GENERAL PATTERN OF POPULATION TRENDS OF MIGRATING PASSERINES AT THE SOUTHERN BALTIC COAST BASED ON TRAPPING RESULTS (1961–1990)

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ABSTRACT The evaluation of population trends is based on standard mist-netting data from three Operation Baltic stations working every year in autumn from the midst of August till the beginning of November. The stations are located at different positions in the flyways of bird populations inhabiting a wide area of Scandinavia and northeastern Europe.
The trends shown by the data are to some extent differentiated, in few cases very clearly. However, the general picture is similar at all stations. The trends show a cyclic character with a pronounced decline of about 3.5% per year on average. Different ecomigrational groups of birds show a different degree of decline: the smallest in reed-bed birds wintering in Africa, the highest in eruptive forest species.

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INTRODUCTION

After some discussions about the use of trapping results as a means of assessing population trends in migrating birds (Berthold & Schlenker 1975, Busse 1980, Svensson 1978), a number of papers presented such data for different bird observatories in Central and Northern Europe (Baumanis & Rute 1986, Berthold *et al.* 1986, Busse 1984, Busse & Cofta 1986, Lindholm *et al.* 1983, Payevsky 1990, Pettersson & Hedenstrom 1986, Rabol & Lyngs 1988, Svensson *et al.* 1986). These papers contain data in series of different length of time. Few comparisons between breeding bird censuses and migration counts have been performed and have shown no clear relationships. The migration pattern of many species is not known well enough. Recent work has shown that several aspects have to be taken into account when analyzing data on migratory birds:

1. the time series should be long enough to avoid overestimation of short term effects;
2. data gathering should be stratified not only in time but also in space;
3. knowledge on the ecology of the species concerned is essential to enable an accurate interpretation of the data. Aggregation of data of species according to ecological aspects may be helpful in this respect.

This paper intends to present the general pattern of population trends for passerine migrants at the Southern Baltic coast when the birds from a wide range of territories in northern and north-eastern Europe are migrating through. It also points out, by means of a few examples, the complexity of the problem.

MATERIAL AND METHODS

Basic data were collected in the Operation Baltic programme by means of mist-netting at three bird observatories (Mierzeja Wislana (54°21'N, 19°19'E), Hel (54°46'N, 18°28'E) and Bukowo/

Bukowo-Kopan (54°21'N, 16°17'E/54°28'N, 16°25'E)) during 30 years (1961–1990). It is obvious that the thirty years time-span of the study evokes problems of comparability of trapping data. Growth of trees and bushes at the locations where most of the nets were situated, led to the design of a program of active adaptation to the changing environment by shifting of the catching area to new places being in an optimal succession stage for netting. This operation was possible because all mentioned stations are concentration points of migration. At Hel, Bukowo and Bukowo-Kopan stations the pieces of forest with the active netting were only some tens of meters wide. Mierzeja Wislana is a few hundred meters wide, but there is concentration of migration at a line of about one hundred meters. In such conditions even night migrants move along the forest pieces, at least when they occur in high numbers, in relation with the occurrence of specific succession stages. The nets were situated in different habitats for a better balancing of catches during extreme weather conditions.

Apart from this care about 'biological' comparability of the data, there was a strict regime in the methods of the field work consisting of:

1. standard period of station work in the season (August 17th–October 25th);
2. netting of the birds was permanent, i.e. the nets posted at the start date of the season were in operation till the end of that season, without temporary closing them;
3. a constant number of nets in use during the whole period of field work within one year. Between years, numbers of nets were at a comparable level, except for the two first years of the programme.

Any deviations from the rules listed above were compensated by means of recalculations (mathematical corrections). This implies that the basic data for each station consist of a number of birds caught per standard net per season. The problems of the comparability of catching data in relation with using these for monitoring purposes were discussed in detail elsewhere (Busse 1990).

In this paper all values describing the number of birds are expressed in percentages of an average number for the years 1961–1970. The basic level of calculations is one station, while the 'total' for a species, is an average value for all three stations where every station has the same weight despite of the number of individuals caught there. The totals for ecological groups of birds are constructed according to the same rules to avoid domination of the mass species over less numerous ones. The graphs present raw data and smoothed data (five year moving average) with additional information, including:

- number of individuals caught (N);
- coefficient of fluctuations (CF = coefficient characterizing fluctuations of raw data around smoothed curve, see Busse 1990);
- regression coefficient (R) with statistical significance.

RESULTS

Population trends of 47 passerine species were evaluated. The number of individuals caught ranges from some tens to several hundred thousands per species. Detailed data are given in an another paper (Busse, *in press*), while here a general pattern and few examples are presented. The species are grouped according to migratory habits (migrants, invasive species, sedentary species), but a special group of wetland birds is extracted from the migrants wintering in Africa, because of outstanding population trends (table 1).

The species groups will be treated one by one.

Wetland species

The wetland group includes Great Reed Warbler *Acrocephalus arundinaceus*, Reed Warbler *A. scirpaceus*, Sedge Warbler *A. schoenobaenus*, Marsh Warbler *A. palustris* and Stonechat *Saxicola rubetra*. Species from that group were regularly caught at Mierzeja Wislana station

Table 1. Trends in different groups of passerine migrants.

	N	*R*		S.E.	–		Changes		+	*M*	*CF*
					**	*	~	*	**	1981–90	
Wetland species	5	–0.30	~	0.690	1	1	2	–	1	94.8	16.67
Non-wetland species											
Migrating species	33	–3.06	**	0.269	24	1	7	–	1	40.6	1.02
African migrants	14	–3.07	**	0.187	11	–	3	–	–	37.6	2.25
European migrants	19	–3.04	**	0.357	13	1	4	–	1	43.4	2.21
Invasive species	5	–3.26	**	0.622	3	–	2	–	–	63.3	20.25
Sedentary species	4	–4.14	**	0.63	4	–	1	–	–	22.5	3.71

** = highly significant ($p<0.01$),
* = significant ($p<0.05$),
~ = not significant.
Explanations of letter symbols: see text.

only. In this group regression coefficient (*R*) varies from –2.91 (Great Reed Warbler) to 3.42 (Sedge Warbler). The total regression coefficient is not significantly negative (–0.30). Average number (species group average of *N*) for this group in the eighties (*M* 1981–90 in table 1) is only a few percent lower than in the sixties. *CF* coefficient group is surprisingly high which suggests high correlation of yearly fluctuations in members of this special ecological group. Reed Warbler (fig. 1) shows population trend closest to the average for that group of species.

Migrating species

The migrating species group is composed of two sub-groups, African and European migrants. Evaluated African migrants are: Tree Pipit *Anthus trivialis*, Pied Flycatcher *Ficedula hypoleuca*, Icterine Warbler *Hippolais icterina*, Red-backed Shrike *Lanius collurio*, White Wagtail *Motacilla alba*, Spotted Flycatcher *Muscicapa striata*, Wheatear *Oenanthe oenanthe*, Redstart *Phoenicurus phoenicurus*, Willow Warbler *Phylloscopus trochilus*, Wood Warbler *Phylloscopus sibilatrix*, Garden Warbler *Sylvia borin*, Common Whitethroat *Sylvia communis*, Lesser Whitethroat *Sylvia curruca* and Barred Warbler *Sylvia nisoria*. Regression coefficients for birds migrating through separate stations vary in this group from –5.19 (White Wagtail at Mierzeja Wislana) to –1.53 (Tree Pipit at Mierzeja Wislana). Eleven out of fourteen species show a highly significant declining population trend.

Redstart (fig. 2) is an example of monotonous decline through all three decades with very small fluctuations around the smoothed curve. Obvious decline is also visual in the trend for the Pied Flycatcher (fig. 3), but this species shows a cyclic pattern in its decline, which is typical for many species. General population trend for the Common Whitethroat (fig. 4) is only slightly negative, which demonstrates that alarming voices published in the early seventies, based on short-term trends, overestimated the bad welfare of this species. More detailed study (fig. 4) shows however that differences between local population dynamics can be very pronounced. Common Whitethroats migrating through the Hel station have shown dramatic decline in the early seventies, while those passing other stations show less pessimistic trends.

The group of studied European migrants includes: Siskin *Carduelis spinus*, Robin *Erithacus rubecula*, Chaffinch *Fringilla coelebs*, Brambling *F. montifringilla*, Great Grey Shrike *Lanius excubitor*, Blue Tit *Parus caeruleus*, Great Tit *P. major*, Black Redstart *Phoenicurus*

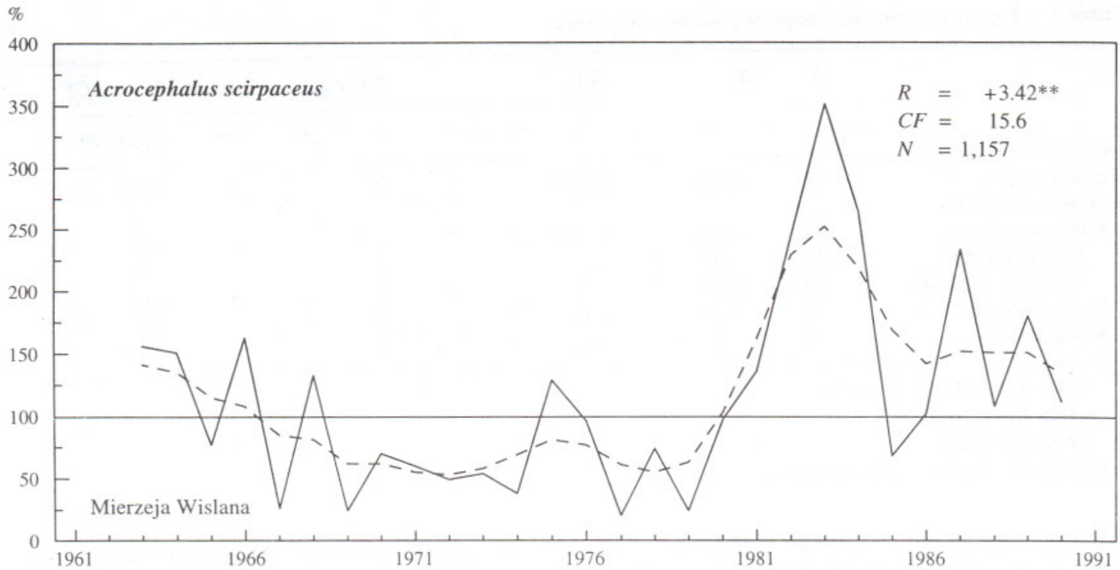

Fig. 1. Population dynamics of the Reed Warbler *Acrocephalus scirpaceus* at Mierzeja Wislana station. Correlation coefficient *(R)* with symbols of significance level (see table 1), coefficient of fluctiations *(CF)* and number of individuals caught *(N)* are given.

ochruros, Chiffchaff *Phylloscopus collybita*, Dunnock *Prunella modularis*, Bullfinch *Pyrrhula pyrrhula*, Firecrest *Regulus ignicapillus*, Goldcrest *R. regulus*, Nuthatch *Sitta europaea*, Blackcap *Sylvia atricapilla*, Wren *Troglodytes troglodytes*, Redwing *Turdus iliacus*, Blackbird *T. merula* and Song Thrush *T. philomelos*. The regression coefficients vary in this group from –4.88 (Bullfinch at Mierzeja Wislana) to +9.70 (Wren at Mierzeja Wislana). 14 species show a declining trend (13 highly significant) and only one species grows significantly in number (Wren, fig. 5). This tendency in Wren is caused by very pronounced population growth of birds migrating through Mierzeja Wislana station (R = +9.70), while Wrens passing other stations show different patterns (fig. 5).

Similar to the Wren is the general population trend pattern for the Goldcrest. Differentiation into station-specific curves suggests that statements on a clear relation at the population level in these two species on the severity of winters oversimplify the problem. The other extreme, nearly perfect correlation of the station-specific curves, can be shown by the example of the Chaffinch (fig. 6).

Although both sub-groups of migrants are differentiated internally, the total trends are very similar (table 1). The overall values of the coefficient of fluctuations (*CF*) are very low which suggests that annual fluctuations of the species are not synchronized.

Invasive species

The overall regression coefficient for invasive species (Long-tailed Tit *Aegithalos caudatus*, Treecreeper *Certhia familiaris*, Jay *Garrulus glandarius*, Coal Tit *Parus ater* and Willow Tit *P. montanus*) is more negative than for regular migrants, but the amount of fluctuations does not allow to confirm this difference statistically. Regression coefficients are from –5.51 (Coal Tit

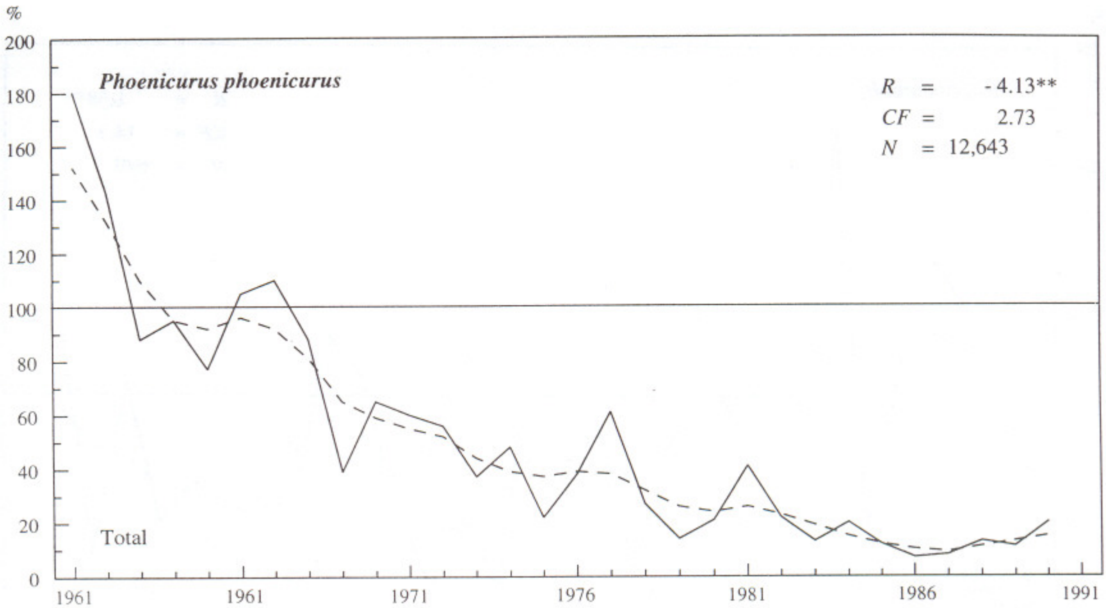

Fig. 2. Population dynamics of the Redstart *Phoenicurus phoenicurus.* Explanations as in figure 1.

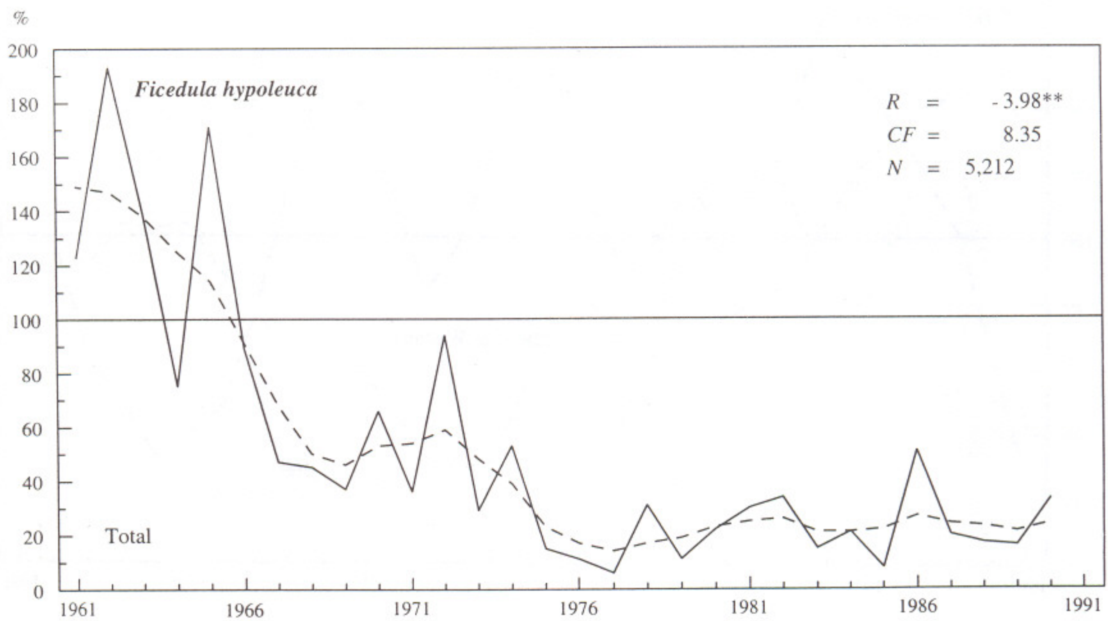

Fig. 3. Population dynamics of the Pied Flycatcher *Ficedula hypoleuca.* Explanations as in figure 1.

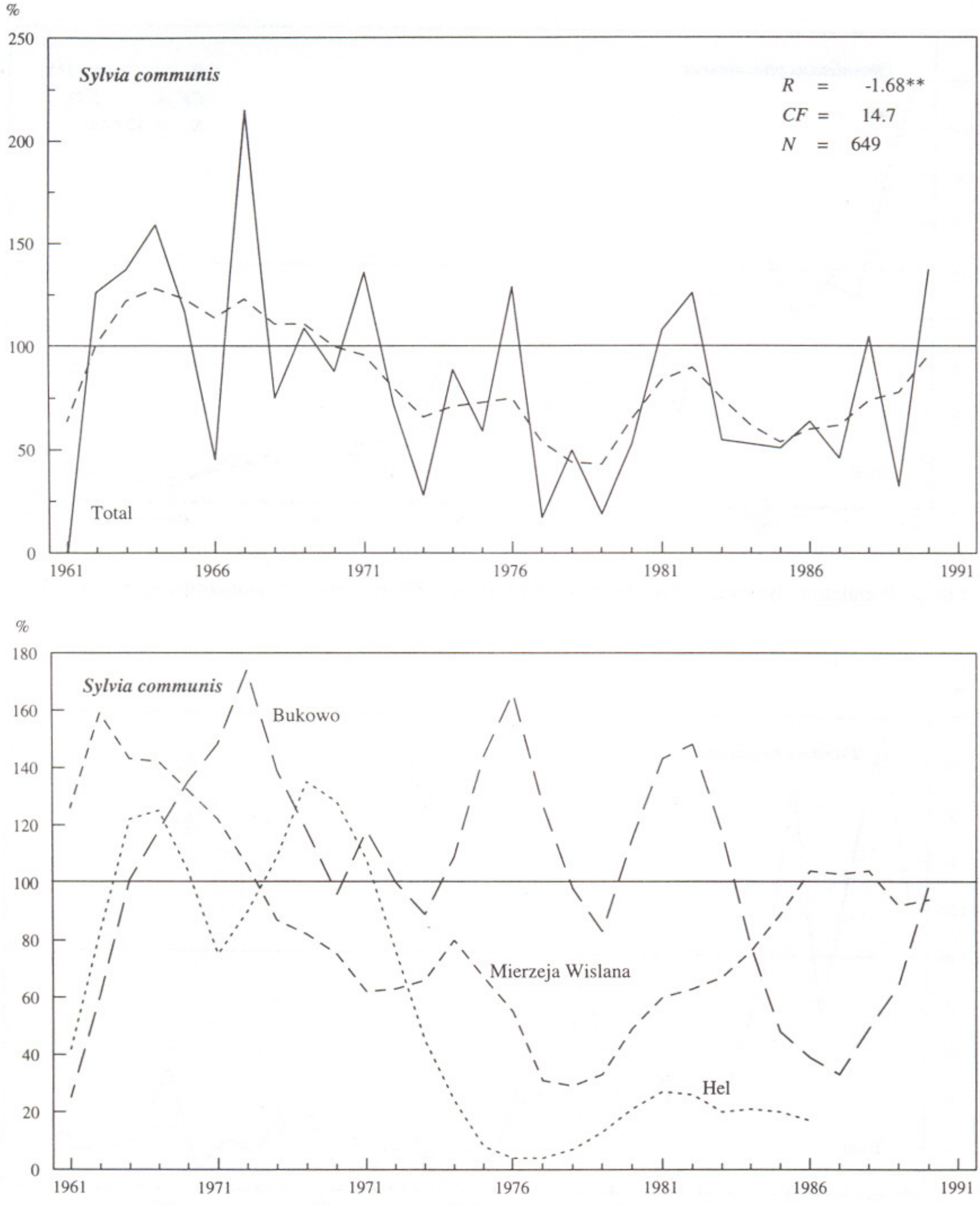

Fig. 4. Total population dynamics of the Whitethroat *Sylvia communis* and smoothed population dynamics for separate stations. Explanations as in figure 1.

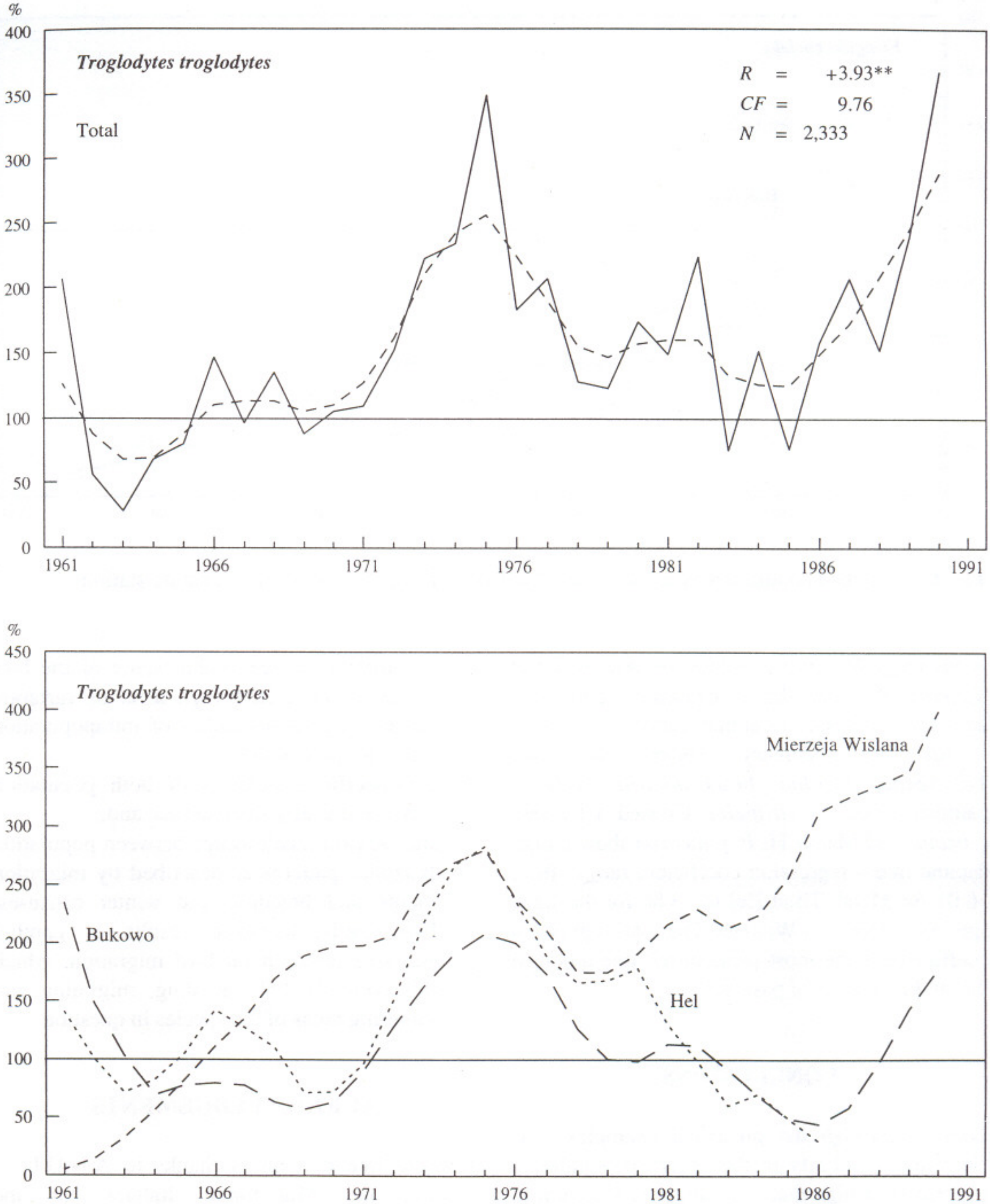

Fig. 5. Total population dynamics of the Wren *Troglodytes troglodytes* and smoothed population dynamics for separate stations. Explanations as in figure 1.

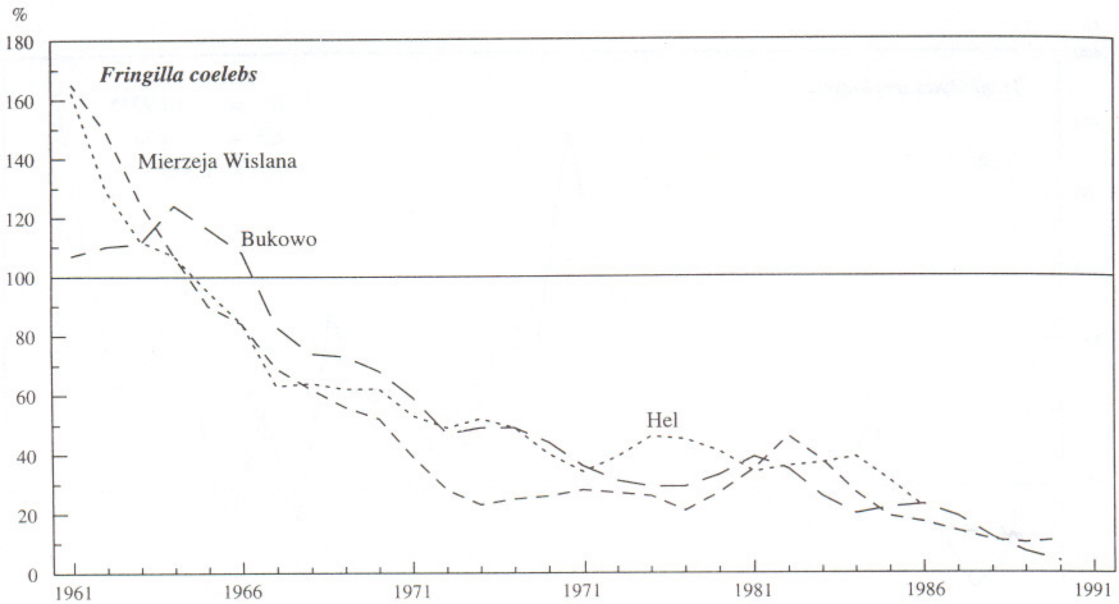

Fig. 6. Smoothed population dynamics of the Chaffinch *Fringilla coelebs* for separate stations.

at Mierzeja Wislana) to +2.28 for Willow Tit at Mierzeja Wislana (this is caused by enormous invasion of this species at that station in 1983).

All four sedentary species (Short-toed Treecreeper *Certhia brachydactyla*, Yellowhammer *Emberiza citrinella*, Crested Tit *Parus cristatus* and Marsh Tit *P. palustris*) show a high decline rate – regression coefficient ranges from –6.01 for Marsh Tit at Hel to –3.86 for the same species at Mierzeja Wislana. The total regression coefficient is the most pronounced one amongst the studied groups of passerines.

CONCLUSIONS

Looking through the presented examples it is clear that variability in the observed population patterns is so high that any simple explanation of trends will be hasty. Detailed studies are needed on:

1. species-specific and locality-specific causes of population dynamics, including dimension of variation (it seems that some of the bird species show such a high level of variation that it suggests instability of intrapopulation dynamics processes);
2. intraspecific correlation of both population trends and yearly fluctuations, and;
3. inter-season relationships between population dynamics patterns as described by migration counts and breeding and winter censuses. This needs, however, results of parallel intensive research on bird migration, which will correctly link breeding, migrating and wintering areas of the species in question.

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