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Brief report

Red-backed Shrike (*Lanius collurio*) nest performance in a declining British population: a comparison with a stable population in Poland

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We compare the breeding ecology of Red-backed Shrike *Lanius collurio* prior to its effective extinction (in 1990) as a breeding bird in the UK with that of a stable population in southwestern Poland. We use breeding performance data derived from the UK and Polish Nest Record Schemes. Although the clutch size in the UK was slightly smaller than in Poland (4.52 ± 0.09 and 4.79 ± 0.11, respectively), brood sizes of UK nests were significantly larger (3.21 ± 0.14 v.s. 2.21 ± 0.23) than those from Poland. These data do not suggest that poor breeding performance drove the population decline in the UK. We argue that other evidence suggests that egg collecting and delayed phenology may have contributed to the extinction, although we have been unable to assess the influence of other possible factors such as predation and post-fledging survival.

1. Introduction

The Red-backed Shrike *Lanius collurio* was formerly widespread in farmland, scrub and heathland over much of England and Wales, but had started to decline from the north of its range by the latter half of the 1800s (Peakall 1962, Holloway 1996). Following a continued decline, it ceased to be a regular breeder in the UK after 1988 (Ogilvie & RBBP 1999). As recently as the first breeding bird atlas of Britain and Ireland (1968–72) there was confirmed breeding in 87 10-km grid squares (Sharrock 1976) but its breeding range had declined by 86% by the next atlas in 1988–91, with breeding confirmed in only 2 10-km squares (Bibby 1993). By 1980 the population was almost confined to heathland in East Anglia and, in 1989, there was no confirmed breeding for the first time (Peakall 1995). The Red-backed Shrike is currently a Red List Species and is of high conservation concern in the UK (Gregory *et al*. 2002).

In Europe the Red-backed Shrike is widely distributed but is declining throughout much of its range, especially in north-west Europe (Tucker *et*

Table 1. Mean (together with SE and sample size – n) for first egg date, clutch size and brood size from the British and Polish (PL) Nest Record Scheme data and the egg collector Burne. British Nest Record Scheme data are also presented for the period from 1960.

		Britain			Poland	Burne		
		All years	Before 1960	1960–	All years	All years	Before 1960	1960–
First egg date	Mean	June 5	June 4	June 8	June 4	June 8	June 7	June 10
	SE	1.3	1.5	2.1	1.6	0.7	0.8	1.2
	n	96	75	21	108	174	103	71
Clutch size	Mean	4.52	4.52	4.51	4.79	5.09	5.16	4.99
	SE	0.09	0.10	0.17	0.11	0.06	0.07	0.11
	n	166	129	37	112	174	103	71
Brood size	Mean	3.21	3.12	3.57	2.21			
	SE	0.14	0.16	0.28	0.23			
	n	189	152	37	97			

al. 1994, Yosef 1994). In Central Europe it is still a characteristic bird of farmland. The causes of its extinction in the UK are unclear and to help understand why shrikes were lost from the British avifauna we compare the breeding performance of the Red-backed Shrike in a sustainable population in SW Poland (Dombrowski *et al*. 2000, Kuźniak & Tryjanowski 2003, Takacs *et al*. 2004) with the equivalent information from the UK population in the years leading to its extinction. Additionally we present data from egg-collector activity in south-eastern England that may have contributed to its extinction (Ash 1970, Bibby 1973).

2. Methods

Data from the national UK and Polish Nest Records Schemes were analysed using standard approaches similar to those used by others working on data from nest cards (Wesołowski & Czapulak 1986, Crick *et al*. 2003) including the Red-backed Shrike (Matyjasiak 1995, Tryjanowski 2002). Information was available from the British Trust for Ornithology's (BTO's) Nest Record Scheme for 252 nests in the period 1931–1992. Equivalent data were used from the Polish Nest Record Scheme for 116 nests in the period 1985–1999. UK data covered mainly southeast England, and all Polish data were from the southwest part of the country (see Tryjanowski 2002). In addition, we used published data from the field notes of H.J.K. Burne, an amateur oologist (Dawson 1985) who collected eggs, presumably illegally, from 174 nests in the period 1934–1980. We have assumed that he collected only completed clutches. Complete information was not available for all nests, so the sample sizes tend to be smaller than those noted above. Since the Polish data are more recent we also examined the BTO data from 1960 onwards.

First egg date was calculated for all nests for which there were sufficient visits to enable an accurate estimate to be made. First-egg dates were back calculated (Crick *et al*. 2003) assuming one egg laid each day, an incubation period of 14 days and a nestling period of 15 days (based on the intensive study of Tryjanowski *et al*. (2000) and Kuźniak & Tryjanowski (2003). For some nests it was only possible to calculate a range of possible dates for first egg dates; if this range was less than 14 days a mean of the earliest and latest dates was used to estimate first egg date. Clutch and brood size were estimated as the maximum number recorded for each nest, so long as laying or hatching, respectively, was likely to have been completed.

To investigate phenology further we examined the arrival phenology from Suffolk, UK taken from the Suffolk Bird Reports and from the Wielkopolska region in Poland (Tryjanowski *et al*. 2005). In both regions we used the date of the first observed shrike of that year, converted to day number after December 31. Comparisons between the three nesting data sources were made using Analysis of Variance (ANOVA) followed, if significant, by Tukey's test. The data before and from 1960 onwards are compared separately for the BTO and Burne data using ANOVA to examine changes between older and more recent data. Finally, the BTO data from 1960 onwards are compared with all Polish data using ANOVA to check for differences in more recent data.

3. Results

3.1. Timing of breeding

The mean first egg dates across all years are shown in Table 1. There were significant ($F_{2,375} = 5.61$, $P = 0.004$) differences between the datasets in mean first egg dates, but Tukey's test confirmed that the only significant comparison was between the Burne data and the Polish data. The mean of the 1960– Burne data was significantly later than that of the earlier years ($F_{1,172} = 5.34$, $P = 0.022$). The later BTO mean first egg date from 1960 onwards did not differ significantly from the pre-1960 BTO mean date ($F_{1,94} = 2.11$, $P = 0.150$) or from the Polish data ($F_{1,127} = 2.29$, $P=0.132$).

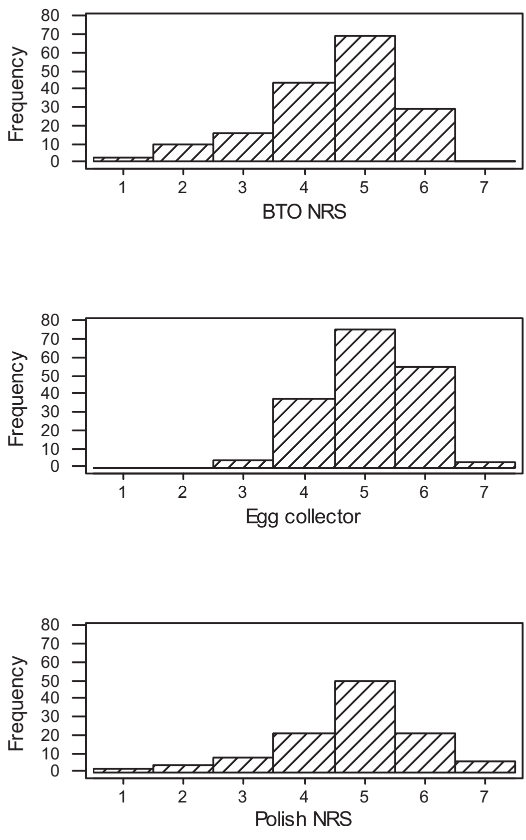

Fig. 1. Red-backed Shrike clutch size distribution in the three data sets.

3.2. Clutch size

In the studied populations clutch sizes ranged from one to seven eggs, however there were different patterns between the data sets (Fig. 1): the mean clutch size from data obtained by Burne was significantly greater (Tukey's test following ANOVA) than that from the two national nest record schemes (Table 1, $F_{2,449} = 12.98$, $P < 0.001$). There was no significant difference in clutch size between the two time periods for either the BTO data ($F_{1,164} = 0.00$, $P = 0.98$) or the Burne data ($F_{1,172} = 1.98$, $P = 0.16$). A comparison between BTO data from 1960 onwards and Polish data was also not significant ($F_{1,147} = 1.51$, $P = 0.22$, Fig. 2).

3.3. Brood size

Mean brood sizes are presented in Table 1. There was a significant difference between the BTO and Polish brood sizes ($F_{1,284} = 15.05$, $P < 0.001$) which

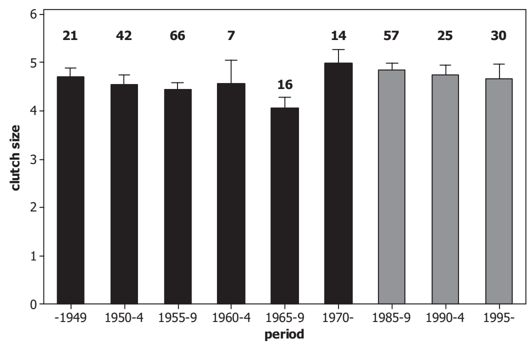

Fig. 2. Mean ± SE clutch size from nest record schemes in Britain (black bars) and Poland (grey bars) in specified periods. Sample sizes given above each bar.

was still significant ($F_{1,132}$ = 11.21, P = 0.001) when restricting the BTO data to the period from 1960 onwards. There was no significant difference between the means in the BTO data for the two time periods($F_{1,187}$ = 1.52, P = 0.22).

3.4. Arrival phenology

Patterns of first arrival are shown in Fig. 3; UK dates becoming significantly later (r = 0.65, P < 0.001) and Polish ones significantly earlier (r = –0.74, P < 0.001). In both locations there was an increase in January–March mean temperatures between 1960 and 1999 (UK r = 0.401, P = 0.021; Poland r = 0.405, P = 0.019).

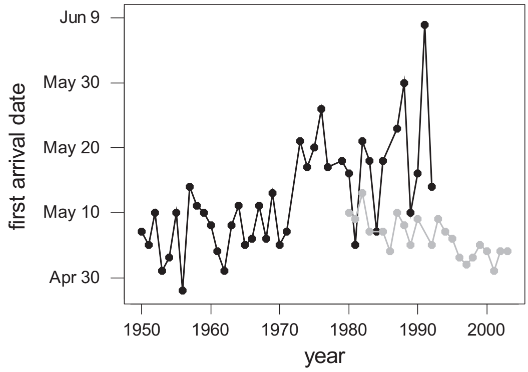

Fig. 3. First arrival dates of the Red-backed Shrike in Suffolk, UK 1950–1992 (black symbols and lines) and the Wielkopolska region, Poland 1980–2003 (grey symbols and lines). Both trends are highly significant (P<0.001); UK r = +0.65, Poland r = –0.74.

4. Discussion

Data on bird breeding biology based on nest-record cards and on museum, including oological, collections have some limitations, e.g. habitats are not covered randomly, and observers have both species and time-of-year preferences (Wesołowski & Czapulak 1996, Tryjanowski 2002, Crick *et al*. 2003). However, in this comparative study, any biases are likely to be similar between the nest record schemes, though data from the oologist differ in several important ways, as described by Tryjanowski (2002), including the selection of the best or larger clutches.

One possible source of bias may arise as a result of reduced population size in Britain. The delayed arrival and breeding phenology may be partly or wholly a symptom of reduced population size (Sparks *et al*. 2001), either for biological reasons or as an artefact of rarity (for more details, especially on Red-backed Shrike, see Tryjanowski & Sparks (2001)). Plausible biological reasons for increasing lateness as abundance declines include the reduction in the competition for resources on breeding grounds that reduce the selective advantage of arriving early compared with the cost of doing so (through, say, increased risk of encountering detrimental conditions on the breeding grounds or on passage, Kokko 1999). Timing of breeding may become later if birds find it harder to find a mate under conditions of low population density. However, delayed arrival dates may be a function of the decreased likelihood of observers coming across birds during the course of their birdwatching, purely because of their increased rarity (Sparks *et al*. 2001). This may also affect the likelihood of finding early nests before they fail. However, it should be noted that in the UK there has been a general increase in interest and activity of birdwatchers during spring migration in recent years which would suggest that the trend towards lateness is more due to biological reasons than an artefact of decreased probability of recording.

This analysis suggests that the demise of the UK population of Red-backed Shrike is unlikely to have been a consequence of its poor breeding performance, as assessed from clutch and brood size, since both clutch and brood size was comparable or even superior to that in the currently self-sustaining population in southwest Poland. If the trend of delayed nesting phenology in the UK was real, then this may have reduced the opportunity for replacement clutches following nest failure, theft or the disturbance to which this species is susceptible (Tryjanowski & Kuźniak 1999).

In addition, egg collectors may have had a particularly important direct effect on the Red-backed Shrike population as it shrank, through the taking and disruption of an increased proportion of the population's productivity as the population declined. Red-backed Shrike clutches appear to hold a special attraction to egg collectors (Ash 1970, Peakall 1995). The egg collector, Burne, appeared to consistently take the larger clutches and his notes suggest his willingness to collect replacement or even second replacement clutches. Presumably as his collection grew there was an incentive only to take the more outstanding nests with larger clutches. The fact that Burne, as an individual, collected 174 clutches even though the population was declining, suggests that the combined activities of a number of egg collectors could collectively have caused a substantial reduction in the output of this species at the later stages of its decline.

The decline of the Red-backed Shrike in the UK has also been connected to marked habitat changes, and consequently with reduced food supplies on their breeding grounds (Bibby 1993). It is also possible that delayed phenologies may indicate problems (perhaps through habitat change and reductions in food supplies) for the birds on their wintering grounds or while on passage.

One further problem could have arisen through nest disturbance by birdwatchers. The Red-backed Shrike attracts attention from birdwatchers in considerable numbers if it nests in a publicly accessible place. Studies from Poland suggest that the species is sensitive to human visits to the nest and nest vicinity (Tryjanowski & Kuźniak 1999). Both factors might have had an accentuated effect once the population became seriously reduced.

Finally, the Red-backed Shrike populations in Britain are at both the northern and western distributional limits of the species. Therefore, the possible causes of the British decline may include problems connected with stochastic processes; small population size generally linked with high variability in breeding performances (e.g. Holsinger 2000), and the low population growth rate associated with small populations (Muller *et al.* 2005). Alternatively a simple shift westwards to its core distribution may have occurred.

In conclusion, our study suggests that in areas where Red-backed Shrikes nested, they were able to accrue sufficient resources to produce and rear good-sized clutches and broods. It is possible that egg collectors may have had an influence on their nesting success and hence overall productivity once the population became small. However, it appears likely that other factors, such as the availability of suitable habitat and possibly climate, survival rates or immigration rates may have been more important ultimate factors. Future conservation plans will need to consider the problems that the species might face on its wintering grounds and migration routes, in addition to ensuring that good habitats with appropriate food sources and with low nest predation (Roos & Part 2004) are maintained in Britain. The chances of re-establishment of the species in the UK may be enhanced by climate warming (Sparks *et al.* 2002) and climate scenario modelling of European distributions would be useful to indicate whether this might be important.

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Pikkulepinkäisen (*Lanius collurio*) pesintämenestyksen vertailu taantuvan brittiläisen ja vakaan puolalaisen populaation välillä

Vertailimme pikkulepinkäisen pesimäbiologiaa Brittein saarilla ennen lajin ajautumista sukupuuttoon (vuonna 1990) suhteessa vakaaseen populaatioon Lounais-Puolassa. Käytimme aineistona Brittein saarien ja Puolan pesäkorttiaineistoa. Vaikka munaluku oli Briteissä (4.52 ± 0.09) hieman pienempi kuin Puolassa (4.79 ± 0.11), oli poikuekoko Briteissä merkitsevästi suurempi kuin Puolassa (3.21 ± 0.14 vastaan 2.21 ± 0.23). Aineisto viittaa siihen, että populaation taantuminen Briteissä ei johtunut heikosta pesintämenestyksestä. Esitämme, että muiden tietojen valossa munien keruu ja myöhästynyt fenologia voivat olla syynä lajin sukupuuttoon, vaikkakin emme pysty arvioimaan muiden tekijöiden, kuten saalistuksen ja nuorten lintujen myöhemmän selviytymisen, vaikutusta.

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