Nota Curta / *Short Note*

Winter diet of Long-eared Owls *Asio otus* in the Ebro valley (NE Iberia)

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We studied the diet of Long-eared Owls *Asio otus* in a communal winter roost in the Ebro valley (NE Iberia). Overall, 846 prey items from more than 400 pellets were analysed. Rodents constituted the bulk of the owls' diet (98%), above all *Mus spretus* (69.9%), followed by *Microtus duodecimcostatus* (18.7%), *Apodemus sylvaticus* (8.3%), *Rattus norvegicus* (1.0%) and *Microtus arvalis* (0.4%). The rest of the prey items (1.9%) consisted of small passerines. Qualitatively, our results were more similar to those reported from N Iberia than from S Iberia, although quantitatively our results were much closer to those from S Iberia (with a greater amount of mice, *Mus* spp.) than from N Iberia.

Keywords: Long-eared Owl, *Asio otus*, diet, Ebro valley, winter.

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Received: 08.07.09; Accepted: 03.10.09 / Edited by S. Herrando

The diet of wintering Long-eared Owls *Asio otus* has been well documented for several regions of Iberia (García & Cervera 2001). *Apodemus* spp. are the dominant prey items in both northern and central regions, whilst *Mus spp*. are more often consumed in S Iberia (Sans-Coma *et al.* 1987, Moreno & Barbosa 1992). The Ebro valley in NE Iberia is important as a breeding area for the species (Cortés & Martí 2003) and, probably, also as a wintering area (Cramp 1985). To our knowledge, however, the Long-eared Owl's diet is still poorly known in NE Iberia.

Our aim was to determine the content of Long-eared Owls' diets during the winter at a locality in the Ebro Valley in NE Iberia. In addition, we analysed to what extent this winter diet differs from that of other areas of Iberia.

Material and methods

The sampling site was a communal roost in a small group of Aleppo pines *Pinus halepensis* near the cemetery at Corella, Ebro valley, NE Iberia (42º07' N 01º46'W; Fig. 1), used in winter by nearly 60 Long-eared Owls. The landscape in a 5.0 km radius around the roost site was primarily occupied by irrigated crops (91.8%) and fallow fields (6.8%). The rest of the area (1.4%) was occupied by a mosaic of small patches of riparian, holm-oak and Aleppo-pine forest, poplar groves, fruit trees, shrublands, grasslands and vineyards.

Long-eared Owls remain at this site for the whole winter period (DA pers. obs.). In January 2008, a sample of nearly 400 pellets was collected

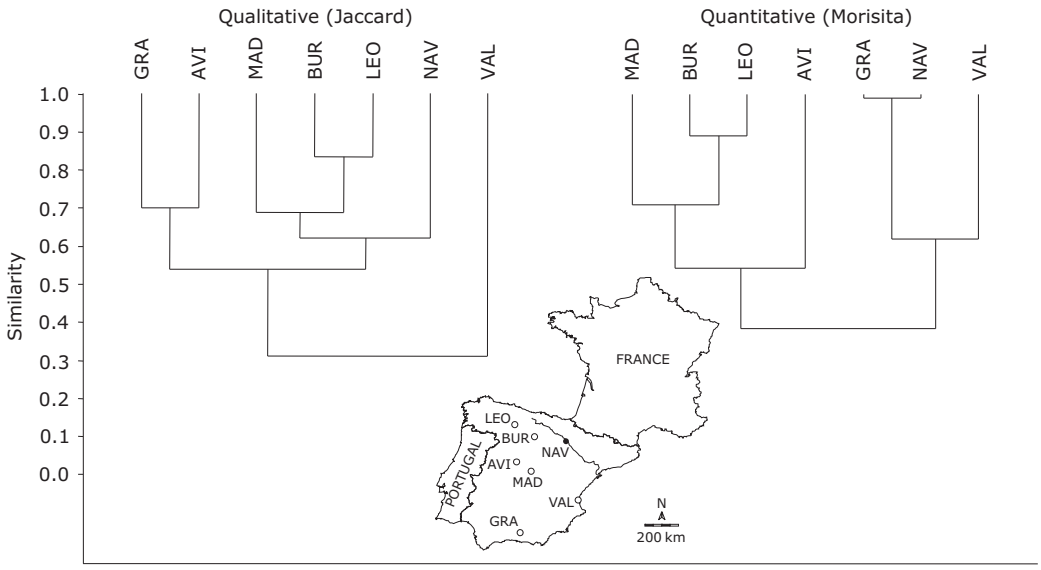

Figure 1. Hierarchical Cluster Analysis used to analyse similarities in Long-eared Owl diets in different regions of Iberia. The data were analysed both qualitatively (based on Jaccard's index of similarity) and quantitatively (based on Morisita's index of similarity). White dots on the map represent the sampling sites used in the literature, whereas the black dot (Corella) is the study site discussed in this paper. The Ebro River is shown as a black line. Abbreviations as used in Table 1.
Anàlisi jeràrquic de clusters utilitzat per conèixer la similitud de la dieta del Mussol Banyut entre diverses zones de la península Ibèrica. Les dades es van analitzar tant quantitativament (seguint l'índex de similitud de Jaccard) i quantitativament (seguint l'índex de similitud de Morista). Els punts blancs del mapa fan referència a les localitats d'on s'han agafat dades bibliogràfiques, mentre que el punt negre (Corella) correspon a lloc d'estudi d'aquest article; el riu Ebre es mostra amb una línia negra. Les abreviatures són les mateixes utilitzades a la Taula 1.

and studied with hand-lenses to determine the diet of the Long-eared Owls. Whenever possible, we identified each prey item to specific level (small mammals: Niethammer 1978, 1982, Gosálbez 1987; birds: Moreno 1985, 1986). Of these 400 pellets, a sub-sample of 60 pellets was used to assess the number of prey items per pellet, whilst another sub-sample of 30 pellets was used to calculate the size of the pellets (measured with calliper, 0.5 mm accuracy).

The diet of the Long-eared Owls from this locality was compared both qualitatively and quantitatively (see Table 1) with those from other sites in Iberia by means of a Hierarchical Cluster Analysis, using the UPGMA method (Sneath & Sokal 1973). Because the taxonomic accuracy with which the prey items were determined was not constant in the previous studies and given the taxonomical changes that have taken place in recent decades, prey items were only considered at generic level in the statistical analyses. For the qualitative analysis, the original matrix was used to calculate a matrix based on Jaccard's index of similarity (Margalef 1998). This index is based on the number of shared species (prey items) from each sampling site. For the quantitative analysis, Morisita's index of similarity was used, which considers the relative abundance of each species (Margalef 1998).

Statistical analysis was conducted with SPSS 15.0 and PAST 1.60 packages; means are given ± SE.

Results

The mean size of the pellets was 37.6 ± 1.6 × 23.3 ± 0.6 mm (N = 30), while the number of prey items per pellet was 2.0 ± 0.1 (N = 60; mode = 2). We identified 846 prey items in total. Of them, most (98.1%) were small mammals (Rodentia) and the rest (1.9%) passerines

Table 1. Diet (% of prey items) of Long-Eared Owls in Iberia during the winter. Abbreviations: VAL: Albufera de Valencia, E Iberia (García & Cervera 2001); GRA: Granada, S Iberia (Corral *et al.* 1979); MAD: Madrid, C Iberia (López-Gordo *et al.* 1976); AVI: Ávila, C Iberia (Segundo 1988); BUR: Burgos, N Iberia (Delibes *et al.* 1983); LEO: León, NW Iberia (Alegre *et al.* 1989); NAV: Navarra, N Iberia (this work).
Dieta (% de preses) del Mussol Banyut a Iberia durant l'hivern.

Location / *Lloc*	**VAL**	**GRA**	**MAD**	**AVI**	**BUR**	**LEO**	**NAV**
Sample size (prey ítems)	864	2474	255	2574	232	874	846
Mostra (núm.preses)							
Mammal / *Mamífers*	47.90	94.26	98.78	93.32	99.10	87.88	98.10
Unidentified mammal *Mamífers no identificats*	–	–	–	3.26	–	–	–
Mus spp.	–	0.04	–	5.17	35.30	19.32	–
Mus domesticus	11.80	67.50	9.80	–	–	–	–
Mus spretus	29.40	–	–	–	–	–	69.86
Apodemus spp.	–	–	–	–	–	46.22	–
Apodemus sylvaticus	–	1.01	81.63	18.61	31.50	–	8.27
Rattus rattus	5.00	–	–	–	–	–	–
Rattus norvegicus	1.30	–	2.45	–	–	–	0.95
Arvicola sapidus	0.40	0.08	–	–	–	–	–
Microtus spp.	–	0.40	–	–	23.70	–	–
Microtus agrestis	–	–	–	–	–	2.06	–
Microtus lusitanicus	–	–	–	52.25	–	10.63	–
Microtus duodecimcostatus	–	24.86	2.45	9.75	–	–	18.68
Microtus arvalis	–	–	–	1.17	5.60	8.35	0.35
Eliomys quercinus	–	0.24	–	0.16	–	–	–
Crocidura spp.	–	–	–	–	–	1.14	–
Crocidura russula	–	0.04	0.41	2.95	3.00	–	–
Suncus etruscus	–	–	1.22	–	–	–	–
Oryctolagus cuniculus	–	0.04	0.82	–	–	0.14	–
Myotis spp.	–	0.04	–	–	–	–	–
Bird / *Ocells*	52.10	5.17	1.22	4.39	0.90	12.12	1.89
Insect / *Insectes*	–	0.57	–	2.29	–	–	–

(Passeriformes). Small mammals were identified to specific level, with most (N = 591) being *Mus spretus*, followed by *Microtus duodecimcostatus* (N = 158), *Apodemus sylvaticus* (N = 70), *Rattus norvegicus* (N = 8) and *Microtus arvalis* (N = 3). Passerines could not be identified to specific level since their bones were broken and skulls were incomplete. Of the 16 passerines detected, six were identified as *Fringillidae*.

A Hierarchical Cluster Analysis based on the qualitative relationship between sampling sites revealed that our locality in the Ebro valley was closely related to those found in other areas of N Iberia (Burgos, León) and to Madrid (Fig. 1). However, in a second Hierarchical Cluster Analysis based on the relative abundance of each prey item at each locality, the Ebro valley was found to be more closely related to the more Mediterranean localities of S Iberia (Fig. 1).

Discussion

The wintering diet of the studied population of Long-eared Owls in the Ebro valley (NE Iberia) consisted almost entirely of small rodents (98%), of which *Mus spretus* was the main prey item (70%). This is the commonest small mammal within the study area (Escala *et al.* 1997) and our findings agree with previous studies that have reported that the Long-eared Owl is an opportunistic predator (see for a review García & Cervera 2001).

Qualitatively, the owls' diet at our sampling site was similar to that reported in other areas

of N Iberia (*e.g.* Delibes *et al.* 1983, Alegre *et al.* 1989). However, quantitatively, the Ebro valley was much more similar to areas of S Iberia (with significant amount of mice, *Mus* spp.; Corral *et al.* 1979; see also a review in García & Cervera 2001) than to N Iberia, where voles and allies (mainly *Apodemus* spp.) are the principal prey items (López-Gordo *et al.* 1977, Delibes *et al.* 1983, Alegre *et al.* 1989). This highlights that fact that, unlike other areas of NW Iberia, there is a clear Mediterranean influence in the Ebro valley, which is hence biogeographically closer to S Iberia (Palomo *et al.* 2007).

Most of the land area surrounding the roost site was occupied by irrigated crops, indicating that the original natural habitat is highly altered. Such a circumstance is thought to influence the presence and distribution of the Long-eared Owl's potential prey items such as small mammals (Escala *et al.* 1997). Thus, *Mus* spp. could be proportionally more abundant than *Apodemus* spp. in habitats that have been severely altered by human activity (Palomo *et al.* 2007). Studying the relationship between land use and prey availability is key for reaching a better understanding of the impact of current agricultural systems on Long-eared Owls' diets.

The breeding population of the Long-eared Owl has declined in many western European countries (BirdLife International 2004) and further studies are required to determine whether or not prey availability in wintering grounds such as the Iberian Peninsula plays a significant role in this negative trend.

Acknowledgements

Thanks are due to S. Llorente, for his help during the field work. JA was supported by a post-doctoral fellowship from the Basque Government, and AV was funded by a doctoral fellowship from the Navarran Government. R. Jovani, S. Herrando and two anonymous referees provided valuable comments that helped us improve on an earlier version of the manuscript.

Resum

Dieta hivernal del Mussol Banyut *Asio otus* a la vall de l'Ebre (NE d'Ibèria)

Es va estudiar la dieta hivernal del Mussol Banyut *Asio otus* a partir de les dades obtingudes en un dormidor comunal a la vall de l'Ebre (NE d'Espanya). D'una mostra d'aproximadament 400 egagròpiles es van obtenir i identificar 846 preses. Els rosegadors van constituir la major part de la dieta (98%), principalment *Mus spretus* (69.9%), seguit de *Microtus duodecimcostatus* (18.7%), *Apodemus sylvaticus* (8.3%), *Rattus norvegicus* (1.0%) i *Microtus arvalis* (0.4%). La resta de la dieta (1.9%) va estar constituïda per petits passeriformes. Qualitativament els nostres resultats van ser més similars als d'altres zones del N d'Espanya que als del S d'Espanya. Quantitativament, no obstant això, van ser més similars a les d'altres localitats del S d'Espanya, on l'abundància relativa de *Mus* spp. és major.

Resumen

Dieta invernal del Búho Chico *Asio otus* en el valle del Ebro (NE de Iberia)

Se estudió la dieta invernal del Búho Chico *Asio otus* a partir de los datos obtenidos de un dormidero comunal en el valle del Ebro (NE de España). De una muestra de aproximadamente 400 egagrópilas se obtuvieron e identificaron 846 presas. Los roedores constituyeron la mayor parte de la dieta (98%), principalmente debido a *Mus spretus* (69.9%), seguido de *Microtus duodecimcostatus* (18.7%), *Apodemus sylvaticus* (8.3%), *Rattus norvegicus* (1.0%) y *Microtus arvalis* (0.4%). El resto de la dieta (1.9%) estuvo constituida por pequeños paseriformes. Cualitativamente nuestros resultados fueron más similares a los de otras zonas del N de España que a los del S de España. Cuantitativamente, no obstante, fueron más similares a los de otras localidades del S de España, donde la abundancia relativa de *Mus* spp. es mucho mayor.

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