End of Year Report for DAFMs Wildlife Unit for 2020

Introduction

This is the 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 2020 to 31st December 2020.

Overview and Trends in Bovine TB

Levels of bovine TB have been rising since 2016, and this deteriorating trend has continued into 2020. The herd incidence increased from 3.72% in 2019 to 4.37%. The number of reactors increased from 17,009 to 23,040 from 2019 to 2020 indicating a marked rise in TB. Herd incidence has breached 4% for the first time since 2012. The Minister has stated that these trends highlight the need for urgent action by all stakeholders to manage the risk more effectively across all transmission routes.

The reasons for the recent increase are multifactorial and often relate to a combination of national and local factors. Many recent research studies have indicated that TB risk is greater in large herds and in dairy herds [16,17,18]. The proportion of reactors within dairy herds has increased from 48% to 64% (2021 YTD) in recent years. This has coincided with a large expansion of the dairy herd since 2015. This expansion has resulted in a greater proportion of larger herds, farm fragmentation and trading of animals. Wildlife is also a factor as increased prevalence of *M. bovis* will result in all susceptible species within the transmission cycle being increasingly exposed.

Each TB outbreak is investigated by a veterinary inspector to identify the source of infection. In the case of outbreaks involving two or more standard reactors, there is a veterinary visit to advise the herdowner on how to eliminate infection and necessary measures to assist in reducing the risk of recurrence. Within each county, the TB programme focuses on wildlife protection through vaccination, badger removal in response to badger sourced TB, how disease is distributed in the area, contiguous programmes, gamma interferon testing, cleansing and disinfection, testing compliance and frequency and isolation of reactors.

Attaining TB-free status remains critical from a farm family profitability and sustainability perspective and from a trade perspective at national and at international level. Every TB restriction represents a significant emotional and financial challenge to the farm family concerned.

Badger Vaccination Policy

DAFMs policy regarding badger vaccination is to introduce badger vaccination in suitable candidate areas in order to protect both badgers and cattle from future outbreaks of TB caused by *Mycobacterium bovis*. Research has demonstrated the efficacy of badger vaccination. In a field trial over 755 Km2 in County Kilkenny using the BCG vaccine and a blind placebo demonstrated that badger vaccination, with an efficacy of 60%, could lower the R value (reproductive ratio) of badger to badger TB spread from 1.22 to 0.5 [1,2]. Furthermore, in 2020, vaccination has been demonstrated as comparably effective and thus as an appropriate replacement for culling[3]. The Non-Inferiority Trial was established in 7 areas of the country over 7 years, finishing in 2017. With the efficacy of BCG vaccination in reducing the spread of *Mycobacterium bovis* between badgers proven in the Kilkenny trial, this trial sought to examine if vaccinating badgers would keep spread to cattle suppressed. A large part of a county was subject to badger vaccination and was compared to culling badgers (in response to TB breakdowns) in another similarly sized part of the county. While TB increased in some of the trial areas the overall result of the trial was that badger vaccination was not inferior to badger culling in terms of spread to cattle.

Suitable areas are those where badger population density is low [4,5] and there is also a lower prevalence of TB in the local cattle population. As reported previously, the Minister, in 2018, announced that badger vaccination would roll out incrementally over time, with vaccination gradually replacing the removal of badgers as the default position in response to TB in cattle, noting that some level of badger culling in

response to severe TB episodes would still be required in places. The roll out that was flagged was progressed to a large extent in the last few months of 2019 and early 2020 when the area of the country subject to vaccination was doubled. A map of the area under vaccination at the end of 2019 and 2020 is shown in the appendices.

Roll Out of Vaccination in 2019 and 2020

At the end of 2020, 19,079 Km^2 were subject to badger vaccination. During the roll out, Wildlife Unit management visited all 16 Regional Veterinary Offices and identified candidate areas for switching from culling to vaccination. Vaccination requires a veterinary resource and, as such, it is more expensive than culling. Therefore, the areas under vaccination will be constantly under review regarding the availability of resources in each Regional Veterinary Office. Throughout 2020, additional quartiles were added to vaccination. Vaccination is implemented at the level of the quartile. A quartile is a rectangular area measuring 2Km x 1.5Km ($3Km^2$). The grid overlay used by the Wildlife Unit is based upon the Ordnance Survey Ireland (OSI) orthophotography (see appendices) contains an overall total of 24,874 individual quartiles. In Table 1 below, the distribution of quartiles between the removal alone and removal/vaccinate components of DAFM's wildlife program as of 31st December, 2020, are outlined.

Table 1. The distribution of quartiles which contain a sett between the removal alone and removal/vaccinate components of DAFM's wildlife program as of 31st December, 2020

2020	All Quartiles	Removal alone Quartiles	Vaccine Quartiles
Grand Total	24,874	6,395	6,373

Of the 24,874 quartiles that overlay any part of Ireland, 12,768 (51.33%) quartiles have some of their $3Km^2$ of land in either vaccine programme (6,373) or removal programme (6,395) zones. The vaccine zones at the end of 2020 represent 49.91% (2019 figure was 42.26%) of the total areas where DAFM operated a wildlife programme, and this reflects an increase of 18% in the proportion of vaccination areas during 2020. It is intended to continue to increase the area under vaccination in coming years.

Criteria for Vaccination switch-over

With the transition to vaccination, the aim is to increase the population of BCG vaccinated badgers in areas that previously underwent a 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. Each sett recorded on the Wildlife Unit information system is uniquely numbered, and the number associates the sett with the quartile in which it is located. The non-inferiority trial which demonstrated that, subsequent to a period of removal, introduction of vaccination in an area is not inferior to badger removal in terms of the prevalence of bovine TB in that area. Switching an area from removal to vaccination is based on the same criteria – the expectation that badger densities will be low due to pre-existent removal and low TB prevalence in the cattle population.

A map of the country, overlain by Quartiles (see Appendices), has been generated by colleagues in CVERA that shows the vaccination areas in green, the remaining removal/remove areas in yellow and the rest of the country's lands which are not part of the WU capturing program. The breakdown of Quartiles between Vaccine, WU capturing and All Quartiles per county area is tabulated in the Appendices. The data presented in the appendices shows the movement in Quartiles between the start of 2019 and the end of 2020.

Wildlife Unit Training

Because of the Lockdown it was difficult to complete the training targets in 2020. Since then, training has been successfully digitised. However, in 2020 a number of training initiatives were successful. In February, the field officers, both veterinary and technical, were trained in relation to the local area risk project. The training consisted of learning to use rapid sett-side TB tests to diagnose TB. These type of tests are used in deer, elephants, wild boar and pigs. DAFM is trialling their use in terms of testing badgers prior to

vaccination. Later in the year, review meetings were held in the RVOs. The success of the previous year's vaccination effort was assessed, and plans were drawn up for how best to use resources in 2021. Unfortunately, the underlying increase in TB was the constant backdrop for considerations at these meetings.

Wildlife Unit Research

DAFM is actively involved in a number of research projects relating to TB in badgers and spread to cattle. In County Cork, a UCD led project is studying the population trends as badger density increases in an established vaccination area.

Further research papers were published in the collaboration of DAFM and TCD in relation to badger ecology in the M11 motorway construction.

A large multi-site and multi-annual research project involving DAFM, UCD and University of Wageningen was commenced. This research involves testing all badgers captured for vaccination in 9 areas around Ireland in subsequent sweeps over 4 years. The purpose of the research is to monitor vaccinated badgers potential infection status over time, estimate badger population and vaccination population penetration and the local prevalence of TB in badgers. This will help to inform a mathematical model of risk associated with spread from badgers at the local (farm) level. Each of the sites is 20 quartiles in size. In addition to the sett-side test, further testing on blood samples will take place. Another aspect of this study which is informed by the field results is purely mathematical in nature and is being progressed in the University of Wageningen.

DAFM was involved in whole genome sequence research in relation to badgers, deer and cattle where similar strains of *M. bovis* were found to be circulating between all 3 species[6] in an area in Co Wicklow. Similar research studies are progressing in relation to the Burren and Co Monaghan, two areas where there are ongoing intractable TB problems.

DAFM conducted studies of the risk of TB in relation to road building and forestry clearfelling. Further research is being completed in a collaboration with UCD.

Wildlife Unit Stakeholder Engagement

2020 was a difficult year for stakeholder engagement but ended on a positive note. The TB Stakeholder Forum held two meetings towards the end of the year. The Forum is based on the 4 principles outlined in the National Farmed Animal Health Strategy. These are:

1. Working together to improve animal health standards,

2. The roles and responsibilities of all stakeholders must be clear),

3. The principle of 'prevention is better than cure' must be consistently applied, and

4. Finally, animal health programmes will have clear objectives, and will be sustainably and appropriately funded.

There were many press releases and farmer interactions with the farming media during 2020. Many of these focussed on spread of TB from wildlife and deer. Some farming organisations or their senior representatives stated that vaccination of badgers does not work. This is contrary to the evidence. There is also ongoing pressure from some farming stakeholders to increase badger culling.

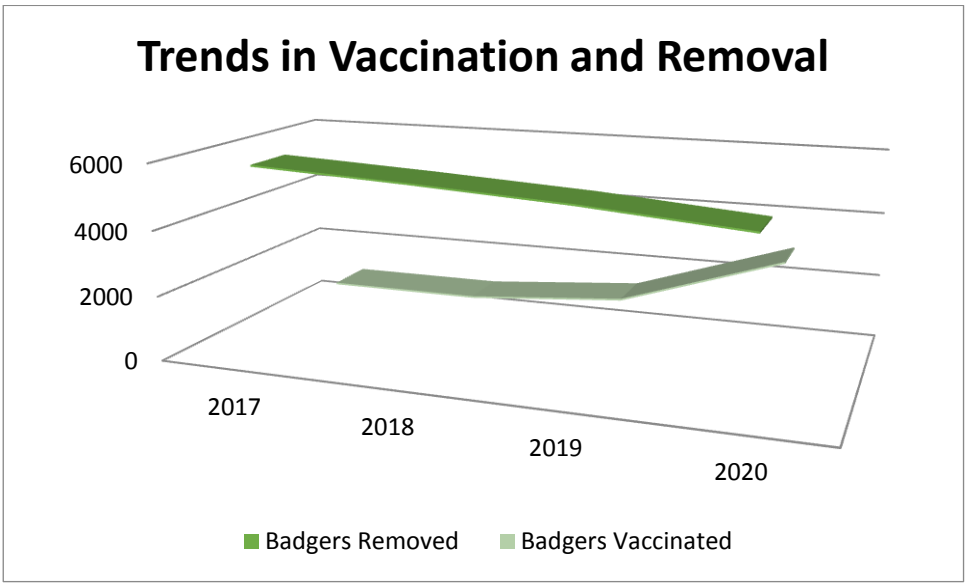
DAFM had two campaigns to seek greater farmer involvement in biosecurity around the risk of TB spread from badgers. Farmers were texted and asked to aid in identifying and fencing off badger setts on farmland in relation to vaccination. The latter campaign was dubbed STOP/STOP/TELL – Stop cattle accessing badger habitat, Stop badgers accessing cattle feed and drink areas and Tell DAFM of any badger activity on farm.

Wildlife Unit Software

In addition to the progression of work practices and processes, the software used as part of the Wildlife Unit had further upgrades during 2020. Every badger in the vaccination area is now being recorded electronically when it is captured. In 2020, one badger which had first been vaccinated in 2013 and 8 badgers first vaccinated in 2014 were captured and tested for TB in the study area. This is a good indication of the health benefits of the badger vaccination programme. New survey layers were added to the system to help to pinpoint where we may be missing setts. This is crucial to the success of badger vaccination because, as with all vaccination efforts regardless of the disease or the species, population penetration is crucial with regard to attaining good herd level immunity.

Vaccination Data

As mentioned, population penetration is crucial in attaining herd immunity. Currently, approximately 64% of badgers being captured in vaccination areas are new captures and have not been vaccinated previously. This is 6% less than 2019 and is expected to fall more over time as greater population penetration is achieved. Of the 4,698 badgers that were recorded in the vaccination area last year, 3,004 were vaccinated with BCG, 258 were removed for epidemiological reasons, 22 were either deceased at capture or were found dead on land or roads within the vaccination area, 885 had been previously vaccinated (termed goodgers), 526 had been captured within the previous month and 3 were euthanised for health reasons. See the table in the appendix for a county-by-county breakdown. The ongoing trend is for more badgers to be vaccinated and less badgers to be removed. In terms of the population penetration of vaccination in any given area, the goodger rate is a key rate. A high goodger rate is reflective of good population penetration. It is expected that once an area is recruited to vaccination for a number of years and has identified a majority of the setts that this will be plateau at a high level.



Removal of Badgers

In non-vaccination areas, 4,723 badgers were captured and removed. Details of areas where all badgers removed or vaccinated during 2020 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 the Appendices.

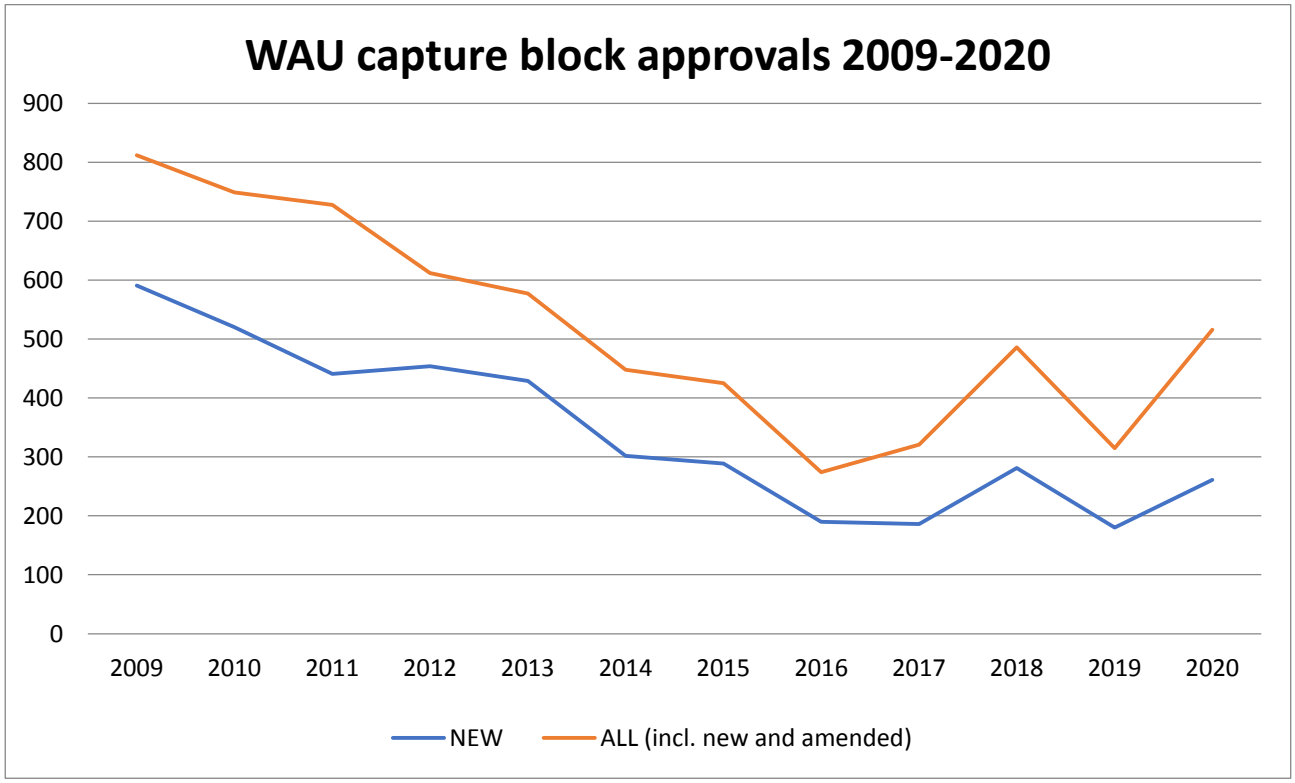
The expanded table which first appeared in the 2011 report is again included with the respective bar-charts for 2020 activities. Approvals for badger removals are actioned through the use of capture blocks which relate to a TB breakdown in a herd and the setts relevant to that herd. The approvals are sub-divided per county areas into first time approvals and approvals for setts added to areas/blocks that were approved for removal 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 2020, the UCD Centre for Veterinary Epidemiology and Risk Analysis (CVERA) approved setts for removal in 516 areas where DAFM 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 516 areas, 261 were new areas where capturing had not been undertaken previously since the current Wildlife program commenced in 2003. The corresponding figures in 2016 were 274/190, 2017 were 321/186, 2018 were 486/281and in 2019 315/180. The information in Table 2 and in Figure 1 outlines trends since 2009.

Number of new and total approved areas for removal in each year 2009-2020

	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
2019	180	315
2020	261	516

New and total approved areas for removal in each year 2009-2020



The basic tenet on which the Wildlife program is based is that a majority of new herd breakdowns are due to previously uninfected cattle herds falling victim to bovine tuberculosis (bTB). This, despite removal of the infected cattle, perpetuates 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 the years, the reduction 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 of the addition of areas subject to removal. Expansion of vaccination has resulted in a contraction of the area subject to removal alone, while expanding the area in which vaccination is carried out. However, the increase seen in 2020 is indicative of the general increase of TB in most localities in Ireland.

Reduction in Removals

There were 4,803 badgers removed in removal areas during 2020 which reflects the ongoing transitioning of removal areas to vaccination areas. This figure is continuing a trend of lower figures for removal areas seen in recent years: 5,352 in 2019, 5,614 in 2018 and 5,835 in 2017 (The table in the appendices outlines the

DVO areas where these removals took place). To recap on how removal is organised, the approach is that out of roughly 43,000 setts on DAFMs database, at least one badger has been removed at roughly 20,000 setts, and each year's re-capturing is focused on these setts/areas. In the 2020 removal area activity badgers were removed at 3,025 setts. At 36% of these, more than one badger was removed. Because badger social groups typically use between 4-6 setts, one of which is a main sett, the roughly 43,000 setts on the DAFM database represent perhaps 7-10,000 badger social groups.

Removal Approval Process

Following a breakdown where badgers are identified as contributing to the disease outbreak, DAFM staff may seek approval for removal of 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.[7] has confirmed that badgers, in the main, forage, on lands within 1.5Km of the main sett. While DAFM staff have permissions to capture badgers at setts that are within 1.5-2Kms of 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 programmes focus on setts that are within the first 1Km radius of affected farms, and rarely does capturing extend to the full 2Km limit.

Activity Scoring

On an ongoing basis each year (a program which began in Feb 2011) the setts where one or more badgers have been removed are visited and rated using an activity score. Based on the activity observed during these evaluations, the subsequent capturing program targets the highest density areas. Unfortunately, our officers have reported a reduction of activity at a number of vaccination area setts. This may be caused by natural phenomena but there are anecdotal reports of an increase in illegal badger persecution throughout Ireland, especially since the coronavirus lockdowns began.

Permit to Remove in Vaccination Areas

Bovine TB breakdowns continue to occur in some areas under vaccination and can be associated with spread from the environment thus indicating badger involvement. In this scenario the Veterinary Inspector managing the TB breakdown from an epidemiological perspective completes an application where they demonstrate that infection from various means other than spillover from wildlife is very low risk. They pinpoint the fragments where introduction has most likely occurred. The Wildlife Unit (WU) Superintending Veterinary Inspector (SVI) then assesses the application and, if successful, approves a re-survey of the area. Following a re-survey of the area the WU SVI recommends the removal of badgers from within a more restricted zone of 1Km of the affected parts of the farm. Depending on the epidemiological situation locally and the length of time under vaccination the recommendation to CVERA is at the level of a) every second unvaccinated badger which is the usual entry point, b) every unvaccinated badger, c) every badger or d) every test positive badger. The last category is continuing to be evaluated as more tests have become available. No category c permits have been sought or issued. CVERA assess the applications and issue an end-dated permit. In 2020, 258 badgers were removed under such permits. This is an increase from 42 in 2019 as it was the first full year of operations in the expanded vaccination area and the vaccination scheme has encroached on some areas where TB prevalence in cattle has been higher. The disease situation in badgers removed in these areas is being closely monitored. For example, in two local areas - one in the north of the country, the other in the south - over 50% of removed badgers had TB which led to the decision to recommend removal of every unvaccinated badger on a subsequent removal permit. The existence of fall-

back removal has been critical to stakeholder acceptance of badger vaccination. We vaccinate to protect badgers and cattle from TB and remove where there are breakdowns epidemiologically linked to TB breakdowns is a summary of the policy.

Switching removal areas to vaccination areas

The primary objective of the Wildlife Unit when it was established was to address any involvement of badgers in tuberculosis breakdowns in herds in areas where badgers were also implicated. Progress has been made in the levels of bTB in cattle herds since DAFM's Wildlife programme commenced, and it is acknowledged that the major driver of these improvements have been facilitated by DAFM's wildlife strategy and by the work done by Wildlife Unit staff assisted by operatives engaged through the Farm Relief Network.

Discussion

Bovine TB eradication has been ongoing in Ireland for more than 50 years. TB in all species, is a chronic disease and the pathogen that causes TB, *Mycobacterium bovis*, is particularly well adapted to evading detection by eliciting an unusual cell-mediated immune reaction that does not readily lend itself to common methodologies. It is also well adapted to live in the host species for protracted periods of time causing a very slow chronic disease. Despite this, many countries, using the same eradication techniques in the cattle population as Ireland, have been successful in eradicating TB. Following studies into badger involvement in bovine TB[9,10,11,12,13,14], Ireland set up a badger removal programme in the early 2000s. This has helped halve Ireland's incidence of bovine TB in the last 20 years but, unfortunately, the disease has reached another state of equilibrium in terms of ongoing disease prevalence and disease levels have stagnated since 2013 and are beginning to rise. A recent publication[8] examines why the British Isles have struggled to fully eradicate TB compared to other European countries and concludes that many ecological and environmental factors have an additive impact. In Ireland we, in broad terms, through the wildlife programme, address the spread from wildlife but the main focus of the renewed TB strategy[15] is in relation to other controls and stakeholder involvement.

The Wildlife Unit vaccination program ultimately aims to have high levels of BCG vaccinated badgers in "high TB risk, high animal density" areas. The areas where badgers are removed 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 need for expansion of the Wildlife Unit program into new areas, as each year the WU removal areas only expand by circa 1% per year and these expansions are largely due to new foci of infections arising via animal movements (predominantly due to cattle, but also due to badgers and deer).

The study previously referred to[1] where an oral presentation of BCG vaccine was evaluated in badgers showed that vaccinated badgers had longer intervals to seroconversion, which is considered to be a proxy measure for infection. The study also demonstrated that TB lesions were substantially lower in vaccinated badgers as compared to unvaccinated badgers. A second study using blood samples from badgers in the same Kilkenny study by Aznar et al.[2]. 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". This study also demonstrated that the R_0 (a concept which has become mainstream with Covid-19) is reduced in vaccinated badgers from over 1 (whereby TB persists within the badger population) to 0.5 (whereby, on average, it takes 2 infected badgers to infect another one).

As outlined in earlier reports, DAFM commenced field testing BCG, administered intra-muscularly, in wild badger populations in Longford in 2011. Similar vaccination programs commenced in Cork, Galway,

Monaghan, Tipperary and Waterford and in Louth during 2012 and 2013. The Non-Inferiority Trial[3] was established in 7 areas of the country over 7 years, finishing in 2017. With the efficacy of BCG vaccination in reducing the spread of *Mycobacterium bovis* between badgers proven in the Kilkenny trial, this trial sought to examine if vaccinating badgers would keep spread to cattle suppressed. A large part of a county was subject to badger vaccination and was compared to culling badgers (in response to TB breakdowns) in another similarly sized part of the county. While TB increased in some of the trial areas the overall result of the trial was that badger vaccination was not inferior to badger culling in terms of spread to cattle.

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.

Conclusions

The early work estimating numbers of badger social groups by Byrne et al.[7] confirmed that badger populations are not in any short or medium term threat at the county or national level. How badger populations recover once removal is reduced is part of the current research project mentioned above and it will continue to be the focus of DAFM in the coming years as the effectiveness of badger vaccination is measured and verified. Culling badgers will continue to be necessary in certain areas which experience ongoing or new outbreaks of bovine tuberculosis. 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.

The other key element is ensuring an acceptable level of population penetration through ongoing recruitment of hitherto unknown setts to the vaccination effort. 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 cattle test and removal 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. Disease prevalence in both species will require to be monitored on an ongoing basis so that policies can continue to be relevant, effective and responsive.

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Appendix

Table 3 Results of captures in Vaccination areas in 2020

	Unhealthy	Deceased or Found Dead on land/road	Epi Permit	Goodger	New	Recapture	Grand Total	% Goodger
Carlow		1			39	3	43	0.00%
Cavan		1	1	1	44	8	55	2.13%
Cork North		2	32	34	133	15	216	16.92%
Cork South			4	15	119	16	154	10.87%
Donegal		2			105	16	123	0.00%
Galway				52	137	22	211	27.51%
Kerry		2	34	13	186	26	261	5.53%
Kildare				5	184	31	220	2.65%
Kilkenny		3	7	231	409	129	779	35.54%
Laois		1	7	12	151	38	209	7.02%
Leitrim					20	1	21	0.00%
Limerick		3	4	4	110	10	131	3.31%
Longford				41	141	11	193	22.53%
Louth		1	64	79	189	38	371	23.72%
Mayo			3	7	161	5	176	4.09%
Meath		1	11	2	34	0	48	4.17%
Monaghan		1	27	35	89	16	168	23.03%
Offaly	1	1	7	33	91	14	147	24.81%
Roscommon		2		22	88	10	122	19.64%
Tipperary North	1		9	31	84	12	137	24.80%
Tipperary South	1		30	108	186	19	344	33.23%
Waterford		1		154	165	58	378	48.13%
Wexford			18	2	109	16	145	1.55%
Wicklow East				4	30	12	46	11.76%
Total	3	22	258	885	3004	526	4698	21.21%

Table 4. Badgers Removal Area Removals per DVO area in 2020

DVO Office	Total Badgers Removed
Carlow	79
Cavan	278
Clare	548
Cork North	310
Cork South	276
Donegal	59
Dublin	21
Galway	250
Kerry	240
Kildare	56
Kilkenny	39
Laois	105
Leitrim	244
Limerick	82
Longford	0
Louth	0
Mayo	121
Meath	172
Monaghan	173
Offaly	144
Roscommon	126
Sligo	142
Tipperary North	340
Tipperary South	114
Waterford	127
Westmeath	270
Wexford	154
Wicklow East	148
Wicklow West	185

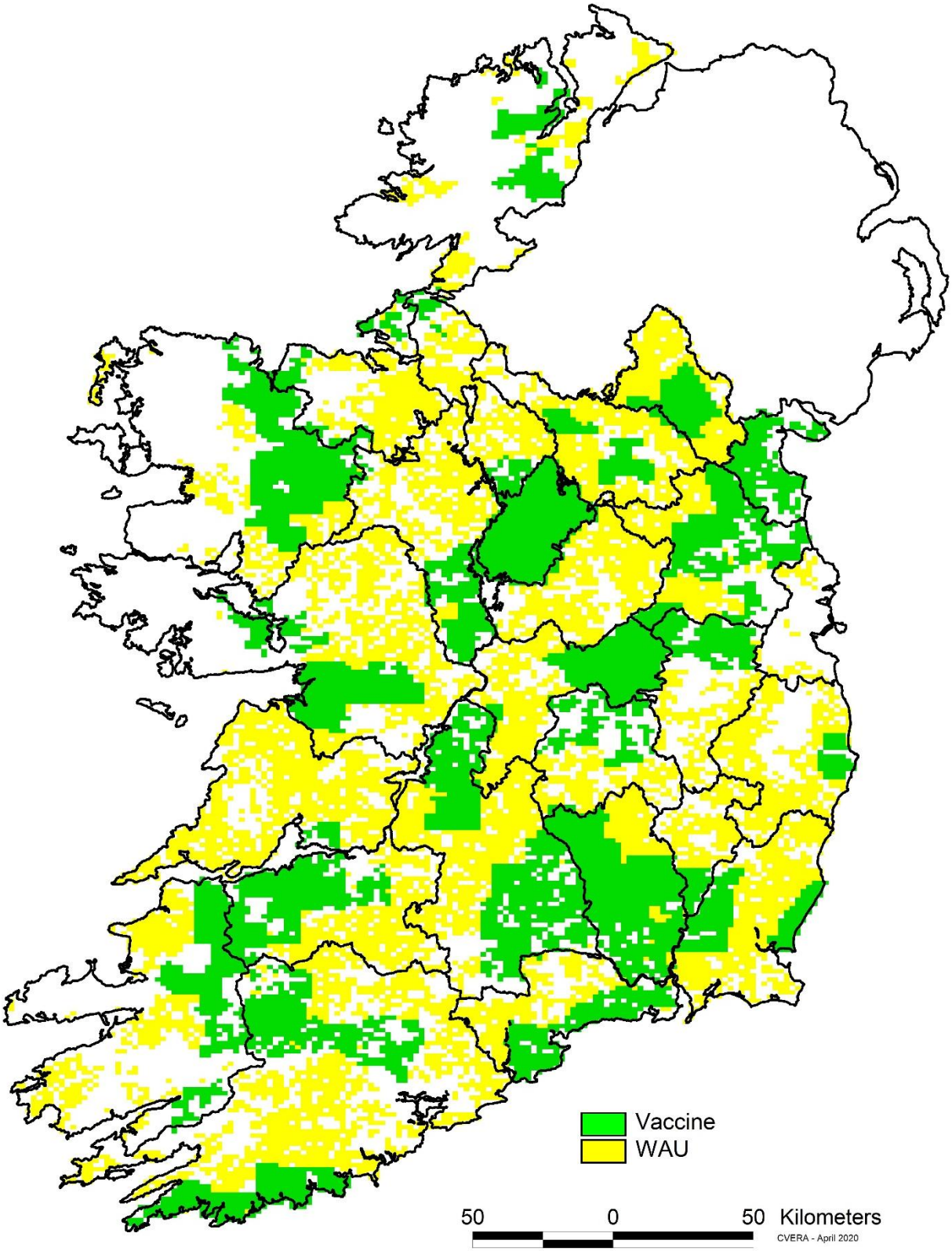
Table 5. National Quartile Distribution per County 2018 - 2019.

Some quartiles may not all contain a sett

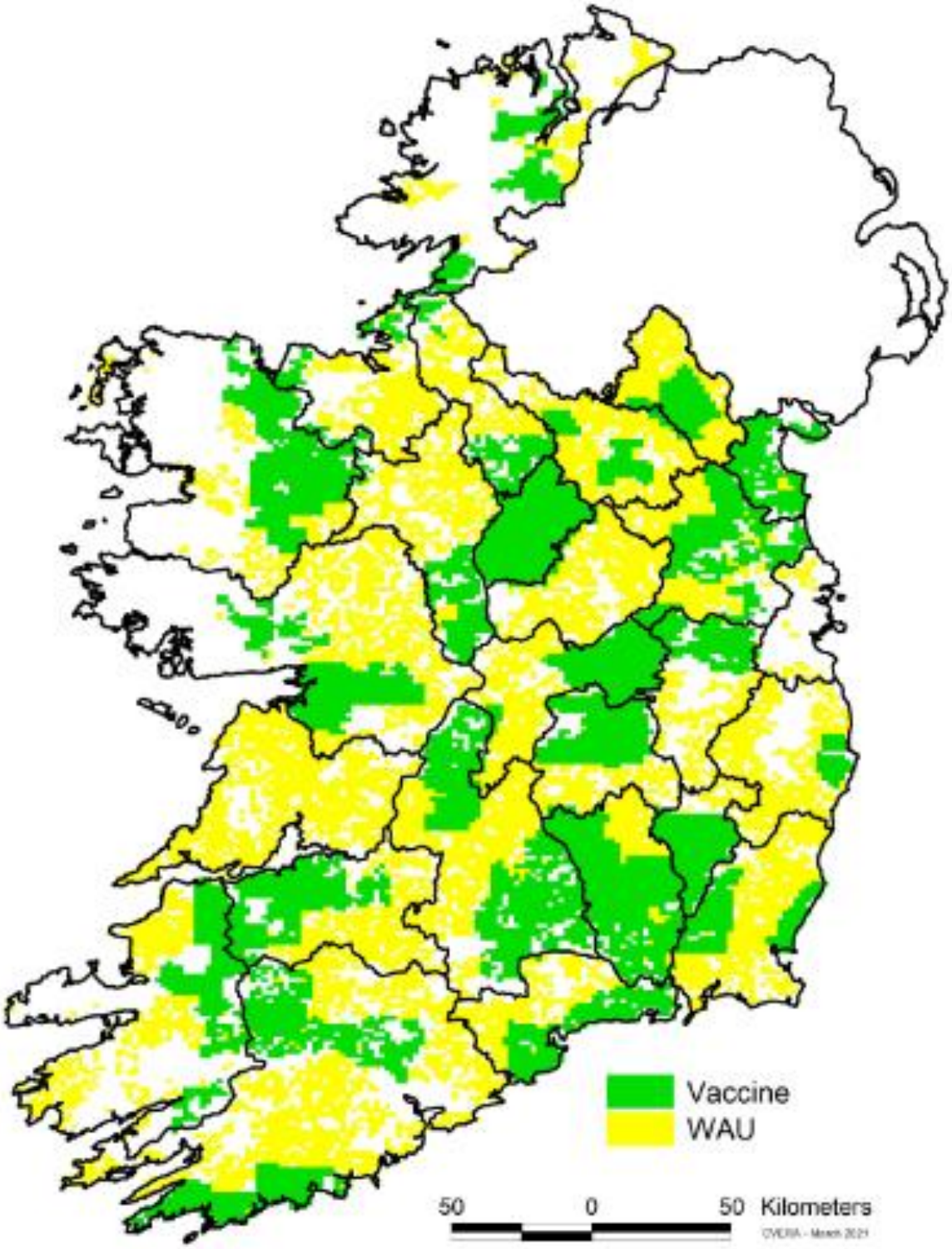
COUNTY	All Quartiles	WU Removal Quartiles 2019	WU Removal Quartiles 2020	End 2019 Vaccination Quartiles	Vaccine Quartiles added 2020	Vaccine Quartiles end 2020
Carlow County	299	161	56	39	160	199
Cavan County	665	353	352	130	1	131
Clare County	1209	746	746	27	0	27
Cork North	1275	448	440	319	14	333
Cork South	1429	532	530	309	6	315
Donegal County	1889	209	163	160	47	207
Galway County	2240	529	527	348	3	351
Kerry County	1782	397	394	299	2	301
Kildare	769	304	303	151	6	157
Kilkenny County	691	143	142	458	52	510
Laois County	576	179	155	137	127	264
Leitrim County	543	273	210	66	68	134
Limerick County	910	309	309	335	1	336
Longford County	361	2	2	329	47	376
Louth County	317	0	0	173	26	199
Mayo County	2081	250	250	468	21	489
Meath County	787	230	229	354	2	356
Monaghan County	476	277	277	133	0	133
Offaly County	669	276	276	277	9	286
Roscommon County	846	362	362	170	13	183
Sligo County	658	276	276	82	1	83
Tipperary North	673	307	306	394	10	404

Tipperary South	764	185	178	272	23	295
Waterford County	661	220	216	218	14	232
Westmeath County	619	386	386	28	0	28
Wexford County	852	447	443	189	7	196
Wicklow E	833	282	276	51	5	56
Grand Total	**24874**	**8083**	**7804**	**5916**	**665**	**6581**

Map showing National Quartile Distribution per County 1st Jan, 2020.

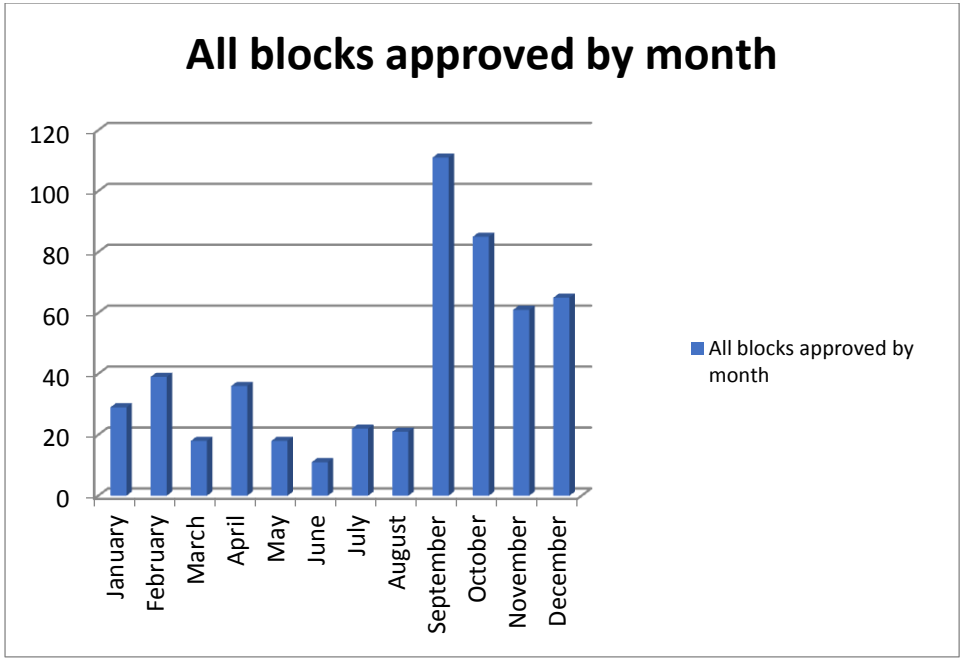


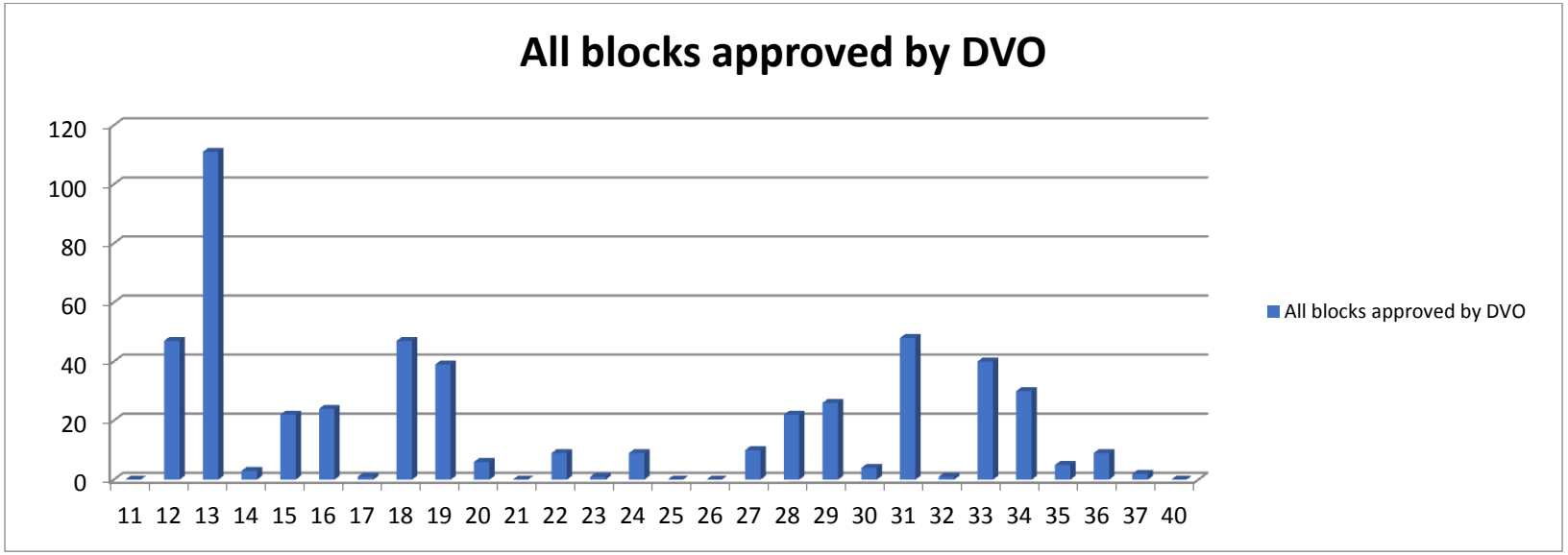
Map showing National Quartile Distribution per County 1st Jan, 2021.



ALL APPROVALS BY MONTH (new approvals and amended)

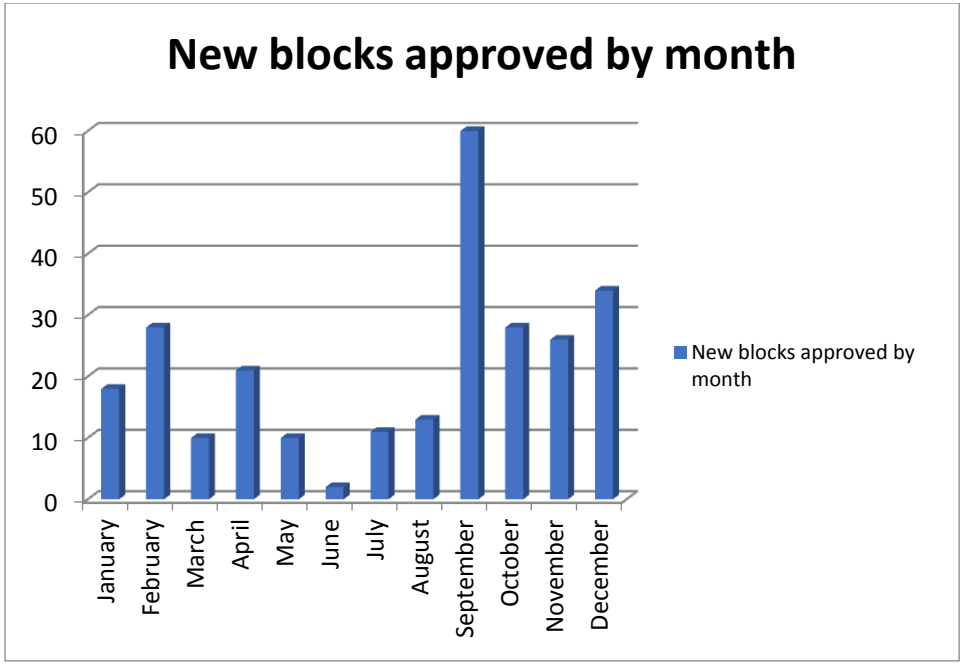
2020	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20/39*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*40*	TOTALS
January	0	3	6	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	2	1	5	0	0	2	0	0	**29**
February	0	2	8	1	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	3	4	0	0	**39**
March	0	1	7	2	0	0	0	1	0	0	0	4	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	**18**
April	0	9	4	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	5	0	0	0	8	3	1	0	1	0	**36**
May	0	1	3	0	0	2	0	1	0	0	0	2	0	1	0	0	0	0	0	0	2	0	4	2	0	0	0	0	**18**
June	0	0	5	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	**11**
July	0	1	10	0	5	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	1	0	1	1	0	**22**
August	0	1	4	0	3	0	0	2	4	0	0	0	1	1	0	0	3	0	0	0	2	0	0	0	0	0	0	0	**21**
September	0	1	31	0	2	8	0	3	32	1	0	1	0	0	0	0	2	5	10	0	4	0	4	7	0	0	0	0	**111**
October	0	17	6	0	4	1	1	3	0	3	0	0	0	4	0	0	3	12	3	3	17	0	4	3	1	0	0	0	**85**
November	0	1	15	0	3	11	0	5	1	0	0	2	0	2	0	0	0	2	2	0	8	0	4	5	0	0	0	0	**61**
December	0	10	12	0	4	1	0	4	0	2	0	0	0	1	0	0	0	3	4	1	10	0	6	6	0	1	0	0	**65**
TOTALS	**0**	**47**	**111**	**3**	**22**	**24**	**1**	**47**	**39**	**6**	**0**	**9**	**1**	**9**	**0**	**0**	**10**	**22**	**26**	**4**	**48**	**1**	**40**	**30**	**5**	**9**	**2**	**0**	**516**


All blocks approved by month
120
100
80
60
40
20
0
January
February
March
April
May
June
July
August
September
October
November
December
All blocks approved by month


All blocks approved by DVO
120
100
80
60
40
20
0
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
All blocks approved by DVO

NEW APPROVALS BY MONTH

2020	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20/39*	*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	10	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	2	0	0	**18**
February	0	2	0	1	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	3	3	0	0	**28**
March	0	1	1	2	0	0	0	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**10**
April	0	9	1	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	2	0	0	0	1	2	0	0	1	0	**21**
May	0	1	0	0	0	2	0	1	0	0	0	2	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	**10**
June	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
July	0	1	1	0	5	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	1	0	0	**11**
August	0	0	0	0	3	0	0	0	4	0	0	0	1	1	0	0	3	0	0	0	1	0	0	0	0	0	0	0	**13**
September	0	0	2	0	2	8	0	2	32	1	0	1	0	0	0	0	1	4	1	0	1	0	1	4	0	0	0	0	**60**
October	0	6	0	0	4	0	1	2	0	3	0	0	0	3	0	0	1	7	0	1	0	0	0	0	0	0	0	0	**28**
November	0	1	0	0	3	9	0	5	1	0	0	2	0	1	0	0	0	2	1	0	0	0	0	1	0	0	0	0	**26**
December	0	8	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	3	4	0	9	0	0	2	0	0	0	0	**34**
TOTALS	**0**	**31**	**5**	**3**	**22**	**20**	**1**	**42**	**39**	**4**	**0**	**9**	**1**	**6**	**0**	**0**	**7**	**16**	**8**	**1**	**14**	**1**	**8**	**13**	**3**	**6**	**1**	**0**	**261**


New blocks approved by month
60
50
40
30
20
10
0
January
February
March
April
May
June
July
August
September
October
November
December
New blocks approved by month

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