MIGRATION DYNAMICS OF RED-BACKED (*LANIUS COLLURIO*) AND GREAT GREY SHRIKES (*L. EXCUBITOR*) IN THE BALTIC REGION, 1961–1990

PRZEMYSLAW BUSSE

Bird Migration Research Station, University of Gdansk, Przebendowo, Poland

ABSTRACT.—Since 1961, the Operation Baltic research program has monitored autumn migrants by catching birds at three field stations on the Baltic coast. Most species of small passerine migrants show a trend of declining numbers. Great Grey Shrikes (*Lanius excubitor*) show one of the highest rates of decline. Average regression coefficient for 30 years is −5.12. An extremely rapid decline occurred at the end of the 1970s; in the 1980s the average was only 4.2% that of the 1960s. The Red-backed Shrike (*L. collurio*) exhibits a moderate decline (reg. coef. = −2.89). At two stations the decline is higher (reg. coef. −3.26 and −5.17), while at the third station, numbers of migrating Red-backed Shrikes, originating probably from Scandinavia, show entirely different dynamics with a peak in the 1970s (167% of 1960s level) and strong decline at the beginning of the 1980s (level for 1984–1990 = 44% of that of the 1960s).
Proceedings Western Foundation Vertebrate Zoology 6:55–60, 1995.

Monitoring population dynamics on a large scale is difficult. This "large scale" should be understood as both large in space and long in time. Most studies, to date, cover short periods and are limited to one or very few localities, and the results are in part contradictory. Some examples are presented in another paper (Busse in press). Another example occurred in the early 1970s when the population trend of Common Whitethroat (*Sylvia communis*) was described as dramatically declining in western Europe (e.g. Berthold 1974). However, after analyzing 30 years' data from central Europe, it appears to be declining very little, if at all. Differences between trends found at different banding stations are pronounced, even if situated relatively close to each other as in the case of the south Baltic coast where Polish 'Operation Baltic' stations are located. The 30-year trends of 40 species studied there are presented elsewhere (Busse in press). Here I present data on the Red-backed (*Lanius collurio*) and Great Grey shrikes (*L. excubitor*). As I have received raw data from several bird-banding stations in central and northern Europe, I will discuss in detail the population trends of these two shrikes over a large area and present examples of the advantages of large scale monitoring.

MATERIALS AND METHODS

Polish data were collected in the Operation Baltic program by mist-netting birds at three stations in autumn—Mierzeja Wislana (54°21'N, 19°19'E), Hel (54°46'N, 18°28'E) and Bukowo/Bukowo-Kopan (54°21'N, 16°17'E/54°28'N, 16°25'E)—during 30 years (1961–1990, except Hel 1961–1986). All data are comparable within each station's data set through all period of work (Busse in press). Additionally, data from other bird stations were used: (1) Falsterbo Bird Station (55°22'N, 12°52'E), 1980–1988; (2) Helgoland Bird Station (54°00'N, 8°00'E), 1953–1988, except data for 1953–1960 are not used because of limitations in comparability (Moritz 1981, 1982a, 1982b, 1983; Moritz and Vauk 1979); (3) Mettnau, Reit, and Illmitz—Mettnau (47°44'N, 8°58'E), Reit (53°28'N, 10°06'E), Illmitz (47°46'N, 16°48'E), 1974–1983, data comparable (Berthold et al. 1986); (4) Ottenby Bird Station (56°12'N, 16°24'E), 1961–1988, data nearly comparable (pers. comm.); (5) Pape (56°09'N, 21°02'E), 1967–1989, data with limited comparability (A. Celmins, J.Baumanis pers. comm.). At this study station the data were corrected according to the period of work by recalculating to per day values for migration period of the species. *L. excubitor* data for 1967–1970 were excluded because of inconsistency of trapping method (this species is attracted to nets by other birds caught); (6) Rybatchy (55°09'N, 20°52'E) 1961–1986, data comparable (Payevsky 1990), 1985–1986 data from a nearby site were recalculated for comparability on the basis of relationships from the data of a common, eight-year period of work; (7) Sorve (57°54'N, 22°03'E), 1981–1988, for *collurio* data not comparable because of period of work, for *excubitor* data roughly comparable; (8) Tankar (63°57'N, 22°51'E), 1972–1988, data roughly comparable because of variable number of nets (T. Harju, pers. comm.), recalculated according to period of work, as for Pape. General problems of data comparability are discussed elsewhere (Busse 1990).

Here, all values describing the number of individuals of the species are expressed as a percentage of the average number of the species at the station for the years 1974–1983, because these years are common for most of the studied series. Because the period 1974–1983 is used as our standard, numbers for Polish stations presented here, as well as regression coefficients values, are not the same as in Busse (in press). The values given as common for a group of stations were calculated as averages for all stations in question, where every station had the same weight. As the basic data values are independent of real number of individuals caught (they are comparable between stations) they can be pooled for regional values. This method avoids suppressing trends observed at the stations where fewer individuals were caught because of peculiarities of catching methods and/or location and habitats. The graphs present raw and smoothed data (5-yr moving average), number curves with additional information containing coefficient of fluctuations (CF = coefficient characterizing fluctuations of basic data around smoothed curve, see Busse 1990), and regression coefficient (*R*) with statistical significance.

$$\mathrm{CF} = \frac{1}{\mathrm{M}} \times \frac{\Sigma\,(Xoy - Xy)^2}{n} \times 100\%$$

where: M = mean value of population size for all years, Xy = the value of population size index for year y, Xoy = local value of moving average for the year y, and n = number of years in sample.

Results

Red-backed Shrike.—General data on frequency of trapping, number fluctuations, and population dynamics are presented in Table 1. An unusually high number of individuals of this species are caught at Ottenby (Oland), Sweden, where shrikes concentrate prior to crossing the Baltic Sea. High numbers of Red-backed Shrikes were caught at Illmitz and Falsterbo, relatively high numbers at Rybatchy and Mierzeja Wislana, but very few at Tankar station (located at the northern limit of the breeding area).

Data on population dynamics, as evident by trapping at Polish stations (Figs. 1,2), show pronounced differences in the shape of the smoothed curves and the values of the regression coefficients. At Mierzeja Wislana and Hel, the largest numbers of migrants occurred in the early-1960s and the lowest in the 1970s (Mierzeja Wislana), or late-1970–early-1980s at Hel. Data from Bukowo station are less differentiated and numbers were the lowest in the early-1960s and again in the late-1980s. Regression coefficients for two eastern Polish stations (Mierzeja Wislana and Hel) are significantly negative, while that for the western station at Bukowo is slightly positive. This discrepancy suggested that population trends from other stations should be evaluated. Shrikes at the Swedish Ottenby station, situated north of the Polish coast, showed no trend (Fig. 2) and is similar to Bukowo (Table 1). The trend at Helgoland (Fig. 2) is slightly positive, with a local peak in the late-1970s. This peak does not occur elsewhere. Two east Baltic coast stations (Rybatchy and Pape, Fig. 1) show population crashes in mid-1970s, similar to that at Hel, but without a recovery in mid-1980s, which was evident at Mierzeja Wislana (Fig. 1). Similarities of trends suggested we combine the data into two groups; the "western" (Bukowo, Helgoland and Ottenby) and the "eastern" (Mierzeja Wislana, Rybatchy and Pape) stations (Fig. 3). The trends calculated for these groups are clearly different. The long-term regression coefficient for eastern stations is significantly negative, while that for western stations is not statistically significant. However, it should be noted that both groups show periods of pronounced declines. In the eastern stations the decline occurred in 1973–1976 and the decline rate is about threefold. Since 1976 the number of Red-backed Shrikes migrating through these stations is stable at the new, lower level. The western-stations population trend shows that from the early-1960s to the late-1970s, numbers increased almost threefold, and then in a very short time (1981–1985) declined to a level lower than that of the early-1960s. Low values of the coefficient of fluctuations (CF) calculated for these groups of stations (Table 1) shows that the smoothed curves of trends can be treated as reliable ones. The 17 years of data from the northernmost station, Tankar, show the trend to be different from those presented above. After several years (1972–1978) of small numbers, a peak occurred in the early-1980s, and then followed a few years (1983–1986) of intermediate level. The positive trend at this station should be treated cautiously because the numbers are very low, the coefficient of fluctuation is extremely high, and the standardization of data insufficient. Despite these doubts, it should be mentioned that the results obtained at this station for Great Grey Shrikes appear to be meaningful although different from other areas.

Shorter series can be evaluated against the background of the trends calculated for the ma-

TABLE 1. Number of *Lanius collurio* mist-netted at the Baltic Sea banding stations.

Station	Period No. of years	Ind. per season	CF	R 1961–86	R 1974–83	R 1980–88
Mierzeja Wiślana	1961–90 30	12.2	(20.08)	−12.55**	+8.96~	+2.17~
Hel	1961–1986 26	3.1	37.15	−19.89**	−9.01*	–
Bukowo	1961–90 30	5.5	31.74	+0.66~	+1.14~	−14.43**
Helgoland	1961–88 28	2.5	29.38	+0.89~	−1.91~	−9.93**
Ottenby	1961–88 28	206	3.04	−0.24~	−3.36**	−5.62**
Rybatchy	1961–86 26	17.2	17.2	−12.68**	−24.47**	–
Pape	1967–89 21	3.0	319.9	–	−31.87**	−0.78~
Tankar	1972–88 17	0.8	231.3	–	+18.69**	−15.73**
Falsterbo	1980–88 9	31.7	3.08	–	–	−0.68*
Mettnau	1974–83 10	8.9	13.42	–	−2.18~	–
Illmitz	1974–83 10	42.4	5.81	–	−7.81**	–
Reit	1974–83 10	3.6	9.79	–	−3.29**	–
Poland			14.86	−2.97**	+1.02~	−8.73*
"West"			6.94	−1.08~	−2.13~	−9.98**
"East"			15.99	−14.09**	−8.19*	+4.77**
Total			7.95	−6.90**	−5.16**	−4.90**

Explanations: CF-coefficient of fluctuations, R-coefficient of regression; statistical significance: ** $-p < 0.01$, * $-0.05 > p > 0.01$, ~ $-p > 0.05$;
"West" = Bukowo + Ottenby + Helgoland;
"East" = Mierzeja Wislana + Hel + Rybatchy

jor stations. Ten-year series collected in the Mettnau-Reit-Illmitz Program show negative trends (Berthold et al. 1986; Table 1), with the most negative at the Austrian Illmitz station. The shapes of smoothed curves are much differentiated. The data available from Falsterbo (1980–1988) shows a similarity to that from Ottenby.

The similarities and differences mentioned above and visible in the figures strongly suggested that we check them statistically. I calcu-

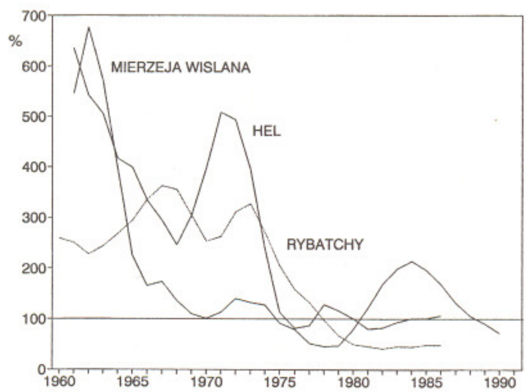

Fig. 1. Numbers of *L. collurio* at Mierzeja Wislans, Hel, and Rybatchy. Smoothed curves expressed as percent of 1974–1983.

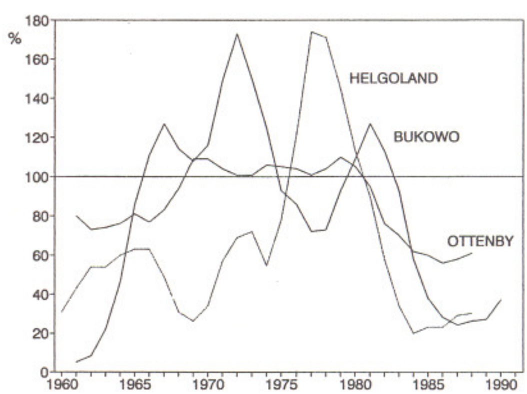

Fig. 2. Numbers of *L. collurio* at Bukowo, Helgoland, and Ottenby.

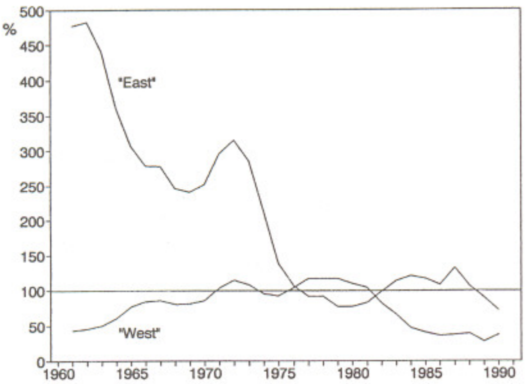

Fig. 3. Numbers of *L. collurio* in the 'eastern' and the 'western' groups.

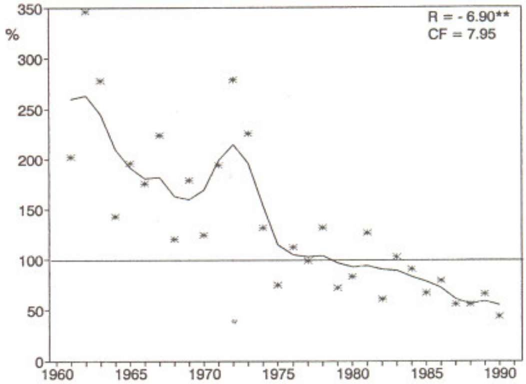

Fig. 4. Numbers of *L. collurio* at all banding stations with long-term data. Smoothed curve and total annual trapping success (asterisks).

lated correlation coefficients between all stations, and separately, for raw and smoothed data, in periods common for pairs of stations. Although many of them were not statistically significant, these two values of correlation coefficient for every pair were combined into one value and, used as a rough coefficient of similarity of trends. The picture is surprising; it shows good connections between eastern group of stations and the southernmost stations, Illmitz and Mettnau. The similarities between pairs excludes the possibility of casualness of these data; for Illmitz average r value for "east" and "west" are 0.42 and 0.03, respectively; and for Mettnau average r values for "east" and "west" are 0.14 and 0.00, respectively. Combining these results with the picture of Red-backed Shrike migration based on band recoveries (Zink 1975) suggests that the migration pattern of this species is much more complicated than would be expected by evaluating only band-recovery data.

The r values treated as indicators of trends are differentiated greatly when different periods are taken under consideration (Table 1). In a few cases the trends are statistically significant but opposite when various time-spans are taken under consideration, e.g. at Mierzeja Wislana for years 1961–1986, $r = -12.55$, while for 10 years comparable with Mettnau-Reit-Illmitz Program during 1974–1983, $r = +8.96$. This confirms that trends calculated for short periods of time are of limited value for monitoring purposes (Busse 1990).

General patterns of the Red-backed Shrike population trend (Fig. 4) show high levels in the 1960s and the early-1970s, a very sharp decline during 1971–1975, and a more moderate but continuous decline during 1975–1990.

Great Grey Shrike.—The data for the Great Grey Shrike are poorer than those for the Red-backed Shrike. At several stations (Mettnau-Reit-Illmitz Program) data for this species were not collected, or are unavailable. The numbers of individuals caught at other stations are usually considerably lower (Table 2) than that for the Red-backed Shrike (Table 1). Only Helgoland and Tankar caught more Great Grey Shrikes.

Data from the Polish stations (Figs. 5,6) show a similar general pattern of differentiated, but high, numbers during the 1960s–mid-1970s, and then a very sharp decline during 1976–1980. Since 1979, no Great Grey Shrikes have been trapped at Hel and Bukowo. At Mierzeja Wislana the rate of decline was about ten-fold. A small recovery occurred in the mid-1980s, but the average level was about three times lower than in the 1960s and early-1970s. Number dynamics at Ottenby and Helgoland (Fig. 6) were similar to each other and to Bukowo station. I grouped these three stations into the "western" group. This group had two pronounced peaks in the mid-1960s and mid-1970s (Figs. 7,8). At the easternmost stations (Mierzeja Wislana, Hel, Pape) numbers of migratory Great Grey Shrikes were characterized by a pronounced peak in the early-1970s, and then a very rapid decline, which also occurred at the same time at the western stations. The decline was also observed at Tankar, but with a five-year lag, and at a slower rate. Short-term data from Sorve agree with the pattern from Tankar. It seems that this

TABLE 2. Numbers of *Lanius excubitor* mist-netted at the Baltic Sea banding stations.

Station	Period / No. of years	Ind. per season	CF	R
Mierzeja Wiślana	1962–90 / 29	2.59	48.04	−5.80**
Hel	1961–86 / 26	1.04	107.06	−10.69**
Bukowo	1961–90 / 30	1.03	123.81	−12.67**
Helgoland	1961–88 / 28	5.10	32.31	−3.68**
Ottenby	1961–88 / 28	7.60	53.32	−4.54**
Pape	1971–89 / 19	0.30	168.56	−25.83**
Tankar	1972–88 / 17	2.65	17.01	−5.00**
Falsterbo	1980–88 / 9	1.78	76.08	–
Sorve	1981–88 / 8	1.38	53.47	–
Poland			35.80	−9.05**
"West"			35.00	−7.82**
"East"			47.11	−7.18**
Total			33.27	−7.42**

Explanations: CF-coefficient of fluctuations, R-coefficient of regression (all years); statistical significance: ** $-p < 0.01$, * $-0.05 > p > 0.01$, ~ $-p > 0.05$

Great Grey Shrike population, which migrates longer distances, suffered greater losses than their short-distance migrant conspecifics. As this crash was observed at all other southern stations, possible causes should be searched for in the winter quarters.

The values of the correlation coefficients between number dynamics at different stations is much higher for Great Grey than for Red-backed shrikes and reaches 0.71 for Bukowo-Ottenby. The only station dissimilar to other stations, where longer data series are available, is the northernmost Tankar. For this reason the total curve (Fig. 7) does not contain data from Tankar and Sorve. The general population dynamics pattern contains two periods: one (1961–1977) with a relatively high population level and a very high level of fluctuations; and the second (1978–1990) when the population level was low with small fluctuations. Average

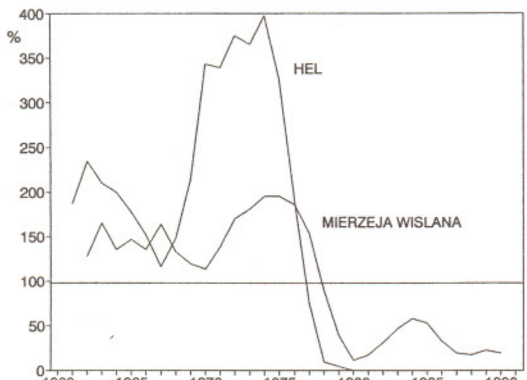

Fig. 5. Numbers of *L. excubitor* at Mierzeja Wislana and Hel.

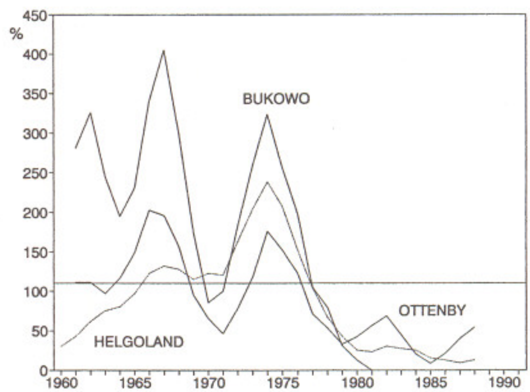

Fig. 6. Numbers of *L. excubitor* at Bukowo, Helgoland, and Ottenby.

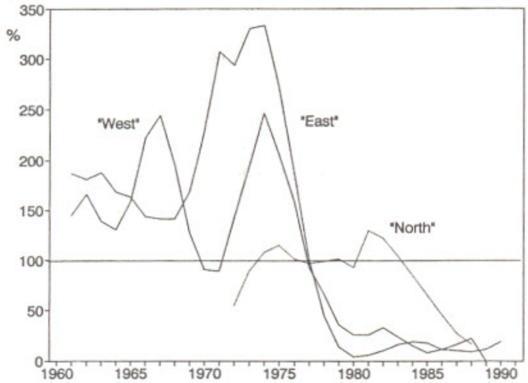

Fig. 7. Numbers of *L. excubitor* in the 'eastern', 'western', and 'northern' groups.

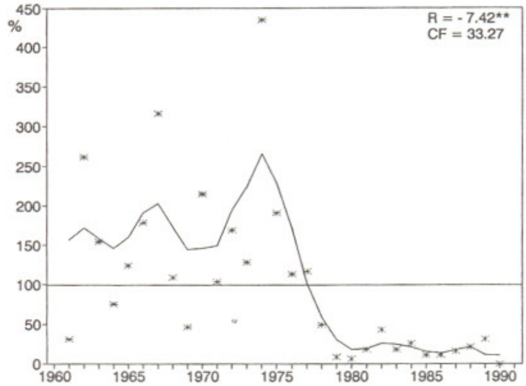

Fig. 8. Numbers of *L. excubitor* for 'east' and 'west' stations combined. Smoothed curve and total annual trapping success (asterisks).

regression coefficient (Table 2) is statistically significant and higher than for Red-backed Shrikes.

Conclusions

Both species of shrikes show a decline in their populations. There are, however, pronounced inter- and intraspecific differences. The number of Red-backed Shrikes migrating through the more western stations (Bukowo, Ottenby, Helgoland) differs clearly from that of eastern ones (Hel, Mierzeja Wislana, Rybatchy). Average trend for the former group is not significantly negative, while that for the latter is significantly negative. Short periods of rapid declines are evident but these periods are not similar in both groups.

The pattern for the Great Grey Shrikes is more similar in both groups of stations, and similar rapid declines have been observed at all the stations concurrently. At the northernmost stations the decline started few years later.

Correlations between number dynamics patterns at different stations strongly suggest that the more eastern Red-backed Shrike populations migrate through central Europe in a southwesterly direction, perpendicular to the route of Scandinavian and central European groups.

Acknowledgments

I thank my colleagues who supplied me with their banding data from the bird stations: Falsterbo Bird Station, Sweden; Helgoland Bird Station, Germany; Mettnau-Reit-Illmitz Program, Germany; Ottenby Bird Station, Sweden; Pape, Latvia; Rybatchy Station, Russia; Sorve, Estonia; and Tankar Bird Station, Finland. I further thank the A.N.U.U.—Associazione Migratoristi Italiani for the Conservation of Natural Environment (Bergamo, Italy), and the Lions Club Schleswig and Max-Planck Institute (Germany) for supporting the analysis of the data sets. I thank the Kosciuszko Foundation, New York, and the American Ornithologists' Union for having supported my attendance at the International Shrike Symposium.