DISTRIBUTION AND BREEDING HABITAT OF THE RED-BACKED SHRIKE (*Lanius collurio*) IN AN INTENSIVELY USED FARMLAND

Stanisław Kuźniak and Piotr Tryjanowski

ABSTRACT

Kuźniak S., Tryjanowski P. 2000. *Distribution and breeding habitat of the Red-backed Shrike (Lanius collurio) in an intensively used farmland.* Ring 22, 1: 89-93.

The breeding sites of the Red-backed Shrike ($N = 191$) in an intensively used farmland near Leszno (western Poland) were analysed on the basis of data collected during 1995-1998. All sites were located on maps and aerial photographs and habitat analysis were done in 40 grid squares (500 × 500 m). Stepwise multiple regression analysis showed that the number of breeding shrikes is significantly positively correlated with the percentage of meadows ($p < 0.001$) and wastelands ($p = 0.017$), but it is slightly negatively correlated with the percentage of buildings in the plot ($p = 0.08$). These three factors explain the occurrence of 41% of shrike pairs in the grid squares. Green's index, used as a measurement of the degree of clustering ($GI = 0.27$), indicated a nearly random distribution of the territories. Mean distance between nests was 255 (± 124) m and did not show a significant change between years, although in following years numbers of breeding pairs varied (range 41-59) in the study plot (ANOVA: $F_{(3, 106)} = 0.336$, $p > 0.79$).

S. Kuźniak, Sikorskiego 28/10, 64-100 Leszno, Poland; P. Tryjanowski, Department of Avian Biology and Ecology, Adam Mickiewicz University, Fredry 10, 61-701 Poznań, Poland, E-mail: ptasiek@amu.edu.pl

---

Key words: *Lanius collurio*, habitat selection, farmland, conservation

INTRODUCTION

The Red-backed Shrike has exhibited population declines over large parts of its range, especially in Western Europe (Tucker *et al*. 1994, Bauer and Berthold 1996). For its protection and conservation it is important to identify factors influencing population dynamics. The loss of breeding habitat is considered as a major cause of decline (Jakober and Stauber 1987a, 1987b; Carlson 1995; Diehl 1995), with intensification of agriculture as the most significant factor (Ellenberg 1986, Tucker *et al*. 1994, Lefranc 1997).

Wielkopolska region (in western Poland) boasts one of the longest continuous farming traditions in Poland. Since the 1900s, the region has been affected by the

broad-scale use of chemical and mechanical cultivation (Denisiuk *et al*. 1992) and the state of its agricultural development is now most similar to that in Western Europe. The changes taking place in agro-ecosystems in this region may be indicative for the future changes in agriculture in the rest of Poland.

In this paper, we analyse the breeding densities and habitat selection of the Red-backed Shrike in the intensively used farmland in Wielkopolska region. We investigate also habitat factors affecting density values in the study area in the years with various numbers of breeding pairs (density-dependent aspects of habitat selection).

STUDY AREA AND METHODS

The study was conducted near Leszno, in southwestern Poland (51°51'N, 16°35'E). A detailed description of this study area has been presented elsewhere (Kuźniak 1991). During 1995-1998, the study area (10 km^2) was surveyed for shrike nests. The distance to the nearest occupied nest was measured (only cases, which localisation is thought to be certain were included in this analysis, n = 110). Only nests with first clutches (N = 191) were included in this analysis. All sites were located on maps and aerial photographs, and habitat analysis were done in 40 plots (500 × 500 m). In each grid square (25 ha plot), using a digesting pan and checking in the field, percentage (with an accuracy to 1%) of seven habitat variables was established:

- area of trees (woodlots < 2 ha, hedgerows, *etc*.) – mean ± *SD* = 23.3 ± 33.4%, range 1-99%,
- area of fields (arable fields and alfalfa crop) – 60.2 ± 35.3, 0-98%,
- area of grassland (meadows – small patches along ditches and pastures) – 9.4 ± 17.6, 0-93%,
- area of wasteland (boundary strip, fallow land, area under hayrick, small illegal rubbish dumps, roads) – 2.0 ± 2.1, 0-12%,
- area of human settlements (villages) – 3.0 ± 7.7, 0-31%,
- area of water (small mid-field ponds, ditches) – 2.2 ± 7.7, 0-49%.

To obtain information on clustered shrike distribution we used Green's index (*GI*) according to formula:

$$GI = \frac{s^2/a - 1}{n - 1}$$

where:
s^2 – variance,
a – average number of breeding pairs in a grid cell,
n – number of grid cells.

GI is independent of the total population size and varies between 0 (random distribution) and 1 (maximal clustering) (Jongman *et al*. 1995). For this analysis, data from all years were combined.

All basic statistics followed Sokal and Rohlf (1995). To produce linearity and to normalise variables, all variables representing proportions were *arcsin* (x) trans-

formed and distance between occupied nests was log transformed before analysis. In stepwise regression, $p < 0.05$ was used to enter or remove variables. All analyses were conducted using the statistical package SPSS/PC+ (Norusis 1994).

RESULTS

Density and distribution

In the study area (10 km^2), an average of 47.8 ± 7.8 pairs nested each year (in 1995 – 41 pairs, in 1996 – 59, in 1997 – 45 and in 1998 – 46). Therefore, in one grid square, a mean of 1.0-1.5 pairs (range 0-6) nested, while the average number of nests per plot during 4 years was 4.8 ± 3.8 (range 0-17). Green's index ($GI = 0.27$) indicated a nearly random distribution of the territories. Mean distance between nests was 255 (± 124) m and did not show a significant change between years (ANOVA: $F_{(3, 106)} = 0.336$, $p > 0.79$), although the number of breeding pairs varied among years.

Habitat selection

We used multiple regression to analyse the number of breeding Red-backed Shrike territories per plot occupied during 4 years. The results show that the number of breeding shrikes is significantly positively correlated with the percentage of meadows ($p < 0.001$) and waste lands ($p = 0.017$), but it is slightly negatively correlated ($p = 0.08$) with the percentage of buildings in the plot (Table 1). These three factors explain 41% of the occurrence of shrike pairs on the grid. Analysis of data from each separate year led to the conclusion that the most essential habitat factor independent of density was percentage of grassland (Table 1). However, in 1997 we found no significant habitat variable influencing the Red-backed Shrike density.

DISCUSSION

Breeding densities of the Red-backed Shrike in 1995-1998 (*ca* 5 p/km^2) are among the highest in Europe (obtained on similar plot size, contained also other than preferred habitats – Glutz von Blotzheim and Bauer 1993). Results of this study indicate that shrike territories were distributed nearly randomly, but preferred nesting landscapes were hedgerows and forest edges. However, statistical tests did not indicate influence of area of trees on number of pairs in a grid square (in all years $p > 0.42$). It seems, that the availability of suitable nest places, at least on a landscape scale, is not a limiting factor of presence of the Red-backed Shrike in the study area.

The Red-backed Shrike shows a clear preference, independent of density, for habitats with young tree plantations, grasslands and wasteland. The nests are built in close proximity to them. These habitats are the basic hunting areas, which is con-

nected not only to higher abundance of insects (*cf.* Ryszkowski and Karg 1977), the main food source, but also to ease of obtaining them in young tree plantations (Jakober and Stauber 1987, Solari and Schudel 1988, Olsson 1995). The density of trees in a plantation seems to be also of high importance to foraging success as it can influence prey visibility. Insects, especially epigeic taxa, form a substantial part of the diet in the nestling period (*e.g.* Mielewczyk 1967, Olsson 1995). Thus, the visibility of ground-dwelling animals in any particular microhabitat may play a crucial role in choices of foraging habitat and foraging strategy (Solari and Schudel 1988, Olsson 1995).

Table 1
Multiple regression of mean number of territories per grid square on habitat characteristics. Given are coefficients (*b*), their standard errors (*SE*) and two-tailed probabilities that *b* differs from zero (*p*). Results for all materials (data combined from four years) and for each year were given separately. Only variables with probability $p < 0.05$ were included.

Variable	*b*	SE	*p*
1995			
Constant	0.832	0.173	< 0.001
arcsin (% of grassland)	1.899	0.746	< 0.02
1996			
Constant	0.735	0.232	< 0.005
arcsin (% of grassland)	3.191	0.744	< 0.001
arcsin (% of wasteland)	27.515	0.738	< 0.001
arcsin (% of human Settlements)	4.312	2.022	< 0.05
1997			
No significant variables			
1998			
Constant	0.896	0.157	< 0.001
arcsin (% of grassland)	2.497	0.678	< 0.001
All years combined			
Constant	2.699	0.716	< 0.001
arcsin (% of grassland)	9.108	2.347	< 0.001
arcsin (% of wasteland)	58.109	23.191	< 0.02

The negative influence of villages on territory distribution was slightly surprising, considering that boundaries of villages include plenty of edge habitats and suitable nesting shrubs. Areas near human settlements are avoided even during the years of the greatest number of breeding pairs. It seems possible that the Red-backed Shrike avoids human settlements and their connected predator pressure from domestic cats and corvids (Tryjanowski and Kuźniak 1999).

In conclusion, the existence of rich food supply and varied habitats (meadows, pastures, boundary strip, fallow land, unpaved roads etc.) among crop fields is of vi-

tal importance for management of the Red-backed Shrike in intensively used farmland. Generally, this is in agreement with other European data (Jakober and Stauber 1987, Van Nieuwenhuyse 1998).

ACKNOWLEDGEMENTS

We thank G. Kucharczyk and Z. Kosiński for their review of the first version of manuscript. The research was partially supported by the Faculty of Biology's (Adam Mickiewicz University) small grant to P. T.

REFERENCES

Bauer H. G., Berthold P. 1996. *Die Brutvögel Mitteleuropas. Bestand und Gefährdung*. Aula-Verlag. Wiesbaden.

Brandl R., Lübcke W., Mann. W. 1986. *Habitatwahl beim Neuntöter (Lanius collurio)*. J. Orn. 127: 69-78.

Denisiuk Z., Kalemba A., Zając T., Ostrowska A., Gawliński S., Siwenkiewicz J., Rejman-Czajkowska M.. 1992. *Interaction between agriculture and nature conservation in Poland.* IUCN. Oxford.

Diehl B. 1995. *A long-term population study of Lanius collurio in a heterogeneous and changing habitat*. Proc. West. Found. Vertebr. Zool. 6: 157-162.

Ellenberg H. 1986. *Warum gehen Neuntötern (Lanius collurio) in Mitteleuropa im Bestand zurück?* Corax 12: 34-46.

Glutz von Blotzheim U. N., Bauer K. M. 1993. *Handbuch der Vögel Mitteleuropas: Passeriformes*. Vol. 13. Aula-Verlag. Wiesbaden.

Jakober H., Stauber W. 1987. *Habitatansprüche des Neuntöters (Lanius collurio) und Maßnahmen für seinen Schutz*. Beih. Veröff. Naturschutz Landschaftsplepe Bad.-Wurtt. 48: 25-53.

Jongman R. H. G., Terbraak C. F. J., Van Tongierien O. F. R. 1995. *Data analysis in community and landscape ecology*. Cambridge University Press. Cambridge.

Kuźniak S. 1991. *Breeding ecology of the Red-backed Shrike Lanius collurio in the Wielkopolska region (Western Poland)*. Acta orn. 26: 67-84.

Lefranc N. 1997. *Shrikes and the farmed landscape in France*. In: Pain D. J., Pienkowski M. W. (Eds). *Farming and birds in Europe*. Academic Press. London: pp. 236-268.

Mielewczyk S. 1967. *On the food of the Red-backed Shrike, Lanius collurio L., near Gniezno (prov. of Poznan)*. Acta orn. 10: 157-175.

Norusis M. J. 1994. *SPSS 6.1 Base System User's Guide*. SPSS Inc. Chicago.

Olsson V. 1995. *The Red-backed Shrike Lanius collurio in southeastern Sweden: Habitat and territory*. Ornis Svecica 5: 31-14.

Sokal R. R., Rohlf F. J. 1995. *Biometry*. Freeman. New York.

Solari C. H., Schudel H. 1988. *Nahrungswerb des Neuntöters (Lanius collurio) während der Fortpflanzungszeit*. Orn. Beob. 85: 81-90.

Ryszkowski L., Karg J. 1977. *Variability in biomass of epigeic insects in the agricultural landscape*. Ekol. pol. 25: 501-517.

Tryjanowski P., Kuźniak S. 1999. *Effect of research activity on the success of Red-backed Shrike Lanius collurio nests*. Ornis fenn. 76: 41-43.

Tucker G. M., Heath M. H., Tomiałojć L., Grimmet R. F. A. 1994. *Birds in Europe. Their conservation status.* Cambridge University Press. Cambridge.

Van Nieuwenhuyse D. 1998. *Conservation opportunities for the Red-backed Shrike (Lanius collurio)*. IBCE Tech. Publ. 7: 79-82.