Acta Zoologica Academiae Scientiarum Hungaricae 48 (2), pp. 101–106, 2002

A LONG-TERM COMPARISON OF LAYING DATE AND CLUTCH SIZE IN THE RED-BACKED SHRIKE (LANIUS COLLURIO) IN SILESIA, SOUTHERN POLAND

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In this paper laying date and clutch size of breeding Red-backed Shrike *Lanius collurio* in two time periods (1905–1925 and 1985–1999) in southern Poland are compared. Comparisons were made on two separate data sets: a museum collection and nest-cards from the Polish Nest Record Scheme. No significant differences between time of laying (median was 26 May in both periods) and clutch size (5.01 vs. 5.06, respectively) were found. The possibility of using museum collections and nest-cards to analyse long-term trends in life-history traits is discussed.

Key words: *Lanius collurio*, climate change, long-term studies, museum collections, nest-cards

INTRODUCTION

Global warming, or climate change, is at present a popular subject and has been shown to affect birds. Studies have dealt mainly with changes in the geographic distribution of some species, their behaviour and migration pattern (BERTHOLD 1991, ŻELAKIEVIĆIUS 1997). However, recent studies have shown that climate change may also have beneficial effects on the reproduction of birds. Several authors have described changes in laying date and in clutch size linking these changes with an increase in temperature during the breeding period (CRICK *et al*. 1997, 1999, BROWN *et al*. 1999).

However, in most studies only data from the last 20–40 years are available. MEARNS and MEARNS (1998) suggested that better data sets might be obtained from museum collections.

In the current paper comparisons in laying initiation dates and clutch sizes of the Red-backed Shrike in southern Poland are presented. The hypothesis that, like other European species, the time of laying in Red-backed Shrike should be earlier in recent years and clutch size should also be bigger is tested.

METHODS

Two data sets from 1904–1925 and 1985–1999 were used. Only data from first clutches were included, i.e. replacement broods were omitted. Only clutches initiated before June 10th were considered as first clutches (after KUŹNIAK 1991 and similar to MATYJASIAK 1995).

Data from 1904–1925 were obtained from the oological collection of Muzeum Górnośląskie at Bytom. Most of the clutches were collected by E. DRESCHER (POTRZEBOWSKA-DUTKA 1969). For analysis, only clutches collected in the Opole Silesia and Upper Silesia regions were used. For describing clutch size parameters, details found on the museum labels were used. The problem was to establish the laying initiation date, which was only exceptionally given on the label. If unavailable, these were calculated from the information on incubation period as found on the labels. Only two kinds of information were used, whether the eggs were fresh or incubated (methods after SCHARLEMANN 2001). The blown holes of 20 fresh eggs and of 10 incubated eggs chosen at random were compared. Due to embryo development, the fresh eggs have, on average, a smaller hole than incubated eggs (1.72±0.24 *vs*. 2.49±0.48; $t=-5.9$, $p<0.0001$). In the case of clutches with fresh eggs (at least 70% of all analysed clutches) the laying initiation date was calculated as the collection date, as found on the label, minus the number of days equivalent to the clutch size + 1 (the margin for the collectors waiting for the full clutch). For incubated clutches the laying initiation date was calculated by taking the collection date minus the clutch size + 7 (half of the incubation period, OLSSON 1995, PANOW 1996). In total data from 73 clutches in the museum collection were used.

Data from the Polish Nest Records Scheme based on nest cards were used in the same way as other authors (MAYER-GROSS 1972, WESOŁOWSKI & CZAPULAK 1986, CRICK *et al*. 1993, MATYJASIAK 1995). Only in very rare cases was the information available directly from the nest-card. For others, the laying initiation dates were calculated assuming that birds lay one egg per day (OLSSON 1995, PANOW 1996), incubation starts from laying the last egg in clutches of 5 eggs or less or from the penultimate egg in larger clutches, and incubation lasts 14 days (OLSSON 1995, PANOW 1996, S. KUŹNIAK – unpubl. data). In rare cases information on nestling feather development, based on data from OLSSON (1995), was also used to establish the laying initiation date.

Data were split into two groups: (1) museum collection and (2) nest-record cards. Differences in breeding parameters were tested using t-test (clutch size), chi-square test (number of clutches with various number of eggs) and Mann–Whitney U-test and Kolmogorov–Smirnov test (timing of laying).

RESULTS

Number of nests

During 1904–1925 E. DRESCHER collected annually 4.6±4.9 (mean±SD) clutches, during 1985–1999 R. PIEŁA observed 4.8±2.7 nests ($t=-0.17$, $p=0.864$).

Time of laying

Between the years 1904–1925, the Red-backed Shrike laid the first egg between 1st May and 10th June (median 26th May).

Between 1985–1999 clutches were initiated between 9th May and 10th June (median 26th May). Differences in laying date between the two study periods were not significant (U = 2939, p = 0.297), nor was the difference in the distribution of the egg laying period (Fig. 1, Kolmogorov–Smirnov test, K-S Z = 0.61, p = 0.852).

Clutch size

In the first period, clutch sizes ranged from 2 to 6 eggs, and in the second period, from 2 to 7. Both results showed a similar pattern overall distribution (Fig. 2). The difference between mean clutch size in both periods (5.01±0.87 *vs*. 5.06±1.01, respectively) was not significant (t = – 0.31, p = 0.757).

DISCUSSION

Laying dates obtained by analyses of nest-cards are susceptible to biases if the observation intensity are not evenly spread over the breeding season. WESOŁOWSKI and CZAPULAK (1986) indicated that the highest proportion of searching activity by collaborators of the Polish Nest Record Scheme occurred during May. However, in June 90% of the collaborators that were active in May were still active. Therefore, there was no need to analyse the temporal differences between observ-

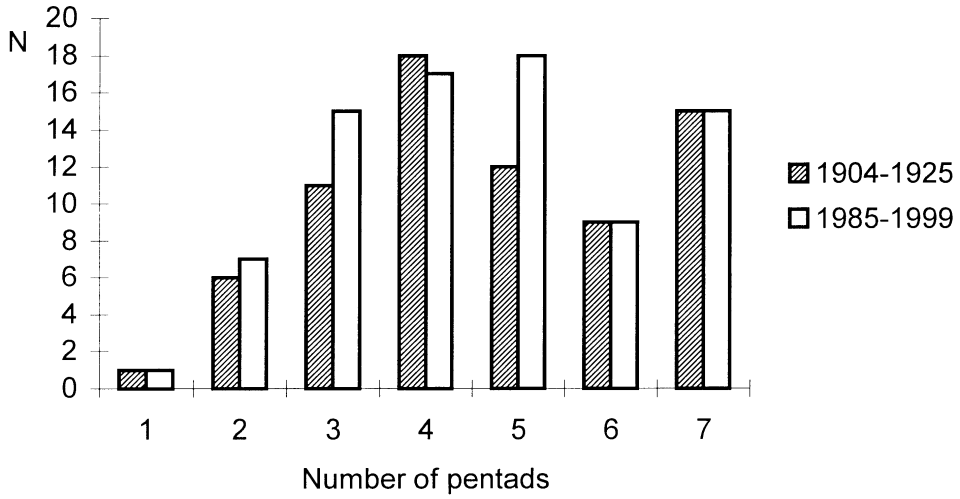

Fig. 1. The number of Red-backed Shrike clutches laid during successive five-day periods (1 = 6–10 May) in the two study periods. For sample size – see text

ers' activity in nest searching. Additionally, comparisons were made as accurate as possible because the two separate data sets were each collected by only one person, E. DRESCHER and R. PIEŁA respectively.

Data from nest-record cards were used in a similar way as for British birds (CRICK *et al*. 1993). Unfortunately, there is a lack of similar studies on old museum collections despite the fact that collectors provide good data and make useful comments for future analysis. In this paper, long-term data analysis was only made possible by the use of museum data.

The timing of laying and mean clutch size of the Red-backed Shrike in other areas of Poland has not changed (KUŹNIAK 1991, MATYJASIAK 1995, DIEHL 1998). However, DIEHL (1998), reported that mean clutch size increased between 1964–1990 in conditions of increasing temperatures. The increase resulted mainly from a growth in the proportion of 6 and 7 egg clutches. In contrast, MATYJASIAK (1995) did not show similar long-term trends in reproductive parameters based on data from the Polish Nest Record Scheme. LUDER (1986) analysed data from nest record cards in Switzerland and reported mean clutch size decreases from 5.32 to 5.06 eggs during the period 1901–1977. However, in the same period there were decreases in the frequency of May clutches. Moreover the mean arrival date of Red-backed Shrike in Switzerland had changed, since the birds started to arrive later. This was in contrast to other European studies on different bird species

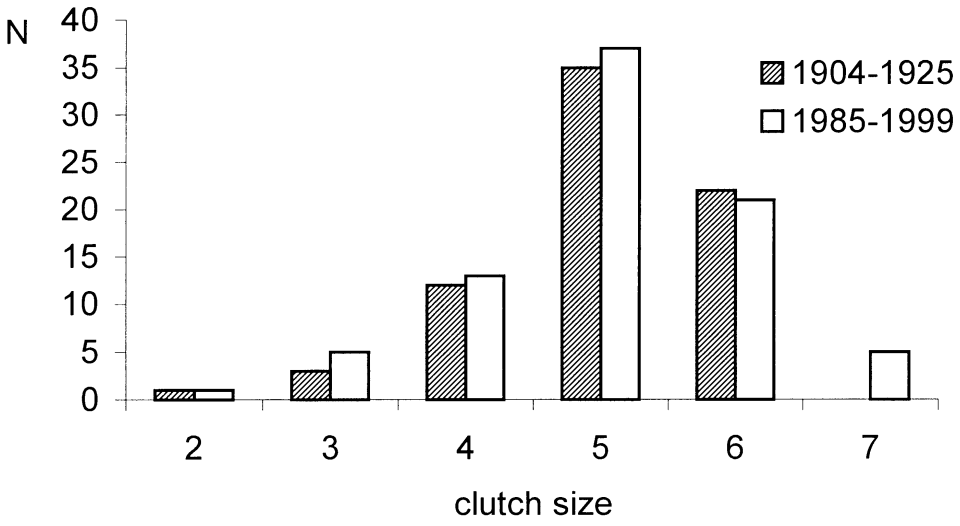

Fig. 2. Comparison of clutch size frequency between the two data sets, from museum collection (black bars) and from nest-cards (white bars). No significant differences were recorded (chi-square = 0.303, df = 5, $p > 0.9$)

(CRICK *et al.* 1997, CRICK & SPARKS 1999). According to JAKOBER and STAUBER (1983), arrival time and the timing of laying were strongly correlated and depended on temperature. The results of LUDER (1986) might differ from the others, because the author analysed only data up to 1977 and the impact of climate change on the environment, observed as the increase of temperature, started to occur only from the 1980s onwards.

The data presented here differed from the above results. In the two compared study periods there were no significant differences in laying date or in clutch size despite small changes in temperature in May. Between 1905–1925 the temperatures were relatively warmer compared to recent years (TREPIŃSKA 1997). The influence of this appears to be minimal.

Although the study of life-history traits is important, they are not the only factors that should be considered. For example, from the conservationist point of view, information on breeding density and data on the number of fledglings per pair are important but unfortunately neither are available from museum specimens.

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Acknowledgements – I thank the employees of the Department of Natural History of the Upper Silesian Museum in Bytom: R. DOBOSZ, J. BETLEJA and T. HADAŚ for their technical help. I especially thank T. HADAŚ for his help in translating notes on old nest-cards in the Museum.

Special thanks go to all Polish amateur ornithologists, especially to ROMAN PIEŁA, who compiled the nest cards. The Polish Nest Record Scheme data was made available by T. WESOŁOWSKI. L. KOLENDOWICZ helped with climatological data. M. GOULDING, two anonymous referees and especially T. SPARKS improved the manuscript with his comments and valuable suggestions. This research was supported by a grant from UAM (no. PBWB 2/99).

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Revised version received 4th July, 2002, accepted 20th July, 2002, published 10th August, 2002