

The impact of culling on badger (*Meles meles*) populations in England and measures to prevent their 'local disappearance' from culled areas

Supplementary advice¹ provided under the Protection of Badgers Act 1992 and Wildlife & Countryside Act 1981 (as amended)

4 July 2011²

1. Pursuant to section 10(6) of the Protection of Badgers Act 1992 and section 16(10)(b) of the Wildlife and Countryside Act 1981 (as amended), Natural England offers the Secretary of State the following additional advice regarding
 - the impact of badger culling to prevent the spread of the disease bovine tuberculosis (TB) in cattle on the conservation status of the badger in England and
 - measures to minimise the risk of 'local disappearance' of badgers from culled areas and non-compliance with the Bern Convention.

Summary

2. To provide advice on the potential consequences of the proposed badger control policy³ on the badger population in England (estimated at 190,000 badgers), and UK obligations under the Bern Convention, culling at a range of scales was evaluated.
3. The maximum geographical extent of culling under the policy is at least 31,000 km² and up to 39,000 km² (approx. 25 - 30% of England). Within this area a total of 10 licences, each with a minimum area of 150 km² but no maximum size, may be issued each year. The potential number of concurrent control licences, assuming the duration is the minimum of four years, would be 40. Natural England is required by law to issue licences for all applications satisfying licensing criteria in a timely fashion.
4. Our analysis concludes that it is unlikely that the survival of the badger nationally would be jeopardised by culling but the local disappearance of the badger in some areas cannot be ruled out if culling is carried out at a large scale. In the event that only a handful of licenses are issued, there is unlikely to be any threat to conservation status and little risk of local extinction, except where a license is granted for the entirety of an isolated population.
5. Using values published by the Independent Scientific Group from the Randomised Badger Culling Trial (RBCT) the number of badgers that will be killed in an average-sized control area (350 km²) is expected to range from 965 - 1379 in the first year and 2300 - 3300 over the full 4 years (lower estimates assume the minimum requirement of 70% access and upper limits assume 100% access for control).
6. The Chief Scientific Adviser of the Department for Environment, Food and Rural Affairs (Defra), [REDACTED] and a group of scientific experts have concluded that to have a significant impact on national disease incidence, culling would need to be conducted over a 'very large area'. We have been advised by Defra that this is not the aim of the policy⁴, but it is consistent with our evaluation of current agricultural industry aspirations to tackle TB through badger control. Farmer groups are already developing cull applications covering at least 10,954 km², although how many applications will actually be submitted and licences issued is unknown at this stage.

¹ This advice is a supplement to advice provided in January 2011

² The first version of this advice was submitted to Defra in draft form on 12 May 2011

³ As set out in the current draft Policy Guidance for licensing, version 20110628, itself based on proposals announced on 15 September 2010 and set out 'Bovine Tuberculosis: the Government's approach to tackling the disease and consultation on a badger control policy' (Ref 35/10).

⁴ At present, the intention that control makes only a local, and not national contribution to disease control is not clear in either the Policy Guidance or the *Bovine TB Eradication Programme for England* (version 20 June 2011)

7. If culling takes place on the scale proposed in industry preparations then there is a realistic prospect of significantly reducing badger populations in areas of the English south-west and west Midlands. The estimated national population could be reduced by up to 30% and the population in the west and south-west regions by up to 50% (NB this would account for about one-third of the total eligible control area).
8. If implemented on a large scale (e.g. as envisaged by industry or if the policy becomes one to tackle TB prevalence nationally) it is our opinion that culling poses a significant risk of contravening Articles 8 and 9 of the Bern Convention. We therefore support the government's plan to seek clarification from the Convention's Secretariat on interpretation of obligations (including defining 'local' in the context of English badger populations).
9. There are also risks, as yet unquantified, associated with those components of the policy that deviate from the evidence base provided by the RBCT, including:
 - a. the use of two rather than one culling method (including one untested method),
 - b. the increased geographical scale over which culling will take place (size of each control area: RBCT = 113 km² vs. expected average of 350km² (max. ~1400km²); total area: RBCT = 1130 km² vs. 10,954km² for applications being prepared, which includes the whole of Cornwall, an area of 3,500 km²), and
 - c. the ability of farmers and landowners to deliver an effective cull (the RBCT was funded, coordinated and delivered by government)
10. If the Secretary of State is satisfied that badger culling will contribute to an effective disease control strategy and is minded to proceed with this policy then to mitigate these risks inclusion of further safeguards is advised, including: setting a limit on the size of control areas, permitting fewer control areas to run concurrently, and allowing Natural England to stipulate, if deemed appropriate, the retention of un-culled areas to act as a source of badgers to assist repopulation of culled areas.
11. Reducing the badger population to the extent and on the scale permitted under this policy has not previously been sanctioned for any protected native mammal species in modern times. If implementation proceeds, we recommend that it does so with caution and with appropriate checks, and that the proposed pilot evaluates all the key uncertainties (at paragraph 9 above) before proceeding with full implementation.

Scope

12. This advice supplements earlier advice provided to the Secretary of State in January 2011. That advice highlighted the importance of safe-guards to ensure culling does not give rise to concerns about the conservation status of the badger and to ensure that the provisions of the Bern Convention are complied with⁵. Since offering that advice we have received detailed information on industry preparations, which has allowed us to undertake a specific appraisal of the potential impact using data for areas which are expected to form the basis of actual applications.
13. This supplementary advice considers the impact of culling over a range of scales, including the scale anticipated if current industry preparations are fully realised, so that the potential consequences for the badger population and our obligations in respect to the Bern Convention are properly understood.
14. In light of this analysis we offer advice on measures that could be adopted to ensure the survival of badgers in culled areas. These measures are applicable to culling over a range of scales and would be expected to minimise the risk of non-compliance with the Convention.

⁵ See paragraph 22, 'Protected species and habitats' of the Advice (dated December 2010)

15. This analysis is based on the latest version of the draft Policy Guidance (version 20110628), which takes into account earlier advice on this topic provided by Natural England. In its current form, the guidance proposes that a maximum of 10 licences may be issued each year within the total eligible area (which is at least 31,000 km² and up to 39,000 km², approx. 25 - 30% of England)⁶. There is no upper limit on the size of licensed control areas beyond the practical limitations of satisfying licensing criteria. Natural England is required by law to issue licences to all applications satisfying these criteria in a timely fashion⁷.

Legal provisions relevant to conservation status

16. Our understanding of the advice that the department has received from Treasury Counsel, expressed simply, is that the hurdles set out in the Convention on the Conservation of European Wildlife and Natural Habitats 1979 (The 'Bern Convention') must be considered as part of the development of any policy. The badger is listed in Appendix III of the Convention and its control or management is subject to certain constraints and obligations. The key provisions relating to badger conservation are:
- Prohibiting the use of all means capable of causing local disappearance of, or serious disturbance to, populations of badgers, and
 - Exceptions (i.e. licences) will not be detrimental to the survival of the population of badgers concerned.
17. The terms 'local' and 'population' are clearly key to the interpretation of the Convention, but are not defined in it. In the absence of any definition, the term 'population' is given a normal biological interpretation in implementation of Bern Convention obligations, and in its guidance⁸ on licensing the Convention's Standing Committee makes it clear that Competent Authorities (Natural England in this case) need to consider impacts at a range of geographical scales and these need to be ecologically meaningful (which we interpret to mean ranging from a GB-wide scale to a resolution that is likely to be smaller than a county).

Further detail of key provisions is given in Annex B.

18. As a general rule, the guidance states that '*no derogation [licence] should be granted if it has a significant negative effect on a species' conservation status – whether on the specific population (or its prospects) or at biogeographical level.*' To evaluate this, Competent Authorities are required to address two key questions:
- Actual conservation status of the population of a species in its natural range, and
 - Impact of the proposed derogation on the population or populations concerned.

Each of these issues is considered below

Conservation status of the badger population

19. Although the badger is one of the most studied mammals in Britain, there are no up-to-date reliable figures for the total national or regional populations of this species. The most recent evaluation of the badger population, in 2005, cited an estimated population

⁶ To be eligible to apply for a licence, an area must be composed wholly of land within a Parish Test Interval 1 (PTI 1; which requires annual TB testing of cattle) at the time of application and must cover an area of at least 150km². The total area within PT1 is 39,000 km² (which is approximately 30% of England), but this includes some isolated patches that are < 150km². The total area of the 10 English counties that are in their entirety categorised as PTI 1 is 32,000 km² (which is approximately 25% of the land area of England). The total eligible area therefore lies somewhere between 32,000 and 39,000 km².

⁷ Licences '*shall not be unreasonably withheld*'; section 10(9) Protection of Badgers Act 1992.

⁸ 'Interpretation of Article 9 of the Bern Convention'; Standing Committee guidance published October 2010

of 190,000 badgers in England, while long-term datasets indicate an upward trend in the population over the last 25 years. Densities of badgers in England, especially in pastoral areas in the west of the country, are amongst the highest recorded in Europe and it is reasonable to conclude that the conservation status of the national badger population is currently favourable (although abundance in some areas, such as Norfolk, remains lower than expected due to historic culling).

20. If it is assumed that some further increase has taken place since the last detailed surveys, it may be reasonable to take an estimate of the population at the higher end of the range suggested by surveys for the purpose of evaluating the impact of culling, and to that end we have used a total population in England of ~220,000.
21. Surveys in the 1980s and 1990s suggest that the West Midlands and South West regions of England, combined, hold about 45% of England's badger population; a total of up to ~100,000 badgers.

Further analysis of the badger's population status is given in Annex A

Impact of licensed culling on the badger population

Geographical extent of badger culling

22. Approximately 25-30% of England (at least 32,000 km² and up to 39,000 km²) is potentially eligible for badger control under this policy (see footnote 6). At present, we do not know how much of this area will be subject to licensed control. The policy sets a limit on the minimum size of areas (150 km²) and the number of licences that may be issued each year (10), but it does not limit the size of individual control areas. There is not, thus, a fixed upper limit on the geographical extent of culling in any year or overall (except as dictated by the total eligible area), although the practicalities of delivering a cull will become less favourable with increasing area size.
23. The Chief Scientific Adviser for the Department for Environment, Food and Rural Affairs, [REDACTED] and a group of scientific experts have advised that to have a significant impact on national disease incidence, culling would need to be conducted over a 'very large area'⁹. This is consistent with our evaluation of current industry aspirations to tackle TB through badger control.
24. Initial discussions with Defra and the industry (in 2010) had led us to expect fewer than 10 applications in total, most ranging between 150 km² and 300 km². Information provided by industry sources in February and March 2011 revealed that farmer groups were already developing cull applications for a total of 33 areas covering a total of almost 11,000 km² (which is about one-third of the total eligible area) across the western and south-western part of England (see Figure 2). Under the current policy proposals this number of applications would have to be phased in over a four year period. The largest of the proposed control areas is estimated to be approximately 1400km² and the average control area is approximately 350km². We do not know if the recent inclusion of a limit on the number of licenses issued each year will influence the size of proposed control areas (for example, a number of proposed control areas are contiguous and applicants could decide to merge these into a smaller number of large applications to increase their chances of an early licence; see Figure 2).

Further details of these areas are given in Annex C and Figure 2.

Number of badgers culled

25. The number of badgers that would be culled depends on the number and size of control areas and the timing that culling commences in each. Using values published by the Independent Scientific Group (ISG) from the Randomised Badger Culling Trial (RBCT) the number of badgers that will be killed in an average-sized control area (350 km²) is

expected to range from 965 - 1379 in the first year and 2300 – 3300 over the full 4 years (lower estimates assume 70% access and upper limits assume 100% access for control; this is Method 1 for estimating numbers culled as described in Annex C).

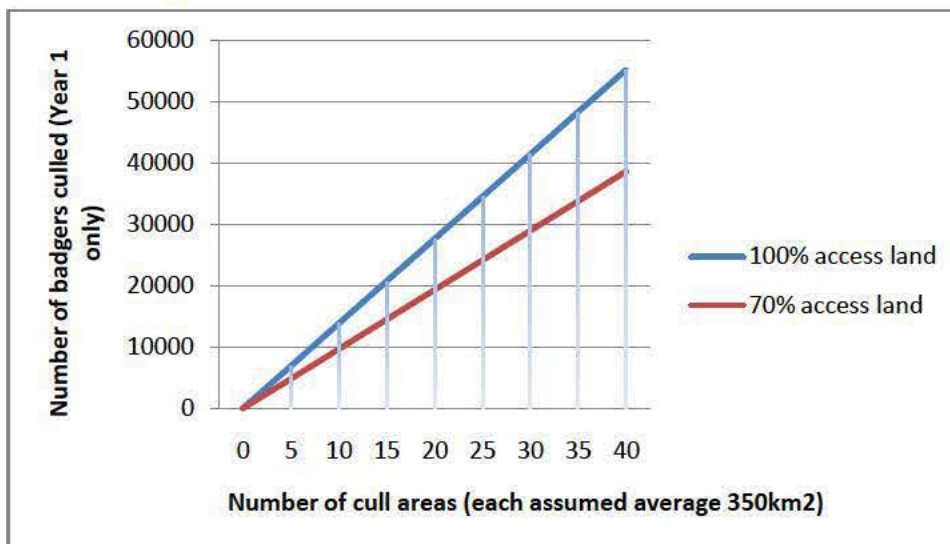
26. Figure 1 gives estimates for the number of badgers that it is predicted would be killed under this policy for the range of different numbers of licensed control areas (using an average control area of 350 km²) up to the maximum of 40 for a four year period. It should be noted that four years is the minimum duration of badger control for each licence (although it is expected to be the norm) and it is also expected that badger numbers would continue to be depressed for some years after the cessation of culling.
27. To allow us to assess the potential impact of culling at the scale envisaged by current industry preparations we have also estimated the level of badger removal for all 33 areas where plans are being prepared by farmer groups, using a range of estimates of cull numbers based on ISG and other survey data. While in practice not all licence applications are likely to succeed because of the stringent licensing criteria, additional applications from other areas and farmer groups are anticipated. In addition, whilst not all of these licences could be issued in years 1 and 2 of the policy, if all are issued within the first 4 years (i.e. later licences are issued whilst the earlier licences are still running) the cumulative effect on badger numbers will be additive and ultimately reach the same level as if the licences had all been issued at the same time.
28. This level of culling represents the higher end of the range of plausible scenarios, but it is important to note that it is a credible and objective assessment of the industry's aspirations for badger control, and is not the maximum extent to which culling could occur under the policy, should the review at the end of 4 years conclude that the issue of licences should continue, or if individual licences are issued for more than 4 years.
29. The cumulative total number of badgers that would be killed if all 33 areas received licences is expected to be from about 70,000 to over 100,000 animals, while for the initial year 1 culls alone, between about 30000 to 59000 animals would be expected to be culled. Assuming an average control area of 350km², the cumulative maximum that might be reached under the policy (for 40 control areas and using ISG data only) is about 90,000 to 130,000 in total and 39,000 to 55,000 in first year culls alone (Figure 1). These figures compare with a cull of 1000 to 1700 badgers each year by the Ministry of Agriculture under the 'interim' strategy in the early 1990s (e.g. MAFF, 1994 & 1996).
30. This level of culling represents ~14% to 27% of the total English population, or 25% to 54% of the West Midlands/South West population (assuming culling commences in all licensed areas within 4 years and each area succeeds in reducing badger populations by ≥ 70% for 4 years, as required under the Policy Guidance).
31. If culling is successfully completed we estimate that approximately 30 to 50 badgers would be killed for each bTB breakdown prevented.

See Annex C for a breakdown of culling estimates and Annex D for a summary of potential benefits for disease control in cattle.

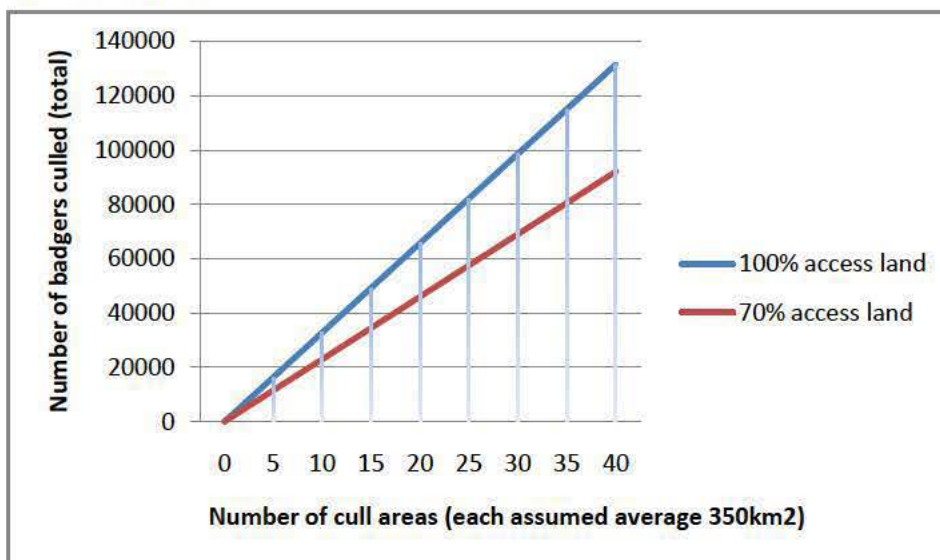
Figure 1

A range of estimates for the number of badgers expected to be killed in (a) year 1 and (b) over 4 years, with increasing numbers of licensed control areas (using ISG cull data and an average 350km² area estimated from the sizes of proposed control areas being developed by farmer groups) up to the maximum of 40 that might run concurrently under the proposed policy. collectively, these areas would account for up to approximately one third of the total area potentially eligible for culling under the policy.

(a) Year 1 only



(b) Over 4 years



Conclusions

32. While there is a high level of uncertainty in these estimates, available information leads us to conclude the following with regard to the potential impact of a badger control policy on populations of this species:

- **National and regional populations:** It is highly unlikely that the survival of the badger nationally would be jeopardised as we predict that even if control is undertaken on a large scale, licensed culling is expected to remove less than 30% of the total English badger population.

In the west and south-western regions, where a high proportion of the badger population occurs and where culling would be focused, the risk to survival is potentially greater. However, even here the overall removal rate of a large scale cull (based on current proposals) is not expected to exceed about 50% of the population. Badger distribution and abundance at a county or regional resolution could, however be significantly depressed if culling occurs at a large scale, possibly for many years.

In the event that only a handful of licenses are issued, there is unlikely to be any threat to conservation status.

- Local populations: The outcome for 'local populations' is more uncertain. It will depend on the geographical extent of contiguous culling and its intensity. It will also depend on interpretation of 'local' in the context of English badger populations.

As there is no agreed threshold of population size or geographical area for a 'local' badger population (unless the Bern Secretariat provides further clarity) we consider it prudent to consider 'local' to be no greater in area than the minimum size of a control area (150 km²).

On this basis, it is our view that the local disappearance of the badger in some areas cannot be ruled out, not least because of uncertainties regarding the size of badger populations and the fact that culling operations could be more effective than observed in the Randomised Badger Culling Trial (due to the longer period during which culling is permitted and the potential use of two, not one culling technique). For example:

- i. The highest estimate of the initial cull alone equates to 79% of the lowest estimate of the total SW/West Midlands regional population (see Annex B).
- ii. Nearly 100% of Cornwall is included within proposed culling areas and an effective cull would remove at least 70% of the badger population over an area of about 3500 km². The recovery of the population would be a slow process as its unique combination of coast and rivers would severely impede immigration into the county.

33. Previous decisions by the Bern Standing Committee have ruled that the Randomised Badger Culling Trial (RBCT), the Welsh Assembly Government's (WAG) proposed cull in Pembrokeshire, and badger culling in the Irish Republic were not in breach of Bern. It is understood¹⁰ that factors contributing to these decisions were:

- a. The relatively small size and number of areas involved (RBCT 10 x 100km² and WAG proposal 1 x 288km²);
- b. The relatively small number of badgers removed (RBCT <2060/yr compared with estimated national population of 190,000; Irish cull ~5500/yr compared to estimated national population of ~130,000; WAG cull <2000 compared to estimated Welsh population of ~42,000);
- c. The comparative inefficiency of the removal method (RBCT used cage trapping alone; this was also the method of the WAG proposal considered by Bern. It is considered to have "limited efficiency" compared to other methods, such as snaring. RBCT likely maximum ~80%, and WAG suggested removal rate 35-85%), and
- d. The likelihood of immigration leading to relatively rapid population recovery.

34. While past decisions demonstrate that badger culling, even on a relatively large scale, can be compliant with the Bern Convention, there remain differences between the

¹⁰ Summary of decisions in Defra TB Project Board paper 'The Bern Convention and supporting monitoring requirements', 29 November 2010.

proposed policy and previous culls. Considering the factors cited at paragraph 32 (a-d), above, current proposals would potentially allow:

- a. culling to occur over a much larger geographical area;
- b. a far higher total number of badgers to be killed;
- c. the more efficient removal of badgers from local areas through use of two techniques of culling, and
- d. a reduced scope for immigration to aid population recovery where culling areas are large and / or contiguous.

35. It is our view that in the event that culling is permitted over a large area, which is a plausible outcome if current industry plans and aspirations are realised or if it became government policy to tackle TB prevalence nationally through badger control, there would be a significant risk of contravening Articles 8 and 9 of the Convention. Widespread control which is undertaken with the specific aim of reducing populations by at least 70% may prove detrimental to the survival of badger populations at least in some localised areas of the south-west of England, and reliance on past decisions under different detailed circumstances by the Standing Committee is considered unsafe. We therefore welcome the Government's decision to seek advice from the Convention's Secretariat on the current proposals prior to their implementation.
36. In the event that a policy of licensed culling is approved, we recommend that the Policy Guidance on licensing issued to Natural England is further amended to provide additional safe-guards to protect badger populations. A series of recommendations are given below.

Risks for badger populations and obligations under Bern Convention

37. Culling could be carried out differently to the way it was done in the RBCT, but the closer the policy is to the RBCT the greater the certainty there is concerning outcomes for both badgers and disease control. It is those aspects of the policy that deviate from this evidence-base, and whose effects on the population are difficult to predict, that pose the most significant unquantified risk to badger populations.
38. The decision to limit culling to a single 6-week period (which would aim to replicate the intensive, simultaneous culls carried out in a single 8-11 day period each year during the RBCT) and not to permit culling to continue until the onset of the close season (which could have extended culling to a 6-7 month period each year) significantly reduces the risk of local disappearance.
39. The remaining elements of the policy deviating from the RBCT and which may increase the risk of local disappearance include:
- a. *Use of two methods of culling*: this is expected to increase the efficiency of culling making it possible to remove a greater percentage of resident badgers than the estimated 70% removal achieved in the RBCT.
 - b. *Size of control areas*: The proactive control areas in the RBCT averaged 113 km², whereas the size of control areas being developed by industry average 350 km² (the largest is over 1400 km²) with groups of contiguous control areas covering areas of several thousand square kilometres (e.g. a series of contiguous control areas are being developed for the whole county of Cornwall, which is 3,500 km² or ≈35 times the size of a RBCT proactive control area). Culling over such large areas will reduce the potential for immigration to contribute to the recovery of badger populations in culled areas (although we acknowledge that large control areas will benefit disease control).
40. The policy deviates from the evidence-base in another key element, and that is the reliance on farmers rather than government, to fund, coordinate and undertake badger

control. While this risk is not of direct relevance to badger population status and Bern obligations, it is relevant to the attainment of disease control benefits from culling and thus to the defensibility of derogating the protection afforded to badgers under UK law and the Convention.

41. If the Secretary of State is satisfied that badger culling will contribute to an effective disease control strategy and is minded to proceed with this policy then we recommend that these risks are mitigated, and that its implementation proceeds with caution and with appropriate checks.

Mitigating the risks

42. There are well-established methods of evaluating badger presence and abundance and past studies provide us with a range of densities for the areas of the country where culling is proposed. These are not, however, sufficiently precise to accurately evaluate the impact of culling for individual licences. Furthermore, the policy will not require licensees to carry out detailed pre-cull (or post-cull) surveys and even if this were so, the best methods available could not realistically be used to provide sufficiently precise populations estimates at the necessary geographical scale (due to costs).
43. Using available information, Natural England proposes to set targets and upper limits for the number of badgers to be killed in each control area. These will aim to achieve at least 70% removal of badgers while ensuring the survival of the badger population within each area. These thresholds will be reviewed annually using information on badgers killed and culling effort provided by licensees. Post-cull monitoring by the Food and Environment Research Agency (Fera) will provide information on the presence/absence of badgers, but not population density.
44. Because the evidence-base is imprecise, the thresholds set by Natural England cannot guarantee badger survival locally. Nor will it be possible to institute precise trigger points or signals relating to badger survival that can be relied upon to fine tune culling during the period of individual licences. The best indicator of survival will be the post-cull surveying conducted by Fera, which if conducted annually in each culling area, will provide important evidence concerning the presence and distribution of surviving badgers.
45. Without precise information on badger populations we advise that further safeguards are built into the design of the culling regime. Drawing on previous Bern Standing Committee decisions we consider inclusion of the following measures to have the potential to reduce the risk of causing the disappearance of local badger populations and (as a result) non-compliance with the Bern Convention. Values are given for illustrative purposes and will require further consideration, which should be informed by any advice received from the Bern Convention Secretariat.
- a. Limit the total number of control areas that may run concurrently (e.g. maximum of 5 in any one year).¹¹
 - b. Limit the size of individual control areas (e.g. maximum 400km²);
 - c. Limit the number and extent of contiguous control areas that may operate concurrently (i.e. set maximum of, for example, 1000km²); and
 - d. Allow Natural England to impose, where it deems necessary, a requirement that part of the boundary of a control area adjoins an un-culled area to allow migration of badgers to contribute to population recovery (this may be applicable where, for example, culling takes place over such a high proportion of a control area that it

¹¹ The current proposal is to issue a maximum of 10 licences issued each year, which would allow badger control in up to 40 areas simultaneously by the fourth year of implementation);

is deemed unlikely that the surviving, post-cull population will be sufficient to allow recovery in a reasonable timescale)¹².

These measures could be explicitly included in the Policy Guidance or Natural England could exercise discretion as the licensing authority to apply the measures where it deems it necessary to ensure compliance with the Convention. This discretion should apply applications individually and collectively.

46. It is acknowledged that measures necessary to mitigate adverse impacts of large scale culling on the badger population are likely to influence the potential benefits accrued from badger control on TB incidence in cattle. For example, restricting the number of control areas to the five where the greatest benefit is expected would reduce the number of TB breakdowns in cattle prevented for the 33 industry proposed control areas from 2450 to ~550 (see Annex D).

Proceeding with caution: a pilot

47. A combination of appropriate safeguards in the design of the culling regime and monitoring will reduce risks to the badger population. However, because of differences between current proposals and the evidence base there remains significant uncertainty regarding the consequences of culling on badger populations, especially if implemented on a widespread scale. It is important, therefore, that policy implementation proceeds with caution and with appropriate checks. The decision to include a pilot phase at the outset in involving 2 control areas is thus welcome. This pilot should evaluate all the key uncertainties identified above (at paragraph 39 and 40).
48. A pilot will have the added benefit of ensuring the scale of culling operations in the initial phase of implementation does not exceed the capacity of government to readily step in and complete culls if the farmer-led model proves unsuccessful.

Natural England

30 June 2011 (first submitted in draft 12 May 2011)

¹² As the licensing authority, Natural England will need to balance attainment of the primary objective of licensing, which is to control TB in cattle (including minimising the risks that badger perturbation causes increased TB incidence in neighbouring areas) and the Bern Convention obligations to ensure the survival of badger populations. In some situations, for example, it may be appropriate to limit the extent that a control area borders other culling areas to provide a source of badgers to contribute to the recovery of a culled population. This could be applicable where culling is proposed over a very high percentage of a licensed area or where such areas are very large. Assessments would be undertaken on a case by case basis.

Annex A

A summary of the key legal provisions of the Convention on the Conservation of European Wildlife and Natural Habitats 1979 (The 'Bern Convention') relevant to badger culling

The badger is not listed in Appendix II to the Convention as a species requiring strict protection, but it is listed in Appendix III, and its control or management is subject to certain constraints and obligations. The key provisions relating to badger conservation are:

- Prohibiting the use of all means capable of causing local disappearance of, or serious disturbance to, populations of badgers, and
- Exceptions (i.e. licences) will not be detrimental to the survival of the population of badgers concerned.

The key Articles are summarised below:

Article 7

This states that

1. Each Contracting Party shall take appropriate and necessary legislative and administrative measures to ensure the protection of the wild fauna species specified in Appendix III.
2. Any exploitation of wild fauna specified in Appendix III shall be regulated in order to keep the populations out of danger, taking into account the requirements of Article 2¹³.

Article 8

States that in respect of the capture or killing of wild fauna species specified in Appendix III and in cases where, in accordance with Article 9, exceptions are applied to species specified in Appendix II, Contracting Parties shall prohibit the use of all indiscriminate means of capture and killing and the use of all means capable of causing local disappearance of, or serious disturbance to, populations of a species, and in particular, the means specified in Appendix IV.

The following methods of killing and taking are included the list of prohibited methods in Appendix IV, and their use as part of this policy would require a derogation¹⁴. Only the first three methods (in bold) will be authorised for killing / taking badgers under the proposed policy.

- **Artificial light sources**
- **Devices for illuminating targets**
- **Traps** (if applied for large scale or non-selective capture or killing)
- Sighting devices for night shooting comprising an electronic image magnifier or image converter
- Semi-automatic or automatic weapons with a magazine capable of holding more than two rounds of ammunition
- Motor vehicles in motion

¹³ Article 2: The Contracting Parties shall take requisite measures to maintain the population of wild flora and fauna at, or adapt it to, a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements and the needs of sub-species, varieties or forms at risk locally.

¹⁴ These methods are prohibited as means of killing and taking badgers under English law by the provisions of section 11 of the Wildlife and Countryside Act 1981 (as amended).

Article 9

This allows for exceptions to be made from the protection afforded by Article 7 and the prohibition of methods in Article 8 for a number of purposes, including:

“to prevent serious damage to crops, livestock, forests, fisheries, water and other forms of property”; “in the interests of public health” and “overriding public interests”.

provided that there is *“no other satisfactory solution and that the exception will not be detrimental to the survival of the population concerned.”*

Appendix IV

This lists prohibited methods (which may be allowed under an Article 9 exception), including snares, artificial light sources, devices for illuminating targets, electronic image magnifiers or convertors for night shooting, traps (“if applied for large scale or non-selective capture or killing”), gassing or smoking out and semi-automatic or automatic weapons with a magazine capable of holding more than two rounds of ammunition.

Annex B

Badger population and conservation status

- a) Although one of the most studied mammals in Britain, there are no up-to-date reliable figures for the total national or regional populations of badgers. There have, however, been a number of national surveys from which estimates of the population can be derived.
- b) The first stratified survey was that of Cresswell *et al* (1990) in the mid-1980s. They estimated that there were ~43,000 badger social groups in Britain (~32,600 in England) and, assuming a mean of 5.9 adult badgers per social group, suggested a total population of ~250,000 (~190,000 in England). However, Wilson *et al* (1997) suggested that a mean of 5.9 might be an over-estimate, giving examples of regional mean estimates of 3 and 4 adult badgers per social group. Using 4 as an overall mean would have given figures for the mid-1980s of 172,000 for Britain, with 130,000 in England.
- c) A second stratified survey was carried out in the mid-1990s (Wilson *et al*, 1997). In this survey the number of social groups was estimated to have increased to ~50,000 giving a total population, assuming 4 or 5.9 adult badgers per social group, of ~200,000 or 295,000 respectively. For England, assuming the same proportion of the total as in the 1980s survey, these give a population of ~152,000 or 224,000, respectively.
- d) There are no more recent national surveys of badger numbers. In a 2005 evaluation of mammal populations, the *Tracking Mammals Partnership* categorised the badger as “widespread and common” and estimated the badger population in England to be approximately 190,000 badgers (Battersby, 2005). Ongoing surveys carried out by the Partnership show that badger numbers have increased over the last 25 years, as well as during the decade since the last detailed surveys (Tracking Mammals Partnership, 2009).
- e) **On this basis, it is reasonable to conclude that the conservation status of this species nationally is favourable, although densities in some areas, most notably Norfolk, remain lower than expected based on habitat** (Heydon *et al*, 2000). This is believed to be a consequence of historic culling leading to a long-term suppression of the population from which it is still recovering.
- f) If it is assumed that some further increase has taken place since the last detailed surveys, it may be reasonable to take the higher of the above estimates as the more likely figures for the purpose of evaluating the impact of culling; i.e. a total population in England of ~220,000.
- g) The findings of both the 1980s and the 1990s surveys suggest that the West Midlands and South West regions of England, combined, hold about 45% of England’s badger population; a total of ~68,400 or 100,000, based on the total population estimates for England in (c) above. It is in this part of the country that the majority of the proposed control areas are located.

Annex C

Scale of badger culling

Number and size of known proposals for control areas

- a) Based on information provided so far by industry sources we have identified 33 proposed control areas, for 22 of which indicative maps have been provided to date.
- Total area of 33 proposed control areas = 10954km²; mean individual area = 332km²
 - Total area of 22 for which maps received = 7784km²; mean individual area = 354km².

Number of badgers culled

- b) Under the policy proposals licensees are required to reduce the population within culling areas by at least 70% in the first year and maintain the population below 30% of the original population over the entire 4-year culling period (this emulates what was achieved during the Randomised Badger Culling Trial).
- c) The number of badgers that would be culled under the policy can be estimated; such estimates are inevitably approximations, but in an effort to compensate for this, three different approaches are used:
- Method 1: using the Independent Scientific Group (ISG) data (Bourne *et al*, 2007) to estimate the mean number of badgers culled per km² in the initial cull (3.94/km²) and the mean number culled per km² in each of the first three annual follow-up culls (1.82/km²)¹⁵.
- Method 2: using the ISG data as above, but using figures from the triplets that correspond most closely to the proposed control areas – referred to here as 'regional' data. Where there were no triplets near the proposed area the mean figures are used.
- Method 3: using the data from the Food and Environment Research Agency (Fera) distance sampling surveys for Cornwall, Devon, Gloucestershire and Herefordshire to estimate the initial intensive cull (year 1) in those counties (Fera unpublished report summaries). For areas outside these counties the mean ISG figures are used, as above.
- d) No account is taken in these estimates of the fact that culling intensity could exceed that observed in the Randomised Badger Culling Trial. This is a realistic prospect due to (i) the use of shooting in addition to cage trapping, and (ii) extending the period of culling from 8-11 days each year under the RBCT, to 6 weeks.
- e) The number of badgers that would potentially be killed under this policy estimated using Method 1 for different numbers of licensed culls areas, using an average-sized control area of ~350 km², is presented in Figure 1 (see above). Further estimates, using all three methods are given below. Two values are given for each, one which assumes access to the whole control area for culling and one which assumes access only to the *minimum* of 70%¹⁶.
- f) In an average-sized control area of ~350km², following these three methods, the initial cull would be expected to be 1280 to 1878 badgers (mean = 1513), with the overall total

¹⁵ NB: This under-estimates the total number of badgers killed in follow up culls in the RBCT as seven out of the 10 control areas had more than three follow up culls (maximum, initial cull plus six follow up culls).

¹⁶ It is not possible to make a simple adjustment for different levels of access for the combined distance sampling/ISG data (Method 3), but in this case, in calculating the 70% access total, the follow-up cull figure (which is solely based on ISG data) is similarly corrected.

being 3142 to 3789 badgers culled (mean = 3407) over the 4 year culling period. If only the minimum 70% of land were accessible for culling, the figures would be 896 to 1878 (mean = 1247) in the initial cull and 2199 to 3216 badgers culled (mean = 2573) in total.

Estimated size of badger cull for the 33 proposed control areas

Data used	100% access to land			70% access to land	
	Initial cull	Three follow-up culls	Total (over 4 years)	Initial cull	Total
Method 1	43158	59808	102966	30210	72076*
Method 2	40075	58261	98336	28052	68835
Method 3	58783	59808	118591	58783	100649
MEAN	47339	59292	106631	39015	80520

*NB: Defra calculation using ISG data and assuming 70% access gives a total figure of 68200, but this is based on a total area of 10,372km² not 10,954km².

- g) These figures suggest that for all 33 areas the total number of badgers culled over a 4 year cull period is likely to be at least around 70,000 and may be over 100,000. For the initial cull alone, between about 30000 to 59000 animals would be expected to be culled.
- h) If culling were followed through and successfully completed in all 33 areas, such that the benefits estimated above were realised, the figures suggest that around 30 to 50 badgers would be killed for each bTB breakdown prevented.
- i) If only the 22 areas for which indicative maps have already been received were licensed, and using the same methods as above, the number of badgers culled is estimated as follows:

Estimated size of badger cull for 22 areas (for which maps have been provided)

Data used	100% access to land			70% access to land	
	Initial cull	Three follow-up culls	Total (over 4 years)	Initial cull	Total
Method 1	30670	42502	73172	21469	51220
Method 2	28438	41013	69451	19906	48616
Method 3	44255	42502	86757	44255	74006
MEAN	34454	42006	76460	28543	57947

Impact of culling on badger populations

- j) The impact of the culling on the badger population will depend on a number of factors, including the number and size of control areas that are licensed, the proximity of control areas to each other, and the timing that culling commences in each area. It will also be influenced by the level of access to land and efficiency of culling within each area.
- k) Using the industry proposals as the basis for evaluating what a large scale cull might realistically look like it is plausible that ~14% to 27% of the total English population, or 25% to 54% of the West Midlands/South West population, might be removed as a result of initial culls and maintained at these reduced levels (assuming culling for all 33 areas commences within a 4 year period, and deducting ~5,000 for control areas outside these regions). If only the 22 areas for which indicative maps have so far been submitted were culled, this would be around 10% to 20% of the total English badger population or 18% to 42% of the West Midlands/South West population (deducting 2000 for control areas outside these regions).
- l) The rate of recovery of culled populations is likely to depend on the population density and structure of any residual population, the size of area over which culling has taken place and the potential for immigration of badgers from adjacent areas. Published studies of badger populations following culling have suggested that recovery to pre-

culling levels can take from as little as 3 years (Tuytens *et al*, 2000) to 9-10 years (Cheeseman *et al*, 1993). These findings were, respectively, for an area of 13.4km², where only about one third of the population was removed, and an area of 104km², where the badgers were effectively eradicated. It is likely that the recovery of populations culled under the proposed policy would be more comparable with the latter study and that the time taken for complete recovery in some areas could be significantly longer.

Comparison with European populations

- m) Data reviewed by Griffith & Thomas (1997) permit comparison with the density of badgers in different European countries. In many states, stable populations of badgers are maintained at densities below 1 badger/km². For example, densities of 0.3 to 0.5 badgers/km² are common in Slovenia, Hungary, Germany and Finland, where the species is not considered to be threatened, although higher densities, comparable with those in England¹⁷, have been also been reported (e.g. 2-4 badgers/km² in parts of Germany and mean ~1.35/km² in Sweden).
- n) Because of the relatively high density of badgers in the parts of England eligible for culling under this policy it is likely that, in most cases, residual post-culling populations would persist at densities comparable to some other European countries. This could be interpreted as evidence that the proposed culling would not contravene the Bern Convention. It should be noted, however, that under Article 2 of the Convention, the status of the badger population in England is expected to be maintained at the level which corresponds in particular to ecological, scientific and cultural requirements of this country, and not a European average.

¹⁷ Mean over whole country ~1.15-1.69/km², using national population estimates given above. Densities in excess of 20/km² recorded in high density areas (Rogers *et al*, 1997; Macdonald & Newman, 2000).

Annex D

Potential benefits for disease control in cattle in industry proposals

- a) The number of TB breakdowns in cattle prevented by culling badgers has been estimated for each of the 33 proposed control areas identified from information provided by industry using the 'Donnelly model', as used by Jenkins *et al* (2010). Unfortunately, the model assumes 5 years culling plus 4 years post culling incidence, whereas the draft licensing criteria propose (minimum) 4 years culling, so the model may over-estimate the benefits compared to 4 years culling.
- b) Using the standard figures for herd density and incidence data provided in the model, assuming the same background incidence inside and outside control areas and, where possible, making allowance for no-risk boundaries (i.e. coast & major rivers), the number of breakdowns expected over the whole 9 year period was estimated with and without culling.
- c) The total number of new breakdowns expected over the whole 9 year period in the 33 control areas in the absence of culling would be ~12800. With 5 years culling and a 4 year post-culling period the number of breakdowns would be ~10350, representing an overall reduction of 2450 (19%) in expected breakdown incidents.
- d) We estimate that an individual farmer 'destined' to suffer a bTB breakdown during the 9 year period in the absence of badger control would, if culling took place, have a 1 in 5 chance of avoiding such a breakdown. If the farm was within the control area then the chance of avoiding a breakdown would increase to 3 in 10.

Annex E

Limiting the number of control areas

Limiting the number of culling areas to the five industry proposals where the model suggests the greatest benefit, avoiding extensive contiguous areas and the one area over 1000km², would be expected to prevent ~545 TB breakdowns in cattle. A total of ~18,500 to 26,000 badgers would be culled over four years culling; ~34-48 badger per breakdown prevented in these five areas.

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Figure 2: Location of badger control areas in proposals being developed by farmer groups. Areas for which indicative maps have been received (22 out of the total of 33 areas) are shown as outlines of the actual areas as displayed on the maps submitted to Natural England. Approximate locations of proposed areas for which indicative maps have not been received are shown by blue circles.

