FOOD HABITS AND TROPHIC ATTRIBUTES OF THE MAGELLANIC HORNED OWL (*BUBO MAGELLANICUS*) IN THE PATAGONIAN STEPPE, SOUTHERNMOST CHILE

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Abstract · For most of southern South America, the food habits of Magellanic Horned owls (*Bubo magellanicus*) are well known. In Chile, several researchers have reported the owl's diet in northern xerophytic environments, as well as subpolar forests; however, other than a short note on the owls' summer diet in Punta Dungeness (Martínez 2018), no major studies have documented the food habits of Magellanic Horned owls in the Chilean Patagonian steppe. Based on 278 fresh pellets, we reported the food habits of owls inhabiting two sites located at > 52°S in the southernmost Patagonian steppe in continental Chile, and compared our findings with those reported for owls inhabiting eight localities from 39 to 52°S in the Argentinean Patagonian steppe. Our results indicate that in Patagonian steppe environments of both Argentina and Chile, the Magellanic Horned Owl is a generalist predator, which consumes whatever prey available, ranging in size from invertebrates to introduced juvenile lagomorphs. Because all five major vertebrate prey here reported (*Abrothrix olivacea, Loxodontomys micropus, Microcavia australis, Reithrodon auritus, Lepus europaeus*) are broadly distributed in the Argentinean Patagonian steppe and occur abundantly from 36°S southwards to the Strait of Magellan and Isla Grande de Tierra del Fuego, their generalized occurrence as prey does not allow for expression of latitudinal trends in species composition in the owl's diet.

Resumen · Dieta y atributos tróficos del búho magallánico (*Bubo magellanicus*) en estepa patagónica de Chile austral.
En la mayor parte de Sudamérica austral, la dieta del búho magallánico (*Bubo magellanicus*) es conocida. Particularmente en Chile, varios autores han reportado su dieta en ambientes xéricos y bosques subpolares; sin embargo, aparte de un trabajo reciente (Martínez 2018), que documenta la dieta estival de búhos magallánicos en Punta Dungeness, no se han efectuado estudios en la estepa patagónica chilena acerca de la dieta de estos búhos. Basados en 278 egagrópilas frescas, aquí documentamos la dieta de búhos magallánicos que habitan dos sitios localizados a > 52°S en la estepa patagónica del extremo sur continental de Chile y comparamos nuestros hallazgos con aquellos documentados para búhos que habitan ocho localidades entre 39 y 52°S en la estepa patagónica argentina. Nuestros resultados indican que, en los ambientes esteparios patagónicos de Argentina y Chile, el búho magallánico es un depredador generalista que consume cualquier presa disponible, desde el tamaño de invertebrados hasta juveniles de liebres introducidas. Dado que los cinco tipos de presas más consumidas (*Abrothrix olivacea, Loxodontomys micropus, Microcavia australis, Reithrodon auritus, Lepus europaeus*) están ampliamente distribuidas en la estepa patagónica argentina y son abundantes desde los 36°S hacia el estrecho de Magallanes e Isla Grande de Tierra del Fuego, su presencia generalizada como presa no permite la expresión de tendencias latitudinales en composición de especies en la dieta del búho magallánico.

Key words: *Bubo magellanicus* · Caviidae · Leporidae · Magellanic Horned Owl · Patagonian steppe

INTRODUCTION

The food habits of the Magellanic Horned Owl (*Bubo magellanicus*) in Chile are well known. For instance, Jaksic et al. (1978), Jaksic & Marti (1984), and Jaksic et al. (1981) have reported this owl's diet for sites located from the northernmost xeric environments to subpolar forests, ranging from 33 to 51°S. With such data, Jaksic et al. (1986) were able to report latitudinal trends in trophic ecology for this species. Nonetheless, no data on food habits is available for owls inhabiting the Chilean Patagonia, at their southernmost continental distribution range, except for the study by Martínez (2018) in Punta Dungeness. Here, we reported the food habits of Magellanic Horned owls inhabiting two sites located at > 52°S in the southernmost Patagonian steppe in continental Chile and compared our findings with those reported for owls inhabiting seven localities from 39 to 52°S in the Argentinean Patagonian steppe by Donázar et al. (1997), Trejo & Grigera (1998), Nabte et al. (2006), Formoso et al. (2012), and Udrizar Sauthier et al. (2017). In addition, we highlight the novel contribution of the Southern Cavy (*Microcavia australis*) to the owl's diet in Chile, a small mammal species considered extinct in this country.

METHODS

Study areas. From 2001 until 2017, in six field trips conducted during contrasting seasons (austral summer versus winter), we collected pellets of Magellanic Horned owls in two coastal sites located at the southernmost Patagonian steppe region (as described by Olson et al. 2001) in continental Chile. According to Gajardo (1994), the vegetation covering both sites corresponds to the *Lepidophyllum cupressiforme* (Mata Negra) and *Festuca gracillima* (Coirón Dulce) association. It is made up of small-sized shrubs and Coirón herbaceous clumps patchily distributed in sandy and cobble soils. The climate is cold-temperate (with a mean annual temperature of 8°C) and, following Köppen (*fide* Santana et al. 2010), it is a cold steppe type (BSk'c) with a decreasing precipitation gradient from west to east (mean annual rainfall varies from 200 to 300 mm at the study area) and strong winds year-round, mainly from the west and southwest. At both sites, the current land use is twofold: large pasture lots devoted to extensive sheep raising, as well as developments of oil and gas fields and their concomitant infrastructure and road network.

The first site is located at the northern shore of the Strait of Magellan (52°11'28.77"S, 69°11'45.42"W, 30 m a.s.l.), roughly 2.5 km east of the Cañadón Grande locality, at the banks of route Y-545, which goes east to Campamento Posesión, a governmental gas and oil facility located in the province of Magallanes, Chile (ENAP-Magallanes). The range north of the study site is an almost flat plateau (100 m a.s.l.), with a soft slope southwest in aspect, extending through the seashore. Meadows cover the bottom of ravines formed between the soft slopes, southwest-northeast in aspect, which were formed by the past Quaternary glacial events and by the forces of trade winds prevalent in the region. Pellets were found on the ground underneath Calafate (*Berberis microphylla*) shrubs, which an owl pair used as perches, and along the road's steel safety barriers, mainly at fence postings. The cover present in the surroundings of the roosting site were patches of shrubs, such as *Lepidophyllum cupressiforme*, grassy area fringes with introduced *Ammophila arenaria*, sparse shrubs of *Adesmia boronioides*, *Senecio patagonicus* and *Berberis microphylla*, as well as extensive steppe areas covered mainly by Coirón (*Festuca gracillima*).

The second site, Punta Dungeness (52°20'57.55"S, 68° 26'08.61"W, 5 m a.s.l), is a cuspate foreland formed by accretion and progradation of sand and shingle. It is located at the eastern entrance of the Strait of Magellan on its northern coastline and represents the southernmost point in mainland South America. Additional information about this landform can be found in Martínez (2018). On January 2017, one of us (DRM) found a Magellanic Horned Owl pair perched on prostrated branches of old Calafate and Mata Negra shrubs, and collected the pellets scattered on the sandy ground below these bushes. Surrounding the roosting site there were patches of Calafate and Mata Negra and sparse smaller shrubs, including *Adesmia boronioides, Senecio patagonicus*, and *Festuca gracillima* clumps.

Pellet collection. For the purposes of this study, and at both sites and sampling bouts, only fresh pellets were collected and analyzed. Although present, weathered pellets and disaggregated material were not collected.

Pellet analysis. We identified and quantified most vertebrates in the pellets on the basis of skulls (Reise 1973, Pearson 1995) or dentary pairs (whichever gave the highest count). For pellets containing none of the former diagnostic structures, but hairs and/or feathers, we used reference collections and quantified these prey assuming the smallest possible number of individuals (e.g., hair or feathers of a given species were deemed as representing only one individual). Insects were quantified counting head capsules and mandibles. Except for insects, we identified vertebrate prey items to the most detailed resolution of taxonomical category. Mass estimates for vertebrate preys were taken from literature (Pearson 1983, Jaksic et al. 1986, Lozada et al. 1996, Pardiñas & Galliari 2001, Tognelli et al. 2001, Teta et al. 2009). Masses of hares, birds, reptiles and insects were from specimens collected at both study sites (D. R. Martínez, unpubl. data). We estimated the biomass contribution of each prey type to the owls' diet by multiplying the number of individuals in the pellets by the mean body mass of that item. We assumed that masses of unidentified prey were similar to the average mass of the most closely related identified taxa. As we later found that there were no important differences in the contents of pellets collected at different times and sites, we pooled these data and analyzed the combined diet on a contrasting seasonal basis (i.e., summer vs winter).

Statistical analysis. To quantitatively characterize the owls' diet (see Marti et al. 1993, 2007 for further details), we calculated the geometric mean mass of vertebrate prey (GMMP = antilog (Σ n_i ln m_i / Σ n_i) as the geometric grand mean, obtained by adding the products of the number of individual prey times their log_e transformed mass, and dividing by the total number of prey used in the computation. Food niche breadth was computed using Levins' (1968) index (FNB = 1 / Σ $pi2$), where pi is the proportion of prey taxon i in the diet. As the FNB index generates values ranging from 1 to n, when n resources were used equally we computed its standardized version, which ranged between 0 and 1 (FNBs = (FNB -1) / (n -1)), where n is the total number of prey categories (Colwell & Futuyma 1971). Prey number evenness was calculated using Pielou's evenness index: J' = H' / log n, where H' is the Shannon-Wiener diversity index (Krebs 1989) and n is the number of prey categories. Statistical significance was set at p$\leq$ 0.05 for all tests, unless otherwise stated.

RESULTS

At Cañadón Grande, we collected 175 pellets during the winter and 60 pellets in the summer, whereas at Punta Dungeness we used the data reported by Martínez (2018), obtained from 43 pellets collected during the summer. From the whole sample (N = 278 pellets), we measured and weighed 211 intact pellets. Since the mean values for length, width and dry mass of pellets showed no significant differences between sites and seasons (independent samples t- tests), all measurements were pooled and a grand mean and standard deviation were calculated for each variable. Thus, the 211 whole pellets averaged 55.3 ± 12.4 mm x 25.8 ± 3.5 mm and had a mean dry mass of 7.01 ± 2.80 g (mean ± SD).

Table 1. Food habits and trophic statistics of Magellan Horned owls (*Bubo magellanicus*) in Patagonian steppe environments of southernmost continental Chile. B% is percent by biomass and N is prey by number. FNB is food-niche breadth, FNBs is standardized FNB, J' is evenness, and GMMP is geometric mean mass of vertebrate prey.

Prey species	Mass (g)	Summer B% (N)	Winter B% (N)	Total B% (N)
Mammals				
Abrothrix olivacea	17.5	6.9 (58)	9.7 (117)	8.4 (175)
Loxodontomys micropus	63	29.3 (72)	50.5 (170)	41.6 (242)
Reithrodon auritus	80	20.7 (40)	17.7 (47)	19.0 (87)
Microcavia australis	263	34.0 (20)	16.1 (13)	23.7 (33)
Lepus europaeus	127[a]	3.3 (4)	0.6 (1)	1.7 (5)
Unidentified rodents	53.5	3.5 (10)	3.5 (14)	3.5 (24)
Subtotal mammals		97.7 (204)	98.1 (362)	97.9 (566)
Birds				
Unidentified Furnariidae	27	1.4 (8)	1.7 (13)	1.6 (21)
Subtotal birds		1.4 (8)	1.7 (13)	1.6 (21)
Reptiles				
Liolaemus magellanicus	15	0.1 (1)	0	0.1 (1)
Subtotal reptiles		0.1 (1)	0	0.1 (1)
Insects				
Unidentified Coleoptera	0.5	0.8 (237)	0.2 (84)	0.4 (321)
Subtotal insects	0.5	0.8 (237)	0.2 (84)	0.4 (321)
Total prey items (No.)		450	459	909
Total biomass (g)		15461.5	21203.3	36664.8
Total pellets (No.)		103	175	278
FNB		3.022	4.032	4.115
FNBs		0.252	0.433	0.389
J'		0.648	0.756	0.723
GMMP (g)		51.16	43.81	46.52

At both sites we collected 278 pellets, which were sorted according to the season of collection: 103 pellets were collected in the summer and 175 corresponded to winter depositions. The 278 pellets analyzed yielded 909 prey items (Table 1), out of which small mammals were the most frequent vertebrate prey. The mean number of vertebrate prey/pellet was 2.2 (SD = 1.2; Range = 1-7 individuals), which compares well with those reported by Trejo & Grigera (1998; 2.3 ± 1.1; Range = 1-7 individuals), but it is higher than those reported by Nabte et al. (2006; 1.1 ± 1.0; range 0-4 specimens). Four native rodent species (*Abrothrix olivacea, Loxodontomys micropus, Microcavia australis*, and *Reithrodon auritus*) accounted for over 90% of the biomass in both seasons and 92.7% on a year-round basis. The remaining vertebrate species (6.9% year-round in biomass) consisted of unidentified small rodent species (other than *Microcavia australis*), five leverets (*Lepus europaeus*), unidentified Furnariidae (most likely Short-billed miners, *Geositta cunicularia*), and one lizard (*Liolaemus magellanicus*).

Food niche breadth was higher during the winter and smaller in the summer. Although prey richness was higher during the summer, evenness was lower compared to the winter. The preys' geometric mean mass was lower in the summer, but higher during the winter. All differences between seasons were explained by the higher number of insects preyed during the summer. Total trophic niche breadth was FNB = 4.11, while Levins' standardized index was FNBs = 0.389.

DISCUSSION

Measurements obtained from the pellets are quite similar to those reported by Yáñez et al. (1978) and Jaksic et al. (1981) for Magellanic Horned Owl pellets collected at Torres del Paine National Park, as well as those provided by Trejo & Grigera (1998) and Nabte et al. (2006) for individuals of this species inhabiting Patagonian Argentina. Although the mean

length and width of the pellets are similar in all the studies cited above (ranging from 45.0 to 48.0, and 25.4 to 27.0 mm, respectively), our mean length value was above range (55.3 mm), but our calculated mean width value (25.8 mm) fell within the former interval. These conservative width values among studies could be explained by the upper limit imposed by the owl's gape (Trejo & Grigera 1998). Otherwise, the larger value for length we obtained could be attributed to the fact that all pellets we measured were intact, not weathered nor broken. Further comparisons with Chilean studies were avoided because none of these were performed in Patagonian steppe environments.

By numbers, the Southern Pericote (*Loxodontomys micropus*) was the most frequent item in the Magellanic Horned owls' diet during summer, winter, and both seasons pooled; it was the main prey for the owls on a year-round basis. In Argentina, the species is only marginal both in numbers and biomass, as reported in studies from Donázar et al. (1997), Trejo & Grigera (1998), Formoso et al. (2012). However, at the town of Esquel, the Pericote's biomass contribution was over 45% (Nabte et al. 2006), while at our sites its biomass contribution was the highest during the winter. During the summer, although more frequent in numbers, its contribution was surpassed by Southern cavies (*Microcavia australis*). Even though they are numerically scarce, Southern cavies were the main prey during the summer, according to biomass percentage (34.0%); however, during the winter, their biomass contribution was ranked third, after Southern pericotes and Bunny rats (*Reithrodon auritus*), followed by Patagonian Olive mice (*Abrothrix olivacea*). On a yearly basis, Southern cavies provided ca. 25% of all of the biomass ingested by Magellanic Horned owls. Southern cavies are reported as prey in all Argentinian studies, except for Trejo & Grigera (1998) and Udrizar Sauthier et al. (2017). Its biomass contribution ranged from as low as 0.7% in Junín de Los Andes (Donázar et al. 1997), to 27.2% in Estancia La Angostura (Formoso et al. 2012), and up to 62.8% of biomass in Telsen

Table 2. Trophic attributes of Magellanic Horned owls (*Bubo magellanicus*) along a latitudinal transect in Patagonian steppe environments of Argentina and Chile. FNB is food-niche breadth, FNBs is standardized FNB, J' is evenness, and GMMP is geometric mean mass of vertebrate prey.

Location	Source	Coordinates	No. of vertebrate prey species	FNB	FNBs	J'	GMMP (g)
Junín de Los Andes	Donázar et al. (1997)	39°29'S 70°30'W	13	10.65	0.26	0.836	32.2
Las Grutas	Nabte et al. (2006)	40°50'S 65°07'W	7	3.70	0.40	0.779	64.7
Telsen	Nabte et al. (2006)	42°21'S 67°01'W	10	4.10	0.40	0.798	86.6
Isla Leones	Udrizar et al. 2017	45°03'S 65°36'W	10	6.06	0.23	0.713	32.7
Astra	Nabte et al. (2006)	45°44'S 67°29'W	12	4.50	0.30	0.77	47.9
Río Gallegos	Formoso et al. (2012)	51°41'S 69°06'W	5	2.13	0.05	0.643	36.5
Tres Hermanos	Formoso et al. (2012)	51°57'S 69°33'W	6	2.89	0.09	0.552	13.5
Cañadón Grande	Present study	52°11'S 69°11'W	6	4.11	0.38	0.723	39.3
Cabo Vírgenes	Formoso et al. (2012)	52°19'S 68°24'W	7	4.51	0.16	0.517	30.6
Punta Dungeness	Martínez (2018)	52°20'S 68°26'W	7	6.54	0.55	0.807	43.8

(Nabte et al. 2006). The Patagonian Olive Mouse was consistently preyed upon in both seasons but, by biomass, it was not the staple food of these owls during winter nor summer. In all Argentinian studies, except for the one conducted by Udrizar Sauthier et al. (2017), the Patagonian Olive Mouse was recorded as prey; however, its biomass contribution was minor, just like in Chile. The largest biomass contribution for this rodent was reported by Nabte et al. (2006) in Cerro Gorra de Vasco. The Bunny Rat was also consistently preyed upon in both seasons, although its numbers and biomass contribution ranked third on an annual basis. In Argentina, the Bunny Rat's biomass contribution to the Magellanic Horned Owl ranges from low (Nabte et al. 2006) to intermediate (Donázar et al. 1997, Formoso et al. 2012), or can be of utmost importance and supply the greatest amount of biomass year-round (Trejo & Grigera 1998).

Birds (Furnariidae) made minor contributions to biomass during summer and winter, and most likely all specimens were Short-billed miners (*Geositta antarctica*). Overall, their biomass contribution was less than 2%. The contribution of lizards (Tropiduridae) to total biomass consumed was negligible, and the tail remain detected was assigned to *Liolaemus magellanicus*, the only lizard species more commonly reported for the area (Jaksic & Schwenk 1983, Venegas & Sielfeld 1998). Similar trends regarding the low contribution of birds and reptiles to the Magellanic Horned Owl's diet elsewhere in Argentina were reported by Donázar et al. (1997), Trejo & Grigera (1998), Nabte et al. (2006), and Formoso et al. (2012), although at Isla Leones, Udrizar Sauthier et al. (2017) reported a high consumption (N = 377 specimens) of *Homonota darwinii*, a small gekkonid lizard.

Insects outnumbered small mammal preys only during the summer, but their biomass contribution in both seasons was very low (0.8% in the summer; 0.2% in the winter). Although the pellets' sample size was almost two-fold, the number of insects dropped at least three-fold during the winter, and their biomass contribution dropped four times. Despite this marked decrease, insects were indeed preyed during winter, as opposed to the observations by Trejo & Grigera (1998) and Formoso et al. (2012). Although Cañadón Grande and Punta Dungeness are located far south from these sites in the mainland Argentinian Patagonia, both localities are very close to the seashore. Here, weather during the winter is much milder than inland, with a higher mean temperature (Santana et al. 2010), thus permitting some insect activity during this season (DRM, pers. obs.). Despite the fact that insects were grouped as unidentified Coleoptera for analysis, the diet contained individuals of Geotrupidae (Earth-boring Dung beetles), and Carabidae, as well as some specimens of

Promecheilidae. Overall, the mean biomass contributions of insects to the diet was only 0.4%.

Standardized food-niche breadth was greater in the winter than in the summer. Although the number of prey was higher during the summer, evenness was lower during this season than in winter. The annual standardized food-niche breadth value (FNBs = 0.389) was higher than that reported by Trejo & Grigera (1998) for an Argentinean Patagonian steppe (FNBs = 0.202), and considerably higher than the values reported by Formoso et al. (2012), which ranged from 0.100 through 0.220. Notwithstanding, our figure falls well within values provided by Nabte et al. (2006), where FNBs ranged between 0.2 through 0.6. In search of a potential latitudinal pattern, we arranged values provided by Donázar et al. (1997), Nabte et al. (2006), Formoso et al. (2012), Udrizar Sauthier et al. (2017), and ours in a north-south fashion, and including only sites located in the plain Patagonian steppe, as judged from the predominant cover determined from both Google Earth Pro imagery and *in situ* inspection (Table 2). Just as it was reported by Muñoz-Pedreros et al. (2017) for Magellanic Horned owls in Chile and Formoso et al. (2012) for their Argentinian counterpart, no latitudinal trends were detected for niche breadth, number of vertebrate prey species, and GMMP values. As most studies just reflect the local availability and/or spectrum of prey available at the time of diet evaluation (Figueroa et al. 2017), latitudinal trends (Jaksic et al. 1986) reported in some results could be just an artifact that emerged from the low number of localities sampled.

Although hare consumption is consistent for most sites, in terms of biomass their contribution is minor. At our sites, all hare remains were from leverets, judging from bone sizes and amount of calcification. As stated by Donázar et al. (1997), but see Trejo & Grigera (1998), the low incidence of lagomorphs in the diet of Magellanic Horned owls could be related to their ability to escape due to their size (Jaksic 1986): Magellanic Horned owls are only able to capture leverets but no adult lagomorphs, as shown in our study.

Southern cavies were consistently preyed upon. They have a wide latitudinal distribution in the Argentinian Patagonia (Udrizar Sauthier et al. 2016) and their southernmost range abuts the north of the Strait of Magellan's shore, part of which coincides with the easternmost projection of continental Chile, where our study sites are located. Thus, this fringe of terrain corresponds to the Southern cavies' southernmost distribution, as they have not been detected in Tierra del Fuego Island. The Chilean area is not large, and most likely Southern cavies have faced multiple bouts of local extinctions there due to agents like overgrazing by sheep and,

to a minor extent, oil and gas prospecting and production. Concomitant re-colonization processes are warranted because the border between Argentina and Chile in this area consists only of simple wire fences erected to avoid sheep crossing between countries. Thus, Southern cavies' numbers there should be very variable and their distribution could contract or relax. Currently, a thriving population of Southern cavies inhabits the area and has successfully re-colonized it from where the species was previously presumed extinct (Muñoz-Pedreros & Gil 2009).

Our results indicate that in Patagonian steppe environments of Argentina and Chile the Magellanic Horned Owl is a generalist predator that takes on whatever prey available, ranging in size from invertebrates to introduced juvenile lagomorphs. Because all five major prey here reported (*Abrothrix, Loxodontomys, Microcavia, Reithrodon, Lepus*) are broadly distributed in the Argentinean Patagonian steppe, and occur abundantly from 38°S southwards to the Strait of Magellan and Tierra del Fuego Island, their generalized occurrence among prey does not allow for expression of latitudinal trends in species composition in the owl's diet.

REFERENCES

Colwell, RK & D J Futuyma (1971) On the measurement of niche breadth and overlap. *Ecology* 52: 567–576.

Donázar, JA, A Travaini, O Ceballos, M Delibes & F Hiraldo (1997) Food habits of the Great Horned Owl in northwestern Argentine Patagonia: The role of introduced Lagomorphs. *Journal of Raptor Research* 31: 364–369.

Figueroa, RA, S Alvarado, ES Corales, D González-Acuña, R Schlatter & DR Martínez (2017) The Owls of Chile. Pp. 159–290 *in* Enríquez, P (ed). *Neotropical Owls. Diversity and Conservation.* Springer International Publishing AG, Cham, Switzerland.

Formoso, AE, P Teta & G Cheli (2012) Food habits of the Magellanic Horned Owl (*Bubo virginianus magellanicus*) at southernmost Patagonia, Argentina. *Journal of Raptor Research* 46: 401–406.

Gajardo, R (1994) *La vegetación natural de Chile. Clasificación y distribución geográfica*. Editorial Universitaria, Santiago, Chile.

Jaksic, FM (1986) Predation upon small mammals in shrublands and grasslands of southern South America: ecological correlates and presumable consequences. *Revista Chilena de Historia Natural* 59: 209–221.

Jaksic, FM, HW Greene & JL Yáñez (1981) The guild structure of a community of predatory vertebrates in central Chile. *Oecologia* 49: 21–28.

Jaksic, FM & CD Marti (1984) Comparative food habits of *Bubo* owls in mediterranean-type ecosystems. *Condor* 86: 288–296.

Jaksic, FM & K Schwenk (1983) Natural history observations on *Liolaemus magellanicus*, the southernmost lizard in the world. *Herpetologica* 39: 457–461.

Jaksic, FM, JL Yáñez & JR Rau (1978) Oferta de presas y predación por *Bubo virginianus* (Strigidae) en el Parque Nacional Torres del Paine. *Anales Instituto Patagonia (Chile)* 9: 199–202.

Jaksic, FM, JL Yáñez & JR Rau (1986) Prey and trophic ecology of Great Horned Owls in western South America: an indication of latitudinal trends. *Journal of Raptor Research* 20: 113–116.

Krebs, CJ (1989) *Ecological methodology*. Harper and Row, New York, USA.

Levins, R (1968) *Evolution in changing environments*. Princeton University Press, New Jersey, USA.

Lozada, JM, A Monjeau, KM Heinemann, N Guthmann & EC Birney (1996) *Abrothrix xanthorhinus*. *Mammalian Species* 540: 1–6.

Marti, CD, E Korpimäki & FM Jaksic (1993) Trophic structure of raptor communities: a three-continent comparison and synthesis. Pp. 47-137 *in* Power, DM (ed). *Current Ornithology*, Volume 10.

Plenum Publishing Corporation, New York, USA.

Marti, CD, M Bechard, & FM Jaksic (2007) Food habits. Pp. 129-151 *in* Bird, DM & KL Bildstein (eds). *Raptor Research and Management Techniques*. Hancock House Publishers, Blaine, Washington, USA.

Martínez, DR (2018) The summer diet of the Magellanic Horned Owl (*Bubo magellanicus*, Gmelin, 1788) at the easternmost projection of continental Chile, Punta Dungeness. *Anales Instituto Patagonia (Chile)* 46: 67–71.

Muñoz-Pedreros, A & C Gil (2009) Orden Rodentia. Pp. 93–157 *in* Muñoz-Pedreros, A & JL Yáñez (eds). *Mamíferos de Chile*. Segunda Edición, CEA Ediciones, Valdivia, Chile.

Muñoz-Pedreros, A, JL Yáñez, C Gil, HV Norambuena & ER Carmona (2017) Spatial differences in the diet of the Magellanic Horned Owl *Bubo magellanicus* (Gmelin, 1788) in central Chile. *New Zealand Journal of Zoology* 44: 25–38.

Nabte, M, S Saba & U Pardiñas (2006) Dieta del Búho Magallánico (*Bubo magellanicus*) en el desierto del monte y la Patagonia Argentina. *Ornitología Neotropical* 17: 27–38.

Olson, DM, E Dinerstein, ED Wikramanayake, ND Burgess, GVN Powell, EC Underwood, JA D'Amico, I Itoua, HE Strand, JC Morrison, CJ Loucks, TF Allnut, TH Ricketts, Y Kura, JF Lamoreux, WW Wettengel, P Hedao & KR Kassem (2001) Terrestrial ecoregions of the world: A new map of life on Earth. *BioScience* 51: 933–938.

Pardiñas, UFJ & CA Galliari (2001) *Reithrodon auritus*. *Mammalian Species* 664: 1–8.

Pearson, O (1983) Characteristics of a mammalian fauna from forests in Patagonia, southern Argentina. *Journal of Mammalogy* 64: 476–492.

Pearson, O (1995) Annotated keys for identifying small mammals living in or near Nahuel-Huapi National Park or Lanin National Park, Southern Argentina. *Mastozoología Neotropical* 2: 99–148.

Reise, D (1973) Clave para la determinación de los cráneos de marsupiales y roedores chilenos. *Gayana Zoología* 27: 1–20.

Santana, A, C Olave & N Butorovic (2010) Estudio climatológico con registros de alta resolución temporal en Campamento Posesión (ENAP), Magallanes, Chile. *Anales Instituto Patagonia (Chile)* 38: 5–34.

Teta, P, UFJ Pardiñas, DE Udrizar-Sauthier & G D'Elía (2009) *Loxodontomys micropus* (Rodentia: Cricetidae). *Mammalian Species* 837: 1–11.

Tognelli, MF, CM Campos & RA Ojeda (2001) *Microcavia australis*. *Mammalian Species* 648: 1–4.

Trejo, A & D Grigera (1998) Food Habits of the Great Horned Owl (*Bubo virginianus*) in a Patagonian steppe in Argentina. *Journal of Raptor Research*, 32: 306–311.

Udrizar-Sauthier, DE, AE Formoso, PV Teta, DC de Tommaso, AM Bernardis, MN Tammone & UFJ Pardiñas (2016) Dense sampling provides a reevaluation of the southern geographic distribution of the cavies *Galea* and *Microcavia* (Rodentia). *Mammalia* 80: 335–340.

Udrizar-Sauthier, DE, AE Formoso, G Cheli & G Pazos (2017) Food habits of the Magellanic Horned Owl (*Bubo magellanicus*) in a coastal island of Patagonia, Argentina. *Ornitología Neotropical* 28: 237–241.

Venegas, C & W Sielfeld (1998) *Catálogo de los vertebrados de la región de Magallanes y Antártica chilena*. Ediciones Universidad de Magallanes, Punta Arenas, Chile.

Yáñez, JL, JR Rau & FM Jaksic (1978) Estudio comparativo de la alimentación de *Bubo virginianus* (Strigidae) en dos regiones de Chile. *Anales del Museo de Historia Natural de Valparaíso (Chile)* 11: 97–104.