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SEGREGATION BY SIZE AT THE INDIVIDUAL PREY LEVEL BETWEEN BARN AND MAGELLANIC HORNED OWLS IN ARGENTINA

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KEY WORDS: *Barn Owls*; Tyto alba; *Magellanic Horned Owls*; Bubo magellanicus; *prey size*; *rodents*; *Argentine Patagonia.*

Barn Owls (*Tyto alba*) and Magellanic Horned Owls (*Bubo magellanicus*) are sympatric throughout much of their breeding range in Argentina and Chile (del Hoyo et al. 1999), and their diets are often similar (e.g., Donázar et al. 1997, Travaini et al. 1997, Trejo and Grigera 1998, Pillado and Trejo 2000, Sahores and Trejo 2004, Trejo and Ojeda 2004). Both owls predominantly fed on small mammals, but took variable amounts of other prey types (birds, reptiles, and insects). These species differ mainly in size (Barn Owl, ca. 300 g, and Magellanic Horned Owl, ca. 800 g; Christie et al. 2004), and thus, represent a suitable model to study partitioning of prey resources.

The body size–prey size hypothesis (Rosenzweig 1966) proposes a positive relationship between the body size of predators and their prey, which in turn, reflects partitioning of prey resources. Empirical studies in Chile have attempted to examine this hypothesis and found that, in general, mean prey size (based on mean adult prey size) was greater for Magellanic Horned Owls than for Barn

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Table 1. Mass of prey (g) consumed by Barn and Magellanic Horned owls in northwestern Argentine Patagonia. D is the largest absolute difference between distributions, $D_{0.05}$ is the critical value for D (two-tailed Kolmogorov-Smirnov two-sample tests). Alternatively, these results may be attributed to the limited accuracy of size estimation based on jaw measures.

	Barn Owls		Magellanic Horned Owls				
Prey Species	Mean ± SD (N)	Range	Mean ± SD (N)	Range	D	$D_{0.05}$	P
Rabbit rat *Reithrodon auritus*	53.2 ± 21.8 (115)	10.7–90.2	58.3 ± 19.9 (134)	8.8–94.5	0.195	0.173	0.018
Austral greater mouse *Loxodontomys micropus*	52.3 ± 16.2 (236)	10.0–97.1	60.0 ± 11.1 (77)	10.0–97.1	0.309	0.178	<0.000
Long-tailed rice rat *Oligoryzomys longicaudatus*	20.8 ± 4.5 (136)	10.7–33.9	23.4 ± 5.2 (116)	9.4–40.2	0.250	0.172	0.001
Long-haired mouse *Abrothrix longipilis*	24.0 ± 6.7 (127)	7.2–44.1	25.8 ± 5.3 (98)	11.9–39.3	0.226	0.183	0.007
Yellow-nosed mouse *Abrothrix xanthorhinus*	13.4 ± 2.2 (62)	7.9–17.2	14.4 ± 2.3 (42)	7.6–18.4	0.275	0.272	0.050
Silky desert mouse *Eligmodontia morgani*	16.1 ± 3.2 (77)	8.8–26.9	15.7 ± 3.1 (105)	8.3–28.8	0.216	0.204	0.031

Owls (Jaksic and Yánez 1980, Iriarte et al. 1990). However, when considering the mass of the individual prey, results were not conclusive. Castro and Jaksic (1995) showed that sympatric Barn and Magellanic Horned owls in central Chile did not take different sizes of their most frequent prey, the leaf-eared mouse (*Phyllotis darwini*, ca. 45 g). However, Santibáñez and Jaksic (1999) applied the same type of analysis to a prey larger in mass than the mean prey size of both owls (chinchilla rat, *Abrocoma bennetti*, ca. 180 g). These authors found that Magellanic Horned Owls consumed larger individuals than Barn Owls and proposed that these two predators showed segregation by size when relatively large prey was available; probably because of the greater opportunity afforded by the ample size range of this prey species (i.e., chinchilla rat).

I determined the masses of prey captured by these two owls in the northwestern part of the Argentine Patagonia to test if: (1) the owls took different-sized prey related to their own size and (2) segregation by size occurred only in the case of larger prey. Mean prey sizes of Barn and Magellanic owls are 44.5 g and 47.0 g, respectively, at this study site (Trejo et al. 2005). I considered six frequent prey species; two relatively small prey species (silky desert mouse [*Eligmodontia morgani*] and yellow-nosed mouse [*Abrothrix xanthorhinus*], <20 g), two medium-sized prey species (long-tailed rice rat [*Oligoryzomys longicaudatus*] and long-haired mouse [*Abrothrix longipilis*], ca. 35–40 g), and two relatively larger prey species (rabbit rat [*Reithrodon auritus*] and austral greater mouse [*Loxodontomys micropus*], 60–80 g). It is notable that the mean prey mass of Magellanic Horned Owls is low in my study area (Trejo et al. 2005) compared to other regions both in Patagonia (Iriarte et al. 1990, Donázar et al. 1997) and in central Chile (Jaksic and Yáñez 1980).

Methods

This study was conducted in northwestern Río Negro Province, Patagonia, Argentina, in an area of approximately 5000 km^2 (40°45′–41°25′S, 70°48′–71°27′W). The climate is cold-temperate, with predominant winds from the west; mean annual temperature is 8°C (Paruelo et al. 1998). Vegetation is determined by a distinctive west-east precipitation gradient (3000–500 mm; Mazzarino et al. 1998). To the west, vegetation is dominated by southern beech (*Nothofagus* spp.) forest that covers the eastern slopes of the Andes. To the east, evergreen *Austrocedrus chilensis* forests occur in isolated patches of trees (*A. chilensis, Maytenus boaria, Lomatia hirsuta*, and *Schinus patagonicus*) in a matrix of grassland (*Festuca pallescens, Stipa* spp.) and low bushes (*Discaria articulata, Berberis buxifolia, Adesmia boronoides*, and *Mulinum spinossum*). Typically, low *A. chilensis* patches grow on isolated rocky outcrops within grasslands.

During two breeding seasons (2001–02 and 2002–03), I collected pellets of Barn and Magellanic Horned owls under known perches or nests in 10 owl territories (belonging to at least seven pairs of Barn Owls and four of Magellanic Horned Owls). All sampled localities were separated by a distance of ≥5 km, which indicated that they belonged to different pairs. All pellets were dissected using standard techniques (Marti 1987). Small mammals bone remains were identified by the use of keys (Pearson 1995). Details of the diets were published elsewhere (Trejo et al. 2005).

Jaws of the six species under consideration found in owl pellets were measured. According to the morphometric characters of each jaw, I estimated the body mass by regression analysis. The relationship between jaw measurements and body mass (BM) was calculated from specimens

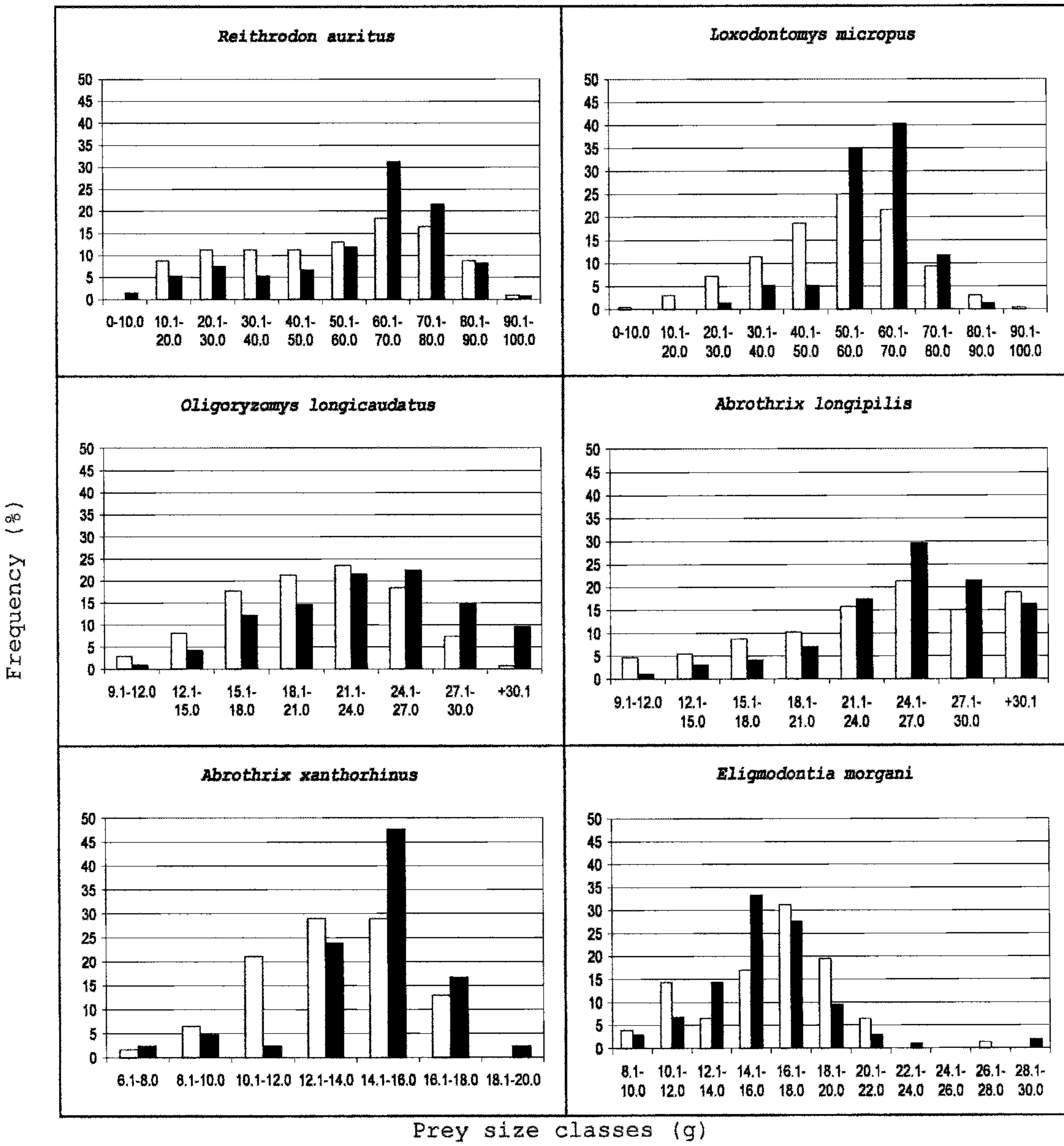

Figure 1. Body mass (g) frequency distributions of six prey species consumed by Barn Owls (white bars) and Magellanic Horned Owls (black bars) in northern Argentine Patagonia.

of known mass captured in the study area and housed in collections of Administración de Parques Nacionales and the University of Comahue. Reference collections include specimens captured year-round, reducing seasonal bias in the relationship between body mass (BM) and cranial measurements.

The jaw measurements used were (following Dickman et al. 1991): M1—length of dentary excluding incisors; M2—height of dentary at, and including, first molar; M3—maximum height of dentary, excluding coronoid process; M4—length of lower diastema; and M5—length of lower tooth row. The regression equations ($P < 0.01$) obtained were *A. xanthorhinus*, BM = $-32.2627 + 3.1015M1 + 3.5468M3$ ($r^2 = 0.71$); *E. morgani*, BM = $-14.8880 + 3.3359M1 + 2.6964M2 - 3.5428M5$ ($r^2 = 0.70$); *O. longicaudatus*, BM = $-47.9158 + 6.4399M1$ ($r^2 = 0.92$);

A. longipilis, BM = −92.9475 + 4.8877M1 + 2.7157M2 + 6.7674M3 + 1.5258M4 + 3.1570M5, (r^2 = 0.75); *R. auritus*, BM = −126.59 + 10.6490M1, (r^2 = 0.87); *L. micropus*, BM = −114.3620 + 25.4710M2 − 10.4400M4 + 9.5800M5, (r^2 = 0.89).

To analyze predation on prey size classes, I grouped prey individuals into 2-g (*A. xanthorhinus*, *E. morgani*), 3-g (*O. longicaudatus*, *A. xanthorhinus*), and 10-g (*R. auritus*, *L. micropus*) increment classes. To test differences between the size distribution of rodent prey taken by each species of owl, I used the Kolmogorov-Smirnov two-sample test ($P < 0.05$; Sokal and Rohlf 1981). I followed the methods of Santibáñez and Jaksic (1999).

RESULTS AND DISCUSSION

Barn and Magellanic Horned owl prey differed in size, except for *A. xanthorhinus* where D and $D_{0.05}$ (the critical value for D) were similar and the null hypothesis of equal distributions was accepted (Table 1). On average, masses of individual prey captured by Magellanic Horned Owls were larger than those taken by Barn Owls for all prey species, except for *E. morgani* (Table 1). The lack of clear segregation by size of the two smallest prey species seems to agree with the observation made by Santibáñez and Jaksic (1999) that their limited size range does not allow size differentiation by the two owls.

Even when both owl species captured prey in a broad range of size categories (Fig. 1), in general, Barn Owls captured prey in the lower tail of the prey size distribution, and Magellanic Horned Owls took the heaviest individuals, except in *E. morgani* for which no clear pattern could be distinguished (Fig. 1).

In conclusion, my results seem to confirm the proposal that larger predators capture larger prey, and that this can be observed most clearly in prey with a wider range of masses. However, although statistically significant, the differences in prey taken by both species were relatively small. Thus, the question arises: if Barn Owls are capable of killing juveniles hares (Pillado and Trejo 2000) with a mass (300 g) equivalent to that of the owl, what advantage would the smaller owl obtain by taking smaller individual prey than do Magellanic Horned Owls? The selective hunting of smaller prey than available has also been observed in Chile by small predators (Bozinovic and Medel 1988). Among other reasons which may favor selection for smaller prey, Marti and Hogue (1979) suggested (1) within a prey species, smaller individuals would likely be younger and less experienced (more vulnerable to predators); (2) energy expended in catching and killing large prey may not be worth risking; and (3) risk of injury to the owl may be greater with relatively larger prey. Barn Owls are classified as mostly in-flight hunters, whereas Magellanic Horned Owls are considered sit-and-wait foragers (Marti 1974). However, both species probably use both hunting modes to a certain extent. In addition, I suggest that younger (lighter) rodents could use (or are forced to use) microhabitats that make them more vulnerable to predators employing different hunting techniques (Dickman et al. 1991).

SEGREGACIÓN POR TAMAÑO EN LAS PRESAS CONSUMIDAS POR *TYTO ALBA* Y *BUBO MAGELLANICUS* EN ARGENTINA

RESUMEN.—Las especies *Tyto alba* y *Bubo magellanicus* son simpátricas en el noroeste de la Patagonia argentina, donde comparten ambientes y hábitos similares. La principal diferencia entre estas especies radica en su tamaño (300 g en *T. alba* vs. 800 g en *B. magellanicus* respectivamente). Por estas razones, estas especies constituyen un buen modelo para estudiar la partición del recurso presa. Se analizó el tamaño de las presas consumidas a nivel individual por ambas especies de rapaces. El peso de las presas se estimó a partir de ecuaciones obtenidas de medidas mandibulares. Se encontró que *T. alba* consume los individuos más pequeños de todas las especies presa consideradas en comparación con *B. magellanicus*, excepto en aquellas especies de menor tamaño. Además, *B. magellanicus* consume preferentemente individuos en clases de tamaño más grandes dentro de cada especie. Estos resultados apoyan la hipótesis de que los depredadores más grandes consumen presas de mayor tamaño, y que esto puede observarse mejor en presas que presentan un amplio rango de variación en peso.

[Traducción del equipo editorial]

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