Department
for Environment
Food & Rural Affairs

Setting the minimum and maximum numbers in badger cull areas in 2020

Advice to Natural England

September 2020

This publication is available at www.gov.uk/government/publications

Any enquiries regarding this publication should be sent to us at

BTBengage@defra.gov.uk

Contents

Overview

1. Natural England is the competent authority for badger control licensing for the purpose of preventing the spread of bovine TB. It is a requirement of the Guidance and the licences to set a minimum number in advance of each year's cull in an authorisation letter that is issued to each cull company once the licensing authority is satisfied that the cull company's preparations, planning and funding are sufficient to deliver a successful cull. The purpose of setting a minimum number under the current licence is to ensure that the cull company delivers the required level of population reduction in order to achieve the expected benefits in controlling bovine TB.

2. This advice to Natural England sets out the approach for estimating the badger population in the cull areas in 2020 and the minimum number of badgers to be removed and the minimum number of badgers that need to be vaccinated for a site in an Edge Area county to qualify for a no-cull zone.

3. The minimum number is intended to achieve a 70% reduction of the population relative to the initial starting population. The culling objective is for no more than 30% of the starting population to remain on conclusion of the cull. The 70% target is derived from the Randomised Badger Control Trial (RBCT) where it was estimated that the culls achieved a mean of 70% control of the starting populations across the 10 areas[1], which resulted in disease reduction benefits for the cattle herds in those areas.

4. Culling also needs to "*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 set a maximum number of badgers to be removed from the licensed area.

5. The approach to setting the minimum and maximum numbers was published by Defra in 2014 to 2019, in advice to Natural England.[2] [3] [4] [5] [6] [7] [8]

---

[1] Woodroffe, R., Gilks, P., Johnston, W. T., Le Fevre, A. M., Cox, D. R., Donnelly, C. A., Bourne, F. J., Cheeseman, C. L., Gettinby, G., McInerney, J. P. and Morrison, W. I. (2008), Effects of culling on badger abundance: implications for tuberculosis control. Journal of Zoology, 274: 28–37. doi:10.1111/j.1469-7998.2007.00353.x

[2] Setting the minimum and maximum numbers for Year 2 of the badger culls. Advice to Natural England. August 2014
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/347536/badger-cull-setting-min-max-numbers-2014.pdf

6. The estimate of population size must relate to the whole culling area, including any land within that area on which no culling is planned to take place. Any population estimate will have some degree of uncertainty which leads to an interval around the population estimate within which the true population is likely to lie. However, operating with uncertainty does not prevent an effective cull from being carried out, as shown during the RBCT culls, where no minimum numbers or targets were set.

7. This advice is divided into four sections.

    - Section A covers the ten areas where Supplementary Badger Culling is taking place in 2020.
    - Section B covers the areas where culling began in 2017 to 2019.
    - Section C covers the new areas that will begin culling in 2020.
    - Section D covers concluding remarks affecting all of the areas.

---

[3] Setting the minimum and maximum numbers for Year 3 of the badger culls. Advice to Natural England. August 2015. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/456777/bovinetb-min-max-advice-glos-somerset.pdf

[4] Setting the minimum and maximum numbers in Dorset for Year 1 of the badger cull. Advice to Natural England. August 2015. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/456776/bovinetb-min-max-advice-dorset.pdf

[5] Setting the minimum and maximum numbers in licensed badger control areas. Advice to Natural England. August 2016 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/548562/min-max-licensed-badger-control-areas-160824.pdf

[6] Advice to Natural England on setting the minimum and maximum numbers in licensed badger control areas in 2017. https://www.gov.uk/government/publications/advice-to-natural-england-on-setting-minimum-and-maximum-numbers-of-badgers-to-be-controlled-in-2017

[7] Setting minimum and maximum numbers of badgers to be controlled in 2018: Advice to Natural England. https://www.gov.uk/government/publications/advice-to-natural-england-on-setting-minimum-and-maximum-numbers-of-badgers-to-be-controlled-in-2018

[8] Advice to Natural England on setting minimum and maximum numbers of badgers to be controlled in 2019 https://www.gov.uk/government/publications/advice-to-natural-england-on-setting-minimum-and-maximum-numbers-of-badgers-to-be-controlled-in-2019

8. Areas will be ordered for numbering firstly by starting year, secondly by TB risk area with High Risk Area and Edge areas coming before Low Risk Area, thirdly by alphabetical order of the county[9] and fourthly by decreasing area size.

9. To ensure that the special status of the LRA remains, it is vital that we deal swiftly and decisively with any incursion of TB which involves both cattle and badgers. As such, adaptive management, where assessment of the evidence and consideration of a range of options takes place annually, is required. This is so that the most effective course of action is taken to enable eradication within the shortest timescale. The Chief Veterinary Officer (CVO) advises that eradication can only be achieved in an area if infection in the badger population is addressed alongside the cattle population.

10. This year culling will begin in Area 54-Lincolnshire and continue in part of Area-32 in the Low Risk Area. Although these areas will not have minimum and maximum numbers issued as part of their licence due to the different objective of a cull in this area, they are included here for completeness.

Section A: Areas 1 to 10

11. In 2019, Area 1-Gloucestershire, Area 2-Somerset and Area 3-Dorset will continue Supplementary Badger Control. Areas 4 to 10 will begin Supplementary Badger Control.

12. Both minimum and maximum numbers of badgers to be removed are required in order to sustain the benefits of licensed badger control while avoiding local extinction. As in 2019, for SBC areas 36% of the year one cull total is set as the baseline and the minimum and maximum numbers are set equidistant above and below the baseline so that the difference between them is equivalent to 25% of the pre-cull population. The minimum and maximum numbers are listed in table 1 of Annex A.

13. This approach will be kept under review as culling in contiguous areas and the larger size of the cull areas could affect the relative levels of immigration and reduce the comparability of cull returns to those in the RBCT. Therefore the amount of effort deployed by the cull companies and its spatial distribution will continue to be monitored given the uncertainty in the size of the remaining badger population.

[9] Where an area spans county borders, the county comprising the highest proportion of an area will be used to name the area.

Section B: Areas 11 to 43

14. As several hundred badgers have been removed from these areas in previous culls, methods based solely on an un-culled population are no longer appropriate. Instead, as in previous years, surveys of the number of active setts were used to estimate the current population.

15. In order to ensure that accurate assessments of sett activity were available to provide robust evidence to inform an estimate of the population and minimum numbers, all cull companies were instructed to carry out a thorough sett survey programme. APHA surveyors carried out a Quality Assurance check in sample parcels across the whole of the cull areas in year two areas.

16. As described in detail in the 2015 advice to Natural England, the population can be estimated by multiplying the number of active setts by the number of badgers per active sett.

17. As described in 2018, the starting population is estimated by reducing the estimate of the population at the start of year two by one-sixth, to account for 20% population growth in the intervening period, and adding the number culled in year one. The minimum and maximum numbers are then calculated as in previous years, see Table 2 in Annex A. Given the overall uncertainty associated with the methods and the range (lower to upper limits), we consider that it is still more prudent to manage the uncertainty by defining a realistic minimum number that aims to achieve the desired level of population reduction to secure the anticipated disease control benefits than to define it too high, with a risk of removing too many badgers.

18. Areas 12, 14, 24 and 37 have no minimum number, this is because the population estimates indicate a population below 30% of the pre-cull population.

19. In 2018 a cull was licensed in the Low Risk Area for the first time. As explained in the December 2017 consultation document[10] and the Government's subsequent response[11], minimum and maximum numbers are of less utility in

[10] Bovine TB: consultation on proposals to introduce licensed badger control to prevent the spread of bovine tuberculosis in the Low Risk Area (England)
https://consult.defra.gov.uk/bovine-tb/badger-control-in-low-risk-area-england/supporting_documents/bovinetbconsultlicensecontrollraengland.pdf

[11] Summary of responses to the consultation on proposals to introduce licensed badger control to prevent the spread of bovine tuberculosis in the Low Risk Area (England)

the Low Risk Area given the different aim of the cull. However, Area 32-Cumbria is included in this paper for completeness. Further details on the areas and the evidence supporting a cull there is set out in Annexes B and C.

Section C: New areas for 2020

20. Over the last five years, 40 successful first year culls have been carried out, these have taken place across the High Risk and the Edge Area, all taking place in the autumn and all using similarly trained contractors putting in similar levels of effort and using a mixture of controlled shooting and cage trapping. Therefore, we have a better picture of what success looks like and draw on the experience of previous culls and take the average number of badgers culled per km^2 in previous first year culls as the anticipated cull and set the minimum and maximum numbers equidistant around that value.

21. Using the same method as in 2019 the average number of badgers culled was taken as 3.18[12] badgers per km^2. The minimum and maximum numbers are therefore set at 2.70 and 3.66 per km^2 which are equidistant about the average and maintains the 70%:95% ratio between the minimum and maximum number.

22. Given the overall uncertainty associated with all methods and the range (lower to upper limits), we consider that it is still more prudent to manage the uncertainty this year by defining a realistic minimum number that can be revised in the light of new data, than to define it too high, with a risk of removing too many badgers.

23. The minimum and maximum numbers of badgers for the new areas in 2020 are shown in table 3 of Annex A. This approach simplifies the process of setting the minimum and maximum numbers and allows companies to plan earlier without the need for complex calculations. As with previous years this range may prove too high for some areas and too low for others, but provided sufficient effort is expended the minimum and maximum numbers can be updated for a given area in the light of the experience in the field following the methodology used in previous years.

---

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/736059/bovine-tb-lra-consult-sum-resp-updated.pdf

[12] Standard deviation 1.18, range 1.81-7.21

24. A second cull is now being licensed in the LRA. As explained in the December 2017 consultation document[13] and the Government's subsequent response[14], minimum and maximum numbers are of less utility in the Low Risk Area given the different aim of the cull. However, Area 54-Lincolnshire is included in this paper for completeness. Further details on the areas and the evidence supporting a cull there is set out in Annexes B and C.

25. For the purposes of determining the amount of vaccination required in 2019 to make a vaccination site in an Edge Area county eligible for a no-cull zone, sites should meet the following criteria.

    a. For sites with an area of 2.25km^2 or larger there should be at least 2.7 badgers vaccinated per km^2. The 2.7 per km^2 minimum is based on the approach taken in paragraph 20 in setting the number of badgers that should be removed from a cull area in its first year. This is to ensure vaccination coverage is equivalent to the required cull level.

    b. For sites smaller than 2.25km^2 the number should be at least 6 badgers which is equivalent to the number needed for a 2.25km^2 site to vaccinate 2.7per km^2. This is to ensure that small sites are awarded a no-cull zone only if they have vaccinated a sufficient number of badgers to warrant preventing a cull on adjacent land.

[13] Bovine TB: consultation on proposals to introduce licensed badger control to prevent the spread of bovine tuberculosis in the Low Risk Area (England)
https://consult.defra.gov.uk/bovine-tb/badger-control-in-low-risk-area-england/supporting_documents/bovinetbconsultlicensecontrollraengland.pdf

[14] Summary of responses to the consultation on proposals to introduce licensed badger control to prevent the spread of bovine tuberculosis in the Low Risk Area (England)
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/736059/bovine-tb-lra-consult-sum-resp-updated.pdf

Section D: Conclusions

26. As badger culling continues we have learnt that there is uncertainty in estimating badger populations, and therefore in defining minimum numbers in subsequent years we needed to avoid false levels of confidence. As with previous years, we need to consider two realistic scenarios:

    a) that during the cull, there is accumulating evidence that the number of badgers in the cull area is low, and that the number of badgers removed, despite a high level of contractor effort sustained across the whole cull area, is towards the lower end of our estimates. In this scenario, if the minimum and maximum numbers were set too high, Natural England would need to consider adjusting the numbers down to bring them in line with the actual circumstances being observed in the cull, so as to manage the risk of too many badgers being removed; OR

    b) that during the cull, there is accumulating evidence that the number of badgers is higher than the minimum and maximum numbers suggest, either because the cull company quickly exceeds the minimum number, or because feedback from observations suggests there is a higher level of activity observed than expected. In these circumstances, Natural England would need to consider the need to compel the cull company to continue the cull by revising the minimum and maximum numbers upwards to ensure that the optimum disease benefits can be secured.

27. Daily data collected through the course of the cull about the level of effort being applied across the cull area, and locations of badgers removed, will enable Natural England to build an assessment of progress towards the cull total. This will allow Natural England to assess whether the estimated population was a reasonable reflection of the true population.

28. If the evidence suggests that there are more badgers than the estimates indicated (e.g. because the number of badgers killed per unit effort is relatively high), Natural England will have the ability to revise the number upwards at an appropriate point, to ensure that the cull company is required to carry on the cull in order to achieve effective disease control.

29. Conversely, if the estimates are too high there will be a risk of removing too many badgers. In these circumstances, Natural England could, on the basis of careful consideration of the evidence and provided that the level of effort applied by the cull company has been sufficient, adjust the maximum number downwards at an appropriate point.

Annex A: Minimum and maximum numbers

Table 1 Minimum and maximum numbers for cull areas undergoing Supplementary Badger Culling.

Area	Minimum number	Maximum number
Area 1-Gloucestershire	125	540
Area 2-Somerset	109	578
Area 3-Dorset	163	383
Area 4-Cornwall	131	380
Area 5-Cornwall	152	461
Area 6-Devon	294	1173
Area 7-Devon	145	455
Area 8-Dorset	475	1685
Area 9-Gloucestershire	219	1118
Area 10-Herefordshire	90	359

Table 2 Minimum and maximum numbers for cull areas in their second, third and fourth years of badger control.

Area	Minimum number	Maximum number
Area 11-Cheshire	228	514
Area 12-Devon	0	416
Area 13-Devon	86	617
Area 14-Devon	0	328
Area 15-Devon	306	542
Area 16-Dorset	691	2321
Area 17-Somerset	356	993
Area 18-Somerset	108	360
Area 19-Wiltshire	50	1067
Area 20-Wiltshire	217	657
Area 21-Wiltshire	625	1266
Area 22-Cornwall	216	1716
Area 23-Devon	1505	2824
Area 24-Devon	0	294
Area 25-Devon	402	897
Area 26-Devon	590	1104
Area 27-Devon	9	127
Area 28-Devon	34	299
Area 29-Gloucestershire	185	890
Area 30-Somerset	1063	2660
Area 31-Staffordshire	1397	3516
Area-32 Cumbria	N/A	N/A

Area	Minimum number	Maximum number
Area 33-Avon	226	650
Area 34-Cheshire	1127	1939
Area 35-Cornwall	1665	3128
Area 36-Staffordshire	724	1272
Area 37-Devon	0	366
Area 38-Devon	1570	2696
Area 39-Dorset	175	472
Area 40-Herefordshire	719	1629
Area 41-Staffordshire	149	727
Area 42-Wiltshire	2310	4141
Area 43-Wiltshire	1058	1846

Table 3 Size, and minimum and maximum numbers for new areas for 2020

Area	Size (km^2)	Minimum number	Maximum number
Area 44-Avon	561	1514	2053
Area 45-Derbyshire	761	2054	2785
Area 46-Gloucestershire	222	599	812
Area 47-Herefordshire	557	1505	2040
Area 48-Leicestershire	392	1059	1435
Area 49-Oxfordshire	607	1640	2223
Area 50-Shropshire	1551	4187	5676
Area 51-Somerset	606	1636	2218
Area 52-Warwickshire	607	1640	2223
Area 53-Wiltshire	251	677	918
Area 54-Lincolnshire	102	NA	NA

Annex B: Summary of Area 32-Cumbria

Background

A potential 'hotspot' area (HS21) was declared in east Cumbria in the LRA of England during 2016. This was due to the emergence of a cluster of breakdowns associated with *Mycobacterium bovis* genotype 17:z. This genotype had not previously been identified in Great Britain, and investigations concluded that this was most likely introduced by cattle imported from Northern Ireland.

An update on the disease situation in HS21 has been given in the publication '*TB Surveillance in Wildlife – Low Risk Area hotspots*'[15].

Assessing the options

In 2018, a simulation model was used to predict the potential epidemic length in badgers in HS21 as there was little information on the level of infection in badgers. Culling was found to be the intervention most likely to result in the removal of infection from the badger population within an acceptable timescale. In 2019, the results from the surveillance carried out on culled badgers were considered by APHA epidemiologists and ecologists to make recommendations for intervention measures. This year, APHA experts have considered the results from the surveillance of culled badgers[1].

In the central minimum infected area (MIA), the prevalence level in sampled badgers is similar to infection levels found in the Randomised Badger Culling Trial (RBCT) in the west and midlands of England where there is a known reservoir of disease. There had been a prevalence reduction in the sampled culled badgers since the first year of operations (20.9% in 2018, 14.3% in 2019). There are now no infected badgers in the outer cull area.

The CVO has considered the results and her advice is that badger control needs to remain in place for a third year as we are making tangible progress towards eradication. The aim of badger control within the LRA is disease eradication. The CVO has previously stated that two years of culling with no disclosed infection in the badger population would have to be achieved before a move away from culling could

[15] www.gov.uk/government/publications/bovine-tb-surveillance-in-wildlife-in-england

be considered. As there has now been two years of culling with no infected badger identified, it is appropriate for part of the area to move to vaccination. However, culling will remain in the MIA, as infected badgers have been found here, and the 2019 extensions, as only one year of culling has taken place. Culling will take place over 111km^2 and vaccination will take place over 103km^2.

Cattle keepers are actively engaged with the eradication of disease in the area having delivered two years of cull operations. In Autumn 2019, a steering group involving local stakeholders, with Defra funding, has implemented tools to further improve biosecurity such as free on-farm advice visits by private vets and issuing keepers with information packs.

Based on the evidence to date from cattle and wildlife surveillance, APHA have now reduced the cattle testing frequency in part of the wider hotspot area (outside of Area 32) from six monthly to annual. Cattle keepers that are eligible will have to meet various risk based criteria and will be assessed on a case-by-case basis.

Annex C: Summary of Area 54 – Lincolnshire

Background

A potential 'hotspot' area was established in June 2018 following the disclosure of *M. bovis* in a cattle herd in south west Lincolnshire in the LRA of England, near the border with north east Leicestershire in December 2017. Due to its proximity to, and shared genotype with, a cluster of Officially TB Free status Withdrawn (OTFW) breakdowns in north east Leicestershire, the hotspot is situated partially in the LRA and partially in the Edge Area.

An update on the disease situation in HS23 has been given in the publication '*TB Surveillance in Wildlife – Low Risk Area hotspots*'[13].

Additional surveillance measures have been implemented in cattle and wildlife since June 2018 including;

- Extension of annual testing to the LRA portion of the hotspot, continuation of annual testing in the Edge Area portion (changed September 2020);
- Pre-movement testing of cattle moved out of herds in the LRA section of HS23, in which this measure is not normally required;
- Increased surveillance by completing radial (RAD) testing in areas where OTFW breakdowns occur,
- Surveillance of non-bovines within a RAD or close proximity to a positive 'found-dead' badger, and (changed September 2020);
- Continuation of the collection and post mortem examination of 'found-dead' wildlife (badgers and wild deer).

As described in *'TB Surveillance in Wildlife'*, published in September 2020, there have been 15 OTFW breakdowns that share genotype 25:a and five Officially TB Free status Suspended. Whole Genome Sequencing indicates that they are part of a distinct local cluster.

To date, there have been three *M. bovis* positive 'found dead' badgers identified in the hotspot, all found to have the genotype 25:a, the same as found in the local cattle breakdowns in the hotspot. One badger was located in the Edge Area portion of the hotspot, with the others located in the LRA portion.

Assessing the options

For HS21, modelling was carried out to predict the potential epidemic length in badgers as there was little information on the level of infection in badgers.

Briefly, this model uses both the badger population distribution in the area as estimated with sett surveys and knowledge of general epidemiology of bovine TB in badgers. Modelling of the effect of different control policies e.g. culling only, vaccination only, and culling followed by vaccination was carried out by APHA. Culling was found to be the intervention most likely to result in the removal of infection from the badger population. A scientific paper on this modelling work is being prepared for publication in a scientific journal.

WGS in HS23 suggests that the level of badger infection may be greater than in Cumbria. There is more variation in sequences and less of a direct relationship to the local cattle cases, indicating that it may have been in the area for a longer period of time. This may limit the effectiveness of some of the control strategies modelled, such as vaccination.

The CVO has considered the issue and her advice is that badger culling is the most appropriate measure in this instance.

Defining the intervention area

As has been previously described in other hotspots, the disease control intervention area is composed of:

- The minimum infected area, based on: the location of the infected badgers, associated farms and contiguous breakdown areas, plus a radius of the estimated average social group territory based on main sett distribution
- an outer area, also based on estimated average badger social group territory size surrounding the minimum infected area, to take into account the possibility that infection may have already spread in the badger population. The boundary was adjusted to adhere to natural boundaries to badger movement as far as practical to minimise any possible perturbation effects.

APHA ecologists defined the area by using badger abundance estimates described in the national badger survey (Judge et al., 2014)[16] and sett density estimates

[16] Judge, J., Wilson, GJ., Macarthur, R., Delahay, RJ., & McDonald, RA. (2014) Density and abundance of badger social groups in England and Wales in 2011-2013. *Scientific Reports*. **4**. https://www.nature.com/articles/srep03809

(Judge et al., 2017)[17]. However, the boundary could not be refined further as detailed sett surveys could not be conducted by APHA wildlife experts due to Covid-19 restrictions.

The size of the intervention area is 102km^2.

Culled badgers will be tested and the results of this, alongside the ongoing intensive surveillance of cattle, will inform future disease control measures in badgers and cattle in this area.

[17] Judge, J., Wilson, GJ., Macarthur, R., McDonald, RA., & Delahay, RJ. (2017) Abundance of badger (*Meles meles*) in England and Wales. *Scientific Reports*. **7**. https://www.nature.com/articles/s41598-017-00378-3