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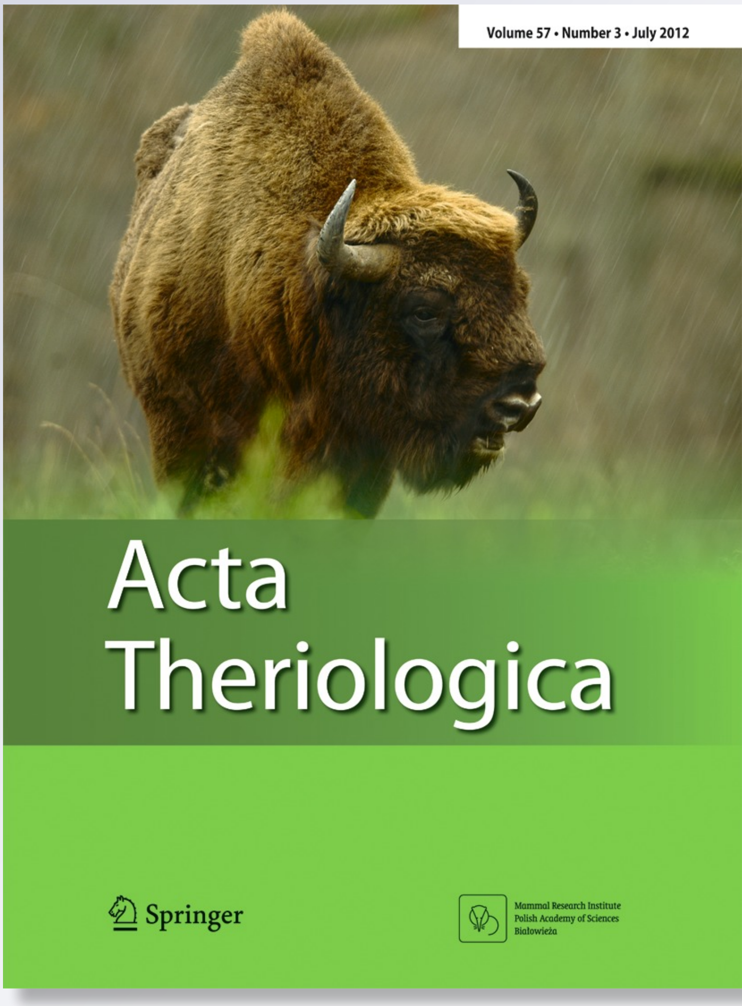

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ORIGINAL PAPER

Diet selection of the southern vizcacha (*Lagidium viscacia*): a rock specialist in north western Patagonian steppe, Argentina

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Abstract The southern vizcacha (*Lagidium viscacia*) is a rock specialist that inhabits small colonies in isolated rocky outcrops of northwestern Patagonia. This study analyzes its diet selection in relation to food availability, establishes the degree of dietary specialization, and discusses the potential competition with exotic herbivores. Diet composition and food availability were determined in summer and winter in eight rocky outcrops by microhistological analysis of fecal pellets, and food availability was estimated by the Braun Blanquet cover abundance scale. Vegetation cover differences were detected by using a random analysis of variance (ANOVA) factorial block design, and dietary preferences were determined by the confidence interval of Bonferroni. The southern vizcacha showed a specialized feeding behavior despite the consumption of a wide variety of items. Their diet was concentrated on a few types of food, mainly grasses, and the trophic niche was narrow and without seasonal variations. In winter, when food was scarce and of lower quality than summer, diet was dominated by *Stipa speciosa*, suggesting a selection according to the selective quality hypothesis. Our results (narrow trophic niche, restricted activity near rocky outcrops, and a diet with high proportions of low-quality grasses) showed that the vizcacha is an obligatory dietary specialist, and these characteristics made it highly vulnerable to changes in food availability. In this scenario, overgrazing caused by alien species with similar diets, as the European hare and livestock, could negatively affect their colonies.

Keywords Trophic niche · Food quality hypothesis · Rocky outcrops · Selectivity

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Introduction

The diet selection of herbivores is a complex process that depends on the interaction of various factors such as the abundance and quality of food, the presence of toxins in plants, predation risk, and competition (Crawley 1983; Belovsky 1986; Stephens and Krebs 1986; Senft et al. 1987; Brown 1988; Stuth 1991; Sih 1993; Dearing et al. 2000). Moreover, the use of refuges, water availability, and topography can also influence dietary selection (Covich 1976; Ellis et al. 1976; Senft et al. 1987; Stuth 1991; Kotler and Brown 1999). Rocky habitats are unique environments in the world, with a wide variety of flora and fauna, and have many endemic species of high conservation value. They serve as refuges from climatic fluctuations, fire, human activities, and predation (Matheson and Larson 1998; Nutt 2007). The feeding behavior of specialized animals in this type of habitat is limited to the vicinity of the rocky refuge, because travel costs and risk of predation increase with distance to rocks (Covich 1976; Huntly 1987; Holmes 1991; Kotler et al. 1999; Galende 2010). For these consumers, feeding distances depend mainly on the abundance of food in the proximities and the risk of predation; therefore, the selection of diet will be influenced by these costs. This feeding behavior produced a high intensity of grazing in the vicinity of the rocky shelter and in some cases, modifies the surrounding plant communities (e.g., Huntly 1987; Branch and Sosa 1994; Branch et al. 1996). In addition, the coexistence with herbivores of similar diets could reduce food availability and lead to changes in the diets (Sih 1993).

The selection and use of a particular type of food also depends on the physiological limitations (Hanley 1982; Penry 1993), the smaller herbivores have a nonspecialized digestive system to extract nutrients from low-quality food, and they must eat low fiber and high in protein items (Milton 1979; Crawley 1983; Dement and Van Soest 1985; Bergeron and Jodoin 1987; Caughley and Sinclair 1994). Despite of these restrictions, some rodents obtain energy and nutrients from low-quality grasses by increasing the digestive tract capacity, post-gastric fermentation, or coprophagy (Bozinovic et al. 1988; Veloso and Bozinovic 1993; Bozinovic 1995; Sassi et al. 2007; Naya et al. 2008). The degree of dietary specialization of an herbivore could be determined by parameters such as the trophic niche breadth, responses to seasonal changes in food availability, spatial scales, and the processing of "difficult foods." For example, specialist herbivores possess unique physiological, behavioral, and anatomical characteristics that allow them to consume large amounts of one type of food, which could be unpalatable to other herbivores (Shipley et al. 2009). However, these characteristics could limit a population's capacity to respond to environmental changes (Crawley 1983) and enhance its vulnerability, particularly for specialized herbivores in restricted habitats.

The southern vizcacha (*Lagidium viscacia*, Molina 1872) is an ideal species for studying the feeding behavior of a rock specialist, because its activity is associated to the rocky substrate and decreases at greater distances from rocky outcrops (Walker et al. 2000a; Walker 2001; Reus Ruiz 2006; Galende and Raffaele 2008; Galende 2010). In northwestern Patagonia, the vizcachas are distributed throughout the Andes Mountains at altitudes over 2000 m; and toward the east, in rocky outcrops located at ca. 700 m in the steppe (Crespo 1963; Pearson 1995; Galende et al. 1998). In this region, this medium-sized rodent (2000 g) lives in colonies (<20 individuals) constituted by small family groups and produces one offspring per year (Weir 1971; Walker et al. 2000b; Walker 2001). Diet composition is based on grasses (Galende et al. 1998; Galende and Grigera 1998; Puig et al. 1998), and have high similarity with diets of exotic herbivores as European hare (*Lepus europaeus*) and livestock (Galende and Grigera 1998). Their predators are eagles (*Geranoatus melanoleucus*) and owls (*Bubo magellanicum*), but the rate of predation is low (Galende and Trejo 2003).

In Argentina, the conservation status of this species is of low risk and least concern (Díaz and Ojeda 2000). However, it is presumed that in the Patagonian steppe, vizcacha populations are declining, probably due to hunting, restricted and fragmented habitats, and food competition with exotic herbivores (Walker 2001).

The objectives of this study were to determine the diet composition and food selection in relation to availability and to establish the dietary specialization degree of this rock specialist herbivore. We also discuss the possible competition with the exotic European hare and livestock.

We propose the hypothesis that due to specialized behaviors, these rock specialist rodents are selective consumers and have a narrow trophic niche. We expect a high consumption of grasses available near the rocky outcrops.

Material and methods

Study area

This study was carried out in eight rocky outcrops of NW Patagonian steppe (41º05 S; 70°03 W) in the western district of the Patagonian phytogeographic province. The steppe is dominated by grasses: *Stipa speciosa*, *Festuca pallescens*; and shrubs: *Mulinum spinosum* and Senecio spp. (León et al. 1998; Galende 2010). In this area, the rocky outcrops (vizcacha's typical habitats) are distinct entities, with a mean altitude of 750 m, and separated between them by more than 5 km in a homogeneous landscape. In Patagonia, as in some other sites of the world, the rocky outcrops are complex habitats surrounded by arid environment, which explains in part the limited information about them (Nutt 2007; Galende 2010). Mean annual precipitation is ca. 600 mm with high fluctuations among years (Farji-Brener and Ghermandi 2004). The mean temperature of the coldest month is 2.1 °C (July) and the warmest month is 15.3 °C (January; Muñoz and Garay 1985; Bustos 1996). There are significant seasonal changes in vegetation cover and winter is a critical period for the survival of animals (Somlo et al. 1985, 1994).The overgrazing by introduced livestock since the early 1900s, resulted in high degree of desertification in large areas of steppe and the rocky outcrops (Bertiller and Bisigato 1998; Adler et al. 2001). In addition to livestock in the last middle century, wild species such as the red deer (*Cervus elaphus*) and European hare (*L. europaeus*), which invaded different environments including the study area (Grigera and Rapoport 1983; Vázquez 2002), were introduced.

Field sampling

During the last days of August 2005 (winter season), at eight rocky outcrops (sampling areas) selected at random, we carried out vegetation sampling at three distances from the rocks: close (0–20 m), medium (20–50 m), and far (50–90 m). We established four 100 m transects at each outcrop, and 2×2 m plots every 10 m along each transect, with a total of ten plots per transect. At each plot, we estimate the cover percentage per species and functional groups (shrubs, grasses, and herbs), using the cover abundance scale of Braun-Blanquet. The average cover values were obtained from the scale values of conversion of this method (Mateucci and Colma 1982). To estimate seasonal variation in food availability, summer vegetation data were reanalyzed from Galende and Raffaele (2008). These data were collected with the same sampling methods and in the same rocky outcrops, during January 2005. Simultaneously during summer and winter, in 40 sampling units of 1 m diameter per outcrop, we collected 30 fresh fecal pellets in the vegetation transects. Fecal samples were formed by ten pellets randomly extracted from ten groups of feces, obtaining three samples from each sampling area, being in total 48 fecal samples. Freshness was evaluated on the basis of appearance and degree of aggregation of pellets.

Laboratory analysis

The diet of the southern vizcacha was studied by microhistological analysis of fecal pellets (Baumgartner and Martin 1939; Sparks and Malechek 1968). Unknown species of plants were collected to be included in the reference collection of our laboratory microhistological, which has a total of 96 plant species of the region. The fecal pellets and plants were processed with a similar treatment which consisted in drying them at 60 °C and milled to a size of 1 mm to reduce variation. The material was depigmented with 90 % alcohol, cleared with sodium hypochlorite and colored with safranin. Finally, the sample was mounted with glycerin jelly for microscopic observation (Sparks and Malechek 1968; Latour and Pelliza de Sbriller 1981).

A number of five slides per fecal sample were made to recognize plant fragments, and 20 microscopic fields in 100× magnification were observed for each slide. The presence of food items was recorded for each microscope field, and its percentage of occurrence was determined for all microscope fields (Holechek and Gross 1982). Plants consumed were grouped by epidermal characteristics into three functional groups: shrubs, herbs, and grasses (Gramineae and Cyperaceae and Juncaceae). The plant material found in fecal pellets was identified to species level whenever possible, using the reference collection of epidermal tissues of leaves, fruits, and flowers from our laboratory. Identification was based on the characteristics of the epidermis: the cell wall, the size of the fragments, stomata, and trichomes.

Statistical analysis

In summer and winter (2005), we analyzed the effect of distance from the outcrops on the vegetation by using a random block design with a factorial 3×3 analysis of variance (ANOVA; Zar 1999), where D=distances from the rocky outcrops (with three levels: close, medium, and far) and functional groups (FG=shrubs, herbs, grasses) were applied as factors. We used part of the summer vegetation data provided from our previous study (Galende and Raffaele 2008) and the winter sampling vegetation from this study to compare food availability between these seasons. Differences in plant cover between summer and winter were evaluated in eight rocky outcrops by a 2×3 factorial randomized block arrangement design with these factors: season (S; winter–summer) and functional groups (FG; herbs, grasses, and shrubs). Variability between outcrops was controlled considering each outcrop as a block, and the mean total cover of functional groups was used as a dependent variable. Data on the percentage of plant cover were transformed by square root, and normality assumptions were verified. We tested the significant differences in the ANOVA by applying posteriori Tukey test.

To assess seasonal differences in diet and cover of dominant species, we applied the Wilcoxon rank sum test for dependent samples (Zar 1999). In summer and winter, proportions of functional groups in diet were compared by Kruskal–Wallis ANOVA for multiple comparisons and significant differences between functional groups were detected by posteriori test.

The selection by functional groups and plant species (>5 %) in relation to their availability was detected by using simultaneous confidence intervals of Bonferroni (Neu et al. 1974; Byers et al. 1984). These intervals determine the actual proportion of use (pu) for each vegetation group and compare them to the expected proportion (pe=relative plant cover×diet frequency). Plant use was qualified as: selected, proportional, or avoided, depending on whether the expected proportion was located below, within, or above the confidence interval of the dietary frequency.

As an estimator of trophic specialization, in summer and winter, we estimated trophic niche breadth (B) with Levins' standardized index (Bst): Bst=$(B-1)/(n-1)$, where B is the Levins niche breadth and n is the number of resources available (Feinsinger et al. 1981; Krebs 1989). Values of this index near 0 indicate narrow trophic niche or more specialized diet, and values near 1 indicate a broader niche or more generalized diet.

Seasonal differences (winter–summer) in trophic niche breadth were evaluated using mean index values, and we applied the Wilcoxon test for dependent samples (Zar 1999).

Results

Vegetation composition

The vegetation was constituted by 77 plant species, and there were no differences in cover abundance (%) among sites (outcrops, Table 1). In summer, cover abundance (%) showed significant differences among functional vegetation groups (Table 1), and the herbs were less abundant (Tukey test, $p=0.01$). Functional groups no showed significant changes in relation to distance from rocky outcrops (Table 1).

Winter was similar to summer showing significant differences in cover abundance (%) between functional groups (Table 1), with low abundance of herbs (Tukey test, $p=0.01$). As in summer, functional groups no showed significant changes in relation to distance (Table 1). The cover of different functional groups depended on the season (Table 2). In winter, the shrubs ($F(1,56)=3794$, $p=0.01$) and grasses ($F(1,56)=763.7$, $p=0.02$) decreased significantly compare to summer.

The dominant grasses *F. pallescens* (Wilcoxon test $W=1.54$, $p=0.12$) and *S. speciosa* ($W=0.40$, $p=0.84$) showed no significant seasonal differences in cover. However, *Poa lanuginosa* ($W=1.96$, $p=0.04$) and the shrubs *M. spinosum* ($W=2.38$, $p=0.01$) and *Senecio* spp. ($W=2.38$, $p=0.01$) decreased significantly in winter (Table 3).

Diet selection

Southern vizcacha consumed 47 species from the total 77 available species (61 %) growing in the vicinity of the rocky outcrops, although the annual trophic niche breadth was narrow (Bst=0.25±0.01) and without significant variation between summer and winter (Wilcoxon test, $W=1.18$, $p=0.23$). The grasses were the main component and *S. speciosa*, *P. lanuginosa*, *Bromus* spp., and *F. pallescens* constituted 50 % of the diet (Table 3). The proportions of plants groups in diet showed no significant changes between summer and winter: grasses ($W=1.26$, $p=0.20$), shrubs ($W=0.56$, $p=0.57$), and herbs ($W=1.82$, $p=0.06$).

Table 1 Distance effects from the outcrop on the structure of the vegetation by using a random block design with a factorial 3×3 analysis of variance (ANOVA), where distances from rocky outcrops (*D*), with three levels—close, medium, and far—and functional groups (FG) with three levels—shrubs, herbs, and grasses—are applied as factors

	DF	MS	*F*	*P*
Winter				
Distances (*D*)	2	151.07	1.82	0.170
Functional groups (FG)	2	1085.71	13.11	0.001
D×FG	4	44.50	0.53	0.708
Rocky outcrops (*R*)	7	176.12	2.12	0.050
Error	56	82.80		
Summer				
Distances (*D*)	2	261.59	1.23	0.299
Functional groups (FG)	2	2795.35	13.17	0.001
D×FG	4	422.89	1.99	0.108
Rocky outcrops (*R*)	7	217.84	1.02	0.423
Error	56	212.21		

Table 2 Results of 2×3 factorial ANOVAs for the effects of seasonal variation (*S*), on the abundance of the functional plant groups (FG)

	DF	MS	*F*	*P*
Season (*S*)	1	9.276665	21.93	0.004
Groups (FG)	2	7.51281	17.76	0.001
S×FG	2	1.575279	3.72	0.034
Rocky outcrops (*R*)	7	0.678110	1.60	0.166
Error	35	0.422868		

The dependent variable is cover abundance (%) of functional plant groups: shrubs, herbs and grasses. $n=8$ are random blocks, seasons= winter–summer

R Rocky outcrops

Table 3 Food availability and diet composition of *Lagidium viscacia* in eight rocky outcrops in summer and winter

	Summer	Winter	Summer	Winter
Grasses				
Poa lanuginosa	2.49±1.01	0.89±0.38	7.62±0.97	6.41±0.95
Festuca pallescens	6.43±1.32	4.40.±1.32	9.74±1.64	5.59±1.12
Stipa speciosa	9.66±2.11	8.15±2.59	23.0±2.13	38.3±1.97
Bromus spp.	2.29±1.21	1.25±0.79	5.09±1.39	5.16±1.46
Hordeum spp.	1.23±0.65	0.61±0.60	2.38±0.96	2.41±0.89
Juncus balticus	0.11±0.11	0.01±0.01	1.97±0.86	0.53±0.46
Shrubs				
Mulinum spinosum	7.51±1.76	1.18±0.51	16.2±2.27	2.77±0.84
Senecio spp.	4.52±1.00	2.20±0.88	2.81±0.72	1.33±0.58
Berberis heterophyla	3.73±1.20	2.17±0.84	1.45±0.38	5.37±0.94
Adesmia spp.	1.26±1.07	–	0.56±0.18	2.53±1.35
Fabiana imbricata	1.60±0.79	0.34±0.28	1.42±0.57	8.89±1.82
Nasauvia glomerulosa	1.92±1.23	1.65±1.12	0.47±0.13	3.68±1.62
Herbs				
Eryngium paniculatum	0.47±0.30	0.62±0.38	2.60±1.19	4.34±1.56
Cerastium arvense (E)	1.36±0.27	0.38±0.27	1.46±0.29	1.51±0.26
Rumex acetosella (E)	3.30±0.30	0.46±0.30	3.63±0.84	0.27±0.12
Verbascum thapsus (E)	0.09±0.06	–	2.16±0.58	0.78±0.26
Plantago lanceolata (E)	0.95±0.95	–	1.22±0.36	0.21±0.11
Hypochoeris spp.	0.03±0.03	–	2.52±0.59	0.63±0.26
No identity			1.37±0.61	0.53±0.23

Availability is expressed as cover abundance (%) and food items (proportions>1%) as percentage of frequency (±ES), $n=48$ fecal samples

E Exotic species

In summer, food resources were more abundant, and the southern vizcacha consumed 47 plant species (Bst=0.28±0.06). There were significant differences in the contributions of plant groups (Kruskal–Wallis, $H(2,24)=16.4$, $p=0.03$), and the grasses were consumed in greater proportion than shrubs ($p=0.012$, Posteriori test p values) and herbs ($p=0.001$; Fig. 1). The main dietary components were *S. speciosa*, *F. pallescens* and *P. lanuginosa*; in addition, the consumption of flowers and fruits of the shrub *M. spinosum* was important (Table 3).

During winter, the diet was composed of 40 items, and there were significant differences in the proportions of functional plant groups ($H(2,24)=19.8$, $p=0.001$), these results being similar to summer. The grasses were consumed in highest proportions in comparison to herbs ($p=0.001$, Posteriori test p values). The trophic breadth was narrow (Bst=0.24±0.01), with the highest values of *S. speciosa*, and its consumption increased significantly in this season (Wilcoxon test, $W=2.24$, $p=0.02$). A similar pattern showed the shrubs *Fabiana imbricata* ($W=2.36$, $p=0.01$) and *Berberis heterophyla* ($W=2.24$, $p=0.02$). In contrast, the shrub *M. spinosum* decreased in the diet ($W=2.52$, $p=0.01$; Fig. 2).

The southern vizcacha showed a selective feeding behavior by grasses that were consumed in a highest proportion to their availability in summer and winter (Table 4). Among the main species of diet, *S. speciosa*, *P. lanuginosa*, and the herb *Eryngium paniculatum* were the only selected species in the two seasons; also selected were the shrubs *M. spinosum* and *F. imbricata* in summer and winter, respectively (Table 4).

Discussion

The southern vizcacha in northwestern of Patagonia showed a specialized feeding behavior despite of the consumption of a wide variety of plant species. The diet was concentrated on high proportions of a few types of food, and trophic niche was narrow and without significant variations between summer and winter.

This feeding behavior was reflected in a high consumption and selectivity for grasses in both seasons, despite the strong seasonal changes in food availability. In other regions of the country, the southern vizcacha's diet presented a similar pattern, showing a selective feeding behavior for grasses, and *S. speciosa* was the main dietary component (Galende and Grigera 1998; Puig et al. 1998; Galende et al. 1998; Reus Ruiz 2006). Our results showed that the vizcachas modified the proportions of some species in the diet according to the season (summer and winter), but they did not expand nor changed their trophic niche, thus showing a high dietary specialization. In contrast, in the Chilean altiplane, the vizcachas presented a more general dietary trend, and grasses were only selected in summer, probably because food resources were very limited, highly fluctuating, and unpredictable (Cortés et al. 2002). In Patagonia, the main forage species (*P. lanuginosa*, *S. speciosa*, and *M. spinosum*) contain the highest nutritional values in summer (Somlo et al. 1985) and constituted the most consumed items in the southern vizcacha diet. In winter, when the food availability declined and forage species had lower quality (Somlo et al. 1985), the diet of the southern vizcacha was characterized by high proportions of *S. speciosa*. Despite of its low quality, the grasses and this plant species generally have higher values of digestibility and protein and lower levels of secondary compounds (tannins and terpenes) than most of the shrubs growing near the rocky outcrops (Somlo et al. 1985; Cavagnaro et al. 2003). Our results suggested that the southern vizcacha was more selective when food abundance declined, because high-quality items were scarce or not palatable, as predicted in selective quality hypothesis (Weckerly and Kenedy 1992; Branch et al. 1994). This

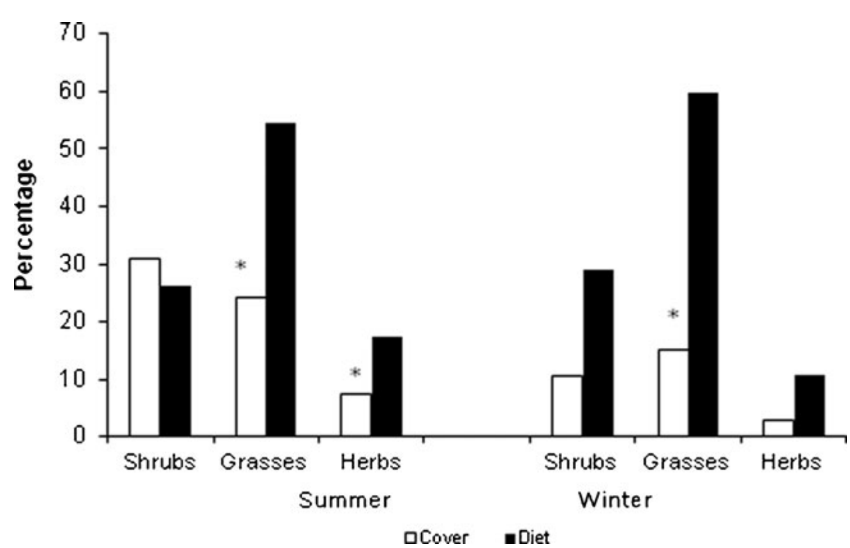

Fig. 1 Selection of functional groups by the southern vizcacha (*Lagidium viscacia*), in summer and winter, in the northwestern Patagonian steppe. Values are given in percentage, and asterisks (*) indicate selected item and significant differences ($p<0.05$)

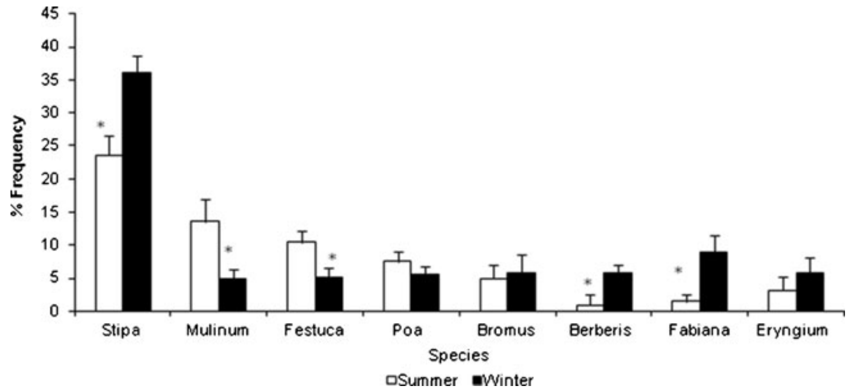

Fig. 2 Seasonal variation (summer–winter) of food items (>5 %) in the diet of the southern vizcacha (*Lagidium viscacia*). Values are expressed as the percentage of frequency (±SE), and asterisks (*) indicate significant differences ($p<0.05$). Dietary items: *Stipa: Stipa speciosa*, *Mulinum*: *Mulinum spinosum*, *Bromus*: *Bromus* spp. *Poa*: *Poa lanuginosa*, *Festuca*: *Festuca pallescens*, *Eryngium*: *Eryngium paniculatum*, *Fabiana*: *Fabiana imbricata*, and *Beberis*: *Berberis heterophyla*

feeding behavior was also observed in herbivores of semi-arid environments, such as guanacos (*Lama guanicoe*, Puig et al. 1997), the plains vizcacha (*Lagostomus maximus*, Branch et al. 1994), and tuco tuco (*Ctenomys haigi*, Rosi et al. 2003), which increased the dietary selectivity in periods of food scarcity.

The selective feeding behavior of the southern vizcacha for grasses can be explained in several ways. In the Patagonian steppe, they are perennial species, while main palatable shrubs are deciduous (Somlo et al. 1985). Moreover, the biomass of high-quality herbs is low, so their consumption could be limited by the higher cost of searching time (Dement and Van Soest 1985), especially for this herbivore

Table 4 Plant species and functional groups selected (S), avoided (A), or used proportionally (P) by the southern vizcacha during summer and winter in the northwestern Patagonia

	Summer			Winter		
Functional groups	Pe	Pu		Pe	Pu	
Shrubs	0.495	(0.305–0.335)	A	0.376	(0.257–0.295)	A
Grasses	0.388	(0.507–0.540)	S	0.524	(0.596–0.638)	S
Herbs	0.117	(0.143–0.167)	S	0.100	(0.092–0.115)	P
Species						
Stipa speciosa	0.250	(0.305–0.349)	S	0.384	(0.449–0.505)	S
Mulinum spinosum	0.194	(0.212–0.252)	S	0.056	(0.023–0.043)	A
Bromus spp.	0.059	(0.057–0.081)	P	0.059	(0.053–0.081)	P
Poa lanuginosa	0.064	(0.094–0.123)	S	0.042	(0.066–0.097)	S
Festuca pallescens	0.166	(0.124–0.157)	A	0.207	(0.054–0.083)	A
Eryngium paniculatum	0.012	(0.027–0.044)	S	0.029	(0.044–0.076)	S
Fabiana imbricata	0.042	(0.013–0.023)	A	0.016	(0.107–0.145)	S
Berberis heterophyla	0.097	(0.013–0.026)	A	0.102	(0.056–0.085)	A
Senecio spp.	0.117	(0.034–0.054)	A	0.104	(0.008–0.021)	A

Data in parentheses are Bonferroni confidence intervals

Pe Proportion expected (relative cover × frequency in diet), *Pu* observed proportion of use in diet

restricted to rocky outcrops. Other native Hystricomorphs of medium size, such as the mara (*Dolichotis patagonum*), a typical running herbivore of Patagonia, and the plains vizcacha (*L. maximus*), which lives in burrow systems, also preferred grasses despite differences in habitat use (Jackson 1985; Branch and Sosa 1994; Rodriguez and Dacar 2008). These herbivores have high digestive efficiency and through coprophagy make better use of consumed forage, especially in poor areas (Jackson 1985). At the present, there are no studies of the digestive morphophysiology of the southern vizcacha, although it was observed that this species is coprophagic (Walker et al. 2000b; Galende 2010), which may allow it to overcome the difficulties presented by a diet with high proportions of grasses of low quality.

On the other hand, the choice of foraging areas of rock specialists, such as the pikas (*Ochotona* spp.) and hyraxes (*Procavia johnstoni* and *Heterohyrax brunei*), depends on the rocky protection and food availability in the surroundings, because the greater the feeding distances, the greater is the risk of predation (Hoeck 1975; Huntly et al. 1986; Holmes 1991; Kotler et al. 1999). However, the rock cavy (*Kerodon rupestris*) exhibited distinct food selection patterns in response to changes in food availability, and the nutrient content could play an important role in diet selection (Willig and Mares 1991).The spatial activity of the southern vizcacha was concentrated in 30 m from the rocky outcrops vicinity, and there were no significant seasonal variations despite the decline in food resources (Walker 2001; Reus Ruiz 2006; Galende and Raffaele 2008; Galende 2010). In contrast, the degus (*Octodon degu*) changed their range areas in response to seasonal changes in food supply (Quirici et al. 2010). The restricted spatial activity of the southern vizcacha was reflected in a high consumption and preference for *S. speciosa*, a dominant low-quality grass (Somlo et al. 1985) in the rocky outcrops proximity and without seasonal changes in its abundance. This is a key species in Patagonia, because it is an available food throughout the year and constitutes a basic component in the winter diet of exotic and native herbivores such as *L. europaeus*, *L. guanicoe*, *D. patagonum*, and sheep *Ovies aries* (Pelliza et al. 1997; Baldi et al. 2004; Puig et al. 2007, 2009). Moreover, the vizcachas also selected a high quality grass as *P. lanuginosa* (Somlo et al. 1985) although their abundance is currently low due to the overgrazing by exotic herbivores (Paruelo et al. 1993; Bonino 1995; Pelliza et al. 1997; Puig et al. 2007).

Selectivity for grasses could also be explained by restrictions in the detoxification of secondary metabolites and the elimination of plant toxins. For example, the vizcachas avoided feeding on *Senecio* spp., an abundant shrub near rocky outcrops, probably due to its high content of secondary components (Cavagnaro et al. 2003). Similarly, the mara (*D. patagonum*) consumed high values of grasses and seemed to avoid shrubs high in secondary metabolites (Sombra and Mangione 2005).

The southern vizcacha's activity resulted in a narrow trophic niche and without significant seasonal variations despite strong changes in food availability. Moreover, their diet contained a high proportion of grasses that are difficult to process (Dement and Van Soest 1985); due to these characteristics, we classified the southern vizcacha as an obligatory dietary specialist sensu Shipley et al. (2009).

In summary, diet selection of the southern vizcacha was influenced by the food abundance and reflected specialized behaviors to life on the rocks. The high consumption of a low-quality grass, such as *S. speciosa*, could favor their survival, since it is an abundant resource in the vicinity of rocky outcrops. However, this species is also very important in the diet of several exotic herbivores, especially in winter (Pelliza et al. 1997). For example a case of particular attention is the exotic European hare because of its similar size, great capacity of dispersal (Grigera and Rapoport 1983; Cossíos 2004; Merino et al. 2009), and high population densities that fluctuate in time (Novaro et al. 1992). In situations of food restrictions, the hare expands its foraging area and uses different plant communities (Somlo et al. 1994), and it has a significant impact on the vegetation (Bonino 1995; Kitzberger et al. 2005). These characteristics, in addition to the dietary overlap and the similar use of space in the middle distances to the rocky outcrops with the southern vizcacha (Galende and Grigera 1998; Galende and Raffaele 2008), could lead to an interspecific competition for food.

In this scenario, the specialized behaviors of the southern vizcacha limited to the proximity of rocky outcrops make it very vulnerable to changes in food availability, so that grazing by exotic species probably affect their small colonies.

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