Variation in the numbers of some migrating passerines at Ottenby[1]

Claes-Göran Lindholm, Christian Hjort and Jan Pettersson

Ottenby Bird Observatory, Pl 1500, S-380 65 Degerhamn, Sweden

In an earlier paper (Hjort & Lindholm 1978) we suggested that ringing figures for Whitethroats *Sylvia communis* at Ottenby decreased due to the Sahelian drought (cf. Berthold 1973, Winstanley et al. 1974). We also suggested that the ringing figures of the Wren *Troglodytes troglodytes*, a typical European winterer, were influenced by the relative severeness of the preceding winter. This paper is an attempt to investigate, for an expanded number of trans-Saharan and West-European migrants, (1) whether the ringing figures of different species of each group fluctuate in a similar way, and (2) whether any general relationship exists between trends in these figures and different climatic variables. Things are further complicated because climatic fluctuations in Europe and Africa are interrelated (Winstanley 1973, Riehl & Meitin 1979). Periods with low precipitation in the Sahel are usually parallelled by rather continental weather in western Europe, and wetter conditions in Sahel by wetter conditions in Europe. But whereas much rain has a positive effect on life in Sahel, the opposite is often the case in Europe, at least during the breeding season.

Methods

Autumn ringing figures (Hjort & Lindholm 1978) for 14 passerines trapped at the Ottenby Bird Observatory (56° 12′ N, 16° 24′ E) in 1946—79 were logarithmically transformed and subjected to a principal component analysis. The same procedure was done for four climatic variables: precipitation (PE) and average minimum temperatures (TE) for Jan-Feb in western Europe during the preceding winter (data from NOAA), and the maximum water volume (WC) in Lake Chad (data from Matlock & Cockrum 1974, Chouret 1977) and the precipitation (PC) at Bol, Lake Chad (data from Sircoulon 1976), for the preceding year.

Factor scores for each year were computed, using only the species and climatic variables relevant to each component. Thus only the values for the European winterers were used to construct European Bird Scores, for the component showing the highest loadings for European winterers. A regression analysis of the Bird Scores with respect to the Climatic Scores was then performed, but due to lack of climatological data, only for the period 1951—75. All calculations were performed according to SPSS-subprograms (Nie et al. 1975).

Results

Three components accounted for 80 % of the variance in the ringing figures. The European winterers loaded substantially on the first component, and trans-Saharan migrants on the second. *Emberiza citrinella* and *Acroceph-*

alus schoenobaenus both loading highly on the third component but with different signs (Fig. 1, Table 1), differed considerably from the other species.

The climatic variables were reduced to one European and one African climate component, together accounting for 72 % of the variance in the original variables (Table 2).

The European Bird Scores showed only a weak regression on the European Climatic Scores ($Y = -0.14X + 0.18$, $r^2 = 0.04$), but the African Bird Scores showed a significant one on the Sahelian Climate Scores ($Y = 0.35X + 0.19$, $r^2 = 0.28$).

Discussion

Both the European winterers and the African migrants showed a high degree of covariation within their respective groups. This suggests that conditions in the winter quarters are important for the regulation of numbers in at least one of the two groups. There is a slight correlation between the two groups (Fig. 1), which may be an effect of conditions acting upon both groups, e.g. on the breeding grounds, but could also be due to yearly variations in the trapping effort.

Of the species which deviate from the general pattern, *Emberiza citrinella* may be explained by the poisoning effect of mercury compounds which were earlier used in Swedish agriculture (Westermark et al. 1975, Hjort & Lindholm 1978). *Sylvia curruca* chooses a more easterly route than the other African migrants and may not cross as much desert as the other species. *Acrocephalus scho-*

Table 1. The first three principal components of the ringing figures after rotation.

| Variables	PCA 1	PCA 2	PCA 3	Communality
1 *Erithacus rubecula*	.802	.269	.304	.808
2 *Troglodytes troglodytes*	.788	.226	.056	.675
3 *Turdus philomelos*	.840	.329	.151	.837
4 *Turdus iliacus*	.841	.184	—.118	.756
5 *Sylvia communis*	.419	.811	—.075	.840
6 *Phylloscopus trochilus*	.635	.704	—.046	.901
7 *Acrocephalus schoenobaenus*	.246	.177	—.812	.751
8 *Phoenicurus phoenicurus*	.373	.874	.138	.922
9 *Emberiza citrinella*	.302	.074	.757	.670
10 *Turdus merula*	.913	.048	—.194	.873
11 *Fringilla coelebs*	.735	.455	.233	.802
12 *Carduelis chloris*	.743	.265	.080	.629
13 *Sylvia curruca*	—.172	.804	—.355	.802
14 *Muscicapa striata*	.509	.800	.127	.915
Eigenvalue	7.816	1.993	1.372	
Percent of variance explained	55.8	14.2	9.8	
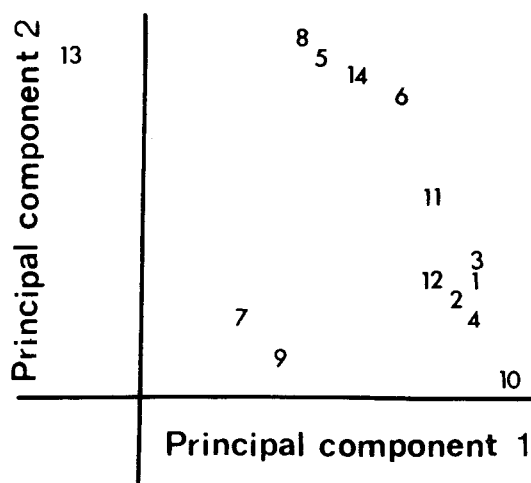
Fig. 1. The first two principal components of the ringing figures after rotation. Species numbered like in Table 1.

enobaenus could be expected to covary with the other Sahelian migrants, but it does not. However, the strong correlation between the scores from the third Bird Component and the Sahelian Climate Scores suggest that it is only because of a small phase difference that the species loads so weakly on the second component.

References

Berthold, P. 1973: Über starken Rückgang der Dorngrasmücke Sylvia communis und anderer Singvogelarten im westlichen Europa. — J. Orn. 114: 348—359.

Table 2. The first two principal components of the climatic variables after rotation. Codes explained in methods.

Variables		PCA A	PCA B	Communality
TE		—.168	—.804	.675
PE		—.023	.793	.629
WC		.862	.238	.799
PC		.889	—.065	.795
	Eigenvalue	1.736	1.162	
	Percent of variance explained	43.4	29.0	72.4

Chouret, A. 1977: La persistence des effects de la sécheresse sur le Lac Tchad. — Contr. Centre ORSTOM de N'djaména. 14 pp.

Hjort, C. & Lindholm, C.-G. 1978: Annual bird ringing totals and population fluctuations. — Oikos 30: 387—392.

Matlock, W.G. & Cockrum, E.L. 1974: A framework for evaluating the Sahel-Sudan region. — In: A framework for agricultural development planning, vol. 2. Cambridge, Mass.

Nie, N.H., Hull, C.H., Jenkins, J.G., Steinbrenner, K. & Bent, D.H. 1975: Statistical package for the social sciences. — New York.

NOAA (National Oceanic and Atmospheric Administration) 1949—79: Climatological data, national summary. — Ashville.

Riehl, H. & Meitín, J. 1979: Discharge of the Nile river: A barometer of short-period climate variation. — Science 206: 1178—1179.

Sircoulon, J. 1976: Les données hydropluviométriques de la sécheresse récente en Afrique intertropicale. Comparison avec les sécheresse 1913 et 1940. — Cah. ORSTOM, sér Hydrol., 13(2): 1—75.

Westermark, T., Odsjö, T. & Johnels, A.G. 1975: Mercury contents of bird feathers before and after Swedish ban on alkyl mercury in agriculture. — Ambio 4: 87—92.

Winstanley, D. 1973: Rainfall patterns and general atmospheric circulation. — Nature 245: 190—194.

Winstanley, D., Spencer, R. & Williamson, K. 1974: Where have all the Whitethroats gone? — Bird Study 21: 1—14.

[1]Contribution no. 89 from Ottenby Bird Observatory.