Animal Health and Veterinary Laboratories Agency

Bovine tuberculosis:

Infection status in cattle in GB

Extract of the executive summary and figures

From the annual surveillance report

For the period

January to December 2011

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List of figures (in order of appearance in the report)

Executive summary

New bovine TB breakdowns in Great Britain

- In 2011, there were 4938 total new bTB breakdowns, of which 3207 were classified as **OTF-W** breakdowns and 1731 as **OTF-S** breakdowns, which includes a total of seven unclassified breakdowns on 10th October 2012. Overall, the total number of new breakdowns in Great Britain (GB) increased non-significantly by 5.1% in 2011 relative to 2010 ($p \approx 0.1$). The number of OTF-W breakdowns increased by 7.4%, but there was little change in the number of OTF-S breakdowns (1711 in 2010; 1731 in 2011). Of the 4938 bTB breakdowns disclosed in GB in 2011, 3207 (65%) were OTF-W, a similar proportion to 2010 (63.5%).

- **Since the beginning of 2003, the relative rate of increase of OTF-W new breakdowns has fallen by more than half compared with 1986-2000**; in the period January 2003- December 2011, OTF-W new breakdowns doubled every 9.5 years. The doubling time of all bTB breakdowns since the start of 2003 has been longer at 12.1 years (Figure 2.6).

- In GB in 2011, there were 7.4 new bTB breakdowns per 100 herd years at risk. This means that for every 1000 unrestricted herds that were tested in a year, one would expect a new bTB incident to be detected in 74 herds. For England, new bTB breakdowns would be expected to be detected in 92 herds per 1000, in Scotland, 3 herds per 1000 and in Wales, 92 herds per 1000.

- There was an increase in the number of OTF-W new breakdowns per 100 live herds in 2011 relative to 2010 (11% increase). This reflected an increasing absolute number of breakdowns and a 3% decline in the number of live herds.

- The herd incidence expressed as OTF-W breakdowns in *unrestricted herds tested* also increased by 6.3% between 2010 and 2011 (Figure 3.2).

- The number of OTF-S breakdowns per 100 live herds increased by 4.1% between 2010 and 2011, but there was a 0.3% reduction in the number of OTF-S breakdowns per 100 unrestricted herds tested.

- **In 2011, 398 (8.1%) of total new breakdowns, and 245 (7.6%) of OTF-W new breakdowns were disclosed through pre-movement testing (PrMT).** This was not statistically different to the percentage of total breakdowns (7.4%, $p=0.3$) and OTF-W breakdowns (6.6%, $p=0.2$) identified by PrMT in 2010.

- In GB, 15% of total new breakdowns and 23% OTF-W new breakdowns were disclosed through slaughterhouse surveillance, which increased non-significantly by 1% in 2011 relative to 2010 (14% and 22%, respectively, $p=0.3$).

- Overall, the median duration of OTF-W breakdowns increased non-significantly in 2011 by 1.5 days (median 221.5; inter-quartile range 158 to 351) compared to 2010 (220; 156 to 375) ($p>0.05$). OTF-S breakdowns were 18 days longer in 2011 than 2010 ($p<0.001$).

Variation between Countries

- There was an overall increase (5.1%) in the total number of new breakdowns between 2010 and 2011. In England the number increased by 6.2%, and accounted for 78% of the total new breakdowns in GB. Wales increased by 1.7% and Scotland showed a 4.5% reduction in the number of total new breakdowns.

- The number of OTF-W breakdowns increased in GB by 7.4% in 2011 compared to 2010 (Table 2.1). There was an 8.9% increase in England, accounting for 84% of all OTF-W breakdowns. The number of OTF-W breakdowns increased in Wales by 0.8% and in Scotland there was a 16.7% decline. The relative increases and decreases of OTF-W and OTF-S incidences between 2010 and 2011 were insignificant across all countries ($p>0.05$).

- The number of OTF-W breakdowns **per 100 live herds** increased in England and Wales (and GB overall), but in Scotland there was a small reduction from 0.09 to 0.07. OTF-W incidence in Wales and GB overall remains at below 4% of all cattle herds and for England, at below 5%.

- There is a 6.3% overall increase in GB in the number of OTF-W breakdowns **per 100 *unrestricted* herds** tested between 2010 and 2011, an 11.2% increase in England and a 0.5% increase in Wales. Scotland saw a 37.2% reduction in the number of OTF-W breakdowns per 100 unrestricted herds tested (Figure 3.2).

- Substantial **reductions** of greater than 20% in the number of OTF-W new breakdowns were observed in South and West Glamorgan in Wales, and Lancashire and North Yorkshire in England (Table 3.2). Reductions of greater than 20% were also observed in the following counties, but were derived from very low numbers the previous year: West Midlands, Cambridgeshire, Essex, Hertfordshire, Norfolk, Surrey, Durham, Humberside, North Yorkshire (Southern), West Yorkshire, Ayrshire, East Lothian, Fife, Lanarkshire and Perthshire.

- Substantial **increases** in the number of OTF-W new breakdowns in 2011 compared to 2010 were observed in; Avon (+21%), Cornwall (+21%), Warwickshire (+90%), East Sussex (+100%), Hampshire (+30%), Oxfordshire (+46%), Staffordshire (+31%) and Clwyd (+67%). Increases of greater than 20% were also observed in the following counties, but were derived from very low numbers in the previous year: Berkshire, Buckinghamshire, Cumbria, Lincolnshire, Nottinghamshire, Mid Glamorgan and Wigtown. Northumberland also showed an increase of 1 breakdown in 2010 to 8 in 2011 (+700%).

- The duration of OTF-W breakdowns that ended in 2011 varied by country ($F=5.53$, $p=0.004$). OTF-W breakdowns in Wales were significantly longer than in England or Scotland ($p<0.001$).

Variation between different herd sizes and type

- The proportion of OTF-W breakdowns in Beef herds decreased non-significantly in 2011 (p=0.68) and the proportion of 'Other' herds increased non-significantly from 2010 to 2011 (p=0.23) but there was a significant increase in the proportion of OTF-W breakdowns in Dairy herds, increasing from 57% of Dairy herds in 2010 to 60% in 2011 (p=0.03).

- The proportion of all new breakdowns in 2011 varied significantly between herd type and testing interval (p=0.001). The proportion of beef herds in 4-yearly tested areas was greater compared to yearly tested areas. The proportion of Dairy herds was higher in 2-yearly tested areas compared to yearly tested areas.

- When comparing the proportion of OTF-W breakdowns by country and herd type, there was no significant difference in 2011 (p=0.63), but the proportion of OTF-S breakdowns differed significantly across herd type and country in 2011 (p=0.005). In both OTF-W and OTF-S breakdowns, the proportion of Beef herds was highest in Scotland and in Dairy, was Wales for OTF-W and England for OTF-S breakdowns.

Routine slaughterhouse surveillance

- The number of OTF-W incidents disclosed by the inspection of routinely slaughtered cattle by the FSA in 2011 was 745, an increase of 14% on 2010 and nearly a quarter (23.2%) of all new OTF-W incidents. The proportion in England was greater than that in Wales (24.4% vs. 16.5%; p<0.001), a phenomenon that was accentuated after Health Check Wales in 2008. The proportion in Scotland has tended to be large since 2005; in 2011 it was 50%, but based on only ten OTF-W breakdowns. A greater proportion of OTF-W breakdowns have been disclosed by routinely slaughtered cattle in Beef herds than in Dairy herds since 2002 or before, but the difference in proportion has been narrowing (now 24% vs. 22%).

- Herd tests (check tests) to look for skin test reactors in the herds of origin of slaughterhouse cases found reactors in 41.3% of them, little changed since 2010. The relationship between the proportion of herds of origin that had reactors and the time since the previous herd test was, as usual, weak. Check tests were recorded for all except 21 of the 745 herds; the median time between slaughterhouse case and check test was 63 days (upper quartile 81 days).

- Of the samples from suspected slaughterhouse cases sent to the laboratory, 75.3% yielded *Mycobacterium* bovis and 19.6% yielded *Actinobacillus* spp.

Recurrence

- Of herds that had breakdowns in a 36-month period before 2011, 16.4-19.9% had a further OTF-W breakdown in 2011 and 23.5-25.6% had a further breakdown of any kind in 2011. Herds with a 36-month history of breakdowns were 6.3-8.5 times more likely to have a breakdown in 2011 than herds without such a history. Conversely, around 56% of herds with OTF-W breakdowns in 2011 and around 47% of herds with OTF-S breakdowns in 2011 had a history of a breakdown in the previous 36 months; Wales and England showed similar patterns.

Post-mortem examination

- A total of 34,710 cattle were slaughtered in GB in 2011 with evidence of bTB. Of these, 31,615 (91.1%) were reactors, 2244 (6.5%) were inconclusive reactors and 851 (2.5%) were dangerous contacts

Report on the spoligotype database (SB4020)

- There were 3794 isolates in the spoligotype database genotyped from non-bovine samples cultured in 2011 or cattle breakdowns disclosed in 2011(4578 in 2010) representing 3631 cattle isolates and 163 non-bovine isolates. We obtained full genotype data for 92% of the cattle isolates (representing 87.2% or 2795 of the 3207 OTF-W breakdowns, a dramatic reduction from the 97% in 2010). For each breakdown an average of 1.2 isolates per breakdown were genotyped (1.1 per breakdown in 2010).

- There were 164 non-bovine isolates genotyped in 2011 (175 in 2010). 140 isolates were *M. bovis* and 24 were *M. microti*. The 140 *M. bovis* isolates represent 91 (99 in 2010) separate non-bovine breakdowns (an incident includes multiple isolates from animals in the same location). In general, the genotypes found in non-bovines reflect those found locally in cattle and are typical *M. bovis* genotypes. The exception is feline samples in which, as seen in previous years, *M. microti* ("vole" bacillus) isolates are common. Over 75% of the non-bovine breakdowns are located in the relevant cattle homerange for the genotype.

- Breakdowns among sheep continued to increase in 2011; however, fewer isolates from swine were genotyped in 2011 than in 2010. In general, sheep and swine isolates had genotype frequencies representing the common genotypes found in cattle.

Classification of breakdowns

- Since January 2011, herds have been described by their Official Tuberculosis Free (OTF) status. This can be OTF-W (OTF withdrawn), OTF-S (OTF suspended), or if free from any restrictions, OTF. For consistency we have adopted the same terminology in this report.

- In general, OTF-W corresponds to the previous 'CNI' (confirmed new breakdowns), i.e. those herds suffering a new TB breakdown in which post mortem evidence of *M. bovis* infection is found, but in Wales and Scotland since January 2011 a small proportion of reactor herds without post mortem evidence of infection have been designated OTF-W, but *for the purposes of the analyses in this report such breakdowns have been treated as OTF-S*.

- OTF-S breakdowns describe reactor herds without visible lesions or positive cultures. Some herds that can have their OTF status temporarily suspended after suspect lesions have been observed in a slaughterhouse pending a culture result, when restrictions are served due to overdue tests, or when singleton IRs only are found within three years of a previous OTF-W breakdown; but such herds do not contribute to OTF-S totals in this report.

- Since the epidemiological risk factors on which the status of an OTF-W incident is changed to an OTF-S incident were not available, all OTF-W breakdowns described in this report are incidents in which there is specific post mortem evidence of bovine TB. This evidence can be either (a) the identification of *M. bovis* in cultured tissue from any bovine or (b) the presence of visible lesions in the carcass of a reactor to the skin test or the interferon-gamma test.

1. Cattle demographics in relation to TB

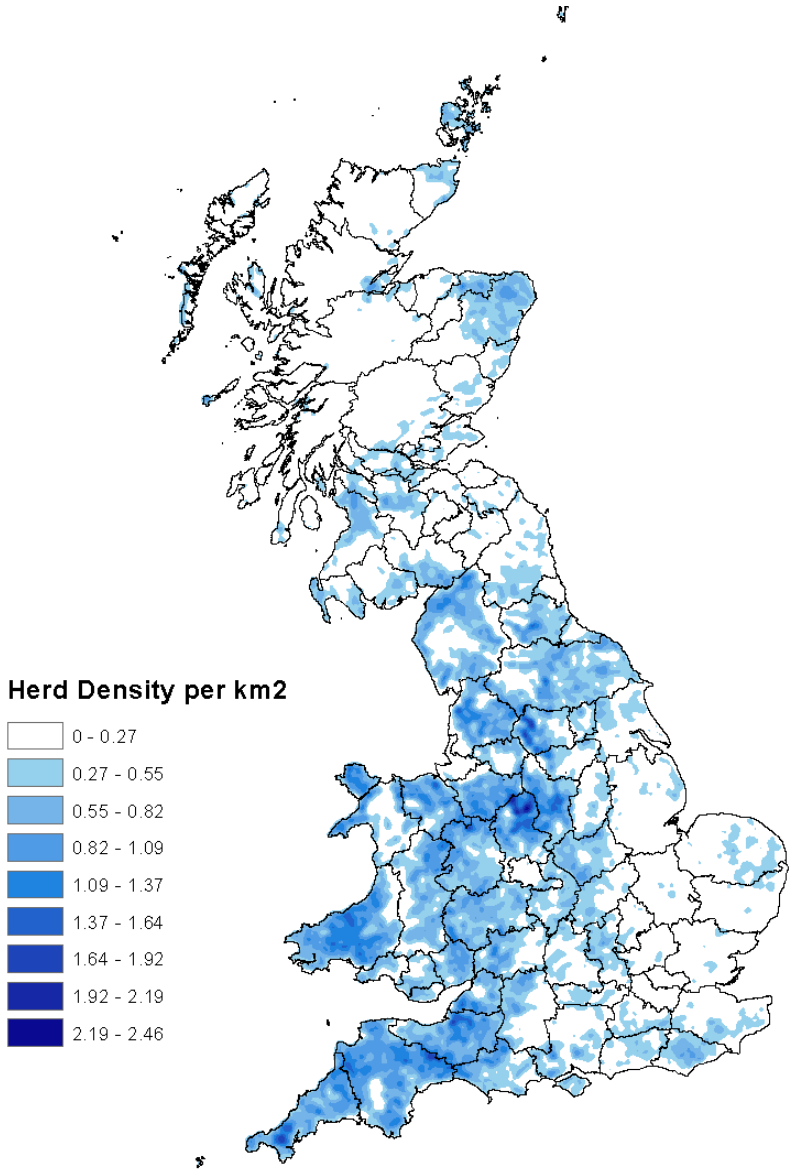

Figure 1.1: The density of live cattle herds registered on Sam in 2011

Figure 1.1 shows wide variation in the number of herds per square km in Great Britain, with large areas having fewer than 0.27 herds per km^2 and a few areas where the herd density was more than eight times greater.

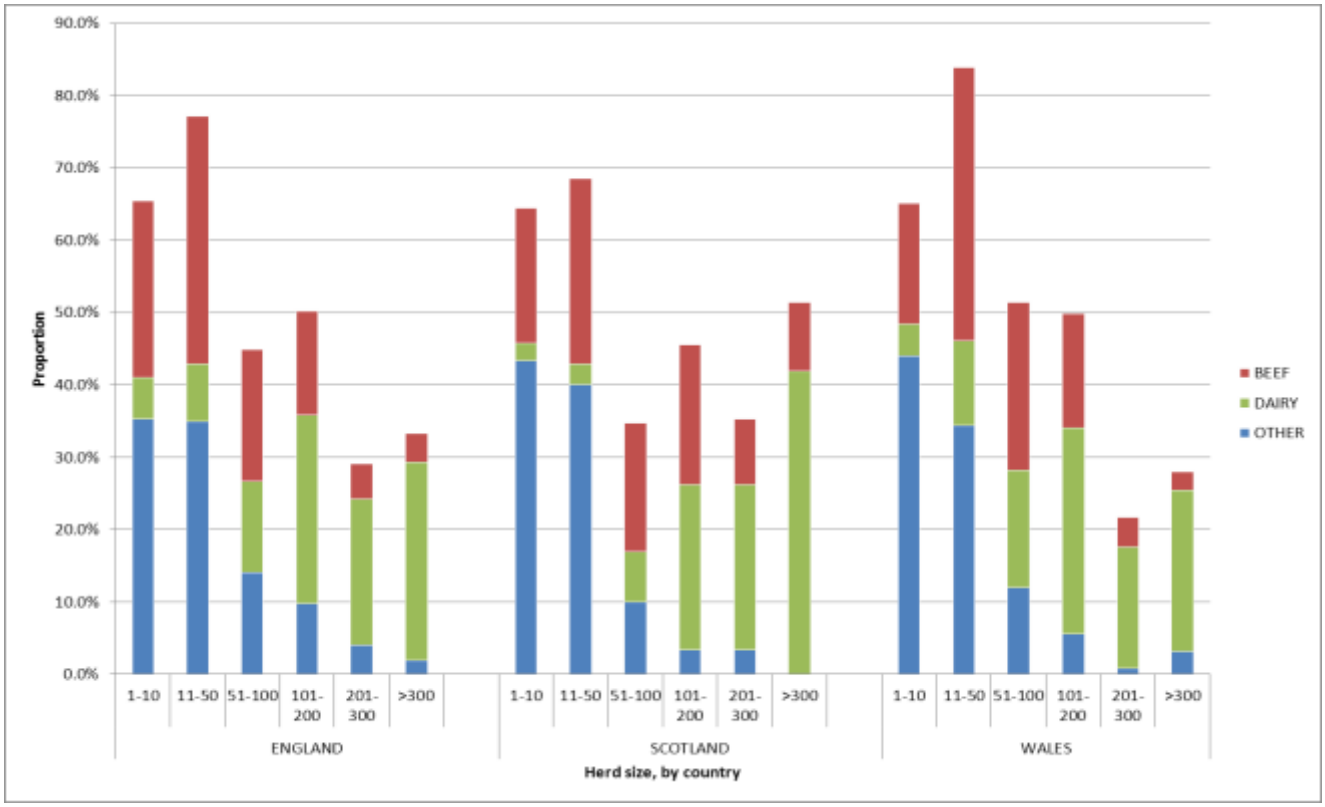

Figure 1.2: The distribution of herd sizes in 2011, by herd type and country.

The distribution of different herd sizes within the three major herd types, by country, is shown in Figure 1.2. In common with previous years, a much smaller proportion of live Beef herds had more than 100 animals, compared to Dairy herds. In England 23% of the total live Beef herds had more than 100 animals, compared to around 74% of Dairy cattle. Wales was fairly similar, with 22% in Beef and 68% in Dairy herds. In Scotland herds tended to be larger than elsewhere, as close to 40% of Beef herds and 88% of Dairy herds had more than 100 animals.

2. The number and geographical distribution of new breakdowns and reactor density

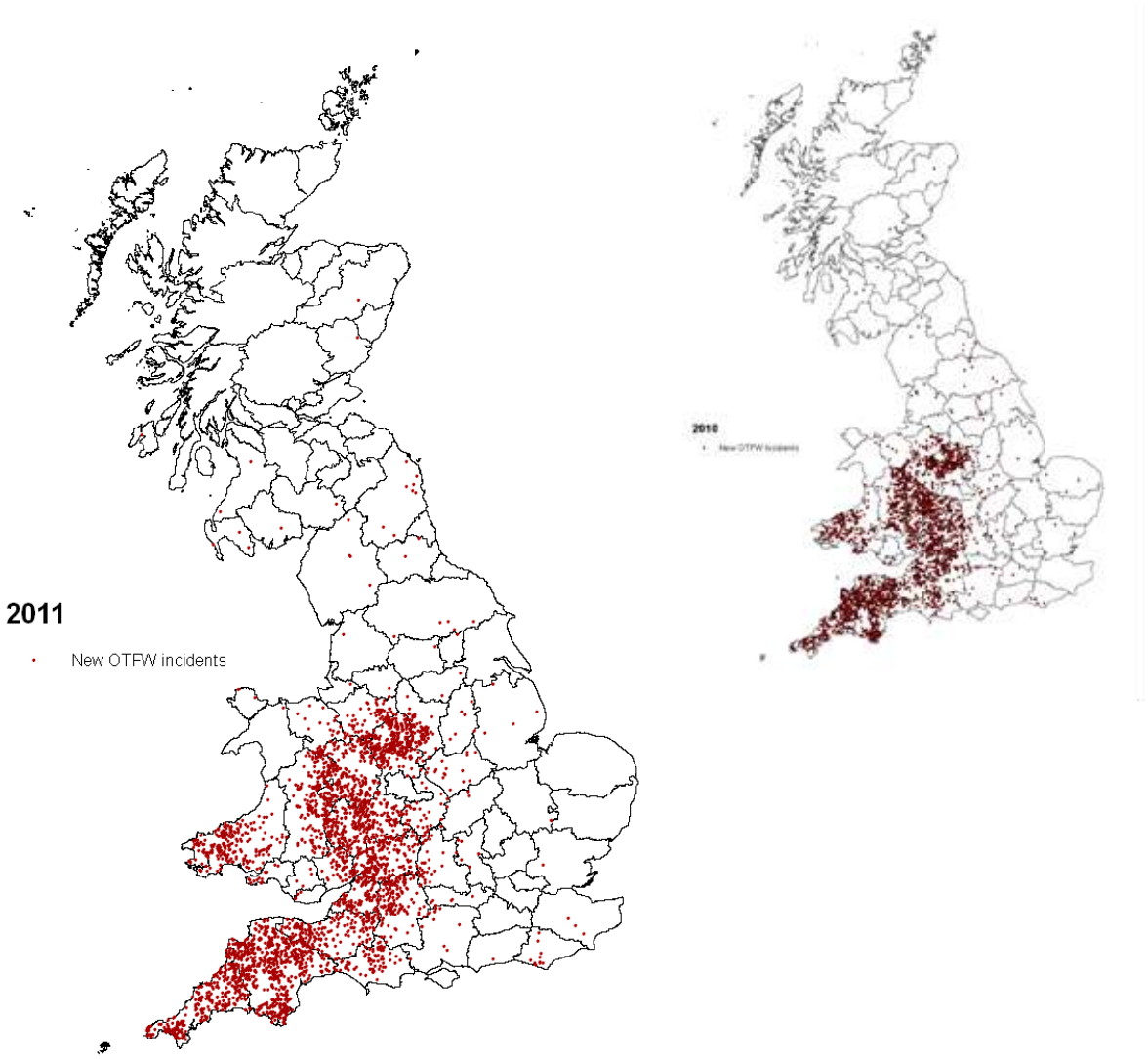

Figure 2.1: Geographical distribution of OTF-W new bovine TB breakdowns between January and December 2011, with inset showing the distribution of OTF-W new breakdowns in 2010

The distribution of OTF-W new breakdowns in GB in 2011 is shown in Figure 2.1. In comparison with 2010 (see inset), increases were observed in the West of England: Avon, Cornwall, Dorset, Gloucestershire and Somerset; East of England: Derbyshire and East Sussex and the North of England: Cheshire, Shropshire, Staffordshire and Northumberland. In Wales, increases were observed in all counties except Powys, and South and West Glamorgan. Sporadic OTF-W new breakdowns continued to be disclosed (where there were no breakdowns in the previous year) and occurred in Kent, Merseyside, and in Scotland; Angus, Argyll, Dumfriesshire and Kirkcudbright.

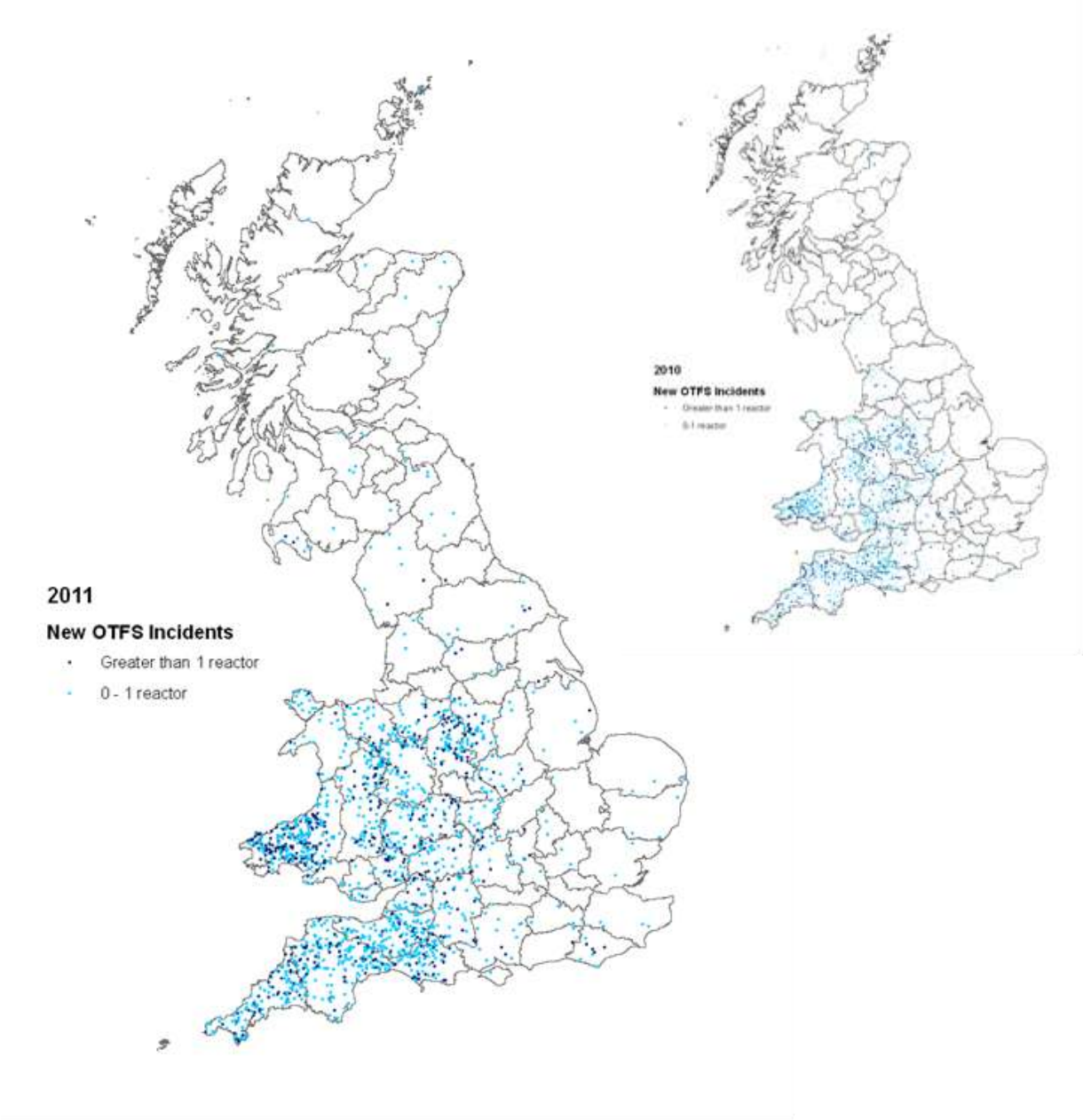

Figure 2.2: Geographical distribution of OTF-S new bovine TB breakdowns between January and December 2011, with inset showing the distribution of OTF-S new breakdowns in 2010

The distribution of OTF-S new breakdowns in 2011 is shown in Figure 2.2 with an inset showing the distribution in 2010. As in previous reports, OTF-S breakdowns have been split into two categories; those with zero or one reactor at the time of data download, and those with two or more. Those with two or more reactors tend to be inside the endemic areas; the South West and West of England and Dyfed and Powys in Wales. Those counties with zero or one reactors were relatively more common in the East and North regions and in Scotland.

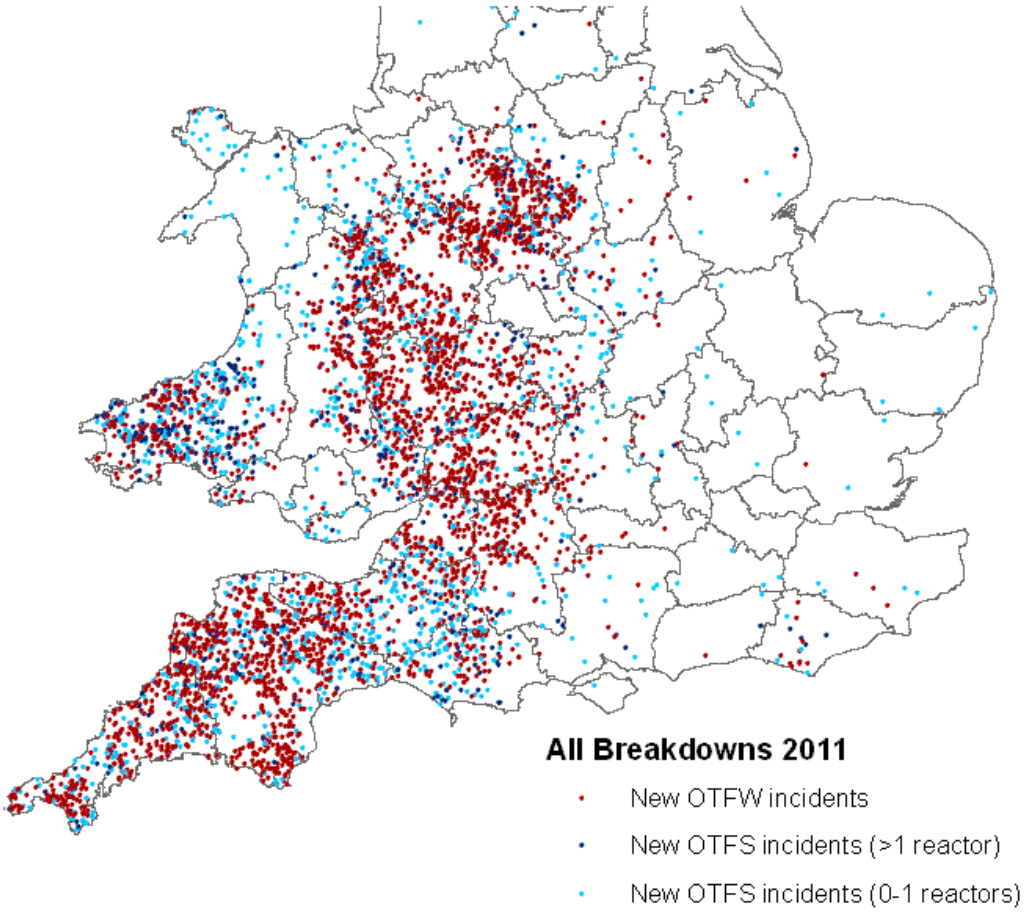

Figure 2.3: Geographical distribution of OTF-W and OTF-S new bovine TB breakdowns in 2011: Detail for the southern part of Great Britain

Figure 2.3 shows all new breakdowns occurring in the southern part of GB; West, East and Wales. The commonly observed pattern in which OTF-S breakdowns tend to surround areas with OTF-W breakdowns was clearly seen in the endemic TB areas with spread of both OTF-W and OTF-S breakdowns eastwards and northwards in the following counties; Buckinghamshire, Cheshire, Derbyshire, East Sussex, Hampshire, Leicestershire, Lincolnshire, Nottinghamshire, Oxfordshire and West Sussex and Clwyd.

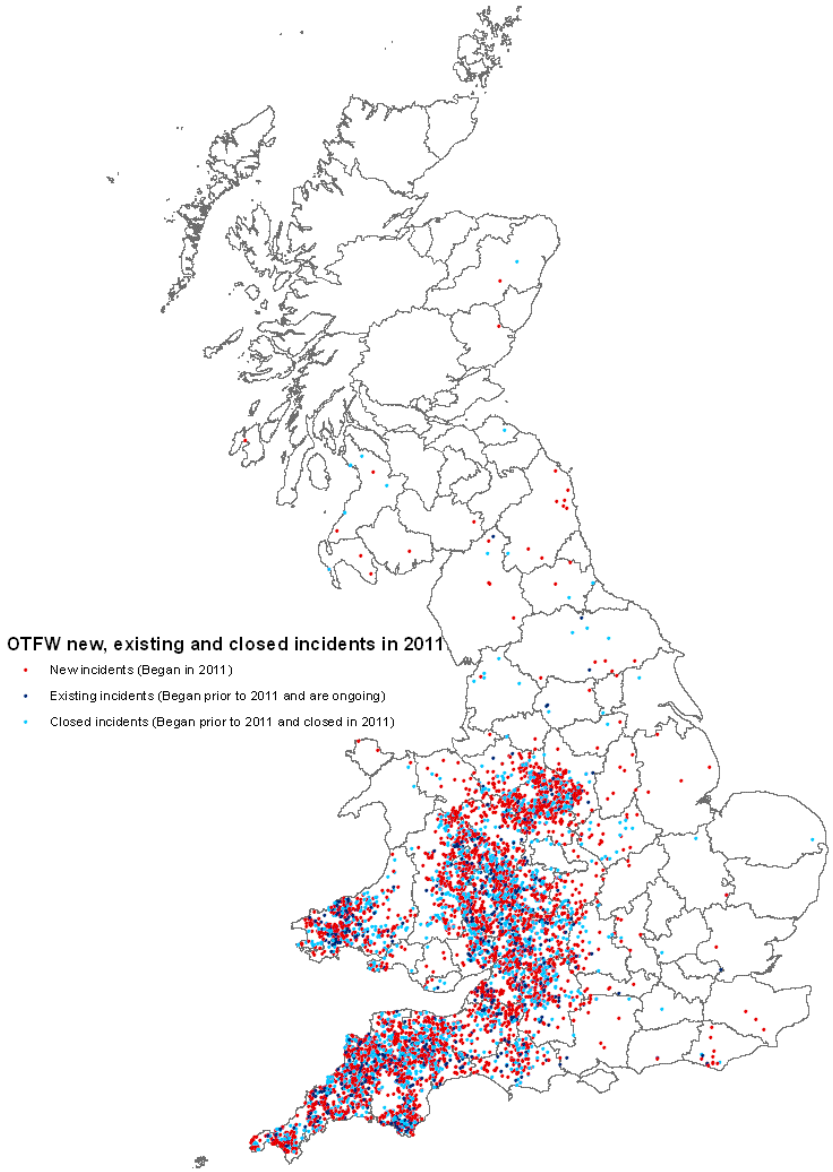

Figure 2.4: OTF-W new, existing and closed breakdowns in 2011

Figure 2.4 display OTF-W breakdowns according to three categories: 1, breakdowns that begin in 2011, 2, breakdowns that began prior to 2011 and end in 2011, and those that are open throughout 2011. Most OTF-W new breakdowns are found in similar locations to existing breakdowns. Spread of new breakdowns northwards and eastwards can be observed in the following counties; Buckinghamshire, Cumbria, East Sussex, Hampshire, Kent, Leicestershire, Lincolnshire, Northumberland, North Yorkshire, Nottinghamshire, Oxfordshire, Surrey and West Sussex.

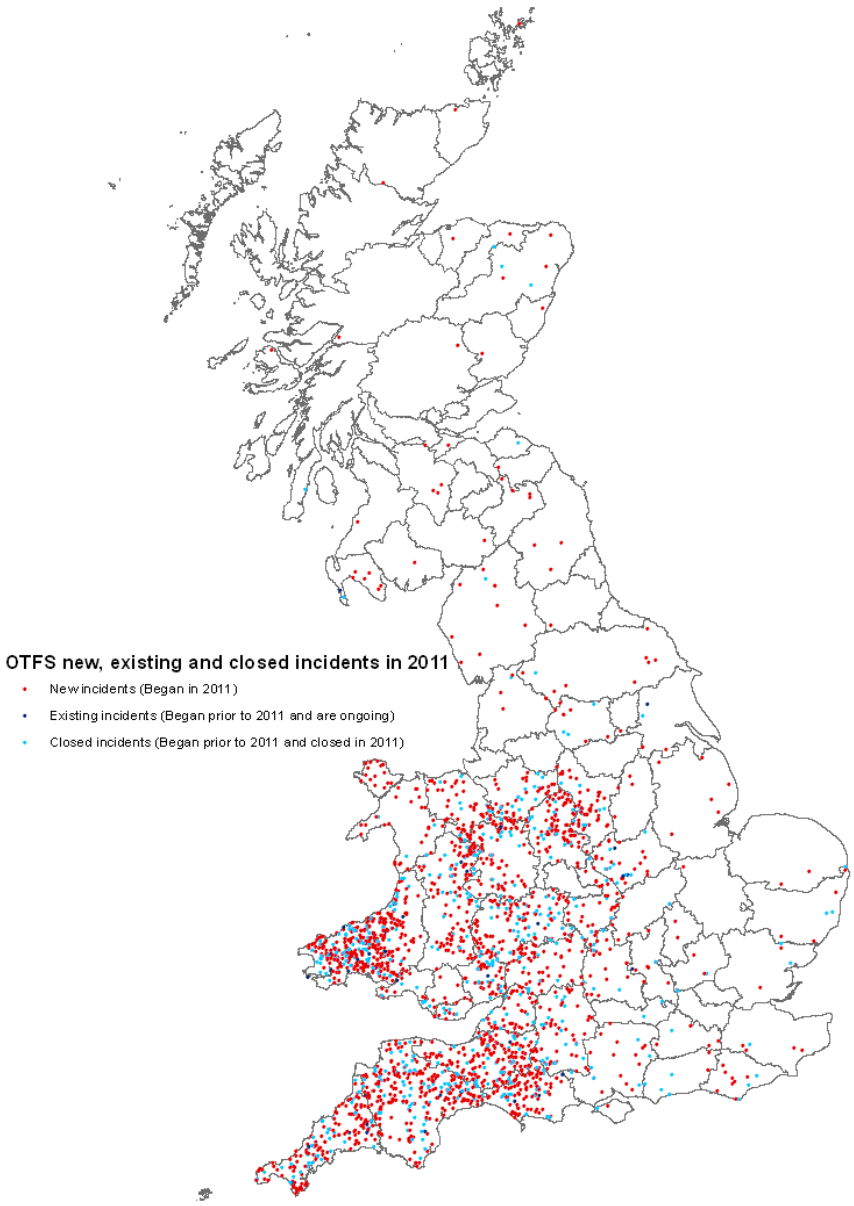

Figure 2.5: OTF-S new, existing and closed breakdowns in 2011

The distribution of new (breakdowns beginning in 2011), existing (breakdowns that are open throughout 2011) and closed (began prior to 2011 and end in 2011) OTF-S breakdowns in GB are displayed in Figure 2.5. OTF-S new breakdowns are often located in areas with existing or closed breakdowns, with some exceptions (Scottish counties, Gwynedd in Wales and Buckinghamshire, Durham, Lincolnshire, Northumberland and Nottinghamshire in England.

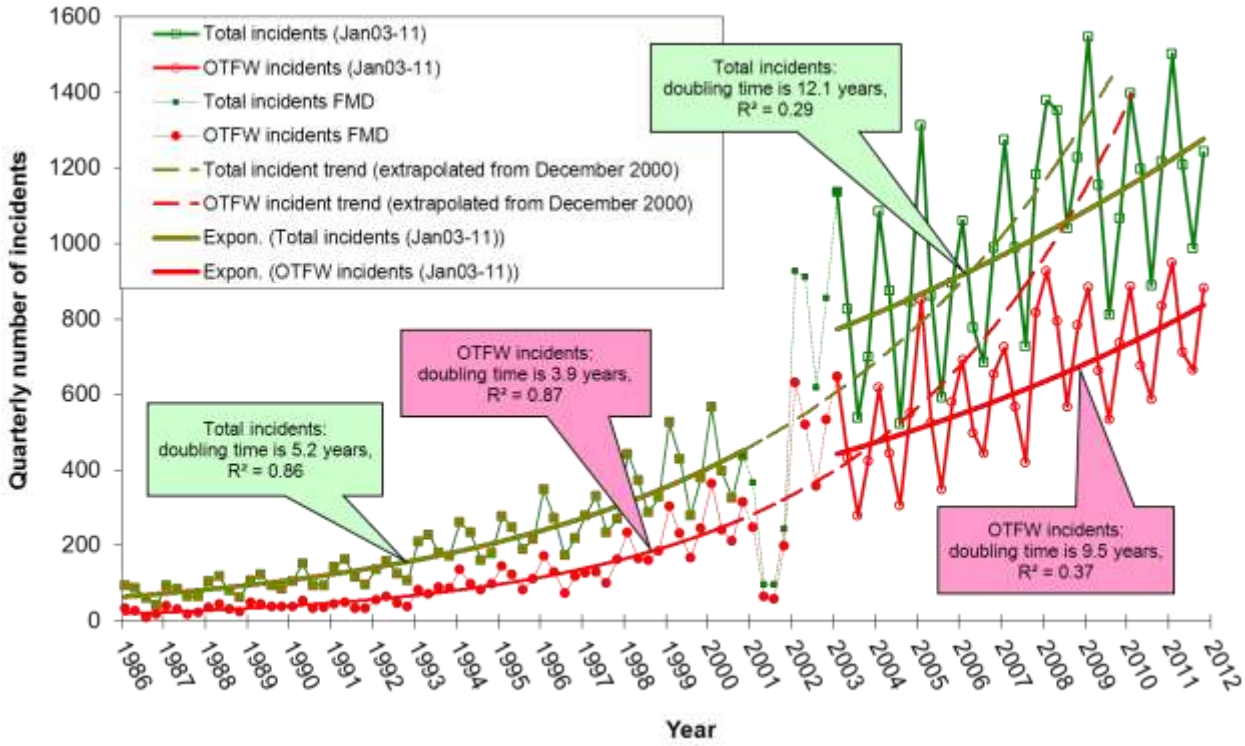

Figure 2.6: Quarterly numbers of total and OTF-W new bovine TB breakdowns between January 1986 and December 2011

The slopes of the exponential trends in Figure 2.6 are expressed as doubling times. Up to 2000, OTF-W new breakdowns doubled every 3.9 years, equivalent to a year on year increase of 19.3%. Since 2002, the relative rate of increase of OTF-W new breakdowns has fallen by more than a half: OTF-W new breakdowns doubled every 9.5 years between January 2003 and December 2011 (slightly increased from every 9.3 years for 2003-2010), and the year-on-year rate of increase was 7.7%.

For total breakdowns, the doubling time since the beginning of 2003 has been longer than for OTF-W breakdowns, at 12.1 years (up from every 11.5 years to the end of 2010) and the year-on-year rate of increase was 6.3%. Pre-FMD, the doubling time was 5.3 years and the year-on-year rate of increase was 19.9%.

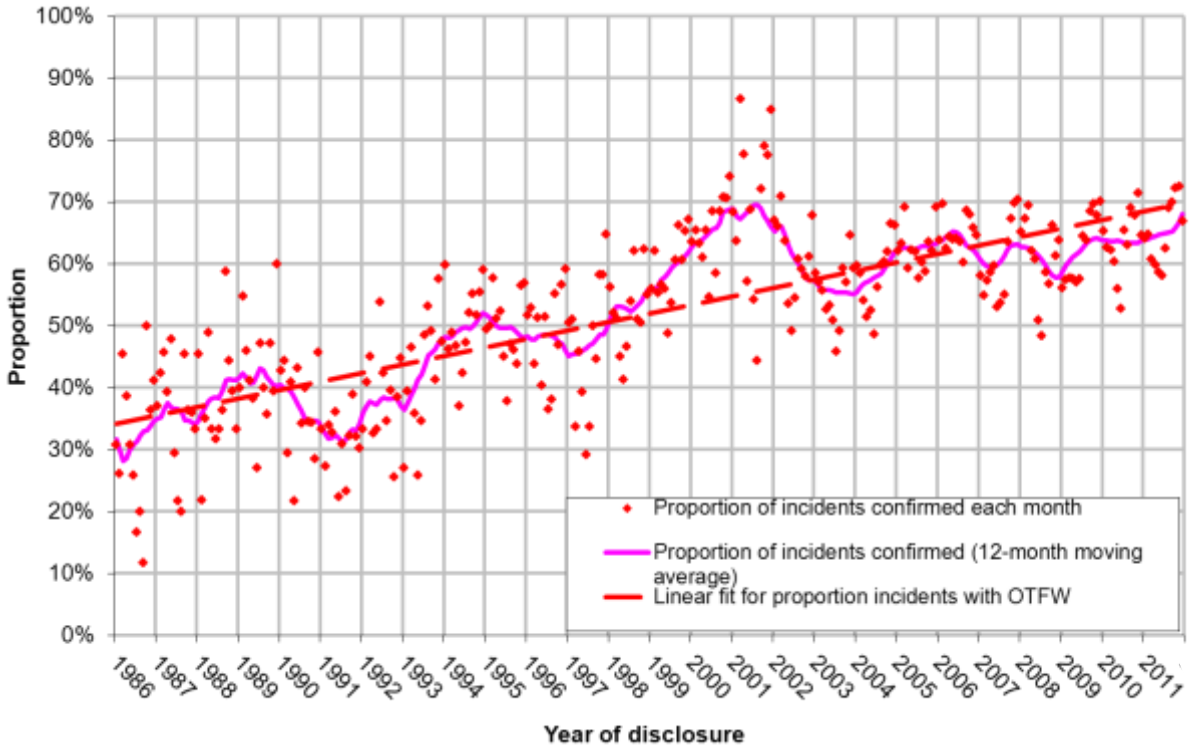

Figure 2.7: Proportion of new TB breakdowns that were OTF-W in GB per month from January 1986 to December 2011

The monthly proportion of breakdowns that were OTF-W in GB between 1986 and 2011 is shown in Figure 2.7. The proportion had been oscillating around 62% since 2005, remaining very slightly below the trend line, rising slightly to 63% including 2011 data. The proportion of total breakdowns that were OTF-W in 2011 was 65% overall which was a slight increase from the previous year.

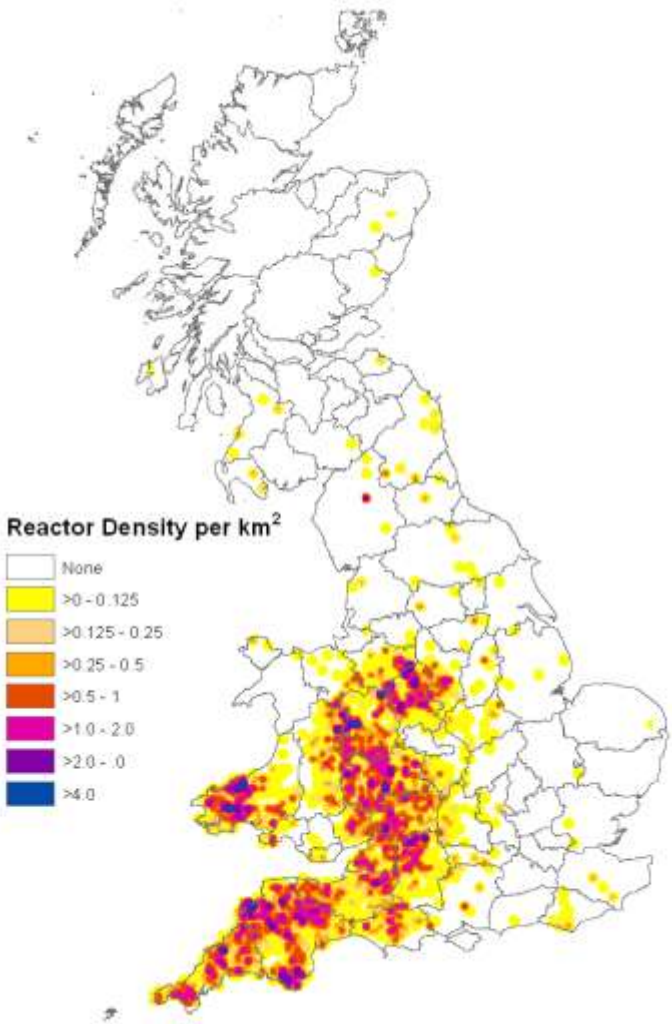

Figure 2.8: Density of skin test, IFN-gamma test reactors and slaughterhouse cases in OTF-W breakdowns per km² taken in 2011

The density of bTB infected cattle in herds per km² is shown in Figure 2.8. Only animals in OTF-W breakdowns that were tested during the reporting year are included in this figure, and comprise skin test reactors, IFN-gamma test reactors and OTF-W slaughterhouse cases. Data was calculated for 5 x 5 km² map squares and was kernel-smoothed using a 6 km search radius. Dyfed, Gwent, Powys, Cornwall, Devon, Somerset, Dorset, Wiltshire, Gloucestershire, Hereford & Worcester, Shropshire, Staffordshire and Derbyshire contained substantial areas in which the density was greater than 1 per km^2. There were some areas which had higher reactor density hotspots in OTF-W breakdowns in 2010 than in 2011, including Surrey, Angus and Norfolk. Nottinghamshire, Northumberland and South Yorkshire showed increases in reactor density in small areas of the county in comparison to 2010.

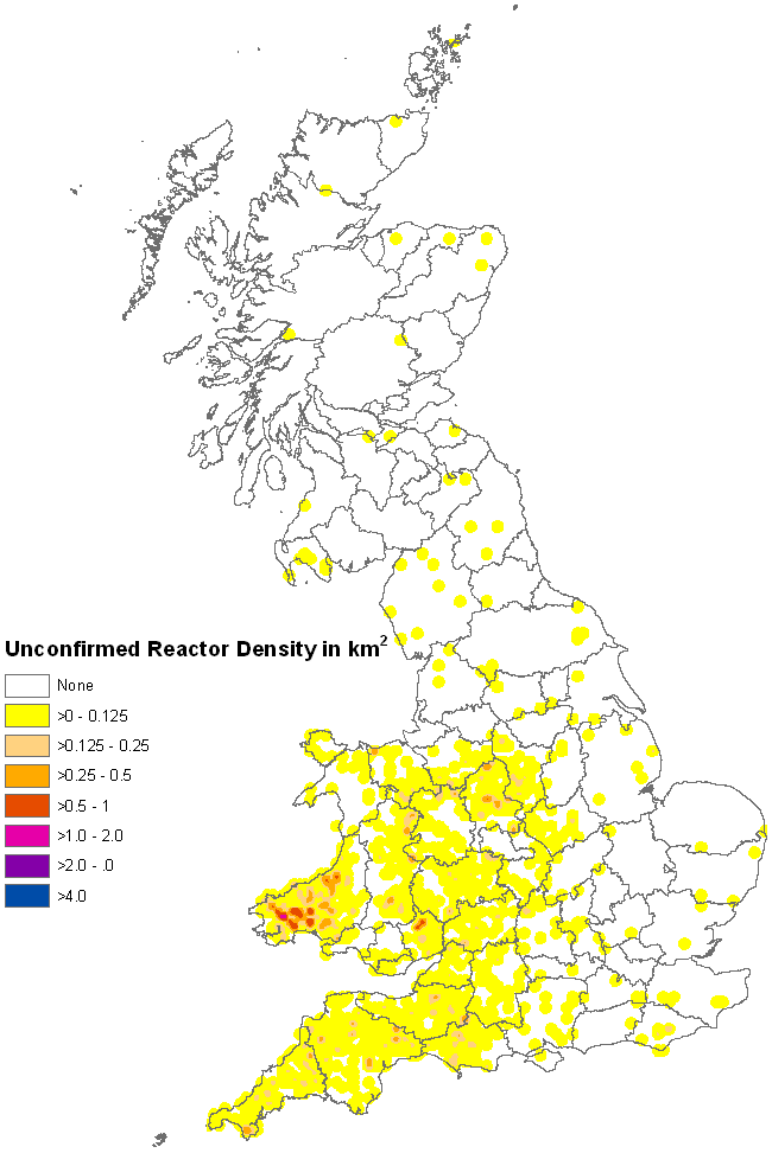

Figure 2.9: Density of skin test reactors taken in OTF-S breakdowns per km² in 2011

The density of skin test reactors in OTF-S new breakdowns per km^2 is shown in Figure 2.9. The geographical distribution of reactor densities in OTF-S breakdowns was similar in 2010 and 2011. However, there were higher densities of reactors in OTF-S breakdowns in Dyfed and Gwent in 2011 compared to 2010 and lower densities in Cheshire, Hereford & Worcester, Staffordshire, Warwickshire, West Sussex and Wiltshire.

3. Herd incidence and prevalence; by country and at county level

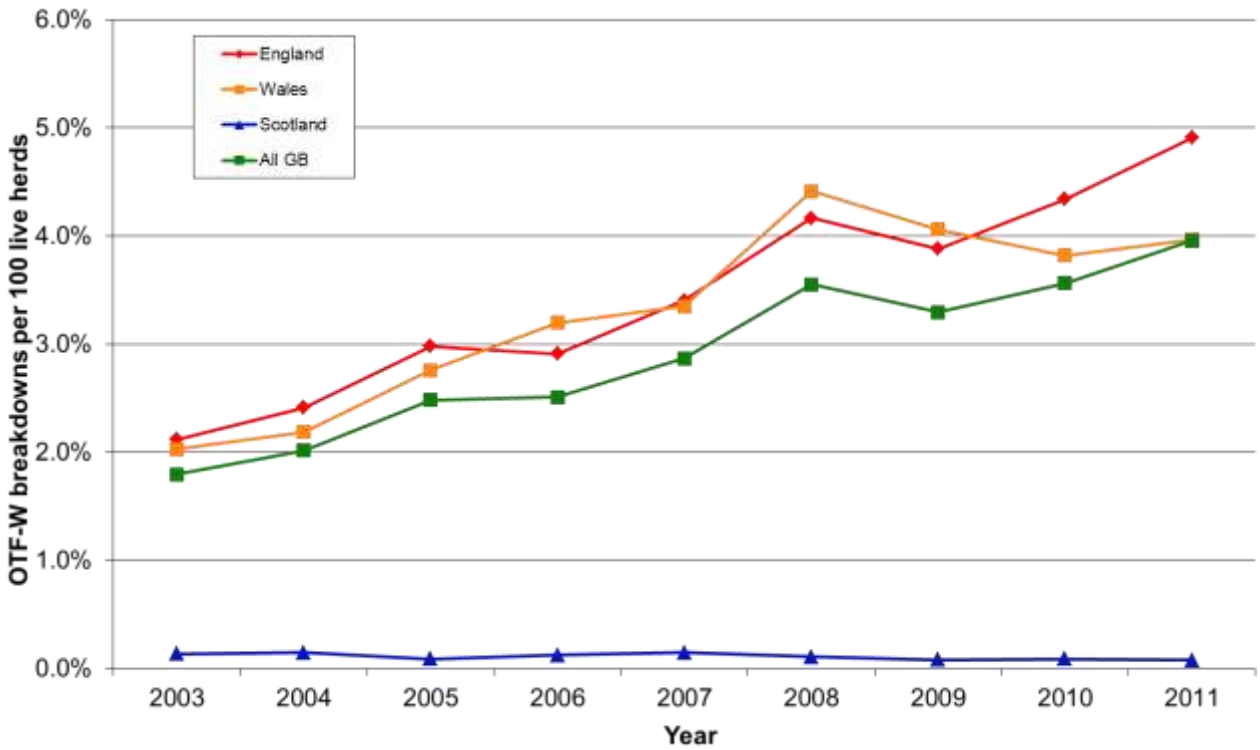

Figure 3.1: Variation in the number of OTF-W new bovine TB breakdowns per 100 live herds between 2003 and 2011 by country

The annual proportion of new OTF-W breakdowns per 100 live herds since 2003 is shown by country in Figure 3.1. Despite an observed decrease between 2008 and 2009 for GB and England, OTF-W incidence has continued to increase. The number of OTF-W new bTB breakdowns per 100 live herds peaked at near 5% in England and close to 4% for GB overall. In Wales, OTF-W new breakdowns decreased from 2008 to 2010 and there has been a plateau in the number of OTF-W breakdowns per 100 live herds from 2010 to 2011 (3.8% to 4% respectively). The percentage of new OTF-W breakdowns remains lower than in 2008, which may be related to the implementation of annual testing of herds (Health Check Wales). In Scotland, OTF-W incidence has remained constant (0.1% or lower) over a long period (2003-2011), with the numbers of breakdowns remaining too low for proportional increases to be of concern.

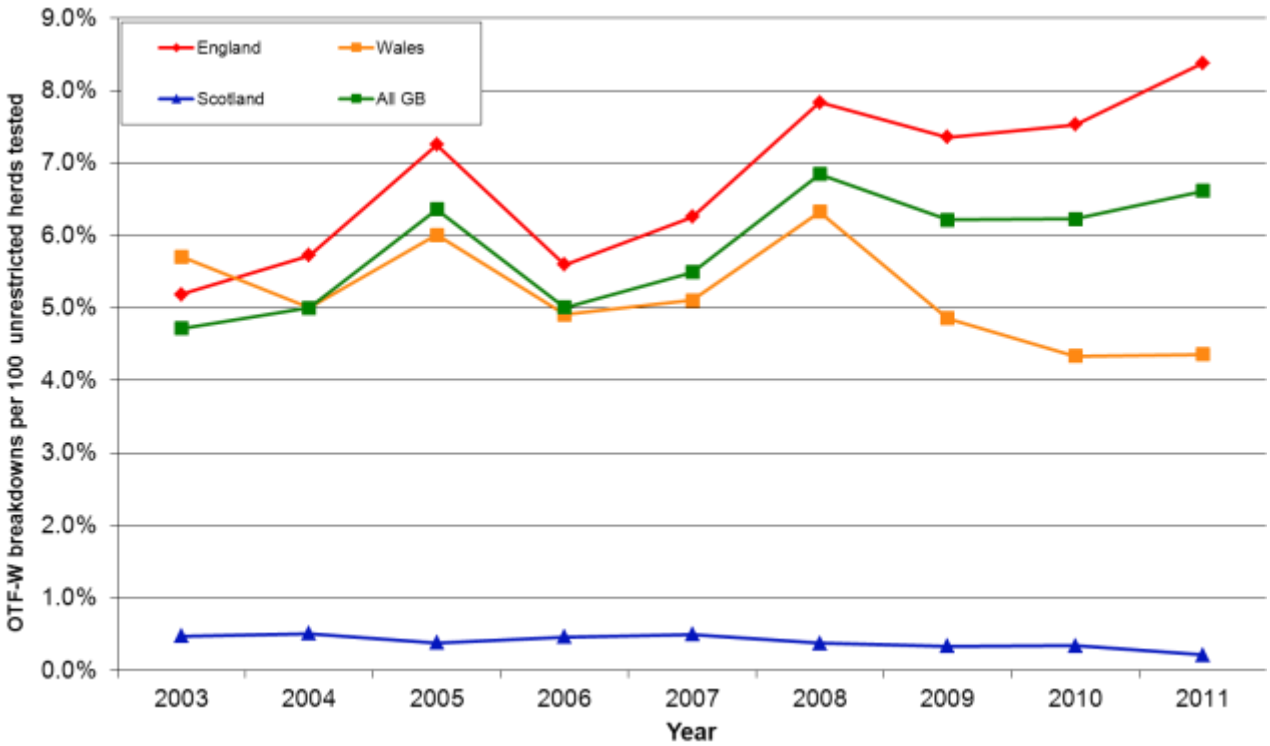

Figure 3.2: Variation in the number of OTF-W new bovine TB breakdowns per 100 unrestricted herds tested between 2003 and 2011, by country

An alternative statistic to compare OTF-W new breakdowns is the number of breakdowns disclosed *per 100 unrestricted herds* tested. The variation in the number of OTF-W new bTB breakdowns per 100 unrestricted herds tested is shown in Figure 3.2. In GB, the decrease in the number of breakdowns per 100 unrestricted herds tested between 2008 and 2009 was not maintained; there was a plateau in 2010 and a further increase in 2011. In England, the number of breakdowns has continued to increase since 2009. In Wales, there has been a decline observed since 2008 which plateaued in 2011, which, as mentioned previously, could be associated with the implementation of Health Check Wales for annual bTB testing. Scotland showed a slight decline in the number of breakdowns in 2011 compared to previous years.

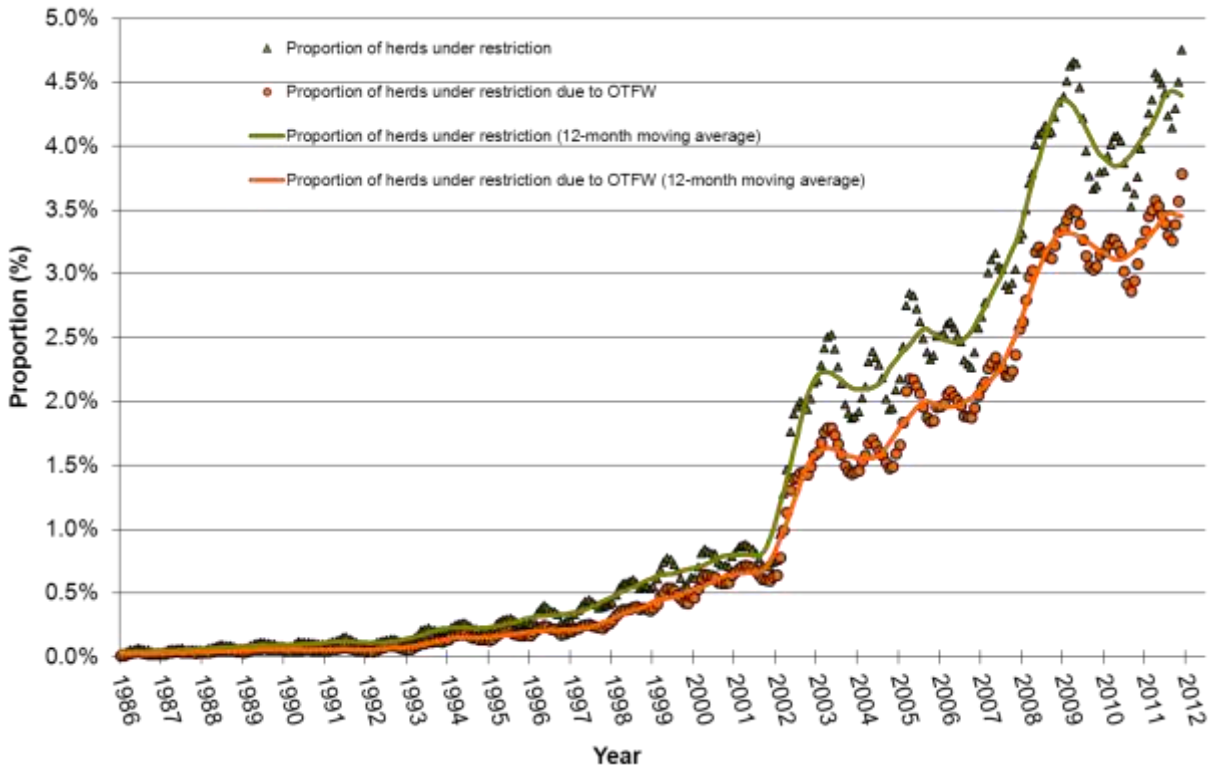

Figure 3.3: Proportion of live GB herds under TB movement restrictions as a result of a TB breakdown by month between January 1986 and December 2011

The proportion of live GB herds under restriction at the middle of each month between January 1986 and December 2011 is shown in Figure 3.3. On average, 4.4% of live herds in GB were under restriction in 2011. The proportion peaked at 4.7% of herds in December 2011 and the rolling average a peak of 4.4% in the autumn of 2011. For OTF-W breakdowns, an increase was also observed, although it was not as steep as for total breakdowns. There are seasonal fluctuations in the proportion of OTF-W and total breakdowns, but the moving average reached a higher level in 2011 compared to the previous peak in 2009. At the end of 2011, the average proportion of live GB herds under restriction for an OTF-W incident was 3.5%. Whilst there were almost equal numbers of OTF-W and OTF-S breakdowns disclosed each year, a much smaller proportion of herds were under movement restrictions due to an OTF-S incident than an OTF-W incident. This results from the much shorter restriction duration of OTF-S breakdowns relative to OTF-W breakdowns, as discussed fully in Section 4. The proportions of live GB herds under restriction prior to 2000 is less than in previous reports due to some older data not being migrated from VetNet into Sam, but this did not affect the pattern shown in Figure 3.3.

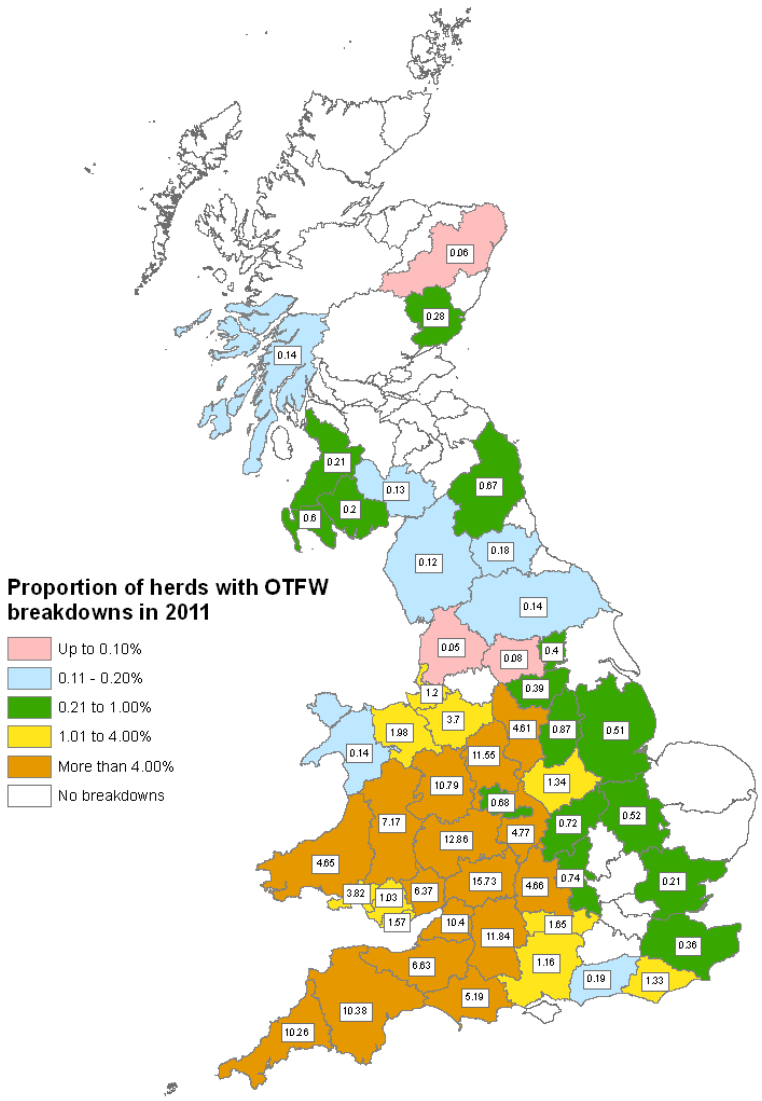

Figure 3.4: Proportion of live herds with OTF-W bovine TB breakdowns by county between January and December 2011: Number of OTF-W new breakdowns of bovine TB per 100 live herds.

The number of OTF-W new breakdowns per 100 live herds in 2011 is shown in Figure 3.4. There were six counties with one or more OTF-W new incident in 2011 that had none in 2010. An incidence of 4% greatly exceeds the criterion for allocating a yearly testing interval, and is seen in large areas of western England and Wales, for example in Dyfed and Powys (Table 3.2). In 2011 there were 16 counties with more than 4 OTF-W new breakdowns per 100 live herds, a slight increase on 2010 (n=14). Nine were in the West of England, two in the North of England (Shropshire (10.8%) and Staffordshire (11.5%)), two in the East of England (Derbyshire and Oxfordshire (both 4.6%)) and 3 in Wales (Dyfed (4.6%), Gwent (6.4%) and Powys (7.2%)). In 2010, Derbyshire and Warwickshire had proportions of OTF-W new breakdowns per 100 live herds of 3.91 and 2.42, respectively; indicating the spread of bTB eastwards and northwards.

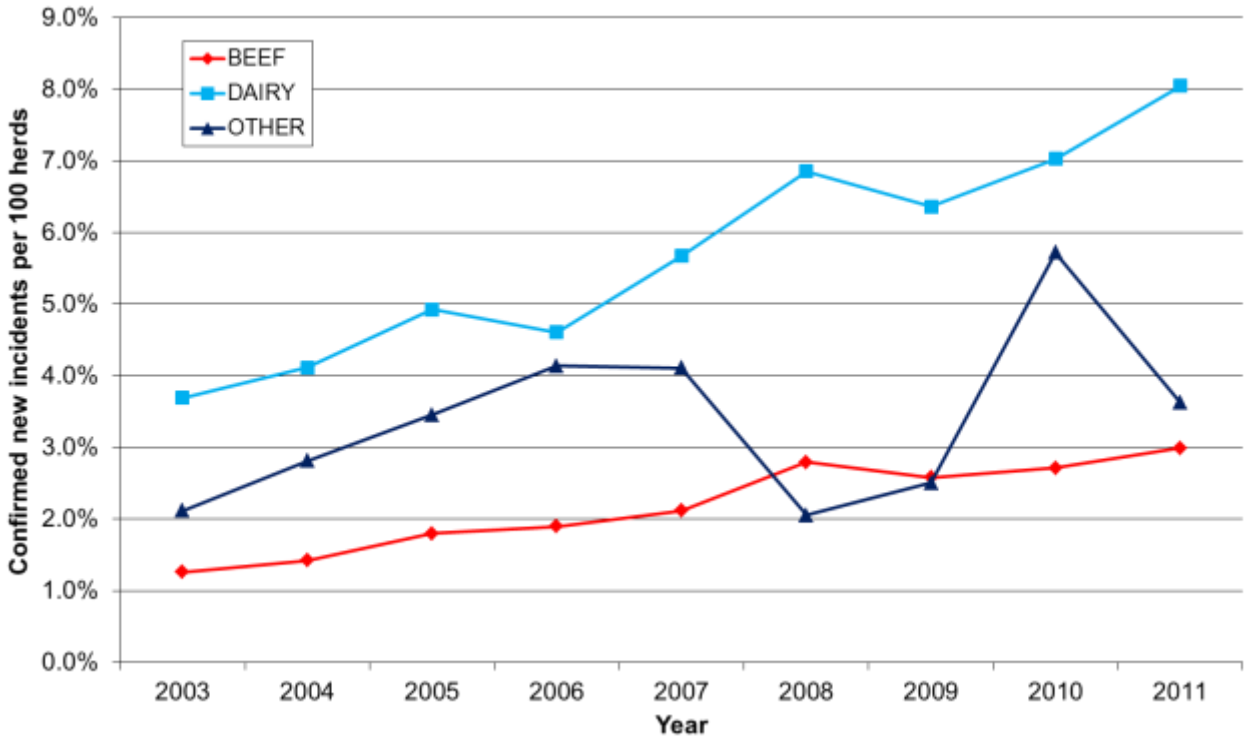

Figure 3.5: The number of OTF-W new breakdowns per 100 live herds by herd type between January 2003 and December 2011

The number of OTF-W new breakdowns per 100 live herds by herd type is shown in Figure 3.5. OTF-W incidence has been on an upwards trend since 2003 in live Dairy herds and this has continued in 2011 to just over 8% of new breakdowns per 100 live herds, with small decreases in 2006 and 2009. OTF-W incidence in Beef herds has consistently been less than half the incidence in live Dairy herds since 2003, and has shown a similar trend in 2011. There was a slight decline in 2008 but the highest incidence in Beef herds was recorded this year at 3%.

Note - the change in definition of Other herds in 2008, which reduced the number of herds in this category, has affected the shape of the graph for this herd category, and the spike in 2010 is likely to be due to the move of data from VetNet to Sam and subsequent re-categorisation of herd but the refresh of the most recent years' data only in these tables/figure. When herd details were transferred into Sam, the number of herd categories was increased in an attempt to better define herds previously classified as 'Other', of which some may not have been cattle herds (e.g. alpacas and other camelids, which tend to have a high bTB incidence).

4. Duration of bovine TB breakdowns and the number of reactors per incident

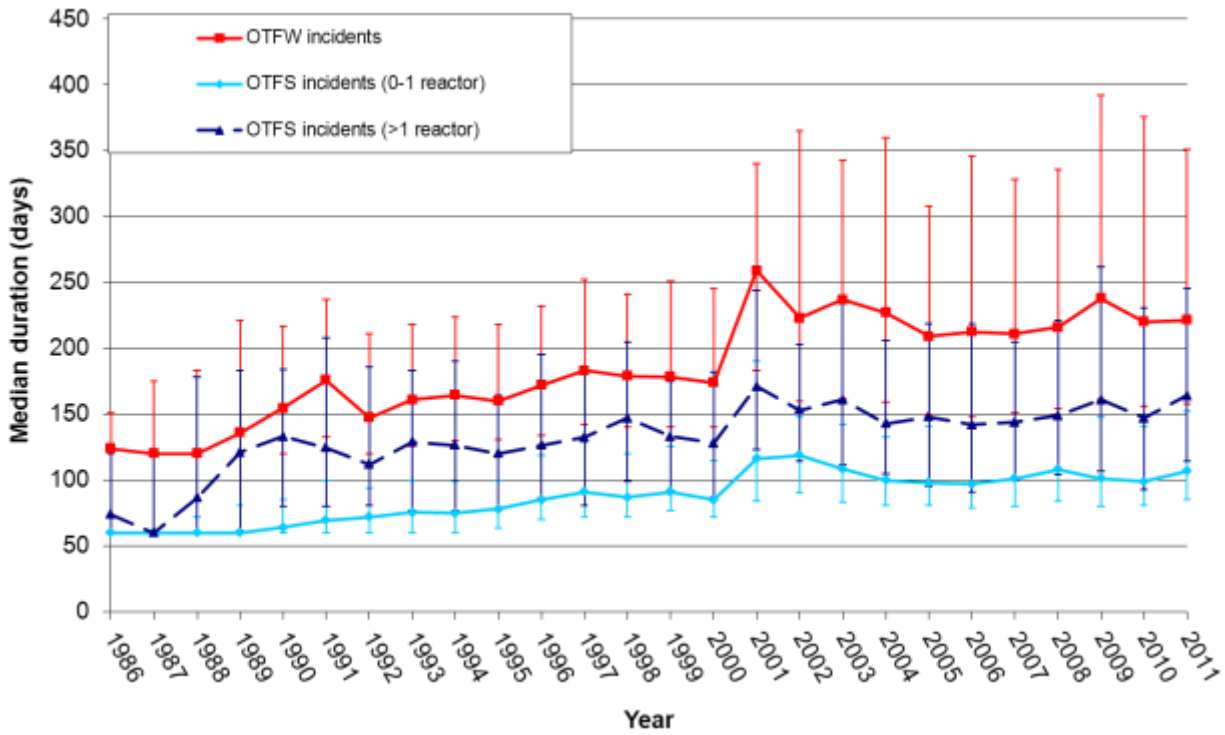

Figure 4.1: The median duration of OTFW and OTFS breakdowns with 0-1 reactors or >1 reactor, ending between January 1986 and December 2011.

The median durations of OTF-W and OTF-S breakdowns that ended each year from January 1986 to December 2011 are shown in Figure 4.1. OTF-W breakdowns were of longer duration than OTF-S breakdowns each year, and OTF-S breakdowns with more than one reactor were of longer duration than breakdowns with 1 or fewer reactors. The median duration of OTF-W breakdowns in 2011 was only one and a half days longer than in 2010. Median durations of OTF-S breakdowns were 18days longer in 2011 (123 days) than 2010 (105) ($p<0.001$).

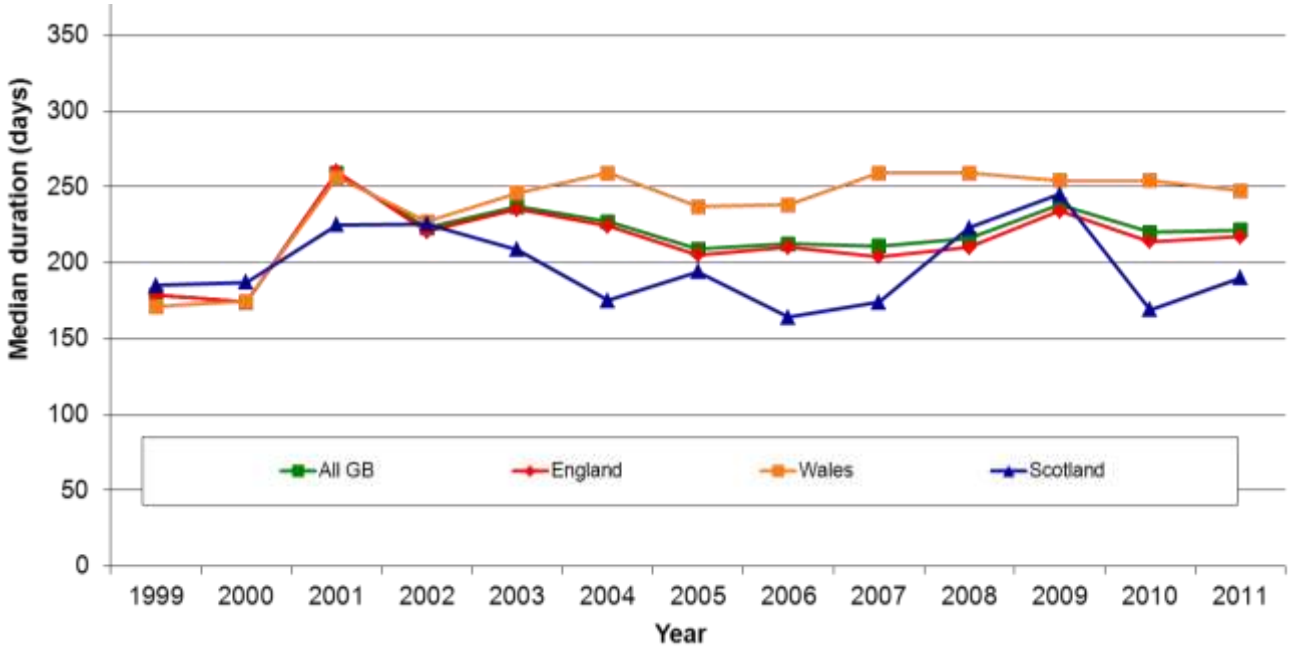

Figure 4.2: Median duration of OTF-W breakdowns ending between January 1999 and December 2011, by Country

Figure 4.2 illustrates the median duration since 2002 for each country and for GB overall. The interquartile ranges have not been plotted for clarity.

Since 2001, Wales has shown a consistently prolonged duration exceeding that for England and Scotland, and GB overall. England is only slightly lower than GB overall, and both have shown a decline from 2009. The median duration in Scotland has increased slightly since 2010.

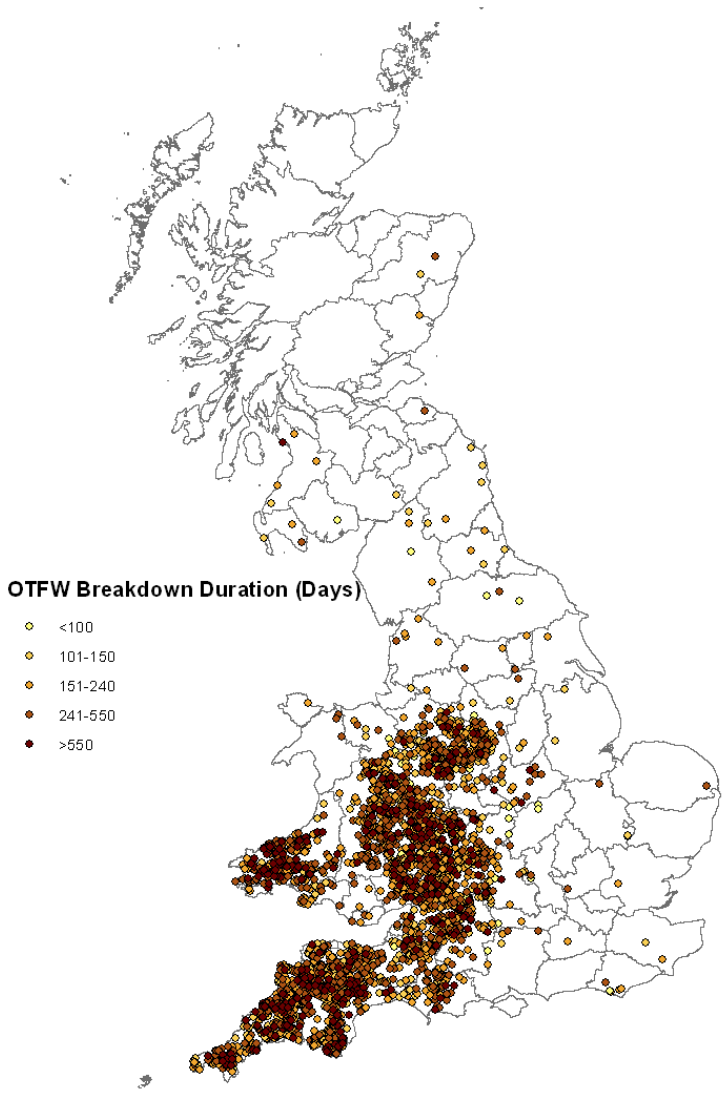

Figure 4.3: Geographic distribution of OTFW bovine TB breakdowns that ended in 2011, according to their duration.

The geographical distribution of durations of restriction in OTF-W breakdowns ending in 2010 is shown in Figure 4.3. Outside of endemic areas, OTF-W breakdowns of long duration (>240 days) were also recorded in: Aberdeenshire, Ayrshire, East Lothian and Wigtown in Scotland, and in Buckinghamshire, Cambridgeshire, Cheshire, Derbyshire, East Sussex, Hampshire, Hertfordshire, Lancashire, Leicestershire, Norfolk, North Yorkshire, Oxfordshire, South Yorkshire and West Yorkshire in England. The number of breakdowns ranged from 1 to 3 for most counties outside endemic areas, apart from Cheshire (25), Derbyshire (28), Leicestershire (10) and Oxfordshire (11).

OTF-W breakdowns of more than three years duration were predominantly located in the West, South West and Wales, but there were also breakdowns of long duration observed in Leicestershire, Oxfordshire and Wigtown.

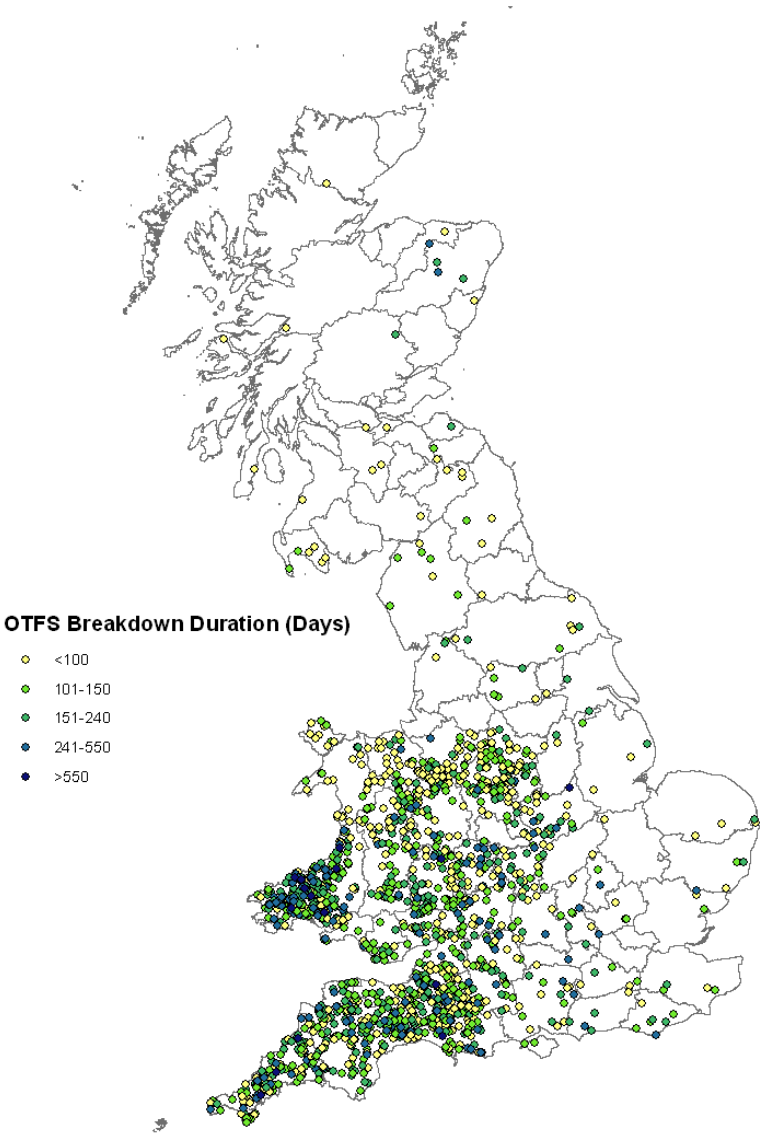

Figure 4.4: Geographic distribution of OTFS bovine TB breakdowns that ended in 2011, according to their duration.

The geographical distribution of different restriction durations of OTF-S breakdowns that were closed in 2011 is shown in Figure 4.4. As with OTF-W breakdowns, OTF-S breakdowns that were restricted for longer than 240 days were predominantly clustered in the endemic regions of Wales and South West England but were also recorded in: Banffshire in Scotland, and Bedfordshire, Berkshire, Buckinghamshire, Cheshire, East Sussex, Essex, Hampshire, Leicestershire, Middlesex, Northamptonshire and West Sussex. The number of OTF-S breakdowns in each county outside of endemic areas ranged from 1-3. Three OTF-S breakdowns ended restrictions after 3 years; two dairy herds in Dyfed and one dairy herd in Cornwall.

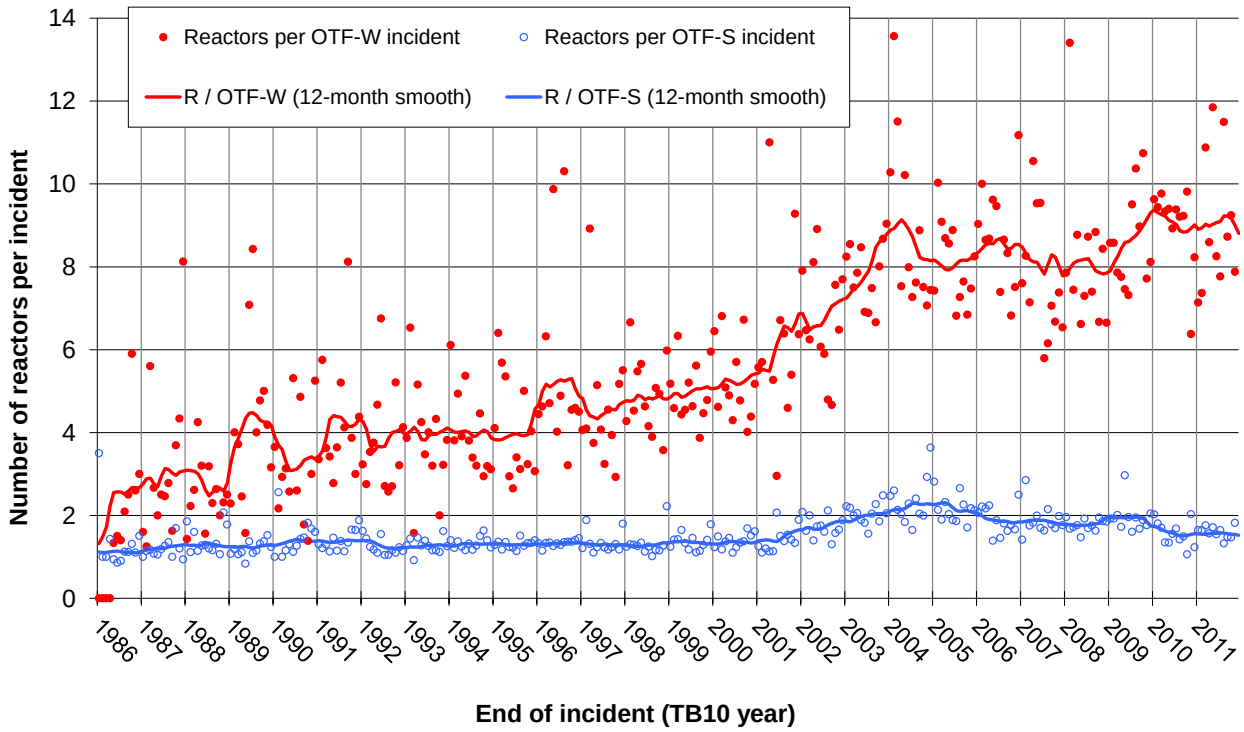

Figure 4.5: The mean total monthly number of reactors taken per OTFW and OTFS breakdown that closed between January 1986 and December 2011

The number of reactors per OTF-W and OTF-S incident that *closed* between 1986 and 2011 is shown in Figure 4.5. As in the 2010 report, the month of the disclosing test is always earlier than the month shown in the graph. The total number of reactors removed in an OTF-W breakdown had reached a peak in 2010 and this was maintained in the first half of 2011. The monthly figures tended to decrease through 2011; the average number of reactors in OTF-W breakdowns in 2011 was 9.03, only slightly smaller than the number in 2010 (9.10). The total number of reactors removed in an OTFS breakdown has been slowly declining between 2005 and 2011 although this number has remained approximately constant since the middle of 2010. The decline could be due to the early taking of IRs from 2009, as 2xIRs do not contribute to the figures, and these animals may have gone on to become reactors at a 2nd retest (or to 3xIRs which tended to be recorded as reactors in VetNet).

5. Routine slaughterhouse surveillance

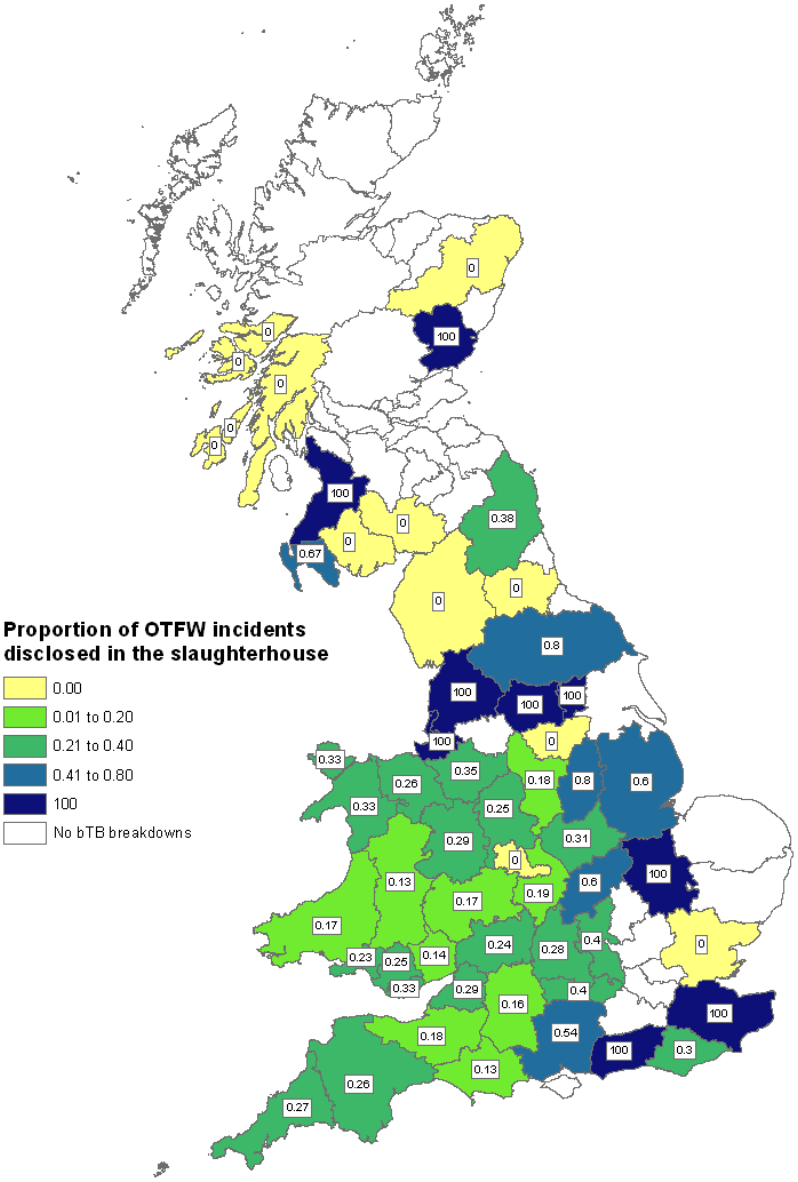

Figure 5.1: Geographical distribution of OTF-W new breakdowns that were disclosed by slaughterhouse cases, relative to all OTF-W new breakdowns disclosed in 2011.

Figure 5.1 displays the proportion of OTFW breakdowns in 2011 that were first detected in the slaughterhouse. There were nine counties where all OTFW breakdowns were disclosed in the slaughterhouse, six of which disclosed only one new OTFW incident: Angus (1), Ayrshire (2), Cambridgeshire (2), Kent (3), Lancashire (1), Merseyside (1), North Yorkshire (Southern)(1), West Yorkshire (1), West Sussex (1).

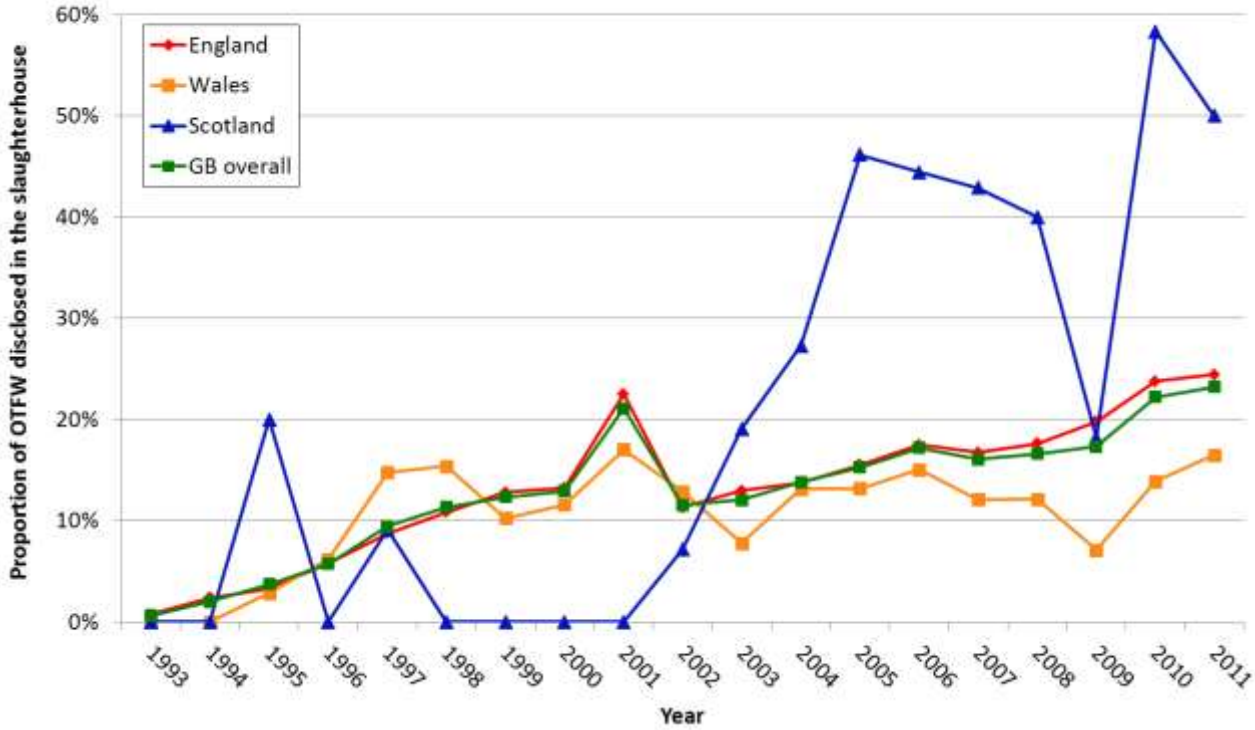

Figure 5.2: Trends in the proportions of OTF-W new breakdowns that were disclosed by slaughterhouse cases, by country

There has been a steady upward trend in the proportion of OTF-W new breakdowns that were disclosed in the slaughterhouse (Figure 5.2). Eighty-eight percent (88.1%) of OTF-W breakdowns disclosed in the slaughterhouse originated in England, which dominates this trend. There was a temporary peak in 2001 (the year when routine testing was suspended), followed by a continuation of the upward trend. Wales (with 11.3% of slaughterhouse disclosures in 2011) approximately followed the pattern for England ($p>0.01$) until 2008 ($p=0.001$), the year in which yearly testing was first applied to all herds in Wales. This reduction in proportion seems to be slowly eroding.

The proportion of OTF-W new breakdowns disclosed by slaughterhouse cases in Scotland has recently exceeded the GB average, but the small total number of OTF-W breakdowns and the years 1998-2001 in which none were disclosed in the slaughterhouse prevents us from deriving firm conclusions.

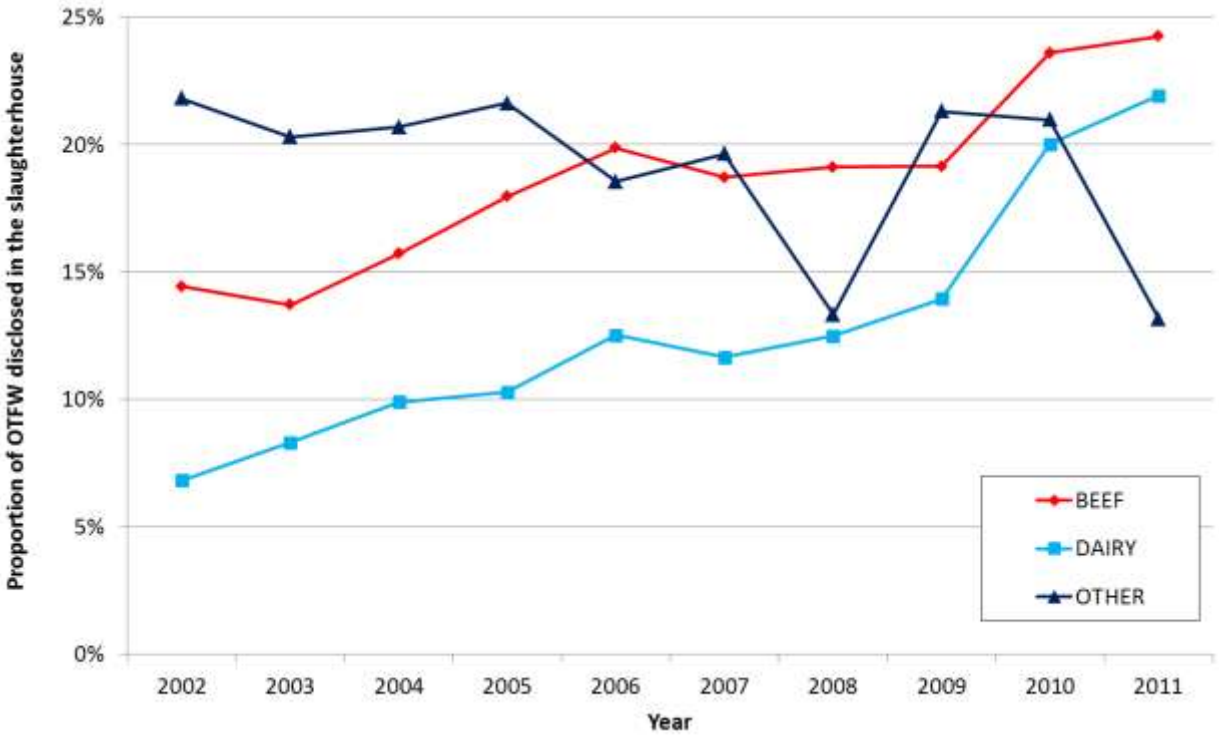

Figure 5.3: Trends in the proportion of OTFW new breakdowns first detected at slaughterhouse inspection between 2002 and 2011, by herd type

A larger proportion of OTFW breakdowns in beef herds than in dairy herds have been consistently disclosed by slaughterhouse cases (Figure 5.3). Possible explanations include higher sensitivity of the SICCT test in dairy herds or lower susceptibility to bTB in dairy herds resulting in less pathology (see Project SE3013) and the generally larger size of dairy herds (further increasing the herd sensitivity of the skin test). Also, a greater proportion of the Beef herd ends up in the slaughterhouse. *Other* herds showed the largest proportion up to 2005, but since then the proportion has come to resemble that of Beef and Dairy herds, probably as a result of redefinition of the types of herds considered to be Other.

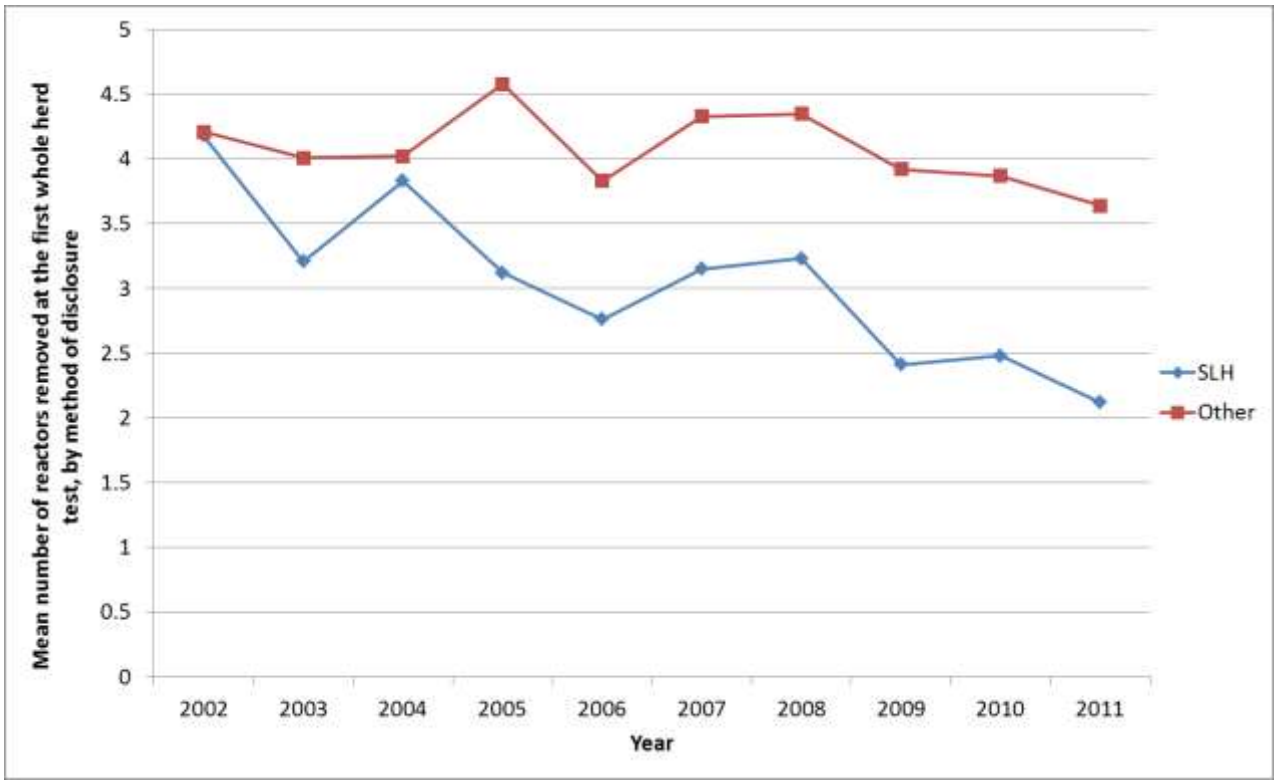

Figure 5.4: The mean number of reactors removed at the first whole herd test between January 2002 and December 2011, by method of disclosure

Figure 5.4 shows the mean number of reactors removed at the first whole herd test between January 2002 and December 2011, for two methods of disclosure (slaughterhouse or other). The mean number of reactors removed in the first skin test after disclosure by slaughterhouse case is consistently lower than for disclosure by other methods by around 1.5, and both numbers have tended to decrease after 2008. Between 2008 and 2011, the mean number of reactors removed at the first whole herd test declined from 3.2 to 2.1 with slaughterhouse disclosure and from 4.3 to 3.6 with other methods of disclosure. The distributions of numbers of reactors were skewed. Since 2003, the median number of reactors removed in the slaughterhouse at the first whole herd test has been 0 (IQR 0 to 2) and for other methods of disclosure has been 2 (IQR 1 to 4 or 5).

6. Post mortem examination and culture of suspected bTB animals slaughtered for TB control reasons

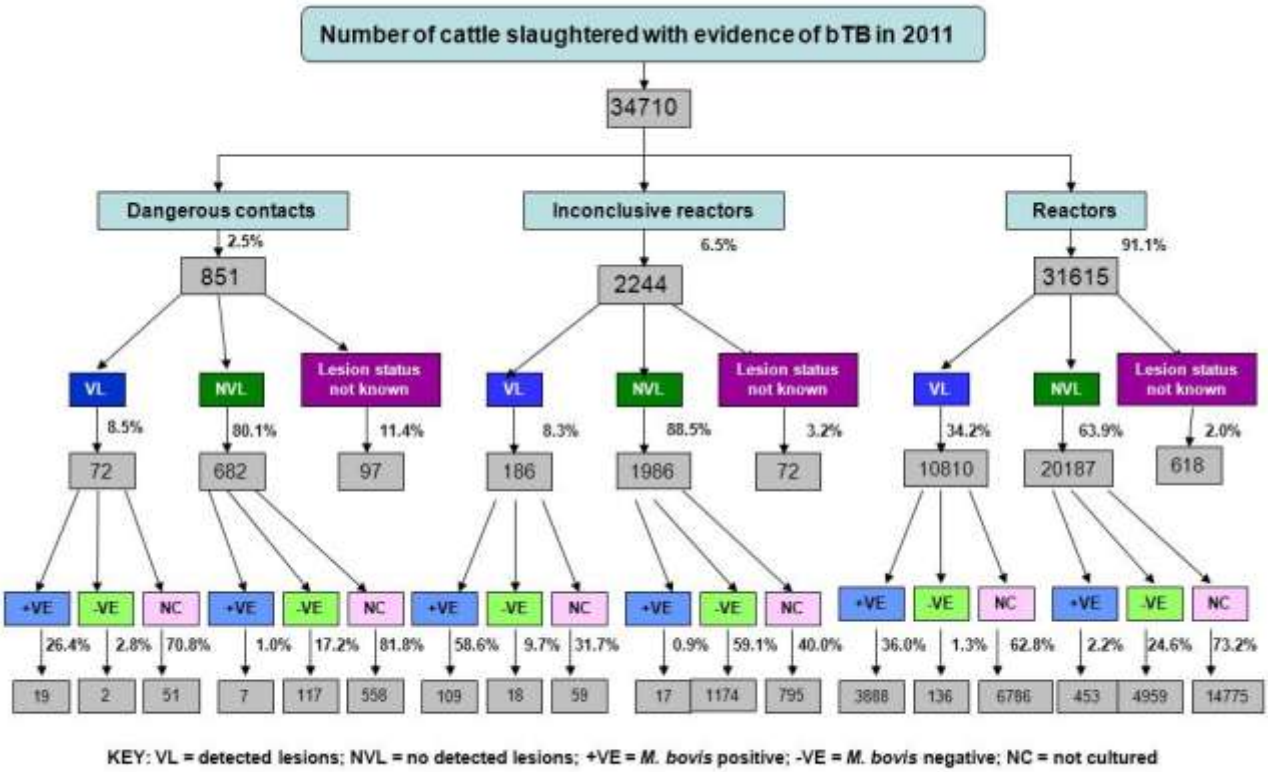

Figure 6.1: Testing pathways of animals slaughtered for bTB control in GB in 2011, using data from Tables 6.1, 6.2 and 6.3.

Figure 6.1 is a chart of all animals taken as dangerous contacts, inconclusive reactors and reactors, classified according to the findings of abattoir inspection (lesions) and laboratory tests (culture). Just over 90% (91.5%) of cattle slaughtered with evidence of bTB in 2011 were reactors; 6.5% were inconclusive reactors and 2.5% were dangerous contacts.

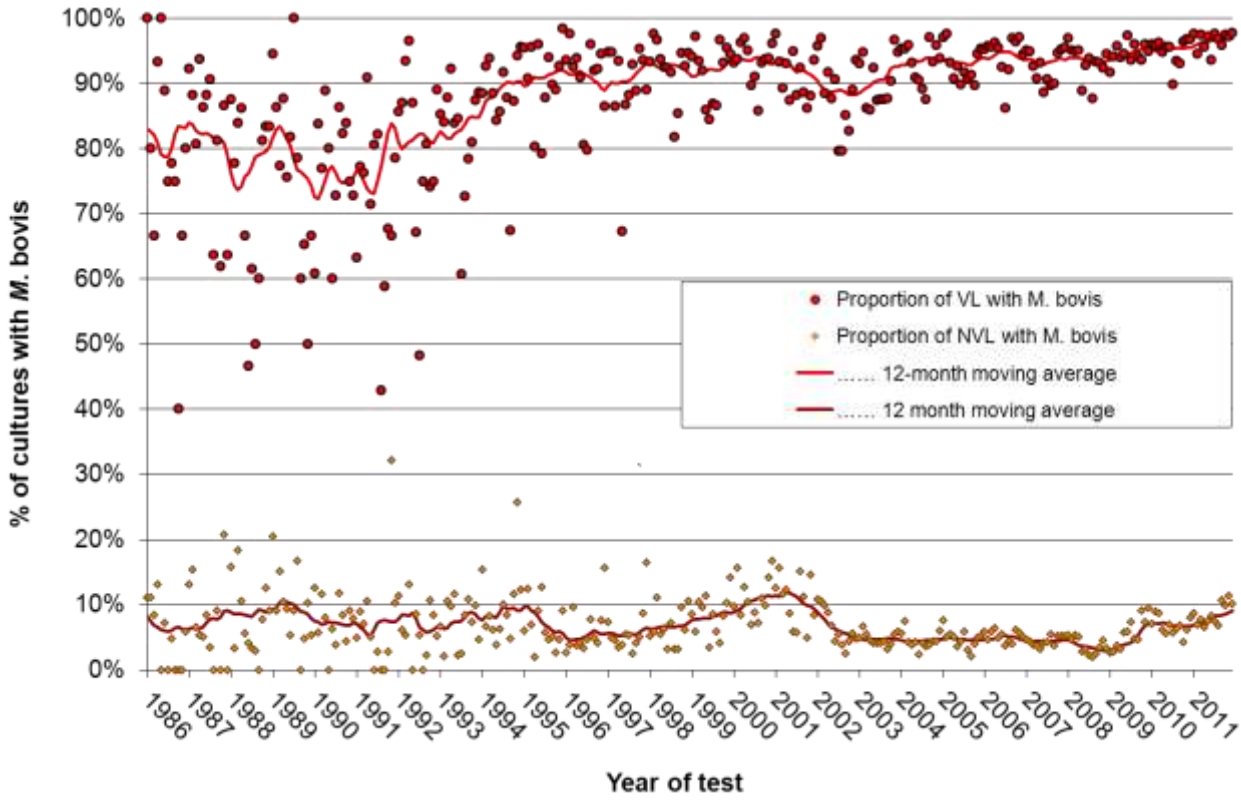

Figure 6.2: Proportion of visible lesions and non-visible lesions submitted for culture from which M. bovis was obtained, by month

The proportion of VL samples from which *M. bovis* was cultured has continued an upward trend that started in mid-2008 (Figure 6.2). The proportion of NVL samples from which *M. bovis* was cultured was also increasing, approaching 10% by the end of 2011.

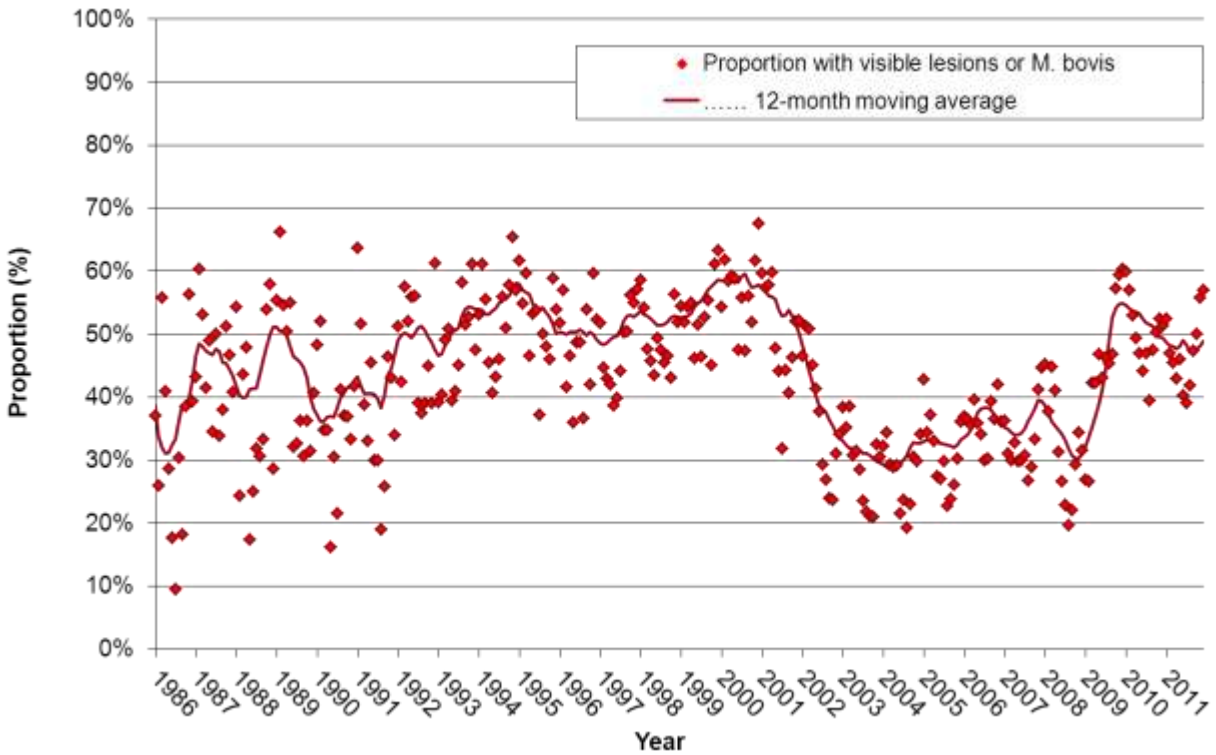

Figure 6.3: The proportion of all reactors to the skin test (including severe interpretation) and/ or the IFN-gamma blood test, that were cultured and either had visible lesions or were culture positive in 2011

The proportion of animals with evidence of bovine TB – either having visible lesions or being culture positive – has been low between 2003 and the first part of 2008 (Figure 6.3). In 2008 there was a steep rise, reflecting the curves in Figure 6.2, but the proportion has shown a decrease from 2010. The steep rise since 2008 brings the proportion [of slaughtered reactors with visible TB lesions or positive culture results] up to the historical levels seen in the 1990s and early 2000s. This may indicate that the positive predictive value of the skin and IFN-gamma tests has increased following the gradual introduction of tuberculin from The Netherlands and the eventual replacement of Weybridge tuberculin in 2009 (Defra project SB4011, unpublished).

7. Recurrent breakdowns herds

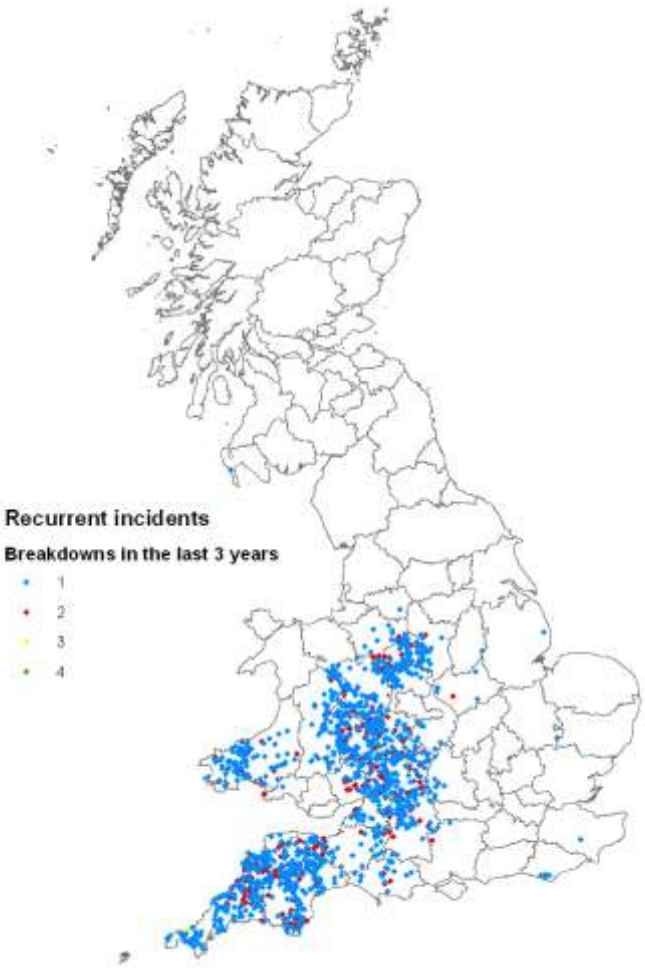

Figure 7.1: Geographical distribution of herds with OTFW breakdowns ending in the 36-month period before an OTF-W breakdown was disclosed in 2011.

Herds with a history of OTF-W breakdown(s) ending in the 36-month History Period that had a recurrent OTF-W breakdown are shown in Figure 7.1. The number of OTF-W breakdowns that occurred in the History Period tends to be greatest in the endemic areas of bTB occurrence. At least two herds with a new OTF-W breakdown in 2011 following a history of **two** OTF-W breakdowns in the last 3 years was observed in a number of counties in the West, South West of England and Wales and also in Cheshire, Hampshire, Leicestershire and Staffordshire. Twenty four herds in seven counties experienced OTF-W new breakdowns in 2011 following a history of **three** OTF-W breakdowns; Devon, Gloucestershire, Hereford & Worcester, Avon, Shropshire, Somerset and Cornwall. There was one beef herd that had a history of **four** OTF-W breakdowns in the past 3 years, in Shropshire.

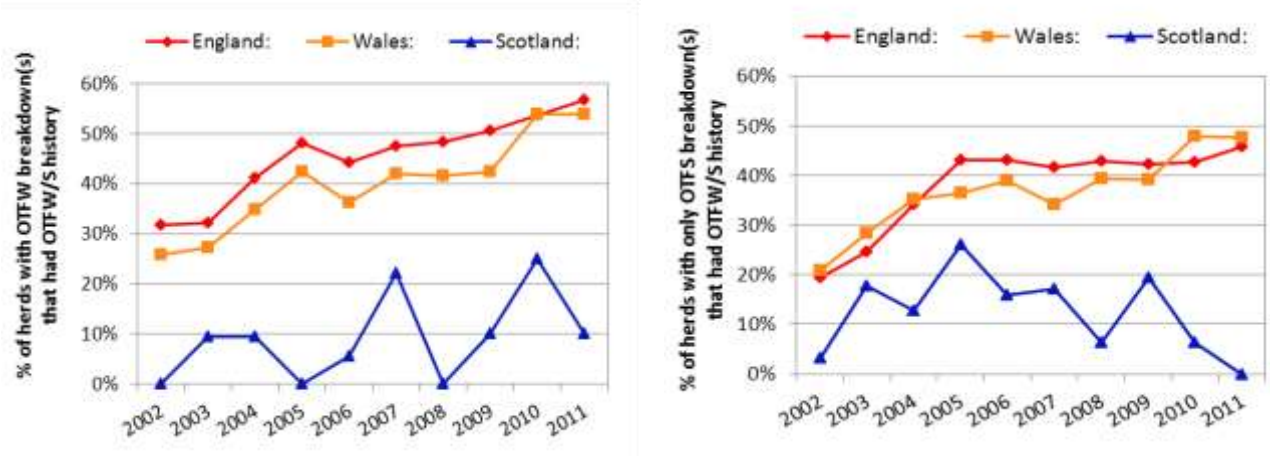

Figure 7.2a and 7.2b: The proportion of herds with breakdowns (a. OTF-W or b. OTF-S) in each year that had recurrent breakdowns (i.e. they occurred in herds that had OTF-W or OTF-S breakdowns in the previous 36 months), by country. The left-hand Figure 7.2(a) shows herds with OTFW breakdowns in 2011 and 7.2(b) shows herds with OTFS breakdowns in 2011 (provided that they had no OTFW breakdown in 2011)

In England and Wales, about one half of all herds that had breakdowns in 2011 had a history of being under restriction for bTB in the previous 36 months (Figures 7.2a and b). The equivalent proportion in Scotland was lower, reflecting the low incidence of bTB in that country. The median proportion of breakdown herds with a history of restriction was only slightly higher (13%) when the current breakdown was OTF-W than when it was OTF-S.
There was an upward trend in the proportion of breakdowns with a history of restriction between 2002 and 2011. The doubling time for England and Wales was between 9.1 and 11.5 years, very similar to the doubling time for OTF-W breakdowns (Figure 2.6). For OTF-S breakdowns in Scotland, the rate of increase was too erratic for doubling time to be calculated.

8. Inconclusive reactors

Omitted from the 2011 report only.

9. Report on the spoligotype database for 2011 (SB4020)

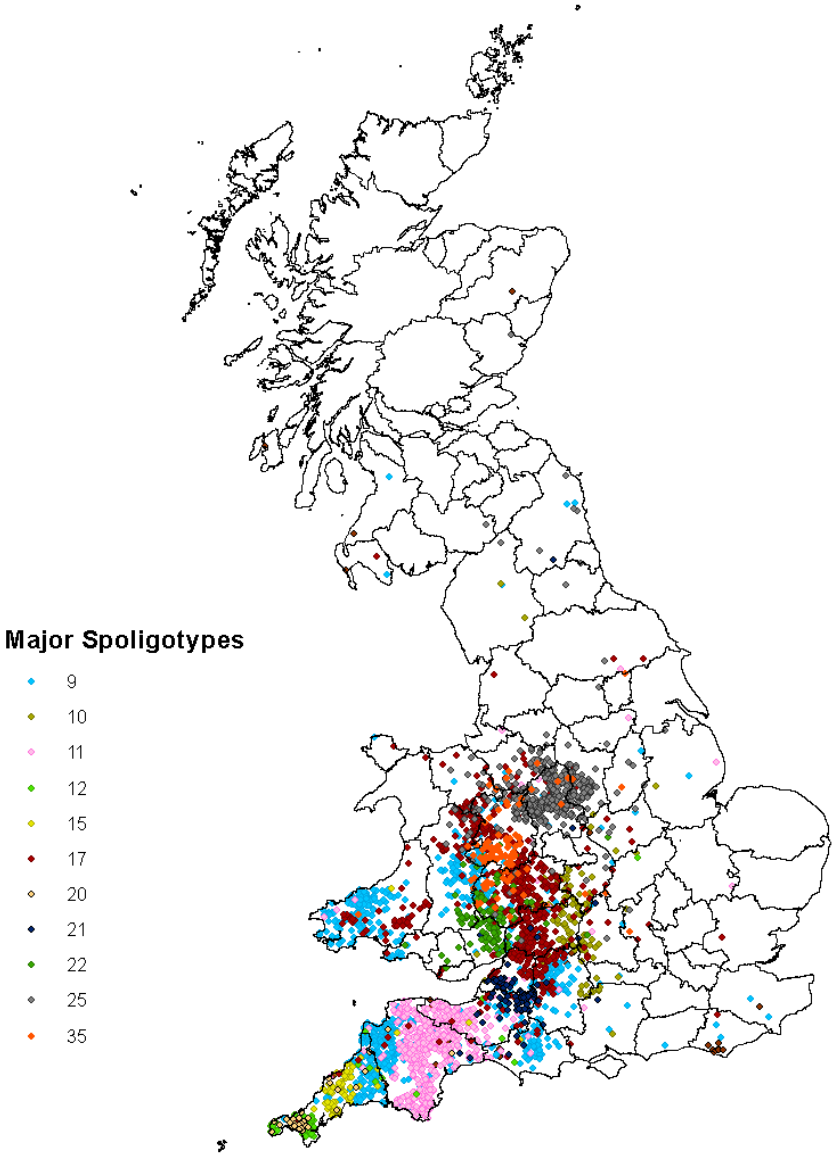

Figure 9.1: Locations of cattle breakdowns with one of the 11 major spoligotypes isolated in 2011.

Figure 9.1 shows the locations of cattle breakdowns with one of 11 major breakdowns in 2011. In general, genotype frequencies for 2011 were similar to the frequencies found in 2009 and 2010. It was noted in the report for 2010 that genotype 25:a had increased in frequency from 8.1% (2009) to 10.7% (2010). This increase in the frequency of genotype 25:a is continuing in 2011 (13.5%).

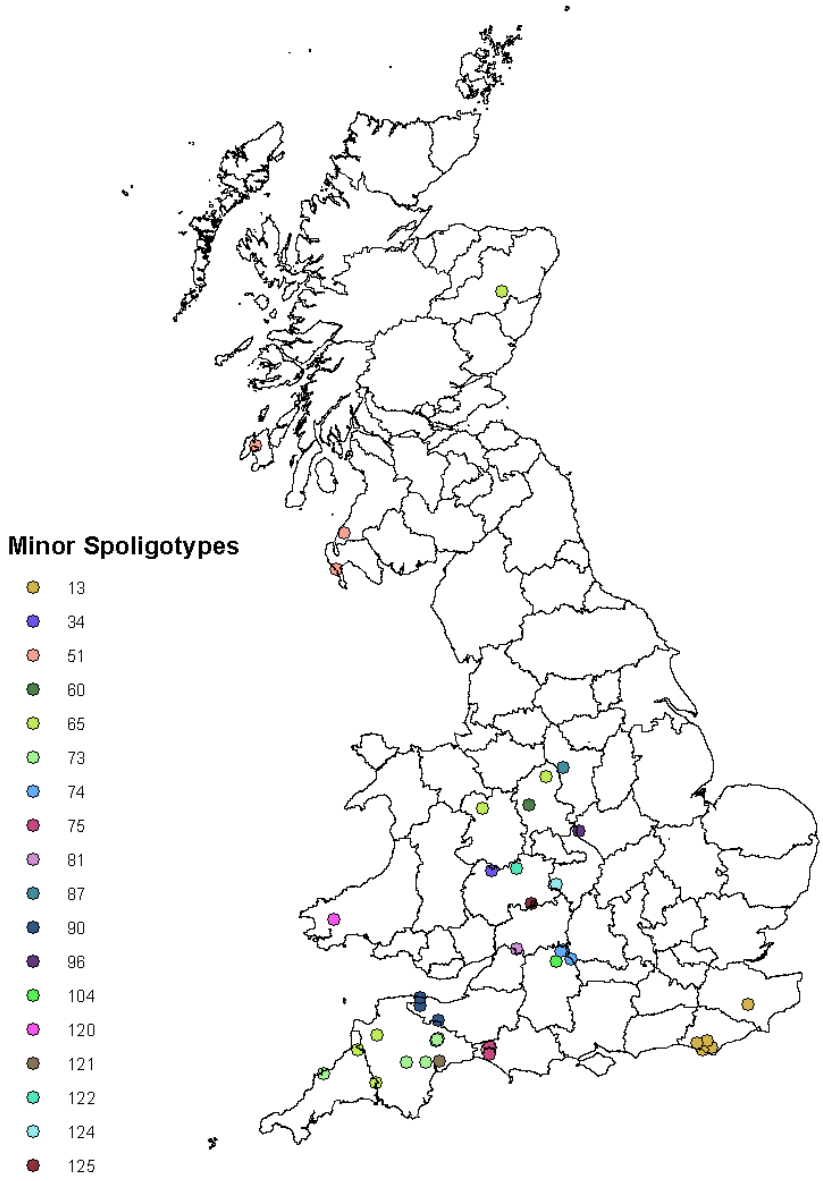

Figure 9.2: Locations of cattle breakdowns with one of the 18 minor spoligotypes isolated in 2011.

Figure 9.2 shows the locations of cattle breakdowns with one of the 18 minor spoligotypes in 2011. Genotypes, 22:j, 17:m, 100:a and 9:ae which have been highlighted in previous reports because of a sudden increase in frequency were rarely seen (one breakdown or less) in 2011 underscoring the small fluctuations in genotype frequency that occur among the rare genotypes. However, genotype 65:a was found in four separate breakdowns in 2011 although it has rarely been seen before (a large breakdown on the Isle of Man, 2001/2 and single breakdowns 2002, 2005 and 2006). The four separate breakdowns of 65:a in 2011 are not geographically clustered (Devon, Shropshire, Staffordshire, Aberdeenshire).

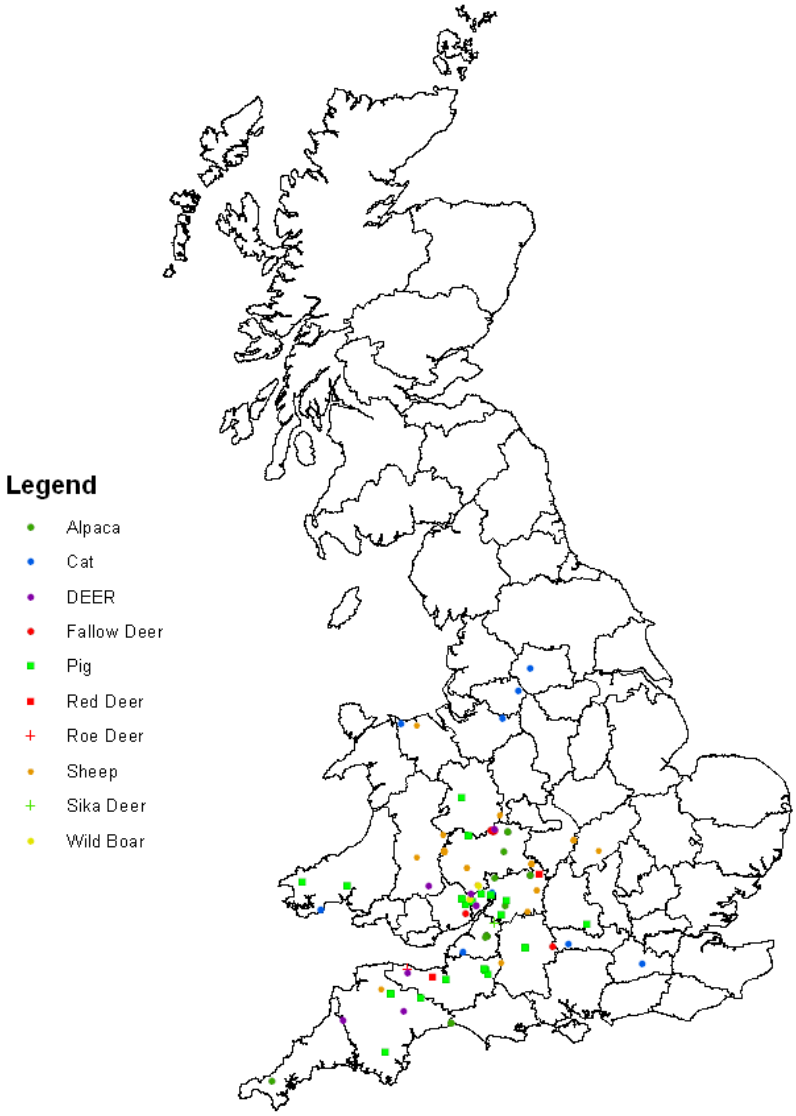

Figure 9.3: Locations of M. bovis isolates from animal hosts other than cattle and badgers in 2011 where location data exists.

Figure 9.3 shows the locations of *M. bovis* isolates from animal hosts other than cattle and badgers in 2011. There were 164 non-bovine isolates genotyped in 2011 (175 in 2010). 140 isolates were *M. bovis* and 24 were *M. microti*. The 140 *M. bovis* isolates represent 91 (99 in 2010) separate non-bovine breakdowns (an incident includes multiple isolates from animals in the same location). In general, the genotypes found in non-bovines reflect those found locally in cattle and are typical *M. bovis* genotypes. Over 75% of the non-bovine breakdowns are located in the relevant cattle homerange for the genotype.

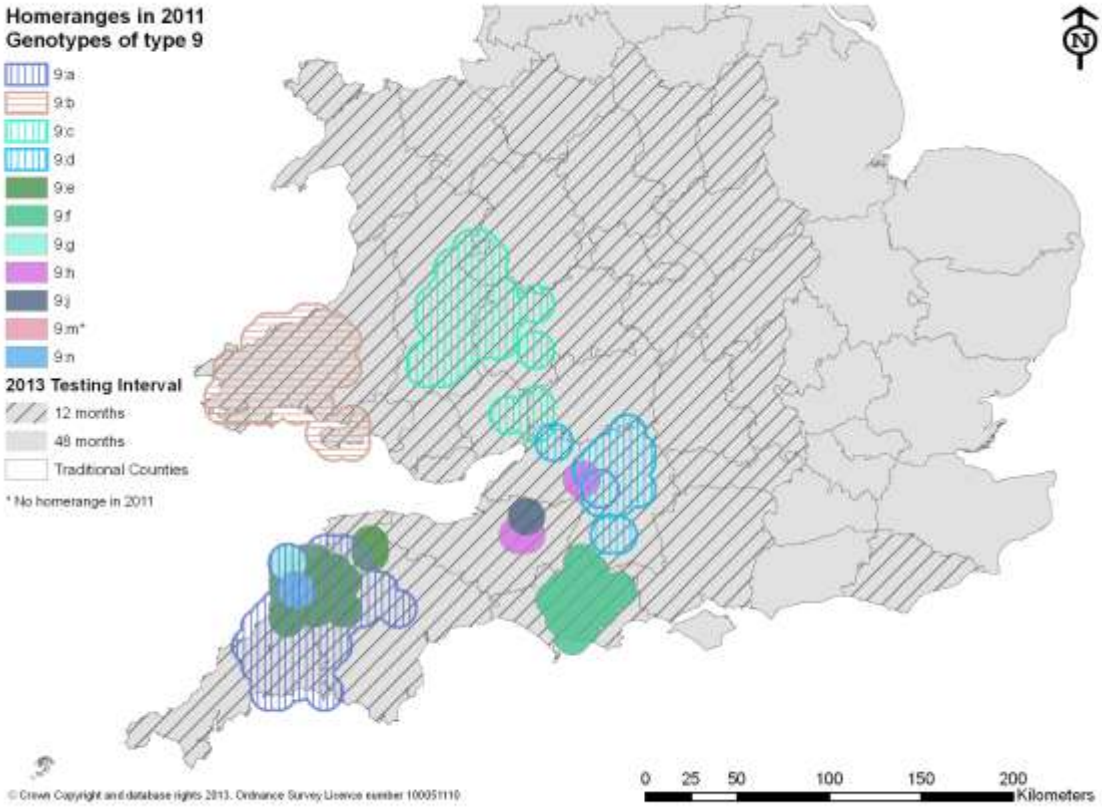

Figure 9.4: Homerange areas using 2007-2011 data for VNTR types of spoligotype 9. The 1-year and 4-year testing areas are shown.

Figure 9.4 displays the homerange areas using 2007-2011 data for VNTR types of spoligotype 9. The legend of the map indicates which genotypes and testing intervals for the locations. All homeranges displayed in this map are within yearly-tested areas.

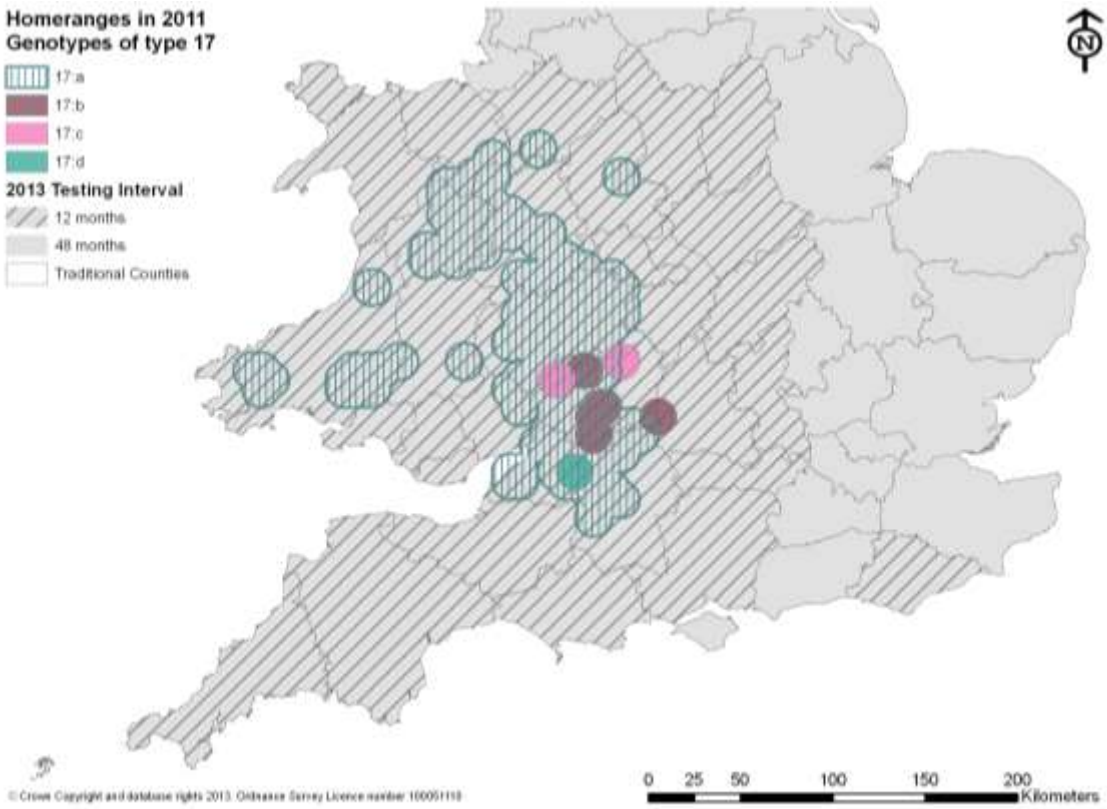

Figure 9.5: Homerange areas using 2007-2011 data for VNTR types of spoligotype 17. The 1-year and 4-year testing areas are shown.

Figure 9.5 displays the homeranges of the various genotypes for spoligotype 17. All home ranges are within yearly tested areas, mostly in Western England with the exception of genotype 17:a which also has homeranges in Wales.

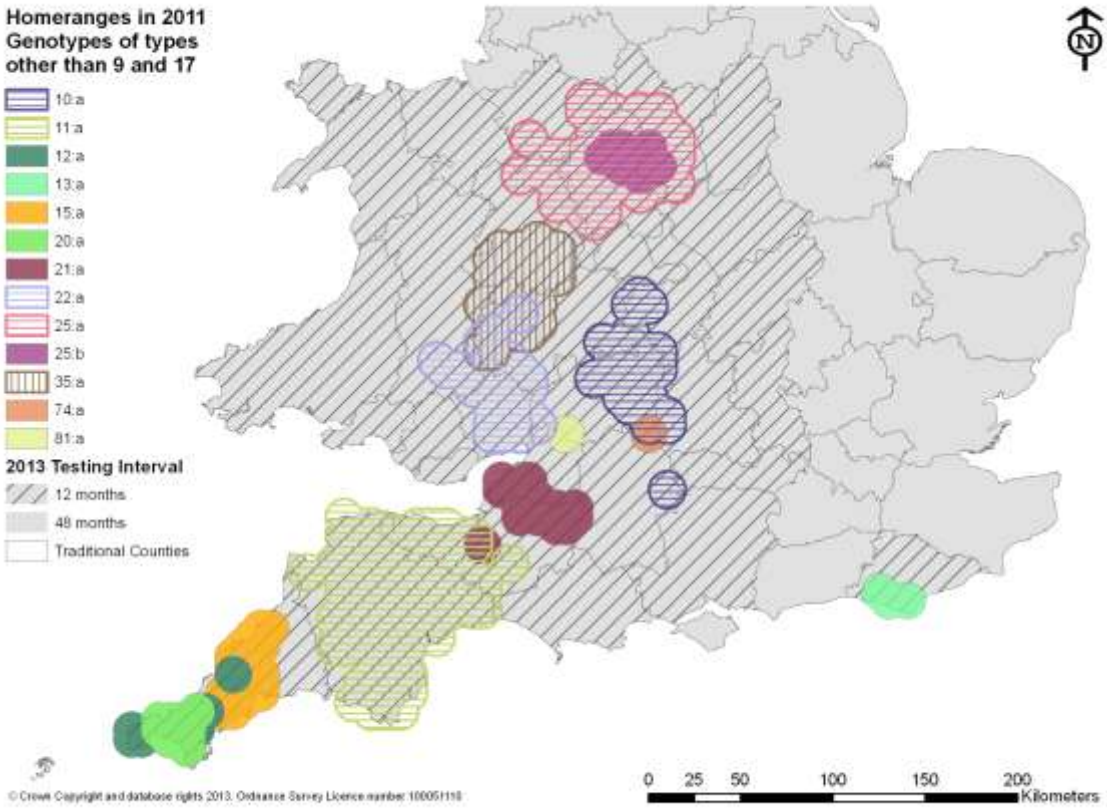

Figure 9.6: Homerange areas using 2007-2011 data for genotypes 10:a, 11:a, 12:a, 13:a, 15:a, 20:a, 21:a, 22:a, 25:a, 25:b, 35:a, 74:a and 81:a. The 1-year and 4-year testing areas are shown.

Figure 9.6 shows the homerange areas for genotypes 10:a. 11:a, 12:a, 13:a, 15:a, 20:a, 21:a, 22:a, 25:a, 25:b, 35:a, 74:a and 81:a; all within yearly tested areas, mostly located around the West and South West of England, with the exception of genotype 13:a which has a homerange of West Sussex.

Appendices

Appendix 1 – Abbreviations and Definitions

AHVLA: The Animal Health and Veterinary Laboratories Agency formed in April 2010 by the merger of Animal Health and the Veterinary Laboratories Agency.

ATI: Area Testing Interval (in years), also known as the Area Monitoring Regime.

A ***breakdown*** is also referred to as an incident (see below) in this report.

bTB: bovine tuberculosis caused by *Mycobacterium bovis*.

A ***disclosing test*** of an incident is the test that initiates a new OTF-W or OTF-S bTB breakdown, which in turn marks the start of movement restrictions. For the purposes of analysis it includes the detection of a slaughterhouse case.

A ***herd*** is a bovine herd defined in the County/Parish/Holding/Herd notation which was "live" (i.e. not archived) on Sam (formerly VetNet) for at least 183 days in any one year. Unless stated, all such herds are included in the denominator for the analysis of incidence, whether or not they had been tuberculin tested or under restriction in the year. It is acknowledged that this definition of a herd does not give the same values as the Agricultural Census or the Cattle Tracing System (CTS). On the other hand, unlike census or CTS data, Sam gives separate data for each herd within a holding, is maintained continuously for all herds (not just by sample surveys), and represents all herds no matter how small. Delays in reflecting the true activity periods of herds in SAM, and changes in herd sizes since it was recorded on Sam at the previous bTB test, can affect the accuracy of Sam-derived estimates of numbers of herds or of cattle. Differences in the way Sam stores herd information to that available in VetNet and migration of herds into Sam and given an active from date of that migration date has resulted in a greater difficulty in determining the active period of a herd. The administration of herds in Sam has made it difficult in using the traditional methods for herds live in the reporting period, such as the numbers used as incidence denominators, and thus it is prudent to note that numbers of live herds in any period used may not be as reliable as used in previous reports, although should still provide a fairly accurate denominator figure.

Herd size (for a bTB incident) is the largest number entered in the VetNet Herd size field at any time during the incident. Other than for breakdowns, herd size is generally the size recorded at the most recent whole herd test. It has come to our attention that veterinarians performing tests do not always record *Numbers of animals not tested*, with the result that herd size may be under-estimated in some lower-risk herds and areas. That is, in herds where only breeding bulls, cows that had calved and animals purchased since the previous test were tested. As a result, the size of herds that were tested every two years or longer may sometimes have been underestimated.

Herd types have been aggregated as follows:

- ***Beef****,* as well as Beef herds, includes Beef finisher, suckler, dealer, rearer and stores herds, and buffalo herds;

- ***Dairy***, as well as Dairy herds, includes Dairy dealer, rearer, producer, retailer, domestic, and flying herds;

- ***Other*** includes calf rearers, heifer rearers, heifer, AI, unspecified dealer, and those classified as unknown and 'other bovine'

A ***homerange*** defines a geographical area in which a genotype of *M. bovis* is not unexpected. A simple algorithm to define homerange area for the common genotypes of *M. bovis* was developed as part of Defra Project SE3257. A 5 km square is considered as part of the homerange if there have been three different breakdowns of that genotype, on at least 2 holdings, within a 5 year window. A 10km buffer is then applied in order to create coherent homerange area for each genotype.

A TB ***incident*** (also referred to as 'breakdown') refers to one herd not previously under movement *restrictions* in which at least one test reactor or a culture-positive slaughterhouse case has been found, and also 2xIR since 2009 in Wales, 2010 in remainder of GB. The *restriction*, and thus the incident, commences on the date of the disclosing test, and ends on the date that *Form TB10* is issued. A herd may commence or experience more than one TB incident in the same year.

An ***IR*** or ***inconclusive reactor*** to the skin test is an animal with skin test measurements that indicate a suspicion of bTB infection but has smaller measurements than those for a reactor. Animals having two successive tests giving Inconclusive reactor measurements are generally considered to be skin test reactors, but may be described as "IRs After 2 [or more] tests as IR" to distinguish them from other reactors in some parts of this report.

M. bovis: *Mycobacterium bovis*, the causative bacterium of bovine tuberculosis.

An ***OTF-W*** [new] incident: A herd bTB incident (breakdown) in which at least one test reactor has been identified with post-mortem evidence of *M. bovis* infection (i.e. by the presence of visible lesions typical of TB and/or identification of *M. bovis* in culture) or at least one slaughterhouse case has yielded *M. bovis* on culture. To qualify as being "new", the incident must have been disclosed in a herd not under TB restrictions in the period specified.

An ***OTF-S*** [new] breakdown: A bTB incident (breakdown) that did not meet the conditions for an OTF-W breakdown (see above) in a herd in which at least one test reactor has been identified or a suspect slaughterhouse case has been found but not confirmed to be infected. OTF-S breakdowns that are caused by overdue tests are not recognised in this report.

Reactors are animals showing a particular pattern of reactions to a comparative intradermal tuberculin ("skin") **test** or to a gamma interferon assay which indicates infection with *M. bovis*. Inconclusive reactors that fail to resolve at the first re-test are also treated as reactors. Only actual reactors flagged as such contribute to reactor counts in the tables. 2 and 3xIRs will not, unless mis-flagged as reactors. Reactors do *not* include animals first suspected to have bTB at the slaughterhouse.

Slaughterhouse case*:* This refers to a breakdown (rather than an animal) that is triggered by the disclosure of an animal that had lesions consistent with bTB in an unrestricted herd during routine slaughterhouse inspection that had lesions consistent with bTB. In order that the case becomes an OTF-W incident, *M. bovis* must be isolated on culture

from samples of the lesions. Until *M. bovis* is isolated at culture, a slaughterhouse case remains suspect and does not contribute to breakdown figures within this report.

Testing interval for *herds* denotes the Area Testing Interval (ATI or Area Monitoring Regime) to which herds have been allocated; for January to December reports, the ATI is recorded for the third quarter of the year in question, whether or not the herd was tested in that year. Any shorter interval assigned specifically to an individual herd within a parish has not been used.

Appendix 2 – AHVLA Regions, Government Offices and Animal Health (AH) Divisions

No reorganisation of Animal Health Regional or Divisional boundaries occurred in Wales or Scotland, but there were significant changes in England.

- The boundaries of Leeds, Leicester, Lincoln, Preston and Stafford AH Divisional Offices in England were changed during 2009 in order that each fit within a pre-existing Government Office (G.O.) boundary.
- Humberside moved from LINCOLN AHDO to LEEDS AHDO in the Yorkshire and Humberside G.O.;
- West Midlands and Warwickshire moved from LEICESTER AHDO to WORCESTER AHDO in the West Midlands G.O.;
- Derbyshire moved from STAFFORD AHDO to LEICESTER AHDO in the East Midlands G.O.;
- Cheshire moved from STAFFORD AHDO to PRESTON AHDO in the North-West G.O.
- Cumbria moved to PRESTON AHDO in the North-West G.O., so that CARLISLE ceased to be a separate AHDO.

Appendix Table 2a: Relationship between new Animal Health Regions, Government Offices, AHDOs and Counties in England after the re-organisation in 2009

Country	Government Office (G.O.) and AH region	Animal Health Divisional Office (AHDO) and number	Counties (and number of counties)
ENGLAND	South West (SW)	GLOUCESTER (28)	Avon, Gloucestershire, Wiltshire (3 counties)
		TAUNTON (42)	Dorset, Somerset (2 counties)
		EXETER (44)	Devon (1 county)
		TRURO (45)	Cornwall, Isles Of Scilly (2 counties)
	West Midlands (WM)	WORCESTER (27)	Hereford & Worcester, Warwickshire, West Midlands (3 counties)
		STAFFORD (24)	Shropshire, Staffordshire (2 counties)
	North East (NE)	NEWCASTLE (1)	Cleveland, Durham, Northumberland, Tyne & Wear (4 counties)
	North West (NW)	PRESTON (8)	Cheshire, Cumbria, Greater Manchester, Lancashire, Merseyside (5 counties)
	Yorkshire & Humberside (YH)	LEEDS (7)	Humberside, North Yorkshire, South Yorkshire, West Yorkshire (4 counties)
	East Midlands (EM)	LINCOLN (12)	Lincolnshire, Nottinghamshire (2 counties)
		LEICESTER (21)	Derbyshire, Leicestershire, Northants (3 counties)
	East of England (EE)	BURY ST EDMUNDS (17)	Cambridgeshire, Norfolk, Suffolk (3 counties)
	EE or London	CHELMSFORD (33)	Greater London, Bedfordshire, Essex, Hertfordshire (4 counties)
	SE or London	REIGATE (35)	Middlesex, East Sussex, Kent, Surrey, West Sussex (5 counties)
	South East (SE)	READING (29)	Berkshire, Buckinghamshire, Hampshire, Isle Of Wight, Oxfordshire (5 counties)

Appendix Table 2b: Relationship between Animal Health Regions, Devolved Administrations, AHDOs and Counties in Wales and Scotland in 2009

Devolved administrations	**Animal Health Divisional Office (AHDO)**	**Counties (and number of counties)**
WALES (Welsh Government)	CAERNARFON (47)	Clwyd, Gwynedd, Powys (Northern part, parish numbers 52101 to 52169) (2 + 1 part county)
	CARMARTHEN (57)	Gwent, Mid Glamorgan, South Glamorgan, West Glamorgan, Powys (Southern part, parish numbers 52001 to 52091 and 52201 to 522264), and Dyfed (5 + 1 part county)
SCOTLAND (Scottish Executive)	INVERNESS (61)	Caithness, Inverness-shire, Lewis, Nairn, Ross and Cromarty, Sutherland (6 counties)
	INVERURIE (65)	Aberdeenshire, Banffshire, Kincardine, Moray, Orkney, Shetland (6 counties)
	PERTH (68)	Angus, Argyll, Clackmannan, Dunbartonshire, Fife, Kinross, Perthshire (7 counties)
	AYR (72)	Ayrshire, Bute, Dumfriesshire, Kirkcudbright, Renfrew, Wigtown (6 counties)
	GALASHIELS (78)	Berwickshire, East Lothian, Lanarkshire, Peebles, Roxburgh, Selkirk, Stirling, West Lothian (8 counties)

Appendix 9: The effect of area testing interval and test type in England

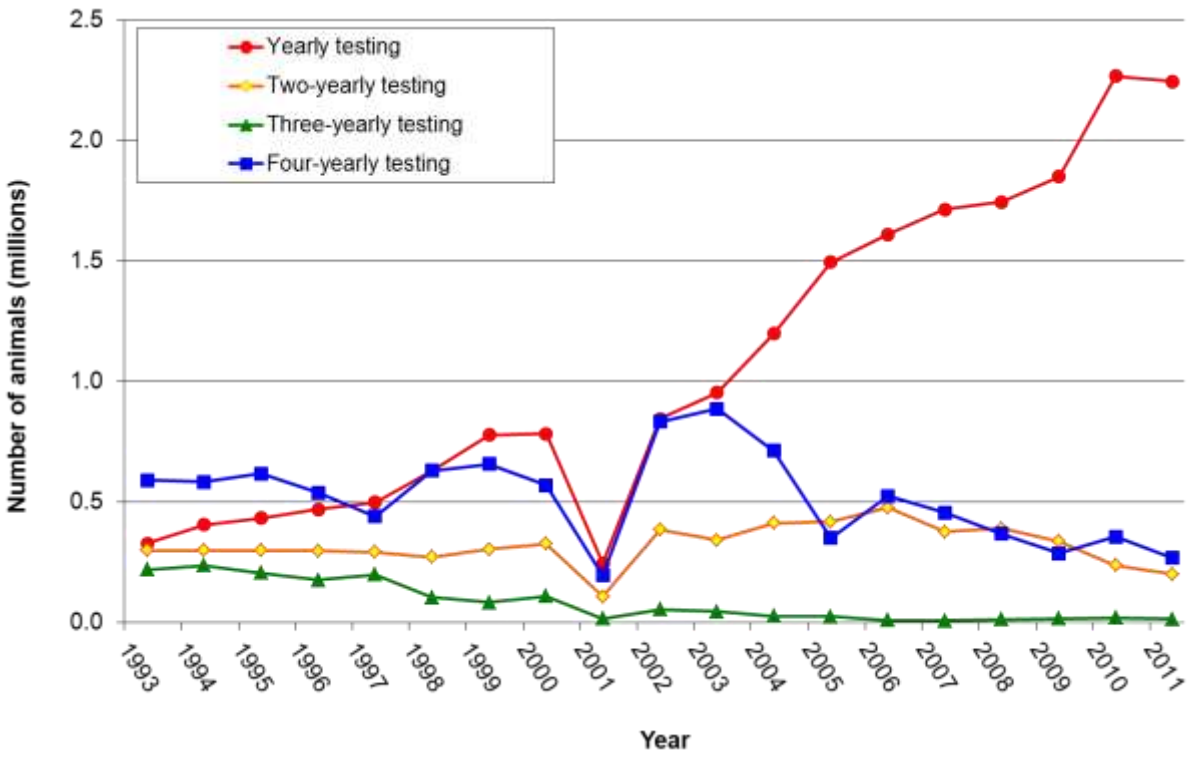

Figure A1.1: Number of whole herd type tests in animals in unrestricted herds in England (i.e. excluding short interval tests) within area testing intervals between January 1993 and December 2011

After the sharp increase in number of yearly-tested areas in the West of England in 2010 (Figure A1.2) the relative number of tests and herds in yearly-tested areas has been comparatively similar in 2010 to 2011. The number of animals in two- and four-yearly tested areas has declined from 2010 to 2011.

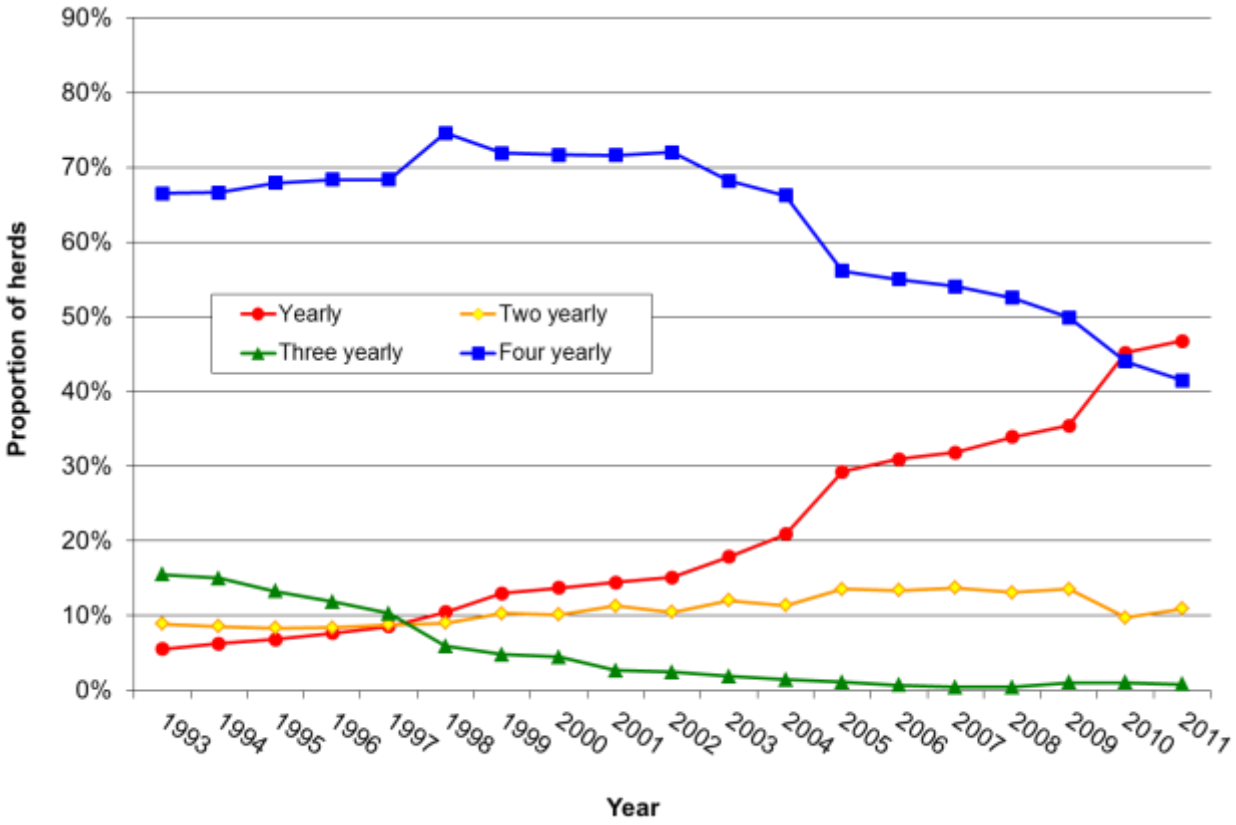

Figure A1.2: Proportion of live herds in England within each area testing interval between January 1993 and December 2011

In England in 2011, the proportion of herds in yearly tested areas exceeded that of four-yearly tested herds, increasing to over 45% and the proportion of herds in four-yearly tested areas decreased to around 40%.

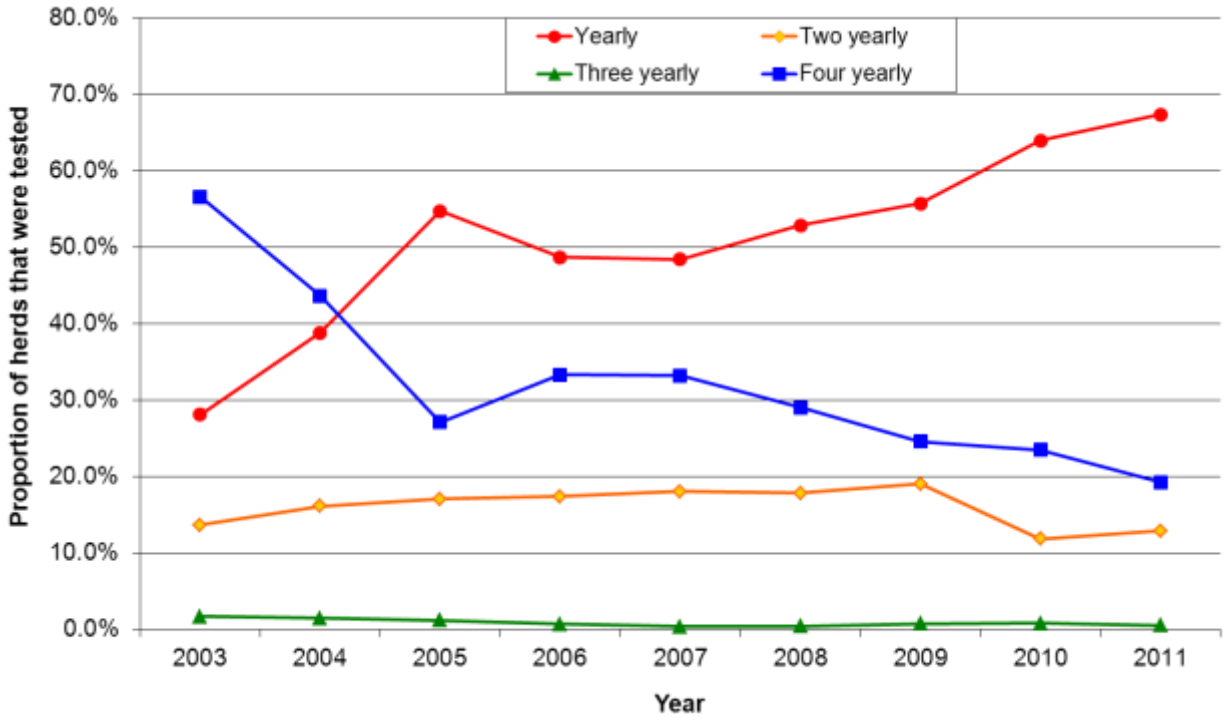

Figure A1.3: Proportion of tested herds within each area testing interval in England between January 2003 and December 2011

In England in 2011, the proportion of herds that were tested in yearly tested areas increased to over 65% and the proportion in four-yearly tested areas declined to below 20%.

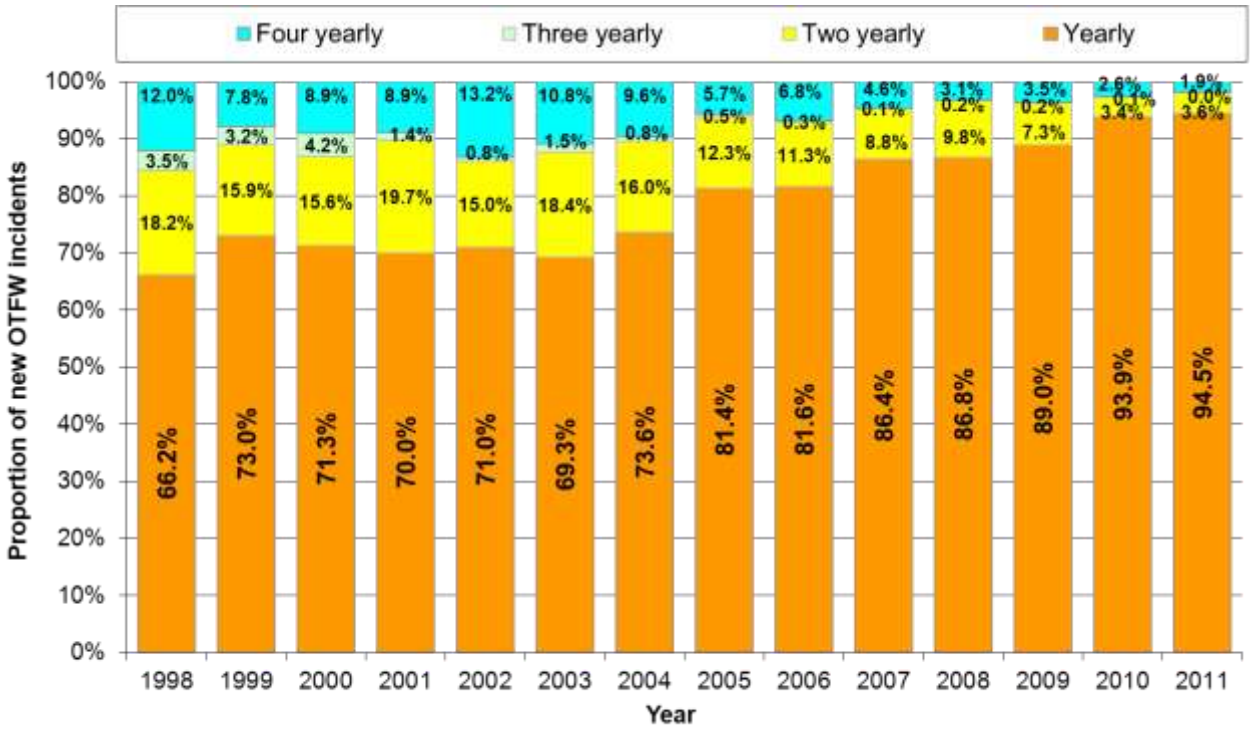

Figure A2.1: The proportion of OTF-W new breakdowns occurring in each area testing interval in England between January 1998 and December 2011.

Since 2003 there has been a steady decrease in the proportion of OTF-W breakdowns in three-yearly and four-yearly testing intervals (Figure A2.1). Contributing factors could be the precautionary allocation of testing intervals (intensified in the West of England in 2010) and – since 2007 – the success of pre-movement testing in preventing the movement of many infected animals into 3 and 4-yearly tested herds.

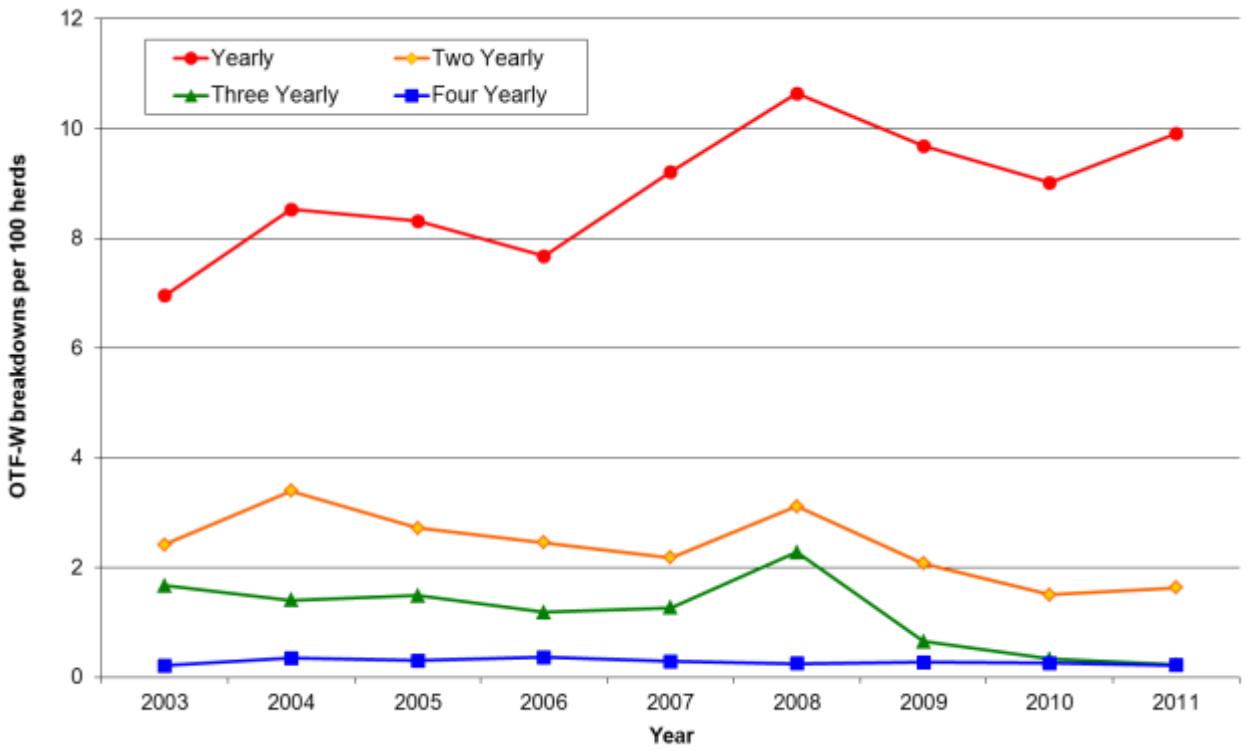

Figure A3.1: OTF-W new breakdowns per 100 live herds in different area testing intervals in England between January 2003 and December 2011

The proportion of breakdowns that were OTF-W increased slightly in 2011, but the increase was generally within the range seen between 2008 and 2010 (Figure A3.1).

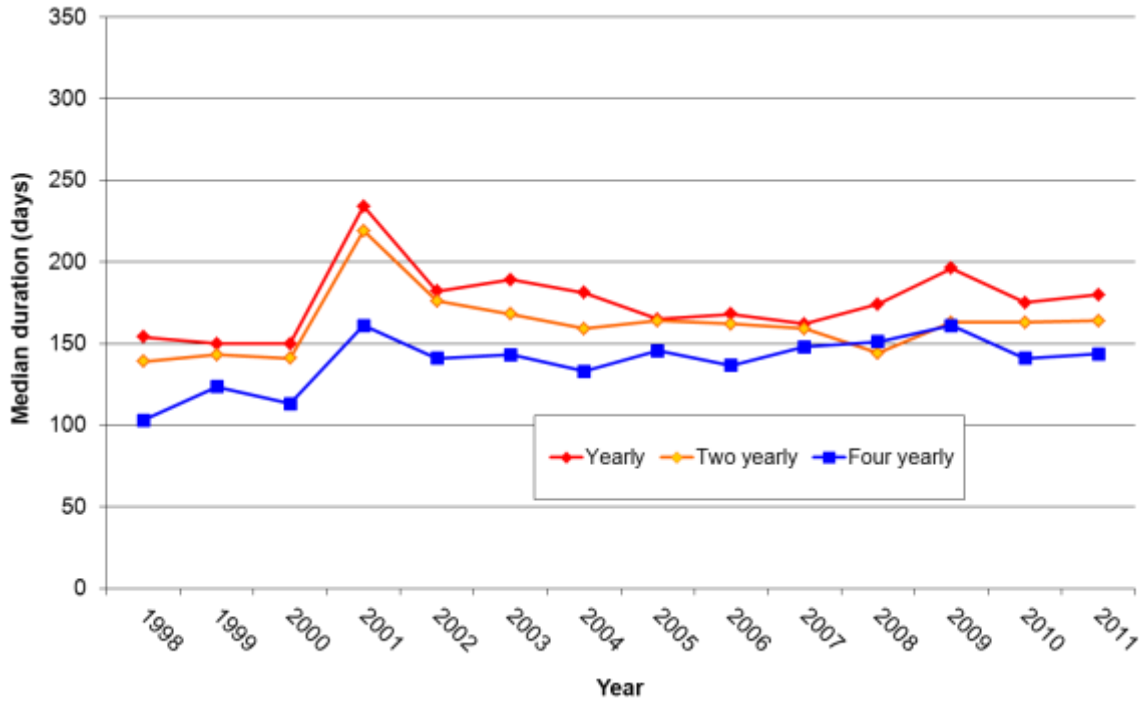

Figure A4.1: Median duration of OTF-W breakdowns in England ending between January 1998 and December 2011, within area testing interval that was in force at the start of the incident.

The median duration of OTF-W breakdowns in England that ended in 2011 increased slightly per area testing interval compared to 2010 (excluding three-yearly tested areas as this related to only one breakdown); between 186 and

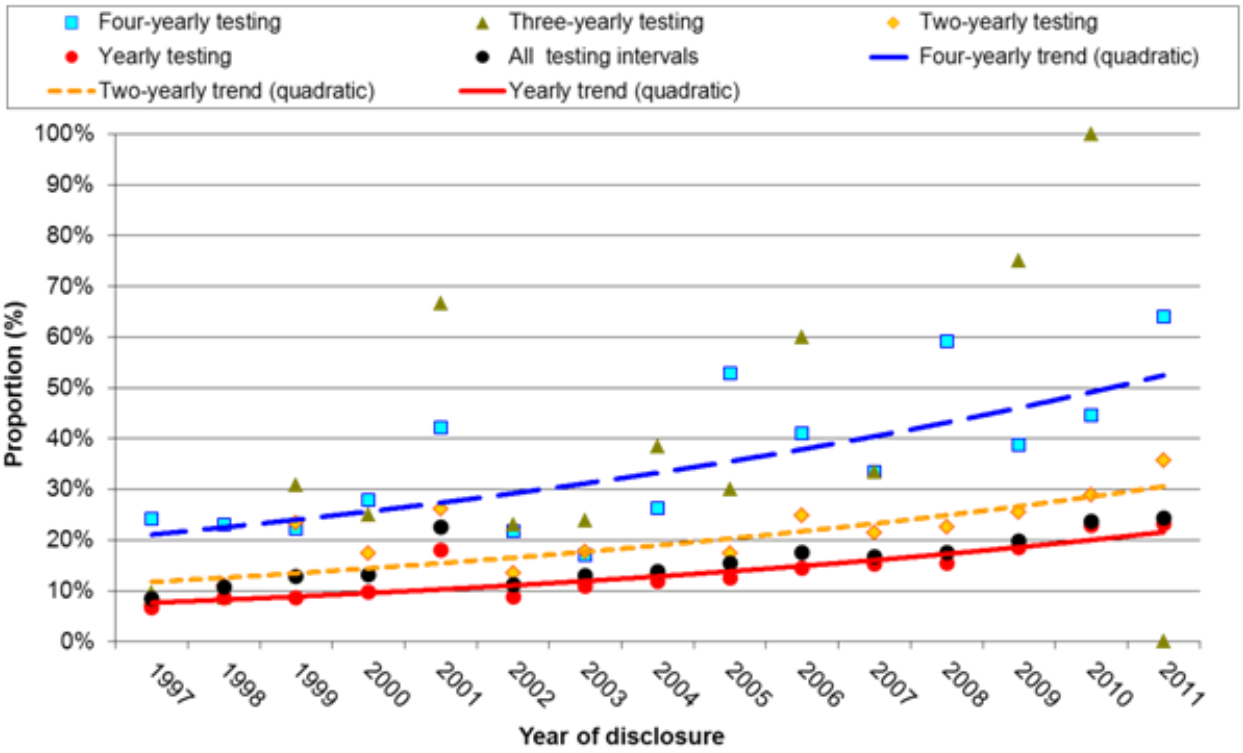

Figure A6.1: Trends in the proportions of OTFW new breakdowns that were disclosed by slaughterhouse cases, by area testing interval

Figure A6.1 shows the trends in the proportions of OTF-W new breakdowns that were disclosed by slaughterhouse cases, by area testing interval. Overall there was an upward trend in the proportion for yearly, two yearly and four yearly tested herds which were disclosed by a slaughterhouse case.

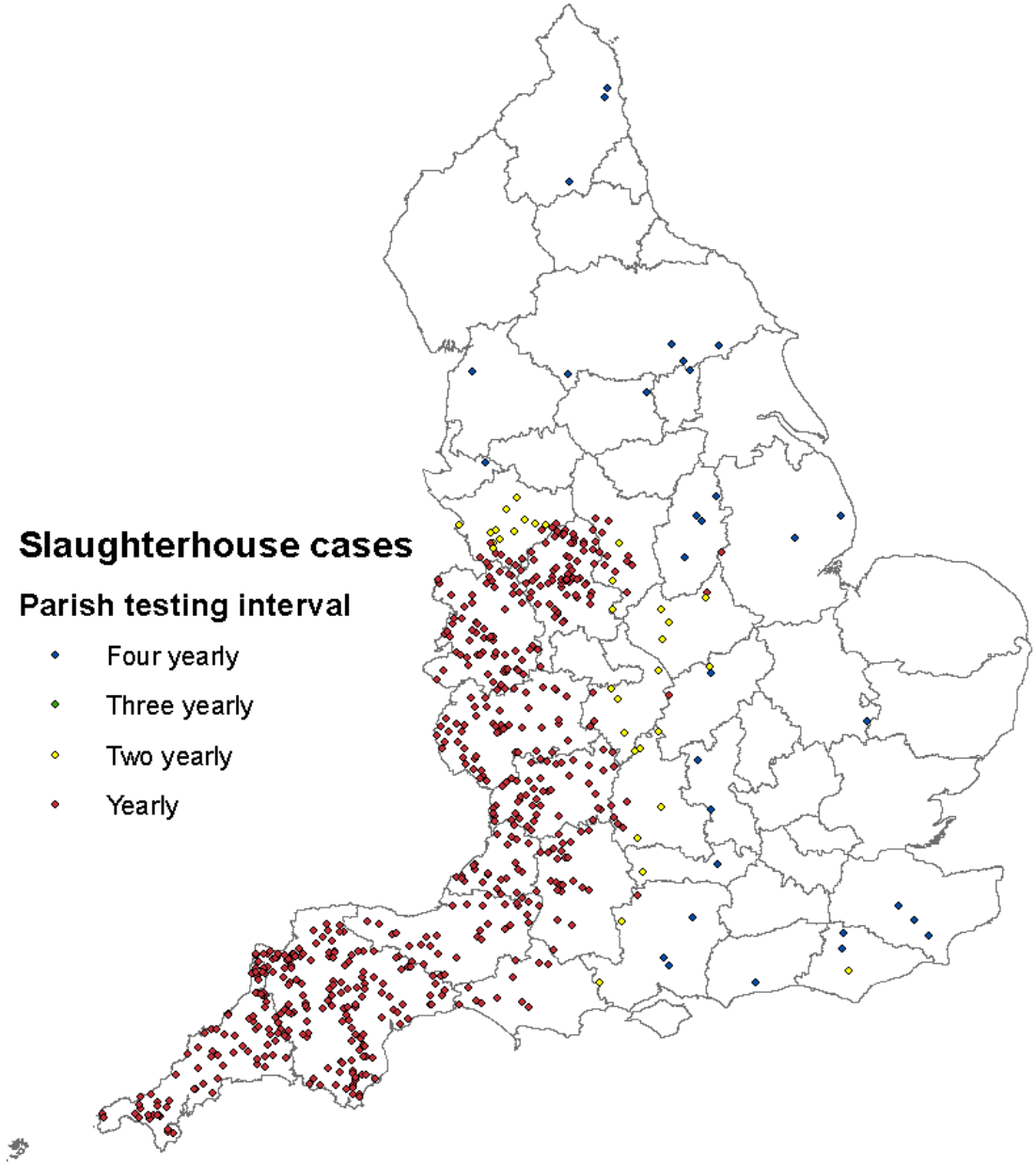

Figure A6.2: Slaughterhouse cases in 2011, by area testing interval. Dots represent the location of the herds of origin of the slaughterhouse case, not the location of the abattoir identifying the case.

Figure A6.2 shows the distribution of slaughterhouse cases in England, according to area testing intervals. Slaughterhouse cases were most concentrated in the South West, especially in Cornwall, Devon, Shropshire and Staffordshire, where their geographical distribution resembled the distribution of confirmed new breakdowns but less widespread.