CONSERVATION ADVICE No. 2

Bird monitoring at a local scale

A guide for local project coordinators and volunteer birdwatchers

BTO Birds Science People

Acknowledgements

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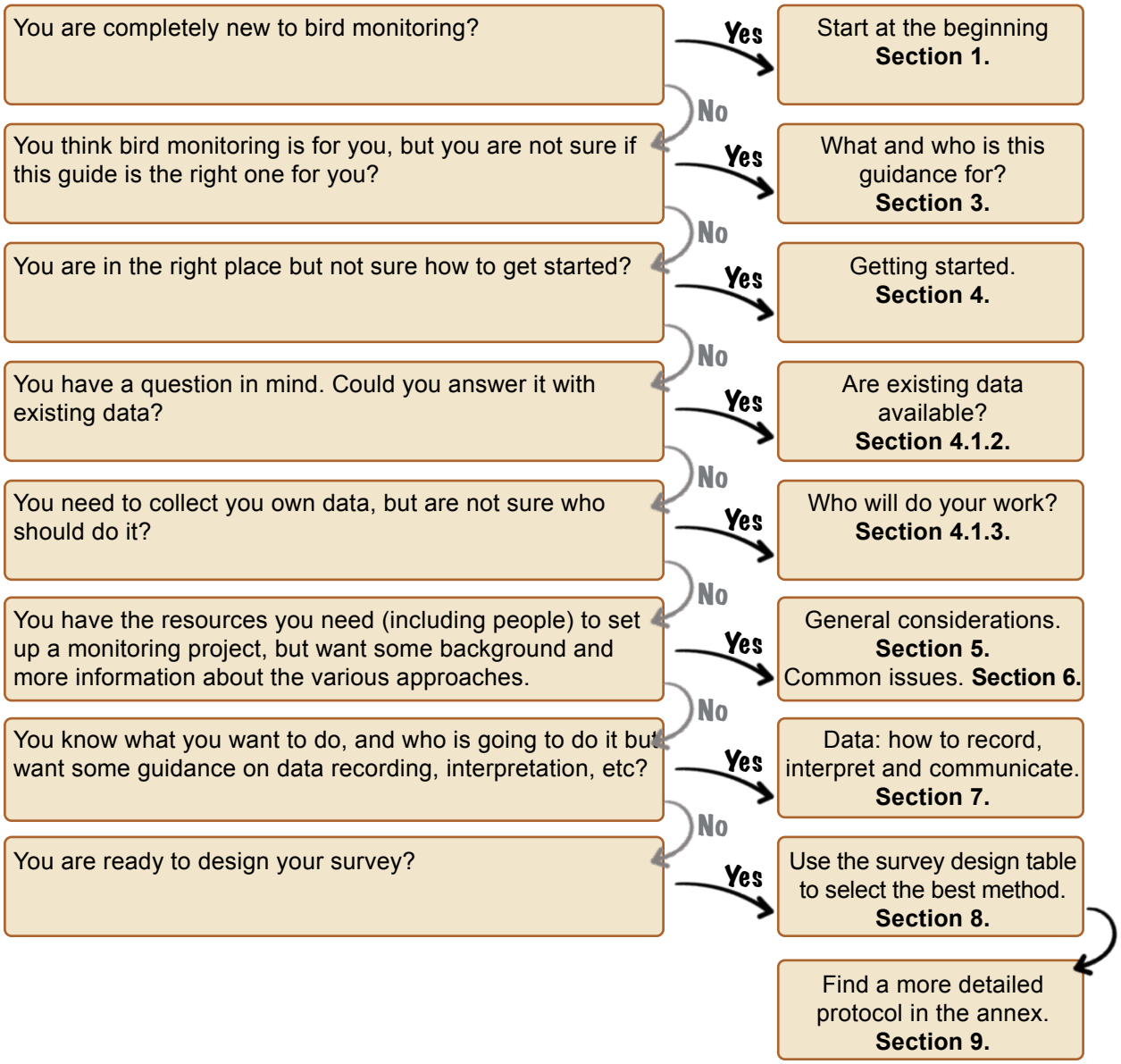
About this guide

Monitoring biodiversity in general is an important activity. Data collected on our wildlife contribute to conservation, research and framing policy. Birds are a particularly good group to choose and there is a long history of bird monitoring in the UK. Understanding more about our birds, particularly at more local scales, will help us better understand what does and does not work well for their conservation. However, designing and setting up monitoring programmes is a far from a trivial exercise.

This guide seeks to help organisers of – and participants in – local scale monitoring projects to decide on what it is they want to measure and why, to choose between established methods for sampling and counting, and how to best manage volunteers and the data they collect.

How to use this guide

Whilst this guide has been written for a non-academic audience, there is a lot of other information available, ranging from the general principles of setting up citizen science projects to the technicalities of survey design. Although not exhaustive, this guide has been written to give the reader as much information as possible. This flowchart will hopefully help you navigate to the right place quickly.



1. Aims and Objectives

By reading this guide, you will hopefully be able to establish:

- some background to the UK bird monitoring landscape and existing schemes.
- why you might want to monitor birds.
- a method that best suits your needs, whilst giving the data you collect the greatest value as possible beyond your own project.
- advice on what data collection and data management techniques you can use, whilst acknowledging that there is much to be done to improve the tools and infrastructure for collecting data.
- how to consider the needs of your participants.

2. Monitoring birds: background and introduction

2.1. Why monitor birds?

- Birds are charismatic, well known and well loved, and so an ideal target for people to count.
- Birds are good indicators of the environment, responding relatively quickly to environmental change.
- They are, with some training, relatively easy to identify in the field by sight and sound and – if using traditional observation methods – don't require additional equipment beyond a pair of binoculars, or perhaps a telescope.

For these reasons, bird monitoring has formed the backbone of the UK's main wildlife monitoring schemes. Data collection for whole groups of birds as part of national surveys has been going on since the 1960s. Some single-species surveys have been in existence for much longer. The data collected from these surveys, which are typically undertaken by volunteer birdwatchers, contribute to official statistics, both as species-specific population trends and aggregated to form multi-species indicators. These data are used variously in setting policy, measuring progress against biodiversity targets derived from those policies, measuring the success of conservation interventions, establishing conservation priorities, and in bespoke research.

Long-term surveys, such as the BTO/JNCC/RSPB Breeding Bird Survey (hereafter BBS), and specific surveys, such as **Nightingale**, **Hen Harrier**, **Turtle Dove** and **Woodcock** surveys, have specially designed methods with the aim of delivering robust statistics at the national and regional level, and in some cases for protected sites and National Parks.

It should be recognised that these methods have been carefully tuned to be appealing to volunteers and to generate inferences across large samples of sites. In the case of BBS, the fact that robust population trends for more common and widespread species can be calculated at smaller scales – say that of a county – is a testament to good design and the success and popularity of these schemes among volunteers, who have been able to survey enough sites.

3. What is this guidance for?

For monitoring at smaller spatial scales, the methods of national schemes do not always work well to meeting the needs of local data. This is because the methods used for monitoring at larger spatial scales using a large number of sites will trade off the accuracy of any estimates at any given location – which might need relatively intense methods – to sample using less intensive methods from many locations to provide representative data across a wide area.

There is growth in demand for monitoring at smaller scales, in part driven by Local Nature Recovery Strategies, Environmental Land Management Schemes (ELMS) – especially within the context of **Defra's Landscape Recovery Scheme** – but also covering entirely voluntary initiatives. This means that there is a need to support this demand with guidance on how to undertake monitoring that is suited to these smaller scales, information needs and prospective audiences.

Guidance and manuals for bird monitoring are nothing new; there are several widely cited guides and textbooks – some freely available – that describe and explain many of the field methods and study designs that are included here (See References 1–4 on Page 54). Survey methods of one kind or another, particularly atlas-based survey, can be found in various places, for example in county bird club reports. However, some of these sources are only available in academic libraries or to purchase. Making guidance on bird monitoring available to a wider audience is therefore an important aim. However, one key consideration of monitoring at smaller scales is not only to find an approach which best suits the local need, but also to make the data collected easily comparable to those from national schemes, so giving the data added value in its reuse.

Therefore, whilst this guide provides a range of survey methods to suit a range of local scales and objectives, these are deliberately limited in scope to those which give the most direct comparison to national scheme methods and valuable reuse for bird conservation. In some cases, simply directing the reader to an existing scheme will be sufficient.

3.1. Who and what is this guidance for?

How big?

This guidance has been written with the following geographical scales in mind:

- 'Landscape' scale – for example, National Character Areas, National Parks, counties/Local Nature Recovery Strategy Areas, Landscape Recovery Project Areas or larger rewilding projects (areas over 10,000 ha/100 km^2).
- 'Large land holdings' – an estate, farm, parish or smaller rewilding projects (areas between 1,000 ha/10 km^2 and 10,000 ha/100 km^2.
- 'Site' – a local wildlife site, or greenspace (areas up to 1,000 ha/10 km^2).

How long?

The guidance is mainly focused on what might be referred to as 'long-term', or at the very least 'multi-year' monitoring.

Who for?

This document is mainly aimed at project coordinators or participants in any form of local scale monitoring exercise. For example:

- Conservation NGOs, especially site or area managers.
- Local Government, Local Nature Recovery Strategy Responsible Authorities, Parish Councils.

- Farmers, estate owners and land managers.
- Independent volunteer community groups.
- Teachers.
- Businesses.

It is acknowledged that many of the kinds of organisations included above will already have the necessary expertise in this area. Even then, it is likely that programmes will involve some or all of the work being undertaken by volunteers. As such, it can be considered as a 'guide for citizen scientists'. Citizen science is often used in the specific context of mass participation, often involving the collection of large volumes of data. This guide and the methods described range from simple to complex and, as such, take the view of citizen science as any bird monitoring project involving volunteers.

3.2. What is not covered

This guidance is not aimed at the following applications:

- **Single year assessments**, such as those typically undertaken for Ecological Impact Assessments (EclAs). Many of the field methods here are often not suitable for the kinds of assessments undertaken in the commercial sector. For example, the 1-km transect based BBS methods are not likely to be appropriate for single year site-based assessment, being based on only two survey visits with partial coverage of the area of interest, and therefore associated with significant uncertainty at the site-level, although it is often mistakenly used in this way.
- Any other specific methods designed for applications typical of the **commercial sector** (e.g. windfarm proposals). Consultant ecologists are instead directed to Bird Survey Guidelines (Reference 5) for best practice on how to conduct ornithological assessments for development.
- **Species-specific methodologies** are not explicitly excluded, as many of the approaches listed will be relevant (e.g. territory mapping). However, this guide will not provide species-specific survey advice in the same exhaustive way as presented in the *RSPB Bird Monitoring Methods* (Reference 6.) or *Seabird Monitoring Handbook* (Reference 7). We also do not cover 'play back' methods, where song/calls are used to elicit responses during species-specific surveys.
- '**Special methods**', i.e. those involving high levels of expertise, training and licencing (Reference 8), e.g. tracking studies. As such, many of the methods used to measure survival, movement and migration are not covered.
- **Acoustic methods**. There is fast-growing popularity in the use and availability of acoustic recording equipment and techniques targeted at monitoring birds. The design of surveys, both solely acoustic and in combination with human observation, demands a dedicated guide on its own and is not considered here. Future iterations of this guidance may integrate the two. The term 'acoustic methods' applied here refers to the use of dedicated sound recording equipment, often, but not necessarily in a static location and operating remotely. Another aspect of acoustic monitoring is that which is freely and increasingly available on personal mobile devices – referred to herein as 'auto-ID' – and thus opens up an additional tool for human observers to aid detection and identification. We cover the challenges that this new form of observation presents in the section on 'How to manage and look after your data' (Page 22).

4. Getting started

There is a great deal of literature on setting up and designing monitoring programmes (see References and Further Reading). Before you begin designing your programme of monitoring, it is important first to spend time considering what it is you want to achieve, what resources you have, etc. Only then should you embark on the specifics of your survey design. A good way to approach this is to work backwards – what information will you want to show, to whom and when? From there, many things will fall into place.

4.1. Ask yourself some questions

4.1.1. What are your objectives?

- Knowing what sort of information you want – i.e. the question(s) you want to answer – is essential to knowing how to get it. Do you have a hypothesis that you wish to test? Do you just want to see what is happening? Are you as interested in engaging a wider audience in nature as you are about answering a particular conservation question?

Before continuing, **we advise you read and complete the interactive tool and associated guidance on setting objectives for biodiversity monitoring** (Reference 9).

As highlighted above, there are existing schemes collecting high quality data about our wildlife; it might be that there are already datasets that will answer your questions (see BirdFacts). The process of establishing objectives may well be iterative, as knowledge of your resources, the skill set of your workforce and other constraints become better known; so your objectives may need to be refined. Survey design should be seen as an iterative process and is the most important issue to get right (see Figure 1).

Additional ways to think about setting objectives include asking “what do you want at the end of your monitoring period?” Or, if the project is many years in the making, “what will you want periodically during the project?” Below are some common examples of higher-level project objectives:

- To **collect evidence** on whether actions aimed at benefiting birds, or biodiversity more generally, are working. If you are undertaking management changes on a site, recording birds before and after making a change, or comparing areas that have and have not had the changes are potential ways of answering this question.
- To **understand which species use a given area** at a particular time of year and how their numbers may be changing. It may often be the case that simply the presence or absence of certain, priority species (however defined) is the sole aim. A further extension to this may be to ask not only which species are present, but also how they use the site (feeding, breeding, passage, moulting, roosting, etc).
- To **compare the value of a particular site with other sites** locally, regionally or nationally. To do so requires that the data collected are comparable to those collected elsewhere.
- To **contribute to existing monitoring schemes**. Whilst most of the methods described in this guide are deliberately limited to those which allow for relatively simple comparisons with data from national schemes, in many cases the *direct* contribution to such a scheme can be an aim, whilst simultaneously contributing to local knowledge. This represents a win-win for nature conservation.
- Whilst maybe not a primary aim, you might also want to **engage members of the public** in your area. You might want to help people in your local community engage

with nature by observing birds, perhaps in gardens or shared spaces, perhaps also with a view to involving them in other projects requiring more experience later on.

4.1.2. Are there data already available?

Before getting too deeply involved in planning your own programme, is it possible that there are data already available that will answer your question? Whilst many of the UK's national schemes were designed to report only at the national or regional scale, many have enough coverage to allow for reporting at much smaller scales, such as counties or National Parks.

Do consider spending time searching for data you might need. There are a number of free and interactive services to extract information on birds (e.g. at BTO's **BirdFacts**); data, summaries and inferences (population trends, indices, etc) at national scales (e.g. BTO's **Trends Explorer**) and at smaller spatial scales. Data on rare birds can be requested via the **Rare Breeding Birds Panel** and data on birds and other organisms are available via the National Biodiversity Network Atlas (**NBN Atlas**). If not freely available, BTO data can also be made available on request.

4.1.3. Who will do your work?

This guide is largely intended for voluntary groups working in local contexts. But that doesn't mean that the people undertaking the work will always be volunteers. To get the right data you may need professionals, or at least a combination of professionals and volunteers who have the right skills. There is a trade-off between using volunteers and using professionals:

Volunteers:

BENEFITS

Cost effective: Volunteers will rarely be free, as they need resources and coordination to support them.

Engaged & motivated: Volunteers are likely to be local and share your motivations, but also make a study more sustainable – reducing travel needs, etc.

Community: Participation builds a sense of identity and teamwork.

Health and well-being: Participation can also help participants in a number of ways. For example, engagement with nature has been shown to help many aspects of health, as well as enabling individuals to develop skills and experience.

Carbon footprint: Volunteers are more likely to be local, so reducing the travel burden of a study.

COSTS

Engagement: Volunteers can be difficult to recruit, manage and retain.

Reliability: Volunteers may be less reliable – how long and how frequently can someone commit to the work for? They may have other motivations/priorities that trump the needs of a project, often without any notice. Younger volunteers may be more mobile because of their education or employment needs.

Support: Volunteers are likely to need ongoing support, including feedback and training, compared with professionals.

Maintaining quality. Volunteer data have been shown to be as good, if not better than those collected by professionals. However, there may be a greater variability in the quality of data collected, if the skill level is not matched with the demands of the project. There is potentially a greater challenge in maintaining that quality in a long-term project.

Professionals:

BENEFITS

Maintaining quality: Should be more reliable to deliver quality data, in that there is a 'contract'. Should have a guaranteed minimum skill level, though this is not a given.

COSTS

Financial cost: Professionals cost money, though not necessarily very much – there is a difference between paying a consultant or 'trained professional', with rates reflecting their overheads etc, to someone who might be a sole-trader or 'the birder down the road'.

Connection: Professionals may not share your personal philosophy or vision for nature conservation in your area, or be willing to go the extra mile.

Community: They may not necessarily be able to help foster any community-based benefits, especially if they don't live in your area.

Regardless of whether you use volunteers, professionals or a combination, your workforce will have a bearing on the methods you decide to employ. It may be desirable to have a wide pool of people collecting data, but only use a subset for more formal analysis, for example those with the most experience and skill, and/or those who have received specific training, and whose skills have been tested. Ensuring that you have the right amount of data from the right people is another important part of the planning process.

If you need to look outside of your own organisation or group to resource the project, where will you look? Below are some directories or places to look for further information:

- **BTO Regional Network** – The Regional Network is a specific group of BTO volunteers who help run BTO and its partners' national monitoring schemes.
- **Existing local groups** – The RSPB, for example, has a large number of local groups. There are also a large number of very active bird clubs around the country, which range in remit from entire regions/counties to specific sites and are also likely to have skilled and motivated people.
- **Skopeo** – A relatively new directory that attempts to link skilled field ornithologists with the organisations who need surveys. Members of the directory are paid for the work, though field ornithology may not be their primary occupation.
- **CIEEM** – Chartered Institute for Ecology and Environmental Management. The Registered Practice Directory lists available consultants, ranging from sole traders to multinational firms.

Whoever ends up doing your work will need coordination, feedback and possibly training. A good example of how this has been put into practice is the Purbeck Natural History Forum. The Forum helps to coordinate multiple landowners (who are participants just as much as the people doing the monitoring), advertise events and provide useful links to recording schemes.

4.1.4. What are you monitoring?

Below are the typical features of bird ecology and conservation that you might wish to measure as part of your programme.

- **Distribution:** You might want to know whether or not a species or group of species are present or absent at a given location.
- **Abundance:** Either actual, meaning a census of numbers/pairs/territories – because you want to benchmark it against somewhere else, or just relative (an index) – because you are more concerned with whether numbers are changing.

- **Behaviour:** You might be particularly interested in which species are breeding/feeding/roosting etc. in your site and if so, which habitats are particularly important.
- **Breeding biology and performance:** Do you wish to measure productivity (e.g. the number of young reared per female) or the success of individual nesting attempts?
- **Survival and movement:** As well as breeding success, populations depend on survival and so this may be your focus. Or, you may want to demonstrate connectivity. For example, is my site functionally linked to a nearby designated site?
- **Habitats:** You might actually be more interested in habitat change and are using birds as an indirect indicator of that change.

An adult Lapwing with its chick, by Chris Knights / BTO

5. General Considerations

5.1. Seven guiding principles

Irrespective of the details of what, where and how, one can consider seven guiding principles on setting up a monitoring programme (adapted from Reference 10):

- Keep it as simple as possible.
- Aim as high as you can, but not so high that it risks failing altogether.
- Listen to and communicate with your participants, be they your counters, coordinators or landowners. Ideally trial your methods with them before finalising to be confident they are achievable and effective.
- Listen to, communicate and co-design your methods with the people who might want to use the information – they may not necessarily be the same people as above.
- Work under the principle that your programme will be ongoing (i.e. over several years), but that you can adapt if resources change.
- Can your study be enlarged in scope or shrunk as resources demand?
- Keep good records and look after your data. That doesn't just apply to field data, but everything.

5.2. Use existing schemes where you can.

The survey designs provided in this guidance from Page 26 onwards have been kept to a deliberately limited number and, where possible, encourage the use of existing national monitoring schemes or methods that are closely aligned with them.

Several schemes, like the BTO/RSPB/JNCC Wetland Bird Survey (WeBS) and BTO/JNCC Seabird Monitoring Programme (SMP), allow the user to choose their own area of study. As such, a monitoring scheme can contribute both to local objectives and to national datasets used by government and conservation bodies.

If your main motivation is to contribute to a national recording scheme, but to do so locally, then it is possible that there are sites already set up that enable you to do this. In many cases, sites are self-selected and we encourage you to put your efforts into recording birds where you will contribute both to your local knowledge and to national datasets. In some cases, as in the BBS, the sites available to survey are generated randomly, so may or may not be close to you.

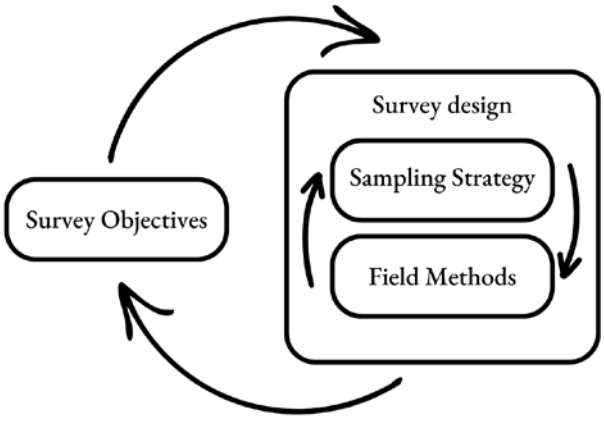
In addition to this, the methods employed for national purposes aren't necessarily the same as needed for local needs, and this guide will help you decide which is the best approach for you. However, if you value participating in a national scheme above all else, then please review the **available projects on the BTO website**, where you will be able to find a survey that best matches your skill, time commitment and interests.

6. Common issues in designing a monitoring project

6.1. Survey design

Survey design can be thought of as the combination of a sampling strategy (where and how to dedicate your effort in space and time) and your field methods (how you go about your counting/measuring). A useful model to consider (Reference 4) is that your survey design will be influenced by your objectives, as well as resources, which in turn may influence your objectives in an iterative process (Figure 1).

Figure 1. Survey objectives will drive the survey design initially, but in practice the whole process is iterative – the constraints of certain designs and the resources needed to undertake them are likely to influence objectives (usually by making them more realistic) which in turn may lead to amendments to a survey design. (Adapted from Reference 4).



Before going into specific survey designs on Page 26, below we consider some common requirements that apply to all or many of the methods described.

6.1.1. Sampling strategies – designing your survey

As well as choosing a survey method, you will need to decide how to apply that method across your area of interest or study area. How you do this will be largely dictated by your monitoring objectives, as well considering the resources you have available.

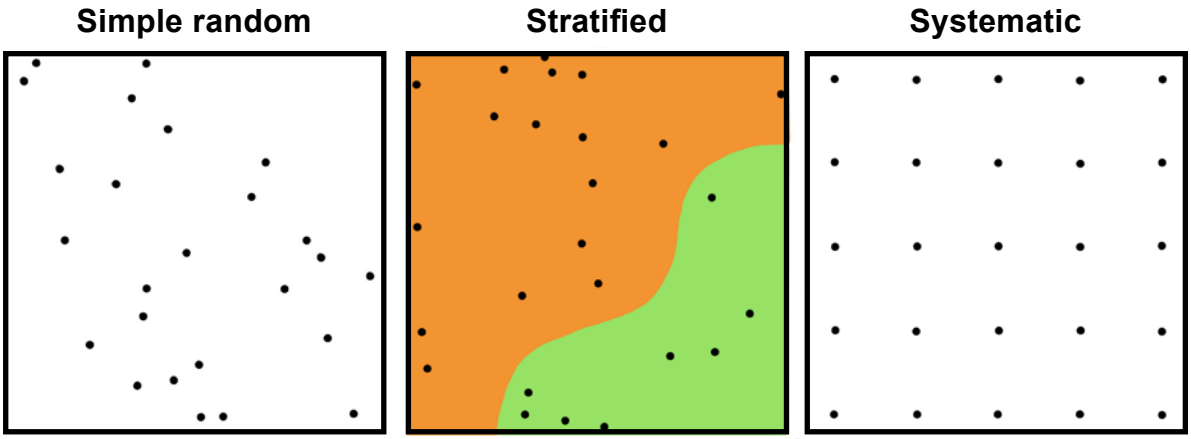
When surveys are at a level of a single location and that location is small enough to cover in its entirety, sampling coverage can be considered to be ‘complete’. When the site is too large, or your aim is to cover many sites, you will almost certainly need to take samples. To ensure that your study area is representative – i.e. avoiding bias – it is likely that your approach will involve some form of random sampling, be that completely random, stratified or other form (Figure 2).

A relatively common example of a stratified sampling strategy might be in relation to habitat or land management interventions; here, sampling units are randomly selected within each habitat area but ensuring that a set number of units are present within each habitat (Figure 2b).

Stratified sampling is a method to ensure that all the types of areas you want to measure are included, which can sometimes not happen if using a purely random approach, for example if there is only a relatively small area of a particular habitat in your sampling

area but which you are still interested in. Regular or systematic sampling has the benefit that it might be easier to explain to volunteers and ensures full coverage of a fixed area at some level. The latter can be helpful if you wish to map species distributions as part of your study.

Figure 2. Three approaches to sampling, each with the same number of locations (25). Simple random: locations are generated completely at random. Stratified random: locations are randomly selected but constrained to ensure a fixed amount per feature of interest (e.g. habitat). Systematic: locations are laid out in a repeated pattern, usually a grid. The initial point or 'seed' for the grid may be randomly generated.



The important feature is that your sampling strategy should be reflected in your objectives. The type of question you have may dictate how you deploy your sampling effort. Below are some common examples:

- If you are interested to know whether a particular intervention is working, it will be necessary to compare areas that have and have not had the intervention (also known as 'control–intervention'). Alternatively, you may compare sites in the same time window, with the variation between them coming from whether or not, or how long ago any intervention was applied ('space for time').
- Sites are monitored before and after an intervention or action ('before and after'). Doing so at sites that have all had interventions raises the possibility that any changes to birds might have happened anyway or have happened because of other factors. Having data from other sites (known as 'control' sites) may help this. Data collected from other schemes, particularly if using similar methods, can also provide a 'counterfactual' comparison – "what is happening in the wider landscape?"; BBS data can be used in this way (Reference 11).
- To avoid the need for information from a different source, a control site can be included in the study which has no intervention but is monitored over the same time period as the intervention site ('before-after-control-intervention'). In both before-and-after studies, more planning and foresight is needed to establish monitoring before changes are made and ideally to do so over more than a single year, which may have been unusual for some other reason, such as extreme weather (see section 6.1.5.).

In all cases, it is almost always a useful exercise to check after the first year of data collection whether or not your sampling method will give you the right information to answer your question. Pilot studies are therefore quite often an essential part of a citizen science project.

6.1.2. Field methods

This is the way you collect your data in the field once you have chosen your study locations. The most common field methods, particularly those that are used in national monitoring schemes, are described briefly below. A full description of all field methods is outside of the scope of this manual, but may be found in other published volumes, (e.g. Reference 2), with more details given against each survey design in the Annex.

6.1.2.1. Territory or spot mapping

During the breeding season, the location and behaviour of individual birds at a study site are recorded and plotted on a map over multiple visits. When repeated, the location of observations from each species can be built up to form clusters, which then correspond to established bird territories. The behaviour recorded corresponds to breeding behaviour and uses standard codes and symbols to represent these. Rules are applied to derive clusters, which will vary according to survey effort and species ecology and behaviour. The method is best applied to strongly territorial species, particularly passerines. Modifications can be applied for colonial or semi-colonial species. Survey plots are walked by an observer, aiming to walk within a set distance – typically 50 m – of all available habitat. The number of visits may vary, according to aim.

Territory mapping was the method used for the BTO Common Birds Census (CBC), the scheme that ran between 1966 and 2000 and which formed the main monitoring scheme for terrestrial breeding birds in the UK until the development of BBS. CBC surveys typically used 10 visits per plot per year in farmland or woodland. Territory mapping allows fine-grained associations between bird abundance and habitat to be made. It is also used extensively in the professional sector for ornithological assessments of developments sites (Reference 5). The downside is that it usually requires several visits to establish territory patterns and the analysis of clusters takes time and experience, though increasingly automated clustering techniques are available.

Other, more assemblage or species-specific mapping methods exist. Waders are a popular group for local monitoring – with several Red- and Amber-listed species – and there are a number of similar methods that use mapping protocols. A summary of these is available at the **BTO Wader Hub** (Reference 12).

Examples: Common Birds Census, English Farm Woodland Survey, Reference 13

6.1.2.2. Line transects

Line transects are primarily designed for estimating relative and absolute abundance. The approach is particularly popular for citizen science projects, as observers are nearly always recording and do so when on the move. Therefore, line transects gather more data per unit time compared to other approaches.

Line transects are typically used alongside ‘distance sampling’ methods, whereby observers record the perpendicular distance of birds from the transect, either within set bands or where the absolute distance of each observation is made. The estimation of distance is challenging (though can be improved with practice), so the use of a number of distance bands is a popular choice. Distance sampling and the associated analysis takes into account that birds differ in their detectability.

The UK’s BBS is based on such a method and, as such, some of the protocols provided in the Annex are based on this method, so allowing for direct comparison between local and national data collection. It is recognised, however, that in certain contexts, transects are not always the most appropriate method. In dense woodland or scrub, point counts may be better.

Examples: BTO/JNCC/RSPB Breeding Bird Survey; Winter Bird Survey

6.1.2.3. Point counts and point transects

Birds are counted from set points while the observer is standing still. Points have the advantage of being easier to layout without bias in the landscape (e.g. in grids) and require much less access. The theory of distance sampling may be applied as for line transects, with distance bands as concentric rings around the recording point.

Observers count for a fixed amount of time, often with a 'settling' period on arrival so that birds disturbed on arrival may acclimatise to the observer. This time can be used to record other information, such as habitat. The recommended time period is five minutes, or 10 minutes split into two five-minute blocks, with a one- to two-minute settling period. If using distance sampling, birds can be recorded up to a maximum distance (usually 100 m), in distance bands, or as absolute distances.

Several international monitoring schemes use a point count method, including the North American Breeding Bird Survey and others in Europe.

Examples: On the whole, line transects are favoured over point counts in UK national schemes. However, they have been used in specific contexts, for example in the study of Welsh woodlands.

6.1.2.4. Site census

The objective is to undertake a count of all the birds within a given area or site. In some cases, it may target a particular species or assemblage and takes advantage of known associations of these with particular habitats. It is distinct from a 'timed survey' in that the aim is to cover a given area without any time constraint and derive a total count.

This might be done using a number of field-approaches. For example, in a winter stubble field – where bird detectability will be relatively low compared to the breeding season – an observer will aim to cover a pre-defined area and walk within a set distance (50 m is typical) of all parts of the study area. Cryptic birds are more likely to be counted under these conditions, especially if they are flushed by the observer. Surveys of winter arable farmland may combine line transects with these whole area searches.

Other habitat types may adopt a different approach, though the outcome will be the same. For wetlands, a surveyor may take up a vantage point (as distinct from 'vantage point surveys', see Section 6.1.2.6. below) to count the number of waterbirds on a lake or estuary. The most well-known national scheme that uses this approach is the Wetland Bird Survey. For the main 'core count', waterbirds are counted at monthly intervals at estuaries, rivers and wetlands throughout the year.

To derive reliable estimates of population abundance or indices thereof, a series of site visits over the relevant time of year is needed.

Also known as: 'whole area search', 'look-see' method.

Examples: BTO/RSPB/JNCC Wetland Bird Survey

6.1.2.5. Timed visit

Observers cover a set area (either a site, or more usually a grid square) and aim to cover as much habitat as possible within a fixed time period. The 'Timed Tetrad Visit' is a well-known method in Atlas studies.

Either counts or simple lists of species can be made, depending on the objective. For studies of single sites, recording repeated lists can be used to generate a 'site inventory'; the question of "how many species use this site?" is a typical aim, often to compare it to somewhere else. If species counts are recorded as well across a series of locations, then variation in relative abundance can be calculated. This is only possible if any variation in detectability due to differences in habitat is taken into account first; a species may be more visible in one habitat than it is in another. With counts, the fact that time is standardised across sites enables a direct comparison. Lists too can be used to generate relative abundance measures. If, as well as a note of the presence of a particular species, the time at which it was first recorded is recorded, then birds which are more abundant will tend to appear earlier in a list than later. These can then be attributed a score (e.g. 'six' if in the first 10 minutes, 'one' in the last 10 minutes of a one-hour survey). When several visits are completed over a season, these scores can be averaged (Reference 14).

Also known as: 'Timed Tetrad Visit (a special case of a Timed Visit)

Examples: BTO Bird Atlases

6.1.2.6. Vantage point survey

A Vantage point survey has several applications, but all are unified by an observer adopting a fixed location (or if in a team, a series of locations) to count birds in an area, often when in flight. In many cases, particularly for counting raptors and/or migrating birds, this vantage point is elevated. Vantage point surveys can be thought of as a special application of a timed survey. Below are some examples of its application.

Roost counts: These take advantage of the behaviour of species that naturally aggregate at certain times of day, but which may otherwise be widespread and difficult to assess. The visibility of birds when at the roost, e.g. shorebirds on an estuary, is taken advantage of in WeBS, where counting dates are coordinated around high tides, when birds are closer to the observer and spatially restricted. In other cases, birds are counted from vantage points when flying into roost. This approach is suitable for many wintering raptors (e.g. Hen Harrier) or gulls, which aggregate in the non-breeding season. Observers counting birds coming into roost at (usually) dusk would adopt a suitable vantage point and survey for a set time prior to dusk (where diminishining light levels will eventually limit identification). Sites where multiple flight lines may exist may need more than one observer.

Migration: Visible migration (aka 'vismig') counts, either along coasts or inland, rely on observers adopting a suitable vantage point to count birds passing past or overhead. Birds passing in both directions should be counted and any which are remaining relative stationary (e.g. raptors using thermals) are excluded.

Raptor counts: Displaying raptors are often only visible from elevated positions overlooking forests or upland valleys. Depending on the objective, counts of birds or estimates of the number of territories are typical recording outcomes.

Examples: Winter Gull Survey; Cudyll Cymru – Welsh Raptor Monitoring Scheme

6.1.2.7. Colony counts

Most colonial-nesting species in the UK are seabirds, where there are well-established methods for deriving estimates of the size of breeding populations and their productivity. These differ by species – they may measure the number of apparently occupied sites (AOS, e.g. Fulmar), apparently occupied nests (AON, e.g. Kittiwake) or individual adults (e.g. Guillemot). Counting approaches are not uniform, as colonies of the same species may vary substantially in size or ease of access. Larger colonies may require a sampling approach to be taken, where only a sample of the whole colony is counted and an estimate derived. Samples may take the form of plots or quadrats (e.g. for cliff nesters viewed from a vantage point) or transects (e.g. for ground nesting birds on a cliff top). Species nesting in burrows present extra challenges. The survey of colonial species nesting inland will often take the form of counting apparently occupied nests, particularly where nests in trees or holes offer little other option.

Examples: BTO/JNCC/RSPB Seabird Monitoring Programme, BTO Heronries Census, All Wales Rook Survey

6.1.2.8. Nest recording

Records of nests and their contents can be broken down into two elements. Firstly, one may wish to locate and record the presence of nests as a direct measure of the population in an area. Secondly, and once located, the recording of the stage of nesting, nest contents and other variables can be used in studies of breeding phenology and breeding success.

Examples: BTO/JNCC Nest Record Scheme, BTO Nesting Neighbours

6.1.2.9. Capture and marking

Methods for establishing survival, dispersal and migration – and some approaches to estimating population size – require that birds be caught and marked. A typical marking method is the application of a ring or combination of rings, which may or may not be designed to be visible by an observer without the need for recapture (e.g. colour rings or flags). Using a range of analytical methods, estimates of local density may be calculated using the ratios of those captured, marked and recaptured. Capture and marking studies require fieldworkers with dedicated training and permits (see section 6.2).

Examples: BTO/JNCC Ringing Scheme and its subsidiaries: Constant Effort Sites (CES), Retrapping Adults for Survival (RAS)

6.1.3. When to visit?

Time of day: In the breeding season, and in the majority of cases, field surveys will usually start just after dawn but avoiding the dawn chorus[1]. As an approximate guide, visits should start between 30 minutes to an hour after sunrise and be completed by mid-morning (10:00 a.m.–11:00 a.m.). Where evening surveys are conducted, a survey should aim to cover the dusk period, before and after sunset, ending around one hour after sunset. Timings may otherwise be dictated by the species (e.g. Black Redstart) or assemblages (e.g. nocturnal birds) you are studying, or by a particular method (e.g. roost counts, ringing etc). For surveys in the non-breeding season, surveys can take place throughout daylight hours, though it is advisable to avoid the first and last hour of daylight if there is a risk of double-counting birds moving in and out of roosts.

[1]Whilst apparently counter intuitive, it is recommended to avoid the high intensity period of bird song at dawn. Not only is this a lot more challenging to survey, but because there is strong temporal and inter-specific variation in vocal activity it makes data collected at this particular time not comparable to those collected at other times.

Time of year: Just as above, the choice of the correct time of year will be driven by your objectives. Traditionally, bird monitoring can be split coarsely between breeding and non-breeding seasons. You may wish to operate all-year round. Even within these periods, however, it is important to think about which months of the year to target. Breeding season surveys are typically run between the end of March through to the end of June. However, the peak of detectability of some species will fall outside of this time; Raven, Mistle Thrush, Peregrine are early breeders, so may warrant visits earlier in the year. Other species will still be breeding – or at least have dependent young – through July and August (Reference 15.). If run all year, your monitoring exercise may well wish to apply different methods at different times – for example a method to record a more detailed survey of breeding birds may operate during March and July, with a separate method in the non-breeding season producing simpler abundance information.

Information on species-specific recommendations on survey dates and times is supplied in *Bird Monitoring Methods: A Manual of Techniques for Key UK Species* (Reference 6).

6.1.4. How many survey visits?

The question of how often to record, or how many samples to take is a common, critical but often difficult question to answer. The number of survey visits and the number of different locations to undertake your recording is tackled, where necessary, within each of the survey designs. Some general principles apply, as follows:

- Depending on their frequency and the length of the survey season, different visits can either provide repeat samples (which are important for averaging over day-to-day or week-to-week variation) or coverage of different peaks in abundance or detectability (such as early- or late-singing species, or waves of migratory movements). Each visit provides a snapshot of the birds present in an area. Accuracy generally increases with the time spent surveying per unit area but note that more birds will come and go the longer a survey lasts, especially in winter, so there can be variation in what is actually present, as well as in whether it is detected.
- If it is essential to have highly accurate numbers, it may be necessary to take repeat counts at short intervals, say days to a few weeks, so that any day-to-day or week-to-week variation due to other factors (e.g. the weather) can be averaged out in some way. Repeat counts at longer intervals within winter will reflect some variation in the detection of sedentary birds but will also show movements through the landscape as factors like migratory movements, agricultural land-use (notably stubbles and ploughing) and food availability elsewhere (e.g. beechmast) vary. Repeat counts at longer intervals in the breeding season will detect different species that sing more at different times, such as early breeders, late migrants and multi-brooded species, and may be influenced by counts of juveniles, which it is often necessary to exclude (as is done in BBS).

6.1.5. How many years?

Deciding how many years to collect data for is also important. Many of the national schemes collect data annually. Whilst this might be desirable for many local projects, it might not be feasible – will you have the resources to carry this out and for how long? For multi-year projects, there are two broad options:

Annual: The gold standard. If data are collected every year, as in BBS, WeBS, etc. then year-to-year variation can be accounted for and smoothed out over longer periods.

Periodic: Resist the temptation to record once every so often, say every five years. In each year, bird numbers (or whatever you are measuring) will vary for other reasons beyond local population size – for example the weather in this year or the year before. Therefore, taking samples on single years several years apart increases the risks of you making the wrong inference – were the changes because there were more/fewer birds,

or because the two years in question had peculiar weather events? Instead, it is better to collect data over two to three years over your chosen intervals and then use these to capture some sort of average value. The changes between those two averages will be a much truer account of real change.

As such, when starting out on a project, it is usually a good idea to collect three years of data at the outset. This then affords you flexibility; if you can, then carry on with annual monitoring. If you cannot, then you can still use that initial period as a strong baseline, and then repeat the exercise later. In before-and-after studies, being able to collect baseline data is essential to the success of the project.

6.2. Licencing and permits

One should be aware of legislation surrounding birds before commencing any monitoring. All birds are protected in some form and some species are afforded an additional level of protection during the breeding season, so-called '**Schedule 1 birds**'. Many types of surveys do not pose much, if any, risk of surveyors/fieldworkers committing offences under wildlife legislation. Monitoring that takes advantage of the Nest Record Scheme should ensure that fieldworkers are familiar with and abide by the scheme's **Code of Conduct**. Monitoring that involves ringing should only be conducted by trained ringers and any involving 'special methods' (e.g. tagging) requires dedicated training and analytical expertise, and is outside of the remit of this guidance.

Watching a Chiffchaff back to its nest, by Keith Mindham / BTO

7. Data: recording, interpretation, communication and archiving

7.1. What data to collect?

Whether made as a single, casual observation, or as part of a structured survey with many visits and a dedicated protocol, observers will always want to collect the core elements that make up a biological record. There are many good guides on what constitutes a good biological record, for example NBN's ***Improving Wildlife Data Quality*** (Reference 16). Below we outline the key bird and non-bird data required when undertaking a structured survey.

7.1.1. Bird data

No matter your approach, you will always want to record at least four things, which form the basis of any biological record.

- **What?** As a minimum, this will be the species.
- **When?** At least the date and sometimes the time of day. It is normally sufficient to record the start and end times of a survey visit as a measure of effort, not the time of individual events.
- **Where?** For mapping techniques, these will be the precise points of observation plotted on a map; in other cases it may simply be the sampling location (e.g. a grid square). If you need to, use meaningful labels to subdivide your area but bear in mind that simple labels are easier to write down or type when in the field.
- **Who?** It is nearly always necessary to record who made the observation, either so that observers can be contacted for data queries, or to take into account any observer bias. It may also be useful to include some measure of skill, either self-identified or by an 'assessor' (formal or otherwise) so that data can be appropriately separated for different purposes.

In addition to these four core elements of a biological record – and depending on the aims of the study – the following may also need to be recorded:

- **How many?** Some approaches require only the presence of a species, but in many cases you will be interested in their numbers as well. You should decide whether you want counts of adults, juveniles, males, females, etc. By way of reference, only adult birds are recorded in BBS and related surveys.
- **What – extra detail?** As well as species, it is likely that there will be a need to record other attributes, such as the sex of the bird, age/life stage or its behaviour.

7.1.2. Other data

Often referred to as 'metadata', it is important to record certain aspects of your sampling event in addition to the recording of birds themselves. These include start and end times (as a measure of effort) and the weather, which affects detectability. Avoid the use of 'free text', instead use codes or existing reference schemes (e.g. Beaufort Scale for wind, Oktas for cloud). You can record absolute temperature, or use ranges (e.g. 10–15°C). BBS and other BTO-run surveys use a simple categorical set of codes, which are likely to suffice for many applications (Table 1). You will also need to capture – whether in the field or as part of the project setup – other variables relevant to your study, for instance which plots are control or intervention.

Table 1: Weather recording codes used for the BBS and other BTO surveys.

Cloud cover		Rain		Wind		Visibility	
0–33%	1	None	1	Calm	1	Good	1
33–66%	2	Drizzle	2	Light	2	Moderate	2
66–100%	3	Showers	3	Breezy	3	Poor	3

7.1.3. Habitat type

Whilst habitat recording might seem outside of the traditional skill set of bird recorders, a bird monitoring study may well need it. Indeed, it may often be the habitat type or its management that is the very subject of the monitoring programme. Or, for more detailed studies that require estimates of population density, knowledge of habitat type may be important when accounting for detectability. It is therefore advisable, before commencing, to establish a relatively simple and repeatable method of habitat recording.

When choosing your habitat classification method, you should consider how easy it is to collect, the skill set of your workforce and, above all, the objectives of the study. A number of classification types exist. BTO uses that described by Crick (1992, Reference 17). However, if one of your goals of monitoring is in relation to new development or biodiversity offsetting, you may be well-advised to choose the same method used under mandatory Biodiversity Net Gain (Reference 18), itself a variant of the UK Habitat Classification (Reference 19). If you are applying any interventions in relation to habitat management, it is important that your classification takes that into account.

7.2. How to collect your data

Historically, field data collection has been conducted with paper and pencil, with carefully designed recording forms used to ensure that the right data are collected in the right way. For mapping studies, there will be additional data in the form of maps. Those data are typically digitised into tabular datasets, which can be managed in spreadsheet software packages or, preferably, database applications.

Many national monitoring schemes are supported by dedicated web-based applications that manage data collection, alongside special modules for project coordinators to help manage volunteers and data verification. There are also applications for mobile devices used by thousands of birdwatchers to record birds whilst in the field – digital data capture – including **BirdTrack**. However, BirdTrack and other 'list-based' tools only account for the minimum requirements of a biological record – there is presently nowhere to record project context or other information about the sampling design like transect route or visit number, or how the sites were selected.

There is therefore a gap between these two extremes. There is a need for web-based applications to enable groups to set up and manage studies, plus web- and mobile-based applications to enable the collection of data. Filling that gap is an important aspiration of the NCEA programme and one that, in time, will accompany this guidance. Until such a time, BTO can provide suggested recording form templates specific to each of the survey designs.

As well as keeping and curating your own structured dataset of your scheme locally, and in the absence of data collection infrastructure that allows for structured datasets outside of national schemes, we also recommend submitting your survey data as a **BirdTrack complete list**. For a study using line-transect and distance sampling over four visits, the BirdTrack list will not include the context of the distance bands and other visits in the project but is still a valuable step in the meantime to give your data added value beyond your own local project.

For studies involving mapping or locations of individual birds or nests, these can be collected using a range of technologies, many of which are available on mobile devices and applications. However, many of these require some level of technical expertise. You will need to decide what level of resolution is important to your study and have the necessary equipment to record at that resolution (e.g. 1 m, 5 m, 10 m). Whilst challenging to set up, a range of mobile applications run alongside desktop Geographical Information Systems (GIS) software, which not only enable you to collect spatial data, but also attributes about those data, and can collect a range of geometry types beyond simple points, e.g. lines and polygons. Qfield (Reference 20), which accompanies QGIS (Reference 21) is one open-source option used by many professional ecologists.

7.3. How to manage and look after your data

7.3.1. Validation and verification

Once collected, it is important to validate and verify your data. Validation is the step taken to ensure the quality of the recording is sufficient (checking for appropriate locations and other metadata). Verification is making sure that the biological data is accurate, e.g. the correct species has been identified at an appropriate number at the right time of year.

How will you handle data that might be collected by someone using 'auto-ID' (see Page 7), i.e. (typically) mobile applications that detect and identify bird song? For BTO's structured national schemes, particularly BBS, the **position statement** is that it should not be used. Whilst in some cases it may help observers detect hard-to-hear species, like Goldcrest, the very introduction of a new tool represents a change to a previously consistent recording method, one that the survey depends upon. It can also generate incorrect detections which, if placed in the hands of the unwary or inexperienced, could be damaging. However, for your project, you may wish to allow the use of these tools, especially if one of your aims is to widen participation and engagement. There is no single right answer, but making expectations of your workforce clear at the outset and maintaining those expectations is an important job.

7.3.2. Data curation

If not done directly in the field, it is usually necessary to digitise data, and the sorts of data collected can be transferred into readily available software. Leaving data undigitised makes it almost impossible to analyse and increases the risk of irreversible damage or loss. Whilst widely used, there are many reasons not to use spreadsheets as a tool to manage data, and appropriate care should be taken if so. Relational databases have the advantage of reducing common pitfalls with spreadsheets and avoid unnecessary duplication or 'redundancy'. Sharable resources have the advantage that many different people can contribute to a single file or database, though in certain cases have the increased risk of mistakes being made with data entry and maintaining order.

The National Biodiversity Network (NBN) has produced **this guide** on managing biological data; a summary of which can be made by reading through the items titled 'Check Box' found throughout the manual.

7.4. How to present and interpret your data

Tailoring bird survey work to requirements does not end with the collection of data: how the data are processed and analysed can be critical for what they can infer, for whatever conclusions can be drawn, and how they can be reported. For example, a common aim is to find out how many birds there are in an area.

First, care may be required if the objective of the work is to estimate the real numbers of birds in a given area for various reasons: territories may overlap the boundary (is the bird then in or out?), birds may be predated or move between visits (do these birds

count?), birds may be imperfectly detectable and birds may be transient (recorded as they happen to pass through). Based on the aims of the study, a policy is needed to deal with such situations. For example, maximum counts will reflect when the birds present are most detectable, but may also include unwanted transients, while mean counts may underestimate the total number of birds that use a site.

Second, individual counts can be interpreted in different ways and do not always mean the same thing. Numbers of birds recorded will rarely comprise all those that are present because detectability is often less than 100%. Given records of areas searched completely or of the distance from the observer to the bird, counts can be converted to estimates of density (number of birds per unit area), i.e. correcting for an estimate of detectability. Further, given certain records of bird behaviour in the count data, counts can be converted to estimates of numbers of territories or pairs. Depending on the species, females are often less detectable than males, especially in the breeding season, so simple counts represent an unknown proportion of 'real' numbers of males, plus a smaller proportion of females.

Populations are often thought of in terms of numbers of pairs, which can be estimated from numbers of (singing) males, or from numbers of territories, the locations of which can be mapped by looking at where different birds were seen exhibiting territorial behaviour. This sort of interpretation obviously requires that the behaviour is mapped in the field in the first place and requires considerably more field survey effort than a simple survey of numbers. The choice usually depends on time or resources available and how important this level of precision is for the purpose of the survey; this should be clearly defined in the proposed methods.

For some purposes, counts of species are not needed, just presence or absence. This is best done as a list over a set time period as a standardised method of recording, compared with ad hoc records of species presence; the former allows for estimating what was absent as well as what was present. List recording is easier to survey, because no recording is needed after the first individual of a species is detected, but it is necessary to record both the time and the area covered. This is because it is never 100% certain that another species would not be detected if another minute were spent looking. Therefore, the time spent surveying allows the analyses to consider how confident we can be about the apparent absences in the data. The timing of visits should also be detailed, for instance to have confidence that migratory species of concern aren't omitted simply because fieldwork was undertaken before they had arrived.

8. Choosing a survey design

Having considered what is necessary in setting up a local bird monitoring project, you are now ready to consider the various designs. The survey designs included in this guide are included below in a ‘decision matrix’ (Table 2). The methods presented here will satisfy a number of requirements but no one approach will cover everything. The information that can be gathered from each approach is grouped into themes, ranging from bird ecology to project-based considerations. Methods can therefore be scored for whether or not they cover a particular potential project objective. We encourage the reader to pick the approach that satisfies as many requirements as are necessary, though trade-offs may be needed. It is also advisable that potential methods be piloted at small scale, as that may be the best litmus test of their practicality and help flag any issues or preferences of volunteers or other surveyors.

Once selected, each method is given a dedicated summary, which may be taken as a stand-alone guide or protocol. In some cases, these protocols may be subdivided according to the geographical scale, so ensure you are looking at the correct one. For surveys methods that can be applied at different scales, typically with a different sampling strategy, an attempt has been made to quantify the size of those areas. These are very approximate and there may be some overlap depending on context and the available resources. Alternatively, familiar qualitative terms are used (e.g. county, parish etc).

Where possible, it is always advisable to consult with experienced analysts prior to choosing a survey method, though it is recognised that this will be relatively rare luxury in the volunteer sector.

Table 2: Bird monitoring options: decision matrix.

	Approach	Mapping	Line transects	Point counts	Site census	Timed counts	Site inventory	Colony counts	Vantage point	Garden birds	Ringing[a] (CES)	Ringing[a] (RAS)	Nest recording
Geographic scale	Small (up to 100 ha)	1			1	1		1	1	1	1	2	1
	Medium (100–1,000 ha)		1	1		1			2			2	
	Large (1,000–10,000 ha)		1	1		1						2	
	Very large (>10,000 ha)		1	1		1							
Abundance	Relative (indices)	1	1	1	1	2	2	1	1	1	1		
	Absolute	2	2	2				1	1				
Season	Breeding	1	1	1	1	1	1	1	1	1	1	1	1
	Non-breeding		1	1	1	1	1	1	1	1	1	1	
Demographic information	Breeding status	1	2	2	2	2	2	1	2	2	1		1
	Breeding success							2	2	2	1		1
	Survival										1	1	1
	Breeding phenology/timing							2			1	1	1
Distribution	Distribution					1	1						
	Habitat association	1	2	1									
Minimum skill level	Low					1			1	1			
	Medium				1	1	1	1					1
	High	1	1	1									1
	Very high – licensable										1	1	
Engagement	Suitable for engagement					1	1	1	1	1			1
Average effort level	Low		1	1	1	1	1	1	1	1			
	Medium				1								1
	High	1									1	1	
PAGE		26	28	38	41	43	45	47	49	52	51	51	51

A primary aim or characteristic of a survey approach

A secondary aim or characteristic, or one that can be added via some variation in the protocol

[a] Bird ringing encompasses a range of different study types with different aims, including Constant Effort Sites (CES) and Retrapping Adults for Survival (RAS)

9. Annex: The survey protocols

9.1. Territory mapping

Territory mapping is often held synonymously with the Common Birds Census (CBC). However, the CBC represents one particular application of territory mapping, albeit one which forms the basis for almost all applications. Variations tend to result in a reduced number of visits, especially where only a single/limited number of species are the subject of a study.

9.1.1. Monitoring aims

- **Primary:** Detailed knowledge of an estimate of the number (abundance) and location of breeding bird territories, most typically of territorial passerines (with adapted methods for other species).
- **Secondary:** Will collect information on species occurrence, the breeding/non-breeding status of recorded species and habitat use. Can be used to survey or census single species with a specific survey design and objectives.

9.1.2. Geographical scale

Small sites up to 100 ha/1 km^2. No more than 150 hectares (1.5 km^2), if covering over two days and will be habitat dependent. As a guide, original farmland CBC sites were around 50–100 hectares, woodland sites 10–20 hectares.

9.1.3. Sampling method

If applied to a single site or plot, then the likelihood is that you will be attempting to cover the entire site. Where you are employing a mapping approach to compare a range of different sites, your sampling strategy will be dictated by your study aims (see 'Common Themes').

9.1.4. Field protocol

Walk through all habitats of interest, ideally maintaining a consistent route, which itself is mapped for ongoing reference. In farmland environments, your route will largely be dictated by the division of land parcels, but the aim should be to cover each linear feature at least once. In other contexts, particularly scrub and woodland, observers should aim to pass no more than 50 m from any given part of the site.

9.1.5. Site visits

The number of site visits chosen will vary from project to project, depending on the aims, species recorded and/or number of sites. Visits are undertaken typically just after dawn, though some evening visits may be helpful. Here are three example 'deployments':

- **Ten visits:** The approach taken by the CBC – what might be considered to be the 'gold standard'. Visits are typically undertaken between mid March to late June.
- **Six visits:** As of 2022, the approach established by the professional sector when used for Ecological Impact Assessments. One of these visits is done at dusk.
- **Four visits:** Fewer visits may be appropriate if the aim is to spread resources over many sites, and comparisons between sites is more important than individual site-level inferences. An example is the English Farm Woodland Survey (Reference 13).
- **Species dependent:** Territory mapping forms the foundation of many species-specific methods. *Bird monitoring methods: a manual of techniques for key UK species* (Reference 6) remains the best source of information for conducting species-specific assessments. The protocols for many species, especially passerines, use a variation on territory mapping.

9.1.6. Recording method/options

Using maps of an appropriate scale, record the location, number and behaviour of birds seen – a 'registration' – using the symbology established and published in the CBC instructions (Reference 22). At present, paper maps are recommended, though digital methods using GIS-based applications on mobile devices have been developed in other countries and are under consideration for development by BTO. A half-way position is feasible, whereby map tiles may be saved as image files to a tablet, and the recording completed on a tablet-sized mobile device. EMR (electromagnetic resonance – not capacitive) styluses and compatible tablets are recommended in this case.

9.1.7. Preexisting schemes and data use

The CBC was the original scheme that monitored the numbers of breeding birds in the UK, primarily in woodland, farmland and special sites, prior to the adoption of BBS in 1994. It is therefore not an active scheme, but data derived from CBC-like surveys are well known and comparable with past datasets. Other, periodic national or regional surveys dedicated to particular habitats or specific questions (e.g. English Farm Woodland Survey), still use this intensive approach to collect high quality data. There is no existing infrastructure to handle data collected by local volunteers, though some bespoke solutions – albeit with some limitations – can be made using open source GIS software.

The unit of analysis will be the territory, the estimation of which is based on well-established methods based on clustering. The number and type of registrations required to confirm a cluster will vary depending on the number of visits. For single-species assessments, a smaller number of visits is usually sufficient. For recommendations on the number and timing of visits for individual species, please refer to *Bird monitoring methods: a manual of techniques for key UK species*.

Summary data are likely to include tables of breeding species, their breeding status as typically used in Atlas surveys ('Confirmed', 'Probable', 'Possible'), the number of territories of each breeding species, plus any other non-breeding species. This may be divided by area/habitat management.

9.1.8. Limitations

- **Time:** The approach is time consuming and labour intensive. Of all the methods described in this guide, it requires some of the highest levels of skill and experience as not only is species identification required, but so too the various elements of breeding behaviour. As well as the field method, there is also an additional demand of territory analysis.
- **Species:** Territory mapping works well with classically territorial, mostly passerine species, but less so for species that are colonial, defend small nesting areas but otherwise range over wide areas. Examples include Linnet, martins, wildfowl and raptors.
- **Edge species:** How will you define territories of species on the edge of your plot? Whatever rule is chosen, apply it consistently year to year.

9.2. Line transects and distance sampling

9.2.1. Monitoring aims

- **Primary:** Relative abundance change over time of more common and widespread birds present.
- **Secondary/variations:** Estimation of absolute density (using distance sampling); breeding evidence (if recorded separately). Can be used efficiently to survey single species with specific design and objectives.
- **Time of year:** Breeding season (March to July) and non-breeding (July to March).

9.2.2. Geographical Scale

Variable. Can be applied, with different sampling strategies to:

- **'Medium-sized sites':** Landholdings where near complete coverage using established transects over one or two mornings is feasible. 150–1,000 ha (1.5 km^2–10 km^2): farms, parishes, small estates.
- **'Large landholdings':** For estates/landholding greater than approximately 1,000 ha (10 km^2) up to 10,000 ha (100 km^2), i.e. where the area is too large to cover completely or is too small to adopt a landscape scale approach which may directly replicate the existing BBS method.
- **'Landscape scale':** For scales equivalent to National Landscapes Areas, National Parks or Local Planning Authorities, e.g. over 10,000 ha/100 km^2, but smaller than most English counties. Anywhere where the scale can afford to directly replicate the methods and sampling approach of the BBS, but where existing sampling in that scheme is insufficient to yield robust population trends and indices.

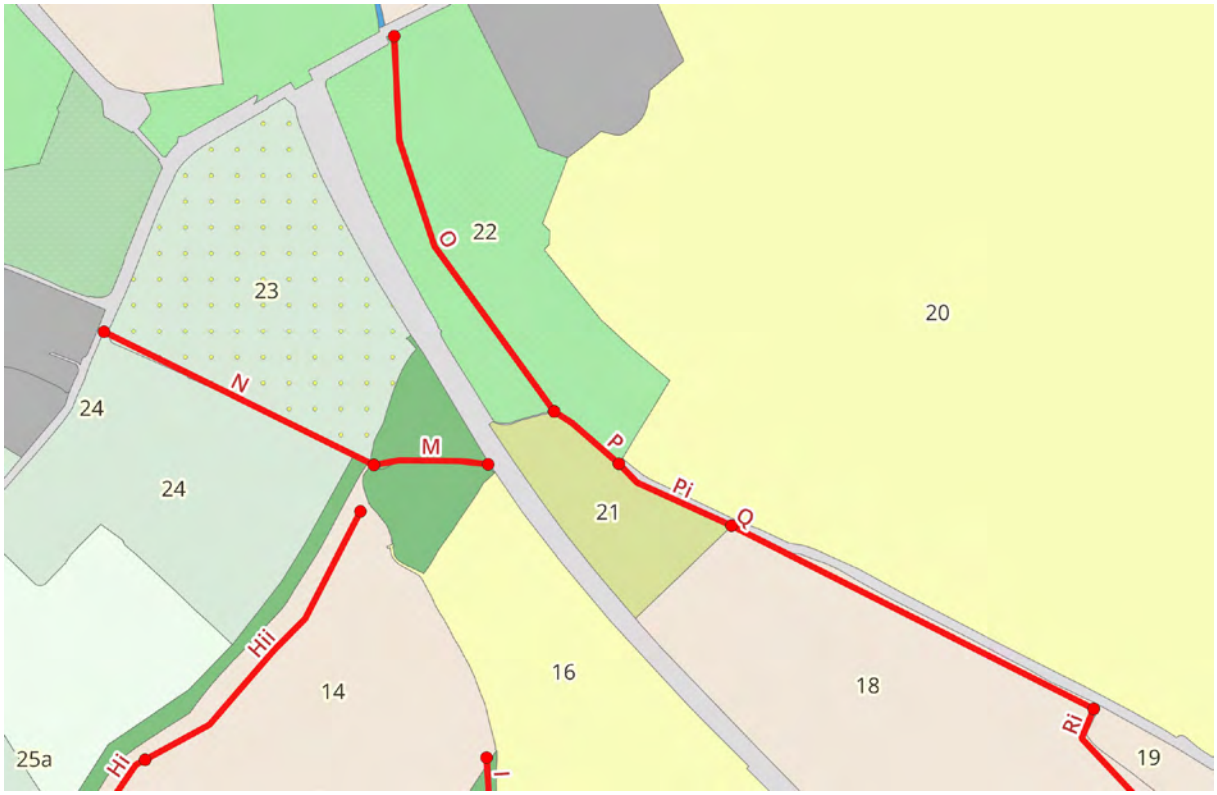
9.2.3. Field protocol

9.2.3.1. Line transects

- A BBS like line-transect method. Choosing a method which closely aligns with the method used in the BBS gives the opportunity for direct comparison.
- Transect routes will pass within 100 m of points of interest (Figure 3); points of interest may include areas of habitat that are being managed for particular outcomes, along with those areas which are not that may act as a form of control.
- This is a 'sampling approach', so aiming to record a representative sample of the total bird community present, rather than trying to count everything. Standard analytical approaches, as used with the BBS, will allow conversion to densities (numbers per unit area) and hence estimation of total local population sizes.
- For non-breeding season surveys, particularly in farmland, additional 'whole area searches' of discrete patches of habitat may supplement transects (see below).
- Depending on the geographical scale, transects will be laid out either across an entire site or within predetermined sampling units (usually grid squares).
- Transect sections need not be fixed in length (unlike BBS) but instead relate to features, fields or habitats, such that sections change with habitat (Figure 3). Aligning sections to habitat features, rather than fixed length will aid analysis and interpretation. The distance of these sections, plus the total, should be recorded.
- Where the geographical scale of sampling is at the largest scale (Landscape) an approach that directly replicates the method used in BBS can be employed, as demonstrated in the 'Tracking the Impact' project in the Chilterns AONB.

- If habitat type/condition is relevant to the study, this should be recorded using some classification system. A number of options are available, but one that is used for BBS and designed for non-specialists in mind is that used widely by BTO volunteers (Reference 17). For surveys of farmland and where specific management regimes or options are the subject of study, additional or alternative classifications may be necessary.

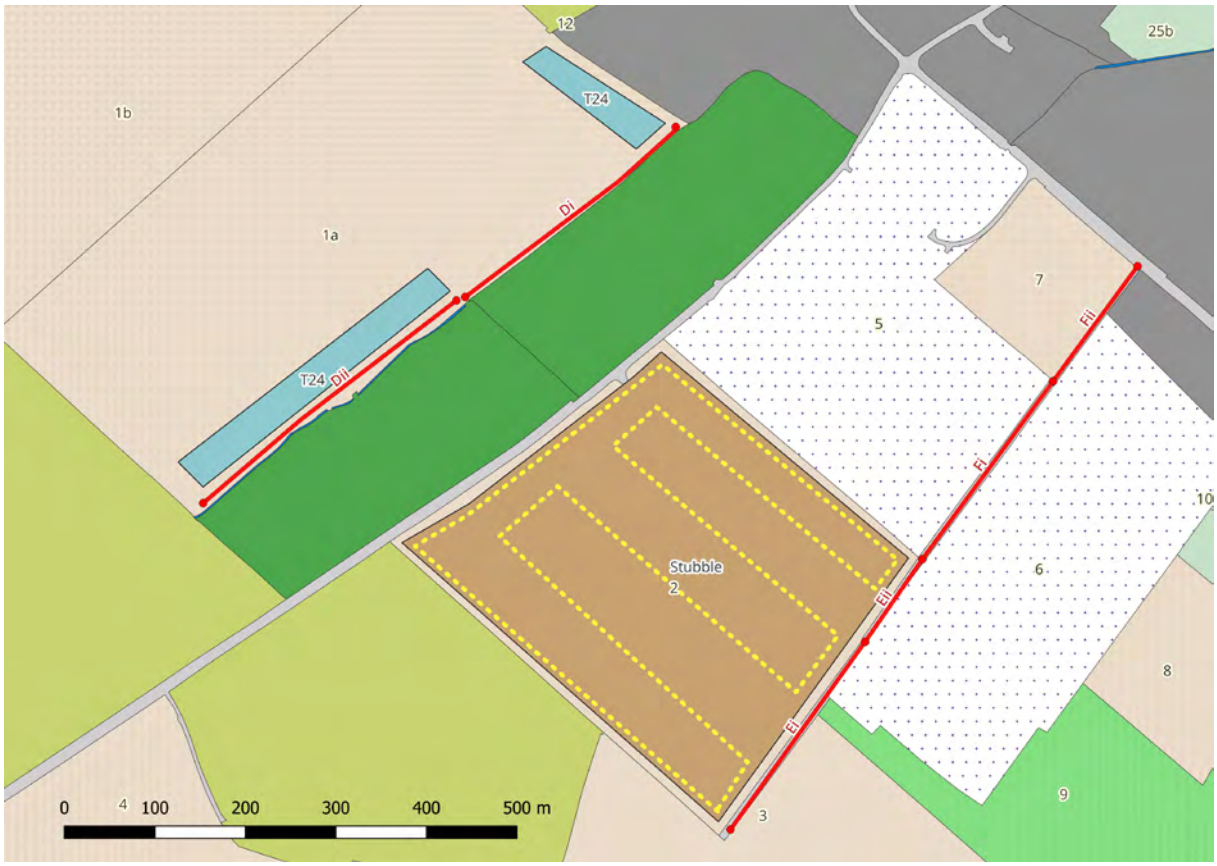
Figure 3. Example of bird transect sections (red, lettered labels) and field codes (numerical labels). Transect sections are divided according to habitat parcel or land management units. Coloured habitat parcels are arbitrary and illustrative only.



9.2.3.2. Whole area searches

- Due to the differences in bird detectability between breeding and non-breeding seasons, it may be necessary to add additional elements to your field protocol to ensure that, for example, otherwise cryptic flocks of seed-eating passerines in stubble fields are recorded.
- Line-transects can be supplemented with 'whole area searches' (see 6.1.2.4 on Page 15), where plots or fields are walked such that the observer is no more than approximately 50 m from any point in the field (Figure 4).
- Counts derived from these whole area searches can be made alongside those of the standard line transects but marked in such a way that they are easily separated during analysis.

Figure 4: Line transects (red) associated with particular field codes (numerical labels) can be supplemented with 'whole area searches' (yellow lines on brown areas – 'stubble'). Whole area searches can be further supplemented with dedicated methods to assess bird use of areas under discrete management (blue, e.g. particular seed mixes under different agricultural stewardship schemes) though these are not described here.

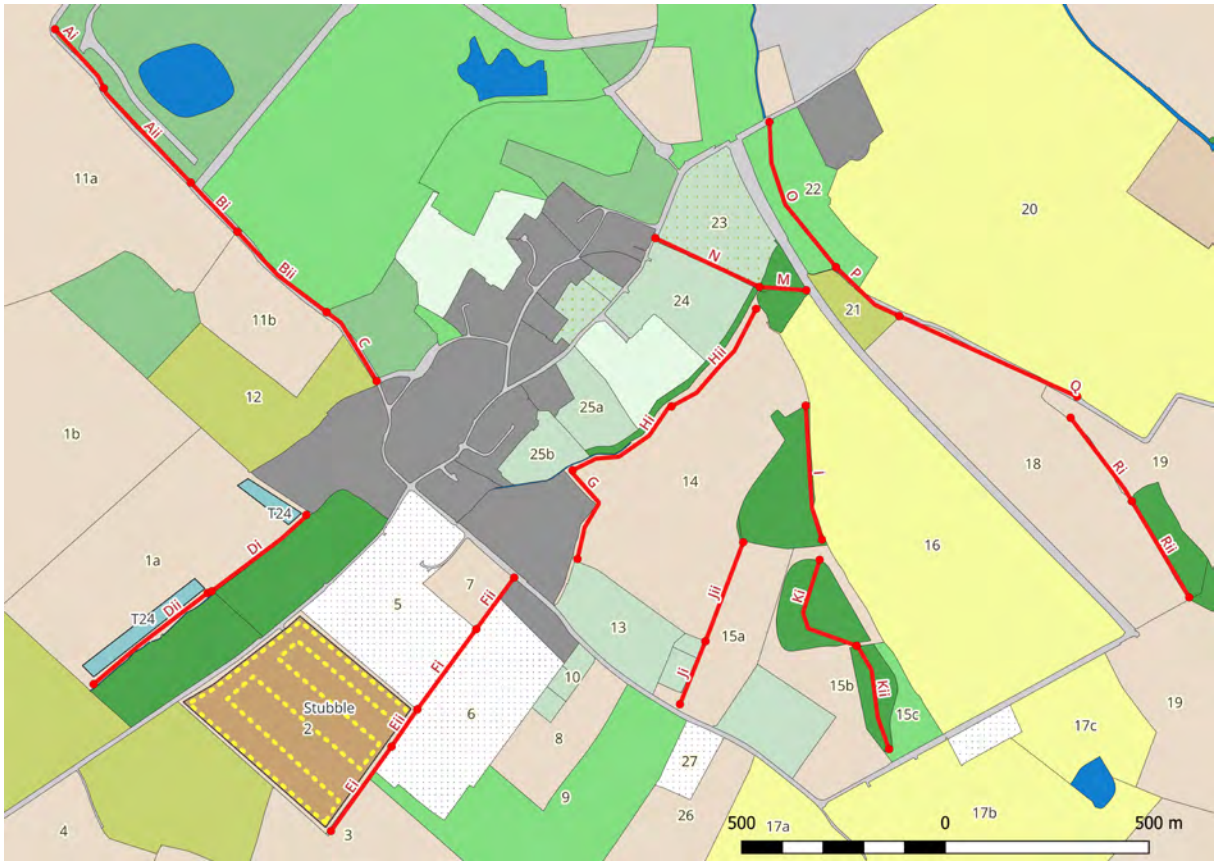


9.2.4. Sampling methods

9.2.4.1. Medium-sized site (150–1,000 ha)

Transects will be laid out across the entire site for surveys to be conducted either during the breeding or non-breeding season (Figure 5). The route should encompass a variety of habitat features within the landholding, with a particular focus on features of interest (e.g. those designed to encourage birds and support other wildlife; wild bird seed crops, tree planting etc. see Figure 3), along with unmanaged habitat for comparison.

Figure 5: Example of the 'entire site survey' approach. The transect routes (red, labelled with letters) encompass multiple conservation features throughout the landholding. Field/habitat codes (labelled numerically) enable the attribution of bird observations with particular parcels of land.



9.2.4.2. Large landholdings (1,000 ha–10,000 ha)

A sample of 1-km^2 grids will be selected at the start of the study. Any stratification – e.g. by habitat or to ensure areas with and without interventions are appropriately sampled, should be applied at the start of the study. Three approximately 1-km transects should be laid out within each sampling unit (Figure 6), or a transect totalling 3 km in length, depending on circumstances.

In some cases, for example in river catchment areas which are often the subject of Landscape Recovery Grant funding, and/or where areas within the study area are largely linear, a mixed approach may be necessary. In this case, a stratification involving randomly selected grid squares within the main body of the area (with additional stratification as necessary for different habitats) may need to be combined with single linear areas (rivers, ditches), using the approach taken for the Waterways Breeding Bird Survey (WBBS).

Figure 6. Example of transect layout (red lines) within a single 1-km square as part of a wider sampling approach. Transect routes encompass a variety of farm habitat features or land parcels. A project will contain a number of such squares, with stratification enabling a representative sample to be taken from different areas (e.g. habitat types) of interest.

9.2.4.3. Landscape scale (10,000 ha or more)

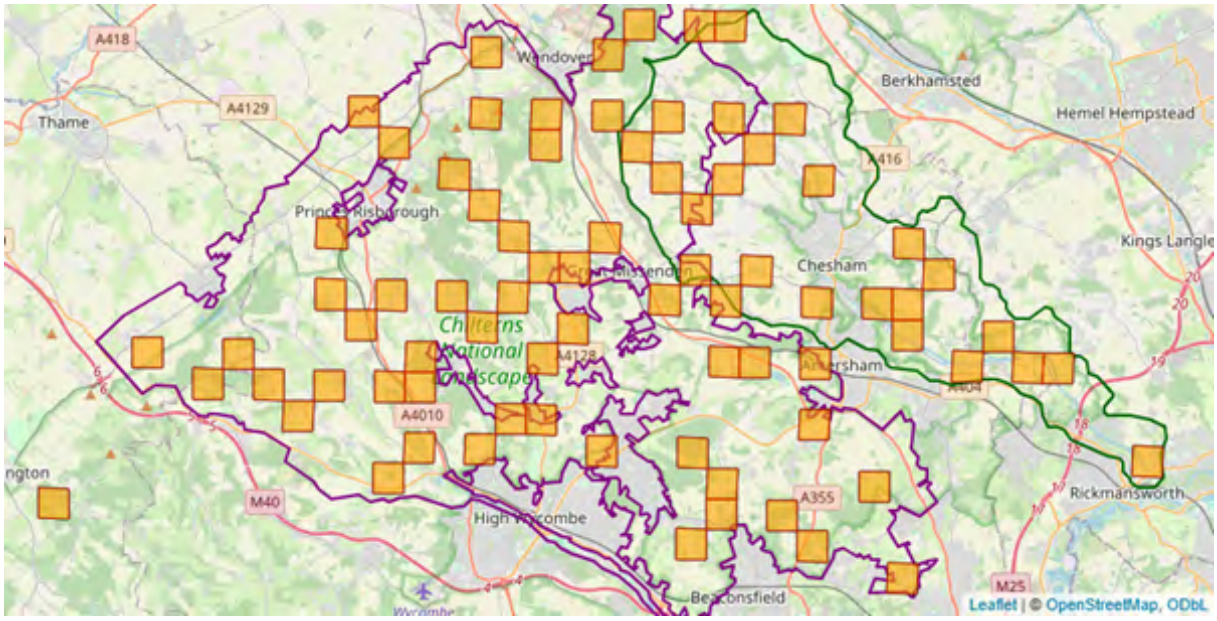
A sample of 1-km^2 will be selected at the start of the study. Any stratification – e.g. by habitat or to ensure areas with and without interventions are appropriately sampled, should be applied at the start of the study (e.g. Figure 7). For national and regional BBS trends, species are required to be observed on an average of 30 squares across the time period of the trend. To account for variation in distribution, it is recommended that around 50 squares per year of monitoring be covered.

For projects of this scale, two 1-km transects should be laid out per 1-km sampling unit, directly replicating the method used in the BBS.

An example of a sampling approach covering approximately 50 squares can be found in an ongoing project in the Chilterns National Landscape – 'Tracking the Impact.' This existing project acts as a model for other landscape scale monitoring programmes and may also include monitoring for other taxa, particularly where those taxa have existing monitoring schemes that use similar sampling units and therefore can achieve co-located data.

As above for 'Large landholdings', where a project area is a river catchment area or if the study area is largely linear, a mixed approach may be necessary. In this case, a stratification involving randomly selected grid squares within the main body of the area (with additional stratification as necessary for different habitats) may need to be combined with single linear areas (rivers, ditches), using the approach taken for the WBBS.

Figure 7: An example – 'Tracking the impact' – of a landscape scale study area where a random sampling design has been applied to select 1-km squares.



9.2.5. Site visits

Breeding season:

For 'medium site' or 'Large landholding' scale surveys, a minimum of three visits should be conducted, roughly monthly from April through to mid July inclusive.

- Early visit – April
- Mid visit – May
- Late visit – June to mid July

In all cases, timings may need to be altered to account for early or late breeding species.

For landscape scale surveys, the same timings as used in the BBS can be used:

- Early visit – April to mid May
- Late visit – mid May to June

Visits should start shortly after dawn (approximately between 6:00 a.m. and 7:00 a.m.) and be completed no later than around 10:00 a.m.

Field recording methods/forms should aim to follow the same structure as BBS, though the recording sections will reflect the self-defined sections as above, rather than fixed length sections. Bird observations should be clearly affiliated with a distance band, transect section and, if necessary, feature (e.g. field number or plot).

Bird registrations should be recorded onto the data tables or field recording sheets (see 'recording method/options').

Non-breeding season:

A minimum of four visits a year, approximately monthly and similar to the schedule laid out in the English Winter Bird Survey:

- November–mid December
- December–January
- January–February
- February–March

All birds should be counted and there is no need to record additional aspects of behaviour.

As in all surveys, avoiding double-counting is something to emphasise in the non-breeding season where birds may be more likely to flock together. In the case of flocks, it is always better to provide an estimate of the number of birds, rather than providing an 'at least' count or similar.

Projects with sufficient interest and resources can start earlier than this (e.g. July) and if combining breeding and non-breeding season surveys, can aim to achieve monthly sampling throughout the year.

Visits can take place at any time of day in fair weather conditions, between an hour after sunrise and an hour before sunset.

9.2.6. Recording method/options

- Recording can be done onto standardised 'field recording sheets' (Figure 8), as used in the BBS, or directly onto recording tables (Figure 9). The former, when used with additional symbols and subscripts, allows the complete capture of all data needed and allows partial representation of your study area in space and may therefore be easier in the field. However, compared to the latter, it is more time consuming as it needs subsequent transcription.
- Bird registrations (using **BTO two-letter field codes**) should be recorded onto data sheets by transect section and unique field codes, ideally separating records of birds detected by different methods (song, call and visual). For example, a singing Blackbird should be recorded in a separate row to a Blackbird that is merely detected by calling or just sighted – see the pale yellow highlighted example, Figure 9). This 'detection method' recording makes the estimation of density more accurate.
- If also recording breeding evidence, record that in a separate column. Depending on your objectives, it may be sufficient to record the highest breeding evidence you observe during the entire visit, rather than that for each registration. The latter – in combination with detection method – will generate many rows of data.
- You may find yourself recording a bird singing in this column, yet still your detection method may be visual (row 1, Figure 9). This may happen if you saw the bird first, and then subsequently heard it sing. The distinction between detection method and behaviour per se is further explained in the **BBS Instructions**. The **self-assessment quiz** may also help.
- Ensure every bird registration has a field transect number, field code and distance band associated with it.
- Depending on your objectives, you may wish to only record detection method or highest breeding behaviour, but not both.
- Birds in flight need not be recorded in the same way, unless observed at high altitude, in which case they can be ignored; you are usually only interested in birds

whose presence might be influenced by the land-use in the study area, not those that just happen to be passing. Err on the side of recording too many birds/species if in doubt.

- For surveys in the breeding season, juvenile birds should not be recorded. If using this approach in the non-breeding season, all birds should be counted. For non-breeding surveys, breeding codes/symbology can be omitted, though detection method retained.

Figure 8: Representation of the data collected in Figure 9, but using a similar 'field recording sheet' approach as used in the BBS. Symbols can either be used to denote breeding behaviour (as used in CBC) or detection method (as for BBS). If both are needed, an alternative subscript will be needed to record both. Song is represented here by a circle and call by underline.

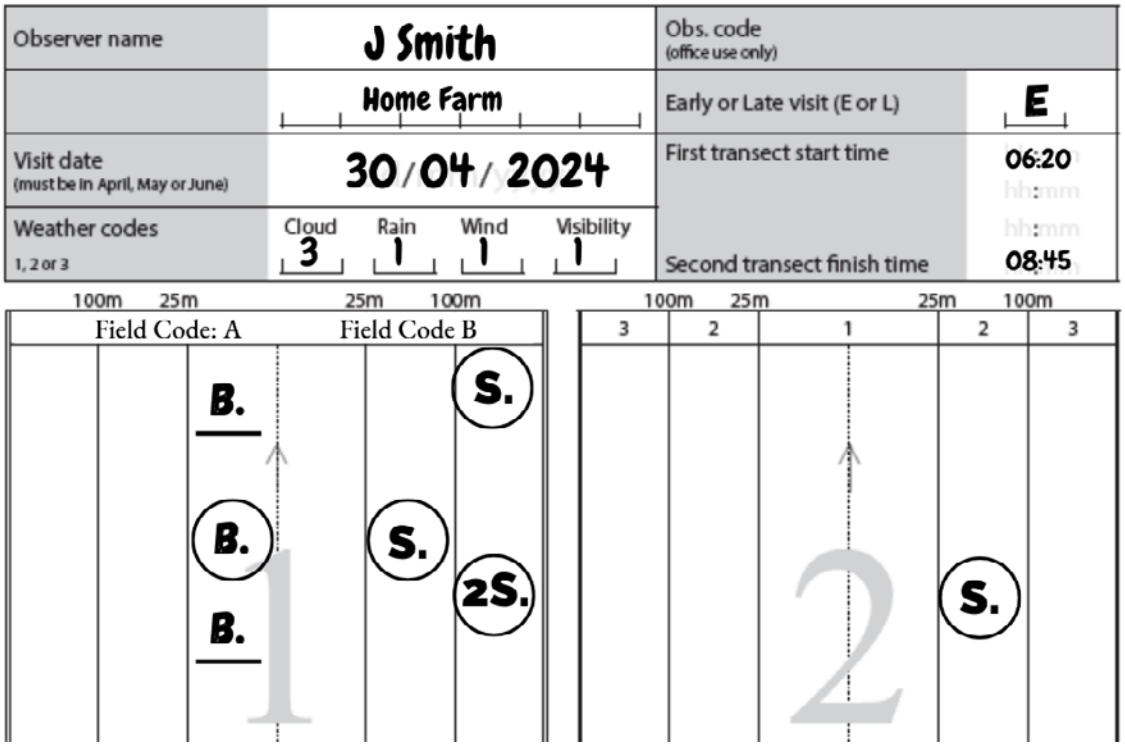


Figure 9. Example of a recording data sheet. Detection method is distinct from breeding behaviour and, depending on objectives, one or both may be required. Each record should have a transect section number and field/habitat code associated. Highlighted section (pale yellow) see 9.6.2. bullet on bird registrations.

Observer	J. Smith	Farm	Home Farm		Date	30/04/2024		Visit number		1 / Early	
Start time	06:20	End time	08:45	Wind	1	Rain	1	Cloud	1	Visibility	1
Transect section number	Field/ Feature code	Species	Detection method (V/S/C)	Breeding code / symbol	0–25 m		25–100 m		>100 m		Flight	
					Tally	Total	Tally	Total	Tally	Total	Tally	Total
1	A	B.	V	song	I	1						
1	A	B.	C		I	2						
1	B	S.	S	song			I	1	III	3		
2	C	S.	S	song			I	1				
3	D	GC	S	song	I	1						
4	E	LB	C								𝍸 I	6
5	E	WP	V	nest			II	2				
5	E	WR	S	song	I	1						

9.2.7. Pre-existing schemes and data use

For the 'medium site' and 'large landholding' scales, no pre-existing schemes and web-based data collection applications are available. However, the approaches described here are based on the method of the **BBS**, deliberately so to allow direct comparison. Similarly, the approaches recommended in the non-breeding season have been chosen to most closely align with the **Winter Bird Survey**, which itself uses BBS squares and the same line transect method.

In the case of a landscape scale approach, sampling of 1-km squares may result in some sites being the same as those used in the national scheme. In these cases, projects should aim for squares to contribute to both projects, though original BBS squares will remain allied to the national scheme and its recording infrastructure. It is advisable that anyone seeking to undertake a project at this scale contact the BBS management group at the beginning of the project's development.

Using the same analytical approaches to BBS, count data from squares can be modelled to produce population trends and indices. For those wishing to estimate absolute density from transect surveys, dedicated software is available, e.g. **Distance**.

9.2.8. Limitations

- Rarer or less detectable species. The above approach is designed for more common and widespread UK breeding species. Farmland species such as Skylark and Yellowhammer will be reasonably well covered using this approach, however a different method or higher sampling intensity (more visits) would be needed for rarer species such as Quail. Similarly, crepuscular or nocturnal birds are not well served by these approaches.
- Colonial/aggregating species. The BBS method does not work well for species which may range widely from breeding areas, e.g. gulls, whose population trends are not published from BBS data. Colonial nesting species (e.g. Little Egret and Common Tern) are reported, but with the associated caveats. Alternative methods specifically for monitoring colonial birds are included in this guide.

9.2.9. Further information/advice

Support for farmers: The above survey approaches have been developed and used in BTO's longstanding work on farmland birds. Their design is primarily aimed to support landowners who currently implement wildlife conservation measures on their land, and looks to assess the effectiveness of these measures on an annual basis, or as a 'before-and-after' comparison. The protocols are designed to be repeatable across years and also to be comparable with the BBS, such that standardised data are collected to allow comparisons of absolute abundance and changes in abundance between focus farms and populations in the background environment.

BTO would like to continue supporting high-quality monitoring of farmland management and to contribute appropriate background data for comparison. We can do this by designing and conducting a highly subsidised farm-specific survey programme that is tailored to individual needs and interests. BTO charge a nominal amount for this but are happy to discuss details and individual requirements. Farmers are asked to contact **info@bto.org** for more information.

9.3. Point counts and point count transects

9.3.1. Monitoring aims

- **Primary:** Relative abundance change over time of more common and widespread birds present.
- **Secondary/variations:** Estimation of absolute density (using distance sampling); breeding evidence (if recorded separately). Can be used to survey single species with specific design and objectives. If habitat is also recorded, point counts are particularly good at measuring associations of species occurrence or abundance with habitat.
- **Time of year:** Breeding season (March to July) and non-breeding (July to March).

9.3.2. Geographical Scale

Variable. Point counts represent an alternative to line transects and are particularly well suited to areas with dense vegetation or where access is limited. Multiple points are usually laid out across a study area, though the point count method – an observer standing at a single location for a fixed period of time – can ultimately be used on a single point only. Such an application may tell you only very little beyond species diversity at that location but may serve as a training aid or means of developing survey skills. It is a simple approach that lends itself to people with less survey experience.

A number of sampling strategies – similar to that described above for line transect methods – could be described to cover multiple scales. However, as we are encouraging projects to adopt methods most closely aligned with national recording schemes, we limit what follows to a typical application of point counts – equivalent to the size of 'small' or 'medium-sized' sites as described above (as an approximate guide, up to 2 km^2 / 20 hectares) – for example the survey to estimate changes in relative bird abundance in a woodland. The point count method offers a simpler alternative to mapping as a means of inferring finer grained species-habitat associations and may be suitable for less experienced project participants.

9.3.3. Sampling methods

Points can be laid out within a study area using a range of methods, including systematic sampling or stratified random. Systematic sampling involves laying points out according to some pattern, usually a grid. However, if habitat variation is important, an area with one dominant habitat will tend to be over sampled. Stratified random sampling may also avoid the accidental coincidence of your sampling points with features in the landscape (e.g. road networks or ditches). Applying a stratification to your sampling will ensure that different areas of interest (e.g. management methods) are included to the right level (e.g. Figure 2).

9.3.4. Field protocol

- Point locations should be laid out in such that they are approximately 150 to 200 m apart, using whichever sampling approach.
- Observers arrive at their station and allow for a one to two minute settling-in period, which can be used to record habitat data if required.
- The decision whether or not to record some form of distance measure may be made on the basis of what is most practical for your resources. If this is deemed important, one should reconsider whether the use of line transects and alignment with BBS-like methods (see above) would be more appropriate.
- For most purposes and for the scope of this guidance, the observer records all birds seen and heard, regardless of distance, within a fixed time period – recommended at five minutes.

- Alternatively, to allow for estimates of density, some measure of distance – and therefore detectability – could be recorded by either:
    i Recording only within a set radius (for example, 100 m).
    ii Recording within set intervals (e.g. 0–25 m, 25 and over, etc).
    iii Recording absolute distance.
- Measuring distance is challenging – though is a skill that can be improved with practice – and inevitable errors can have a greater impact on estimates from point counts compared with transects.

9.3.5. Site visits

Breeding season:

As for line transect methods, three visits should be conducted, roughly monthly from April through to midJuly inclusive.

- Early visit–April
- Mid visit–May
- Late visit–June to mid July

In all cases, timings may need to be altered to account for early or late breeding species. Visits should start shortly after dawn (approximately between 6:00 a.m. and 7:00 a.m.) and be completed no later than around 10:00 a.m.

Non-breeding season

A minimum of four visits a year, approximately monthly.

- November–mid December
- December–January
- January–February
- February–March

Visits in the non-breeding season can take place at any time in daylight hours.

9.3.6. Recording method/options

Counts can be easily recorded using paper forms or, with some rules in place, existing mobile applications. By recording each station as a separate site, BirdTrack or other applications can be used for recording directly in the field, ensuring that start and end times and weather conditions are recorded for each point. Existing mobile applications will not allow for additional recording of distance information and habitat will need to be recorded separately.

9.3.7. Preexisting schemes and data use

Point counts are a popular method of collecting data on birds and are used by a number of national monitoring schemes, including in North America and Europe. However, this method is not used in any long-term monitoring scheme in the UK. As such, any data collected at a local scale by this method are much less comparable to schemes such as the BBS. Given this, we encourage volunteers consider alternatives which allow for line transect methods in the first instance before embarking on a method using point counts. Nevertheless, there are several individual studies of various systems within the UK which use point counts.

As for line transects, and if using distance sampling, estimates of density may be calculated using similar analytical approaches to BBS and count data from sites can be modelled to produce population trends and indices. For those wishing to estimate absolute density from transect surveys, dedicated software is available, e.g. **Distance**.

9.3.8. Limitations

- Estimates of absolute density from point counts are prone to errors in distance and density estimation compared with line transects.
- Whilst more efficient at collecting data from a large area compared with mapping, it is less so than for transects.

9.4. Site Census methods

9.4.1. Monitoring aims

Site census methods are used in a wide range of applications, including estimating population abundance and trends, to distribution and single-species studies. Here, it's application to surveys of waterbirds in wetland habitats via WeBS is used to illustrate the application of this method in a long-term annual monitoring scheme. Monitoring a local wetland – for example a new lake created alongside a residential development – is a good example of a local monitoring project. In this case, the observer is typically stationary and chooses from one or a handful of vantage points. In other instances, for example in winter surveys of farmland, the observer would walk through an area, relying in part to flush birds which otherwise might be difficult to detect. The aim and principles are the same – to derive counts of birds over a defined area.

9.4.2. Geographical Scale

Variable. Sites, with data collected across any geographies being combined to increase the scale. Groups wishing to undertake monitoring of waterbodies are encouraged to do so as part of **WeBS**.

Field Protocol

There is no one particular protocol, but the general principle is that an area/habitat is searched for a particular species or group that are associated with that area. The approach used for WeBS serves as a useful model for other potential studies.

Here, waterbodies are visited on a monthly basis and the waterbirds seen are counted, usually from a single vantage point. The method used at each site should be consistently applied at each visit but need not necessarily be the same if many sites are chosen if trends in abundance are the required outcome. Areas that cannot be covered by one person (e.g. a series of lakes in close proximity) will need teams of people to cover them. In the case of WeBS, straightforward counts of all birds seen make up the recording unit, but in other applications, this may be pairs, nests or territories.

9.4.3. Sampling method

WeBS sites are self-selected. Any waterbody or wetland is a potential site. Sites that have previously been surveyed, or are deemed important, are already mapped and available to select in **WeBSonline**. However, more recent sites (especially those created as part of development) may not be. Contact the WeBS office [**webs@bto.org**] to set up a new site and be added to the scheme. In other cases, the same principles of sampling a larger area (Section 6.1.1) apply.

9.4.4. Site visits

WeBS core counts are done monthly, with the key period being September to March, coordinated around a particular weekend each month. Consult the WeBS counter instructions for further details. Where sites require more than one person to cover, it is more important to ensure your team of counters are counting at the same time than it is to count on the prescribed date.

9.4.5. Recording method/options

Counters record the number of wetland birds seen, ensuring to keep this and other aspects consistent from visit to visit. Further information is available in the **WeBS Taking Part** pages. Where counts of individual birds are the unit being recorded, BirdTrack acts as a convenient recording tool in the field. Indeed, for WeBS volunteers, there is a specific option to submit WeBS counts via this route. Here, the study site (lake, or wetland) is defined as a polygon and this used repeatedly for each count.

9.4.6. Preexisting schemes and data use:

WeBS is an existing scheme that monitors wetland birds at the UK and national scales. The submission of data is done via a dedicated web-based application (WeBS Online). Data for individual sites and counts can be **made available on request** and summarised data (peak, average, totals) are available at the site level via **WeBS Report Online**. Further information on WeBS data availability and uses is available via the **WeBS Data page**.

9.4.7. Limitations

WeBS deals purely with numbers of birds. As such, it may be required, depending on your needs, to combine the a 'site census' method with others approaches geared towards estimating the number of pairs or such like during the breeding season. This can be especially challenging for wetland species. One approach to use alongside WeBS – which runs throughout the year, counts being accepted in all months – is that adopted for CBC for colonial or non-territorial species (Reference 2). 'Group clusters' are assigned the number of pairs based on the second highest count of males, which for wildfowl during the breeding season, tend to be the most conspicuous. The second highest count is used from those collected throughout the season so that potentially spurious elevated counts from late wintering groups are excluded.

9.5. Timed counts

Timed counts are typically used in studies of distribution, for example Atlases, and maybe used to collect information on abundance, particularly relative abundance.

9.5.1. Geographical Scale

Timed counts can be applied to almost any scale. Below are three main applications.

- **Atlases:** 'Large scale'. International, national or regional (e.g. county). BTO organises periodic Bird Atlases, the most recent in 2007–2011. Many groups wishing to undertake county atlases will use the national atlas and the associated infrastructure to organise their own study.
- **Single species:** These may tend to be smaller, for example from a large estate/ landholding up to county scale.
- Habitat associations within smaller sites.

9.5.2. Sampling methods

- **Atlas/large scale distribution for all birds:** In the UK, tetrads (2 km x 2 km) are the typical sampling unit. If resources allow, complete coverage may be possible (especially if done in conjunction with national atlases) or a proportion of tetrads within a 10 km square/hectad. The last national atlas aimed for eight tetrads (out of 25) in each 10 km square.
- **Single species:** Sampling may be directed towards specific habitats and/or use prior knowledge of distribution. As well as sampling previous sites, additional sites that include suitable habitat can be included to account for range shifts. Sampling should be based on a scale appropriate to the subject, e.g. 500 m or 1 km grids.
- Smaller scales or 'sites', these maybe blocks within a woodland, or fields.

9.5.3. Field protocols and site visits

- The general idea is to walk around the sampling unit for a fixed period of time, recording all birds seen and heard, and visiting all the suitable/relevant habitats. This will depend on the size of the area being sampled, but in the case of the last BTO Bird Atlas, this was for at least one hour.
- In the breeding season, and if interested in recording information about breeding, additional codes can be recorded which will summarise the highest level of breeding evidence for that species in that sampling unit. The breeding status codes are available **on the BTO website**, with the higher level categories of 'Possible', 'Probable' and 'Confirmed' a common method for reporting.
- Surveys in the breeding season should start in the mornings, whereas non-breeding visits can occur more or less throughout daylight hours (see 'When to visit', section 6.1.3).
- If appropriate, your project may wish to gather all information about species presence, in which case observers may supplement their counts with so-called 'casual' records, which might be gathered after the end of the formal recording period, or at other times if visiting the site. These give information about species presence, but unlike the structured timed counts, don't provide any information about absence.
- The number of site visits to conduct will be entirely down to the scale of study. For large scale distribution studies, two per season is typical. For multi-species studies at smaller sites, several visits may be necessary to account for differences in phenology and detectability throughout the year.

9.5.4. Recording methods/options

Timed counts are relatively simple and so lend themselves to the use of straightforward notebooks. No mapping is necessary, so counts can be accumulated as simple tallies and summed later. If recording over two separate time periods, record these as two separate parts and ensure the time is recorded.

BirdTrack provides a useful mobile-application for recording whilst in the field. Timed counts can be submitted as 'complete lists', recording the start and end times, and the site can be defined – usually as a polygon – to match the sampling units. Using regular polygons (e.g. grid squares) offers a simple way of defining a site and, if using the OS National Grid, comes with a well-known nomenclature.

BirdTrack also enables the user to record other information about observations, in particular breeding evidence (using the codes already described) and the individual location of particular sightings of interest can be pinpointed.

9.5.5. Pre-existing schemes and data use

BirdTrack: Timed counts, when submitted to BirdTrack and recording all birds heard or seen, will contribute to the wider body of knowledge and information about UK bird distribution and phenology. By the use of the 'complete list', these provide not only information about what is present, but what was also likely to be absent. Casual lists, whilst still useful – especially for some scare species – only tell us about presence. BirdTrack data, particular the more structured 'complete list' can be combined with schemes like BBS to provide additional data for modelling species trends for rarer species that structured schemes alone cannot.

***Bird Atlas 2007–11*:** Timed counts, coupled with casual records, formed the cornerstone of the last Bird Atlas. The next Atlas is planned to run from 2027 to 2031.

9.6. Site inventory

Producing a relatively simple list of species that use your site is a relatively common objective for monitoring. By adding some additional structure to recording, simple measures of relative abundance can be made.

9.6.1. Monitoring aims

- **Primary:** To derive a list of species that use a site (or series of sites) and how that varies during the course of a year. This is often to compare against some other site.
- **Secondary:**
    - **Breeding evidence.** If recorded separately, as is typically feature of the main recording applications.
    - **Simple measures of relative abundance.** If either the time on which a species was first recorded in a list, or the number of times it appears in sub-divisions of a fixed time period.

9.6.2. Geographical Scale

There is no absolute limit to how this approach could be applied, but its most common application will be at relatively small sites, where groups of individuals can submit lists under a common project.

9.6.3. Field Protocol

With the aim being to derive as complete a species list as possible, site inventory survey work does not need to impose set rules on survey effort. Indeed it is more normal to aim to saturate effort to ensure all species are identified. The goal of maximising effort lends this approach to group participation.

As a guide, surveyors might walk a set route across the area/site of interest or establish a series of recording locations (as for Point Count surveys, 9.3). When encountered add each species to your list. ‘Complete lists’ require that effort (start and end time) is recorded and give information about likely absence as well as presence. There are no set rules on the amount of time spent, simply that it be recorded.

For additional basic information on relative abundance, some structure is needed. Either separately or as part of the above process, one can restrict at least part of the recording to a fixed amount of time (usually an hour, depending on the size of a site) and record the time in which the species was first encountered, later assigning the species to one of six 10-minute blocks. Or, by creating separate lists for each 10-minute block, relative abundance can be derived from the number of lists a species will appear.

In both cases, the assumption is that the more abundant a species is, the more blocks or lists it will appear in. If using this method for measuring relative abundance and if your site has varied habitat areas and therefore species assemblages, it is likely to be necessary to create separate recording list for each area – if a set route is always followed or is constrained by access, some species will only ever appear at certain times in your list.

9.6.4. Site visits

There is no fixed rule on the number of visits, though the more visits conducted will lead to more complete data. If information is needed throughout the year (for example to know the differences between breeding, passage and non-breeding assemblages, survey effort needs to be spread throughout the year.

In addition to recording ‘complete lists’ where effort is recorded explicitly, projects may wish to accept ‘casual’ records, which may record the presence of additional (often rarer) species, as well as adding extra information (e.g. breeding status).

9.6.5. Recording method/options

BirdTrack is an ideal tool for recording species lists in the field. Two types of list can be generated, a 'complete' list, where the observer records all birds seen and heard within the time (recorded by entering start and end times). 'Casual lists' allows for recording the presence of one or more species but not necessarily recording effort or that every species was recorded. A special type of casual record, the 'Quick add', allows for rapid upload of one species at a particular location.

Other applications, for example iRecord, eBird and BirdA, allow similar types of recording.

9.6.6. Pre-existing schemes and data use

BirdTrack was set up in 2005 following from the original Migration Watch project. The data collected through the mobile- and web-applications are used to track bird migration and distribution, as well as monitoring rare birds. Data are used at a continental scale by **EuroBirdPortal** and its derivatives, including **Bird Flu Radar**, a Europe-wide tracking system for monitoring outbreaks of High Pathogenicity Avian Influenza in wild birds.

In addition to species presence, additional information can be added to provide your data with added value. One major way is via the submission of breeding behaviour codes, which are available both via BirdTrack, eBird, iRecord and others. Either the highest breeding evidence for a given species can be recorded, or individual spot locations of observations of interest can be added (a form of spot mapping, not sufficient for full-scale territory/spot mapping exercises).

9.6.7. Limitations

- **Establishing absence:** Whether a species is likely to be absent can be difficult to establish with any certainty, unless a site is very intensively sampled. This is especially true when a species' detectability is comparatively low.
- **Existing data recording tools** (e.g. BirdTrack) are not compatible with recording the time at which an individual species was recorded, only the list. This would have to be done separately.

9.7. Monitoring colonies

Monitoring colonial birds in the UK, as well as gathering information on some of our most vulnerable species (e.g., seabirds, Swift), are also excellent surveys for engagement; they are usually limited to a single species and – in some cases – colonies are relatively easy to count once located. Swift and House Martin are also associated with human habitation.

9.7.1. Monitoring aims

Population abundance; breeding performance (for certain species where measures of productivity are practical), occupancy.

9.7.2. Sampling method

Sampling can take place at the level of an individual colony, (e.g. in large seabird colonies where it is impractical to count every pair/nest) or at the landscape level, where individual colonies can be counted, but where it is impractical to count every colony in a given area.

Examples

Plot-level sampling – Seabird Monitoring Programme It may be impractical to count every nest on a cliff or cliff top. Instead, samples across the colony may need to be taken and then extrapolated to estimate the total. To avoid the potential bias that might occur when sampling colonies, where densities of birds/nests will vary (e.g. higher densities may occur in the centre of a colony compared to the lower-density edges), sampling is advised to be stratified (where, for example, the colony is subdivided according to density, and then sampling plots selected at random within each subdivision to ensure they are represented fairly).

Details on methods for plot-level sampling approaches, specific to individual seabird species, are given in the *Seabird Monitoring Handbook* (Reference 7).

Landscape-level – All Wales Rook Survey: A stratified sampling strategy based on three strata, with tetrads as the sampling unit, was chosen: [1] Those tetrads covered in the previous survey in 1996. [2] a random sample of 15–20% of those tetrads surveyed in the 1975/1980 survey of Rooks in Wales and [3] a random sample of 10–15% of remaining tetrads which were occupied by Rook in *Bird Atlas 2007–11*. Here, previous information is used to guide surveyors to areas where Rook occupancy had been known from previous work, or where prior surveys had been conducted for comparison.

9.7.3. Field protocol and site visits

Seabirds: See the *Seabird Monitoring Handbook* (Reference 7)

Inland waterbird colonies: See **The Heronries Census guidance** information.

Sand Martin: Two visits in May and June (Reference 6), with dates depending geographical location. The first visit is used to search for suitable nesting habitat (riverbanks, exposed workings or artificial sites), the second to count the number of Apparently Occupied Burrows/Nests (AON).

House Martin: Three visits between mid May and late July, firstly to initially identify the location of colonies, then to count nests and their status. Periodic surveys for House Martin are run by the BTO, with survey protocols and resources available on the **2015 House Martin Survey project page**.

Rook: A single visit between 1st March and 15th April, crucially before the full spring leaf emergence to count Apparently Occupied Nests. Where a rookery spans the sampling unit (e.g. 1-km grid square or tetrad) the whole colony should still be counted.

Swift: June to July, either at dawn or before dusk. Initial surveys of 'screaming parties' to identify Swifts in suitable habitat (buildings). Swifts flying at or just above roof height give a good indication that nests may be nearby. Secondary visits to target these areas and count the number of active nests. See also the **Swift Conservation guide** on surveys for Swift.

9.7.4. Recording method/options

For species that are part of existing schemes or if you are submitting records to the Nest Record Scheme on individual nests, existing web-based applications are available following registration. For other colonial species, other bespoke surveys and applications are available from time to time, for example:

- **RSPB's Swift mapper**
- **House Martin Conservation UK & Ireland's House Martin mapper**

In all cases, colony counts can be submitted via BirdTrack, either as part of a wider list, or by marking the location of an individual colony, recording the number of nests against each of the relevant breeding category (e.g. occupied (13), being built (9)).

9.7.5. Pre-existing schemes and data use:

For seabirds (both coastal and inland – e.g. tern or gull colonies), we encourage you to sign up to and undertake your monitoring via the **BTO/JNCC Seabird Monitoring Programme (SMP)**. There is no one single method for monitoring under this scheme – the approaches are species-specific.

For colonial species of inland wetlands (herons, egrets, spoonbill, cormorants etc), we encourage you to sign up to and undertake your monitoring via the **BTO Heronries Census**. Counts are made at heronries/colonies of apparently occupied nests. Often, a single visit during the year will be sufficient for each species, but if colonies include multiple species, additional later visits (e.g. for Little and Cattle Egret) may be required. Among the guidance for monitoring heronries, there is additional advice for monitoring rarer species and other techniques.

As well as recording the number of nests or sites in a colony, you should also consider whether you have enough information to record any information about individual nests within the **Nest Record Scheme**, where advice on how to record nests for colonial species is provided.

9.8. Vantage point surveys

Vantage point surveys have several applications, but the two primary ones described here concern counting roosting birds and raptor monitoring. Other applications of the vantage point approach tend to be associated with assessing the impacts of infrastructure on flightlines and so are outside the scope of this guide.

9.8.1. Monitoring aims

- **Primary:** There are various applications:
  - To count the number of birds moving through a defined air space.
  - To count birds as they fly into or out of a roost.
  - To count birds that would otherwise be difficult to detect using other methods – usually birds of prey – over a set area.
- **Secondary:**

  Other aspects of breeding success or behaviour such as territory number or number of nests.

9.8.2. Geographical scale

Various. Roost counts or counts of raptors can be applied at individual sites, for example for comparison with other sites, or applied at large scales for regional monitoring.

9.8.3. Field protocol

Roost counts: Observers adopt a location that affords a clear view of birds as they move in or out of a roost, or, in the case of counting flocks of sedentary birds at high tide estuarine roosts, a location that enables a clear view of the area. If too large, or if your site is split up into several individual roosting hotspots (e.g. a gull roost on a complex of gravel pits) then multiple observers are needed. Roost counts make use of the movement of birds as they fly into roost, so observers look to count birds in flight before they settle and where counting a flock becomes too difficult.

Raptor monitoring: Observers should find a location, usually elevated, overlooking an area. The viewable area from a location is sometimes referred to as a viewshed. If the area of interest cannot be covered by one viewshed, multiple observers maybe needed, with the ability to communicate with each other to avoid double counting of birds if they move between areas.

In both cases, the areas are scanned for the target birds and counts made, taking care not to double count, especially if in a team.

9.8.4. Site visits

Roost counts: Site visits should start a set period before dusk (when birds typically start arriving to roost). For example, to count gulls or corvids (especially Jackdaws and Rooks) flying into a communal roost, recording should start around two hours prior to sunset.

Raptor counts: Morning (from an hour or two after sunrise) or late afternoon is often the best time to observe them, and the ideal conditions are light winds with clear skies. Light conditions including the position of the observer relative to the sun, can influence the ease of counting significantly. The time of year and the number of visits will depend on the species being recorded. For more detailed guidance about when to survey, what to look for and how to avoid disturbance, see the species accounts in *Raptors: A Field Guide for Surveys and Monitoring* which are available via the **Scottish Raptor Monitoring Scheme website**.

9.8.5. Recording method/options

Roost counts: Record the number of birds, their flightlines and – if recording – species using simple tallies. Counts of the number of birds leaving the roost should also be made and the difference used to estimate the number using the site in any given visit.

Due to often declining light conditions during field work, it may be necessary to pool counts into indeterminate species groups, e.g. small gulls and large gulls. At least this way, the total number can still be reported.

Raptors counts: At a minimum, count the number of birds that you see and record their behaviour (soaring, perching). If breeding information is required, then recording additional behavioural observations will be necessary – display, calling, food passes, mating or carrying prey or nesting material. From these, and potentially with the aid of maps, the aim is to produce estimates of the number of territories.

9.8.6. Pre-existing schemes and data use

Roost counts: The Winter Gull Survey is a periodic survey of gulls in winter, which uses a stratification with 'key sites' (e.g. large waterbodies) being more intensively sampled, alongside 'sample sites' to improve estimates of gulls using roosts in the wider landscape. Raptor roost counts are used to monitor some protected sites, where raptor roosts may be a designating feature.

Raptor counts: Wales and Scotland both have their own raptor monitoring schemes, both with varying levels of participation depending on skills and interests:

- **Scottish Raptor Monitoring Scheme**
- **Cudyll Cymru – Welsh Raptor Monitoring**

9.8.7. Limitations

Defining what is and is not in your search area, especially when adopting an elevated position is not always straightforward. Counting of stationary flocks, especially when very dense, can be difficult, though well known techniques and practice can reduce errors.

9.9. Demographic studies

9.9.1. Bird ringing

Marking and ringing birds is used in a number of study types, ranging from estimating population size, defining migration routes, productivity and estimating survival rates. Ringing in Britain and Ireland is organised by BTO. The Bird Ringing Scheme has many sub-schemes, each of which is designed to answer specific questions. The two primary schemes are:

- **BTO/JNCC Constant Effort Sites (CES)** – volunteers operate the same nets at the same location over the same period at regular intervals during the breeding season. The data contribute information on the abundance of adults and juveniles, productivity and adult survival rates for 24 species of songbird.
- **BTO/JNCC Retrapping Adults for Survival (RAS)** – ringers aim to catch or re-sight at least 50 adult birds of a single species in a study area during the breeding season. Proposals for species and sites are welcome, but potential participants are encouraged towards a set of target species.

Ringing requires substantial training, and a licencing system operates around it. Local projects that can and wish to incorporate ringing have the added benefit of it being a really valuable engagement opportunity. Ringing presents some of the only opportunities for people to see birds up close and in the hand. Local project coordinators may wish to make use of that opportunity.

9.9.2. Nest recording

A typical local project might involve the installation of nest boxes at a site. As well as conducting monitoring on the uptake of nesting sites and estimating population of the target species within the site more generally using approaches mentioned in other parts of this guide, records of each nesting attempt themselves may be made. These will contribute valuable data about the breeding success of your target species by following the fate of individual nesting attempts in your study area.

The **BTO/JNCC Nest Record Scheme** webpages provides all the necessary information on how to register and take part in the scheme, including:

- *NRS Handbook*
- NRS mentoring
- Code of conduct
- Submission of data: Demography Online (DemOn)

In brief, nest recorders are asked to make repeated visits to a nest to record the number of eggs and/or young, the status of the nest contents. The frequency of visits will depend on the species, but for passerines it is advised to visit ever four to five days.

Whereas NRS is geared towards the recording of a large number of nests across multiple locations, its sister survey, **Nesting Neighbours**, which is targeted at those wishing to record a small number of nests in a park or garden. Whilst the code of conduct and overall methods used are the same as for NRS, slightly less detailed information on each visit is needed, and as such will be an ideal option for certain projects.

9.10. Building capacity for monitoring – surveys for engagement

In some cases, the primary aim of your project may be to engage a wider audience, to get local people interested in wildlife in general and/or to set them on a journey where they can learn more about birds and how to identify them, with a view to them becoming involved in other projects in the future. A number of schemes exist either specifically or partly developed to enhance engagement for a wider audience who can be at any skill level. Some are available for a short period (e.g. a single weekend each year), but where the sole purpose is to engage a wider audience; the data is not used for formal monitoring purposes. Surveys which are used partly as a means of engaging with the wider public, but which still produces valuable data on the health of garden wildlife are the BTO Garden BirdWatch and the RSPB's Bird Garden Birdwatch (BGBW).

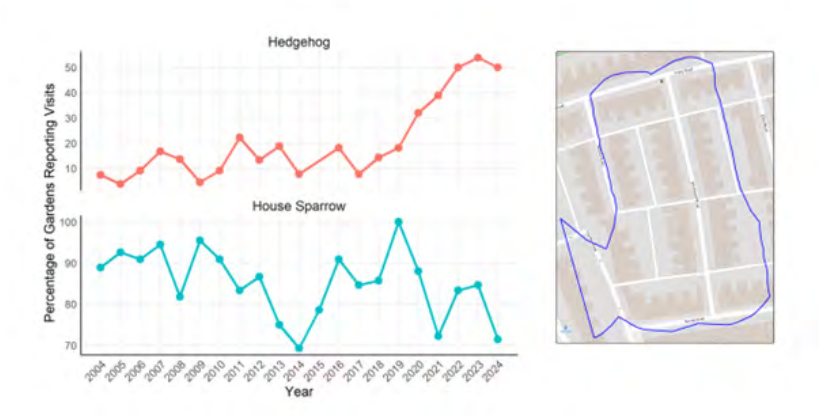
9.10.1. BTO Garden BirdWatch (GBW)

GBW is a long-term citizen science project run by BTO, which monitors the populations of birds and other wildlife in gardens across the UK. The main aims of the project are to inform conservation action by tracking long-term trends in garden wildlife, studying the effects of environmental changes such as urbanisation and disease, and identifying species in decline.

Volunteers submit weekly counts of birds and (optionally) other wildlife in their gardens. Volunteers can spend as much or little time as they like recording for GBW but are asked to spend a consistent amount of time and over a consistent area making weekly lists, so that they are comparable with each other. GBW is especially suitable for engagement in local community projects as:

- Recording is year-round, so provides a regular source of information on birds in a given area throughout the seasons, which in turn is useful for providing regular feedback to volunteers.
- If a number of volunteers can join the scheme from the same place (e.g. a village), records can be requested using a postcode or other geography and results returned for all participants.
- As well as providing regional level results on reporting rate, long-term trends and submission information at a regional level, if a sufficient number of households (gardens) register for the survey and regularly submit data (a minimum of 30 is recommended), it is possible to calculate more localised trends and patterns of garden use by birds within a smaller area (e.g. Figure 10).
- While volunteers are ideally expected to upload 52 weeks' worth of data, the minimum number of submissions required to record the least common garden bird species (that is not seasonal) is 38 weeks. This is because the data needs to cover enough of the year to accurately reflect the presence of species that may not be observed as frequently, ensuring reliable results for less common birds.

Figure 10: Change in garden use patterns of House Sparrow and Hedgehog across two decades (2004–2024) from the postcode shown on the right. The plot shows the percentage of gardens reporting visits by these species over time, with separate facets for each species.



Web resources:

BTO GBW Survey: **www.bto.org/gbw**

RSPB BGBW: **www.rspb.org.uk/whats-happening/big-garden-birdwatch/info**

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12. Codes & symbols used during data collection

A number of useful resources, including lists of BTO species codes, breeding codes and behaviour symbologies are available at: **www.bto.org/survey-essentials**

13. Glossary

Acoustic monitoring – The use of sound recording equipment to detect and study bird species. This guide does not cover this approach.

Aggregated data – Combined data from multiple sources or studies to provide broader insights or trends.

Atlas surveys – Bird surveys that systematically record species distributions within defined geographic grids, often published as bird atlases.

Auto-identification – A process (often provided to the user in as a mobile applications or devices) that use artificial intelligence to identify bird sounds. More generally can be applied to the identification of many taxonomic groups using sound and/or image recognition.

Before–after study – A study design comparing conditions before and after an intervention to assess its impact.

Before–aftercControl–intervention (BACI) study – A study design incorporating both before-and-after comparisons and control sites to provide a stronger assessment of intervention effects.

Bias – A systematic error in data collection that leads to incorrect conclusions, often caused by non-random sampling or observer bias.

Biological record – The fundamental data collected in biological surveys, typically including what species was observed, when and where it was observed, and who recorded it.

Citizen science – Scientific research conducted with the help of non-professional volunteers, often contributing to large-scale data collection projects.

Conservation interventions – Actions taken to protect, restore, or manage wildlife and habitats to improve species survival and biodiversity.

Control–intervention study – A study design comparing areas with and without an intervention to assess its effects.

Control site – A site used in monitoring studies that does not undergo the intervention being tested, allowing researchers to compare results against an unaffected area.

Counterfactual data – Data collected from a separate, non-intervention site or source, used to compare and determine the effects of an intervention.

Detectability – The ability of something to be detected by an observer (human or machine). This varies according to a number of factors, including the species, time of day, time of year and distance from the observer. Distance sampling is a field method that takes account of the last of these.

Digital data capture (DDC) – the collection of data via a digital device (phone or tablet) for either immediate upload to a central database, or when connectivity allows. The process of transferring bird observations to a database is nearly immediate, compared with traditional pencil/paper methods, which need later digitisation.

Diurnal – Active during the daytime, as opposed to nocturnal species that are active at night.

Distance sampling – Birds vary in how detectable they are, with one of the main factors being the distance from the observer (birds closer are more detectable than those far away), which in turn may bias estimates of numbers. By recording the distance between an observer's route or location, and a bird obbservation, this difference in detectability can be taken account of to make better estimates.

Distribution –The geographical area in which a species is found.

Effort (sampling) – A measure of the how much surveying has taken place. This might be measured in time (with a start and end point) or using a fixed route with known length. Knowing effort is important to establish if difference is bird numbers are due to real differences, or because they were observed for longer.

Environmental land management schemes (ELMS) – UK government programs supporting environmentally friendly land use and conservation practices.

Geographical information systems (GIS) – Software used for mapping and analyzing spatial data, commonly used in ecological studies.

Habitat – The natural environment in which a species lives, including the vegetation and physical conditions that support its survival and reproduction.

Habitat classification – A system for categorising types of environments based on vegetation, land use, and other ecological factors. Different classification schemes exist, such as the Crick (1992) classification or the UK Habitat Classification system.

Indicators – Species or ecological factors that provide insight into the health of an environment based on their presence, abundance, or behaviour. Multi-species indicators use several species with shared habitat associations.

Landscape recovery scheme – A component of ELMS focused on large-scale ecological restoration and habitat recovery projects.

Local Nature recovery strategies (LNRS) – Plans designed to enhance and restore biodivensity at local and regional levels in the UK.

Metadata – Additional data recorded alongside biological records, such as weather conditions, and measures of effort (time or distance).

Observer bias – The potential for variation in data due to differences in observer experience, perception, or method of data collection.

Point count – a fixed bird recording location, usually as part of a series of points that are laid out as part of the study. They are different from ‘vantage points’ in that the latter tend to be chosen by volunteers to give good views of an area for specific applications.

Population index – A relative measure of the abundance of a species in an area, used to track changes in numbers over time rather than to count absolute numbers.

Population trends – Patterns in the relative increase or decrease of species numbers over time, often used to assess conservation status.

Protected sites – Special Protection Areas (SPA), Special Areas for Conservation (SAC) and Special Sites of Scientific Interest (SSSI) are the main types of sites in the UK that aim to safeguard species or habitats listed under both EU and UK conservation designations.

Relational database – A system of storing data in tables, but unlike a spreadsheet makes use of multiple tables that join together, meaning that data doesn’t have be unnecessarily repeated (leading to so called ‘redundancy’). Relational databases are managed using specific systems and overall, their use is more robust than simple spreadsheets.

Sampling bias – Errors that occur when some portions of the population are overrepresented or underrepresented in a study, potentially leading to misleading results.

Sampling methods –

- **Random sampling:** A method where survey locations are chosen at random to ensure an unbiased representation of the study area.

- **Stratified sampling:** A sampling method where areas are divided into distinct sub-groups (e.g. different habitats or land management types), and samples are taken randomly within each subgroup to ensure all are represented.
- **Systematic sampling:** A method where sample locations are laid out in a regular pattern, such as a grid.

Site-based monitoring – Bird surveys conducted within a specific local area, such as a nature reserve, park, or farm.

Space-for-time study – A study design that examines different areas to infer changes over time by comparing locations where an intervention has and has not been applied.

Species-specific surveys – Monitoring programs focused on studying particular bird species (e.g. Yellowhammer) rather than whole assemblages (farmland birds).

Territory mapping – A bird survey method used to determine breeding territories of individual birds within a given area by mapping their territorial and breeding behaviour.

Transects – A linear route along which a surveyor walks during bird surveys. Recording may be done whilst on the move or done at specific points along the transect.

Validation (of data) – The process of ensuring that collected data meets required quality and consistency standards, including location accuracy and proper metadata recording.

Vantage point – A bird recording location, usually selected by the observer, to give good views of an area or habitat.

Verification (of data) – The process of confirming the accuracy of biological data, including correct species identification and appropriate counts.

Front cover: Fieldworkers, by Mike Toms / BTO; Back cover, Survey volunteer, by Ben Igglesden / BTO

Bird monitoring at a local scale: a guide for local project coordinators and volunteer birdwatchers

The British Trust for Ornithology (BTO) is a non-governmental, non-campaigning organisation focused on securing the future for birds and nature. BTO uses its science, monitoring and data to inform good environmental decisions and inspire others with the wonder of birds. The heart of BTO encompasses three key areas: Birds, Science, People.
www.bto.org

The Joint Nature Conservation Committee (JNCC) is the only statutory nature advisor to all four countries of the UK. We provide robust scientific evidence and advice to help decision makers turn science into action for nature conservation and recovery. We work across land, sea and air with partners throughout the UK, the UK Overseas Territories, the Crown Dependencies and around the world.
www.jncc.gov.uk

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NCEA | Natural Capital and Ecosystem Assessment

BTO | Birds Science People