

Which method is most suitable for censusing breeding populations of red-backed (*Lanius collurio*) and great grey (*L. excubitor*) shrikes?

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Up to now, studies have shown that it is very difficult to estimate accurate numbers of shrike (*Lanius spp*) breeding pairs. During our shrike biology research in Western Poland this problem was evident. Actual breeding pair numbers were derived from a combination of special counts in the pre-breeding period, intensive nest searches and colour ringing. Empirical tests have shown point counts and line transect methods, with regard to Red-backed (*Lanius collurio*) and Great Grey (*L. excubitor*) Shrike population size estimates, to underestimate numbers severely. Furthermore, we have found that the 'improved mapping technique' underestimates the actual numbers of Red-Backed Shrike breeding territories by as much as 45-80%. It underestimates the actual numbers for the Great Grey Shrike by just under 40%. In the case of the Red-Backed Shrike, the accuracy of results from the 'improved mapping technique' was negatively correlated with the population density. However, we did manage to achieve accurate numbers of shrike breeding pairs, but only by using specific methods. For the Great Grey Shrike, counts during pair formation period yielded the most precise results and for the Red-backed Shrike, intensive nest searches proved to be the most effective method.

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1. Introduction

The abundance estimates of any bird species are potentially useful for faunistic, zoogeographic or long-term monitoring studies. Information covering longer time periods is crucial for efficient bird conservation. One of the fundamental conditions for such studies is the use species density estimation methods that are valid, applicable and reliable, particularly where endangered species are concerned. Accurate assessments of population size and of the

changes it undergoes in time and space form the basis of good species management and sound conservation projects (Marzluf & Sallabanks 1998).

In recent decades, a documented widespread decline has been recorded for all European shrike species over most of their various ranges (Yosef 1994, Bauer & Berthold 1996). The Red-backed Shrike and Great Grey Shrike have the status of declining species in Europe (Tucker *et al.* 1994). Here, we present results of our comparison of the main census methods for these two shrike species. The data arising

from this study originated from research into several aspects of the species' biology and ecology in the Wielkoposka and Śląsk regions (Kuźniak 1991, 2000a; Kuźniak *et al.* 1995, Tryjanowski *et al.* 1999, Kuźniak & Tryjanowski 2000, Lorek 1995a, 1995b; Lorek *et al.* 2000).

The main aim of our research was to ascertain whether the methods used for shrike censusing are suitable for monitoring studies, and in particular, whether the results they provide are reliable.

2. Study area, material and methods

The study was carried out in the Wielkopolska region, over the area within a radius of 100 km of Poznań (52°28'N; 16°48'E). The study plots were located in a typical agricultural landscape comprising arable fields, meadows and small woodlots. The study areas (sizes in km²) were located near the towns of Odolanów (160 km²) and Koło (176 km²) (Great Grey Shrike censuses), and near the towns of Leszno (10 km²) and Koło (12 km²) (Red-backed Shrike censuses) (see Tryjanowski *et al.* 1999 and Kuźniak & Tryjanowski 2000 for more details about shrike habitats and habitat selection). The Great Grey Shrikes were censused from March through June 2000, but earlier (1990-1999) we had studied in detail Great Grey Shrike breeding ecology not only on the same plots but also in other parts of the Wielkopolska region (Tryjanowski *et al.* 1999). The territories were classified as occupied on the basis of observed territorial behaviour and nests found. The observed bird locations were recorded on maps and notes were taken on territorial behaviour, hunting strategy, habi-

tat selection and (especially) the presence of nests. During the breeding season, a total of 24 census days was spent in the field in the 100 km area.

The Red-Backed Shrikes were censused from May through July 1999 and 2000 on the Leszno study plot and in 2000 on the Koło study plot. Particular attention was paid to the location of all nests. The history of each nest was recorded. Furthermore, the adult birds were trapped and colour ringed to aid subsequent intensive observation. During the breeding season, a total of 30 research days was spent the field in the 10 km² area.

We simulated a situation typical of a census using the 'improved mapping technique' so that we could compare several census methods (Tomiałojć 1980). Two controls were chosen for the Great Grey Shrike (in April-May) and four (May-June) for Red-backed Shrike. The efficiency of the 'improved mapping technique' was estimated on the basis of a comparison with the data obtained by more sophisticated methods that are assumed to give 100% breeding pairs nesting on the research plot. Point counts and transects were made twice, the first in the second half of April and second in the second half of May in 2000 in the Odolanów and Koło Great Grey Shrike study plots and the Koło Red-backed Shrike study plot. The data were analysed using the SPSS statistical package (Norusis 1986).

3. Results

3.1. Actual density of breeding pairs

In 2000, 30 breeding pairs (bp) of the Great Grey Shrike were found in the

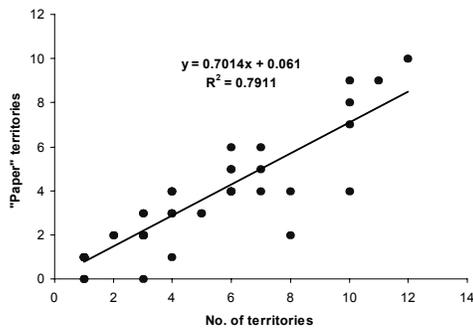


Fig. 1. The relationship between the true number of territories and the number of 'paper' territories, established on the basis of the results from mapping ($p < 0.0001$).

Odolanów study plot and 29 in the Koło study plot, giving an average density of 17.63 bp/100 km². From 1998-2000, we found 47, 52 and 58 bp of Red-backed Shrike respectively, in the Leszno study plot and in 2000, 64 bp in the Koło study plot, giving an average density of 4.5 bp/km².

3.2. Efficiency of count point and transect methods

11 bp out of 59 bp (19%) of Great Grey Shrike in both study plots were detected by point count, the detectability not differing between the study plots (χ^2 with Yates correction=0.01, $p=0.92$). The transect method yielded 10 bp of Great Grey Shrike (17%), the detectability between plots showing no differences (χ^2 with Yates correction=0.04, $p=0.85$).

3.3. Efficiency of the mapping method

In 2000, 24 bp out of 59 bp (41%) of Great Grey Shrike were found by the 'improved mapping technique' in both study plots. We found no significant differences in the detection rate between plots (χ^2 with Yates

correction=0.03, $p=0.86$). From 1998-2000, the number of territories of the Red-backed Shrike detected by the 'improved mapping technique' was significantly correlated to the actual number of nesting pairs within 1 km² squares ($p < 0.0001$). However, only $74 \pm 27\%$ of nesting pairs are detected by mapping method (range 0-100).

3.4. The data from regional studies vs. actual density

Density of Great Grey Shrike bp in the large study plot in the Wielkopolska region was estimated as 1.6-4.3 bp/100 km² in the regional bird monograph (Kuźniak 2000b). Kuźniak located 7 bp near Odolanów, but only two near Koło, a value at least seven times lower than that arising from our more comprehensive methodology. The numbers of Red-backed Shrike were estimated only in width range level (Kuźniak 2000a) as a common breeding species whose breeding density varied from 0.1-6.4 bp/km²; our results generally support this value, but suggest that the real value is closer to higher numbers obtained in previous estimates.

4. Discussion

The central-western part of Poland, the Wielkopolska region, boasts one of the longest-running farming traditions in Poland. Most of the region recently has been affected by the introduction of chemical and mechanical cultivation (Denisiuk *et al.* 1992), and its development stage now quite representative of that in Western Europe. The processes now taking place in agro-ecosystems in this region are probably indicative of future changes

in Polish agriculture generally. However, despite intensive agriculture occurring over a relatively long period, one of highest breeding densities of Great Grey Shrike has been noted in this region (Kuźniak *et al.* 1995, Lorek 1995a, Tryjanowski *et al.* 1999). Similarly, breeding densities of Red-backed Shrike observed in 1999 to 2000 ($c5$ bp/km²) rank among the highest in Europe (obtained on plots similar in size; likewise, they contained other than preferred habitats; Glutz von Blotzheim & Bauer 1993, Dombrowski *et al.* 2000). There is the caveat that censuses performed in conditions of high densities can produce results subject to greater error than when other conditions apply (DeSante 1981, Tomiałojć & Lontkowski 1989), but on the other hand, results of censuses on high-density areas can be more reliable in reflecting the species' population abundance.

First of all, it is important to differentiate between the main methods of shrike censuses (point counting, transect and the 'improved mapping technique') and to suggest why their use has produced underestimates. As we have shown, the first two methods are markedly less effective than ours; our results corresponded to those reported by other authors (*e.g.* Tomiałojć 1987, Tomiałojć & Verner 1990, Surmacki & Tryjanowski 1997). Even the third method we have shown to be unsatisfactory, especially in the case of Great Grey Shrike.

4.1. Why should shrike censuses have been so ineffective?

We suggest that above all, these anomalous results arise from specifics of shrike

biology and from the periods selected for observations; historically, the general schedule of shrike censusing has in the past been adjusted to that pertaining to the rest of the bird community. Normally, study censuses start in April, but the peak of Great Grey Shrike breeding activity occurs half in March. During this early part of breeding activity, both members of the pair build the nest and the main body of pair and social interactions takes place (mate guarding, territory defence, copulation, courtship feeding) (Lorek 1995b). Also, the most intense song activity is practically confined to this brief time period, which makes discovery of the birds much easier. From early April, often until about the 20th, the birds exhibit shy and skulking behaviour, because this prevents attention being drawn to females incubating, or being fed by males, or to changeovers at the nest. By then, nest and bird location becomes increasingly confounded by the rapid foliation of trees and bushes

In the period between arrival from return migration and nest building, the Red-backed Shrike remains very silent, except when the males sing to establish territory, or fight other males to defend it; direct observation of these activities is the best method of detecting this species (Durango 1956). A little later in the breeding season, it is even more difficult to confirm the presence of birds, and then it is mainly through more desultory singing. Activity then increases in the period of intense nestling feeding (late June), when usually standard observations of breeding bird communities have ended.

4.2. How do we improve shrike censuses?

1. The choice of a study plot.

The ideal study area should cover *c*50-100 km² for the Great Grey Shrike and *c*5-10 km² for the Red-backed Shrike in conditions and circumstances similar to those in western Poland. In both cases, it would be possible for one person to perform the censuses. Before beginning a census, it is important to assess potential shrike habitats (trees, bushes) using maps, photos and field reconnaissance, and to record them particularly thoroughly. It is recommended that possible shrike habitats be identified beforehand in late autumn, when searches for nests from the previous breeding season should be undertaken (Seitz 1992). The nests of each species have a characteristic construction and often contain food remains, mainly large insects and grasshoppers.

2. The timing of study.

The optimum date for census is from 15 March to 30 April when 2-3 controls of the entire plot should be made, followed by 1-2 controls between 15 May and 15 June. It is necessary to complement visual records by searching for nests. The Red-backed Shrike may nest at in high densities in some habitats, such that the distance between nests of different pairs may be as little as 40 m (mean 225 m, Kuźniak & Tryjanowski 2000, also their unpublished data).

3. More attention to be paid to specifics of shrike biology.

Visual observations should be comple-

mented by searches for pellets, food remnants, prey, bird plucks and, above all, impaled caches. Birds frequently use isolated or free-standing *Prunus*, *Rosa* or *Crataegus* bushes and barbed-wire fences. These places may be favoured for more than one season and so the quantities of droppings, pellets and another remains can be significant. Of course, records of pellets or prey remnants alone cannot be the basis of territorial pair confirmation, but it is a sign that a more intensive search for the birds themselves and their nests might be profitable. Our study is the first-large scale comparison of the commonly used method for shrike censusing. Despite large area censuses was carried out by us, our results cannot be regarded as exhaustive in detecting all methodological problems with shrike census work. More comparative studies of methods, especially in areas with low numbers of Great Grey and Red-backed Shrikes, are urgently needed.

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