

BTO Research Report 322

**Waterways Breeding Bird Survey:
progress report for 2001–02**

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*A report to the Environment Agency in respect of
R&D project W1–071*

April 2003

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Registered Charity No. 216652

Recommended citation:

Marchant, J.H. & D.G. Noble. 2003. *Waterways Breeding Bird Survey: progress report for 2001–02*. Research Report 322. British Trust for Ornithology, Thetford.

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EXECUTIVE SUMMARY

- 1 The Waterways Breeding Bird Survey (WBBS), which is operated by BTO and funded in collaboration with the Environment Agency's R&D Programme, began in 1998. Phases 1 and 2 of the project are already complete. The present interim Phase 3 report covers the scheme's development during 2001–02, with emphasis on the results of the 2002 field season. Summary data from earlier years are included for comparison. Results are given also for the BTO's long-running Waterways Bird Survey (WBS).
- 2 WBBS coverage was due to be increased in 2001, as part of Phase 3 of the project. Plans for this development were shelved, however, owing to the outbreak of Foot & Mouth Disease (FMD), which restricted access to open land across the UK throughout spring 2001. Only 51 WBBS surveys were conducted in 2001, compared with 175 in 2000, and 23 WBS mapping surveys, compared with 97 in 2000. The surveys that were conducted showed a changed geographical distribution, being concentrated mainly in the English Midlands and the north of Scotland.
- 3 Owing to FMD, efforts to increase the sample were postponed until spring 2002. A further 249 WBBS stretches were selected randomly for coverage beginning in 2002, bringing the total number of random sites selected to 512. WBS observers were also asked to continue with both WBS and WBBS surveys on their stretches in 2002. An excellent response was received from volunteer observers in both the random and the WBS-linked WBBS samples. The number of WBBS surveys conducted in 2002 was the highest ever, at 220, covering 1472 500-metre sections of river and canal.
- 4 Estimates of numbers of birds per unit waterway length in 2002 were similar to those recorded for 1998–2000. Wood Pigeon was the most abundant species and Chaffinch the most widespread. Dipper was found on 61 stretches and Kingfisher on 41.
- 5 Population changes from WBBS and WBS in 2001–02 showed a preponderance of increases, perhaps related to poor coverage of some sites in 2001.
- 6 Mammal data were returned from 190 (86%) of the 220 WBBS stretches surveyed in 2002. There were 30 mammal species recorded, of which Rabbit and Mole were the most widespread, and Rabbit and Red Deer the most numerous.
- 7 Increases in the number of random WBBS sites surveyed in 2002 brought more species over the threshold required for population monitoring. Seventeen waterbirds and 41 other bird species had sample sizes of more than 40 plots. Where sample sizes are too small from the random WBBS alone, there may be scope for combining them with the non-random sites, and/or with Breeding Bird Survey data, to provide a sufficient sample.
- 8 Further efforts have been made to increase the number of WBBS surveys to be conducted in spring 2003, which is the final year of the project's Phase 3.

1 INTRODUCTION

1.1 The Waterways Bird Survey (WBS)

The BTO has since 1974 been conducting censuses alongside linear waters, both rivers and canals, with the aim of monitoring bird population change in these important yet vulnerable habitats throughout the United Kingdom. The Waterways Bird Survey (WBS) produces data on population changes and on the location of territories in relation to physical features of the waterway environment. These data can be used to investigate, at a variety of spatial and temporal scales, the ways in which breeding birds use river and canal habitats. The primary role of the WBS has been to record population changes among species poorly represented in the BTO's Common Birds Census (CBC). Carter (1989), Marchant *et al* (1990), Marchant & Balmer (1994) and Newson *et al* (2003) have provided overviews of the WBS and its results.

The BTO/JNCC/RSPB Breeding Bird Survey (BBS) began in 1994 and is an ongoing programme that was designed to take over from CBC as the main way in which population changes of birds are measured in the wider countryside. After a seven-year overlap period between BBS and CBC, the CBC ceased to perform this function in 2000. WBS continues alongside BBS, supplying valuable extra data on a small number of specialist waterside bird species.

The WBS suffers the same disadvantages for bird population monitoring as the CBC did. Sites are non-random and, because the method is labour-intensive, are relatively few in number. In addition, WBS covers only a set list of waterside bird families and species, and so provides no information on more widespread bird species as they occur in the waterside environment. These problems could be addressed by applying BBS-style methods to waterside surveys.

1.2 WBBS development during 1998–2002

With this background, the BTO has been developing a Waterways Breeding Bird Survey (WBBS) since 1998, in conjunction with the Environment Agency's R&D programme. The overall aims of the project are to develop a transect method suitable for collecting breeding bird survey data from random waterway sites, and test its implementation, to

- *supplement data from the BBS with counts from rivers and canals, thus maintaining or expanding the level of bird population monitoring currently available through BBS and the BTO's long-running WBS, and satisfying the needs of organisations with specific interests in bird monitoring, such as JNCC and RSPB; and*
- *provide bird and bird-habitat data, relevant to nature conservation along waterways, that fulfil the requirements of the Environment Agency, and its sister organisations in Scotland and Northern Ireland, that have responsibilities specific to linear waters.*

In Phase 1 of the survey, methods of field survey and plot selection were tested, and a study was conducted of breeding bird numbers along canals in relation to the timing of the coarse fishing season. In Phase 2, the non-random canal sample was dropped, and WBS observers were invited to contribute to the WBBS as well as WBS. Also in Phase 2, WBBS bird data were compared with RHS habitat data that was collected from the same sites by Environment Agency

contractors. Phase 3 continues the same protocol as Phase 2 but aims to increase the size of the annual sample from randomly selected sites.

It was intended that the 2001 breeding season should mark the beginning of Phase 3 of WBBS development. In practice, this was prevented by the outbreak of Foot & Mouth Disease (FMD) in February 2001. Owing to FMD, no additional fieldwork was requested from BTO volunteers in 2001. Many were prevented from repeating previous surveys; others were able only to make one of the two survey visits, after access restrictions to their stretches were lifted in mid season. Active promotion of WBBS, with a view to increasing the sample size, was postponed until 2002.

Previous reports from WBBS have covered progress in Phase 1 (Marchant 1999, Marchant & Gregory 1999, Marchant *et al* 1999), Phase 2, to the end of the 2000 breeding season (Marchant 2000, 2001, Marchant & Noble 2000, Marchant *et al* 2002a), and 2001, the year in which Phase 3 had been scheduled to begin (Marchant *et al* 2002b, Marchant & Beaven 2002).

A major innovation of WBBS is that it is designed to allow linkage to the Environment Agency's River Habitat Survey (RHS). Initial analyses of WBBS bird and RHS habitat data have been reported by Marchant & Gregory (1999) and Marchant *et al* (2002a).

1.3 The scope of this report

This is an interim report that covers WBBS results and developments in the initial part of Phase 3, with emphasis on the 2002 breeding season. Coverage and results obtained from the WBBS and WBS surveys in 2002 are reported here, with some summary data for earlier years included for comparison.

The disappointing coverage in 2001, for which FMD was responsible, has affected the estimation of year-to-year population changes in 2001–02 and limited the conclusions that can be drawn from these results. A fuller review of WBBS population changes from 1998 to 2003, making allowance for the poor coverage in 2001, is planned for the next report in this series.

2 METHODS

2.1 Methods of the Waterways Bird Survey

2.1.1 WBS fieldwork methods

WBS procedures have been described in full by Taylor (1982) and Marchant (1994). The bird census method used is territory mapping, which produces an estimate of breeding numbers and a map of breeding territories for each species, stretch and year. Details of the habitats available to the birds are also mapped. Plots are chosen by the observers themselves, under guidance from BTO staff, and are stretches typically 4–5 kilometres long that are of relatively easy access and of which at least one bank can be walked. Observers are asked to make nine visits to their site each breeding season. WBS coverage is restricted to waterside specialist birds such as grebes, ducks, geese, swans, waders, and reedbed passerines.

By 2002, the WBS had completed 29 seasons of mapping fieldwork and recorded much very valuable information on population change and relationships between birds and habitat (e.g. Rushton *et al* 1994, Marchant & Beaven 2000, 2002, Marchant 2001). Surveys continue in 2003.

2.1.2 Calculation of year-to-year population change from WBS data

The units of WBS mapping results are apparently occupied territories, whereas for WBBS and BBS they are the numbers of birds counted. Long-term monitoring from WBS data is possible for around 24 species that occur on at least 15 or so plots in each year, where number of territories can be modelled as a function of year and site (e.g. Newson *et al* 2003). Year-to-year changes from WBS are typically presented using a simpler chain-index method that pairs the year-1 and year-2 data for those plots that were surveyed in both years (e.g. Marchant & Beaven 2000, Marchant 2001). This approach is taken here in considering population change between 2001 and 2002 – the advantages of modelling being hardly evident when only a single year-to-year change is being estimated.

Only those WBS plots where coverage was similar in 2001 and 2002 contributed to the calculations, and any individual counts that were not comparable between the two years were also excluded.

2.2 Methods of the Waterways Breeding Bird Survey

2.2.1 Selection of sites for coverage

A major innovation of WBBS is its use of random waterway sites for bird surveys. This sampling strategy allows WBBS results to be treated as representative of waterways generally, throughout the United Kingdom.

To select waterways randomly, we made a random selection of 2x2-km national grid squares, discarded those without a waterway running through them, and sought coverage of the waterway that ran through the selected square. The tetrad (2x2 km) was selected as the most appropriate grid-square size since, after a trial run, it emerged that too high a proportion of 1-km squares held

no waterway. Larger squares (5x5 or 10x10 km) frequently held more than one waterway, and so raised questions about which to select from within the square. RHS reference sites have been chosen from 10-km squares, however, using the protocol of taking the stretch closest to a predetermined point within the square.

A clear definition was required of the water bodies that formed the population being sampled. The linear waters that were to be studied could have included rivers, canals, stretches that could be defined as both river and canal, and various kinds of ditches and drains. For rivers, a policy was needed on whether headwaters should be excluded and how this could be achieved, and also on whether broad or tidal stretches should be included. For the purpose of the WBBS, a waterway has been defined as any double blue line, with shaded in-fill, on the Ordnance Survey (OS) 1:25,000 Pathfinder/Explorer/Outdoor Leisure map series. Single blue lines, typically minor headwaters and drainage ditches, and all non-linear water features were ignored. Enquiries with OS revealed that double blue lines with 'water stipple' are used on this scale only for features that are 6.5 metres or more wide (W. Debeugny, pers. comm.). Rivers were considered to finish at the normal tidal limit as marked as 'NTL' on the OS maps; no width limit was applied.

Stratification, for example by waterway type, RHS data, water quality, waterbird density or observer density, has not been employed but could be applied to WBBS in the future, either to reduce the variance of selected results or to make best use of the available manpower. No stratification of the sample was required to meet the aims of survey's initial phases.

For each selected random waterway, a map was prepared showing the boundaries of the random tetrad and the selected waterway. The waterway was picked out with a highlighter, typically for several km from the tetrad boundary, in both directions. These maps were sorted by BTO region and sent to the relevant BTO Regional Representative (the RR), whose job it was to match each site with an observer.

Start and end points of the actual survey stretch within the highlighted length of waterway were not pre-set, but were left for the observer to determine with regard to:

- *the requested location;*
- *the requirement for a whole number of complete 500-metre transect sections;*
- *convenience of access; and*
- *the observer's preference for the number of sections to be covered (maximum ten).*

These concessions were designed to ensure that access problems could be overcome in the majority of cases, and a survey route set up that could be used on a long-term basis.

Aside from the random stretches, determined on the basis described above, the WBBS sample has also, since 1999, included a substantial number of non-random stretches that were chosen because there are WBS mapping data available for the same sites. The latter are referred to in this report as 'WBS-linked stretches' and are treated separately in most analyses. They differ from the random stretches in their geographical distribution, and may be biased towards places that are richer in breeding birds.

Sites falling into neither of these categories have been dropped from the WBBS sample.

2.2.2 WBBS fieldwork methods

The BBS method had already proved to be enjoyable, popular with observers, and well fitted to its purpose. It was their transfer to waterways that was being tested. Modifications to BBS procedures were therefore kept to a minimum.

BBS uses a transect method in which two visits are made, termed 'early' and 'late', one in the first and one in the second half of the breeding season (BTO 1998, Gregory *et al* 1998). The transect route is divided into up to ten sections of fixed length. During each visit, all birds seen or heard are counted, section by section, in each of three distance bands from the transect line (0–25 metres, 25–100 metres, and >100 metres, summing counts from both sides of the transect line); birds seen only in flight are recorded separately.

WBBS instructions and recording forms are based heavily on those designed for BBS. Some details of the design of forms were altered in minor ways between 1998 and 2000 but, once established, the field methods of WBBS have been kept constant. Forms for 1998–99 are each appended to the reports for those seasons (Marchant & Gregory 1999, Marchant & Noble 2000). These contain full details of fieldwork methods and recording.

The methods for WBBS differ from those of BBS in that:

- *routes within sites follow the waterway rather than a predetermined pattern based on the national grid;*
- *the sections composing each transect stretch are each 500 metres, to match RHS, not 200 metres as in BBS;*
- *transects are not fixed at 2 km, as BBS transects are, but are of variable length, with a maximum of 5 km (ten 500-metre sections); and*
- *habitat recording is extended from the BBS standard to allow extra information to be recorded about the waterway itself.*

Other aspects of fieldwork and analysis are identical.

As on BBS, mammals and signs of mammals were noted on each counting visit. For each species of wild mammal detected, either presence or a pair of counts (one early in the season and one late) was recorded. WBBS observers coded the main features of up to three habitat types per 500-metre section of canal, of which the first habitat was the canal itself and the other one or two were those considered by the observer to be the most important adjoining habitats. The system of habitat coding used was that devised by Crick (1992) and now used for all BTO monitoring surveys.

WBBS requires only two visits to count birds, compared to BBS's nine, and so is much quicker and simpler for observers. WBBS's transect data require relatively little processing and so there are efficiencies also for analysts in using this method. Importantly, its random sampling design ensures that the results are representative of the waterway habitat.

2.2.3 Application of WBBS methods in 2002

Sites designated for coverage in 2002 were the 512 sites randomly selected for Phase 2 of WBBS. These random stretches represent a sample drawn from the whole of the UK (Figure 1).

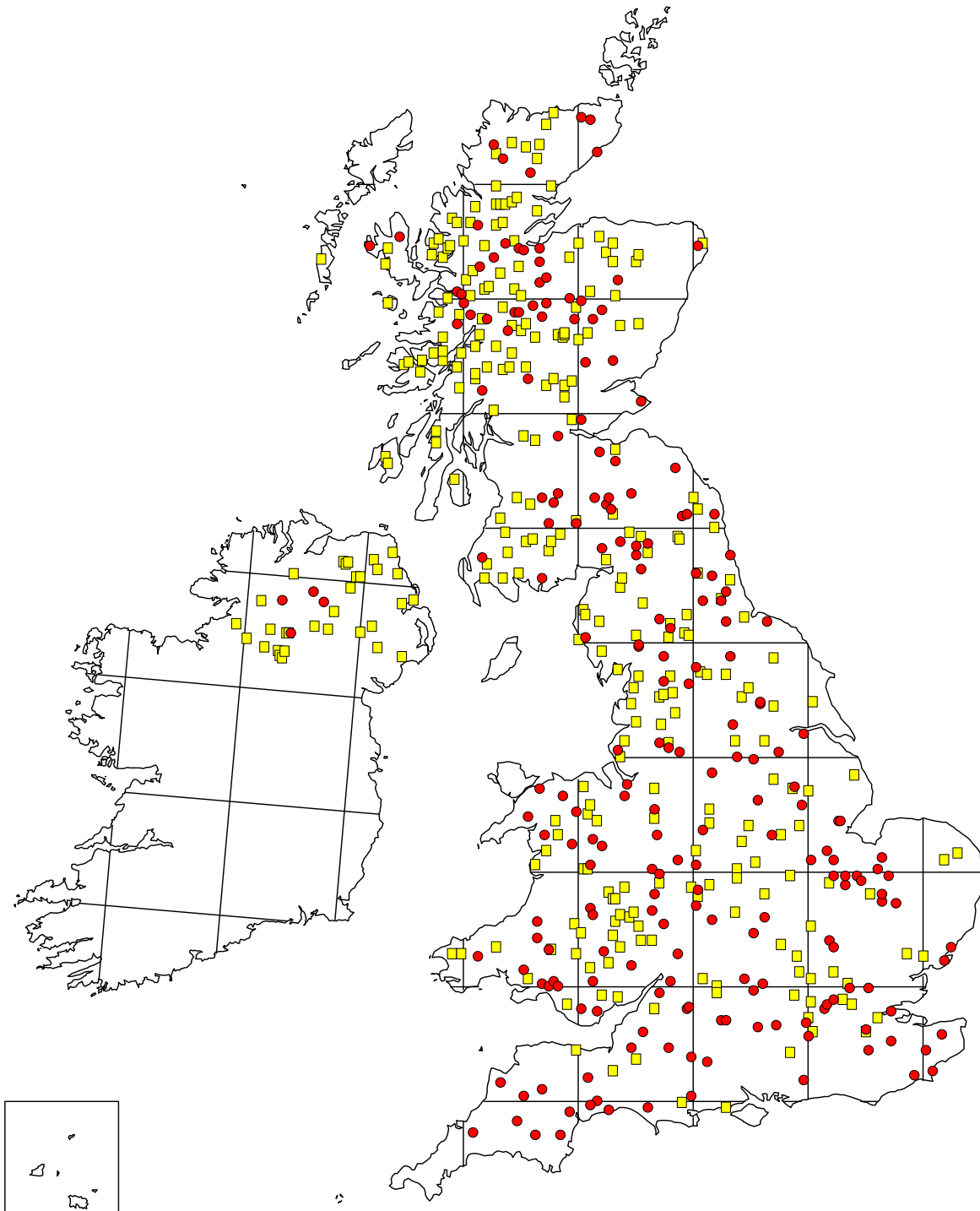


Figure 1. Distribution of the 512 random WBBS stretches selected for coverage. Those surveyed at least once during 1998–2002 are shown as black spots and those not surveyed as grey squares.

Figure 1 shows the wide geographical scatter of the randomly selected plots, but also the absence of stretches in some parts of the UK. The pattern of their distribution follows from the area-based method of selection which, since the density of river courses in a catchment is greatest in the upper reaches, is more likely to score a hit with random tetrads that lie close to the watershed. Few stretches were selected in coastal regions and there were concentrations in some areas of higher ground, for example the Grampians, Southern Uplands and Welsh Marches. Eastern East Anglia, where river courses are few and well scattered, was barely represented in the sample since, by chance, just two of the tetrads selected there contained a waterway.

Within each region, each stretch was allocated a priority number (beginning at 1 for top priority), which was derived from the order of the random selection. BTO RRs then sought volunteer observers to cover as many of their selected sites as possible, beginning at priority 1 and working down the list. RRs distributed survey packs and collected completed forms for return to BTO HQ.

WBBS survey packs were distributed from BTO headquarters to all current WBS observers with a request to contribute to both surveys in 2002, as in 1999–2001.

2.2.4 Calculation of year-to-year population change from WBBS data

This report contains estimates of population change between 2001 and 2002, derived from WBBS data for stretches covered in both years. For each year, species and stretch, a mean count was calculated by summing all the counts across 500-m sections and distance categories and dividing the total by the number of sections to give a mean value per 500-m section. The overall means of these values, across all stretches for which paired data were available for 2001 and 2002, were used to estimate year-to-year change for each species.

The two main parts of the WBBS sample – the random stretches, and the WBS-linked ones (non-random sites surveyed because of the existence of WBS mapping data for the same stretches) – were treated separately in this analysis.

3 RESULTS FROM WBBS AND WBS IN 2002

3.1 Coverage achieved by WBBS in 1998–2002

The numbers of stretches surveyed are shown in Table 1. Totals for both 2000 and 2001 are higher than those given in the previous report, because they include a few returns that were received well after the set deadlines. Late data for 2002 or earlier years, which already include one survey for 1999 and five for 2002, will be included in future summaries and analyses.

Table 1. Totals of WBBS stretches surveyed in 1998–2002.

Reason for survey	1998	1999	2000	2001	2002	New in 2002	Surveyed at least once
Random stretches	107	116	109	24	157	65	213
WBS-linked (non-random)	19	67	65	27	63	10	90
Other non-random stretches	42	1	1	0	0	0	43
TOTAL	168	184	175	51	220	75	346

The 1998 sample included a total of 60 canal stretches that had been chosen non-randomly on the basis of the fishing seasons in operation there. The 42 plots that did not also fall into either the random or the WBS category were dropped from the survey in subsequent seasons.

WBS observers were asked to contribute WBBS data also from their stretches, beginning in 1999 (Phase 2). By chance, and as part of the study of fishing seasons, 18 sites overlapped between the two schemes also in 1998.

Of the 263 stretches that had been selected randomly for the first four years of WBBS, 107 were surveyed in 1998, 116 in 1999 and 109 in 2000 (Table 1). Only 24 of them were surveyed in 2001, when FMD put severe restrictions on access to the countryside. In all in 2001, just 51 sites were surveyed, representing only 29% of the coverage in the previous year. These were concentrated in the English Midlands and the north of Scotland, these being areas where access generally was less restricted than elsewhere (Marchant *et al* 2002b). The 2001 WBBS sample is thus rather different in character from the samples in other years.

A further 249 waterway stretches were added to the random sample before the 2002 field season, bringing the total number of sites available for coverage to 512. Of these, 157 were surveyed in 2002, by far the largest total achieved by WBBS so far. There were 65 stretches in the random selection that were covered for the first time in 2002 and these provided a substantial boost to the WBBS sample. The grand total of 220 WBBS surveys in 2002 comprises 1472 500-metre sections of river and canal.

A full list of stretches covered since the inception of WBBS is given in Appendix 1.

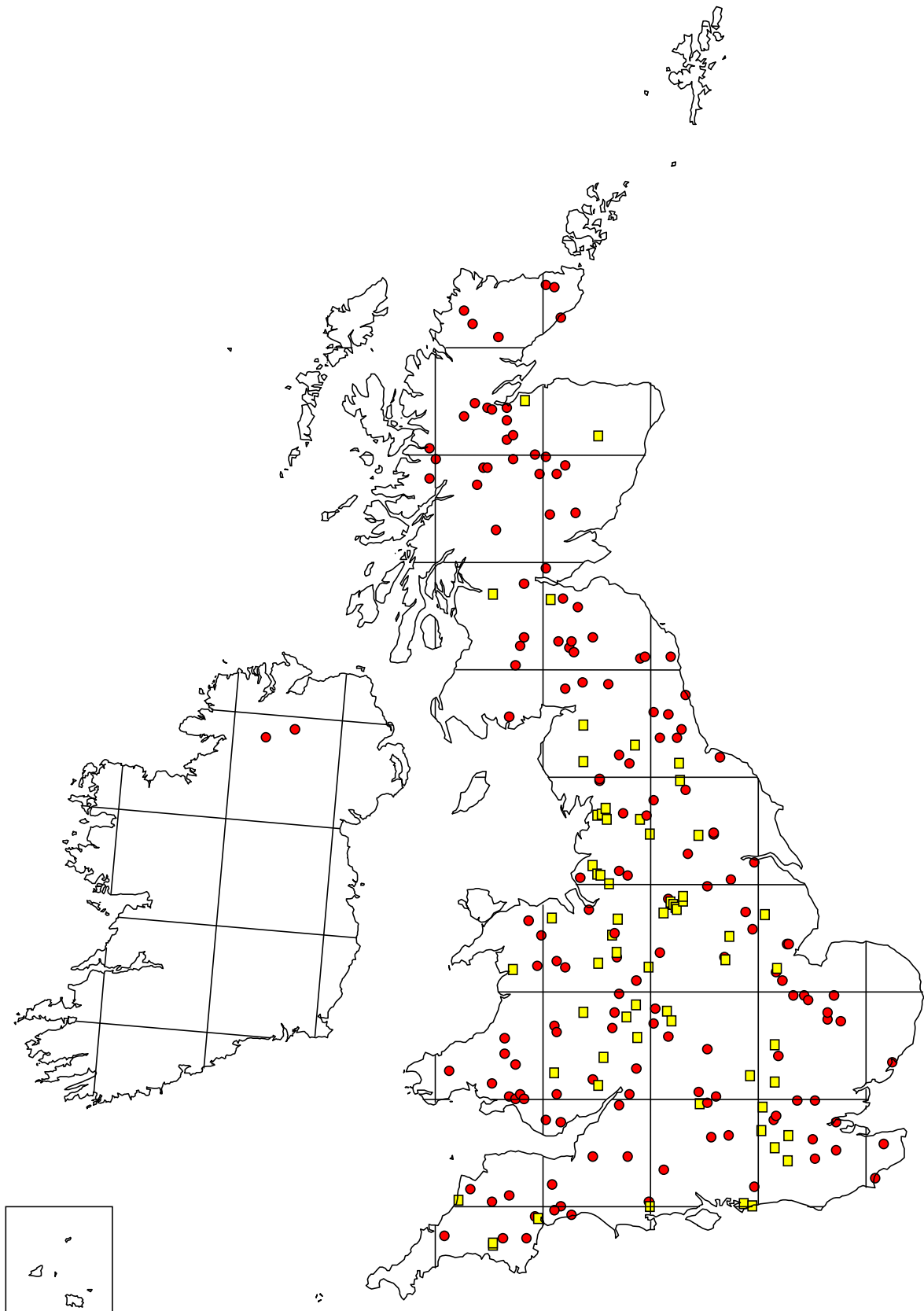


Figure 2. The 220 sites at which WBS fieldwork was conducted in 2002. Surveys at randomly chosen locations are shown as black spots, and those conducted at non-random WBS plots as grey squares.

3.2 WBBS data collection for birds

Table 2 records the mean overall recording frequencies of bird species recorded on randomly selected WBBS stretches, for each year 1998–2002. The figures are the mean number of individuals recorded per 10 km of waterway. No estimate is tabulated where a species was found on fewer than six stretches. WBS and other non-random sites are not included.

Zero values from stretches where the species was absent are included in the means, which are therefore comparable across species. The five most abundant species recorded in 2002 were as follows: Wood Pigeon (72.9 birds per 10 km), Starling (51.0), Wren (47.1), Mallard (43.8) and Chaffinch (41.9). The most widespread species in 2002 on these stretches were Chaffinch (found on 138 stretches), Wren (134), Wood Pigeon (128), and Mallard and Carrion Crow (both 127). Dipper was found on 61 stretches and Kingfisher on 41.

Standard errors are not tabulated but were larger than the means in all cases. Differences between years in the mean figures reported for particular species result from chance effects and the effects of plot turnover as well as from population changes among the birds themselves.

Table 2. Birds recorded on randomly selected WBBS stretches in 1998–2002. Numbers of birds per 10 km are the means from all random stretches covered, including those where the species was not found. The number of occupied stretches is also given. No figures are presented where the sample size was fewer than six plots.

Species	Birds per 10 km (number of stretches occupied)				
	1998 (n=107)	1999 (n=116)	2000 (n=109)	2001 (n=24)	2002 (n=157)
Little Grebe	1.3 (12)	1.1 (12)	0.6 (8)	.	0.4 (8)
Great Crested Grebe	0.8 (6)	1.0 (9)	.	.	0.9 (14)
Cormorant	2.4 (27)	2.7 (29)	2.8 (25)	.	3.1 (34)
Grey Heron	5.3 (63)	4.8 (71)	5.3 (70)	3.8 (12)	5.2 (91)
Mute Swan	10.4 (40)	7.4 (45)	5.6 (38)	2.5 (8)	7.8 (46)
Greylag Goose	7.0 (13)	4.7 (11)	2.5 (12)	.	5.0 (17)
Canada Goose	7.6 (35)	7.9 (27)	10.1 (28)	.	8.9 (39)
Shelduck	13.5 (10)	9.2 (10)	15.4 (10)	.	6.4 (11)
Gadwall	1.3 (7)	0.9 (6)	1.5 (8)	.	1.1 (11)
Teal	0.5 (8)	0.4 (6)	0.8 (11)	.	0.5 (7)
Mallard	42.3 (91)	43.0 (98)	48.6 (89)	42.6 (16)	43.8 (127)
Tufted Duck	7.0 (17)	4.1 (17)	3.4 (17)	4.1 (6)	4.6 (27)
Goosander	1.4 (18)	1.2 (14)	1.1 (16)	.	1.6 (27)
Sparrowhawk	0.9 (20)	0.5 (16)	0.6 (11)	.	0.9 (24)
Buzzard	2.3 (31)	2.4 (43)	2.7 (38)	.	3.4 (60)
Kestrel	1.6 (35)	1.3 (28)	1.9 (25)	.	1.3 (43)

Species	Birds per 10 km (number of stretches occupied)				
	1998 (n=107)	1999 (n=116)	2000 (n=109)	2001 (n=24)	2002 (n=157)
Red Grouse	.	.	0.3 (6)	.	0.5 (6)
Red-legged Partridge	2.2 (16)	2.5 (15)	2.1 (17)	.	1.4 (16)
Grey Partridge	1.0 (12)	0.4 (9)	0.9 (12)	.	0.4 (8)
Pheasant	8.8 (59)	11.4 (68)	11.2 (65)	10.7 (12)	9.2 (87)
Moorhen	9.5 (62)	10.3 (63)	11.4 (60)	12.8 (13)	7.4 (67)
Coot	5.9 (29)	7.2 (24)	5.3 (22)	10.9 (10)	5.1 (29)
Oystercatcher	7.8 (26)	8.7 (32)	8.1 (27)	8.7 (6)	8.7 (43)
Lapwing	21.1 (35)	8.2 (39)	9.1 (37)	20.3 (6)	11.6 (51)
Snipe	0.8 (10)	0.6 (12)	0.6 (11)	.	1.7 (19)
Curlew	4.2 (25)	5.0 (30)	4.3 (29)	.	5.1 (45)
Redshank	1.7 (8)	1.5 (7)	2.0 (12)	.	2.2 (11)
Common Sandpiper	5.2 (34)	3.6 (30)	4.1 (35)	3.6 (6)	5.0 (51)
Black-headed Gull	33.0 (35)	11.4 (32)	16.8 (37)	14.7 (8)	16.2 (49)
Common Gull	4.8 (15)	4.4 (14)	13.5 (14)	.	3.7 (20)
Lr Bl-backed Gull	8.2 (22)	5.1 (28)	5.7 (27)	4.3 (7)	3.6 (27)
Herring Gull	18.7 (28)	8.2 (28)	9.3 (25)	.	7.1 (35)
Gt Bl-backed Gull	.	.	0.9 (6)	.	0.6 (6)
Common Tern	1.0 (11)	1.1 (13)	.	.	1.6 (17)
Feral Pigeon	14.8 (23)	13.9 (21)	15.2 (24)	37.3 (6)	10.3 (35)
Stock Dove	5.4 (30)	8.4 (39)	6.3 (37)	4.4 (7)	3.7 (49)
Wood Pigeon	64.2 (89)	76.0 (94)	79.5 (93)	64.2 (16)	72.9 (128)
Collared Dove	5.4 (43)	5.8 (45)	7.3 (47)	5.7 (12)	6.9 (60)
Turtle Dove	1.2 (9)	1.9 (15)	1.3 (11)	.	1.1 (14)
Cuckoo	2.3 (41)	2.4 (37)	2.3 (45)	1.7 (6)	1.5 (41)
Little Owl	0.3 (6)	.	.	.	.
Tawny Owl	.	0.2 (6)	0.2 (6)	.	0.1 (9)
Swift	30.3 (61)	21.3 (59)	21.6 (55)	13.4 (9)	20.3 (79)
Kingfisher	1.9 (30)	1.6 (37)	1.7 (29)	.	1.3 (41)
Green Woodpecker	1.9 (29)	1.8 (31)	2.2 (35)	.	1.6 (42)
Gt Sp Woodpecker	2.5 (37)	1.3 (32)	1.6 (36)	.	2.6 (61)
Skylark	11.4 (56)	10.2 (54)	9.2 (53)	11.8 (12)	7.8 (64)
Sand Martin	16.3 (29)	10.7 (32)	16.6 (31)	5.4 (6)	14.6 (46)
Swallow	15.1 (73)	18.4 (87)	19.5 (82)	11.7 (16)	17.8 (109)
House Martin	14.8 (48)	18.7 (53)	16.0 (52)	7.6 (9)	10.4 (59)
Tree Pipit	0.2 (6)	0.8 (11)	0.4 (10)	.	0.3 (9)
Meadow Pipit	19.7 (38)	18.8 (42)	19.5 (42)	28.4 (9)	15.6 (57)

Species	Birds per 10 km (number of stretches occupied)				
	1998 (n=107)	1999 (n=116)	2000 (n=109)	2001 (n=24)	2002 (n=157)
Yellow Wagtail	2.3 (12)	1.6 (11)	1.9 (10)	.	0.9 (14)
Grey Wagtail	3.6 (42)	5.2 (63)	5.5 (57)	2.5 (7)	7.1 (87)
Pied Wagtail	6.2 (63)	6.4 (63)	6.4 (70)	4.8 (14)	6.2 (96)
Dipper	3.3 (39)	2.8 (42)	3.1 (44)	.	4.6 (61)
Wren	37.6 (87)	43.9 (101)	46.6 (95)	23.8 (17)	47.1 (134)
Dunnock	8.1 (63)	6.8 (71)	7.4 (68)	6.3 (12)	8.4 (89)
Robin	18.1 (77)	20.1 (93)	22.0 (92)	11.4 (17)	21.4 (125)
Redstart	1.1 (11)	1.0 (12)	0.9 (13)	.	1.0 (16)
Whinchat	0.7 (11)	0.8 (11)	1.2 (11)	.	0.7 (11)
Stonechat	.	0.4 (6)	1.0 (10)	.	1.5 (14)
Wheatear	2.3 (16)	1.9 (21)	1.6 (10)	.	1.3 (22)
Ring Ouzel	.	.	.	.	0.3 (6)
Blackbird	32.6 (85)	31.5 (95)	40.3 (91)	25.2 (17)	37.0 (125)
Song Thrush	10.4 (73)	10.9 (80)	11.5 (81)	5.9 (14)	15.1 (118)
Mistle Thrush	4.8 (48)	5.3 (57)	4.8 (56)	4.8 (8)	4.7 (75)
Grasshopper Warbler	.	.	.	.	0.3 (9)
Sedge Warbler	6.6 (31)	7.4 (37)	9.8 (42)	13.5 (12)	8.9 (52)
Reed Warbler	7.4 (23)	8.8 (24)	9.0 (23)	12.9 (9)	6.3 (28)
Lesser Whitethroat	0.9 (12)	0.4 (7)	0.5 (8)	.	0.4 (13)
Whitethroat	7.6 (50)	7.7 (44)	8.0 (53)	10.1 (11)	8.9 (68)
Garden Warbler	2.7 (35)	2.7 (39)	2.5 (32)	.	2.0 (41)
Blackcap	10.8 (61)	8.7 (66)	9.7 (67)	4.1 (7)	10.2 (83)
Wood Warbler	.	.	0.5 (7)	.	0.5 (8)
Chiffchaff	8.1 (56)	4.9 (53)	6.1 (47)	.	7.3 (72)
Willow Warbler	16.0 (78)	15.4 (88)	14.1 (72)	12.5 (13)	15.6 (96)
Goldcrest	2.2 (30)	3.4 (36)	4.5 (44)	.	3.5 (44)
Spotted Flycatcher	1.4 (21)	1.6 (28)	2.1 (29)	.	1.3 (22)
Long-tailed Tit	6.7 (52)	8.2 (56)	7.7 (51)	1.7 (6)	7.0 (71)
Marsh Tit	0.5 (10)	0.5 (11)	0.7 (11)	.	0.3 (13)
Willow Tit	0.5 (9)	0.2 (6)	.	.	.
Coal Tit	2.5 (25)	3.4 (33)	2.5 (32)	.	4.5 (58)
Blue Tit	30.3 (84)	23.5 (91)	27.0 (88)	11.3 (13)	28.4 (121)
Great Tit	17.8 (82)	13.3 (87)	14.5 (86)	4.6 (10)	15.6 (113)
Nuthatch	0.9 (18)	1.6 (23)	1.4 (20)	.	1.2 (24)
Treecreeper	1.6 (29)	2.2 (39)	1.9 (30)	.	1.9 (51)
Jay	2.3 (27)	1.9 (32)	1.7 (30)	.	1.5 (26)

Species	Birds per 10 km (number of stretches occupied)				
	1998 (n=107)	1999 (n=116)	2000 (n=109)	2001 (n=24)	2002 (n=157)
Magpie	11.0 (66)	12.1 (74)	10.4 (68)	9.3 (11)	10.4 (85)
Jackdaw	23.2 (56)	26.1 (60)	24.6 (64)	15.5 (9)	25.0 (85)
Rook	57.8 (57)	70.7 (59)	49.9 (53)	.	39.4 (69)
Carrion Crow	32.2 (88)	31.0 (92)	33.0 (89)	14.8 (16)	36.6 (127)
Hooded Crow	0.6 (8)	0.9 (12)	0.6 (9)	.	0.5 (14)
Raven	0.5 (9)	0.7 (13)	0.7 (16)	.	1.2 (18)
Starling	64.6 (65)	60.5 (72)	54.7 (75)	60.7 (14)	51.0 (93)
House Sparrow	9.9 (45)	11.0 (47)	13.9 (49)	20.0 (11)	10.7 (55)
Tree Sparrow	.	.	1.0 (6)	.	1.4 (12)
Chaffinch	38.6 (93)	39.6 (101)	41.0 (98)	21.5 (17)	41.9 (138)
Greenfinch	8.8 (58)	8.5 (61)	9.7 (60)	10.0 (13)	10.6 (91)
Goldfinch	9.3 (55)	8.4 (62)	10.0 (68)	8.7 (13)	9.6 (90)
Siskin	0.8 (10)	1.1 (10)	0.9 (11)	.	1.2 (15)
Linnet	7.0 (27)	8.8 (38)	7.1 (30)	7.2 (13)	6.4 (49)
Lesser Redpoll	0.4 (7)	.	0.3 (6)	.	1.2 (11)
Bullfinch	1.6 (24)	1.1 (22)	0.8 (18)	.	2.6 (45)
Yellowhammer	3.8 (35)	4.1 (38)	3.6 (38)	2.2 (8)	3.6 (39)
Reed Bunting	5.1 (44)	5.3 (42)	4.2 (40)	6.5 (11)	5.1 (52)
Corn Bunting	0.8 (7)	.	1.0 (7)	.	0.4 (6)

3.3 WBBS estimates of population change, 2001–02

The unexpectedly poor coverage in 2001, through FMD, has reduced the samples available for estimating population changes between the two most recent WBBS seasons. The data that are available are presented in Table 3.

Results for random and WBS-linked stretches are tabulated separately, because of the differences between these two parts of the WBBS sample. In a typical year, their distributions are similar to those in Figure 2 of this report, with WBS-linked sites clustered in scattered English localities and a more even pattern for the random sites. The 2001–02 comparison is constrained, however, by the distribution of sites where surveys were possible in 2001. For both parts of the WBBS sample, surveys in 2001 were concentrated in a band across England from Lancashire to the London area (Marchant *et al* 2002b), and the results in Table 3 therefore refer particularly to this area.

Table 3. Percentage changes in population between 2001 and 2002 as estimated from WBBS data. Results from random stretches are shown separately from those from non-random stretches surveyed because they were WBS plots.

No data are presented where the sample of sites providing data in both years was less than 11 (about 50% of each sample).

Species	Mean count per 10 km (random sites)		2001–02 change (random sites)	Number of paired sites (random)	Mean count per 10 km (WBS-linked sites)		2001–02 change (WBS-linked sites)	Number of paired sites (WBS-linked)
	2001	2002			2001	2002		
Cormorant	.	.	.	.	2.8	3.8	+34%	11
Grey Heron	4.3	5.0	+17%	13	10.9	9.2	-15%	20
Mute Swan	.	.	.	.	10.8	28.3	+161%	17
Canada Goose	.	.	.	.	11.0	15.8	+43%	13
Mallard	31.8	36.4	+14%	15	89.4	108.6	+22%	22
Pheasant	11.9	14.0	+18%	12	6.4	7.5	+19%	16
Moorhen	.	.	.	.	26.9	27.7	+3%	20
Coot	.	.	.	.	10.2	14.5	+43%	14
Lapwing	.	.	.	.	11.2	10.5	-6%	13
Black-headed Gull	.	.	.	.	9.6	16.1	+67%	14
Feral Pigeon	.	.	.	.	16.4	29.2	+78%	12
Stock Dove	.	.	.	.	3.6	4.2	+16%	13
Wood Pigeon	74.8	93.1	+25%	14	102.5	93.3	-9%	21
Collared Dove	.	.	.	.	11.1	15.7	+41%	16
Cuckoo	.	.	.	.	1.5	1.4	-10%	12
Swift	14.2	22.4	+58%	11	41.4	40.8	-3%	19
Kingfisher	.	.	.	.	1.6	1.7	+8%	11
Green Woodpecker	.	.	.	.	2.0	2.5	+26%	11
Gt Sp Woodpecker	.	.	.	.	2.7	2.3	-13%	11
Skylark	13.7	15.6	+14%	11	9.3	7.2	-23%	14
Swallow	12.4	16.0	+29%	14	29.2	22.9	-22%	19
House Martin	9.1	9.1	no change	11	32.5	19.6	-40%	14
Grey Wagtail	.	.	.	.	3.4	4.9	+44%	12
Pied Wagtail	5.4	6.0	+13%	16	3.8	3.7	-4%	14
Wren	23.4	30.0	+28%	15	51.1	58.1	+14%	22
Dunnock	7.0	7.9	+13%	12	12.0	13.4	+12%	21
Robin	12.3	12.2	-1%	17	26.9	26.4	-2%	22
Blackbird	24.4	22.5	-8%	15	57.6	55.5	-4%	22
Song Thrush	6.8	6.7	-1%	14	21.4	9.2	-57%	20
Mistle Thrush	5.3	3.8	-27%	12	3.6	4.6	+27%	15
Sedge Warbler	15.4	13.6	-12%	11	19.2	22.1	+15%	16
Whitethroat	11.3	11.9	+6%	11	15.5	12.9	-17%	19
Blackcap	.	.	.	.	10.2	11.5	+13%	20
Chiffchaff	.	.	.	.	10.3	9.4	-9%	16
Willow Warbler	14.7	12.9	-13%	12	17.0	11.2	-34%	15
Long-tailed Tit	.	.	.	.	7.0	6.4	-8%	13
Blue Tit	10.8	14.2	+31%	12	37.5	34.7	-8%	22
Great Tit	4.8	9.4	+96%	13	21.7	23.2	+7%	22

Species	Mean count per 10 km (random sites)		2001–02 change (random sites)	Number of paired sites (random)	Mean count per 10 km (WBS-linked sites)		2001–02 change (WBS-linked sites)	Number of paired sites (WBS-linked)
	2001	2002			2001	2002		
Jay	.	.	.	.	4.9	1.7	-65%	11
Magpie	.	.	.	.	25.9	24.5	-6%	21
Jackdaw	.	.	.	.	22.8	29.9	+32%	17
Carrion Crow	16.0	22.9	+44%	16	39.7	42.8	+8%	22
Starling	60.7	63.0	+4%	13	63.7	61.6	-3%	20
House Sparrow	.	.	.	.	25.1	31.0	+24%	18
Chaffinch	24.9	25.2	+1%	16	38.4	40.4	+5%	22
Greenfinch	9.3	14.4	+55%	11	21.1	19.3	-9%	22
Goldfinch	9.1	7.5	-17%	13	10.5	15.2	+44%	18
Linnet	8.0	16.9	+113%	11	6.9	6.1	-12%	16
Yellowhammer	.	.	.	.	5.0	4.7	-5%	11
Reed Bunting	7.1	7.7	+8%	11	11.8	9.0	-24%	17

Mean counts per 500-m stretch have been multiplied by 20 and expressed as birds per 10 km. Means in Table 3 are designed to be comparable between years, within each paired sample, and not between species or between samples within species. These values tend to be higher than the overall figures in Table 2, because the means in Table 3 are drawn only from those stretches where the species was present in at least one of the two years, rather than from all stretches (including those where the species was absent), as in Table 2.

Both counts and sample sizes tended to be higher on stretches that were also WBS plots, perhaps because of greater observer experience or because the WBS-linked stretches were chosen partly for their high numbers of birds.

The random sites recorded 19 species that increased and seven that decreased, and the WBS-related stretches recorded 25 that increased and 25 that decreased. These changes go some way towards reversing the preponderance of decreases noted in the 2000–01 comparison (Marchant *et al* 2002b). Relatively poor coverage in some surveys conducted in 2001 may be responsible for this pattern.

Because the sample sizes of stretches in each group are small, the corresponding 95% confidence intervals around each estimate will be wide. Individual estimates do not correspond well between the two classes of stretches, therefore. Of the 28 species for which both estimates were calculated, for only 11 species did the estimates have the same sign. Seven of these 11 species (Mallard, Pheasant, Wren, Dunnock, Great Tit, Carrion Crow and Chaffinch) showed increases on both samples of stretches, whereas four species (Robin, Blackbird, Song Thrush and Willow Warbler) decreased on both.

3.4 Data collection for mammals

The mammal data recorded by WBBS observers are always likely to be minimum figures, because mammal recording is secondary to the main tasks of recording birds and habitat, and in

general is not systematic. Nevertheless, since mammals are generally an under-recorded group in the UK, any monitoring data, especially from random sites, are valuable.

Across the 220 WBBS returns for 2002, mammal forms were completed and returned for 194 (88%). Mammal recording was therefore well supported by WBBS volunteers, as in 1998–2001. Of these 194 returns, four recorded that no attempt had been made to record mammals, and a further 13 recorded that no mammals had been observed, leaving 177 sites from which mammals had been recorded.

In all, 30 mammal species were recorded (Table 4). Those found most frequently were diurnal species, such as Rabbit and Grey Squirrel, or ones that left obvious signs of presence, such as Mole. Half the sites recorded fewer than three species. Eight stretches recorded ten or more mammal species; the maximum was 14. By far the most numerous mammals seen were Rabbit and Red Deer.

Of specialist waterway mammals, Otters were found on 15% of stretches in 2002 (15% in 1998, 11% in 1999, 13% in 2000, but just 2% in 2001), Water Vole on 12% (9% in 1998, 16% in 1999, 12% in 2000, 19% in 2001), and American Mink on 10% (8% in 1998, 21% in 1999 and 2000, 14% in 2001).

The mammal data collected so far are insufficient to establish whether any changes in numbers or distribution have occurred. Increases in the frequency of recording over time should not necessarily be interpreted as a population change in the species concerned, because they will also be influenced by the observer's increasing knowledge of the stretch; decreases are more likely to be biologically significant.

Table 4. Mammals recorded on all WBBS stretches reporting mammal data in 2002 (n=190). Species are ranked according to the number of stretches they occupied. The number of animals counted is the sum of early and late counts across all occupied stretches.

Species	Animals counted	Number of occupied stretches	% of stretches occupied
Rabbit	2329	132	69%
Mole	35	109	57%
Grey Squirrel	131	84	44%
Red Fox	41	80	42%
Roe Deer	95	57	30%
Brown Hare	247	56	29%
Feral/domestic cat	46	34	18%
Badger	1	34	18%
Otter	5	29	15%
Water Vole	16	22	12%
Red Deer	1460	21	11%
Brown Rat	4	19	10%
Stoat	4	19	10%
American Mink	1	19	10%
Hedgehog	0	16	8%
Weasel	6	13	7%
Red Squirrel	6	8	4%
Mountain Hare	9	7	4%
Muntjac Deer	3	4	2%
Common Shrew	2	4	2%
Bank Vole	1	4	2%
Fallow Deer	1	3	2%
Feral goat	3	2	1%
Pine Marten	0	2	1%
House Mouse	1	1	1%
Field Vole	0	1	1%
Wood Mouse	0	1	1%
Common Dormouse	0	1	1%
Wild Cat	0	1	1%
Sika Deer	0	1	1%

3.5 Coverage and results from WBS in 2002

Participation in the mapping WBS survey increased from 23 sites in 2001 to at least 88 in 2002. This increase represents a welcome return to fieldwork by the majority of observers after an enforced break for many in 2001 due to FMD. Even allowing for the expected arrival of a small number of late submissions, the 2002 total compares rather poorly with the 121 surveys for 1998, 105 for 1999, and 97 for 2000. A decrease in WBS participation could have been expected, following the launch of WBBS in 1998. Attempts are being made, however, to reverse the slow decline in the WBS sample. An encouraging sign in 2002 was that no fewer than nine new sites were surveyed for the first time: these may become eligible for inclusion in the monitoring sample if re-surveyed in 2003.

Of the 88 WBS mapping surveys for which 2002 data were available, there were comparable data from 2001 for just 18 plots (Table 5). This low total is a legacy of the 2001 season, when only 23 surveys were conducted. It does represent a small increase, however, from the 15 sites from which paired data were available for 2000–01 (Marchant *et al* 2002b).

Table 5. A summary of the 18 WBS plots providing data on population change for 2001–02.

Category	No. of plots	Mean length (km)	Total length (km)
All paired plots	18	4.0	72.5
<i>Changes since 2000–01 comparison</i>			
Plots gained	7	3.7	25.6
Plots lost	4	5.1	20.3
<i>Regional distribution</i>			
Eastern England	6	4.2	25.2
Northern England	4	3.6	14.5
Southern England	2	3.5	7.0
Western England	3	4.1	12.4
Scotland	3	4.5	13.4
<i>Distribution by waterway type</i>			
Canal	7	3.9	27.3
Mixed canal/river	1	4.5	4.5
Slow river	5	4.5	22.3
Fast river	5	3.7	18.4

Since the sample of plots contributing to the calculations was only around one-fifth of normal in 2002, the number of species for which population change 2001–02 could be estimated was reduced, and the precision of those estimates that could still be made was much less than usual.

A further problem concerns changes in the nature of surveys that may have affected the analyses. The centre of gravity of the plots surveyed in 2001 appeared to have shifted to the south and east, and towards canals (Marchant *et al* 2002b). This pattern may have arisen through access restrictions being less widespread in parts of eastern England, and because of the easier access to many canals (along towpaths), as opposed to rivers. Many observers made fewer WBS visits than normal in 2001, or shifted the timing of these visits towards the later part of the breeding

season. This may have reduced the effectiveness of some surveys in 2001, relative to 2002, although cases where the data were obviously different in quality have been excluded as part of the normal vetting procedure. Results of the 2001–02 comparison are presented in Table 6.

Table 6. WBS estimates of population change for 2001–02, drawn from 18 plots in total for which comparable data were received for both years. No estimates are given where the number of contributing plots was less than eight.

Species	Territory total 2001	Territory total 2002	% change	Number of contributing plots
Little Grebe	1	1	.	1
Mute Swan	21	19	-10%	11
Greylag Goose	0	2	.	2
Canada Goose	17	36	+112%	9
Mallard	348	360	+3%	16
Tufted Duck	9	12	.	6
Goosander	3	6	.	2
Moorhen	159	160	+1%	16
Coot	50	55	+10%	11
Oystercatcher	13	9	.	3
Lapwing	21	42	.	7
Curlew	4	3	.	2
Redshank	6	7	.	1
Common Sandpiper	4	2	.	1
Kingfisher	6	7	.	5
Sand Martin	14	4	.	2
Dipper	11	14	.	6
Grey Wagtail	28	33	+18%	11
Pied Wagtail	17	17	no change	11
Sedge Warbler	108	138	+28%	12
Reed Warbler	84	73	.	7
Whitethroat	80	80	no change	13
Reed Bunting	65	55	-15%	12

The ten population changes presented in Table 6 include six increases and two decreases, although in none of these cases can the statistical significance of the apparent change be assessed. Once a few more seasons have passed since the FMD-affected 2001, it may become clear whether these changes are part of long-term trends, or just short-term fluctuations that may perhaps be strongly influenced by chance. The largest increase was for Canada Goose, for which the WBS trend has been strongly upward since 1980 (Marchant 2001).

4 DISCUSSION

4.1 Conclusions from fieldwork and results for 2002

The substantial increase in sample size achieved in 2002 has demonstrated once again that volunteer fieldworkers are keen to participate in WBBS fieldwork. It is encouraging that, after an enforced break for many observers in 2001, through FMD, the sample can be increased to 220 from the low base of only 51 in the previous year. The increase was accounted for by the 65 random sites that were covered for the first time in 2002 (Table 1). There were also ten new WBS-linked sites, although there were a similar number of drop-outs from this part of the sample since 2000 and the overall total of these dropped slightly.

Although a higher total than in any previous year, the 220 surveys in 2002 are fewer than was hoped at this stage of Phase 3. With only one season remaining in Phase 3, in 2003, it remains to be seen whether the random sample can be doubled, as was planned for this phase of the project.

Volunteers and RRs have been asked to help increase the sample wherever possible. It should be noted, however, that BTO volunteers have been given a heavy workload of other surveys in the 2003 season, which may compete with WBBS for additional fieldwork effort.

It is already clear from Phases 1 and 2 of WBBS that the method is valuable as a quick and easy way to assess bird populations in 500-metre river sections. Data gathered in this way can be of value at local or catchment scales, for example for pre- or post-project site appraisals, or for the identification of river or canal sections of special conservation value. Use of the method by the BTO's UK-wide network of volunteers allows large samples to be surveyed on a UK basis and enables assessments to be made of changes in breeding bird numbers in the waterside habitat.

Numbers of birds counted per 10 km in 2002 were generally within the ranges already established in 1998–2000 (Table 2). For some species, including Coot, Feral Pigeon and Swift, the 2001 figure was noticeably different from all other years and it is likely that this follows from the small samples and bias that resulted from FMD in that year. Year-to-year monitoring in 2001–02 was also adversely affected by FMD (Tables 3, 5 and 6). Table 3 confirms, as was found in 2001 (Marchant *et al* 2002b), that the WBS-linked stretches tend to find more species and more individual birds than the random WBBS sites.

WBBS collected a substantial amount of mammal information in 2002 (Table 4), as in previous years. This may prove to be of value for faunistic records, since these are much scarcer for mammals than for birds, or for mammal monitoring, perhaps in conjunction with other BTO schemes that collect mammal information. In this context, the WBBS data may be of particular value for waterside species such as Otter, Water Vole and American Mink.

4.2 Implications for long-term monitoring

A measure of the potential of WBBS for long-term monitoring of population changes for a bird species is the number of sites that hold that species. The larger the sample of sites, the narrower will be the confidence interval around the estimates of population change, although the width of the confidence interval will also be influenced heavily by the abundance of the species within sites and also by various features of its biology, such as its tendency to occur in flocks. A full

appraisal of WBBS monitoring, including the calculation of confidence intervals, is not within the scope of the present report.

The sample sizes tabulated in Table 2 are summarised in Table 7 for two example years. BBS experience indicates that, as a general rule, a minimum of 40 sites is likely to provide an acceptable confidence interval for monitoring purposes (Joys *et al* 2003). Table 7 indicates that, at the higher level of coverage achieved in 2002, the random WBBS plots alone could provide adequate monitoring samples for up to 58 species in the waterside habitat, including 17 waterbirds. For non-waterbirds, the data collected are not likely to be representative of the UK population of that species as a whole but do represent population changes in WBBS habitats: comparison of WBBS population indices with BBS indices for other habitat groupings would be valuable, indicating whether populations are faring differently in different habitats.

Table 7. Numbers of species in various categories of sample size on WBBS random sites in 2000 and 2002. Waterbirds are defined as those species included on WBS mapping surveys, including waterfowl, waders, gulls, Kingfisher, and various waterside passerines.

Sample size of random WBBS sites	2000			2002		
	Waterbirds	Others	Total	Waterbirds	Others	Total
26–40 sites	11	11	22	8	3	11
41–100 sites	8	31	39	16	31	47
>100 sites	0	0	0	1	10	11

Where sample sizes are not adequate for stand-alone WBBS monitoring, the potential exists for combining WBBS and BBS data to form joint indices designed to represent the UK population as a whole. This may be especially valuable for waterside specialist species for which WBBS samples are as large or larger than those available from BBS alone.

The sample sizes from random sites could be boosted substantially by the inclusion of the non-random WBS-linked sites. Although fewer in number than the random sites, the WBS-linked surveys tend to find more birds (Table 3). To assess whether monitoring data from the random and WBS-linked WBBS samples can be combined, and to compare monitoring results between the long-running WBS and WBBS, it would be ideal to have a series of at least seven years' overlap between WBS and WBBS. The 2003 season will be only the fourth such season, excluding 2001 when both surveys produced smaller and geographically limited sets of data.

WBBS sample sizes could also be boosted by stratifying the random sample by region, and selecting more sites for coverage in regions where extra observers are available. This possibility should be explored if a large-scale WBBS programme is to continue.

ACKNOWLEDGEMENTS

The launch of WBBS was funded in collaboration with the Environment Agency's R & D programme. We also acknowledge the financial support of Anglian Water, British Waterways, Northumbrian Water, Essex & Suffolk Water, Severn Trent Water, Thames Water and Welsh Water. BBS is funded jointly by the BTO, JNCC (on behalf of English Nature, Scottish Natural Heritage, the Countryside Council for Wales and the Environment and Heritage Service in Northern Ireland), and the RSPB.

The BTO's work relies heavily on volunteers. We are very grateful to all observers who have contributed WBBS or WBS data, and to the BTO's Regional Representatives and others who assisted with finding volunteers and forwarding paperwork.

We acknowledge the help of the following Environment Agency staff during the course of this project (since 1998): Geraldine Daly, Alastair Driver, Andrew Heaton, Marc Naura, Helena Parsons, Paul Raven, Martin Smalls, Adrian Taylor and Mark White. Dr Steve Ormerod of the School of Biosciences at Cardiff University has also provided valuable advice and guidance. At BTO HQ in Thetford, Peter Beaven, Nick Carter, Jackie Coker, Rachel Coombes, Steve Freeman, Richard Gregory, Vivien Hiom, Dave Leech, Angela Rickard, Sam Rider, Fiona Sanderson, Susan Waghorn and Jane Wells have assisted at various stages of the project. Host Data Services Ltd of Watford input the bulk of the WBBS data from the observers' field sheets.

Figures 1 & 2 were produced using the program DMAP, with thanks to Alan Morton.

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Appendix 1. Waterway stretches covered by WBBS 1998–2002, ordered by nominal 1-km grid square, together with the limiting grid references in the most recent survey, number of 500-metre sections covered in each year of coverage and the class of survey (random, WBS-linked, or other).

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
				98	99	00	01	02
Random sites				98	99	00	01	02
H3078	Fairy Water	H304800	H325780	–	–	–	–	6
H4050	Many Burns River	H381495	H504513	–	6	–	–	–
H5688	Glenlark River	H574871	H592889	–	6	6	–	6
H6680	Ballinderry River	unknown	unknown	–	3	–	–	–
NC2634	Maldie Burn	NC252352	NC239340	4	4	4	–	4
NC3422	River Cassley	NC344226	NC368203	6	6	–	–	6
NC5810	Allt Chaiseagail	NC572106	NC582105	–	–	–	–	2
ND0258	Forss Water	ND033613	ND036595	–	–	–	–	3
ND1056	River Thurso	ND107560	ND128580	–	–	–	–	7
ND1628	Dunbeath Water	ND163296	ND143308	–	–	–	5	5
NG1846	Hamra River	NG187480	NG199463	–	4	4	–	–
NG4454	River Romesdal	NG440543	NG460549	–	–	10	–	–
NG9406	Allt Coire Sgoireadail	NG952068	NG974088	–	8	8	8	8
NG9804	Allt Coire nan Eiricheallach	NG998032	NG993054	5	5	5	5	–
NH1264	Abhainn Srath Chrombuill	NH142642	NH102642	–	–	–	8	–
NH1428	Allt a' Choire Dhomhain	NH144269	NH156302	6	–	–	–	–
NH2636	River Farrar	NH267376	NH239387	–	–	–	–	10
NH3648	Allt Cam Ban	NH362497	NH357500	2	1	1	–	1
NH4844	River Beauly	NH497442	NH468423	–	–	–	–	9
NH5242	River Beauly	NH517445	NH497442	–	–	–	–	9
NH6614	River Findhorn	NH665140	NH705170	10	10	10	–	10
NH6632	River Nairn	NH684349	NH674320	10	10	10	–	10
NH6644	River Ness (non-tidal part)	NH664444	NH642413	5	8	8	–	10
NH7218	River Findhorn	NH736200	NH705170	–	–	–	–	10
NH9200	Am Beanaidh	NH923039	NH917099	–	10	10	–	10
NJ3416	Water of Buchat	NJ323189	NJ393157	–	10	–	–	–
NK0446	South Ugie Water	NK015472	NK056485	–	9	–	–	–
NM9478	Dubh Lighe	NM966787	NM932799	–	6	9	–	9
NN0096	River Kingie	NN042978	NN000964	10	10	10	10	10
NN0686	Allt a' Cham Dhoire	NN040863	NN064873	6	–	–	–	–
NN1620	Allt an Stacain	NN153213	NN162218	–	4	–	–	–
NN2082	River Spean	NN183837	NN208814	9	9	–	–	–
NN3872	Allt Feith Thuill	NN400731	NN372711	3	7	7	–	7
NN4488	Allt Coire Ardair	NN466887	NN440883	6	6	6	–	6
NN4888	Allt a' Chrannaig	NN484872	NN488885	3	3	3	–	3
NN5630	River Dochart	NN567321	NN537302	–	–	–	–	8

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
				10	10	10	–	–
NN6094	River Spey	NN640941	NN596938	10	10	10	–	–
NN6884	Un-named, feeds into aqueduct	NN687855	NN681870	3	–	–	–	–
NN7296	Milton Burn	NN744988	NN719956	10	10	10	–	10
NN9682	Bynack Burn	NN980850	NN968830	–	–	–	5	10
NO0298	Coire Etchachan Burn	NO035990	NO022999	–	–	–	6	6
NO0644	Buckny Burn/Lunan Burn	NO090455	NO066480	–	10	10	10	10
NO1282	Baddoch Burn	NO137834	NO129820	5	5	5	5	5
NO2090	River Dee	NO213920	NO201908	4	4	4	–	4
NO3046	Dean Water	NO339479	NO286459	–	7	7	–	7
NO5410	Kenly Water	NO538113	NO553122	4	4	–	–	–
NS6826	River Ayr	NS682263	NS715281	–	–	10	–	–
NS7404	Scar Water	NS765025	NS727040	–	–	–	–	10
NS7822	Duneaton Water	NS781226	NS814213	10	10	10	–	10
NS8230	Douglas Water	NS828300	NS840319	5	5	5	–	5
NS8280	Bonny Water	NS823803	NS793789	8	8	8	–	8
NS9804	Crook Burn	NS973063	NS984039	6	6	6	–	–
NT0294	Black Devon	NT030942	NT038946	–	–	–	–	1
NT1426	Stanhope Burn	NT142260	NT150266	–	–	–	–	3
NT1866	Water of Leith	NT199686	NT173671	–	–	–	–	3
NT2420	Crosscleuch Burn	NT240202	NT245200	–	–	–	–	2
NT2626	Douglas Burn	NT279272	NT281269	–	–	–	–	3
NT2816	Ettrick Water	NT299164	NT160290	–	–	–	–	2
NT3258	River South Esk/Redside Burn	NT324600	NT320591	–	–	–	–	6
NT4630	Ettrick Water	NT474300	NT480314	–	–	–	–	3
NT8452	Blackadder Water	NT857543	NT825529	10	10	–	–	–
NT9010	River Alwin	NT911108	NT926082	7	–	–	–	7
NT9412	Shank Burn	NT973153	NT952137	6	6	6	–	6
NU1812	River Aln	NU186138	NU215125	9	9	9	–	9
NX1674	Cross Water of Luce	NX180772	NX192742	10	–	–	–	–
NX6856	Tarff Water	NX685579	NX682563	–	–	–	–	3
NY0604	River Bleng	NY077033	NY099032	4	4	–	–	–
NY2082	Water of Milk	NY200826	NY230834	–	–	–	–	4
NY3688	Ewes Water	NY368880	NY370900	–	–	–	–	4
NY5076	Black Lyne	NY515784	NY496733	6	–	–	–	–
NY5084	Kershope Burn	NY483828	NY521848	10	10	10	–	–
NY5464	King Water	NY557668	NY527641	3	–	–	–	–
NY6086	Lewis Burn	NY631887	NY623874	–	4	4	–	4
NY7020	Hilton Beck	NY710200	NY719207	–	–	3	–	3
NY8012	River Belah	NY800124	NY819123	–	–	6	–	6
NZ0260	River Tyne	NZ030620	NZ040616	–	–	–	–	2
NZ0836	River Wear	NZ055369	NZ100358	–	–	–	–	10
NZ1658	River Derwent	NZ180599	NZ152572	–	–	–	–	10
NZ2436	River Wear	NZ259374	NZ243361	2	4	4	–	4

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
				6	6	6	–	–
NZ2818	River Skerne	NZ302193	NZ291207	6	6	6	–	–
NZ2844	River Wear	NZ284448	NZ302466	–	7	7	–	7
NZ3276	Holywell Dene	NZ336767	NZ336760	–	–	–	–	2
NZ6418	Skelton Beck	NZ659201	NZ668215	5	–	–	–	5
SD3406	Leeds & Liverpool Canal	SD365069	SD369092	–	–	6	6	6
SD5296	River Sprint	SD521977	SD521973	–	–	–	–	1
SD5298	River Kent	SD522996	SD524992	–	–	–	–	1
SD7012	Eagley Brook	SD727123	SD712134	4	4	4	–	4
SD7466	River Wenning	SD746673	SD715676	8	8	8	–	8
SD7488	Clough River	SD764902	SD718906	–	–	10	–	–
SD7808	Manchester, Bolton & Bury Canal	SD793099	SD779073	–	–	–	–	6
SD8804	Rochdale Canal	SD885079	SD893038	10	10	10	10	–
SD9664	River Wharfe	SE004633	SD981659	–	8	8	–	8
SE0278	River Cover	SE045808	SE023791	6	6	6	–	6
SE3288	River Swale	SE320895	SE337880	8	8	8	–	8
SE3428	Aire & Calder Navigation/R Aire	SE384278	SE340300	–	–	–	–	10
SE3800	Dove & Dearne Navigation	SE411022	SE395012	4	4	4	–	–
SE5846	River Ouse	SE593445	SE600472	–	–	–	–	8
SE5848	River Ouse	SE602500	SE599467	–	–	–	–	8
SE7404	River Torne & un-named drain	SE757067	SE739040	–	–	–	–	7
SE9620	New River Ancholme	SE972164	SE974209	–	–	9	–	9
SH7032	Afon Eden	SH703321	SH700328	–	–	2	–	–
SH8666	Afon Elwy	SH883667	SH878680	–	–	–	–	3
SH9424	Afon Eiddew	SH963244	SH947250	4	4	4	–	4
SH9852	Afon Alwen	SH976528	SH987519	–	–	–	–	2
SJ1006	Afon Banwy neu Einion	SJ107068	SJ117078	3	–	–	–	–
SJ1228	Afon Iwrch	SJ134266	SJ126300	7	7	7	–	7
SJ2022	Afon Tanat	SJ185240	SJ226240	10	10	10	–	10
SJ4066	Shropshire Union Canal	SJ415667	SJ399669	–	10	10	10	–
SJ4276	Manchester Ship Canal	SJ476777	SJ451773	5	5	5	–	5
SJ6402	River Severn	SJ636042	SJ673034	8	8	–	–	–
SJ6654	River Weaver	SJ650523	SJ662552	10	10	6	–	6
SJ6832	Shropshire Union Canal	SJ691325	SJ693316	–	–	–	–	2
SJ8610	Shropshire Union Canal	SJ849142	SJ875102	10	10	10	–	10
SK0206	Cannock Extension Canal	SK021069	SK019045	5	–	–	–	–
SK0836	River Dove	SK102374	SK104346	–	–	10	–	10
SK1686	River Noe	SK168846	SK152864	8	7	7	–	7
SK5298	River Don	SK526400	SK522994	–	–	–	–	2
SK5662	River Maun	SK569638	SK601649	4	4	4	–	–
SK6832	Grantham Canal	SK676307	SK681331	–	–	–	–	7
SK8874	Fosdyke Navigation	SK909749	SK880745	6	6	6	6	6
SK9458	River Brant	SK943600	SK940583	4	4	4	4	4
SN1226	Eastern Cleddau	SN139278	SN127262	–	–	–	–	5

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
SN5214	Gwendraeth Fach	SN543163	SN532160	–	–	–	–	1
SN6442	Afon Twrch	SN652433	SN647414	–	–	–	–	4
SN6456	Afon Teifi	SN646561	SN660569	–	5	5	–	5
SN6802	Lower Clydach River	SN684026	SN687045	5	5	5	–	5
SN7400	River Clydach	SN741010	SS738972	9	9	9	–	10
SN7432	Afon Tywi	SN762352	SN755332	–	–	–	–	5
SN7804	Dulais River	SN781041	SN792057	–	–	–	–	4
SN8200	Melin Court Brook	SN818022	SN838004	–	–	–	–	6
SO1068	Afon Ieithon	SO104660	SO104703	–	–	–	–	10
SO1204	Afon Rhymni	SO120059	SO138040	–	10	10	10	10
SO1262	Mithil Brook	SO115630	SO144628	–	–	–	–	8
SO2230	Grwyne Fawr	SO229309	SO247293	–	6	–	–	–
SO4618	Afon Mynwy	SO477174	SO468200	–	10	10	–	8
SO6466	River Teme	SO629686	SO656691	7	7	7	–	7
SO6680	River Rea	SO662821	SO668787	9	9	9	–	9
SO7098	River Severn	SO722975	SJ707004	8	8	8	–	8
SO7454	River Teme	SO746563	SO758544	6	6	6	–	–
SO8004	River Frome	SO784057	SO808046	7	6	–	–	7
SO8628	River Severn	SO867304	SO844279	6	–	–	–	10
SP0270	Worcester & Birmingham Canal	SP020739	SP016706	–	–	–	–	8
SP0484	Worcester & Birmingham Canal	SP044827	SP059867	–	–	–	–	10
SP1658	Stratford-upon-Avon Canal	SP183565	SP167604	–	–	–	–	10
SP4406	River Thames	SP442086	SP438055	–	–	–	–	10
SP5246	River Cherwell	SP505483	SP490476	–	–	–	–	3
SP6002	River Thame	SP612027	SP605017	4	4	4	–	4
SP6260	Grand Union Canal	SP626619	SP630602	4	4	4	–	–
SS3216	River Torridge	SS340172	SS321178	–	–	–	–	5
SS5204	River Lew	SS533057	SS539043	–	4	4	–	4
SS6810	River Taw	SS682115	SS685099	10	10	10	–	5
ST0280	Afon Elai	ST034824	ST039811	6	6	6	–	6
ST0820	River Tone	ST078203	ST084221	5	5	5	–	5
ST1600	River Otter	ST160012	ST170018	3	3	3	–	3
ST1678	River Taff	ST171780	ST162783	–	–	–	–	2
ST4646	River Axe	ST475475	ST452490	–	–	7	–	7
ST5660	River Chew	ST572617	ST584629	5	5	5	–	–
ST7094	Little Avon River	ST728925	ST697947	–	–	–	–	9
ST7846	River Frome	ST784462	ST787476	5	5	–	–	5
ST9480	River Avon	ST953800	ST960805	2	2	–	–	–
ST9682	River Avon	ST960831	ST977820	6	6	–	–	–
ST9804	River Allen	ST996040	ST990060	4	4	4	–	4
ST9838	River Wylfe	ST948400	ST975395	–	–	5	–	–
SU1234	River Avon	SU127354	SU129330	6	6	6	–	6
SU2470	River Kennet	SU240700	SU253703	–	3	–	–	–

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
SU2870	River Kennet	SU280715	SU299710	5	5	5	–	–
SU5296	River Thames/Isis	SU539989	SU505971	10	10	10	10	10
SU5664	River Enborne	SU567648	SU557633	4	4	4	–	4
SU7266	River Loddon	SU743677	SU734663	4	–	4	–	4
SU9618	River Rother	SU961197	SU980190	–	6	6	–	6
SU9868	Virginia Water (outflow)	SU977686	SU987678	3	–	–	–	–
SX0872	River Camel	SX082742	SX065715	–	10	10	–	10
SX4682	River Lyd	SX478835	SX454834	5	5	5	–	–
SX6270	River Swincombe	SX632718	SX647732	–	–	–	–	5
SX8470	River Lemon	SX833711	SX850209	–	–	–	–	4
SX9290	Exeter Canal	SX923917	SX940894	–	–	–	–	6
SY1096	River Otter	SY112983	SY093960	7	6	6	–	5
SY2692	River Axe	SY262955	SY260922	5	5	5	–	5
SY6094	River Frome	SY606960	SY617955	–	–	3	–	–
TF0210	River Gwash	TF040107	TF028106	–	–	2	–	–
TF1618	River Glen	TF153185	TF168200	–	–	–	–	5
TF2210	River Welland	TF229106	TF237138	–	–	–	–	6
TF2644	North Forty Foot Drain	TF280448	TF262460	–	–	–	–	5
TF2844	North Forty Foot Bank	TF295447	TF280448	–	–	–	–	4
TF6002	Relief Channel	TF602038	TF601032	1	1	–	–	–
TF6412	River Nar	TF640133	TF663136	5	5	–	–	–
TL1840	River Ivel	TL182402	TL184429	5	–	–	–	5
TL2234	River Ivel	TL222369	TL223377	2	2	2	–	–
TL2296	King's Dike (Drain)	TL250965	TL222965	6	6	6	6	–
TL3288	Forty Foot or Vermuden's Drain	TL345879	TL315880	6	6	6	–	–
TL3296	Twenty Foot River (Drain)	TL324969	TL352989	8	7	7	7	7
TL4296	River Nene	TL426973	TL431975	–	–	–	–	6
TL4692	Sixteen Foot Drain	TL454924	TL467947	–	–	–	–	5
TL6474	River Lark	TL666752	TL642764	–	–	–	–	6
TL6480	Mildenhall Drain	TL655813	TL650827	3	3	3	3	3
TL7096	Cut-off Channel	TL719964	TL705988	–	–	–	–	10
TL7672	River Lark	TL731739	TL762728	7	7	7	7	7
TM1822	Landermere	TM489239	TM497238	2	2	–	–	–
TM2434	Shotley Marshes	TM245361	TM252343	4	4	4	4	4
TQ0056	River Wey	TQ020569	TQ033571	5	5	5	–	–
TQ1480	River Brent	TQ146820	TQ146810	2	2	2	–	2
TQ1684	Grand Union Canal	TQ182836	TQ144843	10	10	10	10	10
TQ2288	River Brent	TQ240885	TQ241902	5	–	–	–	–
TQ3698	R Lee Navigat'n/Horsemill Stream	TQ372982	TQ372042	–	–	–	–	7
TQ5062	River Darent	TQ521617	TQ527627	3	3	3	–	3
TQ5244	River Medway	TQ529437	TQ542437	4	4	4	–	4
TQ5298	River Roding	TQ547996	TQ517981	8	8	8	8	8
TQ7252	River Medway	TQ740539	TQ704529	9	9	9	–	9

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
TQ7278	Cliffe Fleet	TQ744782	TQ746792	4	4	4	–	4
TQ9222	River Rother (non-tidal part)	TQ927243	TQ923227	3	3	3	–	–
TR0244	Great Stour	TR038449	TR032430	4	4	–	–	–
TR0826	New Sewer	TR058264	TR090273	7	7	7	7	7
TR1658	Great Stour	TR155590	TR163598	3	3	3	–	3
WBS-linked sites (non-random)				98	99	00	01	02
NH8350	River Nairn	NH806484	NH838507	–	9	8	–	9
NJ5117	River Don	NJ528173	NJ496181	–	9	9	9	9
NS5370	Forth & Clyde Canal	NS531704	NS563690	–	–	8	8	8
NS8696	River Devon	NS895961	NS863961	–	10	–	–	–
NT0765	Linhouse Water	NT068640	NT075660	–	7	7	7	7
NT5434	River Tweed	NT578346	NT528348	–	–	10	–	–
NY3714	Goldrill Beck	NY340125	NY393166	–	–	–	–	10
NY3748	River Caldew	NY371487	NY382516	–	7	7	–	7
NY8529	River Tees	NY857295	NY889283	–	10	10	–	10
NZ2612	River Tees	NZ273123	NZ259137	–	–	–	–	10
SD3710	Leeds & Liverpool Canal	SD375100	SD402119	–	–	–	8	–
SD4610	Leeds & Liverpool Canal	SD494104	SD453112	10	10	10	–	–
SD4617	Leeds & Liverpool Canal	SD461149	SD458193	10	10	10	–	10
SD5009	Leeds & Liverpool Canal	SD524093	SD494104	–	7	7	–	7
SD5064	River Lune	SD522648	SD482631	–	10	10	–	10
SD5284	Lancaster Canal	SD537831	SD520854	7	7	7	–	–
SD5308	Leeds & Liverpool Canal	SD540073	SD525092	–	5	5	5	5
SD5465	River Lune	SD545653	SD558673	–	5	5	–	5
SD5768	Rivers Wenning & Lune	SD585684	SD558673	–	6	–	–	–
SD5870	River Lune	SD571684	SD591721	–	–	5	–	5
SD5960	River Lune	SD592722	SD611574	–	–	–	–	8
SD6100	Leigh Branch Canal	SD602018	SJ630996	8	8	8	8	8
SD6177	River Lune	SD611790	SD609750	–	8	–	–	–
SD8025	River Limy	SD810237	SD807266	–	–	6	–	–
SD9060	River Aire	SD907581	SD901623	–	–	–	–	10
SD9946	River Aire	SD995468	SD986494	–	–	–	–	8
SE1222	R Calder/Calder & Hebble Canal	SE135228	SE128224	–	2	2	–	–
SE2796	River Swale	SE291965	SE257974	–	10	10	–	10
SE4445	River Wharfe	SE440453	SE472447	–	10	10	–	10
SH7220	River Mawddach	SH718193	SH735223	–	7	7	–	7
SJ0868	River Clwyd	SJ092659	SJ082687	–	9	10	–	10
SJ4070	Shropshire Union Canal	SJ394706	SJ418719	–	6	6	–	–
SJ5126	Shropshire Union Canal	SJ526603	SJ541603	–	–	–	3	3
SJ6452	Shropshire Union Canal	SJ629549	SJ638504	10	10	10	10	10
SJ6836	Shropshire Union Canal	SJ683347	SJ671389	–	–	9	–	9
SJ6967	Trent & Mersey Canal	SJ695671	SJ683689	5	5	5	5	5
SJ9279	Macclesfield Canal	SJ933779	SJ936814	8	8	–	–	–

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
SJ9586	Macclesfield Canal	SJ953860	SJ959880	–	5	5	–	–
SJ9785	Peak Forest Canal	SJ964882	SJ971859	–	5	5	–	–
SJ9786	River Goyt	SJ975867	SJ967883	–	5	5	–	–
SJ9822	Staffordshire & Worcs Canal	SJ995229	SJ971214	6	6	6	–	6
SK1273	River Wye	SK138732	SK103725	–	–	–	–	10
SK1883	River Noe	SK168846	SK204826	–	8	6	–	8
SK2181	River Derwent	SK205834	SK234806	–	10	10	–	10
SK2378	River Derwent	SK233806	SK240767	–	10	–	–	10
SK2476	River Derwent	SK244761	SK248727	–	8	8	–	8
SK3084	River Porter	SK302849	SK332857	–	–	–	8	8
SK3088	River Rivelin	SK322886	SK289871	–	7	7	7	7
SK4644	Erewash Canal	SK454471	SK469432	10	9	–	–	–
SK5715	River Soar	unknown	unknown	–	5	–	–	–
SK6236	Grantham Canal	SK639367	SK608368	8	8	8	8	–
SK6929	Grantham Canal	SK709292	SK676307	10	10	10	10	10
SK7351	River Trent	SK743515	SK767522	–	10	10	10	10
SO1024	River Usk	SO123234	SO095253	–	9	9	–	9
SO3780	River Clun	SO361805	SO387814	–	6	6	–	6
SO5112	River Monnow	SO495146	SO512122	–	10	10	–	10
SO5638	River Lugg	SO565372	SO556395	–	–	10	–	10
SO7776	Dowles Brook	SO779764	SO743262	–	–	–	–	9
SO8687	Staffordshire & Worcs Canal	SO864855	SO862887	–	9	9	–	9
SO8757	Worcester & Birmingham Canal	SO865576	SO889577	5	5	5	–	5
SP1581	Grand Union Canal	SP181804	SP144818	8	–	8	8	8
SP1869	Stratford-upon-Avon Canal	SP187711	SP189671	8	8	–	–	–
SP1972	Grand Union Canal	SP192742	SP189706	–	–	–	–	8
SP4915	River Cherwell	SP484159	SP499151	–	–	10	–	–
SP7288	Grand Union Canal	SP727879	SP725901	10	10	10	10	–
SP9013	Grand Union Canal	SP933136	SP889140	–	10	10	10	–
SP9221	Grand Union Canal	SP929202	SP915230	8	8	8	8	8
SS2105	Bude Canal & River Neet	SS207063	SS218038	–	–	–	6	6
SU4595	River Ock	SU473959	SU432963	–	10	10	–	10
SU8602	Chichester Canal	SU858036	SU842013	8	8	8	8	8
SU9400	Alding Bourne/Lidsey Rife	SZ945999	SU958027	–	8	8	8	8
SX5363	River Plym	SX533637	SX569651	–	9	9	–	9
SX5365	River Meavy	SX527650	SX548669	–	10	10	–	10
SX9588	Exeter Canal	SX940894	SX963860	10	10	10	–	10
SY9999	River Stour	SZ004998	SY982994	–	6	6	6	6
TF0671	River Witham & South Delph	TF060715	TF090710	–	–	–	7	7
TF1721	River Glen	TF201245	TF174210	–	10	–	–	7
TL1210	River Ver	TL123103	TL128084	–	4	4	–	–
TL1515	River Lea	TL140160	TL162145	–	7	7	7	7
TL1550	River Ivel	TL156519	TL156508	–	5	5	–	5

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
TL3701	River Lea/Lee Navigation	TL371018	TL375026	–	10	–	–	–
TL4963	River Cam	TL502644	TL487621	–	6	6	6	–
TL8187	River Little Ouse	TL817879	TL786869	–	8	8	–	–
TM1150	River Gipping	TM125491	TM113527	–	10	10	–	–
TQ0370	River Thames	TQ044695	TQ018721	–	10	10	10	10
TQ0492	Grand Union Canal	TQ062940	TQ044902	10	10	10	10	10
TQ0558	River Wey Navigation	TQ050578	TQ055586	–	2	2	–	–
TQ1554	River Mole	TQ169543	TQ154570	–	–	–	–	8
TQ2742	River Mole	TQ276423	TQ259405	–	–	–	–	8
TQ2865	River Wandle	TQ282651	TQ261687	–	9	9	–	9
Other non-random sites				98	99	00	01	02
SD4746	Lancaster Canal	SD487452	SD486488	10	–	–	–	–
SD5913	Leeds & Liverpool Canal	SD596168	SD599124	10	–	–	–	–
SD8434	Leeds & Liverpool Canal	SD843365	SD845327	10	–	–	–	–
SD9012	Rochdale Canal	SD947182	SD917140	10	–	–	–	–
SD9702	Huddersfield Narrow Canal	SD984041	SD977025	4	–	–	–	–
SE0225	Rochdale Canal	SE015259	SE039245	7	–	–	–	–
SE0612	Huddersfield Narrow Canal	SE039119	SE079139	10	–	–	–	–
SE1138	Leeds & Liverpool Canal	SE107399	SE125384	5	–	–	–	–
SE2335	Leeds & Liverpool Canal	SE222368	SE238366	5	–	–	–	–
SE6029	Selby Canal	SE620320	SE585290	10	–	–	–	–
SE6416	New Junction Canal	SE634151	SE650184	7	–	–	–	–
SE6518	Knottingley & Goole Canal	SE648187	SE667193	4	–	–	–	–
SJ3398	Leeds & Liverpool Canal	SJ350994	SJ341969	10	–	–	–	–
SJ3699	Leeds & Liverpool Canal	SJ387981	SJ350994	10	–	–	–	–
SJ5659	Shropshire Union Canal	SJ553599	SJ581588	6	–	–	–	–
SJ6153	Llangollen Branch Canal	SJ621551	SJ617524	6	–	–	–	–
SJ6386	Bridgewater Canal	SJ669871	SJ625864	10	–	–	–	–
SJ6575	Trent & Mersey Canal	SJ644753	SJ666759	6	–	–	–	–
SJ6764	Middlewich Branch Canal	SJ689658	SJ679632	6	–	–	–	–
SJ7992	Bridgewater Canal	SJ784912	SJ796937	6	–	–	–	–
SJ7995	Bridgewater Canal	SJ762986	SJ799945	10	–	–	–	–
SJ8842	Trent & Mersey Canal	SJ881442	SJ885393	10	–	–	–	–
SJ9273	Macclesfield Canal	SJ930744	SJ925716	6	–	–	–	–
SJ9396	Peak Forest Canal	SJ935984	SJ944951	8	–	–	–	–
SJ9398	Ashton Canal (derelict)	SJ925976	SJ948985	6	–	–	–	–
SK2525	Trent & Mersey Canal	SK273274	SK238241	10	–	–	–	–
SK4799	Sheffield & South Yorkshire Canal	SK468997	SE504001	7	–	–	–	–
SK6279	Chesterfield Canal	SK649808	SK611788	10	–	–	–	–
SN7305	Swansea Canal	SN752065	SN724041	6	–	–	–	–
SO7407	Gloucester & Sharpness Canal	SO737049	SO758093	10	–	–	–	–
SO8762	Droitwich Canal	SO868611	SO884627	5	–	–	–	–

Nominal 1-km reference	Waterway name	Start and end grid references		Number of 500-m sections surveyed, 1998–2002				
SO9387	Dudley Canal	SO932892	SO953883	10	–	–	–	–
SP1996	Birmingham & Fazeley Canal	SP202984	SP186938	10	–	–	–	–
SP4083	Oxford Canal	SP382831	SP421822	10	–	–	–	–
SP6791	Grand Union Canal	SP695916	SP664927	8	–	–	–	–
SP8737	Grand Union Canal	SP869398	SP877372	6	–	–	–	–
ST0213	Grand Western Canal	ST023134	SS999131	10	–	–	–	–
ST3134	Bridgwater & Taunton Canal	ST301365	ST322325	10	–	–	–	–
ST7666	Kennet & Avon Canal	ST782657	ST755642	10	–	–	–	–
SU2063	Kennet & Avon Canal	SU224635	SU179618	10	–	–	–	–
SU8953	Basingstoke Canal	SU809536	SU853527	9	–	–	–	–
TL8094	River Wissey	TL807945	TL774962	–	10	10	–	–
TQ9427	Royal Military Canal	TQ958292	TQ938248	10	–	–	–	–

