

Estimated population dynamics of the Corncrake *Crex crex* in Latvia and Europe in the 20th century by ringing data analysis

Oskars Keišs^{1,2*}, Jānis Granāts², Aivars Mednis¹

¹Laboratory of Ornithology, Institute of Biology, University of Latvia, Miera 3, Salaspils LV-2169, Latvia

²Department of Zoology and Animal Ecology, Faculty of Biology, University of Latvia, Kronvalda Bulv. 4, Rīga LV-1586, Latvia

*Corresponding author, E-mail: grieze@lanet.lv

Abstract

We collected data on 2916 Corncrakes ringed in 17 Bird Ringing Schemes in Europe 1908 - 1995 and analyzed the data ($n = 643$) of former Czechoslovakia, Croatia, Estonia, Hungary, Latvia, Lithuania, Norway, Poland and Switzerland to obtain quantitative estimate (TRIM index) of the Corncrake population decline in Europe during the last century. Our analyses is based on the assumption that Corncrakes were captured randomly: bird ringers used every opportunity to ring any bird, encountered, but no specific search for Corncrakes were made. We also analysed the ringing data collected in Latvia in detail to suggest on the behaviour of the ringers in order to test our assumption. We also analysed data on six passerine farmland bird species in Latvia to evaluate if bird ringers were actively ringing farmland birds later in our period of data analyses, when Corncrake ringing has declined. During the period of 1925 - 1995 there were 215 Corncrakes ringed in Latvia: 190 pulli and 25 adults. A decline of ringed pulli was observed in raw data as well as data adjusted to total number of birds ringed in Latvia in the respective year ($r_s = -0.46$; $p < 0.001$) and data adjusted to active bird ringers in Latvia in the respective year ($r_s = -0.43$; $p < 0.001$). A similar decline of ringed Corncrakes ($n = 101$) is observed also in data of the former Czechoslovakian ringing scheme in Prague. Index values of combined data for all ringed Corncrakes in Europe show significant decrease during the study period ($r^2 = 0.26$; $p < 0.00001$). If we remove Latvia from data pool, since it contributes roughly one third of the data ($n = 215$) and therefore drives the index, the observed pattern remains unchanged ($r^2 = 0.11$; $p < 0.01$). Correlation between index of ringed Corncrakes in Europe except Latvia (former Czechoslovakia, Croatia, Estonia, Hungary, Lithuania, Norway, Poland and Switzerland) and number of ringed Corncrakes in Latvia is statistically significant ($r^2 = 0.12$; $p < 0.01$). Similarly to Corncrake, the number of ringed Skylarks ($r_s = -0.50$; $p < 0.001$) and Whinchats ($r_s = -0.23$ $p < 0.05$) have also decreased significantly in Latvia during the period of 1925 - 1995, while number of ringed Meadow Pipits ($r_s = 0.57$), Common Whitethroats ($r_s = 0.68$) and Linnets ($r_s = 0.49$) increased significantly ($p < 0.001$). The only analysed species showing no significant trend was Yellow Wagtail. Qualitatively there is no doubt that ringing data verify the decline of the Corncrake population both in Latvia and in Europe. The average index of ringed Corncrakes of all European countries shows a decrease of about 5.5 times comparing 1925 - 1930 versus 1981 - 1990. Approximation by calculating decrease of available habitat shows a smaller decrease in Latvia by 1.5 - 3 times, but recent population density data for these calculations have been used, which might have decreased as well.

Key words: Corncrake, *Crex crex*, population dynamics, ringing data, TRIM index.

Introduction

Corncrake *Crex crex* is included in the IUCN Red List of Threatened Animals (Hilton-Taylor 2000), because intensive agriculture methods have caused declines in numbers in most of its populations, as well as range contractions in Western Europe (Green et al. 1997). Until the 1990s, when regular and organized annual Corncrake monitoring began (e.g. in Latvia: Keišs 2004; 2005), most of the population dynamic data were obtained only by questionnaires (see overview by Green et al. 1997), “bird of the year” actions (e.g. in Sweden: Enemar 1957; 1969) or breeding bird atlas data (e.g. in Latvia 1980 - 1984: Priednieks et al. 1989). Additionally, most of the data before 1990 come from the surveys with inconsistent area of the sample plots and inconsistent methods over the sites and years. Therefore, there is hardly any reliable estimate of the Corncrake population in any country before 1990, except for those countries with small populations (e.g. United Kingdom: Hudson et al. 1990). Without reliable survey and estimate data it is difficult to analyse the decline quantitatively.

Since the 1990s the decline of the Corncrake populations in Europe has reversed to an increase in numbers (Schäffer, Koffijberg 2004), largely due to changes in agriculture in Eastern Europe (e.g. in Latvia: Keišs 2005). To estimate how this increase compares with historical declines, it is important to understand the quantity of the decrease since its beginning in the 19th century. Since there have been no systematic surveys of the Corncrake in Europe until recent times, the aim of the present study was to evaluate the potential use of data on ringed Corncrakes in Europe (in all existing Bird Ringing Schemes) as a quantitative estimate of the population dynamics of this species in Europe.

Materials and methods

This study is based on the assumption that Corncrakes were captured randomly: bird ringers used every opportunity to ring any bird encountered, but no specific search for Corncrakes was made. Thus, the probability of encountering a Corncrake is higher when there are more Corncrakes present. Therefore, when it was known that this assumption was false (e.g. specific studies involving Corncrake ringing were carried out), ringing data from the respective country were excluded from analysis (see further).

Birds ringed in Latvia

We searched the archives of Latvian Bird ringing center since its foundation in 1925 to identify all ringed Corncrakes, and their age and sex if recorded. A database of all ringed Corncrakes in Latvia was created. We analysed numbers of Corncrakes ringed until 1995, when we started to capture Corncrakes systematically (Keišs et al. 2004).

To evaluate if the behaviour of the bird ringers changed over time and if ringing data corresponds to population dynamics, we chose seven passerine bird species that inhabit similar habitats as Corncrake: Linnet *Acanthis cannabina*, Meadow Pipit *Anthus pratensis*, Skylark *Alauda arvensis*, Whinchat *Saxicola rubetra*, Whitethroat *Sylvia communis*, Yellow Wagtail *Motacilla flava* and Yellowhammer *Emberiza citrinella*. The assumption here is that, if a ringer was in an open landscape ringing these species, he/she might have a chance

to encounter Corncrake (Corncrake pulli to be more precise) and ring it as well. We used published reports on ringed birds by the Latvian ringing center (von Transehe 1939; 1940; Vilks, Pētersons 1943; Spuris 1962; Kazubiernis 1989) to access the numbers of ringed birds of the seven passerine bird species.

Corncrakes ringed in Europe

We collected data on numbers of ringed Corncrakes from published bird ringing reports. Additionally we used unpublished summaries, kindly provided by the Czech Bird Ringing scheme in Prague (J. Cepak, personal communication), by the Lithuanian Bird Ringing Scheme in Kaunas (R. Patapavičius, personal communication) and by the Swiss Bird Ringing scheme in Sempach (E. Wiprächtiger, personal communication). The Finish Bird Ringing Scheme kindly provided a database with ringed Corncrakes (J. Valkama, personal communication). In total we obtained data on ringed Corncrakes of 17 Bird Ringing Schemes in Europe (Table 1).

Data of several countries include birds ringed in special studies conducted on Corncrakes. Data on numbers of Corncrakes ringed in these countries were not used in the further analysis of the population trends. These countries were Finland (J. Valkama, personal communication), Germany (Prünte 1972), Sweden (Alnäs 1974), The Netherlands (van den Bergh 1991) and United Kingdom (Mason 1941; 1947; 1950; Fox 1993). In the studies in Finland and The Netherlands special studies were aimed at capturing only adult birds, therefore we assumed that pulli were still ringed as random events and used number of ringed pulli in the analyses. We also excluded Russia from the analyses, since little data were available and those data available were unreliable.

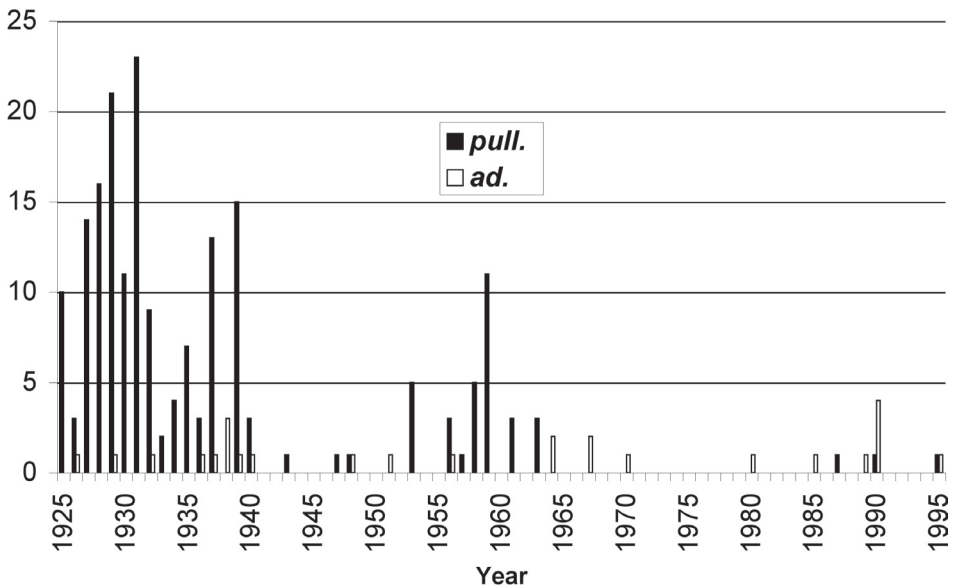


Fig. 1. Number of ringed Corncrakes in Latvia (1925 - 1995; n = 215).

Table 1. Data sources on ringed Corncrakes *Crex crex* in Europe

Ringing Center	Period	Data sources
Czechoslovakia	1934 - 2004	J. Cepak pers. com.; Formánek 1970, 1971/72; Formánek, Škopek 1990, 1991, 1993; Jirsík 1936; Jirsík, Kadlec 1937, 1938; Kadlec 1939, 1940, 1947/48, 1951, 1958, 1959; Kadlec, Bašová 1965; Kadlec, Klůz 1941; Škopek, Formánek 1995
Croatia	1947 - 2000	Čikovič, Kralj 2002; Čikovič, Radovič 1999; Igalffy 1950; Kletečki 1988; Kletečki, Sirotič 1976, 1978, 1980, 1982; Kroneisl 1948, 1952; Kroneisl–Rucner 1954, 1956, 1957, 1959, 1960; Radovič 1990, 1991; Radovič et al. 1993; Radovič, Sušič 1989; Rucner–Kroneisl 1962; Sirotič, Kletečki 1975, 1977, 1979; Štromar 1963, 1965, 1967, 1968, 1970, 1971, 1972, 1973, 1975, 1977, 1980
Estonia	1922 - 1985; 1987; 1990; 1992; 1994 - 2000	Jõgi 1957; Härms 1939; Kastepõld 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985; Kastepõld et al. 1998a, 1998b; Kastepõld, Kastepõld 1990, 1991, 1992, 1999, 2000, 2001a, 2001b; Kumari, Jõgi 1974
Finland	1928 - 1967 1975 - 1991 1993 - 1997 1999 - 2004	Haapala 2001; Sten 1968, 1969; Nordström 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966; Nordström, Sten 1967; Saurola 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1993, 1994, 1995, 1996, 1997, 1999, 2000; Välikangas, 1931; Välikangas, Huuskonen 1952; Välikangas, Hytönen 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940; Välikangas, Koskimies 1950; Välikangas, Nordström 1954, 1956, 1957; Välikangas, Siivonen 1942, 1949; Valkama 2002, 2003, 2004
Germany: Helgoland	1957 1962, 1964 1966 - 1998	Bub 1990; Deutsche Ornithologen–Gesellschaft 1992; Foken 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998; Reiser 1971, 1972, 1973, 1974a, 1974b, 1975, 1977; Rogall 1975, 1976, 1977, 1978, 1979, 1980; Rogall et al. 1977, 1978, 1979; Schloss 1968a, 1968b.
Germany: Hiddensee	1975 - 2005	Köppen 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004; Pörner 1979, 1980, 1981, 1982; Siefke 1975, 1976, 1977; Siefke, Pörner 1978.
Germany: Radolfzell	1947 - 1981 1992 - 2002	Fiedler et al. 1999, 2002; Jacoby, Zink 1966; Zink 1959, 1961, 1962, 1964, 1969, 1974, 1975, 1976, 1977, 1978, 1979, 1980a, 1980b, 1981
Hungary	1908 - 1915 1923 - 1932 1945 - 1953 1975 - 1984 1998 - 2002	Halmos et al. 2003; Halmos, Karcza 2004; Harangi 1984; Harangi, 1923 - 1932 Haraszthy 1983; Haraszthy et al. 1980, 1982, 1954; Haraszthy, 1945 - 1953 Schmidt 1977, 1978, 1979; Keve 1954; Pátkai 1955; Schmidt 1975, 1976, 1981; Schenk 1908, 1909, 1910, 1911, 1912, 1913, 1916, 1924, 1926, 1929, 1930, 1934; Simon 2002; Warga 1955

(continued)

Ringling Center	Period	Data sources
Latvia	1924 - 2005	Kazubiernis pers. com.; Kazubiernis 1989; Spuris 1962; von Transehe 1939, 1940; Vilks, Pētersons 1943
Lithuania	1929 - 2004	R. Patapavičius pers. com.
Netherlands	1975 - 1989	Speek 1975, 1976, 1977, 1978, 1979, 1980, 1981, Wassenaar 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989
Norway	1975 - 1982	Holgersen 1975, 1976, 1977, 1978, 1979; Runde 1980, 1981, 1982
Poland	1932 - 1939 1945 - 1963 1975 - 1983 1998 - 2004	Anonymous 1999a, 1999b, 2000, 2001, 2002, 2003, 2004; Buse, Gromadzki 1966; Czerniakiewicz 1983; Domaniewski 1933, 1934, 1936; Domaniewski, Kreczmer 1937; Gromadska, Kania 1975, 1976; Gromadzka, Kachwicz 1978, 1979, 1980, 1981, 1982; Kania, Surdyk 1977; Rydzewski 1938, 1939, 1949a, 1949b; Szczepski 1951, 1970, 1976; Szczepski, Szczepska 1953, 1956, 1957, 1959, 1963, 1965
Russia	1975 - 1982 1986 - 2004	Dobrovalskaja et al. 1978; Dobrovalskaja, Litvin 1977; Dobrykina 1979, 1980, 1981, 1982; Gurtovaya 1986; Gurtovaya, Litvin 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996; Vronskii 1975, 1976
Sweden	1917 1922 - 2004	Österlöf 1973, 1975a, 1975b, 1975c, 1976a, 1976b, 1977a, 1977b, 1978a, 1978b, 1979a, 1979b, 1980a, 1980b, 1981, 1982, 1983, 1984, 1985a, 1985b; Stolt 1989, 1990a, 1990b; Stolt et al. 1996, 1997, 1998, 1991, 1992, 1995; Stolt, Fernholm 1989
Switzerland	1924 - 2005	E. Wiprächtiger pers. com.
United Kingdom	1975 - 1981	Hudson 1977, 1978, 1979, 1980, 1981; Spencer 1975, 1976

Statistical analyses

The raw data from all countries on ringed Corncrakes could not be used to estimate population trends, since numbers of ringers and ringed birds considerably changed over the time period covered. We used the computer program TRIM (*Trends and Indices for Monitoring data*) 3. version (Pannekoek, van Strien 2001) designed by Statistics Netherlands to analyse bird monitoring data (Pannekoek, van Strien 2001; van Strien et al. 2004) and used widely in Europe (Gregory et al. 2005). The TRIM program calculates a yearly index by using a matrix of observations with missing values. The basic model of the program is the following:

$$\ln \mu_{ij} = \alpha_i + \gamma_j,$$

where α_i shows site effect, and γ_j – year effect on the natural logarithm of the expected value of the count μ_{ij} (Pannekoek, van Strien 2001; van Strien et al. 2004).

We treated each ringing scheme as a site with Corncrakes ringed by the scheme as an observed count of the corresponding year. We also used the value adjusted to the number of ringers active in the scheme in the corresponding year or value adjusted to the number of ringed birds by the scheme in the corresponding year, to prepare input values for the TRIM program. Standard statistical procedures (calculation of the Spearman's Rank correlation coefficient and Pearson's product-moment correlation coefficient) were used to analyse data (Zar 1996).

Results

Birds ringed in Latvia

During the period of 1925 - 1995 there were 215 Corncrakes ringed in Latvia: 190 chicks (pulli) and 25 adults (Fig. 1). A decline of ringed pulli were observed in raw data as well as adjusted data: (1) Spearman's rank correlation between year and proportion of ringed Corncrake pulli to total number of birds ringed in Latvia in the respective year ($r = -0.46$; $p < 0.001$; Fig. 2A) and (2) Spearman's rank correlation between year and proportion of

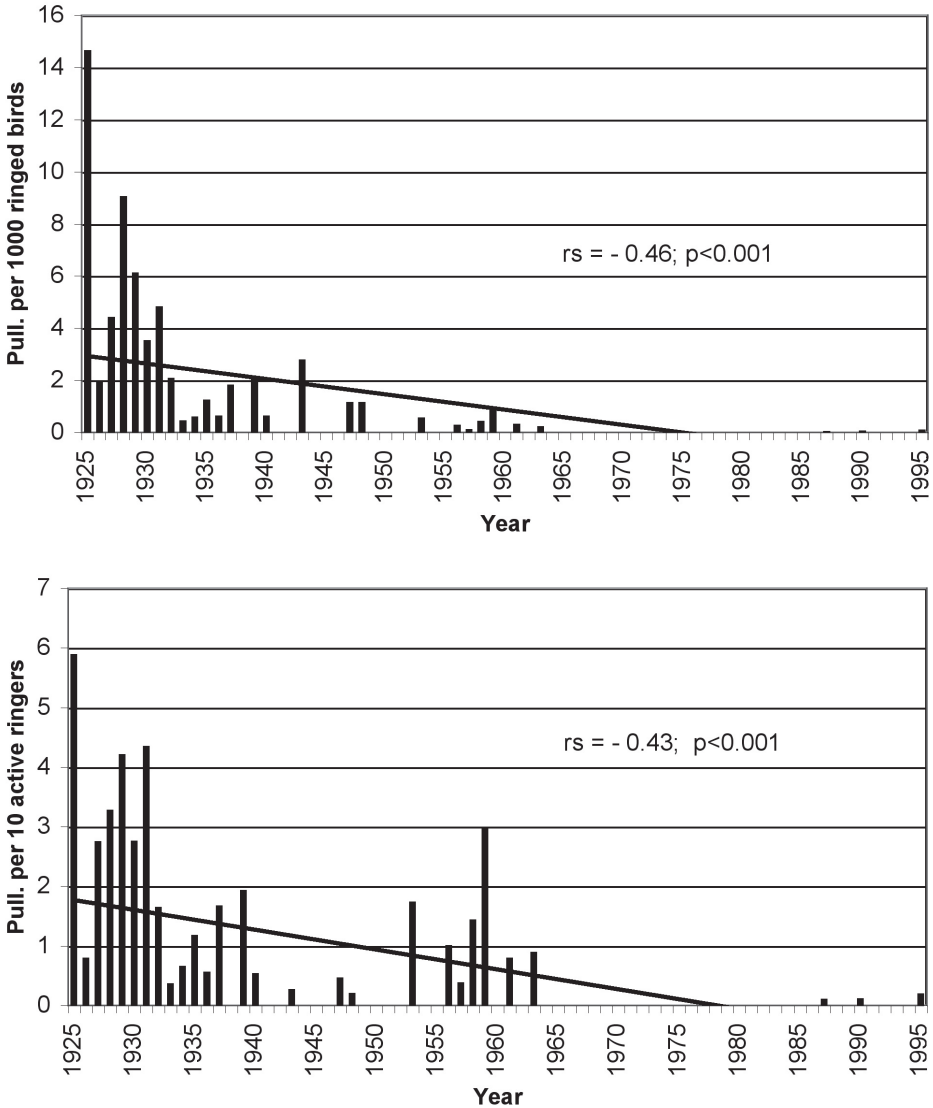


Fig. 2. Decline of ringed Corncrake pulli in Latvia from 1925 to 1995. A, ratio to 1000 birds ringed in Latvia in respective year. B, ratio to 10 bird ringers, active in Latvia in respective year.

Table 2. Collected data of ringed Corncrakes *Crex crex* in Europe 1925 - 1995 (for sources and period covered for each country see Table 1). (*), excluded from analyses; (**), only number of pulli analysed

Country	Pulli	Adults	Age unknown	Total
Croatia	8	12	2	22
Czechoslovakia	0	22	79	101
Estonia	29	2	7	38
Finland**	3	483	8	494
Hungary	4	0	31	35
Germany*	6	217	514	737
Latvia	190	25	0	215
Lithuania	24	8	0	32
Netherlands**	8	0	229	237
Norway	0	16	0	16
Poland	0	0	115	115
Russia*	17	53	1	71
Sweden*	4	245	319	568
Switzerland	23	22	13	58
United Kingdom*	130	47	0	177
Total:	446	1152	1318	2916

ringed Corncrake pulli to the number of active bird ringers in Latvia in the respective year ($r = -0.43$; $p < 0.001$; Fig. 2B).

Similarly to Corncrake, the number of ringed Skylarks and Whinchats also decreased significantly (Spearman Rank correlation coefficient; $p < 0.05$) during the 1925 - 1995 period (Fig. 3); the number of ringed Meadow Pipits, Common Whitethroats and Linnets increased significantly ($p < 0.001$; Fig. 3). The only species, showing no significant trend during the 1925 - 1995 study period was Yellow Wagtail (Fig. 3). The data analysis showed that Yellowhammers were mainly ringed in winter until the 1940s and, since we were interested in the investigation of the breeding population, we did not analyze the trend of ringed birds for this species.

Corncrakes ringed in Europe

We collected data on 2916 Corncrakes ringed in Europe until 1995 (Table 2). Examining ringing data of other Ringing centres in Europe for example, former Czechoslovakia (1934 - 1993), we observed similar decrease in numbers (Fig. 4). Index values of combined data of all ringed Corncrakes ($n = 643$) in former Czechoslovakia, Croatia, Estonia, Hungary, Latvia, Lithuania, Norway, Poland and Switzerland show a significant decrease during the study period (Pearson product-moment correlation; $r^2 = 0.26$; $p < 0.00001$). If we remove Latvia from data pool, since it contributes roughly one third of the data ($n = 215$) and therefore drives the index, the observed pattern remains unchanged (Fig. 5) and a significant decrease is observed (Pearson product-moment correlation; $r^2 = 0.11$; $p < 0.01$). Correlation between index of ringed Corncrakes in Europe, excepting Latvia (former Czechoslovakia, Croatia, Estonia, Hungary, Lithuania, Norway, Poland and Switzerland),

and number of ringed Corncrakes in Latvia, is statistically significant (Pearson product-moment correlation; $r^2 = 0.12$; $p < 0.01$).

Discussion

Criticism of the use of ringing data

Ringing data are the only quantitative data on Corncrake numbers extending back as early as 1908 (Schenk 1908). Because of the advantage of the availability of a long time-series we used the ringing data to access population dynamics. Use of these data, however, has also disadvantages. First, ringing locations are not placed stationary within a country (ringing scheme) as survey sample plots, but might change over time, especially, if our main assumption of ringing as a random event is true. Second, area covered by some ringing schemes have changed in the 20th century due to changes of the political borders of European countries in World War I and World War II (main examples are Germany, Hungary and Poland). Third and most important, changes of the behaviour of ringers over time is impossible to quantify: many of the bird ringers in Latvia in the 1920s and 1930s were students spending their summer in the countryside, where they worked on the farm and might have had opportunity to ring farmland birds. Intensification of agriculture impacted not only bird populations, but also behaviour of people including bird ringers.

We tried to test our assumption of ringing of a Corncrake as a random event, by checking if ringers who ringed Corncrakes also ringed other farmland birds. Ringers who ringed at least one Corncrake ringed 51 % of ringed Meadow Pipits, 40 % of Common Whitethroats, 20 % of Whinchat and 18 % of Linnets. Corncrake pulli were ringed by 57 ringers (identity of ringers of five Corncrake pulli remains unknown). No single ringer has ringed more than 13 Corncrake pulli in a maximum of four years. On average a ringer had ringed Corncrake pulli in 1.3 years or 1.6 occasions. In 68 % of all cases a ringer had ringed only pulli from one clutch. On average one ringer had ringed 3.25 Corncrakes or 2.4 Corncrakes annually. For some ringed birds it was stated on the ringing report that birds were ringed after they have accidentally entered the backyard of the countryside house. The above suggest that most probably Corncrake ringing in Latvia was random – nobody was particularly looking for Corncrake juveniles in order to ring them, confirming our assumption in Latvia.

Table 3. Comparison of farmland bird species trends by the ringing data (1925–1995) in Latvia and expert estimate in Latvia and Europe [+1, small increase (20 - 49 %); -1, small decline (20 - 40 %); -2, large decline (at least 50 %); 0, stable (change < 20 %)]

Species	Ringing in		1970 - 1990		1990 - 2000	
	Latvia	Heath et al. 2000		Burfield, van Bommel 2004		
	1925 - 1995	Latvia	Europe	Latvia	Europe	
<i>Alauda arvensis</i>	-	0	-2	0	-1	
<i>Anthus pratensis</i>	+	0	0	-1	-1	
<i>Motacilla flava</i>	0	0	0	0	-1	
<i>Saxicola rubetra</i>	-	0	0	+1	-1	
<i>Sylvia communis</i>	+	0	0	+1	+1	
<i>Acanthis cannabina</i>	+	0	0	+1	+1	

We compared trends of ringed farmland passerine birds in Latvia in 1925 - 1995 (Fig. 3) with expert estimate (Table 3) of the trends for those six species in 1970 - 1990 (Heath et al. 2000) and 1990 - 2000 (Burfield, van Bommel 2004). The only of those six species not showing any significant changes in Latvia both by ringing data and expert opinion is Yellow Wagtail. This might support the use of ringing data in obtaining population trends, since it suggests that the population of Yellow Wagtail has not changed in numbers (expert opinion), which is correctly reflected by ringing data. We assume that ringers do ring Yellow Wagtails (as well as all of the six analysed passerine bird species) randomly, thus no trend in ringing data and no trend in expert opinion might support the assumption that

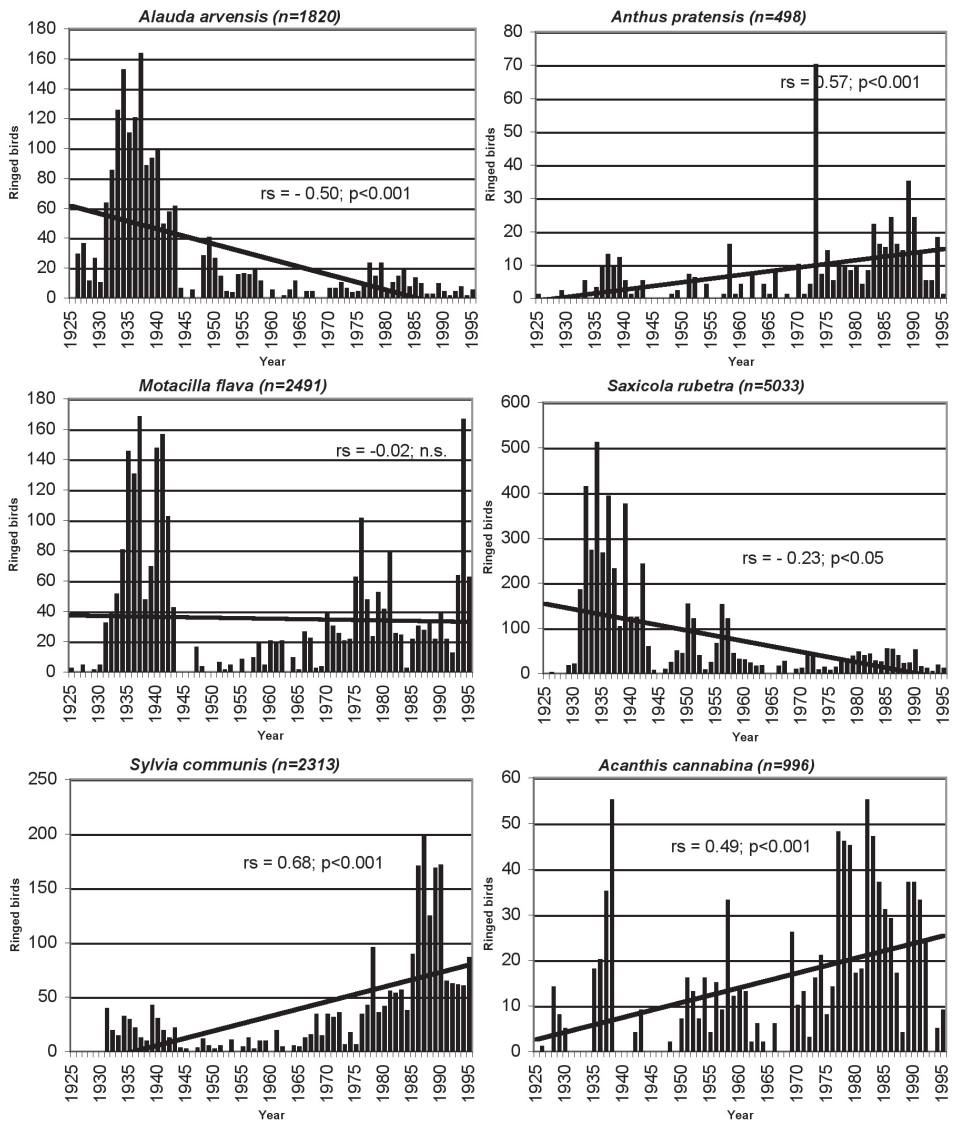


Fig. 3. Number of birds ringed by Bird ringing scheme of Latvia of six farmland bird species.

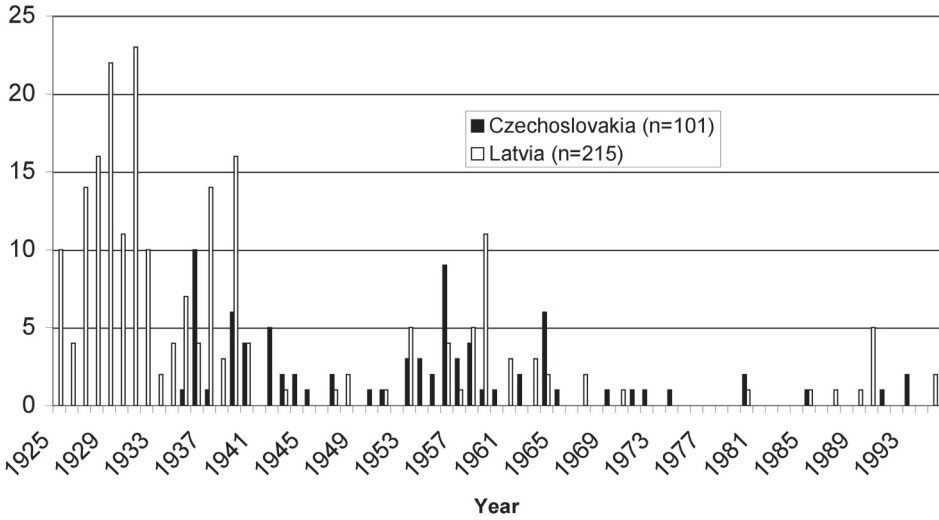


Fig. 4. Number of ringed Corncrakes in former Czechoslovakia (1934 - 1993) and Latvia (1925 - 1995).

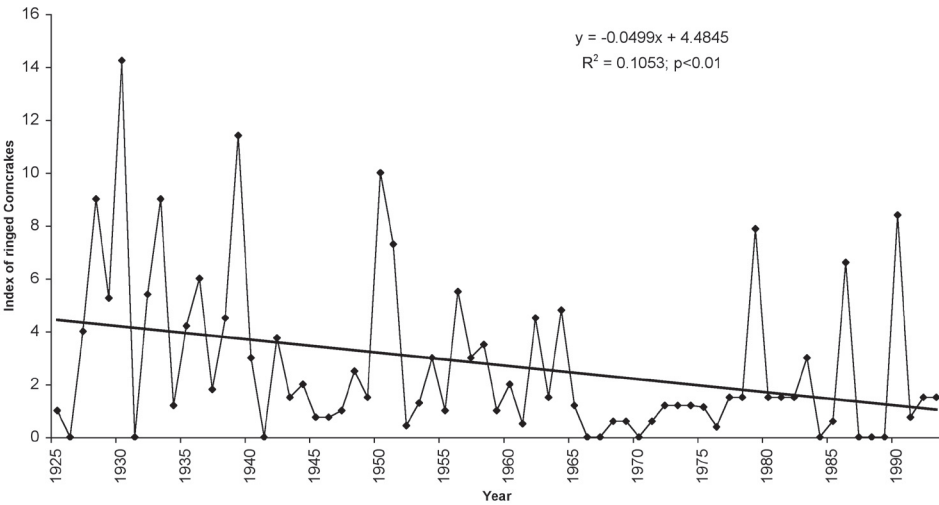


Fig. 5. Index of ringed Corncrakes in Europe (former Czechoslovakia, Croatia, Estonia, Hungary, Lithuania, Norway, Poland and Switzerland) 1925 - 1993.

ringers are still visiting wet meadows and ringing Yellow Wagtails at the same frequency. Therefore the decline in numbers of ringed Corncrakes does not reflect changes in ringer behaviour, but might truly reflect changes in population numbers. Three other species showed the same trend of ringed birds and population trends by the opinion of experts – decreasing for Skylark and increasing for Common Whitethroat and Linnet (Table 3). Meadow Pipit showed increase by the ringing trend, but decrease by expert opinion. In contrast Whinchat decreased by the ringing trend but increased by expert opinion. This might be explained by changes after 1995, which are not reflected in the trend of ringed

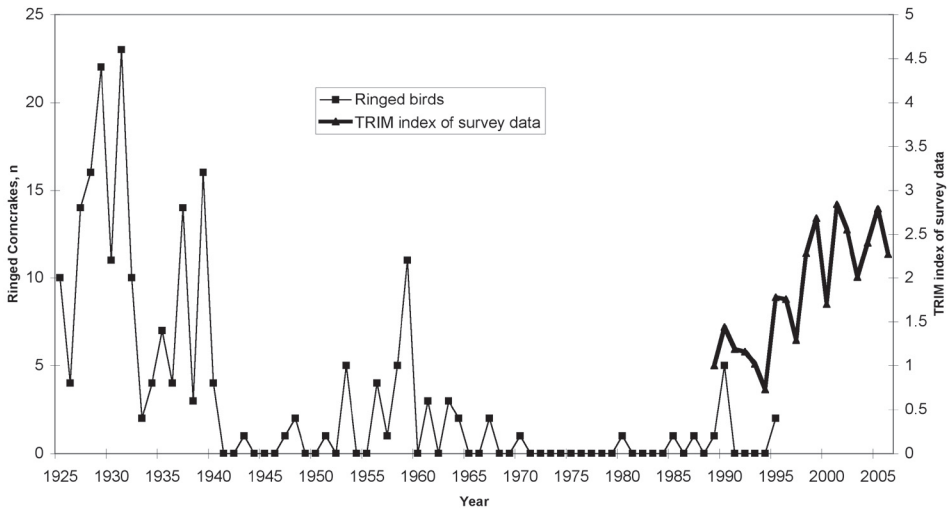


Fig. 6. Corncrakes ringed in Latvia (1925 - 1995) and TRIM index of Corncrake survey data in Latvia (1989 - 2006; Keišs 2006, modified).

birds, since ringing data after 1995 were not analysed. In general it is difficult to prove or disprove the use of ringing data for population trend analyses, since the same factors (intensification of agriculture and abandonment of agricultural lands) influence other species inhabiting similar habitats as Corncrakes and thus it is difficult to distinguish between decrease in population numbers and decrease in ringers activity.

Quantifying the decline of the Corncrake

Qualitatively there is no doubt that ringing data verify that there has been a decline of the Corncrake population both in Latvia and in Europe (Fig. 1, 2, 4, 5) as already reported in the literature (von Transehe 1965; Green et al. 1997). In our data (Fig. 1 - 5) we observed decline of ringing activities of all species during 1941 - 1950, which could be easily explained by World War II. The average index of ringed Corncrakes of all European countries for which data were available (including Latvia) showed a decline by about 5.5 times, if we compare 1925 - 1930 versus 1981 - 1990 (Fig. 6). Thus we can approximate that the population decline might have been the same. The other approximation by calculating decrease of available habitat (Keišs 2005; 2006) showed smaller decrease in Latvia by 1.5 - 3 times, but recent population density data for these calculations have been used, which might have decreased as well (Keišs 2006).

Acknowledgements

First we acknowledge ringers for their enthusiasm for bird ringing. The study was supported by the Royal Society for the Protection of Birds (United Kingdom), European Social fund and Swiss Baltic Net program of *Gebert Rűf Stiftung* (Switzerland). Swiss Ornithological institute (*Vogelwarte Sempach*) provided accommodation during the data collection in the library of the institute. We are grateful to the Elisabeth Wiprächtiger (Swiss Bird Ringing Scheme), Jaroslav Cepak (Czech Bird Ringing Scheme), Jari Valkama (Finish Bird Ringing Scheme) and Ričardas Patapavičius

(Lithuanian Bird Ringing Scheme) who kindly provided data gathered at their ringing centres. Māra Kazubierne and Juris Kazubiernis helped us to search the archives of the Ringing Centre of Latvia. Christian Marti helped with finding publications in the library of the Swiss Ornithological Institute. Verena Keller, Niklaus Zbinden and all other colleagues at the Swiss Ornithological institute are acknowledged for supporting Oskars Keišs during his research visit at the institute. Two anonymous referees provided useful comments to the manuscript.

References

- Alnās I. 1974. Die Ortstreue der gotländischen Wachtelkönige *Crex crex* (L.). *Ornis Scandinavica* 5: 123–129.
- Anonymous 1999a. Report of the Gdańsk Ringing scheme 1998. Unpublished report for Euring General meeting, Helgoland 1999.
- Anonymous 1999b. Report of the Gdańsk Ringing scheme 1999. Unpublished report for Euring General meeting, Helgoland 1999.
- Anonymous 2000. Report of the Gdańsk Ringing scheme 2000. Unpublished report for Euring General meeting, Helgoland 2000.
- Anonymous 2001. Report of the Gdańsk Ringing scheme 2001. Unpublished report for Euring General meeting, Helgoland 2001.
- Anonymous 2002. Report of the Gdańsk Ringing scheme 2002. Unpublished report for Euring General meeting, Helgoland 2002.
- Anonymous 2003. Report of the Gdańsk Ringing scheme 2003. Unpublished report for Euring General meeting, Helgoland 2003.
- Anonymous 2004. Report of the Gdańsk Ringing scheme 2004. Unpublished report for Euring General meeting, Helgoland 2004.
- van den Bergh L. 1991. Status, distribution and research on Corncrakes in the Netherlands. *Die Vogelwelt* 112: 78–83.
- Bub H. 1990. *Eine Geschichte der Beringungsliste*. Wilhelmshaven.
- Burfield I., van Bommel F. 2004. *Birds in Europe: Population Estimates, Trends and Conservation Status*. Birdlife International, Cambridge, UK. 374 pp.
- Buse P., Gromadzki M. 1966. Operation Baltic 1960–1964 Bird ringing report. *Acta Ornithologica* 9: 241–283.
- Czerniakiewicz A. 1983. Numbers of birds ringed and recovered by the Gdańsk ringing centre in 1983. Report of Euring Data Bank.
- Čikovič D., Kralj J. 2002. Results of Bird Ringing and Recoveries of ringed birds from 1998 till 2000 (32nd report). *Larus* 48: 55–71.
- Čikovič D., Radovič D. 1999. Results of Bird Ringing 1993 till 1997. *Larus* 47: 47–82.
- Deutsche Ornithologen–Gesellschaft 1992. Memorandum der Deutschen Ornithologen–Gesellschaft über die Vogelberingung in Deutschland. *J. Ornithologie* 133: 233–234.
- Dobrovalskaja E.V., Dobrykina I.N., Litvin K.E. 1978. Numbers of birds ringed and recovered by the Moscow ringing centre in 1978. Report of Euring Data Bank.
- Dobrovalskaja E.V., Litvin K.E. 1977. Numbers of birds ringed and recovered by the Moscow ringing centre in 1977. Report of Euring Data Bank.
- Dobrynina I.N. 1979. Numbers of birds ringed and recovered by the Moscow ringing centre in 1979. Report of Euring Data Bank.
- Dobrynina I.N. 1980. Numbers of birds ringed and recovered by the Moscow ringing centre in 1980. Report of Euring Data Bank.
- Dobrynina I.N. 1981. Numbers of birds ringed and recovered by the Moscow ringing centre in 1981. Report of Euring Data Bank.
- Dobrynina I.N. 1982. Numbers of birds ringed and recovered by the Moscow ringing centre in 1982. Report of Euring Data Bank.

- Domaniewski J. 1933. Compte rendu de l'activité de la Station pour l'Étude des Migrations des Oiseaux pour l'année 1932 (Résumé). *Acta Ornithologica Musei Zoologici Polonici* 1: 123–146.
- Domaniewski J. 1934. Compte rendu de l'activité de la Station pour l'Étude des Migrations des Oiseaux pour l'année 1933 (Résumé). *Acta Ornithologica Musei Zoologici Polonici* 1: 321–364.
- Domaniewski J. 1936. Compte rendu de l'activité de la Station pour l'Étude des Migrations des Oiseaux pour l'année 1934 (Résumé). *Acta Ornithologica Musei Zoologici Polonici* 1: 467–510.
- Domaniewski J., Kreczmer B. 1937. Compte rendu de l'activité de la Station pour l'Étude des Migrations des Oiseaux pour l'année 1935 (Résumé). *Acta Ornithologica Musei Zoologici Polonici* 2: 87–132.
- Enemar A. 1957. Grasshopper Warbler (*Locustella naevia*) and Corn-Crake (*Crex crex*) in Sweden in 1957. *Vår fågelvärld* 16: 269–287.
- Enemar A. 1969. The Corn-crake *Crex crex* in Sweden in 1968. *Vår fågelvärld* 28: 194–198.
- Fielder W., Hückler U., Maaß S. 1999. Vogelwarte Radolfzell Ringing & Recovery report 1992-1999. Unpublished. 21 pp.
- Fielder W., Hückler U., Maaß S. 2002. Vogelwarte Radolfzell Ringing & Recovery report 2000-2002. Unpublished. 19 pp.
- Foken W. 1981. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1981. Report of Euring Data Bank.
- Foken W. 1982. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1982. Report of Euring Data Bank.
- Foken W. 1983. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1983. Report of Euring Data Bank.
- Foken W. 1984. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1984. Report of Euring Data Bank.
- Foken W. 1985. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1985. Report of Euring Data Bank.
- Foken W. 1986. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1986. Report of Euring Data Bank.
- Foken W. 1987. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1987. Report of Euring Data Bank.
- Foken W. 1988. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1988. Report of Euring Data Bank.
- Foken W. 1989. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1989. Report of Euring Data Bank.
- Foken W. 1990. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1990. Report of Euring Data Bank.
- Foken W. 1991. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1991. Report of Euring Data Bank.
- Foken W. 1992. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1992. Report of Euring Data Bank.
- Foken W. 1993. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1993. Report of Euring Data Bank.
- Foken W. 1994. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1994. Report of Euring Data Bank.
- Foken W. 1995. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1995. Report of Euring Data Bank.
- Foken W. 1996. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1996. Report of Euring Data Bank.
- Foken W. 1997. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1997. Report of Euring Data Bank.
- Foken W. 1998. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1998.

- Report of Euring Data Bank.
- Formánek J., 1970. XIX Bericht der Beringungszentrale des Nationalmuseums in Prag und der Tschechoslowakischen Ornithologischen Gesellschaft für die Jahre 1964 und 1965. *Sylvia* 18: 135–213.
- Formánek J., 1971/72. XX Report of the bird-ringing centre of the National museum in Prague and the Czechoslovak ornithological society for 1966–1970. *Sylvia* 19: 7–82.
- Formánek J., Škopek J. 1990. XXI Report of the ringing centre of the national museum in Prague and the Czech Ornithological society for 1971–1975. *Sylvia* 27: 5–53.
- Formánek J., Škopek J. 1991. 22nd Report of the ringing centre of the National museum in Prague: 1976–80, non passeriformes. *Sylvia* 28: 5–30.
- Formánek J., Škopek J. 1993. 22nd Report of the ringing centre of the National museum in Prague: 1976–80, Passerines. *Sylvia* 29: 81–103.
- Fox J.B. 1993. Corncrake ringing near Dublin, 1939–1959. *Irish Birds* 5: 61–66.
- Green R.E., Rocamora G., Schäffer N. 1997. Populations, ecology and threats to the Corncrake *Crex crex* in Europe. *Die Vogelwelt* 118: 117–134.
- Gregory R.D., van Strien A., Voříšek P., Gmelig Meyling A.W., Noble D.G., Foppen R.P.B., Gibbons D.W. 2005. Developing indicators for European birds. *Phil. Trans. Royal Soc. B* 360: 269–288.
- Gromadska J., Kania W. 1975. Numbers of birds ringed and recovered by the Gdańsk ringing centre in 1975. Report of Euring Data Bank.
- Gromadska J., Kania W. 1976. Numbers of birds ringed and recovered by the Gdańsk ringing centre in 1976. Report of Euring Data Bank.
- Gromadzka J., Kachwicz B. 1978. Numbers of birds ringed and recovered by the Gdańsk ringing centre in 1978. Report of Euring Data Bank.
- Gromadzka J., Kachwicz B. 1979. Numbers of birds ringed and recovered by the Gdańsk ringing centre in 1979. Report of Euring Data Bank.
- Gromadzka J., Kachwicz B. 1980. Numbers of birds ringed and recovered by the Gdańsk ringing centre in 1980. Report of Euring Data Bank.
- Gromadzka J., Kachwicz B. 1981. Numbers of birds ringed and recovered by the Gdańsk ringing centre in 1981. Report of Euring Data Bank.
- Gromadzka J., Kachwicz B. 1982. Numbers of birds ringed and recovered by the Gdańsk ringing centre in 1982. Report of Euring Data Bank.
- Gurtovaya E.N. 1986. Bird ringing in the USSR 1986–1987.
- Gurtovaya E.N., Litvin K.E. 1988. Bird ringing by the Moscow ringing centre in 1988.
- Gurtovaya E.N., Litvin K.E. 1989. Bird ringing by the Moscow ringing centre in 1989.
- Gurtovaya E.N., Litvin K.E. 1990. Bird ringing by the Moscow ringing centre in 1990.
- Gurtovaya E.N., Litvin K.E. 1991. Bird ringing by the Moscow ringing centre in 1991.
- Gurtovaya E.N., Litvin K.E. 1992. Bird ringing by the Moscow ringing centre in 1992.
- Gurtovaya E.N., Litvin K.E. 1993. Bird ringing by the Moscow ringing centre in 1993.
- Gurtovaya E.N., Litvin K.E. 1994. Bird ringing by the Moscow ringing centre in 1994.
- Gurtovaya E.N., Litvin K.E. 1995. Bird ringing by the Moscow ringing centre in 1995.
- Gurtovaya E.N., Litvin K.E. 1996. Bird ringing by the Moscow ringing centre in 1996.
- Haapala J. 2001. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 2001. Report of Euring Data Bank.
- Halmos G., Karcza Z. 2004. 2002 report of the Hungarian bird ringing centre. *Aquila* 111: 167–194.
- Halmos G., Karcza Z., Simon L., Varga L. 2003. 2000–2001 report of the Hungarian Bird Ringing Centre. *Aquila* 109/110: 129–156.
- Harangi I. 1984. Numbers of birds ringed and recovered by the Budapest ringing centre in 1984. Report of Euring Data Bank.
- Harangi I., Haraszthy L. 1983. Numbers of birds ringed and recovered by the Budapest ringing centre in 1983. Report of Euring Data Bank.
- Haraszthy L., Harangi I., Radács A. 1982. Numbers of birds ringed and recovered by the Budapest

- ringing centre in 1982. Report of Euring Data Bank.
- Haraszthy L., Radács A., Schmidt E. 1980. Numbers of birds ringed and recovered by the Budapest ringing centre in 1980. Report of Euring Data Bank.
- Haraszthy L., Radács A., Schmidt E. 1981. Numbers of birds ringed and recovered by the Budapest ringing centre in 1981. Report of Euring Data Bank.
- Haraszthy L., Schmidt E. 1977. Numbers of birds ringed and recovered by the Budapest ringing centre in 1977. Report of Euring Data Bank.
- Haraszthy L., Schmidt E. 1978. Numbers of birds ringed and recovered by the Budapest ringing centre in 1978. Report of Euring Data Bank.
- Haraszthy L., Schmidt E. 1979. Numbers of birds ringed and recovered by the Budapest ringing centre in 1979. Report of Euring Data Bank.
- Heath M., Borggreve C., Peet N. 2000. European Bird Populations: Estimates and Trends. Birdlife International, Cambridge, UK.
- Hilton-Taylor C. 2000. IUCN Red List of threatened species. IUCN/SSC, Gland, Switzerland and Cambridge, UK. 62.
- Holgerson H. 1975. Numbers of birds ringed by the Stavanger Ringing centre in 1975. Report of Euring Data Bank.
- Holgerson H. 1976. Numbers of birds ringed by the Stavanger Ringing centre in 1976. Report of Euring Data Bank.
- Holgerson H. 1977. Numbers of birds ringed by the Stavanger Ringing centre in 1977. Report of Euring Data Bank.
- Holgerson H. 1978. Numbers of birds ringed by the Stavanger Ringing centre in 1978. Report of Euring Data Bank.
- Holgerson H. 1979. Numbers of birds ringed by the Stavanger Ringing centre in 1979. Report of Euring Data Bank.
- Hudson A. V., Stowe T. J., Aspinall S. J. 1990. Status and distribution of Corncrakes in Britain. *British Birds* 83: 173–186.
- Hudson R. 1977. Numbers of birds ringed and recovered by the London ringing centre in 1977. Report of Euring Data Bank.
- Hudson R. 1978. Numbers of birds ringed and recovered by the London ringing centre in 1978. Report of Euring Data Bank.
- Hudson R. 1979. Numbers of birds ringed and recovered by the London ringing centre in 1979. Report of Euring Data Bank.
- Hudson R. 1980. Numbers of birds ringed and recovered by the London ringing centre in 1980. Report of Euring Data Bank.
- Hudson R. 1981. Numbers of birds ringed and recovered by the London ringing centre in 1981. Report of Euring Data Bank.
- Härms M. 1939. Bericht über die Vogelberingung in Estland (Eesti) für die Jahre 1922-1937. *Annales Societatis Rebus Naturae Investigandis in Universitate Tartuensi Constitutae* XLIV: 185–303.
- Igalffy K. 1950. Results of the Ringing of Birds by the Ornithological Institute at Zagreb in 1948. (VIth report). *Larus* 3: 5–15.
- Jacoby H., Zink G. 1966. Beringungsbericht der Vogelwarte Radolfzell für die Jahre 1961 und übersicht 1947-1961. *Auspitium* 2: 179–194.
- Jirsík J. 1936. I Beringungsbericht der Tschechoslowakischen Ornithologischen Gesellschaft für die Jahre 1934 und 1935. *Sylvia* 1: 1–15.
- Jirsík J., Kadlec O. 1937. II Beringungsbericht der Tschechoslowakischen Ornithologischen Gesellschaft für das Jahr 1936. *Sylvia* 2: 1–19.
- Jirsík J., Kadlec O. 1938. III Beringungsbericht der Tschechoslowakischen Ornithologischen Gesellschaft für das Jahr 1937. *Sylvia* 3: 17–44.
- Jõgi A. 1957. Die Vogelberingung in der Estnischen SSR in den Jahren 1938-1955. *Loodusuurijate Selts Eesti NSV Teaduste Akadeemia Juures Abiks Loodusevaatlajale* Nr. 33. Tartu. 84 S.

- Kadlec O. 1939. IV Beringungsbericht der Tschechischen Ornithologischen Gesellschaft für das Jahr 1938. *Sylvia* 4: 33–59.
- Kadlec O. 1940. V Beringungsbericht der Tschechischen Ornithologischen Gesellschaft für das Jahr 1939. *Sylvia* 5: 49–76.
- Kadlec O. 1947/48. VII Compte rendu du baguage de la Société Tchecoslovaque Ornithologique pendant l'année 1941. *Sylvia* 9-10: 1–32.
- Kadlec O. 1951. VIII Compte rendu du baguage de la Société Tchecoslovaque Ornithologique pendant l'année 1942. *Sylvia* 13: 33–70.
- Kadlec O. 1958. X Beringungsbericht der Tschechoslowakischen Ornithologischen Gesellschaft für das Jahr 1947. *Sylvia* 15: 171–204.
- Kadlec O. 1959. XI Beringungsbericht der Tschechoslowakischen Ornithologischen Gesellschaft für das Jahr 1948. *Sylvia* 16: 203–244.
- Kadlec O., Bašová D. 1965. XIV Bericht der Beringungsstation der Tschechoslowakischen Ornithologischen Gesellschaft und des Nationalmuseums-Praha für die Jahre 1951–1952. *Sylvia* 17: 107–206.
- Kadlec O., Klůz Z. 1941. VI Beringungsbericht der Tschechischen Ornithologischen Gesellschaft für das Jahr 1940. *Sylvia* 6: 33–63.
- Kania W., Surdyk A. 1977. Numbers of birds ringed and recovered by the Gdansk ringing centre in 1977. Report of Euring Data Bank.
- Kastepõld T. 1975. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1975. Report of Euring Data Bank.
- Kastepõld T. 1976. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1976. Report of Euring Data Bank.
- Kastepõld T. 1977. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1977. Report of Euring Data Bank.
- Kastepõld T. 1978. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1978. Report of Euring Data Bank.
- Kastepõld T. 1979. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1979. Report of Euring Data Bank.
- Kastepõld T. 1980. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1980. Report of Euring Data Bank.
- Kastepõld T. 1981. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1981. Report of Euring Data Bank.
- Kastepõld T. 1982. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1982. Report of Euring Data Bank.
- Kastepõld T. 1983. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1983. Report of Euring Data Bank.
- Kastepõld T. 1984. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1984. Report of Euring Data Bank.
- Kastepõld T. 1985. Numbers of birds ringed and recovered by the Matsalu ringing centre in 1985. Report of Euring Data Bank.
- Kastepõld T., Kastepõld E. 1990. Estonia Matsalu 1987. Ringing report No. 18. Valgus, Tallin. 150 p.
- Kastepõld T., Kastepõld E. 1991. The bird ringing in Estonia 1968-1979 (with the Moskwa rings). Matsalu Riiklik Looduskaitseala, Tallin. 140 p.
- Kastepõld T., Kastepõld E. 1992. Estonia Matsalu 1990. Ringing report No. 21. Matsalu Riiklik Looduskaitseala, Tallin. 116 p.
- Kastepõld T., Kastepõld E. 1999. Estonia Matsalu 1996/97. Ringing report No. 27/28. Matsalu Riiklik Looduskaitseala, Lihula.
- Kastepõld T., Kastepõld E. 2000. Estonia Matsalu 1998. Ringing report No. 29. Matsalu Riiklik Looduskaitseala, Lihula. 84 p.
- Kastepõld T., Kastepõld E. 2001a. Estonia Matsalu 1999. Ringing report No. 30. Matsalu Riiklik

- Looduskaitseala, Lihula. 71 p.
- Kastepõld T., Kastepõld E. 2001b. Estonia Matsalu 2000. Ringing report No. 31. Matsalu Riiklik Looduskaitseala, Lihula. 104 p.
- Kastepõld E., Kastepõld T., Mann M. 1998a. Estonia Matsalu 1994. Ringing report No. 25. Matsalu Riiklik Looduskaitseala, Tallin. 131 p.
- Kastepõld E., Kastepõld T., Mann M. 1998b. Estonia Matsalu 1995. Ringing report No. 26. Matsalu Riiklik Looduskaitseala, Tallin.
- Kazubiernis J., 1989. Putnu gredzenošana Latvijā (1925-1986). *Putni dabā* 2: 135–165.
- Keišs O. 2004. Results of a survey of Corncrake *Crex crex* in Latvia, 1989-1995. *Bird Census News* 13: 73–76.
- Keišs O. 2005. Impact of changes in agricultural land use on the Corncrake *Crex crex* population in Latvia. *Acta Univ. Latv.* 691: 93–109.
- Keišs O. 2006. Impact of changes in agriculture on the Corncrake *Crex crex* (L.) population in Latvia: population dynamics, habitat selection and population structure (in Latvian with German and English summaries). University of Latvia, PhD dissertation. 100 p.
- Keišs O., Granāts J., Mednis A., 2004. Use of biometrical data to study Corncrake *Crex crex* population in Latvia. *Acta Univ. Latv.* 676: 119–126.
- Keve A. 1954. XV. Report on the Bird-Banding in Hungary. *Aquila* 55-58: 89–107.
- Kletečki E. 1988. Results of Bird Ringing 1983-1985, XXVI report. *Larus* 38-39: 7–24.
- Kletečki E., Sirotič G. 1976. Numbers of birds ringed and recovered by the Zagreb ringing centre in 1976. Report of Euring Data Bank.
- Kletečki E., Sirotič G. 1978. Numbers of birds ringed and recovered by the Zagreb ringing centre in 1978. Report of Euring Data Bank.
- Kletečki E., Sirotič G. 1980. Numbers of birds ringed and recovered by the Zagreb ringing centre in 1980. Report of Euring Data Bank.
- Kletečki E., Sirotič G. 1982. Numbers of birds ringed and recovered by the Zagreb ringing centre in 1982. Report of Euring Data Bank.
- Kroneisl R. 1948. Résultats du baguage des oiseaux de l'institut Ornithologique de Zagreb en 1947. *Larus* 2: 9–21.
- Kroneisl R. 1952. Results of the bird-banding carried out by the Ornithological Institut at Zagreb in 1949 and 1950. VIIth report. *Larus* 4-5: 5–31.
- Kroneisl–Rucker R. 1954. Results of the bird-banding carried out by the Ornithological Institut at Zagreb in 1951–1952. VIIIth report. *Larus* 6-7: 5–30.
- Kroneisl–Rucker R. 1956. Bird banding in 1953: 1. Results of the bird-banding carried out by the Ornithological Institut at Zagreb, IXth report; 2. Foreign recoveries in Yugoslavia, Vth report. *Larus* 8: 5–26.
- Kroneisl–Rucker R. 1957. Bird banding in 1954 and 1955: 1. Results of the bird-banding carried out by the Ornithological Institut at Zagreb, Xth report; 2. Foreign recoveries in Yugoslavia, VIth report; 3. Supplement to the Vth Report of foreign recoveries. *Larus* 9-10: 7–33.
- Kroneisl–Rucker R. 1959. Bird banding in 1956: 1. Results of the bird-banding carried out by the Ornithological Institut, Department of the Zoological Museum at Zagreb, XIth report; 2. Foreign recoveries made in Yugoslavia, VIIth report. *Larus* 11: 5–22.
- Kroneisl–Rucker R. 1960. Bird banding in 1957 and 1958: 1. Results of the bird-banding carried out by the Ornithological Institut, Department of the Zoological Museum at Zagreb, XIIth report; 2. Foreign recoveries made in Yugoslavia, VIIIth report. *Larus* 12-13: 7–35.
- Kroneisl–Rucker R. 1962. Bird banding in 1959: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, XIIIth report; 2. Foreign recoveries in Yugoslavia, IXth report. *Larus* 14: 7–24.
- Kumari A., Jõgi A. 1974. Die Vogelberingung in der Estnischen SSR in den Jahren 1956-1967. Loodusuuriate Selts Eesti NSV Teaduste Akadeemia Juures Abiks Loodusevaatlajale Nr. 67. Tartu, 240 S.

- Köppen U. 1989. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1989. Report of Euring Data Bank.
- Köppen U. 1990. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1990. Report of Euring Data Bank.
- Köppen U. 1991. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1991. Report of Euring Data Bank.
- Köppen U. 1992. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1992. Report of Euring Data Bank.
- Köppen U. 1993. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1993. Report of Euring Data Bank.
- Köppen U. 1994. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1994. Report of Euring Data Bank.
- Köppen U. 1995. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1995. Report of Euring Data Bank.
- Köppen U. 1996. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1996. Report of Euring Data Bank.
- Köppen U. 1997. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1997. Report of Euring Data Bank.
- Köppen U. 1998. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1998. Report of Euring Data Bank.
- Köppen U. 1999. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1999. Report of Euring Data Bank.
- Köppen U. 2000. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 2000. Report of Euring Data Bank.
- Köppen U. 2001. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 2001. Report of Euring Data Bank.
- Köppen U. 2002. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 2002. Report of Euring Data Bank.
- Köppen U. 2003. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 2003. Report of Euring Data Bank.
- Köppen U. 2004. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 2004. Report of Euring Data Bank.
- Mason A. G. 1941. Further experiments with Corncrakes. *Irish Naturalists' Journal* 8: 321–333.
- Mason A. G. 1947. Note on Corncrakes. *British Birds* 40: 191–192.
- Mason A. G. 1950. The behaviour of Corncrakes. *British Birds* 43: 70–78.
- Nordström G. 1957. Die Vogelberingung in Finland im Jahre 1955. *Memoranda Societatis pro fauna et Flora Fennica* 32: 62–98.
- Nordström G. 1958. Die Vogelberingung in Finland im Jahre 1956. *Memoranda Societatis pro fauna et Flora Fennica* 33: 69–108.
- Nordström G. 1959. Die Vogelberingung in Finland im Jahre 1957. *Memoranda Societatis pro fauna et Flora Fennica* 34: 2–48.
- Nordström G. 1960. Die Vogelberingung in Finland im Jahre 1958. *Memoranda Societatis pro fauna et Flora Fennica* 35: 2–63.
- Nordström G. 1961. Die Vogelberingung in Finland im Jahre 1959. *Memoranda Societatis pro fauna et Flora Fennica* 36: 32–106.
- Nordström G. 1962. Die Vogelberingung in Finland im Jahre 1960. *Memoranda Societatis pro fauna et Flora Fennica* 37: 166–252.
- Nordström G. 1963. Die Vogelberingung in Finland im Jahre 1961. *Memoranda Societatis pro fauna et Flora Fennica* 39: 4–128.
- Nordström G. 1964. Die Vogelberingung in Finland im Jahre 1962. *Memoranda Societatis pro fauna et Flora Fennica* 40: 5–176.

- Nordström G. 1965. Die Vogelberingung in Finland im Jahre 1963. *Memoranda Societatis pro fauna et Flora Fennica* 41: 110–238.
- Nordström G. 1966. Die Vogelberingung in Finland im Jahre 1964. *Memoranda Societatis pro fauna et Flora Fennica* 42: 55–163.
- Nordström G., Ilkka S. 1967. Die Vogelberingung in Finland im Jahre 1965. *Memoranda Societatis pro fauna et Flora Fennica* 43: 105–220.
- Pannekoek J., van Strien A.J. 2001. TRIM 3 manual: TRends and Indices for Monitoring data. Research paper No.: 0102. Statistics Netherlands, Voorburg. 58 p.
- Pátkai I. 1955. XVIIth Report on Bird-Banding in Hungary. *Aquila* 59-62: 253–273.
- Priednieks J., Strazds M., Strazds A., Petriņš A., Viksne J. (ed) 1989. *Latvian Breeding Bird Atlas*. Zinātne, Rīga. 352 p.
- Prünte W. 1972. Wachtelkönig: biometrische Ergebnisse und oekologische Randbemerkungen. *Anthus* 9: 73–76.
- Pörner H. 1979. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1979. Report of Euring Data Bank.
- Pörner H. 1980. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1980. Report of Euring Data Bank.
- Pörner H. 1981. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1981. Report of Euring Data Bank.
- Pörner H. 1982. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1982. Report of Euring Data Bank.
- Radovič D. 1990. Results of bird ringing 1988-1989, 28th report. *Larus* 41-42: 1–19.
- Radovič D. 1991. Results of bird ringing in 1990 – 29th report. *Larus* 43: 1–18.
- Radovič D., Kralj J., Tutiš V., Sušič G., Pongrac Z. 1993. Results of bird ringing 1991 and 1992. *Larus* 44–45: 1–12.
- Radovič D., Sušič G. 1989. Results of Bird Ringing 1986-1987, XXVII report. *Larus* 40: 35–52.
- Reiser K.H. 1971. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1967. *Auspicium* 4: 265–271.
- Reiser K.H. 1972. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1968. *Auspicium* 4: 367–374.
- Reiser K.H. 1973. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1969. *Auspicium* 5: 3–9.
- Reiser K.H. 1974a. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1970. *Auspicium* 5: 167–181.
- Reiser K.H. 1974b. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1971. *Auspicium* 5: 297–313.
- Reiser K.H. 1975. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1972. *Auspicium* 5: 353–368.
- Reiser K.H. 1977. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1973. *Auspicium* 6: 107–123.
- Rogall A. 1975. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1975. Report of Euring Data Bank.
- Rogall A. 1976. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1976. Report of Euring Data Bank.
- Rogall A. 1977. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1977. Report of Euring Data Bank.
- Rogall A. 1978. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1978. Report of Euring Data Bank.
- Rogall A. 1979. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1979. Report of Euring Data Bank.
- Rogall A. 1980. Numbers of birds ringed and recovered by the Helgoland Ringing centre in 1980.

- Report of Euring Data Bank.
- Rogall H., Rogall A., Loskamp F. 1978. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1975 und Gesamtberingungszahlen für die Jahre 1909-1975. *Auspicium* 6: 295-311.
- Rogall H., Rogall A., Loskamp F. 1979. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1976 und Gesamtberingungs- und Wiederfundzahlen für die Jahre 1909-1976. *Auspicium* 6: 379-402.
- Rogall H., Rogall A., Loskamp W. 1977. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1974 und Gesamtberingungszahlen für die Jahre 1909-1974. *Auspicium* 6: 199-215.
- Runde O. J. 1980. Numbers of birds ringed by the Stavanger Ringing centre in 1980. Report of Euring Data Bank.
- Runde O. J. 1981. Numbers of birds ringed by the Stavanger Ringing centre in 1981. Report of Euring Data Bank.
- Runde O. J. 1982. Numbers of birds ringed by the Stavanger Ringing centre in 1982. Report of Euring Data Bank.
- Rydzewski W. 1938. Compte rendu de l'activité de la Station pour l'Étude des Migrations des Oiseaux pour l'année 1936 (Résumé). *Acta Ornithologica Musei Zoologici Polonici* 2: 261-317.
- Rydzewski W. 1939. Compte rendu de l'activité de la Station pour l'Étude des Migrations des Oiseaux pour l'année 1937 (Résumé). *Acta Ornithologica Musei Zoologici Polonici* 2: 431-527.
- Rydzewski W. 1949a. Compte rendu de l'activité de la Station pour l'Étude des Migrations des Oiseaux pour l'année 1938 (Résumé). *Acta Ornithologica Musei Zoologici Polonici* 4: 1-113.
- Rydzewski W. 1949b. Compte rendu de l'activité de la Station pour l'Étude des Migrations des Oiseaux pour l'année 1939 (Résumé). *Acta Ornithologica Musei Zoologici Polonici* 4: 115-221.
- Saurola P. 1975. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1975. Report of Euring Data Bank.
- Saurola P. 1976. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1976. Report of Euring Data Bank.
- Saurola P. 1977. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1977. Report of Euring Data Bank.
- Saurola P. 1978. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1978. Report of Euring Data Bank.
- Saurola P. 1979. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1979. Report of Euring Data Bank.
- Saurola P. 1980. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1980. Report of Euring Data Bank.
- Saurola P. 1981. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1981. Report of Euring Data Bank.
- Saurola P. 1982. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1982. Report of Euring Data Bank.
- Saurola P. 1983. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1983. Report of Euring Data Bank.
- Saurola P. 1984. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1984. Report of Euring Data Bank.
- Saurola P. 1985. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1985. Report of Euring Data Bank.
- Saurola P. 1986. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1986. Report of Euring Data Bank.
- Saurola P. 1987. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1987. Report of Euring Data Bank.
- Saurola P. 1988. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1988. Report of Euring Data Bank.
- Saurola P. 1989. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1989.

- Report of Euring Data Bank.
- Saurola P. 1990. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1990. Report of Euring Data Bank.
- Saurola P. 1991. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1991. Report of Euring Data Bank.
- Saurola P. 1993. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1993. Report of Euring Data Bank.
- Saurola P. 1994. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1994. Report of Euring Data Bank.
- Saurola P. 1995. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1995. Report of Euring Data Bank.
- Saurola P. 1996. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1996. Report of Euring Data Bank.
- Saurola P. 1997. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1997. Report of Euring Data Bank.
- Saurola P. 1999. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 1999. Report of Euring Data Bank.
- Saurola P. 2000. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 2000. Report of Euring Data Bank.
- Schenk J. 1908. Bericht über die Vogelmarkierungen im Jahre 1908. *Aquila* 15: 294–301.
- Schenk J. 1909. Bericht über die Vogelmarkierungen im Jahre 1909. *Aquila* 16: 245–276.
- Schenk J. 1910. Bericht über die Vogelmarkierungen im Jahre 1910. *Aquila* 17: 219–257.
- Schenk J. 1911. Bericht über die Vogelmarkierungen im Jahre 1911. *Aquila* 18: 326–355.
- Schenk J. 1912. Bericht über die Vogelmarkierungen der Königlich Ungarischen Ornithologischen Zentrale im Jahre 1912. *Aquila* 19: 321–368.
- Schenk J. 1913. Bericht über die Vogelmarkierungen der Königlich Ungarischen Ornithologischen Zentrale im Jahre 1913. *Aquila* 20: 434–469.
- Schenk J. 1916. Die Vogelmarkierungen der Königlich Ungarischen Ornithologischen Zentrale in den Jahren 1914 und 1915. *Aquila* 22: 270–328.
- Schenk J. 1924. Bericht über die Ungarischen Vogelberingungen im Jahre 1923. *Aquila* 30-31: 145–176.
- Schenk J. 1926. Bericht über die ungarischen Vogelberingungen in Ungarn in den Jahren 1924 und 1925. *Aquila* 32-33: 24–65.
- Schenk J. 1929. Die Vogelberingungen in Ungarn in den Jahren 1926–27. *Aquila* 34-35: 16–85.
- Schenk J. 1930. Die Vogelberingungen des Königlich Ungarischen Ornithologischen Institutes in den Jahren 1928-30. *Aquila* 36-37: 170–209.
- Schenk J. 1934. Die Vogelberingungen des Königlich Ungarischen Ornithologischen Institutes in den Jahren 1931-1932. *Aquila* 38-41: 32–114.
- Schloss W. 1968a. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1964. *Auspicium* 2: 267–272.
- Schloss W. 1968b. Beringungsbericht der Vogelwarte Helgoland für das Jahr 1966. *Auspicium* 2: 357–363.
- Schmidt E. 1975. Numbers of birds ringed and recovered by the Budapest Ringing centre in 1975. Euring Data Bank.
- Schmidt E. 1976. Numbers of birds ringed and recovered by the Budapest ringing centre in 1976. Euring Data Bank.
- Schäffer N., Koffijberg K. 2004. *Crex crex* Corncrake. *BWP Update* 6: 57–78.
- Siefke A. 1975. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1975. Report of Euring Data Bank.
- Siefke A. 1976. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1976. Report of Euring Data Bank.

- Siefke A. 1977. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1977. Report of Euring Data Bank.
- Siefke A., Pörner H. 1978. Numbers of birds ringed and recovered by the Hidensee Ringing centre in 1978. Report of Euring Data Bank.
- Simon L. 2002. 1998–1999 report of Hungarian Bird Ringing Centre: the 39th ringing report. *Aquila* 107-108: 71–102.
- Sirotič G., Kletečki E. 1975. Numbers of birds ringed and recovered by the Zagreb ringing centre in 1975. Report of Euring Data Bank.
- Sirotič G., Kletečki E. 1977. Numbers of birds ringed and recovered by the Zagreb ringing centre in 1977. Report of Euring Data Bank.
- Sirotič G., Kletečki E. 1979. Numbers of birds ringed and recovered by the Zagreb ringing centre in 1979. Report of Euring Data Bank.
- Speek B.J. 1975. Ringverslag No.60: 1975. Vogeltrekstation, Instituut voor oecologisch onderzoek. Kemperbergweg 67, Arnhem.
- Speek B.J. 1976. Ringverslag No.61: 1976. Vogeltrekstation, Instituut voor oecologisch onderzoek. Kemperbergweg 67, Arnhem.
- Speek B.J. 1977. Ringverslag No.62: 1977. Vogeltrekstation, Instituut voor oecologisch onderzoek. Kemperbergweg 67, Arnhem.
- Speek B.J. 1978. Ringverslag No.63: 1978. Vogeltrekstation, Instituut voor oecologisch onderzoek. Kemperbergweg 67, Arnhem.
- Speek B.J. 1979. Ringverslag No.64: 1979. Vogeltrekstation, Instituut voor oecologisch onderzoek. Kemperbergweg 67, Arnhem.
- Speek B.J. 1980. Ringverslag No.65: 1980. Vogeltrekstation, Instituut voor oecologisch onderzoek. Kemperbergweg 67, Arnhem.
- Speek B.J. 1981. Ringverslag No.66: 1981. Vogeltrekstation, Instituut voor oecologisch onderzoek. Kemperbergweg 67, Arnhem.
- Spencer R. 1975. Numbers of birds ringed and recovered by the London ringing centre in 1975. Report of Euring Data Bank.
- Spencer R. 1976. Numbers of birds ringed and recovered by the London ringing centre in 1976. Report of Euring Data Bank.
- Spuris Z.D. 1962. Bird ringing in the Latvian SSR in the years 1950-1960. *Ornitologičeskije issledovanija* 3: 5–21. (in Russian)
- Stolt B.O. 1989. Report on Swedish bird–ringing for 1985. Bird–ringing centre, Swedish Museum of Natural History. 128 p.
- Stolt B.O. 1990a. Report on Swedish bird–ringing for 1986. Bird–ringing centre, Swedish Museum of Natural History. 124 p.
- Stolt B.O. 1990b. Report on Swedish bird–ringing for 1987. Bird–ringing centre, Swedish Museum of Natural History. 128 p.
- Stolt B.O., Ekström L., Fransson T., Kroon C., Staav R., Sällström B., Sällström U. B. 1996. Report on Swedish bird ringing for 1994. Bird–ringing centre, Swedish Museum of Natural History, Stockholm 150 p.
- Stolt B.O., Ekström L., Fransson T., Kroon C., Staav R., Sällström B., Sällström U. B. 1997. Report on Swedish bird ringing for 1995. Bird–ringing centre, Swedish Museum of Natural History, Stockholm 150 p.
- Stolt B.O., Ekström L., Fransson T., Kroon C., Staav R., Sällström B., Sällström U.B., 1998. Report on Swedish bird ringing for 1996. Bird–ringing centre, Swedish Museum of Natural History, Stockholm 158 p.
- Stolt B.O., Ekström L., Fransson T., Malmgren B., Staav R., Sällström B., Sällström U. B. 1991. Report on Swedish bird ringing for 1988. Bird–ringing centre, Swedish Museum of Natural History, Stockholm 124 p.
- Stolt B.O., Ekström L., Fransson T., Malmgren B., Staav R., Sällström B., Sällström U. B. 1992. Report

- on Swedish bird ringing for 1989. Bird-ringing centre, Swedish Museum of Natural History, Stockholm 132 p.
- Stolt B.O., Ekström L., Fransson T., Staav R., Sällström B., Sällström U. B. 1995. Report on Swedish bird ringing for 1993. Bird-ringing centre, Swedish Museum of Natural History, Stockholm. 148 p.
- Stolt B.O., Fernholm B. 1989. Report on Swedish bird-ringing for 1984. Bird-ringing centre, Swedish Museum of Natural History. 112 p.
- Strien A., Pannekoek J., Hagemeyer W., Verstraal T. 2004. A loglinear Poisson regression method to analyse bird monitoring data. *Bird Census News* 13: 33–39.
- Szczepski J.B. 1951. Compte rendu de l'activité de la Station Ornithologique pour les années 1945–1948. *Acta Ornithologica Musei Zoologici Polonici* 4: 237–272.
- Szczepski J.B. 1970. Report of the Ornithological Station for 1955–1957. *Acta Ornithologica* 12: 103–175.
- Szczepski J.B. 1976. Report of the Ornithological Station in Górkki Wschodnie for 1958–1962. *Acta Ornithologica* 15: 145–276.
- Szczepski J.B., Szczepaska M. W. 1953. Compte rendu de l'activité de la Station Ornithologique pour les années 1949. *Acta Ornithologica Musei Zoologici Polonici* 4: 273–310.
- Szczepski J.B., Szczepaska M. W. 1956. Compte rendu de l'activité de la Station Ornithologique pour les années 1950. *Acta Ornithologica* 5: 77–112.
- Szczepski J.B., Szczepaska M. W. 1957. Compte rendu de l'activité de la Station Ornithologique pour les années 1951. *Acta Ornithologica* 5: 161–209.
- Szczepski J.B., Szczepaska M. W. 1959. Compte rendu de l'activité de la Station Ornithologique pour les années 1952. *Acta Ornithologica* 5: 233–282.
- Szczepski J.B., Szczepaska M. W. 1963. Compte rendu de l'activité de la Station Ornithologique pour les années 1953. *Acta Ornithologica* 7: 387–426.
- Szczepski J.B., Szczepaska M. W. 1965. Compte rendu de l'activité de la Station Ornithologique pour les années 1954. *Acta Ornithologica* 9: 187–226.
- Škopek J., Formánek J. 1995. Selected results of specialized ringing in 1994. *Zprávy ČSO* 41: 32–33.
- Štormar L. 1963. Bird banding in 1960: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, XIVth report; 2. Foreign recoveries in Yugoslavia, 10th report. *Larus* 15: 7–26.
- Štormar L. 1965. Bird banding in 1961 and 1962: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, XVth report; 2. Foreign recoveries in Yugoslavia, 11th report. *Larus* 16–18: 5.
- Štormar L. 1967. Bird banding in 1963 and 1964: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, XVIth report; 2. Foreign recoveries in Yugoslavia, 12th report. *Larus* 19: 5–43.
- Štormar L. 1968. Bird banding in 1965: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, XVIIth report; 2. Foreign recoveries in Yugoslavia, 13th report. *Larus* 20: 5–27.
- Štormar L. 1970. Bird banding in 1966: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, 18th report; 2. Foreign recoveries in Yugoslavia, 14th report. *Larus* 21–22: 5–30.
- Štormar L. 1971. Bird banding in 1967 and 1968: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, 19th report; 2. Foreign recoveries in Yugoslavia, 15th report. *Larus* 23: 5–37.
- Štormar L. 1972. Bird banding in 1969: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, 20th report; 2. Foreign recoveries in Yugoslavia, 16th report. *Larus* 24: 5–30.
- Štormar L. 1973. Bird banding in 1970: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, 21st report; 2. Foreign recoveries

- in Yugoslavia, 17th report. *Larus* 25: 5–26.
- Štromar L. 1975. Bird banding in 1971 and 1972: 1. Results of the bird banding carried out by the Ornithological Department of the biological institute of the University of Zagreb, 22nd report; 2. Foreign recoveries in Yugoslavia, 18th report. *Larus* 26-28: 5–43.
- Štromar L. 1977. Bird banding in 1973: 1. Results of the bird banding carried out by the Institute of Ornithology of the Yugoslav Academy of Sciences and arts, Zagreb, XXIII Report; 2. Foreign recoveries in Yugoslavia, 19th Report. *Larus* 29-30: 295–321.
- Štromar L. 1980. Bird banding in 1974 and 1975: 1. Results of the bird banding XXIV Report; 2. Foreign recoveries in Yugoslavia, 20th Report. *Larus* 31–32: 9–53.
- von Transehe N. 1939. Latvijas Ornitoloģijas centrāles darbības pārskats (1925-1936). Latvijas Ornitoloģijas centrāle, Rīga 160 lpp.
- von Transehe N. 1940. Latvijas Ornitoloģijas centrāles 2. darbības pārskats (1937-1939). Latvijas Ornitoloģijas centrāle, Rīga 65 lpp.
- von Transehe N. 1965. Die Schnarrwachtel *Crex crex* [*C. pratensis*]. In: von Transehe N. *Die Vögelwelt Lettlands*. Verlag Harro von Hirschheydt, Hannover–Döhren, S. 158–159.
- Valkama J. 2002. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 2002. Report of Euring Data Bank.
- Valkama J. 2003. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 2003. Report of Euring Data Bank.
- Valkama J. 2004. Numbers of birds ringed and recovered by the Helsinki Ringing centre in 2004. Report of Euring Data Bank.
- Vilks K., Pētersons I. 1943. III Tätigkeitsbericht der Lettländischen Ornithologischen Zentrale (1940 und 1941). *Folia Zoologica et Hydrobiologica* XII: 78–87.
- Vronskii N.V. 1975. Numbers of birds ringed and recovered by the Moscow ringing centre in 1975. Report of Euring Data Bank.
- Vronskii N.V. 1976. Numbers of birds ringed and recovered by the Moscow ringing centre in 1976. Report of Euring Data Bank.
- Välikangas I. 1931. Die Vogelberingung in Finland im Jahre 1928. *Memoranda Societatis pro Fauna et flora Fennica* 6: 7–25.
- Välikangas I., Huuskonen H. 1952. Die Vogelberingung in Finland in den Jahren 1948 und 1949. *Memoranda Societatis pro Fauna et Flora Fennica* 27: 54–60.
- Välikangas I., Hytönen O. 1932. Die Vogelberingung in Finland im Jahre 1929. *Memoranda Societatis pro Fauna et Flora Fennica* 7: 6–26.
- Välikangas I., Hytönen O. 1933. Die Vogelberingung in Finland im Jahre 1930. *Memoranda Societatis pro Fauna et Flora Fennica* 8: 100–136.
- Välikangas I., Hytönen O. 1934. Die Vogelberingung in Finland im Jahre 1931. *Memoranda Societatis pro Fauna et Flora Fennica* 9: 33–67.
- Välikangas I., Hytönen O. 1935. Die Vogelberingung in Finland im Jahre 1932. *Memoranda Societatis pro Fauna et Flora Fennica* 10: 99–137.
- Välikangas I., Hytönen O. 1936. Die Vogelberingung in Finland im Jahre 1933. *Memoranda Societatis pro Fauna et Flora Fennica* 11: 58–96.
- Välikangas I., Hytönen O. 1937. Die Vogelberingung in Finland im Jahre 1934. *Memoranda Societatis pro Fauna et Flora Fennica* 12: 75–106.
- Välikangas I., Hytönen O. 1938. Die Vogelberingung in Finland im Jahre 1935. *Memoranda Societatis pro Fauna et Flora Fennica* 13: 53–87.
- Välikangas I., Hytönen O. 1939. Die Vogelberingung in Finland im Jahre 1936. *Memoranda Societatis pro Fauna et Flora Fennica* 14: 70–107.
- Välikangas I., Hytönen O. 1940. Die Vogelberingung in Finland im Jahre 1937. *Memoranda Societatis pro Fauna et Flora Fennica* 15: 140–174.
- Välikangas I., Koskimies J. 1950. Die Vogelberingung in Finland in den Jahren 1940-47. *Memoranda Societatis pro Fauna et Flora Fennica* 25: 135–155.

- Välikangas I., Nordström G. 1954. Die Vogelberingung in Finland im Jahre 1952. *Memoranda Societatis pro Fauna et Flora Fennica* 29: 59–80.
- Välikangas I., Nordström G. 1956. Die Vogelberingung in Finland im Jahre 1953. *Memoranda Societatis pro Fauna et Flora Fennica* 31: 3–34.
- Välikangas I., Nordström G. 1957. Die Vogelberingung in Finland im Jahre 1954. *Memoranda Societatis pro Fauna et Flora Fennica* 32: 21–62.
- Välikangas I., Siivonen L. 1942. Die Vogelberingung in Finland im Jahre 1938. *Memoranda Societatis pro Fauna et Flora Fennica* 17: 75–106.
- Välikangas I., Siivonen L. 1949. Die Vogelberingung in Finland im Jahre 1939. *Memoranda Societatis pro Fauna et Flora Fennica* 24: 212–233.
- Warga K. 1955. XVIth Report on bird-banding in Hungary. *Aquila* 59-62: 233–251.
- Wassenaar R.D. 1982. Ringverslag No. 67: 1982. Vogeltrekstation, Instituut voor oecologisch onderzoek, Arnhem.
- Wassenaar R.D. 1983. Ringverslag No. 68: 1983. Vogeltrekstation, Instituut voor oecologisch onderzoek, Arnhem.
- Wassenaar R.D. 1984. Ringverslag No. 69: 1984. Vogeltrekstation, Instituut voor oecologisch onderzoek, Arnhem.
- Wassenaar R.D. 1985. Ringverslag No. 70: 1985. Vogeltrekstation, Instituut voor oecologisch onderzoek, Arnhem.
- Wassenaar R.D. 1986. Ringverslag No. 71: 1986. Vogeltrekstation, Instituut voor oecologisch onderzoek, Arnhem.
- Wassenaar R.D. 1987. Ringverslag No. 72: 1987. Vogeltrekstation, Instituut voor oecologisch onderzoek, Arnhem.
- Wassenaar R.D. 1988. Ringverslag No. 73: 1988. Vogeltrekstation, Instituut voor oecologisch onderzoek, Arnhem.
- Wassenaar R.D. 1989. Ringverslag No. 74: 1989. Vogeltrekstation, Instituut voor oecologisch onderzoek, Arnhem.
- Zar J.H. 1996. *Biostatistical Analysis*. Third edition. Prentice Hall, Upper Saddle River, New Jersey. 918 p.
- Zink G. 1959. Beringungs übersicht der Vogelwarte Radolfzell für die Jahre 1947–1957. *Auspicium* 1: 17–26.
- Zink G. 1961. Beringungs übersicht der Vogelwarte Radolfzell für die Jahre 1958. *Auspicium* 1: 207–211.
- Zink G. 1962. Beringungs übersicht der Vogelwarte Radolfzell für die Jahre 1959. *Auspicium* 1: 388–394.
- Zink G. 1964. Beringungs übersicht der Vogelwarte Radolfzell für die Jahre 1960. *Auspicium* 2: 3–6.
- Zink G. 1969. Beringungs übersicht der Vogelwarte Radolfzell für die Jahre 1962–1967. *Auspicium* 3: 371–419.
- Zink G. 1974. Beringungs übersicht der Vogelwarte Radolfzell für die Jahre 1968–1971. *Auspicium* 5: 255–296.
- Zink G. 1975. Numbers of birds ringed and recovered by the Radolfzell ringing centre. Report of Euring Data Bank.
- Zink G. 1976. Numbers of birds ringed and recovered by the Radolfzell ringing centre. Report of Euring Data Bank.
- Zink G. 1977. Numbers of birds ringed and recovered by the Radolfzell ringing centre. Report of Euring Data Bank.
- Zink G. 1978. Numbers of birds ringed and recovered by the Radolfzell ringing centre. Report of Euring Data Bank.
- Zink G. 1979. Numbers of birds ringed and recovered by the Radolfzell ringing centre. Report of Euring Data Bank.
- Zink G. 1980a. Beringungs übersicht der Vogelwarte Radolfzell für die Jahre 1972–1976. *Auspicium*

7: 3–19.

- Zink G. 1980b. Numbers of birds ringed and recovered by the Radolfzell ringing centre. Report of Euring Data Bank.
- Zink G. 1981. Numbers of birds ringed and recovered by the Radolfzell ringing centre. Report of Euring Data Bank.
- Österlöf S. 1973. Report for 1964 of the Bird–Ringing Office. Swedish Museum of Natural History, Stockholm 164 p.
- Österlöf S. 1975a. Report for 1965 of the Bird–Ringing Office. Swedish Museum of Natural History, Stockholm 144 p.
- Österlöf S. 1975b. Report for 1966 of the Bird–Ringing Office. Swedish Museum of Natural History, Stockholm 148 p.
- Österlöf S. 1975c. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1975. Report of Euring Data Bank.
- Österlöf S. 1976a. Report for 1967 of the Bird–Ringing Office. Swedish Museum of Natural History, Stockholm 142 p.
- Österlöf S. 1976b. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1976. Report of Euring Data Bank.
- Österlöf S. 1977a. Report for 1968 of the Bird–Ringing Office. Swedish Museum of Natural History, Stockholm 142 p.
- Österlöf S. 1977b. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1977. Report of Euring Data Bank.
- Österlöf S. 1978a. Report for 1969 of the Bird–Ringing Office. Swedish Museum of Natural History, Stockholm 124 p.
- Österlöf S. 1978b. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1978. Report of Euring Data Bank.
- Österlöf S. 1979a. Report for 1970 of the Bird–Ringing Office. Swedish Museum of Natural History, Stockholm 118 p.
- Österlöf S. 1979b. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1979. Report of Euring Data Bank.
- Österlöf S. 1980a. Report for 1971 of the Bird–Ringing Office. Swedish Museum of Natural History, Stockholm 114 p.
- Österlöf S. 1980b. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1980. Report of Euring Data Bank.
- Österlöf S. 1981. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1981. Report of Euring Data Bank.
- Österlöf S. 1982. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1982. Report of Euring Data Bank.
- Österlöf S. 1983. Numbers of birds ringed and recovered by the Stockholm ringing centre in 1983. Report of Euring Data Bank.
- Österlöf S. 1984. Report on swedish bird–ringing for 1972. Bird–ringing centre, Swedish museum of Natural History, Stockholm 88 p.
- Österlöf S. 1985a. Report on swedish bird–ringing for 1973. Bird–ringing centre, Swedish museum of Natural History, Stockholm 90p.
- Österlöf S. 1985b. Report on swedish bird–ringing for 1974. Bird–ringing centre, Swedish museum of Natural History, Stockholm 98p.

Griezes *Crex crex* Latvijas un Eiropas populāciju skaita izmaiņu novērtējums XX gadsimtā pēc gredzenošanas datiem

Oskars Keiķis^{1,2*}, Jānis Grānāts², Aivars Mednis¹

¹Ornitoloģijas laboratorija, LU Bioloģijas institūts, Miera 3, Salaspils LV-2169, Latvija
Zooloģijas un dzīvnieku ekoloģijas katedra, Latvijas Universitātes Bioloģijas fakultāte, Kronvalda bulv. 4, Rīga LV-1586, Latvija

*Korespondējošais autors, E-pasts: grieze@lanet.lv

Kopsavilkums

Līdz pat 1990-iem gadiem griežu populācijas stāvokļa vērtējums lielākajā daļā Eiropas valstu balstījās uz aptuveniem skaitļiem, kas tika iegūti no dažādu anketēšanu, gada putna akciju, atsevišķu novērojumu un ligzdojošo putnu atlantu rezultātiem, bet nevis no griežu uzskaitēm. Šī iemesla dēļ iegūtie dati tikai aptuveni atspoguļoja patieso griezes populācijas stāvokli Eiropā. Mēs apkopojām datus par 2916 apgredzenotām griezēm no 17 Eiropas gredzenošanas centriem no 1908. līdz 1995. gadam un analizējām datus ($n = 643$) no bijušās Čehoslovākijas, Horvātijas, Igaunijas, Latvijas, Lietuvas, Norvēģijas, Polijas, Šveices un Ungārijas, lai iegūtu kvantitatīvu griezes populācijas samazināšanās novērtējumu (TRIM indeksu) pagājušajā gadsimtā. Šī pētījuma pamatā ir pieņēmums, ka griezes tika gredzenotas nejauši – gredzenotāji izmantoja katru iespēju apgredzenot griezes, kuras tie sastapa, bet īpaša griežu meklēšana, lai tās gredzenotu, nenotika. Mēs analizējām Latvijas gredzenošanas datus sīkāk, lai pārbaudītu savu pieņēmumu par griežu gredzenotāju uzvedību. Papildus mēs analizējām sešu lauku putnu sugu gredzenošanas datus Latvijā, lai novērtētu, vai gredzenotāji gredzenoja lauku putnus vēlāk pētījumu periodā, kad griežu gredzenošana bija apsīkusi. No 1925. līdz 1995. gadam Latvijā apgredzenoja 215 griezes – 190 mazulus un 25 vecos putnus. Apgredzenoto mazuļu skaita samazināšanos var novērot gan neapstrādātiem datiem, gan kalibrējot tos pret attiecīgajā gadā apgredzenoto putnu kopskaitu ($r_s = -0,46$; $p < 0,001$), gan pret attiecīgajā gadā iesniegto atskaišu skaitu ($r_s = -0,43$; $p < 0,001$). Līdzīgu skaita samazināšanos var novērot arī bijušajā Čehoslovākijā gredzenotajām griezēm ($n = 101$). Eiropas valstu kopējais indekss pētījumu periodā ir būtiski samazinājies ($r^2 = 0,26$; $p < 0,00001$). Ja no šīs datu kopas atmet Latvijas datus, jo tie sastāda apmēram vienu trešdaļu no visiem datiem un tādēļ ļoti stipri ietekmē indeksu, novērotā tendence saglabājas ($r^2 = 0,11$; $p < 0,01$). Starp Latvijā gredzenoto griežu skaitu un Eiropā (Čehoslovākijā, Horvātijā, Igaunijā, Lietuvā, Norvēģijā, Polijā, Šveicē un Ungārijā) gredzenoto griežu indeksu ir novērojama statistiski būtiska korelācija ($r^2 = 0,12$; $p < 0,01$). Līdzīgi kā griežu, arī apgredzenoto lauka cīruļu ($r_s = -0,50$; $p < 0,001$) un lukstu čakstiņu ($r_s = -0,23$; $p < 0,05$) skaits Latvijā no 1925. līdz 1995. gadam ir būtiski samazinājies, turpretim apgredzenoto pļavu čipstu ($r_s = 0,57$), brūnspārnu ļauķu ($r_s = 0,68$) un kaņepīšu ($r_s = 0,49$) skaits ir būtiski pieaudzis ($p < 0,001$). Vienīgā suga, kurai netika novērota nekāda būtiska tendence, bija dzeltenā cielava. Nav šaubu, ka gredzenošanas dati apstiprina griežu skaita samazināšanos Latvijā un Eiropā. Vidēji Eiropas valstu kopējais griežu indekss ir samazinājies par 5,5 reizēm, ja salīdzina 1925. - 1930. un 1981. - 1990. gadu periodus. Citi aprēķini par griežu skaita samazināšanos Latvijā parāda mazāku skaita samazināšanos – 1,5 - 3 reizes, bet tie ir izdarīti, balstoties uz mūsdienās iegūtiem populācijas blīvuma rādītājiem, kuri laika gaitā varētu arī būt samazinājušies.