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## FEEDING ECOLOGY OF THE ENDANGERED HUEMUL (*Hippocamelus bisulcus*) IN LOS ALERCES NATIONAL PARK, ARGENTINA

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**ABSTRACT:** The huemul (*Hippocamelus bisulcus*) is one of the most endangered and less known neotropical deer. We evaluated its diet in Los Alerces National Park, Argentina. Botanical composition of the diet was studied seasonally using microhistological analysis of fecal samples. Twenty six of the 72 available plant species were recorded in the huemul diet. The annual diet was largely dominated by shrubs (mean  $\pm$  SE= 64.7  $\pm$  2.4%) and trees (28.1  $\pm$  2.4%). Forbs and grasses only represented 4.6  $\pm$  1.1% and 2.5  $\pm$  0.6%. The huemul predominantly fed on *Nothofagus* sp., *Maytenus* sp., *Embothrium coccineum*, *Schinus patagonicus* and *Gaultheria mucronata*. Diet composition changed significantly between warm-growing and cold-dormant periods. The annual niche breadth was low, indicating a diet concentrated on few species. The data obtained on huemul diet is consistent with the concentrate selector feeding strategy, as was suggested in similar studies for the species in other locations.

**RESUMEN:** Ecología de la alimentación de *Hippocamelus bisulcus* en el Parque Nacional Los Alerces, Argentina. El huemul (*Hippocamelus bisulcus*) es uno de los ciervos neotropicales más amenazado y menos conocido. Evaluamos su dieta en el Parque Nacional Los Alerces, Argentina. La composición botánica de la dieta fue estudiada estacionalmente a través del análisis microhistológico de muestras fecales. Veintiséis de las 72 plantas disponibles fueron registradas en la dieta del huemul. Su dieta anual estuvo ampliamente dominada por arbustos (media  $\pm$  SE= 64.7  $\pm$  2.4%) y árboles (28.1  $\pm$  2.4%). Las hierbas y los pastos sólo representaron el 4.6  $\pm$  1.1% y 2.5  $\pm$  0.6%. El huemul se alimentó predominantemente de *Nothofagus* sp., *Maytenus* sp., *Embothrium coccineum*, *Schinus patagonicus* y *Gaultheria mucronata*. La composición de la dieta cambió significativamente entre el período cálido de crecimiento y el frío de inactividad. La amplitud de nicho anual fue baja, indicando una dieta concentrada en unas pocas especies. Los datos obtenidos sobre la dieta de huemul son consistentes con la estrategia de alimentación denominada "concentrate selector", tal como fue sugerido en similares estudios desarrollados en otras localidades para esta especie.

**Key words.** Cervidae. Deer. Diet composition. Feeding strategy. Patagonia.

**Palabras clave.** Cervidae. Ciervos. Composición de dieta. Estrategia de alimentación. Patagonia

## INTRODUCTION

The Andean deer or huemul (*Hippocamelus bisulcus*) is a medium-sized endemic deer of the Andean-Patagonian forests and forest-shrub ecotones of Argentina and Chile (Cabrera and Yepes, 1960). The historical range of the huemul spread from 34 to 54° S (Díaz and Smith-Flueck, 2000). This range has diminished, and populations have declined over the past two centuries due to direct and indirect human pressures (Povilitis, 1978; Drouilly, 1983; Díaz and Smith-Flueck, 2000; Serret, 2001). Most current populations are small, fragmented, and scattered (Vila et al., 2006). Therefore, the huemul is one of the most endangered Neotropical deer species (IUCN, 2007) and is currently classified as endangered in both Chile and Argentina (Glade, 1988; Díaz and Ojeda, 2000).

Studies on huemul biology and ecology are scarce (Díaz and Smith-Flueck, 2000; Serret, 2001). Field studies on feeding habits have focused on diet composition (Colomes, 1978; Frid, 1994; Merino, 1995; Galende et al., 2005; Van Winden, 2006) and diet selection (López et al., 2001; Smith-Flueck, 2003) in a few locations of both Argentina and Chile. Moreover, only two of these studies included results on winter diet (Colomes, 1978; Galende et al., 2005).

Current huemul distribution extends along a narrow 1900-km strip (Vila et al., 2006), covering a significant latitudinal span that includes highly variable conditions of elevation (sea level to 3000 m a.s.l.), precipitation (800 to 5000 mm), and vegetation types (Dimitri, 1972; Correa, 1998). Furthermore, local conditions such as human pressure, livestock and exotic red deer can affect huemul diet selection. Thus, the huemul diet ought to depend on the habitat types and human pressures that influence the availability of food along their distribution range. However, the foraging ecology of huemul living in sympatry with cattle and sheep has never been studied in Patagonian forests. The aim of this study was to evaluate seasonal diet composition of huemul in Los Alerces National Park, Argentina. Because

rural settlers in our study area raise cattle and sheep, the knowledge gained will provide keys to understand the potential threats of exotic ungulates on this endangered deer.

## MATERIAL AND METHODS

### Study area

We conducted our study in the westerly and southerly facing slopes (4650 ha) of Cerro Risco, Los Alerces National Park (259 000 ha, Fig. 1). Cerro Risco is located within a National Reserve area. This category of management was conceived as a buffer zone where regulated uses are permitted (e.g. livestock raising, tourism) (Martín and Chehébar, 2001). Cattle and sheep grazing licenses had been issued by the National Park Service for the area during the study period (Martínez, 2006). The five rural settlements found in Cerro Risco subsist on traditional livestock husbandry (Martínez, 2006). Settlers colonized the area before the National Park was created in 1937. Stocking rates have been declining since 1940 and

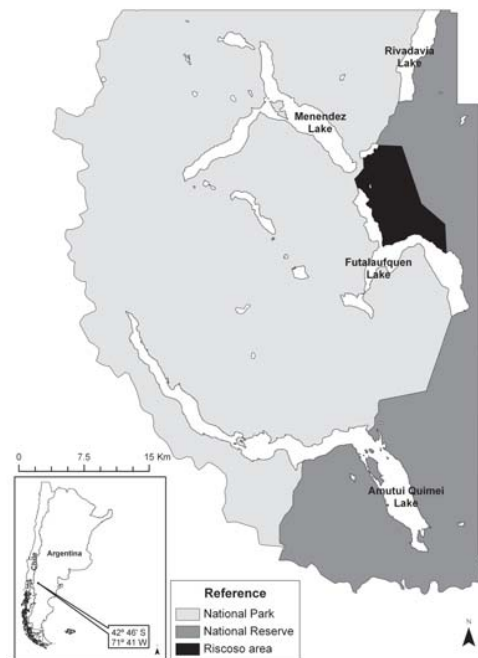


Fig. 1. Location of the study area in Los Alerces National Park, Argentina.

settlers are relying on tourism as an alternative means of livelihood (Martin and Chehébar, 2001; Martínez, 2006). Cattle and sheep densities for the entire study area were low, 2.3 and 2.4 animals/km<sup>2</sup> respectively, during the study period (Martínez, 2006). The huemul has a wide distribution in the National Reserve but population size estimations have not been carried out (Pastore et al., 2005). We estimated a minimum number of 16 individuals based on the track size analysis proposed by Povilitis (1979).

The mean annual temperature is 8 °C. Mean annual precipitation decreases abruptly from west to east, from more than 3000 mm to 800 mm (APN, 1997). Precipitation occurs mainly from April to October, with snow falling in winter (June to September). In the forests of southern South America, the warm-growing period is limited by seasonal changes in temperature and includes spring and summer seasons (Schmaltz, 1991; Donoso Zegers, 1993; Veblen et al., 1995). During the cold-dormant period (autumn and winter seasons) annual plants die and biennials and perennials cease active growth. Thus deciduous plants lose their leaves and evergreens curtail all new growth.

The study area encompasses two phytogeographical types: Subantarctic and High Andean provinces (Cabrera, 1971; Correa, 1998). Subantarctic forests are dominated by pure or mixed stands of conifers (*Austrocedrus chilensis* and *Fitzroya cupressoides*), evergreen (*Nothofagus dombeyi*) and deciduous (*Nothofagus pumilio* and *Nothofagus antarctica*) species. The vegetation of the High Andean Province includes a mosaic of grasses, shrubs and forbs of extremely limited cover. This highland community above the tree line is dominated by bare rocks.

### Feces collection and analysis

Eight transects one m-wide were placed at random on westerly and southerly facing slopes of Cerro Riscoso. Transects ran perpendicular to contour lines, starting from the valley bottom (500 m a.s.l.) to above the tree-line (1400 m a.s.l.). Fresh huemul feces were collected on a seasonal basis in 2001. We used indirect observations to identify huemul feces, such as their location, the type of habitat, the presence of their hairs and other huemul signs.

A total of 163 fecal groups (summer n=58, autumn n=38, winter n=59, and spring n=8) were collected from individuals that were not observed defecating. Therefore, the obtained samples were pooled to form composite diet samples by season.

Thus, a single diet sample for each season consisted of a pooled collection of 25 g (fresh weight) from at least eight pellet groups. These samples were randomly drawn.

The botanical composition of the diet was determined by a standard microhistological analysis of feces (Sparks and Malechek, 1968; Latour and Sbriller, 1981). The samples were oven-dried at 60 °C for 48 hr, ground to <one mm in a Wiley type mill, depigmented with 90% alcohol, cleared with sodium hypochlorite, stained with safranin, and mounted in glycerine-jelly. Samples were mounted on five microscope slides and 20 fields on each slide were examined using 100X magnification (Holechek and Vavra, 1981). Thus, 100 fields for each season were examined.

Plant fragments in samples were identified at the level of genera or species when possible, based on a reference collection of the plant specimens previously collected in the region. Botanical nomenclature followed [www.darwin.edu.ar](http://www.darwin.edu.ar). Species were grouped into the following life forms: forbs (excluding Graminoids), shrubs, trees, and grasses (Poaceae, Juncaceae and Cyperaceae).

### Data analysis

Niche breadth was used to examine the relationship between diet and food availability. The niche breadth was measured for each season using Levins normalized index (Krebs, 1989),  $Bst = (B-1)/(n-1)$ , where  $B = 1/\sum pi^2$ , 'pi' is the proportion of taxon 'i' in the diet and 'n' is the number of resources available in the diet. This index ranges from zero (only one resource used) to one (all available resources used equally). Differences in the proportion of life forms between warm and cold periods were analyzed using a Chi Square test. We also analyzed differences in the proportion of plant species across seasons using a Kruskal-Wallis H-test.

## RESULTS

The huemul diet included trees, shrubs, grasses and forbs of 24 botanical families (Table 1). Most of these families were represented by only one species. Twenty six (36.1%) of the 72 plant species identified in the study area were recorded in the huemul diet. Annual diet was largely dominated by shrubs (Mean  $\pm$  SE =  $64.7 \pm 2.4\%$ ) and trees ( $28.1 \pm 2.4\%$ ). Forbs and grasses only represented  $4.6 \pm 1.1\%$  and  $2.5 \pm 0.6\%$  of the diet, respectively.

The consumption of life forms showed seasonal differences (Table 1). The frequencies of consumed vegetation groups were similar in spring and summer seasons, but showed a different pattern in autumn and winter seasons. Diet composition changed significantly between warm and cold periods ( $X^2=23.4$ ,  $df=3$ ,  $P<0.01$ ). The presence of tree species in the diet declined during the cold period, while consumption of shrub and forb species increased (Fig. 2).

Huemul predominantly fed on *Nothofagus* sp., *Maytenus* sp., *Embothrium coccineum*, *Gaultheria mucronata* and *Schinus patagonicus* (Table 1). These five species accounted for 82 to 92% of the plant fragments found in huemul feces each season. The other 21 species only comprised less than 5% of the diet. The consumption of *Maytenus* sp. and *S. patagonicus* was almost constant throughout the year, whilst an increase in *G. mucronata* consumption was observed in winter (Table 1). Huemul consumed less *E. coccineum* in summer and winter seasons than in autumn and spring seasons. The consumption of *Ribes* sp. also showed this seasonal pattern, while *Aristotelia maqui* was only important during summer. Forb and grass species were often present in small quantities in the diet (less than 2%). However, the forb *Misodendrum* sp.

showed values that ranged from 2.3 to 3.5% in autumn and winter seasons respectively. The grass *Stipa speciosa* also represented more than 2% of autumn and winter diets (Table 1). Although we observed these seasonal changes in species consumption, the only percentages that differed across the seasons were those of *Adesmia boronioides*, *E. coccineum*, *Colletia spinosissima*, *Misodendrum* sp., and *S. speciosa* (Kruskal–Wallis,  $P<0.05$ ). In contrast, percentage of the other species was not different across seasons (Kruskal–Wallis,  $P>0.05$ ).

Diet diversity increased from 11 species in spring to 20 species in autumn, whilst in summer and winter seasons there were 17 and 16 species in the diet, respectively (Table 1). The annual mean niche breadth was low ( $Bst=0.18$ ), indicating a diet concentrated on a few items. Niche breadths were higher in spring and winter seasons, while those observed for summer and autumn were lower (Table 1).

## DISCUSSION

The endangered huemul has a diet dominated by shrubs and trees in Los Alerces National Park. Diets dominated by woody species (from 72 to 78%) were also reported in Nahuel Huapi National Park (Galende et al., 2005) and Lago La Plata (Smith-Flueck, 2003). However, her-

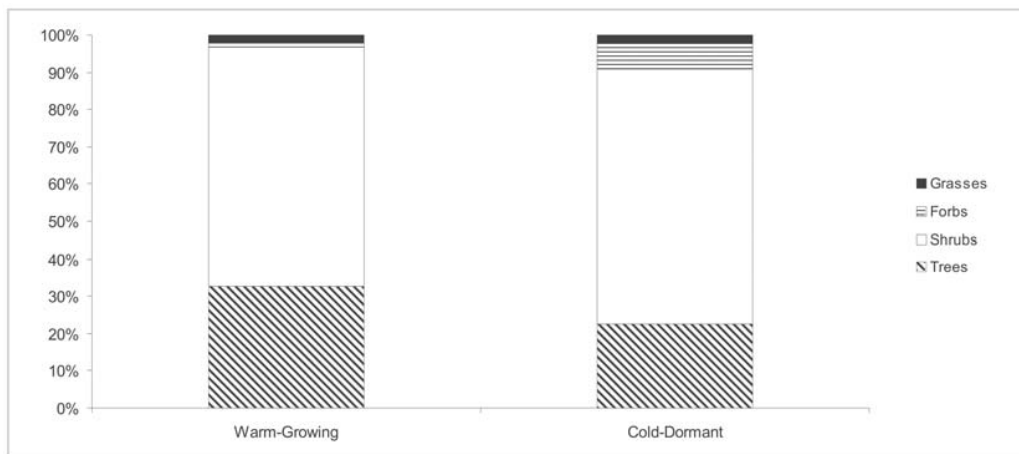


Fig. 2. Composition (%) of plant types consumed by huemul during warm-growing (summer-spring) and cold-dormant (autumn-winter) periods in Los Alerces National Park, Argentina.

**Table 1**

Seasonal variation in percentage (Mean  $\pm$  SE, n= 5 slides per season) of plant species identified in huemul feces in Los Alerces National Park, Argentina.

Species	Spring	Summer	Autumn	Winter	Annual
TREES	33.4 $\pm$ 3.6	34.5 $\pm$ 4.3	23.4 $\pm$ 3.7	21.2 $\pm$ 5.4	28.1 $\pm$ 2.4
<i>Nothofagus</i> sp.	33.4 $\pm$ 3.6	34.5 $\pm$ 4.3	23.4 $\pm$ 3.7	21.2 $\pm$ 5.4	28.1 $\pm$ 2.4
SHRUBS	62.9 $\pm$ 5.0	61.5 $\pm$ 2.3	64.5 $\pm$ 2.9	70.0 $\pm$ 7.6	64.7 $\pm$ 2.4
<i>Schimus patagonicus</i>	9.2 $\pm$ 3.2	6.4 $\pm$ 2.1	9.5 $\pm$ 4.0	6.7 $\pm$ 4.2	8.0 $\pm$ 1.6
<i>Mulinum spinosum</i>	0.0	0.0	0.4 $\pm$ 0.4	0.3 $\pm$ 0.3	0.2 $\pm$ 0.1
<i>Mutisia</i> sp.	1.6 $\pm$ 1.1	1.4 $\pm$ 0.6	2.7 $\pm$ 0.9	0.3 $\pm$ 0.3	1.5 $\pm$ 0.4
<i>Berberis</i> sp.	0.0	0.8 $\pm$ 0.5	0.4 $\pm$ 0.4	0.0	0.3 $\pm$ 0.2
<i>Maytenus</i> sp.	20.6 $\pm$ 1.5	22.5 $\pm$ 1.7	18.9 $\pm$ 5.0	23.2 $\pm$ 4.6	21.3 $\pm$ 1.7
<i>Aristolelia maqui</i>	1.0 $\pm$ 0.6	4.9 $\pm$ 2.4	1.1 $\pm$ 0.5	0.0	1.8 $\pm$ 0.7
<i>Gaultheria mucronata</i>	2.1 $\pm$ 0.9	6.7 $\pm$ 1.7	3.3 $\pm$ 0.8	22.2 $\pm$ 7.9	8.6 $\pm$ 2.6
<i>Adesmia boronioides</i>	0.0	0.0	1.1 $\pm$ 0.5	0.0	0.3 $\pm$ 0.2
<i>Ribes</i> sp.	3.2 $\pm$ 1.5	0.8 $\pm$ 0.5	2.3 $\pm$ 0.8	0.3 $\pm$ 0.3	1.7 $\pm$ 0.5
<i>Embothrium coccineum</i>	26.7 $\pm$ 4.2	16.0 $\pm$ 3.0	26.4 $\pm$ 1.6	14.6 $\pm$ 2.4	21.0 $\pm$ 1.9
<i>Colletia spinosissima</i>	0.0	3.3 $\pm$ 0.9	1.1 $\pm$ 0.7	1.7 $\pm$ 0.9	1.5 $\pm$ 0.4
<i>Diostea juncea</i>	0.0	0.0	0.0	1.0 $\pm$ 0.7	0.3 $\pm$ 0.2
FORBS	2.2 $\pm$ 1.6	2.7 $\pm$ 1.5	8.8 $\pm$ 3.2	4.8 $\pm$ 1.4	4.6 $\pm$ 1.1
<i>Osmorhiza chilensis</i>	0.0	0.0	0.0	0.7 $\pm$ 0.4	0.2 $\pm$ 0.1
<i>Perezia</i> sp.	0.6 $\pm$ 0.6	0.0	1.1 $\pm$ 0.5	0.3 $\pm$ 0.3	0.5 $\pm$ 0.2
<i>Cerastium arvense</i>	0.0	0.7 $\pm$ 0.7	0.0	0.0	0.2 $\pm$ 0.2
<i>Rumhora adiantiformis</i>	0.0	0.0	0.4 $\pm$ 0.4	0.0	0.1 $\pm$ 0.1
<i>Vicia nigricans</i>	0.0	0.3 $\pm$ 0.3	1.8 $\pm$ 1.0	0.0	0.5 $\pm$ 0.3
<i>Misodendrum</i> sp.	0.0	0.0	2.3 $\pm$ 1.2	3.5 $\pm$ 1.0	1.5 $\pm$ 0.5
<i>Chloroea</i> sp.	0.0	0.3 $\pm$ 0.3	0.4 $\pm$ 0.4	0.0	0.2 $\pm$ 0.1
GRASSES	1.6 $\pm$ 1.1	1.3 $\pm$ 1.3	3.3 $\pm$ 0.5	4.0 $\pm$ 1.7	2.5 $\pm$ 0.6
<i>Carex</i> sp.	0.0	0.3 $\pm$ 0.3	0.4 $\pm$ 0.4	0.3 $\pm$ 0.3	0.3 $\pm$ 0.1
<i>Juncus balticus</i>	0.0	0.3 $\pm$ 0.3	0.0	0.0	0.1 $\pm$ 0.1
<i>Cortaderia araucana</i>	0.0	0.3 $\pm$ 0.3	0.4 $\pm$ 0.4	0.0	0.2 $\pm$ 0.1
<i>Hierocloe</i> sp.	0.0	0.3 $\pm$ 0.3	0.0	0.0	0.1 $\pm$ 0.1
<i>Stipa speciosa</i>	1.0 $\pm$ 0.6	0.0	2.5 $\pm$ 0.5	2.3 $\pm$ 1.0	1.5 $\pm$ 0.4
Unknown sp.	0.6 $\pm$ 0.6	0.0	0.0	1.3 $\pm$ 0.9	0.5 $\pm$ 0.3
NICHE BREADTH	0.32	0.24	0.25	0.31	0.18

baceous species were also reported as important food items by other authors (Colomes, 1978; Merino, 1995; López et al., 2001). Observational studies conducted in coastal periglacial populations of southern Chile also reported a diet dominated by forbs and shrubs (Frid, 1994; Van Winden, 2006). These differences may suggest that diet variation is associated with changes in food availability and habitat features. However, information on food availability was only provided in two

places along the huemul's range (López et al., 2001; Smith-Flueck, 2003), thus precluding further comparisons. Nevertheless, Gill et al. (2008) reported a tendency for huemul to use higher elevations in more northerly latitudes. Consequently, this tendency could influence the availability and selection of food.

Some of the differences observed in diet composition among sites could also result from the different approaches used to study huemul diet. Most of the available studies were con-

ducted using microhistological analysis of feces, but Frid (1994) and Van Winden (2006) observed huemul feeding, without disturbing them. In addition, only three of six microhistological studies have been developed on a seasonal basis (Table 2). Another source of bias could be the use of composite or independent samples (Smith-Flueck, 2003).

Although microhistological analysis of huemul feces was used in several studies to evaluate diet composition, the accuracy of this method is problematic because of the differential digestion rate for each plant species (Holechek et al., 1982). This method tends to underestimate the percentage of forbs and overestimates the percentage of grasses in the diet compared to other techniques, and many plant species are difficult to separate at the species and sometimes at the genus level (Holechek et al., 1982). However, the procedure does not interfere with the habits of this endangered deer, and may be helpful for comparisons across study areas. Other methods, such as quantitative information obtained from direct observation, bite-counts, and feeding times, could complement microhistological analysis and provide more accurate results in future studies on the huemul.

Although the percentage of food items consumed varied throughout the huemul range, it was observed that in general shrubs, forbs and trees were the more important items, while the consumption of grasses only accounted for 0.2 to 12% of the diet (Table 2). The presence of small quantities of unknown fungi, lichens and fruits in the huemul diet has been also reported by López et al. (2001), Smith-Flueck (2003) and L. Borrelli (com. pers.). The diversity of food items consumed by huemul ranged from 21 to 34 species (Table 2), but diet composition varied along its distribution range. Based on the percentage of each species in the composition of the diet, only 3.7–19.2% of the species were the most important (Table 2). The low niche breadth observed in our study area was similar to that reported by Galende et al. (2005), showing a diet concentrated on few species. Some key species consumed by huemul in our study, such as *Nothofagus* sp., *Maytenus* sp., *Embothrium coccineum*, and *Gaultheria mucronata*, have been reported as important food items in earlier studies (Colomes, 1978; Merino, 1995; López et al., 2001; Smith-Flueck, 2003; Galende et al., 2005).

The results obtained on the huemul diet are consistent with the concentrate selector feed-

**Table 2**

Comparison of huemul foraging habits based on microhistological analysis of feces in different locations along its distributional range. Woody plants include tree and shrub species, while percentage of shrubs is shown between brackets.

Study area	Chillán	Chillán	Nahuel Huapi	Los Alerces	Lago La Plata	Los Glaciares
Latitude	36°	36°	41°	42°	44°	49°
Country	Chile	Chile	Argentina	Argentina	Argentina	Argentina
Habitat type	Mixed forests of <i>Nothofagus</i> spp	Mixed forests of <i>Nothofagus</i> spp	<i>Nothofagus pumilio</i> forest	Mixed forests of <i>Nothofagus</i> spp	<i>Nothofagus pumilio</i> forest	Mixed forests of <i>Nothofagus</i> spp
Other ungulates		goat	red deer	cattle and sheep	red deer	wild horse
Type of study	seasonal	spring to autumn	seasonal	seasonal	spring to autumn	summer
# of species in diet	30	34	32	26	21-27	34
Principal species	5	2	4	5	1	3
% OF PRINCIPAL ITEMS						
Woody plants (shrubs)	34.4 (26.7)	34.5 (25.0)	78.1 (58.6)	92.8 (64.7)	72.1	37.9 (29.4)
Forbs	42.6	63.9	9.3	4.6	27.3	50.0
Source	Colomes (1978)	López et al. (2001)	Galende et al. (2005)	This study	Smith-Flueck (2003)	Merino (1995)

ing strategy proposed by Hofmann (1989), as was suggested by Smith-Flueck (2003), Galende et al. (2005), and Van Winden (2006). Although salivary glands and ruminoreticular anatomy have not yet been studied in huemul, the available information on their relative muzzle and incisor widths (Janis and Ehrhardt, 1988) also indicates this type of dietary preference. Nevertheless, ungulate diet selection is also largely influenced by forage quantity and quality in spite of anatomical adaptations that facilitate selection of specific diets (Jenkins and Wright, 1987; Ralphs and Pfister, 1992; Christianson and Creel, 2007).

The seasonal variability of huemul diet reported in this study also concurs with results from previous studies (Colomes, 1978; López et al., 2001; Galende et al., 2005; Van Winden, 2006). This seasonal pattern included an increase in consumption of forbs from spring to autumn, while consumption of shrubs was higher in winter and tree species were more important during spring and summer seasons. However, Smith-Flueck (2003) found little difference in diet composition between spring and autumn. Such different results could be related to local differences in food availability and quality. In our study, estimated cover of life forms shows significant differences between seasons (Martínez, 2006). Available cover of tree and shrub species is relatively higher during the cold than warm season, while coverage of forbs and grasses is higher in warm than in cold season. Low-lying perennial forbs are largely unavailable under snow during winter, and the proportion of available woody evergreen species is higher in winter than in summer, while the availability of food provided by trees declines during winter season, with the falling of *Nothofagus* leaves. However, the hemiparasitic forb *Misodendrum* sp. only infects young branches of *Nothofagus* spp. (Tercero-Bucardo and Kitzberger, 2004) and is available to huemul throughout the year. In our study, this species accounted for much of the increase of consumption of forbs during the cold season. It was also mentioned as an

important item of the huemul diet in autumn by Galende et al. (2005).

In temperate habitats, ungulate species face severe scarcity of food in winter. Therefore, they may compensate the declining food abundance by widening their alimentary breadth in winter (Owen-Smith and Novellie, 1982; Illius and Gordon, 1993). As predicted by foraging theory, niche breadth of huemul in our study was wider in winter. However, we also observed a wide niche breadth during spring. This widening of spring niche breadth could be an artifact of the composite samples that include a reduced amount of feces from early to late spring. This limited number of samples could also overestimate the amount of woody plants in the spring diet, when huemul are most likely to shift from a diet of woody plants to forbs or grasses.

This data on the feeding habits of huemul in Los Alerces National Park must be considered with caution due to the presence of livestock. Unfortunately, only two studies have explored dietary similarities between sympatric huemul and exotic ungulates along the huemul range. López et al. (2001) found a dietary overlap between huemul and goat in Chillán, while Smith-Flueck (2003) also found dietary overlap between huemul and red deer in Lago La Plata. Further investigations to describe diet and habitat overlap between huemul and exotic ungulates might provide useful insights to infer the existence of competition and will be helpful to propose science-based actions for the conservation of this rare deer.

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