

Bovine TB: consultation on proposals to introduce licensed badger control to prevent the spread of bovine tuberculosis in the Low Risk Area (England)

Response from the Zoological Society of London

The Zoological Society of London (ZSL) has a long history of scientific engagement with the management of bovine tuberculosis (TB) in British cattle and wildlife. We have commented on each of the seven issues on which Defra has requested views. Our responses are based upon scientific evidence, and supported by references to the literature wherever appropriate.

(a) The principle of controlling the risk from badgers with TB in the LRA

In the High Risk Area (HRA), badger populations are managed with the aim of reducing the immediate risk of TB transmission from infected badgers to cattle. The consultation document indicates a similar aim for the Low Risk Area (LRA). However, an additional or alternative aim would be to reduce the risk of TB transmission from infected cattle to badgers. This latter aim is especially appropriate for the LRA where, as the consultation document states, sporadic TB incidents are caused mainly by movements of cattle from the HRA. In such circumstances, minimising cattle-to-badger transmission could avoid badger populations becoming infected, for example from bought-in cattle, reducing the longer-term risk of badger-to-cattle infection.

The risk of badger-to-cattle transmission is likely to be so low in the LRA that managing badgers may not be worthwhile. In the HRA, the best estimates indicate that just 5.7% of TB-affected cattle herds (95% confidence interval (CI) 0.9-25%) acquire infection from badgers¹. This figure is probably even lower in the LRA, where the consultation document indicates that fewer badgers are likely to be infected, with most herd infections caused by bought-in cattle. Hence, badger management to avoid badger-to-cattle transmission in the LRA may provide a poor return on investment.

In contrast, managing badgers to avoid cattle-to-badger transmission in the LRA is much more likely to be useful. There is strong circumstantial evidence that cattle transmit *M. bovis* to badgers², and hence a risk that moving infected cattle into the LRA might lead to localised infection in the badger population, increasing the risk of longer-term transmission back to cattle. Hence, badger management to avoid cattle-to-badger transmission in the LRA may indeed be worthwhile.

It is important to distinguish whether the short-term aim of badger management is to reduce badger-to-cattle transmission or cattle-to-badger transmission, because the two forms of transmission are likely to require different forms of management. Badger culling is used in the HRA with the aim of reducing badger-to-cattle transmission; however culling badgers is very unlikely to reduce cattle-to-badger transmission. In contrast with culling, badger vaccination should have the capacity to curb cattle-to-badger transmission³.

Badger vaccination differs profoundly from badger culling in that, while culling can increase TB transmission as well as reducing it^{2,4-12} there is no evidence that badger vaccination causes harmful effects in either badgers or cattle^{3,13-15}. For this reason, vaccination can be implemented in smaller areas than culling, and for shorter time periods, without fear of ill-effects. Furthermore, in comparison with culling, vaccination has fewer welfare implications, is cheaper, and is more publicly acceptable. For these reasons, badger vaccination could in principle be implemented routinely as soon as cattle infection is detected in the LRA, as a precautionary measure, pending investigation to determine whether the badger population is infected, and before taking a decision about whether vaccination would be repeated in subsequent years.

On this basis, ZSL supports the principle of badger vaccination in the LRA, but not the principal of badger culling.

(b) The principle of a government-led badger control operation where required.

Government-led badger management was discontinued in 2005 to reduce costs to taxpayers. However, government-led operations are more easily coordinated and quality-controlled than those led by farmers, and might be especially appropriate where a small team of specialist staff is needed to implement multiple localised operations.

However, we are concerned by the suggestion in the consultation document that such government-led action might be conducted outside the provision of the Protection of Badgers Act. If culling in the LRA is unlikely to fulfil "*the purposes of preventing the spread of disease*", as required by the Protection of Badgers Act, then it should not be pursued. Moreover, Parliament voted to protect badgers and, in seeking to bypass the Act, government risks sending a message that it tolerates killing of protected species.

We also note that the consultation document cites – without attribution – the wording of the Animal Health Act, referring to a hope that culling would "*substantially reduce or even eliminate*" TB. The Animal Health Act allows ministers to take strong action (e.g. to authorise "*methods of destruction that would otherwise be unlawful*") if convinced that such action is necessary to "*eliminate or substantially reduce*" disease risks. A plan to cull badgers in Wales under the Animal Health Act was overturned by Judicial Review, and many of the legal arguments against that proposed cull would apply even more strongly in this case, as there is consistent scientific evidence that small-scale culling increases cattle TB^{4-9,12} rather than "*substantially reducing*" it. Moreover, the availability of badger vaccination as a more appropriate tool in the LRA indicates that such culling is certainly not "*necessary*".

(c) The principle of taking a precautionary case-by-case approach, dependent on the local conditions and situation, including as regards the number of years in which culling is carried out.

ZSL challenges the notion that the proposed approach is precautionary. The precautionary principle indicates that action should be taken to avoid causing harm, even if the probability or magnitude of harm is uncertain. In contrast, small-scale badger culling is an action associated with strong evidence of causing harm rather than preventing it. The precautionary principle thus provides no justification for small-scale culling. In contrast, badger vaccination might be used as part of a precautionary approach, as it does not cause harm.

Regardless of whether Defra's planned approach is precautionary, we are concerned that it is perilously vague. No criteria are provided to indicate the circumstances when culling would be preferred over vaccination, how large an area should be targeted, how many times culling or vaccination should be repeated, what proportion of land access would be required, and what level of population reduction would be needed. Such criteria are important for two reasons. First, it is well-established that badger culls which are small-scale, patchy, or short-term can increase cattle TB rather than reducing it^{16,17}; hence clear criteria are needed to avoid harmful impacts on cattle health. Second, badger culling requires killing a protected species, an action that would be unlawful unless legally justified on disease control grounds. Hence, clear criteria are needed to show that the proposed action would have disease control benefits sufficient to justify destruction of protected wildlife. In the LRA, evidence suggests that sustained large-scale badger culling would be unjustifiable on conservation and cost grounds, and small-scale culling unjustifiable because it is ineffective. By contrast, badger

vaccination could be a promising way to reduce TB spread.

(d) The principle of using culling or vaccination or a combination of the two to control risks from badgers with TB in the LRA

As noted above, ZSL supports the principal of using badger vaccination within the LRA.

ZSL does not support the principal of using badger culling in the LRA. As noted above, badger-to-cattle transmission of *M. bovis* is likely to be very infrequent in the LRA, and attempting to prevent it by culling unlikely to be worthwhile. Minimising cattle-to-badger transmission in the LRA might be worthwhile, but is unlikely to be achievable by culling. In the LRA, evidence suggests that sustained large-scale badger culling would be unjustifiable on conservation and cost grounds, and small-scale culling unjustifiable because it is ineffective^{4-9,12}.

The consultation document states that “*The aim of introducing badger control in the LRA would be to ... prevent further geographic spread of TB in badgers*”. In contrast with this stated aim, there is strong evidence that badger culling causes the “*geographic spread of TB in badgers*” as well as in cattle, by disrupting badger movement patterns and hence increasing contact with other badgers and with cattle^{5-7,9,10,18,19}. Indeed, the Godfray *et al.* paper¹⁶ cited in the consultation document states that “*small-scale... badger culling... may exacerbate the disease problem through a perturbation effect*”.

The consultation document dismisses the risk of perturbation, stating that “*the risk of the perturbation effect is... much lower than that in the HRA and Edge Area*” because “*the perturbation effect is associated with infected badgers outside of the cull area increasing their roaming*” and “*there is no evidence which points to widespread infection in the badger population across the LRA*”. These statements indicate a misunderstanding of how perturbation occurs within badger populations*. Perturbation is not thought to result from infected badgers entering a culled area; rather, culling increases mixing within the badger population, encouraging transmission among badgers remaining in the culling area, and between such badgers and those immigrating from adjoining land². Such mixing need not involve immigration of infected individuals; it is possible that immigration could provide a supply of susceptible (uninfected) individuals which become infected through contact with individuals which survived the cull. Importantly, such altered badger behaviour has been linked to increased cattle TB, indicating that the harmful consequences of badger behaviour change can exceed the beneficial consequences of lower badger numbers.

* Defra’s claim that perturbation is unlikely to occur in the LRA contrasts with its parallel claim that “*rapid geographical spread is likely to be more of a risk*” in the LRA because such spread “*is likely to occur when social groups are disrupted or at lower densities*” and “*much of the LRA has a lower density of badgers*”. Defra’s expectation of rapid TB spread through the LRA badger population confuses naturally low population density with population density which has been artificially reduced by culling, two different phenomena likely to have different consequences for badger movement and hence TB spread. In the absence of culling, badger density is determined by food availability²⁰. When food is abundant, many badgers are born but few die, and the population grows. When the number of badgers matches the food supply (termed carrying capacity), many badgers have enough food to survive but not to breed^{21,22}; the birth rate slows^{21,22}, and the population stabilises. At carrying capacity, immigration is rare because the badgers born into a territory fiercely defend its resources from intruders²³. But, when culling suddenly reduces badger numbers, there is more food, and fewer badgers to defend it. Some of the badgers that were unable to breed in their home territories move to exploit food and breeding opportunities in the culled area, and this is what causes perturbation^{2,24}. But those badgers only move because the culled area is below carrying capacity, that is, it contains fewer badgers than the environment could support. In contrast, if carrying capacity is naturally low, badger density is low but immigration would still be rare, because immigrants would not be able to exploit untapped food resources by moving. Evidence suggests that badger social organisation across the low TB risk areas of northern England (density 4.9/km²)²⁵ and Scotland (densities 1.9-6.0/km²)²⁰ is similar to that observed in high risk areas of Cornwall (4.2-6.5/km²)^{26,27}, Avon (5.8/km²)²⁷, Staffordshire (6.2/km²)²⁸ and Gloucestershire (25.3/km²)²⁹, with consistently stable territories and low home range overlap. There is thus no strong justification for expecting more rapid TB transmission between social groups in the LRA, and likewise no reason to dismiss the risk of perturbation.

ZSL is likewise opposed to combinations of culling and vaccination. Our own research suggests that concurrent vaccination and culling, as conducted in Test-Vaccinate-Remove (TVR) programmes, risks increasing cattle TB rather than reducing it¹¹. Vaccination after culling – sometimes portrayed as an exit strategy from culling – is unpromising because, while vaccination impedes disease transmission by protecting susceptible animals³⁰, culling increases prevalence² and is thus expected to reduce the effectiveness of vaccination. In general, vaccination and culling work by different mechanisms and are unlikely to be more effective when used in combination. ZSL considers vaccination on its own to be a more promising approach.

(e): In relation to cases where culling is deployed, the principle of lowering the badger population of the affected area sufficiently to reduce the risk of infection of cattle from badgers (whether through direct or indirect contact), and ideally substantially reduce or even eliminate it.

It is very unlikely that reducing the local badger population through small-scale culling will “substantially reduce or even eliminate” the risk of *M. bovis* transmission to cattle in the LRA. Multiple studies have shown that small-scale badger culling increases cattle TB^{2,4-12}, but there are no studies which have detected benefits of localised culling[†].

We are concerned that the wording “substantially reduce or even eliminate” reflects the text of the Animal Health Act, which allows ministers to take strong action (e.g. to authorise “methods of destruction that would otherwise be unlawful”) if convinced that such action is necessary to “eliminate or substantially reduce” disease risks. As noted above, evidence indicates that localised badger culling will not “eliminate or substantially reduce” TB risks to cattle, and the availability of badger vaccination as a more appropriate tool in the LRA indicates that such culling is certainly not “necessary”.

(f): On the proposed revisions to the Guidance to Natural England on licensed badger control. Draft revised Guidance can be found at Annex B. See the new section on Low Risk Area Badger Disease Control. The new section header and other revisions to the Guidance have been highlighted in yellow for ease of reference.

As we have indicated above, we are concerned that the Guidance to Natural England provides no criteria to determine the geographical extent, timescale, landowner consent, or population reduction needed to deliver a cull likely to “prevent the spread of disease” and therefore justify licensing under the Protection of Badgers Act. Indeed, as there is no evidence to show that small-scale badger culling can “prevent the spread of disease”, but strong evidence that such culling can increase disease spread^{2,4-12}, the draft Guidance requires Natural England to ignore scientific evidence in issuing licences to kill a species it is charged with protecting.

On a much smaller point, we wonder why the section entitled “The Policy” makes no reference

[†]We also note that the wording of this question suggests confusion about the role of contact between badgers and cattle. “Direct contact” refers to very close physical proximity between badgers and cattle, allowing transfer of bacteria from one host species to the other³¹; this contrasts with “indirect contact”, which entails one host species shedding bacteria into the environment, where the other species encounters it and becomes infected. Direct contact is very uncommon³¹⁻³³, and indirect contact is thought to be a more important transmission route. Reducing badger density may not reduce indirect contact risk, because badgers change their defecation and urination behaviour when their territorial system is disrupted³⁴. However, the distinction between these forms of transmission is not highly relevant to this consultation question. We wonder whether Defra is referring instead to the fact that cattle herds originally infected by badgers (badger-to-cattle transmission) may go on to infect additional herds (cattle-to-cattle transmission), with the latter causing a higher proportion of TB cases than the former¹. Management which prevents badger-to-cattle transmission may thus prevent onward cattle-to-cattle transmission, magnifying the apparent benefit of such management. However, management targeted directly at cattle-to-cattle transmission (such as improved testing and controls on cattle movement) is still more promising, and carries no risk of increasing cattle TB.

to licences for badger vaccination, although the consultation document indicates that vaccination would be part of the policy.

(g): Any additional comments or approaches which you feel are relevant but not captured by the questions above.

We have two additional comments.

First, we note that Defra proposes to allow both culling and vaccination only “*when all other cattle and biosecurity measures have been put in place... and there is epidemiological evidence that the disease is present in badgers*”. We recognise the reason for this restriction on the implementation of culling; however we suggest that no such restriction is necessary in relation to vaccination. To the contrary, we suggest that vaccination could be most usefully deployed immediately on detection of cattle TB, without waiting for evidence of infection in the badger population. Such vaccination would be expected to reduce the risks of cattle-to-badger transmission during breakdown management. Samples could be collected in the course of vaccination, and vaccination then repeated in subsequent years only if infection were detected, or breakdown management prolonged.

Second, and more generally, we are concerned that the document fails to convey uncertainty concerning the outcome of badger culling. For example, the statement that “*This action will avoid future breakdowns and reactors in the affected hotspot area and so deliver an economic benefit to both industry and government*” ignores all the evidence that small-scale culling has been consistently linked to **increased** cattle TB (and never shown to deliver reductions in cattle TB). Likewise, the entire section on the “*Benefits*” of the proposed approach is based on an unfounded assumption that small-scale badger culling will reduce cattle TB. Such failure to portray evidence and uncertainty leads to a consultation document which risks misleading the public being consulted, undermining the principal of public consultation.

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