02	0.951
A 08	0.54	0.108	0.43	0.219
W 08	0.01	0.969	0.42	0.225

2011; Wang et al. 2011). However, our 1st hypothesis was not supported by our results because no relation was found between home-range sizes and social group sizes. This also contradicts studies on other mammals (Maher and Burger 2011; Wang et al. 2011). On the other hand, in agreement with the 2nd hypothesis and with previous studies on mammals (McLoughlin and Ferguson 2000), food availability did affect home-range sizes.

It is important to point out that home ranges obtained in this work provide a minimum value because the study was conducted during daylight hours without considering the areas occupied during the night, at which time, even when the activity is much lower, capybara groups are known to move greater distances away from bodies of water (Campos Krauer 2009; Herrera and Macdonald 1989; Schaller and Crawshaw 1981). Taking this into account, the possible overestimation obtained by the use of the minimum convex polygon method, which is heavily influenced by peripheral locations (Don and Rennolls 1983), would not be as important in this study.

We considered that each group could be unambiguously identified because the number of social groups of capybaras was constant throughout the study period, the home ranges overlapped during the 8 seasons, and the adult males were found in the same area.

Home-range sizes for the 10 groups of capybaras observed during the study period were within the range of values recorded in previous studies for the species (reviewed by Herrera et al. [2011] and Soini [1993]). However, home ranges were extremely variable and comparison with other results should be made with caution considering the different environmental conditions and the lack of a uniform approach in the methodologies used to estimate home range. The results of the mean home-range size and the average size of capybara groups present in lakes of the Esteros del Iberá were similar to those found by Salas (1999) in the Venezuelan Llanos (home range: 15 ha, group size: 16 individuals) and somewhat higher than those reported by Herrera and Macdonald (1987) in a different location in the Venezuelan Llanos (home range: 16.1 ha using the minimum convex polygon method, 10 ha using the irregular polygons method; group size: 9.6 adults) and

those of Alho and Rondon (1987) in the Brazilian Pantanal (home range: 12 ha; group size: 10.6 individuals). In turn, in the Amazonian rain forest (with hydric seasonality) Soini and Soini (1992) presented similar home-range values that varied from 17 to 22 ha; however, in contrast to our study, they pointed out that limits and extensions of these areas fluctuated from year to year and were not an exclusive territory. Group sizes reported for this habitat were lower than those obtained in our study (4.8 ± 2.4 individuals—Soini 1993).

Our results support the trend observed by Herrera et al. (2011) that suggests a positive relationship between the overall capybara group size and population density. This relationship also has been reported in other rodent species (Lucia et al. 2008; Randall et al. 2005).

Our results do support the 2nd hypothesis, which agrees with the common observation that population density is associated with the productivity of different ecosystems (Alho et al. 1987a; Quintana and Rabinovich 1993; Robinson and Redford 1986). The results of our study were similar to those obtained by Salas (1999) in the Venezuelan savannas where the basic resources (water and forage) are maintained to be spatially homogeneous and constant throughout the year by means of hydric management (Salas 1999), resulting in conditions similar to those of our study area. Moreover, our results differed from those carried out in less-productive habitats such as the Dry Paraguayan Chaco and Pantanal. In the 1st case, Campos Krauer (2009) observed small group sizes (2–6 individuals) with wide home ranges (minimum convex polygon: 583 ha) and with an approximated ecological density that varied between 0.003 and 0.01 individuals/ha; whereas in the 2nd case, Alho et al. (1987a) estimated an ecological population density of 0.4 individuals/ha. Similarly, populations in alluvial forest in Amazonian Peru presented low density values and strong fluctuations over time due to the instability of the habitat (0.041–0.258 individuals/ha—Soini 1996). These results would support the hypothesis that the abundance and spatiotemporal predictability of resources are major limiting factors in determining population density and home-range sizes (McLoughlin and Ferguson 2000).

Core areas were always located near water (Fig. 3), emphasizing the importance of this resource for survival and reproduction of capybaras (Herrera and Macdonald 1989). The recorded values are similar to the minimum areas of the range observed by Alho et al. (1987a, 1987b) in the Pantanal of Brazil, although these were estimated using different methods. The values obtained by Alho et al. (1987a, 1987b) for core areas ranged from 3 to 50 ha ($\bar{X} = 9.4$ ha), accounting for 12% of the home range, and are lower than those found in our study.

Seasonal fluctuations in home-range sizes were closely related to variations in the composition and abundance of vegetation and water availability. Home-range areas were smaller during the period of the year with high precipitation levels and forage availability (spring–summer), whereas they were higher in the driest period (autumn–winter). Both environmental factors were similar in all habitats between spring and summer and between autumn and winter (Corriale

2010); therefore, no differences in home ranges between the mentioned seasons were observed. On the other hand, the increase in home-range size observed during autumn and winter (period of lower temperatures and rainfall) would be associated with the decrease in forage availability (reduced cover of grass, graminoids, and green plant material—Corriale 2010). Indeed, we found a significant negative association between home-range size and the estimators of food availability. This could mean that different strategies appear to be carried out under different scenarios (i.e., seasons), acting as energy maximizers in periods with relatively lower forage availability, using open space (grassland) with increased risk of predation, whereas acting as a time minimizer when food availability is high, giving priority to minimizing foraging in open areas (Hixon 1980; Torres-Contreras and Bozinovic 1997).

Size and composition of social groups are considered important factors influencing home-range sizes of rodent social groups (Ågren et al. 1989a, 1989b; Batzli and Henttonen 1993; Herrera and Macdonald 1989; Wang et al. 2011), although few studies have focused on these factors. In our study, contrary to what Herrera and Macdonald (1989) observed in capybaras, we did not detect a positive relationship between home-range size and group size, probably due to little variation in the size of social groups (adult group sizes and total group sizes ranged from 14 to 19 and from 25 to 36 individuals, respectively; overall mean group size in our study area ranged from 25 ± 6 to 31 ± 8 individuals), whereas in the work of Herrera and Macdonald (1989) the adult group sizes ranged from 5 to 15 individuals and total group sizes varied from 5 to 40 individuals. The low variability in number of individuals per group could be associated with a good-quality habitat and the lack of perturbation caused by hunting pressure. Quintana and Rabinovich (1993) observed that group sizes were relatively constant in different populations in Corrientes Province (Argentina), but recorded greater variation in sites severely altered by hunting activities.

The distribution of home ranges in our study (Fig. 2) shows a high degree of overlap, whereas capybara home ranges in the Venezuelan Llanos showed little overlap (Herrera and Macdonald 1989). Considering that a territory is an area inside the animal's home range on which it has exclusive or priority use and that this territory can coincide with the home range or simply be part of it (Powell 2000), our evidence indicates that home ranges in Iberá do not constitute territories as they do in Venezuela. In our study, group territories seem to be restricted to core areas where little or no overlap occurred (Fig. 3). The wide overlap observed between home ranges in our study may be related to territorial economy (e.g., Brown 1964; Davis 1978), where the costs of defending a territory outweigh the potential benefits. Carpenter and MacMillen (1976) suggested that, in theory, an animal should be territorial only when resources are limited. When productivity is low, the costs of defending a territory are rewarded with the exclusive use of limited resources, whereas when productivity is high, the requirements can be met without such exclusiveness (Powell

2000). Even though there are seasonal fluctuations in resource availability in the study area, it is probable that these fluctuations are not as strong as in the Venezuelan plains where the dry season is extremely severe (ponds dry up almost completely and productivity is negative—Herrera and Macdonald 1989), and therefore environmental pressures in Iberá are less stressful than those of the Venezuelan Llanos. Consequently, individuals would diminish their aggressiveness, sharing part of their home range with individuals from other social groups and with a larger number of individuals within their social group (Schaffner and French 1997; Soto-Gamboa 2003). In fact, in our study area, social structure of capybara groups showed a greater number of males in the group during seasons of greater resource availability (M. J. Corriale, pers. obs.). In Venezuela, Herrera and Macdonald (1987) reported territorial behavior, smaller group sizes, and expulsion of intruders in order to keep the group membership.

Our work and previous studies conducted in different ecosystems agree with the notion that home ranges are variable and related to both food and water availability and the number of adults in the group (Dawson 1979; Myrsetrud and Ims 1998). This variation suggests that unsuccessful attempts to conduct sustainable management plans in wild populations of capybaras could be due, in part, to the extrapolation of ecological information obtained in other regions. Further, human activities are increasingly disrupting the environment, mainly by converting cattle-ranching land to rice crops, forestation, and pastures and also by altering the natural hydrological rhythms for such activities (Neiff 2004). In this context, our results may help to improve the actual or future capybara management plans, which will be among the top priorities in the short term for balancing human economic development and the health of capybara populations in the wetlands of northeastern Argentina.

RESUMEN

El área de acción puede variar dentro una especie debido tanto a factores intrínsecos como extrínsecos. En este trabajo nosotros pusimos a prueba la hipótesis de que el tamaño de grupo de carpinchos (*Hydrochoerus hydrochaeris*) y la disponibilidad de forraje afecta el área de acción. El área de acción y el área de uso efectivo fueron estimadas por el método del polígono mínimo convexo. El área de acción varió de 11.3 ha a 27.6 ha (media 19 ha \pm 1.89 ES). El área de uso efectivo representó un 22.5% del total del área de acción. Áreas de acción registradas durante el otoño y el invierno fueron significativamente mayores a las registradas en primavera y verano. El análisis de correlación entre el área de acción y el tamaño medio de grupo de adultos fue marginalmente significativo mientras que el análisis de correlación entre el área de acción y el tamaño de grupo total no fue significativo. Por otro lado, una correlación lineal negativa fue encontrada entre el área de acción y los estimadores de la disponibilidad de forraje. En síntesis la evidencia encontrada en este trabajo no permite establecer una relación entre el tamaño de grupo y el área de acción pero sí

avala la hipótesis que indica que la abundancia de alimento constituye uno de los factores limitantes en la determinación del tamaño del área de acción.

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