PREY AND TROPHIC ECOLOGY OF GREAT HORNED OWLS IN WESTERN SOUTH AMERICA: AN INDICATION OF LATITUDINAL TRENDS

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ABSTRACT — Quantitative information on the diet of three Great Horned Owl *(Bubo virginianus)* populations along 18 lat. degrees in western South America (Chile) is compared with that of Great Horned Owls in comparable latitudes along western North America. In Chile, owls preyed mainly on small mammals, with proportion of birds decreasing, and that of insects increasing, toward southern latitudes. Mean prey size and diet breadth declined toward southern Chile. These latitudinal trends closely mirror those documented in western North America.

Although the Great Horned Owl *(Bubo virginianus)* is distributed throughout the Americas, its food habits have received considerable study mainly in North America (Burton 1973). The only published quantitative information on their food habits in South America comes from central Chile (approximately latitude 33° to 38°; see Jaksić and Yáñez 1980; Jaksić and Marti 1984). Except for a preliminary report by Jaksić et al. (1978), no dietary information was previously available from their southernmost distribution (see Humphrey et al. 1970). Here we report the prey identified in 125 fresh pellets collected in September (austral spring) 1977 and in 14 other pellets collected in July (winter) 1978, from under the same nest located at Torres del Paine National Park (approximately 51° 01′S, 72°54′W; 142 km north of Puerto Natales). For purposes of comparison we report earlier dietary data published by Reise and Venegas (1974) in a Chilean journal of very local circulation. Their study material (an unreported number of fresh pellets, ± 55) was collected under one nest, located 10 km north of Puerto Ingeniero Ibáñez (46° 18′S; 71°55′W), in January (summer) 1971. For comparative purposes we also use Jaksić and Yáñez's (1980) report on the prey of the Great Horned Owl at La Dehesa (33°21′S, 70°32′W; 20 km east of Santiago), based on 98 fresh pellets collected during September (spring) 1979, beneath one nest. Although the information analyzed is based on very small sample sizes, we believe it is useful in consolidating new and old information fragmented in the Chilean literature and not readily available to ornithologists elsewhere.

METHODS

Considering that ca. 95% of the pellets analyzed reflect spring and summer diet, and that this dietary information covers approximately 18° latitude, a quantitative comparison seems warranted. We use the following trophic metrics: (a) Geometric mean prey weight in the diet — essentially the back-transformation of the mean prey size obtained with log-transformed weight data, weighted by their relative occurrence in the diet (see Jaksić and Braker 1983 for formula, justification, and assumptions of this trophic statistic). Prey sizes are mean weights of small mammals in Table 1. (b) Diet breadth — the diversity of prey in the diet as computed by Levins' (1968) index: $Bobs = 1/(\sum pi^2)$, where pi is the relative occurrence of prey taxon i in a given population's diet This index generates values between 1 and n (when n resources are used equally). Because Levins' index increases with the number of prey taxa, a standardization is necessary when comparing populations in different localities, where the availability of prey taxa may differ. Colwell and Futuyma (1971) provide a standardized version of Levins' index: $Bsta$ = (Bobs - Bmin)/(Bmax - Bmin), where $Bobs$ is the observed niche breadth (= Levins' index), $Bmin$ is the minimum niche breadth possible (= 1), and $Bmax$ is the maximum niche breadth possible (= n), which is the number of prey taxa actually taken by a given owl population (i.e., each of the taxa that receives a separate line in Table 1; generally, species for mammals and orders for insects). This standardized index renders values between 0 and 1 (i.e., between a comparatively narrow niche breadth, with disproportionately high representation of one or a few prey items, and a broad one, with a more even consumption of the available prey categories, respectively).

RESULTS AND DISCUSSION

Results are summarized in Table 1, and are here discussed in a north-south succession. In La Dehesa, the owls preyed upon all small mammals known to occur in the locality (see Jacksic et al. 1981), with the exception of the rodents *Octodon degus* (a semi-fossorial species) and *Spalacopus cyanus* (a truly fossorial one). Jaksić and Yáñez (1980)

Table 1. Prey of Great Horned Owls in La Dehesa (33° S), Puerto Ibáñez (46° S), and Torres del Paine (51° S), Chile. Figures are percentages by number of prey individuals; subtotals are in brackets.

PREY CATEGORIES	WEIGHT(g)*	33°S	46°S	51°S
MAMMALIA		[88.6]	[86.0]	[87.5]
Lagomorpha				
Lepus capensis	2.000.0	——	5.3	0.6
Oryctolagus cuniculus	1,300.0	15.8	——	——
MARSUPIALIA				
Marmosa elegans	40.0	3.5	——	——
RODENTIA				
Abrocoma bennetti	219.0	18.4	——	——
Akodon lanosus	32.5	——	——	4.8
Akodon longipilis	76/41.0**	16.7	8.7	3.0
Akodon olivaceus	40.0	0.8	——	——
Akodon xanthorhinus	21.5	——	5.3	9.5
Ctenomys cf. *magellanicus*	271.8	——	15.8	——
Eligmodontia typus	26.5***	——	——	0.6
Euneomys chinchilloides	87.8***	——	26.3	0.6
Notiomys macronyx	——	——	——	2.4
Oryzomys longicaudatus	45/29.8**	4.4	1.8	39.8
Phyllotis darwini	66.0	4.4	7.0	——
Phyllotis micropus	75.0	——	12.3	——
Phyllotis sp.	——	——	3.5	——
Rattus rattus	158.0	19.3	——	——
Reithrodon physodes	81.7	——	——	25.6
Unidentified	——	5.3	——	0.6
AVES		[11.4]	[5.3]	[2.4]
Unidentified	——	11.4	5.3	2.4
INSECTA		[0.0]	[8.7]	[10.1]
Coleoptera	——	——	8.7	8.9
Hymenoptera	——	——	——	0.6
Orthoptera	——	——	——	——
Unidentified	——	——	——	0.6
No. pellets		98.00	55?	139.00
No. prey		114.00	57.00	168.00
Geometric mean prey weight (g)		181.9	104.5	41.1
Twice standard error		0.61	0.83	0.31
Sample size (= prey with weight)		95.00	47.00	142.00
Diet breadth *(Bobs)*		6.90	7.18	4.07
Standardized diet breadth *(Bsta)*		0.66	0.62	0.24

*Weights with no decimal places are from Jaksić and Marti (1984); all the remaining (except for those marked with asterisks) are from Jaksić et al. (1983).

**There is a strong latitudinal cline in body size for this species (see Yáñez et al. 1978, and Palacios 1982): the first figure corresponds to its mean weight in central Chile; the second, to its mean in southern Chile.

***From Greer (1965).

suggested that the absence of these 2 species from the Great Horned Owl diet was due to their diurnal-crepuscular activity pattern. In Puerto Ibáñez, owls preyed on essentially all small mammal species trapped by Reise and Venegas (1974) in the same locality, and on 2 additional rodents: *Euneomys chinchilloides* (a scansorial species) and *Ctenomys* cf. *magellanicus* (a fossorial one). These 2 made up more than 40% of the owls' diet (Table 1), but were neither trapped nor seen in the area (Reise and Venegas 1974; Yáñez et al. in press). In Torres del Paine, owls preyed on all small mammal species known to occur there, as well as on 3 other rodents hitherto not recorded (Rau et al. 1978): the terrestrial *Eligmodontia typus* and *Akodon lanosus,* and the semi-fossorial *Notiomys macronyx.* In general, the three owl populations studied preyed mainly on small mammals (averaging 87% of their prey). With increasing latitude, the proportion of birds in the diet decreased, with the opposite trend seen in the insect prey (from no insect consumption at all in La Dehesa, to 10% of the diet in Torres del Paine).

The geometric mean weight of prey declined monotonically from north to south, with no indication of a corresponding trend in owl body size (Johnson 1965; Humphrey et al. 1970). A similar (but not so consistent) decline in mean prey weight away from the equator was reported by Knight and Jackman (1984) for Great Horned Owls along the Pacific coast of the United States. Comparing areas at latitudes 30° to 40° between the two hemispheres, Jaksić and Marti (1984) showed that central Chilean and California Great Horned Owls did not differ significantly in body size (1,227 g vs. 1,166 g, respectively), but mean prey weight of California owls was 59% of Chilean ones. Knight and Jackman (1984) reported mean prey weight of Great Horned Owls in central Washington (46° N), which coincides with the latitude of Puerto Ibáñez. Because Knight and Jackman (1984) used an arithmetic estimate of mean prey weight, we recalculated from their raw data the geometric estimate, thus making their results comparable to ours. Washington owls exhibited a geometric mean prey weight of 22.9 ± 0.21 g (mean ± 2 s.e.; sample size = 872) which amounted to only 22% of the value reported for southern Chilean owls at the equivalent latitude (Table 1). It is difficult to assign causal relations to these patterns without knowing prey sizes available to owls in these different localities. Knight and Jackman (1985), following Herrera and Hiraldo (1976), speculated that the decrease in mean prey weight taken by owls at higher latitudes may be related to smaller prey becoming more abundant as latitude increases. We have no data to substantiate this claim.

Diet breadth in Chile also decreased with increasing latitude, in agreement with trends reported by Knight and Jackman (1984) for the Great Horned Owl along the Pacific coast of the United States and by Herrera and Hiraldo (1976) for the Eagle Owl *(Bubo bubo)* in Europe. Jaksić and Marti (1984) reported that central Chilean and California Great Horned Owls have a similar diet breadth at the class level of prey identification (H'NGG in their Table 3), but that the former have significantly narrower diet breadth at the species level of mammalian prey H'NM in their Table 3). Knight and Jackman (1984) documented a diet breadth of 4.12 (which amounts to a standardized diet breadth = 0.12; because B_{max} = 26, and B_{min}= 1) for Washington Great Horned Owls. These values amount to 57% and 19% (respectively) of those computed for owls at the equivalent latitude in Chile, and are in fact more similar to observations 5 latitudinal degrees south, in Torres del Paine (Table 1). Apparently, both South and North American Great Horned Owls exhibit narrower diets toward higher latitudes, but the latter prey heavily on relatively few items. In fact, only two rodents *(Thomomys talpoides* and *Perognathus parvus)* accounted for 73% of the items in the diet of Washington owls. A similar value in the diet of Chilean owls was accounted for by the six most preyed upon rodent species in Puerto Ibáñez, and by three in Torres del Paine (Table 1). The decreasing diet diversity away from the equator might be related to a decreasing number of potential prey species which is consistent in both hemispheres.

Latitudinal trends in the trophic niche of Great Horned Owls along the Pacific coast of southern South America closely mirror trends documented in northern North America (and of the congeneric Eagle Owl in Europe). Local estimates of trophic statistics for latitudinally-matched localities in the two hemispheres, however, show some marked differences. The pattern of decreasing diet diversity away from the equator could have been expected, but a similar trend in mean prey weights at corresponding latitudes, both related to the local availability/vulnerability of prey, was unlikely to hold within/between the two hemispheres.

ACKNOWLEDGMENTS

We thank Richard J. Clark, Richard L. Knight, M. Ross Lein, Carl D. Marti, Martin K. McNicholl, Karen Steenhof, and an anonymous reviewer, for critically reading different versions of this paper. Jaksić acknowledges the support of grants DIUC 202/83 and 076/85 (awarded by the Pontificia Universidad Católica de Chile), and INT-8308032 (awarded by the U.S. National Science Foundation) during the several stages of preparation of the manuscript.

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Received 28 March 1986; Accepted 25 July 1986.