
DIET OF THE BARN OWL (*Tyto alba* SCOPOLI 1769) FROM THE COPIAPÓ VALLEY, ATACAMA DESERT, CHILE

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SUMMARY

The Barn Owl (*Tyto alba*) is a nocturnal raptor species distributed from Arica to Tierra del Fuego in Chile. The diet of this bird is the best known of any raptor of Chile; it is based on small vertebrates, particularly rodents and birds. We studied the diet of the Barn Owl, by analyzing of pellets collected in Copiapó valley, located in the hyper-arid Atacama Desert. This information was compared to available data from Chile and neighboring countries. Because of the environmental conditions of extreme aridity a low diversity of prey, typical of raptors from arid ecosystems, was expected. In the case of *Tyto alba* populations from the Atacama region, the most consumed species were rodents (76.7%), specially *Eligmodontia dunaris* (27.3%), *Phyllotis darwini* (24%) and *Abrocoma ben-*

netti (12.4%). Other preys corresponded to birds (17.8%) and coleopterans (3.3%). There was no significant correlation between frequency of prey and their body mass ($r^2 = 0.229$, $p = 0.497$) and between frequency of prey and their habitat ($r^2 = 0.538$, $p = 0.088$), indicating that this raptor does not select its preys by either body size or habitat. Regarding biomass, rodents contributed more significantly (95.3%) than birds (3.5%), with the largest individual contribution given by *A. bennetti* (60.1%) and *P. darwini* (26.8%). Both the Simpson ($SI = 0.1683$) and Shannon ($H' = 0.8958$) indices indicate that this species consumes a low diversity of prey, which is consistent with the observations for others raptors inhabiting on arid environments.

Introduction

The nocturnal raptor *Tyto alba* (Scopoli, 1769) is a member of the Strigidae family, a raptor species which is one of the most widespread of all birds in the world (Clark *et al.*, 1978). In Chile, this raptor is found across the entire country, inhabiting a large diversity of environments (Carmona and Rivadeneira, 2006).

There are many dietary studies of the Barn Owl in South America, for example in Argentina (Noriega, 1993; Solaro, 2012; Gómez, 2012; Belloq and Kravetz, 1994; Donadio, 2009; Nanni *et al.*, 2012; Soares and Trejo, 2004; Fernández *et al.*, 2009; Travaini *et al.*, 1997), Bolivia (Vargas *et al.*, 2002;

Reboledo and Lartigau, 1998; Aliaga-Rossel and Tarifa, 2005), Brazil (Bonvicino and Bezerra, 2003; Rocha *et al.*, 2011; Moura de Faria and Passamani, 2013), Colombia (Delgado and Ramirez, 2007, 2009), Cuba (López Ricardo, 2012; Hernández-Muñoz and Mancina, 2011), Perú (Ramírez *et al.*, 2000) and Venezuela (Araujo and Molinari, 2000). In the rest of the world, many others studies have been published, for example in Australia (Debus *et al.*, 2004), France (Bernard *et al.*, 2010), India (Patki *et al.*, 2014), Italy (Catalisano and Massa, 1987; Pezzo and Morimando, 1995), Netherlands (De Bruijn, 1994), Pakistan (Khan *et al.*, 2014), Poland (Kitowski, 2013; Kopij, 2012), Spain

(Braña, 1974; Herrera, 1973; Sans-Coma, 1974; Siverio *et al.*, 2010; Zamorano *et al.*, 1986; Sommer *et al.*, 2005), Syria (Shehab and Al Sharabi, 2006) and USA (Michel, 2009; Colvin and McLean, 1986; Marti, 2010).

In Chile, the dietary habits of the Barn Owl are considered the best known among all the raptors inhabiting the territory (Raimilla *et al.*, 2012) although many other biological variables remain poorly understood or unknown.

In general, the diet of the Chilean population of Barn Owl is composed mainly of small mammals, particularly nocturnal rodents (Jaksic and Yáñez, 1979; Cerpa and Yáñez, 1981; Jaksic *et al.*, 1981), although other

important items are marsupials, birds and arthropods. The diet of this raptor has been studied in many Chilean locations, such as Chiu-Chiu, Antofagasta region (Jaksic *et al.*, 1999), La Dehesa, Metropolitana region (Reise, 1970); Fray Jorge, Coquimbo region (Schamberger and Fulk, 1974); Puchuncaví (Cerdeña and Yáñez, 1981) and La Campana (Zunino and Arcos, 1989) both in Valparaíso region; Lastarria, Araucanía region (Rau *et al.*, 1985); Termas del Flaco, Libertador Bernardo O'Higgins region (Torres-Mura and Contreras, 1989); Burca, Concepción region (Muñoz and Murúa, 1990); Torres del Paine, Magallanes region (Iriarte *et al.*, 1990);

KEYWORDS / Arid Environment / Atacama Desert / Diet / Ecology / Nocturnal Raptors /

Received: 06/02/2015. Modified: 01/21/2016. Accepted: 01/21/2016.

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DIETA DE LA LECHUZA BLANCA (*Tyto alba* SCOPOLI 1769) EN EL VALLE DE COPIAPÓ, DESIERTO DE ATACAMA, CHILE

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RESUMEN

La Lechuza Blanca (*Tyto alba*) es una especie rapaz nocturna que en Chile se distribuye desde Arica a Tierra del Fuego. Su dieta es la mejor conocida de las rapaces del país. La misma se basa particularmente de pequeños vertebrados, particularmente roedores y aves. La dieta de la Lechuza Blanca fue evaluada por medio de egagrópilas recolectadas en valles aledaños a Copiapó, localidad del hiperárido Desierto de Atacama. Los resultados fueron comparados con datos disponibles de Chile y países vecinos. Debido a las condiciones de extrema aridez, se esperaba una baja diversidad de presas, característica de las rapaces que habitan ecosistemas áridos. En el caso de la población de *Tyto alba* en la Región de Atacama, las especies más consumida fueron roedores (76,7%), particular-

mente *Eligmodontia dunaris* (27,3%), *Phyllotis darwini* (24%) y *Abrocoma bennetti* (12,4%). Otras presas correspondieron a aves (17,8%) y coleópteros (3,3%). No hubo una correlación significativa entre la frecuencia de presas y sus masas corporales ($r^2 = 0,229$; $p = 0,497$) y ni entre frecuencia y hábitat ($r^2 = 0,538$, $p = 0,088$), lo que indica que estas rapaces no seleccionan a sus presas por el tamaño o por el hábitat. La biomasa de los roedores en la dieta (95,3%) fue considerablemente mayor que la de las aves (3,5%), teniendo la mayor contribución *A. bennetti* (60,1%) y *P. darwini* con 26,8%. Los índices de Simpson ($SI = 0.1683$) y de Shannon ($H' = 0.8958$) indicaron que las lechuzas consumen una baja diversidad de presas, lo que es consistente con otras rapaces que habitan zonas áridas.

DIETA DA CORUJA-DAS-TORRES (*Tyto alba* SCOPOLI 1769) NO VALE DE COPIAPÓ, DESERTO DE ATACAMA, CHILE

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RESUMO

A Coruja-das-torres (*Tyto alba*) é uma espécie rapina noturna que no Chile se espalha desde Arica até Tierra del Fuego. Sua dieta é a melhor conhecida das rapinas do país. A mesma se baseia particularmente de pequenos vertebrados, particularmente roedores e aves. A dieta da Coruja-das-torres foi avaliada por meio de egagrópilas coletadas em vales circundantes a Copiapó, localidade do hiper-árido Deserto de Atacama. Os resultados foram comparados com dados disponíveis no Chile e países vizinhos. Devido às condições de extrema aridez, se esperava uma baixa diversidade de presas, característica das rapinas que habitam ecossistemas áridos. No caso da população de *Tyto alba* na Região de Atacama, as espécies mais consumidas foram roedores (76,7%), particularmente *Eligmodontia*

dunaris (27,3%), *Phyllotis darwini* (24%) e *Abrocoma bennetti* (12,4%). Outras presas corresponderam a aves (17,8%) e coleópteros (3,3%). Não houve uma correlação significativa entre a frequência de presas e suas massas corporais ($r^2 = 0,229$; $p = 0,497$) e nem entre frequência e hábitat ($r^2 = 0,538$, $p = 0,088$), o que indica que estas rapinas não selecionam a suas presas pelo tamanho ou pelo hábitat. A biomassa dos roedores na dieta (95,3%) foi consideravelmente maior do que a das aves (3,5%), tendo a maior contribuição *A. bennetti* (60,1%) e *P. darwini* com 26,8%. Os índices de Simpson ($SI = 0.1683$) e de Shannon ($H' = 0.8958$) indicaram que as corujas consomem uma baixa diversidade de presas, o que é consistente com outras rapinas que habitam zonas áridas.

and Pampa del Tamarugal, Tarapacá region (Carmona and Rivadeneira, 2006). The diet of the Barn Owl has been studied in almost all regions of Chile, the Atacama region being an exception. For this reason, the aim of the present study is to analyze the diet of the Barn Owl from the Atacama region, specifically in the Copiapó valley. This valley is located in close ecological relationship to a hyper-arid area, where sporadic rainfall triggers the blossoming of a large diversity of endemic plants and flowers. This phenomenon is known as

‘flowering desert’ and the areas where it occurs are considered a Priority Conservation Site *Desierto Florido* (Squeo *et al.*, 2008).

Methods

The study was conducted in the Copiapó valley (35°15'47''S, 69°78'10''W, 221masl), in the Atacama Desert, Northern Chile. The ecological conditions of the Atacama Desert region correspond to a hyper-arid area (Juliá *et al.*, 2008) known as ‘flowering desert of the plains’ (Gajardo, 1994), with a transitional desert climate

(Novoa *et al.*, 2008; Juliá *et al.*, 2008) and geo-morphologically named transitional Pampa (Novoa *et al.*, 2008). In terms of eco-geographical landscape, the study area includes two areas denominated Pampa and Serrano, with the lowest rainfall in the region (<0.5mm in normal conditions).

Pellets were collected under the higher trees, particularly palms from the localities of Piedra Colgada (n= 107) and San Pedro (n= 42) in May-October 2011 and June-December 2012, near Copiapo city, Atacama region. Both localities correspond to a

transversal valley with agricultural systems. Collected pellets were stored in paper bags with a label indicating date of collection, a unique numeric code and the number of pellets found in the particular location. The pellets were transported to the Laboratory of Integrative Zoology, Universidad de Tarapacá, Arica, Chile. The pellets were individually hydrated for 3h. Subsequently, the pellets were disaggregated and all remains were identified to the highest possible taxonomic level. The analysis of bones (skulls and jaws) and exoskeleton fragments was performed under a

stereomicroscope (Olympus XTL-2310). For the recognition of the prey species, we used skull and jaw as reference keys for rodents and lizards that inhabit the Atacama region. These references are in the Zoological Collection of Arid and Andean Zones, Universidad de Tarapacá (CZZA-UTA). Identification of arthropods was achieved by applying the methodology described by Cepeda-Pizarro *et al.* (2005).

Each identified prey item was recorded in a database, and frequency and abundance in each pellet were calculated. The number of vertebrate individuals in each pellet was determined using either skulls or maximum count of jaws. On the other hand, the number of insect preys was established using heads or pairs of elytra. To analyze the contribution of each prey in biomass consumption the number of individuals in each pellet was multiplied by the average mass (g) of each species. This mass value was obtained from previous studies carried out by Cortes *et al.* (1992) for lizards, Spotorno *et al.* (1998) for *Oligoryzomys*, *Abrothrix* and *Abrocoma*, Spotorno *et al.* (2013) for *Eligmodontia* and by Cepeda-Pizarro *et al.* (2005) for arthropods. Subsequently, in order to assess dietary preference for body size or habitat preference of the prey, a linear Pearson correlation analysis was performed between the frequencies for prey and body mass, and between number of prey and type of habitat. Finally Simpson and Shannon indices were calculated to assess the richness of preys (Muñoz-Pedreros and Rau, 2004). Statistical analyzes were performed using SPSS 10.0 software.

Results

One hundred forty nine pellets were analyzed, resulting in a total of 275 prey items identified (Table I). The group mostly consumed was rodents, with an abundance of 76.7%. Of these, the largest prey item (27.3%) corresponds to species of small

TABLE I
BARN OWL (*Tyto alba*) PREY RECORDED IN
COPIAPÓ VALLEY, ATACAMA REGION

Item prey	Abundance		Frequency	
	N	%	Nf	%
Rodentia				
<i>Abrothrix olivaceus</i>	4	1.5	4	2.7
<i>Phyllotis darwini</i>	66	24.0	45	30.2
<i>Oligoryzomys longicaudatus</i>	6	2.2	6	4.0
<i>Eligmodontia dunaris</i>	75	27.3	43	28.9
<i>Abrocoma bennetti</i>	34	12.4	32	21.5
Non identified rodents	26	9.5	26	17.4
		76.7		
Didelphimorphia				
<i>Thylamys elegans</i>	5	1.8	4	2.7
Passeriformes				
<i>Zonotrichia capensis</i>	8	2.9	8	5.4
<i>Troglodytes aedon</i>	9	3.3	9	6.0
<i>Diuca diuca</i>	9	3.3	8	5.4
Non identified birds	23	8.4	22	14.8
		17.8		
Coleoptera				
<i>Gyriosomus</i> sp.	9	3.3	9	6.0
Squamata				
<i>Liolaemus</i> sp.	1	0.4	1	0.7
Total	275	194.5		

animals such as *Eligmodontia dunaris* (Spotorno *et al.*, 2013), and other median and large rodents such as *Phyllotis darwini* (Waterhouse, 1837) (24%) and *Abrocoma bennetti* Waterhouse, 1837 (12.4%). Other species were birds (17.8%), including *Zonotrichia capensis* (Müller, 1776) (2.9%), *Troglodytes aedon* Vieillot, 1809 (3.3%) and *Diuca diuca* (Molina, 1782) (3.3%). Occasional items found were coleopterans (3.3%) and lizards from the *Liolaemus* genus (0.4%).

The group that contributes most to the total biomass is that of mammals (96.4%), particularly *A. bennetti* (60.1%),

and secondarily *P. darwini* (26.8%) and *E. dunaris* (6.3%). Contributions of others species were not significant, for example birds (3.5%), coleopterans (0.1%) and lizards (0.1%) (Table II). There was no significant correlation between frequency of prey and their body mass ($r^2= 0.229$, $p= 0.497$) and between frequency and their habitat ($r^2= 0.538$, $p= 0.088$), both indicating that this raptor does not select their prey by body size or habitat. Finally, both the Simpson index (SI= 0.1683) and the Shannon index ($H^2= 0.8958$) indicate a low diversity of prey, which is consistent with the others raptors that inhabit on arid environments.

Discussion

Our work corresponds to first record of the diet of the Barn Owl from the Atacama region, Chile. The diet of this raptor in the Atacama Desert is primarily composed of smaller mammals of the genus *Eligmodontia*, followed by *Phyllotis darwini* and *Abrocoma bennetti*. These data are in agreement with those found in the literature, where

TABLE II
BIOMASS PROVIDED BY EACH PREY ITEMS IN THE DIET OF BARN OWL*

	N° of ítems	Mass/sp (gr)	Total biomass (gr)	% Biomass
Mammalia				
<i>Abrothrix olivaceus</i>	4	35	140	0.5
<i>Phyllotis darwini</i>	66	57.5	3795	26.8
<i>Oligoryzomys longicaudatus</i>	6	27.8	166.8	1.2
<i>Eligmodontia dunaris</i>	75	11.9	892.5	6.3
<i>Abrocoma bennetti</i>	34	250.5	8517	60.1
Non identified rodents	26			
			13511.3	95.3
Didelphimorphia				
<i>Thylamys elegans</i>	5	30	150	1.1
Passeriformes				
<i>Zonotrichia capensis</i>	8	22.7	181.6	1.3
<i>Troglodytes aedon</i>	9	11.3	101.7	0.7
<i>Diuca diuca</i>	9	24.2	217.8	1.5
Non identified birds	23			
			501.1	3.5
Coleoptera				
<i>Gyriosomus</i> sp.	9	0.8	7.2	0.1
Squamata				
<i>Liolaemus</i> sp.	1	13.3	13.3	0.1

* Average body mass by species collected from Mann (1978), Cofré and Marquet (1999), Muñoz-Pedreros and Yáñez (2009) and Iriarte (2008) for mammals; Anderson *et al.*, (2002) and Salvador and Bodrati (2013) from birds. Reptiles and arthropods own data.

the preference is mammals, values ranging from 76.2% in Tamarugal, northern Chile, to 99.8% in the Torres del Paine, Southern Chile (Carmona and Rivadeneira, 2006). In other studies similar results are found in the consumption of birds: 3.4% in Tamarugal and 0.2% in Torres del Paine (range 0.2-10%), those of reptiles and amphibians are not significant, and arthropods are more important than in the present our study (range 2-16.4%). The smaller marsupial *Thylamys elegans* (Waterhouse, 1839) was less consumed in Atacama than *T. pallidior* (Thomas, 1902) in Tamarugal (range 6.7-25.9%).

On the other hand, *A. bennettii* and *Oligoryzomys longicaudatus* (Bennett, 1832) inhabit the valleys of the Atacama region (Valladares and Campo, 2012) with vegetation cover, scrub and farm fields. *P. darwini* lives in arid hills and ravines (Valladares, 2012) and *E. dunaris* is a small rodent which inhabits in the arid dunes under small scrubs, where they dig their burrows (Spotorno *et al.*, 2013). Despite the fact that the Barn Owl build their nests in the valley of Copiapo, their prey is principally captured from desert and ravines (53.1%), whereas prey from the valleys constitute only 16%. Especially interesting is the complete absence of *Rattus* sp. in the diet of the Barn Owl from the Copiapo valley, despite the abundance of this species in these areas and in the city. The differences in the proportions of mammals and birds consumed may be related to the coincidence in daily activity, since most species of rodents have crepuscular or nocturnal rather than diurnal activities (Iriarte, 2008).

The Shannon and Simpson indices indicate a low diversity of prey in the population of *T. alba* from the Atacama region, compared with populations of southern Chile and Argentina, where the number of prey increases to more than double. Considering

indirect variables such as the wider distribution range and its fundamental trophic niche, displayed on the large number of prey registered, it could be indicating an ecologically generalist species (Futuyma and Moreno, 1988; Kassen, 2002; Calenge and Basille, 2008), and these results indicate a functional response to prey availability (Jaksic *et al.*, 1992; Fariás and Jaksic, 2007).

This study is of relevance since the population of Barn Owl inhabit the Priority Conservation Site *Desierto Florido* (Squeo *et al.*, 2008). When the El Niño phenomenon (ENSO) takes place, rainfall increases and the area blooms, with subsequent changes in populations of all the species that live there. The present data were obtained when rainfall was very low. Therefore this work constitutes a first diagnosis of the dietary biology of the Barn Owl in the Atacama region, which must be also assessed when an ENSO phenomenon occurs, allowing a clearer idea of the consequences of this phenomenon on the biological communities of the Atacama Desert.

ACKNOWLEDGEMENTS

The authors thank Wladimir Wilkomirsky for allowing the collection of pellets of *T. alba* at his property in the locality of Piedra Colgada, the University of Tarapacá for Project N° 4710-15, Paola Moraga for help in processing the pellets and Patricio Velez for help in translation.

REFERENCES

Aliaga-Rossel, E., and Tarifa, T. (2005) *Cavia* sp. como principal presa de la lechuza de campanario (*Tyto alba*) al final de la estación seca en una zona intermedia al norte del Departamento de La Paz, Bolivia. *Ecología en Bolivia* 40(1): 35-42.

Anderson C, Rozzi R, Elphick C, McGehee S (2002) El Programa OMORA de anillamiento de aves en los bosques subantárticos: La estandarización del tamaño de anillos apropiados para las aves de la Región de Magallanes. *Bol. Chil. Ornitol.* 9: 2-11.

Araujo A, Molinari J (2000) Presas de *Tyto alba* (Aves, Strigiformes) en una selva nublada Venezolana. En Péfaur JE (Ed.) *Ecología Latinoamericana*. Actas III Cong. Latinoamericano de Ecología. Universidad de Los Andes, Venezuela. pp. 217-222.

Belloq MI, Kravetz FO (1994) Feeding strategy and predation of the Barn owl (*Tyto alba*) and the Burrowing owl (*Speotyto cunicularia*) on rodent species, sex, and size, in agrosystems of central Argentina. *Ecol. Austr.* 4: 29-34.

Bernard N, Michelat D, Raoul F, Quéré JP, Delattre P, Giraudoux P (2010) Dietary response of Barn owl (*Tyto alba*) to large variations in populations of common voles (*Arvicola terrestris*). *Can. J. Zool.* 88: 416-426.

Bonvicino CR, Bezerra AMR (2003) Use of regurgitated pellets of Barn owl (*Tyto alba*) for inventoring small mammals intecegrado of central Brazil. *Stud. Neotrop. Fauna Environ.* 38: 1-5.

Braña F (1974) Estudio del régimen alimenticio de la lechuza común *Tyto alba* (Scop.), en Asturias. *Asturnatura* 2: 75-83.

Calenge C, Basille M (2008) A general framework for the statistical exploration of the ecological niche. *J. Theor. Biol.* 252: 674-685.

Carmona E, Rivadeneira M (2006) Food habits of the barn owl *Tyto alba* in the National Reserve Pampa del Tamarugal, Atacama desert, north Chile. *J. Nat. Hist.* 40: 473-483.

Catalisano A, Massa V (1987) Considerations on the structure of the diets of the Barn owl (*Tyto alba*) in Sicily (Italy). *It. J. Zool.* 54: 69-73.

Cepeda-Pizarro J, Pizarro-Araya J, Vásquez H (2005) Variación en la abundancia de la artrópodo fauna, con énfasis en tenebriónidos epigeos, del desierto costero transicional de Chile. *Rev. Chil. Hist. Nat.* 78: 651-663.

Cerpa C, Yáñez J (1981) Variación estacional de la dieta de *Tyto alba* (Gray 1929) en la zona mediterránea de Chile central. *Bol. Mus. Nac. Hist. Nat.* 38: 137-145.

Clark RJ, Smith DG, Kelso LH (1978) *Working Bibliography of Owls of the World: With Summaries of Currents Taxonomy and Distributional Status*. National Wildlife Federation, Washington DC. USA. 319 pp.

Colvin, B.A., and McLean, E.B. (1986) Food habits and prey specificity of the Common Barn Owl in Ohio. *Ohio Journal of Science* 86(3): 76-80.

Cortes A, Baez C, Rosenmann M, Pino C (1992) Dependencia térmica del teido *Callopiestes palluma*: una comparación con los iguánidos *Liolaemus nigromaculatus* y *L. nitidus*. *Rev. Chil. Hist. Nat.* 65: 443-445.

De Bruijn O (1994) Population ecology and conservation of the Barn Owl (*Tyto alba*) in farmland habitats in Liemers and Achterhoek (the Netherlands). *Ardea* 82: 1-109.

Debus S, Olsen J, Rose A (2004) Diet of the barn owl *Tyto alba* near lake from in arid south Australia. *Corella* 28(2): 40-42.

Delgado VCA, Ramírez JD (2007) La dieta de la lechuza común *Tyto alba* (Tytonidae) en una localidad urbana de Urabá, Colombia. *Bol. SAO* 17(2): 94-97.

Delgado VCA, Ramírez JD (2009) Presas de la Lechuza Común (*Tyto alba*) en jardín, Antioquia, Colombia. *Ornitol. Col.* 8: 88-93.

Donadio E, Merino M, Bolgeri M (2009) Diet of two coexisting owl in the high Andes of North Western Argentina. *Ornitol. Neotrop.* 20: 137-141.

Fariás AA, Jaksic FM (2007) El Niño events, deland-fat scenario, and long-term guild dynamics of vertebrates predators in a South American semiarid ecosystems. *Austr. Ecol.* 32: 225-238.

Fernández F, Moreira G, Ferraro D, De Santis L (2009) Presas consumidas por la Lechuza de Campanario (*Tyto alba*) en la localidad de Olavarría, Buenos Aires: un caso de elevada batracofagia. *Nuestras Aves* 54: 20-21.

Futuyma I, Moreno G (1988) The evolution of ecological specialization. *Annu. Rev. Ecol. Evol. Systemat.* 19: 207-33.

Gajardo R (1994) *La Vegetación Natural de Chile, Clasificación y Distribución Geográfica*. Editorial Universitaria. Santiago, Chile. 65 pp.

Gómez D, Fontanarrosa G, Ortiz P, Jayat J (2012) Pequeños mamíferos predados por la Lechuza de Campanario (*Tyto alba*) en la ecorregión del Chaco seco en el noroeste argentino. *Hornero* 27: 127-135.

Hernández-Muñoz, A., and C. Mancina. (2011) La dieta de la lechuza (*Tyto alba*) (Aves: Strigiformes) en hábitats naturales y antropogénicos de la región central de Cuba. *Rev. Mex. Biodivers.* 82: 217-226.

Herrera CM (1973) Régimen alimenticio de *Tyto alba* en España suroccidental. *Ardeola* 19: 359-394.

- Iriarte A, Franklin WL, Johnson WE (1990) Diets of sympatric raptors in southern Chile. *J. Raptor Res.* 24: 41-46.
- Iriarte A (2008) *Mamíferos de Chile*. Lynx. Barcelona, España, 420 pp.
- Jaksic FM, Yáñez J (1979) The diet of the Barn owl in central Chile and its relation to the availability of prey. *Auk* 96: 619-629.
- Jaksic FM, Greene HW, Yáñez J (1981) The guild structure of a community of predatory vertebrates in central Chile. *Oecologia* 49: 21-28.
- Jaksic F, Jiménez J, Castro S, Feinsinger P (1992) Numerical and functional response of predators to a long-term the decline in mammalian prey at semi-arid Neotropical site. *Oecologia* 89: 90-101.
- Jaksic FM, Torres-Mura JC, Cornelius C, Marquet PA (1999) Small mammals of the Atacama Desert (Chile). *J. Arid Environ.* 42: 129-135.
- Juliá C, Montecinos S, Maldonado A (2008) Características climáticas de la Región de Atacama. In Squeo FA, Arancio G, Gutiérrez JR (Eds.) *Libro Rojo de la Flora Nativa y de Los Sitios Prioritarios para su Conservación: Región de Atacama*. Universidad de La Serena. Chile. Vol. 3: 25-42.
- Khan AH, Muhammad J, Muhammad S, Muhammad A (2014) Dietary habit of the barn owl (*Tyto alba*) in and agricultural farmland of Faisalabad, Pakistan. *Int. J. Curr. Microbiol. Appl. Sci.* 3: 211-218.
- Kassen R (2002) The experimental evolution of specialists, generalists, and the maintenance of diversity. *J. Evol. Biol.* 15: 173-190.
- Kitowski I (2013) Winter diet of Barn owl (*Tyto alba*) and the long-eared owl (*Asio otus*) in Eastern Poland. *NorthWest. J. Zool.* 9: 16-22.
- Kopij G (2012) Food niche overlap in co-existing Barn Owl *Tyto alba* (Scopoli 1769) and Great Horned Owl *Bubo virginianus* Gmelin 1788 in intensively used farmland. *Pol. J. Ecol.* 61: 179-181.
- López-Ricardo Y, Borroto-Páez R (2012) *Alimentación de la Lechuza (Tyto alba fuscata) en Cuba Central: Presas Introducidas y Autóctonas*. Thesis. Universidad de la Habana. Cuba. 84 pp.
- Marti C (2010) Dietary trends of barn owls in an agricultural ecosystem in Northern Utah. *Wilson J. Ornithol.* 122: 60-67.
- Michel J (2009) *Are Barn Owls (Tyto alba) Biological Controllers of Rodents in the Everglades Agricultural Area?* Thesis, University of Florida. USA. 77 pp.
- Moura de Faria G, Passamani M (2013) Dieta da Coruja-da-Igreja (*Tyto alba*, Scopoli, 1769) no Sul de Minas Gerais e sua relação com disponibilidade de presas. *Rev. Bras. Zool.* 15: 247-252.
- Muñoz-Pedrerros A (2004) Aves rapaces y control biológico de plagas. In Muñoz-Pedrerros A, Rau J, Yáñez J (Eds.) *Aves Rapaces de Chile*. CEA Ediciones. Valdivia, Chile. pp. 299-326.
- Muñoz-Pedrerros A, Murrúa R (1990) Control of small mammals in a pine plantation (Central Chile) by modification of the habitat of predators (*Tyto alba*, Strigiformes and *Pseudalopex* sp., Canidae). *Acta Oecol.* 11: 251-261.
- Nanni A, Ortiz P, Jayat J, Martín E (2012) Variación estacional de la dieta de la Lechuza de Campanario (*Tyto alba*) en un ambiente perturbado del chaco seco argentino. *Hornero* 27: 149-157.
- Noriega J (1993) Birds present in pellets of *Tyto alba* (Strigiformes, Tytonidae) from Casa de Piedra, Argentina. *Raptor Res.* 27: 37-38.
- Novoa C, Dumont-Dayot E, Agnes C (2008) La gestión cynégétique de la perdrix grise des pyrénées. L'exemple des massifs garlit-campcardos (pyrénées-orientales). *Faune Sauv.* 279: 20-26.
- Patki V, Zade V, Wadkatkar J (2014) Diet composition of the Barn Owl *Tyto alba* (Aves: Tytonidae) and spotted owl *Athene brama* (Aves: Strigidae) coexisting in an urban environment. *Int. J. Plant Anim. Environ. Sci.* 4: 188-192.
- Pezzo F, Morimando F (1995) Food habits of the Barn Owl, *Tyto alba*, in a Mediterranean rural area: Comparison with the diet of two sympatric carnivores. *Boll. Zool.* 62: 369-373.
- Raimilla V, Rau J, Muñoz-Pedrerros A (2012) Estado de arte del conocimiento de las aves rapaces de Chile: Situación actual y proyecciones futuras. *Rev. Chil. Hist. Nat.* 85: 469-480.
- Ramírez O, Béarez P, Arana M (2000) Observaciones sobre la dieta de la Lechuza de los Campanarios en la Quebrada de los Burros (Dpto. Tacna, Perú). *Bull. Inst. Fr. Et. And.* 29: 233-240.
- Rau J, Martínez DR, Yáñez J (1985) Dieta de la lechuza blanca, *Tyto alba* (Strigiformes, Strigidae) en el sur de Chile. *Bol. Mus. Reg. Araucanía* 2: 134-135.
- Reboledo CA, Lartigau B (1998) Análisis de regurgitados de *Tyto alba* (Gray, 1929) en el Salar de Uyuni, Departamento de Potosí, República de Bolivia. *Biol. Neotrop.* 1: 19-22.
- Reise D (1970) Algunos datos sobre la alimentación de la lechuza blanca (*Tyto alba*). *Bol. Ornitol. Chil.* 2: 7.
- Rocha R, Ferreira E, Leite Y, Fonseca C, Costa L (2011) Small mammals in the diet of Barn Owls, *Tyto alba* (Aves: Strigiformes) along the mid-Araguaia River in central Brazil. *Zoologia* 28: 709-716.
- Sahores M, Trejo A (2004) Diet shift of Barn Owls (*Tyto alba*) after natural fires in Patagonia, Argentina. *Raptor Res.* 38: 174-177.
- Salvador SA, Bodrati A (2013) Aves víctimas del parasitismo de moscas del Género *Philornis* en Argentina. *Nuestras Aves* 58: 16-21.
- Sans-Coma V (1974) Sobre la alimentación de *Tyto alba* en la región continental Catalana. *Misc. Zool.* 3: 163-169.
- Schamberger ML, Fulk GW (1974) Mamíferos del Parque Nacional Fray Jorge. *Idesia* 3:167-179.
- Shehab AH, Al Charabi SM (2006) Food of the Barn Owl *Tyto alba* in the Yahmool Area, Northern Syria. *Turk. J. Zool.* 30: 175-179.
- Siverio F, Rodríguez B, Siverio M (2010) Datos sobre la alimentación de la lechuza común (*Tyto alba*) en una zona xérico-antrópica de El Hierro, islas Canarias (Aves, Tytonidae). *Vieraea* 38: 159-162.
- Solaro C, Santillán M, Costan A, Reyes M (2012) Ecología trófica de *Athene cucularia* y *Tyto alba* en el cerro Curru-Mahuida, ecotono monte-espinal, La Pampa, Argentina. *Hornero* 27: 177-182.
- Sommer R, Zoller H, Kock D, Böhme W, Griesau A (2005) Feeding of the Barn Owl, *Tyto alba* with first record of the European free-tailed bat, *Tadarida teniotis* on the island of Ibiza (Spain, Balearics). *Folia Zool.* 54: 364-370.
- Spotorno AE, Zuleta C, Gantz A, Saiz F, Rau J, Rosenmann M, Cortéz A, Ruiz G, Yates L, Couve E, Marín JC (1998) Sistemática y adaptación de mamíferos, aves e insectos fitófagos de la región de Antofagasta Chile. *Rev. Chil. Hist. Nat.* 71: 501-526.
- Spotorno C, Zuleta L, Walker G, Manriquez P, Valladares P, Marín JC (2013) A small, new gerbil-mouse *Eligmodontia* (Rodentia: Cricetidae) from dunes at the coasts and deserts of north-central Chile: molecular, chromosomal, and morphological analyses. *Zootaxa* 3683: 377-394.
- Squeo F, Arancio G, Gutiérrez J (2008) *Libro Rojo de la Flora Nativa y de los Sitios Prioritarios para su Conservación: Región de Atacama*. Universidad de La Serena. Chile. 466 pp.
- Travaini A, Donazar JA, Ceballos O, Rodríguez A, Hiraldo F, Delibes M (1997) Food habits of common Bar owl along and elevational gradient in Andean Argentine Patagonia. *J. Raptor Res.* 31: 59-64.
- Torres-Mura JC, Contreras LC (1989) Ecología trófica de la lechuza blanca (*Tyto alba*) en los Andes de Chile central. *Stud. Neotrop. Fauna Environ.* 24: 97-103.
- Valladares P, Campos C (2012) New record of *Abrocoma bennetti murrayi* (Rodentia, Abrocomidae) from the Atacama region. Extension of distribution range in Chile. *Idesia* 30: 115-118.
- Valladares P (2011) Análisis, síntesis y evaluación de la información científica de lagartos de la Región de Atacama. *Gayana* 75: 81-98.
- Vargas JC, Landaeta IJ, Simonetti A (2002) Bats a prey of barn owl (*Tyto alba*) in a Tropical sabana in Bolivia. *J. Raptor Res.* 36: 146-148.
- Zamorano E, Palomo J, Antúnez A, Vargas J (1986) Criterios de predación selectiva de *Bubo bubo* y *Tyto alba* en *Rattus Ardeola* 33: 3-9.
- Zunino S, Arcos M (1989) Nuevos antecedentes de la dieta de *Tyto alba* en el Parque Nacional La Campana. *Anal. Mus. Hist. Nat. Valparaíso* 20: 99-101.