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Home range size and habitat use of the Little Owl *Athene noctua* in East Poland

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Home ranges of 11 Little Owls *Athene noctua* were studied using radio telemetry in agricultural landscapes of eastern Poland during the breeding seasons of 2000–03. Owls were tracked from the time of egg laying until the young dispersed (15 April – 22 August). Areas of use were determined for three periods: egg laying and incubation period (15 April – 17 May), nestling period (8 May – 28 June), and fledgling period (29 June – 22 August). During the egg laying and incubation period use areas were on average 18 ha (SD 20, 2.5–65.3, $n = 9$), during the nestling period 27.5 ha (SD 28.2, 1.9–95.0, $n = 18$), during the fledgling period 9.0 ha (SD 9.4, 1.8–34.1, $n = 11$). Combining data for all owls from all breeding season periods, the area of use was 1.8–95.0 ha (average 19.9 ha, SD = 23.2, $n = 38$). The majority of owl locations were recorded in fields (64%, mainly cereals). Fewer locations were in fields with row crops (12%, sugar beets, potatoes), on buildings (11%), gardens and orchards (9%), meadows and pastures (2%), roads (1%) trees and bushes (1%). During the breeding season, the growth of vegetation limited the access that owls had to the ground. Little Owls spent 85–95% of their time at places where vegetation height did not exceed 20 cm.

Key words: Little Owl, *Athene noctua*, telemetry, home range, habitat use, breeding season, Poland

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INTRODUCTION

The Little Owl *Athene noctua* is a species whose numbers and distribution have decreased rapidly in recent years. This decline has been observed in many European countries with the decrease exceeding 50% in some (Ziesemer 1981, Cramp 1985, Illner 1988, Tucker & Heath 1994, Hagemeijer & Blair 1997, Génot *et al.* 1997, Vogrin 1997, BirdLife 2004, Van Nieuwenhuyse *et al.* 2008). Similarly, in Poland, the Little Owl was regarded as a common species in the past, however, its numbers have been decreasing and its distribution shrinking (Taczanowski 1882, Tomiałojć 1990, Tomiałojć & Stawarczyk 2003, Grzywaczewski 2006). Hence, there is an urgent need to better understand the breeding ecology of the species in Poland.

The Little Owl is present in agricultural landscapes in varied habitats: meadows, pastures, fields, building areas, orchards with low vegetation. Specific features of importance include long and linear fragments of landscape, e.g. tree lines, fences, edges of forests as well as single elements providing outlooks for hunting areas like single trees, bushes and buildings (Génot & Van Nieuwenhuyse 2002, Van Nieuwenhuyse *et al.* 2008). In Poland, the Little Owl is associated with agricultural landscapes and cities, and rarely, with river valleys (Kitowski 2002, Kitowski & Grzywaczewski 2003, Grzywaczewski 2006). A better understanding of qualitative and quantitative characteristics of the habitat used by Little Owl allows for focused conservation actions. The first telemetry studies on the spatial organisation of the Little Owl were done in Germany at the beginning of the 1980s and 1990s (Exo 1988, 1989). Pertinent studies on territorial behaviours and home range use were also conducted by Finck (1990) and Génot & Wilhelm (1993). The aim of this study was to

define the size, structure, and use of the home range areas during different phases of the Little Owl's breeding season.

METHODS

Study area

Radio tracking efforts were conducted in the agricultural landscape of the Lublin region (51°70'N, 22°31'E) in the vicinities of Chełm, Kraśnik and Lublin towns (Fig. 1). The Lublin region is situated in eastern Poland and borders Belarus and Ukraine. It is an agricultural region with c. 69% of agricultural land-use. Wheat, rape seed, sugar beet, vegetables, fruits, rye, oats and potatoes are the dominant crops. The area has a low human population density, averaging 89 persons per km^2. The climate of the Lublin Region is continental and the average annual temperature is 7–7.5°C; warmest months are July and August, the coldest is February; the vegetation growing season lasts 208–218 days. Annual precipitation is 550–600 mm with maximum precipitation observed in summer (July, c. 100 mm); spring rainfall is 50–70 mm (Nowak & Nowak 1996).

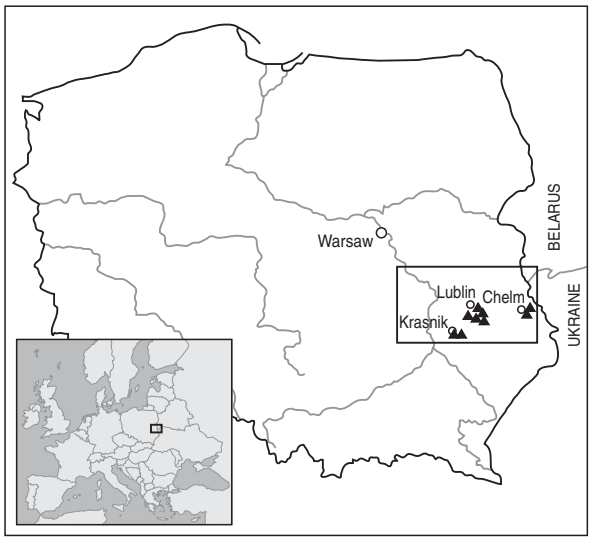

Figure 1. Location of Little Owl study sites in the Lublin Region, eastern Poland.

Radio marking

Eleven territorial adult owls were caught in mist nets in April-June. The nets were set at sunset, 100–200 m from known breeding sites. A decoy Little Owl was placed on a pole by a net with a dictaphone below, emitting the territorial male hoot (Roché 1990). After detecting the decoy, birds attacked it and hence were caught (c. 30–40% of males did not attack). Owls were then ringed and equipped with 'backpack' transmitters. Transmitters were attached using elastic tape that does not limit movements (Exo 1989, Finck 1990). The size and mass of a transmitter (ranged from 5.7 to 9.6 g) was adjusted to the size and mass of the captured bird making up 4.6 to 5.3% of the total mass of the bird. Transmitter signals were sent in the waveband 150029–150268 MHz. Reception was with an MVT 7100 receiver and a multidirectional Y-4 FL antenna; reception was possible up to 1–2 km. Transmitters were used for 6 months.

Locations of radio-marked owls were made between 27 April and 3 August, i.e. from egg laying until the young dispersed, during 2000 to 2003. Observers tracked owls on foot, and observation periods on each owl typically started before nightfall at 19:00–20:00 and lasted until 4:00–5:00. Owl locations were plotted on 1:10 000 scale maps using the triangulation of two or more radio signal azimuths acquired during 2–3 min. Individual owls were located and mapped up to 20–92 times per night.

Analyses

The *Minimum Convex Polygon* method was used to map the home range areas (Kenward 1987, Finck 1990, Génot & Wilhelm 1993). A Planimeter KP-26 was used to determine the area of these home range areas. Based on the method of Génot & Wilhelm (1993), the determined home range was divided into 50 × 50 m squares (0.25 ha). The area of squares was the basis for further analysis. Space used by owls within their ranges was calculated by summing all of the visited squares and then comparing this with the available range. By applying this method the actual use of home ranges was obtained. Additionally, land-use within the home ranges was measured: type of land-use, dominant crop and its height, length of roads and power lines. Vegetation height was measured every 10–20 days. Spatial and time differences were described using observations in different phases of the breeding period. The phases of the breeding season reflected three periods: (1) *incubation period* 15 April – 17 May (reflecting egg-laying, incubation, egg-hatching); (2) *nestling period* 18 May – 28 June (nestlings in the nest); and (3) *fledgling period* 29 June – 22 August (young leave the nest and become independent). The use of home range areas was calculated as on the basis of numbers and percentage shares of owl locations recorded in particular squares. Means are reported ± SD.

RESULTS

A total of 38 breeding season home range areas were determined for 11 different Little Owls: 10 male and 1 female owls were tracked during 1 and 2 breeding seasons, respectively. A total of 256 hours of observations were made yielding 1582 owl locations. Overall, the average breeding season use area of Little Owls in the Lublin Region was 19.9 ha (±23.2, 1.8–95, $n = 38$).

During the incubation period the average use area was 18 ha (±20, $n = 9$), during the nestling period 27.5 ha (±28.2, $n = 18$), and during the fledgling period 9.0 ha (±9.4, $n = 11$) (Table 1). The size of use areas in the nestling and the fledgling periods were significantly different (Mann–Whitney Test, $z = -2.068$, $P = 0.039$). The decrease was probably associated with habitat changes rather than with the phase of the breeding cycle (Fig. 2).

By proportion of area, the habitat types within Little Owl use areas were: fields with tall vegetation (64%, mainly cereal grains), fields with row crops (12%, sugar beets, potatoes), buildings (11%), gardens and orchards (9%), meadows and pastures (2%), roads (1%) and trees and bushes (1%). The accessibility to prey in these areas changed during the breeding season (Table 2). At the beginning of the breeding season (April–May) potential hunting areas were almost unlimited, therefore birds could hunt in the whole area. In the period May–June when use areas were large and some crops were still growing (e.g. beets, potatoes), they could still hunt in the larger part of the area. From July on, these areas became inaccessible (due to the tall vegetation), resulting in the owls shifting their activity close to buildings. In July and August fragments of the field habitat became accessible again after harvesting (mowing). In all periods Little Owls favoured those parts of their use areas in which the height of vegetation was around 20 cm. During the whole breeding period, birds spent 85–95% of time in the areas where the vegetation was shortest.

The percentage of area occupied by fields in the owls' use area dropped from 60% in May to 40% in August. Subsequently, the percentage of an owls' area containing buildings and related urban elements increased from 10% in April–May to c. 30% in August. Also, the home range areas with large percentages of tall vegetation (crops) were significantly larger than owl areas with more short vegetation (Fig. 3). Likewise, areas with more meadows and pastures contained significantly smaller home range areas. A statistically significant relationship was found between the size of the home range and the area used by birds within a home range ($r_s = 0.775$, $n = 34$, $P = 0.0001$).

Table 1. Changes in Little Owl home range areas during different periods of the breeding season in agricultural landscapes of the Lublin Region, Poland, 2000–03.

Period	Dates	*n*	Mean home range area ± SD (ha)	Range (ha)
Incubation	15 April – 17 May	9	18 ± 20.0	2.5–65.3
Nestling	18 May – 28 June	18	27.5 ± 28.2	1.9–95.0
Fledgling	29 June – 22 August	11	9.0± 9.4	1.8–34.1

Table 2. Home range use of the Little Owl during three phases of the breeding season at the Kolonia Dominów (Lublin Region, east Poland) study site[a]. A comparison is made between availability and use (both in percentages) by plant height categories.

	Incubation 15 April – 17 May		Nestling 18 May – 28 June		Fledgling 29 June – 22 August	
Mean home range area (ha)	22.3 ($n = 2$)		37.5 ($n = 3$)		17.0 ($n = 2$)	
Height of plants (cm)	Available	Used	Available	Used	Available	Used
0–20	43.9	92	40	96	37.5	86.2
21–40	1.8	0	0	0	18.4	0
41–60	1.8	2	5	0	3	0
61–80	52.5	6	37.7	3	6.6	6.6
81–100		0	0	0	0	0
101–120	0	0	0	0	17.8	4.8
> 120	0	0	17.3	1	16.4	2.4
Length of paved/unpaved roads (km)	1.79/0.80		5.21/0.53		1.35/0.38	

[a]The density of owl territories was 1.3–1.5/10 km^2.

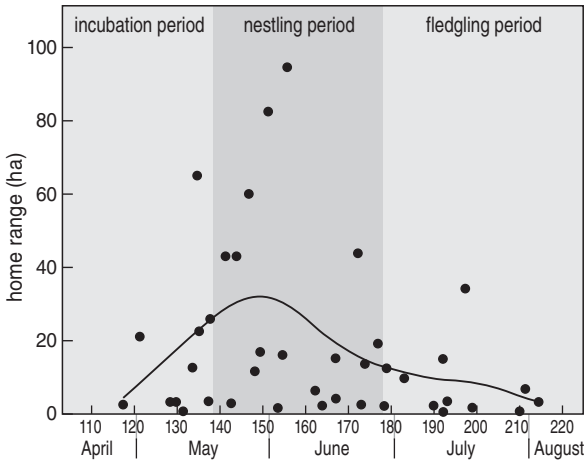

Figure 2. Home range size of the Little Owl during the breeding period.

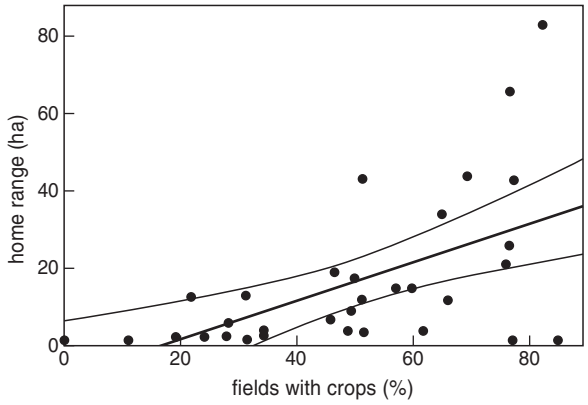

Figure 3. Linear relationship between Little Owl seasonal home ranges and the percentage of crop fields (y = –9.7+0.563x, r = 0.504, n = 34, P = 0.0024).

DISCUSSION

The home range is the area providing suitable year-round energetic supplies for an animal. It is important to distinguish between the annual home range size (i.e. 12 consecutive months) from a shorter (i.e. breeding season) timeframe. In this study, I examined home range aspects of the Little Owl during the five-month breeding season. The division of the breeding season into discrete phases has been done for the first time in this project. Such divisions illuminate the link between the habitat use of adult owls and the specific phases of the nesting cycle.

Little Owl home range characteristics found in the Lublin Region were consistent with observations in Germany and France (Table 3). In particular, Little Owl home range sizes in the Lublin Region showed great similarity with those in the Lower Rhine in Germany (Finck 1990). This is likely a result of the similar agricultural landscapes. However, in this study, the large percentage of fields reflected a lower overall habitat quality. In France, as much as 75% of the home range was comprised of meadows and pastures, 19% of fields and 6% was covered by villages, roads, gardens and orchards (Génot & Wilhelm 1993).

The Little Owl is present in the agricultural landscape in different types of habitats: meadows, pastures, buildings, orchards with low vegetation. Moreover, long and linear fragments of landscape, e.g. roads, tree lines, fences, forest edges as well as single elements like single trees, bushes and buildings (Génot & Van Nieuwenhuyse 2002) provide foraging opportunities. In this project we found that Little Owls use a relatively small area during the breeding period. However, 4–5 ha of the area around the nest must be accessible for hunting during the entire breeding season. While meadows, pastures and orchards show predominant use by owls,

Table 3. Seasonal home range sizes of Little Owls in Europe.

Country	Habitat	Average home range (ha)	Range (ha)	Number of owls	Period of study	Source
Germany	River-valley and the agricultural landscape – lower Rhine	14.5	1–50	12	1982–84	Exo 1992
Germany	River-valley and the agricultural landscape – lower Rhine	14.6	2–107	19	1984–87	Finck 1990
France	Table-land Vosges used agriculturally	30.6	5–107	9	1990–92	Génot & Wilhelm 1993
Poland	Agriculture landscape intensely used in Lublin Region	19.9	1.8–95	11	2000–03	This study

field and road edges, village buildings, and grassy recreation areas were also found to be important foraging areas for owls during the breeding season.

Results of this study help to illuminate which habitats are important to Little Owls and during which periods of the year. Given that the Little Owl population in Poland is declining, proper management is needed to stop the continued decline of the species. Additional demographic and habitat work in the Lublin region will allow us to determine specific guidelines for the management of a self-sustaining Little Owl population.

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SAMENVATTING

In 2000–03 werd van 15 april tot 22 augustus met behulp van telemetrie de grootte van de home range van 11 Steenuilen *Athene noctua* in een akkerbouwgebied in Oost-Polen bepaald. Tijdens de eileg- en broedperiode (15 april tot 17 mei) was de home range gemiddeld 18 ha groot, tijdens de periode met nestjongen (18 mei tot 28 juni) 27,5 ha en tijdens de takkelingenperiode (29 juni tot 22 augustus) 9,0 ha. De meeste uilen werden waargenomen op akkers (64%, vooral graanakkers). Daarna volgden suikerbieten- en aardappelvelden (12%), gebouwen (11%), tuinen en boomgaarden (9%), weilanden en hooilanden (2%), wegen (1%) en bomen en struiken (1%). De hoogte van de aanwezige vegetatie bepaalde in hoge mate waar op de grond kon worden gefoerageerd. De uilen brachten 85–95% van de tijd door in delen van hun home range waar de vegetatie lager was dan 20 cm.

ARDEA

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