Disperse or Stay? Exceptionally High Breeding-Site Infidelity in the Red-Backed Shrike Lanius collurio

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Disperse or stay? Exceptionally high breeding-site infidelity in the Red-backed Shrike *Lanius collurio*

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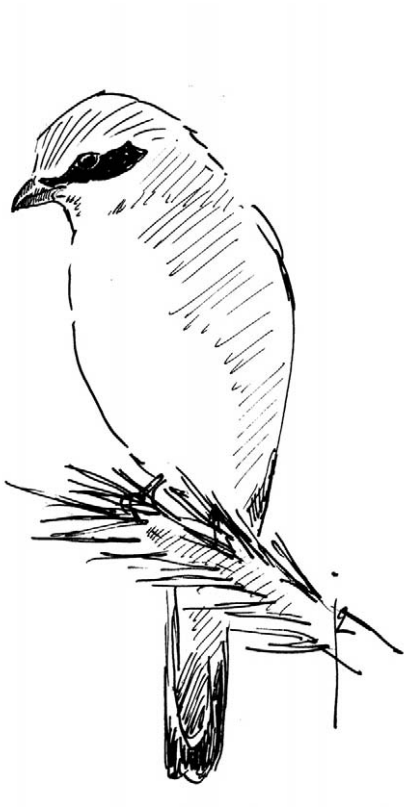

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Nesting in the same breeding area in successive years provides information to help understand the cues used by birds in habitat selection. Moreover, such information may also be an important tool for the conservation and management of endangered species. Based on the ringing results of 122 adult and 1245 nestling Red-backed Shrike *Lanius collurio* in the years 1996–2005, we studied philopatry of the species in two different populations: in western and in eastern Poland. Moreover we analysed all Polish Red-backed Shrike ring recoveries since 1996 (n = 3102 ringed birds). We noted that both natal and breeding philopatry in the populations were almost entirely absent. This is surprising in comparison with other studies, especially those including shrikes. Comparisons with other populations suggest that the lack of philopatry is not related to the breeding success of local birds and/or the size of the study area. In contrast, we suggest that low philopatry is an effect of and/or an adaptation to a relatively high population density at the landscape scale, where many breeding areas and potential nesting sites still remain vacant.

Key words: breeding success, philopatry, Red-backed Shrike, *Lanius collurio*, territory fidelity

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Introduction

Site-fidelity behaviour is a fundamental feature of the organism and the major determinant of many basic patterns and processes (Walter 2000, Newton 2003). Information on site fidelity patterns may help in understanding population persistence (Postma & van Noordwijk 2005), and hence it has consequences in conservation and management of endangered species (Newton 2003, Dale 2001, Kristin *et al.* 2007). For instance, if a species is characterised by high site fidelity, protection of a few locations may be effective in the maintenance of a local population (Vallianatos *et al.* 2002, Dale 2001, Kristin *et al.* 2007).

True shrikes are endangered species, and even the locally most numerous species – Red-backed Shrike *Lanius collurio* – has declined strongly, both in numbers and in the range of its distribution. The Red-backed Shrike is a small passerine species that breeds in shrubs in semi-open habitats in the

middle latitudes of the western Palaearctic and winters in southern Africa (Harris & Franklin 2000). In previous studies the Red-backed Shrike was noted as a species with relatively high breeding fidelity (Jakober & Stauber 1987, 1989, Geertsma *et al.* 2000, Simek 2001), even in comparison with other passerines (Newton 2003). However, this was not true for the populations studied in Poland, the results of which we present in this paper. We try to explain this phenomenon in the light of earlier knowledge of bird dispersal, and we propose an interpretation of the low natal and breeding fidelity in relation to habitat quality.

Material and methods

Fieldwork was conducted in the breeding seasons 1996–2005 near Leszno in western Poland (Fig. 1), which has typical breeding densities of the Red-backed Shrike in Poland: c. 4.7 breeding pairs/km^2 (Kuźniak & Tryjanowski 2000, and unpublished data). In total the study area covered c. 20 km^2. Between 1998 and 2003 another study plot (9 km^2) was established in farmland at Mazowsze in the Mazovian Lowland (central eastern Poland). With a density up to 19 breeding pairs/km^2 the Red-backed Shrike was among the most numerous species at this location (more details in Goławski 2006). Detected nests were checked regularly but due to the adverse human impact of disturbance on nest success (Tryjanowski & Kuźniak 1999) only 1–5 visits (depending on nest searching time) were done, every 4–5 days. At the appropriate age nestlings were ringed. A total of 122 adults and 1245 nestlings (122 adults and 861 nestlings in Leszno, 384 nestlings in Mazowsze) were ringed between 1996 and 2005. The number of investigated breeding pairs per season varied between 42 and 96. Adult birds were trapped and re-trapped by means of mist-nests and bowl-traps with a cricket inserted as a lure. Adults and nestlings were provided with numbered aluminium rings (Ringing Centre, Department of Ornithology PAS, Poland, ring series J) and some were also ringed by a combination of colour rings (33 males and 31 females in 1997–1999). This enabled easy identification of individuals by visual observation. If we observed an individual with only an aluminium ring, we tried to catch it, and were successful in all cases. To help solve the problem when ringed shrikes dispersed long distances or died and were therefore not recovered, we included ring recovery data from the Polish Red-backed Shrike ring data bank (Ringing Centre, Poland). We distinguished recovery information from breeding sites and migratory routes. The places differed both geographically (migration was studied mainly at the Baltic coast), and by habitat (migration sites were mainly along the coast and in marshes). Moreover, we asked eight very active bird observers (see acknowledgements section), undertaking bird-watching in locations with high Red-backed Shrike densities, for information on summer sightings of ringed birds (dead or alive).

Figure 1. Location of the two main study plots in Poland.

Results

At Leszno, we only recovered 4 of 861 (0.46%) nestlings between 1996 and 2005, 2 of 56 adult males (3.6%) and 2 of 66 adult females (3.0%). At

Mazowsze we did not recover any of the ringed nestlings. One nestling ringed at Leszno was noted in the same year on autumn migration in Egypt, and another nestling ringed at Mazowsze was caught in the spring two years later in Yemen (only 0.08% of all the ringed shrikes in the main study plots).

Totally, 130 adult breeders and 932 nestlings were ringed outside our study plots in Poland during a ten years period (1996–2006). None of the adults were recovered whereas 11 (1.2%) ringed young were recovered as long-term records (over 10-day period). However, no bird ringed as nestling was recovered as breeding adult in a later year. Additionally, in the years 1996–2006 a total of 2040 Red-backed Shrikes were ringed at migration sites in Poland, consisting of 1407 first calendar year birds and 633 adults. Totally, 44 were recovered, although only 20 (0.1%) more than ten days after the date of ringing (from 289 to 733 days since first ringing; mean 376.2 days, SD 88.9). Interestingly, all these birds were recorded at the place of first capture, a pattern that differed significantly from random recovery (binomial sign test, $P < 0.0001$).

None of the active bird observers in Poland observed Red-backed Shrikes with rings, either during the breeding season or during migration.

Discussion

These findings are surprising, because it was previously noted that the Red-backed Shrike had a relatively high breeding site fidelity (sometimes over 25%, Jakober & Stauber 1987, 1989, Simek 2001). To date, even the results from the strongly declining English population with a fidelity rate of 5.8% (Ash 1970) were considered exceptional (Simek 2001). Moreover, data from the wintering grounds suggested quite high fidelity to wintering places (up to 35% for adults and 4% for yearlings (Herremans & Herremans-Tonnoeyr 1995). Why did we get such different results?

Firstly, attention in avian philopatry studies, including research on shrikes, is usually focused on breeding success (Jakober & Stauber 1989, Geertsma *et al.* 2000, Takagi 2003, Kristin *et al.* 2007). Our studied populations did not differ in breeding success from others (c. 50% of pairs with success, and exceptionally high success at Mazowsze (87%); Goławski 2006, 2006a). However, due to the small sample size we did not test the hypothesis on the breeding success – fidelity pattern directly. This means that at least at the population level we can be confident that it is not a question of the low-quality hypothesis, which states that birds with low reproductive success are 'low-quality' individuals that are less likely to survive and return to their previous breeding site (Schmidt 2001, Tryjanowski *et al.* 2004).

Secondly, results can be influenced by methodology. However, the number of ringed birds, and the intensity and the duration of the study did not differ substantially from others, and for some seasons were even greater (cf. remarks in Simek 2001, review in Newton 2003). Our results were also not affected by the size of the census area, which is crucial in estimating dispersal distances since estimates based on data from small areas may be seriously biased (Hanski & Gilpin 1997, Clobert *et al.* 2001). Compared to other studies our study plots were similar in size since they ranged from 0.2 up to 20 km^2.

Therefore, we believe that the difference in philopatry between previous studies and our own may be connected to habitat characteristics across the studied populations. To date, breeding fidelity was studied in local populations, relatively well separated from others, both geographically (Ash 1970, Geertsma *et al.* 2000) and/or by other habitat (Fulín & Žolner 1985, Jakober & Stauber 1987, 1989, Massa *et al.* 1993, Diehl 1995, Simek 2001). This means that previously studied shrikes lived in a habitat island. Therefore, the values of fidelity obtained were generally higher and, like results from true islands, suggested higher fidelity than the data from the mainland (Newton 2003). This appears to result from both biological and statistical causes. In habitat islands, Red-backed Shrikes are attracted by conspecifics (e.g. Van Nieuwenhuyse 2000), and are easier to detect. The same effect perhaps operates in the context of habitat islands and a larger matrix. If the local populations

are part of a metapopulation, shrikes have abundant possibilities to settle somewhere across the landscape. Even if shrikes disperse over only dozens of kilometres, this would be undetected by researchers.

Furthermore, the data collected by Diehl (1995) partially support our hypothesis that the dispersal pattern can differ between local (island) and continuous (living in a larger matrix) populations. In a small meadow patch inside a large forest, she noted a higher recovery rate during a phase of population decline than during its stability, and this fits with theoretical predictions that dispersal can be density-dependent (Travis *et al.* 1999). Theoretically, the high breeding site infidelity at the breeding grounds could be due to an extremely high mortality. However, we have two reasons to believe this is an unlikely explanation. Firstly, some of recovered birds were in their third calendar year, which means that they had survived two breeding seasons. Secondly, the population of the Red-backed Shrike in Poland, including the studied sub-populations, is generally stable or even increasing (Goławski 2006, 2006a, Takacs *et al.* 2004), which would be difficult to imagine if mortality among nestlings and adults would be extremely high.

Interestingly, ringing data suggested fidelity to migration sites and individuals using the same place during life. This is in contrast to previous results on migratory routes, which suggested shrikes stayed only a few days, and were never recorded in subsequent years (Csörgő & Parádi 2000, Tryjanowski & Yosef 2002). Is it possible that, for high-density Red-backed Shrike populations, fidelity to migratory hot-spots is more crucial than that to breeding sites? This question raises further speculation; however, the available data are too sparse to solve this problem.

The above-mentioned facts and interpretation have a crucial importance from a conservationist's perspective. Protection at the very local scale may only be effective in cases where the Red-backed Shrike lives in patchy habitats in small isolated populations (e.g. Geertsma *et al.* 2000, Van Nieuwenhuyse 2000), and in a situation with higher population density (such as that of the-red backed shrike in Poland) conservation action should focus more on the landscape scale.

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SAMENVATTING

Veel vogels keren terug naar de plek waar ze zijn opgegroeid of waar ze het jaar daarvoor hebben gebroed. Kennis over waarom ze dat doen, en in welke mate, kan belangrijk zijn om een soort adequaat te beschermen. In deze Poolse studie werd de plaatstrouw van de Grauwe Klauwier *Lanius collurio* geanalyseerd aan de hand van ringwaarnemingen vanaf 1996. Basis voor het onderzoek waren de gegevens van 122 oude vogels en 1245 nestjongen die sinds dat jaar in twee studiegebieden waren geringd. Daarnaast werden alle overige 3102 ringgegevens uit het gehele land sinds 1996 geanalyseerd. Vrijwel geen van de vogels werd later teruggezien op de plek van ringen. Dat is in tegenstelling met verscheidene andere studies aan klauwieren, waaruit een hoge mate van plaatstrouw bleek. Zowel broedsucces als grootte van de studiegebieden in Polen waren vergelijkbaar met die in de andere studies, zodat het verschil niet aan deze factoren te wijten kan zijn. In plaats daarvan wordt verondersteld dat de geringe plaatstrouw het gevolg is van de grote schaal waarop geschikt habitat aanwezig is in Polen. Individuen zijn daarom niet gebonden aan een bepaalde plek, maar kunnen elk jaar kiezen uit een groot aanbod potentiële nestplaatsen. (JP)

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