Influence of temperature on the wintering avifauna of a northern Iberian coastal farmland

A. Galarza

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Influence of temperature on the wintering avifauna of a northern Iberian peninsula coastal farmland.– The abundance of wintering passerines in a coastal farmland was measured by means of line transects for eleven years. There were marked variations in the abundance of most species between December and January. There was no apparent association of measured local temperatures with the abundance of any of the species. These data suggest that birds wintering in these coastal farmlands must be primarily affected by other environmental factors external to the coastal farmland. Variation in the abundance of some species seems to be a consequence of the effect that severe winters have on resident and non-resident populations. However, the hypothesis that some of these species could be affected by land-use changes is not excluded.

Key words: Weather, Wintering avifauna, Farmland, Northern Spain.

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A. Galarza, Depto. de Biología Animal y Genética, Fac. de Ciencias, Univ. del País Vasco, Apdo. 644, 48080 Bilbao, España (Spain).

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Introduction

Weather has been shown to determine the winter distribution and abundance of passerines through its effect on food availability (LACK, 1954; WIENS, 1989). The south-western Atlantic coasts of Europe are the winter quarters of many pre-Saharian passerines (ASHMOLE, 1962; DAVIS, 1966; LANGSLOW, 1979; TELLERÍA & SANTOS, 1982). The populations concentrate mainly on the coastal farmland, a habitat where seeds from the rich grass community are readily available and there is abundant and active insect fauna as a result of the mild winter temperatures (TELLERÍA & SANTOS, 1985). Although these attributes favour a large wintering passerine population, large inter-annual variations in population have been suggested (CARRASCAL & TELLERÍA, 1985), with considerable fluctuations as a consequence of severe winter weather conditions (GALARZA & TELLERÍA, 1985; GALARZA, 1987). Long-term population trends were not studied in previous studies of wintering birds in the farmlands of northern Iberia (CARRASCAL & TELLERÍA, 1985, 1990; TELLERÍA & SANTOS, 1985; FERNÁNDEZ & GALARZA, 1986; TELLERÍA & GALARZA, 1990) and have been shown to play a significant role (WIENS, 1989). This paper examines the relationship between temperature and intra- and inter-annual variability of wintering passerine abundance on farmland in the Basque Country.

Material and methods

This study was conducted in the Urdaibai Biosphere Reserve (43°23'N, 1°00'W). The study area is typical of northern Iberian farmland with regularly cut grassland and small crops, interspersed with hedges and small woods. As the farmland is located in the lower part of an estuary, there are also halophilic pastures and bushes (*Tamarix gallica*, *Baccharis halimifolia*,...), and small clumps of reedwed (*Phragmites australis*).

Censuses of passerines (O. Passeriformes) were taken using the line transect method with a belt of 25 m on either side of the observer (TELLERÍA, 1986) over a distance of 6,200 m. Birds of the Corvidae family and the *Passer* and *Sturnus* genera were not included in the censuses. Abundances (birds/ 10 ha) were not transformed (JÄRVINEN & VÄISANEN, 1977). Two censuses were conducted each winter over an 11-year period (1981/82-1991/92): one in the first two weeks of December and the second in the first two weeks of January. A third census was conducted on two occasions, immediately after particularly cold weather conditions in February 1985 and January 1987 (see GALARZA & TELLERÍA, 1985; GALARZA, 1987). Climatic information was provided by the weather station at Sondika, located 20 km from the study area. Over the study period, the mean temperatures were 10.2°C and 8.8°C in December and January, respectively, and minimum mean temperatures of 6.1°C and 4.4°C were recorded in December and January, respectively. The minimum mean temperature and the mean temperature for the month when the census was conducted as well as the previous month were used as explanatory climatic variables.

Results

Abundance of species recorded in more than half the studied winters is shown in table 1. Large inter-annual variations in abundance of most of the species can be observed. These differences in abundance between December and January are statistically significant ($P < 0.01$) for all the species, the only exception being *Motacilla alba* ($G = 10.31$; $P > 0.05$; d.f. = 10). The variation in abundance between censuses within winters for the wintering community is shown in table 2 and the variation before and after the two cold weather events is shown in table 3. The variation within winters in climatically "normal" years is similar to the variation occurring in the winters when a "severe" event occurred. However, bird abundance showed the largest decrease (- 69.1%) after the cold weather spell in 1985. Conversely, abundance increased after the cold weather conditions in 1987. No correlation was found ($P > 0.01$) between species abundance and the climatic variables examined. Finally, the species abundance (mean of December and January) over the study period is shown for the fifteen most abundant species (fig. 1). Four different patterns can be seen over the 11-year period:

Tabla 1. Species abundance (birds/10 ha) in December (XII) and January (I): Aa. *A. arvensis*; Ap. *A. pratensis*; Ma. *M. alba*; Tt. *T. troglodytes*; Phc. *Ph. collybita*; Sa. *S. atricapilla*; Er. *E. rubecula*; Cc. *C. cetti*; Cj. *C. juncidis*; St. *S. torquata*; Tm. *T. merula*; Tph. *T. philomelos*; Ti. *T. iliacus*; Pm. *P. major*; Fc. *F. coelebs*; Cc. *C. carduelis*; Es. *E. schoeniclus*.

Abundancia (aves/10 ha) de las especies en diciembre (XII) y enero (I). (Para las abreviaturas ver arriba.)

		81/82	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92
Aa	XII	2.3	1.9	5.8	8.1	0.9	12.2	-	-	-	4.8	-
	I	1.6	0.3	0.9	18.4	-	0.9	-	0.3	1.9	1.4	1.0
Ap	XII	30.0	18.7	26.4	53.2	20.6	12.9	27.7	20.6	26.1	40.9	31.1
	I	23.2	25.8	17.1	9.0	11.6	27.7	19.6	63.8	27.4	9.7	27.0
Ma	XII	5.8	8.7	8.7	6.8	6.1	2.9	3.2	3.5	0.6	1.3	3.2
	I	6.4	6.1	6.4	2.3	2.9	3.2	3.5	2.5	0.4	0.9	0.9
Tt	XII	5.8	4.2	3.2	4.2	0.3	1.3	2.5	4.5	2.2	1.9	3.2
	I	4.8	5.8	2.3	1.9	0.9	0.9	1.9	2.2	1.8	1.4	3.8
Phc	XII	1.6	1.6	-	0.9	2.6	0.3	1.6	1.9	0.9	0.6	0.3
	I	0.6	0.9	0.3	-	0.9	2.3	1.3	2.9	0.4	-	2.6
Sa	XII	-	0.3	0.3	1.9	-	0.3	0.6	-	0.6	0.9	-
	I	0.9	0.3	0.3	-	-	0.3	0.3	-	-	-	0.3
Er	XII	15.5	9.7	8.7	5.5	5.2	6.1	7.4	10.3	10.3	10.6	3.2
	I	10.6	8.4	4.2	4.8	4.2	2.6	5.1	10.3	6.9	3.7	8.4
Cc	XII	2.2	1.6	-	-	-	-	-	-	0.3	-	0.3
	I	2.2	0.6	0.3	-	-	-	-	0.3	-	1.4	0.6
Cj	XII	3.6	1.9	0.6	-	-	0.3	0.6	-	0.3	0.3	0.6
	I	0.6	1.6	-	-	-	-	-	-	0.9	-	0.3
St	XII	1.9	1.3	0.3	0.9	-	-	-	0.6	0.6	1.9	2.3
	I	-	1.3	0.6	0.6	-	-	0.6	0.6	1.4	1.4	2.9
Tm	XII	6.4	4.2	5.8	2.3	0.9	0.9	1.3	1.6	3.5	4.2	3.2
	I	1.3	5.5	4.5	6.7	1.3	0.9	1.3	2.2	2.3	1.9	2.9
Tph	XII	17.4	3.2	4.2	4.8	0.3	0.6	0.6	2.5	6.1	2.5	2.9
	I	8.4	4.8	4.2	33.2	1.9	4.5	0.9	4.8	6.9	2.3	1.3
Ti	XII	0.9	0.9	-	-	1.9	-	-	20.0	0.6	9.0	-
	I	0.6	1.3	1.9	9.0	-	-	-	8.0	-	3.7	2.2
Pm	XII	7.1	3.5	3.9	2.6	1.3	3.5	4.5	3.2	5.1	2.2	1.6
	I	9.4	4.8	3.9	1.9	1.9	4.5	0.6	2.4	2.3	-	6.4
Fc	XII	21.6	9.7	14.8	9.4	9.0	14.2	19.1	26.4	45.1	29.3	57.7
	I	8.7	18.7	14.5	4.5	40.0	35.5	17.4	11.9	19.0	20.0	35.2
Cc	XII	5.2	0.6	3.9	0.9	1.3	0.6	5.8	0.6	1.6	0.6	1.0
	I	6.1	3.2	0.9	-	-	-	4.2	2.2	1.4	0.6	13.5
Es	XII	-	0.3	-	-	1.3	0.3	-	3.2	-	1.6	0.9
	I	0.3	0.3	0.6	-	-	0.3	0.6	-	0.3	2.8	0.9

Tabla 2. Total abundance (birds/10 ha) and percentage difference (Dif %) between December (XII) and January (I): * Winters in which cold event occured.

*Abundancia (aves/10 ha) y porcentaje de variación (Dif %) entre diciembre (XII) y enero (I): * Inviernos con ola de frío.*

	81/82	82/83	83/84	84/85*	85/86	86/87*	87/88	88/89	89/90	90/91	91/92
XII	143.2	82.9	92.5	104.5	53.7	59.2	85.3	106.7	117.0	122.7	116.4
I	95.7	97.0	71.2	96.7	68.3	91.6	67.0	118.1	77.3	54.8	118.7
Dif (%)	-33.2	14.5	-23.0	-7.5	21.4	35.4	-21.4	9.6	-33.9	-55.3	1.9

Tabla 3. Total abundance (birds/10 ha) and percentage difference (Dif %) before and after the two severe colds spells.

Abundancia (aves/10 ha) y porcentaje de variación (Dif %) antes y después de las dos olas de frío.

	1985	1987
Before	96.7	91.6
After	36.8	129.3
Dif (%)	-61.9	29.1

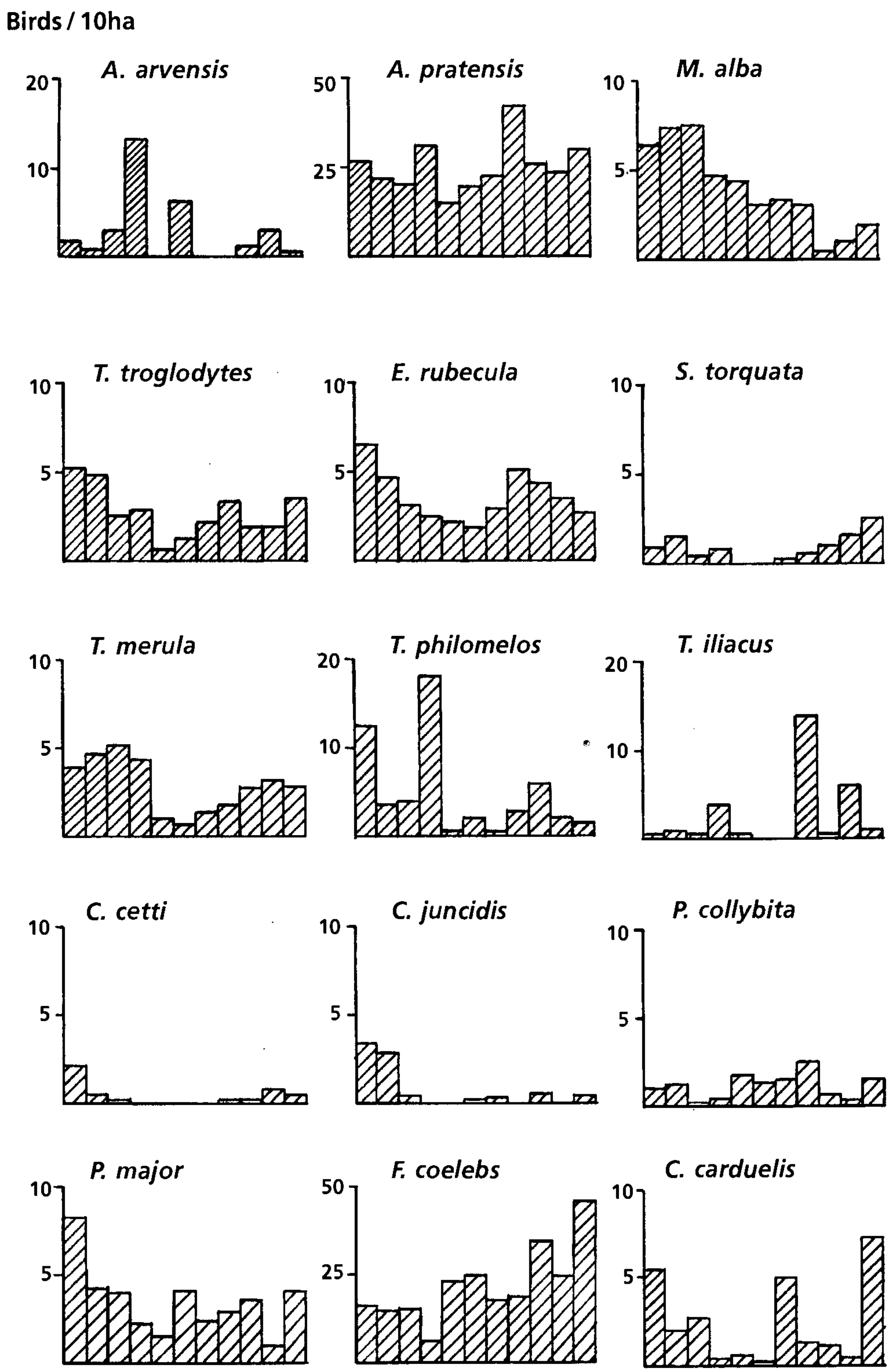
firstly, those species that showed a highly variable occurrence (especially *Alauda arvensis*, *Turdus iliacus*, *Turdus philomelos* and *Carduelis carduelis*); secondly, a group of species that was sensitive to the cold weather conditions in 1984/85 (*Troglodytes troglodytes*, *Erithacus rubecula*, *Saxicola torquata*, *Turdus merula*, *Cettia cetti* and *Cisticola juncidis*); thirdly, a gradual but continued decline in abundance of *Motacilla alba*; and finally, a continued increase in abundance of *Fringilla coelebs*.

Discussion

Variations in abundance of passerines wintering on the farmlands of the northern Iberian peninsula do not seem to be directly associated with local temperature changes under "normal" climatic conditions. Carrascal & Tellería (1985) have suggested that variations in abundance, at least in some species, are related to environmental factors or events occurring outside the study area, for example as a result of escape movements from life-threatening weather conditions. The large fluctuations in abundance within winters during this study period suggest that while local variation in abundance is an intrinsic characteristic of the wintering community, this likely results from critical environmental situations on a regional scale but also from events occurring during local nomadic movements throughout the winter.

Fig. 1. Variation of mean wintering abundance (birds/10 ha) of most abundant species during the1981/82-1991/92 period.

Variación de la abundancia media invernal (aves/10 ha) de las principales especies durante el periodo 1981/82-1991/92.


Birds / 10ha
A. arvensis
20
10
A. pratensis
50
25
M. alba
10
5
T. troglodytes
10
5
E. rubecula
10
5
S. torquata
10
5
T. merula
10
5
T. philomelos
20
10
T. iliacus
20
10
C. cetti
10
5
C. juncidis
10
5
P. collybita
10
5
P. major
10
5
F. coelebs
50
25
C. carduelis
10
5

However, in extreme local climatic situations, weather can affect bird wintering and result in high mortality (LACK, 1986) that affects resident breeding bird abundance (ELKINS, 1983; CAWTHORNE & MARCHANT, 1980; BAILLIE, 1990; GIBBONS et al., 1993). The effect of these severe weather conditions is especially strong in farmlands, due to the susceptibility to extreme weather that birds of open habitats show (FULLER et al., 1995).

The snow and freeze in January 1985 resulted in a large reduction of the population in the study area (GALARZA & TELLERÍA, 1985). The results suggest that the negative effect of this cold event influenced the abundance of some species for several years, probably as a result of the high mortality caused in the local avifauna. The effect is particularly striking on the main resident species (*Troglodytes troglodytes*, *Cettia cetti* and *Cisticola juncidis*) (see GALARZA, 1993 for *C. juncidis*). Some species with large extra-Iberian wintering populations were also affected, notably *Motacilla alba*, *Saxicola torquata*, *Erithacus rubecula*, and *Turdus merula*, whose northern European populations use the coastal Atlantic strip as an important wintering quarter (SANTOS et al., 1990). In these species, the decrease in abundance observed in the winters following the cold spell of 1985 may be a consequence of both a marked loss of local population and a more general decrease of the larger populations in the extra-Iberian breeding areas. The latter would imply that mortality has affected populations of the main winter quarters on the Atlantic Coast.

After the cold spell in 1987 there was an increase in passerine abundance in the study area, probably because the coastal strip was snow and ice-covered for only forty-eight hours while extreme conditions persisted much longer in the rest of northern Iberia. (GALARZA, 1987). As a result, food availability was less affected and these coastal farmlands provided a temporal refuge for many passerines.

Finally, fluctuations in abundance are a consequence of multiple factors other than temperature. Land-use changes, for example, have been suggested as the main factor affecting the population of several bird species in European farmlands (FULLER et al., 1995). The long-term trends observed in some of these species (*Fringilla coelebs* and *Motacilla alba*) may be related to the significative land-use changes over the past decades in the northern Iberian farmlands (TELLERÍA & GALARZA, 1990) and in other European regions (POTTER, 1997).

Resumen

Influencia de la temperatura en la avifauna invernante de una campiña costera del norte de la península Ibérica

Durante un periodo de once años, se estudia la invernada de paseriformes en una campiña costera mediante el método del taxiado (tabla 1). Se observan importantes variaciones intrainvernales de la avifauna (tablas 2 y 3) con diferencias significativas para la mayor parte de las especies. La temperatura local no se asocia con la abundancia de ninguna de las especies analizadas. Aunque la invernada de aves en estas campiñas parece depender esencialmente de factores ambientales externos, la variación de la abundancia de algunas especies en el periodo de estudio (fig. 1) parece ser consecuencia del efecto negativo que producen las olas de frío sobre las poblaciones residentes y no residentes. Asimismo, no se excluye la hipótesis de que ciertas especies hayan sido afectadas también por cambios en los usos agrícolas.

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