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CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE
AND NATURAL HABITATS

Standing Committee

33rd meeting
Strasbourg, 3-6 December 2013

**REPORT ON PROGRESS ON THE IRISH TB
PROGRAMME FOR THE ERADICATION OF
MYCOBACTERIUM BOVIS INFECTION FROM
CATTLE & BADGERS
- 2007-2012 -**



*Document prepared by
the Department of Agriculture, Food and the Marine, Dublin, Ireland*

**REPORT BY THE DEPARTMENT OF AGRICULTURE, FOOD AND MARINE FOR 2012 ON THE
IRISH TB PROGRAMME FOR THE ERADICATION OF *MYCOBACTERIUM BOVIS* INFECTION
FROM CATTLE & BADGERS**

- 2012 -

Introduction

This end of year report on outputs achieved by the Wildlife Unit, Department of Agriculture, Food and the Marine (DAFM) covers the interval 1st January 2012 until 31st December 2012. The report continues the format of recent years. Details of areas where the 6,971 badgers captured/removed under the terms of the conditions specified in the permissions to capture issued by the National Parks and Wildlife Service (NPWS) of the Department of Arts, Heritage and the Gaeltacht (DAHG) are outlined in Table 1 in Appendix 1. The report also contains (Appendix 3) an update of the proportion of agricultural land currently under capture cumulatively since 2005 updated to December 2012. The expanded table (Appendix 2) which first appeared in last year's has been included and again includes graphs and the approvals have again been sub-divided per Divisional Veterinary Office (DVO) area into first time approvals from setts that were added to areas/blocks already approved for capture.

In total during 2012, approvals were granted to capture in 612 areas where DAFM staff sought permissions based on the agreed criteria. This is where a herd must first have had a breakdown of at least 3 standard interpretation reactors or in the opinion of the Superintending Veterinary Inspector locally be very definitely due to *Mycobacterium Bovis*, and that the investigation into the source of the disease outbreak in cattle was not due to purchased infected animals. Of these 612 areas, 454 were new areas where capturing had not been undertaken in since the current Wildlife program commenced in 2003. The corresponding figures in 2011 were 728 and 441 respectively. This reflects the continuing overall decline in the rate of cattle herd breakdowns due to episodes of bovine tuberculosis (BTB).

The basic tenet on which the Wildlife program is based is that a majority of new herd breakdowns are due to previously uninfected cattle falling victim to bovine tuberculosis (BTB), thus perpetuating a cycle of cattle and badgers re-infecting each other and leading to the chronic disease problems becoming endemic in areas in both species. Over previous years, the reductions in the rate of herd breakdowns due to tuberculosis (TB) since the current policy of targeted reductions in densities of badgers commence can be attributed at least in part to the lowered density of badgers continued re-trapping in high incidence BTB areas results in. This in turn leads to the slower expansion of the areas under capture. The 2012 figures suggest a steady state situation is being approached, as with all biological systems the law of "diminishing marginal returns" becomes evident at some point. The rate at which new herd breakdowns due to TB may now begin to slow, so realistically one would be overly optimistic if one were to assume that the rate of improvement witnessed over the past 5 year period will be maintained at a similar rate over the next 5 years.

Badgers Captured

There were 6,971 badgers captured and removed during 2012. Appendix 1 outlines the DVO areas where these removals took place. Based on 2011 capturing, (6,868) this represents an increased extraction rate (circa 1.45%) per area of ground under capture. The rate of increase year on year has slowed however and is well below the 21.85% increase recorded last year. The large increase measured in 2011 was explained as being due to a more focused capturing program being implemented which was planned around a twice yearly pre-capture survey. The current year's capturing effort, and its outturn, confirm that the increased efficiency facilitated by the improved targeting of areas where badger activity is evident which began in 2011 has been maintained and has resulted in a new equilibrium figure of expected returns.

To recap, the basis of this approach is that of the roughly 30,000 setts on DAFMs database, at least one badger has been captured at roughly 10,000 setts. Because badger social groups typically use

between 4-6 setts, one of which is a main sett, the roughly 30,000 setts on the DAFM database represent perhaps 6-7,000 badger social groups. On two occasions each year (a program which began in Feb2011) the setts at which at least one badger have been captured at are visited and scored via an activity score. The visits take place over a two week period in Feb and a second two week period in late September early October. Based on the activity observed during these evaluations, the subsequent capturing program targets the highest density areas. This approach is a change from the previous strategy which tried to cover all the setts that are approved for capture once per year and has resulted in the observed higher numbers of badgers captured. Based on the area of lands approved for capture, this level of badger capturing represents a rate of 0.5 badgers captured per Km² approved for capture, the same levels as achieved in 2011. Assuming our capturing efficiency is 50%, that suggests the current capturing strategy results in overall badger densities of 0.5 badgers per Km² in the areas where DAFMs wildlife program is operational.

As highlighted in last year's report, successive capturing operations are focused predominantly on the same areas, which result in local reductions in badger numbers. It is considered that this lower local density of badgers ultimately leads to less animal-to-animal (badgers to badger or badgers to cattle) transmission of tuberculosis. Of the lands captured this year, 6% were new areas that were being captured for the first time which compares to 2011 figure which was 5%. Of the 94% of lands where capturing commenced prior to 2011, many are now under capture for 5 or more years. This undoubtedly results in lower badger densities in these localities compared with the initial densities when capturing began.

Area of agricultural land where capturing is ongoing

The area of agricultural land under capture in December 2011 was 29.81% and this figure moved on to 31.05% by December 2012 (Appendix 3). When this phase of the badger population control commenced in 2003, DAFM proposed to limit its capturing to not more than 30% of agricultural land during the interval 2003-2008.. While the average of all agricultural land under capture at 31.05% is above the 30% level, not all badgers are culled in these areas. Badgers are culled over an area representing 28.59% of agricultural land, with a further 2.46% of agricultural land where badgers are captured but are vaccinated and released. The average figure of 31.05% varies from a low of 16.8% in County Donegal to a high of 49.8% in County Longford. There is further mention of the culling vs vaccination release program further in this report.

The cost saving agenda being pursued within DAFM, and mentioned in last year's report, is continuing as is the major restructuring of the local office network. This has resulted in the previous network of 28 local offices being reduced to 16. This has resulted in some changes to how the calculations of the area of agricultural land under capture are recorded. In Cork, there were previously local offices for Cork North, Cork Central and Cork West (Clonakilty). These three locations have been rationalised back down to two revised areas, Cork North and South. The table at Appendix 3 reflects these changes from December 2011 onward.

The progression of how areas of lands under capture have grown is again worth highlighting (Totals Row in the table at Appendix 3). The first figure under each December since December 2006 (5.94) is the area added that year and the row percent below that (42.2%) is the proportion of all the land under capture then that was represented by "new lands added". The lands added each year has declined steadily while the trend flat-lined in 2008/2009. The outturn for 2012 is again encouraging, assuming it is maintained in 2013, even as a flat-line outcome. The proportion of each year's land under capture that is new land has consistently trended downward from an initial 42.2% in 2006 through 23.8%(2007), 16.2%(2008), 13.7%(2009), 7.7%(2010), 5.0%(2011) to the present 6.0%(2012)

Ongoing Research

Work is continuing on analysing the data in the DAFMs Wildlife Unit database. Further work was completed in 2012 into badgers ranging patterns and dispersals. In addition a report is being finalising that will explore the feasibility of modelling population estimates for badger numbers. Over the coming years, it is intended to extend the analysis into areas of badger ecology that will inform policy makers as will be necessary when evaluations of the effect of vaccination, the role of vaccine as

a substitute for culling of badgers and how to maximise the potential of BCG vaccination in the national Bovine TB (BTB) eradication program.

Relevant reports and studies published in 2012 include

- Genetic structure of Eurasian badgers and the colonisation history in Ireland (O'Meara et al. 2012; <http://onlinelibrary.wiley.com/doi/10.1111/j.1095-8312.2012.01927.x/full>)
- Population Estimation and Trappability of the European Badger: Implications for Tuberculosis Management (Byrne et al. 2012a; <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0050807>)
- Impact of culling on relative abundance of the European badger in Ireland (Byrne et al. 2013a; <http://link.springer.com/article/10.1007/s10344-012-0643-1#page-1>)
- Factors affecting European Badger capture numbers in one county in Ireland (Byrne et al. 2013b; <http://www.sciencedirect.com/science/article/pii/S0167587712002905>)
- The ecology of the European Badger in Ireland: A review (Byrne et al. 2012b; <http://ria.metapress.com/content/j83n2805271881r8/>)

Vaccination Programme

During 2011, DAFM commenced work in field testing BCG vaccination in wild populations. Work is ongoing in Co. Longford, where capture/vaccinate/release of badgers in roughly 30% of the lands under capture is now part of the local programme. Of the 49.8% of Longford being captured, this is now divided 32.93%:16.87% between continued culling and vaccination.

During 2012, similar vaccination programs commenced in other counties and this process is continuing. A table at Appendix 3 outlines the % of agricultural land under capture and a Net column highlighted in red outlines the area actually under capture which was 28.59% at the end of December, 2012. The vaccination/release areas, comprising 2.46% of agricultural lands, are in Counties Cork, Galway, Longford, Louth, Monaghan, Tipperary and Waterford. These projects will continue during 2014 to 2017 period when they will be evaluated and the optimal strategies will be chosen for the final push toward eradication of TB in Irish cattle. If BCG vaccination in badgers is shown to limit the degree to which infected badgers infect other animals and if it protects badgers not infected with *M. bovis*, then vaccination can be introduced and culling of badgers can be reduced.

Area of agricultural land where capturing

The current calculations of area under capture that was agreed in 2003 would be maintained below 30% is under review. In last year's report, it was explained how the old method used to calculate the area was modified so that in future years a figure that more accurately reflects the areas of the country where capturing is taking place will be calculated. Previously any sett approved for capture had an area of 500 metres buffered around it, and these buffered areas were summed and presented as the area under capture. This was known to be an overestimate of the area under capture, but equally when the program began it was considered prudent to be seen to err on the side of conserving badgers. The experience gained over the 10 years of operating the program has prompted a revised formula to be adopted for 2012 onward.

A revised methodology was proposed by DAHG and agreed to by DAFM. Following this revision, any sett among the 30,000 recorded where either a badger has been captured or any sett within a kilometre of a sett where a capture has ever taken place will be excluded and of the remaining setts any that have been on the system for 3 or more years without any successful capturings having taken place will be excluded from the buffered areas contributing to the aggregated area under capture. This modification results in a 12% reduction in the area under capture when compared to the previously used figure, and is a more accurate reflection of the true extent of DAFM's capturing program. This figure will appear in future years reports. As will be seen in Appendix 3, the net area of agricultural land under capture remains below the previously agreed 30% threshold so the new method of calculating areas where capturing is taking place need not be applied until a future time. In real terms however, the net result is that when the formula is applied, it will reduce the apparent area under capture by 12%. For examples and apparent area under capture of 24, would be adjusted downward to 20 or an area of 32 would be adjusted downward to 28.

Summary

The advent of the capture/vaccinate/release phase of the Medium Term National Strategy will require a revision of the terms and conditions governing the licence issued to DAFM by DAHG. Badgers are no longer automatically culled if captured. In the counties where intra-muscular (I/M) BCG vaccination is being evaluated as an alternative to long-term continued culling of badgers, once a badger is vaccinated it will be released irrespective of where it is captured thereafter. So in the medium term (i.e. 2014-2017) the hope is that vaccination will protect healthy badgers from becoming infected with TB, will result in a slower progression of TB in badgers that are already infected with TB when they are vaccinated and will definitely allow such badgers to avoid being culled until the trials have ended and a conclusion reached on what the final pathway to eradication of BTB will be.

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Appendix 1**Table 1. Badgers Captured per DVO area in 2012**

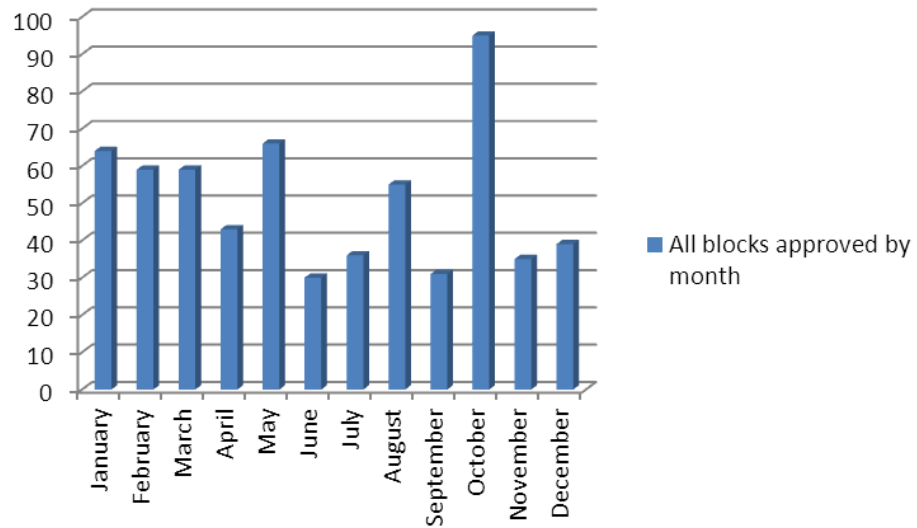
DVO Code	DVO Office	Total Badgers
11	Carlow	147
12	Cavan	215
13	Clare	456
14	Cork Central	138
15	Cork North East	258
16	Donegal	400
17	Dublin	265
18	Galway	403
19	Kerry	341
20	Kildare	126
21	Kilkenny	232
22	Laois	112
23	Leitrim	334
24	Limerick	261
25	Longford	141
26	Louth	64
27	Mayo	321
28	Meath	287
29	Monaghan	140
30	Offaly	111
31	Roscommon	270
32	Sligo	195
33	Tipperary North	331
34	Tipperary South	258
35	Waterford	323
36	Westmeath	154
37	Wexford	421
40	Clonakilty	267
		6971

Appendix 2

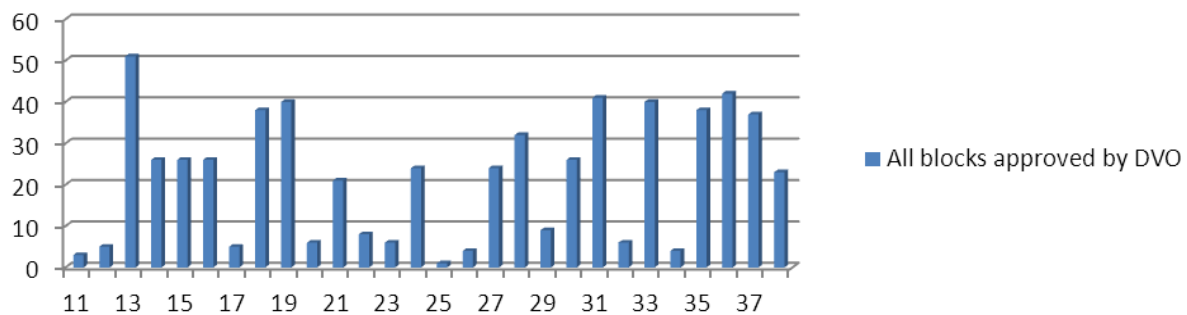
2012 ALL APPROVALS BY MONTH (new approvals and amended)

2012	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40	TOTALS
January	1	0	12	8	3	0	0	2	0	2	3	0	0	0	0	2	6	2	0	4	3	3	0	0	5	5	1	2	64
February	1	0	6	1	3	0	1	2	8	2	4	0	1	0	0	0	0	4	0	2	0	1	1	0	13	0	8	1	59
March	0	0	0	1	1	0	0	4	2	2	1	1	2	0	0	0	0	3	0	6	14	0	6	2	3	4	5	2	59
April	0	0	1	2	1	0	0	5	0	0	0	0	0	5	0	0	2	4	0	2	4	0	3	2	1	7	3	1	43
May	0	1	2	1	5	9	0	4	2	0	2	0	0	4	0	1	0	6	1	3	5	0	7	0	0	6	4	3	66
June	0	1	2	0	0	1	0	8	2	0	0	0	0	0	0	1	0	1	0	3	0	0	3	0	2	2	3	1	30
July	0	2	9	1	1	3	0	8	2	0	0	0	0	2	0	0	1	1	0	1	1	0	1	0	1	0	2	0	36
August	0	0	0	2	5	11	0	2	12	0	0	0	0	6	0	0	0	0	0	3	3	0	0	0	4	4	0	3	55
September	0	0	3	0	2	2	0	3	2	0	1	1	0	5	0	0	2	0	0	0	2	0	2	0	0	2	2	2	31
October	1	1	10	10	3	0	0	0	6	0	4	4	3	0	1	0	6	7	6	2	5	2	5	0	5	7	1	6	95
November	0	0	5	0	2	0	0	0	2	0	1	2	0	0	0	0	4	2	0	0	4	0	5	0	2	0	5	1	35
December	0	0	1	0	0	0	4	0	2	0	5	0	0	2	0	0	3	2	2	0	0	0	7	0	2	5	3	1	39
TOTALS	3	5	51	26	26	26	5	38	40	6	21	8	6	24	1	4	24	32	9	26	41	6	40	4	38	42	37	23	612

All blocks approved by month



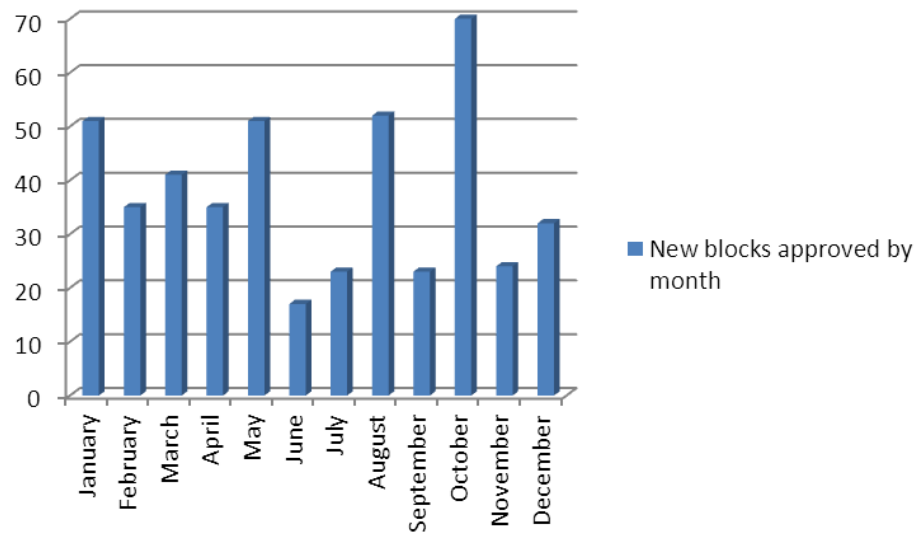
All blocks approved by DVO



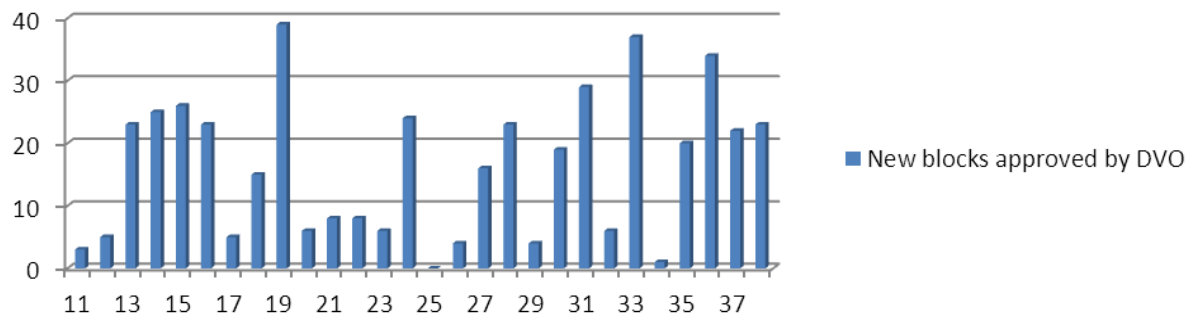
2012 NEW APPROVALS BY MONTH

2012	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40	TOTALS
January	1	0	8	8	3	0	0	2	0	2	0	0	0	0	0	2	6	1	0	4	3	3	0	0	2	3	1	2	51
February	1	0	3	1	3	0	1	1	8	2	0	0	1	0	0	0	0	1	0	2	0	1	1	0	7	0	1	1	35
March	0	0	0	1	1	0	0	2	2	2	0	1	2	0	0	0	0	2	0	3	9	0	4	1	2	4	3	2	41
April	0	0	0	2	1	0	0	2	0	0	0	0	0	5	0	0	1	4	0	2	4	0	3	0	1	6	3	1	35
May	0	1	1	0	5	9	0	2	2	0	1	0	0	4	0	1	0	4	0	1	3	0	7	0	0	3	4	3	51
June	0	1	0	0	0	0	0	3	1	0	0	0	0	0	0	1	0	1	0	2	0	0	3	0	2	1	1	1	17
July	0	2	4	1	1	3	0	1	2	0	0	0	0	2	0	0	1	1	0	0	1	0	1	0	1	0	2	0	23
August	0	0	0	2	5	11	0	1	12	0	0	0	0	6	0	0	0	0	0	3	3	0	0	0	2	4	0	3	52
September	0	0	1	0	2	0	0	1	2	0	0	1	0	5	0	0	1	0	0	0	2	0	2	0	0	2	2	2	23
October	1	1	4	10	3	0	0	0	6	0	3	4	3	0	0	0	5	6	2	2	1	2	4	0	0	7	0	6	70
November	0	0	2	0	2	0	0	0	2	0	0	2	0	0	0	0	1	2	0	0	3	0	5	0	2	0	2	1	24
December	0	0	0	0	0	0	4	0	2	0	4	0	0	2	0	0	1	1	2	0	0	0	7	0	1	4	3	1	32
TOTALS	3	5	23	25	26	23	5	15	39	6	8	8	6	24	0	4	16	23	4	19	29	6	37	1	20	34	22	23	454

New blocks approved by month



New blocks approved by DVO



Appendix 3 Agricultural land (%) under capture on dates since 2003														
COUNTY	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	VaccRel	NetCapt				
Carlow	12.76	17.93	20.05	22.13	27.22	30.70	31.05	31.54	0.00	31.54				
Cavan	7.86	15.93	19.47	24.14	28.87	35.35	37.32	38.26	0.00	38.26				
Clare	7.21	13.70	19.02	24.00	30.15	32.70	34.68	36.40	0.00	36.40				
Cork SouthWest	4.22	9.52	14.46	17.14	19.55	20.19	31.81	33.71	0.00	33.71				
Cork NorthEast	4.30	8.71	10.56	11.48	15.07	16.09	28.79	30.01	3.78	26.23				
Donegal	2.65	5.89	8.54	10.61	12.64	14.55	15.27	16.80	0.00	16.80				
Dublin (Wicklow East)'	0.54	11.89	18.98	23.48	24.69	26.88	33.29	34.01	0.00	34.01				
Galway	5.39	11.12	14.49	15.51	18.93	20.06	21.77	22.72	5.49	17.23				
Kerry	3.74	5.72	10.19	12.90	16.96	18.64	20.80	22.40	0.00	22.40				
Kildare (Wicklow West)'	9.59	15.01	16.72	19.51	24.27	26.74	27.24	28.08	0.00	28.08				
Kilkenny	20.89	27.62	32.09	33.57	35.72	38.35	38.76	40.06	0.00	40.06				
Laois	7.91	11.32	14.70	17.25	21.21	21.83	22.25	23.78	0.00	23.78				
Leitrim	10.33	22.71	32.29	39.76	41.21	42.79	43.91	44.60	0.00	44.60				
Limerick	4.46	9.60	17.33	25.83	30.67	33.15	34.03	35.53	0.00	35.53				
Longford	19.69	33.00	38.46	42.05	46.22	49.41	49.80	49.80	16.87	32.93				
Louth	15.29	18.85	21.37	23.64	25.93	26.37	30.95	32.18	32.18	0.00				
Mayo	6.46	9.36	11.15	13.23	14.61	15.60	17.50	18.98	0.00	18.98				
Meath	6.48	11.19	13.26	16.83	21.98	25.58	29.34	32.17	0.00	32.17				
Monaghan	26.97	34.21	35.89	37.50	39.32	40.77	41.10	41.68	14.16	27.52				
Offaly	5.92	9.41	13.42	19.38	22.66	23.88	26.03	28.01	0.00	28.01				
Roscommon	2.14	4.01	5.90	8.09	11.61	15.65	18.15	21.02	0.00	21.02				
Sligo	8.29	22.13	28.29	36.35	39.54	40.42	41.31	41.87	0.00	41.87				
Tipperary North'	19.62	30.92	38.56	43.28	45.23	46.54	47.76	49.54	7.20	42.34				
Tipperary South'	5.94	14.08	22.28	27.32	31.08	32.61	33.98	34.06	9.37	24.69				
Waterford	12.51	20.26	25.39	29.55	32.56	36.04	37.60	40.58	8.55	32.03				
Westmeath	4.15	9.13	12.81	16.23	19.13	21.49	24.60	31.38	0.00	31.38				
Wexford	10.72	15.85	20.27	23.95	28.07	30.91	33.56	37.35	0.00	37.35				
TOTAL	8.14	14.09	18.50	22.07	25.57	27.71	29.18	31.05	2.46	28.59				
		5.95	4.41	3.57	3.50	2.14	1.47	1.87						
		42.2%	23.8%	16.2%	13.7%	7.7%	5.0%	6.0%						

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In total during 2011, approvals were granted to capture in 728 areas where DAFM staff sought permissions based on the agreed criteria. This is where a herd must first have had a breakdown of at least 3 standard interpretation reactors or in the opinion of the Superintending Veterinary Inspector locally be very definitely due to *Mycobacterium Bovis*, and that the investigation into the source of the disease outbreak in cattle was not due to purchased infected animals. Of these 728 areas, 441 were new areas where capturing had not been undertaken in since the current Wildlife program commenced in 2003. Both figures represent a reduction on last year, when the corresponding figures were 749 and 520 respectively. This reflects the continuing overall decline in the rate of cattle herd breakdowns due to episodes of bovine tuberculosis (BTB).

The basic tenet on which the Wildlife program is based is that a majority of new herd breakdowns are due to previously uninfected cattle falling victim to BTB, thus perpetuating a cycle of cattle and badgers re-infecting each other and leading to the chronic disease problems becoming endemic in areas in both species. The reduced rate observed over the past years in herd breakdowns can be attributed at least in part to a lower density of badgers resulting from the continued re-trapping of badgers in high incidence BTB areas, which in turn again leads to the slower expansion of the areas under capture.

Badgers Captured

There were 6,868 badgers captured and removed during 2011. Appendix 1 outlines the Divisional Veterinary office (DVO) areas where these removals took place. Based on 2010 capturings (5,636) this represents an increased extraction rate (circa 21.85%) per area of ground under capture. This increase is the result of a more focused capturing program which is based on a twice yearly pre-capture survey. Of the roughly 30,000 setts on DAFMs database, at least one badger has been captured at roughly 10,000 setts. Because badger social groups typically use between 4-6 setts, one of which is a main sett, the roughly 30,000 setts on the DAFM database represent perhaps 6-7,000 badger social groups. On two occasions each year (a program which began in February 2011) the setts at which at least one badger have been captured at are visited and scored via an activity score. The visits take place over a two week period in February and a second two week period in late September early October.

Based on the activity observed during these evaluations, the subsequent capturing program targets the highest density areas. This approach is a change from the previous strategy which tried to cover all the setts that are approved for capture once per year and has resulted in the observed higher numbers of badgers captured. Based on the area of lands approved for capture, this level of badger capturing represents a rate of 0.5 badgers captured per Km² approved for capture. Assuming the

capturing efficiency is 50%, that suggests our current capturing strategy results in overall badger densities of 0.5 badgers per Km² in the areas where DAFMs wildlife program is operational.

As highlighted in last year's report, successive capturing operations are focused predominantly on the same areas, which result in local reductions in badger numbers. This lower local density of badgers is what we believe ultimately leads to less animal-to-animal (badgers to badger or badgers to cattle) transmission of tuberculosis. Only 5% of the lands captured this year were new areas that were being captured for the first time. Of the 95% of lands where capturing commenced prior to 2010, many are now under capture for 4 or more years. This undoubtedly results in lower badger densities in these localities compared with the initial densities when capturing began.

Area of agricultural land where capturing is ongoing

The area of agricultural land under capture in July 2011 was 28.52% and this figure moved on to 29.18% by December 2011 (Appendix 3). When this phase of the badger population control commenced in 2003, DAFM proposed to limit its capturing to not more than 30% of agricultural land during the interval 2003-2008. While the average of all agricultural land under capture is 29.18%, this varies from a low of 15.27% in County Donegal to a high of 49.8% in County Longford.

The current cost saving agenda being pursued within DAFM includes a major restructuring of the local office network. This has resulted in the previous network of 28 local offices being reduced to 16. This has resulted in some changes to how the calculations of the area of agricultural land under capture are recorded. In Cork, there were previously local offices for Cork North, Cork Central and Cork West (Clonakilty). These three locations have been rationalised back down to two revised areas, Cork North and South. The table at Appendix 3 reflects this from December 2011 onward. The %land areas prior to Dec2011 are displayed in a smaller font as these are the contemporaneous values for what was previous divisions within Cork on those dates, but do not reflect the newly divided areas which are displayed in the larger font beginning in December 2011.

The progression of how areas of lands under capture have grown is again worth highlighting (Totals Row in the table at Appendix 3). The first figure under each December since December 2006 (5.94) is the area added that year and the row percent below that (42.2%) is the proportion of all the land under capture then that was represented by "new lands added". The lands added each year has declined steadily while the trend flat-lined in 2008/2009. The outturn for 2011 is again encouraging assuming it is maintained in 2012, even as a flat-line outcome. The proportion of each year's land under capture that is new land has consistently trended downward from an initial 42.2% in 2006 through 23.8%(2007), 16.2%(2008), 13.7%(2009), 7.7%(2010) to the present 5.0%(2011)

Ongoing Research

A research project is underway on the analysis of DAFMs Wildlife Unit database which is expected to be completed by the end of 2012. Results from the project, during 2011, indicates that DAFMs capturing system delivers capturing efficiencies of around 50%. This is welcome news to those who feared DAFMs capturing program was destined to threaten the survival of badgers in the Irish Republic. This capturing efficiency estimate is perhaps the principle reason why the worst case scenarios that have been predicted by some commentators who predict a deleterious outcome for badgers are not materialising as they have been warning.

Relevant reports published in 2011 include

- Progress in tuberculosis eradication in Ireland – Michael Sheridan (<http://www.sciencedirect.com/science/article/pii/S0378113511001210>)
- The Biennial Report for 2010-11 prepared by Centre for Veterinary Epidemiology and Risk Analysis (CVERA) on the Badger Vaccine Project (<http://www.ucd.ie/cvera/biennialreports/>)

Vaccination Programme

During 2011 DAFM commenced work in field testing BCG vaccination in wild populations. Work began in Co. Longford, where it is planned to capture/vaccinate/release badgers in roughly 30% of the lands under capture. Of the 49.8% of Longford being captured, this is now divided 32.41%:17.39% between continued culling and vaccination. The trial will continue for 4/5 years and

further areas are due to commence in 2012 in counties Monaghan and Tipperary. If vaccination proves to limit the degree to which infected badgers are capable of infecting other animals and if it protects badgers not infected with *M.bovis*, then strategies whereby culling can be drastically reduced can be introduced.

Summary

The current calculations of area under capture were agreed in 2003 to be maintained below 30%. The method used to calculate the area will be modified so that in future years a figure that more accurately reflects the areas of the country where capturing is taking place will be calculated. Previously any sett approved for capture had an area of 500 metres buffered around it, and these buffered areas were summed and presented as the area under capture. This was known to be an overestimate of the area under capture, but equally when the program began it was considered prudent to be seen to err on the side of conserving badgers. The experience gained over the 10 years of operating the program has prompted a revised formula to be adopted for 2012 onward.

Under this revised methodology that was proposed by DAHG and agreed to by DAFM, any sett among the 30,000 recorded where either a badger has been captured or any sett within a kilometre of a sett where a capture has ever taken place will be excluded and of the remaining setts any that have been on the system for 3 or more years without any successful capturings having taken place will be excluded from the buffered areas contributing to the aggregated area under capture. This modification results in a 12% reduction in the area under capture when compared to the previously used figure, and is a more accurate reflection of the true extent of DAFMs capturing program. This figure will appear in future year's reports.

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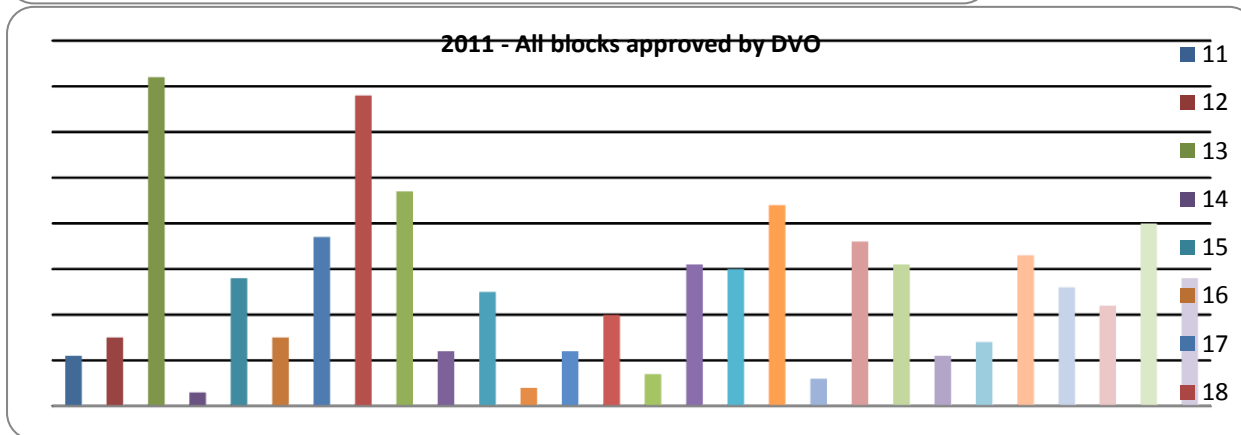
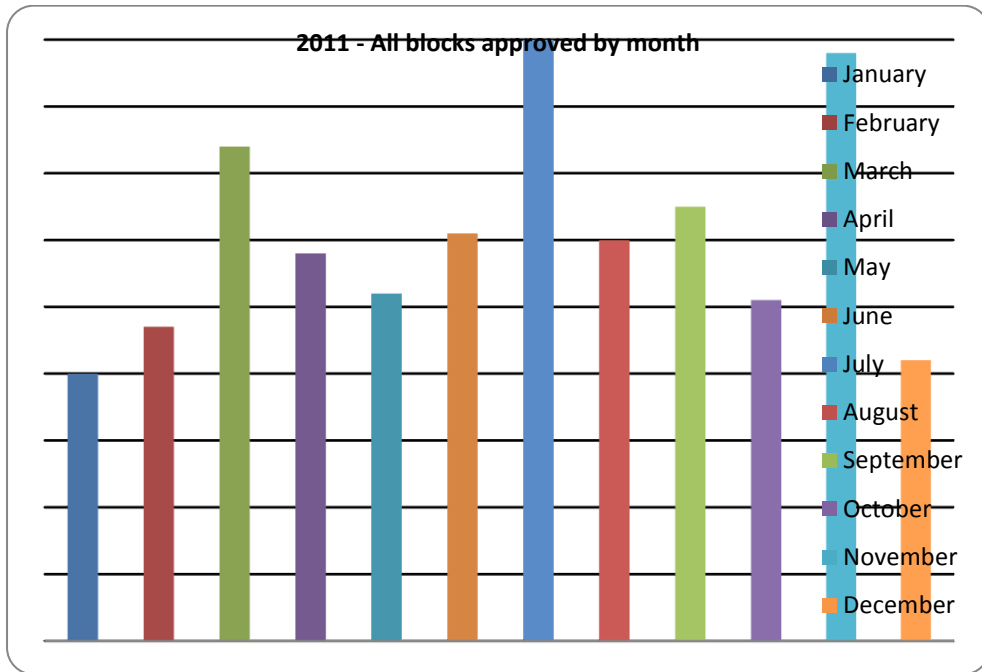
Appendix 1

Table 1. Badgers Captured per DVO area in 2011

DVO Code	DVO Office	Total Badgers
11	Carlow	125
12	Cavan	235
13	Clare	421
14	Cork Central	41
15	Cork North East	218
16	Donegal	341
17	Dublin	168
18	Galway	449
19	Kerry	360
20	Kildare	127
21	Kilkenny	269
22	Laois	129
23	Leitrim	333
24	Limerick	264
25	Longford	153
26	Louth	62
27	Mayo	325
28	Meath	205
29	Monaghan	161
30	Offaly	133
31	Roscommon	220
32	Sligo	243
33	Tipperary North	365
34	Tipperary South	265
35	Waterford	478
36	Westmeath	135
37	Wexford	302
40	Clonakilty	341
	Total	6868

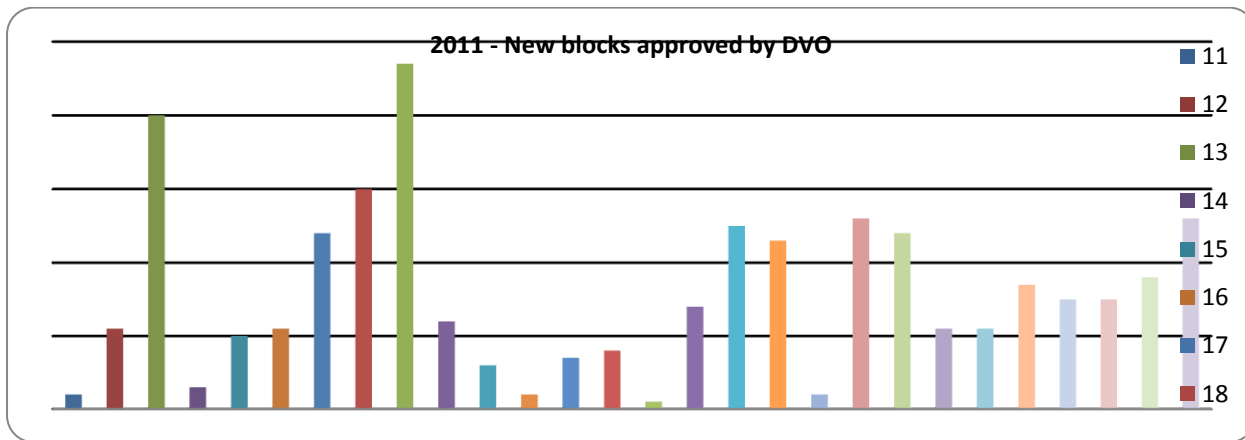
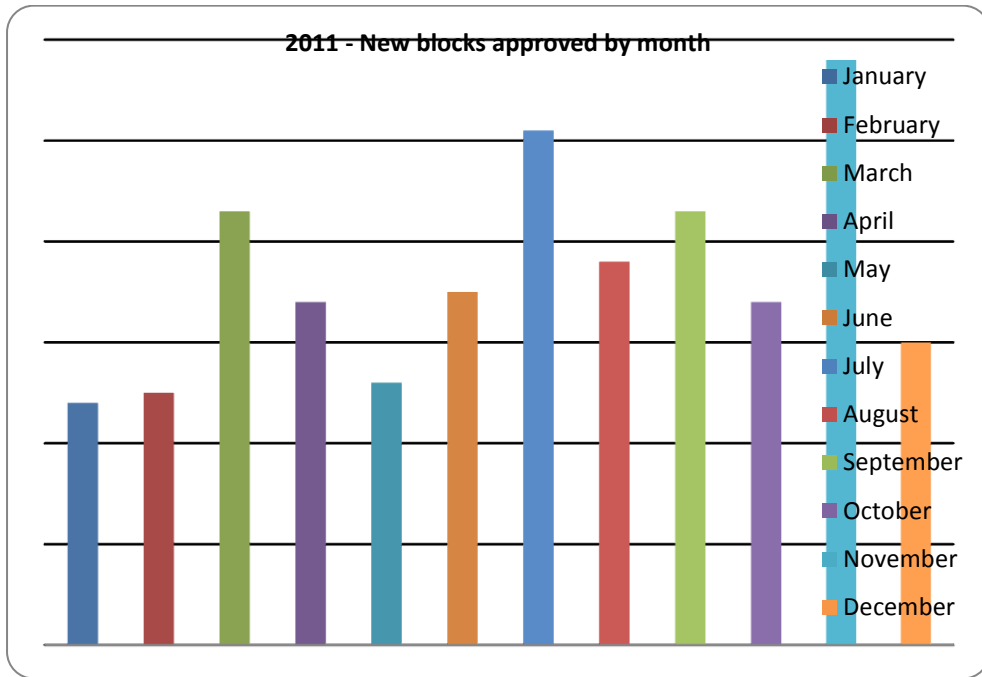
2011 - ALL APPROVALS BY MONTH (new approvals and amended)

2011	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40	TOTALS
January	0	2	2	0	0	0	1	10	2	1	0	1	0	0	3	1	0	1	1	2	2	0	2	2	0	3	2	2	40
February	1	1	0	1	0	0	5	6	2	0	6	1	0	0	1	4	3	4	0	3	0	2	1	2	2	0	0	2	47
March	2	1	2	0	0	3	3	12	5	1	2	0	2	0	1	9	3	9	2	1	3	0	5	2	1	0	1	4	74
April	0	3	7	2	0	0	2	4	2	1	2	1	0	0	0	0	4	7	0	8	4	0	0	6	1	0	4	0	58
May	0	1	3	0	1	3	1	3	3	2	1	0	0	11	0	2	2	2	0	0	4	0	1	4	1	4	0	3	52
June	6	0	7	0	0	1	12	3	0	0	0	0	0	0	0	3	1	1	0	4	4	0	0	0	0	2	17	0	61
July	0	0	22	0	1	7	7	6	3	4	2	0	5	0	1	7	1	4	0	3	2	0	1	2	5	1	0	6	90
August	1	0	10	0	3	1	4	9	5	0	2	0	0	4	0	0	3	1	0	4	7	0	0	0	2	0	1	3	60
September	0	2	6	0	3	0	1	9	3	0	1	1	0	3	0	3	5	3	3	0	0	6	2	10	0	1	1	2	65
October	0	2	2	0	0	0	1	3	7	2	4	0	1	2	1	0	0	1	0	3	2	0	2	2	0	9	4	3	51
November	0	1	4	0	19	0	0	2	6	0	3	0	4	0	0	1	6	7	0	6	2	3	0	3	11	2	6	2	88
December	1	2	7	0	1	0	0	1	9	1	2	0	0	0	0	1	2	4	0	2	1	0	0	0	3	0	4	1	42
TOTALS	11	15	72	3	28	15	37	68	47	12	25	4	12	20	7	31	30	44	6	36	31	11	14	33	26	22	40	28	728



2011 - NEW APPROVALS BY MONTH

2011	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40	TOTALS
January	0	2	0	0	0	0	0	5	2	1	0	1	0	0	1	1	0	0	1	0	1	0	1	2	0	3	1	2	24
February	0	1	0	1	0	0	1	3	2	0	0	1	0	0	0	1	3	3	0	3	0	2	1	0	1	0	0	2	25
March	0	0	2	0	0	2	2	7	5	1	0	0	2	0	0	4	2	4	1	1	3	0	3	0	0	0	1	3	43
April	0	1	5	2	0	0	2	2	2	1	1	0	0	0	0	0	3	2	0	0	3	0	0	5	1	0	4	0	34
May	0	0	1	0	1	3	0	2	3	2	1	0	0	0	0	2	2	1	0	0	1	0	1	3	0	0	0	3	26
June	1	0	6	0	0	0	12	1	0	0	0	0	0	0	0	1	1	1	0	4	4	0	0	0	0	0	4	0	35
July	0	0	9	0	1	6	5	3	3	4	1	0	1	0	0	2	1	1	0	3	1	0	1	1	1	1	0	6	51
August	0	0	6	0	3	0	0	2	5	0	0	0	0	4	0	0	2	0	0	4	6	0	0	0	2	0	1	3	38
September	0	2	3	0	3	0	1	3	3	0	1	0	0	2	0	2	5	2	0	0	0	6	2	4	0	1	1	2	43
October	0	2	1	0	0	0	1	0	7	2	0	0	0	2	0	0	0	1	0	3	2	0	2	0	0	8	0	3	34
November	0	1	2	0	1	0	0	2	6	0	1	0	4	0	0	0	5	5	0	6	2	3	0	2	9	2	6	1	58
December	1	2	5	0	1	0	0	0	9	1	1	0	0	0	0	1	1	3	0	2	1	0	0	0	1	0	0	1	30
TOTALS	2	11	40	3	10	11	24	30	47	12	6	2	7	8	1	14	25	23	2	26	24	11	11	17	15	15	18	26	441



Appendix 3 Agricultural land (%) under capture on dates since 2003															
COUNTY	Dec-05	Aug-06	Dec-06	Jun-07	Dec-07	Jul-08	Dec-08	Jul-09	Dec-09	Jun-10	Dec-10	Jun-11	Dec-11	VaccRel	NetCapt
Carlow	12.76	16.34	17.93	18.54	20.05	21.12	22.13	26.59	27.22	28.96	30.70	30.81	31.05	0.00	31.05
Cavan	7.86	12.18	15.93	18.19	19.47	21.49	24.14	25.65	28.87	31.46	35.35	36.14	37.32	0.00	37.32
Clare	7.21	10.18	13.70	15.39	19.02	22.26	24.00	27.86	30.15	31.44	32.70	33.26	34.68	0.00	34.68
Cork SouthWest	4.22	7.82	9.52	11.73	14.46	15.76	17.14	18.89	19.55	19.87	20.19	20.21	31.81	0.00	31.81
Cork NorthEast	4.30	7.39	8.71	9.49	10.56	11.58	11.48	14.07	15.07	15.33	16.09	16.35	28.79	0.00	28.79
Donegal	2.65	4.29	5.89	7.61	8.54	9.39	10.61	11.96	12.64	14.21	14.55	14.78	15.27	0.00	15.27
Dublin (Wicklow East)'	0.54	9.48	11.89	16.03	18.98	22.01	23.48	24.48	24.69	24.96	26.88	31.72	33.29	0.00	33.29
Galway	5.39	6.53	11.12	12.20	14.49	15.15	15.51	18.26	18.93	19.16	20.06	21.16	21.77	0.00	21.77
Kerry	3.74	4.90	5.72	7.51	10.19	11.18	12.90	14.82	16.96	17.10	18.64	19.42	20.80	0.00	20.80
Kildare (Wicklow West)'	9.59	13.61	15.01	16.10	16.72	17.80	19.51	23.74	24.27	25.37	26.74	26.97	27.24	0.00	27.24
Kilkenny	20.89	24.63	27.62	28.79	32.09	32.49	33.57	34.64	35.72	36.47	38.35	38.56	38.76	0.00	38.76
Laois	7.91	10.41	11.32	12.98	14.70	15.25	17.25	20.36	21.21	21.24	21.83	21.88	22.25	0.00	22.25
Leitrim	10.33	13.66	22.71	28.76	32.29	36.73	39.76	40.11	41.21	42.28	42.79	43.06	43.91	0.00	43.91
Limerick	4.46	7.23	9.60	13.75	17.33	20.52	25.83	28.67	30.67	31.48	33.15	33.30	34.03	0.00	34.03
Longford	19.69	28.05	33.00	36.91	38.46	40.89	42.05	44.75	46.22	47.87	49.41	50.07	49.80	17.39	32.41
Louth	15.29	17.30	18.85	19.25	21.37	22.99	23.64	25.45	25.93	26.18	26.37	28.90	30.95	0.00	30.95
Mayo	6.46	8.59	9.36	10.48	11.15	12.23	13.23	13.82	14.61	15.14	15.60	16.63	17.50	0.00	17.50
Meath	6.48	8.78	11.19	11.91	13.26	14.67	16.83	21.00	21.98	24.13	25.58	27.65	29.34	0.00	29.34
Monaghan	26.97	30.17	34.21	35.68	35.89	36.99	37.50	38.99	39.32	39.70	40.77	41.09	41.10	0.00	41.10
Offaly	5.92	7.71	9.41	12.53	13.42	17.00	19.38	20.73	22.66	23.08	23.88	25.05	29.19	0.00	29.19
Roscommon	2.14	3.09	4.01	5.68	5.90	7.01	8.09	11.20	11.61	14.25	15.65	16.90	18.15	0.00	18.15
Sligo	8.29	13.89	22.13	26.01	28.29	32.55	36.35	38.45	39.54	40.02	40.42	40.79	41.31	0.00	41.31
Tipperary North'	19.62	24.15	30.92	33.28	38.56	40.63	43.28	44.72	45.23	46.12	46.54	47.31	47.76	0.00	47.76
Tipperary South'	5.94	9.98	14.08	18.46	22.28	25.52	27.32	30.53	31.08	31.81	32.61	33.37	33.98	0.00	33.98
Waterford	12.51	16.45	20.26	23.19	25.39	26.83	29.55	31.13	32.56	34.18	36.04	36.41	37.60	0.00	37.60
Westmeath	4.15	6.60	9.13	11.84	12.81	14.27	16.23	17.62	19.13	20.64	21.49	21.63	24.60	0.00	24.60
Wexford	10.72	13.67	15.85	17.99	20.27	23.12	23.95	27.15	28.07	29.04	30.91	32.51	33.56	0.00	33.56
TOTAL	8.14	11.25	14.09	16.29	18.50	20.34	22.07	24.42	25.57	25.54	27.71	28.52	29.18	0.28	28.90

			5.95		4.41		3.57		3.50		2.14		1.47		
			42.2%		23.8%		16.2%		13.7%		7.7%		5.0%		

**REPORT BY THE DEPARTMENT OF AGRICULTURE, FISHERIES AND FOOD FOR 2010 ON THE
IRISH TB PROGRAMME FOR THE ERADICATION OF *MYCOBACTERIUM BOVIS* INFECTION
FROM CATTLE & BADGERS**

- 2010 -

Introduction

This end of year report on outputs achieved by the Wildlife Unit, Department of Agriculture, Fisheries and Food (DAFF) covers the interval 1st January 2010 until 31st December 2010. The report retains last years format and again details the numbers of badgers captured/removed under the terms of the conditions specified in the permissions to capture issued by the National Parks and Wildlife Service (NPWS) of the Department of the Environment, Heritage and Local Government (DEHLG) (see Appendix1). It also provides (see Appendix 3) an update on the proportion of agricultural land currently under capture cumulatively since 2005 updated for July 2010 and December 2010. A table (see Appendix 2) added last year outlining results of the approvals process by which new setts are added to the areas under capture has been expanded in this year's report to include some graphs and the approvals have also been sub-divided per Divisional Veterinary Office (DVO) area into first time approvals from setts that were added to areas/blocks already approved for capture.

In total during 2010, approvals were granted to capture in 749 areas where DAFF staff sought permissions based on the agreed criteria. This is where a herd must first have had a breakdown of at least 3 standard interpretation reactors or in the opinion of the Superintending Veterinary Inspector locally be very definitely due to *Mycobacterium Bovis*, and that the investigation into the source of the disease outbreak in cattle was not due to purchased infected animals. Of these 749 areas, 520 were new areas where capturing had not been undertaken in since the current Wildlife program commenced in 2003. Both figures represent a reduction on last year, when the corresponding figures were 812 and 597 respectively. This reflects the overall decline in the rate of cattle herd breakdowns due to episodes of bovine tuberculosis (BTB). The basic tenet on which the Wildlife program is based is that a majority of new herd breakdowns are due to previously uninfected cattle falling victim to BTB, thus perpetuating a cycle of cattle and badgers re-infecting each other and leading to the chronic disease problems becoming endemic in areas in both species. The reduced rate observed over the past years in herd breakdowns can be attributed at least in part to a lower density of badgers resulting from the continued re-trapping of badgers in high incidence BTB areas, which in turn again leads to the slower expansion of the areas under capture.

Badgers captured and removed.

There were 5,636 badgers captured and removed during 2010. Appendix 1 outlines the DVO areas where these removals took place. Based on 2009 capturings, this represents a reduced extraction rate (circa 6%) per area of ground under capture. As highlighted in last year's report, successive capturing operations are focused predominantly on the same areas, which result in local reductions in badger numbers. This lower local density of badgers is what we believe ultimately leads to less animal-to-animal (badgers to badger or badgers to cattle) transmission of tuberculosis. Only 7% of the lands captured this year were new areas that were being captured for the first time. Of the 93% of lands where capturing commenced prior to 2009, many are now under capture for 4 or more years. This undoubtedly results in lower badger densities in these localities compared with the initial densities when capturing began.

Area of agricultural land where capturing is ongoing.

The area of agricultural land under capture in July 2010 was 26.54% and this figure moved on to 27.71% by December 2010 (Appendix 3). When this phase of the badger population control commenced in 2003, DAFF proposed to limit it's capturing to not more than 30% of agricultural land during the interval 2003-2008. These data confirm that this limit has not, as yet, been reached. The 30% figure will likely be arrived at during late 2011 or early 2012, so new limits to cover a future period require to be discussed and agreed during the year ahead. While the average of all agricultural land

under capture is 27.71%, this varies from a low of 14.55% in County Donegal to a high of 49.41% in County Longford.

The progression of how areas of lands under capture have grown is worth highlighting (Totals Row in the table at Appendix 3). The first figure under each December since Dec 2006 (5.94) is the area added that year and the row percent below that (42.2%) is the proportion of all the land under capture then that was represented by “new lands added”. The lands added each year has declined steadily while the trend flat-lined in 2008/2009. The outturn for 2010 is encouraging assuming it is maintained in 2012, even as a flat-line outcome. The proportion of each year’s land under capture that is new land has consistently trended downward from an initial 42.2% in 2006 through 23.8%(2007), 16.2%(2008), 13.7%(2009) to the present 7.7%(2010).

Ongoing Research

The 2009 report provided details of the phase of the Wildlife Program (WP) which was first rolled out in Co. Monaghan in 2003, as a sustained capturing effort has been maintained in that county for longer than anywhere else nationally.

The good progress has continued in Co. Monaghan, which along with counties Mayo and Kerry, have this year been joined by 5 additional Divisional Veterinary Office (DVO) areas whose herd incidence is now below 4%. In 2010 in Co. Monaghan, there were 12 new areas added to the area under capture, which reflects the continuing lower number of herd breakdowns in new areas. Co. Longford is an area where similar encouraging results are now being witnessed, as the wildlife program in that county lagged behind the Co Monaghan work by perhaps 3 years the improvement being witnessed now mirrors the sequence of events previously observed in Monaghan.

Ds. Lynsey Stuart, published a report on aspects of the Reproduction of Irish badgers in 2010 which will assist the scientific community in their understanding of aspects of badger reproductive behaviour.

http://stella.catalogue.tcd.ie/iii/encore/record/C_Rb14384686_Sbadger_Ff%3Afacetmediatype%3Ax%3Ax%3ATCD%20Thesis%3A%3A_Orightresult_X5?lang=eng&suite=cobalt

The DAFF funded research programme on badgers will continue to operate at University College Cork (U.C.C). (<http://publish.ucc.ie/profiles/D026/psleeman/new>)

Vaccination Programme

DAFFs plans for testing the efficacy of BCG vaccination of badgers as part of the effort to control the spread of and ultimately eradicate Tb from both cattle and badgers was mentioned in last years report. A proposal has been agreed with farming organisations that will see a programme of intra-muscularly administered BCG (I/M BCG) beginning in Co. Longford in March, 2011 and these trials will later be extended to include vaccination I/M with BCG to areas in counties Tipperary and Monaghan. These trials will test the hypothesis that I/M vaccination with BCG is as good as (not worse than) reactive culling as operated by DAFFs Wildlife Unit in controlling BTB levels in herds locally.

Summary

The current year will see the lands where the WU capturing program reach or almost reach the self-imposed 30% figure agreed in 2003. The current phase of evaluating the benefits and/or usefulness of incorporating I/M BCG vaccination as an adjunct to and ultimate replacement of culling badgers in high BTB areas will last for 3-5 years. Between 2011-2015 DAFF may require to extend the capturing areas above 30%, net of vaccination trial areas. There is no reason to believe an area greater than 40% will be required up to and including 2015. If vaccination proves to be a viable alternative to repeated culling, and assuming the costs are neutral at the societal level, then vaccination will likely replace culling. If, on the other hand, the promise vaccination has shown under experimental conditions is not maintained in wild badger populations then culling may have to be intensified and perhaps encompass up to 60% of agricultural land. While this is the worst case scenario, and there is no evidence to suggest the outcome of vaccine in wild populations will be any less successful than in experiments to date, it would still leave

40+% of agricultural land outside trapping areas and its native badger population unaffected by DAFFs wildlife program.

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Appendix 1

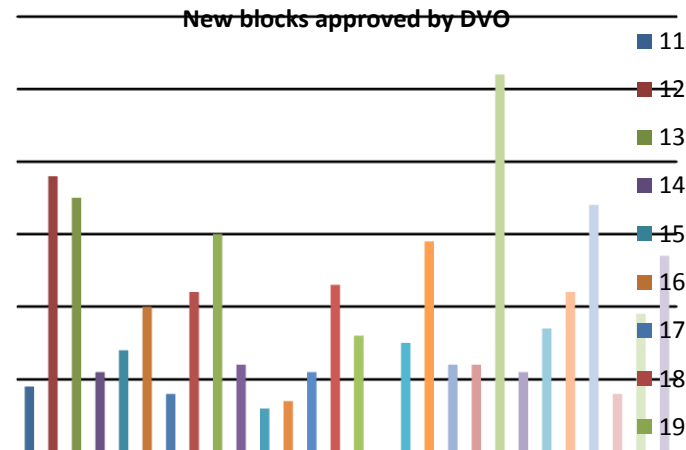
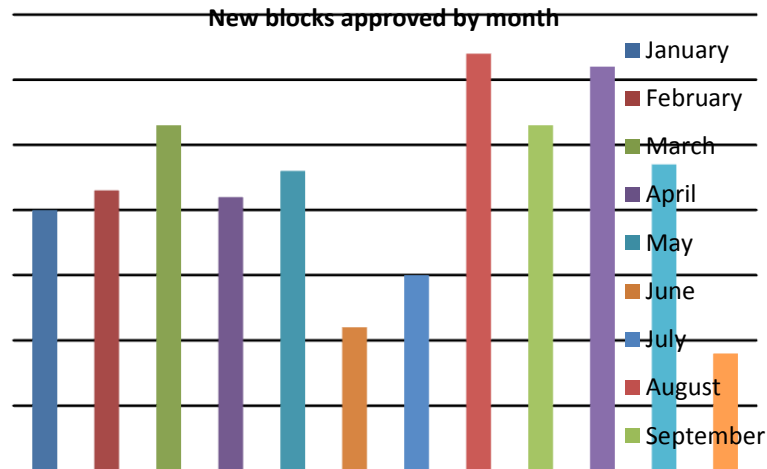
Badgers Captured per DVO area in 2010

DVO Code	DVO Office	Total Badgers
11	Carlow	125
12	Cavan	290
13	Clare	386
14	Cork Central	51
15	Cork North East	278
16	Donegal	297
17	Dublin	12
18	Galway	321
19	Kerry	286
20	Kildare	103
21	Kilkenny	167
22	Laois	119
23	Leitrim	328
24	Limerick	222
25	Longford	190
26	Louth	64
27	Mayo	238
28	Meath	163
29	Monaghan	120
30	Offaly	111
31	Roscommon	65
32	Sligo	253
33	Tipperary North	284
34	Tipperary South	248
35	Waterford	301
36	Westmeath	138
37	Wexford	201
40	Clonakilty	275
	Total	5636

Appendix2

NEW APPROVALS BY MONTH (new only)

2010	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40	TOTALS
January	5	4	4	0	1	0	0	0	0	0	1	0	0	1	2	0	1	1	1	0	3	1	2	0	1	1	3	8	40
February	0	7	1	0	0	0	0	4	3	2	0	0	0	1	0	0	3	2	2	1	6	0	2	3	1	3	1	1	43
March	0	0	2	3	1	10	0	1	0	1	3	0	3	0	1	0	4	4	1	1	4	3	2	2	3	0	2	2	53
April	0	1	4	0	2	3	0	0	2	1	0	0	4	2	3	0	1	2	0	0	3	0	3	3	1	3	3	1	42
May	0	1	2	0	0	0	0	0	0	1	1	0	0	4	0	0	1	6	2	1	5	1	4	2	12	1	0	2	46
June	0	1	1	1	2	4	0	0	0	0	0	1	0	0	0	0	1	1	0	0	5	0	0	0	0	0	0	5	22
July	1	6	7	0	3	0	0	0	0	0	1	0	0	4	0	0	0	0	1	0	1	0	0	1	4	0	0	1	30
August	0	4	3	5	3	1	0	0	4	0	0	3	2	2	5	0	1	0	1	3	13	5	0	0	4	0	1	4	64
September	1	9	3	0	0	0	3	8	11	0	0	0	1	1	2	0	2	0	0	4	1	1	0	0	2	0	3	1	53
October	0	2	3	2	0	2	2	3	8	3	0	3	0	8	1	0	1	10	1	2	0	0	0	3	5	0	3	0	62
November	2	3	3	0	2	0	1	2	1	3	0	0	0	0	1	0	0	3	1	0	11	0	3	6	1	0	2	2	47
December	0	0	2	0	0	0	2	4	1	1	0	0	1	0	1	0	0	0	2	0	0	0	1	2	0	0	1	0	18
TOTALS	9	38	35	11	14	20	8	22	30	12	6	7	11	23	16	0	15	29	12	12	52	11	17	22	34	8	19	27	520



ALL APPROVALS BY MONTH (new and amended)

2010	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40	TOTALS
January	7	4	4	0	1	0	0	0	0	0	2	0	0	1	2	0	1	1	1	0	3	1	2	0	1	1	4	8	44
February	0	7	2	0	0	0	0	11	3	3	0	0	1	3	0	0	3	4	9	2	6	0	3	5	1	4	1	1	69
March	1	0	14	3	1	10	1	3	0	1	3	0	3	0	4	0	4	6	1	4	4	3	6	3	3	0	2	2	82
April	0	1	4	0	2	3	0	0	3	2	0	0	5	2	5	1	2	2	0	0	3	0	5	3	1	3	3	1	51
May	0	1	3	0	0	0	0	0	0	2	1	0	0	5	0	1	1	7	2	3	5	1	4	2	14	1	0	2	55
June	0	1	1	1	2	4	0	0	0	1	0	1	0	0	0	1	1	2	0	0	5	2	0	0	1	0	0	5	28
July	1	6	11	0	3	0	1	0	0	0	1	0	0	5	0	1	0	0	1	0	1	0	0	3	5	0	0	1	40
August	0	4	3	7	4	1	0	1	4	0	0	5	2	2	8	0	1	0	1	3	14	6	0	0	6	0	1	4	77
September	2	9	6	0	0	0	3	14	12	0	1	0	1	2	9	0	2	0	0	5	4	1	0	1	5	1	4	1	83
October	1	5	6	2	0	2	3	7	8	3	2	3	0	9	1	0	1	11	6	2	0	0	0	3	5	0	5	0	85
November	2	3	5	0	2	0	1	4	1	9	5	0	1	0	2	1	0	3	1	0	25	6	4	8	2	0	10	2	97
December	0	0	2	0	0	0	2	4	1	2	4	0	1	0	1	0	0	1	4	0	2	0	1	2	0	0	11	0	38
TOTALS	14	41	61	13	15	20	11	44	32	23	19	9	14	29	32	5	16	37	26	19	72	20	25	30	44	10	41	27	749

Appendix3

Agricultural land (%) under capture on dates since 2003												
COUNTY	Dec-05	Aug-06	Dec-06	Jun-07	Dec-07	Jul-08	Dec-08	Jul-09	Dec-09	Jun-10	Dec-10	
Carlow	12.76	16.34	17.93	18.54	20.05	21.12	22.13	26.59	27.22	28.96	30.70	
Cavan	7.86	12.18	15.93	18.19	19.47	21.49	24.14	25.65	28.87	31.46	35.35	
Clare	7.21	10.18	13.70	15.39	19.02	22.26	24.00	27.86	30.15	31.44	32.70	
Cork North'	5.76	10.68	13.00	16.03	19.76	21.53	23.42	25.81	26.71	27.15	27.58	
Cork Central'	6.70	11.51	13.55	14.77	16.44	18.03	17.87	21.91	23.45	23.86	25.04	
Cork West'	10.78	14.83	16.95	20.65	24.29	27.36	29.88	32.55	33.37	35.16	36.32	
Donegal	2.65	4.29	5.89	7.61	8.54	9.39	10.61	11.96	12.64	14.21	14.55	
Dublin (Wicklow East)	0.54	9.48	11.89	16.03	18.98	22.01	23.48	24.48	24.69	24.96	26.88	
Galway	5.39	6.53	11.12	12.20	14.49	15.15	15.51	18.26	18.93	19.16	20.06	
Kerry	3.74	4.90	5.72	7.51	10.19	11.18	12.90	14.82	16.96	17.10	18.64	
Kildare (Wicklow West)	9.59	13.61	15.01	16.10	16.72	17.80	19.51	23.74	24.27	25.37	26.74	
Kilkenny	20.89	24.63	27.62	28.79	32.09	32.49	33.57	34.64	35.72	36.47	38.35	
Laois	7.91	10.41	11.32	12.98	14.70	15.25	17.25	20.36	21.21	21.24	21.83	
Leitrim	10.33	13.66	22.71	28.76	32.29	36.73	39.76	40.11	41.21	42.28	42.79	
Limerick	4.46	7.23	9.60	13.75	17.33	20.52	25.83	28.67	30.67	31.48	33.15	
Longford	19.69	28.05	33.00	36.91	38.46	40.89	42.05	44.75	46.22	47.87	49.41	
Louth	15.29	17.30	18.85	19.25	21.37	22.99	23.64	25.45	25.93	26.18	26.37	
Mayo	6.46	8.59	9.36	10.48	11.15	12.23	13.23	13.82	14.61	15.14	15.60	
Meath	6.48	8.78	11.19	11.91	13.26	14.67	16.83	21.00	21.98	24.13	25.58	
Monaghan	26.97	30.17	34.21	35.68	35.89	36.99	37.50	38.99	39.32	39.70	40.77	
Offaly	5.92	7.71	9.41	12.53	13.42	17.00	19.38	20.73	22.66	23.08	23.88	
Roscommon	2.14	3.09	4.01	5.68	5.90	7.01	8.09	11.20	11.61	14.25	15.65	
Sligo	8.29	13.89	22.13	26.01	28.29	32.55	36.35	38.45	39.54	40.02	40.42	
Tipperary North'	19.62	24.15	30.92	33.28	38.56	40.63	43.28	44.72	45.23	46.12	46.54	
Tipperary South'	5.94	9.98	14.08	18.46	22.28	25.52	27.32	30.53	31.08	31.81	32.61	
Waterford	12.51	16.45	20.26	23.19	25.39	26.83	29.55	31.13	32.56	34.18	36.04	
Westmeath	4.15	6.60	9.13	11.84	12.81	14.27	16.23	17.62	19.13	20.64	21.49	
Wexford	10.72	13.67	15.85	17.99	20.27	23.12	23.95	27.15	28.07	29.04	30.91	
TOTAL	8.14	11.25	14.09	16.29	18.50	20.34	22.07	24.42	25.57	26.54	27.71	

			5.94		4.41		3.57		3.50		2.14	
			42.2%		23.8%		16.2%		13.7%		7.7%	

**REPORT BY THE DEPARTMENT OF AGRICULTURE, FISHERIES AND FOOD FOR 2009 ON THE
IRISH TB PROGRAMME FOR THE ERADICATION OF *MYCOBACTERIUM BOVIS* INFECTION
FROM CATTLE & BADGERS**

- 2009 -

Introduction

This end of year report on outputs achieved by the Wildlife Unit, Department of Agriculture, Fisheries and Food (DAFF) covers the interval 1st January 2009 until 31st December 2009. The report details the numbers of badgers captured and removed under the terms of the conditions specified in the permissions to capture issued by the National Parks and Wildlife Service (NPWS) of the Department of the Environment, Heritage and Local Government (DEHLG). It also provides an update on the proportion of agricultural land currently under capture cumulatively since 2005 updated for July 2009 and December 2009. A new table (Table 3) has been added this year which outlines the net results of the approvals process by which new setts are added to the areas under capture.

Badgers captured and removed.

There were 6066 badgers captured and removed during 2009. Table 2 outlines the Divisional Veterinary Office (DVO) areas where these removals took place. This represents a reduced extraction rate (circa 10%) per area of ground under capture. Successive capturing operations are focused predominantly on the same areas, which result in local reductions in badger numbers. This lower local density of badgers is what we believe ultimately leads to less animal to animal (badgers or cattle) transmission of tuberculosis. 14% of the lands captured this year were new areas captured for the first time. Of the 86% of lands where capturing commenced prior to 2009, many are now under capture for 3 or more years. This undoubtedly results in lower badger densities in these localities compared with the initial densities when capturing began.

Area of agricultural land where capturing is ongoing.

The area of agricultural land under capture in July 2009 was 24.42% and this figure has moved on to 25.57% by December 2009 (Table 1). When this phase of the badger population control commenced in 2003, DAFF proposed to limit capturing to not more than 30% of agricultural land during the interval 2003-2008. These data demonstrate that this limit has not, as yet, been reached. The 30% figure will likely be arrived at during 2011, so new limits to cover a future period require to be considered. While the average of all agricultural land under capture is 25.57%, this varies from a low of 11.61% in County Roscommon to a high of 46.22% in Longford.

A new table (Table 3.) is added to this year's report, outlining the activity levels in each DVO area over the year from the perspective of requests granted for new areas of land for capture. Of the 812 additional areas approved, 597 were new areas and the remainder were additions to/expansions of areas where capturing was already instigated. Galway has the highest growth in areas under capture at 119 additions, followed by Clare at 80 and Kerry with 65. These counties cover huge land areas, and the landscape is such that agricultural land is interspersed with areas of higher more mountainous terrain such that capturing becomes focused in more dispersed pockets as is the case with areas of rolling farmland.

Ongoing Research

The current phase of the Wildlife Program (WP) was first rolled out in Co. Monaghan in 2003, so a sustained capturing effort has been maintained in that county for longer than anywhere else nationally. The county was chosen back then because of the high cattle Bovine Tuberculosis (BTB) incidence in herds there. The hypothesis driving the WP is that a focused removal of badgers in areas where BTB is known to be a major problem will lead to a reduction in the transmission of tuberculosis (Tb) between animals, both badgers and cattle, and that this leads in turn to lower numbers of herd breakdowns in those areas where badger densities are maintained at lower levels. This is so far proving to be the case in Co. Monaghan, which is running at the 3 lowest herd incidence in the country.

behind counties Mayo and Kerry. In 2009 in Co. Monaghan, there were 11 new areas added to the area under capture, which in turn reflects the lower number of herd breakdowns in new areas.

Various research projects and reports published in 2009 include

- Study of the Diet of Irish Badgers in 2008 – Dr. Grainne Cleary (<http://www.sciencedirect.com/science/article/pii/S1616504709001244>)
- An assessment of injury to European Badgers due to capture in stopped restraints - Dr. Denise Murphy (<http://www.jwildlifedis.org/doi/abs/10.7589/0090-3558-45.2.481>)
- The prevalence and distribution of *Mycobacterium Bovis* infection in European badgers as determined by enhanced post mortem examination and bacteriological culture - Dr. Denise Murphy (<http://www.sciencedirect.com/science/article/pii/S0034528809001441>)
- The Biennial Report for 2008-09 prepared by Centre for Veterinary Epidemiology and Risk Analysis (CVERA) on the Badger Vaccine Project (<http://www.ucd.ie/cvera/biennialreports/>)

Other research projects underway in 2009 include aspects of the Reproduction of Irish badgers. The DAFF funded research programme on badgers will continue to operate at University College Cork (U.C.C) and includes analysing various elements of the data currently stored in DAFF's Wildlife Unit's database.

Since the current phase of DAFF's WP began in 2003, a considerable body of data on sett locations has been collected. This sett location data has been shared with the National Biodiversity Data Centre (NBDC), and is now accessible via their website along with data in relation to sett locations.

Vaccination Programme

It is hoped to shortly begin testing the efficacy of BCG vaccination of badgers as part of the effort to control the spread of and ultimately eradicate Tb from both cattle and badgers. Proposals to that end are under preparation currently, so the hope and expectation is that a draft DAFF policy position will emerge shortly that can be the basis of agreement between DAFF and DOELG.

Wildlife Unit
 Department of Agriculture, Forestry and Food
 Agriculture House
 Kildare Street
 Dublin 2
 Ireland

Table 1**Agricultural land (%) under capture on dates since 2003**

COUNTY	Dec-05	Aug-06	Dec-06	Jun-07	Dec-07	Jul-08	Dec-08	Jul-09
Carlow	12.76	16.34	17.93	18.54	20.05	21.12	22.13	26.5
Cavan	7.86	12.18	15.93	18.19	19.47	21.49	24.14	25.6
Clare	7.21	10.18	13.70	15.39	19.02	22.26	24.00	27.8
Cork North'	5.76	10.68	13.00	16.03	19.76	21.53	23.42	25.8
Cork Central'	6.70	11.51	13.55	14.77	16.44	18.03	17.87	21.9
Cork West'	10.78	14.83	16.95	20.65	24.29	27.36	29.88	32.5
Donegal	2.65	4.29	5.89	7.61	8.54	9.39	10.61	11.9
Dublin (Wicklow East)'	0.54	9.48	11.89	16.03	18.98	22.01	23.48	24.4
Galway	5.39	6.53	11.12	12.20	14.49	15.15	15.51	18.2
Kerry	3.74	4.90	5.72	7.51	10.19	11.18	12.90	14.8
Kildare (Wicklow West)'	9.59	13.61	15.01	16.10	16.72	17.80	19.51	23.7
Kilkenny	20.89	24.63	27.62	28.79	32.09	32.49	33.57	34.6
Laois	7.91	10.41	11.32	12.98	14.70	15.25	17.25	20.3
Leitrim	10.33	13.66	22.71	28.76	32.29	36.73	39.76	40.1
Limerick	4.46	7.23	9.60	13.75	17.33	20.52	25.83	28.6
Longford	19.69	28.05	33.00	36.91	38.46	40.89	42.05	44.7
Louth	15.29	17.30	18.85	19.25	21.37	22.99	23.64	25.4
Mayo	6.46	8.59	9.36	10.48	11.15	12.23	13.23	13.8
Meath	6.48	8.78	11.19	11.91	13.26	14.67	16.83	21.0
Monaghan	26.97	30.17	34.21	35.68	35.89	36.99	37.50	38.9
Offaly	5.92	7.71	9.41	12.53	13.42	17.00	19.38	20.7
Roscommon	2.14	3.09	4.01	5.68	5.90	7.01	8.09	11.2
Sligo	8.29	13.89	22.13	26.01	28.29	32.55	36.35	38.4
Tipperary North'	19.62	24.15	30.92	33.28	38.56	40.63	43.28	44.7
Tipperary South'	5.94	9.98	14.08	18.46	22.28	25.52	27.32	30.5
Waterford	12.51	16.45	20.26	23.19	25.39	26.83	29.55	31.1
Westmeath	4.15	6.60	9.13	11.84	12.81	14.27	16.23	17.6
Wexford	10.72	13.67	15.85	17.99	20.27	23.12	23.95	27.1
TOTAL	8.14	11.25	14.09	16.29	18.50	20.34	22.07	24.4
			5.94		4.41		3.57	

Table 2

Table of badger numbers captured 2009

DVO Code	DVO Office	Captures 2009
11	Carlow	132
12	Cavan	337
13	Clare	335
14	Cork Central	52
15	Cork North East	227
16	Donegal	264
17	Dublin	159
18	Galway	247
19	Kerry	316
20	Kildare	149
21	Kilkenny	155
22	Laois	124
23	Leitrim	337
24	Limerick	400
25	Longford	210
26	Louth	69
27	Mayo	271
28	Meath	169
29	Monaghan	113
30	Offaly	88
31	Roscommon	49
32	Sligo	216

33	Tipperary North	353
34	Tipperary South	315
35	Waterford	270
36	Westmeath	75
37	Wexford	193
40	Clonakilty	441
Total	.	6066

Table 3

See Table 2 on previous page for DVO codes used below i.e. DVO code 11 = Carlow, 12 Cavan 13 Clare etc

Of the 812 approvals granted during 2009, 597 were for new areas with the remainder additions/extensions to existing areas.

APPROVALS BY MONTH

2009	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40	TOTALS
January	2	0	12	0	2	0	2	26	6	2	3	0	1	2	8	1	1	1	0	5	0	12	4	7	3	4	8	1	113
February	1	4	1	0	1	6	1	0	6	0	1	0	0	3	1	2	5	6	2	0	1	0	0	0	0	1	3	1	46
March	5	0	4	0	8	3	2	33	2	0	1	2	0	2	1	2	1	2	0	1	0	0	3	2	0	0	0	1	75
April	0	0	3	0	2	0	0	5	2	1	0	1	0	5	5	0	2	10	2	1	2	0	5	3	3	0	1	1	54
May	1	0	6	0	1	3	3	1	0	2	3	0	0	5	2	1	0	3	1	2	1	2	3	8	1	0	5	2	56
June	0	1	9	0	2	4	1	22	0	2	0	0	0	4	5	0	1	0	1	0	1	1	3	1	4	0	0	1	63
July	0	6	6	0	2	0	0	21	0	5	2	0	1	5	4	0	4	0	0	0	1	0	4	3	1	6	0	1	72
August	0	0	5	0	2	4	0	1	10	0	1	0	4	4	2	0	11	0	0	0	0	0	2	1	2	0	1	2	52
September	0	8	14	3	5	0	0	1	26	1	0	0	2	4	3	2	0	3	1	0	0	14	2	0	6	0	0	1	96
October	0	1	9	0	3	4	0	0	4	5	4	0	2	4	1	1	4	2	0	2	0	10	0	16	1	0	3	0	76
November	0	2	9	0	1	1	1	9	5	3	6	1	0	0	1	1	2	0	3	8	0	3	1	3	2	1	2	2	67
December	2	0	2	1	3	0	0	0	4	0	0	4	1	1	3	0	4	4	1	4	1	0	0	2	4	0	0	1	42
TOTALS	11	22	80	4	32	25	10	119	65	21	21	8	11	39	36	10	35	31	11	23	7	42	27	46	27	12	23	14	812

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INFECTION FROM CATTLE & BADGERS
- 2008 -**

Introduction

This end of year report on outputs achieved by the Wildlife Unit, Department of Agriculture, Fisheries and Food (DAFF) covers the interval 1st January, 2008 until 31st December, 2008. The report details the numbers of badgers captured and removed under the terms of the conditions specified in the permissions to capture issued by the National Parks and Wildlife Service (NPWS) of the Department of the Environment, Heritage and Local Government (DEHLG). It also provides an update on the proportion of agricultural land currently under capture at July 2008 and December 2008. Finally, following on from a request for more formal inter-departmental sharing of information at the level of front line staff, DAFF encouraged its field personnel to make contact with NPWS field staff and set up systems whereby planned capturing sites would be notified in advance to NPWS staff. The degree to which these contacts took place is outlined.

Badgers captured and removed.

There were 7284 badgers captured and removed during 2008. Table 1 outlines the Divisional Veterinary Office (DVO) areas where these removals took place.

Area of agricultural land where capturing is ongoing.

The area of agricultural land under capture in July 2008 was 20.34% and this figure had move up to 22.07 by December, 2008 (Table 2). When this phase of the badger population control commenced, DAFF proposed to limit capturing to not more than 30% of agricultural land during the interval 2003-2008. These data demonstrate that this limit has not been reached. The 30% figure is likely to be reached during 2011, so new limits up to 2014 require to be discussed an agreed during the year ahead. While the average of all agricultural land under capture is 22.07%, this varies from a low of 8.09% in County Roscommon to a high of 43.28% in Tipperary North.

Meetings between DAFF and NPWS field staff

During 2008 DAFF field staff at all the 28 District Veterinary Offices were requested to contact the NPWS counterparts and agree methods of sharing information of relevance between both staff groupings. Meetings or contacts took place in 18 of DVO locations. A formal transfer of an advance itinerary of planned capturing is in place in 15 DVO areas.

Wildlife Unit, Department of Agriculture, Fisheries and Food
Agriculture House, Kildare Street, Dublin 2, Ireland

Table 1***2008 Badger Capturings***

11	Carlow	143
12	Cavan	251
13	Clare	415
14	Cork Central	92
15	Cork North East	279
16	Donegal	228
17	Dublin	250
18	Galway	489
19	Kerry	353
20	Kildare	147
21	Kilkenny	183
22	Laois	132
23	Leitrim	346
24	Limerick	472
25	Longford	318
26	Louth	87
27	Mayo	220
28	Meath	175
29	Monaghan	158
30	Offaly	240
31	Roscommon	95
32	Sligo	277
33	Tipperary North	483
34	Tipperary South	463
35	Waterford	296
36	Westmeath	70
37	Wexford	241
40	Clonakilty	381
Total	.	7284

Table 2**Agricultural land (%) under capture on dates since 2003**

COUNTY	Dec-05	Aug-06	Dec-06	Jun-07	Dec-07	Jul-08	Dec-08
Carlow	12.76	16.34	17.93	18.54	20.05	21.12	22.13
Cavan	7.86	12.18	15.93	18.19	19.47	21.49	24.14
Clare	7.21	10.18	13.70	15.39	19.02	22.26	24.00
Cork North'	5.76	10.68	13.00	16.03	19.76	21.53	23.42
Cork Central'	6.70	11.51	13.55	14.77	16.44	18.03	17.87
Cork West'	10.78	14.83	16.95	20.65	24.29	27.36	29.88
Donegal	2.65	4.29	5.89	7.61	8.54	9.39	10.61
Dublin (Wicklow East)'	0.54	9.48	11.89	16.03	18.98	22.01	23.48
Galway	5.39	6.53	11.12	12.20	14.49	15.15	15.51
Kerry	3.74	4.90	5.72	7.51	10.19	11.18	12.90
Kildare (Wicklow West)'	9.59	13.61	15.01	16.10	16.72	17.80	19.51
Kilkenny	20.89	24.63	27.62	28.79	32.09	32.49	33.57
Laois	7.91	10.41	11.32	12.98	14.70	15.25	17.25
Leitrim	10.33	13.66	22.71	28.76	32.29	36.73	39.76
Limerick	4.46	7.23	9.60	13.75	17.33	20.52	25.83
Longford	19.69	28.05	33.00	36.91	38.46	40.89	42.05
Louth	15.29	17.30	18.85	19.25	21.37	22.99	23.64
Mayo	6.46	8.59	9.36	10.48	11.15	12.23	13.23
Meath	6.48	8.78	11.19	11.91	13.26	14.67	16.83
Monaghan	26.97	30.17	34.21	35.68	35.89	36.99	37.50
Offaly	5.92	7.71	9.41	12.53	13.42	17.00	19.38
Roscommon	2.14	3.09	4.01	5.68	5.90	7.01	8.09
Sligo	8.29	13.89	22.13	26.01	28.29	32.55	36.35
Tipperary North'	19.62	24.15	30.92	33.28	38.56	40.63	43.28
Tipperary South'	5.94	9.98	14.08	18.46	22.28	25.52	27.32
Waterford	12.51	16.45	20.26	23.19	25.39	26.83	29.55
Westmeath	4.15	6.60	0.00	11.84	12.81	14.27	16.23
Wexford	10.72	13.67	15.85	17.99	20.27	23.12	23.95
TOTAL	8.14	11.25	13.83	16.29	18.50	20.34	22.07

**REPORT BY THE DEPARTMENT OF AGRICULTURE, FISHERIES AND FOOD FOR 2007 ON
THE IRISH TB PROGRAMME FOR THE ERADICATION OF *MYCOBACTERIUM BOVIS*
INFECTION FROM CATTLE & BADGERS
- 2007 -**

Introduction

This end of year report on outputs achieved by the Wildlife Unit, Department of Agriculture, Fisheries and Food (DAFF) covers the interval 1st January, 2007 until 31st December, 2007. The report details the numbers of badgers captured and removed under the terms of the conditions specified in the permissions to capture issued by the National Parks and Wildlife Service (NPWS) of the Department of the Environment, Heritage and Local Government (DEHLG). It also provides an update on the proportion of agricultural land currently under capture at July 2007 and December 2007.

Badgers captured and removed

There were 5,952 badgers captured and removed during 2007. Table 1 outlines the Divisional Veterinary Office (DVO) areas where these removals took place.

Area of agricultural land where capturing is ongoing

The area of agricultural land under capture in July 2007 was 16.29% and this figure had move up to 18.50 by December, 2007 (Appendix 2). When this phase of the badger population control commenced, DAFF proposed to limit capturing to not more than 30% of agricultural land during the interval 2003-2008. These data demonstrate that this limit has not been reached. While the average of all agricultural land under capture is 18.50%, this varies from a low of 5.90% in County Roscommon to a high of 38.56% in Tipperary North.

A document titled "Calculation of WAU Treated Land Areas" is included as part of this report. This report, prepared by the Centre for Veterinary Epidemiology and Risk Analysis (CVERA) University College Dublin (UCD) explains the rationale that underpins and informs the methodology used to calculate the proportion of agricultural land under capture. These calculations of area of agricultural land commenced in 2006, and will continue as the programme develops.

A copy of the Biennial Report for 2006-07 prepared by CVERA on the Badger Vaccine Project can also be accessed at <http://www.ucd.ie/cvera/biennialreports/>

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Table 1***2007 Badger Capturings***

11	Carlow	111
12	Cavan	306
13	Clare	276
14	Cork Central	88
15	Cork North East	236
16	Donegal	221
17	Dublin	167
18	Galway	385
19	Kerry	181
20	Kildare	138
21	Kilkenny	221
22	Laois	112
23	Leitrim	369
24	Limerick	297
25	Longford	293
26	Louth	65
27	Mayo	184
28	Meath	102
29	Monaghan	127
30	Offaly	94
31	Roscommon	72
32	Sligo	263
33	Tipperary North	380
34	Tipperary South	382
35	Waterford	298
36	Westmeath	76
37	Wexford	183
40	Clonakilty	325
Total	.	5952



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**Wildlife Administration Unit Badger Control Program.
Department of Agriculture, Fisheries and Food.**

Document Title;

Calculation of WAU Treated Land Areas

Summary

The Centre for Veterinary Epidemiology and Risk Analysis (CVERA), University College Dublin (UCD), calculate the area of land under Wildlife Administration Unit (WAU) capture. The calculations are performed on a Geographical Information System (GIS). All badger setts assigned for capture are buffered to a circular distance of 500 metres. Calculated areas are cumulative from the start of the program.

Introduction

The Centre for Veterinary Epidemiology and Risk Analysis (CVERA), University College Dublin (UCD), were assigned the task of overseeing applications for badger removals through the Department of Agriculture, Fisheries and Food's (DAFF) tuberculosis eradication program. Agreements between the Department of the Environment, Heritage and Local Government's National Parks and Wildlife Service (NPWS) and DAFF stated that an annual County-based badger removal licence be granted once certain operational guidelines were adhered to. Two of these guidelines are monitored independently by CVERA; the first of these ensures that setts are removed from distances of no more than 2 kilometres from the boundary of an eligible breakdown herd. In the case of setts classified as 'main setts', this distance is reduced to 1.5km. The second guideline refers to ensuring the area of land under capture does not exceed 30% of total agricultural land in Ireland.

Methodology

A methodology was devised to estimate the area of land treated when a badger sett became assigned to a capture block. Data recorded for the Four Area Project (Griffin *et al.*, 2005) and the East Offaly Project (Martin *et al.*, 1997 and Ó Máirtín *et al.*, 1998) contained the location and sett classification for approximately 6,500 setts. The locations of these study areas represented varying habitat types. All setts within the removal and buffers areas of the study sites were subjected to a Nearest Neighbour analysis (appendix 1). The variation in nearest neighbour

distances between the different areas is substantial and represents the carrying capacity of the land on badger population and distribution. When the study boundaries are used to refine the analysis it becomes evident that badger main setts are distributed as far apart from one another as is possible.

Generating a circle with a radius of half the distance of the average nearest neighbourhood value of main setts gives us an approximation of the territorial area of a social group. By averaging the nearest neighbourhood distances of main setts from all Four Area Project and the East Offaly Project setts, we achieve a crude estimate of the expected nearest neighbourhood distance nationally (917 metres). Halving this distance therefore gives us a robust radius to use as an estimate for calculating land treated for each sett assigned to a WAU capture block. Additional measures are used to ensure that this is a very conservative means of calculating area;

- All setts assigned to an approved capture block are assumed to be treated regardless of that block's capture status, ie. even if a sett has had no removals or restraints placed, it is still included in calculating area treated.
- All setts are buffered to 500 metres regardless of sett classification. This ensures that misclassification of setts does not effect calculations of area treated.

In calculating overall treated areas overlap circles are merged to avoid over-estimating captured land. The treated area figures are cumulative from commencement of WAU activities in 2004. Figure 1 gives an example of the area associated with treatment for a capture block in County Laois (3,973,967 square metres). The callout numbers are the number of badgers caught to-date at each sett within the block.

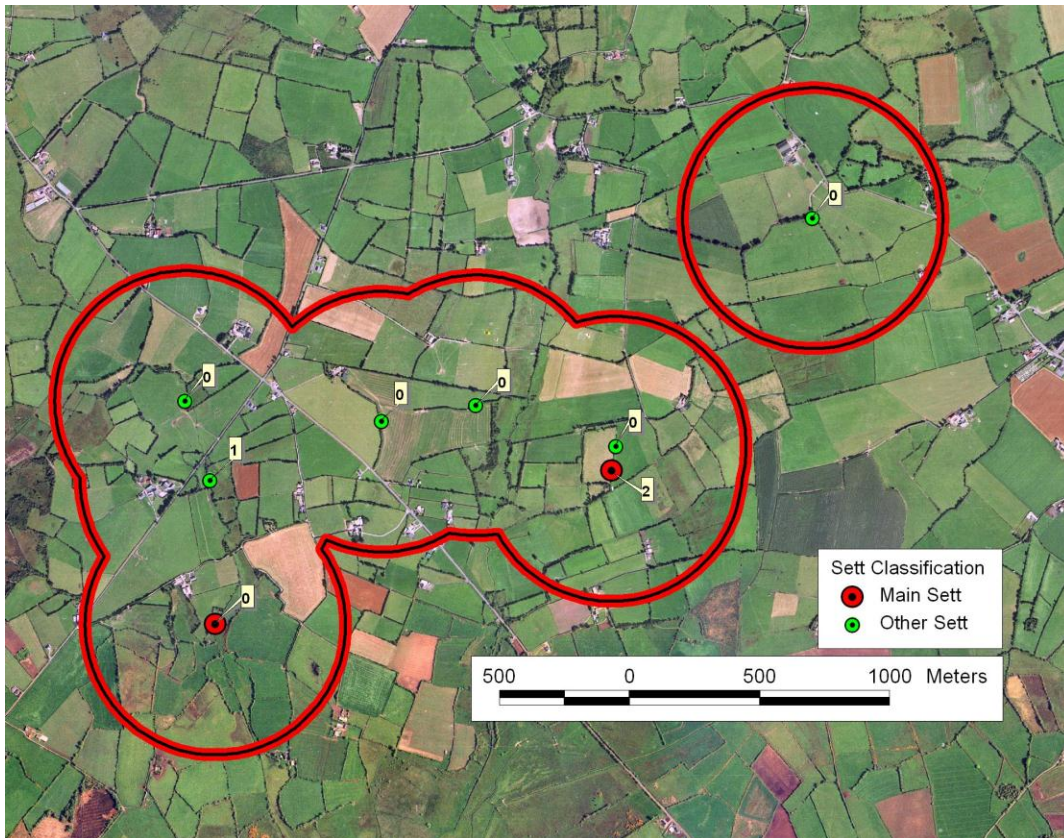


Figure 1. 500 metre buffer generated around setts in a capture block in County Laois.

References

- J.M. Griffin, D.H. Williams, G.E. Kelly, T.A. Clegg, I. O'Boyle, J.D. Collins and S.J. More (2005). The impact of badger removal on the control of tuberculosis in cattle herds in Ireland. *Preventive Veterinary Medicine* 67; 237-266.
- D. Ó Máirtín, D. H. Williams, J. M. Griffin, L. A. Dolan and J. A. Eves (1998). The effect of a badger removal programme on the incidence of tuberculosis in an Irish cattle population. *Preventive Veterinary Medicine* 34; 47-56.
- S. W. Martin, J. A. Eves, L. A. Dolan, R. F. Hammond, J. M. Griffin, J. D. Collins and M. M. Shoukri (1997). The association between the bovine tuberculosis status of herds in the East Offaly Project Area, and the distance to badger setts, 1988–1993. *Preventive Veterinary Medicine* 31; 113-125.

Contact details;

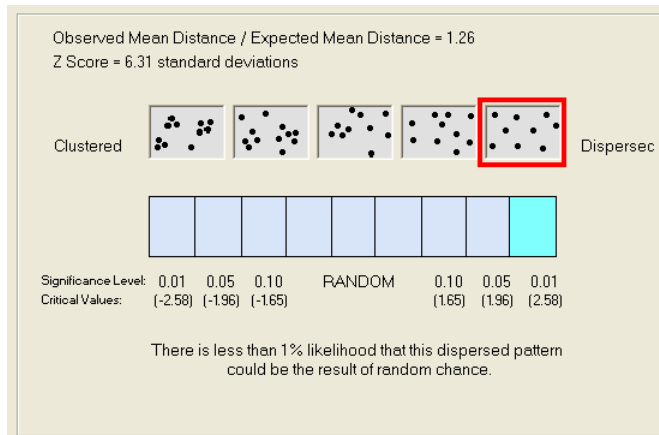
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Appendices

Appendix 1

Co. Kilkenny Nearest Neighbourhood Analysis.



Corrected by area:

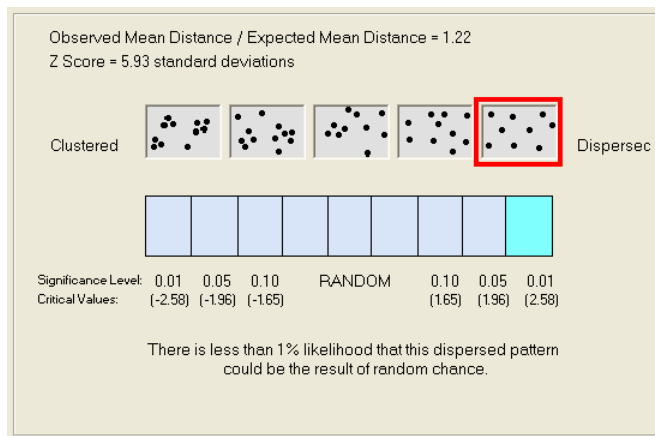
Nearest Neighbor Observed Mean Distance = 875.037527

Expected Mean Distance = 694.852325

Nearest Neighbor Ratio = 1.259314

Z Score = 6.314151 Standard Deviations

Co. Cork Nearest Neighbourhood Analysis.



Corrected by area:

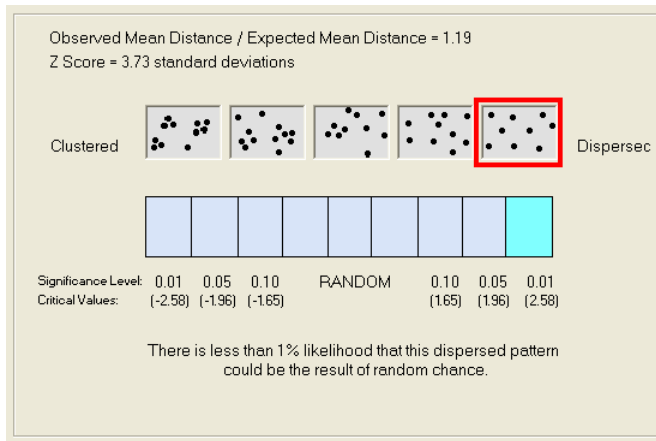
Nearest Neighbor Observed Mean Distance = 749.157505

Expected Mean Distance = 615.357219

Nearest Neighbor Ratio = 1.217435

Z Score = 5.926641 Standard Deviations

Co. Donegal Nearest Neighbourhood Analysis.



Corrected by area:

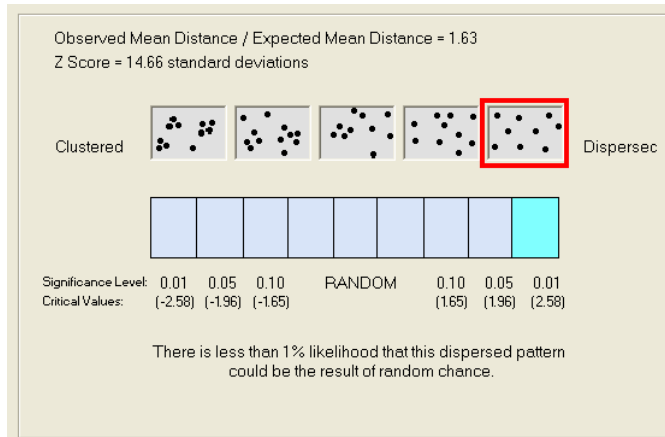
Nearest Neighbor Observed Mean Distance = 863.919325

Expected Mean Distance = 727.000782

Nearest Neighbor Ratio = 1.188333

Z Score = 3.726921 Standard Deviations

Co. Monaghan Nearest Neighbourhood Analysis.



Corrected by area:

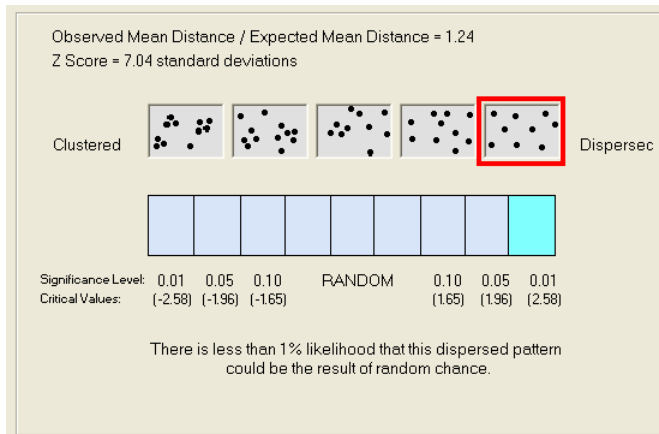
Nearest Neighbor Observed Mean Distance = 1002.810870

Expected Mean Distance = 616.075066

Nearest Neighbor Ratio = 1.627741

Z Score = 14.659014 Standard Deviations

Co. Offaly Nearest Neighbourhood Analysis.



Corrected by area:

Nearest Neighbor Observed Mean Distance = 1093.290001

Expected Mean Distance = 882.337042

Nearest Neighbor Ratio = 1.239084

Z Score = 7.041354 Standard Deviations

Annex 2

COUNTY	Total Area (OS)	LPIS	Commonage	Treated 2005	August 1st 2006	Dec. 22nd 2006	June 7th 2007	Dec. 19th 2007
Carlow	896,546,200	736,382,792	28,729,725	93,973,484	120,351,361	132,008,592	136,524,046	147,620,842
Cavan	1,931,880,800	1,478,025,520	47,670,650	116,232,580	179,996,122	235,483,887	268,898,024	287,831,039
Clare	3,449,067,700	2,421,389,513	47,781,798	174,611,233	246,556,162	331,673,196	372,715,909	460,459,282
Cork North'	2,650,434,330	2,117,855,895	10,987,528	122,024,419	226,112,179	275,342,540	339,471,195	418,501,721
Cork Central'	2,470,385,236	1,914,680,817	23,149,124	128,224,582	220,379,792	259,482,342	282,846,576	314,738,757
Cork West'	2,348,398,655	1,771,057,835	174,178,773	190,902,344	262,622,778	300,116,798	365,769,387	430,131,688
Donegal	4,861,978,000	2,774,234,953	670,834,039	73,438,267	119,090,699	163,319,825	211,142,879	236,904,987
Dublin (Ww East)'	2,321,665,478	1,086,207,448	179,802,084	5,919,143	102,977,510	129,151,198	174,076,093	206,177,223
Galway	6,150,304,600	3,843,976,995	640,925,332	207,337,337	251,071,821	427,264,815	469,142,058	557,110,166
Kerry	4,814,949,000	3,128,174,653	613,497,081	117,128,313	153,128,466	178,859,820	235,019,648	318,778,603
Kildare (Ww West)'	2,319,173,468	1,522,063,699	118,109,716	145,975,045	207,141,639	228,469,693	244,999,539	254,488,625
Kilkenny	2,071,887,300	1,791,249,686	5,750,866	374,257,038	441,217,136	494,803,369	515,663,379	574,898,631
Laois	1,719,495,400	1,299,689,223	26,899,941	102,826,661	135,275,563	147,084,153	168,699,673	191,089,442
Leitrim	1,588,703,700	998,377,530	117,465,483	103,096,675	136,423,747	226,750,687	287,095,271	322,425,032
Limerick	2,755,975,300	2,173,413,404	20,911,607	96,950,901	157,105,994	208,638,011	298,767,838	376,752,826
Longford	1,091,242,500	800,331,029	3,182,959	157,555,059	224,471,028	264,130,880	295,433,040	307,777,224
Louth	823,034,200	645,369,183	31,001,424	98,699,911	111,644,370	121,669,194	124,234,026	137,909,433
Mayo	5,589,129,100	3,206,505,461	971,523,403	207,220,933	275,371,924	300,004,019	336,098,792	357,541,356
Meath	2,344,879,100	1,938,557,412	1,006,824	125,638,159	170,226,004	216,914,387	230,852,448	256,976,263
Monaghan	1,294,558,800	1,089,143,875	28,350	293,795,758	328,634,817	372,641,427	388,561,964	390,907,675
Offaly	2,000,799,500	1,391,986,660	4,737,950	82,436,393	107,333,821	130,946,120	174,435,660	186,854,692
Roscommon	2,548,021,300	1,970,305,970	14,294,430	42,129,292	60,870,887	78,929,648	112,009,088	116,251,975
Sligo	1,836,827,200	1,259,111,498	121,550,113	104,437,012	174,894,475	278,682,778	327,477,655	356,203,451
Tipperary North'	2,005,964,675	1,626,144,059	12,137,994	319,098,158	392,794,454	502,844,600	541,217,211	626,996,836
Tipperary South'	2,248,520,763	1,732,425,231	103,076,674	102,868,751	172,967,249	243,907,743	319,854,240	385,910,579
Waterford	1,857,543,300	1,364,658,798	76,036,003	170,721,346	224,445,489	276,546,510	316,499,159	346,524,858
Westmeath								
	1,838,947,800	1,389,983,422	1,946,761	57,687,833	91,690,967	126,857,986	164,525,537	178,014,914

Wexford	2,365,498,000	1,934,368,313	23,642,441	207,389,569	264,457,089	306,686,692	347,929,765	392,069,584
TOTAL	70,195,811,406	49,405,670,873	4,090,859,071	4,022,576,196	5,559,253,544	6,959,210,909	8,049,960,099	9,137,847,702

' denotes areas subdivided for administrative reasons by DAFF.

COUNTY	2005%	Aug1st_06_ %	Dec22nd_06_ %	June7th_07%	Dec19th_07%
Carlow	12.76	16.34	17.93	18.54	20.05
Cavan	7.86	12.18	15.93	18.19	19.47
Clare	7.21	10.18	13.70	15.39	19.02
Cork North'	5.76	10.68	13.00	16.03	19.76
Cork Central'	6.70	11.51	13.55	14.77	16.44
Cork West'	10.78	14.83	16.95	20.65	24.29
Donegal	2.65	4.29	5.89	7.61	8.54
Dublin (Ww East)'	0.54	9.48	11.89	16.03	18.98
Galway	5.39	6.53	11.12	12.20	14.49
Kerry	3.74	4.90	5.72	7.51	10.19
Kildare (Ww West)'	9.59	13.61	15.01	16.10	16.72
Kilkenny	20.89	24.63	27.62	28.79	32.09
Laois	7.91	10.41	11.32	12.98	14.70
Leitrim	10.33	13.66	22.71	28.76	32.29
Limerick	4.46	7.23	9.60	13.75	17.33
Longford	19.69	28.05	33.00	36.91	38.46
Louth	15.29	17.30	18.85	19.25	21.37
Mayo	6.46	8.59	9.36	10.48	11.15
Meath	6.48	8.78	11.19	11.91	13.26
Monaghan	26.97	30.17	34.21	35.68	35.89
Offaly	5.92	7.71	9.41	12.53	13.42
Roscommon	2.14	3.09	4.01	5.68	5.90
Sligo	8.29	13.89	22.13	26.01	28.29
Tipperary North'	19.62	24.15	30.92	33.28	38.56
Tipperary South'	5.94	9.98	14.08	18.46	22.28
Waterford	12.51	16.45	20.26	23.19	25.39
Westmeath	4.15	6.60	9.13	11.84	12.81
Wexford	10.72	13.67	15.85	17.99	20.27
TOTAL	8.14	11.25	14.09	16.29	18.50