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## **The number of badgers in the pilot cull areas of Somerset and Gloucestershire**

### **Advice from the Chief Scientific Adviser**

3 October 2013

1. Current culls being carried out in Somerset and Gloucestershire are designed to test the efficacy, safety and humaneness of free shoot as a method for reducing badger density as one route towards the control of bovine tuberculosis in cattle and wildlife in the countryside. This note concerns the measurement of efficacy only and provides an update to the estimates of badger populations in the two areas where the pilot culls are taking place. The note is for guidance only because efficacy will be adjudicated by the Independent Expert Panel (IEP).
2. An updated estimate of the number of badgers in each area has become available because of analyses carried out on data collected in both regions immediately before the cull began. These data have been generated from hair traps set in a random pattern across both areas. The hair from the badgers is analysed for DNA and this allows an estimate to be made of the number of individual badgers within small sub-areas. This allows a new estimate to be made of the number of badgers per sett and, knowing the number of active setts in each pilot cull area, it then allows an estimate to be made of the total number of badgers in each pilot cull area. In 2013, hair traps were set mainly during August so any population estimates reflect the number of badgers in the population at that time.
3. The culls have been conducted under a licence issued by Natural England to companies established by local farmers and coordinated by the National Farmers Union. The licences specify a minimum number of badgers that must be culled. This is defined as the number that gives an 80% probability of culling at least 70% of the population. The number specified in the licences has a number of weaknesses:
  - a. It was based upon surveys carried out mainly in October 2012 and so is one year out of date.
  - b. The methods used in 2012 were not initially designed to provide this type of population estimate and so were not optimised for this purpose.
  - c. Partly because of this the numbers have broad confidence intervals.
  - d. These wide confidence intervals mean that there could be fewer badgers in the population than was specified as the objective.
4. The provision of new estimates for 2013 means that these disadvantages can be overcome and these new estimates should provide a more accurate guide to the number of badgers in each of the pilot cull areas. This should provide a more realistic efficacy objective for the licence holder.

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5. It is important to consider that all of the numbers quoted here are estimates. As such, they are accompanied by confidence intervals\* that include known uncertainties. The confidence intervals represent a probable range for the population given the known uncertainties. If there are unknown uncertainties then the real population could be outside this range. An example of a potentially important unknown uncertainty is given in paragraph 9.
6. The 2013 estimate of the badger population in Somerset was from 997<sup>†</sup> to 1908<sup>†</sup> with a central estimate of 1450<sup>†</sup> badgers. This translates to an objective of 1183<sup>†</sup> badgers killed to achieve an 80% chance of culling at least 70% of the population.
7. The 2013 estimate of the badger population in Gloucestershire was from 1522<sup>†</sup> to 3464<sup>†</sup> with a central estimate of 2347<sup>†</sup> badgers. This translates to an objective of 1919<sup>†</sup> badgers killed to achieve an 80% chance of culling at least 70% of the population.

**Table: showing the number of badgers estimated for the pilot cull areas in Somerset and Gloucestershire. All numbers are rounded to the nearest 10 badgers.**

	<b>Somerset</b>		<b>Gloucestershire</b>	
	<b>2012</b>	<b>2013</b>	<b>2012</b>	<b>2013</b>
<b>Central population estimate</b>	2500	1450	3400	2350
<b>Probable range (95% confidence intervals)</b>	1500-3910	950-2130	2000-5420	1520-3460
<b>Minimum number to be culled</b>	2080	1180	2860	1920
<b>80% range</b>	1970-2970	1190-1690	2660-4080	1925-2740

8. The survey conducted in 2013 found that there was about a 99% chance that there were fewer badgers per sett in Somerset in 2013 than in 2012. There was also a 92% chance that there were fewer badgers per sett in Gloucestershire in 2013 than in 2012. When these measurements are expressed in terms of total populations, there is high confidence<sup>‡</sup> that the populations in both areas have declined between 2012 and 2013.
9. No sett survey was carried out in the two pilot cull areas in 2013. This meant that, in order to produce the population estimates (paragraphs 6 and 7) in 2013, the number of active setts present in 2012 was also used in 2013. This is an

\* In this case all confidence intervals are given at the 95% level of confidence

<sup>†</sup> The audits carried out on this work by internal and external auditors confirm that the processes and methodology for collecting and analysing hair trapping data were correctly followed by AHVLA. The analysis depends on reasonable assumptions that are listed in the report. The final report was signed off by AHVLA on 3 October 2013.

<sup>‡</sup> This terminology uses the definitions developed by the Intergovernmental Panel on Climate Change [http://www.ipcc.ch/publications\\_and\\_data/ar4/wg1/en/ch1s1-6.html](http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1s1-6.html). High confidence suggests about an 8 out of 10 chance.

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example of an unknown uncertainty. However, badger setts change little between years so this is unlikely to have caused an important difference.

10. Based upon this analysis alone, it is not possible to account for the likely decline in the estimated badger population between 2012 and 2013. There are a range of potential external causes such as weather, food availability and disease. Causes internal to the methods used, including statistical or sampling error, cannot be categorically excluded. Additional and more protracted analysis would be required to determine the sensitivity of the current estimates to both internal and external causes.
11. The IEP does not intend to use these estimates as the primary method for testing efficacy. Their preferred estimate of efficacy is likely to be the proportion of the individual badgers identified using DNA from hair samples that are present within the culled badgers. However, for this method to work it is important that culling takes place independently of information about the presence of hair traps. Any activity that causes regions where hair trapping was carried out to be either avoided or preferred by those carrying out culling will compromise this method.

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