

Estimates of badger population sizes in the West Gloucestershire and West Somerset pilot areas

A report to Natural England



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1. INTRODUCTION

The Government's policy is to allow controlled culling and vaccination of badgers in areas of high incidence of bovine TB in cattle in a carefully regulated way for the purpose of controlling the spread of the disease, in accordance with the requirements set out in Defra's Guidance to Natural England: "Licences to kill or take badgers for the purpose of preventing the spread of bovine TB under section 10(2)(a) of the Protection of Badgers Act 1992" (Defra publication PB13692).

In the first year of culling, a minimum number of badgers must be removed during an intensive cull which must be carried out throughout the land to which there is access, over a period of not more than six consecutive weeks. This minimum number should be set at a level that in Natural England's judgement should reduce the estimated badger population of the application area by at least 70% (para 10(c)(i) and (ii) of the Guidance).

Natural England should aim to ensure that culling will "not be detrimental to the survival of the population concerned" within the meaning of Article 9 of the Bern Convention on the Conservation of European Wildlife and Natural Habitats. For that purpose Natural England should determine appropriate area-specific licence conditions, and set a maximum number of badgers to be removed from the licence area (para 12 of the Guidance).

Hence, there is a requirement to gain an estimate of the population size that is sufficiently accurate and precise for setting a minimum and maximum number of badgers that meets these requirements. The estimate of population size must be based on information that is available to Natural England during the application process, and must relate to the whole culling area, whether culling will take place on a landholding or not. With the possible exception of a full census, any population estimate will have some degree of uncertainty; there will be an interval around the population estimate within which the true population is likely to lie: higher uncertainty leads to a wider interval around the estimated population.

Here we present estimates of population size and uncertainty about these estimates (as the relative standard error), using data gathered during surveys for active badger setts immediately prior to the anticipated start of badger culling operations.

2. METHODS

2.1 Selecting survey areas

GIS shapefiles of area outlines of each of the pilot areas and landholdings within them participating in the cull or vaccination programme were received from Natural England. Using Arc GIS 10 (ESRI, Redlands, California) a grid of 1km cells was superimposed over each area outline, which was aligned with the British National Grid. Cells that overlapped with the boundary of a pilot area were excluded from further work. From the remaining cells, 100 were selected at random from each area.

Participating landowners were contacted by the badger control companies to inform them that they would be receiving a request from Fera to survey their land. Fera staff contacted sufficient landowners to ensure access to at least 67km² of land in the West Gloucestershire pilot area and 55km² in the West Somerset pilot area. We intended to survey only land falling within a randomly-selected cell, but time and access limitations forced us to survey land falling into immediately adjacent cells if it was a continuation of land falling within the selected cell.

2.2 Sett surveys

Surveyors worked in pairs, walking every linear feature and inspecting farmyards present within the survey area, noting the presence of badger setts, active latrines and badger runs on a 1:10,000 scale map and, on a data sheet, noting their location to the nearest 1m (i.e. with a 12-figure grid reference) using a hand-held GPS. Large woodlands were surveyed using multiple surveyors walking parallel transects within 20m of each other, until the entire woodland had been surveyed. Setts were classed as active if at least one entrance hole showed signs of recent badger activity, such as fresh spoil on the spoil heap, smooth, compacted earth in the entrance, or badger footprints in the entrance or on the spoil heap.

2.3 Quality assurance.

2.3.1 Staff training and auditing

All staff engaged in sett surveying activities were experienced badger sett-surveyors who received two days of training in the use of the relevant standard operating procedures. Adherence to the standard operating procedures was independently assessed and verified by an independent experienced badger sett surveyor during visits to the pilot areas.

2.3.2 Re-surveys

For each pilot area a total of 15 of the surveyed cells was repeatedly randomly drawn from the full database of cells surveyed until a set of 15 cells was drawn that contained at least 30 putative active setts. Land to which we had access within the 15 cells and contiguous land outside the cell that had been surveyed were re-surveyed by surveyors with no experience of those cells during the primary survey. Re-surveys were undertaken in the same way as during the primary surveys.

2.3.3 Photographic checks

During the primary surveys, surveyors took at least one photograph of at least one entrance hole of each putative active sett using a compact digital camera. A laminated sheet of white, A4 paper was placed next to the entrance hole, and on the paper was written the date, location (grid reference), unique cell identifier, unique sett identifier and unique surveyor identifier. This allowed

identification of the location and sett as well as providing a means of assessing the scale of the entrance hole and accompanying signs of activity.

Photographs were downloaded and examined by an independent experienced sett surveyor. This observer looked for evidence within each photograph to refute the claim that the photograph was of an active badger sett entrance hole, therefore belonging to an active badger sett. Such evidence included debris blocking the entrance, vegetation covering the entrance, footprints other than those of badgers in the entrance, faeces from animals other than badgers in the entrance or on the spoil heap (especially rabbit droppings), size (holes appearing less than half the height of the A4 sheet were assessed as mis-classified).

The intention was to quantify overlap and mis-match rates between primary surveys and re-surveys in order to correct active sett counts upwards from the primary surveys, and to estimate the uncertainty component due to imperfect sett detection.

2.4 Data analysis

Data were analysed as described in Fera (2012) Advice on setting badger control target numbers for the purpose of the West Gloucestershire and West Somerset pilots.

3. RESULTS

A total of 259 active setts were reported for West Gloucestershire and 254 for West Somerset. However, these were over-estimates in both cases (Table 1).

	West Gloucestershire	West Somerset
Number of active setts reported	183	255
Area surveyed (km ²)	74.4	61.7
Total pilot area (km ²)	311.4	260.7
Number of photographs of putative active setts	71	106
Number of mis-classified photographs	6	25
Number of uncertain photographs	7	15
Sett observation rate (assumed)	1	1
Correct sett classification rate	0.881	0.737
Relative standard deviation of sett numbers between survey areas	0.145	0.120
Relative standard error of correct photo classification rate	0.028	0.034

Photographic checks reduced total sett counts by a small fraction (Table 1), but substantial variability in sett surveying ability meant that variation in sett counts between primary surveys and re-surveys was very high and biased. Consequently, sett counts could not be corrected for imperfect sett detection rates, so we assumed that all active setts were found).

Assuming 5.4 badgers per active sett, with a relative standard error of 0.135 (see Fera (2012) Advice on setting badger control target numbers for the purpose of the West Gloucestershire and West Somerset pilots), this gives total population estimates as follows:

West Gloucestershire: 3644 (RSE = 0.200)

West Somerset: 4289 (RSE = 0.184)

4. DISCUSSION

These estimates equate to densities of 16.45 badgers per km² in the West Somerset area and 11.70 badgers per km² in the West Gloucestershire area. These are well within the limits of other populations in the west-country, which have included densities as low as 5.8km⁻² and as high as 30.7km⁻². (Cheeseman *et al.* 1981. J. Appl. Ecol. 18: 795-804).

The inability to correct for imperfect sett detection rates is unlikely to substantially affect estimates of sett abundance. We anticipated that sett detection would be imperfect in only one direction, *i.e.* that setts that were present were not detected, because those incorrectly recorded as active setts were likely to have been filtered out during the analysis of photographs. However, rarely, some surveyors also reported multiple setts when only one was present *i.e.* they classified a single sett as multiple setts. This means that the error was more symmetrical than anticipated, limiting its impact on the central estimate or its uncertainty. Therefore, we are confident that the estimates presented here are as robust as they can be given the data available from which to calculate them.