MONITORING OF COMMON BREEDING BIRDS IN HUNGARY USING A RANDOMISED SAMPLING DESIGN

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ABSTRACT

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In Hungary, bird monitoring has traditionally focused on rare and threatened species or on Important Bird Areas (IBAs). Most of this monitoring is organised by the Hungarian BirdLife Partner – MME. No scheme covering the wider countryside had existed. To overcome this, a pilot project to establish a common breeding bird monitoring scheme based on a formal randomised sampling design was started in 1998. The scheme was instigated following discussions with the European Birds Census Council (EBCC) and has financial support from the RSPB. The aim of the pilot year was to test methods of sampling, counting and organising the volunteers who undertook the fieldwork. Volunteers are not evenly distributed across the Hungarian landscape, so the design of the scheme had to consider this while still ensuring that allowing observers to choose their sample plots did not bias the scheme. To do this, participants outlined a geographical area in which they would be able to count, and a 2.5 x 2.5 km UTM square was randomly selected from within this area. The observer subsequently made two five-minute point counts, one early and one late in the season, at each of 20 points within the square, recording all birds seen or heard in distance categories. In 1998, 95 observers collected data from 127 squares (0.9% of Hungarian territory). The frequency of habitats within the selected squares was similar to that in the country as a whole. Preliminary results from 1999 suggest that at least 207 participants covered 265 squares (1.8% of the territory).

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INTRODUCTION

In September 1996, the European Bird Census Council (EBCC) held a workshop entitled „Monitoring Birds in Europe" at Villa Cipressi in Italy (Executive Committee, EBCC 1997). During this workshop, the importance of monitoring common and widespread breeding birds in Europe was highlighted, because of the absence of annual trend information for these species in most European countries. Such species are probably among the best indicators of the effects of large-scale

changes in agricultural and land management practice on wildlife. However, there are only relatively few European schemes, which yield representative trend data and allow analysis of the factors affecting these trends (Gibbons 1998).

The UK Breeding Bird Survey (BBS – Gregory *et al*. 1996), which was started in 1994, uses a formal randomised sampling design to monitor common breeding birds, thus overcoming biases due to geographical/habitat representation and observer choice of plots. Because of its design, this new scheme provides unbiased estimates of population trend for commoner breeding birds for the UK as a whole, and for individual countries and habitats within it. This scheme has stimulated much interest from other countries and its principles are being adopted in other European countries. Following the Villa Cipressi workshop, the EBCC Executive Committee (with financial and logistical support from the Royal Society for the Protection of Birds) invited the Hungarian Ornithological Society (MME, BirdLife Hungary) to undertake a pilot year for a new common breeding bird monitoring scheme in Hungary. It was recommended that the new scheme should, like its UK counterpart, be based on a formal design.

A number of monitoring schemes already existed in Hungary (Marchant *et al*. 1996), mostly organised and executed within the umbrella of MME: White Stork (*Ciconia ciconia*) surveys since 1958, waterfowl counts since 1974, surveys of rare birds of prey species since 1974, *Actio Hungarica* ringing programme since 1974, national breeding bird atlas programme during 1980-93, constant effort sites (CES) ringing program since 1985 and integrated population monitoring of breeding Sand Martins (*Riparia riparia*) along the river Tisza since 1986 (Báldi *et al*. 1997).

A scheme to monitor rare and colonial birds (known by the acronym RTM), started in 1992, uses territory mapping within observer-chosen 2.5 × 2.5 km UTM squares. Fieldwork is undertaken by a hundred or so volunteers and is mostly concentrated within Important Bird Areas (IBAs – Báldi *et al*. 1997). However, the first country-wide monitoring of breeding birds using a standardised counting method was started as early as in 1988. This used the Danish point count method to monitor breeding passerines, with each observer covering 20 counting stations in one area, with a total of 20-40 areas covered annually by 20-50 participants. Sites were selected by the observers and were mainly in forested areas (Waliczky 1991). Because of the low level of participation, the bias towards forested habitats in relatively few geographical regions of Hungary, and observer choice of sites, population trend data produced by this scheme cannot be taken as representative of trends for common breeding birds in Hungary as a whole. Underlying these problems, there was also little interest in common birds in the late 1980s and early 1990s and limited resources for developing and introducing a more robust scheme.

The Hungarian Ornithological Society (MME), BirdLife Hungary, founded in 1974, is one of the largest nature conservation societies in Central Europe, with 5000 members and countrywide network of volunteers. Since 1974, nearly all ornithological monitoring and survey work in Hungary has been organised and carried out by MME, with a large number of volunteers, highly skilled in bird identification, participating in the various monitoring schemes.

The aim of this paper is to present the methods and results of the pilot year (1998) of a new common breeding bird monitoring scheme in Hungary (MMM – Mindennapi Madaraink Monitoringja). It is based on a randomised sampling design, with fieldwork undertaken by a large number of volunteers. The field method adopted for the first full survey year in 1999 was improved after the trial during the pilot year.

METHODS

Survey work for the 1998 pilot year was undertaken within 2.5 × 2.5 km UTM grid squares. There were several reasons for choosing plots of this size. First, such a grid size is compatible with other national schemes, such as the existing rare and colonial birds monitoring scheme (RTM), which has been running since 1992, therefore fieldworkers are used to working at this scale (Báldi *et al.* 1997). Second, MME has access to maps with this grid size marked on them and the same UTM grid is used by the Hungarian Nature Conservation Agencies. In addition, using 2.5-km squares provides an opportunity to combine RTM and MMM data for the same area.

To remove systematic bias, observers would ideally have been asked to survey 2.5-km squares randomly selected from across all of Hungary. However, this was impractical because of very uneven distribution of observers. Thus, to ensure that survey plots could be readily reached, each potential volunteer was asked to mark on a map (in 10-km square blocks) the area, within which they would be able to do fieldwork. Each was then allocated one or more (depending on the ability and interest of the observers) 2.5-km squares to survey, taken at random from within this area.

Each observer was sent a 1:10 000 map encompassing the selected 2.5-km square on which 36 evenly-spaced counting stations had been marked. All stations were at least 400 m apart, and circles with radii of 50 and 100 m around each station were drawn on the map. Observers were asked to classify the habitat within the 100 m radius around each counting station using the 20 main Hungarian habitat categories (Á-NÉR – Fekete *et al*. 1997). To do this, they used information on the map itself, backed up by visits to all stations before any bird counting. Because it would have been impractical for observers to count at all 36 stations within a single morning, observers were asked to select 20 counting stations that were representative of the main habitats in the 2.5-km square and which would allow them to make five-minute point counts at all 20 stations between 5.00 and 10.00 hour in a single morning.

The field method used for the first full survey year in 1999 differed somewhat and took into account the experience gained during the 1998 pilot year. In particular, it was found that 20 counting stations were difficult to cover in a single morning, and it was felt that observers had too much free choice over which counting stations to include in their survey.

Thus, in 1999 observers were sent a 1:15 000 map (*A4* size) encompassing the selected 2.5-km square. The centres of 25 evenly spaced counting stations (in an array of 5 × 5) were marked on the map – all stations were thus at least 500 m apart. Observers were asked to cover 15 of these counting stations. These 15 were selected using a randomised Latin square design, such that there were always three counting stations in any row or column of the array so that there was no geographical bias in any one direction within the square. The same 15 array locations were used for all 2.5-km squares. Occasionally, however, it would have been impossible for observers to cover some of these locations because they were difficult, dangerous or impossible to approach. Where this was the case, observers were allowed to replace counting stations with another taken from a randomly ordered list. In 1999, observers also provided more detailed habitat categories, though again following Fekete *et al*. (1997).

Within each 2.5-km square, observers undertook two 5-minute point counts, once early in the season (15 April–10 May) and once late (11 May–10 June), at each of the selected counting stations (1998 – 20 stations, 1999 – 15 stations). During each count, observers noted the locations of all birds seen or heard within the predetermined distance bands (0-50 m, 50-100 m). They also noted the locations more precisely on a customised form and indicated the habitat type in which the bird was located to allow for more sophisticated analyses in the future. Observers also recorded all birds seen/heard outside the 100 m radius or which flew over the plot. To assist them, fieldworkers were provided with customised instructions and observation forms, detailed maps of the square, a cassette containing the songs of common Hungarian birds and details on how to record habitats.

In 1999, observers were also sent a questionnaire with a view to obtaining an assessment of the overall identification skills of the pool of observers. This questionnaire listed all species that occur in Hungary (Magyar *et al*. 1998) and observers were asked to indicate for each species whether he/she was certain about its identification or not. Using this form, it will be possible to collect additional information about the potential causes of a species' absence (real absence or lack of observer skill in identification) for a given species in a given square. The questionnaire was handled with special care throughout, with observer names coded so that they were not immediately apparent. Using these data, it should also be possible to tell if observer identification skills improve over time. Inevitably, however, the questionnaire only provided information on observers' perceived identification skills; it would be necessary to test observers in the field to be certain of their skills level.

To promote volunteer participation in the scheme, the EBCC generously donated 80 copies of „The EBCC Atlas of European Breeding Birds" (Hagemeijer and Blair 1997). These were given (by a random draw) to some of those who submitted data – all had an equal chance of winning an atlas in 1998 and 1999.

The CORINE land cover database, which dates from 1990-1992 and is at a 1:100 000 resolution (FÖMI 1997), was used to determine how representative of Hungary as a whole were the habitats in the surveyed 2.5-km squares.

MapInfo, v. 4 GIS software was used for analysing spatial data and creating maps. Statistical analysis was undertaken with SPSS, v. 7.5.

RESULTS

The level of support in the 1998 pilot year was much greater than had been anticipated. It had been thought that 75 or so volunteers could be persuaded to become involved with a maximum of hundred 2.5 x 2.5 km squares covered. In practice, 225 participants volunteered to cover 347 random squares – equivalent to 2.3% of Hungarian territory (Table 1). These squares were taken from a total of 3845 2.5 × 2.5 UTM squares, within which observers had said they would be able to survey – this area is equivalent to 25.8% of the total area of Hungary (Fig. 1).

Table 1
Survey coverage in 1998 and 1999; squares which observers volunteered to survey and which were actually surveyed are given separately. Numbers in parentheses are the % of the Hungarian territory covered by those squares.

Year	2.5-km squares volunteered			2.5-km squares surveyed	
	No. squares	No. participants	No. squares in sampling area[1]	No. squares	No. participants
1998	347 (2.3)	225	3 845 (25.8)	127 (0.9)[2]	95
1999[3]	632 (4.3)	430	5 546 (37.3)	265 (1.8)	207

[1] This is the total number of 2.5-km squares encompassed by the area within which observers said they would be able to undertake survey work.
[2] In practice only 78 of these were completed - see text.
[3] Results are provisional as some data were outstanding at the time of writing.

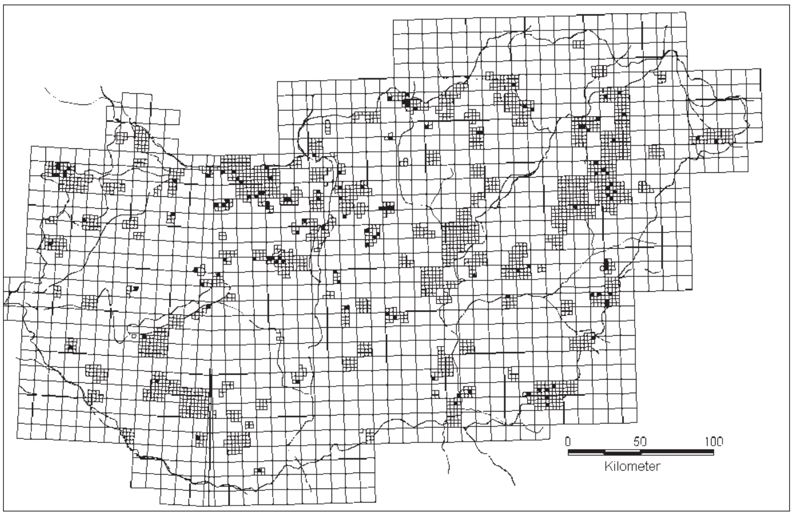

Fig. 1. Distribution of the areas in which observers said they would be able to undertake survey work (shaded grey) and those 2.5 x 2.5 km UTM squares (black dots) actually surveyed in 1998 in Hungary.

Because of technical difficulties in sending out materials in time, many volunteers were unable to complete their fieldwork in 1998. Despite this, 95 observers submitted data from 127 squares – 0.9% of the Hungarian territory. Both early and late counts were made in 78 of these squares. These data have been used for frequency and relative density estimation, below.

In 1999, 430 participants volunteered to cover 632 random squares (4.3% of Hungarian territory) – these squares included those selected and/or surveyed in 1998. By the end of 1999, data from 265 squares (1.8% of Hungary) had been received from 207 participants (Table 1).

Frequency of habitats

The frequency of occurrence of main habitat types, classified using CORINE land cover categories, was similar in the random squares to that in Hungary as a whole (Test of independence, $p = 0.182$; Fig. 2). Only artificial habitats (which are mainly urban, but also include industrial sites, roads, rail, airports, urban green areas *etc.*) were over-represented. This is undoubtedly because observers chose broad survey areas that were within a reasonably short distance of their home.

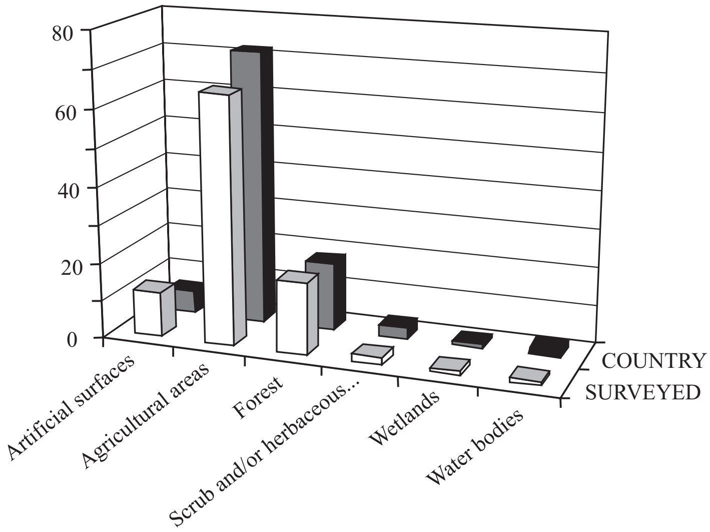

Fig. 2. Frequency of the main CORINE habitat categories in Hungary as a whole (filled columns) and in those 2.5 x 2.5 km squares surveyed (unfilled) in 1994.

In 1998, observers selected counting stations, whose surrounding habitats were representative of the square as a whole. The frequency of CORINE habitats within 100 m radii of the 20 observer-selected counting stations was not different from that around all 36 stations within each square ($\chi^2 = 2.107$, $df = 4$, $p = 0.716$, data from 107 2.5-km squares).

Frequency of bird species

One hundred and seventy-seven bird species were observed in 127 2.5-km squares in 1998 – 167 of these breed regularly in Hungary (85% of the total of 196 species that breed in Hungary – Haraszthy 1998).

Table 2 lists twenty most frequently recorded species. However, as it is apparent from this table, precise rank order is dependent on distance category chosen.

Table 2
The twenty most common species recorded in 1998, based on frequency of occurrence at counting stations. The percentage of counting stations at which each species was recorded is given, (frequency of occurrence), as is the rank of this percentage. The rank data are then further refined to show each species rank based on solely those records from within 100 m, those beyond 100 m, and those flying over. Data are from 78 2.5-km squares in which both early and late counts were undertaken.

	%	Rank (all categories)	Rank (within 100 m)	Rank (beyond 100 m)	Rank (flying over)
Passer montanus	94.9	1	1	11	5
Cuculus canorus	93.6	2	15	1	8
Lanius collurio	92.3	3	2	6	38
Phasianus colchicus	92.3	4	6	2	55
Sturnus vulgaris	92.3	5	5	8	1
Hirundo rustica	91.0	6	19	12	2
Alauda arvensis	84.6	7	3	4	30
Oriolus oriolus	84.6	8	10	3	24
Carduelis carduelis	83.3	9	14	29	4
Luscinia megarhynchos	83.3	10	4	7	104
Saxicola torquata	83.3	11	8	17	49
Carduelis chloris	82.0	12	7	31	12
Turdus merula	79.5	13	9	13	25
Fringilla coelebs	75.6	14	11	19	35
Buteo buteo	74.4	15	41	5	3
Miliaria calandra	74.4	16	16	14	45
Passer domesticus	73.1	17	12	34	19
Sylvia atricapilla	71.8	18	13	20	-
Streptopelia turtur	69.2	19	21	9	7
Streptopelia decaocto	67.9	20	18	10	11

The recorded frequency could depend to some extent on observer identification skills. To investigate this we selected 25 species, five at random, from within each of five frequency of occurrence bands: 1-20%, 21-40%, 41-60%, 61-80%, 81-100%, for 1998. Then we compared the rank order of frequency of occurrence of each species (1 = most frequent) with the proportion of observers that were certain of its identification, as documented by the 166 observers who returned questionnaires in 1999 (Table 3). The rank of frequency of occurrence of a species was strongly correlated with the proportion of observers that were certain ($r = -0.659$, $n = 25$, $p < 0.001$) of its identification. Expressed another way, the mean rank of frequency of occurrence of species for which 90% or more of observers were certain of its identification was much lower (*i.e.* species more ubiquitous) than that for those for which less than 90% were certain ($mean_{> 90\%} = 31.5$, $n = 12$; $mean_{< 90\%} = 70.85$, $n = 13$; $t = -2.959$, $df = 23$, $p = 0.007$). In general, the level of identification skills was encouragingly high, with more than 90% of observers being certain of the identification of 19 out of the 25 species (76%).

Relative densities of bird species

An approximate measure of relative density was calculated for those 19 species for which 90% or more of observers were certain of its identification. This was calculated as the mean of the maximum (of the early and late visits) number of individuals recorded within the 100 m radius, per ha (Table 4). These densities cannot be taken as absolute as they do not take account of the manner in which species detectability falls off with distance.

Densities varied between species and, more interestingly, within species between CORINE habitat categories. For example: densities of Red-backed Shrike (*Lanius collurio*), Chaffinch (*Fringilla coelebs*) and Collared Dove (*Streptopelia decaocto*) were highest in agricultural, forest and artificial habitats, respectively. House Sparrow (*Passer montanus*) was one of the most abundant species, both in artificial and agricultural habitats.

DISCUSSION

The new common breeding bird monitoring scheme received much greater support from amateur ornithologists than had been anticipated. Even though technical difficulties in 1998 thwarted some volunteers' efforts, 0.9% of Hungarian territory was surveyed. This was improved upon in 1999 when the number of observers increased yet further.

The frequency of occurrence of the main CORINE land cover categories in the sampled areas was not greatly different from that in Hungary as a whole, although artificial habitats were over-represented and agricultural habitats slightly under-represented. This suggests that, in general, the method of randomly selecting the 2.5-km squares did not introduce any systematic biases in habitat representation.

Table 4
Relative density of 19 species (individuals/ha) in the five main CORINE habitat types and for all habitats combined. The manner of calculation of density is given in the text. The number of counting stations containing each habitat is shown in parentheses. The ranking is based on the frequency of occurrence in all categories (see Table 2).

	Rank	All (1325)	Artificial (183)	Agriculture (812)	Forest/semi-natural (294)	Wetland (25)	Water-bodies (11)
Passer montanus	1	0.23	0.24	0.30	0.08	0.05	0.03
Lanius collurio	3	0.11	0.04	0.14	0.08	0.05	0.09
Oriolus oriolus	8	0.06	0.04	0.05	0.12	0.00	0.03
Saxicola torquata	11	0.07	0.01	0.09	0.02	0.05	0.03
Fringilla coelebs	14	0.11	0.08	0.05	0.31	0.00	0.03
Sylvia atricapilla	18	0.09	0.09	0.05	0.19	0.06	0.00
Streptopelia decaocto	20	0.07	0.31	0.04	0.02	0.00	0.00
Dendrocopos major	25	0.03	0.02	0.02	0.09	0.00	0.00
Garrulus glandarius	27	0.03	0.01	0.01	0.08	0.00	0.00
Corvus c. cornix	31	0.01	0.00	0.01	0.00	0.00	0.00
Vanellus vanellus	35	0.02	0.00	0.03	0.01	0.06	0.06
Erithacus rubecula	42	0.04	0.02	0.02	0.14	0.00	0.00
C. coccothraustres	51	0.02	0.01	0.01	0.05	0.00	0.00
Sitta europaea	57	0.02	0.02	0.01	0.07	0.00	0.00
Picus viridis	69	0.00	0.00	0.00	0.01	0.00	0.00
Riparia riparia	73	0.01	0.00	0.01	0.00	0.00	0.00
Corvus monedula	89	0.00	0.01	0.00	0.00	0.00	0.00
Perdix perdix	92	0.00	0.00	0.01	0.00	0.00	0.00
Coracias garrulus	143	0.00	0.00	0.00	0.00	0.00	0.00

However, the areas surveyed were representative only of those that observers originally suggested they would be able to cover, rather than all of Hungary. Ideally, the sample squares would have been selected entirely at random, possibly stratified by observer density to take account of variable numbers of observers in different parts of Hungary. This is the approach adopted by the UK BBS. However, there was no information about the distribution of potential volunteers on which to base such a stratification and, if it had been used, it was likely that observers would have had to travel greater distances to get to their survey plot than under the adopted method. The sampling design is thus not as rigorous as that used by the UK BBS, and should probably be described as „partially randomised". A similar design could

be readily used in other countries where the distribution of potential volunteers is unknown and/or the volunteers would be unable to travel far to their survey squares. The method is essentially a compromise between scientific rigour and pragmatism. Over-, or under-representation of particular habitat types (for example the over-representation of artificial habitats in 1998) could be taken into account in the future by retrospective stratification of the data.

In 1998, observers were able to follow the instructions and managed to select counting stations within the 2.5-km squares that were representative of the square as a whole. Despite this, the modification adopted for 1999, with 15 locations selected essentially at random within each square, will ensure that counting stations are representative of the entire square. The reduction in number of counting stations between 1998 and 1999 (from 20 to 15) will also make the survey work easier for fieldworkers.

During 1998, 87% of Hungary's breeding bird species were observed and for the first time it has been possible to produce frequency of occurrence data for each of these species. Preliminary analysis suggest that observers were better at identifying ubiquitous species than less frequently observed species. This result could be interpreted that occurrence and densities of less common species may have been underestimated. Alternatively, it could simply be that observers were less confident in identifying rarer species just because they were less familiar with them. If observer ability in general were to improve with time (which is a real possibility) then declining trends may be masked and rising trends exaggerated. In future years, it will be possible to reassess observers' perceived identification skills to see whether they have improved and to consider their effect on population trends. Of course, such data will require very careful interpretation.

The monitoring scheme presented here, which is modelled on the UK BBS (Gregory *et al.* 1996), produces data which, because of its random sampling design, will provide raw data for a wide range of analysis, both spatial (*e.g.* bird-habitat associations) and temporal (*e.g.* population trends). It will be possible to produce absolute bird densities using distance sampling (Buckland *et al*. 1993, Laake *et al.* 1996) and robust population trend estimates and, because the data are geographically-referenced at a fine scale, will allow combination with other GIS databases (CORINE, administration, management, pollution *etc.*).

The introduction of a new monitoring scheme in Hungary has provided an opportunity for a large number of volunteers to contribute to a countrywide programme of enormous value to nature conservation. We found that many observers had the necessary fieldwork skills, but had not become involved in earlier survey work because these were often undertaken far from where they lived. The new scheme (MMM) allows participants to contribute by carrying out simple fieldwork in areas they know well, close to home. The importance of communicating regularly with fieldworkers by letter, newsletter or meetings proved vital to the success of the scheme and cannot be undervalued.

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