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PREY SIZE MATTERS AT THE UPPER TAIL OF THE DISTRIBUTION: A CASE STUDY IN NORTHCENTRAL CHILE

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Sympatric raptors are known to consume different prey species, often cueing on the abundance, size, morphology, or behavior of the prey (Kotler 1985, Kotler et al 1988, Jaksic 1989). Less known is how raptor predation applies on different size or age classes of a given prey species (Fulk 1976, Marti and Hogue 1979, Zamorano et al. 1986, Vargas et al. 1988, Longland and Jenkins 1987, Dickman et al. 1991), but abundance, size, and behavior of age classes have also been postulated as the cues used for hunting them.

Castro and Jaksic (1995) showed that sympatric Barn Owls (*Tyto alba*) and Great Horned Owls (*Bubo virginianus*) at a study site in northcentral Chile (Aucó) did not take different sizes of their most frequently shared prey, the leaf-eared mouse (*Phyllotis darwini*). The larger Great Horned Owl (1200 g) preyed on average on 50-g mice, while the Barn Owl (300 g) consumed 54-g mice. The lack of statistical difference resulted from both owls preying across all size/age classes of their shared prey.

Because leaf-eared mice in Aucó average 47 g, which is close to the mean prey size for the Barn Owl in Chile (45.1 g, Marti et al. 1993), we decided to investigate predation on a prey species shared by both Great Horned and Barn Owls that exceeds the mean prey size for the Great Horned Owl in Chile (72.8 g, Marti et al. 1993). The species studied was the 182-g chinchilla rat (*Abrocoma bennetti*), the second largest rodent species at our study site in northcentral Chile (Jaksic et al. 1992, Jaksic 1997).

MATERIAL AND METHODS

Las Chinchillas National Reserve (31°31′S, 71°06′W) at Aucó is located approximately 300 km north of Santiago, Chile. This site has a semiarid climate, mean annual precipitation of 157 mm, elevations ranging from 400–1700 m and slopes with vegetation dependent on solar exposure. On equator-facing slopes, vegetation is dominated by cacti, bromeliads and a few evergreen shrubs; on polar-facing slopes, evergreen shrubs are the dominant species. More details about this site may be found in Castro and Jaksic (1995).

From March 1993–February 1996, we collected pellets of Great Horned and Barn Owls under perches, roosts, and nests in Aucó. At least one pair of Great Horned and four pairs of Barn Owls inhabited the study area. Prey remains in pellets (mostly small mammals) were determined to species level. More details about procedures may be found in Castro and Jaksic (1995).

Whole cranial remains of chinchilla rats found in owl pellets were set apart and measured. According to the morphometric characters of each cranium, we estimated the body mass by regression analysis. The relationship between cranial measurements and body mass was calculated from specimens of known mass in the Museo Nacional de Historia Natural (Santiago, Chile). Three cranial dimensions were measured with calipers at 0.5 mm precision: width of the zygomatic arch (cf. Green and Jameson 1975), minimum distance between upper incisor and first molar (upper diastema, cf. Blem et al. 1993) and length of the upper tooth row.

We used bilateral Kolmogorov-Smirnov tests (Sokal and Rohlf 1981) to compare the size distribution of chinchilla rats preyed upon by each species of owl. Although estimates of body mass derived from cranial measurements were computed to 1 g, we preferred to group individuals into 20-g increment classes because of the inherent statistical error contained in making extrapolations based on regressions. We pooled data obtained during the entire study period of 36 mo. (March 1993–February 1996).

RESULTS AND DISCUSSION

The three cranial measurements were good estimators of chinchilla rat body mass ($r > 0.949$), but tooth row length was chosen because of its better fit ($r = 0.978$, $P < 0.05$), and because it could be measured in 97% of the cranial remains (256 out of 264). The equation was: body mass (g) = antilog (2.341953 + 3.386149 log tooth row length in mm).

On average, Barn Owls consumed chinchilla rats weighing 145 ± 73 g (± SD, $N = 182$), whereas those in the diet of Great Horned Owls weighed 178 ± 70 g ($N = 73$). This difference in prey weight consumed was significant at $P = 0.00119$ (Kolmogorov-Smirnov D = 0.28005). Nevertheless, the prey weight ranges consumed overlapped considerably: 31–332 g for Barn Owl and 47–348 g for Great Horned Owl (Fig. 1). How a 300-g Barn Owl can take such large-sized chinchilla rats eludes us, unless our equation overestimates prey weights based on cranial measurements. We would like to emphasize that chinchilla rats >290 g were preyed upon only sporadically by Barn Owls (Fig. 1). On the other hand, it is not surprising that 1200-g Great Horned Owls preyed on

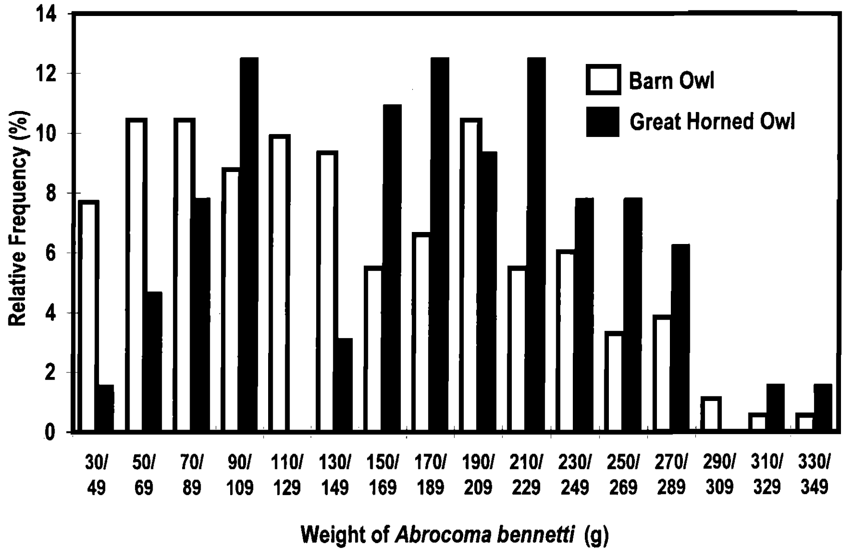

Figure 1. Body mass frequency distribution of chinchilla rats (*Abrocoma bennetti*) consumed by Great Horned Owls (*Bubo virginianus*; N = 73 rats) and Barn Owls (*Tyto alba*; N = 182 rats) in Aucó, northcentral Chile, March 1993–February 1996.

<49-g chinchilla rats because this owl is known to consume even smaller rodents at the study site (Castro and Jaksic 1995). It should also be noted that chinchilla rats comprise only a minor part of the diet of Barn Owls at the study site ($\bar{x}$ = 2.2% by prey numbers throughout 1988–90; see Jaksic et al. 1992), whereas they are the second most common mammal consumed by Great Horned Owls ($\bar{x}$ = 22.7% throughout 1988–90; Jaksic et al. 1992).

Tyto (300 g) and *Bubo* (1200 g), which differ in body weight by a factor of 4, and by 23% in mean prey size (145 vs. 178 g, respectively), were able to exploit a single prey species ranging over one order of magnitude in mass (31–348 g). This suggested that the Barn Owl was able to handle, even if infrequently, prey of 50% its own body weight which is remarkable. The equivalent figure for the Great Horned Owl would be 15%, well within its handling power (Marti et al. 1993).

Our results indicated that small prey such as the 47-g leaf-eared mouse does not allow segregation by size between these two owls, likely because of its limited size range (Castro and Jaksic 1995). However, the two owls did show segregation by size when preying on larger prey such as the 182-g chinchilla rat, likely because of the greater opportunity afforded by its ample size range. These observations support Wilson's (1975) assertion that prey size matters to predators chiefly at the upper tail of the frequency distribution.

RESUMEN.—En un estudio previo en Chile central (Aucó), se detectó que las lechuzas *Tyto alba* (300 g) y *Bubo virginianus* (1200 g) consumían individuos del roedor *Phyllotis darwini* de peso promedio 50 y 54 g, respectivamente. Esta diferencia no era significativa. Debido a que este roedor está cerca del tamaño promedio de presa calculado en Chile para *Tyto* (45 g) y lejos del calculado para *Bubo* (73 g), decidimos investigar qué ocurría con la depredación de estas lechuzas sobre un roedor mucho más grande, *Abrocoma bennetti* (182 g). Encontramos que *Tyto* consumía individuos de peso promedio 145 g y que *Bubo* consumía aquellos de peso promedio 178 g, una diferencia significativa de 28%. Nuestra conclusión es que cuando la presa es pequeña (*Phyllotis*) las dos lechuzas no alcanzan a segregarse en cuanto a los tamaños consumidos, y que ésto sólo ocurre cuando la presa es grande (*Abrocoma*).

[Traducción de Autores]

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SPATIAL AND TEMPORAL VARIATIONS IN THE DIET OF THE COMMON KESTREL (*FALCO TINNUNCULUS*) IN URBAN ROME, ITALY

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KEY WORDS: *Common Kestrel;* Falco tinnunculus; *diet; avian prey; urban area; Rome, Italy.*

Several studies have described the ecology of raptors in urban areas (e.g., Galeotti 1994). Common Kestrels (*Falco tinnunculus*) breed in many European towns, frequently occurring in urban areas in higher densities than in farmland areas (Village 1990, Shrubb 1993). Nevertheless, few studies have described details of the feeding ecology of kestrels in these urban areas (Quere 1990, Romanowski 1996). Therefore, the aim of our study was to describe the composition of the kestrel diet and any sea-