POPULATION NUMBER DYNAMICS 1961-1990 OF *SYLVIA* SPECIES CAUGHT DURING AUTUMN MIGRATION AT SOME NORTH AND CENTRAL EUROPEAN BIRD STATIONS

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ABSTRACT

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Presented material contains catching results from 15 bird stations situated around the Baltic Sea, North Sea (Helgoland, Reit) and the Central Europe (Mettnau, Illmitz). The length of the time series vary between eight and thirty years. Six stations with the longest series (Bukowo, Hel, Mierzeja Wiślana – Poland, Helgoland – Germany, Ottenby – Sweden and Rybatchy – Russia) are treated as the basic net supplemented by the data from the other stations. Blackcap, Garden Warbler, Whitethroat, Lesser Whitethroat and Barred Warbler were studied. The number of individuals caught per species at six main stations varied from 1354 (*S. nisoria*), to 28 349 (*S. borin*). Pooled data from main stations show significant decline in number of all studied species. The highest rate of decline shows *S. nisoria* (regression coefficient $R = -10.42$, there were the highest fluctuations too – fluctuation coefficient $CF = 69.8$), the next high decline was found in *S. communis* ($R = -8.76$), *S. curruca* ($R = -4.45$), *S. borin* ($R = -1.97$).

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INTRODUCTION

Analysing of population dynamics data of migrants at a number of bird stations situated on a wide territory of North and Central Europe (Busse 1995; Busse and Marova 1993) points at some new problems. These are problems connected with differences in numbers of birds caught at the stations, interpretation of the level of yearly fluctuations at the individual stations and of data pooled for many stations, correlations of long-term number dynamics of the species between stations and relations between population dynamics of different species (Busse and Marova 1993). Solving these problems needs description of population dynamics for many species belonging to different systematic and ecological groups of birds.

The paper is intended to present general pattern of population dynamics of *Sylvia* species migrating through the area of interest. Detailed analysis of intra-species as well as inter-specific relations between population dynamics as shown at individual stations will be included in next publications.

MATERIAL AND METHODS

The data were collected in autumn at bird stations shown at Figure 1, within a period 1961-1990. Material from six stations, called here "main stations", covers time series more than 20 years long:

1-3. Operation Baltic research program – mist-netting birds at three stations – Mierzeja Wiślana (54.21 N, 19.19 E), Hel (54.46 N, 18.28 E) and Bukowo/Kopań

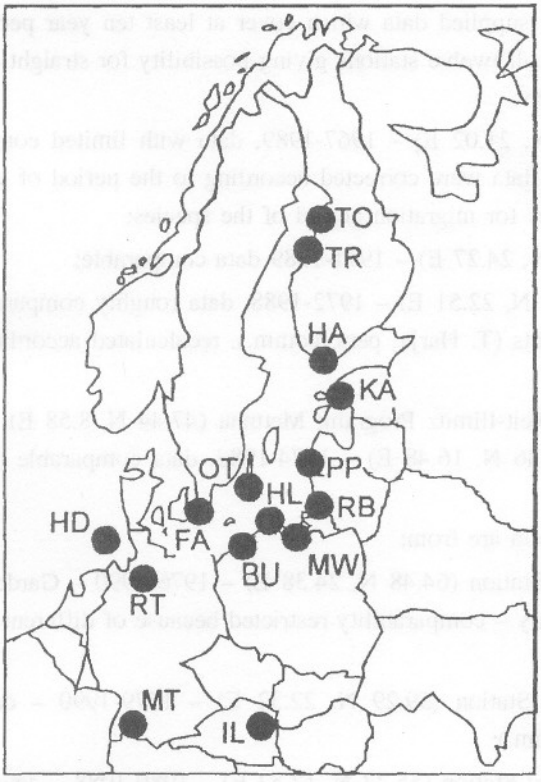

Fig. 1. Geographic distribution of the bird stations included into evaluation. BU – Bukowo/Kopań, FA – Falsterbo, HA – Hanko, HD – Helgoland, HL – Hel, IL – Illmitz, KA – Kabli, MT – Mettnau, MW – Mierzeja Wiślana, OT – Ottenby, PP – Pape, RB – Rybatchy, RT – Reit, TO – Tauvo, TR – Tankar

(54.21 N, 16.17 E/54.28 N, 16.25 E) during 30 years (1961-1990, except Hel 1961-1986). All data are comparable within of station data set through all period of work (Busse 1994);

4. Helgoland Bird Station (54.00 N, 8.00 E) – 1953-1988, data from 1953-1960 are not used because of limitations in comparability (Moritz 1981, 1982a, 1982b, 1983; Moritz and Vauk 1979);

5. Ottenby Bird Station (56.12 N, 16.24 E) – 1961-1988, data nearly comparable (pers. comm.);

6. Rybatchy (55.09 N, 20.52 E) – 1961-1986, data comparable (Payevsky 1990), 1985-1986 data from another catching place, close to the previous one – recalculated for comparative reasons on the basis of relation obtained from the data of common, eight year period of work;

Next six stations supplied data which cover at least ten year period 1974-1983, which is common for all twelve stations giving possibility for straight comparisons of population trends levels:

7. Pape (56.09 N, 21.02 E) – 1967-1989, data with limited comparability – in the present paper the data were corrected according to the period of work – recalculated to per day values for migration period of the species;

8. Kabli (58.01 N, 24.27 E) – 1971-1989 data comparable;

9. Tankar (63.57 N, 22.51 E) – 1972-1988, data roughly comparable because of unstable number of nets (T. Harju, pers. comm.), recalculated according to period of work, as for Pape;

10-12. Mettnau-Reit-Illmitz Program: Mettnau (47.44 N, 8.58 E), Reit (53.28 N, 10.06 E), Illmitz (47.46 N, 16.48 E) – 1974-1983, data comparable (Berthold *et al.* 1986).

Supplementary data are from;

13. Tauvo Bird Station (64.48 N, 24.38 E) – 1976-1990 – Garden Warbler and Lesser Whitethroat only – comparability restricted because of different catching activity, partly corrected;

14. Hanko Bird Station (59.29 N, 22.32 E) – 1979-1990 – data comparable (M. Lehti – pers. comm.);

15. Falsterbo Bird Station (55.22 N, 12.52 E) – 1980-1988 – data comparable.

Covered time-span for the stations numbered 13-15 does not allow direct comparisons with the twelve stations listed under numbers 1-12 and they are not included in values pooled for species. Moreover, data from Sörve Bird Station (57.54 N,

22.03 E) – 1981-1988 and Neringa (55.27 N, 21.04 E) – 1979-1988, should be acknowledged, but not used in this evaluation: at Sörve too short set of comparable years and at Neringa too late beginning of season work for evaluations of early migrating *Sylvia* species.

Table 1

General data on *Sylvia atricapilla* number dynamics at different bird stations

Station	Period / No of year	Ind. per season	*CF*	*R* 1961-86	*R* 1974-83	*R* 1980-88	*R* Max.
Mierzeja Wiślana	1961-90	122.1	15.50	–0.87~	–11.39**	–0.78~	–0.74~
	30			–1.36**	–9.05**	+2.95~	–0.90~
Hel	1961-86	47.0	7.52	–	–	–	–
	26			–10.17**	–9.23**	–	–10.17**
Bukowo	1961-90	101.5	8.15	–6.04**	–8.76*	–6.43~	–5.50**
	30			–5.79**	–7.32**	–7.02**	–5.37**
Helgoland	1961-88	464.8	7.19	+2.75**	+0.49~	–12.37**	+1.74~
	28			+2.76**	–0.02~	–10.68**	+1.74**
Ottenby	1961-88	61.5	9.89	+1.44~	+8.25~	–11.57**	+1.24~
	28			+1.55**	+7.82**	–8.00**	+1.17**
Rybatchy	1961-86	26.8	6.39	+3.24**	+6.33~	–	+3.24**
	26			+3.19**	+2.26~	–	+3.19**
POOLED	*N* =	**23 365**	**2.55**				**–1.92****
6 stations							**–1.97****
Pape	1971-90	33.9	7.11	–	–1.68~	–2.37~	–0.71~
	20			–	–2.83~	–0.37~	–0.70~
Kabli	1971-89	15.6	32.84	–	–7.22~	–12.30*	–5.35~
	19			–	–7.18*	–9.58**	–5.51**
Tankar	1972-88	19.7	68.54	–	+9.62~	–2.38~	+9.62**
	17			–	+13.51**	+2.62~	+9.60**
Reit	1974-83	81.7	12.11	–	+2.08~	–	+2.08~
	10			–	+3.17	–	+3.17
Mettnau	1974-83	623.4	11.29	–	+4.23~	–	+4.23~
	10			–	+4.07**	–	+4.07**
Illmitz	1974-83	35.8	4.53	–	+2.15~	–	+2.15~
	10			–	+2.19*	–	+2.19*
POOLED	*N* =	**32 684**	**2.34**				**–2.03****
12 stations							**–1.99****
Hanko	1979-90	82.1	9.71	–	–		
	12			–	–		
Falsterbo	1980-88	80.5	11.35	–	–	+12.75~	+12.75~
	9			–	–	+9.80~	+9.80~

Explanations: *CF* – coefficient of fluctuations; *R* – coefficient of regression, calculated from raw (above) and smoothed data; statistical significance: ** – $p < 0.01$, * – $0.05 > p > 0.01$, ~ – $p > 0.05$.

Table 2

General data on *Sylvia borin* number dynamics at different bird stations

Station	Period	Ind. per season	*CF*	*R*			
	No of year			1961-86	1974-83	1980-88	Max.
Mierzeja Wiślana	1961-90	83.9	24.11	–3.87*	–10.29*	–11.10*	–3.45**
	30			–4.19**	–7.74**	–6.97**	–3.68**
Hel	1961-86	38.0	24.35	–	–	–	–
	26			–2.25**	–2.94~	–	–2.25**
Bukowo	1961-90	58.5	14.28	–6.56**	–13.74**	–5.93~	–6.37**
	30			–6.27**	–10.84**	–7.43**	–6.16**
Helgoland	1961-88	572.0	3.56	+0.40~	+4.18~	–10.60**	–0.08~
	28			+0.38~	+2.81*	–8.62**	–0.10~
Ottenby	1961-88	118.0	14.97	+0.21~	+3.23~	–1.47~	+0.42~
	28			+0.18~	+4.68**	–1.02~	+0.34~
Rybatchy	1961-86	52.6	12.90	–2.56~	+5.60*	–	–2.65~
	26			–2.33*	+4.68**	–	–2.33*
POOLED	*N* =	**25 947**	**5.28**				**–2.95****
6 stations							**–2.94****
Pape	1971-90	90.3	23.16	–	+4.02~	+5.82~	+0.36~
	20			–	+2.52~	+0.30~	+0.41~
Kabli	1971-89	29.7	29.20	–	–8.92~	–5.12~	–5.93*
	19			–	–9.88**	–4.77**	–6.25**
Tankar	1972-88	19.2	23.56	–	+4.30~	–9.18~	+0.10~
	17			–	+4.51*	–7.40**	+0.09~
Reit	1974-83	24.6	13.53	–	–3.58~	–	–3.58~
	10			–	–1.61~	–	–1.61~
Mettnau	1974-83	49.3	9.32	–	+1.99~	–	+1.99~
	10			–	+2.07**	–	+2.07**
Illmitz	1974-83	65.1	14.99	–	+0.51~	–	+0.51~
	10			–	+1.19~	–	+1.19~
POOLED	*N* =	**34 471**	**4.52**				**–2.93****
12 stations							**–2.86****
Tauvo	1976-90	9.4	11.33	–	–	–2.90~	–4.15~
	15			–	–	–3.52~	–4.11**
Hanko	1979-90	280.4	9.76	–	–	–3.65~	–6.31~
	12			–		–4.12*	–6.11**
Falsterbo	1980-88	290.3	10.65	–	–	+1.67~	+1.67~
	9			–	–	+0.32~	+0.32~

Explanations: *CF* – coefficient of fluctuations; *R* – coefficient of regression, calculated from raw (above) and smoothed data; statistical significance: ** – $p < 0.01$, * – $0.05 > p > 0.01$, ~ – $p > 0.05$.

As Barred Warbler (*Sylvia nisoria*) and Whitethroat (*Sylvia communis*) migrate very early, in some cases comparability at the stations included in evaluation was too

Table 3

General data on *Sylvia curruca* number dynamics at different bird stations

Station	Period / No of year	Ind. per season	*CF*	*R* 1961-86	*R* 1974-83	*R* 1980-88	*R* Max.
Mierzeja Wiślana	1961-90	27.2	21.67	–9.71**	–15.36**	+5.37~	–7.73**
	30			–9.47**	–11.83**	+3.10**	–7.63**
Hel	1961-86	16.6	26.93	–	–	–	–
	26			–7.50**	–3.36~	–	–7.50**
Bukowo	1961-90	20.4	24.42	–2.71~	–13.80**	–7.88**	–3.58**
	30			–2.55**	–12.45**	–8.97**	–3.47**
Helgoland	1961-88	4.6	22.08	+0.19~	–0.03~	–9.35~	–1.01~
	28			–0.28~	–0.05~	–7.47**	–1.02~
Ottenby	1961-88	177.4	10.23	–2.36~	+3.32~	–1.87~	–1.21~
	28			–1.48~	+3.04**	–058~	–1.31*
Rybatchy	1961-86	58.8	17.42	–2.38~	–11.83**	–	–2.38~
	26			–2.42*	–12.14**	–	–2.42*
POOLED 6 stations	*N* =	**8 489**	**4.03**				**–4.50****
							–4.45**
Pape	1971-90	11.6	47.59	–	+12.44~	+14.13~	+6.24~
	20			–	+6.36~	+11.85**	+5.69**
Kabli	1971-89	19.6	20.40	–	–9.23~	–0.20~	–4.37*
	19			–	–9.18**	–2.05**	–4.57**
Tankar	1972-88	2.6	134.07	–	–2.50~	+29.52**	+8.85*
	17			–	–2.15~	+24.42**	+8.57**
Reit	1974-83	135.2	17.12	–	–4.00~	–	–4.00~
	10			–	–0.99~	–	–0.99~
Mettnau	1974-83	153.3	2.71	–	–1.21~	–	–1.21~
	10			–	–0.72~	–	–0.72~
Illmitz	1974-83	14.8	18.52	–	–13.45~	–	–13.45~
	10			–	–9.62**	–	–9.62**
POOLED 12 stations	*N* =	**12 172**	**4.51**				**–3.50****
							–3.45**
Tauvo	1976-90	6.5	23.98	–	–	–8.20~	–5.71~
	15			–	–	–7.40**	–6.04**
Hanko	1979-90	100.5	12.64	–	–	–3.30~	–2.75~
	12			–	–	–4.77**	–3.26**
Falsterbo	1980-88	83.4	3.27	–	–	–1.55~	–1.55~
	9			–	–	–2.30~	–2.30~

Explanations: *CF* – coefficient of fluctuations; *R* – coefficient of regression, calculated from raw (above) and smoothed data; statistical significance: ** – $p < 0.01$, * – $0.05 > p > 0.01$, ~ – $p > 0.05$.

low and they have been skipped in the presentation of data (see Tables 1-5). General problems of data comparability are discussed elsewhere (Busse 1990).

Table 4

General data on *Sylvia communis* number dynamics at different bird stations

Station	Period / No of year	Ind. per season	*CF*	*R* 1961-86	*R* 1974-83	*R* 1980-88	*R* Max.
Mierzeja Wiślana	1961-90	13.3	61.89	–5.18~	–5.48~	+16.87**	–2.83~
	30			–5.60**	–0.71~	+13.40**	–3.06**
Hel	1961-86	1.6	188.26	–	–	–	–
	26			–34.56**	–12.48~	–	–34.56**
Bukowo	1961-90	6.9	37.62	–0.14~	–0.09~	–13.30**	–0.83~
	30			–0.33~	–0.32~	–11.57**	–1.06~
Helgoland	1961-88	62.1	74.60	–3.09~	+5.01~	–11.92**	–3.30~
	28			–3.01~	+3.28*	–11.27**	–3.33*
Ottenby	1961-88	124.6	3.34	–2.71**	+3.29~	–5.57*	–2.65**
	28			–2.75**	+2.52~	–4.92**	–2.66**
Rybatchy	1961-86	17.3	40.94	–11.32**	–0.30~	–	–11.32((
	26			–11.33**	–4.95**	–	–11.33**
POOLED 6 stations	*N* =	**6 328**	**13.95**				**–8.45****
							–8.76**
Kabli	1971-89	8.0	19.24	–	–20.24**	–5.53~	–7.91**
	19			–	–17.82**	–5.97**	–8.26**
Reit	1974-83	82.9	7.53	–	–8.12~	–	–8.12~
	10			–	–7.32**	–	–7.32**
Mettnau	1974-83	25.1	4.94	–	–3.22~	–	–3.22~
	10			–	–2.94~	–	–2.94~
Illmitz	1974-83	13.0	2.14	–	–13.02**	–	–13.02**
	10			–	–12.19**	–	–12.19**
POOLED 10 stations	*N* =	**7 704**	**13.02**				**–9.63****
							–9.83**
Hanko	1979-90	36.7	16.44	–	–	+2.37~	+0.74~
	12			–	–	–0.10~	+0.24~
Falsterbo	1980-88	42.2	11.79	–	–	+2.93~	+2.93~
	9			–	–	+1.78~	+1.78~

Explanations: *CF* – coefficient of fluctuations; *R* – coefficient of regression, calculated from raw (above) and smoothed data; statistical significance: ** – $p < 0.01$, * – $0.05 > p > 0.01$, ~ – $p > 0.05$.

In the paper all values describing population level are expressed as a percentage of the average number of the species at the station for the years 1974-1983, because these years are common for most of the studied series. Because the period 1974-1983 is used as the standard in the paper, numbers for Polish stations presented here, as well as regression coefficients values, are not the same as in papers by Busse (1994a, b). The values given as common for a group of stations ("pooled data") were calculated as averages for all stations included, where every station had the same weight.

Table 5

General data on *Sylvia nisoria* number dynamics at different bird stations

Station	Period	Ind. per season	*CF*	*R*			
	No of year			1961-86	1974-83	1980-88	Max.
Mierzeja Wiślana	1961-90	4.6	28.45	–0.46~	–34.67**	+0.70~	–1.41~
	30			–0.41~	–28.82**	+0.70~	–1.42~
Hel	1961-86	0.1	–	–	–	–	–
	26			–	–	–	
Bukowo	1961-90	0.7	–	–	–		–
	30			–	–		
Ottenby	1961-88	12.2	13.88	+0.64~	+1.97~	–13.78*	–0.21~
	28			+0.71~	–0.29~	–10.42**	–0.21~
Rybatchy	1961-86	32.6	55.28	–16.13**	–26.01**	–	–16.13**
	26			–16.21**	–19.07**	–	–16.21**
POOLED	*N* =	**1 329**	**12.64**				**–6.03****
4 stations							**–6.05****
Kabli	1971-89	3.3	131.88	–	–25.96~	–8.80~	–17.15**
	19			–	–32.19**	–7.67**	–18.07**
Tankar	1972-88	0.2	–	–	–	–	–
	17			–	–		–
Reit	1974-83	0.0	–	–	–	–	–
	10			–	–	–	–
Mettnau	1974-83	0.2	–	–	–	–	–
	10			–	–	–	–
Illmitz	1974-83	2.0	70.60	–	–7.27~	–	–7.27~
	10			–	–3.14~	–	–3.14~
POOLED	*N* =	**1 412**	**5.60**				**–5.99****
9 stations							**–6.01****
Hanko	1979-90	4.4	28.72	–	–	–28.23*	–
	12			–	–	–22.37**	
Falsterbo	1980-88	0.4	–	–	–	–	–
	9			–	–	–	–

Explanations: *CF* – coefficient of fluctuations; *R* – coefficient of regression, calculated from raw (above) and smoothed data; statistical significance: ** – $p < 0.01$, * – $0.05 > p > 0.01$, ~ – $p > 0.05$.

As the basic data values are independent of real number of individuals caught (they are comparable between stations) they can be pooled for regional values. This method avoids suppressing trends observed at the stations where fewer individuals were caught because of peculiarities of catching methods and/or location and habitats. The graphs present raw, smoothed data (five year moving average with coefficients 1, 2, 3, 2, 1) and strongly smoothed data (five year moving average repeated four times). For characterising trends the linear regression coefficient *R* is used, for correlations –

Pearson's *r* coefficient and for fluctuations of basic data around smoothed curve – *CF* coefficient (Busse 1990).

RESULTS

Blackcap (*Sylvia atricapilla*)

Basic data on frequency of trapping, number fluctuations and population dynamics of the Blackcap is presented in Table 1 and Figure 2. Blackcap is one of the two commonest *Sylvia* species caught at the bird stations included in to analysis. However, its frequencies are very much differentiated – from only 15.6 individuals per season at Kabli to 623.4 and 464.8 ind. per season at Mettnau and Helgoland respectively (Table 1, Fig. 2). Yearly fluctuations of the Blackcaps caught at station are frequently low (*CF* values usually under 10) with the lowest values at Illmitz and Rybatchy (*CF* equals 4.53 and 6.39 respectively) – the stations with rather low, but

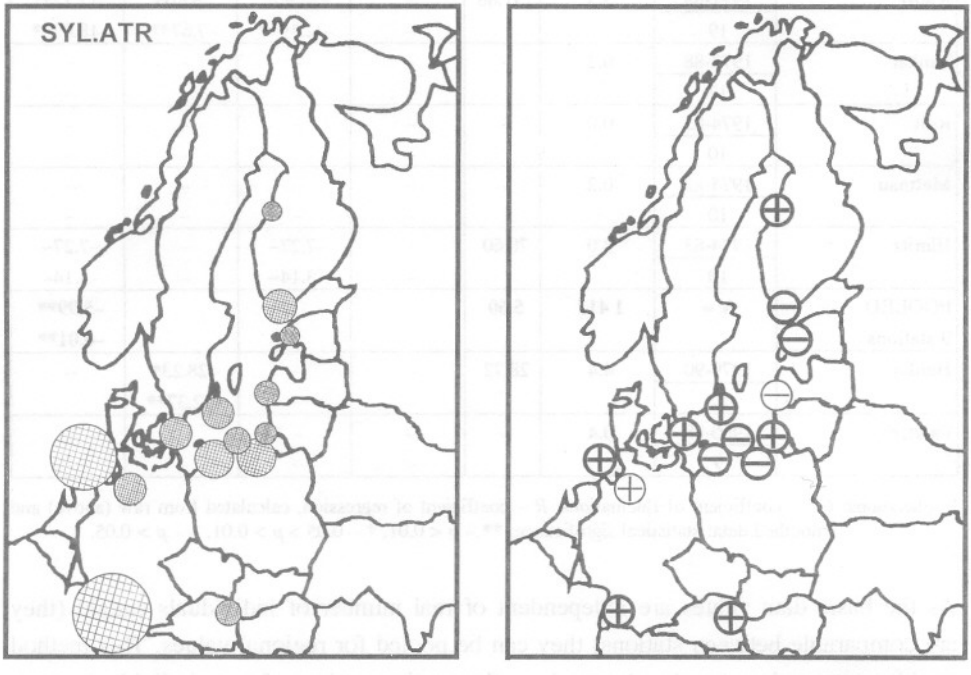

Fig. 2. Blackcap (SYL.ATR). Frequency of individuals caught at stations (left) and population dynamics trends for stations (right). Area of a circle representing frequency at the station is related to the number of individuals caught per season; trends are for full time-span of data; statistically significant trends are printed as a bold signs. For values cf. Table 1, for station names – see Figure 1.

not the lowest, number of birds caught. Very high variation of yearly frequencies are observed at the northern station Tankar (*CF* = 68.54, but note low number of birds). Two stations next to the South – Hanko and Kabli have much differentiated fluctuations (*CF* equals resp. 9.71 and 32.84), but Hanko has much higher number of birds caught. Coefficient of fluctuations calculated for pooled data for both six and twelve stations shows extremely low value – the lowest of all studied *Sylvia* species and much lower than in *Phylloscopus* species analysed by Busse and Marova (1993).

Population trends at the main stations are differentiated from strongly negative (*R* = –10.17, smoothed data for Hel 1961-1986) to moderately positive (*R* = +3.24, raw data for Rybatchy 1961-1986). Other stations show examples of both clearly negative trends (–7.77, smoothed data for Hanko 1979-90 and –5.51, smoothed data for Kabli 1971-1989) and positive ones (+9.62, raw data for Tankar 1972-1988), but note low number of birds and +12.75, raw data for Falsterbo, but not statistically significant, because of fluctuations and short series – 1980-88). It must be stressed that part of these comparisons have limited value as both the length of series and their localisation in time are differentiated. It should be noted too, that inside of the long series trend can change both its value and even sign as it was in the case of e.g. Helgoland and Ottenby (cf. Table 1). The same occurs in other species (Busse 1990, 1994a; Busse and Marova 1993). Geographical distribution of stations with positive and negative trends shows that positive trends occurs rather to the West and South, with exception of positive trend at Rybatchy (surrounded by negative ones) and Tankar. Despite these differentiations, the general trend shown by pooled data is negative. This is a case both for six main stations and full set of twelve comparable stations: *R* equals –1.97 (raw) and –1.92 (smoothed) for six stations and resp. –1.99 and –2.03 for twelve stations. These values are very close to each other and highly statistically significant. In connection with very low *CF* coefficient values they can be treated as well documented.

Garden Warbler (*Sylvia borin*)

Basic data on frequency of trapping, number fluctuations and population dynamics of the Garden Warbler is presented in Table 2 and Figure 3. Garden Warbler is a migrant commonly caught at bird stations. The number of individuals caught at all stations is a little bit higher than of the Blackcap. The scale of differentiation between stations is similar to that for the Blackcap too: from 9.4 ind. per season at Tauvo to 572.0, 290.7 and 280.4 resp. at Helgoland, Falsterbo and Hanko. Helgoland has very high catches of both compared species. Very different situation is at Mettnau and, in smaller scale, at Falsterbo and Hanko.

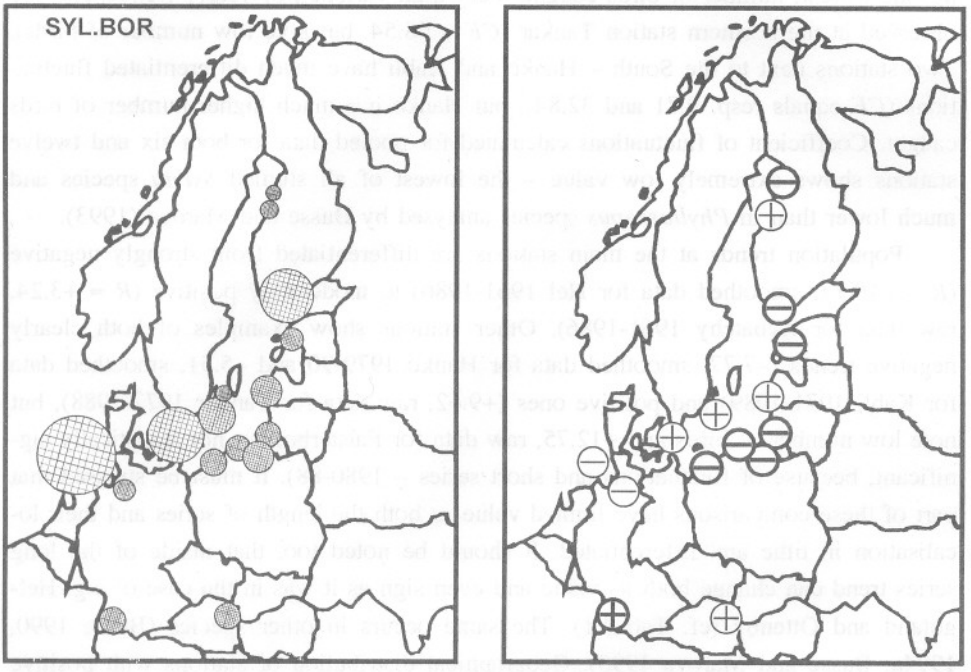

Fig. 3. Garden Warbler (SYL.BOR). Frequency of individuals caught at stations (left) and population dynamics trends for stations (right). Explanations as at Figure 2.

Yearly fluctuations of catches at stations are considerably higher for Garden Warbler than the Blackcap with one exception only – at Helgoland fluctuations are the lowest among data for both species and all stations (*CF* = 3.56). Only two other stations – Mettnau and Hanko – have *CF* values under 10.0. However, pooled data show low level of fluctuations (5.28 for six and 4.52 for twelve stations). This is higher than for the Blackcap, but at a level comparable to Willow Warbler and Chiffchaff (Busse and Marova 1993).

In the population trends as shown by catching at ringing stations dominate negative ones, most of them statistically significant, while positive values are not significant, except that for Mettnau smoothed data (but note that value for raw data at this station does not exceed level of $p = 0.05$). The most negative trends are at Bukowo (–6.37, raw data), Kabli (–6.25, smoothed data) and Hanko (–6.11, smoothed data). Note that Hanko and Kabli are close to each other. The most positive trend was found at Mettnau (see above) and at Illmitz (+1.19, raw data).

The general picture for pooled data shows significantly negative trends both for main stations (–2.95, raw and –2.94, smoothed data) and twelve stations (–2.93 and –2.86 resp.). Very high consistence of pooled trends and low values of *CF* for pooled data suggest that the observed trend is valid for the studied area.

Lesser Whitethroat (*Sylvia curruca*)

Basic data on frequency of trapping, number fluctuations and population dynamics of the Lesser Whitethroat are presented in Table 3 and Figure 4. Lesser Whitethroat is the third as to frequency of catching of the *Sylvia* species at the stations included in evaluation. However, this level is much lower than those for the Blackcap and Garden Warbler. Differentiation between stations is high here, but the most frequently visited are different stations than these for other species. Very low number of Lesser Whitethroat was caught at Helgoland (only 4.6 ind. per season), where the most frequent was Garden Warbler and very frequent Blackcap. The highest numbers of Lesser Whitethroat were caught at Ottenby (177.4 ind. per season), Mettnau (153.3) and Hanko (100.5), the lowest, apart from Helgoland – at Tankar (2.6) and Tauvo (6.5).

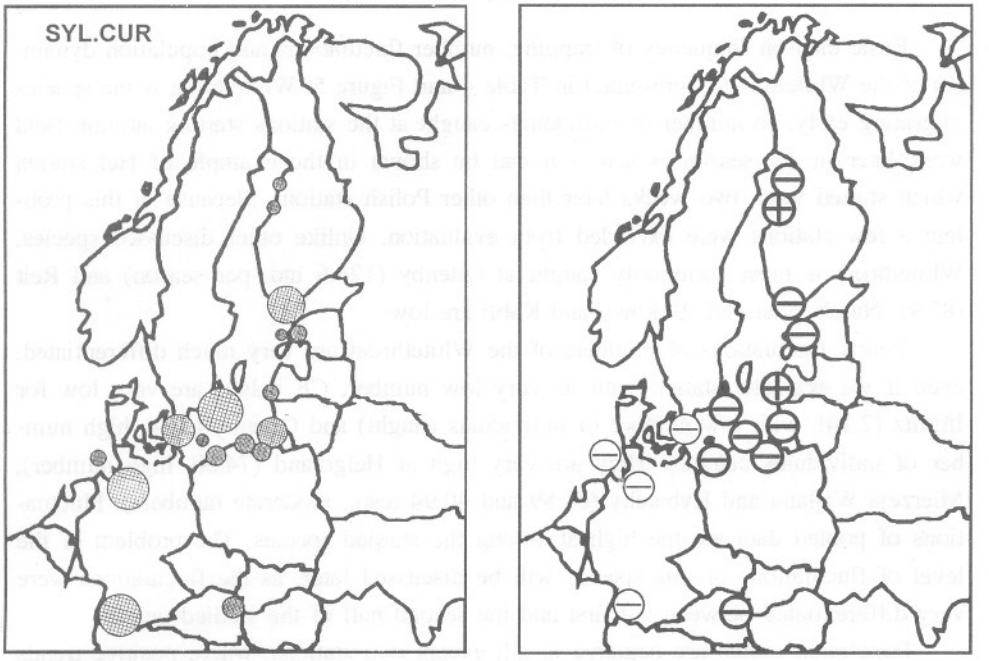

Fig. 4. Lesser Whitethroat (SYL.CUR). Frequency of individuals caught at stations (left) and population dynamics trends for stations (right). Explanations as at Figure 2.

Level of yearly fluctuations at stations is generally higher than those for Blackcap and Garden Warbler, except Mettnau (*CF* = 2.71) and Falsterbo (*CF* = 3.27). Most of the stations have values of *CF* at the level around 20. Higher fluctuations are at Pape (*CF* = 47.59) and extremely high – at Tankar (*CF* = 134.07). This last case can be the result of lower level of year to year comparability as at neighbouring Tauvo the *CF* value is much lower (23.98). However, pooled data show suprising stability – *CF* equals only 4.03 for six and 4.51 for twelve stations. Population trends of Lesser Whitethroat are negative at all except two stations: only Pape and Tankar show clearly positive, significant trends (*R* = +5.69 and +8.57 resp., smoothed data). Negative, but not significant trends dominate in the western part of the area. The most negative, significant trends were at Illmitz (–9.62, smoothed), Mierzeja Wiślana (–7.73, raw and –7.63, smoothed) and Hel (–7.50, smoothed). General trend, calculated for pooled data, is clearly negative: –4.50, raw and –4.45, smoothed data for six stations, –3.50 and –3.45 resp. for twelve stations. High *R* values, while low *CF* and consistence of trends at most of the stations point at not good welfare of the species at the studied area.

Whitethroat (*Sylvia communis*)

Basic data on frequency of trapping, number fluctuations and population dynamics of the Whitethroat is presented in Table 4 and Figure 5. Whitethroat is the species migrating early, so number of individuals caught at the stations starting autumn field work later in the season is low – it can be shown in the example of Hel station which started work two weeks later than other Polish stations. Because of this problem a few stations were excluded from evaluation. Unlike other discussed species, Whitethroat is most commonly caught at Ottenby (124.6 ind. per season) and Reit (82.9). Numbers at Hel, Bukowo and Kabli are low.

Yearly fluctuations of numbers of the Whitethroat are very much differentiated, even if we skip Hel station with its very low number. *CF* values are very low for Illmitz (2.14!, with low number of individuals caught) and Ottenby (3.34, high number of individuals caught). They are very high at Helgoland (74.60, high number), Mierzeja Wiślana and Rybatchy (61.89 and 40.94 resp., moderate numbers). Fluctuations of pooled data are the highest among the studied species. The problem of the level of fluctuations of this species will be discussed later, as the fluctuations were very differentiated between the first and the second half of the studied period.

Population trends are negative at all, except two stations, where positive trends are insignificant (Hanko and Falsterbo). Data from both stations cover the eighties. Here it must be pointed out that in the period 1980-1988 the trend at Mierzeja Wiśl-

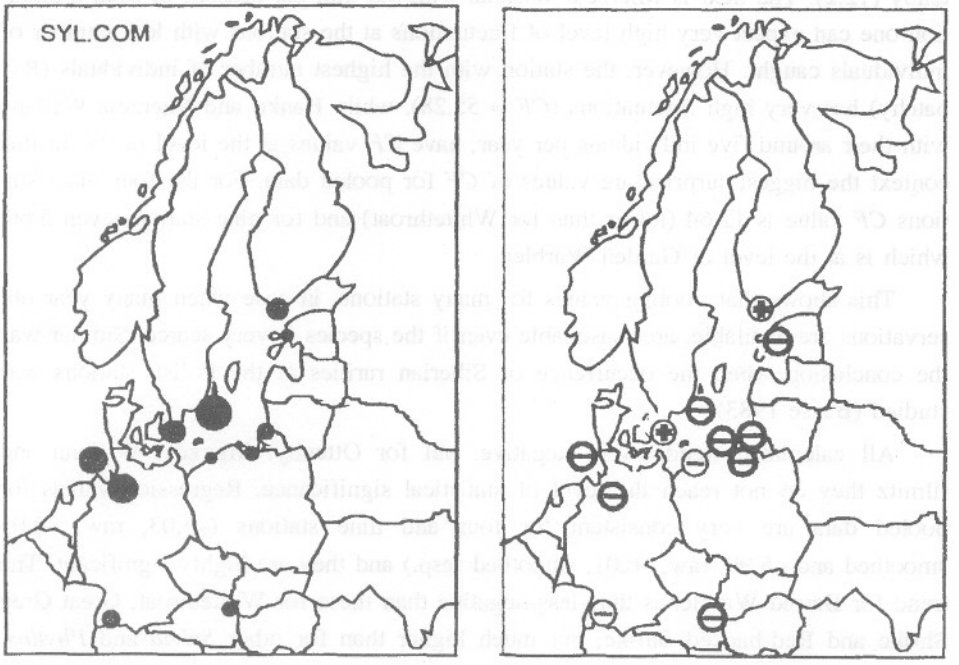

Fig. 5. Whitethroat (SYL.COM). Frequency of individuals caught at stations (left) and population dynamics trends for stations (right). Explanations as at Figure 2.

ana was significantly positive (R value +16.87, raw and +13.40, smoothed data), while at Bukowo, Helgoland and Ottenby, clearly negative.

Pooled data show high negative trend in this species: –8.45, raw and –8.76, smoothed data for six stations and –9.63 and –9.83 resp. for ten stations. This is the most negative trend found till now in evaluation of data from the stations being included in this analysis. Among other analysed species the highest negative trends for pooled data were found for Great Grey Shrike, *Lanius excubitor*, (R = –7.42) and Red-backed Shrike, *Lanius collurio*, (R = –6.90) – Busse (1995).

Barred Warbler (*Sylvia nisoria*)

Basic data on frequency of trapping, number fluctuations and population dynamics of the Barred Warbler are presented in Table 5. Barred Warbler is the least common among species studied here. Data from many stations cannot be used individually as the Barred Warbler was the rarity there. The only two stations catch this species in reasonable numbers. These are Rybatchy (32.6 ind. per season) and Ot-

tenby (12.2). The next is Mierzeja Wiślana with 4.6 ind. per season. In such a situation one can expect very high level of fluctuations at the stations with low number of individuals caught. However, the station with the highest number of individuals (Rybatchy) has very high fluctuations (*CF* = 55.28), while Hanko and Mierzeja Wiślana with their around five individuals per year, have *CF* values at the level of 28. In this context the biggest surprise are values of *CF* for pooled data. For the four main stations *CF* value is 12.64 (lower than for Whitethroat) and for nine stations even 5.60, which is at the level of Garden Warbler.

This shows that pooling values for many stations, in case when many year observations are available, are reasonable even if the species is very scarce. Similar was the conclusion when the occurrence of Siberian rarities at the Polish stations was studied (Busse 1983).

All calculated trends were negative, but for Ottenby, Mierzeja Wiślana and Illmitz they do not reach the level of statistical significance. Regression values for pooled data are very consistent for four and nine stations (–6.03, raw, –6.05 smoothed and –5.99, raw, –6.01, smoothed resp.) and they are highly significant. The trend for Barred Warbler is thus less negative than these for Whitethroat, Great Grey Shrike and Red-backed Shrike, but much higher than for other *Sylvia* and *Phylloscopus* species (Busse 1995, Busse and Marova 1993).

DISCUSSION

Regression coefficients given in the presented results in the preceding chapter give very rough information on trends observed in the discussed species in the area of northern and central Europe. However, they are linear regression trends, while real population dynamics can have more complicated course during a long period. As it was mentioned earlier regression coefficients can be different when different sub-periods are studied.

Figure 6 gives the picture of long-term changes of population levels in discussed species as described by raw and strongly smoothed data pooled for all comparable stations. The Blackcap, Garden Warbler and Lesser Whitethroat have more similar population dynamics to each other than to Barred Warbler and Whitethroat. Similarity of population dynamics of the Blackcap and Garden Warbler is clearly visible in Figure 7, where lower level of smoothing is used. During the sixties the population level was between 140 and 100 per cent of 1974-1983 average used as a standard. Till the beginning of the eighties population numbers fluctuated around the standard, 100 per cent level, and then clear population regress is visible. Lesser Whitethroat population

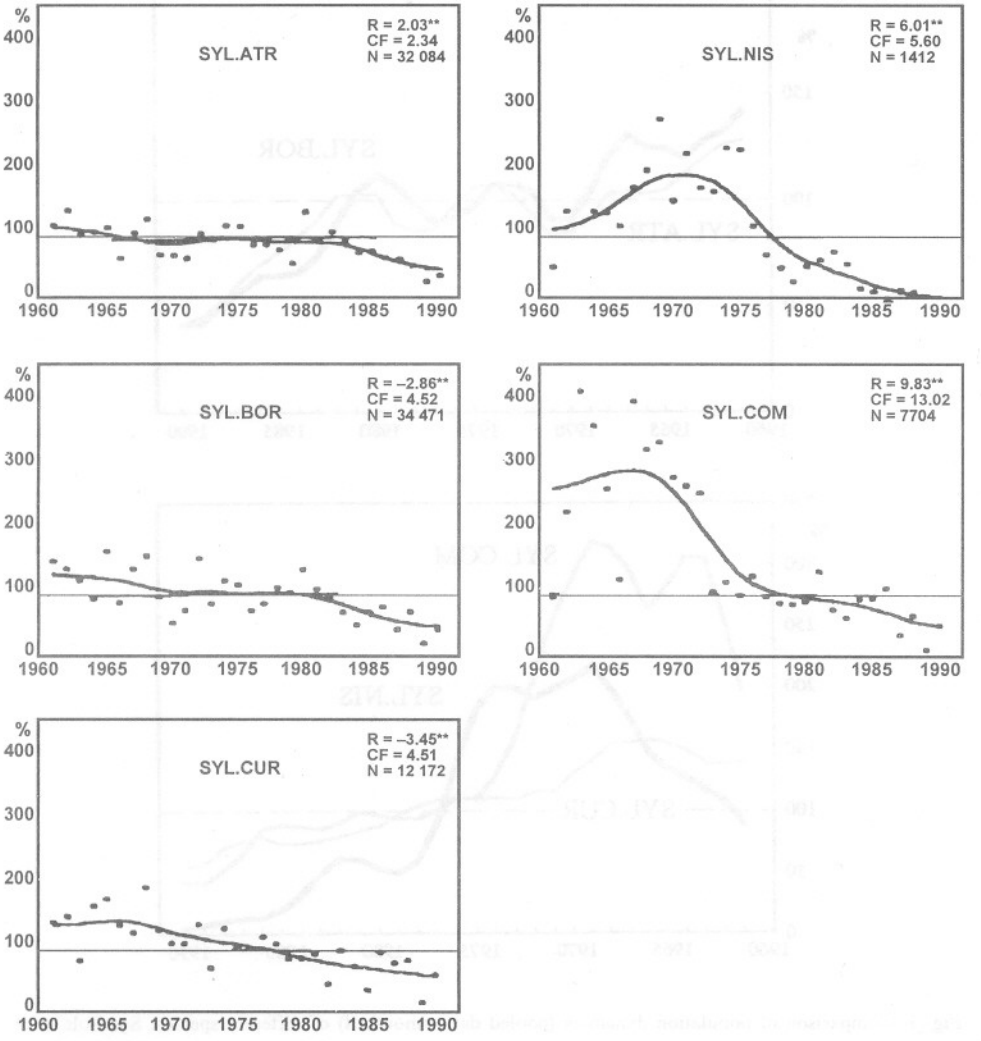

Fig. 6. Population dynamics of discussed species (species codes as at Figures 2-5; SYL.NIS – Barred Warbler) – data pooled for all comparable stations. Raw data (squares) and strongly smoothed data (line). *R* – regression coefficient, with statistical significance symbols as at Table 1; *CF* – coefficient of fluctuations; *N* – total number of individuals caught at the stations included.

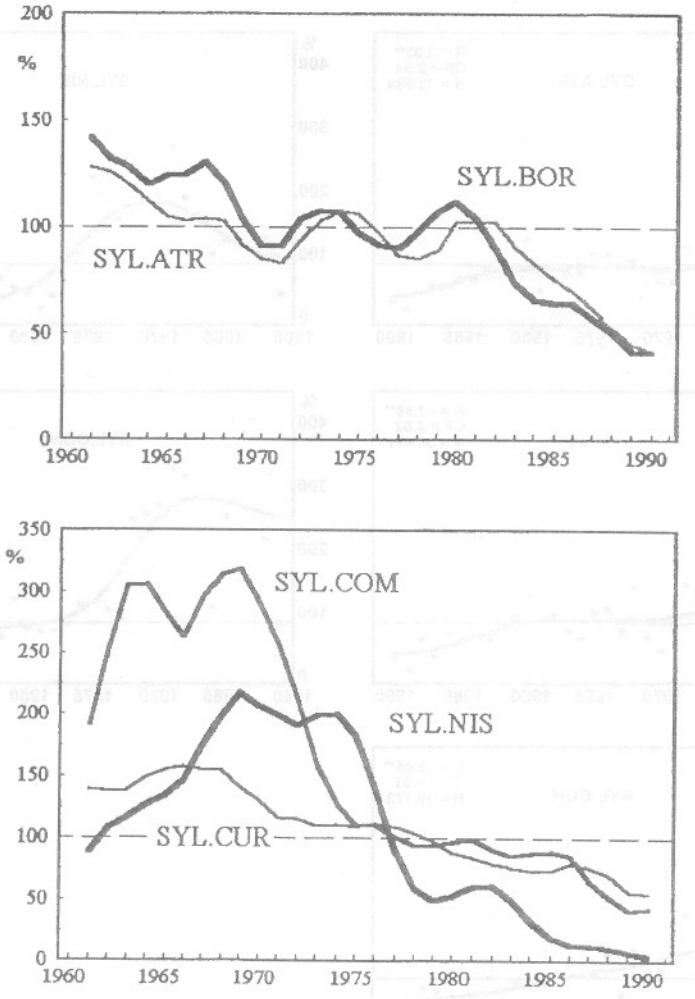

Fig. 7. Comparison of population dynamics (pooled data, smoothed) of different species. Symbols as at Figure 6.

dynamics was similar, but a little bit more monotonously falling down. Barred Warbler and Whitethroat population dynamics were very different from above discussed species. Barred Warbler numbers grew during the sixties reaching around 200 per cent of the standard level and then since seventies fell down to extremely low level at the end of the eighties. Population level of Whitethroat during the sixties was three times higher than in the standard period. This very rapid change was noted in a few

publications (e.g. Berthold 1972) and it gave an impulse to study population dynamics of birds by means of migration counts. It is a matter for discussion whether the level during the sixties was "normal" for this species or the "normal" is the level in the seventies. It is interesting to note that yearly fluctuations of both the Barred Warbler and the Whitethroat were the highest during high population level: Barred Warbler 1961-1966 – average population level 113% and *CF* = 5.16, 1967-1975 – 198% and 18.52, while 1976-1990 – 43% and 4.30 respectively; Whitethroat 1961-1972 – average population level 280% and *CF* = 16.82, while 1973-1990 – 94% and 8.25 resp. This could suggests that these high levels were unstable, thus possibly less "normal" than lower population levels observed later. As from the point of view of bird protection this is a very important question so the problem must be discussed later, when more bird species will be evaluated as to long-term population dynamics.

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