The Breeding Bird Survey for mapping Britain's birds: A preliminary assessment of performance at two spatial scales

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Advances in the application of geostatistics in recent years have improved the precision of predicting occurrence or relative abundance at non-surveyed sites and so allow the potential for producing reliable maps over the entire area of interest. We evaluate the use of geostatistics for producing statistically valid maps of relative abundance at two spatial scales from annual bird monitoring data collected by the UK Breeding Bird Survey (BBS). Whilst development of an approach that optimizes the precision of this methodology is being explored currently, it is important to explore the extent to which the BBS, with about 2,000 1-km squares surveyed annually (<1 % of the UK), is adequate for producing useful maps. To this end, we compare relative abundance, interpolated from 2003 BBS data for 96 species, with independent data collected for these species through intensive survey effort during the last breeding Atlas of 1988-91. Comparisons are made at two spatial scales: at a regional scale with 125 regions and at a local scale comprising some 2,882 10-km squares. Whilst the BBS and Atlas measures of abundance are not the same, and there are over ten years between the collection these data, during which time several species have undergone large population declines or increases and contractions or expansions in range, it was encouraging to find that there was no significant difference at a regional scale between measures of abundance for 84 of the 96 species (88%). At a local scale, there was no significant difference between measures of abundance for 17 of the 96 species (18%). Differences between the interpolated BBS and Atlas measures of abundance at both spatial scales can be explained in part by real changes in abundance between years although, as one would expect, the BBS provides greatest map reliability for the most widespread species as shown by a strong positive relationship between map similarity and number of occupied BBS squares. However, we have yet to examine the extent to which habitat and other landscape variables may improve our predictions for species with patchy distributions.

Key words: Breeding Bird Survey, BBS-Atlas comparison, abundance maps, bird monitoring, Britain.

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Distribution maps demonstrating the presence of particular bird species are often produced from survey data. Whilst maps of this type provide useful information on the distribution of species, and may highlight the strongholds of particular species, these may be biased towards areas of higher coverage if, as in the case of the UK Breeding Bird Survey (BBS) the survey is not strictly random (the BBS is stratified by region). Using 2003 BBS count data for 96 bird species for which trends in relative abundance are produced annually for the UK (see e.g. Raven *et al.* 2004, Appendix lists all the scientific names), we examine an alternative approach by interpolating statistically valid maps of relative abundance over the entire area of interest using geostatistical methods. Specifically we use the Geostatistical Analyst extension of ArcGIS (Johnston *et al.* 2001). Whilst an approach that optimizes the reliability of this methodology is being developed currently, it is important to examine whether the survey effort of the BBS is able to produce useful and reliable maps of this type, although the value of these will depend on the aims of the study. For example, from visualizing broad geographic patterns in abundance at a regional scale at one extreme, to the production of population estimates at the other. As a first step to evaluate the use of BBS data, here we compare predictions from BBS data with independent data for these species collected through intensive survey effort of the last breeding Atlas of 1988-1991 (Gibbons *et al.* 1993), at two spatial scales.

Methods

The Breeding Bird Survey

We use BBS data for 2003, during which fieldwork was undertaken on a total of 2,254 1-km squares. Details of the survey design can be found elsewhere (Raven *et al.* 2004), but in brief, the use of volunteers is maximised through a stratified random sampling design. The number of squares allocated to each of 125 sampling regions was initially a fixed proportion of the number of potential volunteers in the region, estimated using BTO membership information. Within each sampling region, squares are selected randomly, and allocated to volunteers through a network of voluntary regional organisers (ROs). Fieldwork involves three visits by a volunteer observer to each survey square. The first is to determine two parallel ideal 1-km line transects through the square and the second and third visits the 1-km line transects that will actually be surveyed. These actual line transects should follow the ideal transect routes as closely as possible, but allow for minor deviation due to impracticalities for the observer caused by land features or other obstacles. The habitats of each 200-m section along each of the ideal and actual line transects are also recorded on this first visit using a hierarchical coding system (Crick 1992), although we do not examine these data here.

Early morning bird counts are carried out on the second and third visits, between early April and mid-May and between mid-May and late June respectively. It is recommended that the two visits should be at least 4 weeks apart. Counts begin at 06:00-07:00 hours (GMT) so that they coincide with maximum bird activity but avoid concentrated song activity at dawn. Observers record all birds that they see or hear as they walk along their transect routes within each of ten 200 m sections, in one of three distance categories from the line (0-25 m, 25-100 m, 100 m or more) or in flight. Flying birds obviously associated with the square (*e.g.* display flight of Skylark, see Appendix), are assigned to the appropriate distance band rather than recorded as in flight. Distances are estimated at right angles to the transect line. Juvenile and immature birds are recorded in the field, but as far as possible, they are excluded from the computerised data and any subsequent analyses. In these analyses we produce a single count value for all 1-km squares surveyed in 2003. This count is the maximum count recorded across the entire square during this period, where a count is the sum over all the 200-m transect sections, distance categories (0-25m, 25-100 m, 100-m or more and in flight) and the maximum of the two survey visits. Squares surveyed but where the species was not recorded, were assigned a zero count.

The Last Breeding Bird Atlas

The fieldwork for the 1988-1991 Atlas was carried out between the beginning of April and end of July in each of the four years. Fieldwork was coordinated through a network of volunteer regional organisers and undertaken by volunteers. Full details of the survey are discussed in Gibbons *et al.* (1993). In summary, observers visit a minimum of eight tetrads of their own choice within each 10-km square. Two hours were spent in each tetrad, and a species list compiled for each tetrad. It was recommended that the two-hour period be split into two one-hour visits, one early in the season (April to May) and one late visit (June to July). Additional supplementary (non-timed) observations were also requested to ensure that the species lists for each 10-km square were as complete as possible. Whilst counts were not recorded for the Atlas, the results of a pilot survey carried out in 1987 showed that an index of frequency of occurrence was correlated with a measure of absolute density (Gibbons 1987). For this reason, the Atlas calculated a measure of abundance for each 10-km square, expressed as the proportion of tetrads visited in which the species was recorded. For example, if a total of 20 tetrads was surveyed over the four-year period in a particular 10-km square, and a species was recorded in 10 of these, then its frequency of occurrence was 0.5 (10 ÷ 20). In comparison with the BBS, the survey effort was considerably greater, with a total of 42,736 tetrads surveyed in 3,858 10-km squares.

Analytical procedures

Spatial interpolation of BBS data

Geostatistical methods are based on statistical models that model autocorrelation (statistical relationship among measured points). Not only do these techniques have the capability of producing a prediction surface, but they can also provide some measure of the accuracy of the predictions. A number of geostatistical interpolation techniques have been developed, of which kriging is the most applicable to this work. Kriging weights the surrounding counts at surveyed sites to derive a prediction for unsurveyed locations. In these, the weights are based on the distance between measured sites and the prediction location, but also on the overall spatial arrangement in the weights (the spatial autocorrelation). For a full discussion of geostatistics and geostatistical methods, see Chiles & Delfiner (1999). In the analyses, we use Simple Kriging. Once a model was developed for a species, predictions of mean relative abundance were made at a regional scale (based on the 125 BBS sampling regions) and at a local 10-km square scale (2,882 x 10-km squares), which is comparable with the resolution of the last breeding bird atlas.

Comparisons with the Last Breeding Bird Atlas

Before comparison between BBS and the Atlas were made, we first calculated the mean relative abundance from the Atlas data for each BBS sampling region. The surveys were then standardized at both the regional and local scale by dividing the measures of abundance at each scale by the mean across 10-km squares / regions (as appropriate) for each species. Wilcoxon matched-pairs signed ranks tests were then used to test the significance of the difference between the Atlas and BBS measures of abundance for each species at the two spatial scales.

For interpretative purposes we also provide a quantitative measure of dissimilarity or distance between maps by calculating the Euclidean distance (Digby & Kempton 1987). If we define the count for site k as c_k and aim to compare two maps with measures of abundance $\{c_{1k}\}$ and $\{c_{2k}\}$ (k=1,…,N), the Euclidean distance is calculated as:

$$(1/N)\sum_{k=1}^{N}|c_{1k} - c_{2k}|$$

Whilst differences between the BBS and the Atlas maps may highlight differences in the ability of the BBS to predict abundance or limitations of the Atlas methodology, significant differences between maps may be due to real changes in population size and range between these surveys due to the real differences in abundance between years. To examine the importance of population change, we examine whether there is a significant relationship between population change determined from the most reliable source of population trend data for each species (shown in the Appendix) and distance between maps using Spearman rank-order correlations.

Results

Atlas and BBS interpolated measures of relative abundance at a regional scale were significantly different for 12 of the 96 species (Table 1). This includes some of the least abundant species examined, such as Pied Flycatcher, Common Grasshopper Warbler, European Golden Plover and Red Grouse, which were recorded on fewer than 100 BBS squares in 2003. More generally, similarity between the Atlas and BBS is greatest for the most widespread species and least for the most localized species (Spearman rank-order correlation, r_s=-0.841; df=95; p=<0.001, Figure 1). However, a significant difference between measures of abundance for more widespread species such as Common Buzzard, Common Raven and Greylag Goose may be the result of real changes in abundance and distribution between the Atlas of 1988-1990 and BBS in 2003 (r_s=0.241; df=95; p=0.018, Figure 2).

Table 1. Comparison between measures of abundance interpolated from the BBS for 2003 and independent data collected for the last breeding Atlas of 1988-1991 at two spatial scales (Wilcoxon matched-pairs signed ranks tests). Asterisks indicate a significant difference between the Atlas and BBS derived measures of abundance. * p<0.05, ** p<0.01, *** p<0.001.
Comparació entre les mesures d’abundància interpolades a partir del BBS per al 2003 i les dades independents recopilades durant el darrer Atles de nidificats 1988-1991 a dues escales espacials (test de Wilcoxon per a dades aparellades). Els asteriscs indiquen diferències significatives entre les mesures d’abundància provinents de l’Atles i del BBS. * p<0.05, ** p<0.01, *** p<0.001.

Species *Espècie*	Regional *Regional*	Local *Local*
Little Grebe	ns	***
Great Crested Grebe	ns	***
Mute Swan	ns	***
Greylag Goose	**	***
Canada Goose	ns	***
Common Shelduck	ns	***
Mallard	ns	*
Tufted Duck	ns	***
Eurasian Sparrowhawk	ns	***
Common Buzzard	*	***
Common Kestrel	ns	***
Red Grouse	**	***
Red-legged Partridge	ns	***
Grey Partridge	ns	***
Common Pheasant	ns	ns
Common Moorhen	ns	***
Common Coot	ns	***
Eurasian Oystercatcher	ns	***
European Golden Plover	**	***
Northern Lapwing	ns	**
Common Snipe	ns	***
Eurasian Curlew	**	ns
Common Redshank	ns	***
Common Sandpiper	ns	***
Feral Pigeon	***	ns
Stock Dove	ns	***
Common Wood Pigeon	ns	**
Eurasian Collared Dove	ns	***
European Turtle Dove	ns	***
Common Cuckoo	ns	***
Little Owl	ns	***
Common Swift	ns	*
Common Kingfisher	ns	***
Green Woodpecker	ns	***
Great Spotted Woodpecker	ns	***
Sky Lark	ns	ns
Sand Martin	ns	***
Barn Swallow	ns	**
House Martin	ns	**
Tree Pipit	ns	***
Meadow Pipit	ns	*
Yellow Wagtail	ns	***
Grey Wagtail	ns	***
Pied Wagtail	ns	ns
White-throated Dipper	ns	***
Winter Wren	ns	**
Hedge Accentor	ns	ns
European Robin	ns	ns

Species *Espècie*	Regional *Regional*	Local *Local*
Common Redstart	ns	***
Whinchat	ns	***
Stonechat	***	***
Northern Wheatear	**	***
Common Blackbird	ns	ns
Song Thrush	ns	ns
Mistle Thrush	ns	*
Common Grasshopper Warbler	***	***
Sedge Warbler	ns	***
Eurasian Reed Warbler	ns	***
Lesser Whitethroat	ns	***
Common Whitethroat	ns	***
Garden Warbler	ns	***
Blackcap	ns	***
Wood Warbler	ns	***
Common Chiffchaff	ns	**
Willow Warbler	ns	ns
Goldcrest	ns	**
Spotted Flycatcher	ns	***
Pied Flycatcher	***	***
Long-tailed Tit	ns	***
Marsh Tit	ns	***
Willow Tit	ns	***
Coal Tit	ns	**
Blue Tit	ns	ns
Great Tit	ns	ns
Wood Nuthatch	ns	***
Eurasian Treecreeper	ns	***
Eurasian Jay	ns	***
Black-billed Magpie	ns	ns
Eurasian Jackdaw	ns	ns
Rook	ns	ns
Carrion Crow	ns	ns
Hooded Crow	*	***
Common Raven	**	***
Common Starling	ns	***
House Sparrow	ns	ns
Eurasian Tree Sparrow	ns	***
Chaffinch	ns	***
European Greenfinch	ns	*
European Goldfinch	ns	***
Eurasian Siskin	ns	***
Common Linnet	ns	**
Lesser Redpoll	ns	***
Common Bullfinch	ns	***
Yellowhammer	ns	*
Reed Bunting	ns	***
Corn Bunting	ns	***

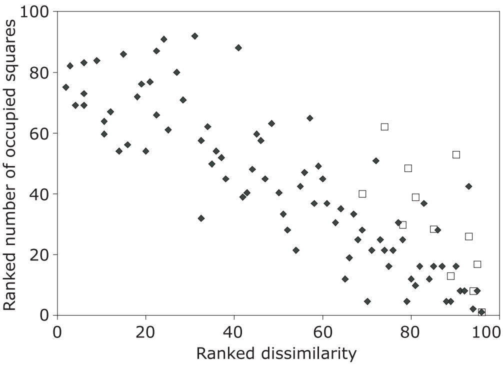


Figure 1. Relationship between the (ranked) number of occupied 1-km BBS squares and (ranked) dissimilarity (Euclidean distance) between the Atlas and BBS derived measures of relative abundance at a regional scale. Species for which there was a significant difference between abundance measures (see Table 1) are shown by open squares. A similar correlation between the number of BBS squares and dissimilarity was observed at a 10-km square scale.
Relació entre el nombre de quadrats 1x1 km ocupats del BBS (ordenats) i la disparitat (distància euclídea, també ordenada) entre les mesures d'abundància relativa a escala regional de l'Atles i del BBS. Les espècies per a les quals hi va haver una diferència significativa entre les mesures d'abundància (vegeu Taula 1) es mostren com a quadrats buits. Es va observar una correlació similar a escala de quadrat 10x10 km.

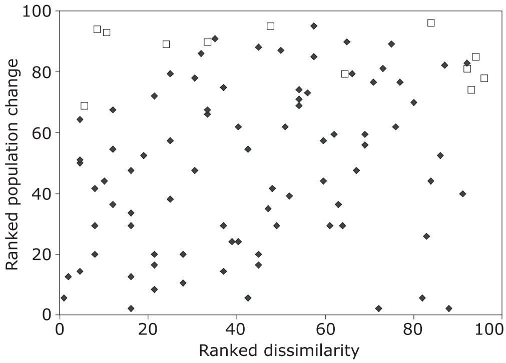
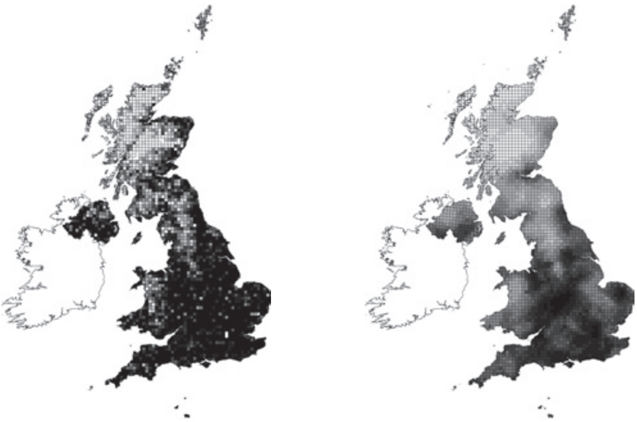


Figure 2. Relationship between (ranked) population change (i.e. % change regardless of direction) and (ranked) dissimilarity (Euclidean distance) between the Atlas and BBS derived measures of relative abundance at a regional scale. Species for which there was a significant difference between abundance measures are shown by open squares (see Table 1). A similar correlation was observed at a 10-km square scale.
Relació entre el canvi poblacional (% de canvi amb independència del seu sentit, ordenat) i la disparitat (distància Euclídea, també ordenada) entre les mesures d'abundància relativa a escala regional de l'Atles i del BBS. Les espècies per a les quals hi va haver una diferència significativa entre les mesures d'abundància (vegeu Taula 1) es mostren com a quadrats buits. Es va observar una correlació similar a escala de quadrat 10x10 km.

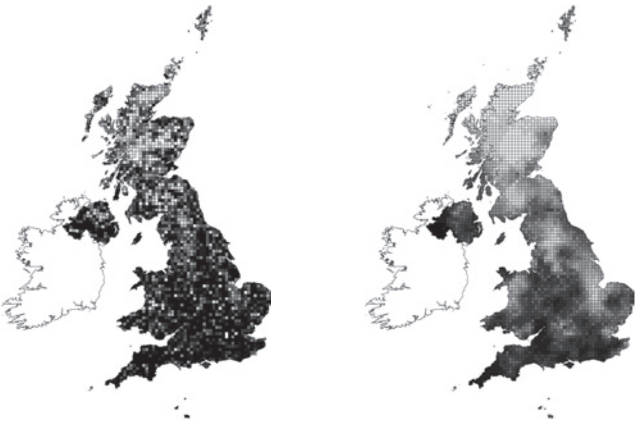
At the 10-km square resolution, the Atlas and BBS measures of relative abundance were significantly different for considerably more species, 79 of the 96 species (Table 1). As above differences between Atlas and BBS measures of abundance were greatest for the most localized species (r_s=-0.875; df=95; p<0.001). There was also evidence that differences between the Atlas and BBS at the 10-km square resolution are in part due to population changes between the Atlas and BBS periods (r_s=0.281; df=95; p=0.006).

Discussion

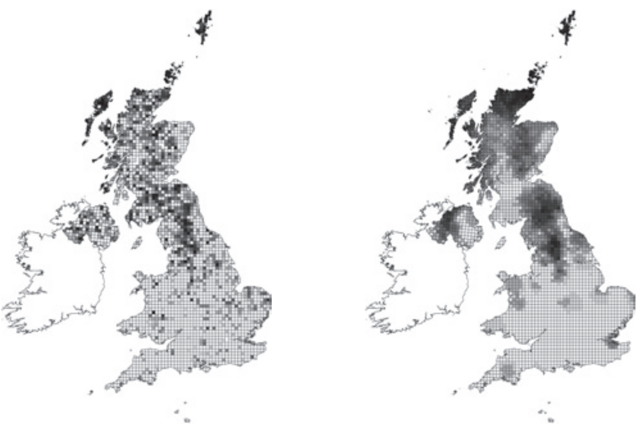
At a regional scale, the Atlas and BBS derived maps were not significantly different for 84 of 96 species. Whilst differences for some of these species can be explained by changes in abundance and distribution between the Atlas and BBS periods, there are some species, which have not changed significantly in abundance, but are highly localized and patchy in their distribution, and for which the BBS may not produce comparable maps at this resolution. However, when making these comparisons it should be remembered that the BBS and atlas measures of abundance themselves as discussed in the methods are not directly comparable. At a 10-km square resolution, Atlas and BBS derived maps of relative abundance were significantly different for 79 of the 96 species. When considering this, it is important to assess this in relation to the aims of producing maps of this type. If the aim is to produce maps that show the broad geographic patterns of relative abundance of particular species, rather than obtain an accurate prediction for a particular 10-km square, the exact similarity at this resolution may be less important and perhaps regional maps more valuable. To illustrate, we present in Figure 3 example maps of relative abundance for six species including two species for which there is high similarity at a 10-km square resolution between the Atlas and BBS (Common Blackbird and Winter



Common Blackbird
Turdus merula

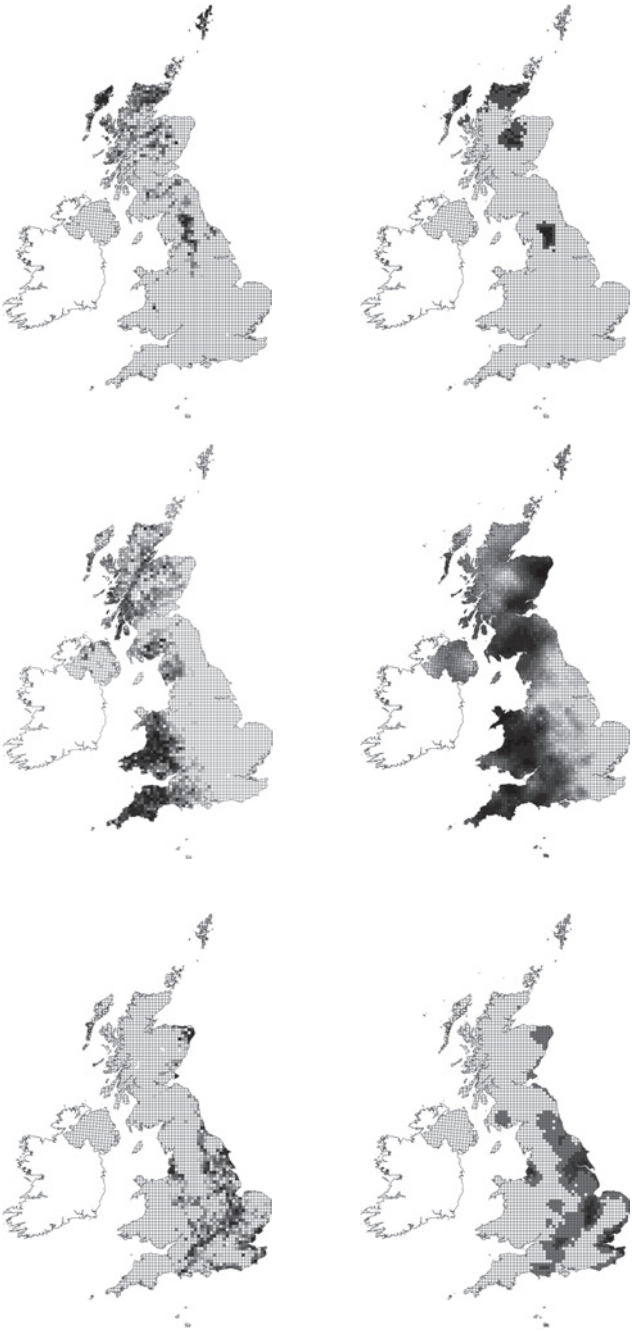


Winter Wren
Troglodytes troglodytes



Common Snipe
Gallinago gallinago

Wren) and four species for which there is low similarity (Common Snipe, European Golden Plover, Common Buzzard and Corn Bunting). The relative abundance maps for Common Blackbird and Winter Wren show that in areas where the species are widespread the BBS performs well in predicting high relative abundance, but where the species is localised such



European Golden Plover
Pluvialis apricaria

Common Buzzard
Buteo buteo

Corn Bunting
Emberiza calandra

Figure 3. Examples of maps of relative abundance at a 10-km square resolution. Column 1 shows Atlas maps based on recorded frequency of occurrence. Column 2 shows maps of relative abundance from interpolated BBS count derived at a local 10-km level. The species are: Common Blackbird, Winter Wren, Common Snipe, European Golden Plover, Common Buzzard and Corn Bunting.
Exemples de mapes d'abundància relativa a una resolució de 10x10 km. La columna 1 mostra els mapes de l'Atles basats en la freqüència de presències. La columna 2 mostra els mapes d'abundància relativa a partir de la interpolació dels comptatges del BBS a una escala local de 10x10 km. Les espècies que es mostren són: Merla, Cargolet, Becadell Comú, Daurada Grossa, Aligot Comú i Cruixidell.

as in parts of Scotland, the coverage of the BBS misses pockets of these species and incorrectly predicts low or zero abundance. However, at a broader scale maps for these species generally perform well, because they are primarily widespread and abundant across their range. The Common Buzzard is an interesting example in that this species is recorded on a large number of BBS squares, so you might expect high similarity between the Atlas and BBS, but this species has experienced significant population growth and range expansion between the two periods which can be seen by comparing the Atlas and the BBS maps. The Common Snipe, European Golden Plover and Corn Bunting are all reported on fewer than 150 BBS squares and are patchy in their distribution, so you would expect low similarity between the Atlas and BBS maps. Whilst predictions at the 10-km level are dissimilar for these species, the BBS is still able to highlight the strongholds of these species, which may be adequate for visualizing broad geographic patterns of relative abundance.

It is important to stress that the BBS interpolations here do not include habitat and other landscape variables in the models. Incorporating these variables into co-kriging models or via regression modeling may be particularly important for improving the predictions for localised species with patchy distributions, which tend to be specialized in their habitat requirements. Additionally, work to convert relative counts to absolute counts will be needed if different schemes, with different survey methodologies, were to be combined to produce maps over a larger geographic area.

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Resum

El seguiment d'ocells nidificants com a eina per a l'elaboració de mapes d'ocells a Gran Bretanya: una avaluació preliminar dels resultats a dues escales espacials

Els avanços en l'aplicació de la geoestadística en els darrers anys han millorat la precisió en la predicció de la probabilitat d'aparició o abundància relativa a llocs no mostrejats i, per tant, han permès el desenvolupament del potencial necessari per a la producció de mapes fiables en tota l'àrea d'interès. En aquest treball s'avalua, a dues escales espacials, l'ús de la geoestadística per a la producció de mapes d'abundància relativa estadísticament vàlids a partir de les dades del seguiment anual d'ocells nidificants del Regne Unit, el *Breeding Bird Survey* (BBS). Si bé actualment s'estan estudiant enfocaments que optimitzin la precisió d'aquesta metodologia, és important explorar fins a quin punt el BBS, amb al voltant de 2.000 quadrats 1x1 km anualment mostrejats (<1% del Regne Unit), és adequat per a la producció de mapes. Per aquest motiu es va comparar l'abundància relativa de 96 espècies interpolada a partir de les dades BBS del 2003 amb les dades independents recollides per a aquestes espècies a través de l'estudi intensiu portat a terme en l'últim atles d'ocells nidificants, en el període 1988-1991. Les comparacions es van realitzar a dues escales espacials: a una regional composada per 125 regions i a una local que va comprendre uns 2.882 quadrats de 10x10 km. Encara que les mesures d'abundància de l'Atles i del BBS no són les mateixes i hi ha més de deu anys de diferència entre els dos períodes d'estudi i diverses espècies han tingut increments o disminucions poblacionals i contraccions o expansions en la distribució, és encoratjador veure que no es van trobar diferències significatives a escala regional entre les mesures d'abundància en 84 de les 96 espècies analitzades (88%). A una escala local, no hi va haver diferències significatives entre les mesures d'abundància en 17 de les 96 espècies (18%). Les diferències entre les mesures d'abundància interpolades a partir del BBS i les de l'Atles a ambdues escales espacials poden ser explicades en part pels canvis reals en l'abundància entre ambdós períodes d'estudi encara que, com cabria esperar, el BBS proporciona major fiabilitat en els mapes d'espècies ben distribuïdes, com mostra la forta i positiva associació entre el grau de similitud entre ambdós mapes i el nombre de zones amb presència de l'espècie en el BBS. No obstant això, encara s'ha d'examinar el pa-

per que l'hàbitat i altres variables paisatgístiques poden tenir per millorar les nostres prediccions en el cas d'espècies amb distribucions fragmentades.

Resumen

El seguimiento de aves reproductoras como herramienta para la elaboración de mapas de aves en Gran Bretaña: una evaluación preliminar de los resultados a dos escalas espaciales

Los avances en la aplicación de la geoestadística en los últimos años han mejorado la precisión en la predicción de la probabilidad de aparición o abundancia relativa a lugares no muestreados y, por tanto, han permitido el desarrollo del potencial necesario para la producción de mapas fiables en toda el área de interés. En este trabajo evaluamos, a dos escalas espaciales, el uso de la geoestadística para la producción de mapas de abundancia relativa estadísticamente válidos a partir de los datos del seguimiento anual de aves reproductoras del Reino Unido, el *Breeding Bird Survey* (BBS). Si bien actualmente se están estudiando enfoques que optimicen la precisión de esta metodología, es importante explorar hasta que punto el BBS, con alrededor de 2.000 cuadrículas 1x1 km anualmente muestreadas (<1% del Reino Unido), es adecuado para la producción de mapas. Para ello, comparamos la abundancia relativa de 96 especies interpolada a partir de los datos BBS del 2003 con los datos independientes recogidos para estas especies a través del estudio intensivo llevado a cabo en el último atlas de aves reproductoras, en el período 1988-1991. Las comparaciones se realizaron a dos escalas espaciales: a una regional compuesta por 125 regiones y a una local que comprendió unos 2.882 cuadrados de 10x10 km. Aunque las medidas de abundancia del Atlas y del BBS no son las mismas y hay más de diez años de diferencia entre los dos períodos de estudio y varias especies han tenido incrementos o disminuciones poblacionales y contracciones o expansiones en la distribución, es alentador ver que no se encontraron diferencias significativas a escala regional entre las medidas de abundancia en 84 de las 96 especies analizadas (88%). A una escala local, no hubo diferencias significativas entre las medidas de abundancia en 17 de las 96 especies (18%). Las diferencias entre las medidas de abundancia interpoladas a partir del BBS y las del Atlas a ambas escalas espaciales pueden ser explicadas en parte por los cambios reales en la abundancia entre ambos períodos de estudio aunque, como cabría esperar, el BBS proporciona mayor fiabilidad en los mapas de especies bien distribuidas, como muestra la fuerte y positiva asociación entre el grado de similitud entre ambos mapas y el número de zonas con presencia de la especie en el BBS. Sin embargo, todavía tenemos que examinar la medida en que el hábitat y otras variables paisajísticas pueden mejorar nuestras predicciones para las especies con distribuciones fragmentadas.

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Appendix. Species included in the analyses here in taxonomic order indicating sample sizes of occupied BBS squares in 2003, and the level of population change between the Atlas period (taken to be 1990) and BBS period (2003) based on the most reliable data source for each species. Data sources include joint Common Bird Census (CBC) / BBS and Waterways Bird Survey (WBS) trends for 1990-2003, and BBS trends for 1994-2003 where longer-term trends are not reliable.
Espècies incloses en les anàlisis realitzades, en ordre taxonòmic. S'indica la mida mostral dels quadrats BBS amb presència de l'espècie l'any 2003 i el canvi poblacional entre els períodes Atles (es pren com a referència l'any 1990) i BSS (es pren com a referència l'any 2003) basat en les dades disponibles més acurades per a cada espècie. Entre les fonts de dades s'inclouen les tendències conjuntes del Common Bird Census *(CBC) / BBS* (Joint CBC/BBS *a la taula*) *i* Waterways Bird Survey *(WBS) per al període 1990-2003, i les tendències BBS per al període 1994-2003 quan no es disposa de tendències fiables a més llarg termini.*

Species *Espècies*	Occupied squares *Quadrats ocupats*	Population Change *Canvi poblacional*	Data Source *Font de les dades*
Little Grebe *Tachybaptus ruficollis*	57	30%	Joint CBC/BBS
Great Crested Grebe *Podiceps cristatus*	52	-28%	BBS
Mute Swan *Cygnus olor*	214	67%	Joint CBC/BBS
Greylag Goose *Anser anser*	152	1269%	WBS
Canada Goose *Branta canadensis*	393	187%	WBS
Common Shelduck *Tadorna tadorna*	125	-19%	Joint CBC/BBS
Mallard *Anas platyrhynchos*	1077	25%	Joint CBC/BBS
Tufted Duck *Aythya fuligula*	109	43%	Joint CBC/BBS
Eurasian Sparrowhawk *Accipiter nisus*	318	33%	Joint CBC/BBS
Common Buzzard *Buteo buteo*	748	118%	Joint CBC/BBS
Common Kestrel *Falco tinnunculus*	607	-3%	Joint CBC/BBS
Red Grouse *Lagopus lagopus*	98	22%	BBS
Red-legged Partridge *Alectoris rufa*	427	-16%	Joint CBC/BBS
Grey Partridge *Perdix perdix*	171	-62%	Joint CBC/BBS
Common Pheasant *Phasianus colchicus*	1462	22%	Joint CBC/BBS
Common Moorhen *Gallinula chloropus*	547	8%	Joint CBC/BBS
Common Coot *Fulica atra*	228	68%	Joint CBC/BBS
Eurasian Oystercatcher *Haematopus ostralegus*	279	-1%	WBS
European Golden Plover *Pluvialis apricaria*	81	-9%	BBS
Northern Lapwing *Vanellus vanellus*	628	-15%	Joint CBC/BBS
Common Snipe *Gallinago gallinago*	149	46%	BBS
Eurasian Curlew *Numenius arquata*	427	-34%	Joint CBC/BBS
Common Redshank *Tringa totanus*	69	-22%	BBS
Common Sandpiper *Actitis hypoleucos*	49	-32%	WBS
Feral Pigeon *Columba livia*	572	14%	BBS
Stock Dove *Columba oenas*	686	7%	Joint CBC/BBS
Common Wood Pigeon *Columba palumbus*	2037	27%	Joint CBC/BBS
Eurasian Collared Dove *Streptopelia decaocto*	1124	49%	Joint CBC/BBS
European Turtle Dove *Streptopelia turtur*	155	-58%	Joint CBC/BBS
Common Cuckoo *Cuculus canorus*	541	-36%	Joint CBC/BBS
Little Owl *Athene noctua*	99	-1%	Joint CBC/BBS
Common Swift *Apus apus*	891	26%	Joint CBC/BBS
Common Kingfisher *Alcedo atthis*	57	12%	WBS
Green Woodpecker *Picus viridis*	661	84%	Joint CBC/BBS
Great Spotted Woodpecker *Dendrocopos major*	815	89%	Joint CBC/BBS
Sky Lark *Alauda arvensis*	1403	-21%	Joint CBC/BBS
Sand Martin *Riparia riparia*	84	-38%	WBS
Barn Swallow *Hirundo rustica*	1564	1%	Joint CBC/BBS
House Martin *Delichon urbicum*	817	16%	Joint CBC/BBS
Tree Pipit *Anthus trivialis*	97	-42%	Joint CBC/BBS
Meadow Pipit *Anthus pratensis*	685	-12%	Joint CBC/BBS
Yellow Wagtail *Motacilla flava*	119	-55%	Joint CBC/BBS
Grey Wagtail *Motacilla cinerea*	220	40%	Joint CBC/BBS
Pied Wagtail *Motacilla alba*	1165	12%	Joint CBC/BBS

Species *Espècies*	Occupied squares *Quadrats ocupats*	Population Change *Canvi poblacional*	Data Source *Font de les dades*
White-throated Dipper *Cinclus cinclus*	48	2%	WBS
Winter Wren *Troglodytes troglodytes*	2045	-2%	Joint CBC/BBS
Hedge Accentor *Prunella modularis*	1744	6%	Joint CBC/BBS
European Robin *Erithacus rubecula*	1952	20%	Joint CBC/BBS
Common Redstart *Phoenicurus phoenicurus*	52	-11%	Joint CBC/BBS
Whinchat *Saxicola rubetra*	55	-21%	Joint CBC/BBS
Stonechat *Saxicola torquata*	149	168%	BBS
Northern Wheatear *Oenanthe oenanthe*	252	2%	BBS
Common Blackbird *Turdus merula*	2042	8%	Joint CBC/BBS
Song Thrush *Turdus philomelos*	1680	5%	Joint CBC/BBS
Mistle Thrush *Turdus viscivorus*	1091	-8%	Joint CBC/BBS
Common Grasshopper Warbler *Locustella naevia*	54	-3%	BBS
Sedge Warbler *Acrocephalus schoenobaenus*	223	-18%	Joint CBC/BBS
Eurasian Reed Warbler *Acrocephalus scirpaceus*	90	26%	Joint CBC/BBS
Lesser Whitethroat *Sylvia curruca*	204	-32%	Joint CBC/BBS
Common Whitethroat *Sylvia communis*	1048	17%	Joint CBC/BBS
Garden Warbler *Sylvia borin*	345	-20%	Joint CBC/BBS
Blackcap *Sylvia atricapilla*	1213	41%	Joint CBC/BBS
Wood Warbler *Phylloscopus sibilatrix*	33	-75%	Joint CBC/BBS
Common Chiffchaff *Phylloscopus collybita*	1291	30%	Joint CBC/BBS
Willow Warbler *Phylloscopus trochilus*	1092	-33%	Joint CBC/BBS
Goldcrest *Regulus regulus*	699	6%	Joint CBC/BBS
Spotted Flycatcher *Muscicapa striata*	171	-64%	Joint CBC/BBS
Pied Flycatcher *Ficedula hypoleuca*	31	-59%	Joint CBC/BBS
Long-tailed Tit *Aegithalos caudatus*	771	22%	Joint CBC/BBS
Marsh Tit *Parus palustris*	136	-12%	Joint CBC/BBS
Willow Tit *Parus montanus*	52	-53%	Joint CBC/BBS
Coal Tit *Parus ater*	669	12%	Joint CBC/BBS
Blue Tit *Parus caeruleus*	1931	12%	Joint CBC/BBS
Great Tit *Parus major*	1802	34%	Joint CBC/BBS
Wood Nuthatch *Sitta europaea*	385	21%	Joint CBC/BBS
Eurasian Treecreeper *Certhia familiaris*	304	-9%	Joint CBC/BBS
Eurasian Jay *Garrulus glandarius*	620	2%	Joint CBC/BBS
Black-billed Magpie *Pica pica*	1569	-4%	Joint CBC/BBS
Eurasian Jackdaw *Corvus monedula*	1392	27%	Joint CBC/BBS
Rook *Corvus frugilegus*	1069	8%	BBS
Carrion Crow *Corvus corone*	1910	14%	Joint CBC/BBS
Hooded Crow *Corvus cornix*	143	-4%	BBS
Common Raven *Corvus corax*	239	99%	BBS
Common Starling *Sturnus vulgaris*	1490	-44%	Joint CBC/BBS
House Sparrow *Passer domesticus*	1330	-24%	Joint CBC/BBS
Eurasian Tree Sparrow *Passer montanus*	147	-39%	Joint CBC/BBS
Chaffinch *Fringilla coelebs*	2038	5%	Joint CBC/BBS
European Greenfinch *Carduelis chloris*	1547	37%	Joint CBC/BBS
European Goldfinch *Carduelis carduelis*	1233	48%	Joint CBC/BBS
Eurasian Siskin *Carduelis spinus*	101	-33%	BBS
Common Linnet *Carduelis cannabina*	1125	7%	Joint CBC/BBS
Lesser Redpoll *Carduelis cabaret*	118	-46%	Joint CBC/BBS
Common Bullfinch *Pyrrhula pyrrhula*	530	-9%	Joint CBC/BBS
Yellowhammer *Emberiza citrinella*	973	-37%	Joint CBC/BBS
Reed Bunting *Emberiza schoeniclus*	400	-8%	Joint CBC/BBS
Corn Bunting *Emberiza calandra*	119	-49%	Joint CBC/BBS