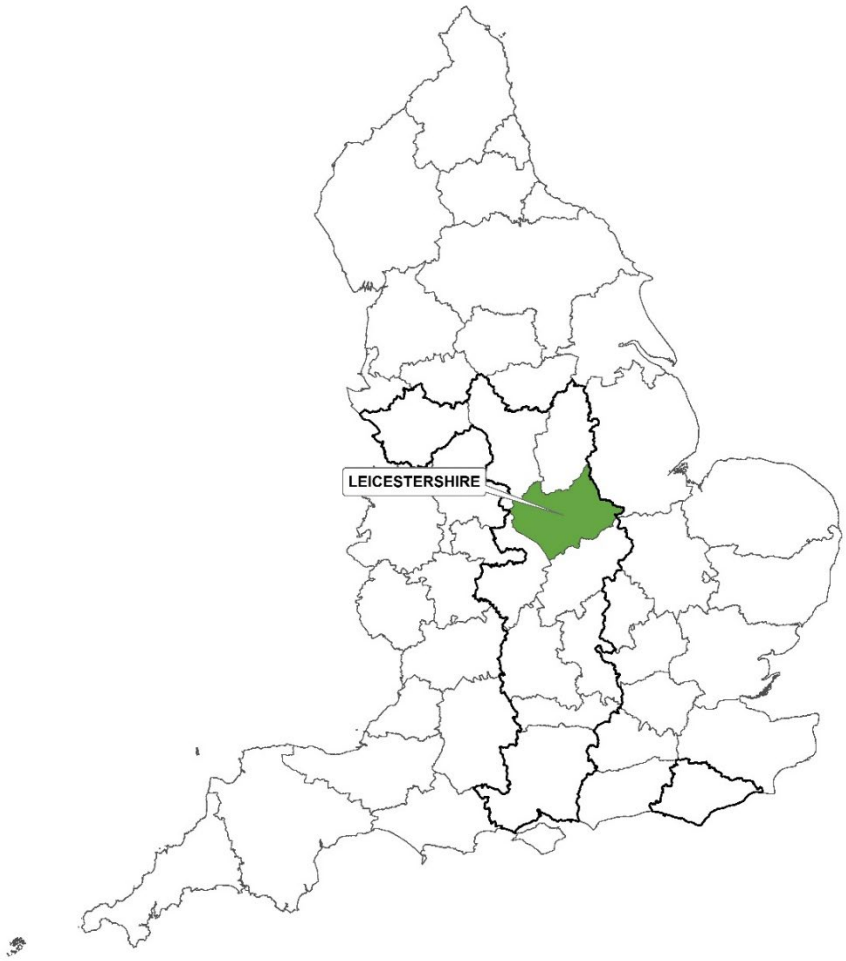
Animal & Plant Health Agency

Year-end descriptive epidemiology report: Bovine TB in the Edge Area of England

County: Leicestershire

Year-end report for: 2020

TB Edge Area - LEICESTERSHIRE



TR398 (Rev. 03/21)

Contents

Executive summary

Reporting area

Leicestershire is part of the Edge Area that was established in 2013. In 2014, the bovine tuberculosis (TB) surveillance strategy for this area was incorporated into the UK government's strategy to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038. This end of year report describes bovine TB in Leicestershire.

Local cattle industry

Small family-run beef herds predominate in Leicestershire, however there is a significant number of large dairy herds in the county mainly in the north-east of Leicestershire.

New TB incidents

The annual TB incidence rate per 100 herd-years at risk was 7.7 in 2020, an increase from 6.0 in 2019. There were 64 new TB incidents detected in 2020, an increase from 50 incidents in 2019. This was the biggest year-on-year increase since 2011. There were the same number of OTF-W and OTF-S incidents in 2020, with 32 cases of each.

Risk pathways for TB infection

Badger-related risk pathways accounted for 35% of the weighted contribution of all risk pathways considered. This represents a 10% decrease from 2019. The data is for all incidents that had an epidemiological investigation completed by APHA; a total of 57 TB incidents.

The main source of infection for OTF-W incidents was badgers, with a total of 45% of weighted risk pathways. In comparison, only 24% of the weighted source of infection in all OTF-S TB incidents were ascribed to badger infection. Many incidents attributed to wildlife reservoirs occurred in north-east Leicestershire, where disease is endemic.

Movement of undetected infected cattle was the second main risk pathway accounting for 30% of the weighted contribution of all risk pathways.

Details of the methodology used to calculate the weighted contribution of the different suspected sources of *M. bovis* infection for all new incidents can be found in the main body of the report and in the Explanatory Supplement to the 2020 bovine TB epidemiology reports.

Disclosing tests

Only 20% of all new incidents in 2020 were disclosed by routine (annual) surveillance testing. Over 45% of all of incidents were disclosed by targeted surveillance of herds located within a 3km radius of a herd with an OTF-W incident (radial testing).

Only 9% of all new incidents in 2020 were disclosed by slaughterhouse surveillance (routine post-mortem meat inspection).

Reactor numbers

In total, 421 cattle were compulsorily slaughtered for TB control reasons in 2020, 91 fewer animals than in 2019 despite the incidence increase. This equated to 6.6 reactors detected per incident in 2020 in comparison with 10.2 in the previous year.

In 2020, the skin test accounted for 242 skin reactors (205 in 2019) and the supplementary interferon gamma (IFN-γ) blood test detected 179 additional positive animals (308 in 2019).

Risks to the reporting area

The risk from the adjacent Edge Area counties remains the same as in the previous year.

The two main risks to Leicestershire are movement of cattle from other Edge Area and High Risk Area (HRA) counties, and encroachment of endemic infection in wildlife reservoirs from the neighbouring counties of Warwickshire and Northamptonshire.

Risks posed by the reporting area

This remains the same as previous reporting year. The cluster of OTF-W TB incidents sharing genotype 25:a in north-east Leicestershire near the boundaries with south Nottinghamshire and west Lincolnshire are associated with wildlife infection and pose a significant risk to the adjoining Low Risk Area (LRA). These incidents occurred in the area known as Hotspot 23 (HS23).

Forward look

The measures needed to address the most common risk pathways for TB infection in Leicestershire are:

- Prevention of interactions of cattle and badgers on farm to minimise spread of TB from wildlife to cattle and cattle to wildlife.
- Incentivising the uptake of effective biosecurity measures by farmers by reducing the purchase of high risk animals
- Improving diagnostics, surveillance, and epidemiology to detect and remove TB more effectively from cattle.

Introduction

This report describes the level of bovine tuberculosis in cattle herds in Leicestershire in 2020. Bovine tuberculosis is caused by the organism *Mycobacterium bovis* (*M. bovis*) and will subsequently be referred to as TB.

This report explores the frequency and geographical distribution of TB in cattle herds. It examines what is likely to be driving TB in this area, and the risks the disease in this county may pose to neighbouring cattle.

Although other sources may refer to TB 'breakdown(s)', this report will use the term 'incident(s)' throughout. This report is intended for individuals involved in the control of TB, both in the local area and nationally. This includes, but is not limited to farmers, veterinarians, policy makers and the scientific community.

In 2014 the Government published its Strategy to achieve Officially TB Free (OTF) status for England by 2038. A key action was to recognise the different levels of TB in different parts of the country and to vary the approach to control accordingly. To this end three management areas were established (refer to Appendix 1).

Leicestershire forms part of the Edge Area. Control efforts are seeking to slow down and reverse geographic spread, and to reduce the incidence rate. The aim is to obtain OTF status for the Edge Area as soon as possible.

Changes to the Edge Area

On 1 January 2018 the Edge Area boundary was expanded westwards to absorb the former High-Risk Area (HRA) parts of the five previously split counties. Cheshire, Derbyshire, Warwickshire, Oxfordshire, and East Sussex all moved fully into the Edge Area.

Furthermore, the routine TB testing frequency of herds in the counties in the west of the Edge Area adjoining the HRA (or parts thereof) was increased from annual to six-monthly. The respective descriptive TB epidemiology reports for those five counties of the Edge Area will focus on the whole county and key differences between the old and new parts will be highlighted where relevant.

Changes due to COVID-19

During 2020, public health measures adopted by the government to contain the COVID-19 pandemic impacted the ability to carry out some TB testing due to social distancing and self-isolation guidelines, affecting both veterinarians and farmers.

In particular, from 23 March 2020, routine or targeted TB skin tests were not mandatory for cattle under 180 days old where, in the official veterinarian's judgement, the young stock could not be tested safely in line with social distancing guidelines. The temporary amendment allowing calves under 180 days old to be excluded from TB testing did not apply to short

interval tests in TB incident herds (required to restore a herds OTF status) or pre- and post-movement testing.

Routine TB skin tests are required within a pre-defined window of time to maintain a herds OTF status. From 23 March 2020, for tests that were allocated until 30 June 2020, the Animal and Plant Health Agency (APHA) permitted an extension to the TB skin testing windows on a case by case basis, where testing had not been completed due to valid reasons associated with COVID-19. The testing window for short interval tests was also extended by up to 30 days, where tests were unable to be completed due to COVID-19.

Furthermore, on-farm epidemiological assessments carried out to establish the route of infection for a TB incident herd were carried out remotely, by telephone, for the majority of 2020.

Cattle industry

Herd types

A total of 855 herds were registered in Leicestershire in 2020, 31 fewer than in the previous year (Appendix 2 Table A2.1). The total number of cattle in Leicestershire in 2020 was 109,752 a reduction of over 7,253 on 2019.

Small herds of up to 50 cattle predominate (45%), the majority being beef cattle (Figure 1 and Appendix 2 Table A2.2). In Leicestershire small beef herds tend to be family-run businesses that practise traditional husbandry based on winter housing and summer grazing.

A small proportion of herds (6%) number over 500 cattle, the majority of which are dairy units.

In Leicestershire there continues to be a predominance of beef cattle (62%) with dairy cattle representing 34% of cattle in the county (Appendix 2). Other cattle (4%) are either dual purpose or unknown. These figures have not changed since the previous reporting year.

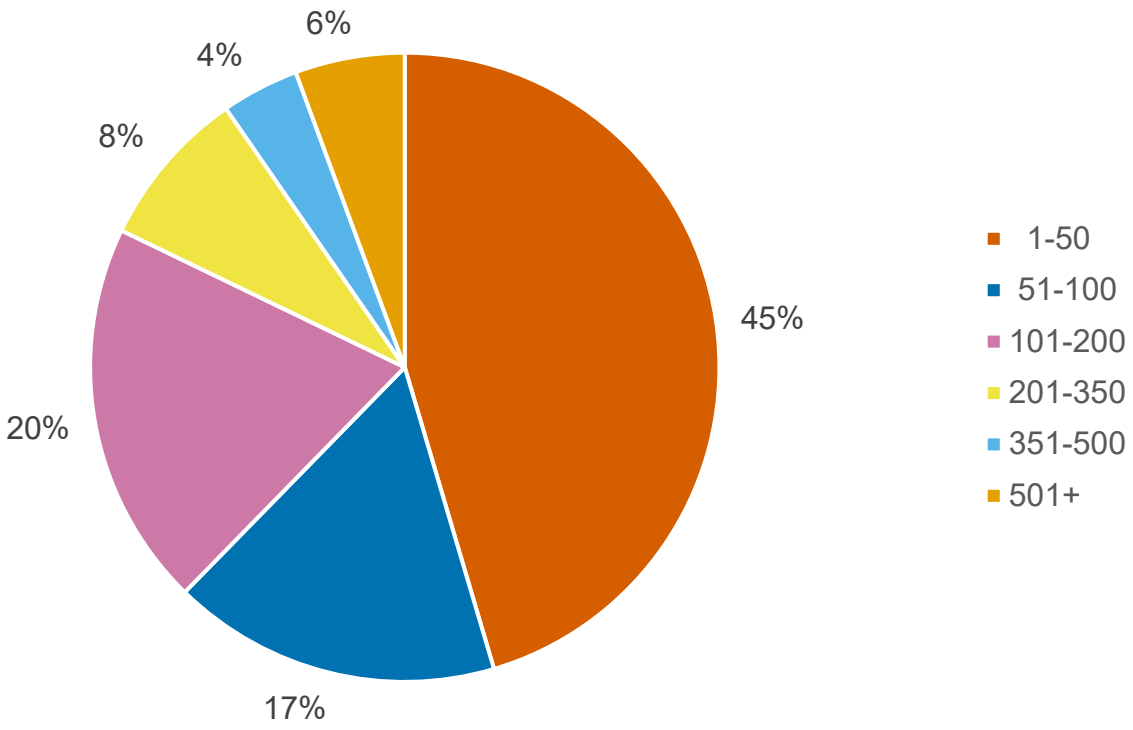


Figure 1: Proportion of cattle holdings in Leicestershire, by herd size in 2020 (n=852). Note herds with an undetermined size are not shown.

Markets and abattoirs

There is one livestock auction market in Leicestershire for cattle: Melton Mowbray Market. This market operates a pre-movement testing exempt market and in 2018 was also approved by APHA to hold dedicated sales for TB restricted cattle, commonly known as 'orange markets'. Several dedicated sales have taken place this reporting year.

No livestock shows were held in 2020 due to COVID-19 restrictions.

Approved Finishing Units

Two new Approved Finishing Units (AFU) were licensed in this reporting year, resulting in a total of 12 AFUs operational in the county. The cattle on these premises are permanently under movement restrictions, housed under strict biosecure conditions, exempt from TB testing, and are moved off directly to slaughter when finished.

These units do not have grazing and if correctly operated are not considered a risk for introduction or spread of TB into the surrounding areas.

Common land

There are some small areas of common land in Leicestershire, with low numbers of cattle grazed and no significant co-grazing by more than one herd. Spread of TB related to cattle usage of common land is unlikely in this area.

Descriptive epidemiology of TB

Temporal TB trends

Three analytical measures are used to describe the level of TB infection in these reports.

1. The number of new herd incidents that were disclosed in each year (Figure 2).
2. The annual herd incidence rate, reported as the number of new incidents per 100 herd-years at risk (100 HYR) (Figure 3). This is the number of new TB incidents detected in the year, divided by the time those herds were at risk of contracting TB. The 100 HYR incidence rate is used in this report as it accounts for different intervals between herd tests that other incidence measures do not (such as new TB incidents per number of herds or tests).
3. The annual end of year herd prevalence (Figure 4). This is the number of herds under restriction due to a TB incident, divided by the number of active herds at the same point in time. Prevalence provides a snapshot of the burden of TB on the local cattle industry.

All three measures include Officially Tuberculosis Free Status Withdrawn (OTF-W) incidents, and Officially Tuberculosis Free Status Suspended (OTF-S) incidents.

OTF-W incidents are those in which at least one animal was identified with typical lesions of TB at post-mortem (PM) inspection, and/or positive for *M. bovis* on culture from tissue samples.

OTF-S incidents are those with one or more reactors to the Single Intradermal Comparative Cervical Tuberculin (SICCT) skin test, but without full confirmation of *M. bovis* infection by PM inspection or bacterial culture.

TB incidents in non-grazing AFUs are not included in the prevalence and incidence calculations (excluding Figure 5) in this report due to the limited epidemiological impact of these cases.

Furthermore, herds restricted because of an overdue test rather than a TB incident are also excluded from calculations. Hence measures of incidence and prevalence in this report may be lower than those reported in the official TB statistics.

The number of individual cattle tests decreased by more than 20,000 in 2020 (from 189,217 cattle tested in 2019 to 168,740 in 2020) as shown in Appendix 3. Despite this, there was a big increase in the number of new TB incidents in 2020 (64) compared to 2019 (50).

There has been a sharp increase in OTF-W incidents from 22 in 2019 to 32 in 2020. The number of OTF-S incidents has also increase from 28 incidents in 2019 to 32 in 2020 (Figure 2).

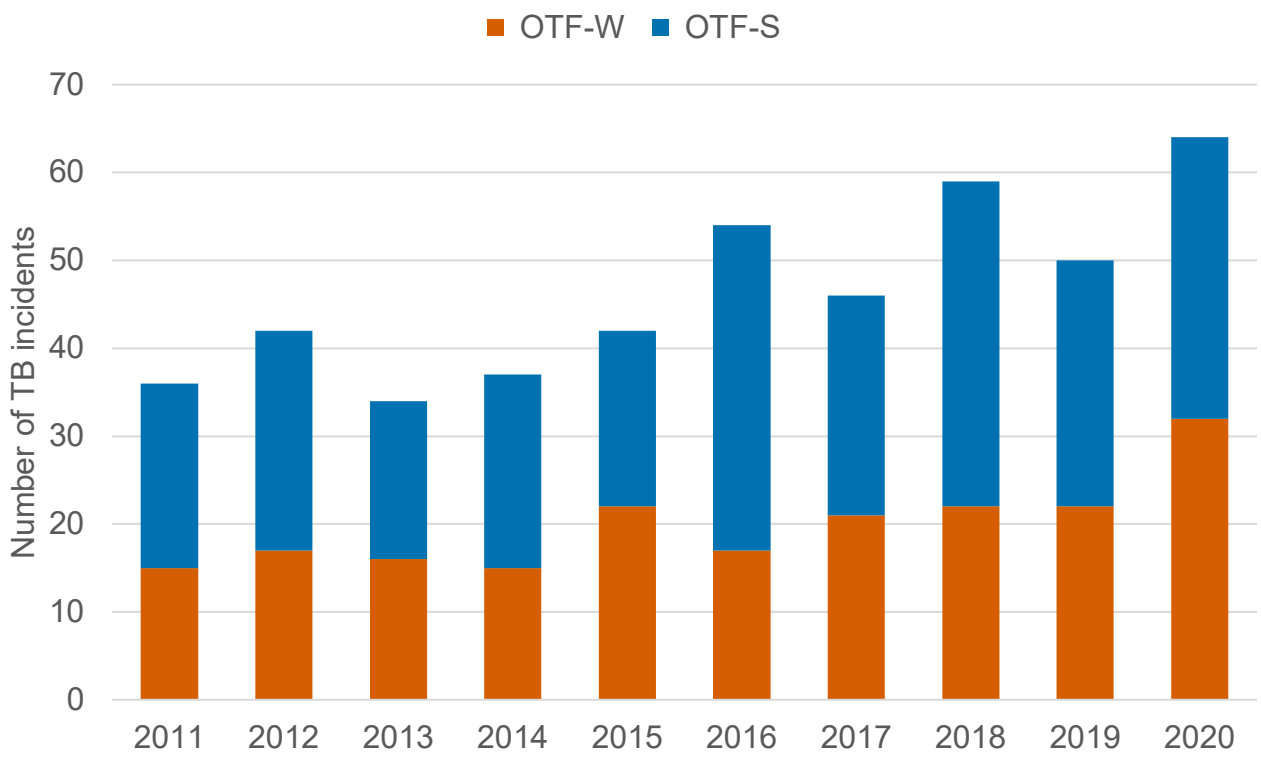


Figure 2: Annual number of new TB incidents in Leicestershire, from 2011 to 2020.

The annual herd incidence rate since 2011 has increased from 3.6 incidents per 100 herd-years at risk in 2011, to 7.7 in 2020 (Figure 3). The biggest single inter-year increase in incidence was in 2020, with an increase of 1.7 from 2019, despite the reduction in the number of tests carried out in 2020.

The annual end of year herd prevalence in Leicestershire increased to 4.0% 2020 from 2.5% in 2019 (Figure 4). This is the biggest increase in prevalence in Leicestershire since 2011, attributed to the higher number of incidents disclosed (50 in 2019 to 64 in 2020).

There has been an increase of OTF-W incidents resulting in longer TB incidents as more testing is required to restore a herd's OTF status.

The increase in prevalence has also been affected by COVID-19 restrictions where there was occasionally a delay to testing during incidents, resulting in prolonged periods for TB incidents.

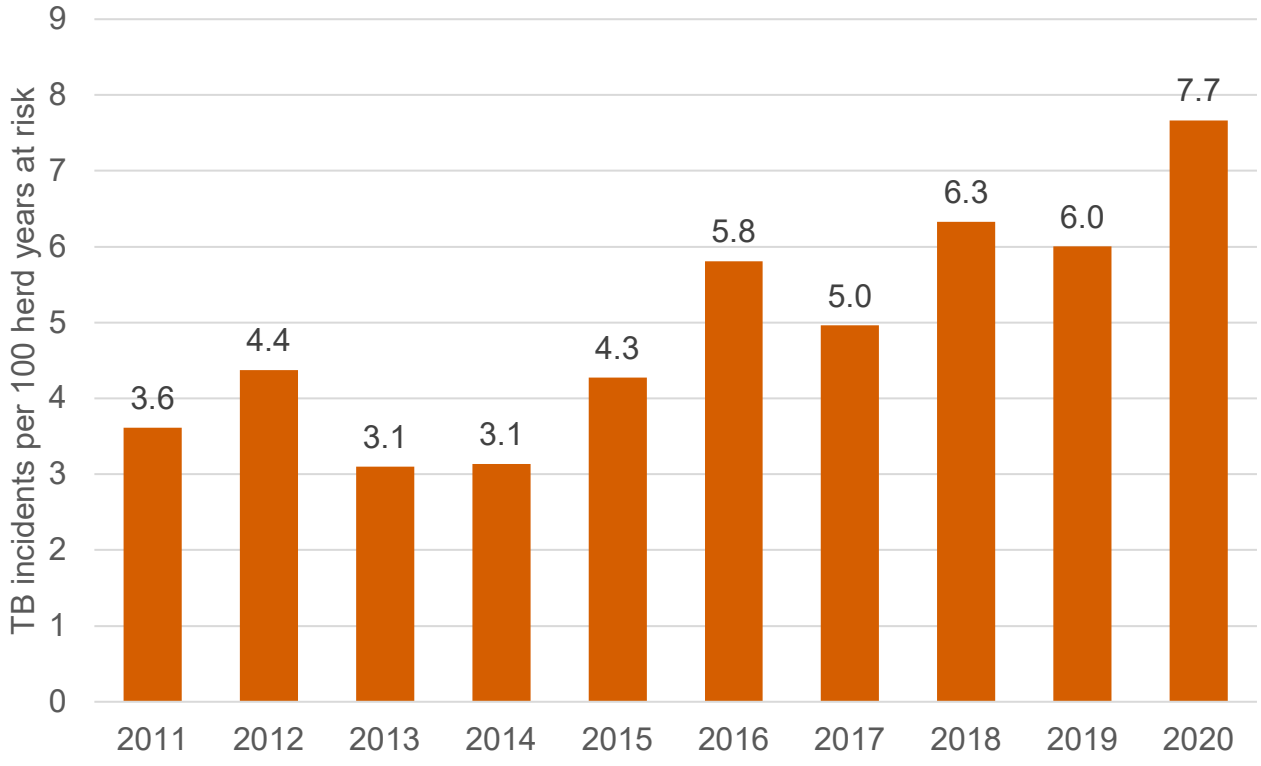


Figure 3: Annual incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in Leicestershire, from 2011 to 2020.

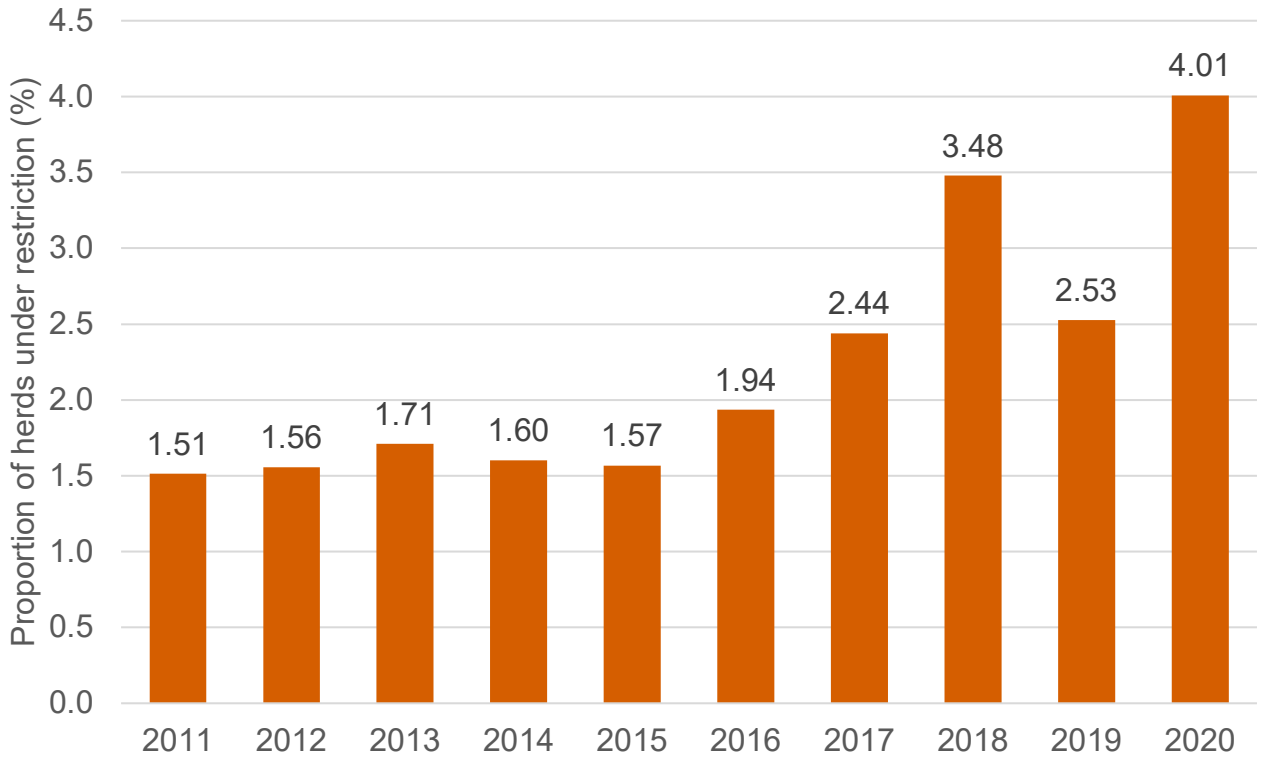


Figure 4: Annual end of year prevalence in Leicestershire, from 2011 to 2020.

Geographical distribution of TB incidents

Leicestershire had the fifth lowest herd incidence rate (7.7 incidents per 100 herd-years at risk) of TB when compared to all Edge Area and HRA counties in 2020 (Figure 5). Despite the rising incidence in recent years, the county incidence rate is still lower than the overall average incidence rate in the whole Edge Area in 2020 (10.1).

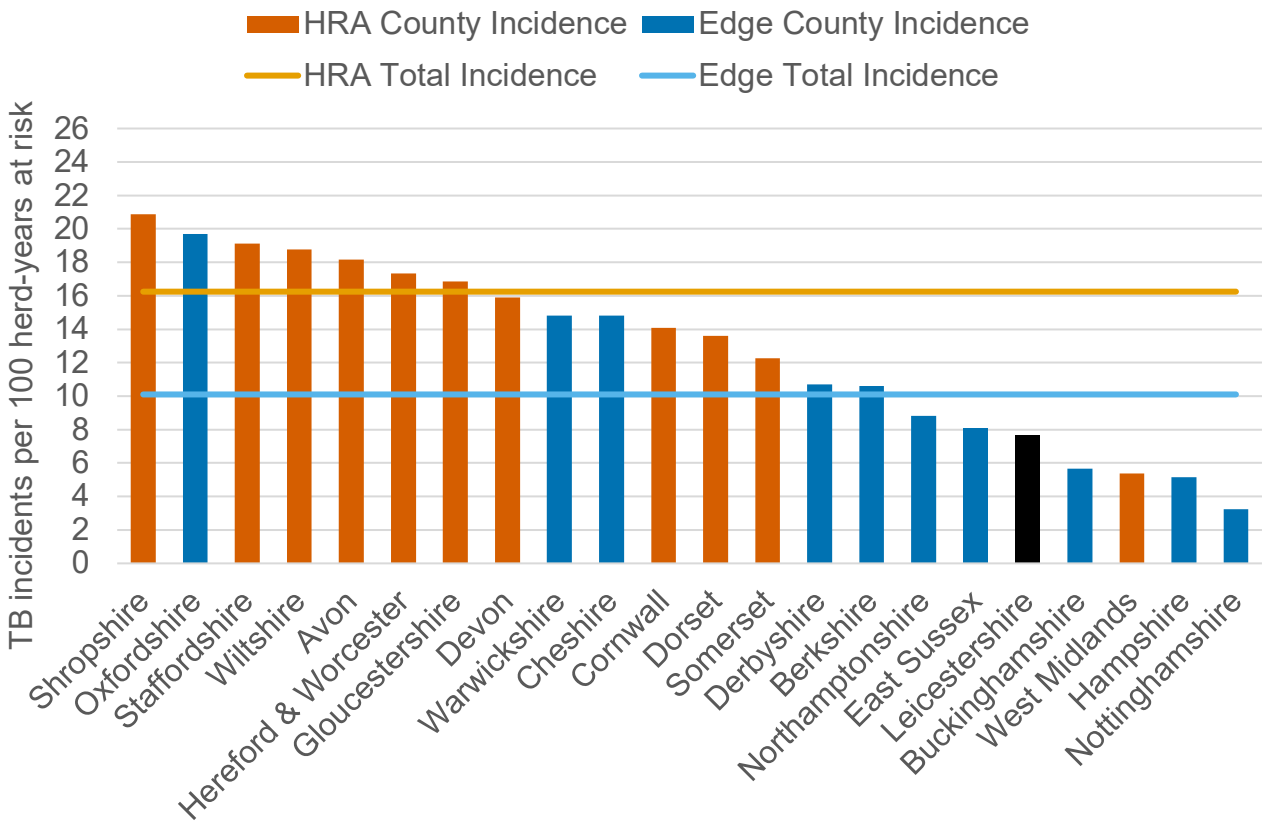


Figure 5: Incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S including finishing units) in 2020, by HRA and Edge Area county, highlighting the county of Leicestershire.

The geographical distribution of herds with new TB incidents in 2020 generally mirrors the density of cattle holdings in Leicestershire and is similar to the distribution in 2019 as shown in Figure 6a.

The majority of OTF-S incidents continued to be disclosed in south-west Leicestershire (Figure 6a). OTF-W incidents have a similar distribution to 2019, predominating in north-east Leicestershire near Melton Mowbray.

This area is covered by Hotspot 23 (HS23), a confirmed TB hotspot which includes parts of Lincolnshire, Leicestershire, and Nottinghamshire.

This cluster of OTF-W was first recorded in 2015 in a parish in the north-east of Leicestershire. All incidents in this area were most likely associated with wildlife infection.

Since 2015, the area where genotype 25:a TB incidents associated with wildlife are detected has increased, moving north-east towards the boundary with Lincolnshire. In 2020 17 incidents of genotype 25:a were isolated in Leicestershire. This was a sharp increase from ten in 2019, with the vast majority situated in the north-east of the county, where TB is now endemic.

TB Hotspot 23 (genotype 25:a, WGS clade B3-11) was identified in a contiguous area of west Lincolnshire and north-east Leicestershire in 2018.

Cattle and susceptible non-bovine farmed species (deer, goats and camelids) have been subject to enhanced TB surveillance and control measures since then. Wildlife have been monitored for TB by laboratory analysis of any deer and badger carcases found dead in the area and reported to APHA.

Following the identification of *M. bovis* infection in badger carcases, the original hotspot boundary was reviewed in June 2020 and its area was extended further into Leicestershire and Lincolnshire and included part of south-east Nottinghamshire (Figure 6a). The extended hotspot became effective from September 2020 and the licensed control of badgers in Leicestershire and Lincolnshire started.

During 2020, 29 badgers and five deer were reported to APHA as part of TB surveillance in found-dead wildlife in HS23. Of these, 18 badgers and one deer were suitable for collection by APHA staff.

Two of the badgers collected were not suitable for post-mortem examination, resulting in 16 badgers and one deer being examined. Of these, five badgers had visible lesions consistent with TB. Bacteriological culture of the lesions was undertaken with one sample being confirmed as culture positive for *M. bovis.*

Further information can be found at the following location which covers a slightly longer time period: An update on wildlife TB surveillance in Low Risk Area Hotspots.

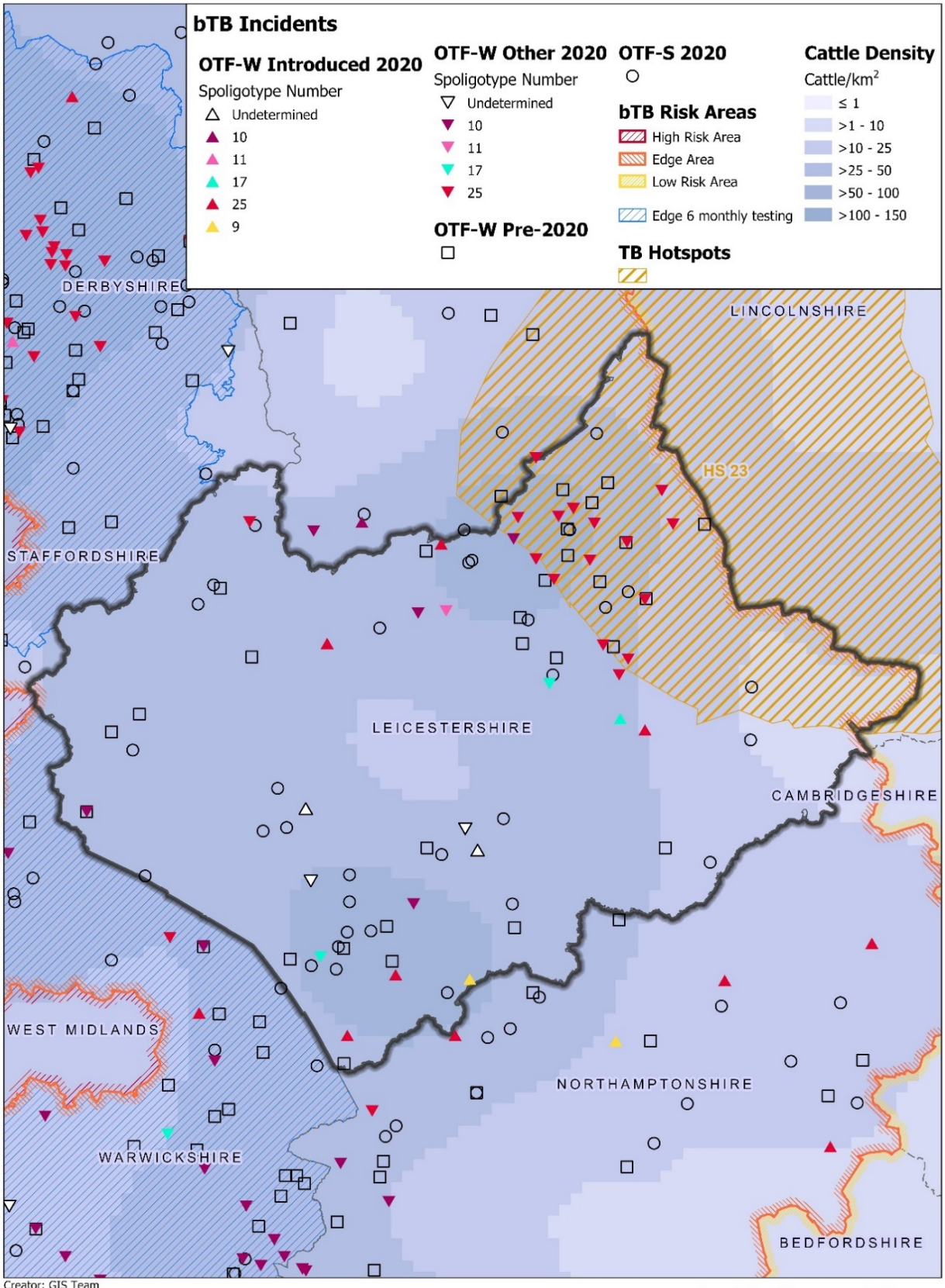
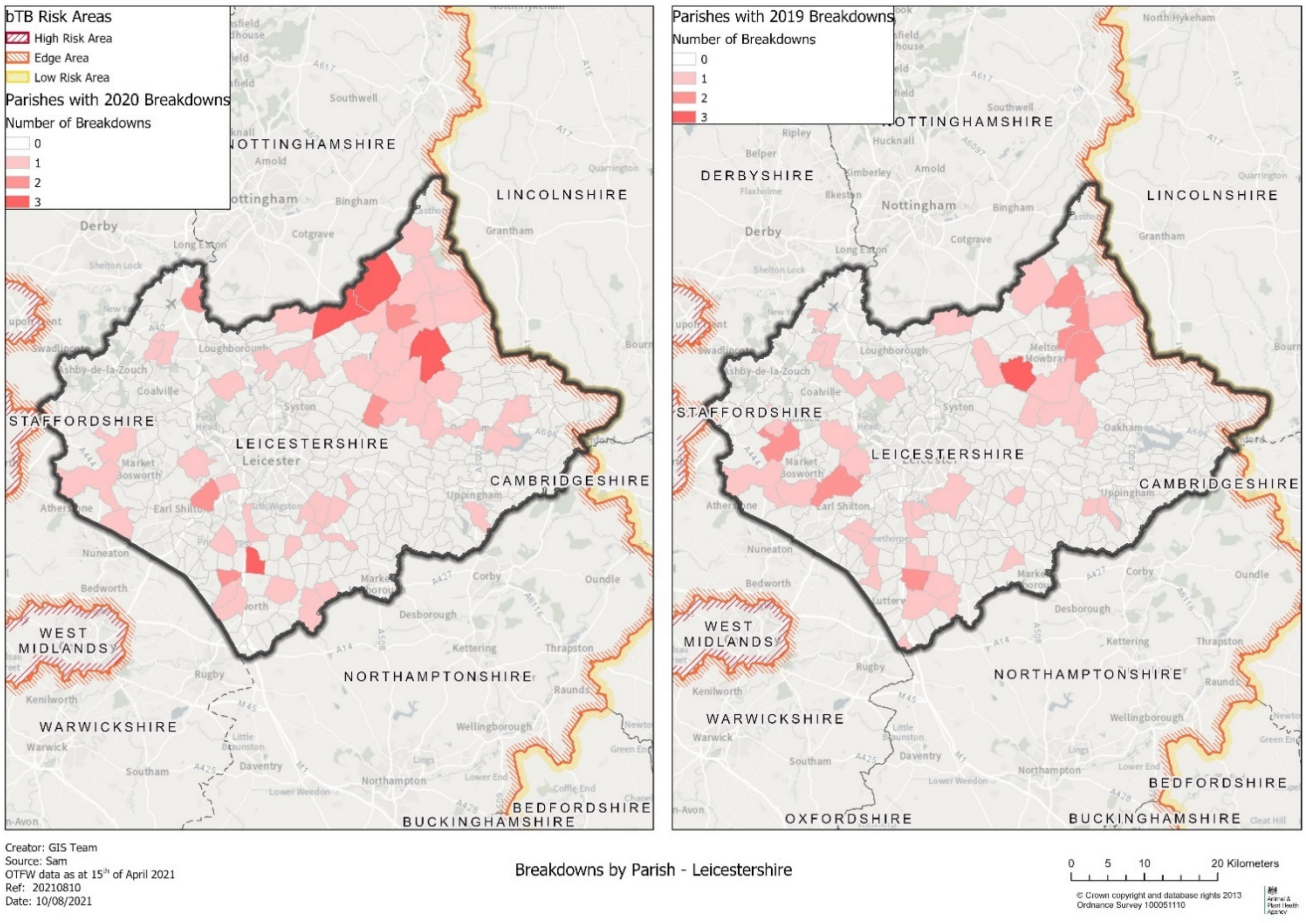
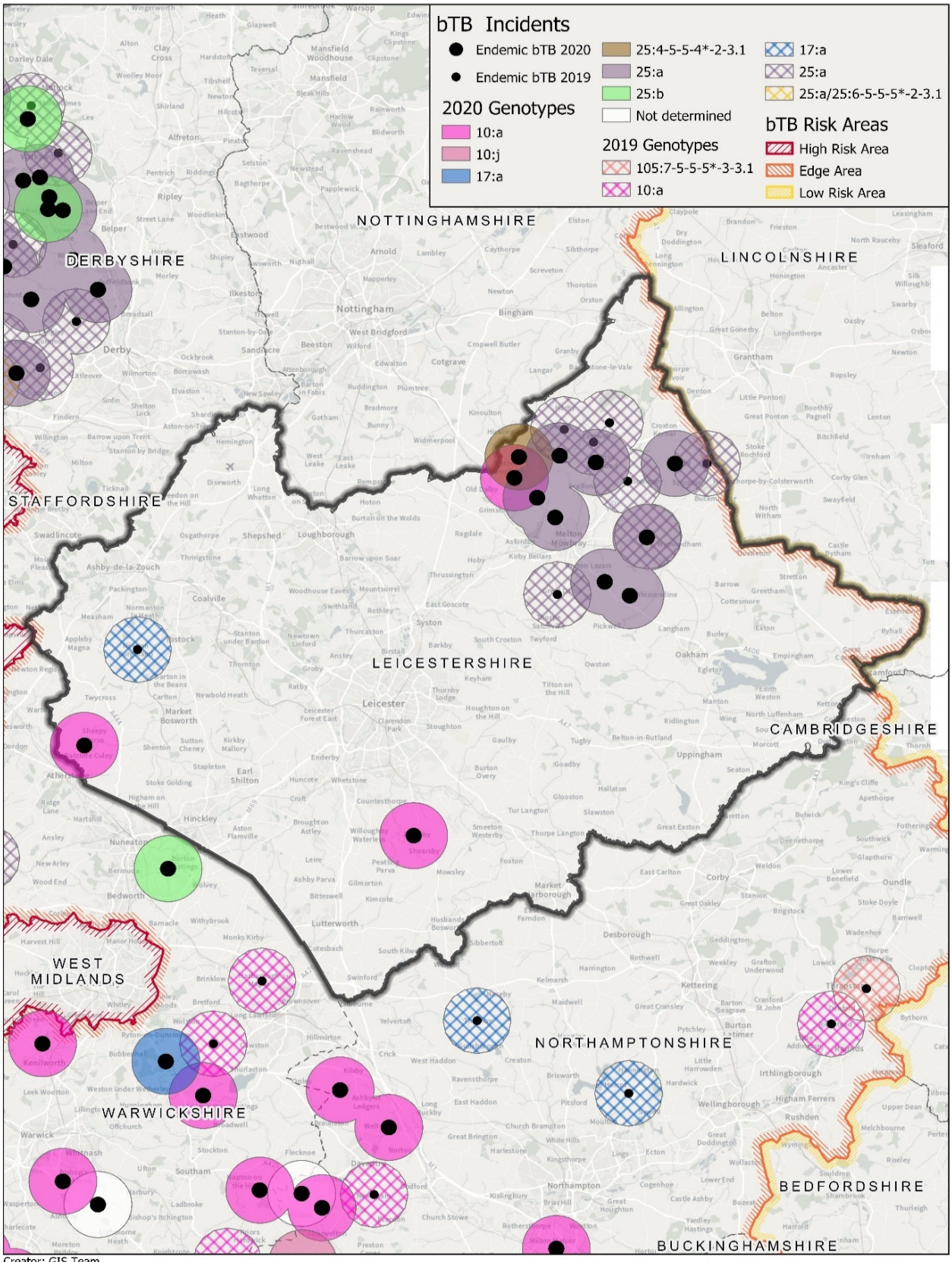

bTB Incidents
OTF-W Introduced 2020
Spoligotype Number
Undetermined
10
11
17
25
9
OTF-W Other 2020
Spoligotype Number
Undetermined
10
11
17
25
OTF-W Pre-2020
OTF-S 2020
bTB Risk Areas
High Risk Area
Edge Area
Low Risk Area
Edge 6 monthly testing
TB Hotspots
Cattle Density
Cattle/km²
≤ 1
>1 - 10
>10 - 25
>25 - 50
>50 - 100
>100 - 150
DERBYSHIRE
LINCOLNSHIRE
HS 23
STAFFORDSHIRE
LEICESTERSHIRE
CAMBRIDGESHIRE
WEST MIDLANDS
NORTHAMPTONSHIRE
WARWICKSHIRE
BEDFORDSHIRE
Creator: GIS Team
Source: Sam
OTFW data as at 15th of April 2021
Ref: 20210701
Date: 01/07/2021
TB Cattle Density - Leicestershire
0 3.75 7.5 15 Kilometers
© Crown copyright and database rights 2013
Ordnance Survey 100051110
Animal & Plant Health Agency

Figure 6b represents the distribution of TB incidents (OTF-S and OTF-W) in 2019 and in 2020. The distribution of TB incidents is similar in both years, with a sharp increase in the number of incidents in the north-east of Leicestershire in 2020.



In 2019, seven OTF-W incidents in north-east Leicestershire were detected where wildlife was attributed with a 75% certainty or above and this increased to ten OTF-W incidents in 2020. This is an indication of expanding endemicity within the local wildlife populations.

Additional genotype 25:a OTF-W incidents are located in Lincolnshire in HS23 but are not shown in Figure 7 as this does not show incidents in the LRA.



Creator: GIS Team
Source: Sam
OTFW data as at 15th of April 2021
Ref: 20210614
Date: 14/06/2021

Endemicity - Leicestershire

0 3.75 7.5 15 Kilometers

Other characteristics of TB incidents

Incidents by herd type

The number of TB incidents disclosed in 2020 in Leicestershire is shown in Figure 8, described by cattle herd size and type of production. These figures are similar the previous reporting year (2019).

- Beef suckler: 28% (18) of all TB incidents, of which 66% were OTF-W
- Beef fattener: 28% (18) of all TB incidents, of which 55% were OTF-W
- Dairy sector: 42% (27) of all TB incidents, of which 37% were OTF-W

As in previous years, the occurrence of TB incidents was more frequent in medium herds (101-200 cattle), with 18 incidents of the total of 64, this represents 28% of all TB incidents in 2020. This herd size represents only 20% of cattle holdings in Leicestershire in the same period. In bigger herd sizes (501+) more than 66% of all TB incidents are OTF-W.

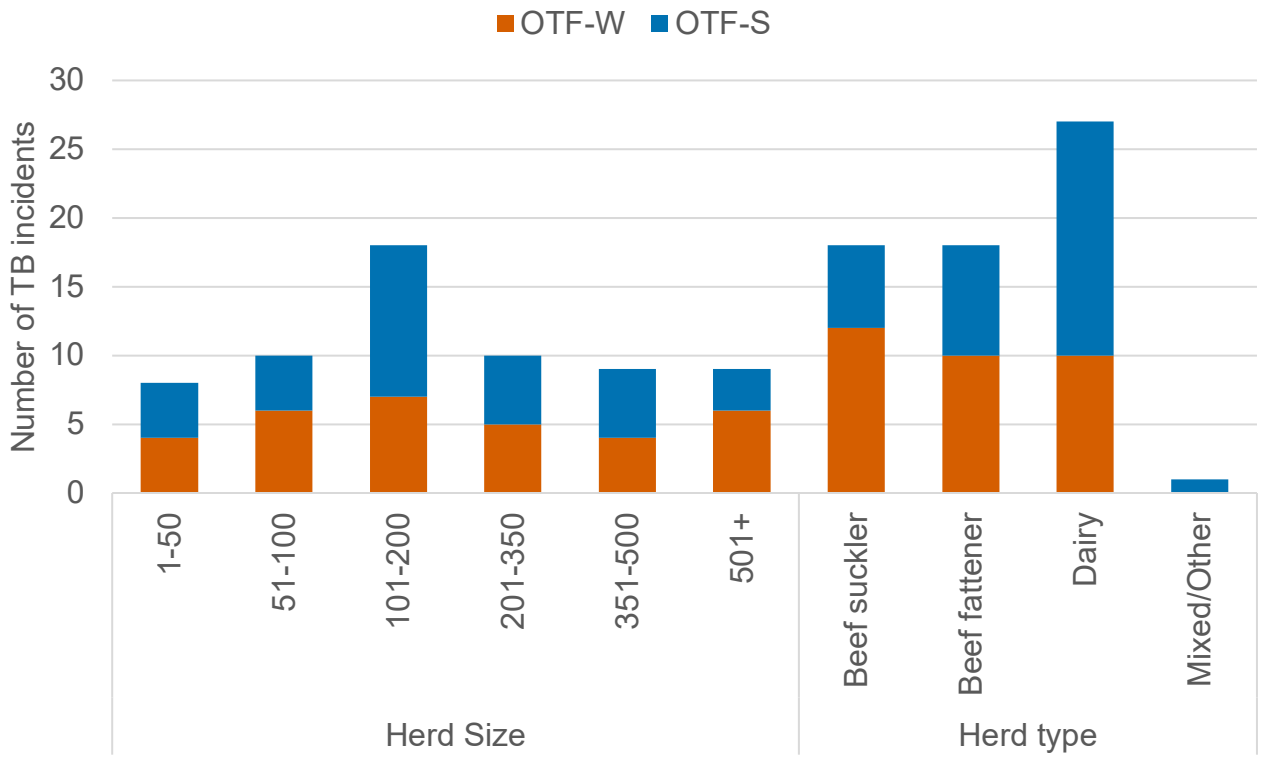


Figure 8: Number of TB incidents (OTF-W and OTF-S) in Leicestershire in 2020, by cattle herd size and type.

Incidents by month of disclosure

In 2020 there were two peaks of incidents disclosed (Figure 9), which has a similar distribution as the previous reporting year. The first one was in early summer, partially due to radial testing disclosing most OTF-S incidents for that period. The second peak was in the autumn, due to a second round of radial testing.

These findings highlight the value of enhanced surveillance testing around OTF-W incidents in detecting lateral spread of infection.

In previous reporting years there has been a more distinct peak in the winter housing period. The introduction of radial testing in 2018 has contributed to a more even distribution of incidents disclosed throughout this reporting year.

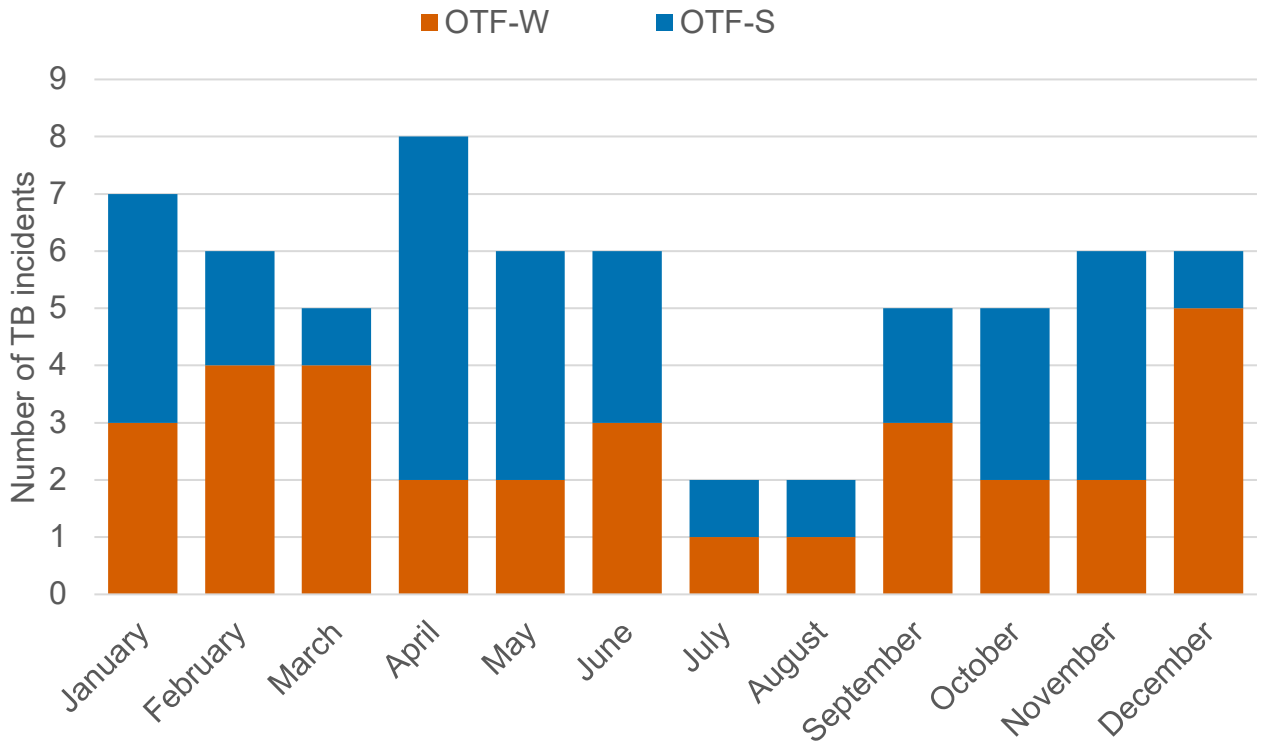


Figure 9: Number of TB incidents (OTF-W and OTF-S) in Leicestershire in 2020, by month of disclosure.

Figure 10 shows the number of surveillance tests undertaken in OTF herds in Leicestershire in 2020, by month.

The distribution of surveillance tests throughout the year correlates with Figure 9 therefore the distribution of incidents by month could be due to a greater number of tests being completed during those months due to radial testing.

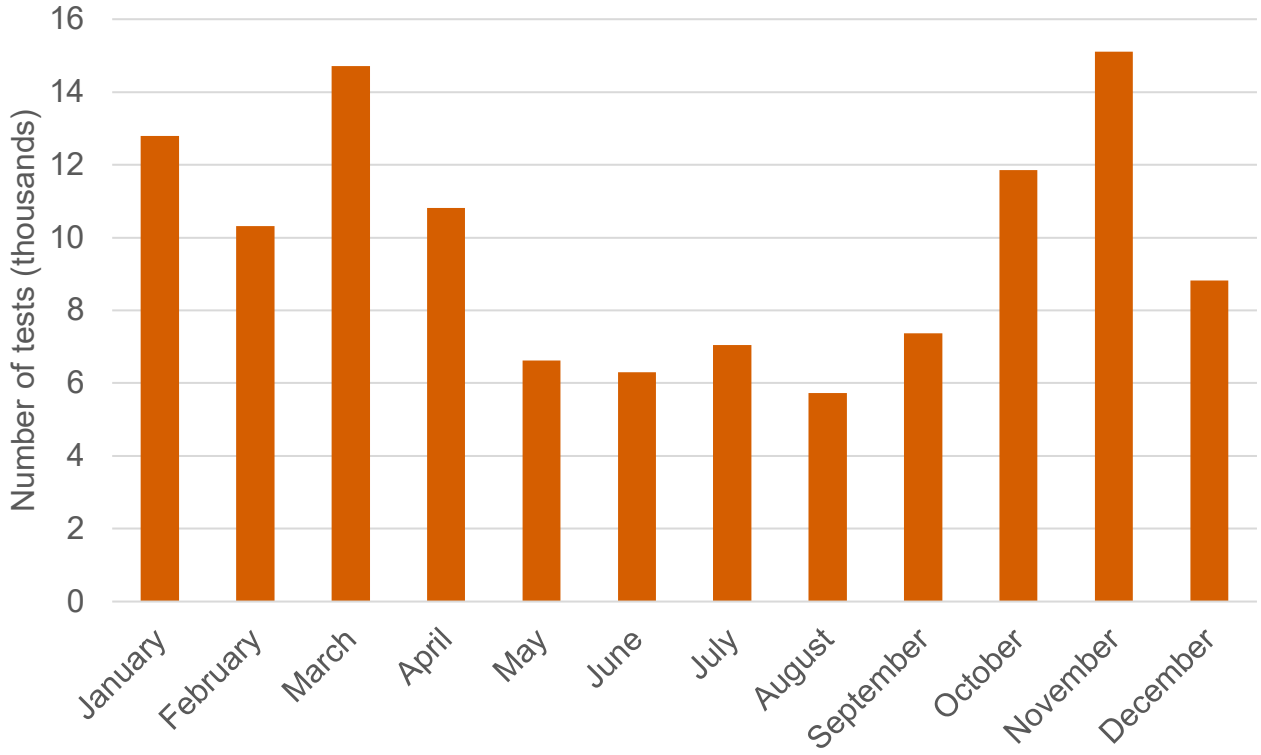


Figure 10: Number of tests undertaken in OTF herds in Leicestershire in 2020, by month.

Duration of incidents

The majority of all TB incidents which ended in 2020 lasted from 151 to 240 days (Figure 12), which accounts for incident herds undergoing at least two short interval tests a minimum of 60 days apart and time elapsing for removal of reactors.

As expected OTF-W incidents tend to last longer than OTF-S incidents, with a median duration of OTF-W incidents of 230 days, compared with 173 days for OTF-S incidents. There was one persistent OTF-W incident (duration exceeding 551 days) that closed during the reporting period.

The number of incidents lasting between 241 to 550 days are mostly OTF-W, making up 75% of all incidents.

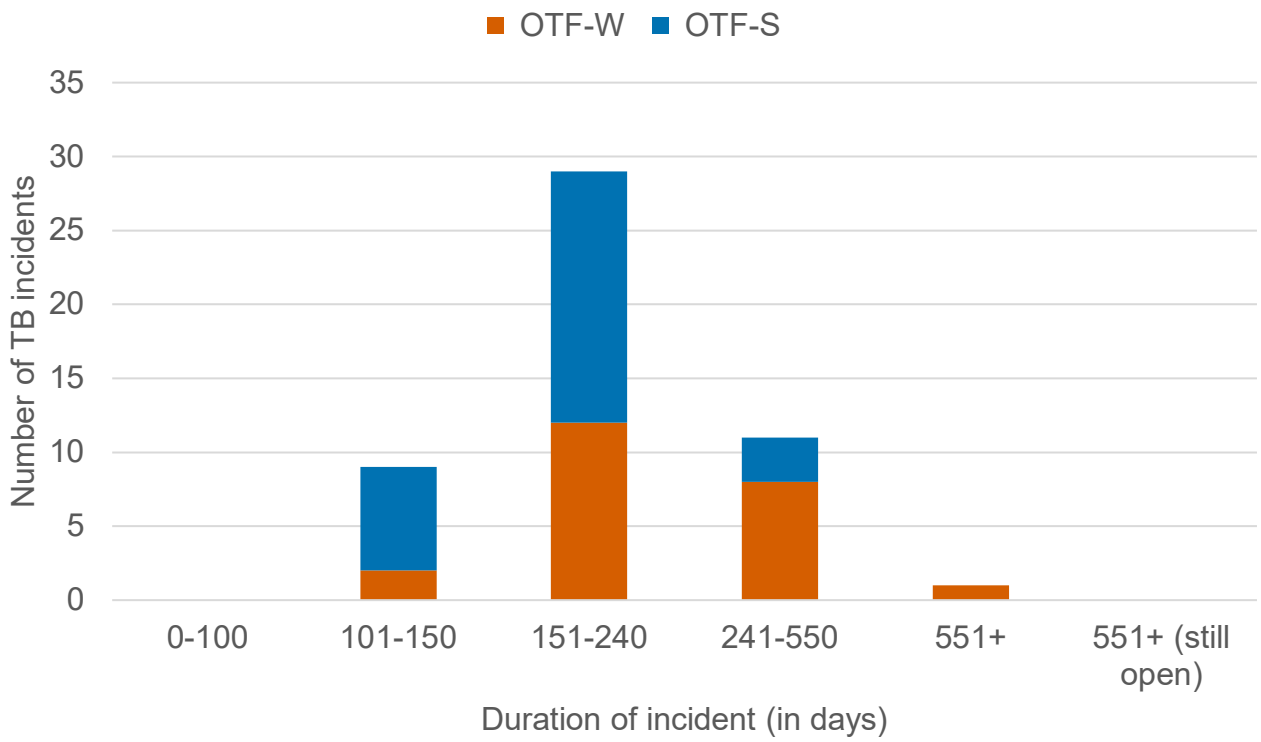


Figure 11: Duration of all TB incidents (OTF-W and OTF-S) that ended in 2020, and the number of persistent TB incidents (551+ days) that were unresolved at the end of 2020 in Leicestershire. Note that Approved Finishing Units (AFUs) have been excluded.

Genotypes associated with TB incidents

Genotyping of *M. bovis* isolates has been used to trace the origin of TB infection. It is particularly useful in identifying where spread has occurred through cattle movements. Stable genotype clusters tend to be found in areas where there is a persistent local reservoir of infection.

APHA implemented whole genome sequencing (WGS) in place of genotyping from April 2021. During 2020 however, genotyping was still performed on *M. bovis* samples isolated from all OTF-W herds in the Edge Area.

Genotype 25:a of *M. bovis* is endemic in the neighbouring counties of Staffordshire (HRA) and Derbyshire (Edge Area). In Leicestershire, it has been identified in 17 of the 27 isolates obtained in 2020 (63% of all genotypes) as shown below in Figure 12a. Genotype 25:a has been identified in OTF-W incidents in Leicestershire in preceding years: 2017 (55%), 2018 (60%) and 2019 (50%).

The geographical distribution of genotype 25:a in Leicestershire in 2020 was similar to the distribution from 2017 to 2019, as shown in Figure 12b. The majority of incidents with genotype 25:a were disclosed in the north-east of the county, near the boundary with the LRA county of Lincolnshire. Wildlife is the most strongly suspected source of infection in the majority of OTF-W incidents in the area, where HS23 is located.

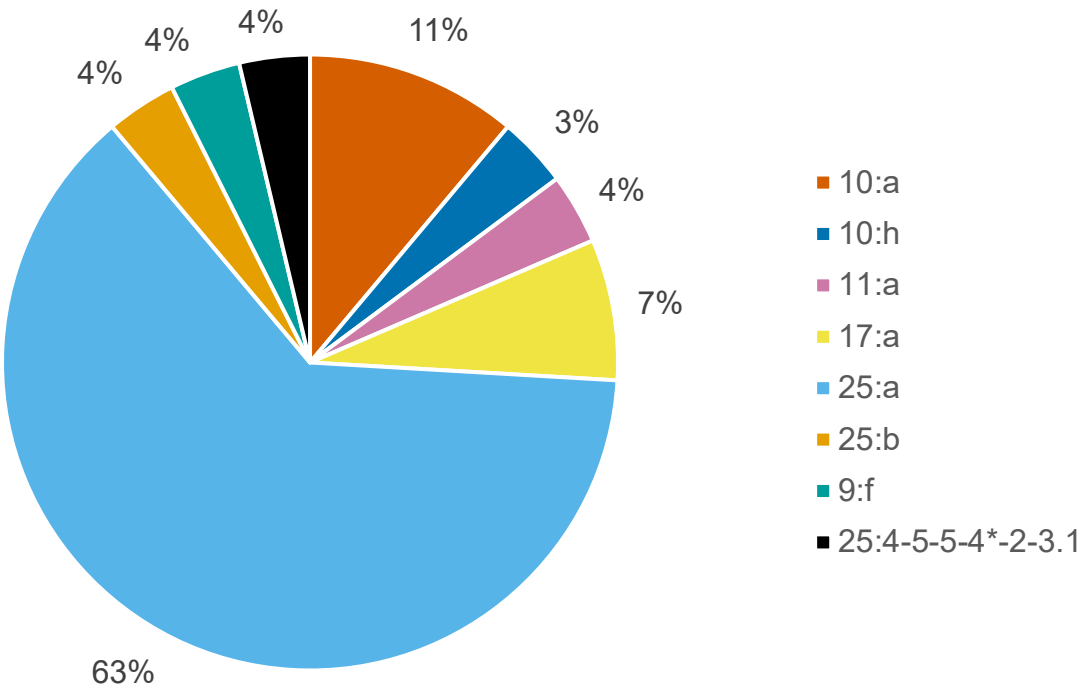
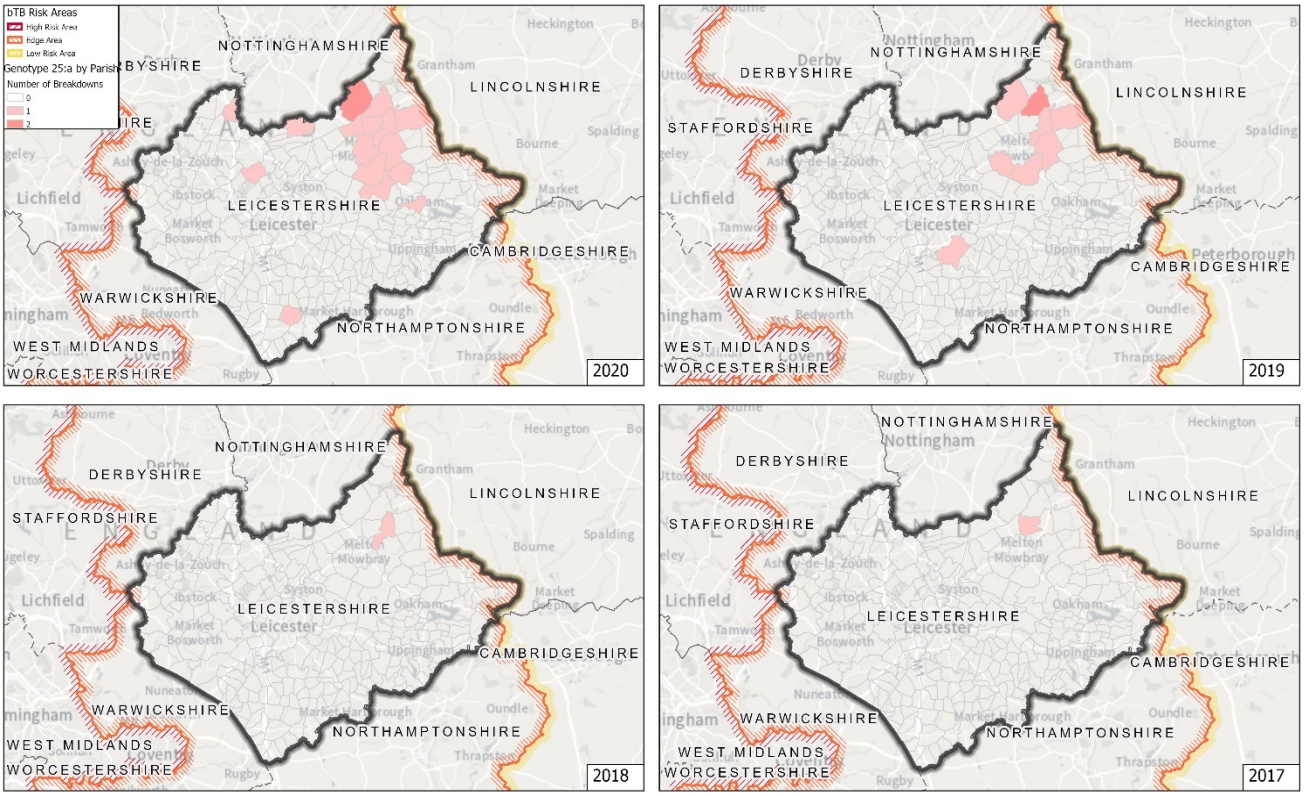


Figure 12a: Genotypes of *M. bovis* identified in herds with OTF-W incidents in Leicestershire that began in 2020 (n=27).



Creator: GIS Team
Source: Sam
OTFW data as at 15th of April 2021
Ref: 20210812
Date: 12/08/2021

25:a Breakdowns by Parish - Leicestershire

0 5 10 20 Kilometers

Unusual TB incidents

During 2020, there were two incidents in the same parish, located within HS23, with an unusually high number of reactors taken. Both incidents were OTF-W with genotype 25:a isolated, and both shared badgers as most likely source of infection.

One of the farms, a beef suckler herd, had an ongoing incident of over 12 months duration. A total of 80 skin and IFN-γ reactors were removed from the herd of 800 cattle, of those reactors, 38 had visible lesions at slaughter.

The other neighbouring farm was also a beef suckler herd with an ongoing incident starting in March 2020. A total of 53 skin and gamma reactors were removed from the herd of 500 cattle: of those reactors, six presented with visible lesions at slaughter.

Suspected sources, risk pathways and key drivers for TB infection

Key drivers of infection

The key drivers of the TB epidemic in Leicestershire during 2020 were as follows:

- Infected wildlife
- Movements of undisclosed infected cattle

Sources of infection and risk pathways

It can be challenging to retrospectively establish the route of infection for a TB incident herd. APHA aims to complete an epidemiological assessment for all TB incidents in the Edge Area (both OTF-W and OTF-S).

This includes a thorough on-farm investigation and scrutiny of routinely collected data, such as cattle movement records, and the results of molecular analyses where available. This information is captured on the Disease Report Form (DRF).

During the assessment up to three risk pathways of infection are selected for each herd. Each risk pathway is given a score that reflects the likelihood of that pathway bringing TB into the herd.

The score is recorded as either definite (score 8), most likely (score 6), likely (score 4) or possible (score 1). Risk pathway data is explored both at the herd and county level.

The mostly likely source of infection in individual TB incidents

The most likely source identified by the APHA veterinary assessment is explored spatially for individual TB incidents. The most likely source of infection for individual TB incidents discounts additional risk pathways identified with a lower level of certainty.

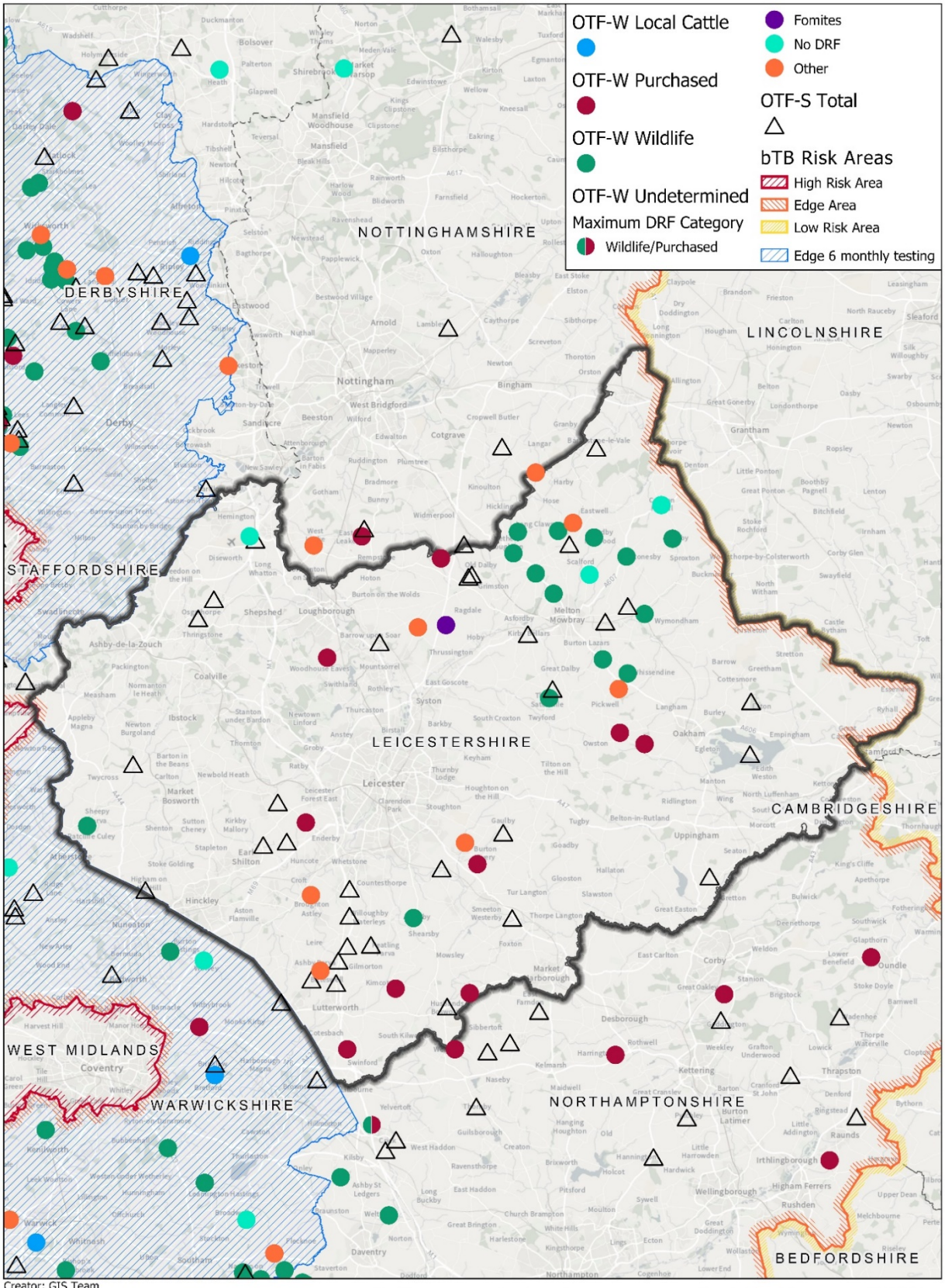
Where two sources were ranked equally as the most likely source for an incident, both sources are reported for the incident using a split symbol in the map.

There has been a reduction in the number of TB incidents associated with wildlife in Leicestershire. In 2019 wildlife infection accounted for 45% of the weighted contribution for all potential risk pathways of infection for new incidents, compared to 35% in 2020. This reduction is due in part to an improved methodology in calculations of the contribution of the different pathways.

The assessment of the source of infection is more accurate in herds with OTF-W incidents, in which *M. bovis* has been isolated from tissue samples in the laboratory and genotype data is available. Genotyping is an important tool to support the analysis of specific transmission pathways.

There has been an increase in the number of OTF-W incidents in which badger infection was considered to be most likely source of infection in the north-east of the county (Figure 13). Only one OTF-W in the south of Leicestershire was assessed to be most likely of wildlife origin.

The distribution of the OTF-W herds in 2019 and 2020 is very similar. There has been an increase in number of OTF-W incidents detected in the south of the county in 2020, although the number of OTF-S is still greater in the area. The cluster of OTF-W incidents attributed to wildlife has increased in number with further spread to the north-west of Melton Mowbray, closer to the Nottinghamshire border.



Creator: GIS Team
Source: Sam
OTFW data as at 15th of April 2021
Ref: 20210604
Date: 04/06/2021

DRF Source - Leicestershire

0 3.75 7.5 15 Kilometers

The weighted source of infection at county level

To consider the contribution of all sources of infection within an area, the source(s) for each incident are weighted by the certainty ascribed. Any combination of definite, most likely, likely, or possible sources can contribute towards the overall picture for possible routes of introduction into a herd.

If the overall score for a herd is less than six, then the score is made up to six using the 'Other/Unknown Source' option. Buffering up to six in this way helps to reflect the uncertainty in assessments where only 'likely' or 'possible' sources are identified.

The weight of infection outputs in Appendix 4 are produced by combining the data from multiple herds. This presents the overall proportion of pathways in which each source was identified, weighted by the level of certainty each source caused the introduction of TB. The outputs do not show the proportion of herds where each pathway was identified (this is skewed by the certainty calculation).

Genotyping of *M. bovis* isolates can be a powerful tool in identifying a likely source of infection, however genotypes are not determined for OTF-S herds. The inclusion of OTF-S herds in these calculations increase the uncertainty in the outputs. As a result, the relative proportions of each risk pathway are very approximate and only broad generalisations should be made from these data. A more detailed description of this methodology is provided in the Explanatory Supplement.

There has been an increase in the number of incidents in which badger infection was considered to be the most likely source in north-east Leicestershire, as previously mentioned. Some areas in this part of Leicestershire are now considered endemic with genotype 25:a, including HS23, where infection has been confirmed in the local wildlife population (see TB surveillance in wildlife – Low Risk Area hotspots for more details).

The weighted source of infection associated with wildlife was higher in OTF-W incidents (45%) in comparison with OTF-S incidents (23%). In OTF-S incidents there was more uncertainty in the risk pathways, with 30% of all incidents attributed to unknown pathways, in comparison with 16% in all OTF-W. This is due to genotyping, which can help to ascertain the likely origin of disease, only being available for OTF-W incidents.

Veterinary investigations deemed badgers to be the main wildlife source for TB infection in cattle in Leicestershire in 2020, whilst deer were considered to play a minor role in transmitting infection (0.9%).

There is limited data available from wildlife surveillance. This must be considered when assessing risk pathways for infection in TB incidents. Where wildlife is assessed as a possible source of infection and cannot be ruled out, the potential involvement is associated with uncertainty.

Cattle movements accounted for 30% of the weighted contribution of all risk pathways in 2020, with no changes from the previous year. This is the second most important driver of the TB epidemic in Leicestershire. Bringing animals into a herd will always carry a risk of

introducing disease. Although, restocking is important for the cattle industry as part of their business model, as well as the need to restock after the incident has concluded.

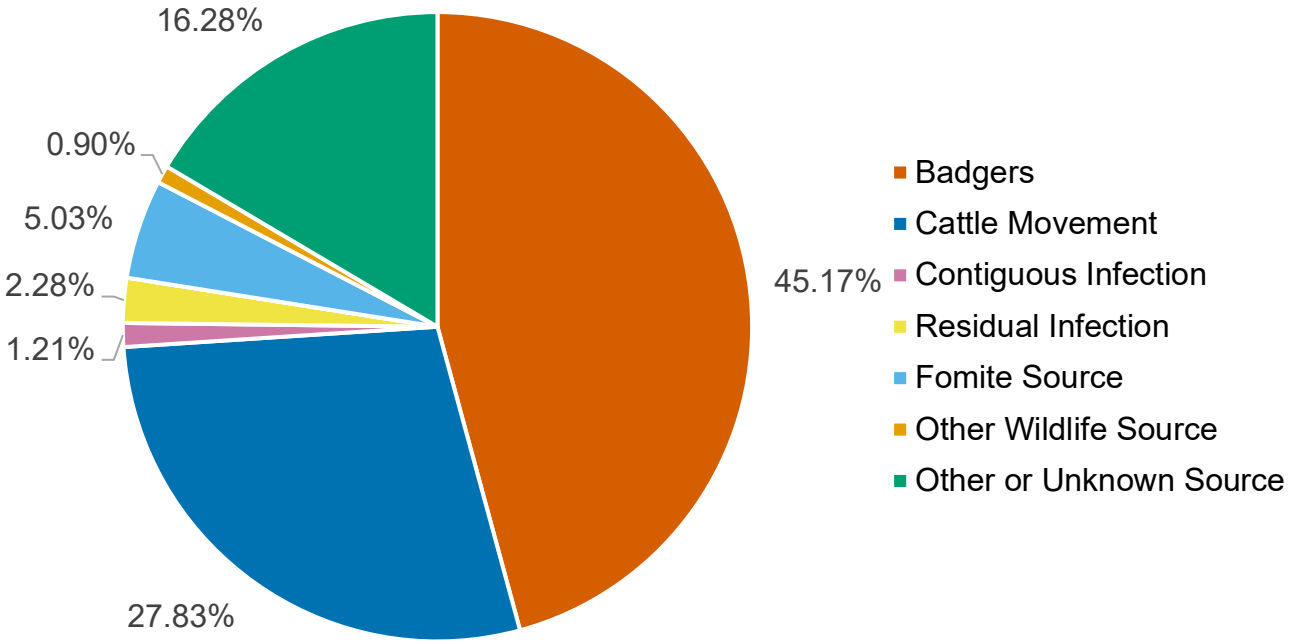


Figure 14a: Summary of the weighted source of infection pathways attributed for OTF-W TB incidents that started in 2020 in Leicestershire, that had a completed DRF (n=29).

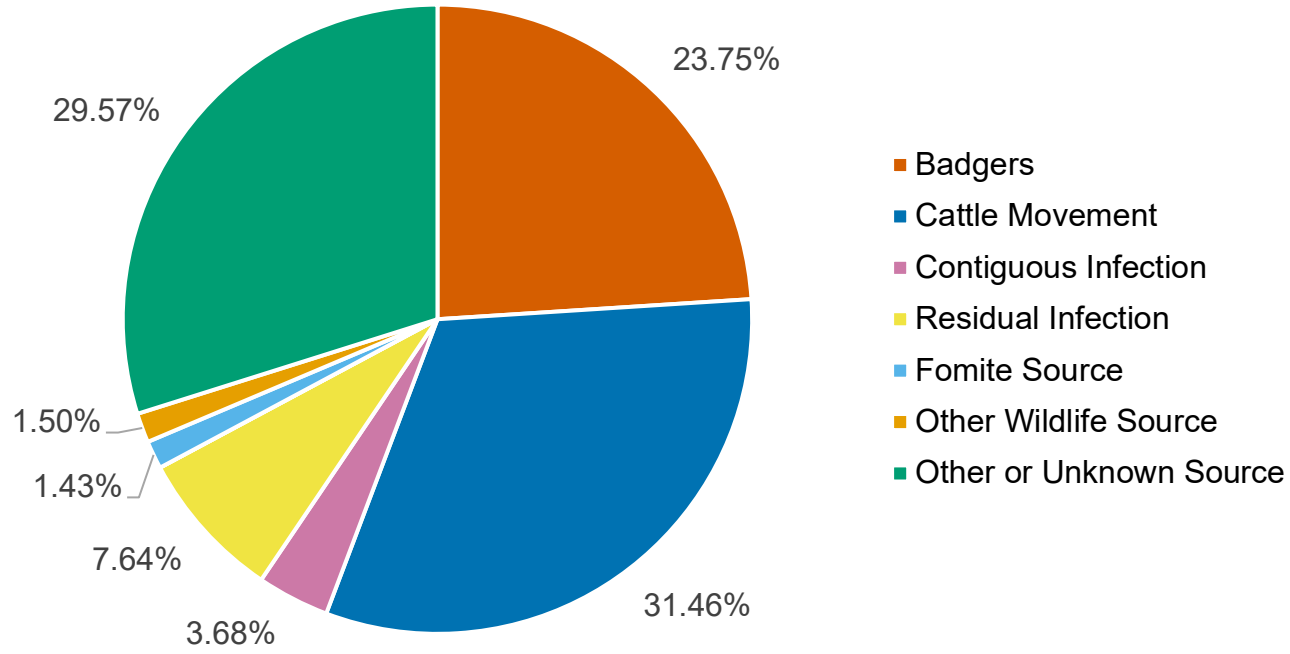


Figure 14b: Summary of the weighted source of infection pathways attributed for OTF-S TB incidents that started in 2020 in Leicestershire, that had a completed DRF (n=28).

TB in other species

There is no statutory routine TB surveillance of live non-bovine species. Post-mortem examination (PME) is performed on suspected clinical cases reported to APHA. Furthermore, post-mortem meat inspection is carried out on all captive animals (for example, sheep, goats, pigs or deer) slaughtered for human consumption.

There were no laboratory-confirmed isolations of *M. bovis* in other species, including domestic non-bovine farm animals (camelids, goats, sheep, and pigs) in Leicestershire in 2020.

Detection of TB incidents

In Leicestershire during 2020, only 25% of new TB incidents were disclosed by routine annual surveillance testing of herds whilst in 2019 it was 42% (Figure 15).

Radial testing (RAD) is a targeted TB surveillance skin test carried out on cattle holdings around all new TB incidents with lesion and/or culture positive animals and was rolled out in 2018 in Leicestershire.

Most new cases this year have been disclosed during RAD around OTF-W incidents, accounting for over 45% of all cases. In 2019, 34% of all TB incidents were disclosed by this method and 15% in 2018. This emphasises the importance of enhanced, targeted surveillance testing. There has been an increase of OTF-W incidents from 22 cases in 2019 to 32 in 2020. Therefore, the number of RAD tests carried out this year was greater than previous due to more new OTF-W TB incidents being disclosed.

Only 9% of incidents starting in 2020 were initiated by passive surveillance through routine post-mortem meat inspection of non-reactor cattle in the slaughterhouse.

This could be an indication of improved and more frequent TB skin testing, leading to earlier detection of disease within a herd with consequently fewer incidents being identified by passive surveillance in the slaughterhouse.

Six-month testing (6M), carried out six months after a herd regains OTF status following resolution of an incident, disclosed 10% of all new TB incidents in 2020.

Herds can suffer a recurrence of infection soon after the end of an incident for several reasons, such as a failure to detect all infected cattle during the previous incident resulting in residual infection being left in the herd, continual reinfection from wildlife, or from the introduction of undetected infected cattle in the herd.

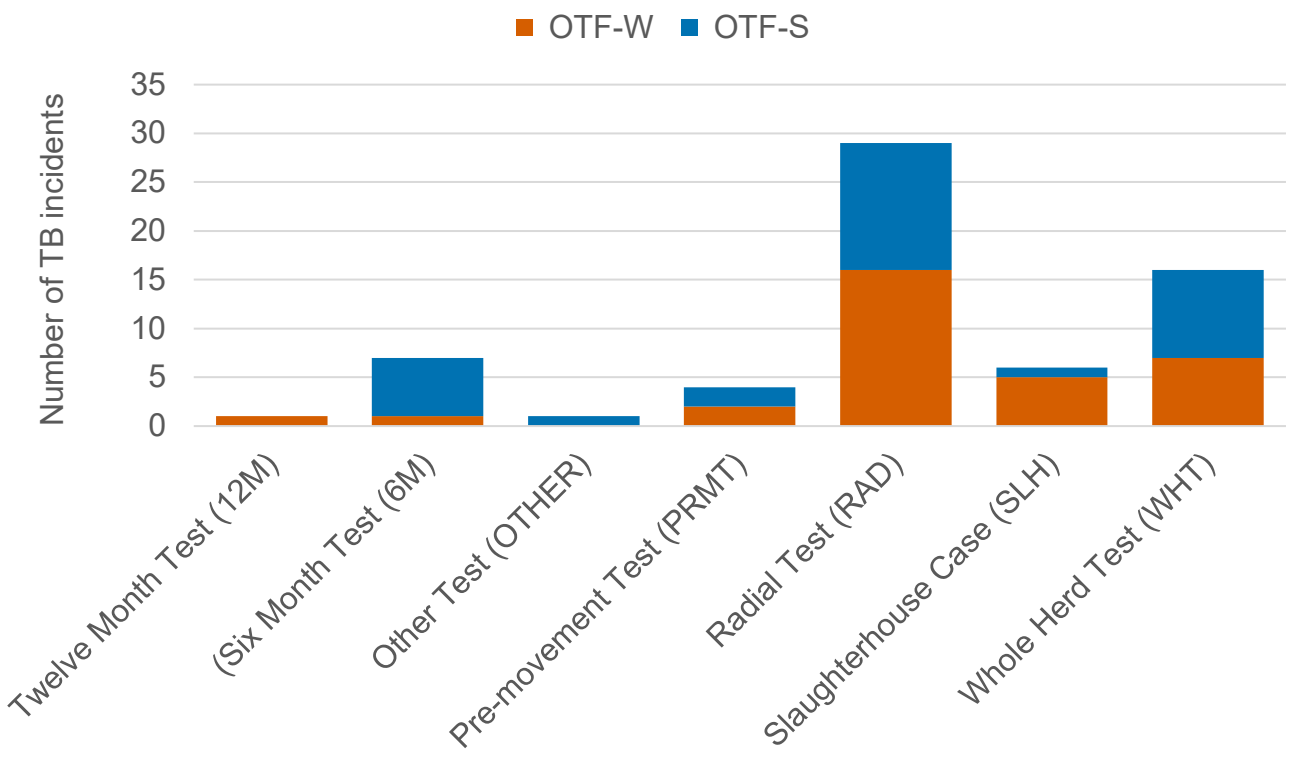


Figure 15: Number of TB incidents (OTF-W and OTF-S) in Leicestershire in 2020, disclosed by different surveillance methods.

Most herds with a new TB incident in 2020 had not experienced TB infection in recent years, with only 20% of both OTF-S and OTF-W incident herds suffering a TB incident in the previous three years (Figure 16).

Herds with recurring infections could be experiencing reinfection or residual infection from a previous incident. In the case of OTF-W incidents, the compulsory application of the supplementary IFN-γ blood test in certain TB incident herds results in increased test sensitivity and therefore the risk of leaving 'false-negative' animals on the affected farm is reduced.

Figure 16 shows the number of new OTF-W and OTF-S incidents in 2020, that had experienced an OTF-W incident in the previous three years. It excludes new incidents that were also on restrictions in the first four or more months of 2020 due to an incident that started before 2020.

The Explanatory Supplement (see section 4.3) provides more details on the reporting of recurrent TB incidents.

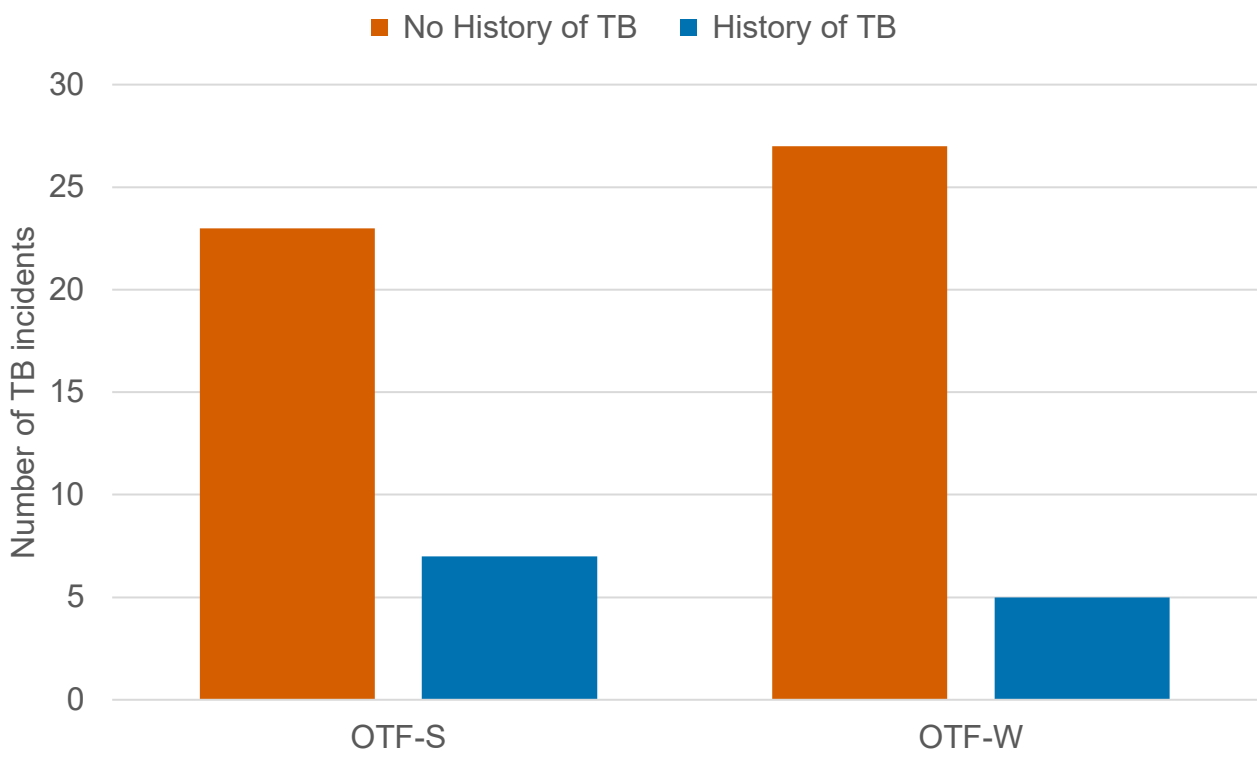


Figure 16: Number of herds with a TB incident (OTF-W and OTF-S) in Leicestershire in 2020, with a history of TB (herds that experienced an OTF-W incident in the previous three years), and holdings without a history of TB in the previous three years.

Skin test reactors and interferon gamma test positive animals removed

The financial burden to the taxpayer and farmers of TB in Leicestershire is significant in terms of the number of incidents and the number of cattle being slaughtered. Taxpayers' money is spent on testing and financial compensation for reactors compulsorily removed for slaughter.

The cost to the farmers is the impact on the ability to move cattle off the incident premises which can have considerable consequences for breeding stock (bulls, cows, and heifers), for weaned beef calves, stores and for dairy calves not normally reared on farm.

Likewise, replacing stock following slaughter of reactors can prove difficult, particularly in the case of pedigree or organic herds and in herds where large numbers of reactors are identified at the disclosing test (when no stock is allowed to move on before the first incident test has been completed).

TB incidents of longer duration undergo more testing, with the removal of additional reactors. The longer the restrictions are in place, the greater the cost to individual farmers and to the taxpayer.

In 2020, a total of 421 reactors were removed, a reduction from 512 in 2019 (Figure 17). In 2020, 42% of the reactors removed were positive at IFN-γ a reduction from 60% in 2019.

There has been a reduction in the number of reactors detected per incident, as shown in Appendix 3. In 2020 there were 6.6 reactors detected per incident compared with 10.2 in 2019. Overall, there were 2.5 reactors per 1,000 animal tests in 2020, similar to the previous reporting year.

The IFN-γ test has a higher sensitivity than the skin test and is applied in parallel with the skin test, to disclose more infected cattle. This disclosure is often at an earlier stage reducing the duration of an incident and minimising the spread of TB.

Despite the increased number of TB incidents (50 in 2019 to 64 in 2020), there was a significant reduction in the number of reactors removed. This may partly be due to the increase of RAD skin testing. This type of testing discloses incidents earlier, meaning the risk of spread within a farm is lower as the diseased cattle are removed.

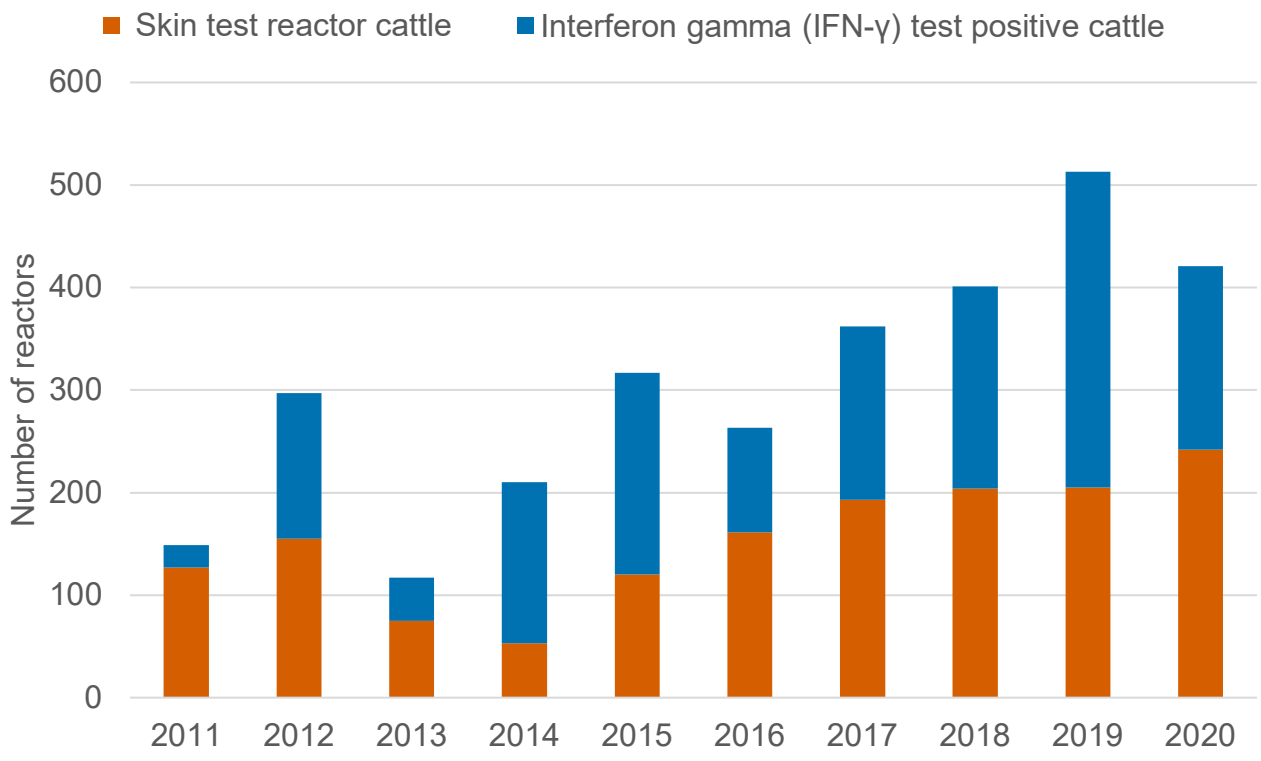


Figure 17: Number of skin test reactors and interferon gamma (IFN-γ) test positive cattle removed by APHA for TB control reasons in Leicestershire, 2011 to 2020.

Summary of risks to Leicestershire

There are two main risks of introducing TB into Leicestershire: movement of undetected infected cattle from herds in other Edge Area counties and the HRA and lateral spread from neighbouring counties as described below. Other counties adjacent to Leicestershire are the Edge Area counties of Nottinghamshire, Northamptonshire, Warwickshire, and Derbyshire.

In 2020 there were several TB OTF-W incidents in Nottinghamshire in very close proximity to the north-east of Leicestershire. However, the incidence in this county is much lower than in Leicestershire, therefore does not pose a major risk at present.

Several OTF-W incidents associated with wildlife have been identified in the neighbouring counties and could pose a risk to Leicestershire. These incidents are in north-east Warwickshire and north Northamptonshire, both counties have a higher TB incidence than Leicestershire.

There were incidents attributed to wildlife reservoirs of infection in north-east Warwickshire on the border with Leicestershire. There are indications that disease is becoming endemic in this area and this poses a risk to south west Leicestershire.

For the third consecutive year, there have not been any TB incidents in Derbyshire near the border with Leicestershire. The greatest risk of spread of infection is in the two areas bordering the counties of Warwickshire and Northamptonshire, particularly since cattle density is high in these two areas

Summary of risks from Leicestershire to surrounding areas

The summary of risks to the LRA and south of Nottinghamshire is unchanged from those detailed in the 2019 report. Specifically, the north-east Leicestershire cluster continues to be of concern because of its persistence and contiguity to the LRA county of Lincolnshire.

Overspill of disease into wildlife has potentially serious consequences in this area and there has been an increase in genotype 25:a OTF-W incidents associated with wildlife in the north-eastern cluster, as well as detections in parishes of south Nottinghamshire and neighbouring Lincolnshire.

The Whole Genome Sequences (WGS) of *M. bovis* isolates obtained from these incidents are being determined in order to further investigate and define the possible transmission pathways. This should help to assess the need for more specific and targeted surveillance and control measures in this area.

In September 2020, Natural England issued a licence for badger culling in Leicestershire. Badger control operations. You can read the results of the number of badgers removed on GOV.UK.

Assessment of effectiveness of controls and forward look

Effectiveness of controls

Parallel IFN-γ testing has been useful in identifying additional infected cattle earlier in herds sustaining OTF-W incidents in the Edge Area. This has been effective in reducing within-herd and herd-to herd spread of TB, but other measures are still required to address the sources and pathways of infection to prevent recurrence or introduction of new infection once testing and slaughter has removed disease.

The implementation of RAD testing is a useful surveillance tool that is also identifying TB infection on farms promptly reducing the chances of spread of TB within the herd as well as other herds and local wildlife.

The application of appropriate measures to control the risk of TB infection from badgers in some areas of Leicestershire starting this year will complement these enhanced measures.

The Badger Edge Vaccination Scheme (BEVS) has been ongoing in areas of Leicestershire and may support the buffering of areas of low disease incidence from pockets of endemic TB. It is unlikely that an immediate effect will be observed for any of these measures, and it is more likely that it will take a further two or three years before benefits become evident.

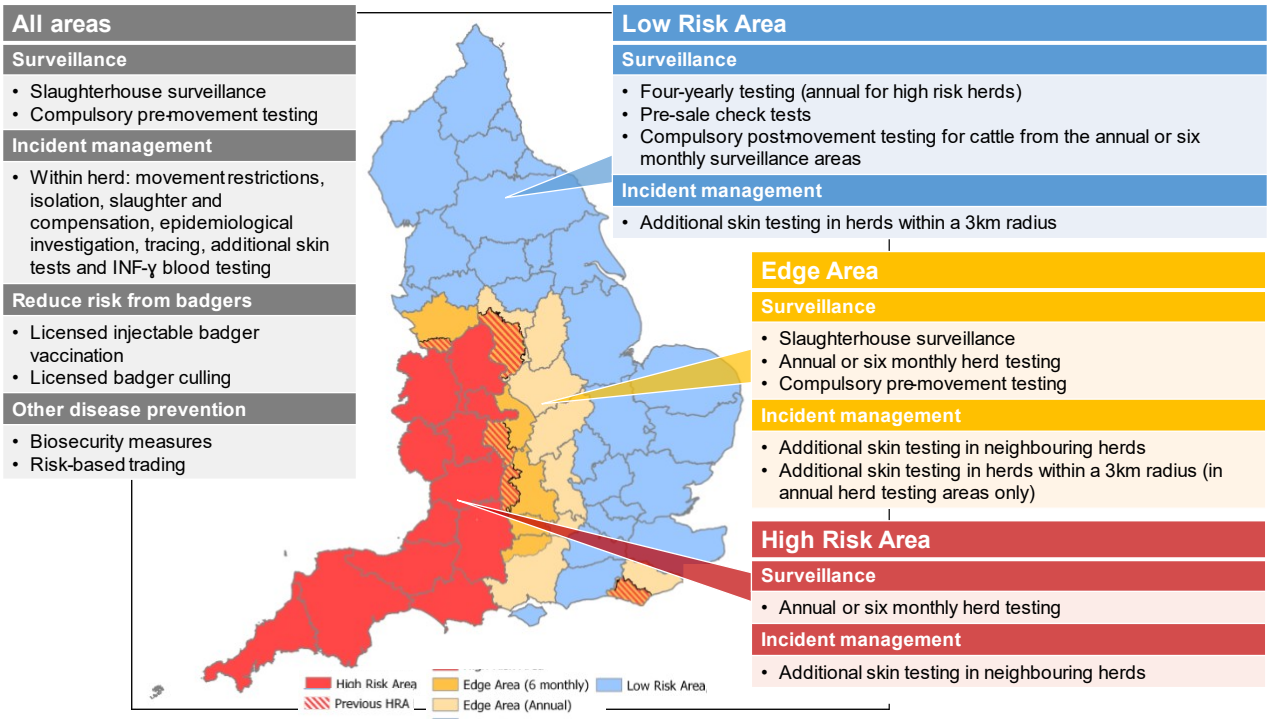
Forward look

It is difficult to provide an opinion on the course of the epidemic over the next two years, partly due to the cyclical component of the TB epidemic and partly because of its multifactorial nature and the constantly evolving control policy, whose assessment overtime is very complex (for the reasons mentioned) and can only be done retrospectively.

The epidemic appears to be established in areas of Leicestershire, with some suspicion that wildlife reservoirs in the north-east of the county could be playing a bigger part than previously thought in the spread and persistence of the disease locally.

Appendices

Appendix 1: Overview of risk and surveillance areas of England and Edge Area objectives and controls



[Explanatory Supplement for England 2020](#).

Policy objectives for the Edge Area

Short to medium term:

- slow down geographic spread of endemic infection
- maintain crude herd incidence of OTF-W incidents less than 2% overall by 2019
- begin to reduce the incidence rate

Longer term:

- reduce geographic spread of TB and push the Edge Area boundaries westward
- reduce OTF-W herd incidence to less than 1% by 2025
- attain OTF status (crude incidence of indigenous OTF-W herd incidents less than 0.1%) for the lowest incidence counties in the Edge Area

For more information about the governments approach to controlling TB, visit the strategy for achieving Officially Bovine Tuberculosis Free status for England, published in 2014 and independently reviewed in 2018, see:

- A strategy for achieving officially bovine tuberculosis free status for England
- Government sets out next phase of strategy to combat bovine tuberculosis

Key Control Measures

Surveillance:

- six monthly or annual routine whole herd testing
- additional targeted surveillance of cattle herds located within a 3km radius of new OTF-W incidents in annual testing sections of the Edge Area (radial testing)
- slaughterhouse (SLH) surveillance

Management of cases ('incidents'):

- increased sensitivity of incident herd testing:
- all incident herds must pass two consecutive short interval skin tests at severe interpretation to regain OTF status, irrespective of PM and bacteriological findings
- mandatory IFN-γ parallel testing of herds with OTF-W incidents
- enhanced management of herds with persistent incidents
- enhanced epidemiological investigation and data analysis
- information sharing - location of incident herds publicly available (using ibTB online interactive mapping tool)
- restriction for life of all inconclusive reactors (IRs) that give a negative result on a re-test was introduced in November 2017 ('resolved IRs' policy). The only permitted movements of these animals are to slaughter or an Approved Finishing Unit, or after being subjected to a private IFN-γ test with negative results

TB controls in the wildlife reservoir (badgers):

- licensed badger culling in high incidence sections of the Edge Area
- Government grants for licensed voluntary badger vaccination projects using injectable badger BCG (Badger Edge Vaccination Scheme (BEVS))

Other measures:

- compulsory pre-movement skin testing of cattle moved between herds
- promotion of herd biosecurity measures to reduce the risk of new incidents

Summary of enhanced TB control measures in Leicestershire

Edge Area testing policy

- Radial testing of herds in a 3km radius around an OTF-W incident holding continues in the whole county, along with annual surveillance testing.
- Mandatory IFN-γ blood testing continues to apply in all new OTF-W incidents. Exemptions are applied on rare occasions, where there is clear epidemiological separation of certain groups of cattle within the herd after the initial round of testing thus making it more targeted and cost-effective.
- To release resolved IRs in OTF herds from life-long restrictions, the option of private IFN-γ blood testing is available to cattle keepers, subject to securing prior approval from APHA

Other testing measures

- Discretionary exemptions from annual routine surveillance whole herd testing have been approved for beef finishing units if they met the following strict set of criteria:
    - All cattle move directly to the abattoir
    - No cattle to be resident on the holding for more than 12 months
    - No births in the unit
    - No breeding activity in the unit
    - All cattle must be permanently housed or yarded (no grazing)
    - Holdings are required to reapply for an exemption on an annual basis in order to ensure regular review of compliance
- North-east of Leicestershire areas are within the HS23 near the border of Lincolnshire and south of Nottinghamshire that was established in December 2017. Additional surveillance measures have been implemented in cattle and wildlife across the whole hotspot, including the collection of ‘found dead’ badger and wild deer.

Other control measures

- Provision of free biosecurity advice by the TB Advisory Service (TBAS)
- Quality Control audits of Official Veterinarians (OV) performing TB testing carried out by APHA and Veterinary Delivery Partners who are contracted to provide the statutory TB skin testing on behalf of APHA.
- APHA liaises with Local Authorities as necessary, especially regarding the enforcement of overdue TB tests, illegal movements, suspicions of fraudulent generation of skin test reactors, and with Public Health England regarding cases of pulmonary TB in cattle or the consumption of unpasteurised milk on farms affected by OTF-W incidents.

Appendix 2: Cattle industry in Leicestershire

Table A2.1: Number of cattle premises by size band in Leicestershire at 1 January 2020. (RADAR data)

Size of herds	Un*	1-50	51-100	101-200	201-350	351-500	501+	Total number of herds	Mean herd size	Median herd size
Number of herds	3	387	144	169	70	34	48	855	128	62

*The number of herds with an undetermined size.

Table A2.2: Number of animals by breed purpose in Leicestershire at 1 January 2020.

Breed purpose	Beef	Dairy	Dual purpose	Unknown	Total
Number of cattle	68,331 (62%)	37,708 (34%)	3,710 (3%)	3 (less than 0.01%)	109,752

Appendix 3: Summary of headline cattle TB statistics

Table A3.1: Herd-level summary statistics for TB in cattle in Leicestershire between 2018 and 2020.

Herd-level statistics	2018	2019	2020
(a) Total number of cattle herds live on Sam at the end of the reporting period	1,048	1,043	1,012
(b) Total number of whole herd skin tests carried out at any time in the period	1,181	1,208	1,157
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	885	847	833
(d) Total number of OTF cattle herds at the end of the report period (herds not under any type of Notice Prohibiting the Movement of Bovine Animals (TB02) restrictions)	971	974	917
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	1,009	1,014	969
(f) Total number of new TB incidents detected in cattle herds during the report period, (including all FUs)	59	50	64
• OTF-S	37	28	32
• OTF-W	22	22	32
(g) Of the OTF-W herd incidents:			
• How many can be considered the result of movement, purchase or contact from or with an existing incident based on current evidence?	11	7	8

Herd-level statistics	2018	2019	2020
• New OTF-W incidents triggered by skin test Reactors or 2xIRs at routine herd tests	18	9	9
• New OTF-W incidents triggered by skin test Reactors or 2xIRs at other TB test types (such as, forward and back-tracings, contiguous or check tests)	2	10	18
• New OTF-W incidents first detected through routine slaughterhouse TB surveillance	2	3	5
(h) Number of new incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds			
• OTF-S	13	9	6
• OTF-W	16	8	3
(i) Number of OTF-W herds still open at the end of the period (including any ongoing OTF-W incidents that began in a previous reporting period, but not including non-grazing Approved Finishing Units)	16	15	24
(j) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	0
(k) Number and type of finishing units active at end of the period:			
• Approved Finishing Units: Grazing	0	0	0
• Approved Finishing Units: Non-Grazing	13	14	14
• Exempt Finishing Units: Grazing	0	0	0
• Exempt Finishing Units: Non-Grazing	0	0	0

Table A3.2: Animal-level summary statistics for TB in cattle in Leicestershire between 2018 and 2020.

Animal-level statistics (cattle)	2018	2019	2020
(a) Total number of cattle tested in the period (animal tests)	179,172	189,218	168,740
(b) Reactors detected in tests during the year:			
• Tuberculin skin test	204	205	242
• Additional IFN-γ blood test reactors (skin-test negative or IR animals)	197	308	179
(c) Reactors detected during year per incidents disclosed during year	6.8	10.3	6.6
(d) Reactors per 1000 animal tests	2.2	2.7	2.5
(e) Additional animals slaughtered during the year for TB control reasons:			
• DCs, including any first-time IRs	0	10	21
• Private slaughters	54	22	20
(f) SLH cases (tuberculous carcases) reported by Food Standards Agency (FSA)	10	20	14
(g) SLH cases confirmed by culture of *M. bovis*	4	8	6

Note: (c) Reactors detected during year per incidents disclosed during year, reactors may be from incidents disclosed in earlier years, as any found through testing during the report year count here.

Note: (g) SLH cases confirmed by culture of *M. bovis*, not all cases reported are submitted for culture analysis. All cases reported are from any period prior to or during restrictions.

Appendix 4: Suspected sources of *M. bovis* infection for all the new OTF-W and OTF-S incidents identified in the report period

Table A4: Suspected sources of *M. bovis* infection for all the new OTF-W and OTF-S incidents identified in Leicestershire, in 2020.

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	19	7	17	1	34.9%
Cattle movements	13	4	14	1	29.9%
Contiguous	5	0	1	0	2.5%
Residual infection	4	2	2	0	5.0%
Domestic animals	1	0	0	0	0.3%
Non-specific reactor	0	0	0	0	0.0%
Fomites	3	1	1	0	3.3%
Other wildlife	5	0	0	0	1.2%
Other or unknown source	6	1	6	0	23.0%

Please note that each TB incident could have up to three potential pathways so totals may not equate to the number of actual incidents that have occurred.

Details of the methodology used to calculate the weighted contribution of the different suspected sources of *M. bovis* infection for all new incidents can be found in the main body of the report and in the Explanatory Supplement.

Data Protection:
For information on how we handle personal data visit www.gov.uk and search Animal and Plant Health Agency Personal Information Charter.

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