Badger Cull Population Estimates

Introduction
At the beginning of the cull Defra stated:
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, which resulted in disease reduction benefits for the cattle herds in those areas.

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 must set a maximum number of badgers to be removed from the licence area.

It was made clear that for the cull to be considered successful, between 70% and 95% of the population of the zone needed to be killed. This meant that an accurate figure of the population was necessary. Defra admitted *The process of estimating wildlife populations in order to set targets is subject to uncertainty...methodologies used to date have provided inconsistent results*. As we will see, this is something of an understatement.

Original Methodology
Despite this, Defra devised seemingly scientific formulae for the numbers to be shot, the first was "S - C + G - (S x P)" where S is the starting population before the first cull, C is the number of badgers culled in year 1, G is the net growth in the population between culls, and P represents the percentage of the population surviving (i.e. 30% or 5%). The second was (N x B) - (S x P) where N is the estimated number of currently active setts and B is the average number of badgers per sett based on the starting population estimates and number of active setts before the first cull.

What becomes clear is that the figure S was never reliably established, G was a guess, N an "esitimate" (i.e. also a guess) and B an average derived from the estimated and inaccurate S.

In the first 5 years, from 2013 to 2017, (2 for the pilot culls, then 3 subsequent roll-outs) three population estimates were derived for each cull area – a lower, a mid-point and an upper value. The method used to derive these figures changed from year to year. Some were based on sett surveys; in the pilots hair-trapping was used, while others were extrapolated from the National Sett Survey of 2012. The lower values of the estimates were used to derive the minimum and maximum badgers to be culled in all zones, so that the minimum figure represented 70% of the lower estimate of the total population, and the maximum figure represented 95%. This gave the minimum and maximum number of badgers that could be shot for each cull area over the 42 day cull period.

In all areas subsequent to the pilots, these figures were revised DURING the cull (35 days into it in 2016, 28 days into it in 2017), and the new figures were such that the number of badgers culled in all cases fell in the required 70-95% of the revised "lower" population figures. This allowed Defra to declare every cull a "success" so far as the numbers shot were concerned.

Table 1 – Original population estimates compared to revised population figures for zones in first five years of the cull

Cull Zones 2013-17	Orig Pop estimate	Updated pop est.	% Diff	1st yr cull	Cull as % updated Pop
Area 1 – Glos 1 (pilot)	1658			921	
Area 2 - Somerset 1 (pilot)	1876			940	
Area 3 – Dorset 1	879			756	
Area 4 – Cornwall 1	1856	840	**-54.74%**	711	85%
Area 5 – Cornwall 2	1249	1043	-16.50%	856	82%
Area 6 – Devon 1	2746	2146	-21.86%	2038	95%
Area 7 – Devon 2	2052	1024	**-50.08%**	833	81%
Area 8 – Dorset 2	1832	3673	**100.48%**	3000	82%
Area 9 – Glos 2	2090	2634	26.04%	1858	71%
Area 10 – Herefordshire	1245	811	-34.83%	624	77%
Area 11 – Cheshire	804	840	4.48%	736	88%
Area 12 – Devon 3	3264	2210	-32.29%	1874	85%
Area 13 – Devon 4	1909	1514	-20.68%	1237	82%
Area 14 – Devon 5	1126	863	-23.37%	708	82%
Area 15 – Devon 6	1212	984	-18.79%	763	78%
Area 16 – Dorset 3	7393	3831	**-48.17%**	3450	90%
Area 17 – Somerset 2	1851	1246	-32.70%	1123	90%
Area 18 – Somerset 3	1258	559	**-55.60%**	489	88%
Area 19 – Wiltshire 1	3922	2451	-37.50%	2252	92%
Area 20 - Wiltshire 2	2278	1233	**-45.88%**	1040	84%
Area 21 – Wiltshire 3	1480	1447	-2.22%	1229	85%

We can see that population estimates were revised down in 15 of 18 areas (column B), by an average of 33% (in three cases by more than 50%). In one area, the population estimate was revised upwards by more than 100%! Looked at dispassionately, it could seem that the population figures were adjusted to fit the number of badgers shot, rather than vice versa.

New Areas 2018

Defra guidance to NE: *Over the last three years, 19 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 now have a better picture of what* success *looks like.* [Interesting use of the word success]

However, we have not improved the method of setting initial minimum and maximum numbers as the methods based on the National Sett Survey in 2016 and 2017 **have not been proven particularly accurate**. *Now that we have a larger sample size of areas that cover a significant proportion of the HRA and experience of what a successful cull looks like in the field, we can use data form the previous culls to set the initial minimum and*

maximum numbers. We therefore draw on the experience of previous culls and take the average number of badgers culled per km2 in previous first year culls as the anticipated cull and set the minimum and maximum numbers equidistant around that value.

Across the 19 areas the average number of badgers culled has been 3.18 badgers per km2. The minimum and maximum numbers are therefore set at 2.70 and 3.66 per km2 which are equidistant about the average and maintains the 70% to 95% ratio between the minimum and maximum number.

Defra admit that their estimates were useless, and so propose to use the numbers killed over the period of each previous cull to set the benchmark for the required numbers to be shot in the new cull zones.

I cannot understand the logic of this. Previously, and logically, they tried to survey the badger setts in each area and calculate the number of badgers from this, a method they now admit has not *proven particularly accurate.* So, rather than trying to find out how many badgers there are, they have decided to *use data from the previous culls.* That is, use data from different areas with different geology, geography, topology and habitat, to calculate the population of the new areas. What data? They will *take the average number of badgers culled per km2 in previous first year culls as the anticipated cull and set the minimum and maximum numbers equidistant around that value.* That is, they will use the numbers killed in other areas to estimate the population in the new areas! How will they translate this to the new areas? By deriving a figure for the average number killed per km2, then multiplying this by the size in km2 of each new area.

DEFRA have now dropped even the pretence of science. They are using the figures for the number of badgers killed over the 42 day period of previous culls to calculate how many to kill in the new areas. How is this related to the population? All that it represents is how many badgers can be killed with a given set of resources in a given period of time. To establish what relation this number has to the population of badgers would require a comprehensive survey of a selection of cull areas before and after the cull.

Table 2 – Original population estimates compared to revised population figures for zones in 2018 cull

Cull Zones 2018	Orig Pop estimate	Updated pop est.	% Diff	1st yr cull	Cull as % updated Po
Area 22 – Cornwall 3	4903	4376	-10.75%	3327	76%
Area 23 – Devon 7	2289	2784	21.66%	2238	80%
Area 24 – Devon 8	1966	1027	**-47.75%**	743	72%
Area 25 – Devon 9	1200	1024	-14.64%	796	78%
Area 26 – Devon 10	1167	1084	-7.10%	867	80%
Area 27 – Devon 11	809	359	**-55.65%**	265	74%
Area 28 – Devon 12	747	616	-17.59%	470	76%
Area 29 – Glos 3	1661	1880	13.16%	1459	78%
Area 30 – Somerset 4	2399	3279	36.69%	2870	88%
Area 31 – Staffs	4549	4537	-0.25%	3979	88%

We can see that the original estimates were just as inaccurate as the ones for the previous cull zones using a different methodology. They ranged from 37% too low to 56% too high. Once again, the revisions resulted in all the final figures falling neatly into the 70 – 95% range. Given how the population figures were derived, or perhaps, massaged, this is no coincidence.

Tables 3 & 4 All Cull Zones 2013-18

The percentage figures for all zones are in the two tables below, which show the following:
A. The number culled in the first year as a % of the original lower population estimated
B. The percentage change between the original (lower) population estimate and the revised estimate after 28 days culling
C. The orginal minimum take (70% of population) as a % of the revised population
D. The orginal maximum take (95% of population) as a % of the revised population
E. The number culled in the second year as a % of the first year cull

Table 3

Cull Zones 2013 -2018	A. Culled as % of Original lower pop estimate	B. % change from original estimate	C. Original Min take as % of Updated Pop	D Original Max take as % of Updated pop	E. % culled in 2nd year as % of first year cull
Area 1 – Glos 1 (pilot)	56%				30%
Area 2 - Somerset 1 (pilot)	50%				36%
Area 3 – Dorset 1	86%				**66%**
Area 4 – Cornwall 1	38%	**-54.74%**	**155%**	**210%**	30%
Area 5 – Cornwall 2	69%	-16.50%	84%	114%	42%
Area 6 – Devon 1	74%	-21.86%	90%	122%	36%
Area 7 – Devon 2	41%	**-50.08%**	**140%**	190%	**30%**
Area 8 – Dorset 2	**164%**	**100.48%**	35%	47%	39%
Area 9 – Glos 2	89%	26.04%	56%	75%	**54%**
Area 10 – Herefordshire	50%	-34.83%	**107%**	146%	**63%**
Area 11 – Cheshire	92%	4.48%	67%	91%	**64%**
Area 12 – Devon 3	57%	-32.29%	**103%**	140%	**61%**
Area 13 – Devon 4	65%	-20.68%	88%	120%	**65%**
Area 14 – Devon 5	63%	-23.37%	91%	124%	**63%**
Area 15 – Devon 6	63%	-18.79%	86%	117%	**65%**
Area 16 – Dorset 3	47%	**-48.17%**	**135%**	183%	**85%**
Area 17 – Somerset 2	61%	-32.70%	**104%**	141%	**82%**
Area 18 – Somerset 3	39%	**-55.60%**	**158%**	**214%**	**111%**
Area 19 – Wiltshire 1	57%	-37.50%	**112%**	152%	**65%**
Area 20 - Wiltshire 2	46%	**-45.88%**	**129%**	176%	**79%**
Area 21 – Wiltshire 3	83%	-2.22%	72%	97%	**88%**

Table 4

Cull Zones 2018	A. Culled as % of Original lower pop estimate	B. % change from original estimate	C. Original Min take as % of Updated Pop	D Original Max take as % of Updated pop	E. % culled in 2nd year as % of first year cull
Area 22 – Cornwall 3	68%	-10.75%	78%	106%	
Area 23 – Devon 7	**98%**	21.66%	58%	78%	
Area 24 – Devon 8	38%	**-47.75%**	**134%**	182%	
Area 25 – Devon 9	66%	-14.64%	82%	111%	
Area 26 – Devon 10	74%	-7.10%	75%	102%	
Area 27 – Devon 11	33%	**-55.65%**	**158%**	**214%**	
Area 28 – Devon 12	63%	-17.59%	85%	115%	
Area 29 – Glos 3	88%	13.16%	62%	84%	
Area 30 – Somerset 4	**120%**	36.69%	51%	69%	
Area 31 – Staffs	87%	-0.25%	70%	95%	

From these tables we can see that of 31 Areas, in only 4 were the original population estimates within 10% of the later amended population figures (Column B). 4 were revised down by greater than 50%, and a further 6 revised down by > 25%, after 4 weeks of culling. One area was revised upwards by 100%! In two areas the number of badgers culled (which should have been between 70 and 95% of the population) was considerably more than 100% of the original estimated population (column A).

What this shows is that the population figures for all the areas were wrong, often by a large amount. This is true regardless of which "system" Defra used. The 2018 figures varied just as much as those used previously. From this we can glean that the new method is no more accurate those based on surveys.

If we look at the original maximum take (i.e. the 95% of pop figure) compared to the revised maximum after 28 days of shooting (Column D), we see that in 20 of 28 areas this would have led to more than 100% of the population being shot, and in 3 areas **more than twice the entire population!**

If we stick with the original population estimates, then in 11 of 28 areas, **greater than 100% of the population would have been shot** (column C) even using the lower "minimum" take figure. Clearly, then, the population figures in the original estimate were seriously out. However, the corrections were derived by, in effect, a rule of thumb based the number of badgers killed over the number of days and the "effort" involved in previous culls (i.e. number of shooters and traps). This means that the number of badgers in the population was being estimated by the numbers being killed over time by the available resources. The duration of the cull was fixed at 42 days, which meant that by using this method you would inevitably end up with a figure that reflected how many badgers the team could kill in a given set of time, rather than anything necessarily to do with how many badgers there were (assuming of course, they did not run out of badgers completely before the end). The assumption seemed to be that this was a simple statistical process and that no effect on badger behaviour was expected. In other words, each day was equal and cumulative in a simple additive way.

If we look at how the second years cull figures compare as a percentage of the number culled in the first year (column E), we find that in 14 of 21 Areas, it is more than 50%. Given that at least 70% were supposed to have been killed in the first year, this figure seems unexpectedly high. In one case it was 111% - i.e. more were killed in the second year than in the first. Assuming 70% of the population was shot in year 1, how could more than that (i.e. 77% of the original population) have been shot in year 2? That is simply impossible, unless a large number of badgers migrated into the area in the intervening gap, which seems implausible. It strongly suggests that the figures for this area were totally wrong (or that the numbers reported as shot were).

This explains why Defra changed the method for deriving the minimum and maximum take so that it was adjusted according to how many were shot after 28 days. By making this tweak they could ensure that the final figure would appear to represent between 70% and 95% of the imagined population – regardless of what the original minimum and maximum take figures (and hence the "estimated" population prior to the cull). By adjusting the figures as they went along they were able to ensure the targets were met and so the cull could be deemed a "success". If this does not qualify as moving the goalposts (as Mr Paterson so memorably said) then I don't know what does.

In summary, the system now in place is to make up figures based on an assumption that badgers live in a standard density of population across all of England, derived from the numbers shot in previous culls. . This gives the theoretical minimum and maximum kill figures. This is then adjusted after 28 days of the cull according to how many badgers have been shot, to "recalibrate" the minimum and maximum numbers.

The huge underlying assumption here is that the "effort" is the only value that matters – no allowance is made for any differences in any other factor. This tells us that the number of badgers is guesswork, and consequently the minimum and maximum to be culled for each area are similarly just guesses. As a result, it is impossible to say whether a cull in any area has breached the Berne convention, or that local extinction has occurred.

There is zero science behind this, and these figures are in effect created by the process of culling. It should be a scandal that a government agency – three in this case (APHA, NE and Defra in general) is manipulating numbers so that they can claim that the "appropriate" numbers were killed. A "successful" cull is one where >70% and <95% of badgers are killed, but the figures are adjusted according to the numbers killed so that the end result always falls into that range. Every cull is successful because the range is moved to match how many were killed! It is the most circular of circular arguments. The reality is Defra have no idea how many badgers there were (or are) and consequently what percentage of the population the numbers killed represent. The only apparently reliable figures are those for the number killed. The rest is artifice.