Ardeola 51(1), 2004, 215-219

Notas Breves

EFFECTS OF HABITAT LOSS ON PERCEIVED AND ACTUAL ABUNDANCE OF THE LITTLE OWL *ATHENE NOCTUA* IN EASTERN SPAIN

EFECTOS DE LA PÉRDIDA DE HÁBITAT SOBRE LA ABUNDANCIA REAL Y LA ABUNDANCIA APARENTE DEL MOCHUELO EUROPEO *ATHENE NOCTUA* EN EL ESTE DE ESPAÑA

José Antonio MARTÍNEZ* & Iñigo ZUBEROGOITIA**

The rate of habitat loss to housing developments and extended road networks in the east coast of Spain has increased steeply over the last fifty years so that little remains of the traditional agro-pastoral landscape. Although it has been widely documented that the carrying capacity of human-maintained semi-natural systems is usually higher than in tracts of intensive agriculture or forest as long as traditional agricultural practices are put into operation (e.g. Martinez & López, 1999; Sánchez-Zapata & Calvo, 1999; Zuberogoitia, 2002), environmental impact studies (EIS), or the corresponding assessments carried out by managers in Alicante (E of Spain), have neglected the preservation of the network of arid plantations that hosts the bulk of the coastal fauna. Currently, the remaining arid plantations consist of Carob *Ceratonia siliqua*, Olive *Olea europaea* and Almond *Prunus amygdalus* agricultural estates and vegetable and orange or lemon smallholdings, most of which have become deserted. One of the most conspicuous inhabitants of such plantations is the Little Owl *Athene noctua*, a species regarded as abundant in Spain, but still sensitive to micro-habitat alteration (Zuberogoitia, 2002). The knowledge of habitat-abundance relationships for the Little Owl in Alicante is especially important because poor quality EIS usually rely on the opinion of local ornithologists to record the abundance of Owls as opposed to conducting systematic surveys. Therefore, as illustrated by some long-term monitoring schemes, surveys are usually biased towards areas known to be occupied, or to apparently suitable habitat for the target species (i.e. Jarvinen & Vaisanen, 1983; Lehman *et al*., 1998; Hof & Flather, 1998; Garshelis, 2000). Moreover, lack of control over the outcome of EIS recommending the protection of arid plantations also contributes to the disappearance of such habitat. For example, some local authorities do not follow recommendations for protection and allow plantations to be designated as suitable building land. The aims of this study are: (1) to reveal habitat-abundance relationship between the traditional agro-pastoral complex of the coast of Alicante and the Little Owl over a decade and (2) to test whether habitat loss can modify Little Owl detectability.

The study area, the Huerta de San Juan, is located north of the city of Alicante. In 1993, main land uses were abandoned Carob, Olive and Almond plantations and vegetable and orange or lemon smallholdings surrounded by small urban developments, i.e. a poorly developed road network and small villages. By 2003, the Huerta had been turned almost completely into golf courses and urban areas with a highly developed road network. Four study plots 700 m to 2.7 km apart were randomly located within this area and changes in owl numbers and habitat availability were monitored. Little Owls were located by censusing dusk point count stations between March and June (Zuberogoitia & Campos 1998; Centili, 2001;

* C/ Juan de la Cierva 43, El Campello, E-03560 Alicante, España. e-mail: qvcocotiers@hotmail.com
** E. M. Icarus S. L., Apdo. 106, Leioa, E-48940 Bizkaia, España. e-mail: inigo.zuberogoitia@wanadoo.es

Zuberogoitia, 2002). Each year, point counts were censused at 40 stations (10 at each study plot). The main purpose of these dusk counts was to locate all individuals present in the study area. Playback sessions started at sunset and finished two hours later at the maximum. Playback protocol was as follows: an initial 2-minute settling period followed by 20, 45, 90 seconds of calling with 1-minute intervals, followed by a 3 minute listening period (Exo & Hennes, 1978; Centili, 2001). Playback was only performed in dry, windless conditions. The taped call was the advertising male call (Centilli, 2001). The same procedure was followed in a rural area located 7 km away from the main study area whose habitat composition and structure resembled that of the altered study area in 1993. This plot has remained unaltered throughout the study period, thus becoming a control area.

Diurnal counts were also carried out, some of which were in the Village of San Juan, taking advantage of the fact that Little Owls can produce territorial calls during the daytime (Mikkola, 1983). Such stations were randomly allocated throughout the day. Four diurnal point count stations were purposefully located by four known communal roosts (Martinez & Zuberogoitia, 2004). At each diurnal point count station, the number of spontaneous vocal contests was recorded (number of bouts; Mikkola, 1983; Cramp & Simmons, 1985; Martinez & Zuberogoitia, 2002, Martinez *et al*., 2002), and the results expressed as the percentage of days when replies were heard. Little Owls and their calls were monitored in the same way in the control area.

Little Owls breed mainly in abandoned arid plantations in the study area (Martinez & Zuberogoitia, 2004). Therefore, the annual change in the area of arid plantations was used as an indicator of Little Owl habitat availability. In order to locate possible Little Owl traffic casualties two 4-Km. roads were driven along slowly (one crisscrossing the main study area, the other passing through the control area) once a month from January 1996 to December 2000.

There was an 84% decline in the number of Little Owls in the main study area between 1993 and 2002 (87 and 14 occupied territories, respectively; Fig. 1). However, the number of territories in the control area showed little os-

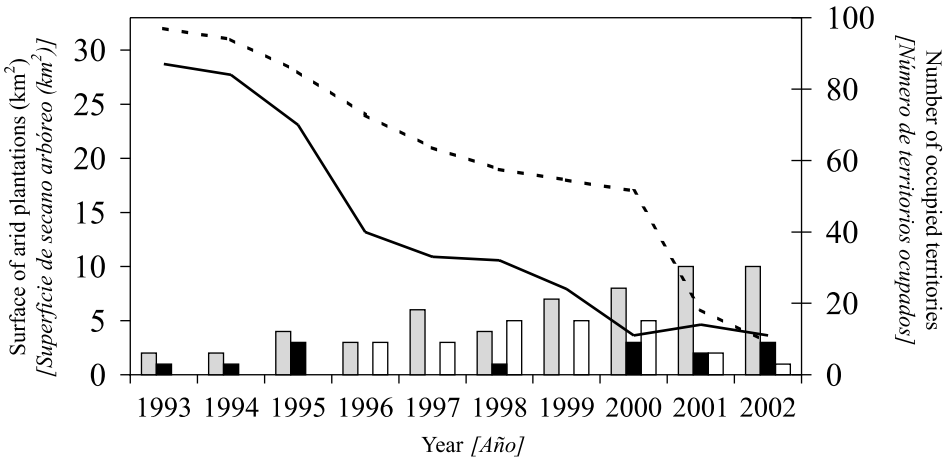

Fig. 1.—Effects of the disappearance of arid plantations (broken line, left axis) on the numbers of occupied Little Owl territories (continuous line, right axis). Vertical bars show the numbers (on left axis) of spontaneous diurnal vocal contests in altered areas (grey bars), in the control area (black bars) and in the Village of San Juan (white bars).

[Efectos de la desaparición de cultivos de secano arbóreo (línea quebrada, eje de la izquierda) sobre el número de territorios ocupados de Mochuelo Europeo (línea continua, eje derecho). Las barras verticales muestran el número de disputas territoriales diurnas espontáneas en el área alterada (barras grises), en el área de control (barras negras) y dentro del pueblo de San Juan.]

cillation, varying between 14 and 17 throughout the study period. A relationship was found between the decline of the owl population and the decreasing availability of arid plantations ($r_s = –0.98$, $P < 0.001$, $n = 10$). The percentage of days when vocal contests were recorded varied significantly between the altered and the control area throughout the study period ($U = 0.001$, $P = 0.043$, $n = 10$). Moreover, there was a negative relationship between the number of spontaneous bouts in altered areas and the availability of arid plantations ($r_s = –0.95$, $P < 0.001$, $n = 10$; Fig. 2). The number of diurnal spontaneous bouts within the Huerta de San Juan increased from nil to five between 1996 and 2000, and then decreased to one between 2000 and 2002 (Fig. 1).

Had the opinion of local ornithologists been relied upon, survey work would have been conducted only in the four most accessible spots close to villages where the communal roosts occurred. By using the same surveying methods the erroneous conclusion would have been reached that the Little Owl population had increased over a decade (1993: 4 individuals; 1994: 4; 1995: 5; 1996: 7; 1997: 6; 1998: 11; 1999: 13; 2000: 10; 2001: 15; 2002: 13).

Road surveys in the main study area produced a total of 67 Little Owl carcases, whereas 16 carcases were found in the control area in the same period and in the same length of road.

Little Owl numbers across the altered area declined commensurately with the reduction in the area of their preferred habitat. However, they were more or less stable in the control area where there was no habitat change. The differences in owl numbers between areas are probably due originally to the relative scarcity of Carobs in the control area, which provide hollows for breeding. The results provide further support to studies showing that the probability of finding Little Owl territories is largely dependent on the availability of the agri-pastoral patchwork in semi-arid Spain (Martinez & Zuberogoitia, 2004).

Little Owl numbers around villages temporarily increased as the area of preferred habitat decreased, presumably as individuals sought refuge there as the habitat was destroyed (Martinez & Zuberogoitia, 2004). This led to an increase in the detectability of the Little Owls as measured by the number of vocal contests (due

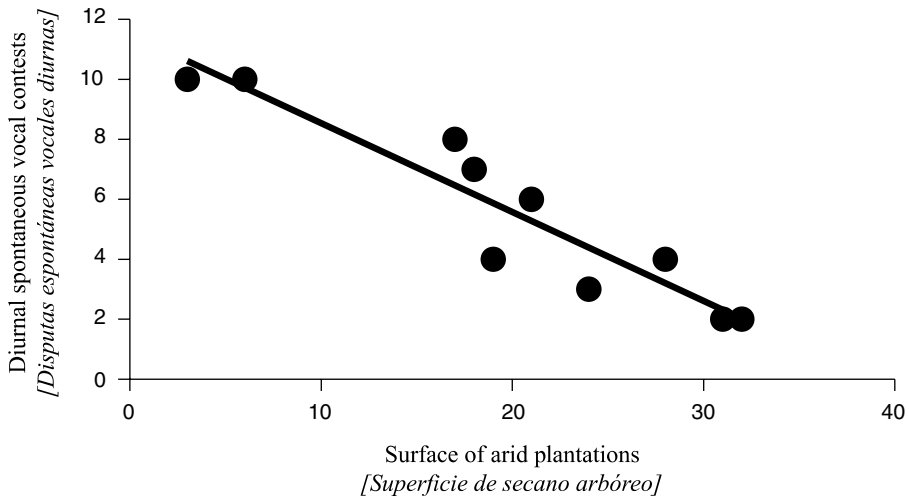

Fig. 2.—Relationship between the shrinking availability of arid plantations and the increasing number of spontaneous diurnal contests in the altered area for Little Owls. Points represent sequential annual values from 1993 (bottom right) to 2002 (top left).
[Relación entre la disminución de la superficie de cultivos de secano arbóreo y el incremento en el número de disputas espontáneas diurnas en la zonas alterada para el Mochuelo Europeo. Los puntos representan valores secuenciales desde 1993(extremo inferior derecho del gráfico) hasta 2002 (extremo superior izquierdo).]

to increased intraspecific competition). Thus, between 1996 and 1998, the number of territorial disputes in the Huerta de San Juan increased fivefold (Fig. 1), coinciding with an increase of the urbanisation of the surrounding arid plantations. Between 1999 and 2002, diurnal spontaneous contests in this village decreased fourfold, coinciding with the changeover of the few remaining houses with carob orchards for housing states and gardens with young exotic trees (*pers. obs.*). This possibly indicated adjustments in the amount of territorial contests arising from changes in the resources obtainable in this village by an increasing number of incomers displaced by habitat loss in the surrounding landscape. In fact, 4 territories were found in the village in 1994, 10 in 2000 and 6 in 2002. Similarly, some owls remaining in the increasingly fragmented altered area roosted communally. Four such roosts where found in the gardens of the four remaining country houses in arid plantations that were under urban development. Such aggregations of individuals were caused by the mounting scarcity of arid plantations (Martinez & Zuberogoitia, 2004). In contrast, in less altered agricultural areas aggregations of Little Owls were caused primarily by social interactions (Van Nieuwenhuyse & Bekaert, 2002). While in the altered area owls engaged in frequent territorial disputes, diurnal contests were scarcer in the control area. Furthermore, owls roosted individually at an average nearest neighbour distance of 294 m (SD = 51, n = 16) in the control area. Whether there are some fitness costs associated with living in altered areas remains an open question, but the costs of living in urbanised areas (as measured by the number of traffic casualties) are considerably higher than the costs of living in the control area. Carrion-eaters such as Foxes *Vulpes vulpes* were present in small numbers in both main and control areas at the onset of this study, but habitat loss caused a sharp decline in Fox numbers and then local extinction in the main area (*pers. obs.*). To our knowledge, there was only one Fox pair some 700 m away of the control area which was likely to be observed at a rubbish dump close to their den. Thus it is unlikely that carrion-eaters may have removed owl carcases to the point of making results not comparable between areas. Furthermore, small or medium-sized carnivores are heavily persecuted by hunters and are scarce in the surroundings of both areas (*pers. obs.*).

These results suggest that poorly-planned surveys of restricted scope may give a misleading impression of the effects of habitat alteration on the populations of Little Owls in similar landscapes. For instance, ornithologists living in the study area are under the impression that Little Owls are more abundant in recent years because they are heard more frequently, in a wider variety of places and because Owls are sought after only in places known to be occupied, mainly in the proximity of villages (*pers. obs.*). However, the results here point out that habitat alteration not only has reduced Owl numbers over a decade, but that they may also be occupying suboptimal areas such as villages where resources (mainly roosting or breeding places) are not predictable. Furthermore, aggregation of individuals in the study area causes owls to engage in territorial disputes more frequently than in unaltered areas, which ultimately may be costly. The preferred environments of the Little Owl are those transformed by human activities into mosaics of different land uses (Génot & Van Nieuwenhuyse, 2002; Ferrus *et al*., 2002; Martinez & Zuberogoitia, 2004). Thus, it would be beneficial if EIS carried out in coastal areas in Alicante considered the effective protection of a network of arid plantations and other traditional land uses at biologically meaningful scales (Martinez *et al*., 2003). This would be advantageous for a number of medium-sized listed predators inhabiting arid plantations, including Little Owls (Martinez & Lopez, 1999; Martinez & Zuberogoitia, 2004; Martinez *et al*., 2003; Alonso *et al*., 2003).

RESUMEN.—*Se estimó la abundancia por medio de censos de los Mochuelos europeos* Athene noctua *en relación a la disponibilidad de cultivos arbóreos de secano en Alicante (este de España). Se analizó la relación entre la disponibilidad de hábitat y el número de cantos espontáneos diurnos entre 1993 y 2002, en una zona transformada en complejos residenciales y en una zona control. La creciente escasez del secano condiciona negativamente la abundancia de mochuelos, y los que restan, agrupados en manchas residuales u ocupando pueblos, se engarzan en más disputas territoriales. Como resultado, los Mochuelos parecen ser más abundantes (en realidad su población decreció un 84%) si no se llevan a cabo muestreos a largo plazo y a escalas espaciales adecuadas.*

ACKNOWLEDGEMENTS.—We are grateful to Mr. Ignacio Buades for making known the cultural values of traditional land uses in Alicante. Dr. Chris Hewson and an anonymous referee made valuable comments on the original manuscript. Jean-Claude Génot, Dries Van Nieuwenhuyse and Michael Exo provided us with relevant references.

BIBLIOGRAPHY

ALONSO-MORENO, R., OREJAS, P., ZUBEROGOITIA, I. & MARTÍNEZ-CLIMENT, J. A. 2003. Autillo Europeo. En, R. Martí & J. C. Del Moral (Eds.): *Atlas de las aves reproductoras de España*, pp 314-315. Dirección General de Conservación de la Naturaleza - Sociedad Española de Ornitología. Madrid.

CENTILI, D. 2001. Playback and Little Owls *Athene noctua*: preliminary results and considerations. En, D. Van Nieuwenhuyse, M. Leysen & K. Leysen (Eds.): *The Little Owl in Flanders in its international context. Proceedings of the Second international Little Owl Symposium*, *Oriolus*, 67: 88-93. Geraardsbergen, Belgium.

CRAMP, S. & SIMMONS, K. (Eds.) 1985. *The Birds of the Western Paleartic, Vol II*. Oxford University Press. Oxford.

FERRUS, L., GÉNOT, J. C., TOPIN, F., BAUDRY, J. & GIRADOUX, P. 2002. Répartition de la Chevêche d'Athéna (*Athene noctua*) et variation d'echelle d'analyse des paysages. *Revieu d'Ecologie (Terre Vie)*, 57: 39-51.

GARSHELIS, D. L. 2000. Delusions in Habitat Evaluation: Measuring Use, Selection, and Importance. En, L. Boitani & T. K. Fuller (Eds.): *Research Techniques in Animal Ecology*, pp. 111-164. Columbia University Press. New York.

GÉNOT, J. C. & VAN NIEUWENHUYSE, D. 2002. Little Owl *Athene noctua*. *BWP Update*, 4*:* 35-63.

EXO, K. M. & HENNES, R. 1978. Empfhlungn zur Methodik von Siedlungsdichte-Untersuchungen am Steinkauz (*Athene noctua*). *Die Vogelwelt*, 99: 137-141.

HOF, J. & FLATHER, C. H. 1998. Accounting for connectivity and spatial correlation in the optimal placement of wildlife habitat. *Ecological Modelling*, 88: 143-155.

JARVINEN, O. & VAISANEN, R. A. 1983. Correction coefficients for line transect censuses of breeding birds. *Ornis Fennica*, 60: 97-104.

LEHMAN, R. N., CARPENTER, L. B., STEENHOF, K. & KOCHERT, N. 1998. Assesing relative abundance and reproductive success of shrubsteppe raptors. *Journal of Field Ornithology*, 69: 244-256.

MARTÍNEZ, J. A., MARTÍNEZ, J. E., ZUBEROGOITIA, I., GARCÍA, J. T., CARBONELL, R., DE LUCAS, M. & DÍAZ, M. 2003. La evaluación de impacto ambiental sobre las poblaciones de aves rapaces: problemas de ejecución y posibles soluciones. *Ardeola*, 50: 85-102.

MARTÍNEZ, J. A. & ZUBEROGOITIA, I. 2002. Factors affecting the vocal behaviour of Eagle Owls (*Bubo bubo*): effects of sex and territorial status. *Ardeola*, 49:1-9.

MARTÍNEZ, J. A. & ZUBEROGOITIA, I. 2003. Lechuza Común. En, R. Martí & J.C. Del Moral (Eds.): *Atlas de las aves reproductoras de España*, pp. 312-313. Dirección General de Conservación de la Naturaleza - Sociedad Española de Ornitología. Madrid.

MARTÍNEZ, J. A. & ZUBEROGOITIA, I. 2004. Habitat preferences for Long-eared Owls (*Asio otus*) and Little Owls (*Little Owls*) in semi-arid environments at three spatial scales. *Bird Study*, 52, 000-000.

MARTÍNEZ, J. A., ZUBEROGOITIA, I., COLÁS, J. & MACIÁ, J. 2002. Use of recorded calls for detecting Long-eared Owls *Asio otus*. *Ardeola*, 49: 97-101.

MIKKOLA, H. 1983. *Owls of Europe*. T & AD Poyser. Carlton.

SÁNCHEZ-ZAPATA, J. A. & CALVO, J. F. 1999. Raptor distribution in relation to landscape composition in semi-arid Mediterranean habitats. *Journal of Applied Ecology*, 36: 245-262.

SEO/BIRDLIFE, 1999. *Seguimiento de Aves Nocturnas en España. Programa NOCTUA. Informe 1998*. SEO/BirdLife. Madrid.

VAN NIEUWENHUYSE, D. & BEKAERT, M. 2002. An autologistic model for prediction of Little Owl (*Athene noctua*) suitability of landscape in East Flanders-evidence for socially induced distribution patterns of Little Owl. En, Yosef, R. (Ed.): *Raptors in the new millennium. Proceedings of the world conference on birds of prey & owls*. pp. 80-90. International Birding & Research Center in Eliat. Israel.

ZUBEROGOITIA, I. & CAMPOS, L. F. 1998. Censusing owls in large areas: a comparison between methods. *Ardeola*, 45: 47-53.

ZUBEROGOITIA, I. & MARTÍNEZ, J. A. 2001. The Little Owl in the «Proyecto Noctua». *Ciconia*, 25: 103-108.

ZUBEROGOITIA, I. 2002. *Eco-etología de la comunidad de rapaces nocturas de Bizkaia*. Tesis Doctoral. Universidad del País Vasco. Leioa.

[Recibido: 15-12-03]
[Aceptado: 29-03-04]