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The BTO Barn Owl Monitoring Programme: third year 2002

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EXECUTIVE SUMMARY

1 The Barn Owl is a scarce breeding species that underwent substantial decline in the UK during the 20th century. It has been placed on the Amber List of birds of conservation concern in the UK but it has been poorly covered within the UK's long-running population monitoring schemes. The BTO Barn Owl Monitoring Programme (BOMP) was set up in 2000 with the aim:

> *To monitor Barn Owl populations through standardised recording of nest occupancy rates, breeding performance and survival at a set of Barn Owl nest sites broadly representative of the distribution of the Barn Owl in Britain.*

2 Fieldwork involves repeat visits to registered sites, particularly to paired nest boxes, during the Barn Owl nesting season between April and October, to assess occupancy, gather breeding statistics, and ring adults and chicks. The Wildlife Conservation Partnership (WCP) has undertaken the development of BOMP methodology and has carried out fieldwork since 2000 at a set of core sites, distributed throughout five regions of England and using standardised nest box designs. In 2002, a network of 72 volunteer ornithologists began gathering additional information over a wider geographical area.

3 This is the third report of BOMP, covering the three seasons 2000–2002. Nesting rates are investigated, along with simple breeding statistics, in relation to year, Government Office region, and main habitat type.

4 WCP visited 156 sites in 2000 and, despite Foot and Mouth Disease access restrictions, 170 in 2001. In 2002, 548 sites were visited in total, of which WCP covered 194 and the BOMP network of volunteers 348. This represents *c.* 14% of the UK Barn Owl population. WCP sites are located across the whole of England, although as a consequence of sampling methodology they tend to be concentrated in the southern and eastern regions. BOMP network sites are more broadly scattered across the UK, including several locations in Scotland and Wales.

5 Nesting rates at WCP core sites fell from 85% in 2000 to 65% in 2001 then rose again to 75% in 2002. The majority of this fall was due to an increase in the proportion of non-breeding birds at these sites. Heavy rains and subsequent flooding in the autumn of 2001 may have led to a reduction in the abundance of small mammals over the winter period. This may have caused a reduction in the body condition of some individuals such that they did not attempt to breed during the 2001 season.

6 It was difficult to distinguish the influence of habitat type and region on nesting rates as the two factors are so closely related. Nesting rates generally appeared to be related to the suitability of the habitat for small mammal prey, with sites located in areas of natural grassland displaying the highest nesting rates, arable areas displaying intermediate rates and pastoral/mixed farming and woodland areas displaying the lowest rates of nesting.

7 There were few differences in breeding performance between years, dominant habitat types or regions. However, brood size at ringing was lower in 2001 in the non-core sites monitored by WCP. This is consistent with the likelihood of poorer food

supplies in that year. Overall success (the proportion of eggs producing fledged young) was highest in southern England and in areas of natural grassland.

8 Larders of small mammal prey were not only larger in areas with higher overall success or nesting rates, but were also larger in some areas exhibiting poor breeding success. The significance of larders for indicating environmental conditions requires further research.

9 BOMP sites are also frequently occupied by other species, particularly Stock Dove, Jackdaw and Kestrel. They may provide the opportunity for the standardised monitoring of these species, particularly the Amber-Listed Kestrel, in the future.

10 Work in 2004 will include further trialling of techniques for estimating the proportions of Barn Owl pairs attempting second broods.

1 INTRODUCTION

1.1 History of Barn Owl population surveys in the UK

The Barn Owl *Tyto alba* is one of the world's most widely distributed land birds, being found on all continents except Antarctica. It is a moderately widespread bird throughout the UK, found especially on farmland, although generally absent from upland and heavily urbanised areas and from the far north and northwest of Scotland, including Shetland, Orkney and the Hebrides (Gibbons *et al.* 1993). Its pale plumage, partly diurnal or crepuscular hunting behaviour, and habit of nesting in buildings make it more noticeable than other owls and many people are familiar with it. Where small mammals are perceived as pests, Barn Owls that feed on them may typically be viewed as actively beneficial to man. Where Barn Owls occur, therefore, their presence is relatively widely known and appreciated.

Throughout the 18th and early 19th centuries, it was regarded as our most common species of owl (Latham 1781, Rivière 1830, Macgillivray 1840, Holloway 1996). Since about the middle of the 19th century, however, factors such as increasing persecution and collection of specimens for taxidermy are said to have contributed to a population decline. This perceived decline prompted one of the earliest national surveys of the breeding population of any wild bird (Blaker 1933, 1934). Blaker's evidence, collected through a request for information he circulated throughout England & Wales, supported a population estimate of about 12,000 breeding pairs in these countries in 1932, and indicated that a substantial decline had indeed occurred over the previous 30–40 years. The decline appears to have continued through the 1950s and 1960s (Prestt 1965, Parslow 1973) and was suggested to have stemmed from the increased use of toxic chemicals (especially organochlorine seed dressings), loss of hunting habitat, increased disturbance and the hard winters of 1946/47 and 1962/63 (Dobinson & Richards 1964). During 1968–72, the population was estimated to number between 4,500 and 9,000 pairs (Sharrock 1976), but these figures are based on only partly quantified observations.

During 1982–85, the Hawk and Owl Trust (known then as the Hawk Trust) undertook a four-year census of Barn Owls in Britain, Ireland and the Channel Islands. They estimated the size of the breeding population at 3,778 pairs in England & Wales, 640 pairs in Scotland, and 4,400 pairs in Britain as a whole (Shawyer 1987). These figures represent a decline of about 70% in England & Wales since Blaker's 1932 survey, although differences in methods between the surveys mean that the precision of this figure is unknown (Toms *et al.* 2001).

The most recent nationwide survey has been Project Barn Owl, undertaken jointly by BTO and Hawk and Owl Trust in the UK, Isle of Man and Channel Islands during 1995–97 (Toms 1997, Toms *et al.* 2000, 2001). This project established a random sample of survey sites, which were 2x2-km tetrads of the national grid, and devised new survey methods that could be repeated at intervals in the future to produce directly comparable results. This survey produced a population estimate of about 4,000 pairs for the whole area of study (Toms *et al.* 2001), a slightly lower figure than produced by the Hawk Trust survey for Britain alone. Because the confidence interval around the Project Barn Owl figure included the previous Hawk Trust estimate and as the methodologies were not identical, it is not clear whether any further decline had occurred between these two surveys.

The difficulty of assessing trends between annual surveys has been emphasised by the finding that, in southwest Scotland, numbers of breeding pairs of Barn Owls can more than double across a single three- to four-year cycle of vole abundance (Taylor *et al.* 1988).

1.2 Conservation status of the Barn Owl

Although the UK Barn Owl population may have declined slightly or remained essentially stable in recent decades, there is ample evidence that a substantial decline took place during the 20th century as a whole. Less comprehensive data from other parts of the world range suggest that similar declines have been widespread across Europe and elsewhere (Colvin 1985, Shawyer 1987, Tucker & Heath 1994). The Barn Owl has qualified under international criteria, through its 'moderate decline' in Europe as a whole, as a species of European conservation concern (SPEC category 3; Tucker & Heath 1994).

In the UK, Barn Owl was included in Schedule 1 of the Wildlife and Countryside Act 1981, affording it protection by special penalties at all times. More recently, it has been included on the Amber List of Birds of Conservation Concern (Gregory *et al.* 2002) due both to its decline in breeding range of between 25-49% and because it is listed as a species with unfavourable conservation status in Europe. A UK conservation action plan for the species has been developed (RSPB Species Action Plan 0735), and a number of local Biodiversity Action Plans under Local Agenda 21 of the International Convention on Biodiversity.

Much conservation work has focused on the Barn Owl in recent years, stimulated in many cases by the work of the Hawk and Owl Trust, Barn Owl Trust and other specialist groups in fostering more widespread recognition of the species' conservation importance. Attention has been directed towards the creation and management of areas of suitable hunting habitat, increasing the availability of prey, providing habitat corridors to promote dispersal, coupled with the provision of nest boxes in areas where a shortage of nest and roost sites could be a limiting factor. Over the same period, attention has also been focused on other factors that may have played a part in the Barn Owl's decline, in particular 'second-generation' rodenticides and mortality due to collisions with road traffic (Bourquin 1983, Massemin & Zorn 1998, Shawyer & Dixon 1999). The second-generation rodenticides difenacoum, bromadiolone, brodifacoum and flocoumafen are used to control Brown Rats *Rattus norvegicus* in and around agricultural premises, particularly in areas where resistance to warfarin is high (Shawyer 1985, Harrison 1990). Barn Owls are potentially vulnerable to secondary poisoning from ingesting poisoned rodents. Chemical residue monitoring by the Centre for Ecology and Hydrology has found that a small proportion of Barn Owl corpses contain potentially lethal doses of rodenticide (Newton *et al.* 1991; Newton & Wyllie 1992).

Attempts to increase the population have, in the past, included large-scale programmes for releasing captive-bred birds (e.g. Ramsden & Ramsden 1989, Warburton 1992). Concerns that some releases may have been against the birds' and the species' best interests led in 1992 to Barn Owl being added to the list, in Schedule 9 of the Wildlife and Countryside Act, of species of animals that may not be released or allowed to escape into the wild, and to the Government setting up the 'Captive Barn Owl Release Scheme', to prevent indiscriminate releases by inappropriate methods. This scheme, which had prompted a very low take-up rate and was felt by the Government to have shown limited benefits, was disbanded in 2002.

The lack of an ongoing, annual monitoring scheme for Barn Owl has hampered the assessment of national population trends and, consequently, of the success or otherwise of

local conservation measures. Furthermore, concerns about the use of newer types of rodenticide require the ability to detect, at the earliest opportunity, any widespread detrimental impact of poisoning through annual monitoring of Barn Owl populations, and of their breeding performance and survival. In addition, a carefully designed monitoring programme can help to identify whether any changes in abundance are driven by changes in breeding performance or survival, and can link these demographic processes to likely causal factors in the environment, such as habitat change.

1.3 Aims and work plan of the Barn Owl Monitoring Programme

The Barn Owl Monitoring Programme (BOMP) was set up in 2000 to address the needs of conservationists to be better informed about this important species. BOMP's overall aim and strategy are:

> *To monitor Barn Owl populations – through standardised recording of nesting rates, breeding performance and survival at a set of Barn Owl nest sites broadly representative of the distribution of the Barn Owl in Britain.*

The key activities of BOMP are as follows:

- *To establish a set of Barn Owl sites, which provide a broadly representative coverage of the British Barn Owl population, for annual monitoring.*
- *To assess changes in numbers attempting to breed, using the rates of site occupancy.*
- *To monitor breeding productivity of Barn Owls, using standardised nest recording.*
- *To monitor survival rates and dispersal of Barn Owls, through the ringing of both young birds and adults.*
- *To examine breeding performance and site occupancy in relation to environmental variables, in particular the type of habitat surrounding each site.*
- *To provide an annual report of each year's results and to provide analyses and interpretation to assist conservation action and research.*

Fieldwork is being undertaken by a combination of professionals and volunteers. The Wildlife Conservation Partnership (WCP) is required to undertake fieldwork to monitor a set of core sites in England and to undertake methodological development. BOMP coverage has been greatly swelled in 2002 by opening the scheme to volunteers and developing BOMP network sites. Even if unable to contribute formally to BOMP, fieldworkers have been encouraged to submit extra records to the national Barn Owl databases held by BTO's Nest Record and Ringing Schemes.

The outline work programme for the first four years of BOMP is as follows:

2000 breeding season: Funding for the programme was confirmed in June, when fieldwork by WCP began. At this time, most nests already contained small young. This reduced the opportunities to catch adult birds (especially males) for ringing, which is

best undertaken during the period of egg laying and incubation. WCP defined a core set of sites for annual monitoring, piloted recording methods at these sites and gathered preliminary data.

2001 breeding season: A letter outlining the objectives of the Barn Owl Monitoring Programme was sent to more than 200 active Barn Owl ringers and nest recorders in early March 2001. Development of the BOMP network continued, and a few volunteers piloted recording methods. Foot and Mouth Disease (FMD) caused a major problem from late February onwards. Volunteers were unable to gain full access to many sites, and 20% of the WCP core sites could not be visited. Since access restrictions in some areas persisted until the end of the year, plans for recording late broods in October could not be implemented.

2002 & 2003 breeding seasons: Full monitoring programme by WCP and the BOMP network, with further developments as necessary; reporting of results in *BTO News* and other publications.

Throughout the project, opportunities have been taken to publicise BOMP, to recruit more volunteers, to provide feedback, and to raise public awareness about the population status of the Barn Owl. We produce an annual newsletter that acts as a forum for the exchange of ideas and information between volunteers, in addition to providing feedback. The BTO works with other organisations concerned with the conservation of Barn Owls, thereby ensuring that the monitoring results provide effective guidance for conservation action.

This report presents a summary of results obtained during the first three seasons of BOMP. Annual reports for 2000 (Crick *et al.* 2001) and 2001 (Beaven *et al.* 2002) are also available.

2 METHODS

2.1 Overall strategy of BOMP

Barn Owl biology and behaviour means that the species is most easily surveyed by the monitoring of potential nest sites during the breeding season (Bunn *et al.* 1982, Bibby *et al.* 1992). Absolute numbers of Barn Owls are difficult to assess (Toms *et* al. 2001) and so the rates of site occupancy are a useful guide to overall population levels of breeding Barn Owls. Nest visits allow the recording of information concerning productivity and also provide good opportunities to trap and ring adult and young birds, thereby enabling the study of survival rates and dispersal.

A key feature of BOMP has therefore been the establishment of a set of nesting sites at which occupancy and breeding parameters are monitored every year. Most of the sites have been selected and surveyed by BTO volunteers, some of whom are ringers and are licensed to handle and ring young and adult Barn Owls at the nest. Volunteers were asked to guarantee to monitor at least one Barn Owl nest site for a minimum of three consecutive years. A further substantial sample of sites in five English regions is monitored by WCP. Additional studies carried out at WCP sites aid the methodological development of the overall scheme. Many BOMP sites are within central strongholds of the Barn Owl's range, and therefore in the areas that are most important to the species' viability, while others are in more peripheral areas, where the amplitude of population changes is likely to be greater.

Nesting rates provide a minimum estimate of Barn Owl abundance in a specified area, as they only include those individuals attempting to breed in monitored sites and do not record the presence of unpaired individuals, pairs not attempting to breed, or any pairs breeding in unmonitored nest sites.

BOMP's collection of detailed information concerning breeding performance and survival can be complemented by that gathered nationally by the BTO Nest Record and Ringing Schemes. These schemes, unlike BOMP, do not impose any requirement on volunteers for consistent recording; thus the potential exists for changes in recording effort and methods to bias results, as the set of sites monitored by volunteers changes over time. While the Nest Record Scheme is able to provide detailed information concerning parameters such as clutch size and changes in the probability of nest failure throughout the nesting cycle, BOMP provides information concerning failure to attempt breeding, partial losses of broods, brood sizes at fledging and double brooding, as well as more accurate measures of mean laying dates.

All BOMP participants, and other BTO volunteers collecting similar data, need a valid Schedule 1 Licence before approaching any nest site.

It is important to note that Barn Owls tend not to be easily disturbed by careful fieldwork (Percival 1990, Taylor 1991). Several long-term studies of the breeding biology of Barn Owls indicate that monitoring active nest sites is unlikely to bring about desertion (Lenton 1984, Wilson *et al.* 1987, de Bruijn 1994, Taylor 1994). Percival (1990) found from Nest Record Scheme data that nests visited only during the late chick stage did not fledge significantly more chicks than others that had also been visited earlier in the breeding period. Taylor (1991) examined the effect of nest inspections and radio tagging on breeding success

of Barn Owls in southwest Scotland. He found that the various measures of productivity did not differ significantly between those nests only visited at the late chick stage and those that received multiple visits. Taylor also noted that site fidelity was high, with only 0.9% of males and 5.6% of females changing nest sites between consecutive breeding seasons. We are confident, therefore, that nest site inspections will not compromise the welfare of Barn Owls, nor the integrity of the data gathered, provided that they are carried out following the protocols described in BOMP's Barn Owl Fieldwork Guidance Notes. These guidelines, which have been given to all BOMP participants, build upon those in the *Nest Record Scheme Handbook,* which themselves have been followed successfully for many years by nest recorders (Crick *et al.* 1999), and also draw upon the field experience of WCP. The guidelines appeared as an Appendix in last year's annual report (Beaven *et al.* 2002).

2.2 Study sites

Each BOMP study site is an actual or potential nest site for a single pair of Barn Owls. Where two or more sites are in close proximity, and likely to be used by the same pair of owls, they are registered separately but their linkage, or pairing, is also recorded. Barn Owl nest boxes are often positioned in pairs, and in some instances paired boxes are occupied simultaneously by the same pair of owls, with one containing old young from the first brood and the other eggs from a second brood.

As there is a relatively high turnover of 'natural' sites, due for example to barn conversions, the shifting location of bale-stacks and waterlogging, and because accurate recording of eggs and young is often difficult where nests are located within deep cavities, observers are encouraged to target nest-box sites. As a result, almost all of the sites that have been registered are nest boxes. The widespread distribution of boxes clearly highlights the extent of the public's interest in Barn Owls (Project Barn Owl estimated that there were some 25,000 boxes in the UK; Toms *et al.* 2000), and their occupation indicates the benefit that conservation measures have had for the species. Although some individuals who erect nestboxes generally inspect them too, BOMP provides a framework for collating such observations, ensuring that the data are recorded to a recognised standard and maximising the benefit derived.

Observers register their sites by sending details of their location to BTO HQ. For nest boxes, information is recorded on floor area, the positioning of the entrance hole (at top or bottom of box), and how the box is sited (for example mounted on a pole, in a barn, or in a tree). Grid references are held in confidence by the BTO in the light of the species' protection under Schedule 1 of the Wildlife and Countryside Act 1981.

Prior to the 2000 pilot survey, 125 sites were randomly selected by WCP to be visited by them every year. These 'core' sites were chosen on the criteria outlined in the 2000 BOMP Report (Crick *et al.* 2001). WCP sites comprise two nest-box designs, the proportions of which are identical in four of the five study regions. Boxes in the fifth region, the southwest, are a hybrid of the two designs, with the characteristics of pole-boxes but mounted on trees. WCP also monitors additional 'extra' sites that are to be included in the programme in as many years as possible.

Because of the regional nature of WCP activities, and because most BTO volunteers have registered several sites within their home areas, there is substantial geographical clumping of

sites. Although BOMP is intended to be a national programme within the UK, no sites have yet been registered in Northern Ireland.

BOMP's concentration of effort into nest-box sites should not affect the analysis of differences between years, regions or habitats, although breeding performance may be somewhat enhanced compared to natural sites. Nesting in boxes may improve Barn Owl breeding success, as the nesting environment has been specially designed for this purpose. Nest recorders may remove old nest debris from boxes at the end of the breeding season, potentially reducing parasite loads in the box. However, to counter these positive effects, nest boxes may be more obvious to predators and may in some circumstances provide less shelter from the elements in some circumstances.

2.3 Fieldwork methods

The volunteer-based component of the Barn Owl Monitoring Programme is carried out at two levels of commitment, described to potential contributors as Option 1 and Option 2. Full details of these are given in the Guidance Notes (Appendix 1 of Beaven *et al.* 2002).

At the first level, key information can be gathered with minimal disturbance to Barn Owls. Option 1 involves checking the registered nest sites at least twice, and preferably more regularly, for signs of occupancy, assessing fledging success, and checking for signs of re-nesting and second broods (see Table 2.1).

- *Site occupancy*: A visit to the site in late April or early May usually reveals whether the site is occupied by Barn Owls (or has been during the current calendar year). A series of brief monthly visits from April to October is ideal. Evidence of usage, including pellet remains, moulted feathers and prey items is recorded, as is the identity and reproductive status of any other species occupying the box.
- *Second broods*: These are important in determining the overall productivity of a pair. Instances of double brooding can be identified more reliably where nest boxes are placed in closely adjacent pairs, as second clutches are often laid at different sites to the first.
- *Habitat/land-use surrounding site*: The habitat surrounding the site is recorded using the standard BTO habitat codes (Crick 1992), which incorporate information concerning broad habitat types as well as more detailed information concerning crop types and livestock. 'Micro-habitat' features near the nest (for example ditch banks within a landscape of large arable fields) are potentially the most important factors in terms of attracting Barn Owls to breed at many sites, and are also recorded. Staff at BTO HQ have access to additional information concerning land-use at a wider scale, such as the Centre for Ecology & Hydrology's satellite-derived Land Cover data (Haines-Young *et al.* 2000).

The second level of monitoring, demanding greater experience and commitment, involves visiting nests to record additional information about the nest contents. Nest recorders choosing Option 2 are invited to record clutch size, brood size, age of young, losses of young, the presence of other species nesting at the site, and details of species, number and weight of any prey animals stored there. The following are to be recorded where possible:

- *Clutch size*: the number of eggs present – recorded during a visit in late April or early May. For the most part, second broods are detected on the visits made in July or

August, when the female is sitting on eggs in an adjacent (paired) nest box while the male is still feeding young from the first brood (as well as his mate).

- *Hatching success*: counts of unhatched eggs or eggshells.
- *Brood size*: the number of young present, preferably at early and late nestling stages.
- *Age of young*: as judged from the development of down, or estimated from feather length and wing length.
- *Losses of young*: any dead or missing young are noted.
- *Prey stored at nest*: presence, species composition, number (and, if possible, weight) of prey stored at nests, to provide an indication of food availability.
- *Dates of laying, hatching and fledging*: these are recorded when visits coincide with these events, but hatching, and hence laying dates, can also be deduced from the age of the nestlings.
- *Fledging success*: The number of young fledged from a site. This must include zeros (total failures) to give an accurate indication of the breeding performance of Barn Owls each year. In practice, this is likely to be measured as the number of young in the nest at 5-8 weeks old, at ringing age, because most chick losses have occurred by this time. A late visit to the nest site is useful to record the presence of any remains or rings of chicks that died prior to fledging. The fledging success of any second broods is assessed through a final site visit in October.

Under Option 2, suitably licensed ringers are encouraged to ring the adults and young, record chick measurements and, for adults, note their age, sex, and state of brood patch and moult.

- *Ringing young*: this is important for measuring survival rates and dispersal, when breeding adults are recaptured in subsequent years and when dead birds are found and reported under the BTO Ringing Scheme; 10-15% of ringed Barn Owls are subsequently reported to the BTO's Ringing Office.
- *Measurements of young*: on each visit, ringers are asked to measure wing length (maximum chord) and weight of chicks. Nestling age can be estimated by taking the length of the unfurled section of the 7th primary feather, or its pin, and consulting one of two separate (pin and feather) growth curves (Shawyer 1998). In addition, the degree of speckling on the underside of the body and wings can be used to estimate a nestling's sex. Chick weight may provide a useful measure of condition; the value of this technique is being assessed.
- *Measurement of dead chicks (length of 7th primary)*: this can help estimate the age at which any dead chicks died.
- *Ringing adults*: only ringers who have experience of catching birds at a nest site are permitted to ring adults and take biometric measurements. Guidelines have been provided as part of the fieldwork Guidance Notes and we encourage the sharing of information between ringers. Ringing of adult birds is necessary for the robust estimation of survival rates, and allows assessments of dispersal and movements by breeding individuals. Typically fewer than 100 adults are ringed each year, and the ratio of chicks ringed to adults ringed is approximately 12:1. Ringers are therefore urged to catch more adults.
- *Measurements of adults*: the age, sex, moult and brood patch condition of adult birds is recorded using standard techniques.

Table 2.1 Visiting schedule adopted as standard for the BOMP network sites, designed to document the key events in the Barn Owl's breeding cycle.

Visit period	Information sought, ringing activity
Late April to mid May	Site occupancy Count eggs and any chicks just hatched Catch and ring adults Identify moulted feathers
Mid July to early August	Count chicks at 6-8 weeks old Ring chicks Identify whether second broods begun Collect/identify moulted feathers
October	Count second broods at 6-8 weeks old Ring chicks

Work by WCP has been carried out at the full Option 2 level and also involves the development and testing of new methods.

- When combined with egg weight, measurements of length and breadth of eggs can be used to assess egg density, which declines predictably through incubation due to respiration by the developing embryo (Rahn & Ar 1974). A portable electronic pan balance is needed for accurate weighing. Egg measurements may prove useful for determining a relatively precise laying date and can also be used by ringers to assess when to revisit the nest in order to optimise data gathering and to ring the chicks. The period between egg measurement and hatching can be estimated by referring to a standard curve (Percival 1990, Shawyer 1998 and pers. comm.).
- A method of estimating post-ringing chick mortality is being investigated by WCP. This involves visiting a sample of sites six to eight weeks after ringing, and making thorough searches of pellet debris at boxes where young have been ringed for a number of years.
- WCP is assessing whether the presence of shredded pellets and of incubating females in July or August are effective indicators of second breeding attempts.
- The presence of moulted wing feathers from the female between late April and mid July may be an effective indicator that a second brood will not be attempted; this, too, is being investigated.

The standard equation used to derive egg density from egg measurements comes from a study by Hoyt (1979), and is drawn from information for 115 species. This equation is applicable to all species, except a few that have relatively pointed eggs. Percival (1990) used a slightly different equation that was based on a smaller number of species, as reported by Hoyt (1979) and Furness & Furness (1981), and created a curve that relates egg density to hatching date, based on Barn Owl egg measurements. Shawyer (see above) has adapted this further, but these curves need to be validated for use, as part of BOMP, to make sure that a curve specific to Barn Owls is available.

2.4 Data collation and analysis

2.4.1 Data collation

Data were recorded using standardised forms (see Appendix for examples) and the information collected was entered into one of two Microsoft Access databases, one for WCP data and the other for BOMP network sites. A separate database was created for the BOMP network data as the design of the forms differs from those used by WCP. In future years, data from both sources will be input into a single database, a modified form of the current BOMP network database which it is based on, and with thus be compatible with, the Nest Record Scheme database.

2.4.2 Nesting rates

A site was classed as 'Used for nesting' if a breeding attempt had been made, as signified by the presence of one or more eggs or chicks at least one visit made during the season. If a Barn Owl(s) was encountered or if fresh pellets were present, but no eggs or chicks were recorded during the season, the site was classed as 'Used for roosting'.

Barn Owls may start to lay a repeat clutch before the first brood has fledged. At some sites paired boxes were erected with the intention of providing a potential site for repeat nesting attempts. These boxes are usually placed very close together and are thus very unlikely to be used simultaneously by two different pairs. For analytical purposes, the pair of boxes was therefore treated as a single site and if a breeding attempt was initiated in either box then the site was classed as 'Used for nesting'. However, in a few cases two pairs did nest in paired boxes. If this occurred during any season, the paired boxes are treated as two separate sites in all years as there was the potential for simultaneous breeding.

All sites that were not visited during the breeding season, as indicated on the recording forms by lack of visit dates or comments from observers, were removed from the analysis. All WCP core sites are visited during every season. If a form for a WCP core site was not returned, this signified that the site had been visited and that it was not occupied. If a form for a WCP extra site was not received, this signified that a visit had not taken place in that year.

2.4.3 Breeding parameters

In total, 61 of the breeding attempts monitored over the period 2000-02 were identified as second broods. The results of Wilcoxon Signed Rank tests indicated that none of the breeding parameters measured - clutch size (N=12, S=-0.5, P=0.992), brood size at hatching (N=7, S=2.5, P=0.688), brood size at ringing (N=32, S=51.5, P=0.115) - differed significantly between first and second broods. However, as the numbers of second broods in the sample were relatively small it was decided to take a conservative approach and remove these data from analyses of all breeding parameters.

- *Maximum clutch size.* Clutch size was estimated as the maximum number of eggs, whether live or dead, found in a nest over the course of the monitoring visits. Clutch size was not estimated at any nest that had only been visited after hatching, as some egg or chick mortality might have occurred by this stage (infertile or unhatched eggs usually disappear through breakage or trampling into the debris at the bottom of a

nest). In addition, clutch size was not estimated at any nest where the maximum observed brood size exceeded the maximum number of eggs recorded. In the BOMP network data set, uncertain counts, indicated for example by a count of '5+' eggs, were included in the analyses as actual counts, e.g. as '5' eggs. The incidence of such uncertain counts was low.

- *Minimum brood size at hatching.* By the time that the brood is ready to be ringed, some chicks may already have perished. The minimum brood size at hatching was estimated as the maximum number of chicks in the nest during any visits made prior to ringing the offspring. As with clutch sizes, minimum brood sizes at hatching were not back-calculated using the brood size at ringing if no visit had been made between hatching and ringing. Where all eggs were recorded as dead, the brood size was specifically recorded as zero (as opposed to a missing value). In the BOMP network data set, uncertain counts, were treated as for eggs (see above).

- *Brood size at ringing.* Since Barn Owl eggs hatch asynchronously, and brood reduction is not uncommon, the brood size at fledging is often less than the maximum recorded. This parameter is difficult to record because nests have to have been visited when fledging is almost complete and because the chicks are likely to leave the nest over a period of two to four weeks. For the purposes of this report, we use the number of chicks ringed as an estimate of brood size at fledging. This estimate is likely to be fairly accurate as post-ringing mortality of nestlings is low. Where all eggs or all young were recorded as dead, the brood size at fledging was specifically recorded as zero (as opposed to a missing value).

- *Breeding success.* BOMP data are not appropriate for the calculation of daily failure rates using Mayfield calculations (Mayfield 1961, 1975), as visits made to the nests are too infrequent. Estimates of hatching success were therefore calculated by dividing the maximum observed brood size by the maximum observed clutch size for each nest. Similarly, fledging success was calculated by dividing the number of chicks ringed by the maximum observed brood size, and an overall measure of egg success was calculated by dividing the number of chicks ringed by the maximum observed clutch size.

2.4.4 Habitat data

Habitat data at WCP core and extra sites are collected using the standard BTO alphanumeric habitat coding system (Crick 1992). WCP sites were allocated to one of three broad habitat classes according to habitat levels one and two (Table 2.2). Habitat categories with small sample sizes were not included in the analyses. Mixed farming and pastoral sites were combined due to small sample sizes. Note that habitats C5 and C6 were classified as 'Natural/Semi-natural grassland' in this analysis, rather than as 'Mixed/Pastoral farmland' as they had been in previous analyses (Crick *et al.*2001, Beaven *et al.* 2002).

Habitat data at BOMP network sites is collected in a slightly different format. Volunteers are asked to record the percentage cover of a simplified list of BTO habitat codes (levels one and two) within the 1-km square surrounding their registered site. Sites were then allocated to one of four broad habitat classes according to the most prevalent habitat type in the square (Table 2.3).

Table 2.2 Broad habitat classes for WCP sites

Level 1	Level 2	Original habitat class	Habitat class for analysis
C	1	Chalk downland	Natural or semi-natural grassland
	3	Grass moor mixed with heather	Natural or semi-natural grassland
	5	Other dry grassland	Natural or semi-natural grassland
	6	Water meadow/grazing marsh	Natural or semi-natural grassland
	7	Reed swamp	Removed from analysis (N=1)
E	1	Apparently improved grassland	Pastoral or mixed farmland
	2	Apparently unimproved grass	Pastoral or mixed farmland
	3	Mixed grass/tilled land	Pastoral or mixed farmland
	4	Tilled land	Arable farmland
	6	Other farming	Pastoral or mixed farmland
F	3	Human rural	Removed from analysis (N=11)
G	4	Lined reservoir	Removed from analysis (N=1)
	7	River (>3m wide)	Removed from analysis (N=1)

Table 2.3 Broad habitat classes for BOMP network sites

Level 1	Level 2	Original habitat class	Habitat class for analysis
A	1	Broadleaved woodland	Woodland
	2	Coniferous woodland	Woodland
	3	Mixed broad/conif woodland	Woodland
B	1	Regenerating woodland scrub	Woodland
	4	Young coppice	Woodland
	5	New plantation	Woodland
	6	Clear-felled woodland	Woodland
C	5	Other dry grassland	Natural or semi-natural grassland
	6	Water meadow/grazing marsh	Natural or semi-natural grassland
	9	Saltmarsh	Removed from analysis
F	-	Human sites	Removed from analysis
G	-	Water bodies	Removed from analysis
J	-	Miscellaneous	Removed from analysis

2.4.5 Regional breakdown

For regional analyses of the BOMP dataset, sites were allocated to one of six regions based on the boundaries of UK countries and the nine English Government Office Regions (GORs) (Table 2.4, Figure 2.1).

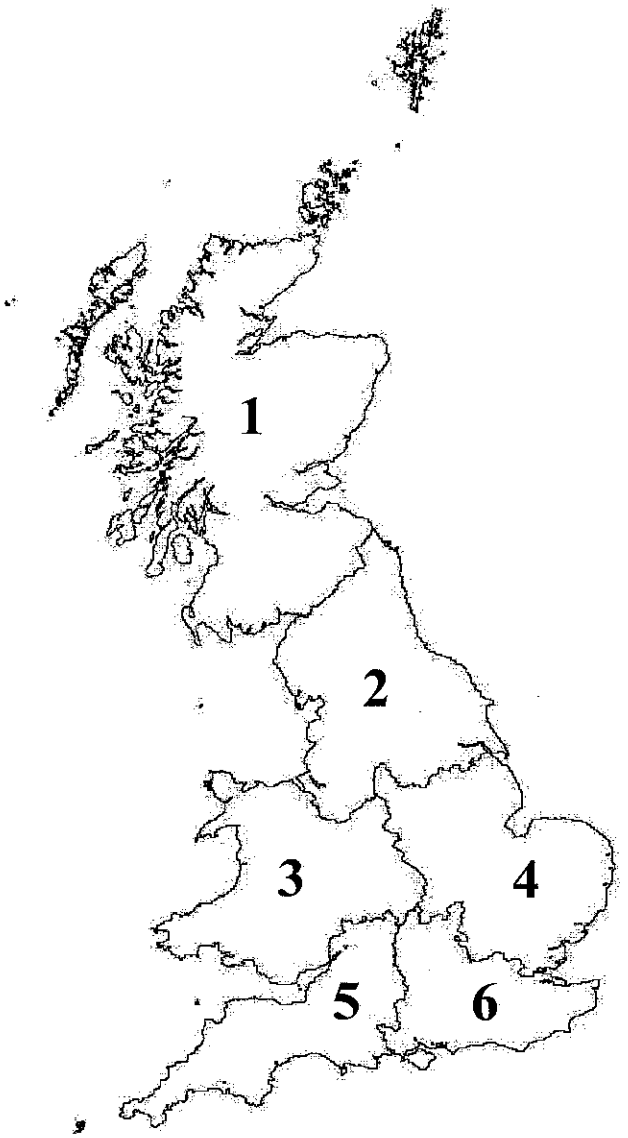

Figure 2.1 Map of regions used in BOMP analysis (see Table 2.3)

Table 2.4 Regions used in analyses of BOMP data

Region	GORs/Countries	English counties
1	Scotland	
2	North West North East Yorkshire & The Humber	Cumbria, Lancashire, Greater Manchester, Merseyside, Cheshire, Northumberland, Durham, Cleveland, Tyne & Wear, North Yorkshire, West Yorkshire, South Yorkshire, Humberside (North Lincolnshire & East Yorkshire)
3	Wales West Midlands	Staffordshire, Shropshire, Warwickshire, West Midlands, Herefordshire, Worcestershire
4	East Midlands East of England	Lincolnshire, Nottinghamshire, Derbyshire, Leicestershire, Rutland, Northamptonshire, Norfolk, Suffolk, Cambridgeshire, Essex, Bedfordshire, Hertfordshire
5	South West	Cornwall, Devon, Somerset, Dorset, Wiltshire, Avon, Gloucestershire
6	South East London	Kent, West Sussex, East Sussex, Surrey, Hampshire, Isle of Wight, Berkshire, Buckinghamshire, Oxfordshire, Greater London

2.4.6 Analytical techniques

Nesting rates, roosting rates and all measures of breeding success were analysed using Generalised Linear Models with binomial errors and a logit link. Clutch and brood sizes were investigated using Generalised Linear Models with Poisson errors and a log link.

Controlling for year, nesting rates varied significantly between WCP core sites, WCP extra sites and BOMP network sites (N=868, χ^2=12.92, P=0.002) with rates highest at core sites and lowest at BOMP network sites. Nesting rates were therefore analysed separately for the three types of site. Roosting rates also differed significantly (N=868, χ^2=22.07, P<0.001), being lowest at BOMP network sites and highest at extra sites, and were therefore also analysed separately.

Hatching success did vary significantly between site types when controlling for year (BOMP network>core>extra: N=71, χ^2=7.56, P=0.023), whilst clutch size displayed a trend towards a significant relationship with type of site (extra>BOMP network>core: N=259, χ^2=5.31, P=0.070). Although no such significant relationship was found for size of brood at ringing (N=455, χ^2=1.25, P=0.536), fledging success (N=125, χ^2=3.73, P=0.155) or overall nesting success (N=205, χ^2=4.86, P=0.088), it was decided that breeding parameters should therefore be analysed separately for each site type. Measures of breeding success were not investigated for WCP extra sites as sample sizes were small (N<10).

3 RESULTS

3.1 BOMP coverage 2000–2002

WCP visited 156 sites in 2000, of which 124 were core sites expected to be visited annually (Table 3.1). With FMD affecting access in 2001, only 109 of the core sites were visited, but the number of extra sites rose considerably and 170 sites were visited in total. In 2002 WCP were able to visit all core sites again, although two had been destroyed since the first year of the project. The number of extra sites covered also rose slightly relative to 2001.

Table 3.1 Coverage of BOMP sites 2000-2002 by observer category.

Sample	2000	2001	2002
WCP core sites	124	109	122
WCP extra sites	32	61	72
BOMP network	–	–	348
Total	156	170	542

Volunteer recorders were encouraged to join the BOMP network from late 2000 onwards. The response was soon very encouraging: by early April 2001, 72 volunteers had already expressed an interest in taking part. Some volunteers made visits during 2001, where access to their sites was available under FMD restrictions. Volunteers visited 348 BOMP network sites in 2002, representing 64% of the BOMP sample in that year.

If the current UK population of Barn Owls is in the region of 4,000 pairs, it can be estimated that BOMP observers (including WCP) recorded about 14% of all breeding attempts in the UK in 2002. The geographical distribution of the 542 sites visited in 2002 is shown in Figure 3.1.

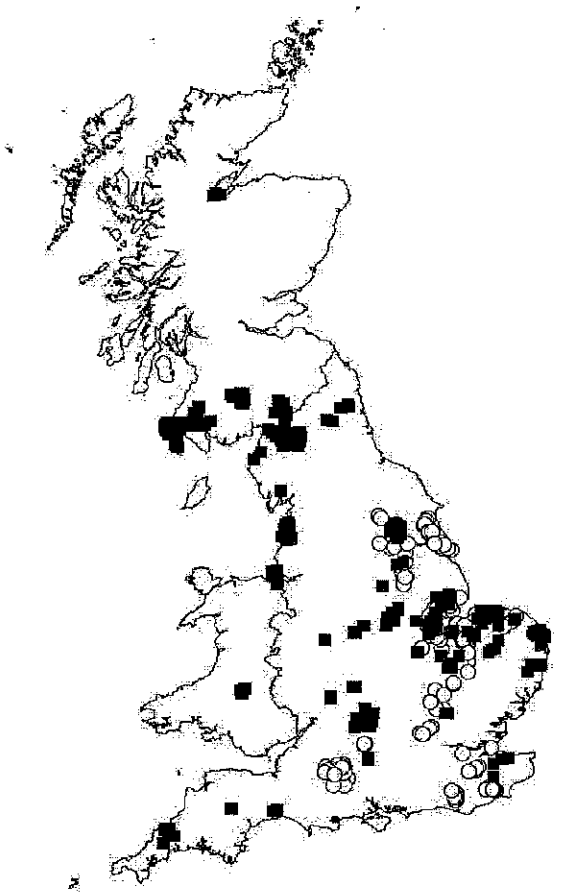

Figure 3.1 **Distribution of BOMP sites monitored in 2002** (black squares = BOMP network sites, white circles = WCP sites).

3.2 Site nesting and roosting rates

3.2.1 Annual variation

Controlling for region and habitat, nesting rates were significantly different between years at both core (N=342, χ^2=13.63, P=0.001) and extra (N=151, χ^2=9.00, P=0.011) WCP sites (sufficient BOMP network data were only available for 2002). For both types of site, nesting rates dropped markedly in 2001, falling from 83% to 65% at core sites and from 81% to 50% at extra sites (Figure 3.2). In 2002, nesting rates increased substantially at core sites, reaching 75%, although nesting rates at extra sites remained low. Extra site data should be interpreted carefully, however, as the number of extra sites covered has increased in each study year.

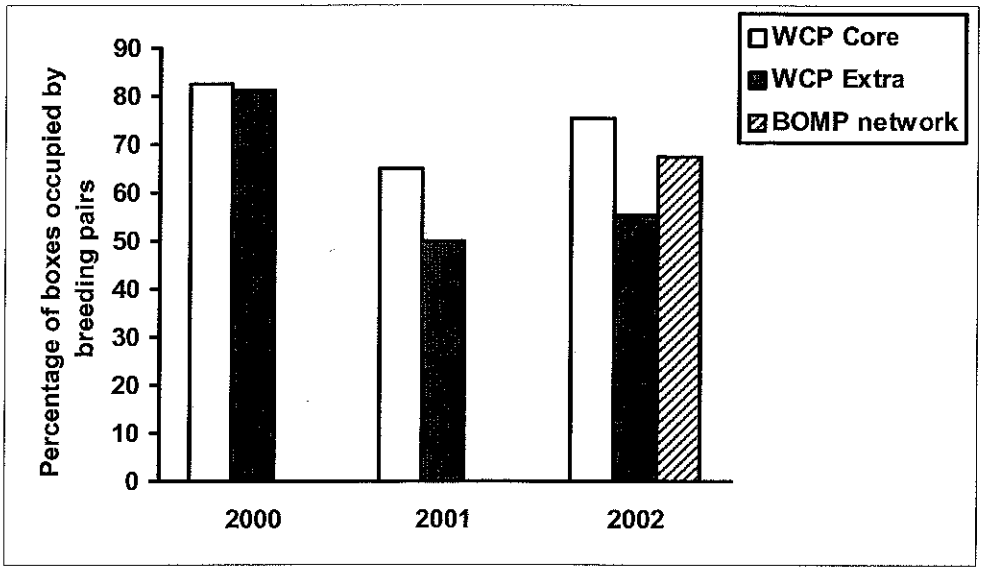

Figure 3.2 Annual variation in nesting rates.

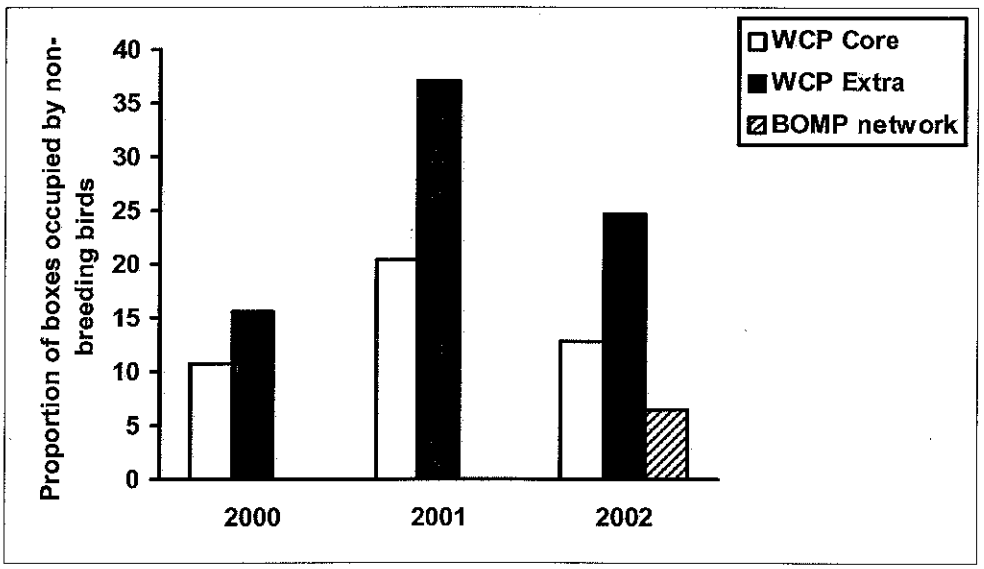

Figure 3.3 Annual variation in roosting rates

Controlling for habitat and region, the proportion of WCP core sites used for roosting (but not for breeding) differed significantly between years (N=342, χ^2=6.25, P=0.044), with the proportion used for roosting highest in 2001 (Figure 3.3). This suggests that the fall in nesting rates in the second year of the project was mainly caused by a reduction in the proportion of pairs attempting to breed. The overall occupation of WCP core sites, whether by breeding or roosting birds, only fell marginally from 93% to 85%. Roosting rates at WCP extra sites displayed a similar pattern, although variation between years was not significant (N=151, χ^2=5.50, P=0.064).

3.2.2 Influence of region and habitat

Region and dominant habitat type were highly significantly correlated at WCP core (chi-square: N=342, χ^2=248.12, P<0.001), extra sites (N=151, χ^2=25.83, P<0.001) and at BOMP network sites (N=291, χ^2=183.17, P<0.001). The majority of WCP sites in the southeast of England were located in areas of pastoral or mixed farmland. Sites in the southwest region were predominantly situated in areas of natural or semi-natural grassland, whilst those in northern and eastern England were divided equally between arable and pastoral/mixed farming habitats. The distribution of BOMP network sites also included Scotland, in which region pastoral and wooded sites dominated, and western England & Wales where pastoral sites were most abundant.

The WCP core site dataset included sites from four regions: northern England, eastern England, southeastern England and southwestern England. Controlling for year and habitat, nesting rates at WCP core sites differed significantly between regions (N=342, χ^2=59.44, P<0.001), with nesting rates highest in southwest England. Controlling for year and region, habitat was not significantly related to nesting rate (N=342, χ^2=3.82, P=0.148). However, when region was removed from the model, nesting rate did display a significant relationship with habitat (N=342, χ^2=32.51, P<0.001), indicating that nesting rates were highest in areas of natural or semi-natural grassland and lowest in mixed farming or pastoral areas (Figure 3.4).

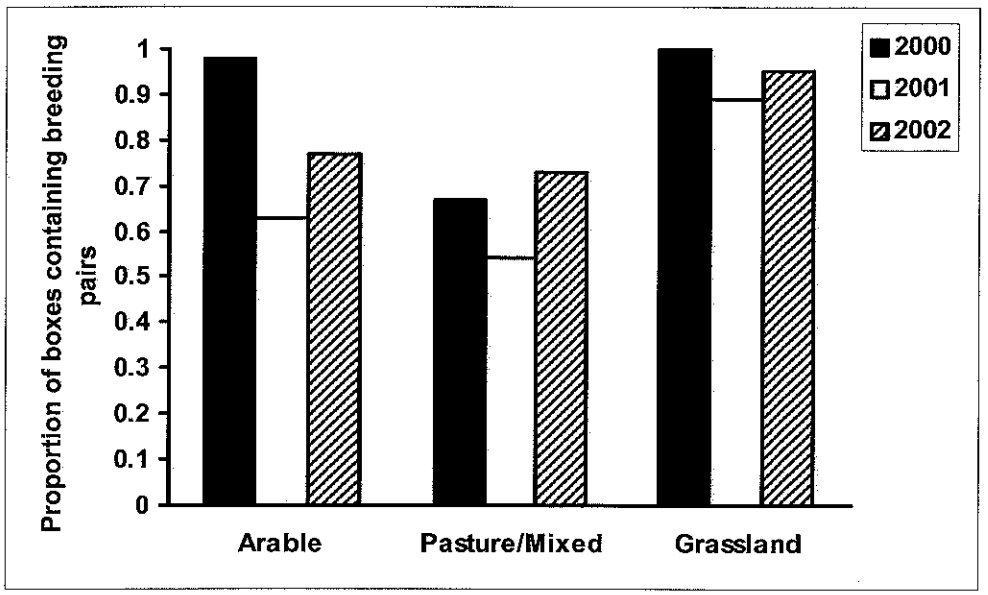

Figure 3.4 Influence of habitat on nesting rates at WCP core sites.

As expected, roosting rates showed the opposite pattern, being significantly lower southwest England when controlling for year and habitat (N=342, χ^2=26.21, P<0.001) and significantly lower in areas of natural or semi-natural grassland only when region was removed from the model (N=342, χ^2=6.83, P=0.033).

The WCP extra site dataset included sites from three regions: northern England, eastern England and southeastern England. Controlling for year and habitat, nesting rates were significantly related to region (N=151, χ^2=6.05, P=0.049), with nesting rates highest in southeastern England and lowest in eastern England. Roosting rates were also significantly related to region (N=151, χ^2=7.49, P=0.024), again displaying the opposite pattern to nesting rates. Nesting rates at extra sites were unrelated to dominant habitat type, even when region had been removed from the model (N=151, χ^2=0.40, P=0.529), and the same was true for roosting rates (N=151, χ^2=2.06, P=0.151). All WCP extra sites were situated on agricultural land, either arable or pastoral/mixed.

The BOMP network dataset contained sites in all six UK regions. Controlling for habitat, nesting rates were significantly related to region (N=291, χ^2=24.12, P<0.001), with nesting rates highest in northern England and lowest in western England & Wales. Nesting rates were also significantly related to dominant habitat type, even when region remained in the model (N=291, χ^2=6.49, P=0.039). The proportion of occupied boxes was highest in pastoral areas (76.8%), slightly lower in arable areas (64.1%) and lowest in woodland areas (46.2%). Roosting rate was not significantly influenced by region (N=291, χ^2=9.59, P=0.088) or by dominant habitat type even when region had been removed from the model (N=291, χ^2=2.33, P=0.311) and was, overall, at the level of 6.5%.

3.3 Breeding parameters

3.3.1 Clutch size

For pairs that produced at least one egg, clutch sizes did not differ significantly between years at WCP sites (Table 3.2).

Table 3.2 The influence of year, region and dominant habitat on clutch size.

		Year		Region		Habitat	
	N	χ^2	P	χ^2	P	χ^2	P
WCP core	137	0.07	0.966	2.20	0.532	0.23	0.891
WCP extra	28	1.77	0.413	2.10	0.351	0.73	0.394
BOMP network	71	-	-	0.65	0.957	0.17	0.920

Furthermore, there was no evidence to suggest that clutch sizes were influenced by region or by dominant habitat type at WCP or at BOMP network sites (Table 3.2). The relationship between clutch size and dominant habitat type remained non-significant even when region was removed from the model for all three types of site (WCP core, N=137, χ^2=0.31, P=0.857; WCP extra, N=28, χ^2=0.34, P=0.560; BOMP network, N=71, χ^2=0.97, P=0.617). Overall, the mean clutch size (± s.e.) at WCP core sites was 4.86 (± 0.10), at WCP extra sites was 5.82 (± 0.38) and at BOMP network sites was 5.21 (± 0.17).

3.3.2 Brood size

For those pairs that produced at least one chick, brood sizes at ringing did not vary significantly between years at WCP core sites, but significant annual variation was detected at WCP extra sites (Table 3.3), where broods were smaller in 2001 (N=13, mean=1.77 chicks per nest) than they were in 2000 (N=14, mean=2.5) or 2002 (N=27, mean=3.15).

Table 3.3 The influence of year, region and dominant habitat on brood size.

		Year		Region		Habitat	
	N	χ^2	*P*	χ^2	*P*	χ^2	*P*
WCP core	189	1.72	0.423	0.33	0.954	1.18	0.556
WCP extra	54	6.16	**0.046**	0.95	0.622	0.00	0.999
BOMP network	167	-	-	11.53	7.45	0.19	0.432

Brood sizes at ringing did not very significantly between regions at WCP or at BOMP network sites. Dominant habitat type was not significantly related to brood size at ringing at WCP or at BOMP network sites (Table 3.3). The relationship between brood size at ringing and dominant habitat type remained non-significant even when region was removed from the model for all three types of site (WCP core, N=189, χ^2=1.25, *P*=0.534; WCP extra, N=54, χ^2=0.12, *P*=0.728; BOMP network, N=167, χ^2=5.28, *P*=0.071). Overall, the mean brood size at ringing (± s.e.) at WCP core sites was 2.95 (± 0.08), at WCP extra sites was 2.65 (± 0.17) and at BOMP network sites was 3.09 (± 0.10).

3.3.3 Hatching success

There was some evidence to suggest that hatching success at WCP core sites varied significantly between years (Table 3.4). However, all five nests for which hatching success data were available in 2000 failed to hatch any chicks. This is obviously not representative of the population as a whole and the significant result is therefore an artefact of the small sample size in this year.

Table 3.4 The influence of year, region and dominant habitat on hatching success.

		Year		Region		Habitat	
	N	χ^2	*P*	χ^2	*P*	χ^2	*P*
WCP core	25	46.95	**<0.001**	-	-	5.36	0.069
BOMP network	33	-	-	1.75	0.781	1.00	0.606

Insufficient data were available to permit analysis regional variation in hatching success at WCP core sites. Hatching success did not vary significantly between regions at BOMP network sites (Table 3.4), nor did hatching success vary significantly between dominant habitat types for WCP or BOMP network sites, even when region was removed from the model (WCP core, see Table 3.4; BOMP network, N=33, χ^2=2.60, P=0.273). Overall, the hatching success at WCP core sites was 45.00% and at BOMP network sites was 61.67%.

3.3.4 Fledging success

There was no evidence to suggest that fledging success varied significantly between years at WCP core sites (Table 3.5). Furthermore, fledging success did not vary significantly between regions at WCP core sites (there were insufficient data to test for a relationship at BOMP network sites), nor was it affected by dominant habitat type at core or BOMP network sites, even when region was removed from the model (WCP core, N=43, χ^2=2.09, P=0.351; BOMP network, see Table 3.5). Overall, the fledging success at WCP core sites was 75.70% and at BOMP network sites was 80.16%.

Table 3.5 The influence of year, region and dominant habitat on fledging success.

		Year		Region		Habitat	
	N	χ^2	P	χ^2	P	χ^2	P
WCP core	43	0.09	0.957	1.46	0.692	2.48	0.289
BOMP network	63	-	-	-	-	1.67	0.433

3.3.5 Overall success

Overall success at WCP core sites did not vary significantly between years (Table 3.6) but was significantly influenced by region, being highest in southeastern and southwestern England, and by dominant habitat type when region was removed from the model (N=105, χ^2=9.10, P=0.011), with success rates greatest in areas of natural grassland. Overall success at WCP core sites was 52.56% and at BOMP network sites was 51.13%.

Table 3.6 The influence of year, region and dominant habitat on overall success.

		Year		Region		Habitat	
	N	χ^2	P	χ^2	P	χ^2	P
WCP core	105	0.82	0.663	8.42	**0.038**	2.79	0.248
BOMP network	68	-	-	10.95	**0.027**	1.40	0.497

There was no evidence for a significant relationship between overall success and habitat at BOMP network sites (Table 3.6), even when region was removed from the model (N=68, χ^2=4.20, P=0.123). However, overall success did vary significantly between regions at BOMP network sites, with success rates lowest in Scotland and Western England & Wales and highest in eastern England and southeastern England.

3.4 Storage of prey items at nest sites

While the female Barn Owl is incubating or brooding young chicks, the male does all of the hunting. The prey that he delivers accumulates at the nest site during the night and is eaten by the female and the nestlings the following day. If a large amount of food has been collected there may be a surplus, which some researchers have suggested could be stored deliberately as an insurance against poor feeding conditions in the future (Taylor 1994).

3.4.1 Presence of larders

Prey 'larders' were found at 99 (20.1%) breeding attempts at WCP sites over the period 2000-2002 and at 54 (18.6%) BOMP network sites during 2002.

Table 3.7 The influence of year, region and dominant habitat on the incidence of stored prey items at nest sites.

		Year		Region		Habitat	
	N	χ^2	P	χ^2	P	χ^2	P
WCP core + extra	493	1.64	0.441	10.11	**0.018**	1.27	0.531
BOMP network	291	-	-	11.24	**0.047**	8.67	**0.013**

There was no evidence to suggest that the incidence of prey storage varied significantly between years at WCP core sites. However, the incidence of prey storage did differ significantly between regions at both types of WCP sites (combined): larders were found at a greater proportion of sites in northern and eastern England. At BOMP network sites, larders were found at a greater proportion of sites in southeastern England and western England & Wales (Table 3.7). The presence of larders was not significantly influenced by dominant habitat type at WCP sites, even when region was removed from the model (N=493, χ^2=2.55, P=0.280). However, habitat did exert a significant influence at BOMP network sites (Table 3.7), with larders found at the greatest proportion of sites in arable areas and at the lowest proportion in pastoral areas.

3.4.2 Size of larders

If sites where no larder was found are removed from the analyses, the number of prey items stored in larders at WCP sites (mean± s.e.= 2.87±0.25) was not influenced by year, region or habitat (even when region was removed from the model - N=99, χ^2=3.30, P=0.192) (Table 3.8). However, region did influence the size of larders at BOMP network sites (mean± s.e.=

3.87±0.54) (Table 3.8), with sites in eastern (5.71±1.26) and northern England (3.64±1.17) containing larger larders than those in Scotland (2.60±0.58), southeastern England (2.67±0.50) and western England & Wales (2.75±1.03). Habitat also had a significant influence, with sites in pastoral areas containing larger larders (mean± s.e.= 4.77±1.43) than sites in arable (3.67±0.61) or woodland areas (3.00±1.05).

The total weight of prey items stored in larders was also measured at WCP sites. Total larder weight was not significantly related to year (N=99, χ^2=4.81, P=0.090), region (N=99, χ^2=1.62, P=0.655) or habitat (N=99, χ^2=1.62, P=0.655).

Table 3.8 The influence of year, region and dominant habitat on the number of prey items stored in larders.

		Year		Region		Habitat	
	N	χ^2	P	χ^2	P	χ^2	P
WCP core + extra	99	0.86	0.649	6.52	0.089	4.35	0.113
BOMP network	54	-	-	36.78	**<0.001**	17.73	**<0.001**

Data from pellet analyses have revealed that the Field Vole is the most nutritionally important species in the Barn Owl diet in mainland Britain (Glue 1974) and Taylor (1994) has demonstrated that Barn Owl productivity is closely related to Field Vole abundance in Scotland.

Table 3.9 The influence of year, region and dominant habitat on the number of Field Voles stored in larders.

		Year		Region		Habitat	
	N	χ^2	P	χ^2	P	χ^2	P
WCP core + extra	99	8.42	**0.015**	6.65	0.084	5.26	0.072
BOMP network	54	-	-	14.78	**0.005**	4.30	0.116

Data from WCP sites (Table 3.9) indicate that the number of Field Voles found in larders was lowest in 2001 and highest in 2002, but region and dominant habitat type (even when region was removed from the model - N=99, χ^2=4.85, P=0.089) did not significantly influence Field Vole numbers. Habitat had no influence on the number of Field Voles stored at BOMP network sites either, even when region was removed from the model (N=54, χ^2=0.40, P=0.820), but region did demonstrate a significant relationship, with a greater number of

Field Voles stored at sites in eastern England and few in Scotland or western England & Wales.

3.5 Other species breeding at BOMP sites

Barn Owls are not the only species that use BOMP sites. Seven other bird species were found to be breeding in BOMP sites, of which Stock Dove, Jackdaw and the amber-listed Kestrel were observed most frequently.

3.5.1 Stock Dove nesting rates

Stock Dove breeding attempts were recorded at 70 (20.6%) WCP sites over the period 2001-02 (data from 2000 were removed from the analysis as they were incomplete) and at 29 (10.0%) BOMP network sites in 2002. Stock Dove nesting rates at WCP sites did not differ significantly between years but did vary between regions, with nesting rates highest in northern England and lowest in southwestern England (Table 3.10 - insufficient data for regional analysis of BOMP network sites). Dominant habitat type was significantly related to Stock Dove nesting rates at both WCP and BOMP network sites (Table 3.10), with nesting rates highest in areas of natural grassland and wooded areas respectively.

Table 3.10 The influence of year, region and dominant habitat on Stock Dove nesting rates.

		Year		Region		Habitat	
	N	χ^2	*P*	χ^2	*P*	χ^2	*P*
WCP core + extra	390	0.06	0.802	18.23	**<0.001**	7.81	**0.020**
BOMP network	291	-	-	-	-	20.75	**<0.001**

3.5.2 Jackdaw nesting rates

Jackdaw breeding attempts were recorded at 60 (17.6%) WCP sites over the period 2001-02 (nesting rates at BOMP network sites were too low to permit analysis). Nesting rates varied significantly between years (N=340, χ^2=7.97, *P*=0.005), with Jackdaws occupying a greater proportion of sites in 2002. Nesting rates were also significantly lower in the southwest than they were in other regions (N=340, χ^2=8.45, *P*=0.038). Habitat type did not have a significant effect on nesting rates (N=340, χ^2=3.92, *P*=0.141) until region was removed from the model (N=340, χ^2=16.45, *P*<0.001), when the results indicated that nesting rates were lowest in areas of natural grassland.

3.5.3 Kestrel nesting rates

Kestrel nesting rates were only investigated at WCP sites, as the occupation rate at BOMP network sites was too low to permit detailed analysis. Kestrel breeding attempts were recorded at 48 (14.1%) WCP sites over the period 2001-02. Nesting rates varied significantly

between years (N=340, χ^2=4.62, P=0.032), with Kestrels occupying a greater proportion of sites in 2002. Nesting rates were also significantly lower in the southwest than they were in other regions (N=340, χ^2=26.08, P<0.001). Habitat type did not have a significant effect on nesting rates (N=340, χ^2=0.22, P=0.897) until region was removed from the model (N=340, χ^2=8.22, P=0.016), when the results indicated that nesting rates were lowest in areas of natural grassland.

4 DISCUSSION

It is clear that BOMP has successfully established a protocol for data collection that will enable trends in population size and in breeding statistics to be calculated and will provide valuable data for the conservation of the species. Fieldwork is inevitably concentrated in areas where Barn Owls are relatively abundant and, by monitoring such populations, BOMP is monitoring a key component of the Barn Owl's national population. Furthermore, the scale of the monitoring effort within BOMP, amounting to *c.* 14% of the national population of Barn Owls and with a good geographical spread, gives the results added importance. Although BOMP concentrates on nestbox sites, these are increasingly used by the species in the UK: 38% of nesting attempts recorded under Project Barn Owl in the mid-1990s were in boxes (Toms *et* al. 2000). While the non-random nature of the sample may influence the resulting trends to some degree, there is every reason to expect that BOMP would detect a major real change in population and would provide information about the demographic mechanisms and environmental factors underlying that change, thus providing valuable pointers to direct effective conservation efforts.

4.1 Nesting rates

Nesting rates at WCP sites dropped sharply in 2001. The proportion of boxes used by breeding Barn Owls increased again in 2002, but nesting rates still fell short of those observed during the 2000 breeding season. The 2001 decline may have been caused by heavy rains and subsequent flooding during the autumn of 2000, leading to a shortage of small mammal prey during the winter period and therefore to increased mortality rates. Alternatively, individuals could have survived the winter but may not have been in good enough condition at the start of the spring to commence breeding. This hypothesis is supported by the significant increase in the number of roosting, i.e. non-breeding, individuals observed at WCP sites in 2001. In addition, the fact that there were significantly fewer Field Voles stored in larders in 2001 suggests that numbers of this nutritionally important species may have been low, although the sample size was relatively small. Anecdotal evidence suggested that 2002 was a very successful year for small mammals, which may help to explain the increase in nesting rates in this year relative to 2001.

It could be argued that, if nesting rates were artificially high in the first year of BOMP due to biases in site selection, they would, by chance, be more likely to drop in subsequent years until a more 'natural' level was reached. However, the fact that nesting rates increased again to 75% in 2002, a level approaching that of the first year of the survey (Figure 3.2), suggests that this was not the case. The increase in non-breeding individuals in 2001 also suggests that the fall in nesting rates was due to some individuals suspending breeding rather than birds moving away or dying.

The separate influences of region and habitat on nesting rates are hard to ascertain as the two factors are so closely correlated. The general pattern from the WCP core site dataset is that nesting rates are highest in the natural grassland areas in southwestern England, intermediate in the arable areas of northern and eastern Britain and lowest in pastoral/mixed farming areas in the southeastern region. This pattern of nesting rates is as predicted if prey availability is the driving factor determining Barn Owl distribution. The extensive areas of rough grassland in southwestern England provide ideal breeding habitat for small mammals and hunting habitat for Barn Owls. Such habitat can also be found in arable areas where it is limited to

field margins but is mainly absent from areas of stock farming, the closely-cropped sward providing little food or cover for rodents.

It should be noted that, while the protocol for data collection and the habitat categories recorded differ somewhat, the results from BOMP network sites suggest that there is little difference in nesting rates of arable and pastoral areas, although a significantly smaller proportion of sites in woodland areas were occupied. These data were, however, all collected in 2002, a year in which the difference between nesting rates at WCP sites in arable and pastoral habitats was also reduced.

4.2 Breeding parameters

There was little evidence to suggest that any of the breeding parameters measured varied significantly between years, implying that, if prey availability was reduced during the previous winter, only Barn Owls in sufficient condition to breed successfully attempted to raise young in the poor year of 2001 (although there was some evidence for reduced brood sizes at non-core WCP sites in that year). The number of Field Voles stored at Barn Owl sites in 2001 was reduced compared with adjacent years but larders generally were no less prevalent nor were they smaller in 2001 relative to the other two study years, suggesting that the abundance of the majority of rodent species may have increased again by late spring/early summer.

Region was found to influence overall breeding success at both WCP core sites and BOMP network sites, with Barn Owl pairs in the south of England tending to raise a greater proportion of the clutch to fledging. These results could reflect more favourable climatic conditions for breeding in this region, although Barn Owls can and do breed in a vast range of habitats and climates around the world. There was also some evidence to suggest that Barn Owls breeding in areas of natural grassland were liable to be more successful, possibly because this habitat supports a higher density of small mammal prey. Interestingly, larder size was not always closely related to breeding performance, as larders could be relatively large in regions and habitats where Barn Owls experience poor breeding success, for example at the BOMP network sites in the West England and Wales region. Thus larders may not only indicate good foraging conditions but may also be important where foraging conditions are poor. This is an aspect that may become clearer as data accumulates within BOMP.

4.3 Recommendations for future analyses

One important parameter influencing Barn Owl productivity is the number of broods produced per season. We are currently developing methods that may allow the estimation of multiple brooding by Barn Owls through observations of female moult and pellet shredding. These may provide valuable indicators of which sites should be followed up later in the season, as it is currently impractical to revisit all WCP core sites to assess the frequency of multiple brooding. Volunteers at BOMP network sites should also pilot such methods in 2004. However, late-season monitoring visits may be more practical for volunteers who monitor just a small number of sites, and this will be encouraged in 2004.

More robust estimates of breeding productivity than are presented here could be calculated using the Mayfield method (Mayfield 1961, 1975) for estimating the daily failure rate of nests in a sample, as is used in the Nest Record Scheme (Crick *et al.* 2003). However, the number of visits made by observers is currently too few and the visits themselves too far

apart to permit such analyses. Again, this is likely to remain the case at WCP sites due to logistical considerations, but the calculation of daily failure rates using Mayfield estimates may be possible in future for breeding attempts at BOMP network sites, if volunteers could be encouraged to make just a few more visits per site. The Mayfield method allows the unbiased analysis of data from sites which haven't necessarily been observed from start to finish and can therefore increase the sample sizes of nests for the estimation of productivity.

For year-round demographic modelling of the Barn Owl population, BOMP requires estimates of the annual survival rates of birds in their first and later years of life. As yet, it is too early to assess these parameters. The first annual report of BOMP presented the information available on Barn Owl movements and dispersal (Crick *et al.* 2001). The additional ringing activity generated by the introduction of BOMP will make more detailed analyses possible in the longer term.

For future data collection, it will be important that observers maintain their full set of registered sites, and do not drop any because they have become disused nor add more that are known to be occupied. It may be necessary to revise the list of sites that contribute to nesting rates, excluding any that are reported only in years when they are occupied.

It would be highly desirable within the next decade to conduct a repeat survey using Project Barn Owl methodology, to assess Barn Owl population trends using a randomised sample of study sites. This would help to validate the annual monitoring approach taken by BOMP and help to put the results in context.

With the exception of those in southwestern England, BOMP sites appear to have provided nesting sites for a wide variety of species other than Barn Owls. In future years it would be worth considering whether the scheme could be extended to cover these species, in particular the amber-listed Kestrel.

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The BTO and WCP are grateful to all the landowners who have allowed them access to Barn Owl sites for monitoring purposes.

We are very grateful to the volunteer Barn Owl observers who have visited sites for BOMP, particularly those who were able to complete fieldwork under difficult access conditions caused by the Foot and Mouth crisis in 2001. Jason Ball, of the Barn Owl Conservation Network, has been very supportive in helping to promote the BOMP and in disseminating its results among volunteer Barn Owl enthusiasts.

Finally, we are grateful to Mike Toms, Andy Musgrove and Karen Wright for help with the development of the BOMP database. Grateful thanks are also due to Angela Rickard who has done a sterling job in producing the recording forms and in formatting the report.

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Barn Owl Monitoring Programme Guidance Notes

Thank you for contributing to the Barn Owl Monitoring Programme, your information will be of great value. To clarify how to complete the recording form, we are providing these guidance notes to help you. Before carrying out any fieldwork please ensure that you have a valid Schedule One Licence, if in any doubt please contact Jez Blackburn, Licensing Officer in the Ringing Unit.

Summary of breeding attempts
Please answer the four questions concerning the number of breeding attempts by the pair you are monitoring. This is to help us understand more about the number of pairs that make a second breeding attempt and whether they move sites between attempts.

Area Map
We are providing you a 1km square map based on the grid reference you provided. Please mark the location of the nest site, together with any other occupied sites in your monitoring area and also other known potential breeding sites.

Habitat Recording
Using the map provided, please try to estimate the percentage (to the nearest 5%) of the habitats listed in the table. To do this, we suggest that you visit a number of points in the square where you can view the habitat within the square and using coloured pencils shade in areas of each habitat. This will help you estimate the percentage of each habitat type within the square. The codes are those used by all BTO surveys including ringing and nest recording. The percentages should add up to 100%.

Important Features for Barn Owls
Twelve features (mostly linear) are listed. Please put a tick in the relevant boxes if the features are present in your square.

Site Details
This section is designed to give us more information about the nest site. If the nest site is in a tree, please name the species of tree and then tick all boxes that apply. For nest sites in buildings or other situations please tick all boxes that apply.

Visit Details
After each visit to the nest site please fill in the details in this box. The first eight columns are based on the BTO's Nest Record Card so should be familiar to many of you. The remaining columns provide important additional information and these data are required for each visit. The bottom line of the table provides a quick and easy summary of the outcome of the nesting attempt. Information required for each column is described in detail below.

Date:	Please record the date as dd/mm *e.g.* 10th June would be 10/06.
Time:	Please record the time using 24 hour clock eg 18 instead of 6pm
No. Live Eggs:	Write in the number of viable eggs. Also use this column if you are uncertain whether the eggs are infertile/addled.
No. Dead Eggs:	Use this column if you are certain the eggs are infertile/addled, or to record broken eggs inside the nest.
No. Live Young:	Write in the number of live young.
No. Dead Young:	Write in the number of dead young.

Approximate Counts

If it is not possible to accurately count the number of eggs and/or young please use the following examples to guide you.

?	- if the contents cannot be counted with certainty or if the adult is sitting and you cannot see the contents.
6+	- if there are six-or-more eggs or young
(6)	- if there are about six eggs or young

Status Codes: These two-letter codes provide an easy way to describe the stage of development of the nest, eggs and young, as well as the observed activities of the parent birds and the eventual outcome of the nest. **Please ensure your status codes always comprise of two characters.** A full list of status codes is printed on the **Status Codes Card**, which should be taken into the field with you to act as a memory jogger. The codes are described in greater detail on page 7. Some of the codes on the card do not apply to Barn Owls. These are self evident.

Birds present?: On each visit please record if birds are present at the nest site. Use '**M**' for male, '**F**' for female and '**P**' for pair. Even if the pair are not making a nesting attempt in the nest site this year, they may still use the box as a roost site; please record their presence.

Other species present?: If another species is present in the nest site please use the BTO 5 letter code to record it. The most likely species are:

Jackdaw	'JACKD'	Tawny Owl	'TAWOW'
Stock Dove	'STODO'	Little Owl	'LITOW'
Kestrel	'KESTR'		

Pellets found: Please record the presence ('**Y**' for yes) or absence ('**N**' for no) of pellets at the nest site. Where possible count the number of whole pellets found and write the number in the table. If you find pellets from other species please make a note in the comments box. Barn Owls typically shred pellets when they are intending to lay.

No. prey items found: If you find any corpses of small mammals please use the guide provided to identify the species, then count the number of individuals of that species and write the number under the appropriate column. Space has been provided to write in additional species found.

Ringing details and biometrics (Option 2 only)
THIS SECTION IS TO BE COMPLETED BY RINGERS ONLY. The codes used for adults and chicks are described in detail below.

Date: Please record the date as dd/mm *e.g.* '10th June' would be '10/06'.

Ring Number: Please record the ring number in full *e.g.* 'GF72936'

Sex: Using Figure 1 and Table 1 as a guideline, please record females as '**F**', males as '**M**' and unsexed birds as '**U**'.

Brood Patch: Please record the development of the brood patch on the 0-5 scale as follows:

0 – absent
1 – starting
2 – well defined
3 – veined and red
4 – wrinkled
5 – feathering over

These are the same codes as those used by B-RING and IPMR to record brood patch. Some of the codes are not well defined or are mutually exclusive (probably designed with passerines in mind!). Please use the codes as a hierarchy, for example if the brood patch is veined and red (3) AND winkled (4), record the brood patch as '4'.

Wing Length: Maximum chord in mm..

Moult: Please record if there is evidence of body moult '**B**' and/or wing moult '**W**' or if moult is absent '**A**'.

Weight: Record weight in grams (g).

Talon Flanges: Use Figure 2 to record the score of the talon flanges (scale of 1-5). It has been shown that Barn Owls can be aged by examination of the talon flange on the third innermost talon. The combed flange develops with age. Young birds have a slight ridge (less than 0.5mm wide) and mature birds may have flanges greater than 1.5 or 2mm. With age, notches develop in the flange and these increase in size. Old birds have flanges with a worn, deeply notched appearance. Please note that there has been some concern over the accuracy of this technique so we want to gather information to test it. If the bird is of known age, please make a note on the form.

P7: Using Fig 3 as a guideline, please record the length of P7 in mm. If the 7th primary is in pin (no feather emerging) then record the length of the sheath. If the feather is emerging, measure the length of the emerged feather (NOT the sheath). Primary number 7 is the 7th feather when counting from the innermost primary outwards.

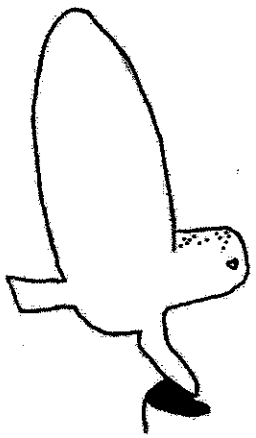
Head/bill: Please record total head and bill length in mm using callipers. Position the callipers at the centre of the back of the skull (nape) and measure to the bill tip, so that the callipers form a right angle to an imaginary line from the bill tip to the centre rear of the skull. Do not exert excessive pressure when closing the callipers.

Appendix 1

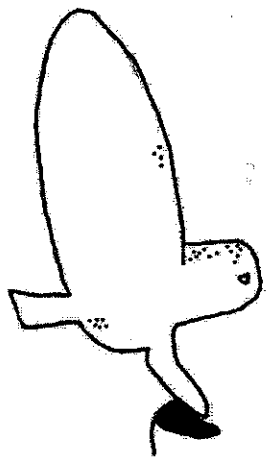
Table 1: Sexing Adult Barn Owls

Males	Females
Lighter than females on the ventral surface and facial disc.	Darker than male on the ventral surfaces and facial disc.
Lighter background colour to plumage on dorsal surface and weaker wing and tail bars than female.	Darker background colour to plumage on dorsal surface and stronger wing and tail bars than males.
Fewer and smaller breast spots than female (see below).	More and larger breast spots than male (see below).
No brood patch.	Brood patch may be present.

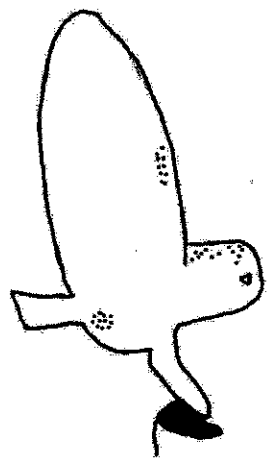
Figure 1: Sexing Barn Owls by the density/area of spotting



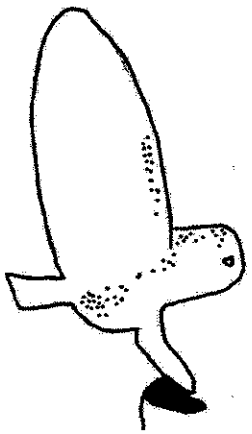
Grade 0



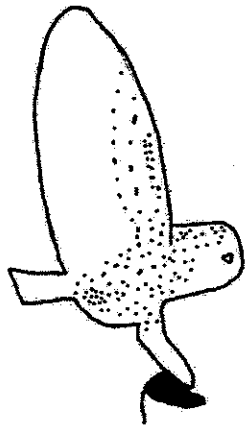
Grade 1



Grade 2



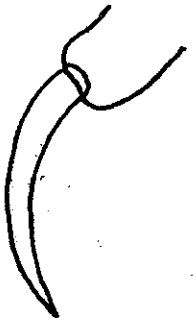
Grade 3

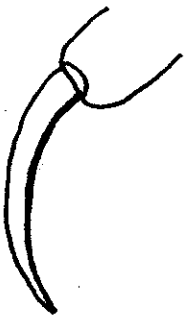


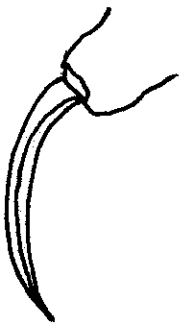
Grade 4

Grades	
0	Male
1	Male or Female
2	Female
3	Female
4	Female

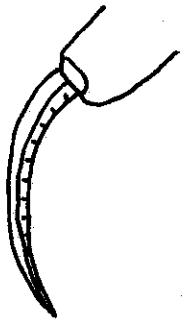
Figure 2: Talon Flanges

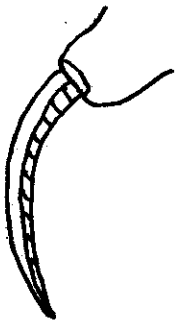






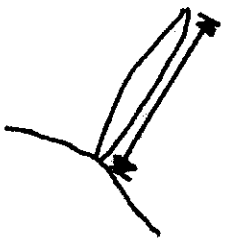
No flange	Ridge <0.5mm	Smooth flange >1.5mm ♂ >2mm ♀
AGE: Fledgling	AGE: 65-75 days	AGE: 7 mths
SCORE 1	SCORE 2	SCORE 3



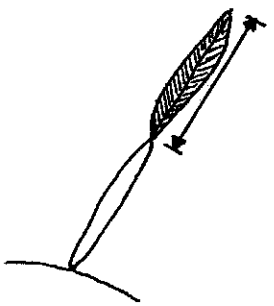


Notched flange >1.5mm ♂ >2mm ♀	Flanges deeply slotted
AGE: 7 mths – 2 yrs	AGE: > 2 yrs
SCORE 4	SCORE 5

Figure 3: P7



If Primary 7 is in pin only (no feather visible) measure the length of the sheath.



If Primary 7 has a feather visible, measure the length of the feather only.

Nest Record Card Status Codes

NEST BUILDING STAGE

N0	=	Nest site empty	**N3**	=	3/4 built
N1	=	third built	**N4**	=	Complete, unlined
N2	=	half built	**NL**	=	Lined

EGGS

CO	=	Cold	**WA**	=	Warm
UN	=	Uncovered	**CV**	=	Covered
FR	=	Fresh	**DE**	=	Growing embryo present
HA	=	Hatching	**PE**	=	Pipping/calling from egg

YOUNG

NA	=	Naked
TO	=	Egg tooth present
DO	=	Downy
BL	=	Blind
EY	=	Eyes just open
IP	=	Primary feathers in pin
FS	=	Primary feathers short; less than 1/3 emerged from sheath
FM	=	Primary feathers medium ; 1/3 to 2/3 emerged from sheath
FL	=	Primary feathers large; more than 2/3 emerged from sheath
RF	=	Ready to fledge
LB	=	Young left nest naturally before fledging; still nearby
YR	=	Ringed
AY	=	Audible young in nest

ADULT ACTIVITY

Combine (*e.g.* **AN**, **PD**, etc)

1st letter		**2nd letter**	
A	= Adult	**D**	= Dead
M	= Male	**F**	= Feeding young at nest
F	= Female	**I**	= Identified by colour mark, at nest
P	= Pair	**N**	= On/at nest
		T	= Trapped at/near nest
		V	= In vicinity of occupied nest – visibly alarmed or carrying food
		B	= Building nest or carrying nest material

Appendix 1

OUTCOME: SUCCESS

Use these when some/all young have successfully left the nest

AC	= Adult carrying food near nest
EX	= Young exploded from nest
HS	= Hatched shell fragments in empty nest of owls, gamebirds, waders, etc.
MR	= Marked young retrapped/resighted
NE	= Nest empty, undisturbed with well-trodden lining, containing feather scale, remains of down in nest and/or droppings.
NN	= Fledged young near nest
SY	= Some young fledged, other live young still in nest
SL	= Last young seen leaving
VA	= Adult visibly agitated or alarms near nest
YC	= Young capable of leaving nest on the previous visit

OUTCOME: FAILURE

Use these codes on any visit to describe the fate of individual eggs and/or young

Combine (e.g. **EP**, **XF**, etc)

1st letter		**2nd letter**	
E	= At egg stage	**A**	= Eggs not hatched, infertile, or addled
J	= At young stage	**B**	= Injured/broken
X	= At egg or young stage	**C**	= Killed or thrown out by Cuckoo
		D	= Deserted/starved/dead
		E	= Empty damaged nest
		F	= Flooded
		I	= Man - intentional
		L	= Livestock
		M	= Man – unintentional
		O	= Other/unknown
		P	= Predation
		T	= Thrown/fallen out
		U	= Usurped from nest by another species
		W	= Wing Damage

OUTCOME: UNKNOWN = OU

NB: For partially successful nests (i.e. where only part of clutch/brood produces fledged young) write both success and failure codes.

Some Status Codes Explained

EGG STAGE

EGGS Eggs Cold/Warm CO/WA: If the eggs can be easily reached, very carefully feel them to see if they are cold or warm.

PE Pipping egg: some chicks call from within the egg for 1 to 2 days before hatching. Before the chick has broken through the shell, "starring" of the shell occurs where the chick has cracked the shell from within.

YOUNG

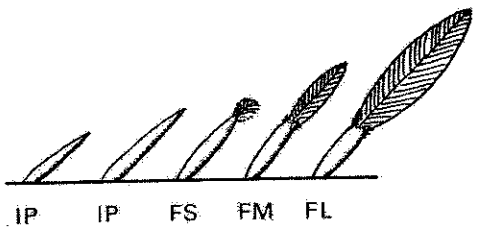
Recording growth of species whose young hatch asynchronously. The broods of some species (*e.g.* owls) normally have young at various stages of growth. In these cases, please record in the columns, status codes to describe the age of the **oldest** chick only. Codes to describe the growth of younger birds may be recorded in the comments section.

TO Egg Tooth present: The egg tooth is a horny bump on the upper side of the beak that is used by nestlings to break through the shell and out of the egg. In Barn Owls the egg tooth is best described as a small white bump on the tip of the beak.

IP Primary feathers In Pin: Primary feathers (the large flight feathers that form the outer half of the wing) which are completely enclosed within the shiny sheath are called 'in pin' (because of their pointed shape).

FS/FM/FL Primary feather growth stages.

RF



Ready to Fledge: When the nestlings are well feathered and look ready to leave the nest (whether they can fly or not), please leave well alone and record this code. Please note that the status code 'YC' (Young capable of leaving nest on the previous visit) is a **success** code and should not be confused with 'RF'. 'RF' should be used when young look ready to fledge but none have yet done so. 'YC' should be used when some or all of the young have fledged and may follow a visit where young are described as 'RF'.

SY Some young fledged; other live young still in nest.

YR Young Ringed: Use every time some young are ringed, even if only part of the brood is ringed.

AY Audible Young in nest: When food-begging or hunger calls of the young are heard in the nest.

ADULT ACTIVITY

Recording the activity of adult birds at or near the nest can be useful when determining the stage of the nest, particularly when the contents cannot be seen (as in the case of a species nesting high in a tree). For example, an adult sitting tight on the nest implies that it contains eggs and/or young; and adults regularly going to and from the nest with food implies that young are present.

The adult activity codes "AN" (Adult on/at nest) and "FN" (Female on/at nest) are probably the most useful, but there are other codes to use if an adult is found dead, feeding young, trapped at/near the nest for ringing purposes, or in the vicinity of the nest.

NB Ringers: when an adult is trapped on the nest, please use both status codes **AT** and **AN** (See guidelines on page 10).

OUTCOME
Put down **all** appropriate codes. If only some young die, then put both failure codes and success codes.

Outcome success codes for nidicolous species. For young that hatch naked, blind and helpless *e.g.* Barn Owl, outcome success codes should only be used when all of the live young have fledged (e.g. codes 'VA' and 'AC').

Partial success. Failure codes for individual eggs or chicks can be written for any visit. When a nest is partially successful (i.e. where only part of the clutch/brood produces fledged young), this can be indicated by putting both a success code (*e.g.* NE) and a failure code (*e.g.* JD) on the final line. Although the code 'NE' means 'Nest empty, undisturbed and well-trodden lining, containing feather scale and/or droppings'.

Also, in the case of nidicolous species such as owls, if some young have fledged whilst others are still in the nest, use the code 'SY' (some young fledged; other live young still in nest), but only record the number of young still in the nest in the young column. The number of young seen outside the nest may be written in the comments section. If you see the last live young leave the nest or the entire brood leaves together, record the date and use the success code 'SL' (last young seen leaving).

OUTCOME: UNKNOWN = OU
If you are unable to make a final visit to the nest site, please use the code 'OU'.

GUIDELINES FOR TRAPPING ADULTS AT THE NEST (for qualified ringers only)

Disturbance

Historically, some fieldworkers have expressed concern that Barn Owls are sensitive to disturbance, especially during the early stages of breeding, and that this disturbance may bring about breeding failure. ***While there is little evidence to support this view we do not want any nest recorder or ringer to do something that they are not confident in doing or are concerned about doing.***

Two studies have been carried out specifically examining the effect of human disturbance on active Barn Owl nests (Percival 1990, Taylor 1991).

Percival examined the possible effects of observers visiting active nests for both Tawny Owl and Barn Owl. Initially he used a questionnaire asking fieldworkers about their opinions and experiences on working around active nests. He then went on to examine nest record data to calculate measures of productivity in relation to the timing and number of visits to the nest. This work suggested that while a number of fieldworker felt it was unsafe to visit nest sites during the pre-laying and hatching stages, the nest record analyses suggested that it was only during the hatching period that birds were sensitive to disturbance. Outside this period, the desertion rate from **all** causes was found to be very low. Nests that were visited only during the late chick stage did not fledge significantly more young than ones that had been visited at other stages of the breeding period.

Taylor examined the effect of nest inspections and radio-tagging on breeding success of Barn Owls in southwest Scotland. He found that the various measures of productivity were similar between those nests only visited at the late chick stage and those that received multiple visits. Taylor also noted that site fidelity was high with only 0.9% of males and 5.6% of females changing nest sites in consecutive breeding seasons.

The evidence from these two studies supports the view that the Barn Owl is generally tolerant of nest visiting (including the capture of adults). In these studies, the fieldworkers all made an effort to minimise disturbance during the incubation period.

Guidelines for trapping adults at the nest

Adult Barn Owls can be safely caught at the nest site during the breeding season. Birds should be caught upon leaving the nest rather than in the nest itself. This reduces the risk of damage to eggs or chicks.

It is important to approach the nest quietly. Where possible, park well away from the site and approach silently on foot. When near the nest site, have a hand net ready. The hand-held net should have a deep bag and padded rim. Gently place the net over the entrance to the nest site, if possible, before putting the ladder up. Birds can then be caught as they emerge from the nest site. In some cases the female will sit tightly and will not leave the nest. In these cases, with great care, lift the female from the box, making sure that the eggs are not damaged. The female can be held in a bird bag while the nest contents are inspected, she can then be processed and returned to the nest. **It is important that the bird is put back on the nest and not released.** If you have caught both adults, place the female

back first followed by the male. When putting the bird/s back into the nest, release it gently so that it does not flap or run in the box and potentially cause damage to the eggs. Place the bird through the nest entrance. It is advisable to then cover the entrance by placing some material (sacking etc) over the hole and leave for a few minutes to allow the bird/s to settle. Remove the covering gently and retreat quietly.

Adults can be caught safely during incubation and at the chick stage. During the hatching period birds are sensitive to disturbance (generally the end of May/early June).

Please keep handling time to a minimum.

If you are in any doubt about procedure, contact BTO and we will provide advice and will try to put you in contact with other ringers who are familiar with this technique.

References

Percival, S.M. 1990. *Population trends in British Barn Owls* Tyto alba *and Tawny Owls* Strix aluco *in relation to environmental change*. British Trust for Ornithology Research Report 57. British Trust for Ornithology, Thetford.

Taylor, I.R. 1991. Effects of nest inspections and radiotagging on Barn Owl breeding success. *Journal of Wildlife Management* 55: 312-315.

Acknowledgements

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23rd July 2001

The Barn Owl Monitoring Programme is generously sponsored by the Sheepdrove Trust. For more information about the Sheepdrove Trust visit their website at http://www.sheepdrove.com/conserv.htm

Barn Owl Monitoring Programme: Site Registration Form

Name:	Permit No.:	NRS Code:	Our Code:	Postcode:

Site Number	Site Name	Natural (N) or Box (B)?	Grid Reference (6 figure)	Year site first visited for monitoring	Your Code	Option 1 or 2
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Please return your completed form to:
Peter Beaven, BTO, The Nunnery, Thetford, Norfolk IP24 2PU