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The winter bird species and their abundance in Lombardy, Northern Italy

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To assess the importance of the region south of the Alps for wintering birds, we made bird counts in Lombardy, Northern Italy, from 1983/84 to 1986/87 using (1) line transects in homogeneous habitats performed in the first half of December and in the first half of January and (2) point counts randomly performed in the entire administrative region, from November 15th to the end of February.

The habitats studied by means of line transects were (a) lowland farmland, (b) lowland broad-leaved woodland, (c) lowland heathland, (d) lowland wetland, (e) hill broad-leaved woodland, (f) mountain mixed woodland. For the point counts, the locations of the stations and hence the types of habitats were defined randomly.

There were no significant differences either in the number of species or in the indices of abundance, between December and January. Conversely, there was a gradient both in the number of species and in the index of abundance, from the mountain mixed woodland, with the lowest values, to the lowland wetland and farmland, with the highest. When the through-winter trends of single bird species were analyzed, no changes, decreases or even increases in numbers were observed, suggesting a number of different wintering strategies.

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1. Introduction

The concept of "wintering" may be relatively easy to define either at extremely northern latitudes that are largely depleted of birds after the main post-breeding migration (Hildén & Saurola 1985, Hildén 1987) or in those southern regions where large numbers of birds arrive to exploit the resources available through most of the non-reproductive season (Moreau 1972).

In the temperate zone, the definition of wintering is more difficult as the resources may be variable to a greater extent through the non-breeding season and between the years. There, it is possible to find a larger spectrum of wintering strategies in birds.

In all seasons, birds move to some extent. However, during the breeding season, birds are bound to their nests.

On the contrary, during the non-reproductive season, there is no general bond to any given area and, for most birds, all movements occur on a larger scale. Among these movements in the non-reproductive period, we can distinguish between directional migratory movements performed on a large scale and winter movements on a variable but generally smaller scale. The definition of "wintering" is usually limited to the "central" part of the non-reproductive period in which only minor movements occur (Lack 1986).

2. Materials and methods

2.1. Study area

Lombardy, in northern Italy, appears as an ideal region to study wintering in the temperate zone, being of a suitable size

(23 842 km²), lying from about 45° to 46°N, and including a significant portion of the Po valley and of the central Alps. Therefore, it has high mountains (with peaks up to more than 4000 m) and large glacial lakes with a variety of arctic-like and, respectively, mediterranean-like climates (TCI, 1957). It is a heavily populated area (about 8.5 millions with an average density of 358/km²), intensively used for agriculture and industry, with a few remains of lowland forests but still very rich in highland broadleaved and coniferous forests.

2.2. Methods

We counted the wintering birds in Lombardy from 1983/84 to 1986/87 using

1) line transects in homogeneous habitats (see Fig. 1) repeated in the first half of December and, respectively, January (Fornasari 1984, Vigorita et al. 1986, 1987, Massa et al. 1986) and, in winter 1986–87, also by means of
2) point counts randomly performed in the entire region from November 15th to the end of February (Massa & Fedrigo 1989).

The aim of these counts was to assess the abundance and the changes of birds wintering in an area south of the Alps.

Line-transects were performed walking at 2 km/h and counting all the birds that could be heard or seen at any distance, according to the method described for the Spanish Winter Bird Count (Sociedad Espanola de Ornitologia 1985).

The habitats studied were:

a) lowland farmland,
b) lowland broad-leaved woodland,
c) lowland heathland,
d) lowland wetland,
e) hill broad-leaved woodland,
f) mountain mixed woodland.

Point counts (Blondel et al. 1970, 1981) were also performed at any distance for 8 minutes. The location of the sites where the counts were performed were based on a two-stage sampling (Snedecor & Cochran 1980), first by randomly selecting 90 10×10 km squares corresponding to the I.G.M. (Ordinance) maps of the Region and subsequently by randomly selecting the geographical coordinates of 20 point count stations to be surveyed within each area represented on a single map. The details of this procedure have been described by Fedrigo & Massa (1989).

3. Results and discussion

Fig. 1 shows the location of the transects covered in the course of the four years. The number of routes was 111 (56 in December and 55 in January, as one of the transects could not be repeated in one year) for a total of 782.8 km.

135 470 birds were observed and the total kilometric index of abundance (I.K.A., Ferry & Frochot 1958) was 173.0 individuals/km with little inter-annual variation (Table 1).

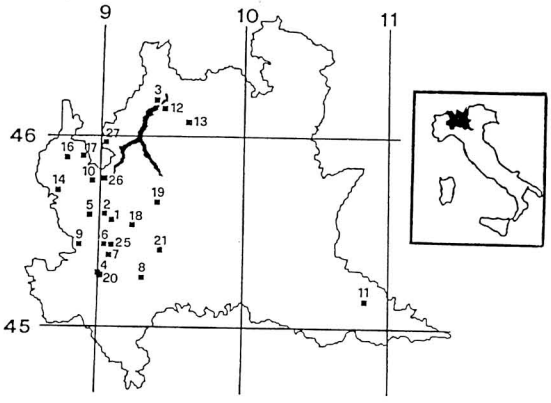

Fig. 1. Location of the transects covered in Lombardy during the winter bird count 1983/87 (number of times walked in parentheses).

1. Pineta di Cesate (6)
2. Groane (6)
3. Albonico (8)
4. Zelata (6)
5. Olgiate Olona (6)
6. Cusago (6)
7. Tainate (6)
8. S. Alessio (8)
9. La Fagiana (6)
10. Castelnuovo B. (6)
11. Bosco Fontana (6)
12. Pian di Spagna (6)
13. Vedello (6)
14. S. Maria del Bosco (2)
16. Campo dei Fiori (7)
17. Val Ceresio (4)
18. Parco di Monza (4)
19. Curone (2)
20. Bosco Zelata (2)
21. Sorgente muzzetta (2)
25. Bestazzo (2)
26. Luisago (2)
27. Val d'Intelvi (2)

The total number of species detected in the 4 years was 108. Among these, 15 species accounted for 113 657 individuals (84%) while the remaining 93 species accounted for only 21 813 (16%). The most abundant species are listed in Table 2. The total number of species detected was 72 after the first year, 96 after the second, 107 after the third and 108 after the fourth.

As the line-transects covered were performed in six different types of homogeneous habitats, the first question to be answered concerned the distribution

Table 1. Number of kilometres walked, number of birds counted and total I.K.A. in the four years of the winter count in Lombardy.

Winter	Km	No of birds	I.K.A.
83/84	159.4	26 346	165.28
84/85	251.2	43 522	173.26
85/86	227.2	39 374	173.30
86/87	157.0	27 500	178.83

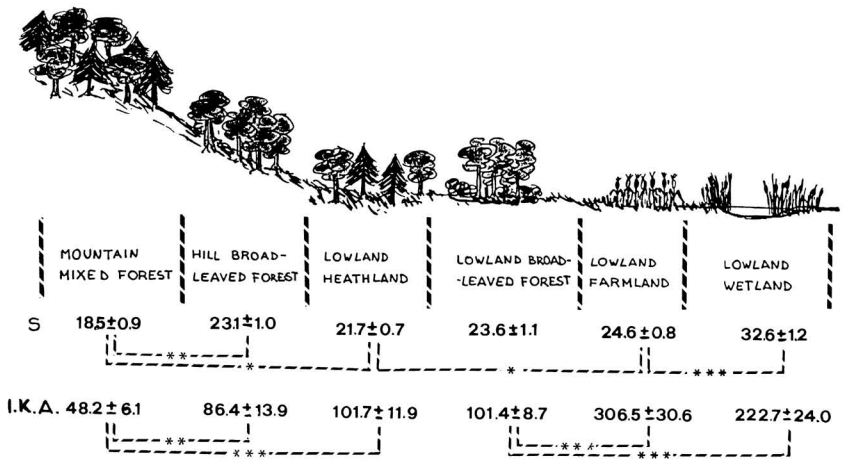

Fig. 2. Mean number of species (S) and I.K.A. ± *SE* in the various habitats of Lombardy in winter (*P<0.05, **P<0.01, ***P<0.001).

Table 2. List of the commonest encountered species in the winter bird count in Lombardy (1983/87).

	Birds	I.K.A.	%
Tree sparrow	36 491	44.65	26.20
Domestic sparrow	27 004	33.98	19.93
Rook	7 312	9.20	5.40
Feral pigeon	7 052	8.87	5.21
Chaffinch	6 138	7.72	4.53
Hooded crow	5 711	7.17	4.22
Lapwing	4 403	5.54	3.25
Siskin	4 023	5.06	2.97
Goldcrest	3 562	4.48	2.63
Skylark	2 600	3.27	1.92
Robin	2 498	3.14	1.84
Starling	2 300	2.89	1.69
Long-tailed tit	1 998	2.51	1.47
Great tit	1 836	2.31	1.36
Black-headed gull	1 729	2.12	1.28
15 commonest species	113 657	145.19	83.90
Others (93)	21 813	27.86	16.10
Total 108 species	135 470	173.06	100.00

and numbers of the 108 species throughout the various habitats and throughout the winter. To answer this question, we calculated the mean number of species and the mean I.K.A. by pooling the data of all four years separately for December and January in each different habitat (Table 3).

It is apparent from the table that there are no significant differences (Student's t-test) within the same kind of habitat, either in the number of species or in I.K.A., between December and January. Consequently, we were able to pool together all the data resulting from the counts of December and January to analyze the differences among the six different types of habitats studied.

Fig. 2 shows that there is a gradient both in the number of species and in I.K.A., from the mountain mixed woodland with the lowest values to the lowland wetland and farmland with the highest.

However, these similar numbers apply to the whole number of species and not to the single species that may show either constant numbers or a decline or

Table 3. Mean number of bird species and I.K.A. ± *SE* in six different habitats in Lombardy in December and January. N = number of routes walked.

Habitat	N	Number of species		I.K.A.	
		Dec	Jan	Dec	Jan
Lowland farmland	32	24.6±0.95	24.6±1.33	338.0±49.4	275.1±36.1
Lowland broad-leaved woodland	20	23.8±1.69	23.3±1.51	117.9±14.6	84.9±6.7
Lowland heathland	12	21.5±1.09	21.8±1.01	123.8±14.8	96.3±6.4
Lowland wetland	6	33.7±2.12	31.5±1.23	244.5±39.0	201.0±28.9
Hill broad-leaved woodland	10	24.2±1.02	22.0±1.70	104.3±21.1	68.5±16.3
Mountain mixed woodland	19	17.9±1.37	19.1±1.43	46.4±9.2	50.2±8.4

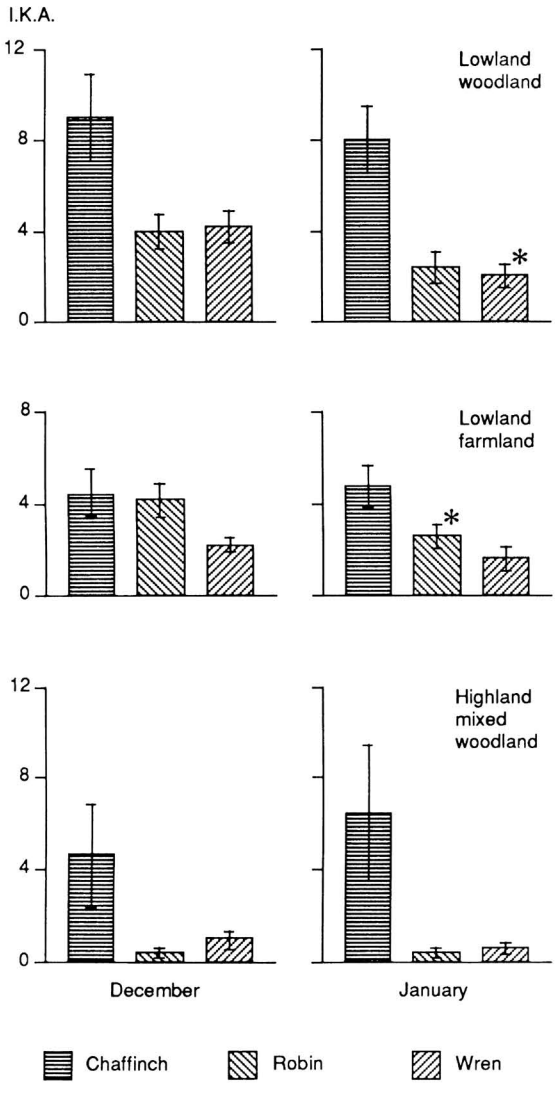

Fig. 3. I.K.A. in the lowland woodland, lowland farmland and highland mixed woodland for three species of birds in December and in January (*$P<0.05$ for Dec. vs. Jan.).

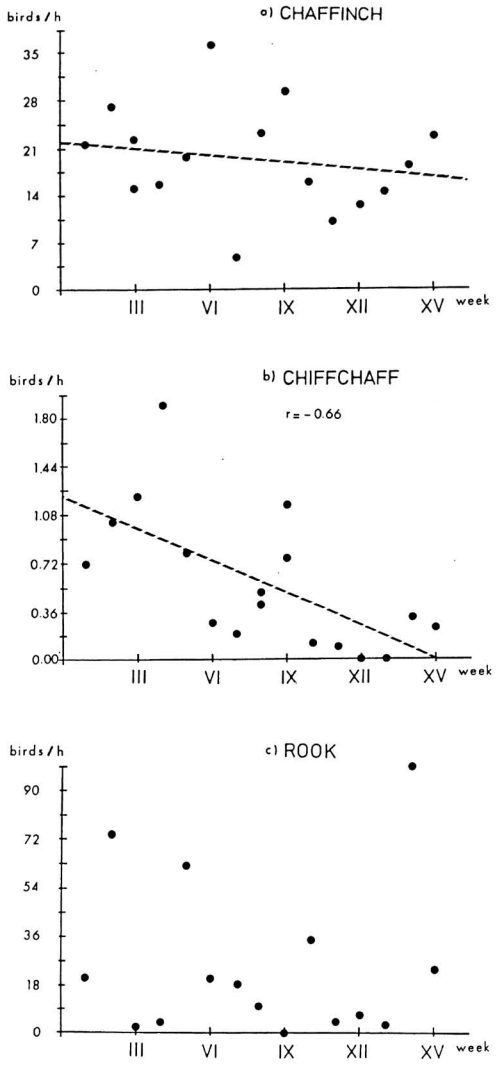

Fig. 4. Through-winter trends identified by means of the point count analysis: a) no change through the winter (chaffinch), b) a significant decline (chiffchaff), c) a decrease to a minimum in the mid-winter followed by a subsequent increase (rook).

even a slight increase, through the period studied. For instance, the number of chaffinches appears stable either on the farmland or in the broad-leaved woodland or mixed woodland, whereas the robin and the wren tend to decrease in the lowland farmland and woodland but appears stable, although in much lower numbers, in the highland mixed forest (Fig. 3). This suggests that the few species or individuals that are able to find their resources in the highlands may be highly adapted to stay in these areas throughout the winter.

A through-winter change in the numbers of several species may also be shown by means of the point-count analysis. However, only a few species are found in a sufficiently large number to allow the evaluation of a through-winter trend after the first year of such kind of survey. Among these species, three different patterns may be recognized:

1) no change through the winter [this applies to the chaffinch (Fig. 4a)]
2) a significant decline [this is typical of a number of small insectivores like the chiffchaff (Fig. 4b)]
3) an apparent decrease to a minimum in mid-winter, followed by a subsequent increase in the late winter [this might be the pattern of the rook (Fig. 4c)].

It is likely that these different patterns do reflect a real difference in numbers either due to mortality or to movements to more favourable areas. In agreement with this interpretation, most decreasing species are small insectivores that may be territorial also in winter but may face serious problems to find food under conditions of snow coverage (Lack 1965); conversely, those that do not change in numbers or decrease in the mid-winter appear to be mainly gregarious seed-eaters or generalists that may survive either by staying or moving elsewhere for a short time when there is a snow cover (Lack 1986).

In conclusion, a "regional" point of view based on regular counts suggests the occurrence of at least three different wintering strategies for migrant birds:
1) to move from the breeding area to different ground and to defend a winter territory or, sequentially, several winter territories,
2) to move to a larger region, mostly in flocks of variable size, and to use different feeding areas where resources are available,
3) the species stays in the same area where it has bred.

For land management purposes, the identification of a wintering strategy of a bird population in a given area is more useful that the assessment of the presence or absence of the species from a given square during the whole winter time.

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