



# LESSER GREY SHRIKE *LANIUS MINOR* AT THE NORTH-WESTERN EDGE OF ITS RANGE: COMMENTS TO POPULATION DECLINE AND MIGRATION STRATEGIES

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## Abstract.

Many long-distance migratory birds are endangered on different geographical scales, continental, regional, and local. The Lesser Grey Shrike belongs to such species and shows a strongly negative population and area trend, especially in the west of the range. During three decades, we monitored the breeding pairs density of the species in the northwest of the area (20 km<sup>2</sup>, Slovakia) and the effects of the modernization of traditional farming area on its population trend. Furthermore, we used geolocators to study its migration behavior, migration routes, stopovers, and wintering grounds, with the aim of knowing the areas where the species may be endangered during migration. We found that the modernization of the rural landscape and the abandonment of the farming lifestyle are strongly correlated with the species' population decline. Also, by observational data of birdwatchers, we partly confirmed that the species moves to South Africa by anti-clockwise loop flight. We found that the site-to-site distance is 8200 km in autumn and 9500 km in spring, with much faster spring migration than autumn (45 vs. 114 days). We localized four stopovers (total mean 97 d) during the autumn migration and three during the spring (total mean 13 d). The wintering grounds were in Botswana, and the birds spent 136-144 days there. Therefore, attention should be paid to protecting the species' environment at breeding sites, known stopovers, and wintering grounds.

**Keywords:** shrikes, population trends, long-distance migration, ecology

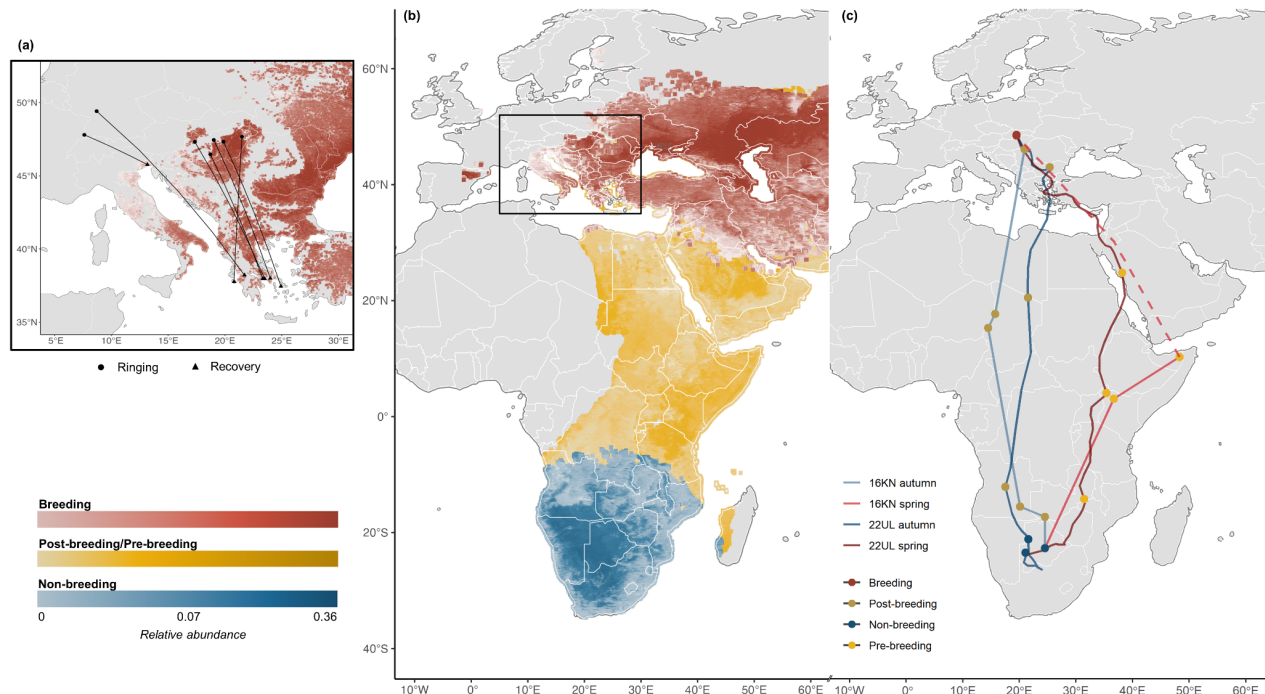
## INTRODUCTION

Birds of agricultural systems are one of the most threatened groups of birds in the world mainly due to their sharp population decline in recent decades (Giralt et al. 2008, Stanton et al. 2018). Many shrikes as strictly insectivorous birds are declining, and some frequently inhabit the farmland habitats. The Lesser Grey Shrike is a typical Palearctic songbird, declining strongly in the north-western range since the middle of 20 century (Lefranc and Worfolk 1997, Lefranc 2023). We studied several aspects of its ecology and behavior at the north-western range edge in the traditional farming area of Slovakia (e.g., Krištín 1995, Krištín et al., 2000, 2007, Hoi et al., 2012). Recently, we summarized the long-term information on the modernization of the rural environment as one of the factors of local population decline in the species (Krištín et al., 2024). As the species is a long-distance migrant to South Africa and is also endangered along the European-African pathway and in winter quarters, we brought new light on species migration strategies using two types of loggers (Adamík et al., 2023, 2024).

## POPULATION DECLINE

In the last century, modernization and intensification of agriculture have been primarily responsible for the dramatic decline in farmland biodiversity. Also, rural settlements have been subject to radical changes due to modernization, but their impact on bird populations could have been better quantified. The Lesser Grey Shrike is a threatened flagship farmland bird already extinct in many western and central European countries. We monitored a population of this long-distance migrant in a traditional

farming area in the Poľana Mountains (Slovakia, 20 km<sup>2</sup>) in three breeding seasons (1996, 2016, 2021). In the study area, 106 territories/nests of the species were recorded, of which 78% were occupied in one, 18% in two, and only 3% in all three study years. The number of breeding territories decreased from 73 in 1996 to 38 in 2016 and 22 in 2021. As the population has declined, the breeding area has also shrunk significantly. For this study, we, therefore, categorized homesteads according to their occupancy type, management, and renovation, which also reflects differences in surrounding habitats, e.g., vegetation structure and complexity, presence of trees and shrubs (Hiron et al., 2013; Rosin et al., 2016). We investigated whether and how the modernization of settlements over almost three decades affects one of the most important breeding populations of the Lesser Grey Shrike in Central Europe (Krištín et al., 2000; Hoi et al., 2012; Lefranc and 2023). We analysed the impact of the increase in modern habitations and the decrease in traditional farmsteads on the population decline. While there were no modern houses in the breeding territories in 1996, their number has increased to the number of farmhouses by 2021. Building a single modern house in a territory reduced the probability of nesting to about 6%. This effect was also evident when one or two farms were still present (17% and 40% respectively). A further modern house in the territory reduced the nesting probability to almost zero, even if a farm was present (Krištín et al. 2024). In this long-term empirical study, we identified these changes as a local threat factor for the species studied. The presented results may help design and implement conservation measures in traditional farming landscapes, not just in Europe.



**Fig. 1.** Lesser Grey Shrike estimated migration tracks and stationary sites/stopovers used by two individuals: 16KN (autumn = light blue, spring = light red) and 22UL (autumn = dark blue, spring = dark red) in this study. The track of 16KN was estimated using *Geo-PressureR*, and shows the shortest most likely path of the bird. The great circle distance between the two sites is the dashed portion of the track connecting the last pre-breeding stopover site to the breeding site. The track of 22UL was estimated using *SGAT* and shows the median most likely path of the bird. The circles indicate the stationary sites used during each season (red = breeding, dark yellow = post-breeding, blue = non-breeding, light yellow = pre-breeding). Stationary sites were defined as stops  $\geq 48$ h (Adamík et al. 2024).

### MIGRATION STRATEGIES

We also need to gain more knowledge of the species migration ecology. All that was known about its non-breeding movements is inferred from observational data of birds on the passage (Dowsett 1971, Lefranc & Worfolk 1997, Lefranc 2023). We deployed two types of loggers, light-level geolocators and multi-sensor loggers, on 20 birds from a declining Slovak breeding population; we present the first direct evidence for non-breeding grounds, loop migration, stopover sites and the timing of annual cycle events (Adamík et al. 2024). In 2017, we equipped ten birds (eight males and two females) with GDL3-PAM multi-sensor loggers (Swiss Ornithological Institute, Sempach). In 2019, we equipped another ten birds (six males and four females) with uTags (Swiss Ornithological Institute, Sempach). In the following years, we detected four birds (males only) with loggers. We retrieved three loggers and one bird we failed to catch. Return rates of logger-tracked birds were 28.6% (4/14) for males and 0% (0/6) for females. With barometric data, we recorded details on flight altitudes during migration. The two tracked males with complete migration cycles migrated to Southern Africa in an anti-clockwise loop (Fig. 1).

Autumn migration tracks went through the Balkan Peninsula and the Mediterranean Sea towards Libya, with unusually long stays around N Chad and Niger. The next stopovers were in Angola, and the main non-breeding/wintering sites were in Botswana. Spring migration

commenced on March 29 and April 7, and the birds took routes along East African countries, with stopovers later in Somalia and Saudi Arabia, before crossing the eastern Mediterranean Sea. Nocturnal migration dominated, but for three days in August, while crossing the Sahara Desert, the bird extended flights into the day with a sudden increase in flight altitudes at dawn. Flight altitudes were higher during barrier crossing and the last phase of spring migration compared to the remaining periods, with the most extreme event recorded at 4530 m asl.

### CONCLUSIONS

1. Traditional human dwellings in rural areas provide essential breeding habitats for declining farmland birds. Detailed knowledge of the impact of their modernization on biodiversity is crucial for the effective conservation of species. In line with the Lesser Grey Shrike's breeding habitat requirements, this is mainly associated with the absence of animal husbandry and horticulture, the loss of tall fruit trees, and, on the other hand, the creation of 'sterile' lawns and the planting of low ornamental trees that are not suitable for nesting. Our study has shown that farmsteads offer an opportunity to promote hands-on nature conservation awareness to farmers, who are important stakeholders in agroecosystems.

2. The migration routes were precise and quantified. Key stopover sites were found in Romania, Bulgaria, N Chad, and N Niger & Angola in autumn, and Mozam-

bique, Kenya, Somalia & Saudi Arabia in spring. Critical wintering grounds are in Botswana. The birds migrate mainly in the night and flight altitude shows significant annual changes. Spring migration is much faster than autumnal. The species needs massive conservation actions at breeding sites, known stopovers, and wintering grounds.

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