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A new approach for compiling a winter bird atlas by means of point-counts

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During 1986–87 we started a winter atlas project in Lombardy, northern Italy, by means of point-counts with habitat recording in the whole area. Our selection of (a) 10×10 km squares to be covered in the first year of field work and of (b) the actual sites where to perform point-counts within each square, was based on a two-stage sampling with a random selection of primary (squares) and secondary (point-counts) sampling units.

During the first year of our survey, we covered 80 squares, performed 1484 point-counts and detected 128 781 birds comprising 113 species. Among these, 15 species made up 93% of the total number of individuals. Among the species found in such large numbers to allow the evaluation of a through-winter trend, four different patterns were recognized: (a) no change, (b) decline, (c) increase, (d) decline followed by an increase. Due to the random distribution of the point-counts performed, the present method allows projections of provisional maps on the whole regional area. Moreover, due to its quantitative approach, it also allows the provision of an index of abundance within each square, correlations between bird presence and type of habitats and a satisfactory standardization in the degree of exploration of the accessible part of the region.

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1. Introduction

Traditional breeding bird atlases are based on field work by many volunteers and do not usually include information on bird abundance or habitats. However, the situation appears different for the non-breeding season. All the winter or all-year atlas projects started in Europe, namely, in France (Cuisin 1979), Holland (Bekhuis 1980, 1985), and Britain/ Ireland (Lack 1983, 1985, 1986) and include abundance assessments. The first published winter atlas, that is the Britain-Irish Winter Bird Atlas (Lack 1986), made use of quantitative information.

In 1986/87 we started a winter atlas project in Lombardy, Northern Italy, taking into full account the British-Irish experience. However, since we lack an organization comparable to the British Trust for Ornithology, we had to rely on a small group of experienced observers, and decided to try a different approach: to perform point-counts with habitat recording at sites selected randomly over the whole area. In this paper we describe our approach and some results obtained after the first year of field work.

2. Methods

Our method of selection of census sites is based on a two-stage random sampling (Snedecor & Cochran 1980) and it is performed as follows:

1) in the first stage we select primary sampling units corresponding to the 10×10 km squares of the region;
2) in the second stage we select secondary sampling units corresponding to the geographical coordinates of 20 point-count stations (Blondel et al. 1970) to be surveyed within each 10×10 km square.

As it was possible to cover six squares per week, we divided the area of the region (336 squares) into 6 "sectors" (North-East, North-West, Central East, Central West, South-East, South-West), each of 56 squares (Fig. 1) and, for each of these sectors we selected, using the tables of the random numbers (Snedecor & Cochran 1980), 15 squares to be surveyed during the 15 weeks of our conventional "Winter" (November 15 to February 28).

To make it easier to reach each point-count station, we did not actually define 20 points but rather 20 areas of 1×1 km and

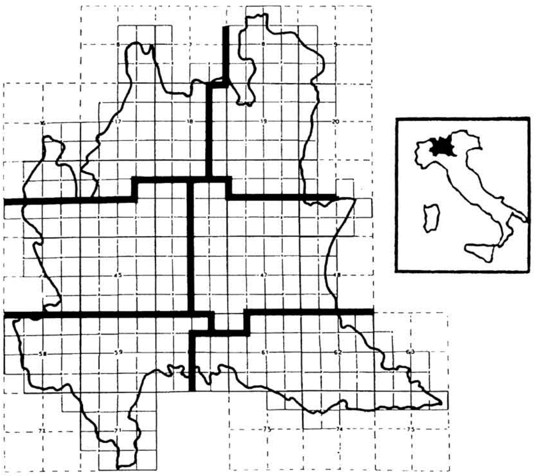

Fig. 1. Lombardy and its subdivision into six sectors of 56 squares each.

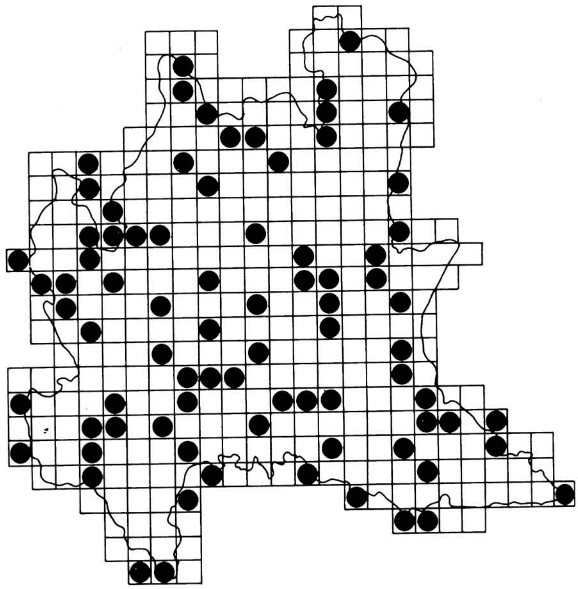

Fig. 2. Squares surveyed after the first year of field work. See text for further explanations.

decided to stop for counting in the most easily accessible point within each area.

In squares with inaccessible mountains, the survey was usually limited to sites where access was possible. Conversely, water bodies of any size were always visited, irrespective of whether they were included in the points selected or not. In this as in all other cases of non-random counts or observations, the data were either recorded in "supplementary cards" or collected through additional selected stations whose counts were kept separate from those of the stations selected randomly, and were not used for abundance assessments.

The six squares to be covered each week were divided in advance within a group of 12 observers. Each of these was made responsible for 5–12 squares, usually accompanied by another observer or a volunteer.

Due to reasons of time and economy we decided to limit each survey in a 10×10 km area to a single day. We moved by car through the 20 randomly selected stations beginning at sunrise and stopping 8 minutes at the point-counts to record all birds heard or seen. At each site, we also recorded habitat and environmental variables, with the aim of relating bird abundance with bird habitats in the final atlas work, and subsequently moved to the next station, each station being at least 500 m apart (Blondel et al. 1981).

The total time spent in the field was usually about 7–8 hours of which only 160 minutes were actually spent counting birds. Therefore, the indices of abundance were calculated in birds/hour only on the basis of the number of birds detected during these 160 minutes (2.7 hrs) of observation. Any other information on species seen or heard during the rest of the time of the day, from the point-count stations, was not used for quantitative purposes, but was recorded on special "supplementary cards". Such cards were also distributed to provincial gamekeepers and volunteers, to incorporate information on species that are seldom encountered for qualitative atlas purposes.

The habitat was recorded at each point by ticking one or more coded alternatives chosen from 50 in 8 large groups (i.e. large coniferous forests, agricultural lands, urban areas etc.) plus the possible addition of notes on meteorological variables and special situations (Fedrigo & Massa 1987).

We will continue to collect data in the winters 1987–88 and 1988–89 using the method described here to complete the Lombardy winter atlas project.

3. Results

During the first year of our survey (1986/87), we covered 80 10×10 km squares (Fig. 2), performed 1484 8-minute point-counts and detected a total of 128 781 birds comprising 113 species. An additional 11 species was added from our own supplementary cards and 9 more from provincial gamekeepers' information.

The number of species detected by means of point-counts at each 100 m altitudinal range was between 74 (0–100 m; 391 point-counts) and 9 (1900–2000 m; 13 point-counts) (Fig. 3a). The number of individuals was even more variable, ranging from 1014 birds/hour at 100–200 m, to 30 birds/hour at 1400–1500 m (Fig. 3b).

Few species were extremely abundant (Table 1) with the Italian sparrow *Passer domesticus italiae* with more than 5×10^4 individuals, the tree sparrow

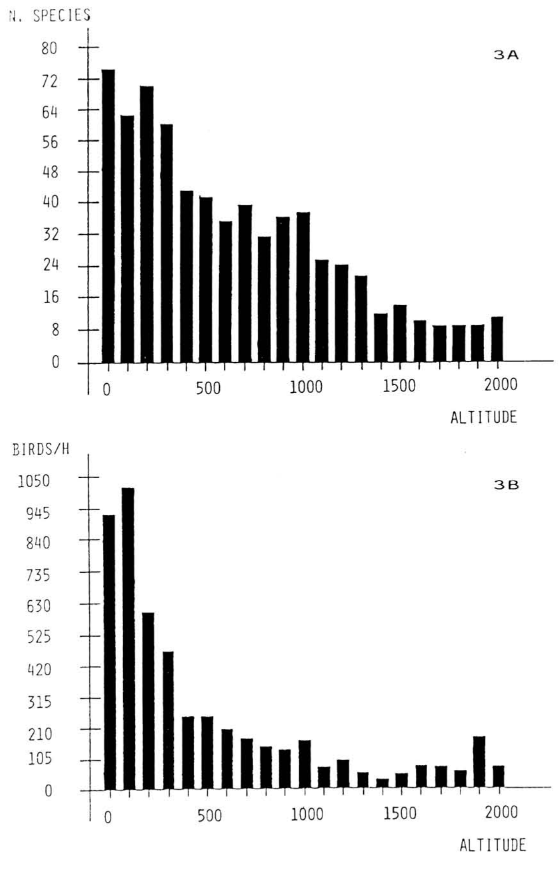

Fig. 3. Altitudinal distribution of the number of bird species (3a) and number of individuals (3b) detected in the 1484 point-counts performed in the first year of survey for the Lombardy winter atlas.

Table 1. The species counted in largest number after the first year of survey of the Lombardy winter atlas.

	Counts	Counts/h	%
Italian sparrow	52 092	263.3	40.45
Tree sparrow	17 213	86.9	13.37
Black-headed gull	10 018	50.6	7.78
Rock dove	6 704	33.9	5.21
Rook	6 057	30.6	4.70
Woodpigeon	5 407	27.3	4.20
Hooded crow	4 782	24.2	3.71
Chaffinch	3 741	18.9	2.90
Lapwing	3 647	18.4	2.83
Starling	3 335	16.9	2.59
Goldfinch	1 592	8.1	1.24
Great tit	1 339	6.8	1.04
Skylark	1 301	6.6	1.01
Robin	1 273	6.4	0.99
Blackbird	1 168	5.9	0.91
Others (98)	9 112	46.05	7.08

Passer montanus and the black-headed gull *Larus ridibundus* with over 10^4, and 12 species ranging between 10^3 and 10^4 individuals. Only fifteen species represented 93% of the total of individuals, with the other 98 species contributing only 7%.

Although all of these 15 species are found in large numbers in the lowland, their altitudinal distribution shows three different patterns:

1) confined to the lowlands (e.g., the lapwing *Vanellus vanellus*, woodpigeon *Columba palumbus* and, to a smaller degree, skylark *Alauda arvensis* and starling *Sturnus vulgaris*),
2) staying mainly in the lowland but also occurring sparsely on the hills (i.e. the hooded crow *Corvus corone cornix* and sparrows *Passer* spp.),
3) occurring in large numbers over most altitudinal ranges (e.g., the chaffinch *Fringilla coelebs* and great tit *Parus major*).

These altitudinal distributions are reflected in the Atlas maps of the species: the true lowland species, e.g., the lapwing (Fig. 4a) are only distributed in the southern half of the region, those such as the hooded crow cover most of the region but with much higher numbers in the lowland (Fig. 4b), those such as the chaffinch cover most of the region but without great differences in numbers (Fig. 4c).

Most species breeding in the highlands are scarce, and they do not to move in winter to altitudes much lower than those at which they breed (see willow tit *Parus montanus* in Fig. 4d).

Another interesting aspect that may be investigated is the temporal distribution through the winter. We analyzed separately the numbers of species and the indices of abundance in each week during the census period.

Only a few species are abundant enough to allow the evaluation of trends in their occurrence through the winter. We recognize four different patterns among these species (Fig. 5):

1) no change through the winter (most finches, corvids, Italian sparrow),
2) a significant decline (a number of small insectivores, e.g., robin *Erithacus rubecula,* wren *Troglodytes troglodytes,* chiffchaff *Phylloscopus collybita*),

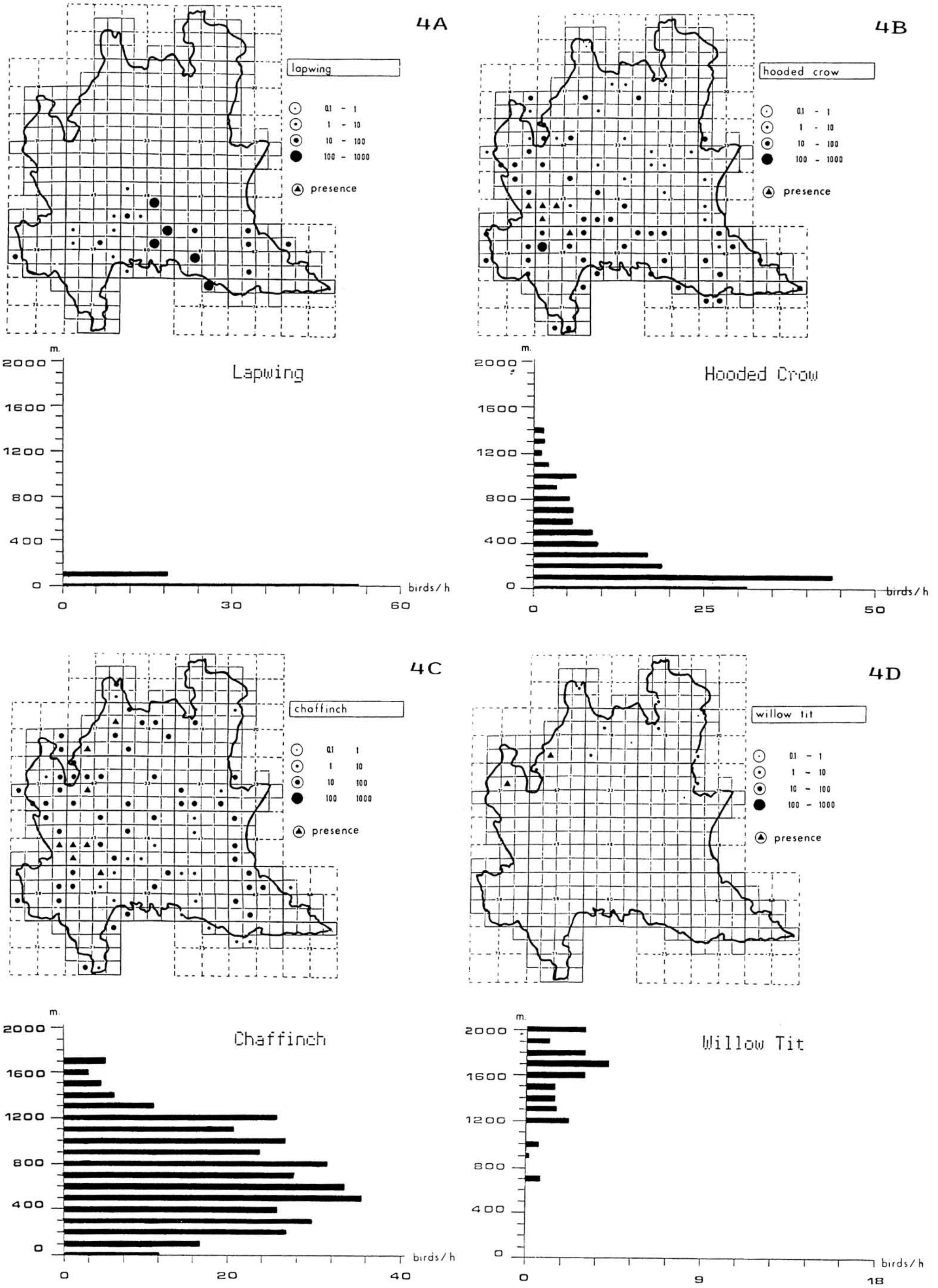

Fig. 4. Geographical and altitudinal provisional distribution and abundance of the lapwing (4a), hooded crow (4b), chaffinch (4c) and willow tit (4d) in Lombardy after the first year of survey.

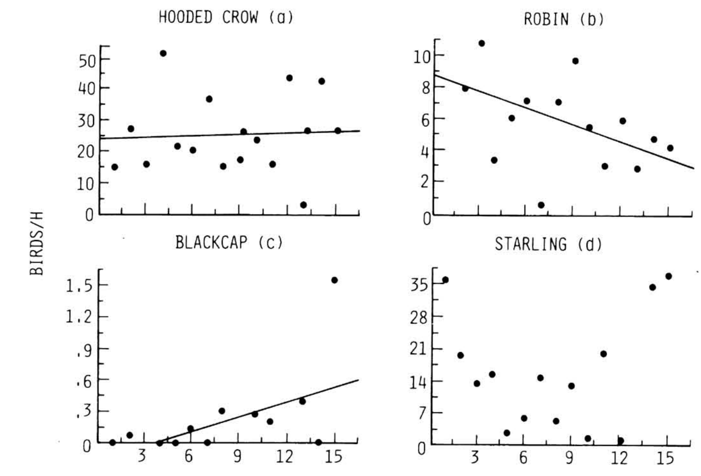

Fig. 5. Through-winter trends in the number of some bird species of Lombardy. See text for further explanations.

3) a progressive increase (e.g., blackcap *Sylvia atricapilla*),
4) a decrease to a minimum in the mid-winter followed by a subsequent increase in the late winter (rook *Corvus frugilegus,* starling, tree sparrow, black-headed gull).

As our sample size is very large (1484 point-counts), it is unlikely that these differences in trends are simply due to the random effects of sampling. Moreover, it is also unlikely that they are due to differences in detectability, as these are especially linked to vegetation cover on the land and to behaviour of birds, both changing very little through the winter. Therefore, it is likely that these trends do reflect changes due to mortality and/or movements.

4. Discussion

Our data show that the compilation of winter distribution maps based only on presence/absence data collected in a limited period of the winter may be misleading for adequately describing the wintering of birds.

Counting the birds and dating the record of every census is essential for detecting possible differences in distribution between different winters, or between different periods of a single winter (Lack 1985). These differences clearly appear for the commonest species while they may be difficult or impossible to detect for rare and scarce species. In this latter case the traditional approach is needed to investigate the distribution while, for the abundance, only specially designed methods of study may be helpful.

Finally, if a suitable sampling design is planned, one may produce provisional maps even after a single year of survey on a limited number of squares. For the British/Irish winter atlas, Lack (1985) found that there were no major biases in the final maps combining the data of three winters, even though some squares are covered in only one year and other squares in another year. Provided that the climatic conditions in the three winters of the study are not too different, it should be expected that provisional maps based on data collected through a random sampling design are affected, even to a lesser extent, by serious biases, and should appear very similar to those that are drawn after completing the three-year survey program.

In addition to allowing projections and to providing an index of abundance within each square, the method allows easy correlations between bird presence and type of habitats and a satisfactory standardization in the degree of exploration of the accessible part of a large area.

On the other hand, the method
1) is not adequate on scarcely accessible highlands unless a much longer time is invested per unit of area,
2) with a single outing of one day only does not usually provide a sufficient degree of exploration to achieve a 10×10 km atlas of the all species,

3) only rarely does it provide information about such furtive or nocturnal birds as tetraonids or owls,
4) does not usually provide quantitative information on waterfowl that is especially surveyed through "supplementary cards" or special point-counts.

In conclusion, for a full coverage including the less common and most furtive species, additional approaches should be used in conjunction with this method. Thus, the contribution of local amateurs still remains important to produce satisfactory maps with a reasonable investment of time and money.

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