Bovine Tuberculosis in Northern Ireland

2014 Annual Report

Department of
Agriculture and
Rural Development

AN ROINN
Talmhaíochta agus
Forbartha Tuaithe

MÄNNYSTRIE O
Fairms an
Kintra Fordèrin

INVESTORS IN PEOPLE

Table of Contents

Foreword

Robert Huey
Chief Veterinary Officer

I am pleased to introduce DARD's second Northern Ireland (NI) Bovine tuberculosis (bTB) Eradication Programme Annual Report. It builds on last year's report and describes and quantifies Programme activities and outcomes for 2014.

As with the 2013 Report, you will see that the Programme is built around fundamental disease control principles and comprises many interdependent elements. The fundamental structure of the programme hasn't changed and we remain committed to progressively reducing and ultimately eradicating this disease in our cattle population.

Some notable actions have taken place during 2014 that will help progress us towards this goal:-

- the first year of field work for the Test and Vaccinate or Remove Wildlife Intervention Research Project (TVR) was successfully completed (http://www.dardni.gov.uk/tvr-year-1-report.pdf);
- the TB Strategic Partnership Group was established and began its work to develop a long-term strategy to eradicate bTB from the NI cattle herd (http://www.dardni.gov.uk/index/animal-health-and-welfare/animal-diseases/bovine-tuberculosis/tbspg.htm);
- EU approval was achieved for the 2015 UK bTB Eradication plan;
- maps showing the density of TB breakdowns across NI were produced and sent to all Veterinary Practices involved in TB testing (http://www.dardni.gov.uk/index/statistics/animal-disease-statistics/statistics-tuberculosis/tb-heat-maps.htm);
- preparations began for a scheduled EU Commission Food and Veterinary Office (FVO) Audit of the TB programme in 2015;
- DARD was represented and presented scientific posters at an International *M.Bovis* conference in Cardiff;
- veterinary and administrative staff received further training in programme delivery; and
- a number of research projects were completed and have been published (details are in this report and on the DARD website).

As with last year I should like to thank all sections of the industry, particularly those directly affected by bTB during 2014, for their efforts and cooperation. I should also like to recognise the role of DARD staff, AFBI, our delivery partners and stakeholders in moving the Programme forward during the year and I look forward to these partnerships continuing into the future.

Robert Huey TD MVB DVPH(MH) MRCVS

Chief Veterinary Officer NI

Executive Summary

The characteristics of bTB make it a very challenging disease to deal with and it is widely regarded as the most difficult animal disease problem currently facing government, the veterinary profession and the farming industry in these islands.

DARD is committed to progressively reducing and ultimately eradicating bTB in cattle. However eradication cannot be achieved by DARD alone, nor can it be achieved in the immediate future.

We have a comprehensive bTB Programme, which involves a wide range of personnel and activities and is approved by the EU Commission as part of the overall UK plan.

This report is based around the key disease control components of the Programme, namely:

1. Disease surveillance - abattoir surveillance through post mortem examination (PME) of all slaughtered animals and live animal surveillance using the single intradermal comparative cervical tuberculin test (SICCT - skin test) augmented by the interferon gamma blood test (IFNG).
2. Removal of reactor animals - disclosure of disease leads to the compulsory slaughter of reactor animals.
3. Veterinary risk assessment and application of appropriate disease controls, which are applied as soon as disease is suspected to prevent further spread and also following investigations to indicate where disease may have come from, or spread to. Herds or animals that are considered to be at increased risk are subject to additional testing and movement controls, if applicable.

The application of measures to control disease leads to more testing. In addition, the sensitivity of the test can be increased by wider application of a more severe interpretation of test readings and additional exposed animals can be removed, whether or not they have given a positive response to the skin test. Application of these measures leads to the removal of an increased number of animals, which in turn leads, temporarily, to an increased disease incidence. However the removal of infected and exposed animals at an early stage reduces the potential for spread and subsequently results in a reduction in disease levels.

There was a sharp rise in bTB levels between September 2011 and October 2012. Since then the disease at herd level showed a downward trend to June 2014. In contrast to the previous rate of rise, the reduction was gradual and herd incidence has essentially remained level for the latter half of 2014. In contrast the animal incidence, having fallen more rapidly from the 2012 peak, remained relatively stable through 2014 until there was a definite rise from October 2014. This resulted in an increase in the number of animals removed and subsequent costs.

2014 Surveillance Summary (compared with 2013)*;

a. There was an overall decrease of 1.5% in the number of herd tests completed during 2014 (32,164 compared with 32,650). There was a slight decrease in risk herd tests in 2014.

b. There was an increase of 2.83% in the number of individual animal level risk (skin) tests completed (8,414 compared with 8,182).

c. The total number of animal tests in 2014 was 2,491,228, which represents a 1.4% decrease. The number of animals tested was 1,607,647, a 0.8% decrease (some animals were tested more than once; hence the figure is lower than the total number of tests completed).

d. The IFNG was used in less herds (184 compared with 215), but a similar number of animals were tested (16,991 compared with 16,930).

e. There were 466,478 cattle slaughtered in NI meat plants of which 1,082 (0.23%) had bTB suspected at routine slaughter (LRS) and had samples submitted for further laboratory examination. During 2013, 1,178 LRS (0.24%) were identified from 489,819 cattle slaughtered.

2014 Disease Summary (compared with 2013)*;

a. During 2014 approximately 1.61 million cattle in NI were bTB tested in 23,150 herds. The annual herd incidence showed a reduction (6.03% compared with 6.44%), but the annual animal incidence increased (0.55% compared with 0.511%).

b. A decreasing level of bTB was observed at herd level in 6 of the 10 DVO areas.

c. The number of bTB skin test reactor animals identified (8,838) was 7% higher (8,262).

d. The number of confirmed bTB positive LRS per 1000 animals slaughtered in NI increased by 3.5%.

e. There was a 33.4% increase in the number of animals that were positive to the IFNG (1,262 compared with 939). However, there was a 50.2% increase in the number of IFNG positive animals that were not also positive to the skin test (1,050 compared with 699).

f. The number of new bTB herd breakdowns was 5.5% lower (1,397 compared with 1,479).

Specified Programme costs amounted to £26,709,337, a 3.5% increase. Co-funding of the 2014 Programme was approved by the European Commission and has been agreed at the time of writing. The amount received as co-funding for the 2013 Programme was £4.46 million.

* Figures correct at time of writing

Overall Conclusions

- The reasonably steady downward trend for annual TB herd incidence which started in late 2012 continued until June 2014. From that point, annual TB herd incidence remained approximately level to the end of the year.
- Annual animal incidence remained relatively stable but showed a definite rise from October 2014. This resulted in an increase in the number of animals removed.
- Overall, there was a reduction in herd incidence but it was not uniform across all DVO areas (4 DVO areas showed a rise).
- Overall, there was an increase in animal incidence but this was not uniform across all DVO areas (2 DVO areas showed a reduction).
- The number of new breakdown herds decreased by 5.5%.
- The number of risk herd tests reduced but the proportion that disclosed reactors increased. This is in contrast to the overall herd incidence trend for 2014, and indicates these herds were correctly identified as being at higher risk.
- The number of LRS per 1,000 cattle slaughtered in NI reduced slightly (from 2.4 to 2.3), but the number of bTB positive LRS per 1,000 cattle slaughtered increased by 3.5%.

1. Introduction

1.1 This Report provides a descriptive overview of the key disease control components of our bTB Eradication Programme (bTB Programme), including a summary of the 2014 statistics.

1.2 Detailed bTB statistics for NI are published each month on the DARD web site[1] and the purpose of this Report is to add context to these statistics.

1.3 Whilst this is not designed to be a detailed technical report it provides the background to key Programme measures and quantifies the outcomes of their application.

1.4 We hope this Report will be of value to anyone who has an interest in the control and eradication of bTB.

2. The Disease

2.1 Bovine tuberculosis (bTB) is an infectious disease of cattle. It is mainly caused by the bacterium *Mycobacterium bovis (M. bovis)* which can also infect and cause disease in many other mammals including humans, deer, goats, pigs, cats, dogs and badgers. In cattle, it is mainly a respiratory disease but clinical signs are now rare. TB in humans is usually caused by a very closely related infectious agent, *Mycobacterium tuberculosis*, but may also be caused by *M. bovis*.

2.2 Bovine TB is a very complex, multifactorial and challenging disease that has proven difficult to eradicate worldwide. This is due to the characteristics of the disease itself; the difficulties in diagnosis; the existence of reservoirs of infection in other species; and the nature of the local farming industry, e.g. fragmented holdings and a large number of cattle movements. It has an adverse impact on those farm businesses affected due to the interruption to market access and the additional disease control measures that are required. It is widely regarded as the most difficult animal disease problem currently facing government, the veterinary profession and the farming industry in these islands. To eradicate bTB in cattle will require the use of a range of measures aimed at addressing the infection in cattle and preventing its spread from wildlife. It is accepted that there is no simple cost-effective solution or 'quick fix'.

> "...Bovine TB is a very complex, multifactorial and challenging disease that has proven difficult to eradicate worldwide..."

[1] http://www.dardni.gov.uk/index/statistics/animal-disease-statistics/statistics-tuberculosis.htm

3. DARD Goals

3.1 DARD is committed to progressively reducing and ultimately eradicating bTB in cattle. Eradication of bTB cannot be achieved by DARD alone, nor can it be achieved in the immediate future. Government, industry stakeholders and individual farmers must work in partnership to tackle this disease and reduce its spread.

3.2 Our immediate goals are to:

(a) maintain trade; and

(b) produce more effective and efficient ways of reducing transmission of bTB between cattle and to/from wildlife.

4. Policy Development and Programme Implementation

Policy Development and Stakeholder Engagement

4.1 Central Policy Group is responsible for the development of bTB policy. Veterinary Service provides veterinary advice in support of policy development and is responsible for bTB Programme implementation. The bTB eradication Programme in NI is directed by a Steering Group, which is supported by an expert group known as the TB Policy Development Group and a specialised TB Implementation Team. DARD continues to work in partnership with its science provider, the Agri-Food and Biosciences Institute (AFBI), to identify knowledge gaps and to explore research and development options to complement current work. Stakeholder engagement is conducted via the Animal Health and Welfare Stakeholder Forum and the TB Stakeholder Working Group with membership from industry, veterinary and environmental organisations. Veterinary Service and Private Veterinary Practitioners (PVPs) engage through a TB Testing Partnership Group and Chief Veterinary Officer meetings. In addition in 2014 the Minister established a government/industry TB Strategic Partnership Group (TBSPG) to develop a long-term strategy, and associated implementation action plan, to eradicate TB from the NI cattle herd. The TBSPG began its evidence gathering towards the end of the year.

Programme Implementation

4.2 The delivery of the bTB Programme involves a wide range of activities, including:

✓ Animal registration and movement control.

✓ Disease surveillance, post mortem inspection of all carcases at abattoirs and, at least, annual bTB testing on all cattle farms.

✓ Disease investigations and application of disease controls.

✓ Provision of advice on biosecurity and disease control.

- ✓ Epidemiological assessment and advice.
- ✓ Monitoring of Programme delivery.
- ✓ Export and import tracing and notifications.
- ✓ Valuation and removal of reactors to slaughter.
- ✓ Compensation payments.
- ✓ Quality assurance.
- ✓ Management of contracts with private sector partners.
- ✓ Training of staff and delivery partners.
- ✓ Engagement with stakeholders.
- ✓ Liaison with external public health agencies, including the Health Service Consultants in Communicable Diseases, Health and Safety Executive and Public Health Authorities.
- ✓ Counter fraud measures.

4.3 Programme delivery also requires a wide range of personnel and expertise including:

- ✓ Veterinary surgeons, who are either DARD employees or DARD approved private veterinary practitioners (PVPs), who carry out all “on farm” bTB skin tests.
- ✓ AFBI Veterinary Sciences Division not only carry out the laboratory testing necessary for the confirmation of the disease but also serve as the primary provider of bTB research and scientific advice for DARD.
- ✓ Animal identity, testing and movement are recorded and controlled through the APHIS database. This includes post mortem results, mainly from abattoirs, and laboratory test results from AFBI. Controlled access to relevant data is provided to various users including farmers, markets, food business operators and PVPs.
- ✓ Veterinary Service is responsible for the integrated delivery of the bTB Programme in NI. There are ten Divisional Veterinary Offices (DVOs), incorporated in DARD Direct Offices, and the administrative area of each office is sub-divided into “patches”, each of which is managed by a DARD Veterinary Officer (VO) supported by a team of technical officers. Each bTB breakdown therefore has an allocated VO who manages the disease control measures necessary to reinstate the herd’s disease free status.
- ✓ Close engagement between the Patch VO and the farmer whose herd has become a new herd breakdown works to mutual benefit; it ensures the farmer has a point of contact to help address problems and concerns and also assists DARD to ensure that the potential for further spread of disease has been addressed.
- ✓ A TB Implementation Team (TBIT) was set up in 2013 to monitor the delivery of the Programme through audit of decision making and field processes.

4.4 **Figure 1** shows the main DARD branches and delivery partners that are involved in the delivery of the bTB Programme.

4.5 **Figure 2** is a map showing the areas covered by the 10 DVOs. Although this section describes the Programme and its delivery from a DARD perspective we must acknowledge the vitally important role that individual farmers play in the development and delivery of the bTB Programme through their cooperation and compliance, and also the contributions of industry stakeholders.

Figure 1: bTB Programme - Main DARD Branches and Delivery Partners

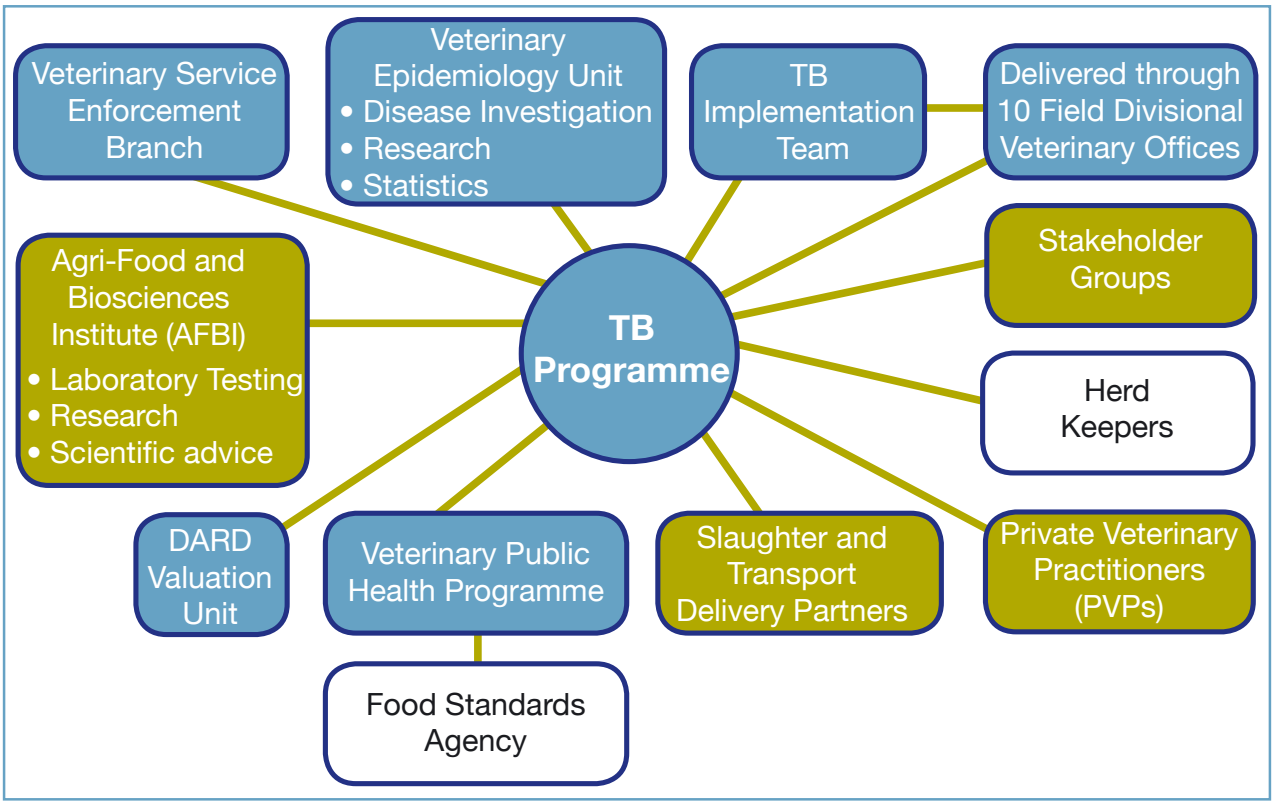
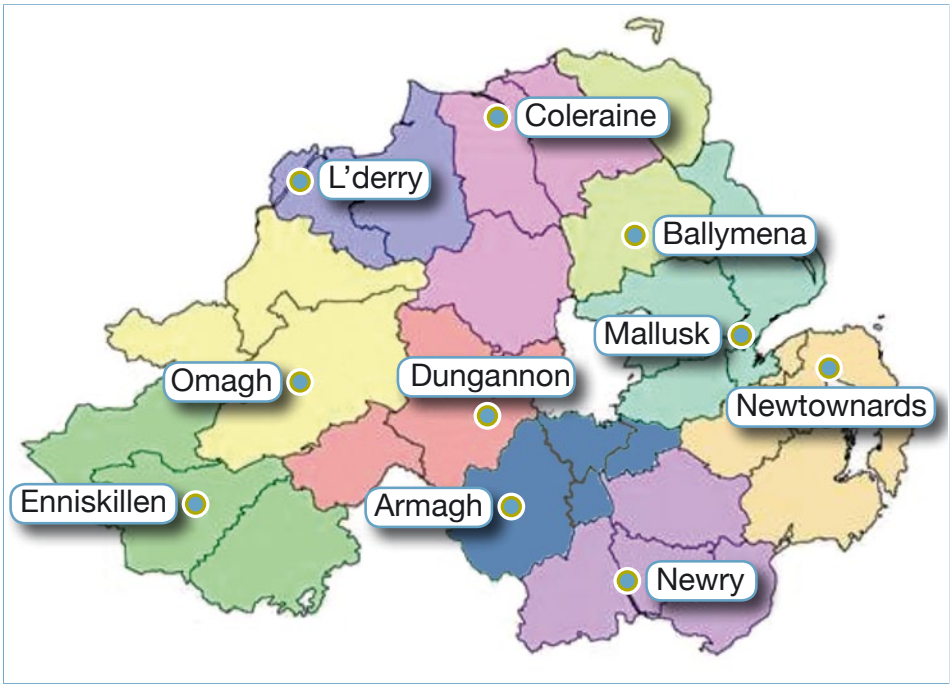


Figure 2: Divisional Veterinary Office (DVO) Locations and Areas Covered



5. The bTB Eradication Programme

> "...Importantly, Programme controls reduce the risk of disease in humans and clinical disease in cattle..."

5.1 DARD has an EU Commission approved bTB eradication Programme, ensuring compliance with the EU Trade Directive 64/432/EEC (as amended). Importantly, Programme controls reduce the risk of disease in humans and clinical disease in cattle. EU approval of our bTB eradication Programme is vital in safeguarding our export-dependent livestock and livestock products industry (worth in excess of £1,000 million per annum). As a result of the assurances deriving from the Programme, over 90% of our herds are free to access international markets at any one time. EU Commission approval also secures some €5 million per year of EU co-funding. The approved bTB eradication Programme for 2014 is available on line[2].

5.2 This Report is based around the key disease control components of the Programme. It describes them, quantifies their delivery and the resultant outcomes. The key components are:

1. Disease surveillance;
2. Removal of reactor animals;
3. Veterinary risk assessment and application of appropriate disease controls.

Disease Surveillance

5.2.1 Our disease surveillance is based on two distinct elements:

Post mortem Examination (PME) of all Slaughtered Animals

(a) All animals slaughtered for human consumption are subject to PME, primarily for public health assurance. This, amongst other things, looks for visible signs of bTB infection. Disclosure of visible signs (or lesions) at PME will, subject to veterinary risk assessment, result in the exclusion of either the infected part of the carcase or the entire carcase from human consumption. It will also trigger the application of disease

"... All animals slaughtered for human consumption are subject to Post mortem examination primarily for public health assurance**..."**

[2] *Eradication Programme for Bovine Tuberculosis United Kingdom*
http://ec.europa.eu/food/animal/diseases/docs/adopted_2013_722_eu_bovine_tuberculosis_uk_en.pdf

control measures to the herd presenting the animal. The finding of bTB - like lesions (granulomas) alone is not definitive because they may be caused by other diseases or conditions. Therefore, samples are taken for further laboratory examination. When suspected visible signs are seen in skin test negative animals that are not compulsorily slaughtered under the bTB Programme, the animal is said to have a "Lesion at Routine Slaughter" (LRS). Appropriate disease control measures, such as movement restrictions and testing, are applied to the relevant herds. The number and distribution of LRS animals can be an indication of the underlying disease levels and trends within the cattle population as they represent an independent sampling system outside live animal surveillance.

Live Animal Surveillance

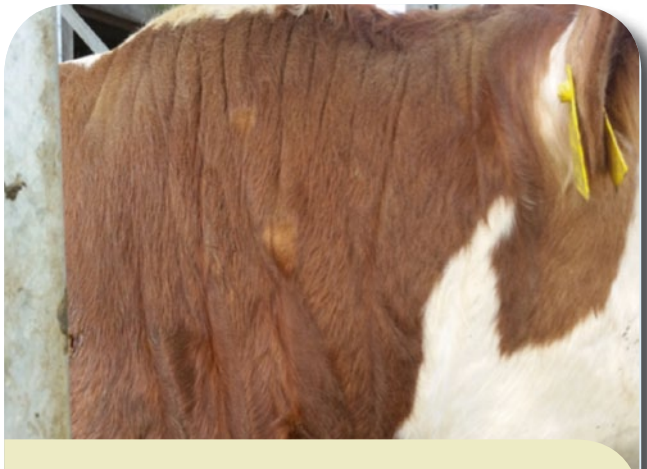
(b) This is based primarily on the single intradermal comparative cervical tuberculin test (SICCT), as approved by the EU. This is usually referred to as the "skin test". All cattle herds must be tested annually, as a minimum requirement, but some are tested more frequently if they are considered at increased risk of disease following veterinary risk assessment of a disease incident. An animal that gives a positive response to the skin test is called a 'reactor' and the herd in which reactors are found is referred to as a 'TB Breakdown Herd' because a positive skin test is considered indicative of infection in a herd. The other live surveillance diagnostic method employed by the Programme is the interferon gamma blood test (IFNG), which is used in conjunction with the skin test to improve diagnosis of bTB in certain situations. Use of the IFNG is voluntary and it is not compulsory for farmers to give up any IFNG positives that are detected, unless they are also skin test positive.

> "...An animal that gives a positive response to the skin test is called a 'reactor' and the herd in which reactors are found is referred to as a 'TB Breakdown Herd'..."

Removal of Reactor Animals

5.2.2 Disclosure of disease as described above, leads to the compulsory slaughter, with compensation at full market value, of reactor animals. DARD aims to remove reactor animals within 15 working days of completion of the positive test. During 2014, this target was met for 92.5% of reactors.

5.2.3 Reactor animals, compulsorily removed by DARD, are subject to PME, which along with further laboratory diagnostic work on samples, provides further information to the Programme. A crucial point to emphasise



"...A positive skin test is considered indicative of infection in a herd..."

is that the absence of visible lesions at slaughter does not mean that the animal was not infected. Infected and reactive animals may not have had time to form a lesion, or the lesion may not have been visible to the inspector conducting the post mortem. This is because the diagnostic test is based on an immunological response to infection that may precede development of visible lesions.

5.2.4 The Programme includes the use of *M. bovis* strain typing, a high-resolution DNA fingerprinting method, which allows the identification of genetically distinct *M. bovis* strains. Currently, all visibly lesioned reactors are cultured in addition to animals cultured for statutory confirmation of disease and, when *M. bovis* is isolated, it is strain typed by AFBI. The multiple strains of *M. bovis* identified show a striking degree of geographical localisation, which can be exploited to inform on potential disease source and spread. The strain typing data are made available to the DARD VOs and are used to retrospectively inform outbreak investigations, and for research into bTB epidemiology and *M. bovis* evolution.

> “...Absence of visible lesions at slaughter does not mean that the animal was not infected”

Veterinary Risk Assessment and Application of Disease Controls

5.2.5 Controls are applied as soon as disease is suspected. Their purpose is to prevent spread from the breakdown herd, to indicate where the disease may have come from or spread to, and to remove infection. Disclosure of disease leads to the immediate restriction of the movement of cattle from infected herds until they are no longer considered to be a bTB breakdown. When a herd is declared a breakdown herd, only routine movements directly to slaughter in NI are permitted. Breakdown herds are unable to access live markets, either directly to another farm (except in very exceptional animal welfare circumstances following disease risk assessment), a market, or to export. This is to prevent disease spread to other herds. In conducting the risk assessment the veterinary officer 1) *considers* which herds the reactor animals came from, or passed through, before reacting in the breakdown herd 2) *checks* what animals have moved from the breakdown herd between the estimated date of infection and the date restrictions were applied and
3) *investigates* possible direct and indirect contacts with livestock in other herds.

5.2.6 Cattle herds that are considered at increased risk of a disease incident are subject to additional testing. This may be because their animals have been in close proximity to animals in the breakdown herd e.g. grazing in neighbouring fields, or because animals from the breakdown herd had moved into the herd before the breakdown was detected. Some individual animals are also tested following a veterinary risk assessment. Therefore the levels of disease risk have a direct influence on the volume of testing that is required to control the disease.

> “...Cattle herds that are considered at increased risk of a disease incident are subject to additional testing...”

5.2.7 To further control disease, primarily within the breakdown herd itself, the risk assessment may lead to the removal of animals that are considered to be at increased disease risk due to the extent of their exposure to disease, even if they do not give a positive skin test result. These animals are called “Negative in Contacts” (NICs). IFNG may also be used to support the control of disease in a breakdown herd.

5.2.8 Further information about what happens when a herd becomes a bTB breakdown can be found in the *‘TB in your Herd’* Booklet[3] which is provided to all keepers of breakdown herds.

Measuring Disease Levels

5.3 We use different measures to monitor levels of disease.

5.3.1 The primary one is a calculation of bTB incidence. It is used both at herd level and at animal level. In our routine statistics we use the 12 month moving average figures because they give the clearest indication of long term trends (see **Glossary of Terms** for definitions).

5.3.2 There is a continuum of infection levels across the Province. Although there are no defined regional differences, certain DVO areas tend to have higher levels of the disease and others tend towards a lower incidence. The disease tends to cluster locally and, depending on how long and in which animal populations infection has been established, it may take some time before the Programme controls take effect. Disease levels therefore fluctuate locally and, if there is significant spread, a rise may be observed at a DVO area, regional or even national level. In this situation the Programme controls are, essentially, those previously described but their intensity and the scale of their application can be adjusted to match the existing disease risk.

5.3.3 Controls can be applied on an area risk basis, rather than on an individual farm basis. In the face of increasing levels of disease the sensitivity of the skin test can be increased by the wider scale application of a more severe interpretation of test readings and additional exposed animals can be removed, as partial or complete herd depopulations, whether or not they have given a positive response to the skin test. Application of these measures leads to the removal of an increased number of animals, which in turn leads temporarily to an increased disease incidence. However the removal of infected and exposed animals at an early stage reduces the potential for spread and subsequently results in a reduction in disease levels.

[3]*TB in your Herd Booklet* http://www.dardni.gov.uk/tb-in-your-herd-booklet.pdf

6. 2014 Disease Summary

6.1 During 2014 approximately 1.61 million cattle were bTB tested in NI, in 23,150 herds. There was a reduction in the annual herd incidence (6.03%), but an increase in the annual animal incidence (0.55%), compared with 2013 (6.44% and 0.511%, respectively).

6.2 At herd level, decreasing bTB incidence was observed in 6 DVO areas, with an increasing level in the remainder. In contrast, only 2 DVO areas had a decreasing bTB incidence at animal level, with an increasing level in the remainder.

6.3 The number of bTB skin test reactor animals identified during 2014 (8,838) was 7% higher than the number identified during 2013 (8,262).

6.4 The number of confirmed bTB positive Lesion at Routine Slaughter animals (LRS) increased in 2014 by 3.5% compared with 2013 (703 compared with 679).

6.5 There was a 33.4% increase in the number of animals that were positive to the IFNG test (1,262) compared with 2013 (939). There was also an increase of 50.2% in the number of IFNG positive, skin test non positive cattle (STNP i.e. SICCT Negative or Inconclusive) (1,050) relative to 2013 (699).

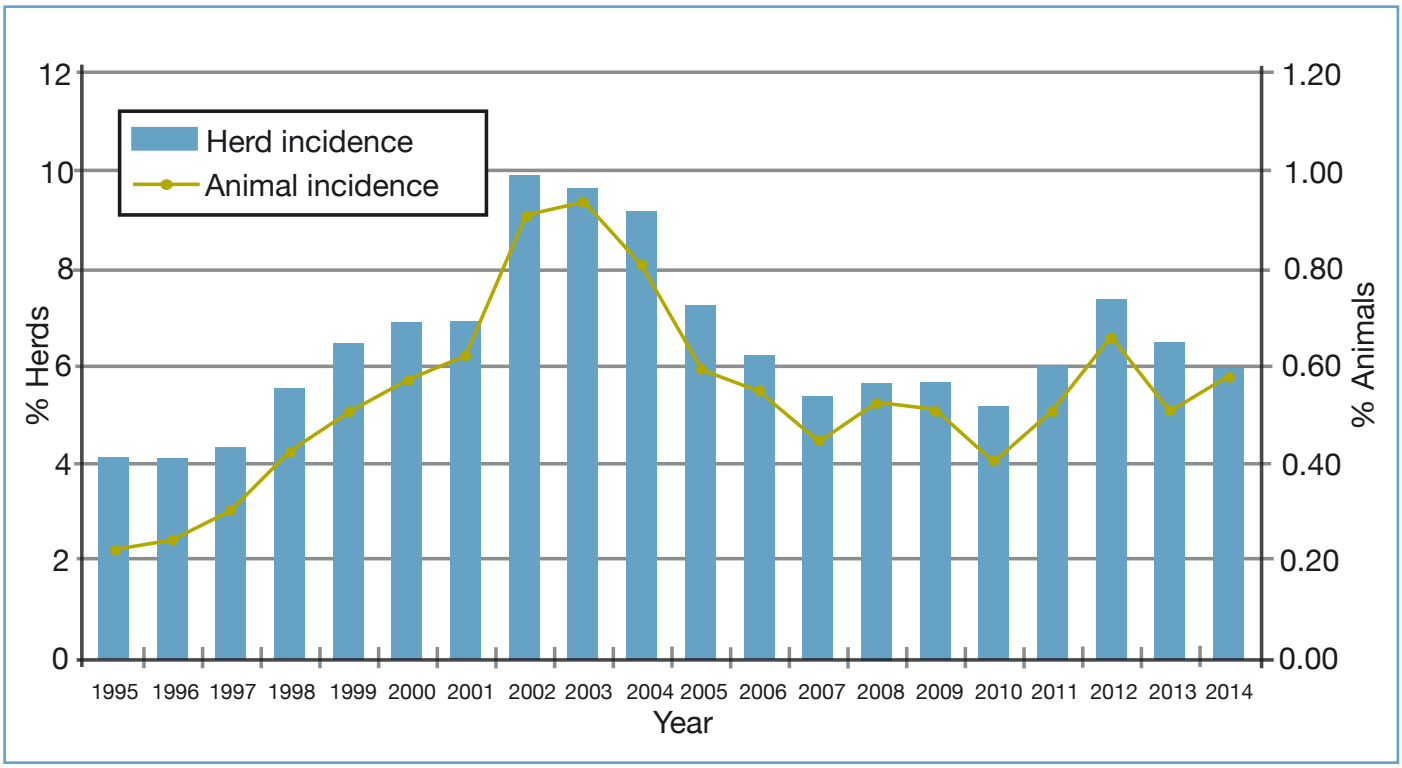
6.6 The number of new bTB herd breakdowns (1,397) was 5.5% lower relative to 2013 (1,479).

7. Disease Levels

Historic Trends

7.1 Looking at the annual bTB herd incidence (i.e. the incidence for each calendar year (**FIGURE 3**)), there was a rising trend in disease levels through the mid to late 1990s which continued into the early 2000s. The annual herd incidence in 1995 was 4.07%, and it rose to 9.92% in 2002 after which it fell to 5.35% in 2007. Over the years 2007-2010, herd incidence remained relatively level and in 2010 the annual incidence was 5.12%, its lowest level since 1998. A sharp rise took place in 2011 and this continued in 2012 when the annual herd incidence was 7.34%. However, over 2013, the herd incidence fell to 6.44% and this trend continued in 2014 reaching 6.03%. The annual animal bTB incidence followed a similar trend in 2013 (0.51%) although it increased in 2014 (0.55%).

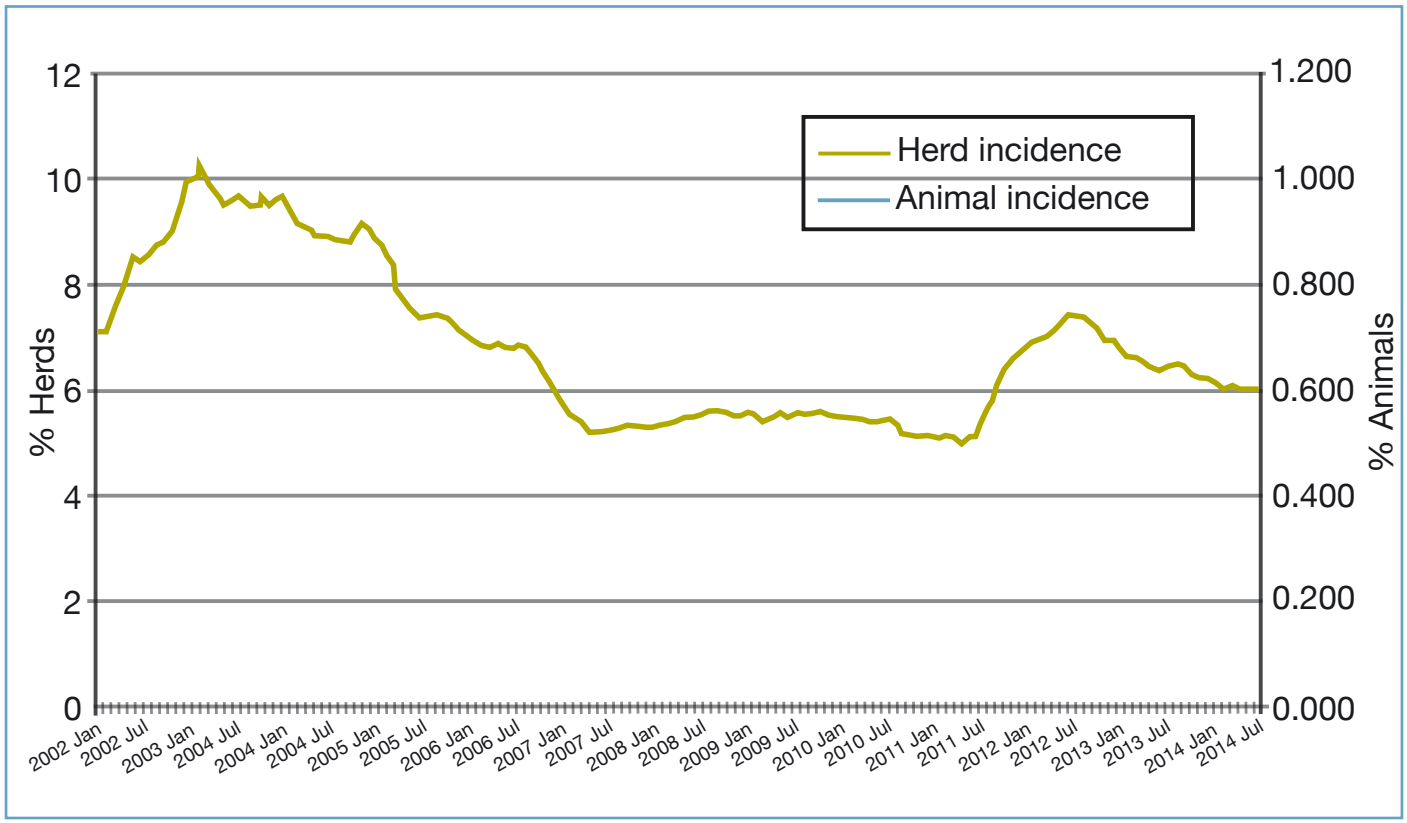
Figure 3: bTB Herd and Animal Incidence from 1995 to 2014



7.2 **Figure 4** shows the 12 month moving average for bTB herd and animal incidence since January 2002. While the overall trends remain the same, this chart shows rises and falls in levels as they occur during the year. For example, a peak in herd incidence of 10.21% occurred in February 2003. In August 2011, the 12 month bTB herd incidence was 4.99% and after this it started to rise, reaching its latest peak of 7.46% in October 2012. Since then there has been a downward trend, with an occasional rise along the way. The lowest herd incidence during 2014 was in September (5.95%), but the year ended at 6.03%

bTB animal incidence has also followed this trend reaching the lowest level in January 2011 at 0.401%. The latest peak in animal incidence was reached in November 2012 at 0.674%.There was a sharp downward trend during 2013. During 2014, it remained relatively stable before showing a definite rise from October peaking in December at 0.55%.

Figure 4: 12 Month Moving Average bTB Herd and Animal Incidence from January 2002 to December 2014



2014 Herd Incidence

7.3 The herd incidence for 2014 was 6.03% (compared with 6.44% in 2013). There was a variable picture across the 10 DVO areas. Six of the 10 DVO areas demonstrated a decrease in annual herd incidence compared with 2013.

Dungannon and Omagh DVO areas had slight increases whereas Coleraine and Londonderry DVO areas showed the most significant rise (0.99% and 1.28% increase, respectively). Armagh DVO area showed the most significant reduction in its herd incidence levels (from 6.66% in 2013 to 4.84% in 2014). Newtownards DVO area, although it also had a reduction, showed the highest incidence (8.03%) out of the 10 DVO areas. The DVO areas with the lowest incidence were Armagh (4.84%) and Londonderry (4.83%) (**Figures 5 & 6**).

Figure 5: Annual bTB Herd Incidence by DVO area (Southern Region) 2013 and 2014

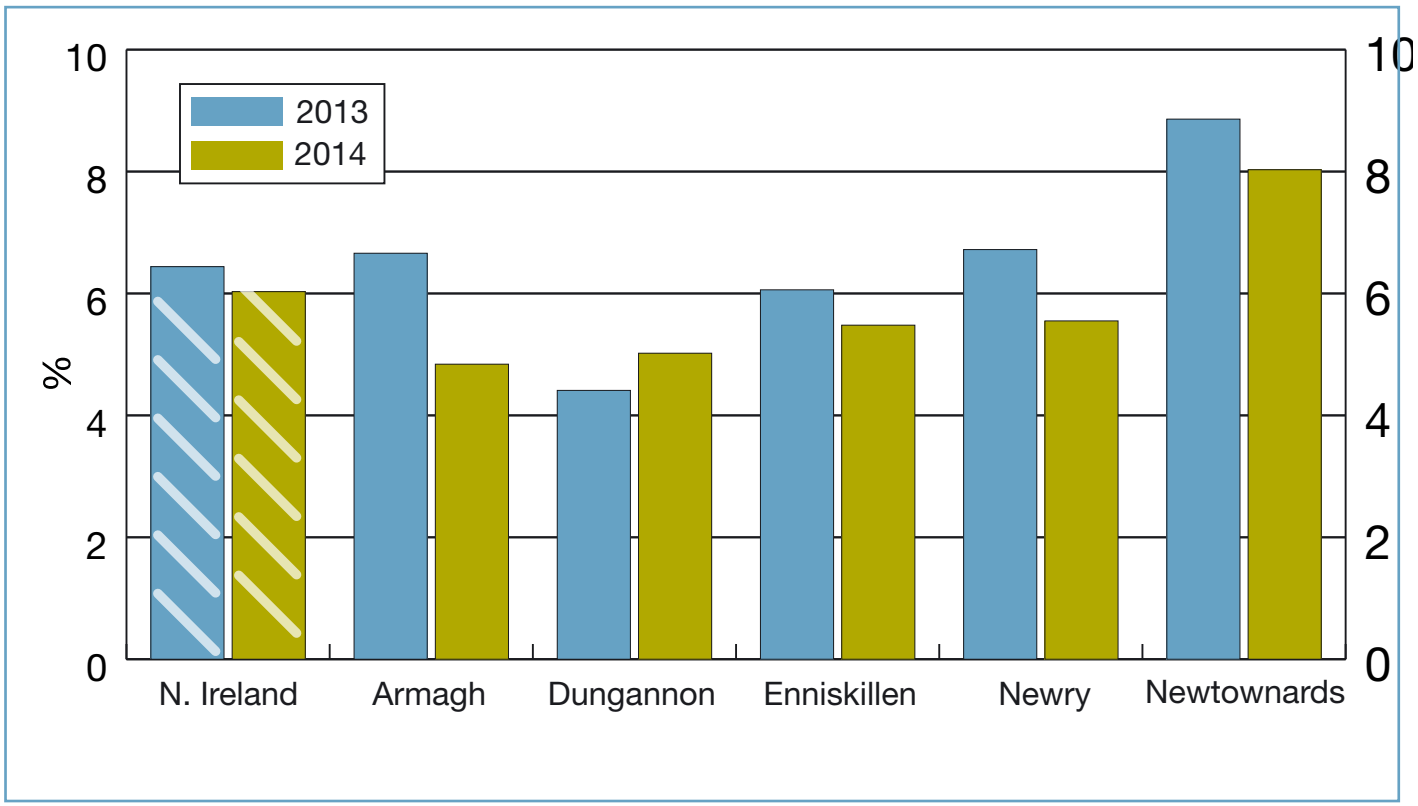
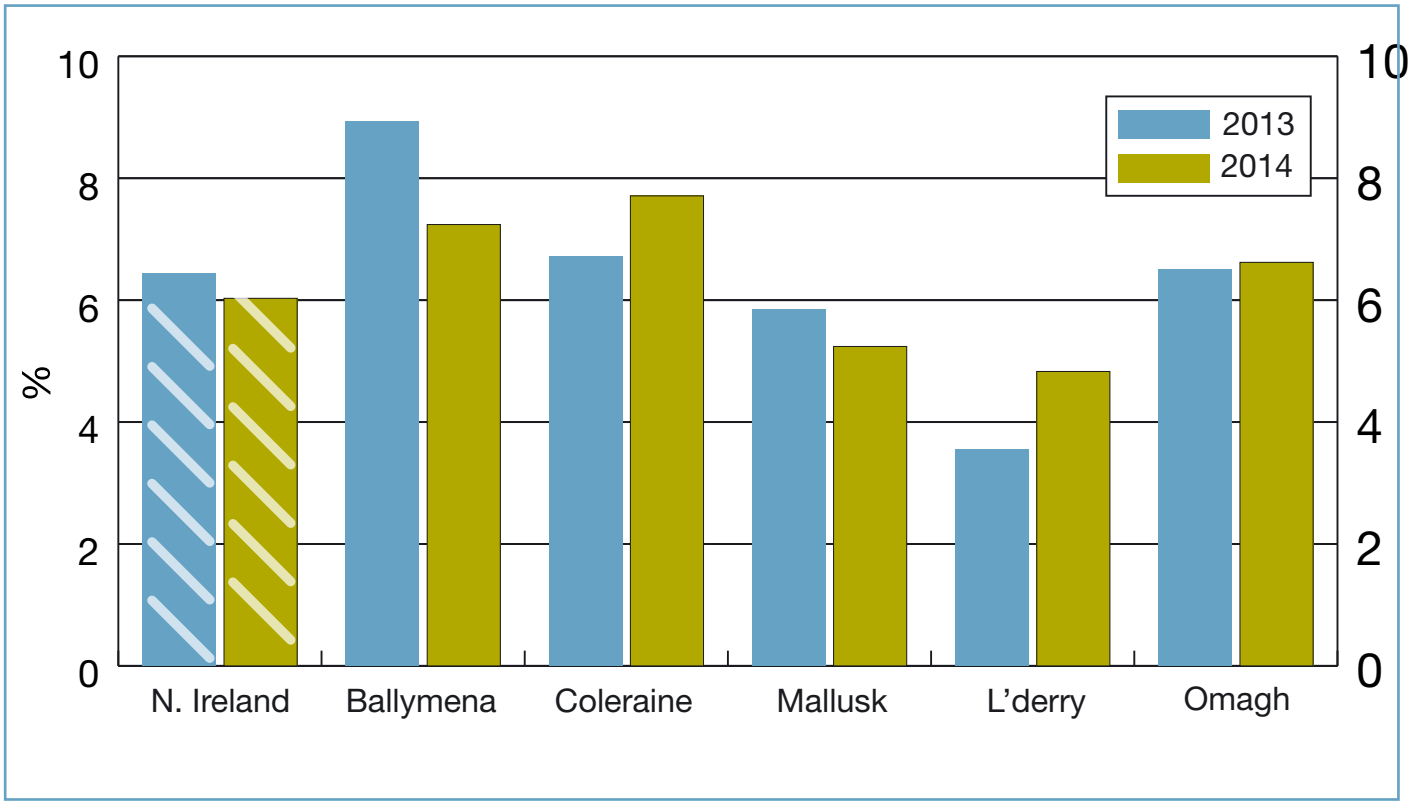


Figure 6: Annual bTB Herd Incidence by DVO area (Northern Region) 2013 and 2014



Animal Incidence

7.4 The annual animal incidence increased slightly to 0.55% in 2014 from 0.511% in 2013, although it showed a sharp upturn towards the end of the year.

7.5 All DVO areas except Ballymena and Armagh showed an increase in animal incidence over 2014 compared with the previous year. The highest increases were in Coleraine and Newry (0.152% and 0.181%, respectively). Newry had the highest animal incidence in 2014 (0.815%) (**FIGURES 7 & 8**). The DVO area with the lowest animal incidence was Londonderry (0.199%).

Figure 7: Annual bTB Animal Incidence by DVO area (Southern Region) 2013 and 2014

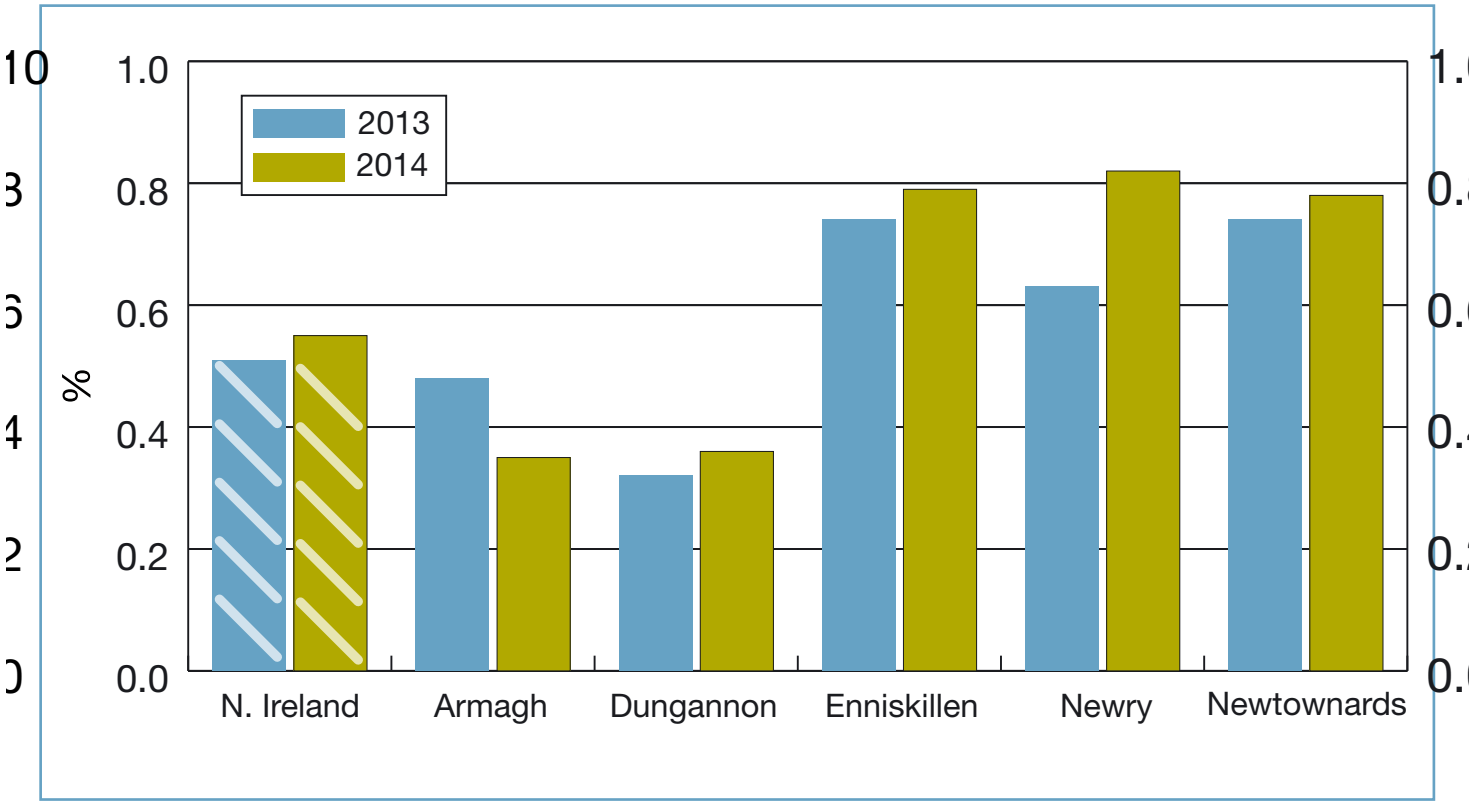
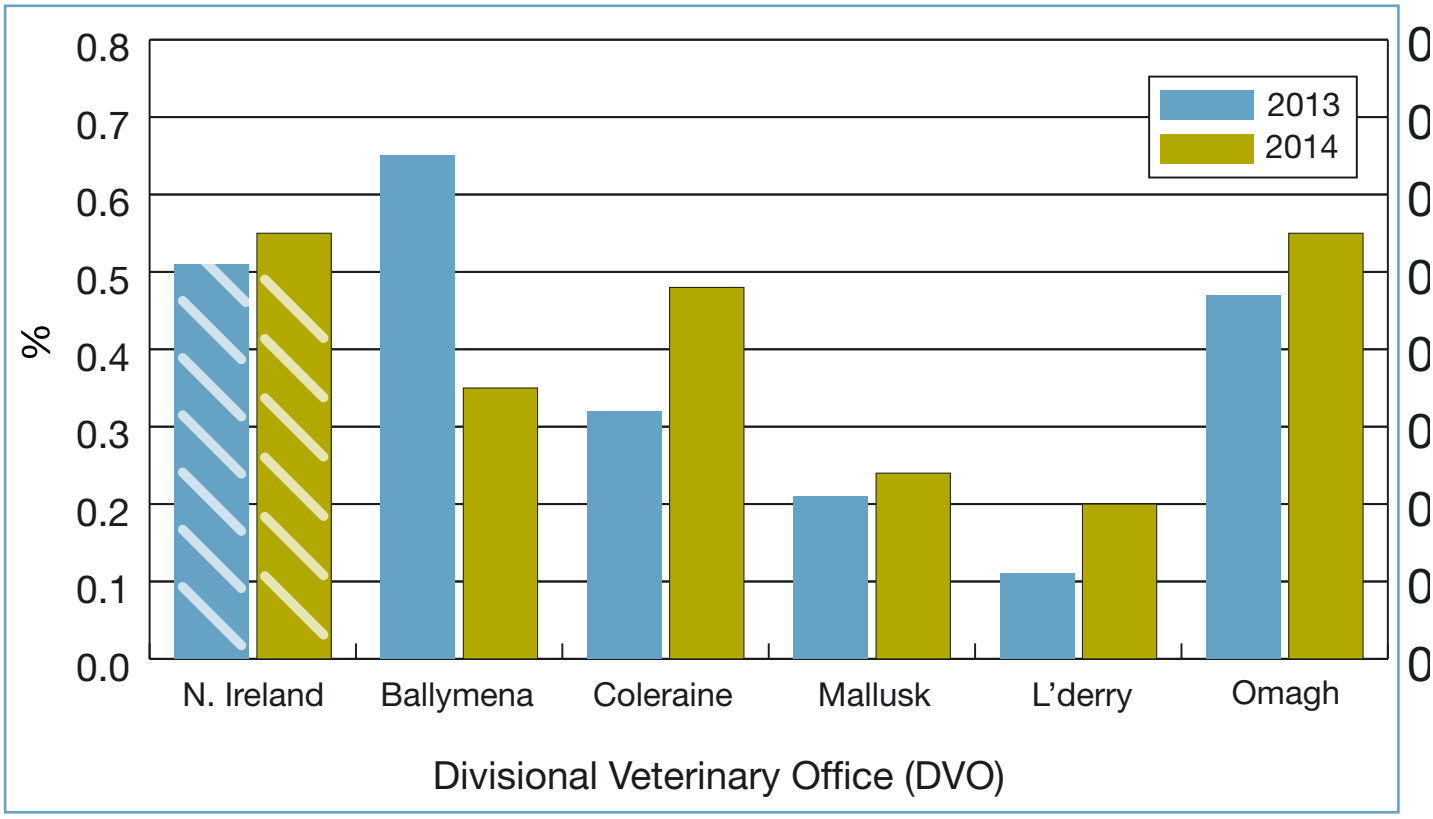


Figure 8: Annual bTB Animal Incidence by DVO area (Northern Region) 2013 and 2014



8. Surveillance Outputs

Post Mortem Examination (PME)

8.1 There were 466,478 cattle slaughtered in NI during 2014 of which 1,082 (0.23%) were found to have Lesions at Routine Slaughter (LRS) from which samples were submitted for further laboratory examination. **TABLE 1** below shows the overall figures for cattle slaughtered during 2013 and 2014 and also the figures after animals that were imported for direct slaughter were excluded, as they were not resident in NI herds, and therefore did not contribute to our disease profile. During 2014, a further 26 LRS were identified in cattle exported from NI directly to slaughter (32 during 2013).

Table 1: Numbers of Cattle Slaughtered and Numbers of LRS for 2013 and 2014

Year	Animals slaughtered	LRS (Number per 1000 animals slaughtered)	Animals slaughtered excluding direct imports	LRS excluding direct imports (Number per 1000 animals slaughtered)
2013	489,819	1,178 (2.40)	455,906	1,108 (2.43)
2014	466,478	1,082 (2.32)	435,485	1,046 (2.40)

Skin Test - Herd Level Tests

8.2 The number of herds that completed a herd test in 2014 was 23,150. A total of 32,164 herd tests were carried out in 2014 compared with 32,650 in 2013 (**TABLE 2**), a decrease of 1.5%. There were more herd tests than herds because a proportion of herds were tested more than once during the year. The decrease in the number of herd tests was less than might have been expected but it reflected the significant disease risk that remained during the year.

Table 2: bTB Herd Tests Completed 2013 - 2014 (By Test Category)

Herd Test Category	Herd tests completed in 2013 (cattle >0)*	Herd tests completed in 2014 (cattle>0)	% Difference in test numbers between 2013 and 2014 (%)
Restricted	5,947	5,494	-7.6
Risk	10,633	10,199	-4.1
Routine	16,070	16,471	2.5
Total herd tests	32,650	32,164	-1.5

**Cattle >0 which means that the herds had cattle in them at the time of the test.*

8.3 The distribution of tests varies in each DVO area and is a function of the number of herds, the disease levels and the predominant disease risk factors in the area (see **TABLE 3** and **FIGURES 9 and 10** below). Newry, Enniskillen and Omagh are the DVO areas with the highest number of herds that are eligible for testing, each with over 3,000 herds. Londonderry, Mallusk and Ballymena DVO areas have the lowest numbers.

Table 3: Number of bTB Herd Tests in 2014 (per category by DVO area)

DVO	Routine Tests	Restricted Tests	Risk Tests	Total Tests
Armagh	1,483	532	1,165	3,180
Ballymena	944	438	568	1,950
Coleraine	1,820	541	938	3,299
Dungannon	2,316	567	685	3,568
Enniskillen	2,084	583	1,638	4,305
Mallusk	1,372	375	319	2,066
L'Derry	799	140	140	1,079
Newry	2,293	959	2,193	5,445
N'Ards	1,142	699	1,160	3,001
Omagh	2,218	660	1,393	4,271
Total	16,471	5,494	10,199	32,164

Figure 9: Percentage of the NI Total bTB Herd Tests Completed by DVO area in 2013 - 2014

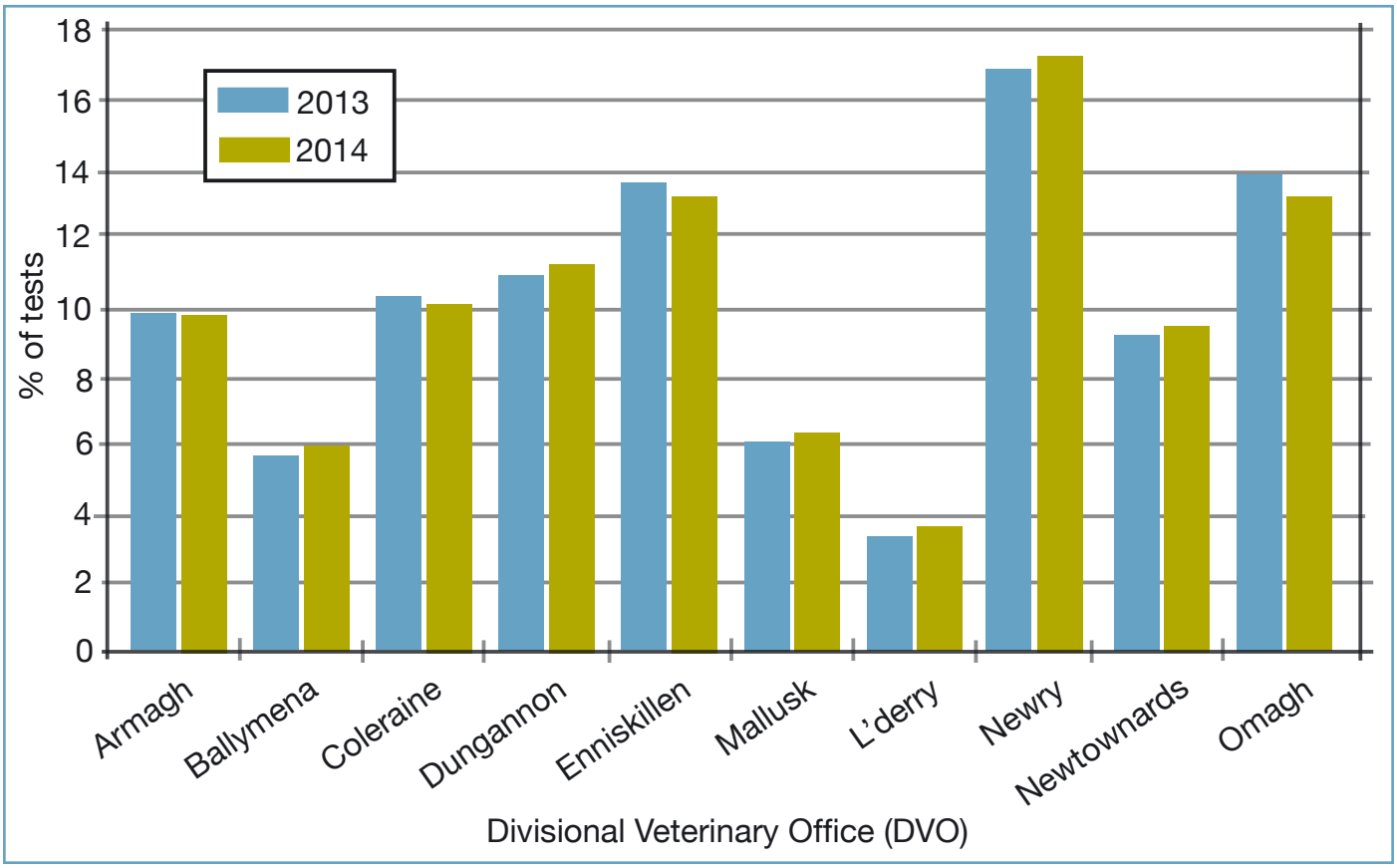
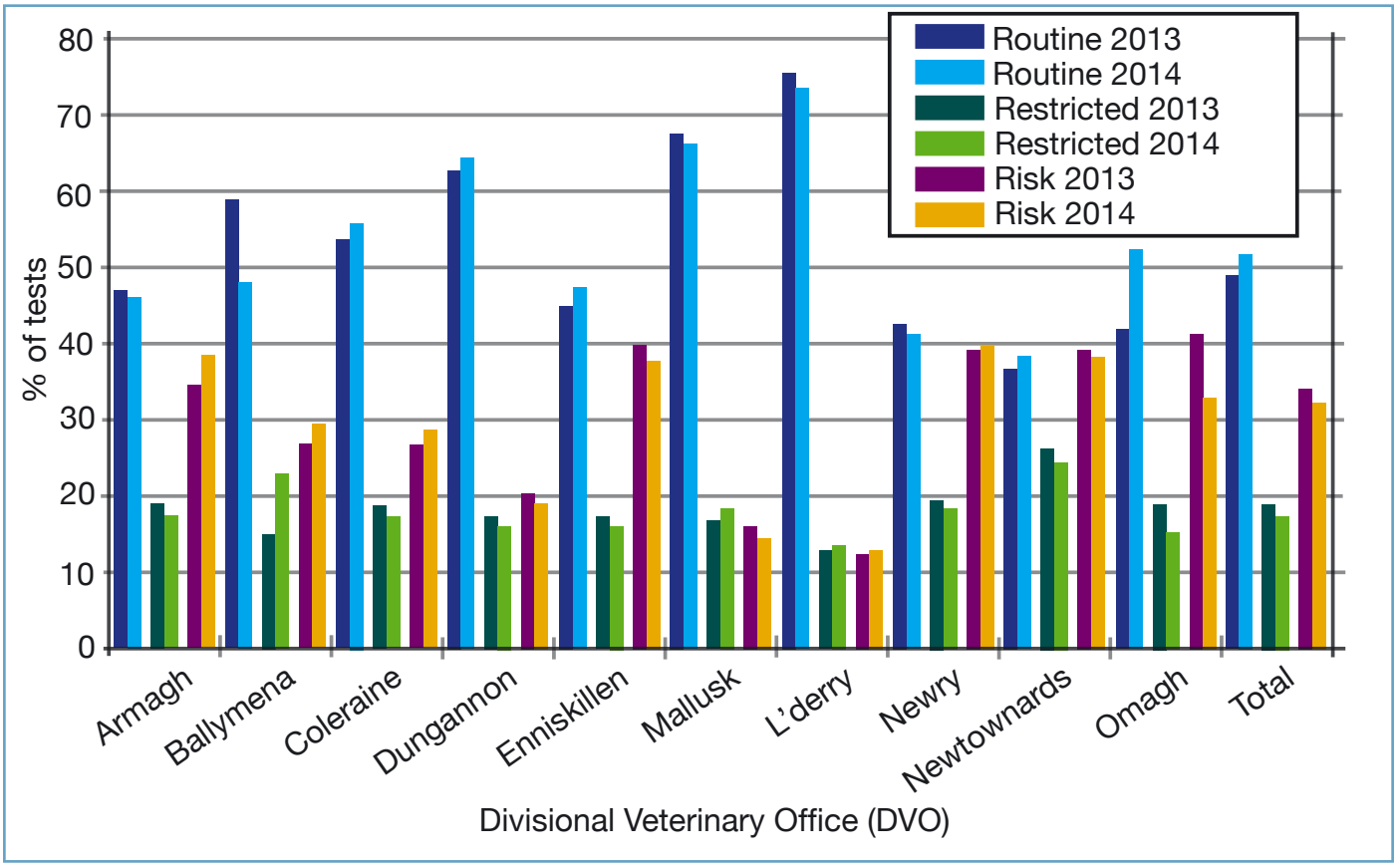


Figure 10: Percentage of bTB Herd Test Categories within each DVO area in 2013 and 2014



8.4 Overall there was a reduction in the volume of restricted and risk herd tests both numerically and proportionally, as one would expect with a decrease in herd incidence. Dungannon, Enniskillen, Newtownards and Omagh DVO areas were the areas with both numerical and proportional reductions in the volume of both categories of test. Ballymena and Londonderry DVO areas were the only areas with both numerical and proportional increases in the volume of both categories of test. For a detailed comparison of the number and percentage of each test category by DVO see **TABLE A** in **ANNEX**.

Skin Test - Individual Animal Level Risk Tests

8.5 There are many and varied reasons for allocating individual animal tests. For the purpose of this report the test reasons included are those allocated as a result of the disease surveillance and risk assessment processes (**TABLE 4**). Other individual animal level tests, such PCTs, PNAs and PNTs (see definitions in the glossary of terms) are paid for by farmers. PCTs are required prior to certain animal movements and pre-export. PNAs and PNTs are imposed by the Programme when an animal has moved from a restricted herd or when an animal has not been tested in the previous 15 months respectively, and are two important Programme controls based on general risk principles. In 2014 there were 5 reactors (from 18,719 animal level tests) identified in these three test reasons and 3 in 2013 (from 17,875 animal level tests). CTI (Check Test Import) tests are used for Trade Branch purposes to ensure animals re-imported from Britain meet testing and standstill requirements. No reactors were identified by CTIs during either 2014 (from 40 animals tested), or 2013 (from 29 animals tested).

The overall number of individual risk animal tests (CTTs, CTS, CTQs and RIs) completed in 2014 was 8,414, compared with 8,182 in 2013, an increase of 2.8%.

Table 4: Individual Animal Level Risk bTB Tests Completed in 2013 - 2014

Test reason *	Tests completed during 2013 (cattle >0)	Tests completed during 2014 (cattle >0)	Difference between years 2013 & 2014 (%)
Inconclusive retest (RI)	2,223	1,798	-19.1
Check Test Trace (CTT)	4,733	5,449	15.1
Check Test Query (CTQ)	781	761	-2.6
Check Test Status (CTS)	445	406	-8.8
Total	8,182	8,414	2.8

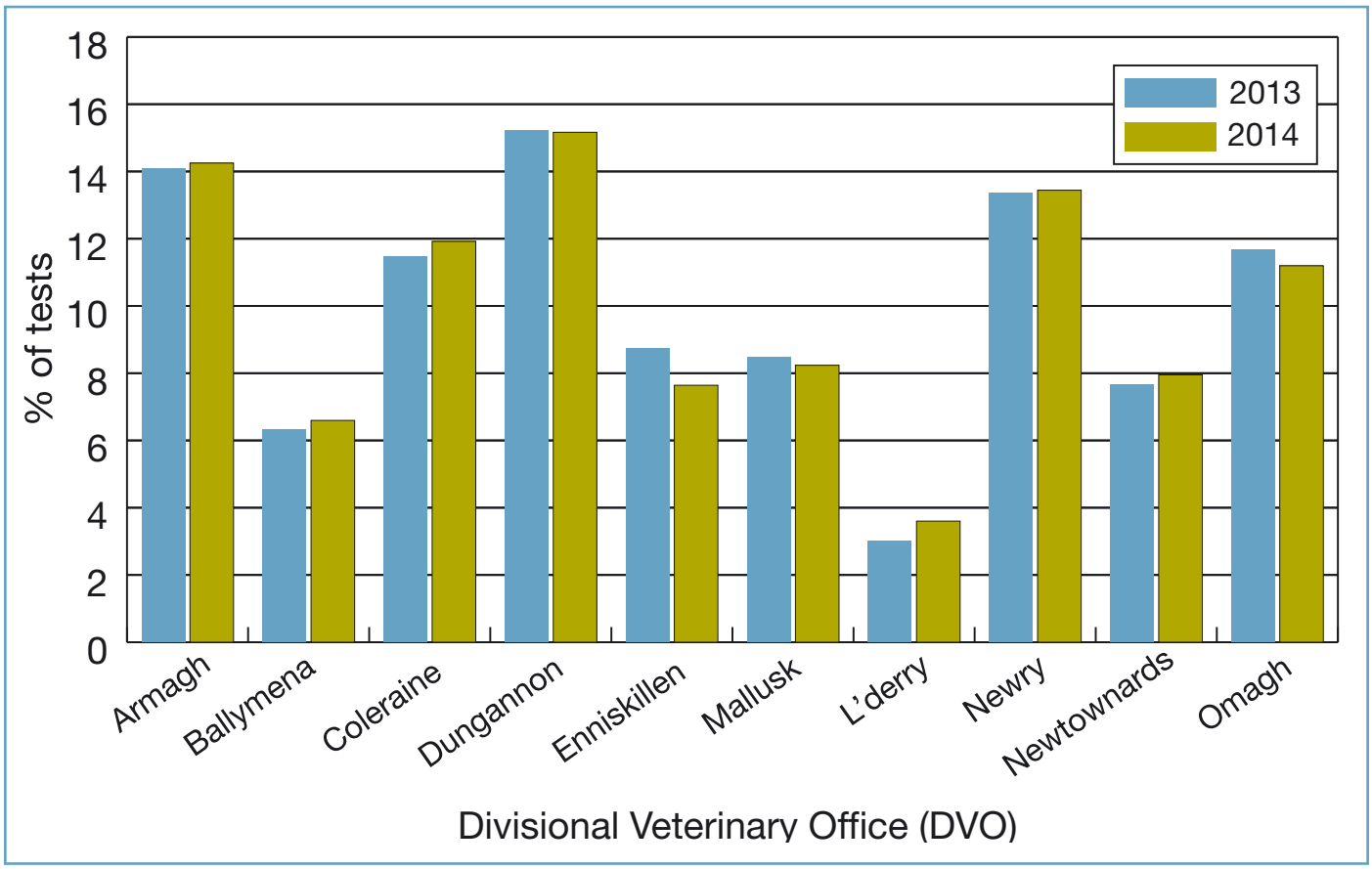
**Description of the test reasons can be found in the glossary.*

8.6 The number of individual animal level risk tests in each DVO area (see **TABLE 5** and **FIGURE 11** on page 18) varies widely and is dependent on the number of herds and animals, the level of disease, the areas from which farmers purchase their stock and other disease risk factors. Dungannon was the DVO area with the highest proportion of individual animal level risk tests. Most check tests of animal(s) forward traced from a breakdown herd (CTTs and CTQs) were also tested in this DVO area which may be an indication of the pattern of movement of animals into, and within, this area from higher incidence areas.

Table 5: Number of Individual Animal Level Risk Tests in each DVO area in 2014

DVO	CTQ	CTS	CTT	RI	Total
Armagh	130	59	802	208	1199
Ballymena	48	17	335	155	555
Coleraine	97	38	603	265	1,003
Dungannon	114	60	848	254	1,276
Enniskillen	45	50	389	159	643
Mallusk	47	66	447	133	693
L'Derry	31	10	203	59	303
Newry	127	53	737	214	1,131
Nt'Ards	57	34	447	131	669
Omagh	65	19	638	220	942
Total	761	406	5,449	1,798	8,414

Figure 11: Percentage of Individual Animal Level Risk bTB Tests* Completed in NI 2013-2014 (By DVO area)

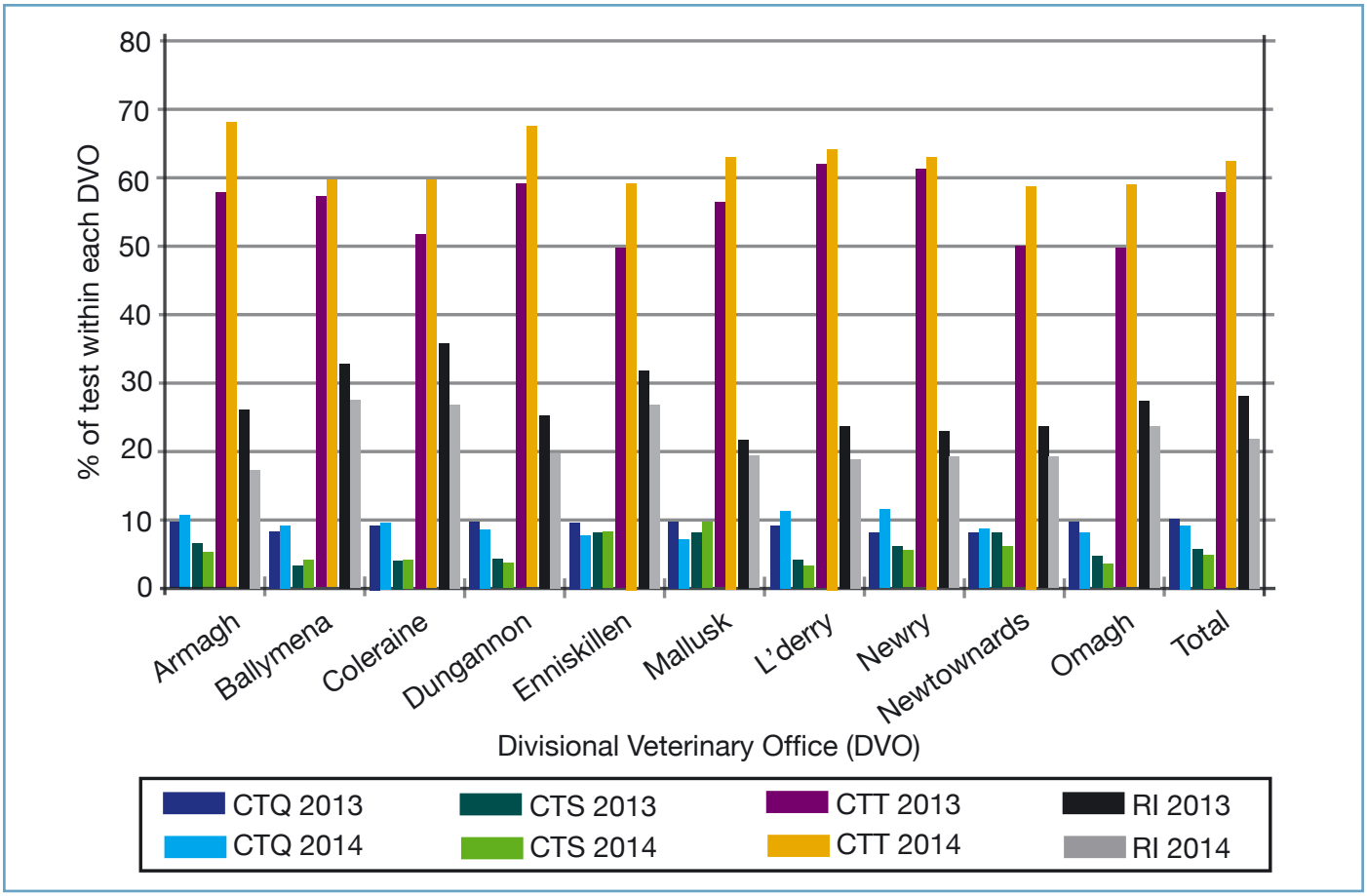


**CTT, CTQ, RI1, CTS*

8.7 There was an increase both numerically and proportionally in the numbers of CTT tests in all DVO areas. While overall the number of CTQ tests was reduced, there were increases both numerically and proportionally in 5 DVO areas. There was a reduction both numerically and proportionally in the number of inconclusive retests overall, but Londonderry DVO area showed a numerical increase.

More detailed figures and comparisons can be found in **TABLE B** in Annex.

Figure 12: The Percentage contribution by test reason of Individual Animal Level Risk bTB Tests within each DVO area in 2013 and 2014



Skin Test - Animals Tested

8.8 The total number of animal tests during 2014 was 2,491,228, which represents a 1.4% decrease compared with 2013 (**TABLE 6**). The number of animals tested was 1,607,647, a 0.8% decrease on the previous year. The number of animal tests is higher than the number of animals tested due to some of the animals being tested two or more times within the same year. The pattern of testing (**TABLES 6 and 7**) generally reflects that described previously but it is worth reiterating that the level of disease risk remained relatively high, and it is therefore important that a strict approach to assessment of risk was maintained.

Table 6: Total Animals Tested for bTB and Total Animal Tests in Herd Tests (2013 - 2014)

Test Category	2013	2014	Difference 2013 v 2014(%)
Total animal tests	2,527,806	2,491,228	-1.4
Total animals tested*	1,620,083	1,607,647	-0.8
Total animals with a restricted herd test	482,629	462,545	-4.2
Total animals with a risk herd test	658,421	637,662	-3.1
Total animals with routine herd test	479,033	507,440	5.9

**Excluding private individual tests.*

Table 7: Number of Animals bTB Tested in Individual Animal Level Risk Tests (2013 - 2014)

Test Reason	2013	2014	Difference 2013 v 2014 (%)
Check Test Trace (CTT)	8,537	9,659	1,122 (13.1)
Check Test Status (CTS)	1,225	1,190	-35 (-2.9)
Check Test Query (CTQ)	1,367	1,701	334 (24.4)
Inconclusive retest (RI)	4,395	3,098	-1,297 (-29.5)
Total	15,524	15,648	124 (0.8)

Interferon Gamma Blood Testing

8.9 Since July 2004, the IFNG has been used in bTB breakdowns, where certain criteria for selection are met, with the purpose of identifying, and thereby providing the opportunity to remove, more infected animals.

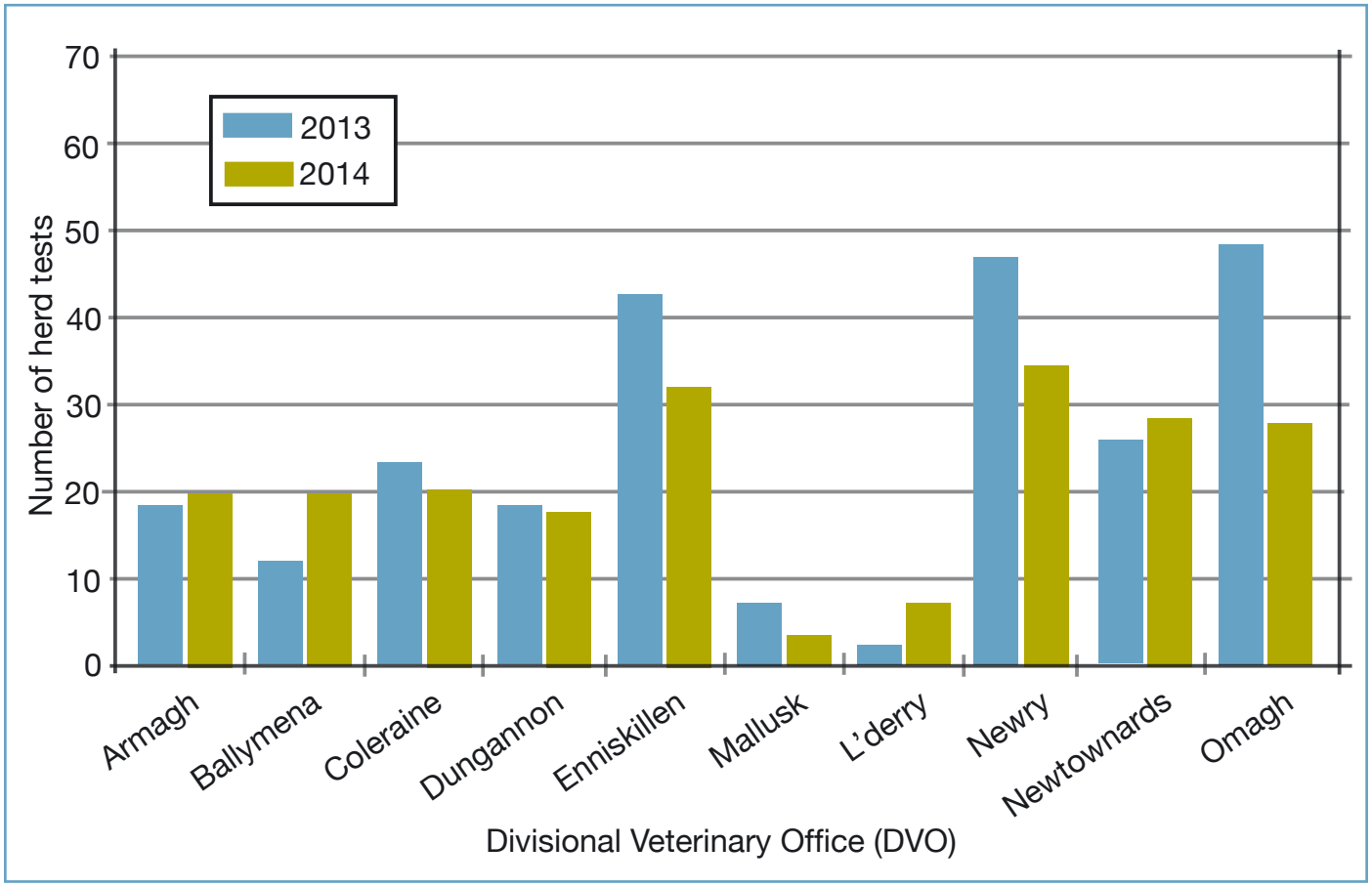
8.10 The number of IFNG samples taken during the year is dependent on the disease levels, the number and the size of eligible herds and resource availability. There were fewer herds, but slightly more animals tested using IFNG in 2014 compared with the previous year (**TABLE 8**).

Table 8: IFNG Tests and Animals Tested (2013 - 2014)

	2013	2014	% difference 2013 v 2014
N° of Herds IFNG Tested	215	184	-14.4
N° of IFNG Herd Tests	243	208	-14.4
N° of animals IFNG tested	16,930	16,991	0.4

8.11 The number of herds IFNG tested by DVO area is shown in **FIGURE 13**. The numbers may seem low but it is an expensive test which is constrained logistically and technically.

Figure 13: Numbers of Herd Tests with an IFNG Test 2013-2014 (by DVO area)



9. Surveillance Outcomes

PME

9.1 There were 1,082 animals with suspect bTB granulomas recorded at routine slaughter (LRS) in NI during 2014, a decrease of 8.1% compared with the previous year (**TABLE 9**). The number of LRS identified per 1000 cattle slaughtered was slightly lower than in 2013, (**TABLE 1**) although the number of confirmed bTB positive LRS per 1000 cattle slaughtered increased (**TABLE 9**). When the figures are adjusted to account for the number of cattle imported for direct slaughter, there is a further relative increase in the number of confirmed LRS. The bTB culture and/or histology positive rate indicates that the underlying disease levels remain significant and have not fallen along with herd incidence. The rise in animal incidence towards the end of the year underlines this conclusion. Further analysis of the LRS pattern has been undertaken by our Veterinary Epidemiology Unit, as described below. During 2014, a further 26 LRS were identified in cattle exported from NI directly to slaughter (32 during 2013). 16 of these LRS were bTB confirmed (61.5%) during 2014 (17 (53.1%) during 2013).

Table 9: Number of LRS Animals and Confirmed LRS Animals (2013 and 2014*)

Year	N° of LRS	N° of confirmed LRS (%)	N° of LRS excluding direct imports	N° of confirmed LRS excluding direct imports (%)	bTB confirmed LRS per 1000 animals slaughtered excluding direct imports (%)
2013	1178	679 (57.6)	1108	639 (57.7)	1.4
2014	1082	703 (65.0)	1046	680 (65.0)	1.6
% change 2013 v 2014	-8.1	3.5	-5.6	6.4	14.3

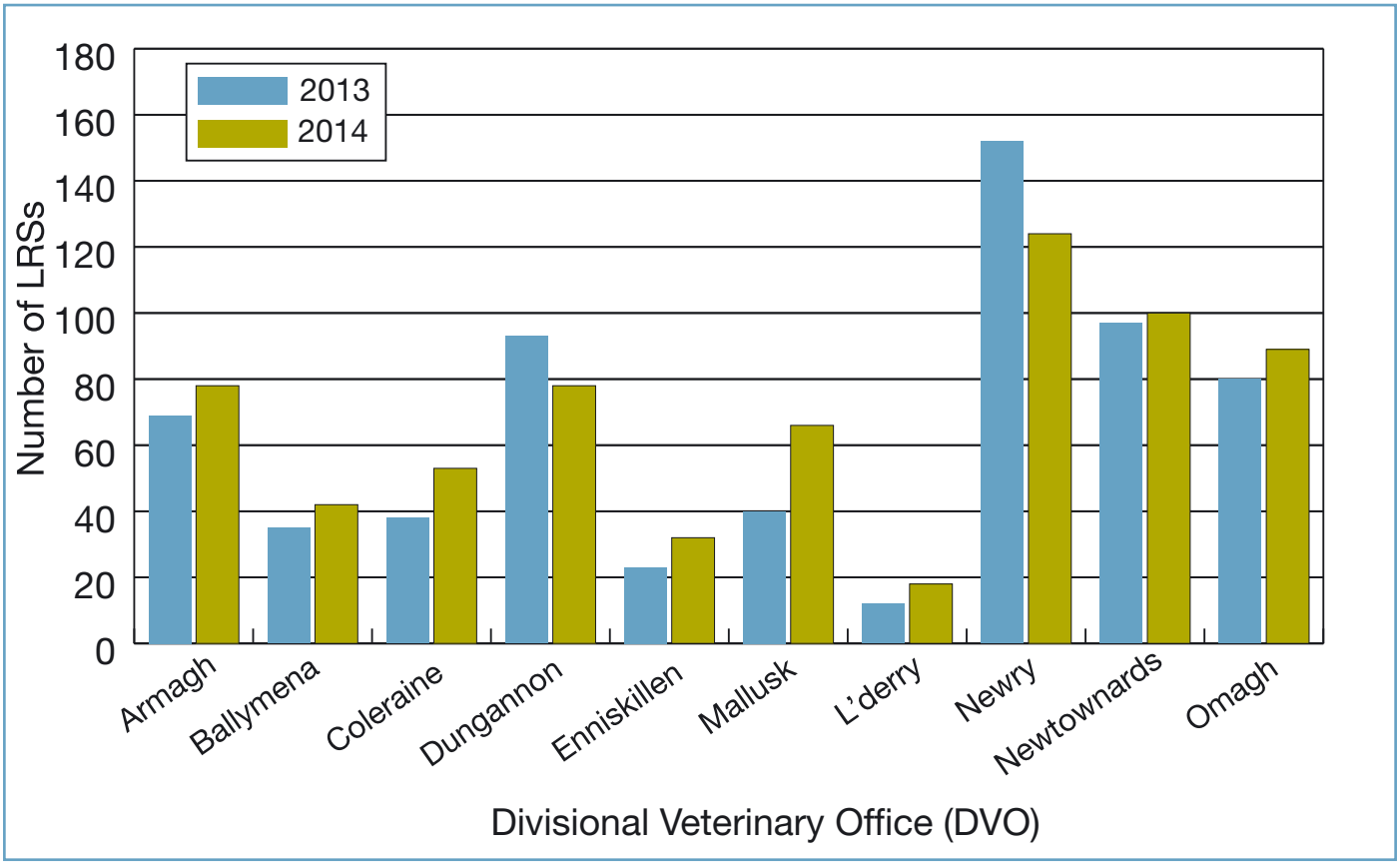
***Histology and/or bacteriology positive**

9.2 The distribution of LRS animals across the 10 DVO areas is shown in **FIGURE 14**. The DVO area considered for each LRS is the one where the herd that presented the animal to slaughter is located. Newry was the DVO area with the highest bTB animal incidence during 2014 and the highest number of LRS. Enniskillen DVO area had relatively high bTB animal incidence but relatively low numbers of LRS, in direct contrast to the situation in Dungannon DVO area. This difference could be explained by both animal movements and animal density in those DVO areas. The animals may have been infected in previous herds located in different DVO areas. This explains the lack of association in some DVO areas between animal incidence (**FIGURE 7 & FIGURE 8**) and location of the presenting herd of the LRS (**FIGURE 14**).

A recent study on LRS during 2011-2013 in NI showed that the likelihood of an animal being an LRS was significantly associated to;

- The herd incidence of the area (patch) from which the animal was moved to slaughter, when the patch incidence was greater than 9%
- Whether the animal was purchased or homebred (purchased animals were more likely to be LRS)
- The age of the animal at slaughter (the likelihood of being LRS increased as the animal got older), and
- The time the presenting herd was free of bTB (relative to restricted herds). There were significantly more LRS found from herds that did not have bTB in the previous 2-3 years. However, there was no statistical difference between restricted herds and herds that were clear of bTB for less than two years or more than 3 years.

Figure 14: Number of Confirmed LRS by DVO area of Origin (2013 and 2014*)



The DVO area of origin is the DVO area of the herd that presented the LRS.

Skin Test

9.3 In relation to the bTB skin test, there was a 7% increase in the number of bTB skin test reactors in 2014 compared with 2013 (8,838 bTB reactors identified in 2014 compared with 8,262 in 2013; **TABLE 10**). The average number of bTB reactors identified per month in 2014 was 737 (compared with 689 in 2013).

9.4 The number of Negative-In-Contacts (NICs) increased by 87%. This increase is partially explained by two large herd depopulations (one in each of Newry and Dungannon DVO areas) and it also reflects the disease incidence at animal level and the associated increase in the number of breakdowns with a large percentage of the herd, or of groups within it, positive to the skin test. In other words, this observation is consistent with more exposure to infection in skin test negative animals.

Table 10: Total Number of bTB Reactors and Negative in Contacts (NICs) 2013 - 2014

Year	N° of reactors	N° of NICs	Total
2013	8,262	565	8,827
2014	8,838	1,060	9898
% change 2013 v 2014	7	87	12.1

Table 11: Number of Negative in Contacts (NICS) in 2013 and 2014 (by DVO area)

	2013		2014	
DVO	N. NICs	N. Herds	N. NICs	N. Herds
Armagh	44	8	40	7
Ballymena	74	5	10	3
Coleraine	3	2	100	17
Dungannon	18	4	227	7
Enniskillen	83	19	93	22
Mallusk	22	6	29	9
L'Derry	0	0	9	2
Newry	49	14	201	12
Nt'Ards	35	7	45	11
Omagh	237	26	316	36
Total	565	91	1060	126

Reactors Disclosed in Herd Tests

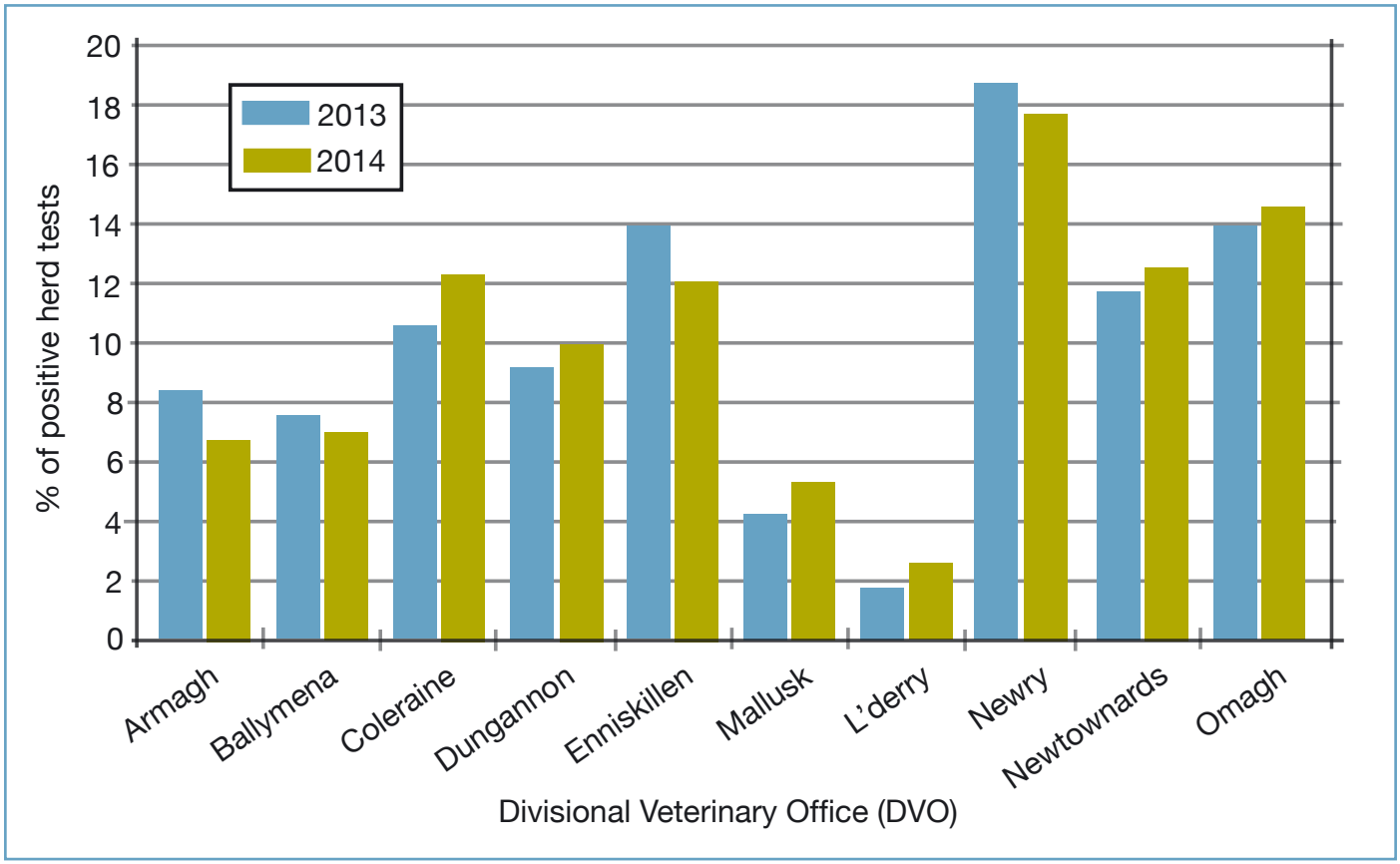
9.5 The number of herd tests that disclosed at least one skin test reactor (positive herd test) decreased by 4.9% (See **TABLE 12**). The reduced disclosure at routine tests, and the increased disclosure in risk tests indicates that risk assessment is correctly targeting more herds for risk testing.

Table 12: bTB Herd Tests with Reactors 2013-2014

Herd Test Category	2013 Herd tests with reactor(s)	2014 Herd tests with reactor(s)	Difference 2013 v 2014 (%)
Restricted	**1,096**	**1,003**	**-8.5**
Risk	**595**	**641**	**7.7**
Routine	**435**	**377**	**-13.3**
Total herd tests with reactor disclosure	**2,126**	**2,021**	**-4.9**

9.6 The DVO area that disclosed the highest proportion of all the positive herd tests in 2014 was Newry (**FIGURE 15**). Although Newtownards has the highest herd incidence there are fewer herds in the DVO area, therefore it contributes a lower proportion of the overall number of positive herd tests.

Figure 15: Percentage Contribution by each DVO area of all Herd Tests with Reactor(s) in NI, (2013 - 2014)



9.7 **Figure 16** shows the percentages of herd tests that disclosed reactor animal(s) for each test reason (see glossary for definitions). Compared with the rate detected in Annual Herd Tests (AHT), the lowest risk category of test, all of the other test reasons had a higher breakdown rate which supports the assessment that the herds were at a higher disease risk. **FIGURE 17** shows that Enniskillen DVO area had the highest relative proportion of new breakdowns disclosed at risk herd tests compared with routine herd tests. This could be an indication of efficient veterinary risk assessments being undertaken to target testing on herds at higher risk. Mallusk DVO area had the lowest relative proportion.

Figure 16: bTB Herd Test Reactor Disclosure Rate for 2013 and 2014 by Test Reason

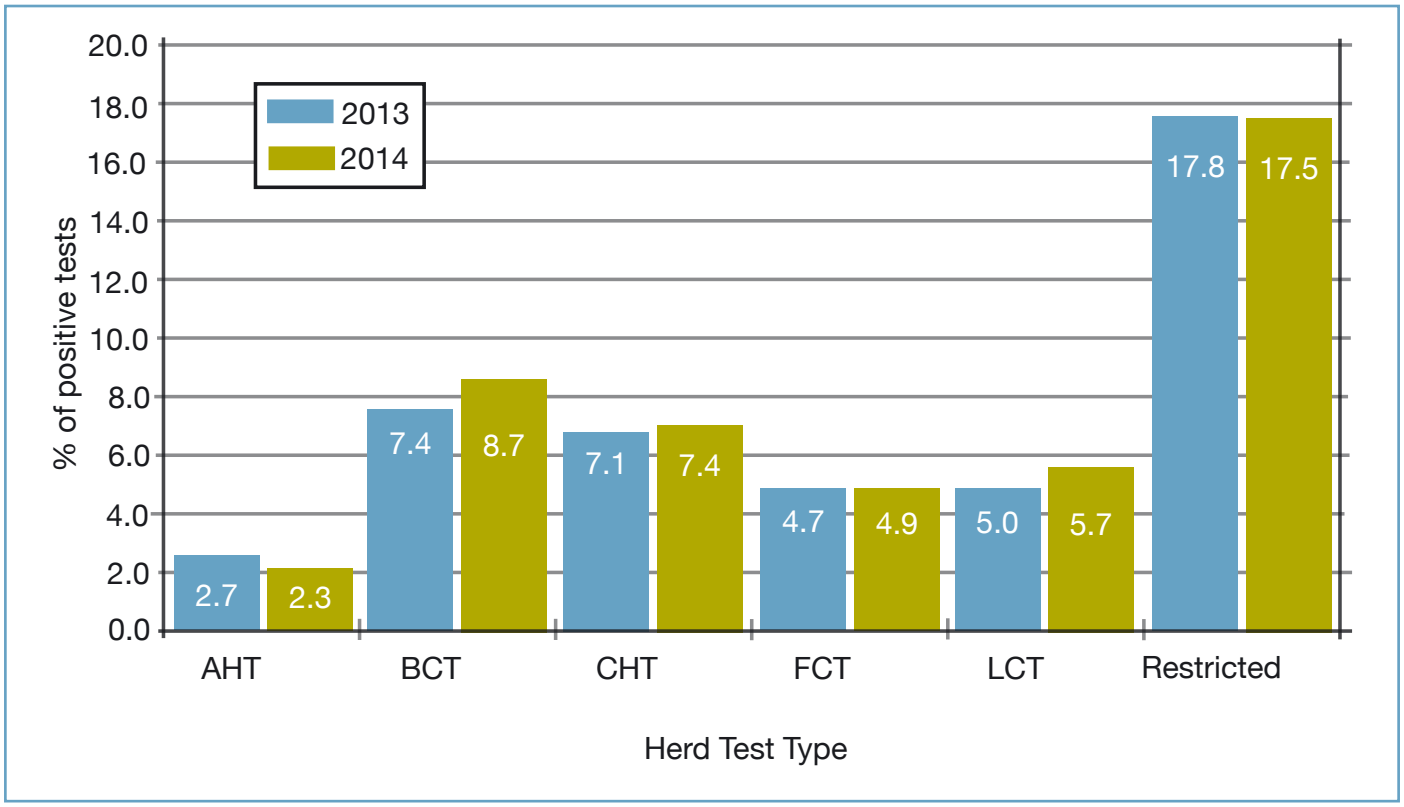
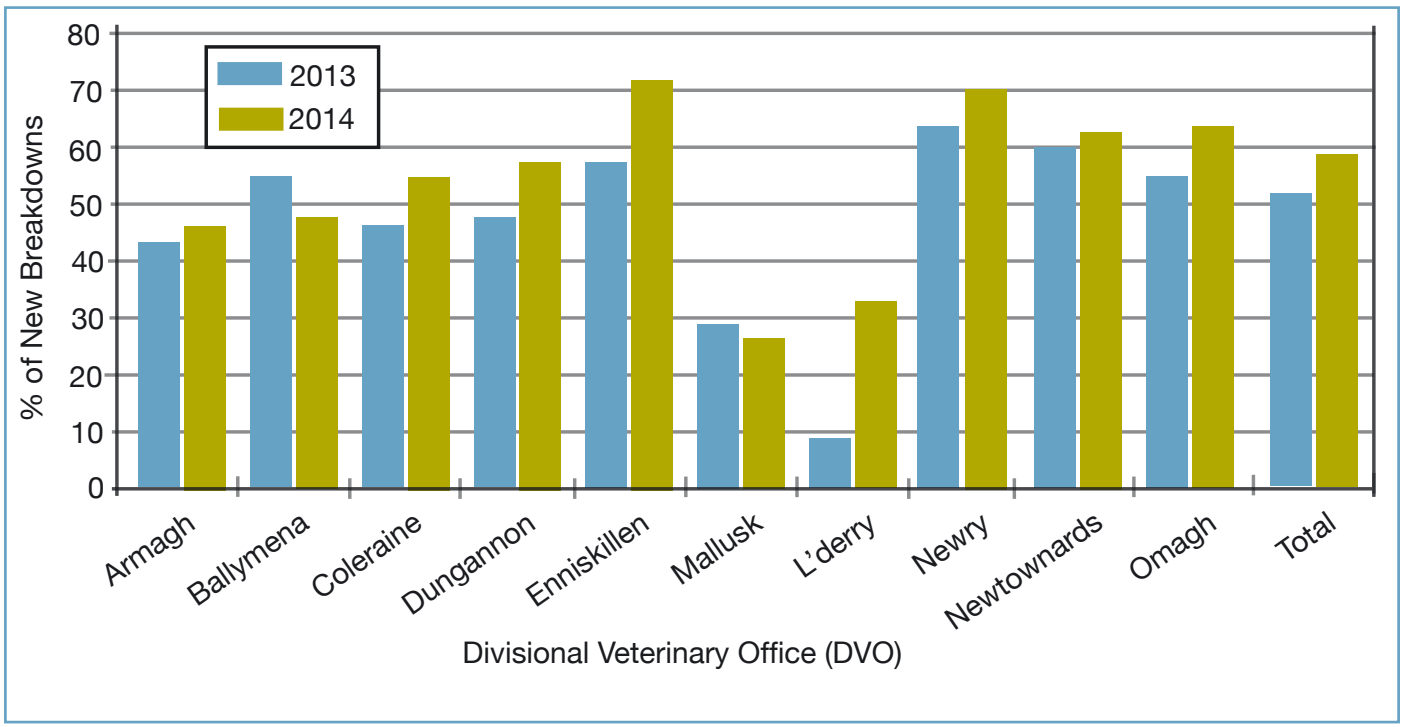


Figure 17: Percentage of bTB New Breakdowns disclosed by skin testing which were detected at Risk Herd Tests by DVO area (2013 and 2014)



Reactors Disclosed at Individual Animal Level Risk bTB Tests

9.8 There has been a decrease of 13.5% in the number of individual animal level risk tests at which a reactor was detected (**TABLE 13**). Inconclusive retests (RI) had by far the highest disclosure rate as 19.2% disclosed a positive animal. Overall, Newry DVO area contributed the largest proportion of positive individual animal risk tests, and also had the highest increase in that proportion (**FIGURES 18 and 19**). This DVO area also had the highest annual animal incidence during 2014 (0.815%).

Table 13: Individual Animal Risk bTB Tests with Reactors 2013 and 2014

Test Reason	2013	2014	% difference 2013 v 2014
Check Test Query(CTQ)	9	5	-44.4
Check Test Status (CTS)	8	11	37.5
Check Test Trace (CTT)	72	88	22.2
Inconclusive retest (RI1)	430	345	-19.8
Totals	519	449	-13.5

Figure 18: Percentage of all Positive Individual Animal Level Risk bTB Tests 2013 and 2014 (by DVO area)

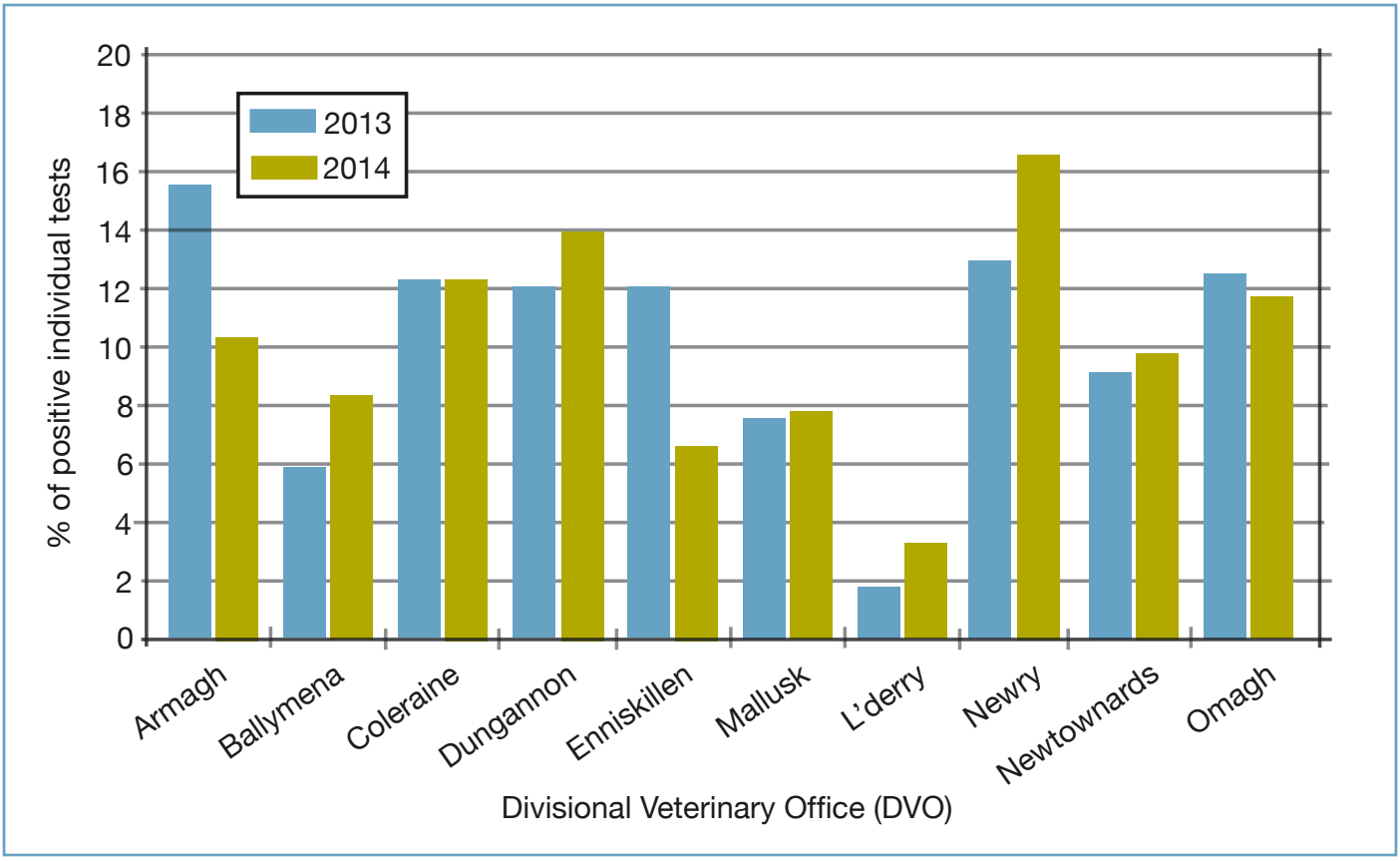
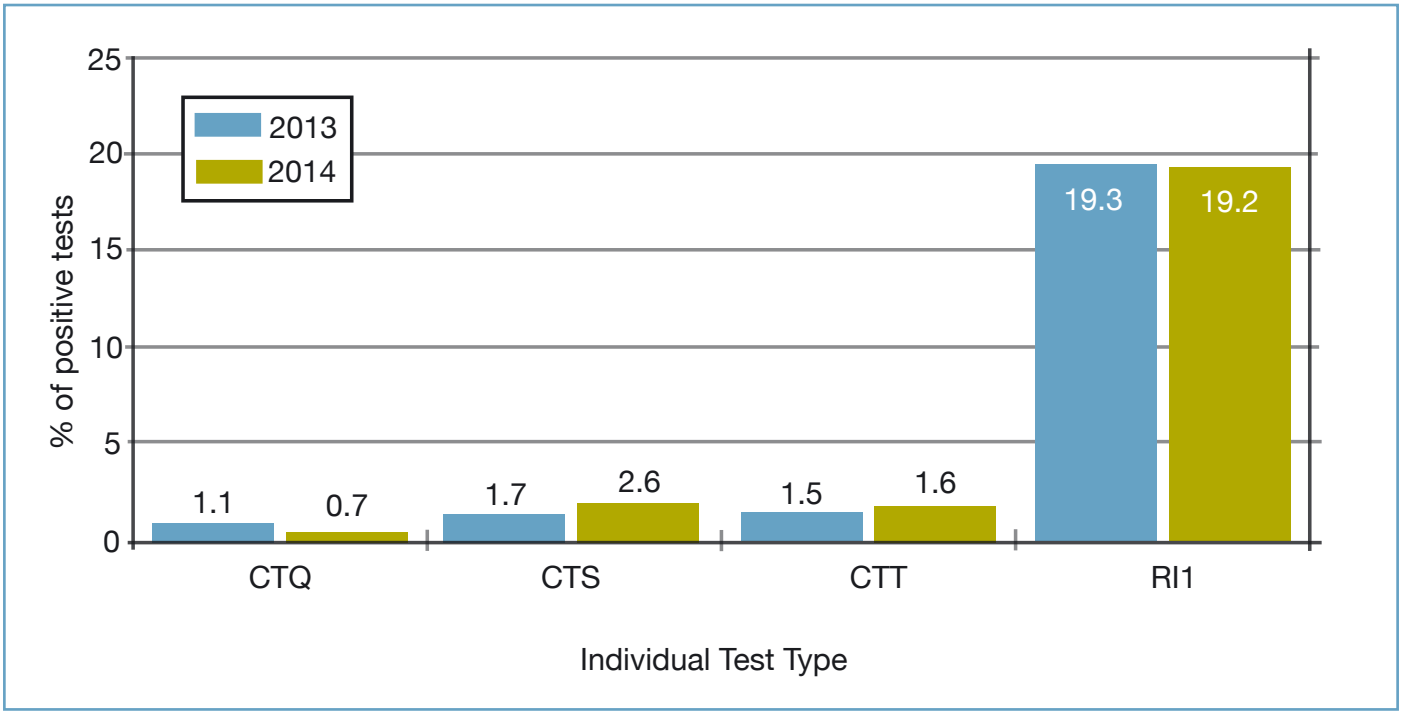


Figure 19: Individual Animal Level Risk bTB Test Reactor Disclosure Rate for 2013 and 2014 (by Test Reason)



Skin Test Reactor Confirmation Rate

9.9 The confirmation rate (see glossary) for skin test reactor animals during 2014 was higher than during 2013 (**TABLE 14**). Overall the number of reactors increased by 7%, but the number of confirmed reactors increased by 15.4%. A positive culture result is definitive evidence of infection. However from a bTB Programme perspective a reactor animal is considered to be confirmed if, in addition to being positive to the skin test, it has bTB like lesions at post mortem inspection or is positive by histological examination or by culture. During breakdowns, where no reactors show visible lesions at slaughter, and bTB has not previously been confirmed, samples from up to 5 reactors per test are submitted for laboratory testing. From a breakdown herd perspective, a herd has its Officially Tuberculosis Free status withdrawn (OTW) if infection is confirmed in a reactor or LRS, if there are more than 5 unconfirmed reactors or LRS during the course of a breakdown, or if otherwise indicated by a veterinary risk assessment. Thus, in Programme terms, more herds and animals are treated as confirmed, and have appropriate control measures promptly applied e.g. use of more severe interpretations of SICCT, two clear whole herd tests required post removal of reactors, disease tracing, lateral check testing, than would be indicated by positive culture alone.

9.10 It is important to re-emphasise that failure to confirm infection does not mean that the animal was not infected (the sensitivities of the confirmatory tests: post-mortem inspection, histology and culture, are not 100% and therefore there will be false negative results). Recently published[4] figures reinforce that the skin test is 99.98% accurate in picking out TB-free animals and is our primary diagnostic tool. Therefore the fact that an animal is a reactor to the skin test means that it is highly likely to be infected, whether or not this is subsequently confirmed after removal.

[4] *http://veterinaryrecord.bmj.com/content/177/10/258.full*

Table 14: Numbers of bTB Reactors and Confirmed Reactors (2013 and 2014)

Year	N° of Reactors	N° of confirmed* Reactors (%)
2013	8,262	3,765 (45.6)
2014	8,838	4, 346 (49.2)
% change 2013 v 2014	7	15.4

**See 9.9 above*

9.11 There were more animals IFNG tested during 2014 (**TABLE 15**), and a higher proportion of these animals tested positive to IFNG. The increased proportion of IFNG positive animals was recorded in all quarters of 2014 relative to 2013. There was also a numerical increase in the number of animals identified as IFNG positive that were not concurrently skin test positive. Neither the use of the IFNG, nor removal of "IFNG positive only" animals, is compulsory so not all IFNG positive animals are removed. The animals that are identified as IFNG positive but are not positive to the skin test (STNP) are the ones that we seek to remove as additional potentially infected animals. In 2014, 68.7% of the identified IFNG positive STNP animals were voluntarily presented for DARD valuation and voluntarily surrendered for slaughter (77% in 2013). However there was an increase of 34% in the number of these animals removed compared with the previous year. Overall there was a 20.9% TB confirmation rate in the IFNG positive cattle slaughtered (including skin reactors) compared to 31.5% in 2013. There was an 8.0% TB confirmation rate in the IFNG positive STNP animals slaughtered as a result of parallel tests delivered during 2014 (52 VL at slaughter and 6 NVL but culture positive from 721 slaughtered) down from 14.5% in 2013 (70 VL and 8 NVL but culture positive from 538). The reduction in TB confirmation rate was recorded in all quarters of 2014 relative to 2013. January–March 2014 was the quarter with the highest % of animals testing IFNG positive (9%), and the lowest confirmation rate in IFNG positive STNP animals (3.4%). April–June 2014 was the quarter with the lowest % of animals testing IFNG positive (5.7%), and the highest confirmation rate in IFNG positive STNP animals (19.8%).

Table 15: Numbers of IFNG Positives (2013 - 2014)

Year	N° of animals sampled	N° of animals IFNG + (%)	N° of animals IFNG + / STNP (% of IFNG +)	N° of IFNG+/ STNP animals removed
2013	16,930	939 (5.5)	699 (74.4)	538
2014	16,991	1,262 (7.4)	1,050 (83.2)	721
% Difference 2013 v 2014	0.4	34.4	50.2	34

10 New Herd Breakdowns

10.1 New bTB herd breakdowns are herds with at least one reactor animal where the herd had no other reactor animals during the previous 12 months. The number of new bTB herd breakdowns (**TABLE 16**) was 5.54% lower for 2014 compared with 2013 (1,397 compared with 1,479). Six out of the 10 DVO areas had a reduced number of new breakdowns during 2014.

10.2 The average number of new bTB herd breakdowns per month was 116 in 2014 (compared with 123 in 2013).

Table 16: Number of New bTB Breakdown Herds (2013 - 2014)

Year	DVO Area										New b/d herds
	Armagh	Ballymena	Coleraine	Dungannon	Enniskillen	Mallusk	L'derry	Newry	N'Ards	Omagh	Totals
2013	149	121	170	125	185	93	31	243	165	197	1,479
2014	110	101	192	142	167	85	43	203	152	202	1,397
%* change 2013 - 2014	-26	-16.5	13	14	-10	-9	39	-16	-8	3	-5.5

**corrected to the nearest %*

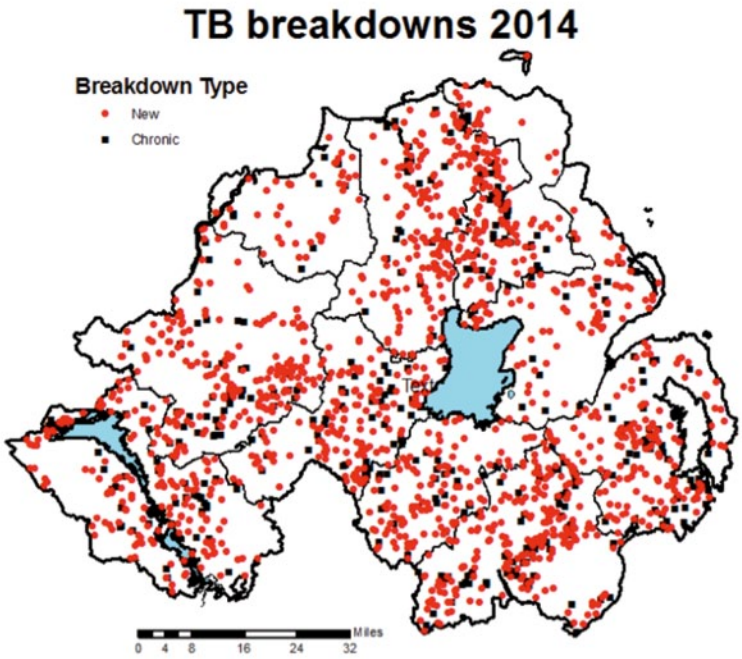
10.3 **Figure 20** shows the location of bTB herd breakdowns recorded during 2014 (2013 breakdown map can be found in **FIGURE A** in the **ANNEX**) and illustrates the widespread distribution of infection.

FIGURE 21 shows the density of herds with reactors per Km^2 in 2014 in NI. This information was requested by Private Practitioners so that they would be more aware of the distribution of infection in their locality. (2013 map in **FIGURE B** in the Annex).

FIGURE 22 shows cattle herd density across NI and when compared with the previous two figures it is clear that the level of disease closely matches the density of cattle.

Taking into account the number of herds in each area and the number of new herd breakdowns, we have produced a patch bTB incidence map (see glossary of terms for definitions) for 2014 (**FIGURE 23**). Every DVO area can be seen to have a variation in incidence across its patches.

Figure 20: Bovine Tuberculosis Breakdowns in 2014



- *New bTB herd breakdowns are herds with at least one reactor animal where the herd had no other reactor animals during the previous 12 months*
- *Chronic herds are defined as all other herds that have had at least one other bTB reactor during the year*

Figure 21: Density of Herds with bTB Reactors in 2014

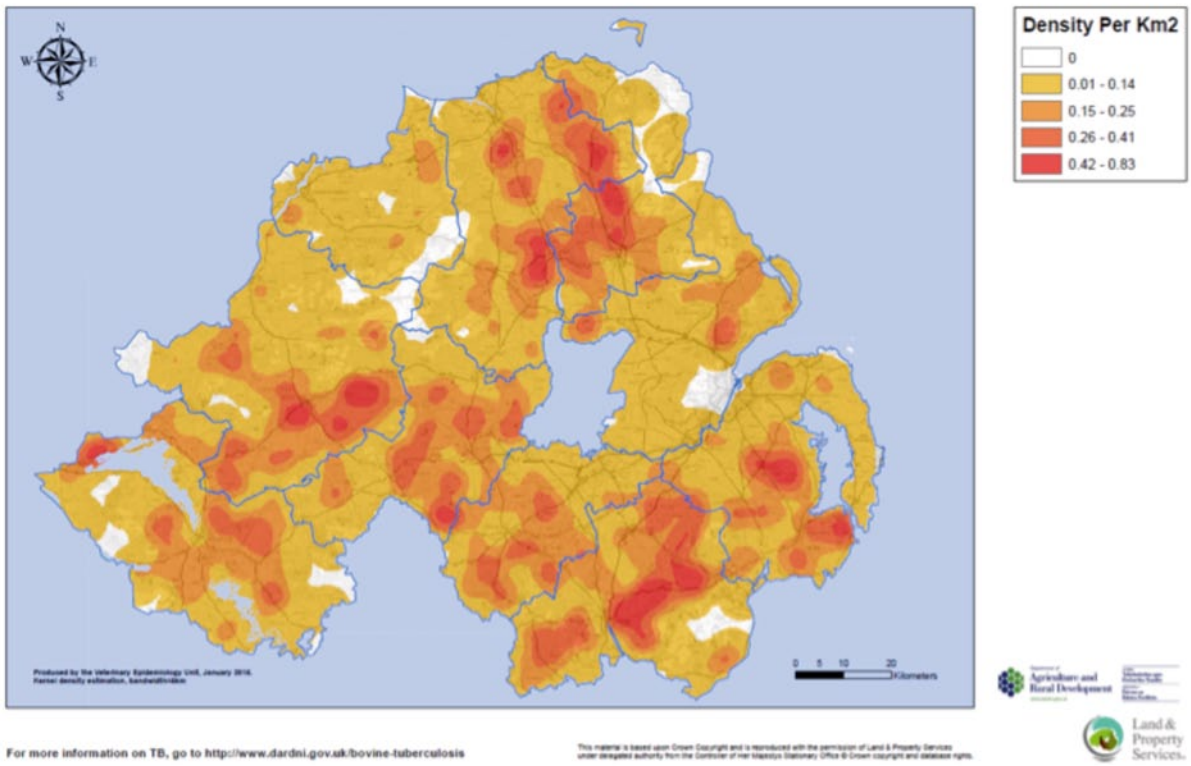


FIGURE 22 Operational cattle herd density in NI 2014

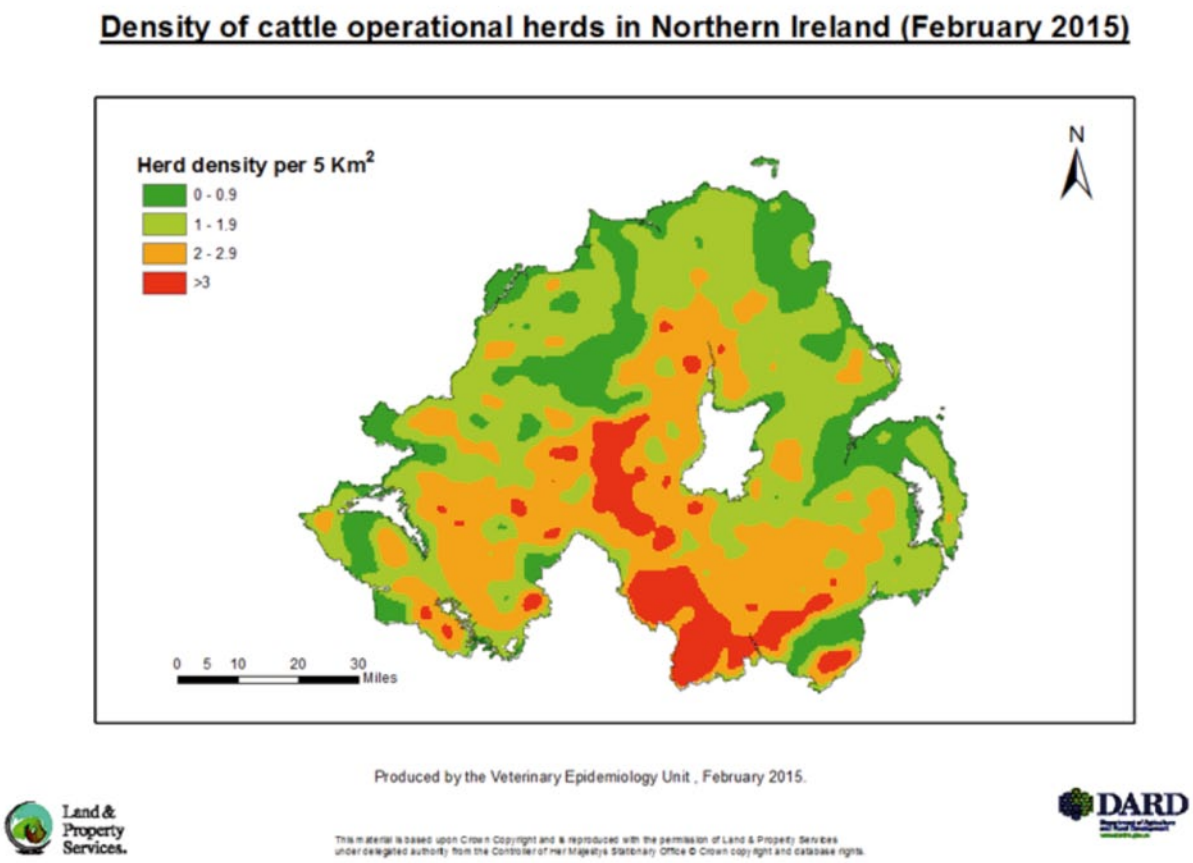
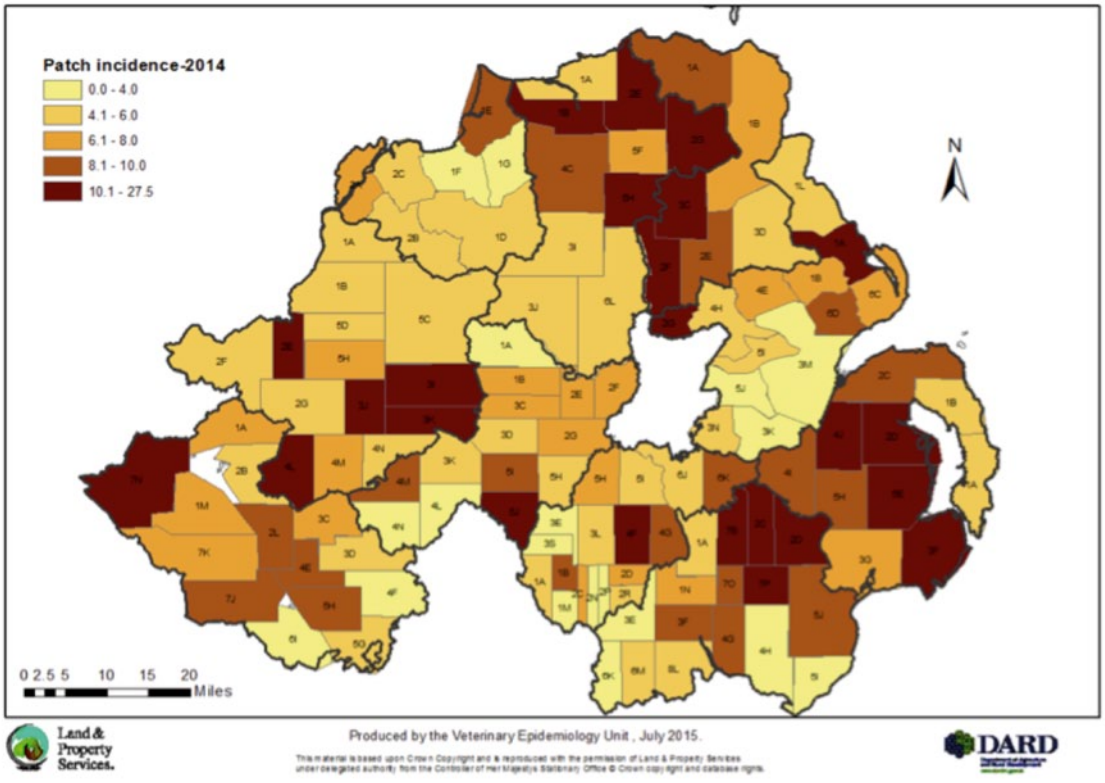


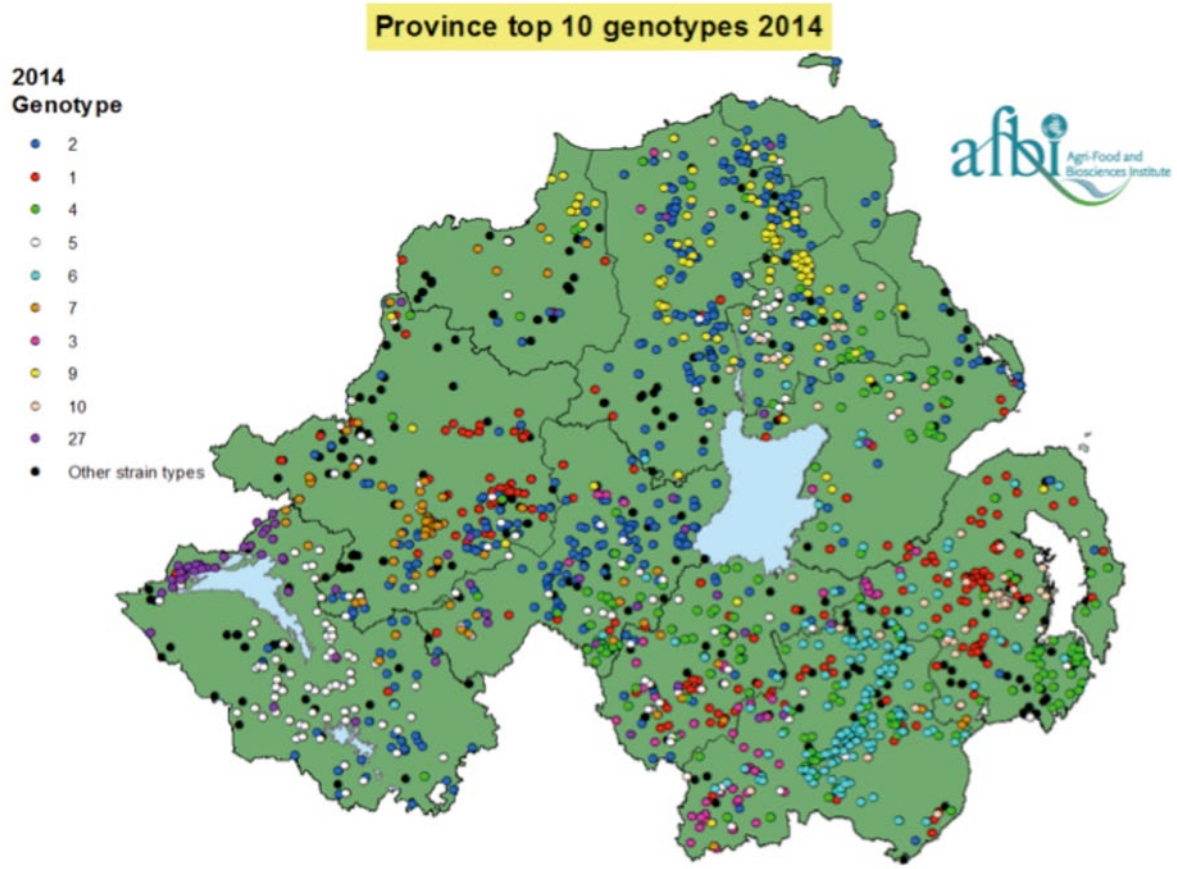
FIGURE 23 Patch Incidence in 2014



M. bovis Strain Types

10.4 **Figure 24** shows the distribution of the most prevalent bTB strain types found in bTB confirmed cases in 2014. The 10 most prevalent strain types remained the same during 2014, but there were slight changes in the relative prevalence. The clustering effect seen with bTB is visible, and the home ranges of strain types appear unchanged. However, some strain types are visible in areas outside their normal cluster, which would suggest spread due to animal movements (Strain types from 2003 to 2014 can be found in **FIGURE C** and the most prevalent strain types in 2013 can be found in **FIGURE D** (both in the **ANNEX**).

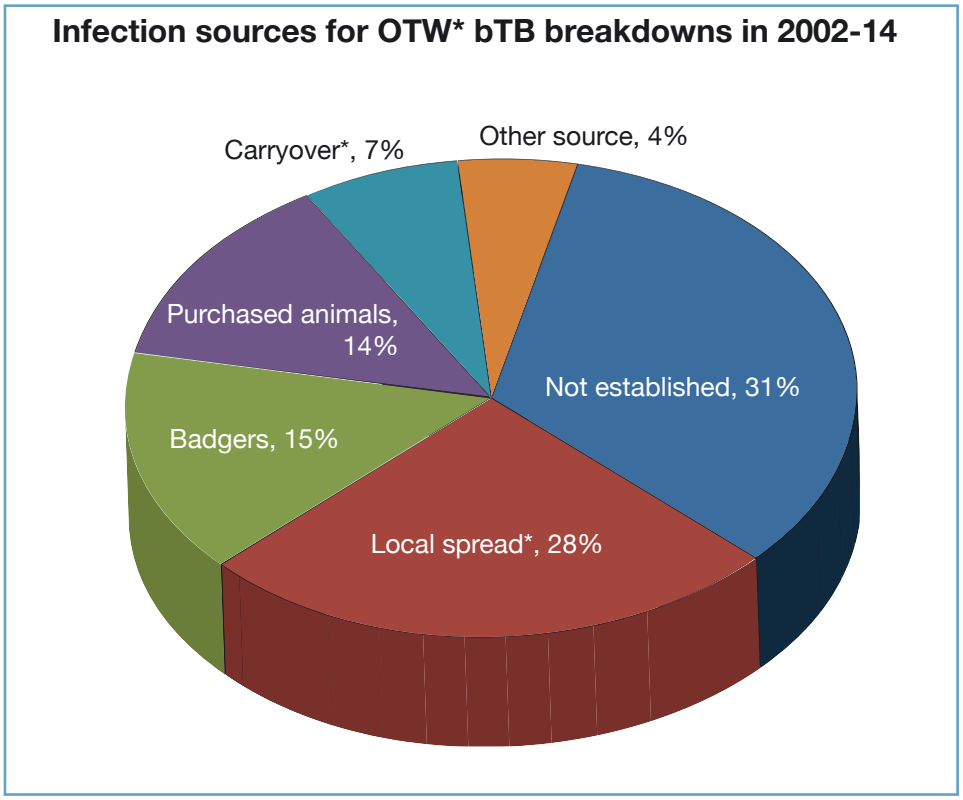
Figure 24: Distribution of the most prevalent strain types in 2014



(Map courtesy of AFBI)

11 bTB Investigations

11.1 During the course of the management of a bTB breakdown, and based on the available evidence, the Veterinary Officer (VO) records an assessment of the cause of the breakdown. In many cases it is not possible to determine a single cause with a reasonable degree of certainty and additional information may only come to light months or years after the breakdown has been dealt with because of the chronic and complex nature of the disease. The percentages of the infection sources recorded by the field VOs for OTW breakdowns during the period 2002 to 2014 is shown in **FIGURE 25**.



*Definitions in the glossary

11.2 These conclusions correlate with established risk factors for bTB. DARD continues to provide advice on biosecurity measures that farmers can employ to reduce the risk of infection affecting their herd. Advice is given by staff during visits to farms and also through the distribution of leaflets to all farmers. These leaflets can be found on the DARD internet web pages[5].

[5] *http://www.dardni.gov.uk/index/animal-health-and-welfare/animal-diseases/bovine-tuberculosis/tb-publications.htm*

12 EU Co-funding and Programme Costs

12.1 Since 2010 our Programme has been annually approved for co-funding as part of the overall UK bTB Eradication Plan. An end of year summary of specified Programme costs is submitted annually to the EU Commission. A summary of the costs for 2014 is shown in **TABLE 17** below.

12.2 The amount of co-funding received from the EU Commission for 2013 was £4.46 million. At the time of writing the 2014 co-funding has been agreed, but has not yet been received.

Table 17: Specified Programme Costs for 2014

TB Programme Element	Cost
Compensation for 10,534 animals (includes reactors, negative in contacts and voluntarily slaughtered interferon gamma positive cattle)	**£ 13,598,025**
Haulier expenses	**£318,099**
PVP Tuberculin testing (excluding travel)	**£6,426,489**
TVO/VOT tuberculin testing (excluding travel)	**£1,534,540**
Tuberculin	**£577,577**
Laboratory analysis for interferon gamma and culture	**£647,813**
Research	**£80,392**
Veterinary and Administrative Staff	**£5,625,342**
Salvage monies	**£ -2,098,940**
Total	**£26,709,337**

12.3 The specified costs of the Programme for 2014 were £909,387 (3.5%) higher than 2013. This is largely due to a significant increase in expenditure on compensation for the increased number of reactor animals, with other less significant increases and reductions across the Programme elements.

13 Research and Development

13.1 There is still much that is not known about how bTB spreads, how it can be diagnosed more accurately, and what can be done to prevent its spread within and between cattle herds and wildlife.

13.2 In 2014 DARD continued to invest in bTB and wildlife research and studies to build the evidence to help deal effectively with all the disease risk factors and reduce bTB further.

13.3 Following discussions with industry stakeholders and informed by the views of the external experts who attended the International Wildlife Vaccination Symposium in Belfast in May 2012, officials were asked to design specific "wildlife intervention research". It was anticipated that the approach would involve testing live badgers, vaccinating and releasing the test negative badgers and removing those that test positive (TVR).[6] The aim was to test
the effectiveness of the approach on the level of bTB in badgers and in cattle. Following the work to design and cost this wildlife intervention research, mathematical modelling[7] and badger sett surveys[8] were carried out during 2013 as part of the design process.

"...Double- fencing is one way of reducing the risk of spread of bTB between neighbouring cattle herds..."

"...In addition to our own research work we followed closely the research and studies being conducted elsewhere..."

[6] *http://www.dardni.gov.uk/index/animal-health-and-welfare/animal-diseases/bovine-tuberculosis/tb-research-and-development/test-and-vaccinate-or-remove.htm*

[7] *FERA TVR Modelling Report - May 2013*

[8] *Field Survey for the Presence of Badger Setts in Co Down Northern Ireland*

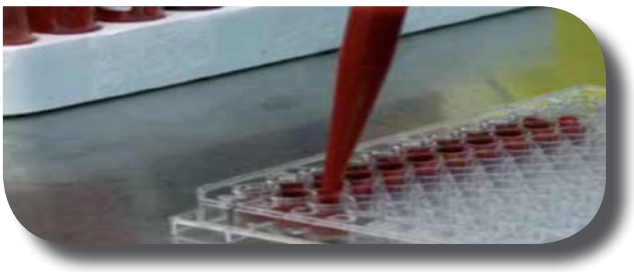
13.4 Approval to commence TVR Wildlife Intervention Research Project was given on 1 May 2014 and preparations were finalised to enable DARD Veterinary Service to carry out TVR field activities between 27 May 2014 and 24 October 2014. The TVR Project will run for 5 years in a 100km² high TB incidence area in County Down.
The degree of support for the TVR project from farmers and landowners in the TVR area was excellent, with 94% of farmers and landowners giving their permission to allow DARD staff access to undertake the TVR research project on their land. During 2014, 280 unique badgers were captured (630 capture events), sampled, micro-chipped, vaccinated and released. No badgers were removed as it was necessary to obtain baseline ecological data. To assist with this, 39 badgers had Global Positioning System (GPS) collars fitted to record their movements. GPS monitoring will continue to take place over the next 4 years of the project. Removal of test positive badgers is planned in 2015.

13.5 In addition to our own research work we followed closely the research and studies being conducted elsewhere, including membership of the project board for the development of an oral bait badger vaccine that can be delivered in a cost effective way. We also carefully watched what happened on the wildlife aspect in England and Wales in relation to culling and vaccination and also work ongoing in the south of Ireland.

13.6 Therefore a number of research projects were underway or completed in 2014.

These included:

- Interferon Gamma Project - to undertake an evaluation of the IFNG as currently implemented here in order to quantify the usefulness of the test to detect additional bTB infected animals. A Literature Review of the International Application of the Interferon-Gamma Test was published in 2012 as part of this project. Work continued on the project throughout 2014.
- Badger-Cattle Proximity Study - to examine and describe the extent of badger-cattle and cattle-cattle interactions, through the use of proximity loggers and GPS devices, at pasture and within cattle houses. The final report has been published on the DARD website[9].

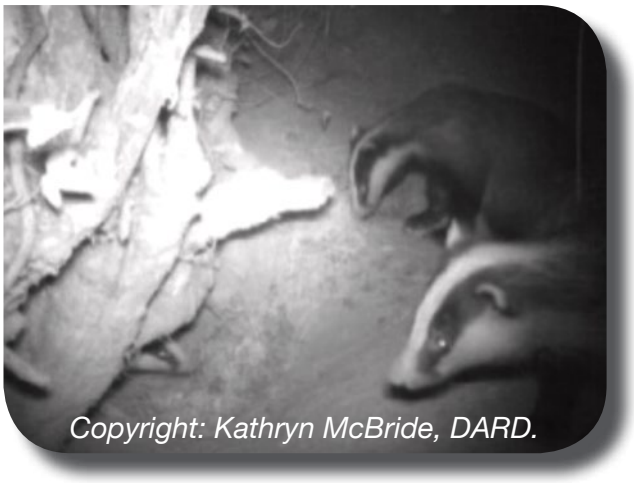


"...Badgers detected by movement sensitive camera as part of Proximity Study..."

Copyright: Dr Declan O'Mahony, AFBI.

[9] http://www.dardni.gov.uk/badger-cattle-proximity-report.pdf *Badger-cattle interactions in the rural environment: implications for Bovine Tuberculosis*

- Badger Road Traffic Accident Survey - a province wide survey has been ongoing since the mid 1990s. 275 badgers were submitted during 2014, and 46 (16.7%), of these were confirmed *M. bovis* positive.
- Literature Review on the role of slurry in spreading bTB - a comprehensive review of the published work or work nearing completion on the role of slurry in spreading bTB and whether it should be treated or disinfected prior to spreading. The review has been published on the DARD website[10].


Copyright: Kathryn McBride, DARD.

- Field survey for the presence of badger setts in Co Down - AFBI collated and analysed all data from badger sett surveys carried out within two 100km^2 areas of Co Down. A report of their findings has been published on the DARD website[11].

13.7 AFBI, as DARD's primary research provider, was commissioned to deliver the studies listed above, with the exception of the Badger RTA, which was led by the Veterinary Service's Veterinary Epidemiology Unit (VEU), with AFBI providing laboratory support. VEU was responsible for the provision of epidemiologically related outputs, including the initial work on the TVR wildlife intervention research project, mentioned above.

13.8 More details about the projects and studies, as well as completed reports and literature reviews, are available on the DARD web site.

http://www.dardni.gov.uk/index/animal-health-and-welfare/animal-diseases/bovine-tuberculosis/tb-research-and-development.htm

14 bTB in Other Species

14.1 DARD considers disease confirmation in a non-bovine species in relation to the risk to the bovine population, and neither vaccination nor treatment of non-bovine animals is permitted. During 2014, suspected TB lesions were examined at AFBI from a sheep, a dog, an otter and 2 cats. No samples were submitted from deer. Only the cats were confirmed *M. bovis* positive. While both lived in rural areas, neither could be specifically linked to any cattle herd. An advisory leaflet was produced for owners of cats and dogs with suspected or confirmed bTB infection and this is available on the DARD website.

http://www.dardni.gov.uk/leaflet-btb-domestic-pets.pdf

[10] *http://www.dardni.gov.uk/tb-slurry-lit-review.pdf A review of the potential role of cattle slurry in the spread of bovine tuberculosis*

[11] *Field Survey for the Presence of Badger Setts in Co Down Northern Ireland*

15 Conclusions

15.1 The downward trend in herd incidence, which started in late 2012 continued until June 2014. From that point, annual TB herd incidence remained approximately level to the end of the year. There was an overall reduction in herd incidence but it was not uniform and 4 DVO areas showed a rise.

15.2 Annual animal incidence remained relatively stable but showed a definite rise from October 2014. There was an overall increase in animal incidence, and this resulted in an increase in the number of animals removed. Only 2 DVO areas showed a reduction in 2014.

15.3 The number of new breakdown herds decreased but the number of tests completed did not reduce proportionally.

15.4 The number of risk herd tests reduced but the proportion that disclosed reactors increased. This is in contrast to the overall herd incidence trend for 2014, and indicates that these herds were correctly identified as being at higher risk.

15.5 The increased number of confirmed LRS and TB reactor animals combined with the increase in animal incidence towards the end of the year indicates an underlying level of infection that could result in increased spread of infection and a subsequent increase in herd incidence.

Annex

Reference Section 8 Surveillance Outputs paragraph 8.4

Table A: bTB Herd Tests Completed in 2013 and 2014 by DVO area (Cattle>0)

	Routine		Restricted		Risk		Totals	
DVO	2013	2014	2013	2014	2013	2014	2013	2014
	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)
Armagh	1523 (9.5)	1483 (9.0)	603 (10.1)	532 (9.7)	1113 (10.5)	1165 (11.4)	3239 (9.9)	3180 (9.9)
Ballymena	1042 (6.5)	944 (5.7)	291 (4.9)	438 (8.0)	464 (4.4)	568 (5.6)	1797 (5.5)	1950 (6.1)
Coleraine	1861 (11.6)	1820 (11.0)	634 (10.7)	541 (9.8)	957 (9.0)	938 (9.2)	3452 (10.6)	3299 (10.3)
Dungannon	2255 (14.0)	2316 (14.1)	616 (10.4)	567 (10.3)	732 (6.9)	685 (6.7)	3603 (11.0)	3568 (11.1)
Enniskillen	2030 (12.6)	2084 (12.7)	672 (11.3)	583 (10.6)	1799 (16.9)	1638 (16.1)	4501 (13.8)	4305 (13.4)
Mallusk	1320 (8.2)	1372 (8.3)	345 (5.8)	375 (6.8)	315 (3.0)	319 (3.1)	1980 (6.1)	2066 (6.4)
L'Derry	778 (4.8)	799 (4.9)	132 (2.2)	140 (2.5)	127 (1.2)	140 (1.4)	1037 (3.2)	1079 (3.4)
Newry	2324 (14.5)	2293 (13.9)	1056 (17.8)	959 (17.5)	2097 (19.7)	2193 (21.5)	5477 (16.8)	5445 (16.9)
Newtownards	1099 (6.8)	1142 (6.9)	744 (12.5)	699 (12.7)	1189 (11.2)	1160 (11.4)	3032 (9.3)	3001 (9.3)
Omagh	1838 (11.4)	2218 (13.5)	854 (14.4)	660 (12.0)	1840 (17.3)	1393 (13.7)	4532 (13.9)	4271 (13.3)
Total	16070 (100)	16471 (100)	5947 (100)	5494 (100)	10633 (100)	10199 (100)	32650 (100)	32164 (100)

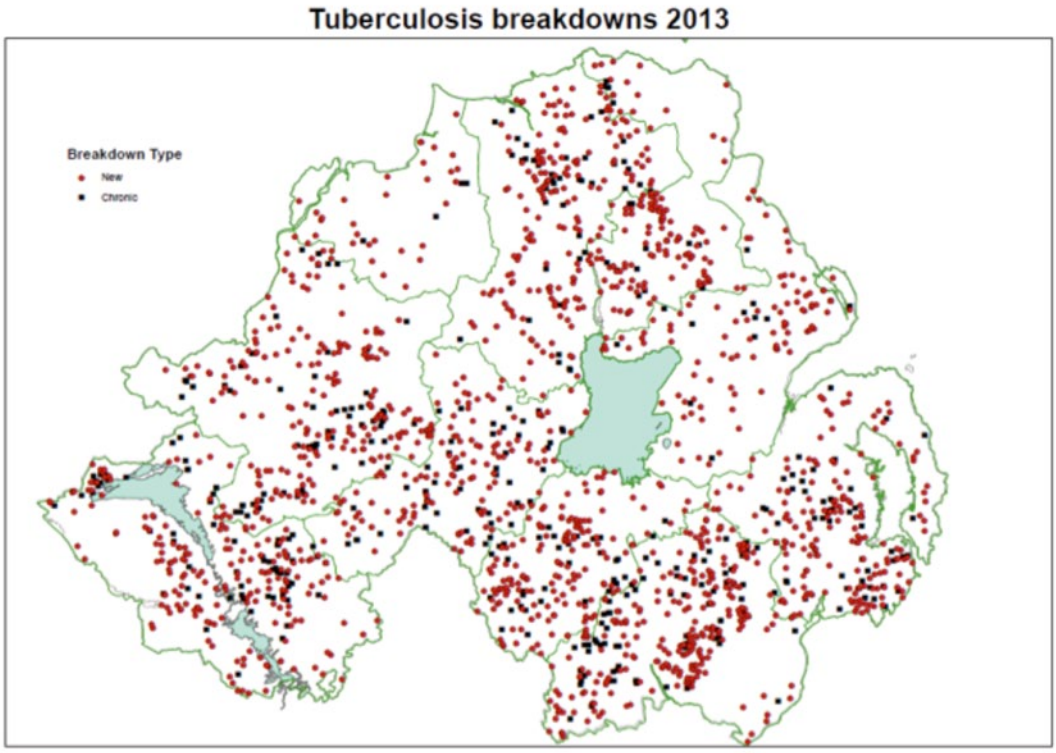
Reference Section 8 Surveillance Outputs paragraph 8.7

Table B: Total Animal Level Risk bTB Tests by DVO area in 2013 and 2014 (Cattle>0)

	CTQ		CTS		CTT		RI1		Total	
DVO	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)	N Test (%)
Armagh	115 (14.7)	130 (17.1)	72 (16.2)	59 (14.5)	669 (14.1)	802 (14.7)	296 (13.3)	208 (11.6)	1152 (14.1)	1199 (14.3)
Ballymena	40 (5.1)	48 (6.3)	12 (2.7)	17 (4.2)	293 (6.2)	335 (6.1)	172 (7.7)	155 (8.6)	517 (6.3)	555 (6.6)
Coleraine	89 (11.4)	97 (12.7)	35 (7.9)	38 (9.4)	483 (10.2)	603 (11.1)	332 (14.9)	265 (14.7)	939 (11.5)	1003 (11.9)
Dungannon	123 (15.7)	114 (15.0)	69 (15.5)	60 (14.8)	746 (15.8)	848 (15.6)	308 (13.9)	254 (14.1)	1246 (15.2)	1276 (15.2)
Enniskillen	69 (8.8)	45 (5.9)	54 (12.1)	50 (12.3)	362 (7.6)	389 (7.1)	230 (10.3)	159 (8.8)	715 (8.7)	643 (7.6)
Mallusk	68 (8.7)	47 (6.2)	60 (13.5)	66 (16.3)	393 (8.3)	447 (8.2)	172 (7.7)	133 (7.4)	693 (8.5)	693 (8.2)
L'Derry	31 (4.0)	31 (4.1)	8 (1.8)	10 (2.5)	152 (3.2)	203 (3.7)	54 (2.4)	59 (3.3)	245 (3.0)	303 (3.6)
Newry	92 (11.8)	127 (16.7)	59 (13.3)	53 (13.1)	689 (14.6)	737 (13.5)	252 (11.3)	214 (11.9)	1092 (13.3)	1131 (13.4)
Nt'Ards	53 (6.8)	57 (7.5)	42 (9.4)	34 (8.4)	382 (8.1)	447 (8.2)	150 (6.7)	131 (7.3)	627 (7.7)	669 (8.0)
Omagh	101 (12.9)	65 (8.5)	34 (7.6)	19 (4.7)	564 (11.9)	638 (11.7)	257 (11.6)	220 (12.2)	956 (11.7)	942 (11.2)
Total	781 (100)	761 (100)	445 (100)	406 (100)	4733 (100)	5449 (100)	2223 (100)	1798 (100)	8182 (100)	8414 (100)

Reference Section 10 New Herd Breakdowns, paragraph 10.3

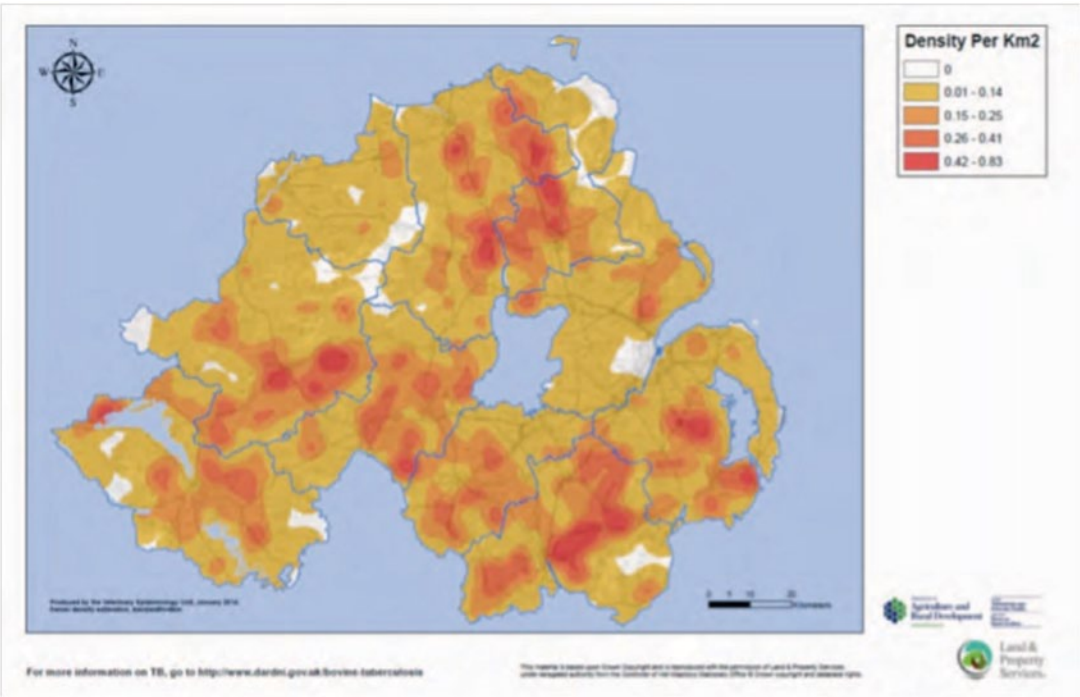
Figure A: bTB Breakdowns in 2013



- New bTB herd breakdowns are herds with at least one reactor animal where the herd had no other reactor animals during the previous 12 months.
- Chronic herds are defined as all other herds that have had at least one other bTB reactor during the year.

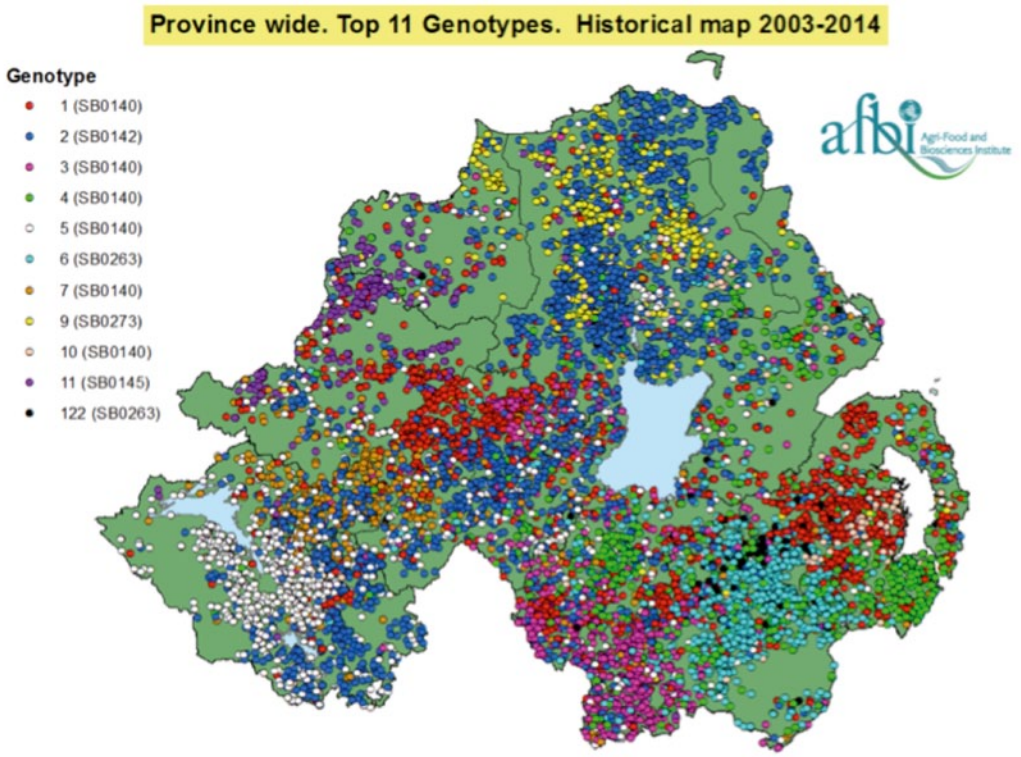
Reference Section 10 New Herd Breakdowns, paragraph 10.3

Figure B: Density of Herds with bTB Reactors in 2013



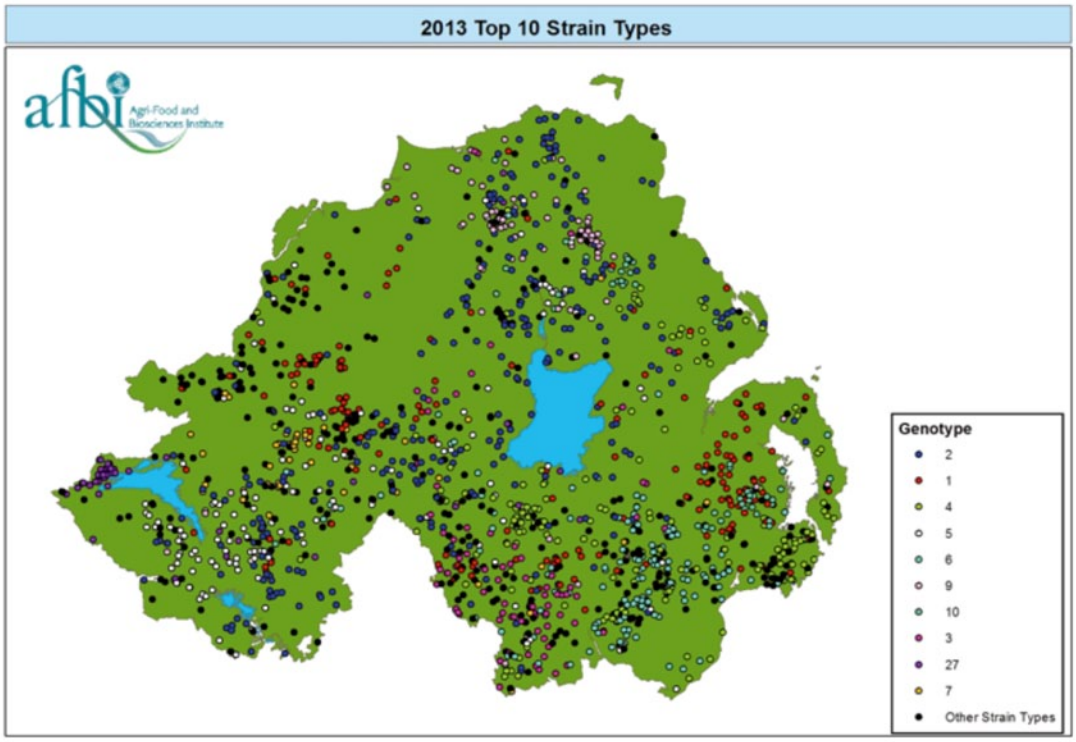
Reference Section 10 New Herd Breakdowns, paragraph 10.4

Figure C: Distribution of the most Prevalent Strain Types in 2003-2014



There has been a slight change to the more historical prevalence in that strain type 122 has replaced strain type 8 in the top 11. Strain type 122 is a “daughter” of strain type 6 and can be seen to cluster mainly in the same area of Newry and Newtownards DVO areas as strain type 6.

Figure D: Distribution of the most Prevalent Strain Types in 2013



Glossary of Terms

Term	Definition
AFBI	Agri-Food and Biosciences Institute.
AHT	Annual Herd Test, a routine herd test carried out on a disease free herd to maintain OTF status.
Animal incidence	Number of reactors divided by the number of animals tested over a specified period of time expressed as a percentage (i.e. one animal with multiple tests is only counted once).
APHIS	Animal and Public Health Information System.
bTB	Bovine Tuberculosis.
bTB confirmed	Two or more of the following have a positive result: SICCT (skin test), PME and histology. It can be confirmed on bacteriological culture alone.
Carryover (source of infection)	The herd had infection recently and although it might have passed two clear skin tests and the restrictions were lifted, it is suspected that some infected animals remained in the herd and this residual infection is the cause of the current breakdown.
Confirmation rate for skin test reactors	A reactor is confirmed either at post-mortem inspection (Visible Lesions) or by laboratory examination i.e. histology and/or bacteriology. The confirmation rate is the number of confirmed reactors out of the total number of skin reactors.
DARD	Department of Agriculture and Rural Development.
Herd incidence	Number of new herd breakdowns divided by the number of herds with a herd level test over a specified period of time expressed as a percentage (i.e. one herd with multiple tests is only counted once).
IFNG	Interferon Gamma blood test.
Local spread (source of infection)	Infection in contiguous or nearby herds is suspected to be the cause of the infection in the herd, either by direct contact between animals or indirect contact (e.g. common contractors or machinery shared by both herds).
LRS	Lesion at Routine Slaughter: Suspect bTB cases identified at post mortem inspection of skin test negative animals slaughtered as part of normal business.

Glossary of Terms

Term	Definition
M.bovis	*Mycobacterium bovis* is the main bacterial agent causing bTB
Median	The value of the observation which splits the number of observations into two equal parts when they are ranked in order of value e.g. if there were 99 observations then the value of the 50th observation equals the median.
New herd breakdown	A herd with at least one reactor animal where the herd had no other reactor animals during the previous 12 months. NB – In DARD's routine statistics, herds with bTB confirmed from lesions found at routine slaughter, and no subsequent reactors during the breakdown, are not currently included.
NIC	Negative In Contacts (NICs) are animals that are not positive to a diagnostic test, but are removed on the basis of being at increased disease risk due to the extent of their exposure to disease.
OTF	Officially Tuberculosis Free.
OTS	OTF Suspended.
OTW	OTF Withdrawn.
Patch incidence	The percentage of herds at risk in each patch that were bTB infected during that year.
PME	Post Mortem Examination.
PVPs	Private Veterinary Practitioners.
Reactor	An animal that gives a positive response to the skin test is called a "reactor".
Reactor removal times	Number of working days between the test revealing the reactor animal and the death of that animal.
Restricted Herd Tests	**RHT, RH1, RH2 where: RHT:** Restricted Herd Test, an immediate test/ part test where the first reactor is disclosed at an individual animal test or infection is suspected at PME (LRS) and the herd has not been tested in the previous 60 days; also known as a stabilising test.

Glossary of Terms

Term	Definition
	RH1: - First Restricted Herd Test carried out at least 60 days after the removal or isolation of any reactor or LRS; or at least 42 days after a clear RHT. **RH2:** - Second Restricted Herd Test carried out at least 42 days (usually 60 days+) after completion of an RH1 without reactors in an OTW breakdown, and at least 120 days after removal or isolation of the last reactor or LRS.
Risk herd tests	**BCT; CHT; FCT; HRT, ICT; LCT; OHT & SCT** where: **BCT:** Backward Check Test set following risk assessment for herds that a reactor animal or routine slaughter case from an OTW herd passed through prior to being disclosed. **CHT:** Check Herd Test, to be completed 4-6 months after de-restriction for all herds that have been restricted due to a bTB breakdown and have no additional risk factors. **FCT:** Forward Check Test, herd test for herds into which a forward traced animal moved, and the animal cannot be tested due to its slaughter, death or export. **HRT:** High Risk Test, a test allocated to herds considered high risk, but which do not fall into other categories. **ICT:** Inconclusive Check Test, herd test to be completed at least 60 days after voluntary slaughter of an inconclusive animal by the herd keeper. **LCT:** Lateral Check Test, carried out on herds assessed as being at higher disease risk due to proximity to a diseased herd. **OHT:** Overdue Herd Test, an additional herd test that is required to restore OTF status of a herd that has failed to test within prescribed time limits. **SCT:** Status Check Test, a herd test carried out to restore OTF status following suspension/withdrawal due to the presence of cattle whose origins cannot be determined to the satisfaction of DARD. It may need to be repeated to restore OTF status, at the discretion of the local S/DVO, depending on the particular circumstances.
Risk individual tests	**RI1; CTS & CTT/CTQ**, where: **RI1:** Inconclusive retest, completed on individual animals at least 42 days after an initial inconclusive result. **CTS:** Check Test Status, check test carried out on animal(s) with identity or movement queries or which have missed a bTB test.

Glossary of Terms

Term	Definition
	CTT/CTQ: Check Test Trace /Check Test Query, check test of animal(s) forward traced from a breakdown herd. ***Note***: **PCT, PNA** and **PNT** are private tests, described but not included, in the figures presented in this Report. CTI tests are also excluded from the report as they are not a TB Programme requirement: **PCT:** Private Check Test; pre-movement tests for cattle being exported or moving to an AI Centre or Embryo Transplant clinic; **PNA:** Private Test, Move Not Allowed; automatically set for animals that have moved from an OTS/OTW herd to an OTF herd; **PNT:** Private Test Not Tested for 15 months; unrestricted cattle exceeding a 15 month bTB test interval. **CTI:** Check Test Import allocated for individual or groups of re-imported cattle for Trade Branch purposes. It is completed at least 42 days after any previous pre-export test, and at least 30 days post re-importation to an isolation facility on the farm of origin.
Routine Herd Tests	**AHTs** and **RSTs** (defined in glossary).
RST	Restocking test, herd test carried out when animals move into a herd that has had no stock for at least 2 years.
Sensitivity	Proportion of infected animals that are correctly detected by the test.
SICCT test	Single Intradermal Comparative Cervical Tuberculin test. Also known as skin test.
Skin test	See SICCT above.
Specificity	Proportion of negative animals that are correctly detected by the test.
STNP	Skin test non positives: animals with a skin test result other than positive. Therefore, negative and inconclusive animals would be included.
TBINVEST	Database system where the Field Veterinary Officer enters epidemiological information gathered during the investigation of OTW breakdowns.
Test coverage	Percentage of tests due during a certain year that are completed within that year.

Glossary of Terms

Term	Definition
VL	Visible lesions: Tuberculosis like lesions identified at post mortem inspection.
VO	Veterinary Officer.
12 month moving average incidence	Average incidence over the previous 12 months.

Bovine Tuberculosis in Northern Ireland

2014 Annual Report

Veterinary Service

TB Section

Department of Agriculture and Rural Development

Dundonald House

Upper Newtownards Road

Ballymiscaw

Belfast BT4 3SB

ISBN 978-1-84807-566-5

Department of
Agriculture and
Rural Development

AN ROINN
Talmhaíochta agus
Forbartha Tuaithe

MÄNNYSTRIE O
Fairms an
Kintra Fordèrin

INVESTORS IN PEOPLE

DMS 15.16.131