



Animal &
Plant Health
Agency

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

County coverage: Lincolnshire

Year-end report for: 2019

TB Low Risk Area - LINCOLNSHIRE



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Executive summary

Reporting area

Lincolnshire is part of the Low Risk Area (LRA) that was established in 2013. The following year, the bovine tuberculosis (TB) surveillance strategy for this area was incorporated into the Government's strategy to achieve Officially Tuberculosis Free (OTF) status for England by 2038. Overall the LRA has a very low and stable incidence of infected herds. This end of year report describes bovine TB in Lincolnshire.

Local cattle industry

The cattle industry in Lincolnshire is predominantly beef based. Beef farms provide an outlet for the abundance of arable crop products and by-products grown in the county. There continues to be a decline in dairy cattle numbers both in terms of farms and animals. Those that remain are spread across the county.

New incidents of TB

In 2019 there was a total of 15 new TB incidents, six of which were lesion and/or culture positive (i.e. OTF status withdrawn or OTF-W) cases. This is in comparison to 2018, when there was a total of 12 incidents, of which six were OTF-W.

Potential or confirmed TB hotspot areas

One potential hotspot area (HS23) has been active since June 2018 near Grantham in the south-west of the county and straddling north-east Leicestershire. By the end of 2019, enhanced wildlife surveillance had identified two badger carcasses with visible lesions consistent with TB. Further bacteriological culture of the lesions was undertaken with [results becoming available in 2020](#).

Unusual TB incidents

There were no unusual TB incidents in cattle in 2019 and no incidents in non-bovines.

Suspected sources and risk pathways for TB infection

The main pathway continues to be the movement of undetected infected cattle bringing disease in from outside Lincolnshire. 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 for England 2019](#).

Disclosing tests

In 2019 there was an increase in the numbers of radial surveillance tests carried out. Seven of the 15 incidents in 2019 were disclosed at radial tests. Routine herd testing (48 months) and post-movement testing continued to disclose reactors.

Reactor numbers

In total, there were 65 cattle removed in 2019 for TB control reasons, with 36 of these skin test reactors and 29 interferon gamma test (IFN- γ) positive animals disclosed in OTF-W incident herds.

Risks to the reporting area

In addition to buying-in infected cattle from endemic areas, the major risk to Lincolnshire is disease encroachment in the north-east of Leicestershire.

Risks posed by the reporting area

Other than the shared risk with Leicestershire in HS23, Lincolnshire represents very low risk to the TB status of neighbouring counties.

Forward look

The current controls are keeping the incidence of TB in Lincolnshire under control and overall the disease incidence remains low. If robust testing is maintained alongside improvements to biosecurity and to trading, the outlook for Lincolnshire maintaining its low-risk status is positive.

Introduction

This report describes the level of bovine tuberculosis in cattle herds in Lincolnshire in 2019. Bovine TB is caused by the bacterium *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 Lincolnshire, 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 amount of TB in different parts of the country and to vary the approach to control accordingly. To this end, three management areas were established (Appendix 1). Lincolnshire forms part of the LRA. Overall, the LRA has a very low and stable incidence of infected herds. The current strategy seeks to rapidly control infection when it arises through high sensitivity testing of affected herds and temporarily enhanced local surveillance (radial and hotspot testing). Compulsory pre- and post-movement testing of cattle entering the LRA from higher risk areas of the UK is also performed to reduce the risk of TB introduction. The aim is to preserve the favourable disease status of this county so that it can be declared OTF as soon as possible.

Cattle industry

On 1st January 2019 there were 81,149 cattle kept in 752 herds in Lincolnshire (Appendix 2). This represented a drop of around 4% over the previous 12 months (84,457 cattle on 1st January 2018), even though the total number of herds remained relatively stable. Most herds (48%) have between 1-50 cattle, with only 3% of herds having more than 501 cattle (Figure 1). The Lincolnshire cattle industry can be broken down (in order of significance) into the following four categories: finishing units (intensive and extensive systems), beef-suckler herds (pedigree and commercial herds), dairy herds, and hobbyists.

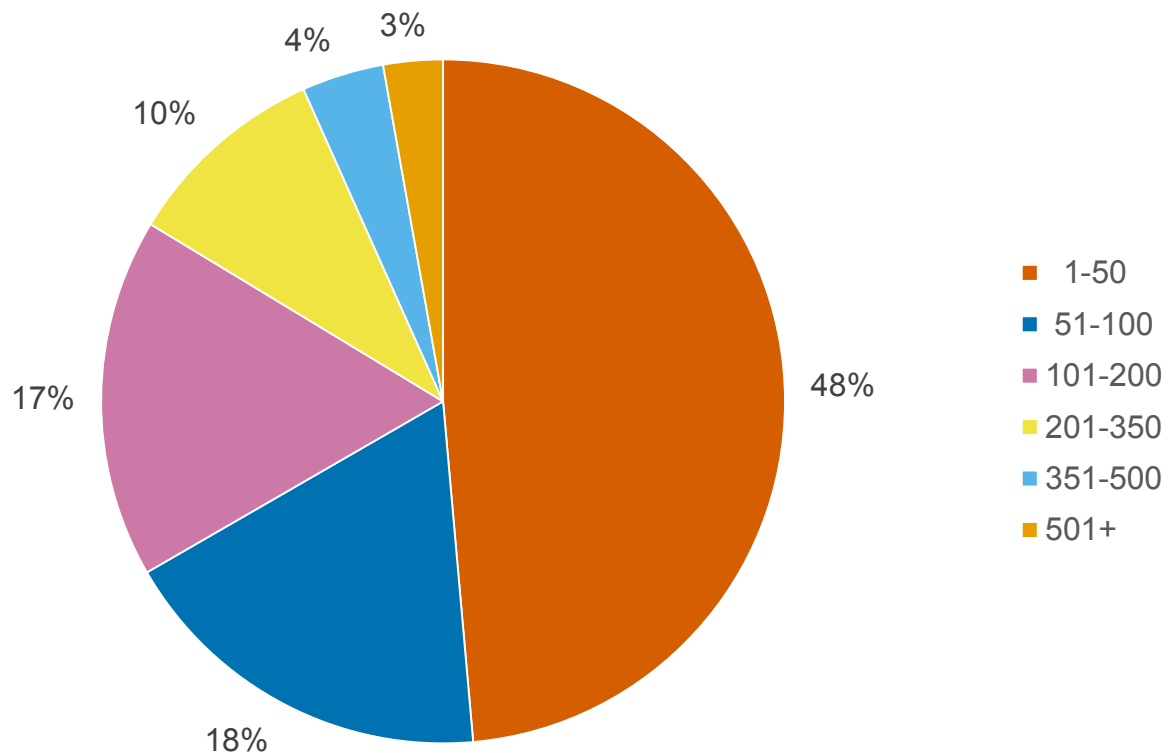


Figure 1: Proportion of cattle holdings in Lincolnshire, by herd size in 2019 (n= 752).

Finishing units

These form the most significant portion of the Lincolnshire cattle population in terms of cattle numbers, but are relatively small in terms of units. Most finishing units are managed intensively with a small proportion of units still operating a traditional extensive grass-based finishing system. A significant feature of the intensive finishing units is that these units originally developed to utilise the products and by-products of the Lincolnshire arable and vegetable industry. As a result several beef units are linked to large arable businesses.

In intensive units, store cattle are primarily sourced from the west and south-west of England and moved to Lincolnshire. The main reason for the cross-country movement of cattle is that Lincolnshire is not able to supply the number of cattle to meet the demand of finishing units. This exemplifies the long-standing stratification of the British cattle industry, and demonstrates the movement of the cattle to the feed, rather than feed to cattle. The majority of these bought-in cattle are sent to slaughter after finishing. Few will be sold through the live auction market system. Finishing units rely on the purchase and slaughter of large numbers of cattle on a weekly basis. The intensive nature of these businesses means that the cattle are on farm for a short length of time varying from a few weeks to six months.

In extensive units, store cattle are primarily sourced from own suckler herds and finished at grass. These finished cattle are sold through live auction markets in Louth (Lincolnshire), Newark (Nottinghamshire, Edge Area county), possibly Melton Mowbray (Leicestershire, Edge Area county) or directly to slaughter.

There are eight Licensed Finishing Units (LFUs) in the County, with no new units approved in 2019. LFUs are a type of TB unit that can be approved by APHA in the Low Risk Area (LRA) of England. They must follow a strict biosecurity and sourcing policy and are inspected annually by APHA. LFUs provide an outlet for the finishing of negative-testing cattle from multiple officially TB free (OTF) herds.

Beef suckler herds

Pedigree herds are of some importance to this county, with their stock being traded both nationally and internationally. These herds will tend to have planned yet sporadic purchases of cattle, mainly to source new bloodlines.

In commercial herds replacements are equally homebred or purchased. Cattle are sold as stores through local markets or finished on farm for sale through live auction markets or direct to slaughter.

Dairy herds

Dairy herds (commercial and pedigree) are present throughout the county. They tend to occur as isolated units rather than clustered in specific geographical areas. Most dairy herds are well-separated from other cattle herds by arable land.

Hobbyists

Small in number, but significant because of the potential lack of owner awareness of TB risks (biosecurity) and occasional non-compliance with routine surveillance testing. They are mostly beef sucklers established for pet or pasture management purposes. They tend to buy and sell privately as well as through live markets. These make up the majority of the 48% of herds with fewer than 50 animals in Figure 1.

Markets and abattoirs

There is one livestock market in the county (Louth), which currently operates one day a week.

There are seven cattle abattoirs in the county.

Descriptive epidemiology of TB

Temporal TB trends

Unless otherwise specified, this report includes all new TB incidents detected during the reporting period. This includes 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), 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 or bacterial culture.

As can be seen in Figure 2, the number of OTF-W cases in 2019 remained at six as in 2018. The number of OTF-S cases rose to nine in 2019 from six in 2018. Overall in the past two years, there has been an upward trend in total cases detected in Lincolnshire. However, the number of cases remains low compared to other areas. One reason for the increase in cases will be the increase in the number of cattle tested due to radial testing, a form of enhanced surveillance in the area surrounding an OTF-W case. Seven out of the 15 cases in 2019 were disclosed at a radial test.

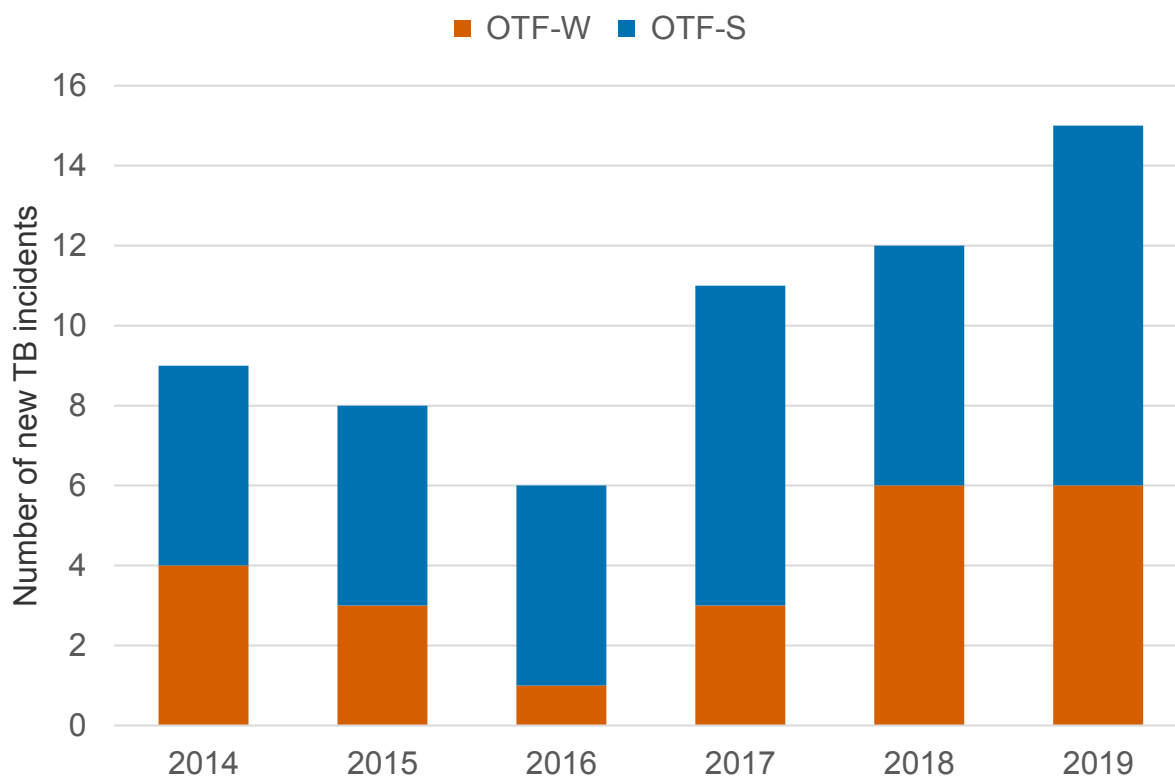


Figure 2: Annual number of new TB incidents in Lincolnshire, 2014 to 2019

Increased testing can be expected to disclose more disease. However, when the number of reactors found per 1000 animal tests is compared (Table A3.2), there were fewer reactors in 2019 than in 2018 (1.86 for 2018 and 1.36 for 2019). So, although there has been an increase in the number of tests and TB cases in 2019 compared with 2018, the number of reactors removed has reduced. The overall picture suggests that the impact of TB in Lincolnshire is unchanged.

Geographical distribution of TB incidents

As in previous years, the new cases were spread across Lincolnshire. Figure 3 shows two notable clusters of cases in areas of higher cattle density. One in the north-east and one in the south-west of the county. The cluster in the north-east of the county represents two OTF-W cases involving herds that were approximately 5km apart. Both cases were disclosed on radial testing from an OTF-W case that lay halfway between them in the previous reporting year (2018). Genetic analysis showed no link between the strains of *M. bovis* found at the three premises and so lateral (local) spread of infection is not thought likely.

The second cluster shown in Figure 3, is close to the border with the Edge Area county of Leicestershire. There was a cluster of cases in north-east Leicestershire (Appendix 6), and that represents the greatest threat to Lincolnshire's LRA status. An OTF-W case of undetermined origin was disclosed in December 2017 near Grantham and subsequently resolved in 2019. This case and the other TB incidents disclosed nearby, are being investigated thoroughly as there is indication of potential spread of TB from the adjoining Edge Area in Leicestershire. As a result, in June 2018, APHA instigated a potential TB hotspot area of approximately 245km² between Grantham and Melton Mowbray, known as HS23 (Figure 4). Additional TB surveillance measures for cattle herds and wildlife (badgers and wild deer) are being implemented within this area. Cattle keepers and stakeholders were informed of these measures.

During 2019, 17 dead badgers and one dead deer were reported to APHA as part of the road traffic accident (RTA) surveillance scheme. Of these, 13 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 11 badgers and one deer being examined. By the end of the 2019, two of these badger carcasses had visible lesions identified consistent with TB. Further bacteriological culture of the lesions was undertaken with results becoming available in 2020 (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/914655/tb-surveillance-in-wildlife-sept2020.pdf).

Figure 4 also shows the radial surveillance zones of enhanced TB herd testing that were active during 2019.

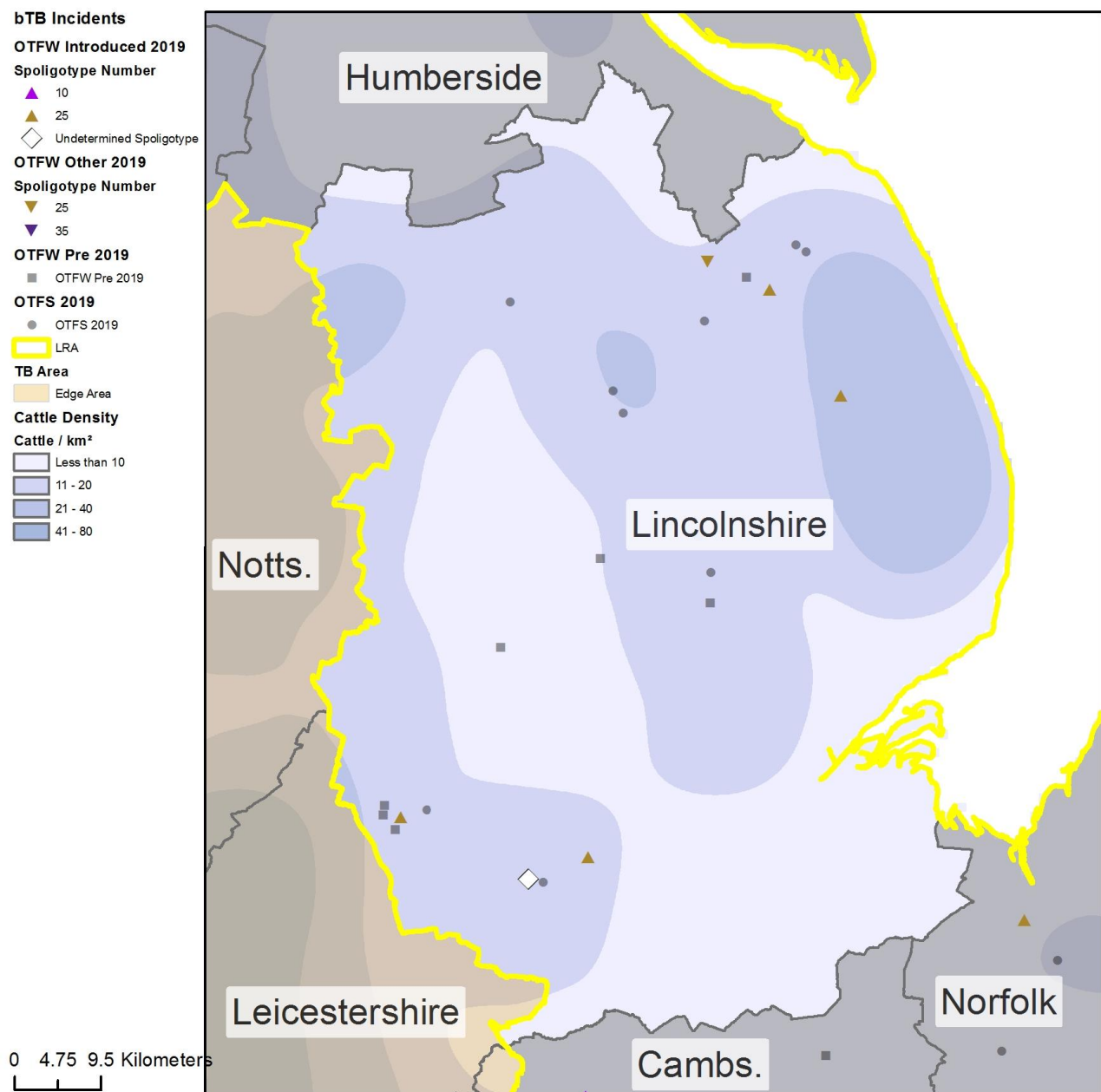


Figure 3: Location of cattle holdings in Lincolnshire with new TB incidents (OTF-W and OTF-S) in 2019, and cattle holdings with pre-2019 OTF-W incidents that are still ongoing at the end of 2019, overlaid on a cattle density map.

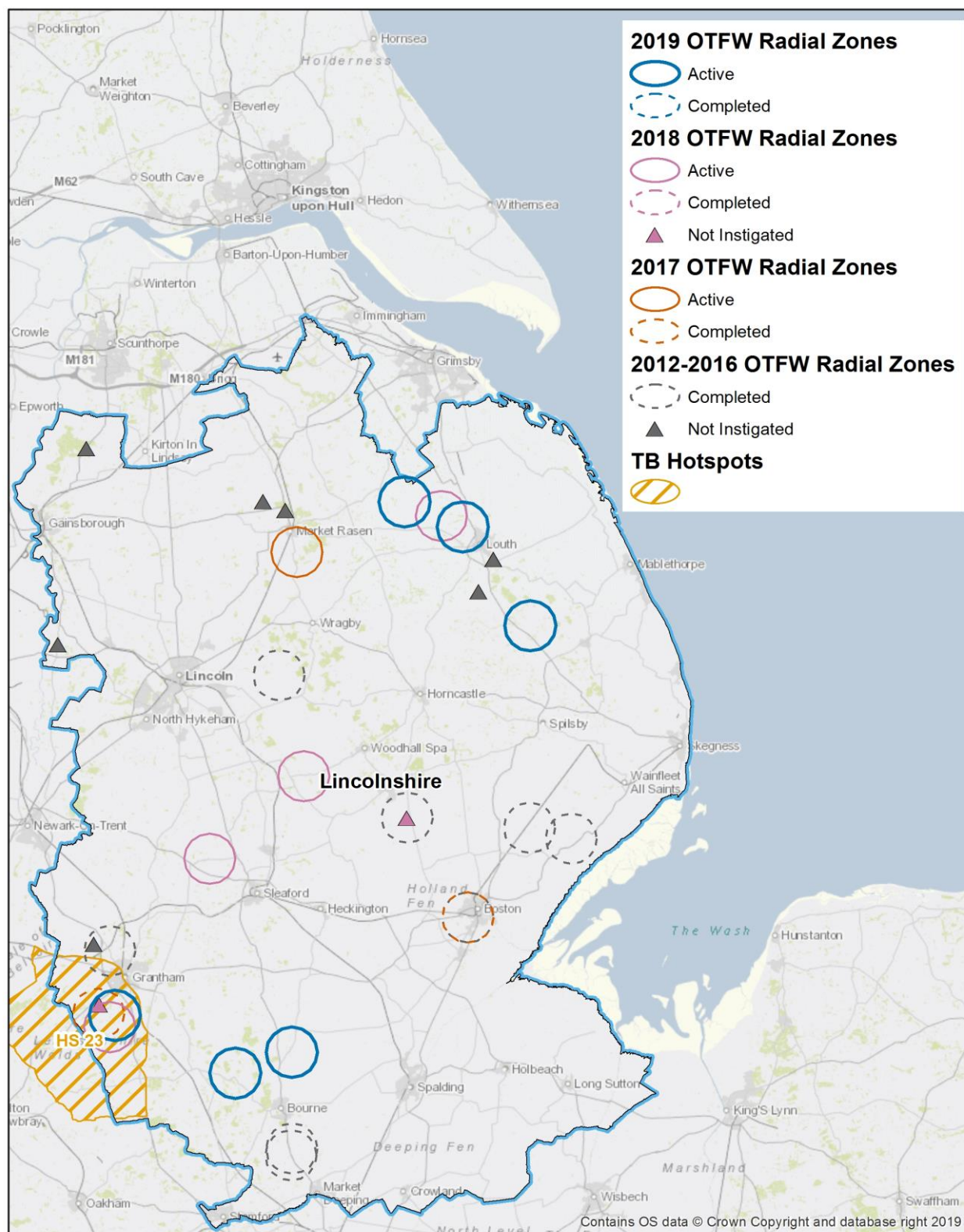


Figure 4: Potential hotspot areas and OTF-W radial surveillance zones that were active, completed or not instigated in Lincolnshire during 2019, by year of initiation.

Other characteristics of TB incidents

Duration of incidents

In the LRA, more testing is required in OTF-W than OTF-S incident herds to lift the movement restrictions and regain OTF status. This testing has an impact on the length of farm restrictions. In 2019, the minimum testing for OTF-S was one Short-Interval Test (SIT) at least 60 days from reactor removal. OTF-W cases require a minimum of two consecutive SITs with negative results and usually a supplementary IFN- γ blood test. In 2019 the median duration of OTF-W cases was 238 days, compared with 128 days for OTF-S cases. Figure 5 shows the distribution of incident durations for cases that concluded during 2019. It is worth noting that some of these cases will have been disclosed in the previous years.

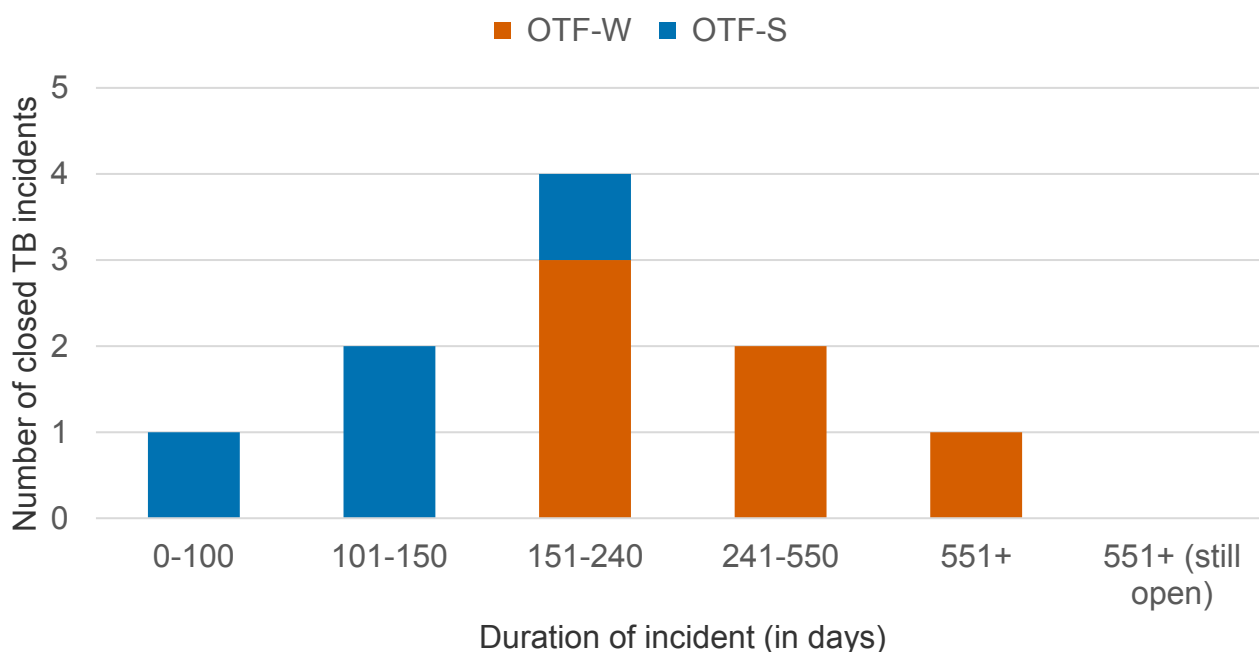


Figure 5: Duration of all TB incidents (OTF-W and OTF-S) that ended in 2019, and the number of persistent TB incidents (551+ days) that were unresolved at the end of 2019 in Lincolnshire. Note that Licensed Finishing Units (LFUs) have been excluded.

Genotypes of *M. bovis* isolated

Genotyping of *M. bovis* isolates is undertaken for all OTF-W cases in the LRA. This allows for more in-depth investigation into likely source of incidents and any local spread of infection. At the time of reporting, five of the six OTF-W cases detected in 2019 had genotyping results. Four of these were associated with genotype 25:a of *M. bovis* and one was an undetermined 25 genotype. As Lincolnshire is not considered to have endemic TB, both of these genotypes were classed as out-of-homerange. The genotyping information helps to maintain Lincolnshire's low-risk status, as it shows that infection has not originated within the county.

Suspected sources, risk pathways and key drivers for TB infection

The key driver for the sporadic presence of TB within Lincolnshire was the purchase of cattle from Edge and High Risk Areas (Figure 6, Appendix 4).

It can be challenging to retrospectively establish the route of infection for a TB incident herd. The Animal and Plant Health Agency (APHA) aims to complete an epidemiological assessment for all TB incidents in the LRA (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.

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 assigned has been updated this year to reflect developing understanding of how likelihood is being assessed in practice. It is recorded as either definite (score 8), most likely (score 6), likely (score 4) or possible (score 1). The source(s) for each incident are weighted by the certainty ascribed. Any combination of definite, most likely, likely or possible 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 and providing the proportion of pathways in which each source was identified, weighted by certainty that 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 is 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 to the 2019 bovine TB epidemiology report for England (<https://www.gov.uk/government/publications/bovine-tb-epidemiology-and-surveillance-in-great-britain-2019>).

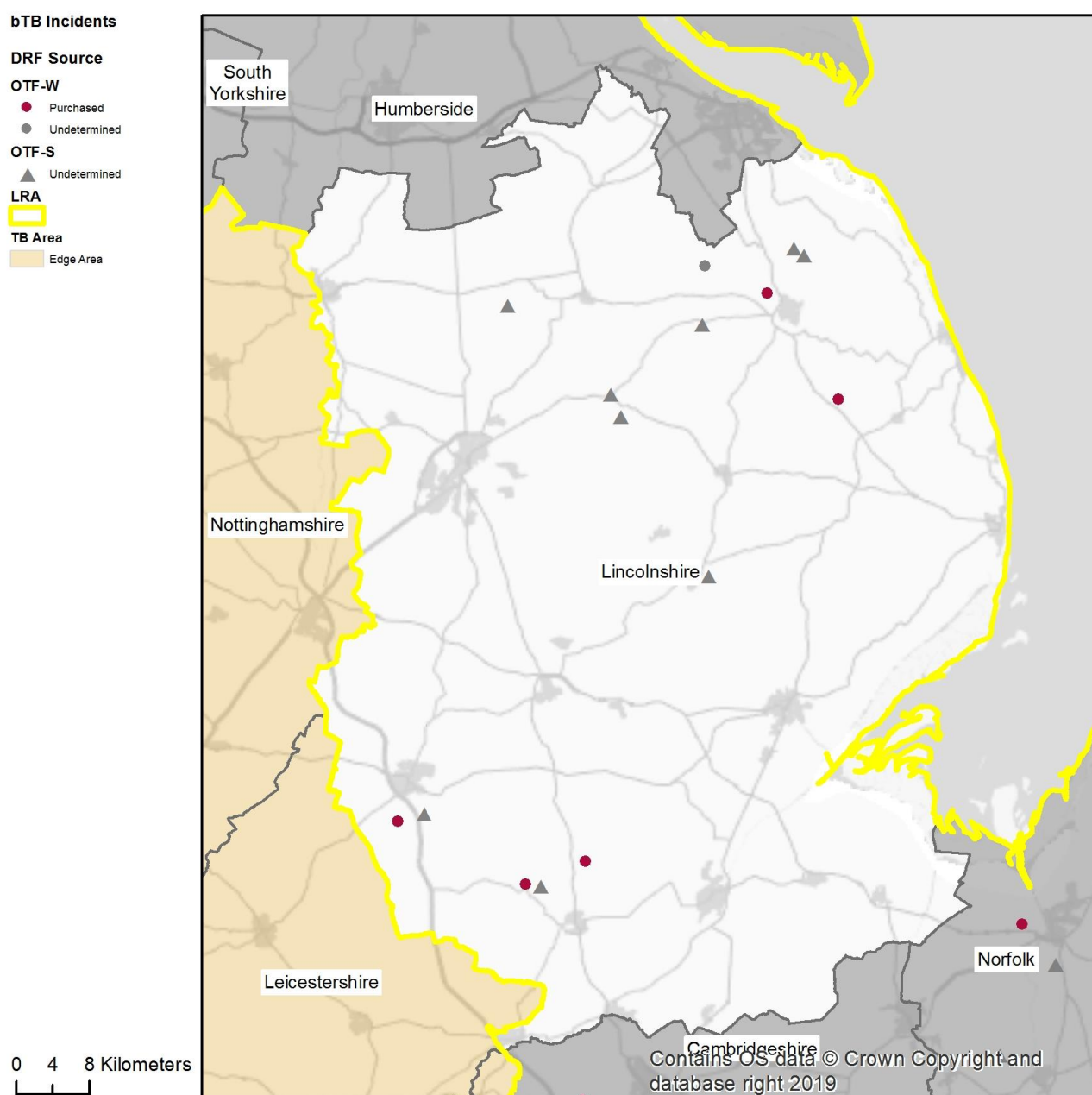


Figure 6: Map of the source of infection pathway recorded with the highest level of certainty for all TB incidents (OTF-W and OTF-S) in Lincolnshire, which started in 2019.

Figure 6 shows the source of the Lincolnshire TB incidents in 2019 as ascribed by the case vet on the DRF (Disease Report Form). Five of the six OTF-W cases could be sourced to an animal purchased from outside the county. OTF-S cases are generally more difficult to ascribe a definitive source to. As a result, all OTF-S cases from 2019 are undetermined. Possible sources to these unconfirmed cases are still reported in the DRFs and are shown in Appendix 4.

TB in other species

There were no reports of *M. bovis* in other farmed species during 2019.

Detection of incidents

Of the six new OTF-W cases in 2019, three were detected on radial surveillance testing, two on post-movement testing and one on routine herd testing. This shows that the current policies of radial and post-movement testing are key to disclosing disease in the LRA; in total seven out of 15 cases were disclosed by radial testing (Figure 7).

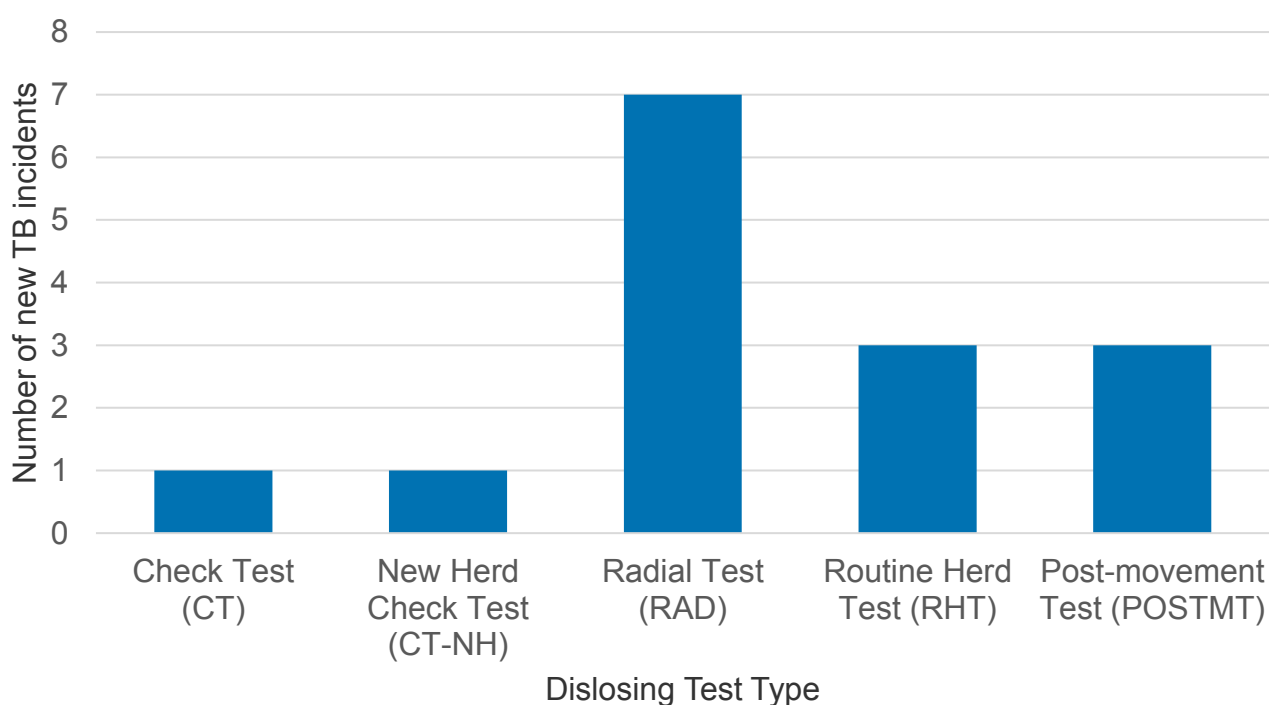


Figure 7: Number of TB incidents (OTF-W and OTF-S) in Lincolnshire in 2019, disclosed by different surveillance methods.

Skin test reactors and interferon gamma test positive animals removed

The burden of TB in Lincolnshire to the tax payer is low in terms of the number of incidents and the number of cattle slaughtered.

State money is predominantly spent on TB testing and compensation for reactors. The annual number of cattle slaughtered for TB purposes is shown in Figure 8. In 2019, APHA removed 36 skin and 29 IFN- γ reactors. The IFN- γ test has a higher sensitivity and lower specificity than the comparative skin test and so will disclose more TB positive animals than

the skin test, often at an earlier stage of infection; this seeks to reduce the duration of an incident and minimise spread.

The burden to the individual farmer of TB controls is variable. The effect on cattle herds of movements on restrictions is dependent on the type of business. Stock will be moved on to finish or for breeding purposes and the main impact of a TB incident is on the restrictions to move cattle off the premises. However, as many of the affected farmers in Lincolnshire are finishing units who sell cattle direct to slaughter, the impact of movement restrictions may be small. For smaller herds relying on sales of store cattle, movement restrictions can prove more problematic. Cattle movements off TB restricted farms in Lincolnshire during 2019 were through Approved Finishing Units (AFUs) in the Edge Area and HRA, or through approved market sales for TB-restricted cattle, of which Newark Livestock Market in Nottinghamshire was the closest.

In addition to looking at the duration of incidents (Figure 5 and associated text), the number of animals removed for TB control purposes should be examined. Knowing the number of reactors in an incident gives a tangible overall picture of the herd and area's TB status. Table A3.2 presents the number of reactors per incident for all cases (OTF-W and OTF-S). For OTF-S cases, the mean number of skin reactors (including unresolved inconclusive reactors) found was 1.3, with 1 being the median. For OTF-W cases, the mean number was 4 and median 3.5. However, one OTF-W case had 15 skin reactors, which constitutes over half of the skin reactors found from OTF-W cases in 2019, thus skewing the data. If IFN- γ test positive animals are included for OTF-W herds, the median number of reactors per incident was 7.5 with a mean of 8.83. These figures suggest that within-herd spread of TB is uncommon in Lincolnshire. In addition cattle density in Lincolnshire is low and so the risk of between-herd or wildlife spread is very low.

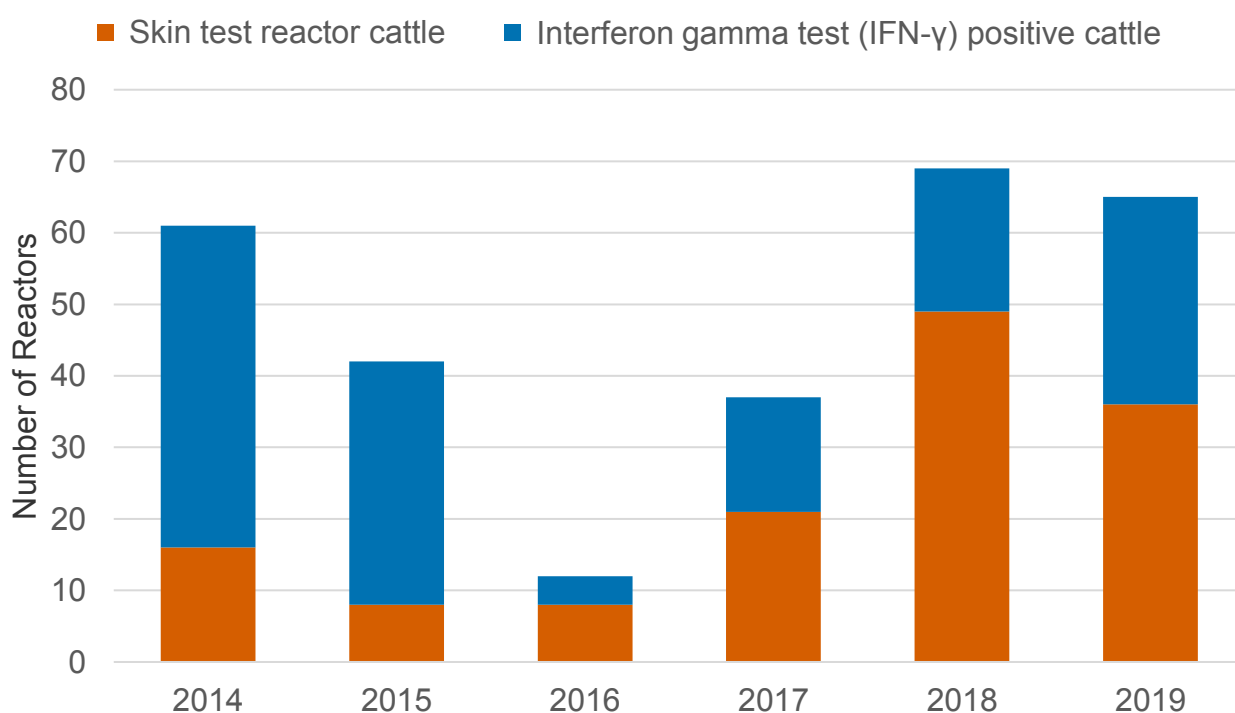


Figure 8: Number of skin test reactors and interferon gamma (IFN- γ) test positive cattle removed by APHA for TB control reasons, in Lincolnshire, 2014 to 2019.

Summary of risks to Lincolnshire

There are two main risks to spread into and within Lincolnshire:

- Risky trading practices: buying in cattle from high risk sources that could bring disease with them
- Local spread in and around HS23 near Grantham from the adjoining Edge Area in north-east Leicestershire, where a level of endemic TB is highly suspected.

Summary of risks from Lincolnshire to the surrounding areas

Other than the shared risk with Leicestershire in potential hotspot area HS23, Lincolnshire represents very low risk to the TB status of neighbouring counties.

Assessment of effectiveness of controls and forward look

The current controls are keeping the incidence of TB in Lincolnshire under control and overall the disease incidence remains low. There is some suspicion of local spread within HS23. Testing in addition to routine surveillance (predominantly post-movement and radial testing) is helping to detect infected herds early, before they develop into substantial incidents. If this testing is maintained alongside improvements to biosecurity and encouragement to farmers to adopt more responsible cattle sourcing practices, the outlook remains positive for Lincolnshire maintaining its low-risk status.

Appendices

Appendix 1: overview of risk and surveillance areas of England and Low Risk Area objectives and controls

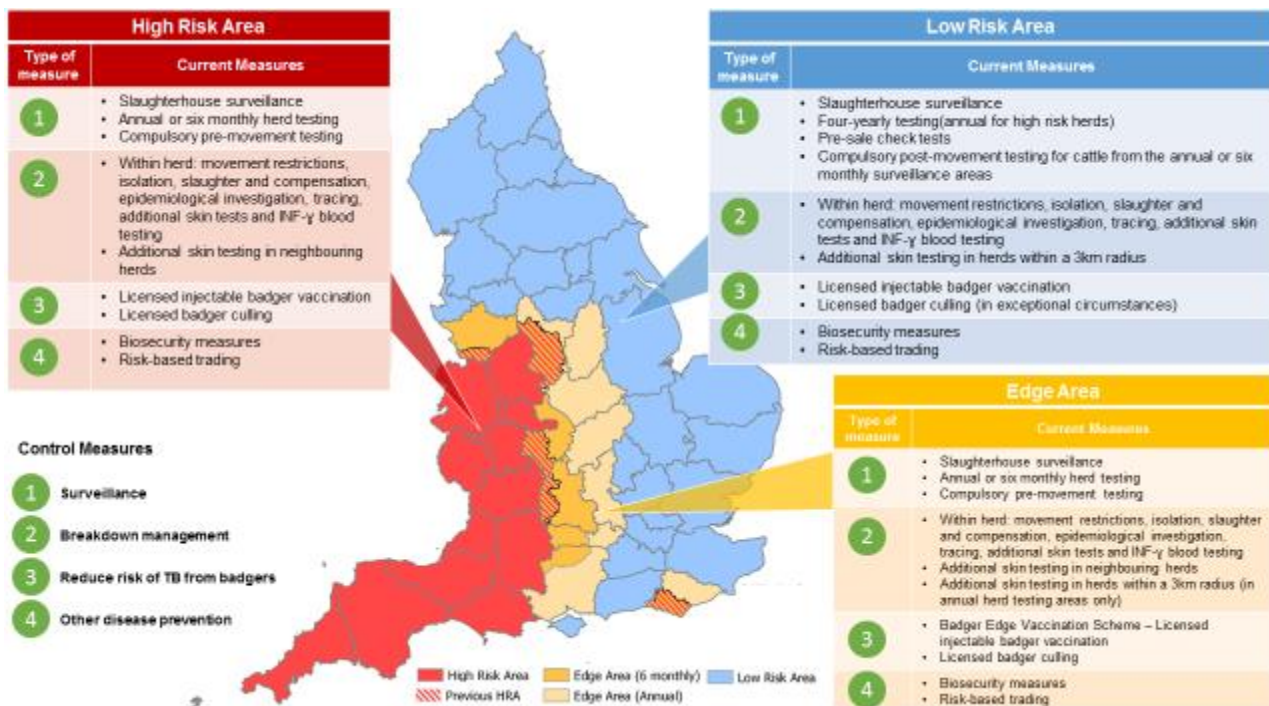


Figure A1.1: TB risk and surveillance areas of England effective since January 2018, as set out in the Government's Strategy for Achieving Officially Tuberculosis-Free Status for England. Map based on information published on www.tbhub.co.uk.

Policy objectives for the Low Risk Area

Progressive attainment of OTF status for individual counties (or groups of counties) within the current LRA, with the declaration of OTF status for all LRA counties by 2025. For more information about the government's strategy for achieving Officially Bovine Tuberculosis Free status for England, published in 2014 and independently reviewed in 2018, see:

<https://www.gov.uk/government/publications/a-strategy-for-achieving-officially-bovine-tuberculosis-free-status-for-england>

<https://www.gov.uk/government/news/government-sets-out-next-phase-of-strategy-to-combat-bovine-tuberculosis>

Key control measures in the Low Risk Area

Surveillance:

- default four-yearly routine surveillance (skin) testing of cattle herds, with annual testing for a small proportion of high risk herds
- voluntary pre-sale skin check tests
- compulsory pre and post-movement testing for cattle entering farms in the LRA (to live) from the annual or six monthly surveillance areas of England and Wales
- additional targeted surveillance (radial testing) of cattle herds located within a 3km radius of new incident herds with OTF status withdrawn (OTF-W) following the detection of lesion-positive test reactors and/or culture-positive animals
- slaughterhouse (SLH) surveillance (through PM meat inspection) of all cattle slaughtered for human consumption

Management of incidents:

- herd movement restrictions, isolation and rapid slaughter of TB test reactors and any direct contacts with statutory compensation payments to farmers, epidemiological investigation, tracing tests (at severe interpretation), and short interval skin testing supplemented in all herds affected by OTF-W incidents with mandatory interferon gamma (IFN- γ) blood testing

TB controls in the wildlife reservoir (badgers):

- licensed injectable badger vaccination
- licensed badger culling in exceptional circumstances, where *M. bovis* infection has been confirmed in badgers and it has a clear epidemiologically link with a local cluster of TB in cattle (e.g. East Cumbria TB hotspot)

Other measures:

- biosecurity measures
- promotion of responsible sourcing of cattle (e.g. through the use of the ibTB online (www.ibtb.co.uk) mapping application)

Summary of enhanced TB control measures in Lincolnshire

There has been strengthened collaboration between APHA and Local Authorities during 2019, which resulted in improved monitoring and enforcement of post-movement testing. Local Authorities have been adopting a more proactive role in communications with farmers and APHA has kept Local Authorities abreast of TB control policy changes.

During 2019 there were no changes in routine surveillance testing intervals for specific herds or parishes in Lincolnshire. There were no IFN- γ test exemptions granted.

One new Official Veterinary (OV) practice set up in Lincolnshire during 2019 and this provided an opportunity to engage with the vets on their key role in combating TB through good standards of skin testing. Auditing of TB testers continued in collaboration with Veterinary Delivery Partners.

All incidents in Lincolnshire received a bespoke disease investigation visit from an APHA veterinarian. This visit enabled the veterinarian to gather information about the farm, likely source and potential spread of disease. They also represented a good opportunity to provide advice to the affected farmers on biosecurity, herd management risk practices and risk-based trading.

Appendix 2: cattle industry in Lincolnshire

Table A2.1: Number of cattle premises by size band in Lincolnshire at 1 January 2019.
(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 in Lincolnshire	5	363	135	127	72	29	21	752	108	54

*The number of herds with an undetermined size.

Table A2.2: Number of animals by breed purpose in Lincolnshire at 1 January 2019.

Breed Purpose	Beef	Dairy	Dual purpose	Unknown	Total
Number of Cattle in Lincolnshire	66,663 (82%)	13,246 (16%)	1235 (1%)	5 (<0.01%)	81,149

Appendix 3: summary of headline cattle TB statistics

Table A3.1: Herd-level summary statistics for TB in cattle in Lincolnshire between 2017 and 2019.

Herd-level statistics	2017	2018	2019
(a) Total number of cattle herds live on Sam at the end of the reporting period	947	924	923
(b) Total number of cattle herds subject to annual TB testing (or more frequent) at the end of the reporting period (any reason)	38	99	141
(c) Total number of whole herd skin tests carried out at any time in the period	221	280	328
(d) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	202	241	254
(e) Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB2 restrictions)	923	890	881
(f) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period.	943	916	910
(g) Total number of new TB incidents detected in cattle herds during the report period	11	12	15
• OTF status suspended (OTF-S)	8	6	9
• OTF status withdrawn (OTF-W)	3	6	6
(h) Of the new OTF-W herd incidents, how many:			
• occurred in a holding affected by another OTF-W incident in the previous three years?			5

<ul style="list-style-type: none"> could be considered secondary to a primary incident based on current evidence? 			1
<ul style="list-style-type: none"> were triggered by skin test reactors or 2xIRs at routine herd tests? 			5
<ul style="list-style-type: none"> were triggered by skin test reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, post-movement, etc.)? 			0
<ul style="list-style-type: none"> were first detected through routine slaughterhouse TB surveillance? 	1	1	0
(i) Number of new incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds			
<ul style="list-style-type: none"> OTF-S 	0	2	4
<ul style="list-style-type: none"> OTF-W 	0	2	3
(j) 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)	3	5	5
(k) New confirmed (positive <i>M. bovis</i> culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	0

Table A3.2: Animal-level summary statistics for TB in cattle between 2017 and 2019.

Animal-level statistics (cattle)	2017	2018	2019
(a) Total number of cattle tested in the period (animal tests, blood and skin)	32,375	37,130	47,698
(b) Reactors detected in tests during the year:			
• tuberculin skin test	21	49	36
• additional IFN- γ blood test reactors (skin-test negative or IR animals)	16	20	29
(c) Reactors detected during year per incidents disclosed during year *	3.36	5.75	4.33
(d) Reactors per 1000 animal tests	1.14	1.86	1.36
(e) Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs)			
• DCs, including any first-time IRs	0	1	12
• Private slaughters	0	1	5
(f) SLH cases (tuberculous carcasses) reported by the Food Standards Agency (FSA) during routine meat inspection	5	4	3
(g) SLH cases confirmed by culture of <i>M. bovis</i>	1	1	0

* Note: If an animal is skin positive and IFN- γ positive, then it will be classed in the skin positive row only, to avoid duplication.

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

Table A4.1: Suspected sources of *M. bovis* infection for all of the new OTF-W and OTF-S incidents identified in Lincolnshire, in 2019.

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	4	1			7.1%
Cattle Movements	8	7	2		42.1%
Contiguous					0.0%
Residual Infection					0.0%
Domestic Animals					0.0%
Non-specific Reactor	2	1			7.1%
Fomites	2	1			6.7%
Other Wildlife	2				2.4%
Other or Unknown Source					34.5%

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 for England 2019

(<https://www.gov.uk/government/publications/bovine-tb-epidemiology-and-surveillance-in-great-britain-2019>).

Appendix 5: assessment of the origin of (and potential for spread of infection from) all of the new OTF-W incidents identified in the report period

A risk matrix was used to identify isolated incidents that were likely to have been introduced to the LRA by cattle movements, while not causing any onward local spread. The following two questions were considered for each incident, and a score attributed. TB incidents with a score of 1A, 1B or 2A may be removed from the county TB incidence calculations during an application for OTF status (but remain in the incidence calculations in this report).

What is the probability of *M. bovis* infection being introduced to the LRA via infected cattle movements?

1. Definite - for example, traced reactors found in the LRA OTF-W incident herd in question as a result of spread tracings from another TB incident herd, genotype/WGS linked.
2. Likely - for example, a Reactor or IR originated from a previous incident herd (and the genotype does not suggest otherwise), other cattle were moved into the herd from previous incident herd (but were subsequently slaughtered without testing), or the trading practice of herd provides likely evidence (purchasing large numbers of cattle from High Risk Area (HRA), or Edge Area, High and Intermediate TB areas of Wales, or from the island of Ireland).
3. Possible - not a closed herd, but cattle are purchased from the LRA, Scotland and/or EU Member States.
4. Not likely - indigenous infection is known in the locality, closed herd, genotype/WGS has been identified in local wildlife.

What is the probability of this being an isolated, sporadic ('one-off') incident, without secondary local spread from the index case?

- A. Likely - no secondary incidents have been detected. There are **no** further incidents as a result of spread tracings anywhere and **no** genotype/WGS linked OTF-W incidents within 3km radial zone around the LRA OTF-W incident herd in question (or the 3km radial surveillance zone was not triggered).
- B. Possible - no secondary incidents have been detected, but the dataset is incomplete. For example, incidents have occurred in the 3km radial zone, but only OTF-S ones, or, if OTF-W, they were of an unknown/different genotype.
- C. Not likely - secondary spread from the index case, or exposure to a common wildlife source has occurred. For example, OTF-W incidents have occurred in the 3km zone linked by genotype or WGS, or there is known wildlife infection in the area with this genotype/close WGS.

Table A5.1: Risk matrix of the veterinary assessment of the origin of, and potential for spread of infection from, all the new OTF-W incidents identified in 2019

Probability of <i>M. bovis</i> infection introduced through cattle movements (1, 2, 3, 4)	Probability of isolated, sporadic ('one-off') incident, without secondary local spread from the index case (A, B, C)		
	A. Likely	B. Possible	C. Not likely
1. Definite			
2. Likely		3	
3. Possible		3	
4. Not likely			

Appendix 6: herd incidence of TB in England

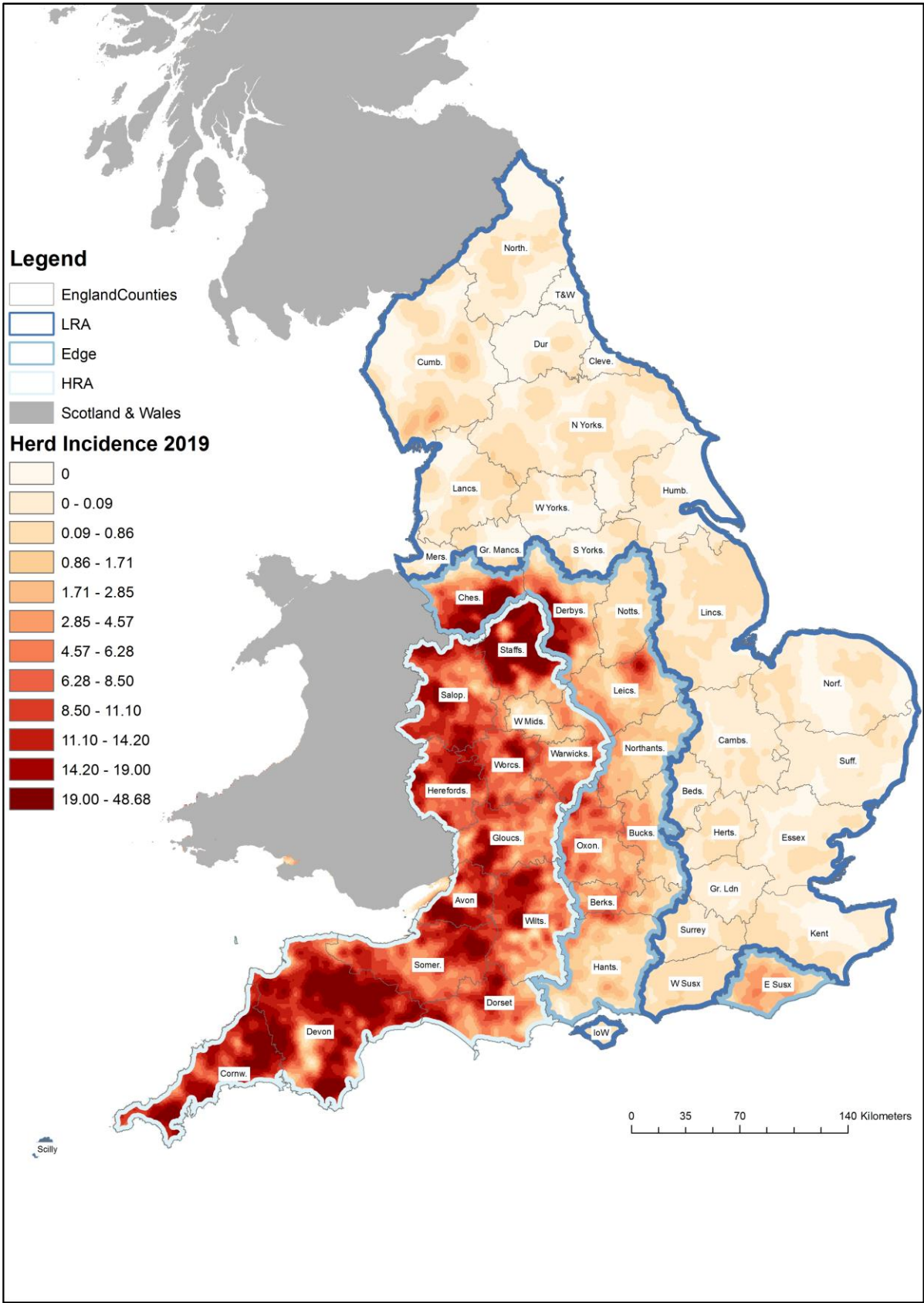


Figure A6.1: Herd incidence of TB in 2019 (incidents per 100 Herd Years at Risk), represented as a spatial kernel of the 100 closest herds per km².



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