An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

End of Year Report for DAFMs Wildlife Unit for 2018

Introduction.

This end of year report on the activities of the Department of Agriculture, Food and the Marine's (DAFM) Wildlife Unit covers the period 1st. January 2018 till 31st. December 2018.

Michael Creed, Minister for Agriculture, Food and the Marine, issued a Press Release on 15th.January, 2018 announcing that vaccination of badgers against tuberculosis (TB) would commence as an integral part of the bovine TB eradication programme from January 2018. Minister Creed's statement outlined that the vaccination programme would commence in the areas which had already been part of the field trials demonstrating the effectiveness of badger vaccination and that it would roll out incrementally to other parts of the country over time, with vaccination gradually replacing the need to remove badgers. Minister Creed's full statement is reproduced at Appendix 5.

Previously reports quantified the area of farmland over which DAFMs wildlife programme ran its capturing activities and this involved calculating the area of land that was within a 500 meter radius of any sett at which traps were set during the year. At the end of December, 2016, this figure was 27.98% of the agricultural land in the country. When the area where capture/vaccination/release of badgers was netted out, the area from where badgers were removed during 2016 was 23.58% of the country's agricultural land. Beginning in 2017, with that year's report, the focus has switched away from setts where capturing takes place to areas, measured in Quartiles (Qtiles). Following on from Minister Creed's policy announcement, over the coming years, areas where previously capture/removal programs operated will be converted to areas where badgers will be captured and then vaccinated with BCG and released back. A Qtile is a rectangular area measuring 2Km x 1.5Km ($3Km^2$). A grid overlay of the country has been created by colleagues in UCD (see Appendices 2, 3 and 4), which contains an overall total of 24,874 individual Qtiles. In Table 1 below, the distribution of Qtiles btween the capture/remove and capture/vaccinate/release components of DAFM's wildlife program as of 31st. December, 2018, are outlined.

Table 1(see Appendix2 for full table which includes details per old DVO areas)

2018	All Qtiles	WU Qtiles	Vaccine Qtiles
Grand Total	**24874**	**10497**	**2629**

Of the overall 24,874 Qtiles that overlay any part of Ireland (excluding Northern Ireland), 13,126 (52.77%) Qtiles have some of their $3Km^2$ of land in either vaccine (2629) or non-vaccine (10,497) zones. The vaccine zones at the end of 2018 represent 20% of the total areas where badgers are captured, and this will increase as outlined in Minister Creed's policy objective over the coming years. A target of 100% has been set as the goal to be reached by the end of 2021/2022 capturing season which runs each year from September to June.

Details of areas where the 5,614 badgers captured/removed during 2018 under the terms of the conditions specified in the licences issued to DAFM by the National Parks and Wildlife section of the Dept. of Arts, Heritage and the Gaeltacht are outlined in Table 3, Appendix 1.

The expanded table (see Appendix 7) which first appeared in the 2011 report is again included with the respective bar-charts for 2018 activities. The approvals are sub-divided per county areas into first time approvals and approvals for setts added to areas/blocks that were approved for capture in earlier years. First

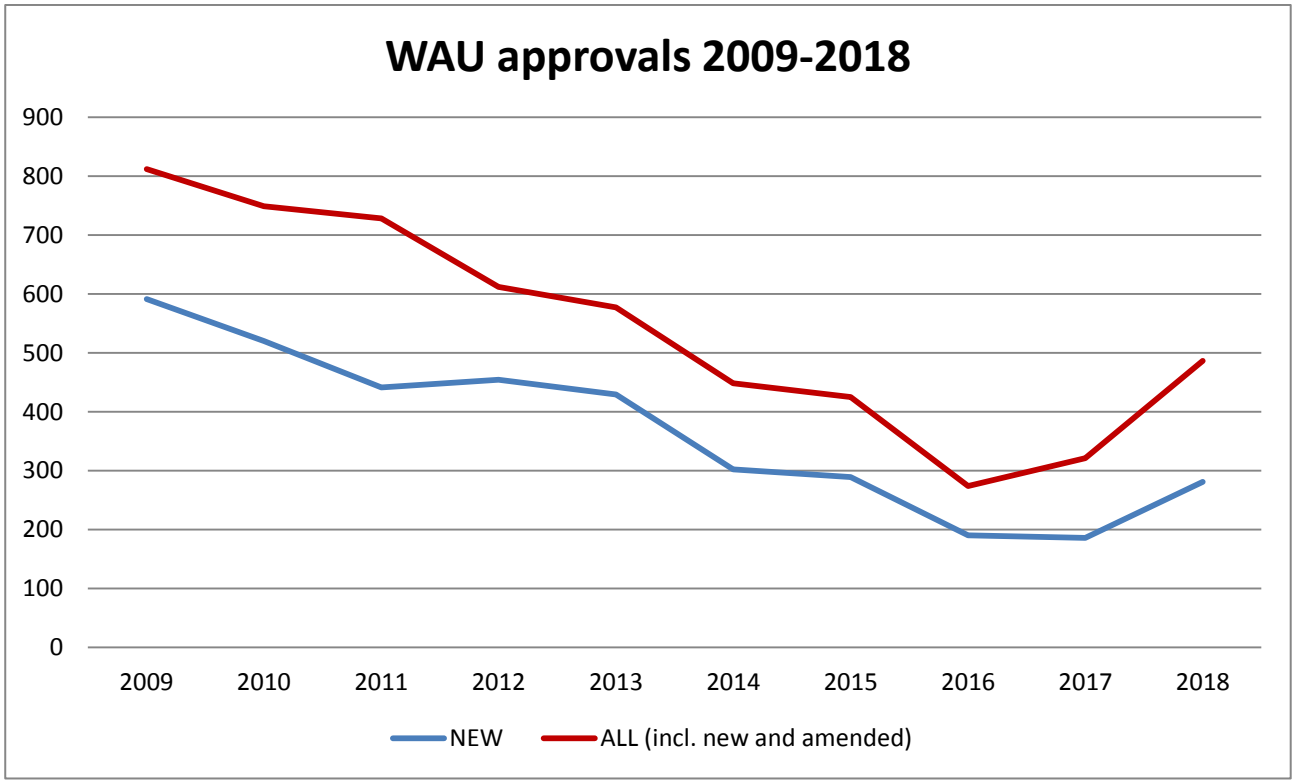
time approvals represent new foci of infected herds, whereas additions to areas previously approved for capturing arise due to clustering of tuberculosis (TB) in herds adjacent to areas that had earlier instances of infected herds detected which is a characteristic of how TB spreads to other herds in local areas.

In total during 2018, colleagues in the Centre for Veterinary Epidemiology and Risk Analysis (CVERA), UCD, approved setts for capture in 486 areas where DAFF staff sought permissions based on agreed criteria. These criteria require that 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 are very definitely due to M.bovis, and that the investigation into the source of the disease outbreak in cattle found it was not due to purchased infected animals. Of these 486 areas, 281 were new areas where capturing had not been undertaken in since the current Wildlife program commenced in 2003. The corresponding figures in 2014 were 448/302, in 2015 were 425/289, 2016 were 274/190 and in 2017 were321/186. The information in Table2 and in Chart1 outlines happenings since 2009.

Table2

	NEW	ALL
2009	591	812
2010	520	749
2011	441	728
2012	454	612
2013	429	577
2014	302	448
2015	289	425
2016	190	274
2017	186	321
2018	281	486

Chart1



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 locally of cattle and badgers re-infecting each other and leading to chronic disease problems that become endemic in areas populated by both species. Over previous years, the reductions in the rate of herd breakdowns due to bTB since the current policy of targeted reductions in densities of badgers began can be attributed in the main to the lowered density of badgers that continued re-trapping in high incidence bTB areas results in. This in turn has led to a slowing in the rate expansion of the areas under capture. The 2018 figures support the hypothesis outlined in the last three year's annual reports which predicted that a steady state equilibrium situation is being reached. A DAFM policy measure introduced in 2014, whereby the automatic cut-point in terms of numbers of standard reactors in herd breakdowns where new capturing programs are triggered were raised, led to an decreasing rate of expansion of capturing areas. Prior to 2018, in counties where less than 20% of the area of agricultural land is under capture, a 2Standard Reactor (2SR) cut-point applies. This became 3SRs in areas where <30% of agricultural land is under capture and so on (i.e. 4 SRs <40%, 5 SRs <50 etc.). As the rate at which new herds experiencing breakdowns due to bTB slows, actively managing levels of expectation regarding the future pace of improvement as we progress toward eradication will be required. The rate of improvement that can be expected over the coming years in bTB levels in cattle will slow down compared to the rates achieved during the previous decade due to the effect the "decreasing rate of marginal returns" will have on the rate of decline of bTB in cattle. In tandem with the move to turn some capture/remove areas over to vaccination in 2018, the measures outlined above to restrict the rate of new herds qualifying to join areas where badger population controls are operating were relaxed. Any herd having 3 or more standard reactors in a breakdown and where the subsequent investigation rules out a purchased/introduced source of bTB is again eligible to have the area adjacent to the lands they farm added to the WU areas approved for capture. This change in eligibility of herds explains the increase in total and new areas approved by colleagues in CVERA, UCD, being added to the WU capture areas.

Badgers Captured

There were 5614 badgers captured and removed during 2018 which is similar to the 5835 badgers captured and removed during 2017 (Table 3, Appendix 1 outlines the DVO areas where these removals took place). To recap on how capturing is organised, the approach is that out of roughly 36,000 setts on DAFMs database, at least one badger has been captured at roughly 17,600 setts, and each year's re-capturing is focused on these setts/areas. Because badger social groups typically use between 4-6 setts, one of which is a main sett, the roughly 36,000 setts on the DAFM database represent perhaps 6-9,000 badger social groups. On two occasions each year (a program which began in Feb2011) the setts where one or more badgers have been captured are visited and rated using 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.

Beginning in 2013, DAFM began evaluating intra-muscular (i/m) vaccination with BCG vaccine as a substitute for continued culling. Of the 5614 badgers removed in 2018, 26 were removed from vaccination/release areas which happens in 2629 Qtiles. The remaining 5588 badgers captured were associated with the 10,497 Qtiles under capture/not vaccinated/not released. The data in Table 3 carries a health warning in relation to the data from Cork. As part of DAFMs rationalising its local office network, 3 local offices in Cork were merged leaving 2 offices remaining, CorkNorth and CorkSouth. The WU software has been modified such that all the badgers removed in Cork are accurately recorded but how they are partitioned between the 2 new geographic divisions is a work in progress and may not allocate each badger removed in Cork county correctly to the correct new north/south subdivision. Modifying the software such that it puts everything in its proper place may take another couple of years as funding for software development is limited and the current priority is adding the functionality necessary to support the change-over from culling to vaccinating.

Switching capture/removal areas to capture/vaccinate/release areas

The primary objective of the WU when it was established was to address any involvement of badgers in tuberculosis breakdowns in herds in areas where badgers were also implicated. Huge progress has been made in the levels of bTB in cattle herds since DAFMs Wildlife program commenced, and it is acknowledged that the major driver of these improvements have been facilitated by DAFMs wildlife strategy and by the work done by WU staff assisted by operatives engaged through the Farm Relief Network. Now that the incidence of bTB is at the lowest levels ever seen since the bTB Eradication Program began in the 1950s, planning for the eventual elimination of BTB can be contemplated. Central to this eradication effort will be the addition of a new objective, namely to create a predominantly BCG vaccinated population of badgers in those areas where bTB has become endemic in susceptible animals, be they cattle, badgers or deer.

With the move to vaccination, the aim will be to grow BCG vaccinated populations of badgers in those areas that previously were the focus of continued removal of badgers designed to maintain an equilibrium population of badgers locally at a density of circa 0.4-0.5 badgers per Km^2. The WU information systems currently operates on a grid basis, in that setts are numbered based on their location in a grid structure comprising roughly 5,000 uniquely identified rectangles that measure 4Km by 3Km called Tiles. Tiles are subdivided into smaller units called quarter-tiles or quartiles, and these measure 2Km by 1.5Km each. Each sett recorded on the WU information system is uniquely numbered, and the number associates the sett with the quartile where it is located. Vaccination will be delivered over areas, so larger areas will be targeted as part of that changeover. Once an area moves from capturing to vaccination, any subsequent culling will only happen in response to a future serious breakdown and will only happen when necessary and will be based on evidence based criteria. Culling in vaccination areas will be very limited, as the new objective will be grow new badger populations, not maintain densities at lower than normal equilibriums.

Following a breakdown where badgers are thought to be contributing to the disease outbreak, DAFM staff are allowed seek approval to capture badgers at any known main sett located within 1.5Km of the affected farm or any known non-main sett located within 2Km of the affected farm. The reasoning behind this rule is to permit DAFM staff to remove badgers in social groups likely to be using lands in common with infected cattle herds. Irish research by Byrne et al. has confirmed that badgers in the main forage on lands within 1.5Km of the main sett (Ref. Large-scale movements in European badgers, Byrne et al. Journal of Animal Ecology 2014, 83, 991–1001). While DAFM staff have permissions to trap at setts that are 1.5-2Kms removed from the farm experiencing a bTB outbreak, the capturing programs most commonly target setts that are within a 1Km radius of the affected farms. When DAFM staff survey areas, they actively seek information on badger habitats/sett locations on lands adjacent to the breakdown farms. A passive survey, in the form of a mail shot to farms on DAFMs Land Parcel Identification System (LIPS) that are within 1Km (i.e. farms in receipt of EU payments) is also used to seek information regarding other sett locations. A majority of capturing programs focus on setts that are within the first 1Km radius of affected farms, and rarely does capturing extend to the full 2Km limit of what's allowed.

A map of the country, overlain by Qtiles (see Appendix4), has been generated by colleagues in UCD* that shows the vaccination areas in green, the remaining capture/remove areas in yellow and the rest of the country's lands which are not part of the WU capturing program. The breakdown of Qtiles between Vaccine, WU capturing and All Qtiles per county area tabulated in Table 4, Appendix3. Over the coming years, the proportion of Qtiles being vaccinated will increase from the current 20%, and the intention is that 100% of Qtiles of the WU Qtiles will be vaccine Qtiles by the end of 2021/22 WU season (season runs from Sept to May each year). The data presented in Table 5, Appendix4 shows the movement in Qtiles between 2017 and 2018. The very observant will note that while the number of total Qtiles remained at 24874 in spite of global warming and increasing sea levels there is an inconsistency in that while vaccination Qtiles increased by 1021, the remaining WU Qtiles fell be 2305 which is more than the area switched to vaccination. The difference of 1284 is explained by colleagues in UCD "cleaning" the database and removing some Qtiles previously misrepresented as being part of the WU capturing areas.

(*Guy McGrath and Daniel Collins manage the Geographic Information Systems (GIS) and relational databases which store all the field data collected as part of the Wildlife Unit programs and are also responsible for delivering an "arms-length" oversight of quality control elements of the Wildlife Unit protocols)

Discussion

bTB endemic areas are clustered so will be more concentrated in areas where cattle densities are highest. The more fertile the farmland, the more likely those lands are locations of higher densities of cattle and badgers. The WU vaccination program will ultimately aim to result in high levels of BCG vaccinated badgers in these "high TB risk, high animal density" areas. The map (see Appendix4) of the locations of Qtiles and their WU "status" is a proxy outline of the areas that were previously endemic for bTB. The areas where badgers are captured by DAFM/FRS colleagues represent the areas where herds experienced large breakdowns of tuberculosis in the past and which resulted in local populations of badgers having their sett locations searched for and recorded on DAFMs GIS systems/databases. Following on from the identification of setts where the local badger social groups colonised lands also used for grazing by herds infected with bTB, capturing programs commenced that maintain the density of badgers locally at around 0.5 badgers per Km^2. These interventions have been successful in reducing the expansion of the WU program into new areas, as each year the WU capture areas only expand by circa 1% per year and these expansions are due to new foci of infections moving via animal movements (predominantly due to cattle, but some due to badgers and on occasion deer may become involved)

A study in Co.Kilkenny where an oral presentation of BCG vaccine was evaluated in badgers and which ended in 2013, with results published (Gormley et al. PlusOne) in 2016, was mentioned in last year's report. This work showed that vaccinated badgers had longer intervals to seroconversion, which is considered to be a proxy measure for infection.

A second study using blood samples from badgers in the same Kilkenny study by Inma Aznar et al. was published in 2017 (Quantification of *Mycobacterium bovis* transmission in a badger vaccine field trial; Preventive Veterinary Medicine Vol. 149, 1 January 2018, Pages 29-37) This study estimated that BCG vaccine had an efficacy of 59%, which means vaccination is likely to protect roughly 6 out of every 10 badgers vaccinated with BCG. The authors further suggested that "these results imply that with vaccination coverage in badgers exceeding 30%, eradication of *M. bovis* in badgers in Ireland is feasible, provided that the current control measures also remain in place". The Kilkenny study site has been converted to a capture/i/m vaccinate/release area, and a long-term study is now ongoing there.

As outlined in earlier reports, DAFM commenced work field testing BCG, administered intra-muscularly (i/m), in wild badger populations in Longford in 2011, where capture/vaccinate/release of badgers in roughly 30% of the lands under capture became part of the local program . Similar vaccination programs commenced in Cork, Galway, Monaghan, Tipperary and Waterford and in Louth during 2012 and 2013. These trails ended in December, 2017 and the analyses of data from this study is completed and has been submitted for publication. The expectation is that it will be published later this year, so will be referred to in next year's report. While the formal trails ended in 2017, vaccination continued as per Minister Creed's announcement in the vaccine areas in these counties and the areas under vaccination have been expanded in these counties. Vaccination also commenced in other counties in 2018 and will expand incrementally over the coming years as the pace of the rolled out of the new program quickens.

Combining the findings of DAFM funded/supported studies undertaken to date, all similarly conclude that vaccination using BCG offers a degree of protection to badgers in the wild, and that vaccination of badgers will have an important role in the end game of finally eliminating bTB from cattle in our country and eventually also from badgers.

As mentioned in previous reports, Andrew Byrne (now returned to DAFM), developed techniques of estimating the national badger population and his estimates of badger numbers in the Republic of Ireland were a huge advance on previous attempts to estimate overall population sizes. Andrew's work continued through a PhD student (Laura Rosen), based in Colorado State University and funded by the Morris Wildlife Foundation, USA. Laura completed her PhD in August2018, and part of her dissertation involves evaluating models that attempt to estimate densities of wildlife species from trapping/re-trapping data. The following excerpt for Laura's thesis summarises her main Chapter 5* findings:

We implemented spatially explicit capture-recapture models using data from a multi-year vaccination trial in County Kilkenny, Ireland, to estimate badger population density according to environmental and management covariates. We found that soil drainage determined badger density, with an estimated 0.8 badgers/km^2 in the moderately drained soil present in most of our study area (range 0.49–1.24 badgers/km^2 for all soil types). We also found evidence of considerable trap-wariness, with the baseline probability of capture decreasing from 0.141 in naïve badgers to 0.045 in previously captured badgers. The magnitude of the behavioural response to trapping we observed has important implications for management using vaccination. Our results provide a baseline density estimate at the start of the vaccination program, and a framework for use in estimating badger densities elsewhere and over time as disease management continues.

*Laura's PhD comprised 7 chapters in total and the full table of contents is presented in Appendix6. Anyone interested in reading any or all of Laura's 7 chapters, should contact me as I'll be happy to provide them with copies as requested.

Devising better methods of estimating badger numbers across our Irish landscape will remain a challenge during the years ahead. Densities of badgers and cattle are the push factors that result in infectious individuals coming into contact with and infecting susceptible contacts locally in groupings of animals that form part of a contact network. As with many environmental systems, critical tipping points dictate when and where local epidemics kick off so our efforts to gather more information and better understandings of the most important relationships and their various tipping points must be the priority for future researchers.

DAFMs future research priorities include projects that will examine areas of badger ecology that will enlighten policy makers whose task it will be to evaluate the effect of vaccination, the role of vaccine as a substitute for culling badgers and how to maximise the potential of BCG vaccination as a future component of the national bTB eradication program. In addition, DAFM is funding research in UCC that is investigating how badgers behave in areas where DAFM staff are trapping badgers. Researchers are using cameras to observe badgers prior to trapping commencing and measure if behaviour changes while trapping is ongoing. Evidence already gathered suggests trapping badgers becomes more difficult after they have experienced being trapped, so this will have to be explored and evaluated further.

The early work estimating numbers of badger social groups begun by Dr. Byrne as part of his PhD and Post-Doctoral program confirmed that badger populations are not in any short or medium term threat at the county or national level. How badger populations recover once capturing ceases will now require more detailed study. This is a primary aim of a study site in Cork, which is a DAFM funded collaboration with UCC based in the "old" removal area of the Four Area Study 1997-2002. Valuable information on how the local population recovers/reacts to replacing culling with i/m BCG vaccination will also come from the other study sites in Cork, Longford, Galway, Monaghan, Tipperary and Waterford along with data from the additional vaccination areas in Kilkenny and in Louth.

Culling badgers will be an unfortunate necessity initially in areas experiencing new outbreaks of bovine tuberculosis. Any culling will, however, be time limited and is unlikely to exceed three (3) years in duration. Given experiences gained so far, allowing a maximum of three (3) years of annual culls will be sufficient for DAFMs WU staff to lower local densities of badgers in new areas to the target equilibrium density levels of circa 0.4-0.5 badgers per Km^2., when vaccination will replace culling. This level of focused capturing will also remove a majority of M.bovis exposed/infected badgers in areas where new breakdowns emerge, and will lower the prevalence of TB in badgers to levels comparable to badgers in adjacent, non-affected areas. Vaccinating badgers with BCG will protect a majority of susceptible badgers from succumbing to a future infection with M.bovis, but will not cure a previously infected badger. The success of vaccination will be improved by ensuring bTb levels in badgers is lowered in so far as that is possible prior to commencing vaccination. Three years of annual local culls should be viewed as preparing local badger populations for vaccination with BCG, with the aim of growing populations of badgers that are more resistant to challenge from M.bovis and less likely to succumb to tuberculosis. The key determinant of the future levels of tuberculosis in cattle and in badgers will be the transmission rate from infected individuals to susceptible ones. The continuing test and slaughter policy will ensure transmission between cattle and from cattle to badgers is lowered and vaccination of badgers with BCG will do the same for transmission from badger to badger and from badgers to cattle.

To conclude, I'll again repeat the closing paragraph from the 2016 Annual Report, as the evidence established during 2018 has added further evidence that supports the assertions made then.

Vaccination is unambiguously good for badgers in terms of reducing their susceptibility to tuberculosis, so what better term to describe a vaccinated badger than a GOODGER©? The word play between good and bad will make it easier for the silent, non-scientific majority to conceptualise the transformation being envisaged for Ireland's Meles meles population and will help in assuring all concerned that it is indeed a positive endeavour i.e. good for cattle, good for farming, good for Ireland as well as being transfromative for goodgers (vaccinated badgers)!

Sin a bhfuil.

James O'Keeffe.

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Appendix 1

Table 3. Badgers Captured per DVO area in 2018

DVO Code	DVO Office	Total	Vaccine Areas
11	Carlow	134	
12	Cavan	176	
13	Clare	392	
14	Cork North	293	7
15	Cork South	179	
16	Donegal	213	
17	Dublin	139	
18	Galway	301	2
19	Kerry	313	
20	Kildare	336	
21	Kilkenny	151	
22	Laois	219	
23	Leitrim	258	
24	Limerick	245	
25	Longford	0	
26	Louth	0	6
27	Mayo	340	
28	Meath	114	
29	Monaghan	233	7
30	Offaly	95	
31	Roscommon	297	
32	Sligo	73	
33	Tipperary North	283	2
34	Tipperary South	190	
35	Waterford	124	
36	Westmeath	200	
37	Wexford	290	
	Total	5588	26

Appendix 2

Table 4. National Quartile Distribution per County 2018.

COUNTY	All Qtiles	WU Qtiles	Vaccine Qtiles
Carlow County	299	189	8
Cavan County	665	403	39
Clare County	1209	736	0
Cork North	1275	430	317
Cork South	1429	655	108
Donegal County	1889	255	80
Galway County	2240	680	148
Kerry County	1782	574	45
Kildare WWW	769	407	35
Kilkenny County	691	360	255
Laois County	576	259	45
Leitrim County	543	271	65
Limerick County	910	556	27
Longford County	361	11	286
Louth County	317	0	173
Mayo County	2081	604	20
Meath County	787	442	79
Monaghan County	476	282	121
Offaly County	669	306	198
Roscommon County	846	448	45
Sligo County	658	317	35
Tipperary North	673	418	136
Tipperary South	764	381	115
Waterford County	661	230	207
Westmeath County	619	376	24
Wexford County	852	596	9
Wicklow E	833	311	9
Grand Total	**24874**	**10497**	**2629**

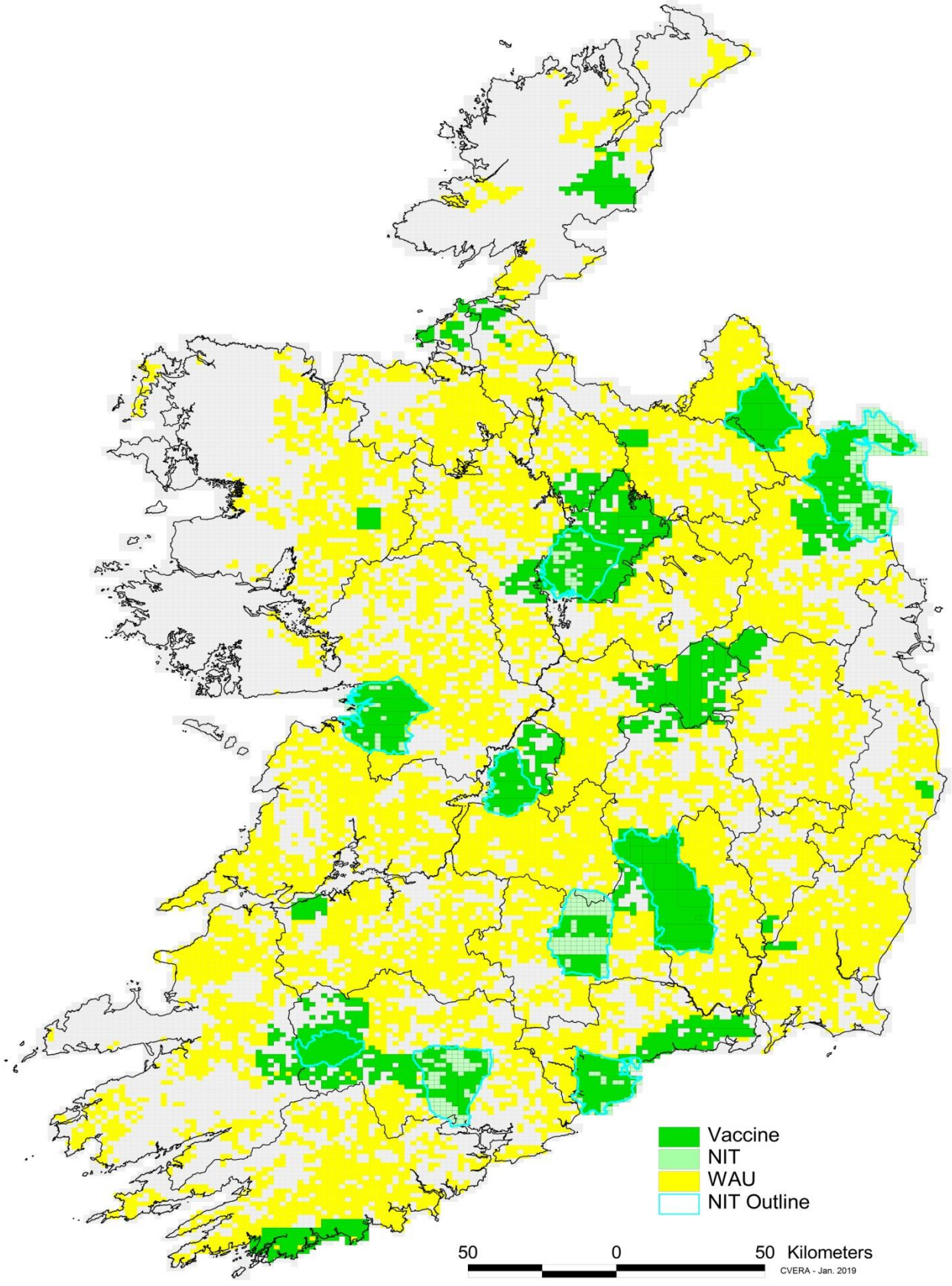
Appendix 3

Table 5. National Quartile Distribution per County 2018.

COUNTY	All Qtiles	C/R 1st.Jan 2018	C/R 1st.Jan 2019	DIFF		VQts 1st.Jan 2018	VQts 1st.Jan 2019	Diff
Carlow County	299	197	189	-8		0	8	8
Cavan County	665	426	403	-23		10	39	29
Clare County	1209	723	736	13		0	0	0
Cork North	1275	733	430	-303		218	317	99
Cork South	1429	741	655	-86		2	108	106
Donegal County	1889	325	255	-70		0	80	80
Galway County	2240	816	680	-136		175	148	-27
Kerry County	1782	562	574	12		0	45	45
Kildare WWW	769	371	407	36		0	35	35
Kilkenny County	691	607	360	-247		247	255	8
Laois County	576	290	259	-31		0	45	45
Leitrim County	543	336	271	-65		0	65	65
Limerick County	910	580	556	-24		0	27	27
Longford County	361	283	11	-272		151	286	135
Louth County	317	317	0	-317		317	173	-144
Mayo County	2081	592	604	12		0	20	20
Meath County	787	518	442	-76		0	79	79
Monaghan County	476	335	282	-53		103	121	18
Offaly County	669	464	306	-158		0	198	198
Roscommon County	846	477	448	-29		4	45	41
Sligo County	658	351	317	-34		0	35	35
Tipperary North	673	554	418	-136		100	136	36
Tipperary South	764	487	381	-106		155	115	-40
Waterford County	661	434	230	-204		126	207	81
Westmeath County	619	385	376	-9		0	24	24
Wexford County	852	584	596	12		0	9	9
Wicklow E	833	314	311	-3		0	9	9
Grand Total	**24874**	**12802**	**10497**	**-2305**		**1608**	**2629**	**1021**

Appendix 4

Map showingNational Quartile Distribution per County 1st.Jan, 2019.



Appendix 5

Press Release: 15th.January, 2018.

Creed announces vaccination of badgers as part of bovine TB eradication programme

The Minister for Agriculture Food and the Marine, Michael Creed, TD has today announced that vaccination of badgers against tuberculosis (TB) will commence as an integral part of the bovine TB eradication programme from January 2018.

Minister Creed said "This marks a major step forward in the bovine TB eradication programme. The move follows years of scientific research funded by my Department into the use of BCG vaccine in badgers, designed to reduce the impact of disease in this wildlife host back into the cattle population".

The Minister added that "The most recent research findings confirm that vaccination of badgers can play a role in reducing the level of infection in cattle. Whilst vaccination of badgers is not a 'silver bullet', it is important in that it addresses one of the critical elements within the complex TB eradication challenge. This will now allow us move forward in the early part of this year to the development and re-launch, in consultation with stakeholders, of a comprehensive strategy to finally eradicate TB ".

Vaccination of badgers will be carried out by staff from the Department of Agriculture, Food and the Marine. The vaccination programme will commence in the areas which have already been part of the field trials demonstrating the effectiveness of badger vaccination. It will roll out incrementally to other parts of the country over time, with vaccination gradually replacing the need to remove badgers.

Minister Creed concluded by welcoming the fact that vaccination of badgers enables Ireland move forward towards eradication of bovine TB in a controlled holistic way, which will serve to protect the badger population whilst also protecting cattle and the livelihoods of farmers.

Appendix6

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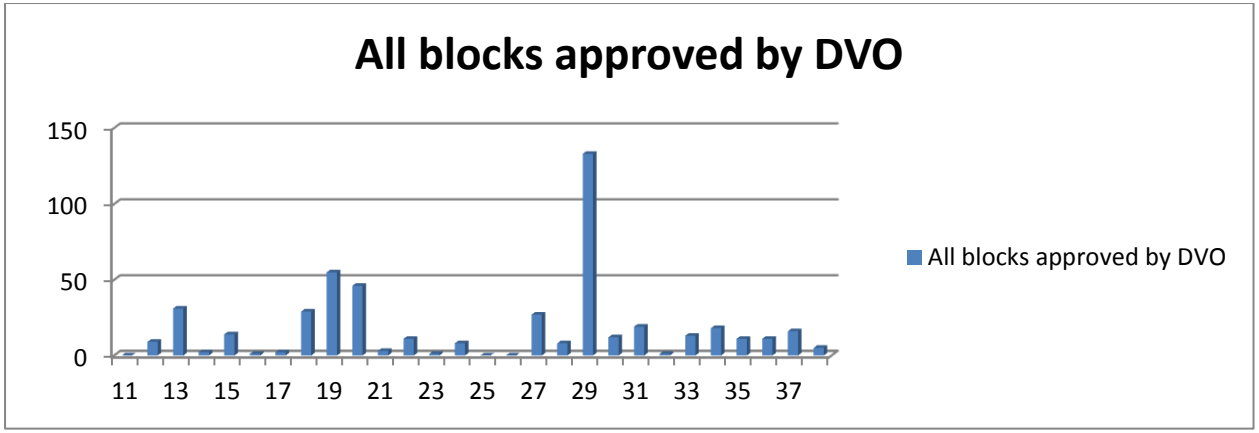
Appendix 7

ALL APPROVALS BY MONTH (new approvals and amended)

2018	*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	0	0	0	1	0	0	3	1	1	0	0	0	0	0	0	0	1	3	0	0	0	0	1	0	0	1	2	**14**
February	0	0	3	0	5	0	0	4	5	6	1	0	0	0	0	0	8	0	12	0	3	0	0	2	0	0	5	0	**54**
March	0	0	6	0	0	0	2	8	5	2	0	3	0	0	0	0	2	0	6	0	7	0	1	2	0	0	0	0	**44**
April	0	0	7	0	0	0	0	4	7	6	0	1	0	0	0	0	3	0	7	0	1	0	0	2	5	0	0	0	**43**
May	0	0	2	0	2	0	0	2	8	4	0	0	0	3	0	0	3	2	22	9	1	0	1	0	1	0	1	0	**61**
June	0	0	0	0	4	0	0	1	3	0	0	0	0	0	0	0	3	2	3	0	1	1	0	1	2	0	1	0	**22**
July	0	0	1	0	0	0	0	1	10	0	0	2	0	2	0	0	2	3	0	0	1	0	1	0	0	2	1	0	**26**
August	0	2	2	0	0	1	0	2	10	16	0	1	0	0	0	0	2	0	0	0	1	0	1	0	2	6	1	1	**48**
September	0	3	2	0	2	0	0	0	3	3	1	3	1	3	0	0	4	0	51	0	0	0	3	7	1	0	1	0	**88**
October	0	1	7	2	0	0	0	0	0	5	0	1	0	0	0	0	0	0	21	1	2	0	2	1	0	0	0	1	**44**
November	0	2	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	1	**10**
December	0	1	1	0	0	0	0	2	3	1	1	0	0	0	0	0	0	0	7	2	2	0	2	2	0	3	5	0	**32**
TOTALS	**0**	**9**	**31**	**2**	**14**	**1**	**2**	**29**	**55**	**46**	**3**	**11**	**1**	**8**	**0**	**0**	**27**	**8**	**133**	**12**	**19**	**1**	**13**	**18**	**11**	**11**	**16**	**5**	**486**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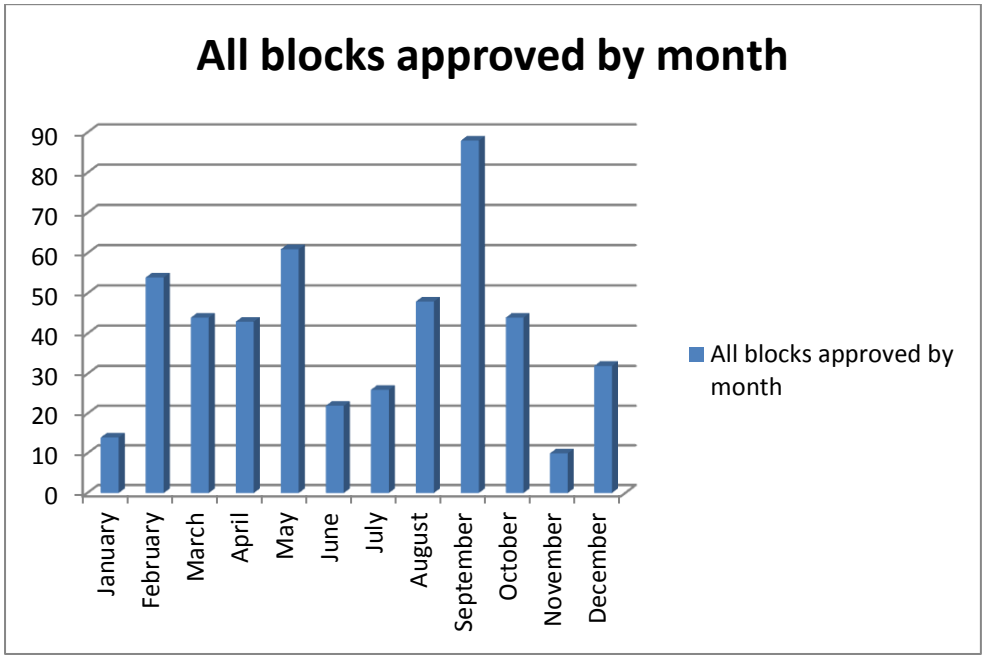
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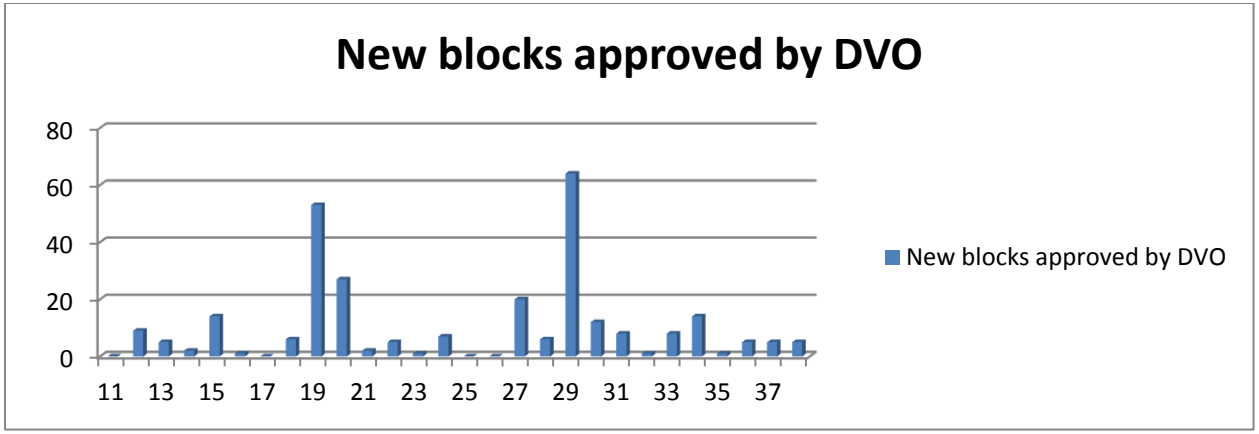
January
February
March
April
May
June
July
August
September
October
November
December
All blocks approved by month

NEW APPROVALS BY MONTH

2018	*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	0	0	0	1	0	0	3	1	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	2	**11**
February	0	0	1	0	5	0	0	3	4	2	1	0	0	0	0	0	6	0	3	0	1	0	0	1	0	0	2	0	**29**
March	0	0	0	0	0	0	0	0	5	2	0	0	0	0	0	0	2	0	3	0	5	0	1	1	0	0	0	0	**19**
April	0	0	1	0	0	0	0	0	7	3	0	1	0	0	0	0	3	0	0	0	0	0	0	2	1	0	0	0	**18**
May	0	0	0	0	2	0	0	0	7	0	0	0	0	2	0	0	2	2	5	9	0	0	0	0	0	0	1	0	**30**
June	0	0	0	0	4	0	0	0	3	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	**10**
July	0	0	0	0	0	0	0	0	10	0	0	2	0	2	0	0	1	3	0	0	0	0	1	0	0	2	0	0	**21**
August	0	2	0	0	0	1	0	0	10	10	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	1	**28**
September	0	3	0	0	2	0	0	0	3	3	1	0	1	3	0	0	4	0	36	0	0	0	3	7	0	0	0	0	**66**
October	0	1	3	2	0	0	0	0	0	5	0	1	0	0	0	0	0	0	8	1	2	0	2	1	0	0	0	1	**27**
November	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	**6**
December	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	5	2	0	0	0	2	0	1	2	0	**16**
TOTALS	*0*	*9*	*5*	*2*	*14*	*1*	*0*	*6*	*53*	*27*	*2*	*5*	*1*	*7*	*0*	*0*	*20*	*6*	*64*	*12*	*8*	*1*	*8*	*14*	*1*	*5*	*5*	*5*	**281**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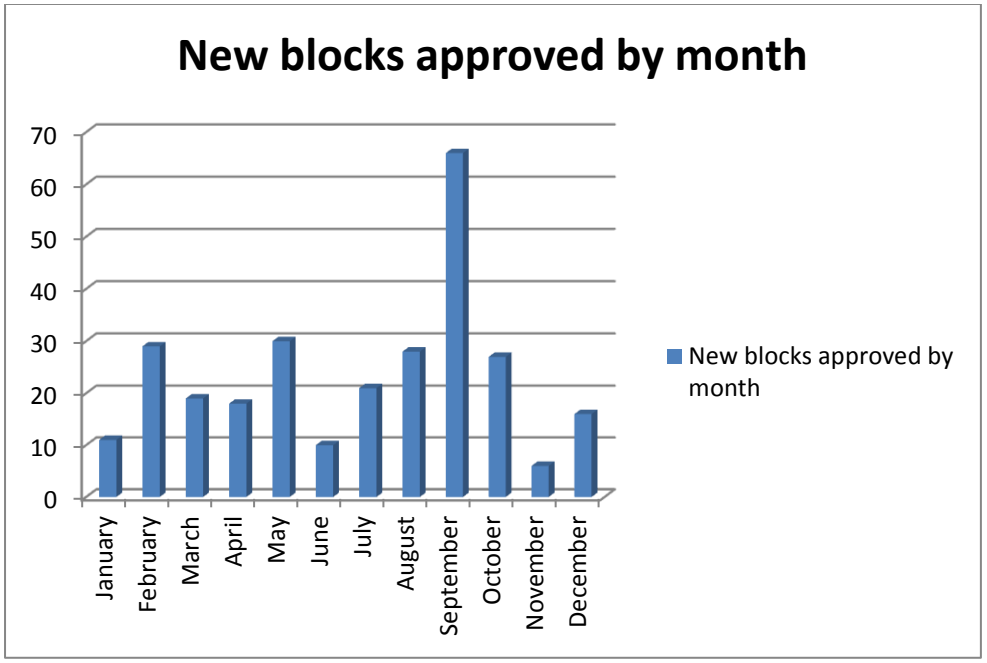
New blocks approved by month
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February
March
April
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June
July
August
September
October
November
December
New blocks approved by month