Avian Ecol. Behav. 7, 2001: 41-74

Comparative analysis of long-term monitoring data on numbers of passerines in nine European countries in the second half of the 20th century

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Abstract: Sokolov, L.V., Baumanis, J., Leivits A., Poluda, A.M., Yefremov, V.D., Markovets, M.Yu., Morozov, Yu.G., & Shapoval, A.P. (2001): Comparative analysis of long-term monitoring data on numbers of passerines in nine European countries in the second half of the 20th century. Avian Ecol. Behav. 7: 41-74.

Analysis of dynamics of autumn numbers in 47 passerine species from Sweden, Russia (Courish Spit), Poland and Belgium in 1957-1975 has shown that in these countries, in most species high numbers were recorded in the 1960s. However in the mid 1970s, in most species numbers have significantly declined in these regions. The decline was recorded in both long- and short-distance migrants. In 1976-1985, in Estonia, Latvia, Sweden, on the Courish Spit, in the Ukraine and in Belgium, numbers of many species started to grow significantly and reached a maximum in the mid 1980s. However in Poland, in northern and southern Germany and in Austria, in most species a decline was recorded on autumn passage. In 1986-1995, numbers of many species significantly declined in Latvia, in Sweden, on the Courish Spit and in the Ukraine. In Poland, Germany and Austria, numbers of many species remained low. Analysis of dynamics of numbers on spring passage on the Courish Spit has shown that in *c.* one-half of studied species numbers were higher in the 1960s and 1980s, even though this trend was not so clear-cut as in autumn. Not a single species of the 36 studied showed any significant trend in numbers of passage populations in 1959-2000. Spring captures of 38 species in Sweden (Ottenby) in 1972-1996 show that over the whole period, a significant decline was recorded only in *Lanius collurio*, *Turdus philomelos* and *Emberiza schoeniclus*, and a significant growth in *Motacilla alba*, *Troglodytes troglodytes* and *Phylloscopus collybita*. Long periods of growing and declining numbers recorded in European passerines in the second half of the 20th century are most likely related to climatic fluctuations which occurred in the northern hemisphere.

Key words: monitoring of numbers, population dynamics, autumn and spring migration, passerines, climate, air temperature.

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Received: 13 November 2001 / Received in revised form: 10 December 2001 / Accepted: 24 December 2001.

1. Introduction

Numerous publications which discuss changes in numbers of passerines in different regions of Europe in the second half of the 20th century, are often contradictory. Some authors suggest a considerable, sometimes dramatic, decline of many passerines, primarily long-distance migrants (Dolnik & Payevsky 1979, Payevsky 1985, Busse 1994, Busse et al. 1995, Wozniak 1997, Berthold et al. 1998, 1999, Chamberlain & Fuller 1999, Gatter 1999, etc.). In some cases this is explained by global warming which causes severe droughts at stopovers and in wintering areas of European birds in Africa, which are thought to increase the mortality rate of migrants and wintering birds. In other cases, declines are explained in terms of anthropogenic factors. However other authors publish data which suggest that numbers of many passerines, including long-distance migrants, in some European regions not only did not decline over the last two decades, but, on the contrary, significantly increased in a number of cases (Payevsky 1990, 2000, Pettersson 1997, Heldbjerg & Karlsson 1997, Sokolov 1999, Sokolov et al., 2000).

The aim of this study was to analyse the long-term monitoring data concerning passage populations of passerines which winter both in Europe and in Africa, and to identify long-term trends in their numbers in different regions of Europe. The crucial factor for selection of regions was the availability of long (20 years and more) series of standardised capture data. It was important to understand, which environmental variables primarily influence dynamics of numbers of passage populations in the Baltic region and in other parts of Europe.

2. Material and methods

Long-term trapping data in stationary Heligoland or Rybachy-type traps and in mist-nets on autumn and spring migration were analysed.

Data from the following sites were included into analysis:

1. Estonia (Kabli, 58°01′N, 24°27′E, 1971-2000, Rybachy-type trap; Bay of Riga, Häädemeeste, 58°05′N, 24°29′E, 1979-1999, mist-nets).
2. Latvia (Pape, 56°11′N, 21°03′E, 1967-1999; Rybachy-type trap until 1992, Heligoland trap since 1993).
3. Sweden (Ottenby, 56°12′N, 16°24′E, 1955-1996, Heligoland traps and mist-nets, published data – Pettersson 1997).

4. Russia (Courish Spit on the Baltic Sea, 55°05´N, 20°44´E, 1957-2000, Rybachy-type traps).
5. Poland (Mierzeja Wišlana = Vistula Spit on the Baltic Sea, 54°21´N, 19°19´E; Bukowo, 54°21´N, 16°17´E, 1960-1996, Heligoland trap and mist-nets, published data – Busse 1994, Busse et al. 1995, Wozniak 1997).
6. Ukraine (Kiev Region, 50°38´N, 30°32´E, 1976-1999, Rybachy-type trap).
7. Germany (Reit, 53°28´N, 10°06´E, 1974-1993; Mettnau, 47°44´N, 8°58´E, 1974-1993; mist-nets, published data – Berthold et al. 1999).
8. Austria (Illmitz, 47°46´N, 16°48´E, 1974-1993, mist-nets, published data – Berthold et al. 1999).
9. Belgium (Limbourg, 1960-1984, mist-nets, published data – Nef et al. 1988).

Autumn trapping season at each station is given in Tab. 1. Spring trapping was done in Sweden (Ottenby) in 1972-1996 annually between 15 March – 1 June, on the Courish Spit in 1958-2000 between 1 April – 1 June. To estimate dynamics of autumn passage on the Courish Spit, in this paper we used capture data on juveniles in only one trap with entrance open towards the north-east (trap No 3 in 1957-1976, trap No 5 since 1977 onwards). To estimate dynamics of spring passage on the Courish Spit, we used data on birds captured in different traps, open both towards the south-west (traps No 1, 4) and towards the north-east (traps No 3, 5). This was done because in spring, birds under certain weather conditions are better captured in "autumn" than in "spring" traps.

Table 1. Timing of autumn trapping at field stations.

Year	Estonia (Kabli)	Latvia (Pape)	Poland (Mierzeja Wišlana)	Ukraine (Kiev Region)
1961			*13.09-14.10	
1962			20.08-03.10	
1963			16.08-30.10	
1964			16.08-25.10	
1965			15.08-25.10	
1966			16.08-26.10	
1967			16.08-27.10	
1968			16.08-25.10	
1969			16.08-25.10	
1970	*16.09-26.10		16.08-01.11	
1971	21.08-03.11		16.08-01.11	
1972	11.08-27.10		14.08-01.11	
1973	14.07-23.10		14.08-01.11	

Table 1. Continued

Year	Estonia (Kabli)	Latvia (Pape)	Poland (Mierzeja Wišlana)	Ukraine (Kiev Region)
1974	04.08-03.11		14.08-01.11	
1975	02.08-22.10	*03.09-27.10	14.08-01.11	
1976	14.08-12.11	*16.09-21.11	14.08-01.11	23.08-31.10
1977	09.08-03.11	26.08-01.11	15.08-01.11	25.08-01.11
1978	14.08-14.11	*30.08-07.11	14.08-01.11	*08.09-20.11
1979	14.08-02.11	*16.09-11.11	14.08-01.11	24.08-31.10
1980	*27.08-27.10	*16.09-07.11	14.08-01.11	*15.09-20.11
1981	04.08-03.11	*13.09-28.10	14.08-01.11	*06.09-31.10
1982	*30.08-03.11	*12.09-30.10	14.08-01.11	*07.09-01.11
1983	24.08-24.10	*16.09-29.10	14.08-01.11	18.08-30.10
1984	22.08-29.10	17.08-27.10	14.08-01.11	06.08-30.10
1985	14.08-27.10	15.08-09.11	14.08-01.11	*02.09-31.10
1986	24.08-02.11	15.08-25.11	14.08-01.11	
1987	21.08-02.11	21.08-18.11	14.08-01.11	*03.09-27.10
1988	16.08-25.10	22.08-11.11	14.08-01.11	19.08-01.11
1989	*27.08-24.10	*10.09-20.11	14.08-01.11	15.08-02.11
1990	22.08-30.10	01.08-15.11	14.08-01.11	*30.08-28.10
1991	*30.08-24.10	08.08-05.11		24.08-26.10
1992	*08.09-24.10	21.08-27.10		*17.09-23.10
1993	*02.09-02.11	*06.09-31.10		*04.09-31.10
1994	*01.09-31.10	23.08-25.10		*07.09-31.10
1995	*30.08-04.11	21.08-11.11		18.08-01.11
1996	*30.08-06.11	*29.08-26.10		*07.09-03.11
1997	*01.09-28.10	25.08-25.10		*04.09-01.11
1998	*01.09-04.11	*27.08-12.11		*10.09-01.11
1999	19.08-30.10	18.08-28.10		
2000	*01.09-30.10			

Note. Periods with late beginning of capturing long-distance migrants are marked by asterisks. Annual autumn trapping period on the Courish Spit is 15.08 – 31.10; in Sweden (Ottenby) – 25.07 – 15.10 (Pettersson 1996), in Germany (Mettnau) – 30.06 – 6.11 (Berthold et al. 1999).

Computerized database in data retrieval system "ARCHIMED" allowed us to process a huge amount of field data in a short period of time (Morozov 1995, Morozov & Yefremov 1997). To reveal long-term trends, three periods were considered: between 1958 and 1974 (17 years); between 1975 and 1985 (11 years); and between 1986 and 1996 (11 years). Besides, trends of transit populations in different regions were tested over the whole study period in the respective region (20 to 44 years). Correlation was statistically tested by Spearman rank correlation and linear regression (Lloyd & Ledermann 1984).

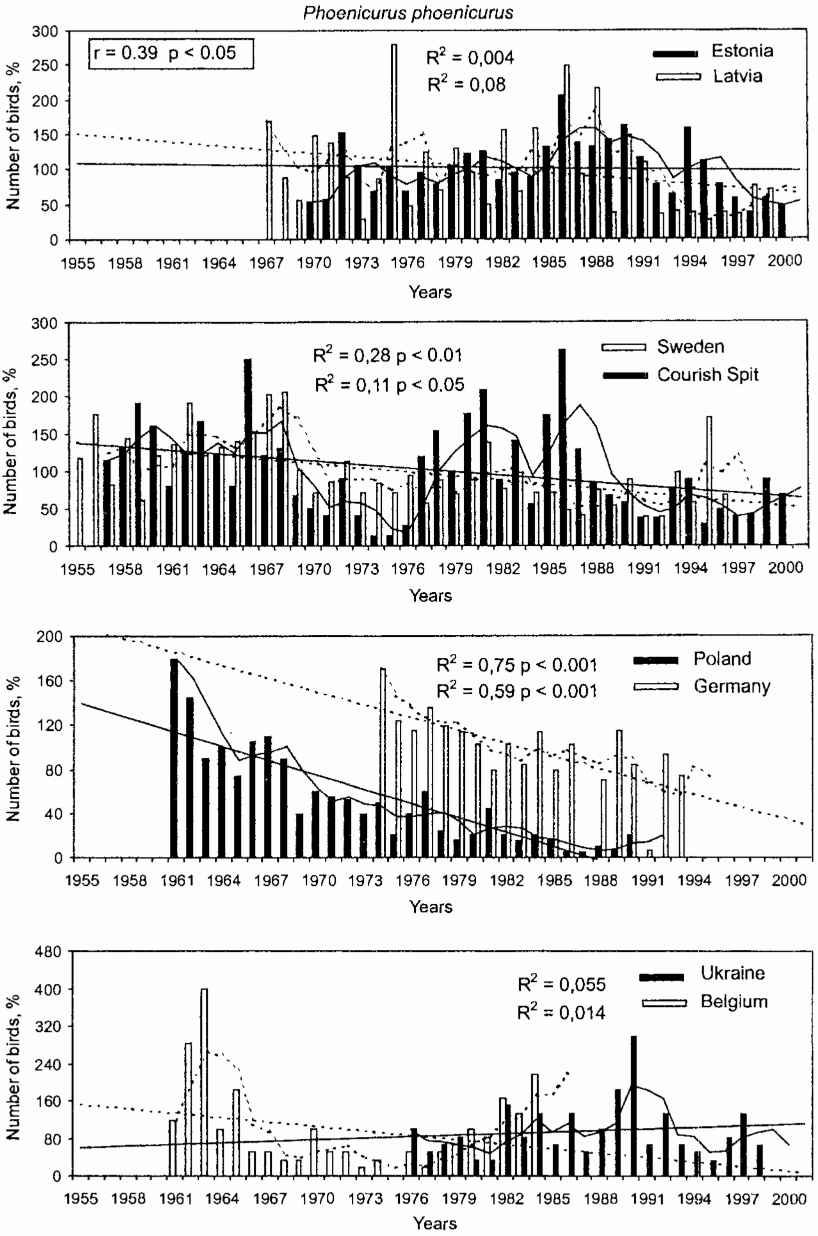
3. Results

3.1. Trends in autumn numbers of passage populations

Analysis of dynamics of autumn numbers of passerines in 1957-1975 based on the data from Sweden, Russia (Courish Spit), Poland and Belgium shows that in these countries, in most species, both of short- and long-distance migrants, high numbers were recorded in the 1960s (Figs 1, 2). However in the middle of 1970s, in most species numbers of migrants in these regions have significantly declined (Tab. 2). Decline was recorded in both long-distance migrants and in species wintering within Europe. Only in some species was a significant growth of passage populations in the Baltic region recorded: in 4 – 13%. Between 1976 and 1985, in Estonia, Latvia, Sweden, on the Courish Spit, in the Ukraine and in Belgium numbers of most species were rising and peaked in the mid or late 1980s (Figs. 1, 2). However in Poland, northern and southern Germany and in Austria, in most species a significant decline of autumn numbers, not a growth, was recorded during this period (Tab. 2). Between 1986 and 1995, a new significant decline occurred in the bulk of species in Latvia, Sweden, on the Courish Spit and in the Ukraine. In Poland, Germany and Austria numbers of many species remained low, as suggested by the published data.

If the whole study period is analysed, a significant decline was recorded in Sweden in only four species: Yellow Wagtail *Motacilla flava*, Redstart *Phoenicurus phoenicurus*, Whitethroat *Sylvia communis*, and Red-backed Shrike *Lanius collurio*. These species winter predominantly in tropical Africa. On the Courish Spit, significant decline in autumn numbers occurred in three species: White Wagtail *Motacilla alba*, Redstart, and Whinchat *Saxicola rubetra*. In the same time, in Poland and in Germany (northern and southern), in most species wintering in Africa, a significant decline of autumn numbers occurred (Tab. 2). The highest number of species which increased their autumn numbers over 42 years of study was recorded in Sweden: in Tree Pipit *Anthus trivialis*, Marsh Warbler *Acrocephalus palustris*, Willow Warbler *Phylloscopus trochilus*, Scarlet Rosefinch *Carpodacus erythrinus*, and some others.

Figure 1. Dynamics of numbers of some long-distance migrants in autumn in different regions of Europe. Numbers of birds is given as percentage of the long-term average. In each figure, (1) numbers in each year (histogram); (2) smoothed numbers over 5 years (curved line); (3) trends and coefficients over the whole study period (straight lines) are given. Significant coefficients of correlation between numbers in different regions are given in boxes.



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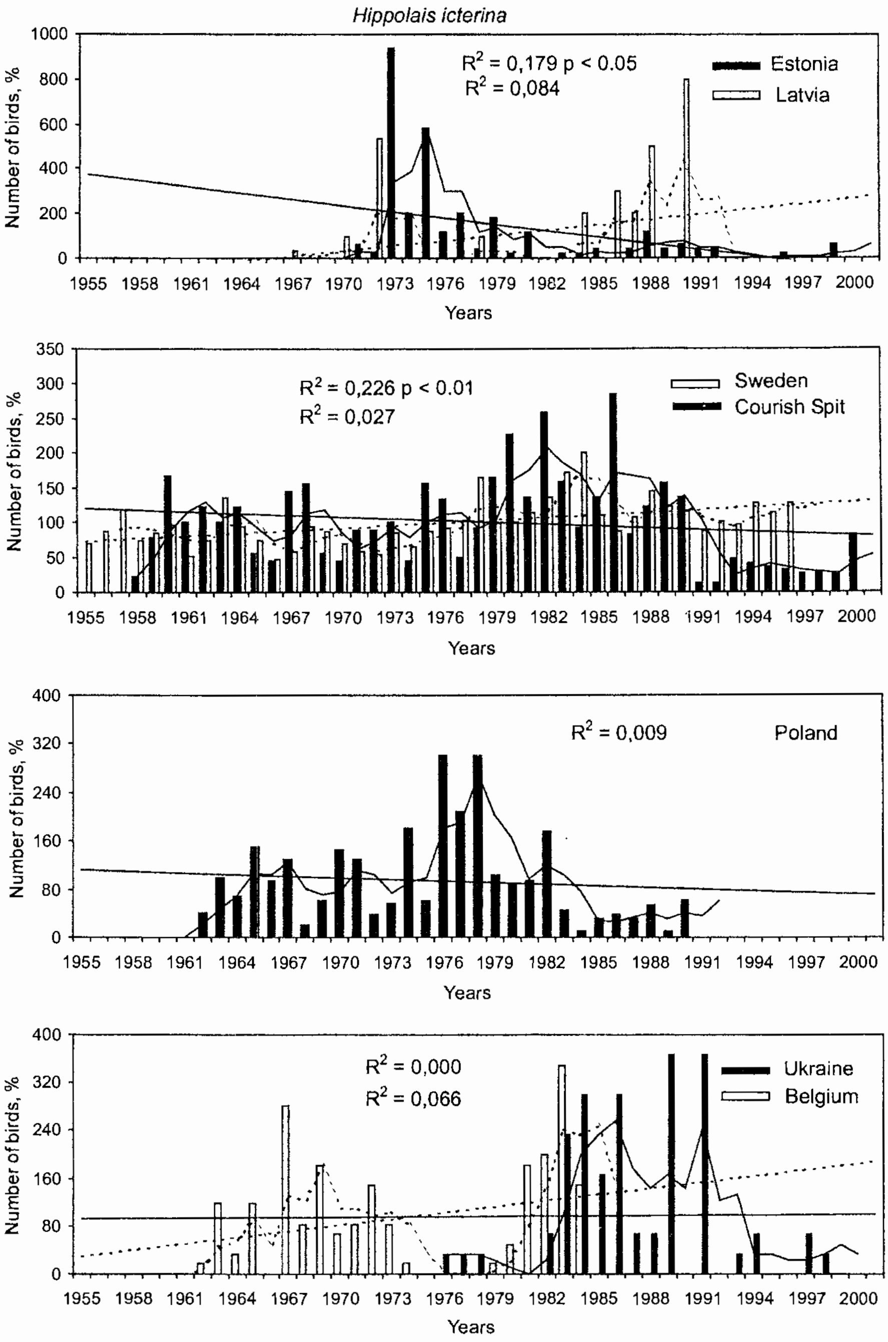

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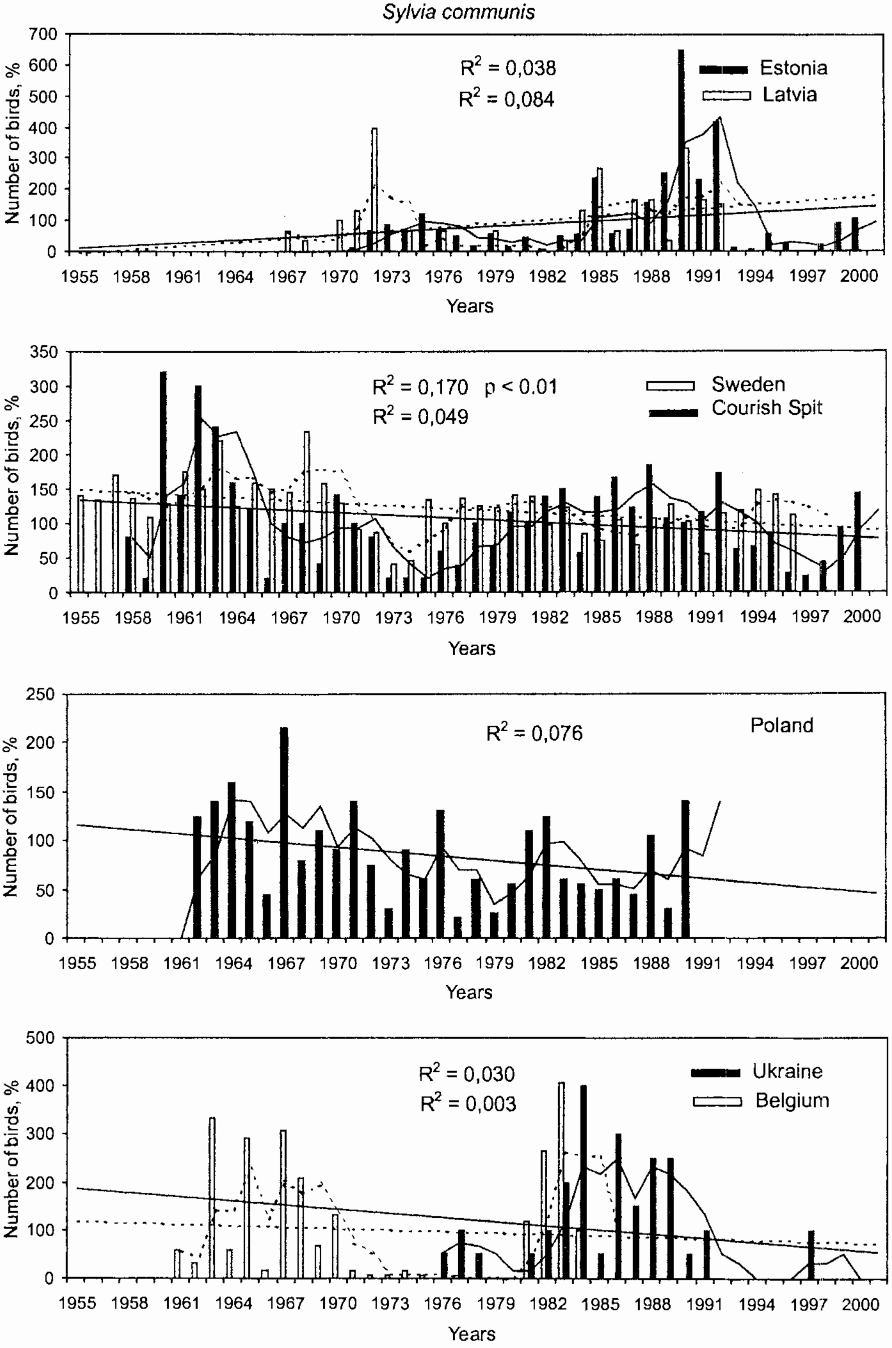

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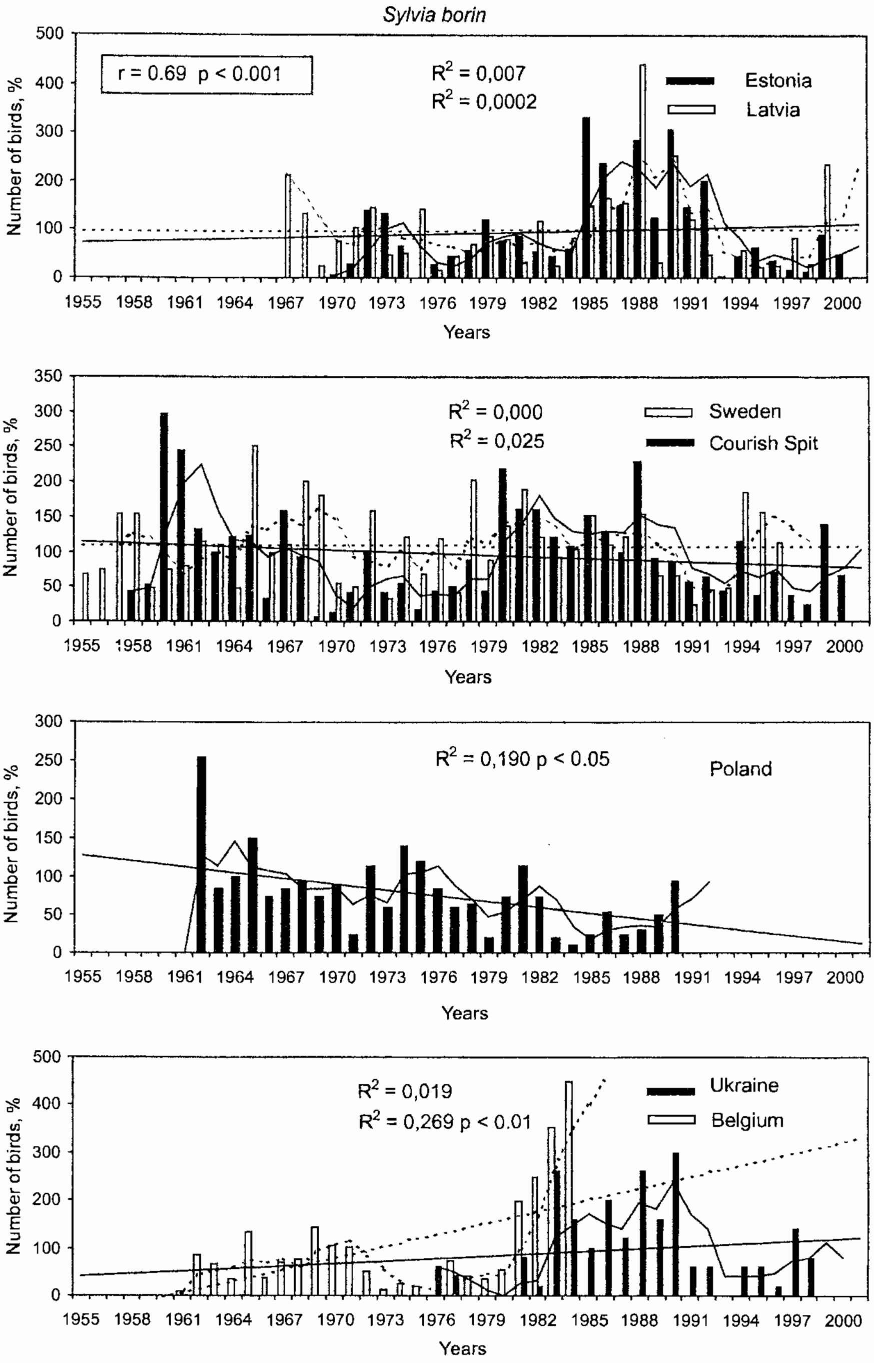

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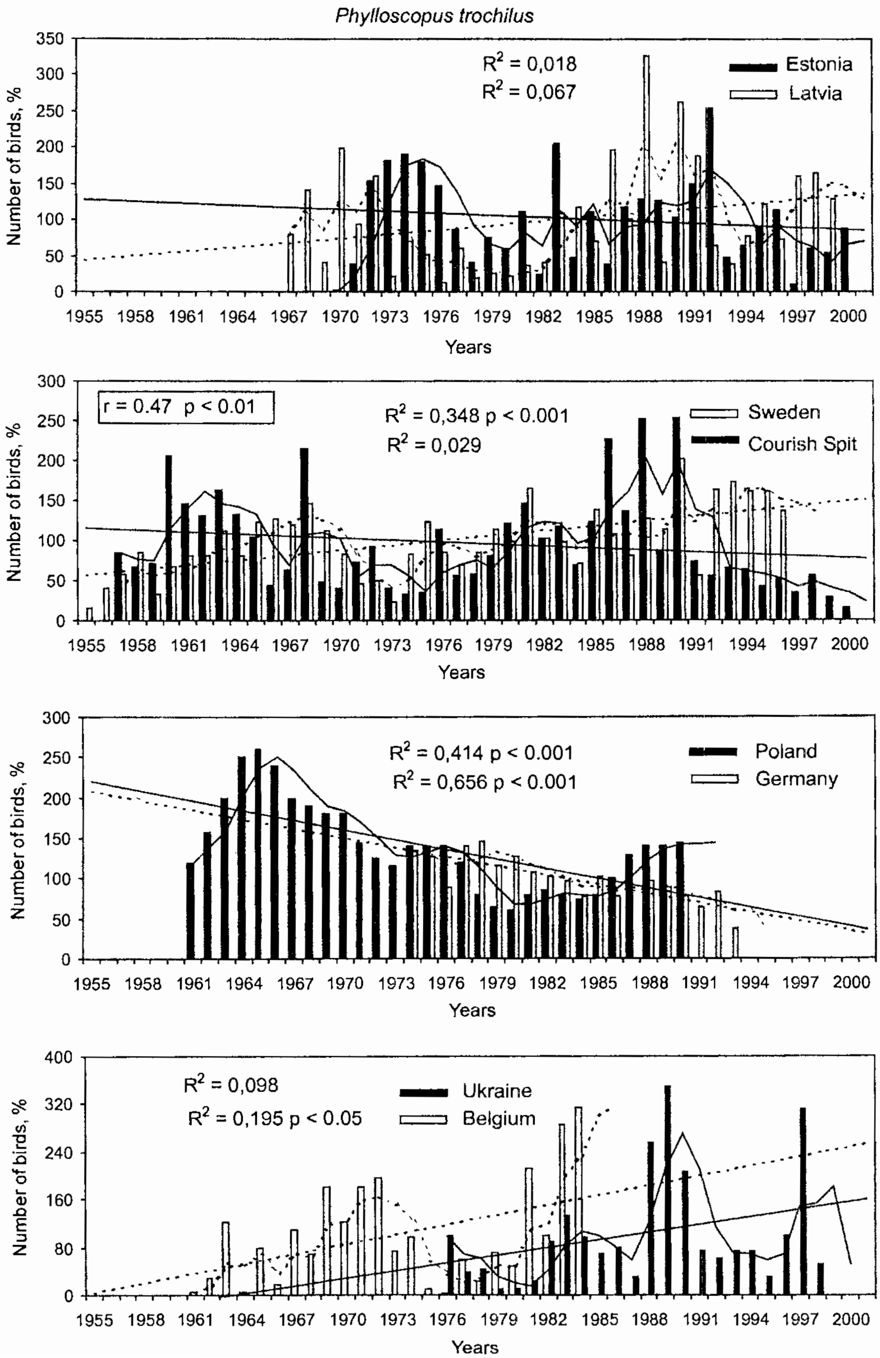

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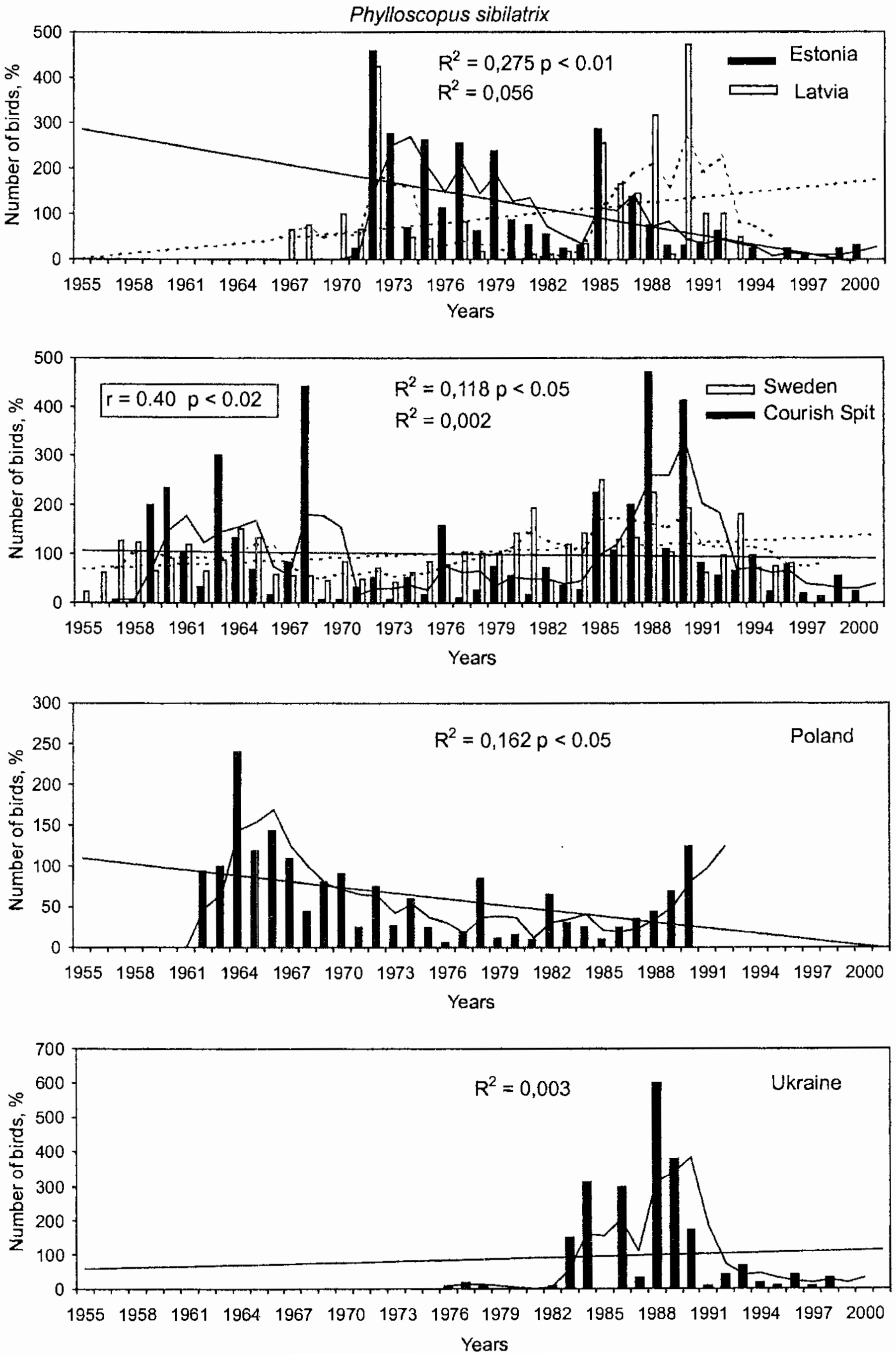

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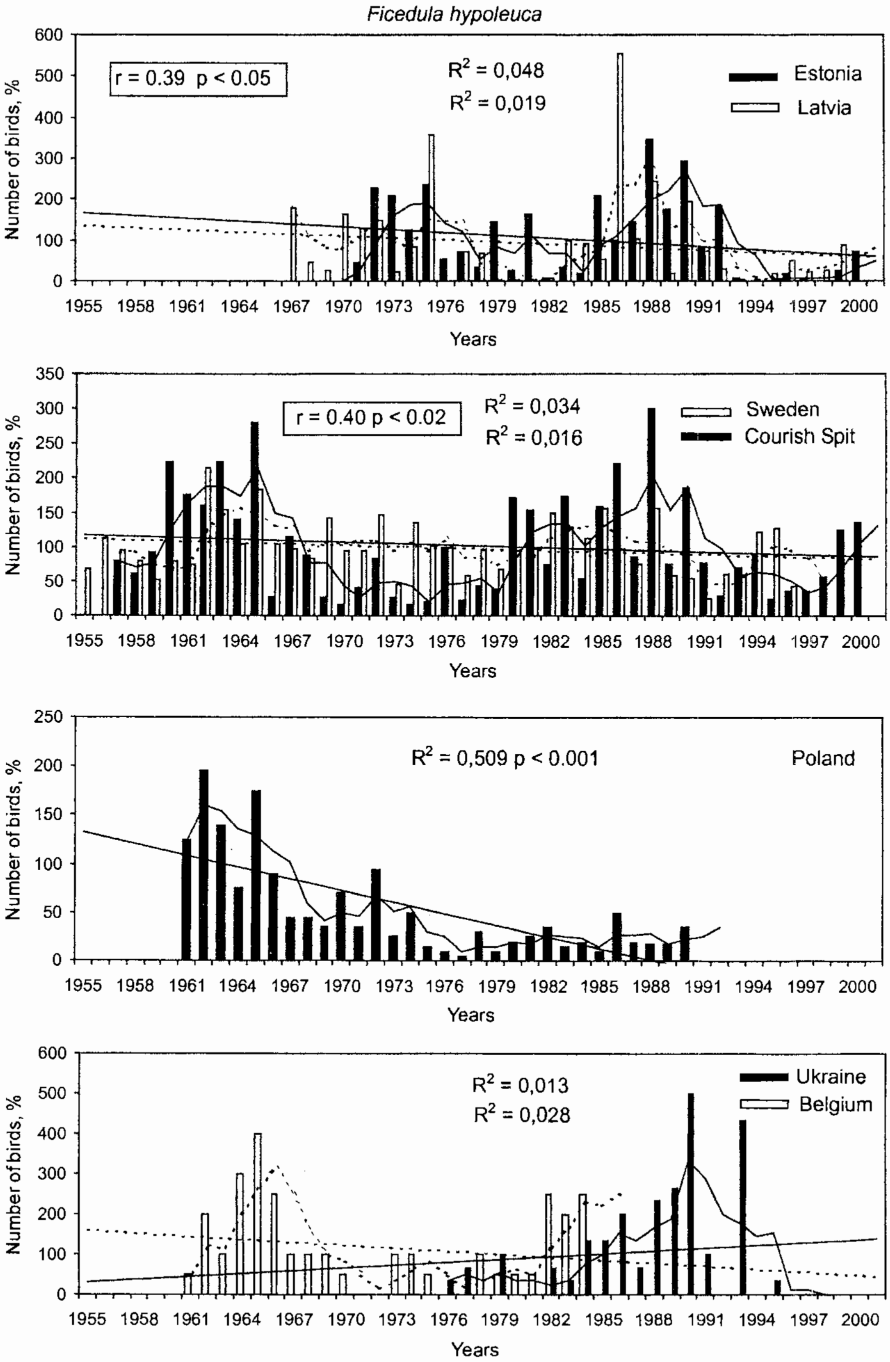

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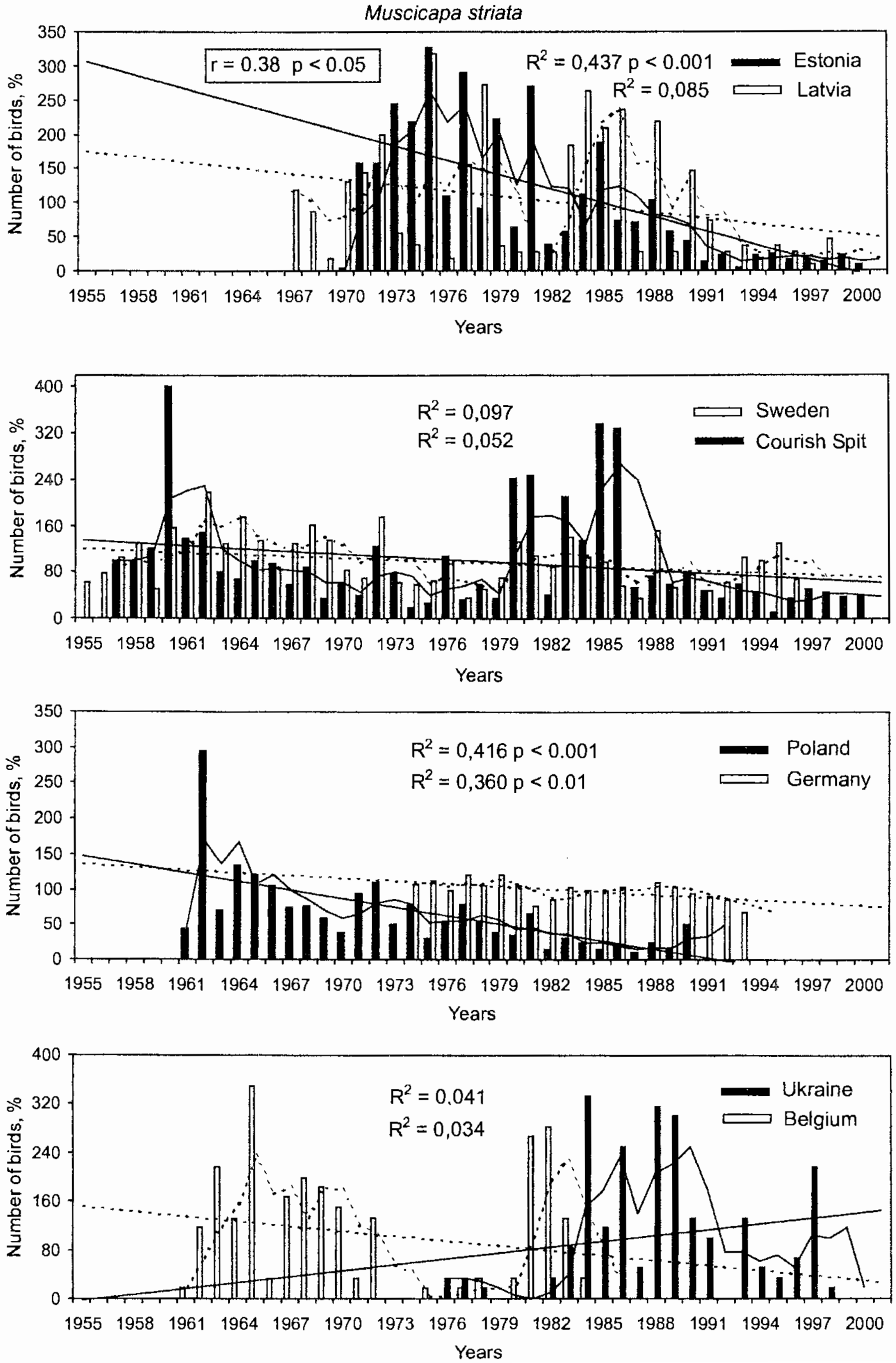

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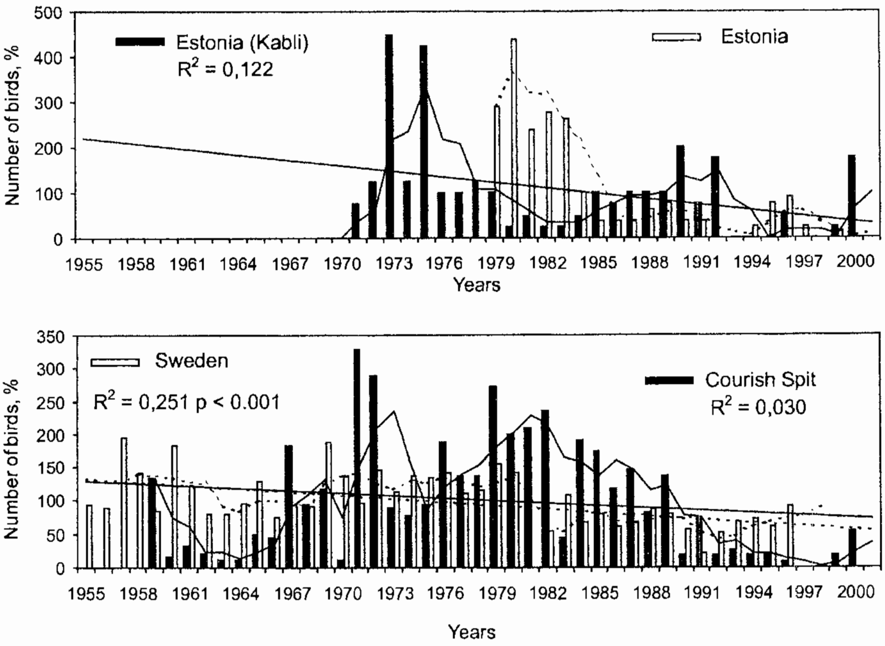
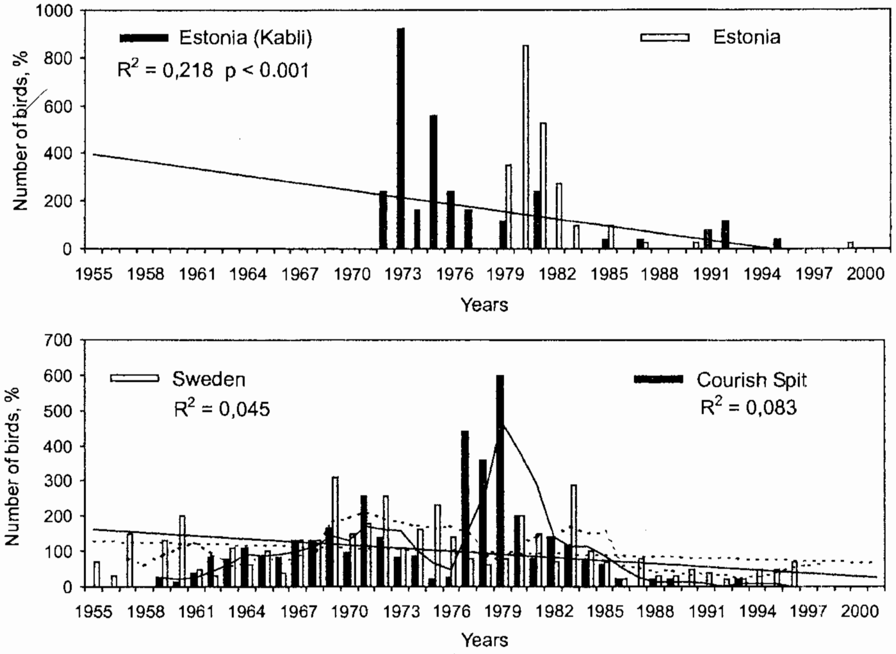
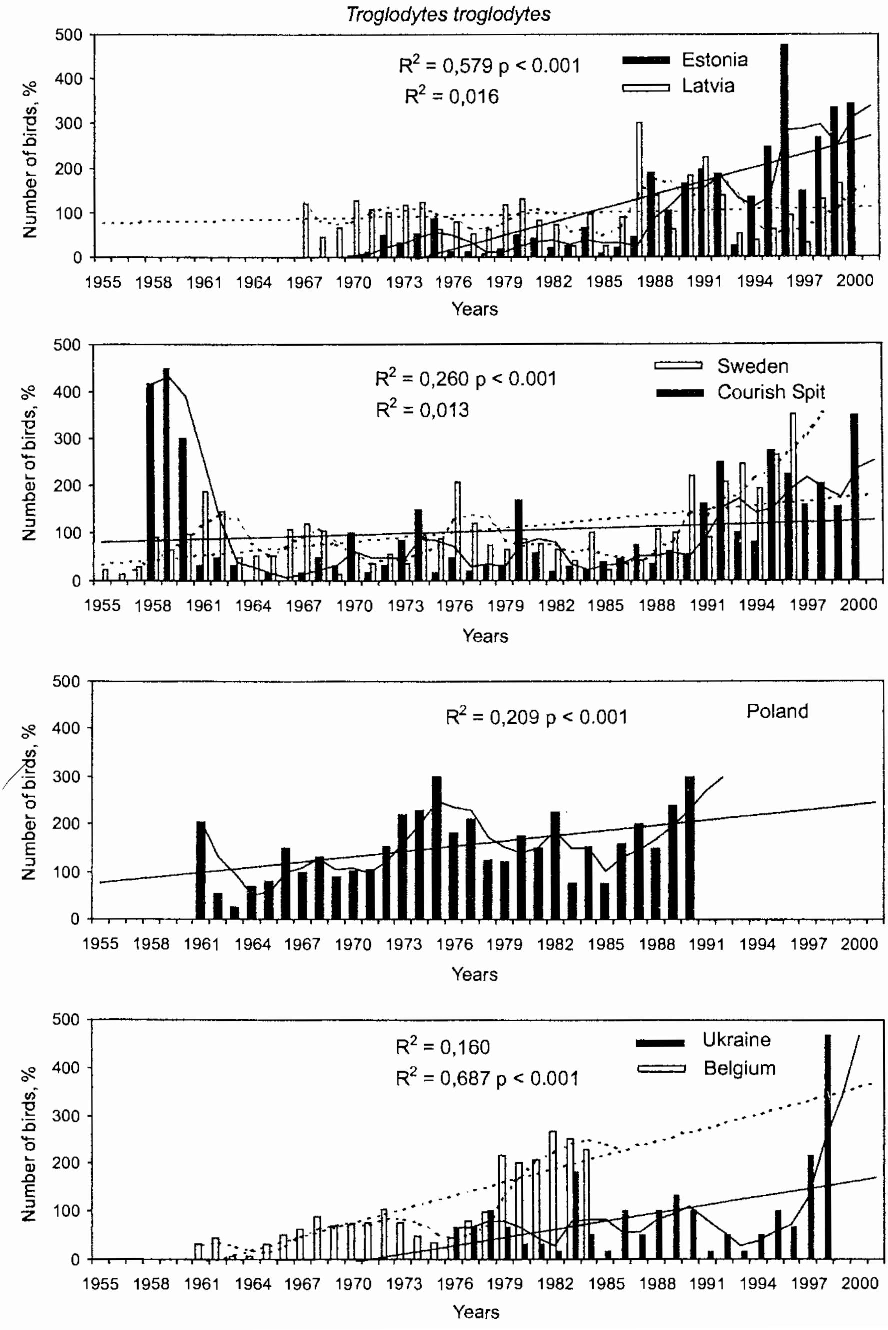


Lanius collurio



Sylvia nisoria

Figure 2. Dynamics of numbers of some middle- and short-distance migrants in autumn in different regions of Europe. Notation as in Fig. 1.



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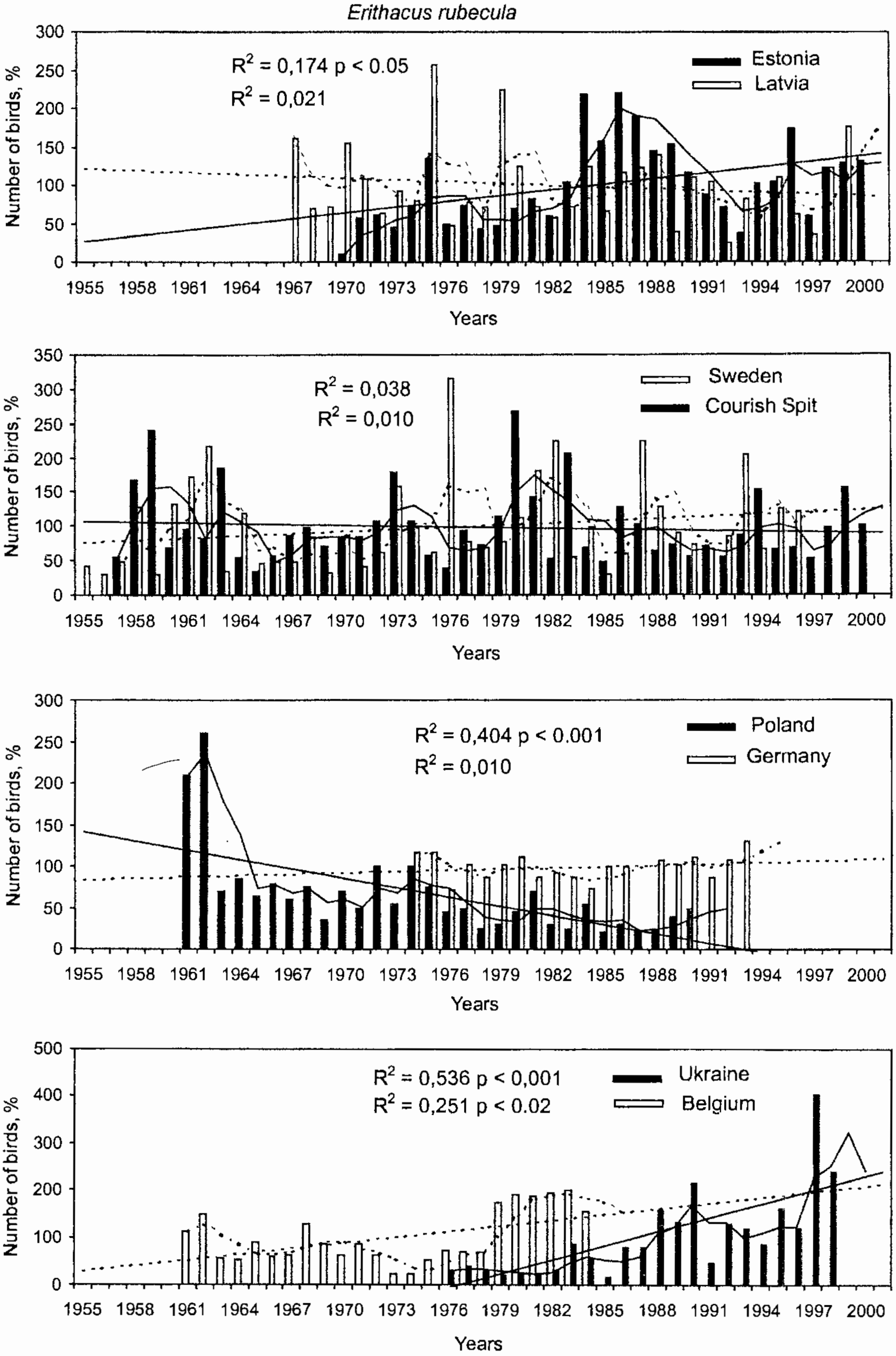

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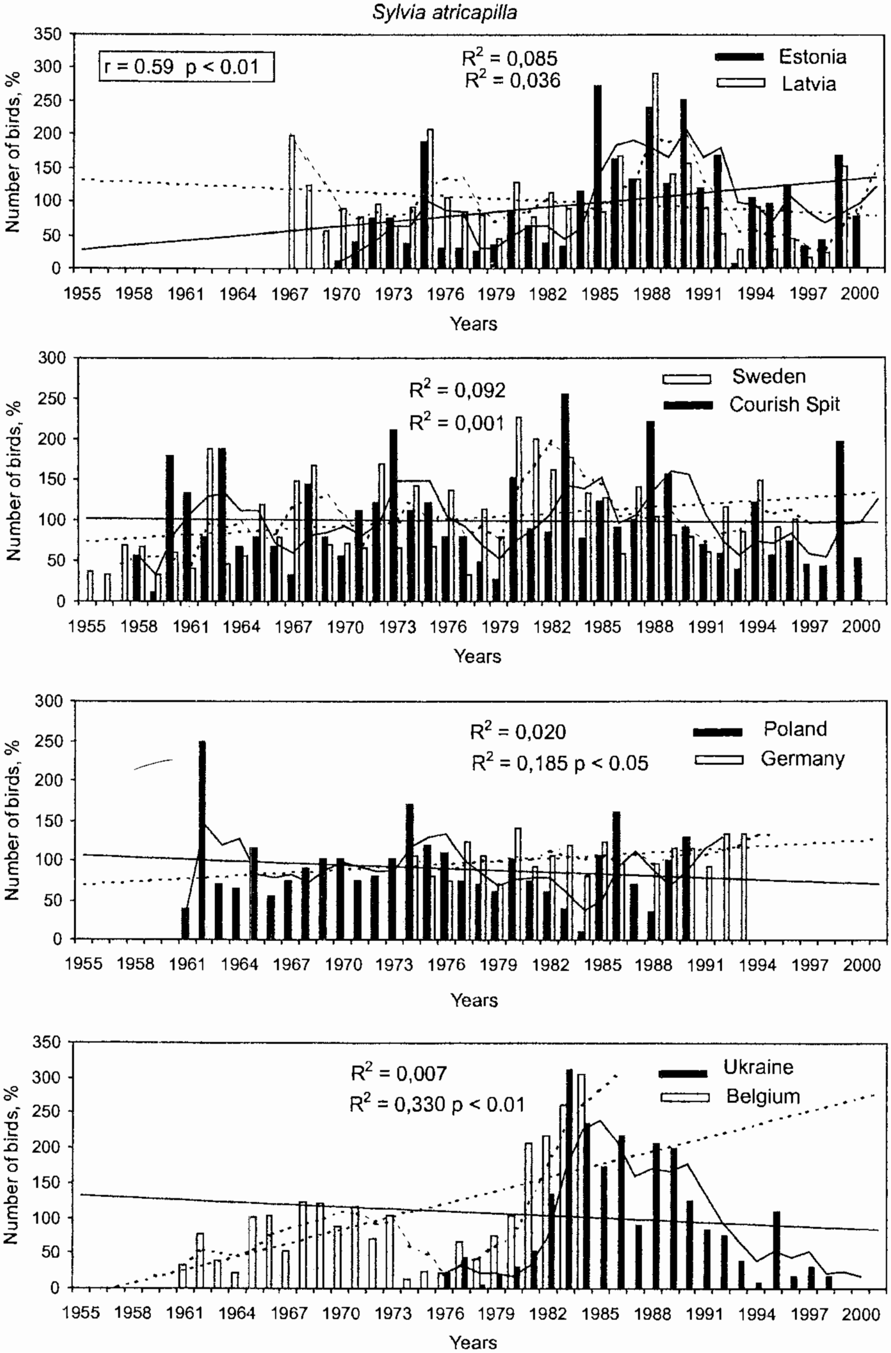

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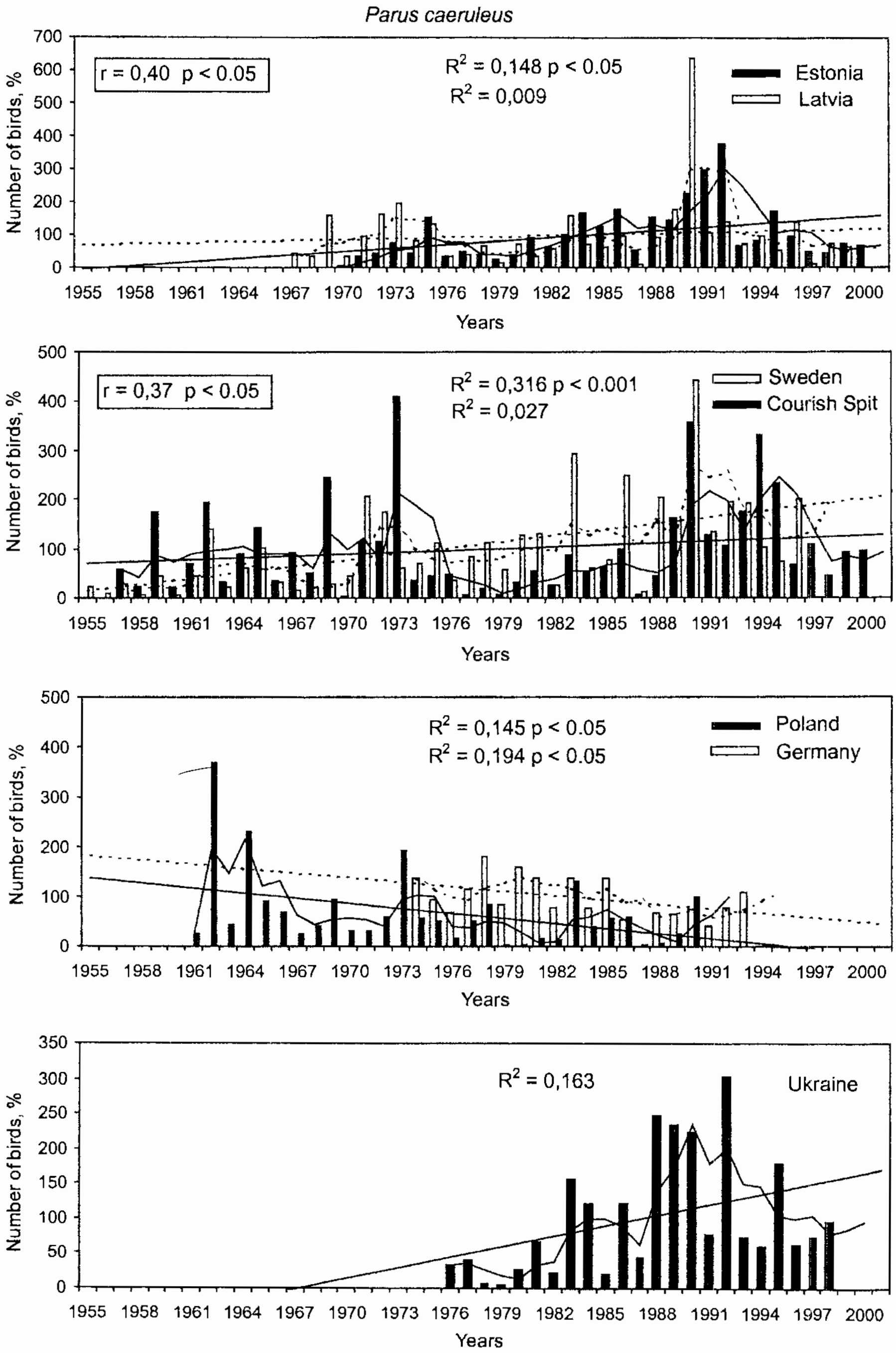

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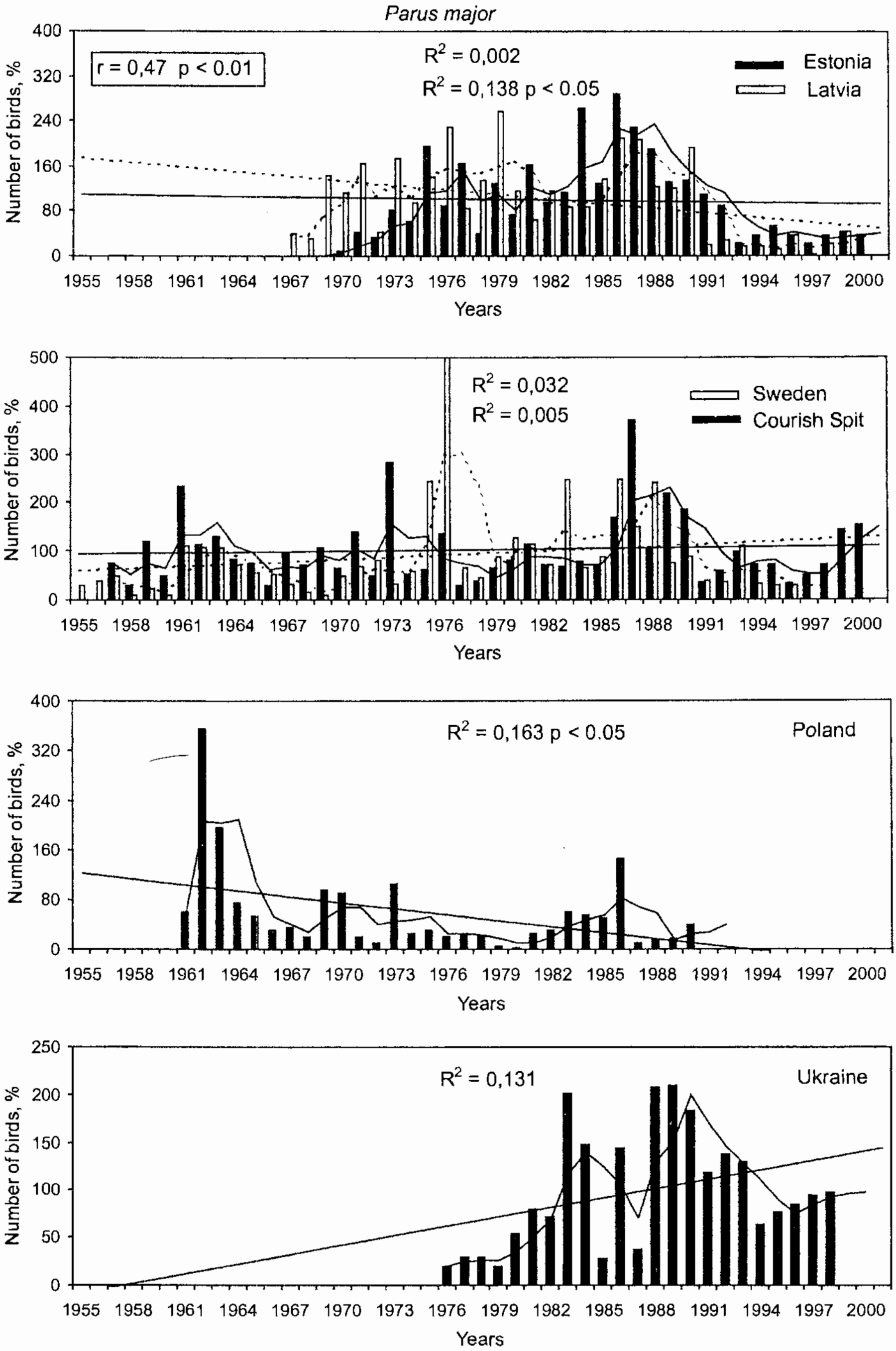

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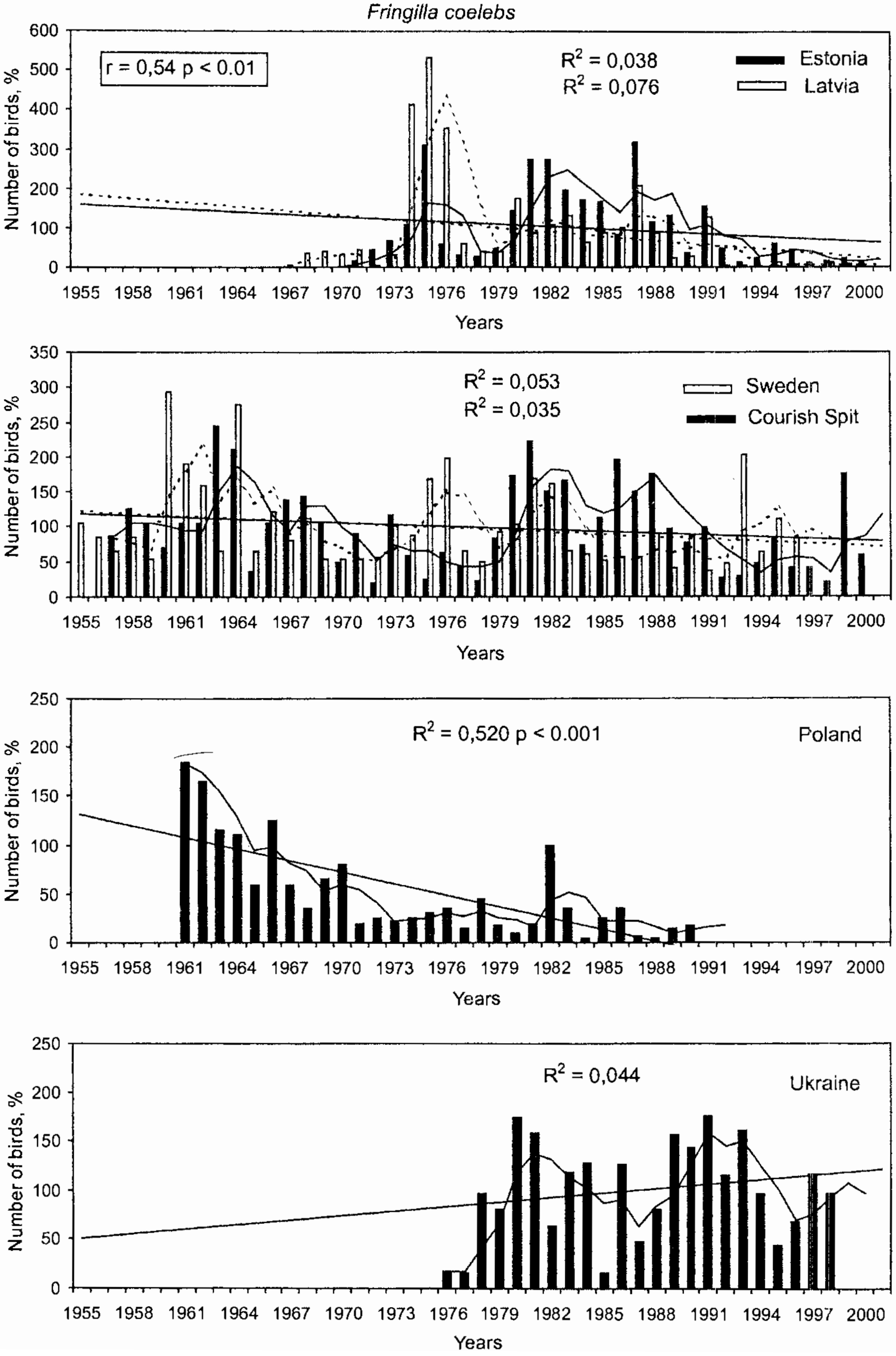

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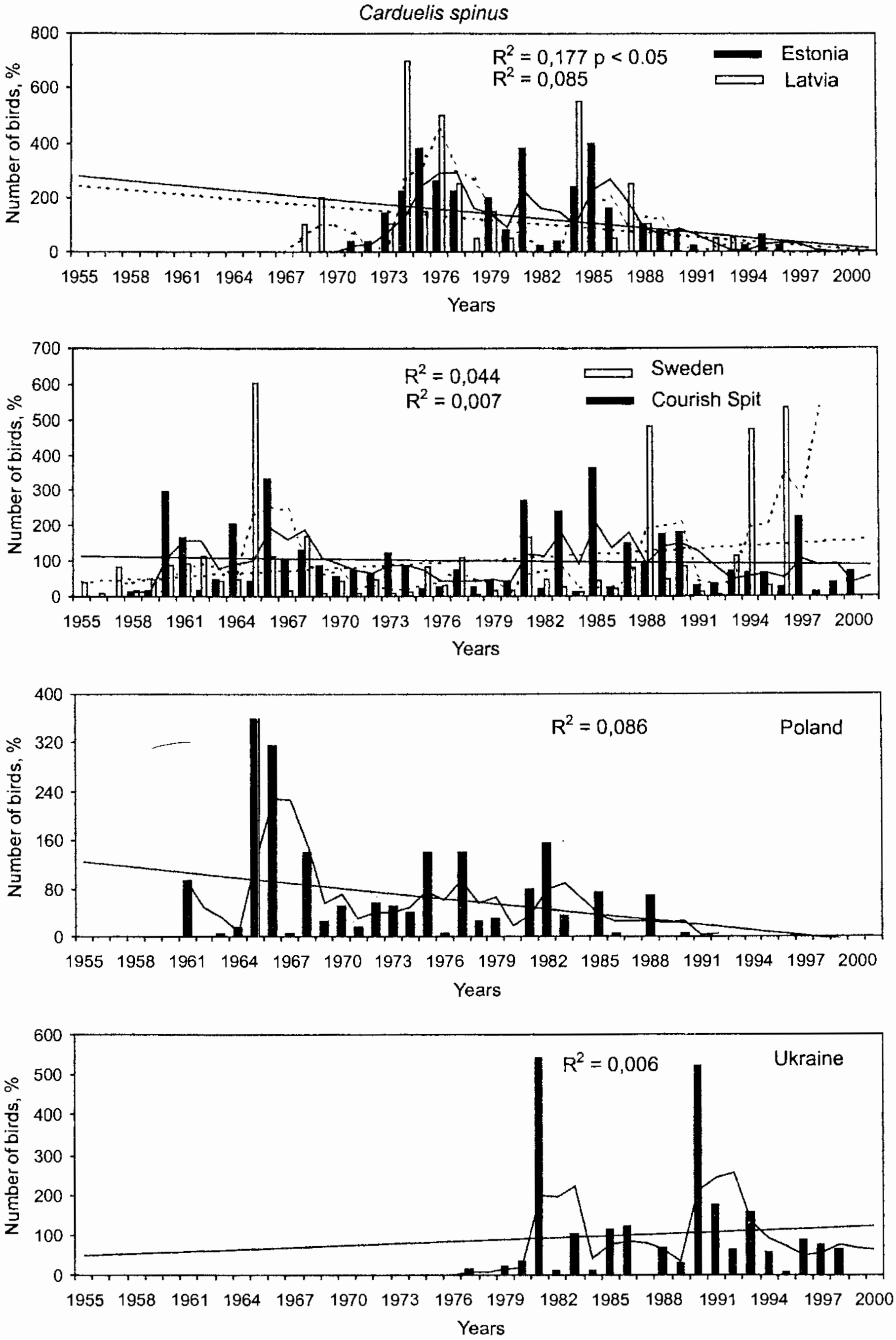

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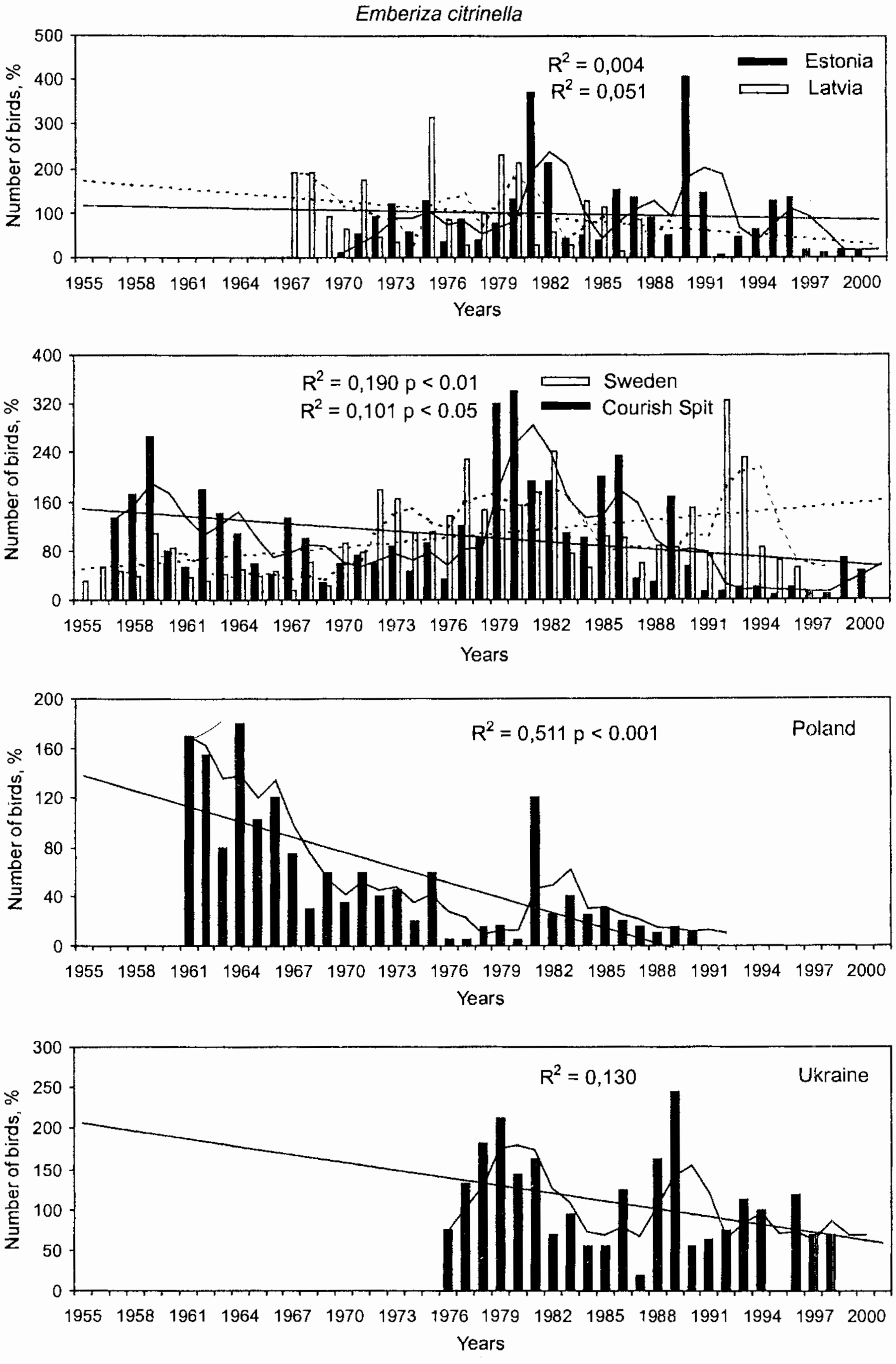


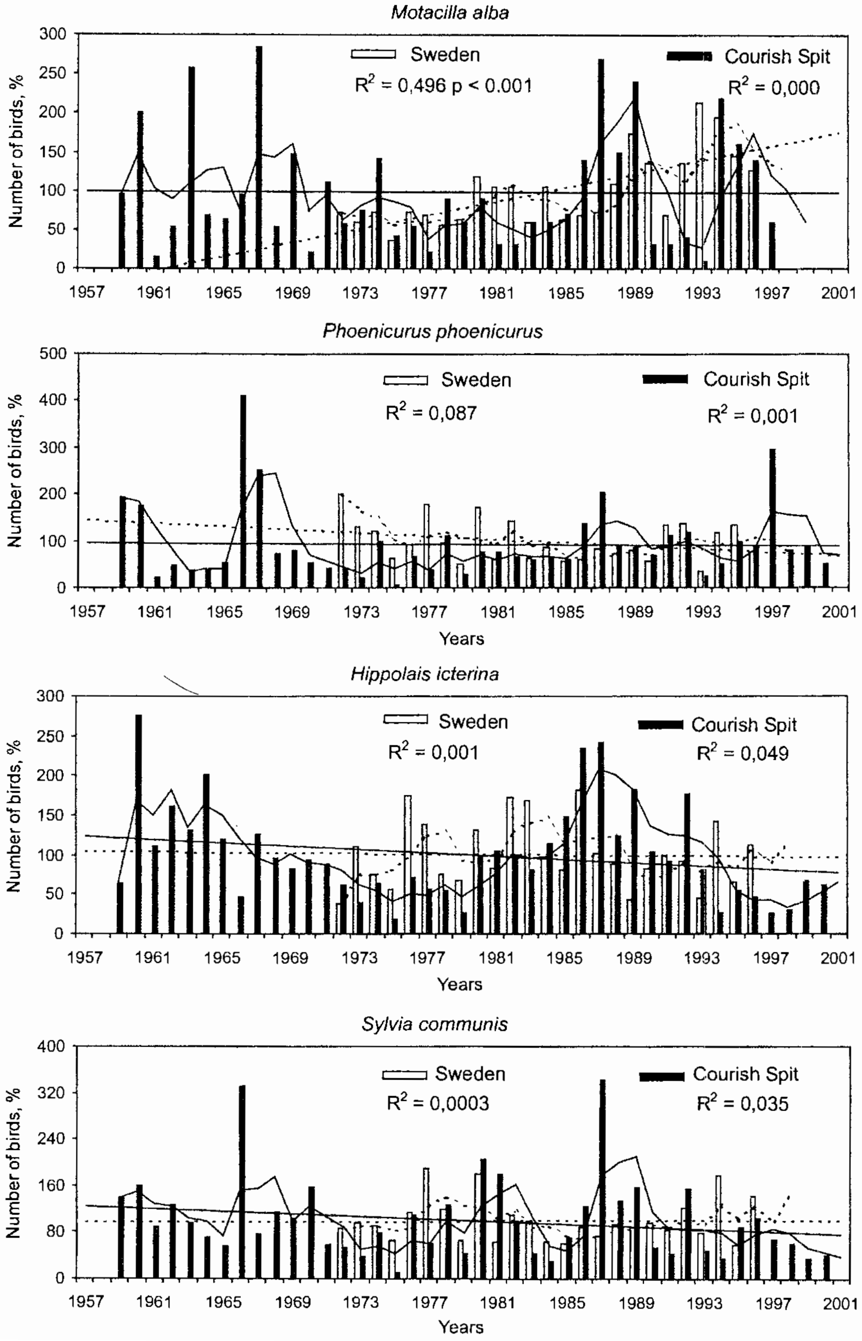
Table 2. Percentages of long (L) and short (S) distance migrants (in %) whose numbers in autumn significantly declined (–) or increased (+) in certain periods in different parts of Europe.

Region	Number of species	1958-1974		1975-1985		1986-1996		All years	
		–	+	–	+	–	+	–	+
Estonia (Kabli)	L 24			16.7	37.5	33.3	0		
	S 30			3.3	43.3	33.3	3.3		
Latvia (Pape)	L 12			0	58.3	66.7	0		
	S 26			0	11.5	46.2	0		
Sweden (Ottenby)	L 23	17.4	13.0	0	47.8	13.0	4.3	17.4	39.1
	S 24	20.8	0	8.3	8.3	8.3	8.3	0	29.2
Russia (Courish Spit)	L 18	72.2	5.6	0	50.0	83.3	0	16.7	0
	S 26	27.0	0	0	38.5	38.5	7.7	7.7	0
Ukraine (Kiev Region)	L 13			0	46.2	61.5	0		
	S 26			0	19.2	11.5	7.7		
Poland (Mierzeja Wišlana)	L 17	64.7	5.9	35.3	29.4			58.8	0
	S 25	48.0	4.0	16.0	16.0			52.0	4.0
Germany (Reit)	L 18			5.6	5.6			50.0	0
	S 13			15.4	0			15.4	7.7
Germany (Mettnau)	L 19			21.1	5.3			68.4	5.3
	S 14			0	0			14.3	7.1
Austria (Illmitz)	L 19			15.8	0			26.3	15.8
	S 13			7.7	7.7			15.4	15.4
Belgium (Limbourg)	L 12	41.7	25.0	0	91.7				
	S 15	40.0	6.7	0	93.3				

3. 2. Trends in spring numbers of passage populations

Analysis of dynamics of bird numbers on spring passage on the Courish Spit shows that in *c.* one-half of studied species, higher numbers were recorded in the 1960s and 1980s, even though this trend was less obvious than the similar trend for autumn numbers (Figs 3, 4). Not a single species of the 36 studied (both long- and short-distance migrants) showed any significant trend in numbers of passage populations in 1959-2000 (Tab. 3).

Figure 3. Dynamics of numbers of some long-distance migrants in spring in Sweden (Ottenby) and Russia (Courish Spit). Notation as in Fig. 1.



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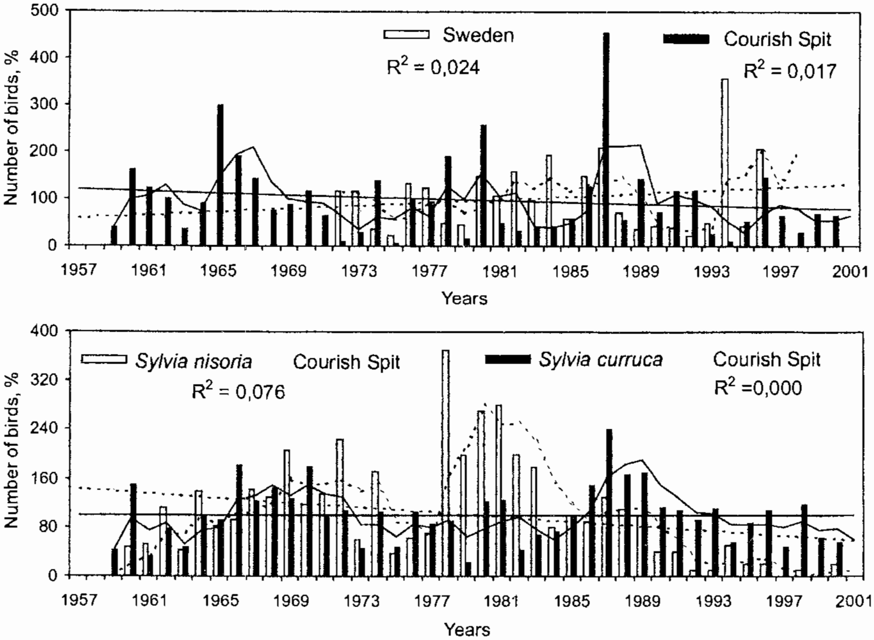
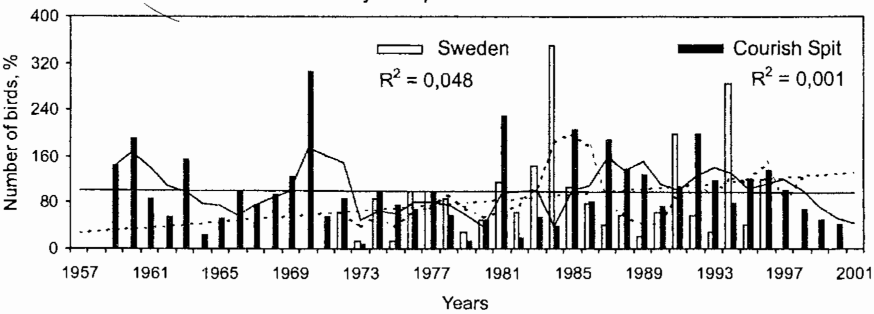
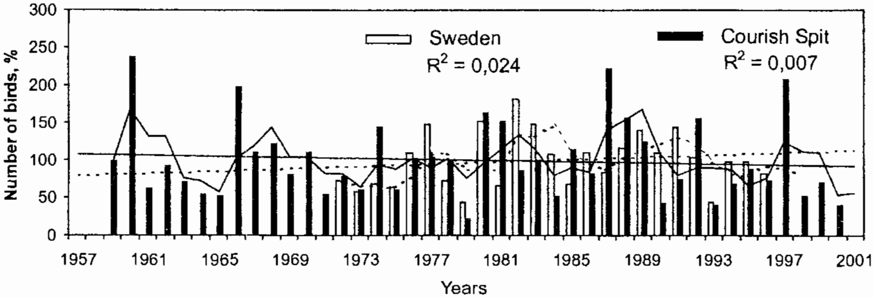
Sylvia borin



Phylloscopus sibilatrix



Phylloscopus trochilus



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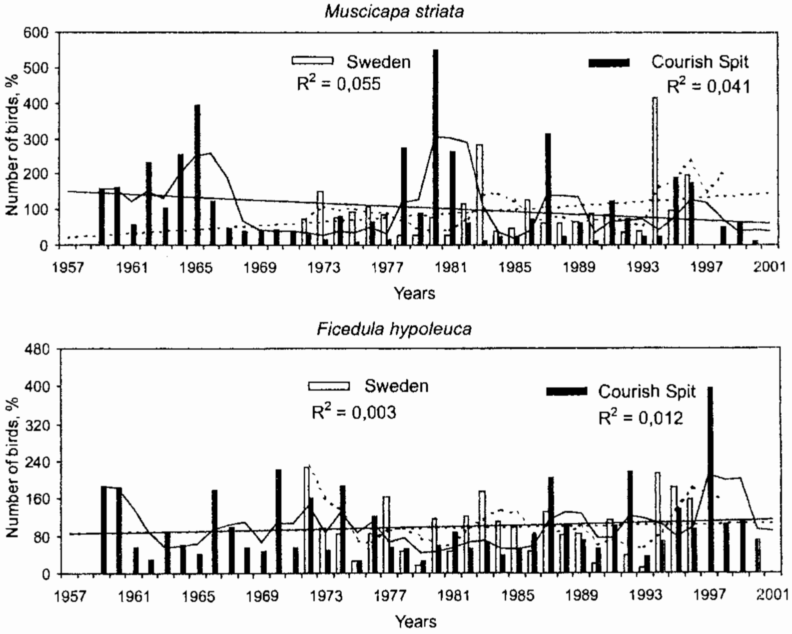
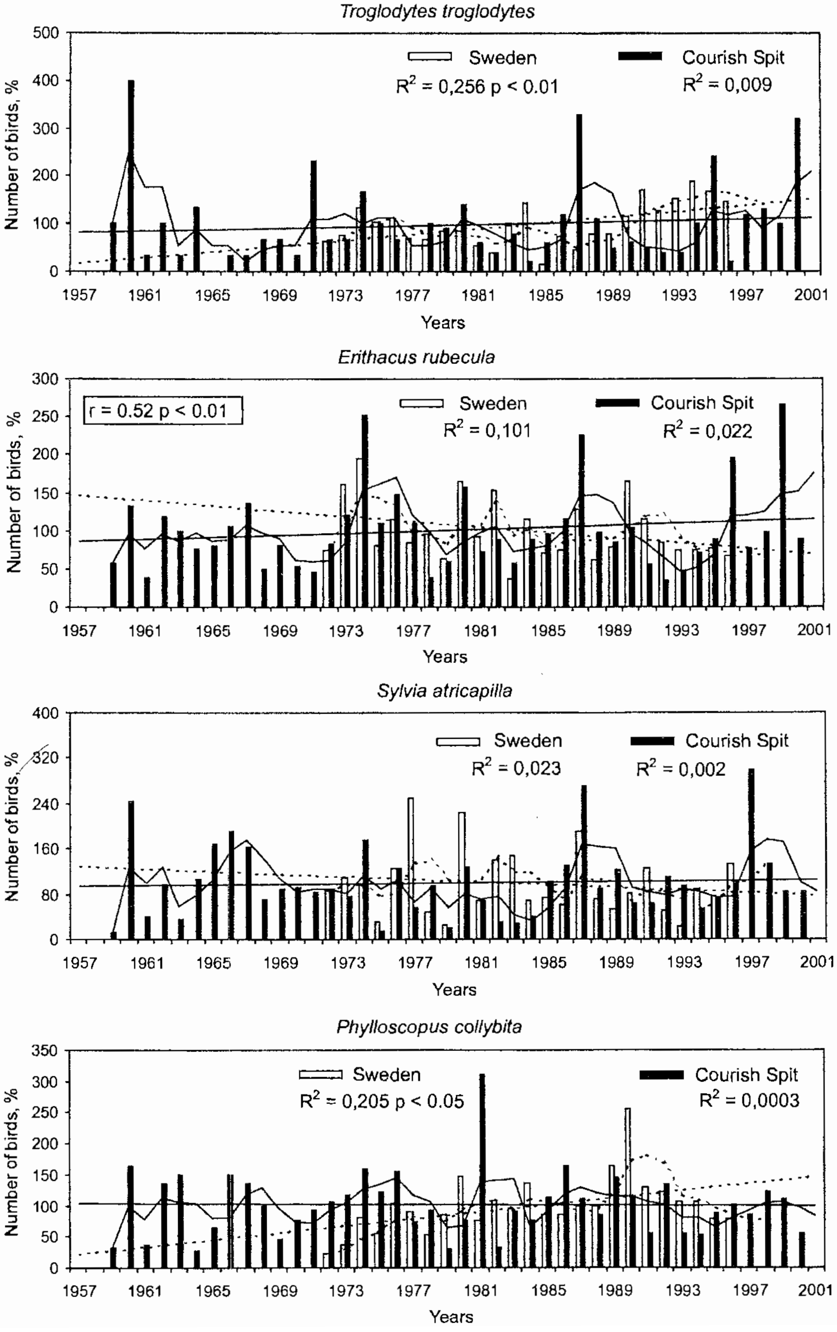


Table 3. Percentages of long (L) and short (S) distance migrants whose numbers in spring significantly declined (–) or increased (+) over the study period on the Courish Spit and in Sweden.

Region	Number of species		Years	Trend	
				–	+
Russia (Courish Spit)	L	15		0	0
	S	21	1959-2000	0	0
Sweden (Ottenby)	L	18		5.6	5.6
	S	20	1972-1996	10.0	10.0

Capture data concerning 38 species of both long- and short-distance migrants from Sweden (Ottenby) between 1972 and 1996 show that bird numbers were higher in the 1980s than in the 1970s or 1990s, but, like on the Courish Spit, this trend was less evident than in autumn (Figs 3, 4). Over the whole study period, numbers significantly declined in the Red-backed Shrike, Song Thrush *Turdus philomelos*, and Reed Bunting *Emberiza schoeniclus*; and increased in the White Wagtail, Wren *Troglodytes troglodytes*, and Chiffchaff *Phylloscopus collybita* (Tab. 3).

Figure 4. Dynamics of numbers of some middle- and short-distance migrants in spring in Sweden (Ottenby) and Russia (Courish Spit). Notation as in Fig. 1.



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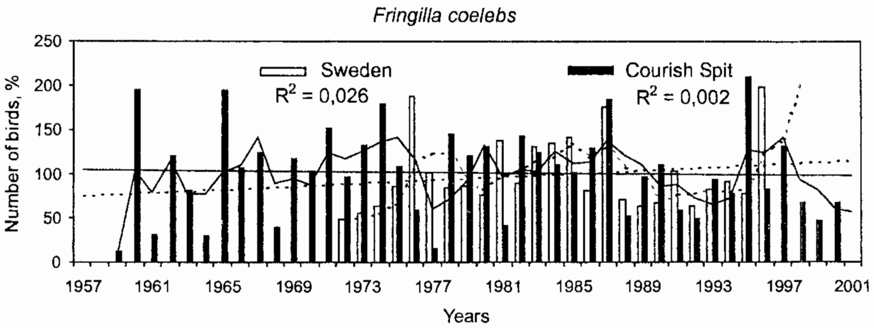

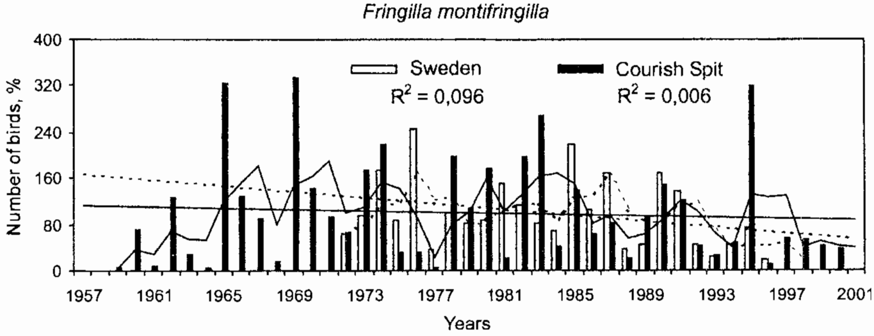

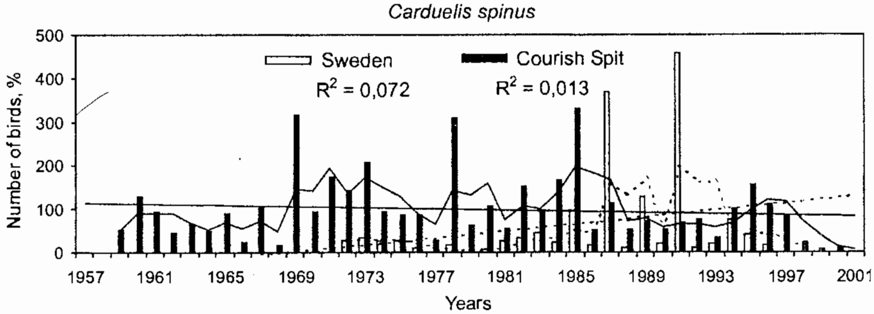

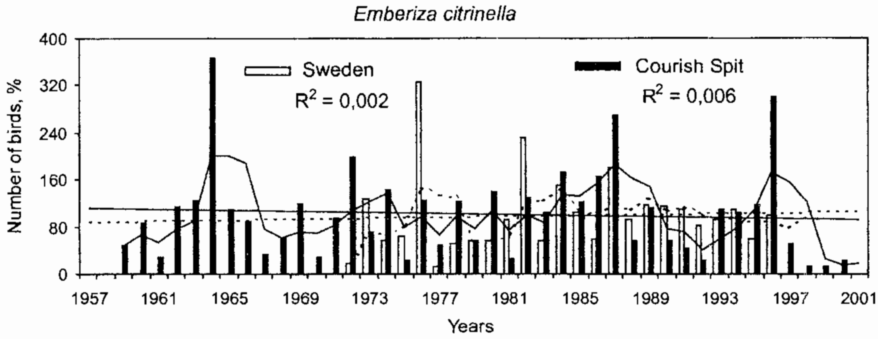

4. Discussion

On the basis of our analysis we conclude that in the second half of the 20th century, in different European regions in the 1960s and 1980s a significant rising of numbers on autumn passage was recorded in many passerines, both long- and short-distance migrants. In the 1970s and partly 1990s, in many species a significant decline occurred in a number of regions. Lack of rise in numbers in most species in the 1980s in Poland, Germany, and Austria is most likely not explained by other populations migrating there. It is most unlikely in the case of Vistula Spit which is situated only 100 km away from the Courish Spit. The reason is probably in habitat change in those regions.

A significant decline in numbers of autumn passage populations in Sweden and on the Courish Spit over the whole study period (42-44 years) was recorded, unlike Poland and Germany, in only few species of long-distance migrants which winter in Africa. It is not impossible that decreasing in trapping figures of these species in Ottenby (Sweden) and on the Courish Spit is due not to a genuine decline in their passage populations, but to decreasing capture efficiency in stationary traps. Some of those species, primarily White and Yellow Wagtails and Whinchat, prefer to fly over open habitats, not over vegetated areas where the traps are now situated.

Spring numbers of transit populations sampled in Ottenby and on the Courish Spit in the vast majority of species did not show any trend, positive or negative, over the last four decades. Of the long-distance migrants, only Red-backed Shrike showed a significant decline in Sweden. Possibly only this species and Barred Warbler *Sylvia nisoria*, of all species studied by us, indeed decreased their numbers in many parts of Europe in the recent decades. This was however most probably caused not by increasing winter mortality due to more severe droughts in Africa, but by deteriorating conditions in the breeding areas due to stronger negative impact of the anthropogenic factor on their breeding success (Sokolov 1999).

If we consider the opinion of German researchers (Berthold et al. 1998, 1999) that declining numbers of many long-distance migrants in the recent decades are due to the global warming, this effect should be present also in more northern populations sampled by us. These populations most probably winter in the same parts of Africa as their central European conspecifics (Payevsky 1973, Zink 1973). In western tropical Africa, where many Palaeartic migrants spend winter, most severe deficit of rainfall was recorded in 1968, 1972, 1973 and 1982-1984 (Jurry 1997). Average rainfall occurred only in 1994. The droughts caused degradation of vegetation, decline in insect abundance, decreasing water area, i.e. food availability and habitat quality deteriorated. The effect of droughts was most dramatic in Sand Martins *Riparia riparia*, Redstarts and Shrikes. This problem was further complicated by the anthropogenic pressure. These data suggest that numbers of many long-distance migrants from both northern and southern parts of their ranges should be noticeably decreasing in the 1970s and 1980s (Jurry 1997). However according to our data, this was not the case in the 1980s in long-distance migrants from the Baltic area. Quite the opposite, numbers of many species which winter to the south of the equator significantly increased.

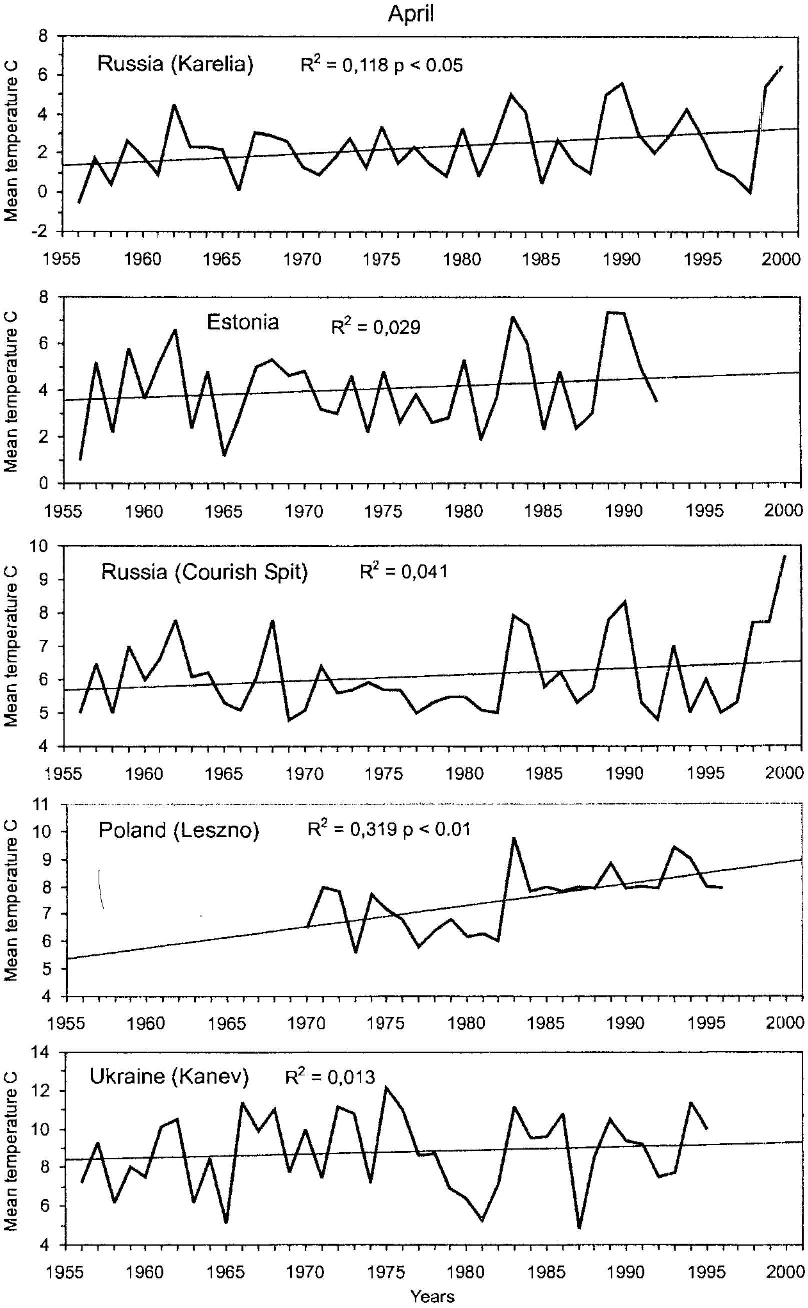

Figure 5. Trends in April monthly temperature in different regions of Europe in the second half of the 20th century. Data on Poland from Tryjanowski et al. (2002). Data on Ukraine from Grishchenko & Jablonowska-Grishchenko (1996).

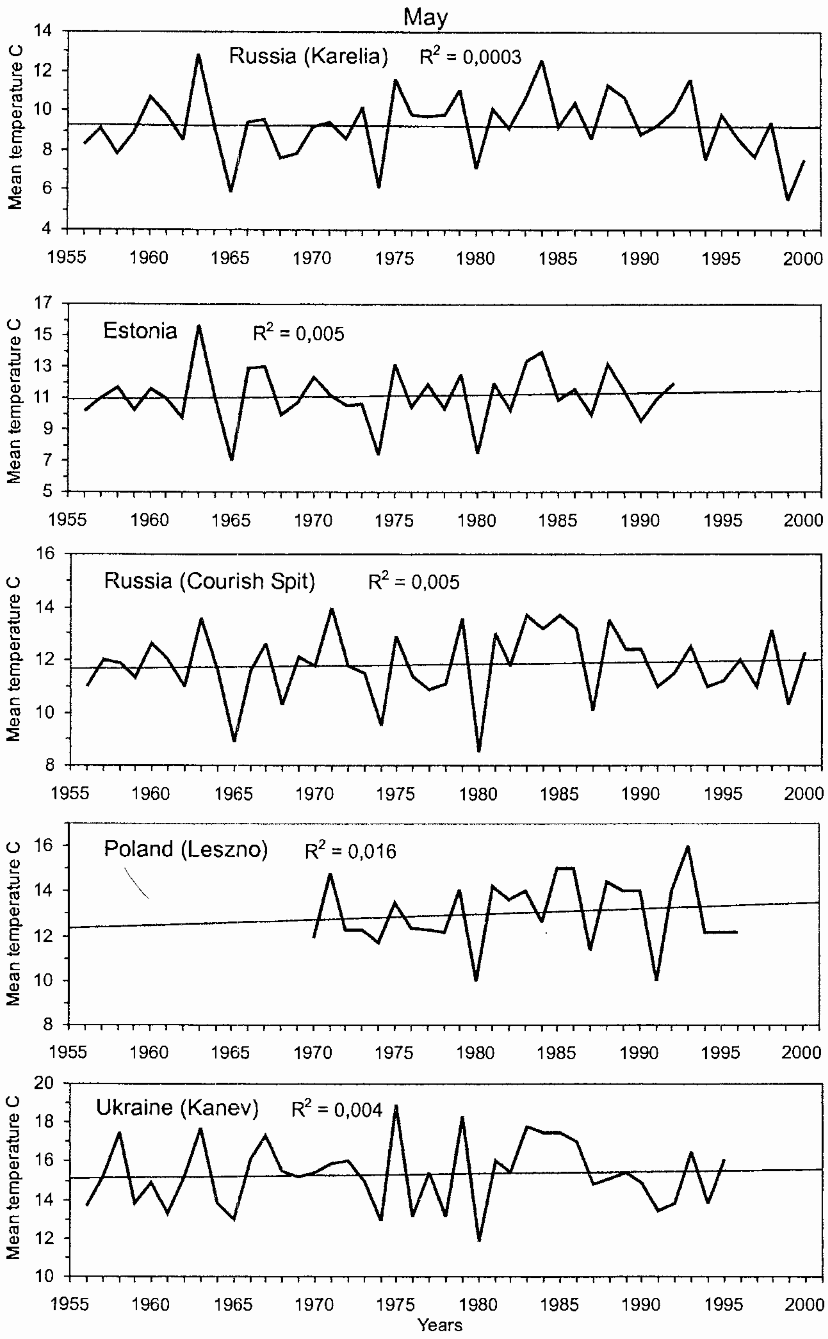

Figure 6. Trends in May monthly temperature in different regions of Europe in the second half of the 20th century.

In our previous papers (Sokolov 1999, 2000, Sokolov et al. 2000, 2001) we analysed the relationship between numbers of breeding and passage populations and the main climatic parameter, air temperature. We conclude that long-term periods of increasing and declining numbers of passerines recorded in the second half of the 20th century in Europe are mainly due to climate fluctuations recorded in the northern hemisphere in this century. This is supported by (1) significant relationship between numbers of passage populations of a number of species and April temperatures; (2) relationship between numbers of passage populations and timing of breeding of local birds; (3) highly significant correlation between numbers of local and passage populations in many species (Sokolov et al. 2000). Rising of spring temperatures above the long-term average (Figs. 5, 6) usually not only causes earlier arrival (Tryjanowski et al. 2002) and breeding (Crick & Sparks 1999), but also enhances breeding success and offspring survival. All these events together lead to increasing numbers of breeding and passage populations in years with warm spring (Sokolov & Payevsky 1998, Sokolov et al. 1998, 2001, Sokolov 1999, 2000, 2001). As numbers of passage populations in autumn are often related to the breeding numbers of passerines, in a number of cases well-founded conclusions are made concerning the long-term dynamics of European breeding populations on the basis of long-term standardised monitoring projects in the areas of massive passage, mainly in autumn. Our analysis of long-term monitoring data of passerine numbers in different parts of Europe does not allow us to conclude that in many species, primarily long-distance migrants, breeding and passage populations declined dramatically in the last decades of the 20th century due to the negative impact of global warming. Quite the opposite, we suggest that if in future global warming processes indeed enhances in the northern hemisphere, numbers of many species, including long-distance migrants, will increase, and their breeding range will expand towards the north. A serious threat for most our species wintering in Africa to the south of the equator could emerge when the breadth of the main barrier for their migration, the Sahara, becomes so great that they can no longer cross it. However capture data of migrating birds from the Baltic region and the Ukraine in the end of the 20th century suggest that this threat has not yet become actual.

Acknowledgements

This study was supported by a grant from Russian Foundation for Basic Research No. 00-07-90181.

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