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ARTICLE

Diet of the Burrowing Owl *Athene cunicularia*, in two locations of the inter-Andean valley Ecuador

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ABSTRACT: We provide the first detailed description of the diet of Burrowing Owls (*Athene cunicularia*) for Ecuador, based on an analysis of 408 pellets collected from one locality in the north and one in the south of the central dry Andean Valley. Our results are consistent with previous studies in the Neotropics that document the importance of insects in the diet. Rodents made up 78.8% of the biomass in our sample. Additionally, we highlight the first record of the Andean eared mouse *Phyllotis andium* in a xeric environment, which was identified in the pellets.

KEY-WORDS: pellets, *Phyllotis andium*, Strigidae, trophic ecology.

INTRODUCTION

The knowledge of the food type that a species consumes is important to establish inter and intraspecific interactions (Marti *et al*. 1993). Most of our knowledge on the feeding habits of owls has been based on the analysis of pellets, which are compact packages of hairs, bones and other indigestible material, regurgitated by these and other birds. Marks *et al*. (1999) mention that diet is the better-known ecological aspect of owls due to the presence of pellets, but this general statement does not necessarily reflects the reality for species in Ecuador (Freile *et al.* 2012, Cadena-Ortiz *et al*. 2013).

The Burrowing Owl (*Athene cunicularia*) usually lives in pairs or family groups, associated with burrows dug into soft ground. This owl has a wide distribution, from the North American plains to Tierra del Fuego in Argentina. In Ecuador, it is considered rare and two subspecies occur; *A. c. pichinchae* in open arid areas of the Andes, mainly between 1500–2000 m a.s.l., and *A. c. punensis*, smaller in size and found in coastal areas of the southwest, below 50 m a.s.l. (Ridgely & Greenfield 2001, König & Weick 2008).

The feeding ecology of *A. cunicularia* has received considerable attention, especially in North America (*e.g.*, Marks *et al.* 1999, Moulton *et al*. 2005) and in Argentina (see Pardiñas & Cirignoli 2002). Other studies from the Neotropics were carried out in Peru (Medina *et al.* 2013, 2014), Brazil (*e.g.*, Motta-Junior & Bueno 2004, Zilio 2006, Bueno & Motta-Junior 2008), Chile (*e.g.*, Schlatter *et al.* 1980, Silva *et al.* 1995, Carevic 2011, Carevic *et al.* 2013) and Paraguay (Andrade *et al.* 2004).

In Ecuador there is no detailed study on the ecology of this owl (Freile *et al*. 2012), only anecdotal references (Arteaga *et al.* 2012, Cadena-Ortiz *et al.* 2013). In the present study we detail the diet of *A. c. pichinchae*, based on pellets from populations of northern and southern Ecuador.

METHODS

Study area

Pellets samples were obtained from two sites in the central dry Andean Valley: 1) Piedra Labrada (03°22'25.4"S; 79°23'12.1"W, 1437 m a.s.l.), Saraguro Canton, Loja Province, southwestern Ecuador (Figure 1). This is an "Ecosistema arbustal desértico del sur de los valles" habitat (Figures 2A–B), with dominant plant species, *Croton* sp., *Acacia* sp. and *Carica parviflora.* This area has a desert bioclimate, with an average annual temperature of 22°C

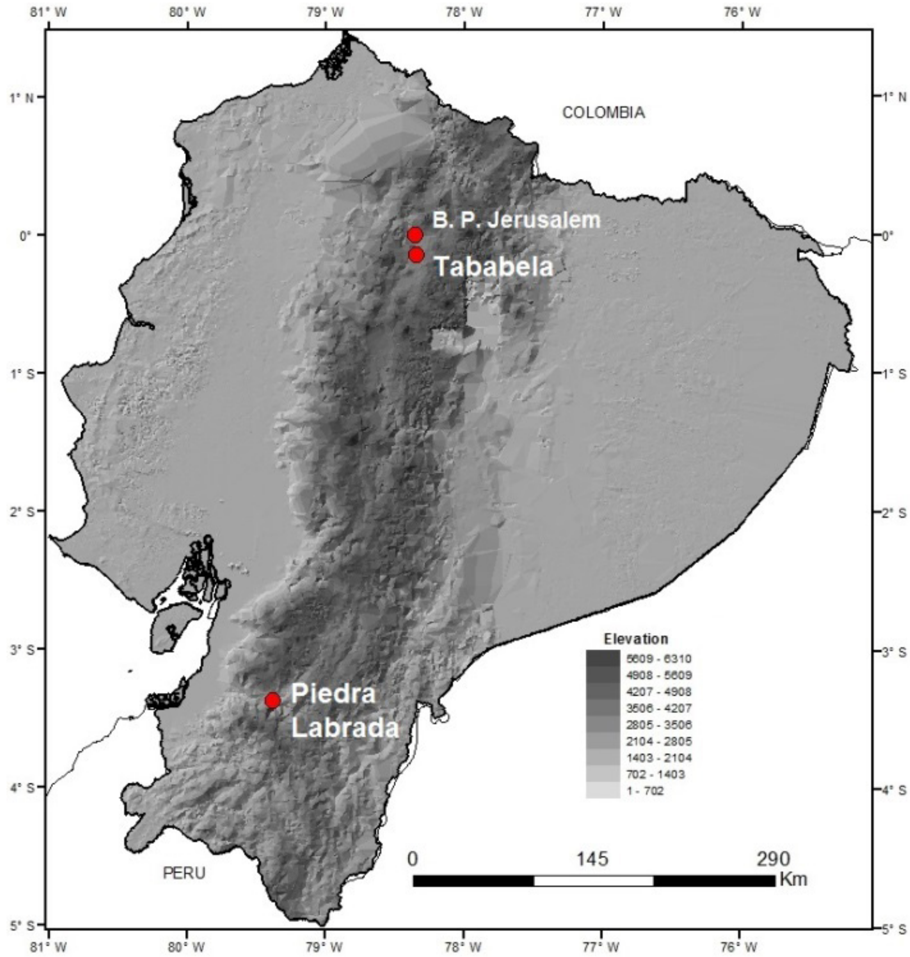

FIGURE 1. Sites in the inter-Andean valley of Ecuador, where the pellets of *Athene cunicularia* were collected.

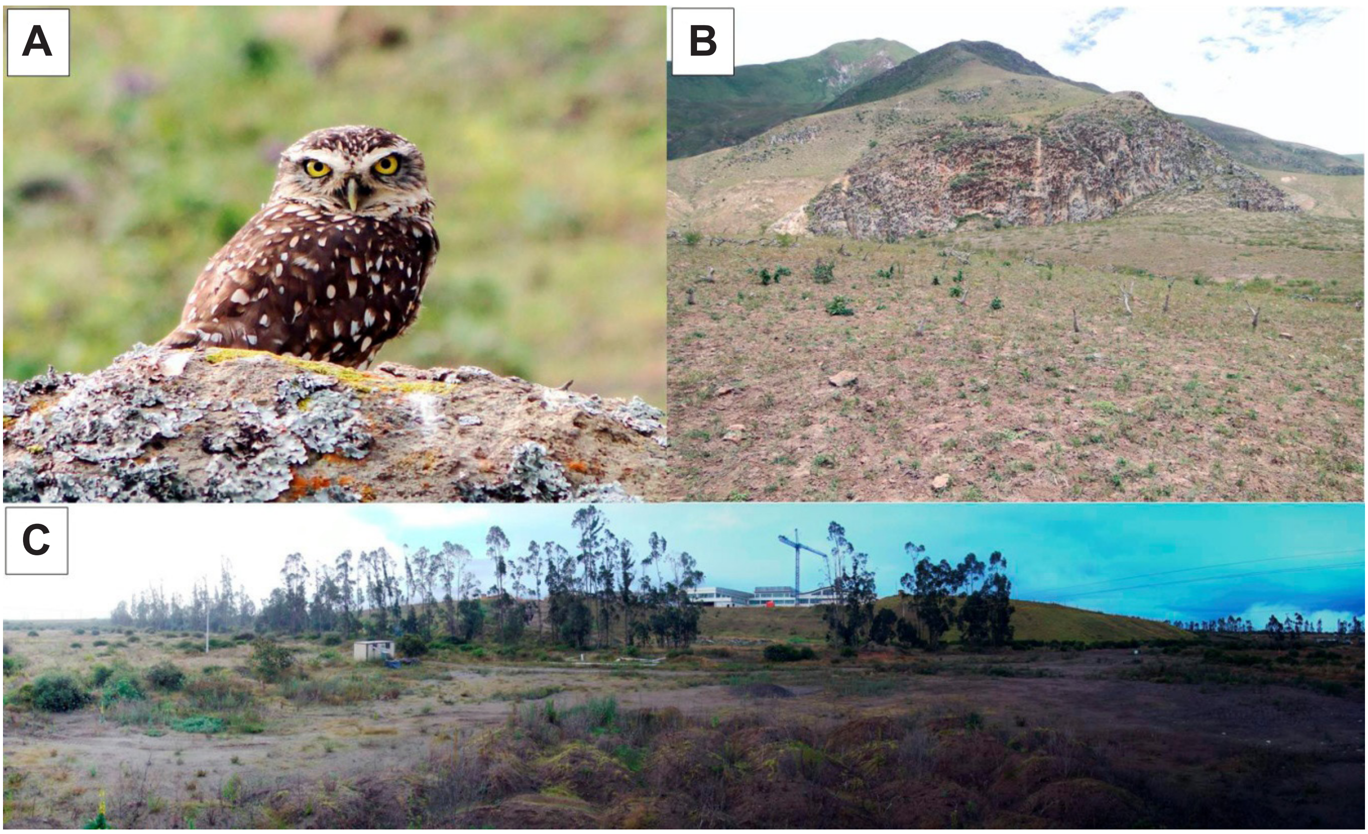

FIGURE 2. (**A**) Burrowing Owl, *Athene cunicularia*, at Piedra Labrada; (**B**) Habitat of Piedra Labrada; (**C**) Panoramic view of the Tababela habitat. Photos: Jorge Brito-M.

and 201 mm of precipitation per year (MAE 2013). 2) Tababela (00°8'42.15"S; 78°20'58.02"W, 2432 m a.s.l.), Quito Canton, Pichincha Province, Caraburo plateau, where the new Quito International Airport (AIMS) for northern Ecuador is located. This is a "Bosque y arbustal semideciduo del norte de los valles". The vegetation is up to 12 m in height and there is a dominance of *Acacia macracantha*, *Inga* sp. and *Eucalyptus globulus* trees and shrubs such as *Opuntia* sp., *Bryophyllum pinnatum* and *Dodonaea viscosa* (Figure 2C), characteristic of dry inter Andean valleys with hills and slopes of rocky soils (MAE 2013). The average annual temperature is 19°C with 360–600 mm of precipitation (Cañadas 1983). Additional qualitative data comes from Bosque Protector Jerusalem (00°00'08.8"N; 78°21'29.8"W, 2304 m a.s.l.) *c.* 12 km from Tababela and similar habitat.

Sampling

In both localities pellets were collected in individual bags with a numerical code. The Piedra Labrada collection came from two owl territories, *c.* 0.2 km apart. Both were visited in April 2012 and December 2013. In Tababela pellets were collected from nine territories, about 1.1 km from each other. All territories were visited nine times, between April 2013 and September 2014.

Data analysis

Pellets were measured with a caliper, ± 0.01 mm precision, the dry weight for each pellet was recorded with an analytical balance 120 ± 0.001 g. After measurement, pellets were manually disintegrated and the bone and arthropod remains were separated and stored in individual vials for later identification. Small mammals were identified through dental characters (Pearson 1958, Hershkovitz 1962, Weskler & Percequillo 2011). Identification of invertebrates was made using different characters (Endrödi 1966, Morón *et al.* 1997, Carvajal *et al.* 2011) and compared to invertebrate reference material in the Museo Ecuatoriano de Ciencias Naturales (MECN).

We determined the minimum number of individuals (MNI) in the sample by counting the homologous jaw or skull remnants for vertebrates, and elytra, heads and mandibles of arthropods. The dietary composition was expressed as relative frequency, MNI of each prey type divided by the total number of prey, multiplied by 100 (Grayson 1984, Formoso *et al.* 2012). Biomass consumed (BM) by *A. cunicularia* was calculated as the average weight of each prey type taxa by the MNI for each locality.

For weight data we used our own records, MECN records, Tirira (2007) and Ramírez-Jaramillo (2015). For invertebrates, the estimated weight of each taxa was only obtained for pellets from Tababela. There was no reference material at MECN to use for weight estimates of invertebrate prey in pellets from Piedra Labrada.

RESULTS

We found 37 taxa (10 vertebrates and 27 invertebrates) in the pellets of *A. cunicularia*, based on 408 pellets analysed from the two localities in Ecuador (Piedra Labrada and Tababela). Pellets were flattened ovals and flat, gray to black in color with average measurements (with standard deviations) of length 32.3 ± 6.1 mm; width 13.9 ± 2.5 mm; height 12.43 ± 2.53 mm and weight 1.55 ± 0.82 g (Piedra Blanca) and length 26.1 ± 6.6 mm; width 12.8 ± 1.4 mm; height 11.0 ± 1.4 mm and weight 1.0 ± 0.5 g (Tababela).

At Piedra Labrada, 40 pellets had remnants of 196 individual prey, grouped into 12 taxa, Coleoptera (5), Dermaptera (3), Scorpionida (1), Gastropoda (1) and small vertebrates (2). Vertebrates were the Andean Eared Mouse (*Phyllotis andium*) and the Guagsa (*Stenocercus rhodomelas*) (Table 1). In this area only two pellets contained exclusively vertebrate remains; the others contained only invertebrate remains or mixed content.

At Tababela, 368 pellets had remnants of 872 prey, grouped into 27 taxa, Coleoptera (14), four orders of other invertebrates (5) and small vertebrates (8). The rodent remains were from, *Akodon* cf. *mollis*, *Phyllotis haggardi*, *Reithrodontomys soderstromi*, *Mus musculus* and *Rattus rattus*; the reptile *Stenocercus guentheri* and anurans *Pristimantis unistrigatus* and *Gastrotheca riobambae* (Table 1). In the pellets from Tababela, 26 contained exclusively vertebrate remains; the others contained invertebrate remains or mixed content.

In both locations, the vertebrates in the diet of *A. cunicularia* were predominantly rodents, 60% of the individual vertebrate prey represented in the pellets; these were followed by reptiles and frogs, 20% each. Of the rodents, the most frequent prey in the diet of *A. cunicularia* was *Reithrodontomys soderstromi* (32 individuals) and *P. haggardi* (26), both species were in pellets from Tababela. *P. andium* (13) was the only rodent found in pellets from Piedra Labrada (Table 1).

In both locations, beetles (Coleoptera) were the predominant invertebrate prey of owls, representing 65.5% of invertebrates with remnants in the pellets, followed by spiders and scorpions with 7% each. Among Tababela samples, most prevalent beetles were Melolonthidae larvae (n = 218), followed by adult Tenebrionidae (n = 81) and *Barotheus andinus* (n = 80). In Piedra Labrada, Melolonthidae larvae (n = 49) were also the most abundant prey, followed by adult Scarabidae (n = 44). We did not find remains of birds in pellets, however, we

TABLE 1. Taxa found in *Athene cunicularia* pellets at two locations in Ecuador. Average weight = AW in g; Minimum number of individuals = MNI and biomass consumed = BM, *only for vertebrates.

ORDER/Family/*Species*	AW	Tababela		Piedra Labrada	
		MNI (%)	BM (%)	MNI (%)	BM (%)*
RODENTIA		84 (9.6)	1669 (74.9)	13 (6.6)	403 (94.8)
Cricetidae					
Akodon cf. *mollis*	15	9 (1.0)	135 (6.1)	0	0
Phyllotis haggardi	20	26 (3.0)	520 (23.3)	0	0
Phyllotis andium	31	0	0	13 (6.6)	403 (94.8)
Reithrodontomys soderstromi	15	32 (3.7)	480 (21.6)	0	0
Muridae					
Mus musculus	14	15 (1.7)	210 (9.4)	0	0
Rattus rattus	162	2 (0.2)	324 (14.5)	0	0
REPTILIA		1 (0.1)	11 (0.5)	2 (1.0)	22 (5.2)
Tropiduridae					
Stenocercus guentheri	11	1 (0.1)	11 (0.5)	0	0
Stenocercus rhodomelas	11	0	0	2 (1.0)	22 (5.2)
ANURA		7 (0.8)	87 (3.9)	0 (0)	0 (0)
Craugastoridae					
Pristimantis unistrigatus	3	1 (0.1)	3 (0.1)	0	0
Hemiphractidae					
Gastrotheca riobambae	14	6 (0.7)	84 (3.8)	0	0
COLEOPTERA		585 (67.2)	269.2 (12.2)	151 (77)	0
Carabidae					
Anchomenus aff. *quitensis*	0.15	46 (5.3)	6.9 (0.3)	0	0
Cerambicidae	0.19	1 (0.1)	0.19 (0.01)	0	0
Curculionidae	0.92	64 (7.3)	58.9 (2.6)	27 (13.8)	0
Chrysomelidae	0	0	0	9 (4.6)	0
Elateridae	0	0	0		0
Chalcolepidius sp1	0.13	30 (3.4)	3.9 (0.2)	0	0
Chalcolepidius sp2	0.14	1 (0.1)	0.14 (0.01)	0	0
Melolonthidae	0	0	0	49 (25.0)	0
Barotheus andinus	0.51	80 (9.2)	40.8 (1.8)	0	0
Clavipalpus whymperi	0.30	41 (4.7)	12.3 (0.6)	0	0
Heterogomphus bourcieri	1.0	4 (0.5)	4 (0.2)	0	0
Morphospecies 1	0.22	8 (0.9)	1.8 (0.1)	0	0
Morphospecies 2	0.20	6 (0.7)	1.2 (0.1)	0	0
Larvae	0.56	218 (25.0)	122.1 (5.5)	0	0
Platycoelia cf. *lutescens*	0.40	1 (0.1)	0.40 (0.02)	0	0
Scarabaeidae	0	0	0	44 (22.4)	0
Tenebrionidae	0	0	0	22 (11.2)	0
Tenebrio sp.	0.16	81 (9.3)	13 (0.6)	0	0
Trogidae					
Omorgus suberosus	0.89	4 (0.5)	3.6 (0.2)	0	0
DERMAPTERA		0	0	5 (2.6)	0
Anisolabiidae	0	0	0	2 (1.0)	0
Labiduridae	0	0	0	2 (1.0)	0
Forficulidae	0	0	0	1 (0.6)	0
HYMENOPTERA		1 (0.1)	0.31 (0.01)	0	0
Formicidae					
Linepithema sp.	0.31	1 (0.1)	0.31 (0.01)	0	0
ORTHOPTERA		7 (0.8)	1.1 (0.05)	0	0
Acrididae					
Paradichroplus sp.	0.16	7 (0.8)	1.1 (0.05)	0	0
ARANEA		174 (19.9)	182.1 (8.2)	0	0
Lycosidae					
Hogna sp.	1.05	171 (19.6)	179.6 (8.1)	0	0
Alopecosa sp.	0.82	3 (0.3)	2.5 (0.1)	0	0
SCORPIONIDA		13 (1.5)	7.4 (0.3)	24 (12.2)	0
Buthidae	0	0	0	24 (12.2)	0
Chactoidae					
Teuthraustes atramentarius	0.57	13 (1.5)	7.4 (0.3)	0	0
GASTROPODA	0	0	0	1 (0.5)	0
Bulimulidae	0	0	0	1 (0.5)	0
Total individuals		872 (100)	2227.14 (100)	196 (100)	425 (100)

observed remains of bird feathers or carcasses of *Zenaida auriculata*, *Columbina passerina*, *Turdus fuscater*, *Phrygilus plebejus* (Figure 3A) and *Sporagra magellanica*, in burrows at Tababela. We found similar results in Bosque Protector Jerusalem, where in a burrow inhabited by at least five individuals of *A. cunicularia*, we found only four pellets, one per visit to the burrow. These pellets only contained remains of invertebrates, mainly Scarabaeidae (adults) and several Dermaptera. Also in the entrance of the burrow we noted pellet remains with several fragments of snail shells (Bulimulidae). Finally, a dead individual of *A. cunicularia*, found on the road bordering Bosque Protector Jerusalem, had remains of lizards, probably *S. guentheri*, in the stomach (S. Varela, pers. comm.).

The weight of vertebrate prey consumed in Piedra Labrada and Tababela averaged 29.6 g (3–162 g; n = 10). Rodents represent 74.9% of the biomass in Tababela, 94.8% in Piedra Labrada and 78.8% for whole samples, excluding the invertebrates from Piedra Labrada (Figure 3B).

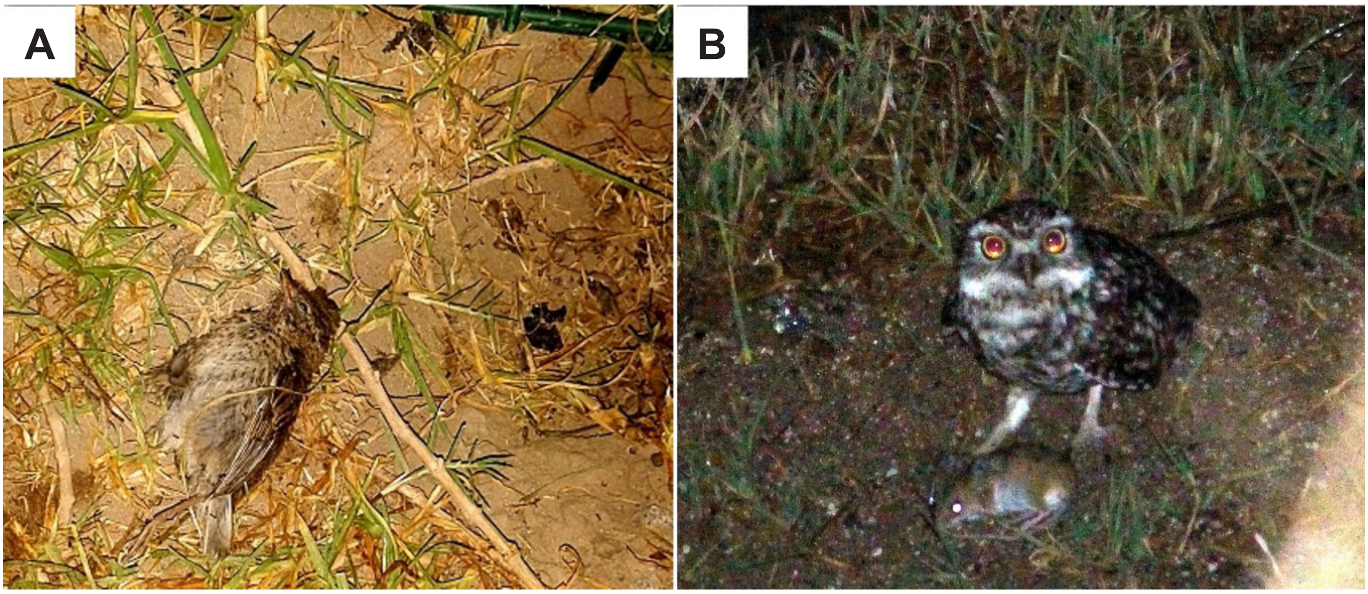

FIGURE 3. Prey of *Athene cunicularia* at Tababela: (**A**) *Phrygilus plebejus* dead at the entrance of the owl burrow; (**B**) *Athene cunicularia* with a *Phyllotis haggardi* recently captured. Photos: Glenda Pozo-Zamora and César Garzón.

DISCUSSION

Our results are in agreement with the descriptions of this owl as a generalist predator using a hunting strategy focused on the most abundant and accessible prey (Vieira & Teixeira 2008). In the *A. cunicularia* pellets from Piedra Labrada and Tababela we found a predominance in number, of invertebrates, mainly beetles, and predominance in biomass of vertebrates, mainly rodents. The diversity of prey found was consistent with the general descriptions of *A. cunicularia* diets in other studies, mainly arthropods (beetles and other insects, spiders and scorpions), small mammals (up to 200 g), but also amphibians, reptiles and occasionally small birds (up to 200 g) (see Marks *et al*. 1999, König & Weick 2008).

A numerical predominance of insects and predominance in biomass of rodents in the *A. cunicularia* diet is a general pattern along its distribution range. For example, in the United States, insects and other invertebrates dominate the diet in numbers of prey, whereas rodents such as *Microtus montanus* contribute the greatest biomass (Moulton *et al*. 2005). In Brazil, termites, orthopterans and beetles are numerically the main prey items, but small rodents such as *Calomys tener* form the bulk of biomass in the diet (Motta-Junior & Bueno 2004). In Argentina, the majority of prey is from three groups, Coleoptera, Scorpionida and eight species of Rodentia (de Tommaso *et al*. 2009). In Peru Tenebrionidae beetles are the most frequent and the rodent *Lagidium peruanum* contributes the largest amount of biomass (Medina *et al.* 2014). In Chile insects and scorpions are the most common prey and the rodent *Phyllotis darwini* is the most important prey in biomass (Carevic *et al.* 2013). In Ecuador, Arteaga *et al.* (2012) analysed 16 owl pellets from Tababela and found 86% of numerical frequency of Coleoptera and Orthoptera remnants, and 14% of small vertebrates remnants, such as mice and lizards, without additional taxonomic detail. Additionally, for Ecuador there are only two zoological specimens of *A. c. punensis* with insects in their stomach contents detailed on their labels (Cadena-Ortiz *et al.* 2013).

These results reported for other locations are consistent with ours in the rate of prey groups, but with different species diversity, even though our research was conducted at only two locations. However, it is important to extend the studies of the diet of owl to different time periods and seasons and more locations in Ecuador to make comparisons and look for patterns.

Birds may be underestimated from owl diet based on pellet analysis since we found vestiges of birds in burrows at Tababela, but did not find remains of birds in pellets. Other studies also show low frequency of birds in the diet of *A. cunicularia*. For example, from 91 pellets analysed in Peru, evidence of only one bird was found (Medina *et al.* 2014); in Argentina evidences of 15 birds were found in 235 pellets (Andrade *et al.* 2010).

Rodents are an important component in the *A. cunicularia* diet, as corroborated by ours and other studies (*e.g.*, Bueno & Motta-Junior 2008, Carevic 2011, Carevic *et al.* 2013). This further highlights the value of this owl as a biological control of peridomestic rat populations (Carevic 2011), and could counteract the bad reputation of *A. cunicularia*, which is usually considered a bad luck bird or a bad omen among local people (Restrepo & Enríquez 2014, authors' pers. obs.).

The analysis of pellets has been proven be an efficient complementary inventory method of biodiversity in unexplored areas (Andrade *et al.* 2010), in particular for small mammals (*e.g.*, Bonvicino & Bezerra 2003, Torre *et al.* 2004, Moreno 2010, Brito *et al.* 2015). Analyses of *A. cunicularia* pellets has been demonstrated to be effective as an inventory method for small mammals in Lomas de Lima, Peru (Mena *et al.* 2007) and the Atacama Desert, Chile (Carevic 2011). We found evidence of the Andean Eared Mouse, an endemic species to the Andes, from central and northern Peru to southern Ecuador (Hershkovitz 1962, Zeballos & Vivar 2008). In Ecuador, this rodent has been reported in subtropical and temperate forests and in highlands, with most records from wetlands with abundant shrub vegetation (Tirira 2007). Our record in the pellets is the first one of *P. andium* in the valleys of southern Ecuador, in Piedra Labrada at 1435 m in a xeric environment.

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REFERENCES

Andrade, A.; Nabte, M. J. & Kun, M. E. 2010. Diet of the Burrowing Owl (*Athene cunicularia*) and its seasonal variation in Patagonian steppes: implications for biodiversity assessments in the Somuncurá Plateau Protected Area, Argentina. *Studies on Neotropical Fauna and Environment*, 45: 101–110.

Andrade, A.; Teta, P. & Contreras, J. 2004. Dieta de la Lechucita Vizcachera (*Athene cunicularia*) en el Parque Nacional Médanos del Chaco (Paraguay). *Ornitología Neotropical*, 15: 87–92.

Arteaga, J.; Toscano, G.; Sánchez, P. & de Vries, T. 2012. Dieta del Búho Terrestre *Athene cunicularia pichinchae* mediante análisis de egagrópilas. *In*: Resúmenes de las XXXVI Jornadas Nacionales de Biología. Guayaquil, Ecuador.

Bonvicino, C. R. & Bezerra, A. M. R. 2003. Use of regurgitated pellets of Barn Owl (*Tyto alba*) for inventorying small mammals in the Cerrado of central Brazil. *Studies on Neotropical Fauna and Environment*, 38: 1–5.

Brito, J.; Orellana-Vásquez, H.; Cadena-Ortiz, H.; Vargas, R.; Pozo-Zamora G. & Curay, J. 2015. Mamíferos pequeños en la dieta de la lechuza *Tyto alba* (Strigiformes: Tytonidae) en dos localidades del occidente de Ecuador, con ampliación distribucional de *Ichthyomys hydrobates* (Rodentia: Cricetidae). *Papéis Avulsos de Zoologia*, 55: 261–268.

Bueno, A. A. & Motta-Junior, J. C. 2008. Small mammal prey selection by two owl species in southeastern Brazil. *Journal of Raptor Research*, 42: 248–255.

Cadena-Ortiz, H.; Freile, J. F. & Bahamonde-Vinueza, D. 2013. Información sobre la dieta de algunos búhos (Strigidae) del Ecuador. *Ornitología Neotropical*, 24: 469–474.

Cañadas, L. 1983. *El mapa bioclimático y ecológico del Ecuador.* Quito: Ministerio de Agricultura y Ganaderia.

Carevic, F. S. 2011. Rol del Pequén (*Athene cunicularia*) como controlador biológico mediante el análisis de sus hábitos alimentarios en la Provincia de Iquique, norte de Chile. *Idesia*, 29: 15–21.

Carevic, F. S.; Carmona, E. R. & Muñoz-Pedreros, A. 2013. Seasonal diet of the Burrowing Owl *Athene cunicularia* Molina, 1782 (Strigidae) in a hyperarid ecosystem of the Atacama Desert in northern Chile. *Journal of Arid Environments*, 97: 237–241.

Carvajal, V.; Villamarin-Cortez, S. & Ortega, A. 2011. *Escarabajos del Ecuador. Principales g*éneros. Quito: Instituto de Ciencias Biológicas. Escuela Politécnica Nacional. Serie Entomología, No. 1.

Endrödi, S. 1966. Monographie der Dynastinae (Col. Lam.) I. Teil. *Entomologische Abhandlungen Museum Tierkunde, Dresden*, 33: 1–457.

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

Freile, J. F.; Castro, D. F. & Varela, S. 2012. Estado del conocimiento, distribución y conservación de aves rapaces nocturnas en Ecuador. *Ornitología Neotropical*, 23: 235–244.

Grayson, D. K. 1984. *Quantitative zooarchaeology: topics in the analysis of archaeological faunas.* Orlando: Academics Press.

Hershkovitz, P. 1962. Evolution of Neotropical cricetine rodents (Muridae) with special reference to the phyllotine group. *Fieldiana Zoology, Chicago Natural History Museum*, 46: 1–524.

König, C. & Weick, F. 2008. *Owls of the world.* London: Christopher Helm.

MAE (Ministerio del Ambiente del Ecuador). 2013. *Sistema de clasificación de los ecosistemas del Ecuador Continental.* Quito: Ministerio del Ambiente, Subsecretaría de Patrimonio Natural.

Marks, J. S.; Canning, R. J. & Mikkola, H. 1999. Family Strigidae (typical owls). p. 76–242 *In*: del Hoyo, J.; Elliott, A. & Sargatal,

J. (eds.). *Handbook of the birds of the world*, v. *5 (barn-owls to hummingbirds).* Barcelona: Lynx Edicions.

Marti, C. D.; Steenhof, K.; Kochert, M. N. & Marks, J. S. 1993. Community trophic structure: the roles of diet, body size, and activity time in vertebrate predators. *Oikos*, 67: 6–18.

Medina, C.; Zelada, W. & Pollack, L. 2014. Estructura alimenticia de la Lechuza de los Arenales, *Athene cunicularia*, en el Cerro Campana, La Libertad, Perú. 2011. *Revista Rebiol*, 34: 73–82.

Medina, C. A.; Zelada, W.; Pollack, L.; Huamán, E. & Gómez, A. 2013. Dieta de la Lechuza de los Arenales, *Athene cunicularia*, en Trujillo y en el Cerro Campana, La Libertad (Perú): 2013. *Revista Rebiol*, 33: 99–106.

Mena, J. L.; Williams, M.; Gazzolo, C. & Montero, F. 2007. Estado de conservación de *Melanomys zunigae* (Sanborn 1949) y de los mamíferos pequeños en las Lomas de Lima. *Revista Peruana de Biología*, 14: 201–208.

Moreno, P. 2010. Mamíferos presentes en la dieta de la Lechuza de Campanario (*Tyto alba*) en Valdivia, provincial de Guayas, Ecuador. *Avances en Ciencias e Ingenierías, Sección B*, 2: B87–B90.

Morón, M. A.; Ratcliffe, B. C. & Deloya, C. 1997. *Atlas de escarabajos de México. Coleoptera: Lamellicornia, v. I. Familia Melolonthidae.* Mexico: CONABIO, Sociedad Mexicana de Entomología.

Motta-Junior, J. C. & Bueno, A. A. 2004. Trophic ecology of the Burrowing Owl in southeast Brazil. *In*: Chancellor, R. D. & Meyburg, B. U. (eds.). *Raptors worldwide: proceedings of the VI world conference on birds of prey and owls*. World Working Group on birds of prey and owls, Budapest: MME BirdLife, 763–775.

Moulton, C.; Brady, R. & Belthoff, J. 2005. A comparison of breeding seasonal food habits of Burrowing Owls nesting in agricultural and non-agricultural habitat in Idaho. *Journal of Raptor Research*, 39: 429–438.

Pardiñas, U. & Cirignoli, S. 2002. Bibliografía comentada sobre los análisis de egagrópilas de aves rapaces en Argentina. *Ornitología Neotropical*, 13: 31–59.

Pearson, O. 1958. *A taxonomic revision of the rodent genus* Phyllotis. Berkeley: University of California Press.

Ramírez-Jaramillo, S. R. 2015. Observaciones sobre la historia natural de *Erythrolamprus epinephelus albiventris* en el valle de Quito, Ecuador. *Avances en Ciencias e Ingenierías*, *Sección B*, 7: B5–B7.

Restrepo, J. S. & Enríquez, P. L. 2014. Conocimiento popular sobre los búhos en poblaciones rurales del suroccidente de Manizales, Caldas, Colombia. *Etnobiología*, 12: 41–48.

Ridgely, R. S. & Greenfield, P. J. 2001. *The birds of Ecuador, v. 1: status, distribution and taxonomy.* Ithaca: Cornell University Press.

Schlatter, R. P.; Yáñez, J. L.; Núñez, H. & Jaksić, F. M. 1980. The diet of the Burrowing Owl in central Chile and its relation to prey size. *Auk*, 97: 616–619.

Silva, S. I.; Lazo, I; Silva-Aranguiz, E.; Jaksić, F. M.; Meserve, P. & Gutiérrez, J. R. 1995. Numerical and functional response of Burrowing Owls to long-term mammal fluctuations in Chile. *Journal of Raptor Research*, 29: 250–255.

Tirira, D. 2007. *Guía de campo de los mamíferos del Ecuador.* Publicación especial sobre los mamíferos del Ecuador. 6. Quito: Ediciones Murciélago Blanco.

de Tommaso, D. C.; Callicó, R. G.; Teta, P. & Pereira J. A. 2009. Dieta de la Lechucita Vizcachera (*Athene cunicularia*) en dos áreas con diferente uso de la tierra en el centro–sur de la provincia de La Pampa, Argentina. *Hornero*, 24: 87–93.

Torre, I.; Arrizabalaga, A. & Flaquer, C. 2004. Three methods for assessing richness and composition of small mammal communities. *Journal of Mammalogy*, 85: 524–530.

Vieira, L. A. & Teixeira, R. L. 2008. Diet of *Athene cunicularia* (Molina, 1782) from a sandy coastal plain in southeast Brazil. *Boletim do Museu de Biologia Mello Leitão*, 23: 5–14.

Weskler, M. & Percequillo, A. 2011. Key to the genera of the tribe Oryzomyini (Rodentia: Cricetidae: Sigmodontinae). *Mastozoología Neotropical*, 18: 281–292.

Zeballos, H. & Vivar, E. 2008. *Phyllotis andium*. The IUCN Red List of Threatened Species. Version 2014.3. www.iucnredlist.org. (access on 08 April 2015).

Zilio, F. 2006. Dieta de *Falco sparverius* (Aves: Falconidae) e *Athene cunicularia* (Aves: Strigidae) em uma região de dunas no sul do Brasil. *Revista Brasileira de Ornitologia*, 14: 379–392.

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