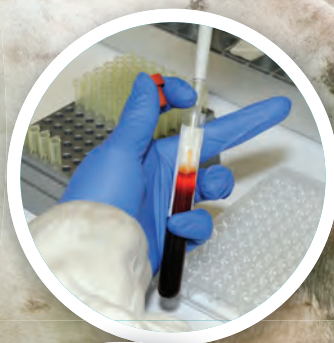


All-island Animal Disease Surveillance Report 2012

A joint AFBI / DAFM Veterinary Laboratories publication



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Introduction

This is the third All-island Animal Disease Surveillance Report, jointly produced by the Department of Agriculture, Food & the Marine in Ireland and the Agrifood & Biosciences Institute in Northern Ireland. The report summarises the information generated on diseases of farmed animals by a network of laboratories operating across the island. As it also deals with equine diseases and diseases associated with aquaculture, this report also features contributions from the Marine Institute and the Irish Equine Centre.

One of the trends now apparent from this annual reporting exercise is the stability of disease patterns from year to year in some ages and classes of livestock. Subtle shifts in incidence or seasonal variation are evident every year, but the overall pattern and relative frequency of disease remains fairly constant. In some ways this is reassuring, as it indicates the constancy of the surveillance effort north and south of the border, and substantiates the argument that these systems would promptly flag a change in these baseline patterns. Increased production is one likely driver of a change in disease patterns and frequencies. The dairy sector is poised to expand significantly after quota

restrictions on milk production are lifted in 2015. Early detection of new and emerging diseases (or new variants of long-recognised diseases) and prompt provision of objective data to inform better disease control and reduce negative impact will be a key component to sustainability and profitability of expanding farm enterprises.

This report isn't all about the familiar patterns of recent years: it also documents the inevitable arrival of Schmallenberg virus in Ireland and Northern Ireland, detected in both jurisdictions within a 48 hour period in October 2012. This novel vector-borne pathogen, first identified in Germany in late 2011, has swept across Europe over the past two years. Despite severe disease in some infected herds and flocks on this island, overall it has had relatively little impact on the livestock industry – a pattern similar to that seen in the rest of Europe. Like any newly-identified disease, much remains to be elucidated on how this disease will evolve in the future, and we hope to monitor and document this additional challenge to the health and welfare of our livestock in future editions of this report.

Animal demographics and the weather

Cattle and sheep demographics

Following a period of relative stasis in the size of the national herds in both Ireland and Northern Ireland between 2010 and 2011, 2012 witnessed a 5.5 *per cent* increase in cattle numbers in Ireland to 6.25 million and a 1.9 *per cent* increase in cattle numbers in Northern Ireland to 1.60 million cattle (Figure 1).

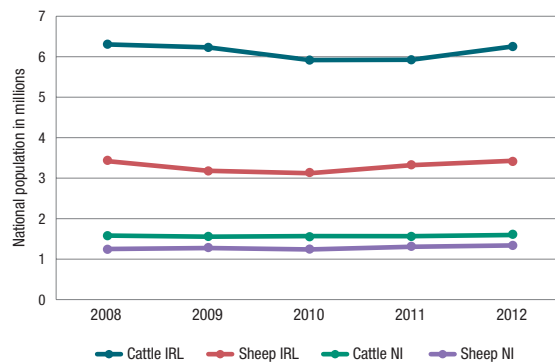


Figure 1: Trends in the national cattle and sheep populations in Ireland and Northern Ireland from 2008 to 2012 (Source: Central Statistics Office www.cso.ie).

Growth in the sizes of the respective national sheep flocks was also recorded during 2012, albeit at a slower rate than the increase recorded in 2011. In 2012 Ireland recorded a national sheep flock of 3.43 million sheep representing an increase of 3.3 *per cent* when compared to 2011 while Northern Ireland recorded 1.34 million sheep during the same period reflecting an increase of 2.5 *per cent* in sheep numbers (Figure 1).

In Ireland the increases recorded in the national herd and flock restores the animal numbers to levels last witnessed in 2008. In Northern Ireland, while the increase in the national herd also restores cattle numbers to 2008 levels, the increase in the

national flock is part of a longer trend in increased sheep numbers.

Weather

Similar to the two previous years, 2012 proved a very wet year with unseasonal levels of rainfall recorded in the summer months in particular (Figure 2).

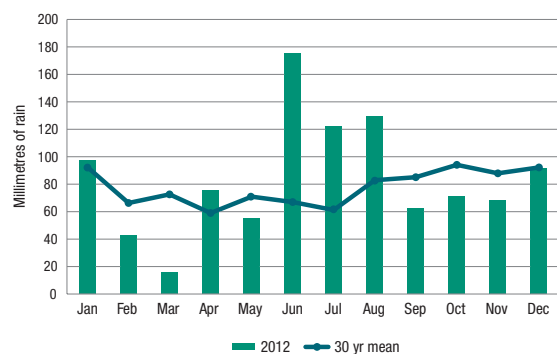


Figure 2: The monthly rainfall recorded during 2012 in Mullingar compared to the 30-year monthly average rainfall (blue line). (Source: www.meteireann.ie).

Both the spring and autumn recorded rainfall below the 30-year average. The excessively wet conditions during the summer however contributed to heavy burdens of fluke on pasture in the early autumn and heavy losses were experienced on many sheep farms as a result, particularly on farms where fluke infestation has not traditionally posed a significant problem. Another consequence of the unseasonal weather was its impact on the quality and quantity of winter fodder which was saved during this time. Poor quality silage and hay led to poor dry matter intake among housed animals in the winter of 2012 which compounded many other animal health problems.

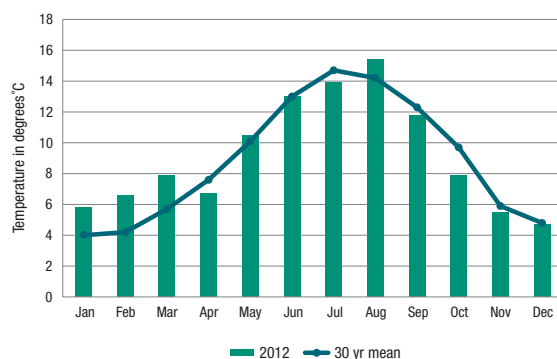


Figure 3: The monthly average temperature as recorded in Mullingar during 2012 compared to the 30-year average temperature (blue line). (Source: www.meteireann.ie).

The early spring of 2012 was warmer than average which facilitated the early release of livestock onto pasture in many areas while both April and October recorded average temperatures below the thirty-year average (Figure 3). The above average temperatures recorded during August 2012, when combined with the excessive rainfall provided optimal temperatures for proliferation of mud-snails (*Galba truncatula*, intermediate host for liver and rumen fluke) or aquatic snails (such as *Planorbis* spp, intermediate hosts for rumen fluke).

Diseases of Cattle

The most frequently occurring causes of death in cattle, as diagnosed by Agri-Food and Biosciences Institute (AFBI) and by the Department of Agriculture, Food and the Marine (DAFM) laboratories on post-mortem examination, are presented in this section. The range of diagnosed causes of mortality in cattle is broad and varies according to the age of the animal. As a result, the causes of mortality are presented by age category in this section. The data from each laboratory service (AFBI and DAFM) for weanlings and calves is presented separately, due to differences in age categorisation for these animals on the respective data management systems.

Over the last number of years, diagnosed causes of mortality in cattle appear to be generally consistent. In order to facilitate their presentation, conditions which affect given systems have been grouped together into more generalised categorisations. More specific details relating to some of these individual conditions are included in other sections of this report.

Neonatal Calves

Enteritis continues to be reported as the most commonly diagnosed cause of neonatal mortality in calves in Ireland and Northern Ireland. In 2012, neonatal deaths attributable to enteric infection were estimated at 26 *per cent* in Ireland (Figure 4) and 39 *per cent* in Northern Ireland (Figure 5). In Northern Ireland, this figure has increased from 31.6 *per cent* in 2010, and 36.6 *per cent* in 2011 representing a noteworthy trend. *Cryptosporidium* spp and rotavirus continue to be the most commonly isolated aetiological agents of enteritis in neonates on the island of Ireland.

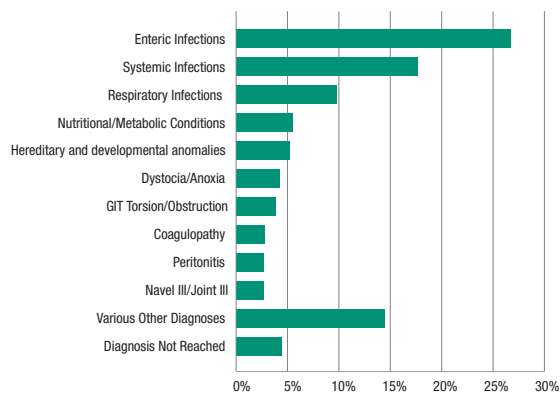


Figure 4: The conditions most frequently diagnosed on post-mortem examination of neonatal (less than one-month-old) calves in Ireland during 2012 (n=1396). GIT=Gastrointestinal tract.

Septicaemia and toxæmia were the second most commonly recorded diagnoses on post-mortem examination of neonatal calves both in Northern Ireland (14 *per cent*) and in Ireland (17 *per cent*). Septicaemia, bacteraemia and toxæmia are often associated with the advanced stages of bacterial infections, whereby toxins produced by the bacteria enter the circulation, triggering an inflammatory response leading to shock. This is mediated by increased vascular permeability and varying degrees of disseminated intravascular coagulation.

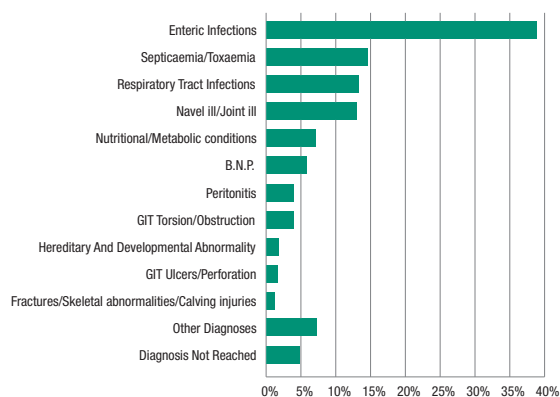


Figure 5: The conditions most frequently diagnosed on post-mortem examinations of neonatal (less than one-month-old) calves in Northern Ireland during 2012 (n=797). B.N.P: Bovine neonatal pancytopenia. GIT=Gastrointestinal tract

Respiratory tract infections were diagnosed in 13 *per cent* of neonatal calf death cases in Northern Ireland and in 9.5 *per cent* in Ireland. The majority of respiratory tract infections refer to pneumonia but other conditions include pulmonary oedema, pleurisy and tracheitis. *Mannheimia haemolytica* was the most frequently identified pathogen responsible for infectious neonatal pneumonia. The most significant non-infectious respiratory condition identified in calves of this age was aspiration pneumonia (25 cases), a condition often associated with stomach-tubed calves.

As in previous years, navel ill and joint ill were significant causes of mortality in neonatal calves in Northern Ireland (13 *per cent*), while the prevalence in Ireland was 2.7 *per cent* (Figure 6). *Trueperella pyogenes* is the pathogen most commonly isolated on bacteriological examination of such cases.



Figure 6: Locally extensive suppurative inflammation associated with navel ill in a calf. (Photo: Dónal Toolan).

Nutritional and metabolic conditions accounted for neonatal mortality in 7.2 *per cent* of cases in Northern Ireland and 5.5 *per cent* of cases in Ireland during 2012. These include a range of conditions of which hypogammaglobulinaemia featured most frequently in both Northern Ireland (42 cases) and Ireland (31 cases). Low levels of blood immunoglobulin arise when calves receive an inadequate supply of maternal protective antibodies from colostrum. The Zinc Sulphate

Turbidity Test is used as a diagnostic tool to determine if there has been adequate transfer of maternal immunity to the neonatal calf *via* the colostrum. The results of this test are reviewed in a separate section this report (see page 15).

Hereditary and developmental abnormalities were responsible for mortality in approximately 5 *per cent* of bovine neonates in Ireland during 2012. In Northern Ireland, the number of deaths due to similar conditions was recorded at 1.8 *per cent*. In Ireland, circulatory defects were the most frequently observed fatal developmental anomalies with 14 cases recorded during 2012. Congenital joint laxity and dwarfism (Figure 7) accounted for the second most common cause of death in this category (10 cases), followed by atresia coli (9 cases) and atresia jejuni (7 cases).



Figure 7: A shortened femur bone associated with congenital joint laxity and deformity (CJLD) in a calf (Photo: Dónal Toolan).

Calves

The age categorisation of “calves” in the data management systems of DAFM (Ireland) and AFBI (Northern Ireland) laboratories differ such that calf mortality data from both jurisdictions are not directly comparable. In Northern Ireland, AFBI defines calves as bovine animals one to five-months of age. In contrast, DAFM laboratories in Ireland record “calves” as bovine animals one to three-months of age. In spite of this difference in age categorisation, the diagnosed causes of mortality are remarkably similar for calves in Ireland (Figure 9) and Northern Ireland (Figure 8).

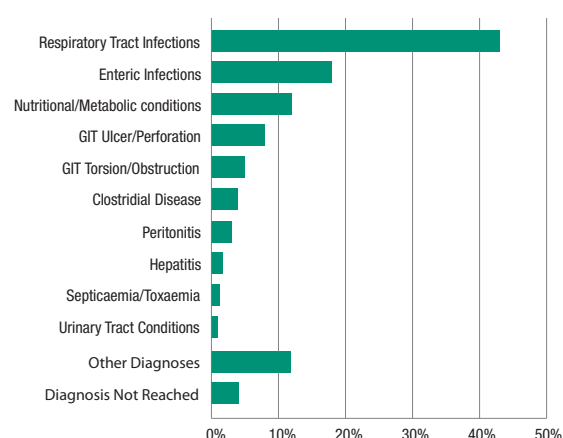


Figure 8: The conditions most frequently diagnosed on post-mortem examination of calves (one to five-months-old) in Northern Ireland in 2012 (n=459).

GIT=Gastrointestinal tract

In a continuation of the trend identified in previous years, respiratory tract infections accounted for the majority of deaths in calves on the island of Ireland during 2012. Forty-three *per cent* of calf fatalities in Northern Ireland and 29 *per cent* of calf deaths in Ireland were attributed to respiratory tract infections. These figures represent an increase in frequency when compared to the 2011 figures of 22.8 *per cent* in Ireland and 34 *per cent* in Northern Ireland. As expected, the most commonly diagnosed respiratory tract infection in Ireland was pneumonia (89 *per cent* of all respiratory tract infections).

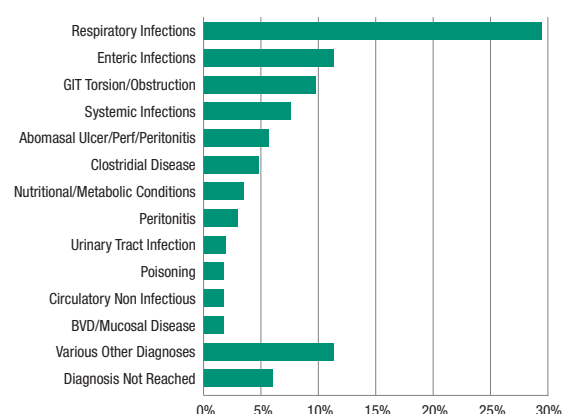


Figure 9: The conditions most frequently diagnosed on post-mortem examination of calves (one to three-months-old) in Ireland during 2012 (n=563).

GIT=Gastrointestinal tract

Enteric infections were diagnosed in 18.7 *per cent* of calves in Northern Ireland and 11 *per cent* of calves in Ireland on post-mortem examination. Haemorrhagic enteritis was reported in 11 cases while 13 cases of coccidiosis were diagnosed *post mortem* in Ireland during 2012.

Gastrointestinal torsions (Figure 10) and obstructions accounted for 5 *per cent* and approximately 10 *per cent* of mortalities in calves in Northern Ireland and Ireland respectively during 2012.



Figure 10: Diffusely hyperaemic intestines associated with intestinal torsion (Photo: Dónal Toolan).

In absolute numbers, intestinal (32 cases) and mesenteric (12 cases) torsion (Figure 11) were more frequently diagnosed than intestinal obstruction (10 cases) in Ireland.



Figure 11: Abomasal torsion in a calf (Photo: William Byrne).

Nutritional and metabolic conditions were recorded on post-mortem examination for 12.4 *per cent* of calves in Northern Ireland during 2012 (57 cases). In Ireland, these conditions were associated with 3.5 *per cent* of mortalities in calves (20 cases). Starvation was recorded as the cause of death in 55 *per cent* of these cases. Bloat was the second most common metabolic condition in this category in Ireland.

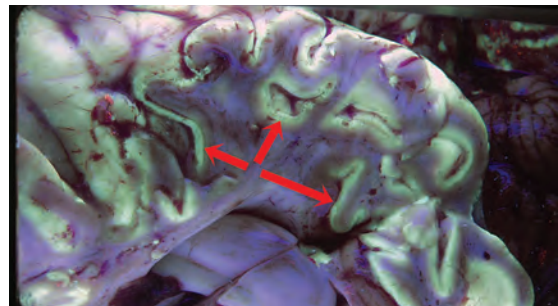


Figure 12: Laminar pattern of autofluorescence (apple-green) in the grey matter of the cerebral cortex when exposed to ultraviolet light (Wood's lamp) is indicative of necrosis associated with acute polioencephalomalacia (Photo: Cosme Sánchez-Miguel).

Gastrointestinal ulceration (Figure 13), perforation and peritonitis accounted for 8 *per cent* of calf mortality cases in Northern Ireland and 5.7 *per cent* in Ireland. This grouping of diagnoses includes ulcers which may have perforated, causing peritonitis. Peritonitis unrelated to ulceration was diagnosed in 3 *per cent* of calf carcasses on post-mortem examination in both Northern Ireland and Ireland.

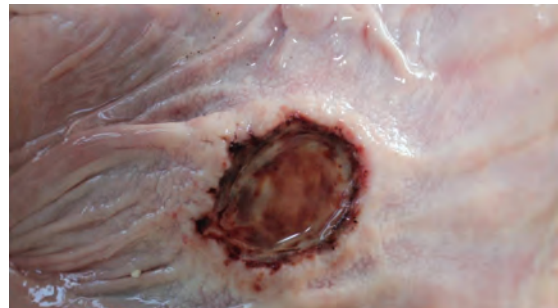


Figure 13: Abomasal ulceration in a calf (Photo: Colm Ó Muireagáin).

Weanlings

Data management systems in DAFM and AFBI laboratories also differ in their age categorisation of weanlings (six to twelve-month-old in Northern Ireland and three to twelve-months-old in Ireland). Despite the differences between AFBI and DAFM categorisation, the most common diagnoses reported are similar in both jurisdictions.

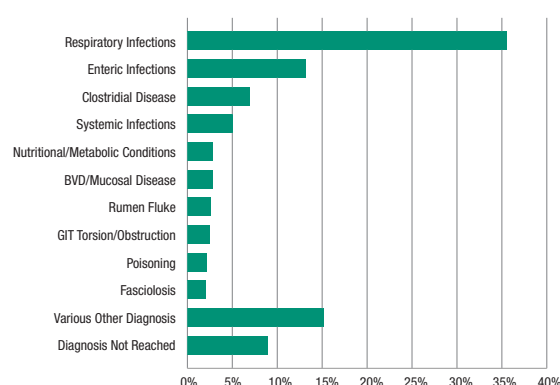


Figure 14: The conditions most frequently diagnosed on post-mortem examinations in weanlings (three to twelve-months-old) in Ireland in 2012 (n=824).

Respiratory disease is identified as the most frequently occurring condition causing mortality among weanlings in both Northern Ireland (40 *per cent*) (Figure 16) and Ireland (35.5 *per cent*) (Figure 14). In comparison to 2011 (25 *per cent*) and 2010 (31.3 *per cent*) in Ireland, the occurrence of weanling respiratory infections in 2012 represents a significant increase in frequency. In contrast, in Northern Ireland the number of deaths associated with respiratory infections during 2012 remains close to the 40 *per cent* level recorded in 2011. In Ireland, the most commonly isolated aetiological agents of weanling respiratory disease during 2012 were lungworm (*Dictyocaulus* spp.) and *Pasteurella multocida*. Bovine respiratory syncytial virus (BRSV), identified in 30 cases, and *Mannheimia haemolytica* (Figure 15), diagnosed as the causative agent of respiratory disease in 26 cases, were also prominent respiratory pathogens.

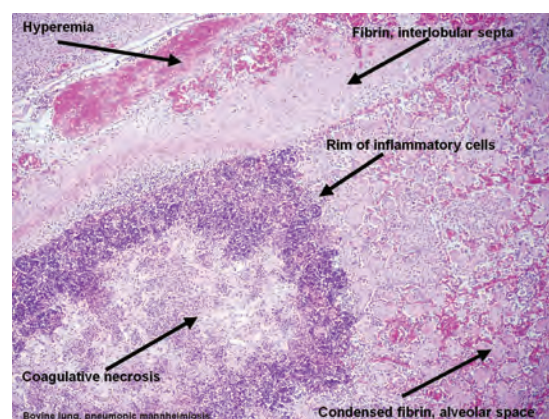


Figure 15: Histological findings in a bovine lung associated with *Mannheimia haemolytica* infection (Photo: Cosme Sánchez-Miguel).

Enteric infections were the second most commonly identified cause of mortality among weanlings in Ireland during 2012 (Figure 14), recorded in a total of 109 cases (13 *per cent*) in this category. In Northern Ireland, diagnoses of enteric infections represent the third most commonly diagnosed cause of weanling mortality accounting for 9.8 *per cent* of weanling post-mortem diagnoses (Figure 16). In Ireland, coccidiosis was identified in 14 diagnoses of enteric disease, rumen fluke were identified in 22 cases and enteritis due to Salmonellosis (serotype Dublin) accounted for 5 cases during 2012.

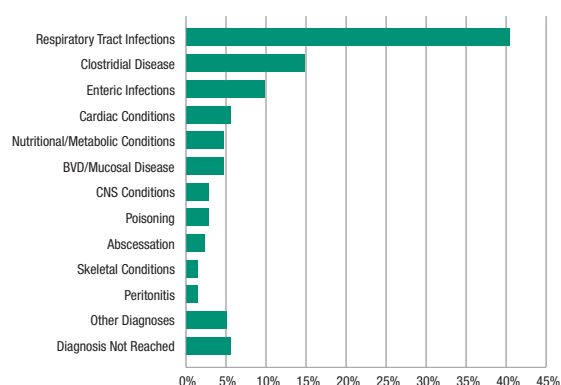


Figure 16: The conditions most frequently diagnosed on post-mortem examinations of weanlings (six to twelve-month-olds) in Northern Ireland during 2012 (n=215).

Clostridial disease (Figure 17) was recorded as the second most frequent cause of death among weanlings in Northern Ireland (14.8 *per cent*, Figure 16). In Ireland, a lower number of deaths were attributed to clostridial infections (6 *per cent*, Figure 14) during 2012. Compared to 2011, there was a decrease in the mortality rate due to this group of diseases in Ireland (9.9 *per cent* in 2011), but an increase was recorded in Northern Ireland (11.3 *per cent* in 2011 and 14.3 *per cent* in 2010). Effective, multivalent clostridial vaccines are available and should be used as a preventive measure to reduce the mortality rates associated with these diseases.



Figure 17: Classical haemorrhagic myositis common in blackleg, associated with the bacterium *Clostridium chauvoei* (Photo: Dónal Toolan).

Bovine Virus Diarrhoea (BVD) virus was detected in 23 weanling carcasses during 2012 in Ireland using PCR methodology. In addition, BVD virus was identified as the aetiological agent in six cases of weanling pneumonia (2.1 *per cent* of pneumonia cases). The virus was also identified in carcasses of other age groups in Ireland, specifically in 24 neonatal and 14 adult carcasses. In Northern Ireland, BVD virus infection in weanlings was diagnosed in 10 cases during 2012 (4.7 *per cent*, Figure 16).

Nutritional and metabolic diseases accounted for 4.7 *per cent* of deaths among weanlings during 2012 in Northern Ireland (Figure 16) compared to approximately 3 *per cent* in Ireland (Figure 14). Starvation was responsible for the deaths of six weanlings in Ireland, while acidosis and bloat accounted for five deaths each.

Adult cattle

In both Ireland and Northern Ireland, adult cattle are classified, for statistical purposes, as those exceeding 12 months of age. This age category displays the most diverse range of diagnoses recorded, reflected in the 23 and 28 *per cent* (Ireland and Northern Ireland respectively) of adult deaths included in the 'Other Diagnoses' category, encapsulating a wide range of disorders.

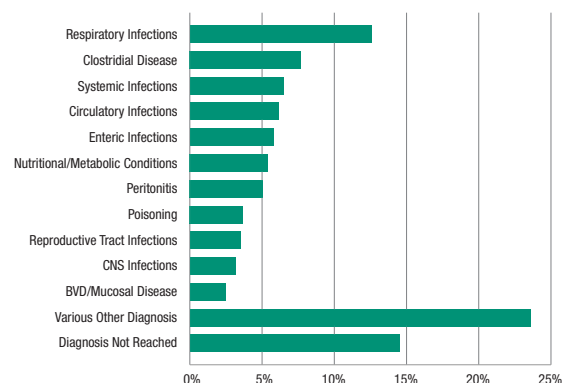


Figure 18: The most frequently diagnosed conditions following post-mortem examinations of adult (greater than twelve-months-old) cattle in Ireland in 2012 (n=572).

As with all of the age categories detailed above (excluding neonates), respiratory disease is the most significant contributor to mortality in adult cattle. This trend is in keeping with previous years. Respiratory related conditions were diagnosed in 12.7 *per cent* of deaths in adult cattle in Northern Ireland (Figure 20) and in 12.5 *per cent* in Ireland (Figure 18).

Similar to the situation in weanlings, clostridial disease was recorded as the cause of death in 7.5 *per cent* of adult cattle in Ireland, and 8.9 *per cent* in Northern Ireland during 2012. A more comprehensive analysis on clostridial disease is presented in another section of this report (see page 12).

Circulatory system conditions were identified as the cause of death in 6 *per cent* of deaths in adult cattle in Ireland and 3.5 *per cent* in Northern Ireland

during 2012. Endocarditis (Figure 19) was the most frequently recorded condition within this group on post-mortem examination. Other diseases in this category included pericarditis (8 cases), vena cava thrombosis (7 cases) and babesiosis (4 cases).



Figure 19: Valvular endocarditis (Photo: William Byrne).

Enteric infections represented 5.7 *per cent* of adult bovine mortality diagnoses in Ireland during 2012. BVD virus was isolated in 3 of these cases, while coccidiosis was recorded as the cause of death in a further 7 cases. In Northern Ireland, 7.9 *per cent* of deaths were diagnosed as enteric infections on post-mortem examination.

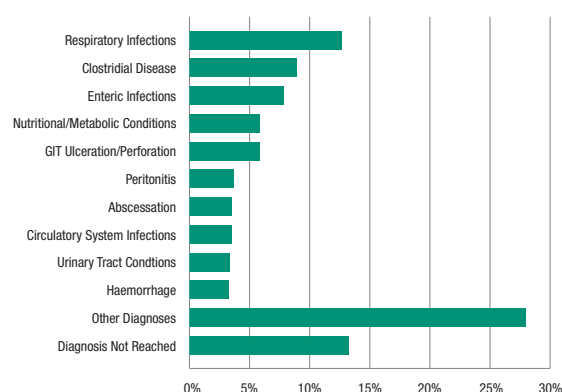


Figure 20: The conditions most frequently diagnosed on post-mortem examination of adult (greater than twelve-months-old) cattle in Northern Ireland in 2012 (n=735).

GI=Gastrointestinal tract

The category 'Other Diagnoses' includes a wide range of disorders. In Ireland, this heading included 199 cases of septicaemia, 45 cases of enteritis with subsequent septicaemia, and 10 cases of grass tetany. Other conditions under this heading were recorded with much lower frequency.

A very significant decrease in diagnoses of fasciolosis causing mortality in adult cattle was recorded in Ireland during 2012 (1.4 *per cent* of deaths), compared to 2009 (9.0 *per cent*) and 2010 (6.6 *per cent*), continuing the trend observed in 2011 (2.0 *per cent*).

Clostridial disease in Cattle

Clostridial disease remained a significant cause of mortality in cattle in 2012. On the island of Ireland, there was an increase in the number of diagnosed cases of clostridial disease in 2012 (244 cases) compared to 2011 (204 cases). As in 2011, Blackleg remained the most frequently diagnosed clostridial disease, accounting for 47 *per cent* of all clostridial diagnoses, with 67 cases diagnosed in Ireland and 48 cases diagnosed in Northern Ireland (Figure 21). Blackleg was more commonly diagnosed in younger animals, with 83 *per cent* of cases (96 cases) recorded in animals less than twelve months of age.

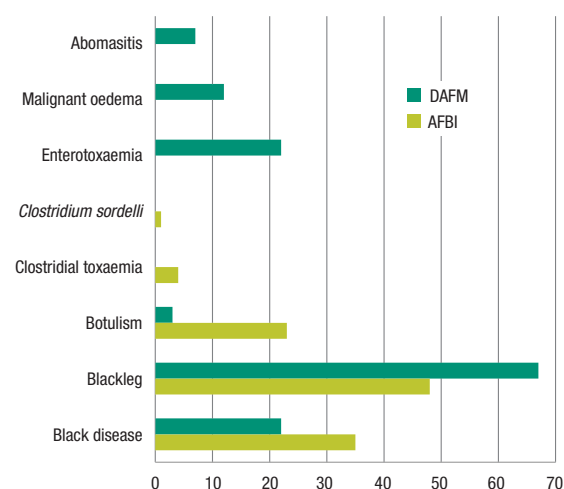


Figure 21: The number of cases of various clostridial diseases recorded by AFBI (n=111) and DAFM (n=133) laboratories during 2012.

Black disease (Figure 22) was diagnosed on post-mortem examination in 35 cases in Northern Ireland during 2012 and 22 cases in Ireland (representing 23 *per cent* of all clostridial diagnoses on the island of Ireland). While cases of Black disease were observed throughout the year, most cases were recorded in grazing animals, older than one year of age, in the autumn and early winter. Black disease is caused by the bacterium *Clostridium novyii* which, under favourable conditions replicates in the liver and produces exotoxins which affect the vasculature throughout the body leading to shock and death. Migrating immature liver fluke can produce a low oxygen environment within the liver which is favourable to the activation of *Clostridium novyii* spores and the development of the disease. The wet conditions experienced during the summer and autumn of 2012 and the increased prevalence of liver fluke was a likely contributing factor to the increased numbers of cases of Black disease observed during 2012 (57 cases) compared to 2011 (40 cases).



Figure 22: The pathognomonic haemorrhagic necrotic tan coloured lesion associated with Black disease in a bovine liver (Photo: Dónal Toolan).

Twenty six cases of botulism (23 in Northern Ireland and 3 in Ireland) were recorded during 2012. Botulism is a condition characterised by flaccid paralysis caused by the toxin of *Clostridium botulinum*, a neurotoxin which interferes with signal transmission at neuromuscular junctions. Suspected clinical cases in cattle are usually

associated with the consumption of decaying organic matter in their feed e.g. carrion, poultry waste, dead vermin etc. In many of the cases of botulism diagnosed on the island of Ireland, there has been an association with spreading broiler house litter on fields which may be contaminated with the carcasses of chicken which have died during production and become embedded in the litter.

Bovine Neonatal Enteritis

Neonatal enteritis (i.e. in calves less than one month of age) continues to account for a large number of submissions to the AFBI and DAFM laboratory services annually and is one of the most significant causes of mortality in calves (see Figure 4 and Figure 5). Control of bovine neonatal enteritis is recognised worldwide as one of the main challenges facing both the beef and dairy industries. In addition, many of the causative agents of enteritis in young calves have zoonotic potential. In this section data from analyses of faecal samples from both clinically ill and post-mortem examination of calves are presented.



Figure 23: A typical presentation of soiled perineum in a calf submitted with a history of neonatal enteritis (Photo: Maresa Sheehan).

The most frequently isolated pathogens are detailed in Figure 24.

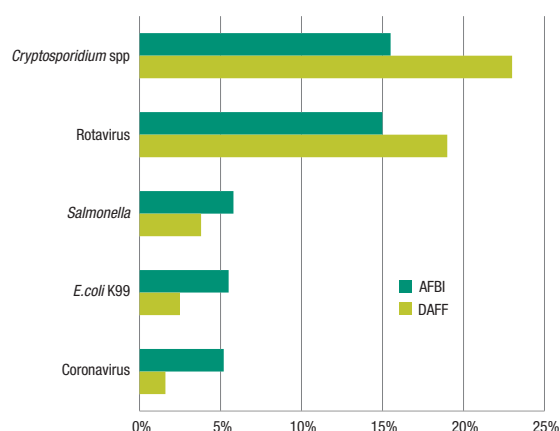


Figure 24: The relative frequency of enteropathogens identified on post-mortem submissions of calves less than one month of age during 2012.

As in previous years, rotavirus and *Cryptosporidium* spp. were the most frequently isolated enteropathogenic agents on the island of Ireland.

Viral pathogens, such as rotavirus and coronavirus, are associated with depression, reluctance to suck and diarrhoea. The severity of the symptoms can vary from sub-clinically affected animals to severe diarrhoea and dehydration. The factors that influence viral infection and its clinical severity include the age of the animal, the immune status of the dam and the adequacy of transfer of maternal immunity to the calf *via* colostrum. The extent of viral exposure and intercurrent infection will also exacerbate the disease. Calves are most susceptible to rotavirus and coronavirus enteritis up to 3 weeks of age.

Cryptosporidiosis is a difficult disease to control. Good hygiene practices at the time of calving and adequate colostrum supply are essential, while other measures such as the isolation of infected animals, the cleaning and disinfection of calf-rearing houses with ammonia based disinfectants on a regular basis, and the operation of an all-in all-out policy are also important. It is important that rodents and pets are excluded from calf-feed and milk-feed storage areas. Using a preventive

treatment with halofuginone lactate together with the above hygiene practices can aid control of this disease.

E. coli K99 is associated with severe diarrhoea in calves up to 1 week of age. *E. coli* K99 toxins cause hypersecretion of water and electrolytes from the intestinal mucosa leading to rapid dehydration.

Salmonella infection in neonatal calves frequently results in necrotic enteritis, and the subsequent septicaemia can cause lesions in other organs (Figure 25). *Salmonella* Dublin is the most common species isolated.

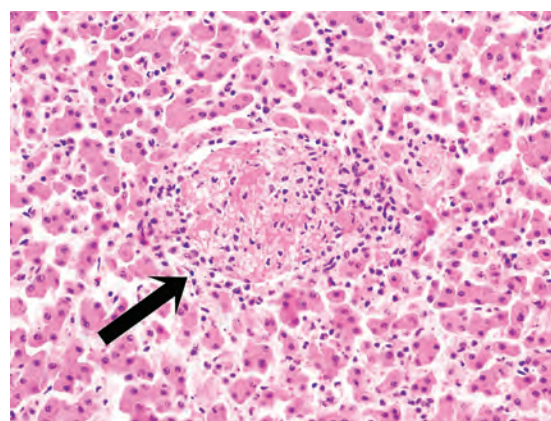


Figure 25: Early Parathypoid lesion caused by *Salmonella* Dublin infection in a calf liver. (Photo: Cosme Sánchez-Miguel).

Eimeria spp. are the causative agent of coccidiosis, and is most commonly associated with diarrhoea in calves older than 3 weeks of age. Clinical and sub-clinical coccidiosis have a serious economic impact through the cost of treatment and the poor performance of affected calves. If coccidiosis is suspected, a number of calves should be sampled for coccidial oocyst detection as disease can occur during the pre-patent period. The detection of coccidial oocysts must be interpreted in conjunction with the farm history and clinical signs as many of the non-pathogenic strains will also result in oocyst detection and may lead to an inaccurate diagnosis.

Campylobacter jejuni, frequently isolated in calf faeces although not generally pathogenic, is also a zoonotic agent. This stresses the importance of taking adequate precautions and maintaining high levels of hygiene around calving time.

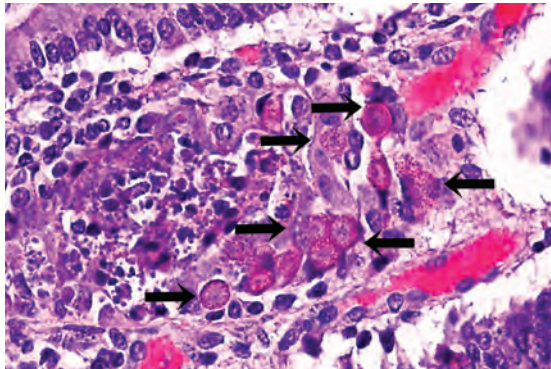


Figure 26: A photomicrograph of enteritis caused by coccidia (arrows) in a 1 month-old calf with a history of diarrhoea (Photo: Maresa Sheehan).

Control and prevention of neonatal enteritis

- Prevent dystocia, including prolonged parturition. This results in hypoxia and acidosis. Dystocia may also decrease the intake of colostrum, reduces body temperatures and decreases the ability to withstand cold stress.
- Provide adequate amounts of good colostrum at the right time. (3 litres, within 2 hours, from 1st milking).
- Steps must be taken to reduce the build-up of infection towards the end of the calving season. Sub-optimal hygiene and high stocking density will result in a build-up of infection. Isolation and prompt treatment of diarrhoeic calves is essential.

Treatment and containment of bovine neonatal disease:

- Prompt isolation and treatment with appropriate oral rehydration therapy.
- Continue milk feeding to provide the energy and nutrients required.
- Appropriate use of antibiotics. The use of antibiotics is only recommended for enteritis cases with systemic illness.
- Ancillary treatment with non-steroidal anti-inflammatory drug therapy.
- Vaccination of the dam and adequate colostrum feeding and/or the use of prophylactic medicines determined by the aetiological agent involved.



Figure 27: Diffuse fibrinous peritonitis associated with a perforated abomasal ulcer in a 1 month old calf. (Photo: Maresa Sheehan).

Zinc Sulphate Turbidity Test

The Zinc Sulphate Turbidity (ZST) test is used to indirectly measure serum immunoglobulin concentrations in calves less than two weeks of age. This test evaluates the adequacy of the passive transfer of colostral immunity from the dam to her offspring. The turbidity produced by the selective

precipitation of the immunoglobulins in serum with zinc sulphate is quantified and expressed in units with values of less than twenty units indicative of a failure of passive transfer of immunoglobulins.

A total of 1,896 ZST tests were performed by AFBI and DAFM laboratories during 2012. These tests were conducted on samples collected from carcasses at post-mortem examinations and also on blood samples submitted by veterinary practitioners from clinically-ill animals. Test results show a failure of the passive transfer of immunity (less than twenty units) in 63 *per cent* of the samples tested (Figure 28).

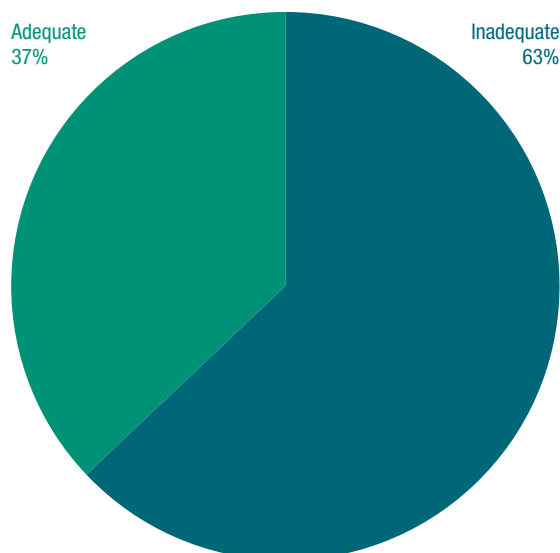


Figure 28: The results of ZST tests performed by AFBI and DAFM laboratories during 2012, presented as reflecting adequate (≥ 20 units) or inadequate (< 20 units) colostral immunity (n = 1896).

These results are very similar to those of the past few years and highlight again the importance of good colostrum management on farms to achieve good calf immunity. Calves with a failure of passive transfer have an increased risk of developing diseases including septicaemia and enteritis.

Results are more noteworthy if only those samples collected at post-mortem examination are studied

(958 samples out of the total of 1896 samples received). There is a higher percentage (70 *per cent*) of results indicative of inadequate colostral immunity, further emphasising the link between poor colostral immunity and neonatal mortality on Irish farms (Figure 29).

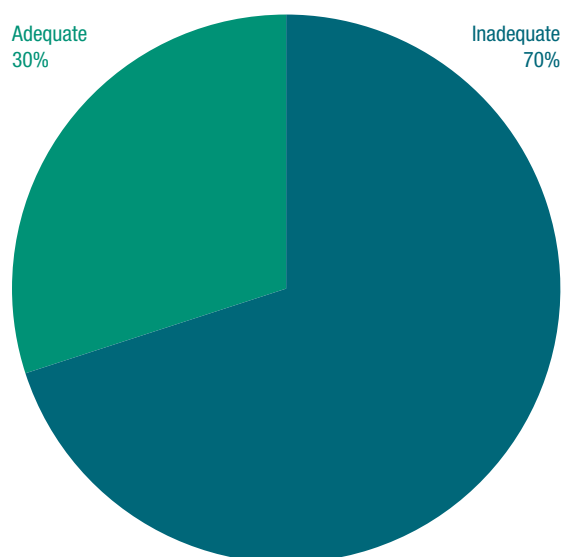


Figure 29: The results of ZST tests performed by AFBI and DAFM laboratories on samples taken from neonatal calves at post-mortem examinations during 2012, presented as reflecting adequate (≥ 20 units) or inadequate (< 20 units) colostral immunity (n = 958).

Bovine Abortion

Bovine abortions still cause considerable economic losses to the cattle industry annually. Some sporadic abortions are inevitable in any farming enterprise. However, if the incidence exceeds 3 *per cent*, particularly when several cases occur in a short period of time, efforts should be made to investigate the cause in order to initiate appropriate control measures. In addition, some abortifacient agents are potentially zoonotic; hence a specific diagnosis is essential on public health grounds.

| Abortifacients | Positive samples | Percentage of total samples | |
|-------------------------------|------------------|-----------------------------|------|
| Agent/Year | 2012 | 2012 | 2011 |
| <i>Trueperella pyogenes</i> | 253 | 6.8% | 6.5% |
| <i>Bacillus licheniformis</i> | 171 | 4.6% | 4.1% |
| <i>Salmonella</i> Dublin | 150 | 4.0% | 7.7% |
| <i>Listeria monocytogenes</i> | 77 | 2.1% | 2.0% |
| <i>Aspergillus</i> spp | 34 | 0.9% | 0.4% |

Table 1: The combined frequency of detection of selected abortion agents on routine foetal culture in the AFBI and DAFM laboratories during 2012 (n=3731) compared to 2011.

The relative proportions of the main agents associated with bovine abortion (Table 1) were similar to those witnessed in recent years with the exception of *S. Dublin* abortions which have decreased notably when compared to 2011.

Trueperella pyogenes was the most commonly isolated bacterial pathogen in foetal stomach contents during 2012 (6.8 per cent). *T. pyogenes* is considered a sporadic cause of abortion and is occasionally preceded by a systemic illness or mastitis, reaching the placenta hematogenously. Placentitis subsequently develops leading to placentomal dysfunction, foetal hypoxia and abortion. Widespread autolysis is grossly noted in the organs and musculature, followed by endometritis. Contaminated placenta, pus or milk may pose a risk to other pregnant cows if they are not promptly removed.

Bacillus licheniformis abortion is also frequently isolated (4.6 per cent of the foetal submissions), but tends to be of a sporadic nature as well. Placentitis with thickening of the allantochorion in a non-autolysed foetus can often be observed. Spoiled forage and feed often act as a vehicle for the introduction of this bacterium into the herd.

Salmonella Dublin is well recognised as an abortifacient and also as an enteric pathogen. *S. Dublin* is especially significant as a cause of bacterial abortion due to its potential zoonotic risk, its high prevalence and associated economic losses. *S. Dublin* abortions present in a seasonal pattern, more frequent in late summer/autumn with a peak incidence in October and November. During 2012 however there were two peaks in July and October as can be seen in Figure 30, which may have been as a result of the unusual weather experienced during the summer of 2012. The 2012 distribution also reflects a decrease in the percentage of cases in comparison with the previous year, from 7 per cent to 4 per cent.

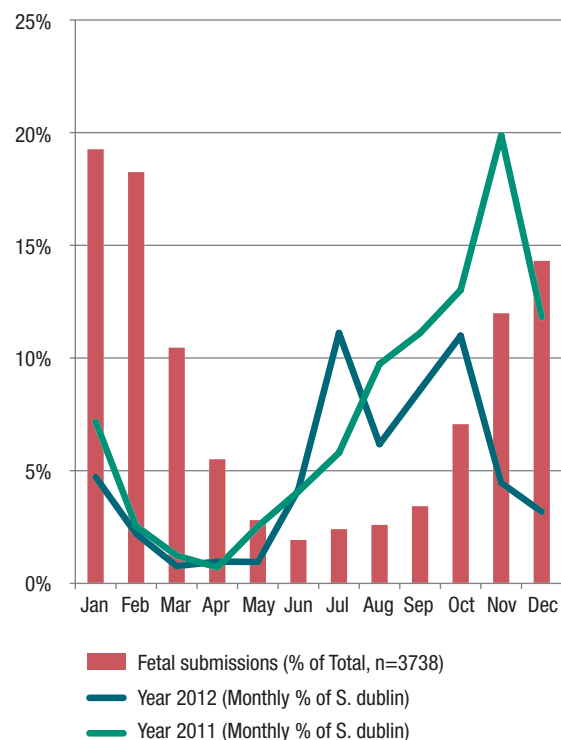


Figure 30: The seasonal distribution of *Salmonella* Dublin isolates from foetal bacterial cultures in both AFBI and DAFM laboratories as a percentage of all bovine submissions during 2012.

The incidence of *Listeria monocytogenes* has not changed to a great extent over the last three years (2.1 per cent). *L. monocytogenes* multiply in poorly

preserved silage and the aborting cow provides a further source of infection. An abortion epidemic, while rare, may occur if environmental conditions are favourable to the contamination of water and feed.

Systemic mycoses (predominantly aspergillosis and rarely candidiasis or zygomycosis) tend to be sporadic, nonspecific and of low incidence within a herd. Characteristic lesions in aspergillosis (0.9 *per cent* of the foetal submissions during 2012) consisted of small circular ringworm-like lesions on the foetal skin, distinct thickening of the placenta and necrosis of the cotyledons (Figure 31). Mycotic abortions are often associated with poor quality roughage, although the ubiquity of fungi must be kept in mind when interpreting the results of the foetal cultures.



Figure 31: Placentitis in a cow associated with mid-term *Aspergillus* sp. infection (Photo: Dónal Toolan)

The relative frequencies of other microorganisms isolated from bovine foetal culture are outlined in Table 2 below. The significance of these pathogens cannot be ignored. On some cases, their occurrence may be attributable to their high prevalence in the environment.

| Agent | Number of cases |
|-------------------------------|-----------------|
| Coliform bacteria | 515 |
| <i>Streptococcus</i> spp. | 81 |
| <i>Bacillus</i> spp. | 28 |
| Fungal and yeast spp. | 25 |
| <i>Staphylococcus</i> spp. | 20 |
| <i>Pasteurella multocida</i> | 11 |
| <i>Listeria</i> spp. | 7 |
| <i>Pseudomonas</i> spp. | 7 |
| <i>Histophilus somnus</i> | 3 |
| <i>Campylobacter</i> spp. | 3 |
| <i>Salmonella</i> Typhimurium | 2 |
| <i>Mannhaemia haemolytica</i> | 2 |
| <i>Rhodococcus equi</i> | 1 |
| <i>Yersinia</i> spp. | 1 |
| <i>Corynebacterium</i> spp. | 1 |

Table 2: The combined frequency of cases of abortion associated with other bacterial and fungal agents in AFBI and DAFM laboratories during 2012.

Other important abortifacients are listed in Table 3. The classification is based on the diagnosis reached by the pathologists who, at their own discretion, select a particular test depending on the clinical history and/or gross lesions observed in the foetus. Therefore, not every submitted foetus was routinely tested for each of these agents. On occasions, a diagnosis was reached by two different tests (e.g. histological examination and/or ELISA for *Neospora caninum*, ELISA and/or FAT for *L. Hardjo*, ELISA and/or PCR for BVDV, etc).

| Agent | DAFM | AFBI |
|--------------------------|---------------------|------|
| Agent identified | Percentage positive | |
| <i>Neospora caninum</i> | 8.2% | 7.4% |
| <i>Leptospira Hardjo</i> | 1.9% | 7.2% |
| BVDV | 8.0% | 5.1% |
| IBR (BHV-1) | 0.5% | 0.5% |

Table 3: Frequency of diagnoses of other important abortifacient agents in foetuses submitted to AFBI and DAFM laboratories in 2012.

Neospora caninum is an obligate intracellular protozoan parasite. Infection occurs through ingestion of oocysts shed in the faeces of dogs, which are the definitive hosts. In turn, dogs may become infected by ingestion of infected bovine placenta, with subsequent oocyst shedding. The major mode of transmission among cattle is from an infected dam across the placenta to the foetus (vertical infection). The majority of calves infected in this way are born clinically healthy and perpetuate infection within the herd; only in a minority of cases does foetal death occur.

Lowered fertility and abortion in cattle associated with *L. Hardjo* infection is still an important cause of economic loss to farmers. The elevated vaccination prevalence has impacted favourably on the incidence of leptospirosis. Infection of susceptible cattle with *L. Hardjo* occurs through mucous membranes and damaged skin or by sexual contact. The low sensitivity of the tests available may explain the significant difference in the percentage of cases detected between the two laboratory services.

In Ireland, the national BVD eradication programme was operating on a voluntary basis during 2012; accordingly numerous foetuses were tested for BVD virus by the laboratories on the basis of gross lesions, herd vaccination and clinical history. Of the foetuses tested in AFBI and DAFM laboratories

5.1 *per cent* and 8 *per cent* of the foetuses were positive for BVD virus respectively.

Bovine herpesvirus 1 (BHV-1) causes a wide variety of clinical syndromes. In Ireland, BHV-1 is primarily associated with Infectious bovine rhinotracheitis (IBR) and bovine abortions are likely secondary to pneumonia and malaise rather than the lesions in the genital tract, placenta or foetus. Only 0.5 *per cent* of the foetuses tested by PCR produced a positive BHV-1 result, a very low percentage considering the high IBR seroprevalence seen in the national herd.

With the recent spread of the Schmallenberg virus (SBV) throughout Europe and its continued detection in Ireland since October of 2012, it should also be considered in any abortion episode, especially in naive herds in certain areas of the country. SBV is described in detail in another section of this report.

Bovine mastitis

Mastitis is the second most common reason for the culling of dairy cows after infertility. Mastitis has important economic implications as a result of direct and indirect costs. Direct costs include; treatment costs, herdsman's and veterinarian's time, discarded milk and reduced milk yields. Indirect costs are also significant and include increased culling and fatalities along with extended calving intervals. Penalties applied by milk processors represent considerable losses (reduced fat/protein percentage, milk taints, reduced keeping quality, and altered casein type).

Early detection of mastitis, and identification of the causative agent by microbiological culture, will help in optimising treatment, reducing costs and ensuring effective use of antibiotics.

The control of mastitis in cows is based on six fundamental principles:

1. Hygienic teat management (and housing management).
2. Prompt treatment of mastitis cases.
3. Appropriate dry cow therapy.
4. Culling of chronic cases.
5. Proper milking machine maintenance.
6. Proper record keeping.

Submission of milk samples to the DAFM and AFBI veterinary laboratories has dropped significantly in the last 2 years (Table 4).

| | 2012 | 2011 | 2010 |
|------|------|------|------|
| DAFM | 2939 | 3528 | 5466 |
| AFBI | 1911 | 4507 | 2787 |

Table 4: Submission of milk samples to DAFM and AFBI laboratories in 2012, 2011 and 2010.

Submissions to DAFM and AFBI laboratories traditionally peak at two periods of the year, during the spring, when large numbers of cows are coming into milk, and again in the autumn. The autumn rise tends to be concentrated in the month of October, as an aid in choosing dry cow therapy.

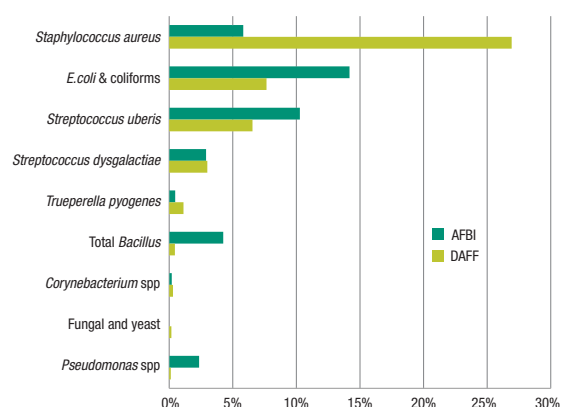


Figure 32: The relative frequency of detection of selected mastitis pathogens by AFBI (n=1911) and DAFM (n=2939) during 2012.

The relative frequency of detection of selected mastitis pathogens in milk samples submitted to AFBI and DAFM laboratories shows a similar pattern to 2011 (Figure 32).

The high prevalence of *Staphylococcus aureus* isolation by DAFM laboratories accounts for over 36 *per cent* of culture results, while *E.coli* and other coliforms were isolated in 10.4 *per cent* of DAFM submissions. The most commonly diagnosed mastitis pathogens in AFBI submissions were *E.coli* and other coliform bacteria (30 *per cent*). The second most commonly isolated pathogen in milk samples in Northern Ireland was *Streptococcus uberis* (22 *per cent*).

S. aureus is a contagious mastitis pathogen commonly associated with chronic mastitis and raised somatic cell counts. Clinical mastitis also occurs following infection with this pathogen, which is known to infect cows particularly at milking time, due to both poor milking hygiene facilitating direct transfer, and faults in milking machine function, for example damaged teat liners and fluctuations in vacuum (Barrett *et al*, 2005).

The prevalence of *S. aureus* in samples submitted to DAFM laboratories is exceptionally high and the national incidence of *S. aureus* infection is likely to

be lower than 36 *per cent*. Receipt of composite samples may lead to an increased estimation of the prevalence of common pathogens such as *S. aureus*, and a high proportion of these samples selected from cows with a high SCC over a prolonged period, will introduce submission bias likely to favour culture of *S. aureus*.

Herds with mastitis caused by *Staphylococcus aureus* infection should reassess their milking hygiene and segregate infected cows for milking last or in a separate unit where this is possible, to prevent spread of infection.

E.coli is both an opportunistic mastitis pathogen and is also associated with contamination of milk samples due to poor hygiene at the time of collection (see panel in page 22 for sample collection advice). Coliform mastitis, sometimes termed acute mastitis or toxic mastitis, is a well recognised clinical presentation in which the release of endotoxin can trigger severe clinical signs. Hygienic teat preparation prior to milking and improvement in environmental hygiene are the most important control measures, and teat injuries and faeces contaminated bedding may be predisposing factors.

Contamination of the sample with dust or faecal material will usually result in the growth of coliform-type bacteria. **It is imperative that samples for mastitis culture are collected aseptically.**

Streptococcus uberis was isolated in a significant proportion of submissions, accounting for 22 *per cent* and 8.91 *per cent* of submissions to AFBI and DAFM laboratories respectively. *S. uberis* is an environmental pathogen and is opportunistic by nature. The organism is found in the housing environment, hence isolation of *S. uberis* is significantly greater in herds with suboptimal housing. (Barrett *et al*, 2005).

Streptococcus dysgalactiae was identified in 6 *per cent* (AFBI) and 4.1 *per cent* (DAFM) of milk samples cultured during 2012. This pathogen resides mainly in the cow's udder and in teat wounds, but also elsewhere in the environment. Clinical symptoms may be more severe than infections caused by other streptococci, and has the features of an acute infection. This bacteria is also isolated from cases of summer (or dry cow) mastitis (Sandholm *et al*, 1995).

Streptococcus agalactiae isolation has increased compared to previous years, with DAFM laboratories identifying 16 cases. This is an obligate pathogen of the cow's udder, and "blitz-therapy", or treatment of all diseased animals simultaneously is recommended (Sandholm *et al*, 1995).

Trueperella pyogenes was isolated from 1 *per cent* and 1.5 *per cent* of submissions to AFBI and DAFM laboratories respectively. This is the most commonly isolated pathogen from cases of summer mastitis, which is associated with a suppurative and foul-smelling secretion, and loss of the quarter from milk production. Insect vectors are considered central to the disease, hence its association with the summer months. A similar syndrome can be found during the indoors season following a teat injury (Sandholm *et al*, 1995).

Bacillus spp. were isolated in 0.6 *per cent* of DAFM laboratory submissions. In contrast, *Bacillus* spp were identified in 9 *per cent* of milk samples submitted to AFBI laboratories during 2012.

Isolation of *Pseudomonas* spp. occurred in only 0.2 *per cent* of submissions to DAFM laboratories. In comparison, 5 *per cent* of milk sample submissions to AFBI laboratories were positively associated with the bacteria. *Pseudomonas aeruginosa* and other species are common in the environment of cattle, and infection can originate in contaminated water (Radostits *et al* 10th edition).

Corynebacterium bovis was isolated from 0.4 and 0.5 *per cent* of submissions in DAFM and

AFBI laboratories respectively. This contagious pathogen commonly causes subclinical mastitis and a raised somatic cell count, but infrequently leads to clinical disease. Incidence is markedly reduced by intensive programmes of teat-dipping and dry cow therapy (Radostits *et al*, 2007).

Other pathogens which can cause mastitis included *Pasteurella multocida* and *Listeria monocytogenes* (isolated by DAFM laboratories in 16 and 1 cases respectively).

Environmental mastitis pathogens found in bulk milk tank may be derived from non-specific contamination from cow skin, bedding, manure, or water. **The sensitivity of a single bulk milk tank bacterial culture is low. Most information is gathered if samples are collected at the quarter level** (Lam *et al*, 2009).

Aseptic technique for milk sample collection

Materials for Sampling

Disposable gloves (if available).
Sterile screw-top plastic tubes (20ml).
70 *per cent* alcohol (or methylated spirit).
Cotton wool balls.
Paper towels.

Sampling Technique

1. Take the samples before milking.
2. Soak a number of cotton wool balls in alcohol.
3. Label the tubes prior to sampling with the cow number and date and quarter if collecting a separate sample from an individual quarter.
4. Using a hand or paper towel, brush any loose dirt, straw or hair from the underside of the udder and teats.

Washing should be avoided if possible, but if teats are very dirty they should be washed and carefully dried with paper towels.

5. Dip all four teats with teat dip and leave for at least one minute.
6. Wear gloves if available. If not, wash and dry the hands thoroughly and use some of the cotton wool balls to wipe them with alcohol.
7. Beginning with teats on the far side of the udder, scrub the ends thoroughly with the cotton wool and alcohol balls until the teats are very clean. Spend at least ten seconds on each teat. Use one cotton wool ball per teat.
8. Begin sampling with the teats on the near side of the udder. Remove the cap of the sampling tube and keep the top face down in the palm. Hold the open tube (in the same hand as the top) at an angle of 45 degrees (holding it straight up will allow dust etc. to fall inside). Using the free hand, discard a few streams of milk on to the ground before collecting three or four streams in the tube. Do not allow the teat ends to make contact with the tube. Close the tube immediately after collection of each sample.
9. If it is felt that some contamination has occurred, discard the sample and use a new tube.
10. Cool all samples as soon as possible to 4°C (fridge). This is very important.
11. Do not store samples. Send to the laboratory as quickly as possible.

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Animal Health Ireland CellCheck webpage at: www.animalhealthireland.ie/page.php?id=29

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Bovine respiratory disease

Respiratory disease impact is significant on cattle farms, resulting in substantial morbidity and mortality. Reduced growth rates due to respiratory infections in young stock are responsible for considerable production losses.

Two types of data are presented in this section:

- Post-mortem examinations data: agents that were identified as the main pathogen isolated from bovine lungs at post-mortem examination, where the diagnosis was respiratory disease.
- Clinical pathology data: viral agents demonstrated in samples submitted for PCR examination, FAT and virus isolation to the AFBI/DAFM laboratory service.

POST-MORTEM EXAMINATION DATA

DAFM laboratories recorded 701 bovine carcass submissions as having a primary diagnosis of respiratory disease during 2012. During the same period in AFBI laboratories, 424 cases of respiratory disease were diagnosed at post-mortem examination.

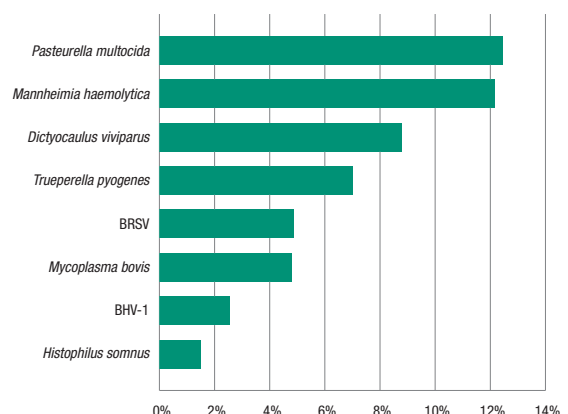


Figure 33: The relative frequency of post-mortem detection of primary respiratory pathogens associated with fatal respiratory disease, as a percentage of all cases in which a primary pathogen was identified in AFBI and DAFM veterinary laboratories during 2012 (n=1125).

Pasteurella multocida and *Mannheimia haemolytica* continue to be the most frequently identified pathogens associated with fatal respiratory disease in Irish cattle (Figure 33). At post-mortem examination, the cranial lobes of the lungs are commonly affected and typically appear firm with minimally compressible lung consolidation (Figure 34).



Figure 34: Mannheimiosis lesions in a bovine lung (Photo: Cosme Sánchez-Miguel)

Bovine Parainfluenza virus type 3 (PI3) is thought to play a role in facilitating invasion of the lungs by these two agents and often referred to as a 'gateway' virus. PI3 virus accounted for 0.4 *per cent* of all respiratory disease diagnoses in Ireland during 2012.

Trueperella pyogenes was isolated from 7 *per cent* of all respiratory diagnoses in bovine post-mortem examinations on the island of Ireland. This bacterium is an important secondary pathogen, where tissues have been previously damaged by an acute infection caused by other infectious respiratory pathogens. *T. pyogenes* is typically associated with chronic suppurative pneumonia.

Mycoplasma bovis was identified on post-mortem examination in 44 cases of respiratory disease in Northern Ireland and in 18 cases in Ireland during 2012. The two most common clinical presentations associated with this pathogen are respiratory disease and arthritis. Often introduced into the

herd by subclinical carriers, *M. bovis* impairs mucociliary clearance in the airways, resulting in a lower respiratory tract infection. At necropsy, the most commonly recorded respiratory lesions are chronic necrotising bronchopneumonia with numerous well-delineated caseous nodules (Figure 35).



Figure 35: Caseous nodules ('ricegrain abscessation') associated with *Mycoplasma bovis* in a bovine lung (Photo: Cosme Sánchez-Miguel)

Histophilus somni is a commensal organism found on the mucous membranes of cattle. One of the manifestations of infection is respiratory disease. Transmission between infectious animals is typically associated with aerosols or by direct contact. The respiratory form of the disease is associated with fibrinosuppurative pneumonia.

Enzootic pneumonia is most common in intensively reared calves and is caused by a number of aetiological agents (Table 5). Young animals are particularly susceptible to deleterious environmental conditions, including cold weather, which impairs mucociliary clearance of foreign materials. As a result, respiratory infections are a common cause of mortality among calves.

Causative agents of Enzootic pneumonia

Bovine respiratory syncytial virus (BRSV)

Parainfluenza virus 3 (PI3)

Mannheimia haemolytica

Pasteurella multocida

Histophilus somni

Mycoplasma bovis

Mycoplasma dispar

BVD virus

Bovine herpesvirus-1

Table 5: Pathogens associated with enzootic pneumonia complex in calves

Parasitic pneumonia was diagnosed in 8.8 *per cent* of respiratory disease diagnoses on the island of Ireland during 2012. *Dictyocaulus viviparus* causing ‘hoose’ in cattle is most prevalent in young cattle in their first grazing season. The highest rate of infection was thus identified in the weanling age category. Outbreaks of hoose can occur in association with wet weather during the grazing season. A peak in the number of clinical cases is usually recorded in early autumn.

Bovine Respiratory Syncytial Virus (BRSV) affects younger cattle mainly. Stress factors such as overcrowding or transportation may result in disease outbreaks.

Bovine herpesvirus-1 (BHV1) infection is associated with several clinical manifestations, of which the respiratory disease Infectious Bovine Rhinotracheitis (IBR) is one. It is an acute febrile illness. The severity of the clinical signs is directly associated with the extent of secondary bacterial infection, often resulting in a fibrinonecrotic tracheitis. Pneumonia may develop as a further complication of IBR infection.

CLINICAL PATHOLOGY DATA

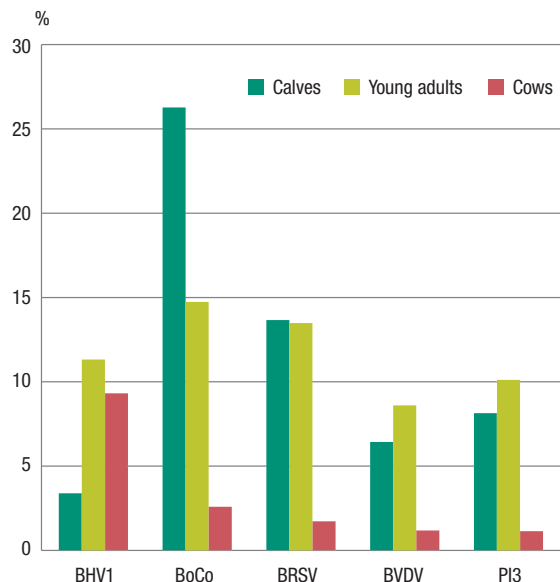


Figure 36: The detection rates (*per cent*) of respiratory viruses on nasal swabs from clinical cases of bovine respiratory disease in DAFM laboratories during 2012, shown for three animal types: calves, young adults (heifers, bullocks, steers, yearlings) and cows. (n=3156).

Bovine coronavirus was the most commonly isolated virus from live clinical cases of pneumonia during 2012 (Figure 36). In the past, coronavirus was associated with calf diarrhoea and winter dysentery in housed adult cattle. In more recent times, the virus has come to be recognised as a major pathogen in the bovine respiratory disease complex.

The significance of the rate of BVD virus detection in respiratory disease cases lies in the fact that BVD virus may predispose to bacterial pneumonia by causing an immunosuppressive state in the animal.

Figure 37 outlines the seasonal patterns observed in the detection of viral pathogens associated with respiratory disease. A trend is evident in the distribution of infection, with a peak in virus detection coinciding with housing. There was a significant increase in coronavirus infections during April of 2012.

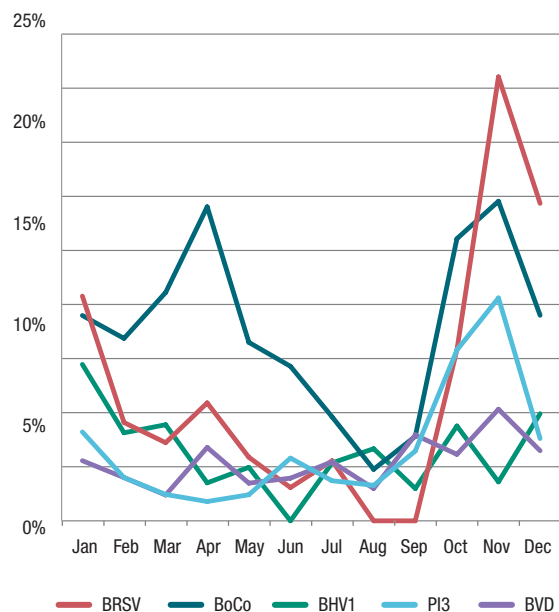


Figure 37: The detection rates of respiratory viruses on nasal swabs from clinical cases of bovine respiratory disease in DAFM laboratories during 2012, shown by month (n=5024). BoCo= Bovine Coronavirus

Hereditary and developmental abnormalities

In 2012, there was a total of 80 post-mortem diagnoses in Ireland classified as congenital or hereditary conditions, most of them recorded in neonatal calves (72 cases), with lesser numbers in calves (7 cases) and weanlings (1 case). These cases were divided across a total of 28 different diagnoses, the most common of which are detailed below.

There were 22 cases of intestinal atresia reported affecting the colon (9 cases), ileum (3 cases), jejunum (7 cases) or other unspecified part of the intestine. They were all reported in neonatal calves.

There were 11 cases affecting the heart including ventricular and atrial septal defects (Figure 38), persistent ductus arteriosus and patent foramen ovale. Typically these cases present at gross post-mortem examination with a large mis-shapen heart

and an enlarged liver. There were 17 separate cases affecting the circulatory system.

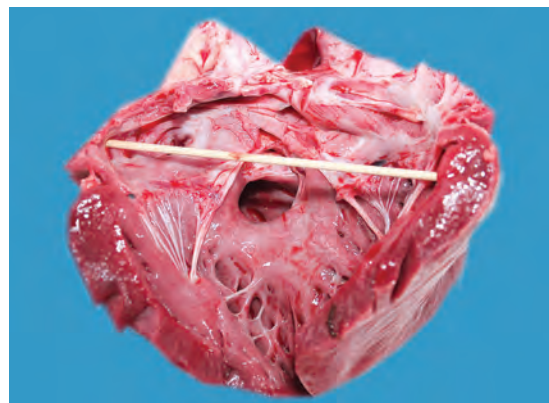


Figure 38: Septal Foramen in a calf's heart (Photo: Cosme Sánchez-Miguel)

Deformities of the skeleton are also occasionally recorded (17 cases). In two of these cases, congenital defects of the circulatory system accompanied defects of the skeleton. Congenital joint laxity and dwarfism was recorded in ten calves (Figure 39). The underlying cause of this condition has not been determined, but it has been suggested that the replacement of 25 per cent of the silage dry matter in the winter diet with a non-silage feed (straw, hay, concentrates) can result in a marked reduction in the incidence of the condition on a farm (Gunn and Caldow, 2000).



Figure 39: Congenital joint laxity and dwarfism in a calf (Photo: Dónal Toolan)

References

Gunn G, Caldow G (2000) Congenital joint laxity and dwarfism in calves. *The Veterinary Record* 147, 199-200.

Johne's Disease 2012

Johne's disease is caused by infection with *Mycobacterium avium* subsp. *paratuberculosis* (MAP) and is a class B notifiable disease. The clinical signs include chronic diarrhoea and weight loss. Most cattle acquire infection early in life, through ingestion of colostrum or milk containing MAP, or by exposure to feed, water or environments contaminated by MAP. The disease is often introduced to a MAP free herd through the purchase of an infected animal.

Samples from infected animals can prove negative initially on both serology and faecal culture, but as the disease progresses MAP will be shed in the faeces and seroconversion typically occurs. Thus, the correlation between serological results and faecal culture tends to be highest in animals showing clinical signs.

Clinical signs often appear when the animal is between 2 to 6 years of age and relate to the development of granulomatous enteritis. Clinically affected animals shed very large numbers of MAP in their faeces and heavily contaminate the environment with MAP.

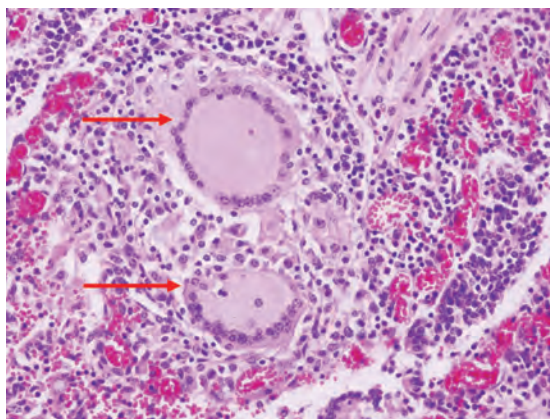


Figure 40: Characteristic Langhan's giant cells (fusion of several macrophages) in the ileum of a heifer, often seen in the intestinal diffuse granulomatous inflammation of Johne's disease. (Photo: Cosme Sánchez-Miguel)

As shown in Table 6, the percentage of positive faecal cultures during 2012 declined when compared to previous years.

In Ireland, analysis of the 143 positive animals showed that they originated from 100 herds. The infected animals consisted of 9 bulls, 122 cows, 9 heifers and 3 steers. Sixty of the cows were of a dairy breed. The age of the infected animals at the time of sample submission ranged from 16 months to 13 years, but most were between 2 and 5 years of age (53.1 *per cent* of infected animals). Two of the 143 infected animals were imported. Of the 141 animals born in Ireland, 88 were still located in their herd of birth at the time of sampling.

| Year | Ireland | | Northern Ireland | |
|------|-----------|-------------|------------------|-----------|
| | No Tested | Positive | No Tested | Positive |
| 2008 | 416 | 92 (22.1%) | 64 | 4 (6.3%) |
| 2009 | 376 | 103 (27.4%) | 50 | 2 (4%) |
| 2010 | 410 | 82 (20%) | 190 | 12 (6.3%) |
| 2011 | 632 | 133 (21%) | 148 | 19 (13%) |
| 2012 | 941 | 143 (15.2%) | 298 | 18 (6%) |

Table 6: *Mycobacterium avium* subsp. *paratuberculosis* (MAP) culture results from cattle for the years 2008 to 2012.

Survival analysis conducted on the 143 positive animals showed that 71 *per cent* were dead within two months of sample submission and this increased to 82 *per cent* by four months after submission. Sixty three *per cent* of infected animals were classified as high shedders which could cause extensive contamination of the farm environment.

The percentage of serology positive animals was similar to those reported in previous years (Table 7). In Ireland, the samples are largely derived from clinical suspects, while some other samples are part of a monitoring programme of herd bloods

collected under the *Brucella* scheme. In Northern Ireland, a proportion of the samples are from herds enrolled in the AFBI Cattle Health Scheme, which involves herd control, monitoring and demonstrating freedom from BVDV, IBR, MAP and leptospirosis.

| Year | Ireland | | Northern Ireland | |
|------|-----------|------------|------------------|-------------|
| | No Tested | Positive | No Tested | Positive |
| 2008 | 3372 | 229 (6.8%) | 6834 | 738 (10.8%) |
| 2009 | 3981 | 251 (6.3%) | 7749 | 689 (8.9%) |
| 2010 | 5062 | 302 (6%) | 12229 | 978 (8%) |
| 2011 | 8010 | 475 (5.9%) | 18751 | 1224 (6.5%) |
| 2012 | 13796 | 760 (5.5%) | 21933 | 2031 (9.3%) |

Table 7: Results of ELISA testing of sera for *Mycobacterium avium* subsp. *paratuberculosis* (MAP) from cattle for the years 2008 to 2012.

For a correct interpretation of MAP ELISA results, these should be interpreted according to their reactivity (Figure 41). Animals with high ELISA readings are probably infected with MAP, but culture should be performed if the disease has not previously been recorded on the farm. It was noted that some strongly positive animals were sold after the laboratory results were issued. This practice should be strongly discouraged as it can contribute to spreading of the disease.

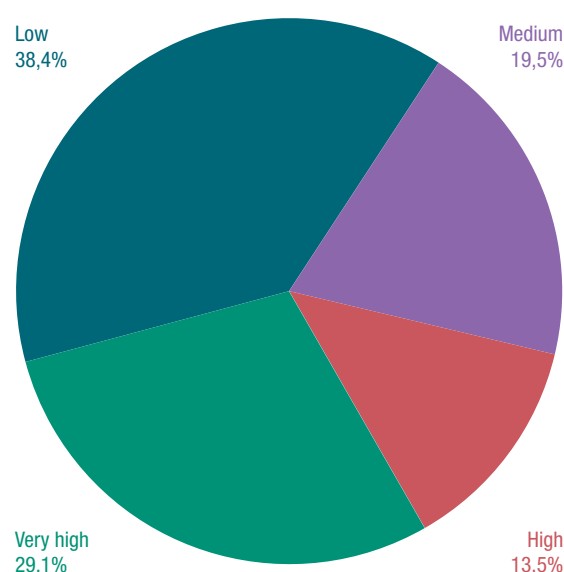


Figure 41: A breakdown of MAP ELISA positive results (n=760) in Ireland during 2012 on the basis of the magnitude of the positive reaction

False-positive serological reactions occur and cause difficulties with the interpretation of MAP ELISA results. The exposure to environmental mycobacteria when cattle are grazing is one cause of such reactions, while in some animals the tuberculin test can cause MAP ELISA results to be temporarily positive. Faecal culture and/or PCR helps establish the true status of seropositive animals and reduces the culling of uninfected animals that display positive MAP ELISA results.

Because the disease is very difficult to eradicate from a herd, it is essential for herd owners and their private veterinary practitioner to develop a plan to prevent MAP introduction and spread on the farm. Critical points include maintaining a closed herd, maternity pen hygiene, appropriate colostrum management, the use of milk replacer or pasteurised milk to feed calves and preventing exposure of younger stock to faeces from adult animals both at housing and at pasture. Owners of herds with a confirmed diagnosis of MAP infection face a significant challenge to prevent its spread within the herd and will have to operate

an effective control programme for several years, before being confident that the disease is no longer present in the herd.

The disease can also be significant for dairy goat enterprises and during 2012 it was identified in Ireland in two goat herds.

TB surveillance in Ireland

Tuberculosis is a disease caused by the bacterium *Mycobacterium bovis*. This is a chronic progressive condition causing considerable production losses in cattle and other species. In addition, there are significant zoonotic implications associated with the disease. *M. bovis* is transmitted in a number of ways by infectious animals. In some cases, wildlife reservoirs represent a major source of infection for grazing cattle. In Ireland, the badger has been identified as the most important maintenance host.

In Ireland, every cattle herd is tuberculin tested at a minimum once annually, in accordance with Directive 64/432/EEC Annex A I.2. Full disease and movement control measures apply to each herd. All parts of a herd which belong to the same epidemiological unit are subject to control if and when disease is identified. An 'epidemiological unit' or herd is considered to be any number of animals that are held, kept or handled in such a manner that they share the same likelihood of exposure to infectious disease agents and that the control of the spread of infectious disease from the unit can be facilitated. Epidemiologically related herds have mandatory tracing and checking in the event of suspicion of disease in any of the herds. Measures implemented include an annual round screening test of all herds, routine veterinary post-mortem slaughter surveillance, controls on movement of animals, restriction of holdings, removal and slaughter of reactors, appropriate follow-up testing (including use of complementary blood tests in addition to the tuberculin skin test), additional targeted risk-based testing, compensation for affected (diseased) herds and a focused

badger population control where they have been implicated as a probable cause of TB. Details of the TB testing regime carried out during 2012 are outlined in Table 8 below.

| TEST | Purpose of test | Number of tests |
|-------------------------------------|-----------------|-----------------|
| Tuberculin Skin test (SICTT) | Screening | 8,534,677 |
| Interferon-γ-Assay | Complementary | 12,773 |
| iELISA | Complementary | 7,714 |

Table 8: Testing volume for TB in live cattle in 2012

The TB levels in cattle are currently at the lowest since the introduction of the eradication programme in the 1950's. Bovine TB has been declining progressively in recent years and in particular over the past 4-years, as outlined in Table 9 and Figure 42 below.

| Year | Herds | Per cent herds tested | Population of Cattle Tested (in thousand animals) | No. of Reactors | APT ** |
|------|---------------|-----------------------|---|-----------------|-------------|
| 2007 | 120652 | 96.9 | 6,084 | 27,711 | 3.03 |
| 2008 | 118030 | 98.4 | 6,150 | 29,901 | 3.25 |
| 2009 | 117287 | 98.2 | 6,026 | 23,805 | 2.66 |
| 2010 | 116815 | 97.6 | 5,752 | 20,211 | 2.41 |
| 2011 | 116061 | 98.5 | 5,819 | 18,531 | 2.22 |
| 2012 | 115787 | 98.4 | 6,145 | 18,476 | 2.16 |

Table 9: Cattle population trends and TB incidence in Ireland 2007-2012 (live cattle)

**The APT, (reactor Animals disclosed Per Thousand animal level tests) is a measure of the incidence of disease compared to the level of testing being carried out.

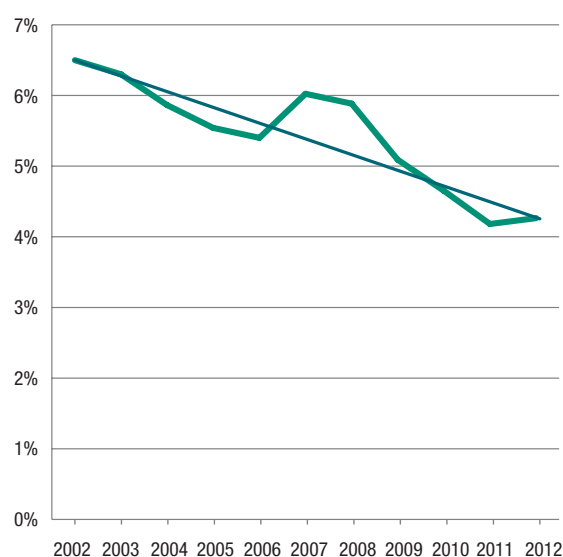


Figure 42: Trends in National Herd incidence of bovine TB in Ireland, 2002-2012

Another fundamental part of the TB eradication programme in Ireland is the post-mortem surveillance of animals slaughtered for human consumption and the traceback of all granulomatous lesions detected with restriction of the supplying herd pending laboratory diagnosis. All cattle presented for slaughter undergo a post-mortem inspection under the control and supervision of the Veterinary Public Health Inspection Service staff in 30 plants in which cattle are slaughtered, or, in the case of small abattoirs, under the control and supervision of the veterinary staff of the local authorities.

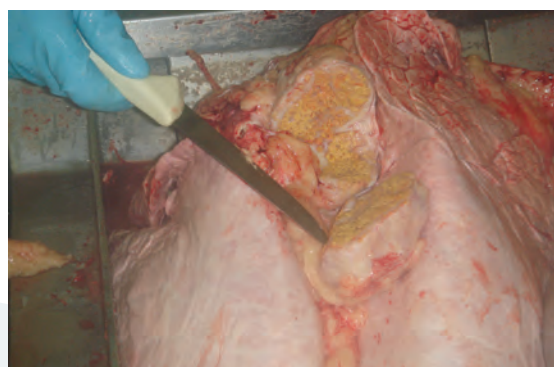


Figure 43: TB lesions detection in slaughterhouses. Tuberculous lesion in a mediastinal lymph node in a bovine animal. (Photo: Colm Brady)

Similarly to declining cattle TB levels, it is notable that TB confirmation levels in captured badgers have also more than halved over the last number of years (Table 10).

DAFM believes that the badger culling, which is only one element of a very comprehensive eradication programme, has contributed very significantly to this development. The long-term objective of the DAFM is to develop a vaccine for badgers and considerable research has been conducted to this end with a view to incorporating badger vaccination into the eradication programme in due course. However, considerable obstacles remain which makes it difficult to foresee the use of such vaccination on its own, especially in heavily infected populations and, in such populations, some culling may still be necessary. It will be some years, however, before a vaccination programme on a widespread basis is a practicable proposition.

| Year | Laboratory tissue submissions (from individual animals) | TB (<i>M. bovis</i>) confirmed |
|------|---|----------------------------------|
| 2008 | 1,754 | 399 (22.7%) |
| 2009 | 1,129 | 159 (14.1%) |
| 2010 | 930 | 117 (12.5%) |
| 2011 | 2,076 | 245 (11.8%) |
| 2012 | 2,442 | 238 (9.7%) |

Table 10: TB levels in badgers in the period 2008-2012

In addition to the bovine TB surveillance carried out, in 2012, three cases of tuberculosis in sheep were recorded in Ireland. A further twelve occurrences of TB were diagnosed in deer (Table 11).

| | Tested (SICTT) | Laboratory tissue submissions (from individual animals) | TB (<i>M. bovis</i>) confirmed |
|-------|----------------|---|----------------------------------|
| Sheep | – | 16 | 3 |
| Goats | 1,126 (clear) | 14 | 0 |
| Pigs | – | 2 | 1 |
| Horse | – | 1 | 0 |
| Deer | – | 51 | 12 |
| Dog | – | 2 | 0 |
| Cat | – | 5 | 2 |

Table 11: TB in other mammalian species during 2012

The National Bovine Viral Diarrhoea (BVD) Eradication scheme

ECONOMICS OF DISEASE

Bovine viral diarrhoea is a disease of great economic importance, particularly where cattle industries account for a sizable proportion of the agricultural output. On an individual herd level, it is also a cause of serious concern as it can precipitate hidden losses within the herd due to lower growth rates causing a poorer return on the farmer's investment. A recent study quantified annual losses due to BVD in the Irish cattle industry to be around 102 million euro (Stott *et al*, 2012).

As a result, a number of countries have embarked on regional or national BVD control programmes, including New Zealand, Germany, Austria, and Slovenia. Other countries have already eradicated this disease including Norway, Sweden, Denmark and Switzerland. From a national industry standpoint, having a BVD free status is of considerable advantage to those countries in relation to the trade of produce and the prices they can attract for the produce.

AETIOLOGY

Bovine viral diarrhoea virus is a pestivirus, which causes a number of distinct disease manifestations.

It can induce immunosuppression in animals within the herd, leaving them more vulnerable to the effects of other diseases such as pneumonia, mastitis or diarrhoea. It may also cause abortions, foetal malformations and early embryo death.

The most emphatic manifestation of the disease is mucosal disease, which induces intractable diarrhoea inevitably leading to the death of that animal. Animals that are affected by mucosal disease, are known as persistently infected (PI) animals. These animals shed viruses in very large quantities into the surrounding herd, and are the main source of BVD infectivity within the herd. PI animals are infected *in utero* prior to the development of their own immune system, and do not typically produce antibodies against the BVD virus.

From a control point of view, it makes most sense to control and eradicate these PIs, as they represent the greatest source of virus within an infected herd.



Figure 44 Detail of linear oesophageal ulceration as a result of Mucosal Disease (BVDV) infection in a cow. (Photo: Cosme Sánchez-Miguel).

PREVALENCE OF BVD IN IRELAND

The estimated seroprevalence of the disease in Ireland, based on published and unpublished sources, may lie on an individual level between 60-80 *per cent*. On a herd level, 98.8 *per cent* of suckler herds and 98.5 *per cent* of dairy herds have seropositive animals, which would indicate exposure to virus at some point in the life of the

herd. The prevalence of PI animals, based on analysis from 2012 submissions is approximately 0.6-0.75 *per cent*.

PROGRAMME STRUCTURE

The programme will last six years initially. During the first year, 2012, participation was on a voluntary basis. Under the Bovine Viral Diarrhoea Order (2012), an attachment to the Diseases of Animals Act (1966), the programme became compulsory from January 1st 2013.

The programme is coordinated by Animal Health Ireland (AHI), an industry-led, not-for-profit partnership between livestock producers, processors, animal health advisers and government which was launched in 2009.

Calves are screened for the presence of PIs by tag testing. The sampling tags are issued as part of the official pair of 'yellow' tags for each calf. Identified PI calves cannot be sold and it is advised to cull them as soon as possible. There is also a double effect from testing calves, as a non-PI calf means a non-PI mother and as a result we can effectively survey both the calf and cow crop with each tissue tag tested.

Once three years of repeated negative results are achieved, it is possible to directly or indirectly assess the virus status of most of the animals in each herd allowing any remaining animals to be identified, tested and if necessary, removed.

The tissue sample obtained by tagging the calf is dispatched to an approved testing laboratory, which is accredited for BVD testing to the ISO 17025 standard. A full list of these laboratories is available on www.animalhealthireland.ie. DAFM Veterinary Laboratories has supported the program by offering confirmatory testing on calf and dam samples, and by the provision of proficiency testing services and reference materials to private laboratories involved in testing.

RESULTS IN 2012

During 2012, approximately 496,000 results were received into the national Irish Cattle Breeding Federation (ICBF) database from the programme. Of these, 0.61 *per cent* were deemed positive, 0.02 *per cent* were deemed inconclusive, 0.44 *per cent* were empty containers and the remainder returned negative results. The presence of a small but nevertheless significant number of empty containers serves as a reminder that farmers need to be sure that they are getting material in the punch and that may be aided by having calves as securely restrained as possible whilst tagging.

IRISH CATTLE BREEDING FEDERATION INVOLVEMENT

Test results are sent by the testing laboratory to the ICBF database and it is the ICBF who make contact with the farmer by phone text or by paper report. BVD free animals can be certified for sale by an 'on farm sales declaration' form from the ICBF website. For animals that are positive or inconclusive however, it is not possible to generate this form, preventing farm-to-farm sale of these animals. During 2012 (voluntary phase of the programme), animals with a negative status sold at market had this result displayed on the mart board. In 2013, legislation prohibits the sale of animals which have not recorded a negative BVD result.

PATH TO SUCCESS

There are three major components to eradication of the disease.

- (i) Biosecurity – The greatest source of threat in relation to infection is the buying in of infected or PI stock. The optimal way to ensure that the disease is kept out is to maintain a closed herd, or failing that, to rigorously screen and isolate for 2 weeks any 'bought in' stock of unknown BVD status. As the national programme develops, the number of negative animals being traded will increase. However, isolation of stock of unknown

status must be encouraged, particularly from pregnant animals. The buying in of pregnant animals must be discouraged and avoided at every opportunity due to the inability to determine the disease status of the unborn calf, this is the so-called 'Trojan horse' principle.

- (ii) Virus elimination – Once identified, the PI animals on the farm should be removed as soon as possible. The longer they remain on the premises, the greater the risk of spreading the disease within the herd.
- (iii) Monitoring to prevent re-infection – This is very tightly linked with biosecurity. Once the herd is negative, it is imperative to keep it that way. This can be achieved by active surveillance for the disease amongst newly introduced stock and each crop of calves.

In conclusion, optimal control results have been seen where the 'short, sharp shock' approach has been adopted, whereby a focused immediate effort may gain appreciable results and minimizes the potential for participant fatigue.

BVD CONTROL IN NORTHERN IRELAND

Animal Health and Welfare Northern Ireland (AHWNI) was formally launched in 2012. It is an industry-led, not for profit partnership supported by the government and overseen by a board of directors (www.animalhealthni.com). It operates in a manner similar to, and in close cooperation with, Animal Health Ireland. AHWNI have established a cross-industry BVD implementation group (BVDIG) to develop and roll out a BVD eradication programme. BVDIG have chosen to implement a programme that closely mirrors that in place in Ireland, with the main screening being done on tissue sample tags collected during routine tagging of calves. This programme is available on a voluntary basis from January 2013.

During 2012, a variety of samples were tested for BVD in AFBI. Serum samples can be pooled in

groups (of up to 25) for herd screening and assayed by RT-PCR. Individual samples from positive pools are then tested by antigen ELISA. During 2012, there were 2,323 pooled PCR tests performed and approximately 16,000 individual antigen ELISAs. These returned 6 *per cent* positive results which include transiently infected and persistently infected animals. The RT-PCR assay is very sensitive and can also be used for the detection of BVD virus RNA in bulk milk samples. 418 milk samples were tested during 2012, 34 (8 *per cent*) positive. The percentage of positive samples detected is higher than the 1 *per cent* seen in the voluntary phase of AHI BVD programme and may be as a result of targeted testing by vets based on clinical suspicion of presence of the disease rather than surveying the general population.

In Northern Ireland, a voluntary CHeCS (Cattle Health Certification Scheme) licensed scheme is also under operation. This scheme is also directed to control leptospirosis, infectious bovine rhinotracheitis (IBR) and Johne's disease as well as BVD. Participation in the BVD CHeCS programme involves annual testing for the disease and increased biosecurity. Biosecurity measures may include vaccination and involve the isolation and quarantine of added animals and stock-proof boundaries as part of other measures. Within the AFBI Cattle Health Scheme there are currently around 40 herds with BVD vaccinated monitored free status and over 20 with BVD accredited status in Northern Ireland plus many more working towards achieving one of these statuses.

References

A.W. Stott, R.W. Humphry, G.J. Gunn, I. Higgins, T. Hennessy, J. O'Flaherty, D.A. Graham. Predicted costs and benefits of eradicating BVDV from Ireland. *Irish Veterinary Journal* (2012) 65:12.

Fatal poisonings

Cattle

Poisoning continued to be a significant cause of death on farms on the island of Ireland during 2012 with an increase in the number of cases with a diagnosis of poisoning relative to 2011. During 2012 poisoning in cattle accounted for 61 case diagnoses on the island of Ireland (Table 12) compared to 47 during 2011.

| Poisonous Agent | AFBI | DAFM |
|-----------------|-----------|-----------|
| Salicylanilides | 1 | 0 |
| Yew | 1 | 0 |
| Lead | 8 | 32 |
| Copper | 5 | 4 |
| Ragwort | 0 | 4 |
| Oak /Acorn | 0 | 1 |
| Bracken | 0 | 2 |
| Cherry Laurel | 0 | 1 |
| Caffeine | 0 | 2 |
| Total | 15 | 46 |

Table 12: Poisonous agents responsible for fatalities in cattle during 2012 in Ireland (DAFM) and Northern Ireland (AFBI).

LEAD POISONING

As in previous years lead was the most common toxicosis in cattle; 40 cases of lead toxicity were diagnosed during 2012. Most cases of lead toxicity were identified during the early part of the grazing season. Sources of lead commonly identified as being the cause of cattle deaths include old batteries (Figure 45), sump oil, lead paint and rubbish fire ash.

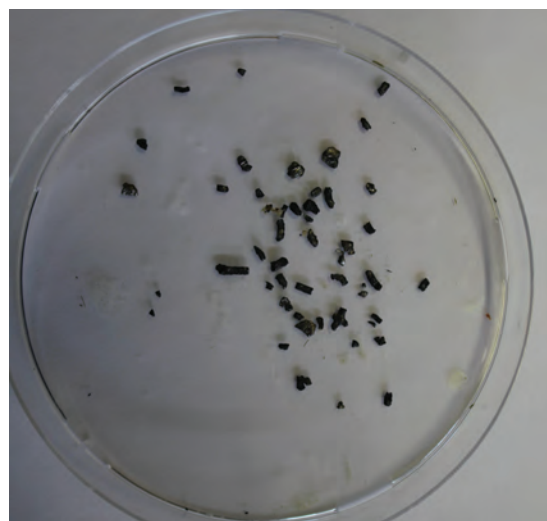


Figure 45: Battery fragments recovered from the rumen contents of an animal in which lead poisoning was diagnosed (Photo: Dónal Toolan).

Herdowners are advised to inspect their land before cattle are turned out to pasture for any potential sources of lead which may have been dumped on their land over the winter months.



Figure 46: Petechial thymic lesions which are a characteristic post-mortem finding in cases of lead toxicity (Photo: Dónal Toolan).

COPPER POISONING

Copper poisoning remains the second most frequently diagnosed toxic cause of cattle deaths across both jurisdictions. During 2012 nine cases of copper toxicity were recorded with seven of these

cases recorded in calves less than twelve months old. Copper is an essential element for growth and production in cattle. Although copper deficiency can be associated with retarded growth and illthrift, supplementation of copper can be hazardous and supplementary copper should only be given when copper deficiency has been definitely diagnosed.

RAGWORT POISONING



Figure 47: Ragwort plant (*Senecio* spp) (Photo: Cosme Sánchez-Miguel).

Four cases of ragwort (*Senecio* spp) (Figure 47) poisoning were diagnosed by DAFM laboratories during 2012. While ragwort is a very common plant in Ireland, it is unpalatable to cattle and at pasture they will tend to avoid ingesting the plant unless grass is very scarce, or during the weeks after mowing or spraying when the plant appears to be more palatable. All stages of the plant are toxic and ragwort remains toxic in hay and silage where cattle may be unable to avoid ingesting the plant. Pyrrolizidine alkaloids contained within ragwort are converted to hepatotoxic metabolites by the liver and produce characteristic pathology notably megalocytosis, hepatic fibrosis and bile duct proliferation (Figure 48).

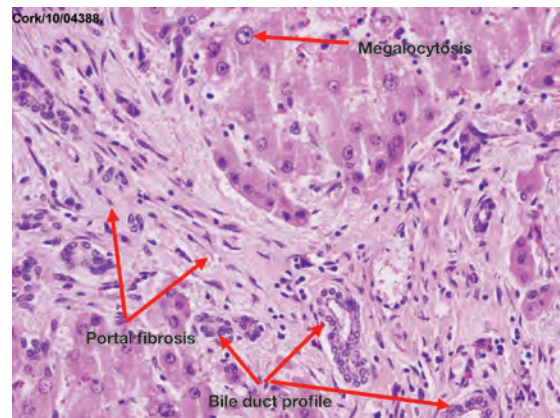


Figure 48: Photomicrograph of a bovine liver showing histological changes typically identified in cases of ragwort poisoning (Photo: Cosme Sánchez-Miguel).

BRACKEN FERN POISONING

Poisoning due to bracken fern (*Pteridium* spp) is a sporadic disease. Two cases of bracken fern toxicity were diagnosed by DAFM laboratories in 2012. The toxicity of bracken depends on the stage of growth and the time of year with underground rhizomes and young green fronds containing higher concentrations of the toxic principle than mature fronds. Poisoning is cumulative and large amounts of the plant must be eaten before poisoning occurs. In most outbreaks cattle have usually had access to the plant for at least two to four weeks. In cattle bracken fern causes an irreversible depression of bone marrow activity resulting in aplastic anaemia and death due to thrombocytopaenic haemorrhage and bacteraemia.

YEW TREE POISONING

Yew (*Taxus* spp) is a highly toxic evergreen tree common in graveyards, ornamental gardens and elsewhere throughout Ireland. The toxic alkaloids present depress electrical conduction within the heart leading to arrhythmias and rapid death. Cattle are most frequently exposed to yew when yew cuttings are thrown over boundary fences or when yew branches are blown down in storms. One case of yew toxicity was diagnosed in 2012 (Figure 49).



Figure 49: Foliage from yew tree found in the rumen of a bovine that died suddenly (Photo: William Byrne).

OAK POISONING

Oak (*Quercus* spp) contains toxicologically important tannins which can lead to poisoning when large numbers of acorns, oak leaves (particularly young ones) or oak buds are eaten. Oak poisoning in cattle is characterised by inappetance, diarrhoea, colic and renal damage. One case of death due to oak toxicosis was diagnosed during 2012 in Ireland.

HALOGENATED SALICYLANILIDES

Halogenated salicylanilides are anthelmintics used in the treatment of liver fluke infestations and include closantel and rafoxanide. One case of suspected toxicity with halogenated salicylanilides was diagnosed by AFBI based on histological findings in the brain and optic nerve. The case involved a twenty month-old heifer which presented with nervous signs, hind-limb inco-ordination progressing to recumbency and blindness.

Sheep

AFBI laboratories recorded 46 cases of poisoning in sheep during 2012, and 29 cases were recorded in DAFM laboratories during the same period (Table 13).

In Northern Ireland, 38 of the total 46 cases (82 *per cent*) of poisoning were due to members of the rhododendron family which includes the

ornamental shrubs *Pieris* (forest flame) and azaleas. Rhododendrons, azaleas and *Pieris* contain the poisonous substance andromedotoxin. Poisoning frequently occurs when sheep break through boundary fences, gaining access to bushes, particularly in cases of severe or inclement weather or when food sources are scarce.

| Poisonous Agent | Number of cases | |
|---------------------|-----------------|-----------|
| | AFBI | DAFM |
| <i>Pieris</i> | 28 | |
| <i>Rhododendron</i> | 9 | |
| Azalea | 1 | |
| Copper | 7 | 27 |
| Laurel | 1 | |
| Cobalt | | 1 |
| Alphacloralose | | 1 |
| Total | 46 | 29 |

Table 13: Causes of death due to poisoning recorded in sheep during 2012 in Ireland (DAFM) and Northern Ireland (AFBI).

Thirty four cases of copper toxicity were recorded on the island of Ireland during 2012. Copper is an essential nutrient but sheep are particularly prone to toxicity. While all breeds of sheep are susceptible to copper toxicity breeds such as Texel, Charollais and Suffolk are more susceptible than Scottish Blackface. Chronic copper toxicity poses a risk in intensive husbandry systems through the feeding of concentrates.



Figure 50: Severe icterus associated with copper toxicosis in a Texel ram (Photo: Colm Ó Muireagáin).

eurycerus) out of a group of six were consistent with those described in closantel toxicosis. The animals were treated with a closantel containing flukicide two days before the onset of clinical signs.

Equines

Two cases of poisoning were recorded by AFBI laboratories in equines during 2012. In one case yew leaves were detected in the stomach of an eight-year-old mare and in the second case ragwort toxicosis was diagnosed on histological examination of a formalin-fixed liver sample.

Cats

Ethylene glycol toxicity was diagnosed by AFBI laboratories in three cats. The primary source of ethylene glycol is radiator antifreeze of cars and cats will consume antifreeze voluntarily.

One case of poisoning due to carbofuran, a highly toxic pesticide now banned in the EU, was recorded by AFBI.

Wild birds

One case of poisoning by alphachloralose was recorded by AFBI laboratories in a buzzard, and 4 cases of the same aetiology were identified by post-mortem examination in birds by DAFM laboratories in 2012. Alphachloralose is a rodenticide.

Exotic Animals

In Northern Ireland, changes observed in neurological tissues of five bongos (*Tragelaphus*

Novel diseases

Schmallenberg Virus

The vector-borne Schmallenberg virus (SBV) was first identified in Germany in late 2011. The virus, which is transmitted by biting midges, is capable of causing disease in infected cattle and sheep, primarily leading to the birth of malformed calves and lambs. Figure 51 shows a deformed lamb with typical signs of arthrogryposis, torticollis and brachygnathia (bent limbs, twisted neck and shortened lower jaw).



Figure 51: Schmallenberg virus: Arthrogryposis, torticollis and brachygnathia in a deformed lamb. (Photo: Cosme Sánchez-Miguel)

Schmallenberg virus appears to grow well in nervous tissue such as the foetal brain or spinal cord. Pathological changes in the foetus depend on the stage of pregnancy of the mother when first infected, with more severe effects observed in animals infected in the earlier stages of pregnancy. Damage to the brain and spinal cord is thought to prevent the foetus from moving in the uterus preventing normal stimulation of developing muscles resulting in the immobile joints (arthrogryposis) and twisted spines (kyphosis and scoliosis) observed in affected lambs and calves at birth (Figure 52). Other abnormalities at birth may include a shortened jaw and brain and skull

deformities (Figure 53 and Figure 54). On occasions, the external appearance of the animal may be normal but they are blind, ataxic, and unable to rise or suck.

Adult cattle initially infected with Schmallenberg virus may show signs of fever, milk drop, decreased appetite or diarrhoea, while usually there are no clinical signs observed in sheep.

Affected lambs and calves are usually carried to full term but difficulties may arise during parturition. Across Europe, flocks with a synchronised breeding programme have been particularly affected as the foetuses are at similar stages of development when the mothers are infected.

Following infection, exposed animals may give birth to malformed progeny but are likely to develop a strong immunity to subsequent infection. They are therefore unlikely to suffer any ill effects if exposed to the same virus in subsequent years. However, just because a herd or flock has affected lambs or calves, this does not guarantee that other animals in the group are immune and these animals may become infected in subsequent years as the virus becomes more widespread.

SURVEILLANCE

Ireland

Since its discovery, evidence of infection of livestock with this virus has been found across Northern Europe with first reports of the virus reaching south east England in January 2012. Given the likelihood that this vector-borne virus would eventually reach our shores, DAFM laboratories began targeted surveillance in January 2012 and all deformed calves and lambs presented for examination to the Regional Veterinary Laboratories (RVLs) since then have been tested for the presence of the virus. The first positive case was detected by PCR in a cattle herd in County Cork in late October 2012. During 2012, the infection was confirmed in foetuses

obtained from a further 19 cattle herds and 1 sheep flock.

All of the 2012 confirmed cases were confined to Co. Cork (14 bovine cases) and south-eastern counties with 3 in Wexford (2 bovine and one ovine case) and 3 in Kilkenny (3 bovine cases).



Figure 52: Schmallenberg virus: Arthrogryposis in calf (Photo: Cosme Sánchez-Miguel)

A sero-prevalence survey was conducted on blood samples from cattle which had been collected for brucellosis testing from herds in all 26 counties since mid-November of 2012. Brucellosis-tested herds were randomly selected from each county and six animals were randomly selected from each of these herds. The number of herds selected was proportional to the number of animals per county so the sample size in small counties was increased to a minimum of 17 herds, resulting in a total national sample of 532 herds. The results are detailed in Table 14 below, and show a very marked regional distribution – the greatest exposure to the virus having occurred in southern and south-eastern counties with much less evidence of exposure in the north and west.

| County | Herds Tested | Herds with 1 or more Positives | Positive Herds (per cent) |
|-----------|--------------|--------------------------------|---------------------------|
| Carlow | 17 | 17 | 100.00 |
| Kilkenny | 21 | 21 | 100.00 |
| Waterford | 17 | 17 | 100.00 |
| Wexford | 17 | 17 | 100.00 |
| Cork | 59 | 54 | 91.53 |
| Dublin | 17 | 15 | 88.24 |
| Wicklow | 17 | 15 | 88.24 |
| Tipperary | 31 | 24 | 77.42 |
| Louth | 17 | 13 | 76.47 |
| Laois | 17 | 12 | 70.59 |
| Offaly | 17 | 10 | 58.82 |
| Limerick | 26 | 14 | 53.85 |
| Kildare | 17 | 9 | 52.94 |
| Kerry | 23 | 11 | 47.83 |
| Meath | 17 | 6 | 35.29 |
| Westmeath | 17 | 5 | 29.41 |
| Monaghan | 17 | 4 | 23.53 |
| Galway | 28 | 3 | 10.71 |
| Leitrim | 17 | 1 | 5.88 |
| Longford | 17 | 1 | 5.88 |
| Sligo | 17 | 1 | 5.88 |
| Clare | 19 | 1 | 5.26 |
| Mayo | 19 | 1 | 5.26 |
| Cavan | 17 | 0 | 0.00 |
| Donegal | 17 | 0 | 0.00 |
| Roscommon | 17 | 0 | 0.00 |
| Totals | 532 | 272 | 51.13 |

Table 14: Sero-prevalence of SBV antibodies in herds in Ireland during 2012. Six animals were tested in

each herd.

Further spread to unaffected herds/flocks in northern and western counties is very likely to occur during the 2013 vector season but should have relatively little impact in non-pregnant livestock. It is generally impractical to attempt midge control measures except for valuable breeding stock.

A vaccine against SBV virus is anticipated in 2013. It is hoped that vaccination of non-pregnant animals will be an effective tool in limiting the impact of virus infection.

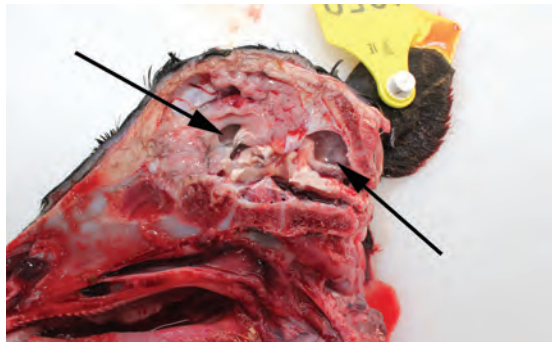


Figure 53: Cerebellar hypoplasia and hydrocephalus associated with Schmallenberg virus infection in a calf (Photo: Cosme Sánchez-Miguel)

Northern Ireland

Surveillance for SBV is ongoing in Northern Ireland via post-mortem examinations of stillborn and aborted ruminants, virology PCR, serology and trapping of insects at various sites.

AFBI laboratories tested 38 animals during 2012 for Schmallenberg virus by PCR, of which one was positive. This first positive case was detected in a cattle herd in County Down in late October 2012.

In addition, 203 animals were tested by serology, of which 3 were seropositive.

It is believed that further spread to other herds and flocks in Northern Ireland is likely to occur during the 2013 summer and autumn insect vector season.

Schmallenberg Virus (SBV) Key Facts:

- Vectored by insects from the genus *Culicoides*, which are indigenous to the island of Ireland and active during April to early December
- More significant clinical picture is of:
 - an increase in lambs, calves & kids born dead or weak, at or near their due date
 - lambs, calves & kids born with varying degrees of fused or stiff limb joints, twisted spines, or abnormal skulls or jaws
- Affects ruminants but no evidence to date that it is likely to cause disease in humans
- Highest risk period is when mother is infected in early-mid pregnancy
- A commercial vaccine for Schmallenberg virus will be available in 2013
- Schmallenberg is **not** a notifiable disease
- DARD/DAFM does **not** impose any restrictions on infected holdings

The European Centre for Disease Prevention and Control has determined that there is unlikely to be any human health risk associated with the disease.



Figure 54: Skull deformity in a calf from a Schmallenberg virus affected herd. (Photo: Alan Wolfe).

Diseases of sheep

The diagnostic analyses for the most frequent causes of sheep mortality in Northern Ireland and Ireland during 2012 are presented in Figure 55. The data are presented on a disease category basis and as a percentage of the total submissions in each catchment area, excluding abortions.

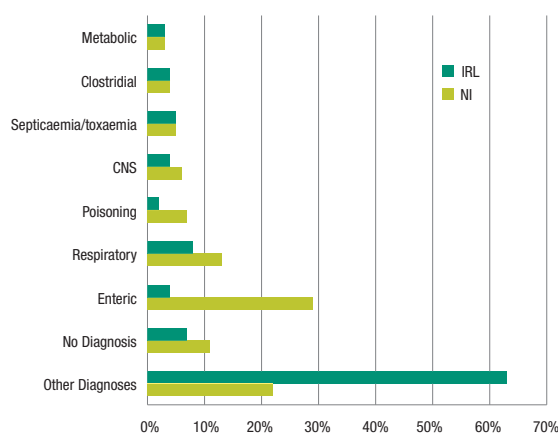


Figure 55: The relative frequency of causes of mortality in sheep of all ages submitted for post-mortem examination in Northern Ireland (n=723) and Ireland (n=1241).

Similar to 2011, parasitic, respiratory and enteric diseases were the most commonly diagnosed causes of death in sheep of all ages on the island of Ireland.

It is important to note that in 2012, many ovine submissions were due to liver fluke disease and this is reflected in the relatively high percentage of “Other Diagnoses” shown in Figure 55.

In the case of respiratory diagnoses, *Mannheimia haemolytica* remains the most common cause of bacterial pneumonia in both Northern Ireland and Ireland. *Trueperella pyogenes* is also a frequent isolate, followed by *Pasteurella multocida*. Jaagsiekte (ovine pulmonary adenocarcinoma) and atypical (mycoplasmal) pneumonia are currently much more common in Northern Ireland than in

Ireland with only a few cases of each of these diseases being reported in Ireland in 2011 and 2012.

Colibacillosis, ovine neonatal enterotoxaemia (‘watery mouth’) and cryptosporidiosis are common causes of enteric disease in young lambs. Enteric viral infections (rotavirus and coronavirus) remain uncommon diagnoses on an all-island basis.

Liver fluke can kill animals and cause serious economic losses

- The wet summer in 2012 increased the risk of disease due to liver fluke
- Sheep and cattle farmers need to assess the risk on their farms and take appropriate action
- This could include avoiding grazing high risk pasture and using specific liver fluke treatments where necessary
- Planning ahead will reduce the losses due to liver fluke next year

As in 2011, septicaemia and toxaemia were more commonly diagnosed in Ireland than Northern Ireland. The prevalence of clostridial disease was similar in both jurisdictions during 2012, again repeating the pattern of 2010 and 2011. Clostridial disease remains a common diagnosis despite the availability of effective vaccines for ewes, rams and lambs. Many cases of clostridial disease are associated with incomplete or non-existent vaccination programmes in flocks.

Listeriosis remained the most frequently diagnosed CNS disease in sheep, and copper and *Pieris* spp (Forest Flame) were the most commonly diagnosed causes of poisoning.

Clostridial disease

Clostridial organisms are naturally present in the soil, where the spores can survive for a long time but they can also live in the gut of healthy animals. Table 15 below shows the prevalence of clostridial diseases diagnosed on the island of Ireland during 2012.

| | Total lambs | Total adults (>12 months of age) |
|----------------------|-------------|----------------------------------|
| Blackleg | 0 | 7 |
| Black Disease | 0 | 11 |
| Abomasitis | 4 | 0 |
| Malignant oedema | 0 | 5 |
| Enterotoxaemia | 0 | 29 |
| Pulpy Kidney disease | 35 | 0 |

Table 15: The number of diagnoses of clostridial disease in sheep on post-mortem examination in veterinary laboratories during 2012.

The overall pattern remains similar to 2011 with pulpy kidney disease the most frequently diagnosed clostridial disease on the island of Ireland. Pulpy kidney disease is caused by infection with *Clostridium perfringens* type D. It is commonly identified in fast growing lambs, typically over one month of age, that are consuming high concentrate rations, or sucking ewes which are heavy in milk. Losses in a flock often coincide with a sudden change in feed or increase in the plane of nutrition which causes proliferation of the organism with the release of the toxin. The finding of rapidly autolytic kidneys ('pulpy kidneys'), glucosuria and the presence of a serous clot in the pericardium are highly suggestive of pulpy kidney disease.

Parasitic disease in sheep

Laboratory submissions have highlighted increased diagnoses of fasciolosis (Figure 56). This has been primarily due to inclement weather

conditions during the late summer and early autumn of 2012 but it has been exacerbated by increasing resistance to triclabendazole and often the inappropriate use of other products.

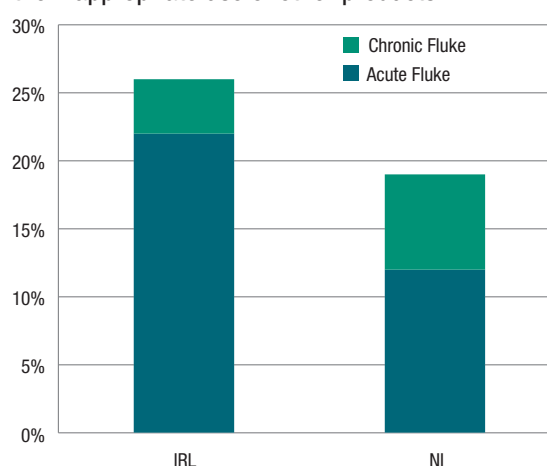


Figure 56: The percentage of all ovine mortality caused by acute and chronic liver fluke infestation as diagnosed by AFBI (NI) and DAFM (IRL) laboratories during 2012

Figure 57 shows the number of cases of acute and sub-acute fasciolosis diagnosed at AFBI's veterinary laboratories from 1998 to 2013 in the periods September to February with a marked increase recorded in 2012/13.

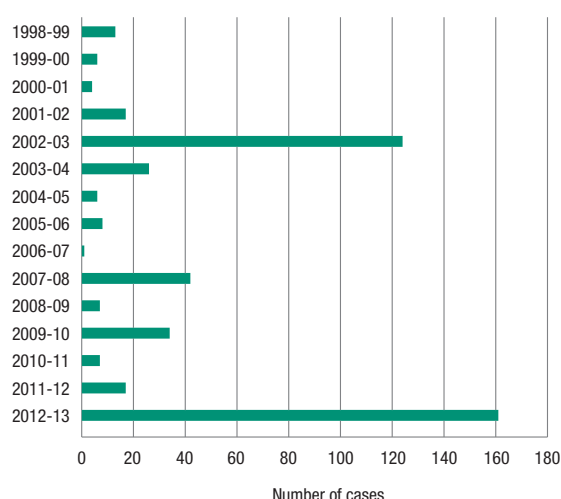


Figure 57: Total number of cases of fasciolosis (acute and sub-acute) diagnosed in NI from 1998-2013 from September to February (Source: AFBI)

Figure 58 shows the diagnostic analyses of all endoparasitic disease ovine cases diagnosed in post-mortem examination in Northern Ireland and Ireland during 2012. Each disease is represented as a percentage of the total number of post-mortem submissions in which parasitic disease was recorded as the cause of death.

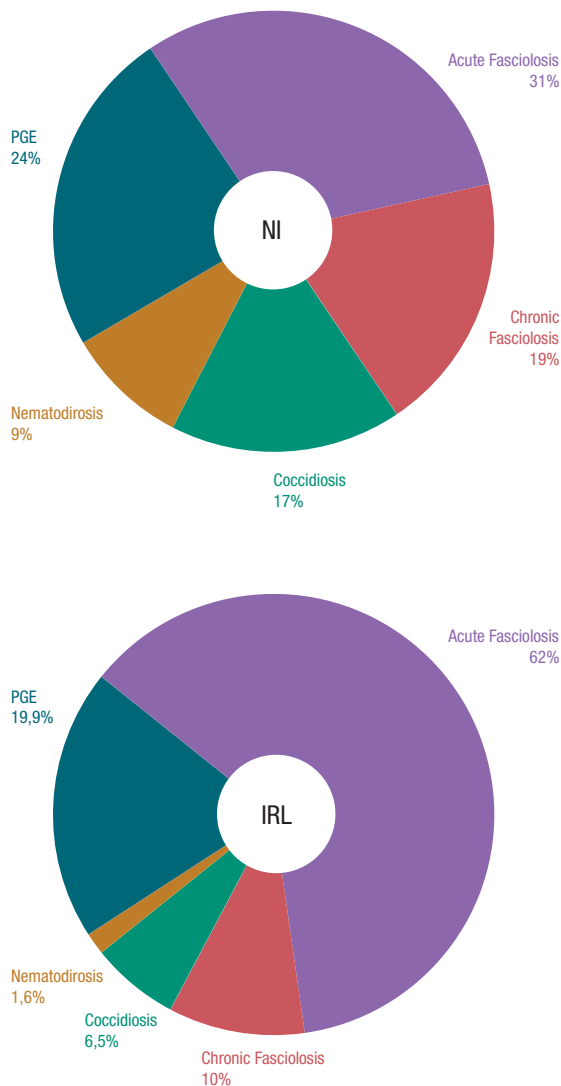


Figure 58: Specific endoparasitic conditions diagnosed during 2012 in sheep as a percentage of all ovine endoparasitic disease diagnoses in post-mortem submissions made in NI and IRL (PGE: Parasitic Gastroenteritis)

Acute inflammation of the duodenum due to infection with ruminal fluke larvae accounted for 41 sheep deaths on the island of Ireland. Since liver and rumen fluke require mud and water snails as intermediary hosts, they are present in similar wet habitats and often occur concurrently. Whereas the adults don't cause much pathology in the rumen of sheep, the immature larvae, when present in sufficient numbers are responsible for severe duodenitis and consequent hypoalbuminaemia and dehydration. Sheep present acutely with very watery diarrhoea. The larvae are not very susceptible to the more commonly used flukicides.



Figure 59: Acutely damaged duodenum with some rumen fluke larvae attached (Photo: Colm Ó Muireagáin).



Figure 60: A magnified image of rumen fluke larvae (Photo: Colm Ó Muireagáin).

Ovine Abortion

The diagnosed causes of abortion in sheep are broadly similar in both Ireland and Northern Ireland. The data presented here is reported as a percentage of all ovine abortion diagnoses, with at least one diagnosis being recorded per case. A case refers to received single submissions of a single or multiple foetuses from one flock at the same time. Ireland recorded 317 diagnoses from 305 cases. Northern Ireland recorded 414 diagnoses from 385 cases. Similar to previous years, the percentage of cases in which no diagnosis was made ranged from 34 *per cent* to 41 *per cent* and *Toxoplasma gondii* and *Chlamydomphila abortus* were the two most commonly diagnosed causes of abortion in both jurisdictions (see Figure 61). Bacterial causes of abortion accounted for the majority of the remaining diagnoses and the rates again were broadly similar between the two jurisdictions. Leptospirosis was diagnosed as the cause of abortion in 23 cases in Northern Ireland but was not diagnosed in Ireland. In Northern Ireland this diagnosis is based on positive maternal serology (*Leptospira* spp. microscopic agglutination test, MAT), whereas no positive *Leptospira* spp. MAT results were reported in Ireland during 2012.

Salmonellosis caused abortions in sheep flocks in Ireland and Northern Ireland; most cases were due to *Salmonella* Dublin¹, although single cases of *S. Mbandaka*² and *S. Arizonae*³ were also diagnosed in Ireland and Northern Ireland, respectively. Schmallenberg virus was detected using reverse transcriptase polymerase chain reaction (RT-PCR) in three cases of Arthrogryposis-Hydranencephaly Syndrome (AHS) seen in early-lambing sheep flocks in Ireland. Based on the current understanding of Schmallenberg virus infection, further cases of AHS were expected to occur in 2013.

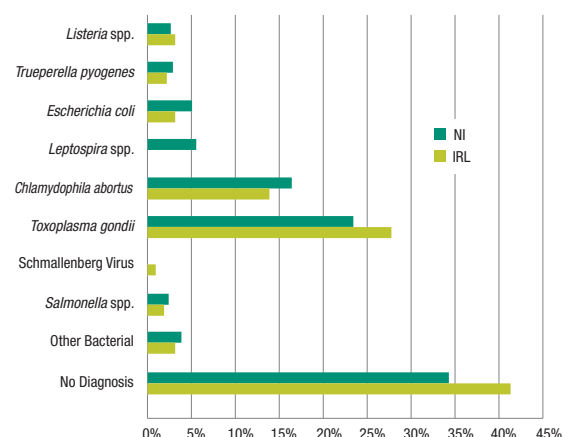


Figure 61. The relative frequency of the causes of ovine abortion in Ireland (n=317) and Northern Ireland (n=414), during 2012. “Other Bacterial” includes: *Pasteurella* sp., *Bacillus licheniformis*, *Yersinia* sp., *Staphylococcus* sp., *Streptococcus* spp., and *Campylobacter* spp.

¹ *Salmonella enterica* . *enterica* serotype Dublin

² *Salmonella enterica*. *enterica* serotype Mbandaka

³ *Salmonella enterica enterica* serotype Arizonae

Equine diseases

The Irish Equine Centre

The Irish Equine Foundation Ltd (trading as the Irish Equine Centre or IEC) is a registered charity. It is an independent organisation whose aim is to protect the wellbeing of Ireland's horse population. The IEC provides laboratory services for the diagnosis, management and prevention of diseases of horses. This is a whole island service.

An extensive range of diagnostic services are provided and supported through a number of units including clinical pathology, microbiology, pathology, virology, quality assurance and administration. Its services are always available, with an emergency service available outside of business hours.

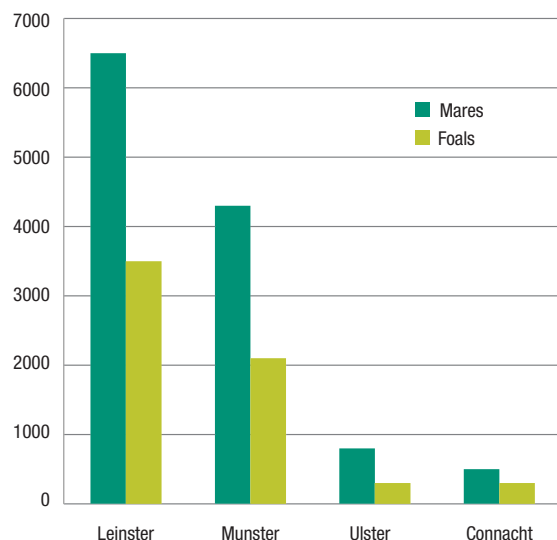


Figure 62: The distribution of Thoroughbred mares and foals by province in Ireland during 2012.

Code of Practice testing

Tests for Equine Viral Arteritis (EVA), Equine Infectious Anaemia (EIA), Contagious Equine Metritis (CEM), Piroplasmiasis and Dourine are tests required by the Code of Practice. Dourine testing is specifically carried out on mares visiting Ireland from Italy. Compliance with code of practice testing

has been identified as a source of concern. In 2010, the level of compliance was 88.8 *per cent* for CEM. This represented a considerable total of 1,456 non-compliant mares.

During 2012, 12,952 active Thoroughbred broodmares and 199 stallions were recorded. The distribution of Thoroughbred mares and foals are recorded by province in Figure 62.

The distribution of EVA, EIA and CEM testing mirrors the distribution of the Thoroughbred mare and foal population (Table 16). Piroplasmiasis, like EIA, EVA, CEM and Dourine, is a notifiable disease in Ireland. The majority of Piroplasmiasis samples are submitted from Munster. The majority of the Dourine tests which are submitted to the IEC are forwarded to the DAFM.

All of the above relates only to the Thoroughbred breeding industry, which represents only 18 *per cent* of Ireland's horse population. Placing this industry in the context of the entire horse population clearly shows that we are "in the dark" about the disease status of the diseases controlled by the Code of Practice for at least the other 82 *per cent* of Ireland's horse population.

| Province | EVA | EIA | CEM | Piro | Dourine |
|---------------|-------------|-------------|-------------|------------|-----------|
| Leinster | 4887 | 4426 | 2797 | 54 | 65 |
| Munster | 3432 | 3184 | 634 | 316 | 26 |
| Connacht | 129 | 109 | 165 | 4 | 1 |
| Ulster | 106 | 90 | 116 | 9 | 3 |
| TOTALS | 8557 | 7809 | 4053 | 383 | 95 |

Table 16: Distribution of IEC Code of Practice tests by province in Ireland during 2012

Clinical pathology service

Submissions to the IEC Clinical Pathology service follow the same geographical pattern as Thoroughbred distribution (Figure 63). This service

is primarily used for the narrowing of differential diagnoses but also includes Piroplasmosis testing.

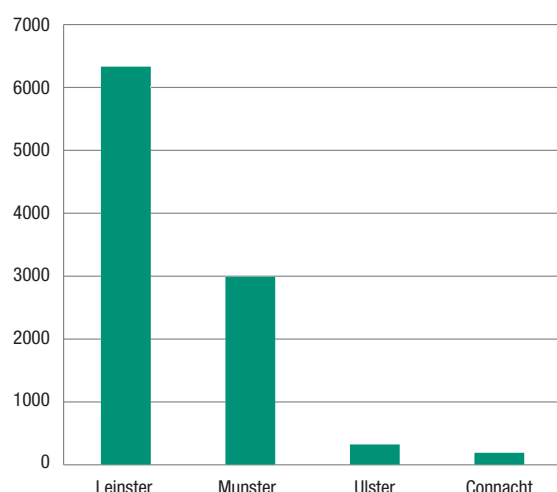


Figure 63: The distribution of IEC Clinical Pathology submissions in Ireland by province during 2012

A summary of the most significant individual diagnostic test findings in 2012 are outlined in Table 17 below.

| Diagnosis | Number of cases |
|--|-----------------|
| Equine Herpesvirus Abortion (EHV-1 & 4) | 9 |
| Equine Influenza | 35 |
| Sleepy foal disease (<i>Actinobacillus equuli</i>) | 3 |
| <i>Rhodococcus equi</i> | 3 |
| Tyzer's Disease (<i>Clostridium piliforme</i>) | 3 |
| Salmonellosis | 4 |
| Equine Coital Exanthema (EHV-3) | 1 |
| Strangles (<i>Streptococcus equi</i>) | 67 |
| Contagious Equine Metritis | 2 |

Table 17: The most significant individual diagnostic test findings for 2012 at the IEC.

Individual testing

Individual diagnostic testing is another valuable

service provided by the IEC. This is used by clinicians to narrow differential diagnoses and to confirm a diagnosis, thus making it a significant part of the diagnostic testing carried out by the IEC. A number of disease outbreaks were identified by the IEC during 2012 and are detailed below.

CONTAGIOUS EQUINE METRITIS (CEM)

There was an outbreak of CEM involving initially two non-Thoroughbred stallions used for artificial insemination during May in Ireland. CEM is a highly contagious, localised bacterial disease and is notifiable. *Taylorella equigenitalis* is the aetiological agent responsible for this venereally-transmitted disease. This condition is economically significant due to its potential to cause significant disruption to Thoroughbred breeding programmes in particular. Prevention measures are based on good hygiene practices at breeding.

EQUINE HERPESVIRUS

During 2012, there were four Equine herpesvirus (EHV) abortion cases on one farm in March and a further five individual cases in January, February, October and November. EHV-1 is associated with both respiratory disease and abortion. EHV-1 is thought to be more virulent than EHV-4 which is mainly responsible for respiratory disease. Diagnosis of EHV infection is achieved by demonstrating the presence of virus in tissues or swabs, by serology or by histological analysis.

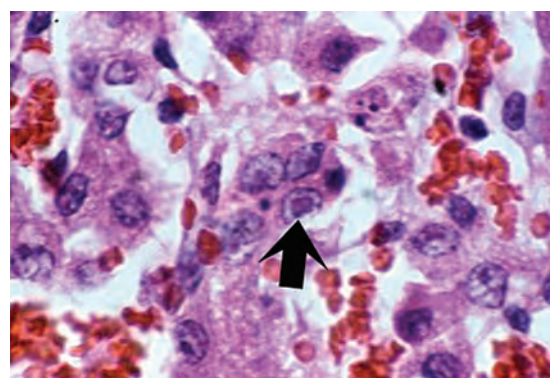


Figure 64: Herpesvirus inclusion bodies (arrow) in the hepatocytes of a horse. (Photo: Ursula Fogarty).



Figure 65: Petechiation of the mucous membranes associated with Herpesvirus infection (Photo: Ursula Fogarty).

ROTAVIRUS

Cases of Rotavirus were recorded in February, April, May, June and July of 2012. Rotavirus causes a mild to severe diarrhoea and usually affects foals less than two weeks of age. Transmission occurs following ingestion of feed contaminated with faeces excreted by infected animals. Stringent hygiene practices should be implemented to decontaminate buildings housing affected animals, as the virus can persist for long periods of time in the environment. Infected animals are often depressed and anorexic.

EQUINE INFLUENZA

Equine Influenza was diagnosed in non-Thoroughbreds in January, in a racing stable in August, on a stud farm in September and on two premises in October (one a racing stable and the other a dealer's yard). Influenza is an acute respiratory disease affecting all Equidae species. H3N8 is the main subtype of the virus identified in Ireland while the occurrence of the H7N7 subtype is rare. Usually, spread of infection is associated

with the gathering and movement of horses. The virus is highly contagious and rapid spread is possible due to the large quantities of virus shed in aerosols of affected animals. The predominant clinical signs associated with Influenza infection in susceptible horses include pyrexia, coughing and nasal discharge.

RHODOCOCCLUS EQUI

Three *Rhodococcus equi* fatalities were recorded by the IEC during 2012. *R. equi* is a bacterium found in soil and in the intestinal tract of animals. This opportunistic pathogen is associated largely with a suppurative bronchopneumonia in foals. An acute form of infection is most prevalent in foals less than 1 month of age, while a chronic form is more commonly seen in older foals. The acute form is characterised by sudden onset fever, anorexia, coughing and dyspnoea. In older foals, characteristic rales are heard on auscultation of the lungs along with accompanying respiratory signs.

STRANGLES

Strangles is an important contagious disease caused by *Streptococcus equi*. In 2012, out of a total of 891 samples submitted for *S. equi* testing, 67 (7.5 per cent) samples were positive for the bacteria.

LAWSONIA INTERCELLULARIS

Twenty-three of 41 submissions (56 per cent) were positive for *Lawsonia intercellularis*. *L. intracellularis* infection is mainly linked to a proliferative enteropathy with accompanying diarrhoea and weight loss.

PARASITIC INFECTIONS

Parasitic infections were identified in a small number of submissions. Three of the 23 submissions (13 per cent) were positive for lungworm (*Dictyocaulus arnfieldi*) while 4 of 44 (9 per cent) submissions were positive for liver fluke.



Figure 66: Tapeworm infection in an adult horse (Photo: Ursula Fogarty).

OTHER FINDINGS

Pneumocystis carinii, *Encephalitozoon cuniculi* and Atypical Myoglobinuria were also reported in individual cases. Also, there were four cases of Salmonellosis in horses in Ireland during 2012.

Post-mortem examination findings

In Ireland, the majority of equine post-mortem examinations are carried out at the IEC. In total, 464 necropsy procedures were performed during 2012 by the IEC. This post-mortem examination service is provided in addition to its Code of Practice testing and it is an all-island service. The distribution of horses submitted for post-mortem examination by province is outlined in Figure 68.

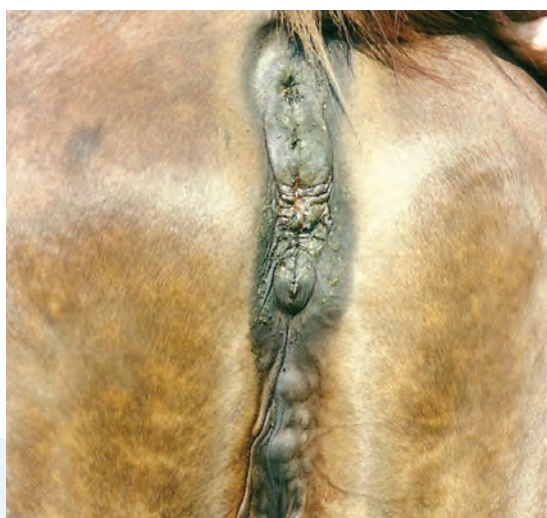


Figure 67: Perineal tumours associated with lymphoma in a 10 year-old mare (Photo: Ursula Fogarty).

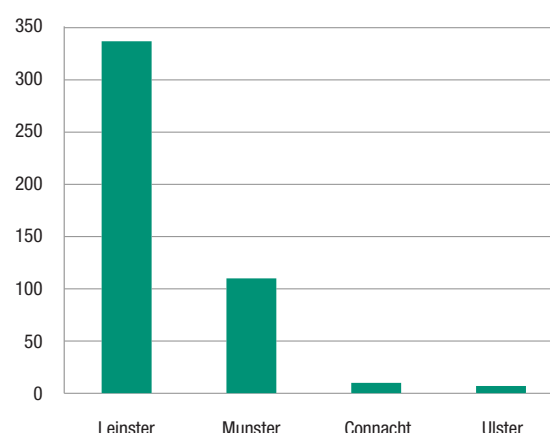


Figure 68: The distribution of horses submitted for post-mortem examination by province in Ireland during 2012

Mortality in adult horses is outlined in Table 18. Neonatal mortality diagnoses are outlined in Figure 69, while causes of death in 1-6 month old foals are presented in Figure 70.

| Diagnosis | No. Of cases |
|--|--------------|
| Trauma to the head and neck / fracture of cervical vertebrae | 10 |
| Colitis / Typhilitis | 8 |
| Exercise induced pulmonary haemorrhage | 4 |
| Uterine related haemorrhage | 4 |
| Gastric rupture | 2 |
| Ruptured aorta | 1 |
| Occlusion of coronary artery by parasites | 1 |
| Clostridial myositis | 1 |
| Flatulent colic | 1 |
| Neoplasia | 3 |
| Parasitism | 15 |
| Total | 50 |

Table 18: The most frequently diagnosed causes of mortality in adult horses diagnosed by post-mortem examination at the IEC during 2012.

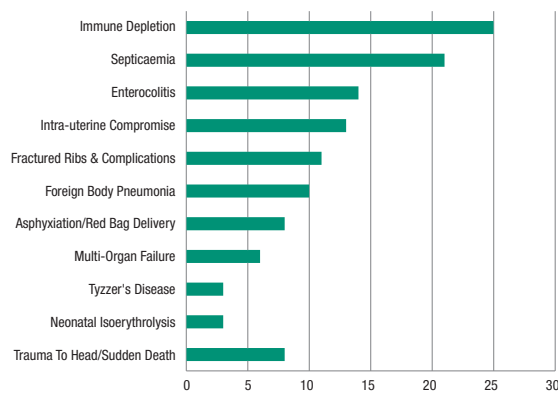


Figure 69: The most frequently diagnosed conditions on post-mortem examinations of neonatal foals at the IEC during 2012.

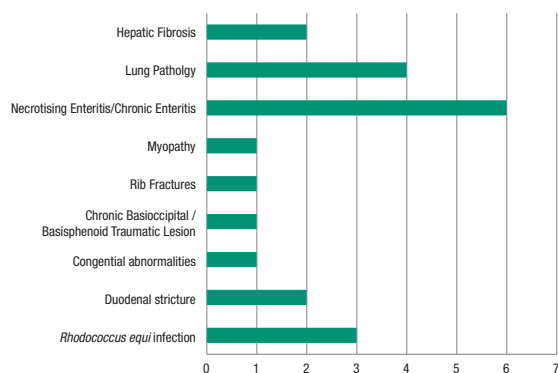


Figure 70: Most frequently diagnosed causes of mortality in foals (one to six-months-old) at the IEC during 2012.

AFBI and DAFM Laboratories

The majority of equine post-mortem analysis in the island of Ireland are carried out at the IEC, which is the only facility specialising in equine diagnostic pathology. Nevertheless, AFBI and DAFM veterinary laboratories complete a significant number of equine post mortem examinations and diagnostic tests throughout the year. In addition, the laboratories perform a number of equine specific tests and continue to be a national reference centre for some equine diseases, like CEM, Dourine and EIA. RVLs and AFBI Laboratories may also perform post mortem examinations in support of animal welfare investigations by law enforcement authorities in their respective jurisdictions.

A summary of equine post-mortem diagnoses carried out in AFBI and DAFM laboratories is shown in Table 19 below. Enteric pathologies were the most common diagnoses, aetiology ranging from parasitic infections (2 in AFBI, 5 in DAFM, with Strongyles isolated in 1 and 3 cases respectively) to intestinal torsion (1 in AFBI, 3 in DAFM) and other enteric related pathologies diagnosed were intestinal obstruction, enteritis, gastric ulceration, peritonitis and gut perforation.

| Diagnosis | Number of cases | |
|-----------------------|-----------------|------|
| | AFBI | DAFM |
| Enteric | 8 | 8 |
| Reproductive/Abortion | 3 | 5 |
| Poisoning | 2 | |
| Tumours | 2 | 2 |
| Myopathy | 2 | |
| Pneumonia | | 3 |
| Septicaemia | | 3 |
| No diagnosis | 4 | 8 |
| Other | 6 | 14 |
| Total | 27 | 43 |

Table 19: Diagnoses of horses submitted for post-mortem examination in AFBI and DAFM veterinary laboratories.

Strangles was diagnosed on 3 occasions in DAFM laboratories, while tumours found in horses submitted to AFBI were classified as equine sarcoids and fibroma/fibrous hyperplasia. Other diagnoses include poisoning due to ragwort toxicity, abortions due to *E. coli*, *Bacillus licheniformis* (AFBI), EHV-1 and *Leptospira* sp., (DAFM) and septicaemia as a result of systemic infections caused by coliforms, *Staphylococcus aureus* and *Streptococcus zooepidermicus*.

The category "Other" includes hepatic related cases, listeriosis, nephritis and dystocias among others.

Diseases of pigs

During 2012 diagnoses were recorded for 162 and 256 (174 separate cases) pig carcasses examined by Ireland and Northern Ireland laboratories respectively. The most frequently recorded cause of death in Northern Ireland and Ireland was pneumonia, followed by enteritis, oedema disease and septicaemia in Ireland and colibacillosis, meningitis, septicaemia and salmonellosis in Northern Ireland (Figure 71). These are broadly similar to findings in previous years.

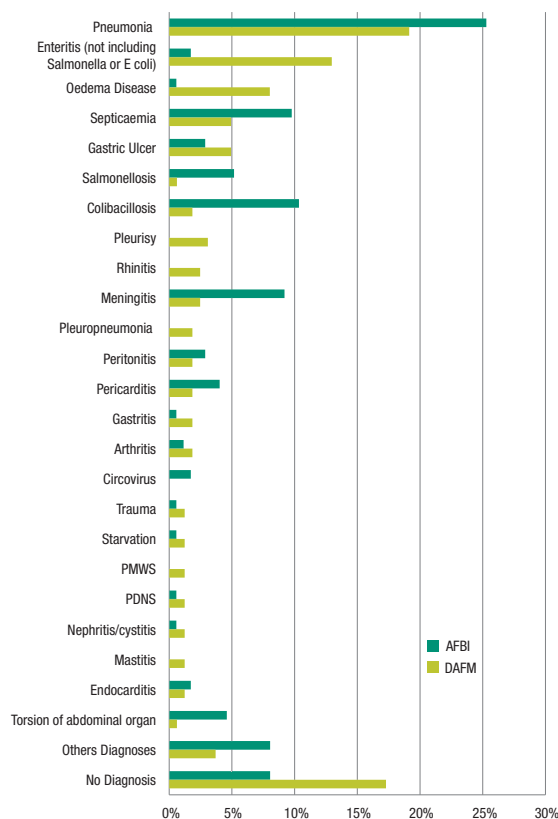


Figure 71: The most frequently diagnosed causes of porcine mortality 2012 (n=418).

Pneumonia

The bacterial pathogens most frequently detected in cases where pneumonia was diagnosed were *Actinobacillus pleuropneumoniae*, *Mycoplasma hyopneumoniae*, *Pasteurella multocida* and

Actinomyces pyogenes. Viral pathogens detected include Swine influenza virus and PRRS Virus among others. Multiple pathogens were detected in a number of submissions.



Figure 72: Pneumonia caused by *Actinobacillus pleuropneumoniae* (Photo: Seán Fee).

Abortion and Stillbirths

Any increase in the rate of abortions or stillbirths within a pig unit can have a serious impact on the productivity and economic viability of the enterprise. Early investigation of increased abortions, stillbirths, mummification, early embryonic death and/or infertility (SMEDI) is essential, as this may be the result of the introduction of a new pathogen to the herd or the re-emergence of an endemic pathogen. Samples from aborted or stillborn pigs will typically be tested for a variety of bacterial pathogens as well as for evidence of exposure to viruses which cause porcine reproductive and respiratory syndrome (PRRS), Aujeszky's disease and parvovirus. While the number of abortions investigated in Ireland during 2012 was small, parvovirus was detected in five pigs from three farms suffering increased abortion or stillbirths, while pseudorabies virus (Aujeszky's disease) was not detected in any samples. Twelve cases of abortion were investigated by AFBI during 2012, and *Escherichia coli*, *Pasteurella* spp, *Streptococcus* spp and *Toxoplasma* spp were isolated in one case each.



Figure 73: The typical presentation of sequential embryonic death caused by *Parvovirus* in a sow, as foetal death occurs at different stages of development (Photo: Seamus Power).

Aujeszky's Disease Free Status

An important landmark for the pig industry in the entire island of Ireland was reached in October 2012 when the entire region attained Aujeszky's disease free status. As well as causing abortion and stillbirth, the virus can also cause central nervous system disease and respiratory disease. The attainment of disease free status at national level will facilitate trade of both live pigs and meat products with EU member states and some non-EU states. As the industry enters the post-eradication era effective surveillance for the re-introduction of the disease is essential. The veterinary laboratory service will play a vital role in the testing of samples from herds experiencing signs where Aujeszky's disease is considered a differential diagnosis.

Salmonellosis

Salmonellosis in pigs may produce outbreaks of septicaemia, acute enteritis or chronic enteritis and wasting. Nine cases of salmonellosis were diagnosed in Northern Ireland laboratories during 2012. *Salmonella* Typhimurium was identified in five of these cases and *Salmonella* Typhimurium phage type 104b was the most frequent phage type recorded. Cases were most frequently seen in 8-14 week-old weaned pigs. All isolations of *Salmonellae* from pigs in Northern Ireland are reported to the Department of Agriculture and Rural Development (DARD). Laboratories in Ireland isolated *Salmonella*

spp. from six carcasses. *Salmonella* Typhimurium phage type DT193 was the most frequent phage type identified (three isolates).



Figure 74: Necrotic enteritis in the small intestine of a pig due to *Salmonella* Typhimurium (Photo: Seán Fee)

Escherichia coli infections

Infections due to *Escherichia coli* were commonly recorded by both AFBI and DAFM laboratories during 2012 including diagnoses of colisepticaemia in newborn piglets, enteritis and diarrhoea in young piglets from birth to weaning, postweaning enteritis and diarrhoea associated with weaning and oedema disease.

Streptococcal infections

Streptococcus suis is a frequent cause of septicaemia, arthritis and meningitis in suckling and weaned piglets. During 2012, AFBI recorded seven cases of meningitis due to *Streptococcus* spp. and five cases of Streptococcal septicaemia. In Ireland DAFM laboratories isolated the pathogen from ten pigs.

Torsion of abdominal organs

Eight cases of torsion of abdominal organs were recorded by AFBI during 2012. Intestinal torsion was most frequently recorded with five cases, while torsion of the stomach and spleen were

recorded in two cases and torsion of the liver was recorded in one case. Management practices often play a role in cases of torsion of abdominal organs with torsions more likely to occur in large units employing once-daily feeding, when sows or pigs waiting to be fed become very excited and may rapidly consume large quantities of feed and water.

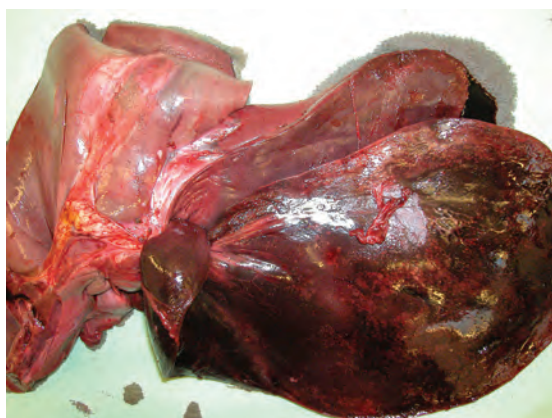


Figure 75: Liver congestion and necrosis associated with torsion of the left lobe of the liver in sow (Photo: Seán Fee)

Diseases of poultry

During 2012, 319 poultry carcasses from commercial and backyard flocks were examined by DAFM laboratories, while AFBI laboratories examined 249 poultry and gamebird carcasses, and 258 viscera/histopathological submissions.

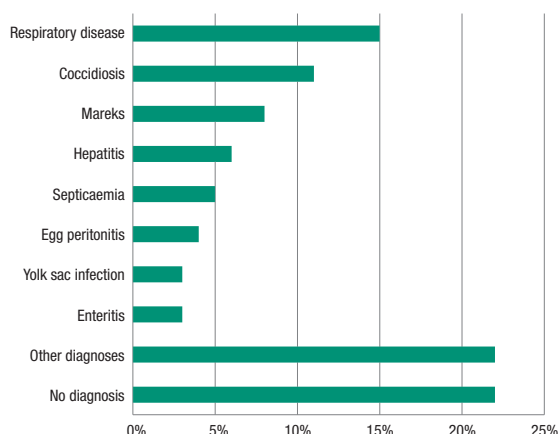


Figure 76: The relative frequency of the most commonly diagnosed causes of mortality in poultry in DAFM laboratories during 2012 (n=319).

Ireland

Respiratory disease (15 *per cent*) was the most common diagnosis recorded by DAFM laboratories in Ireland during 2012 (Figure 76). Respiratory diseases diagnosed in backyard flocks included infectious bronchitis (coronavirus), *Mycoplasma gallisepticum* infection (Figure 77) and fowl cholera (*Pasteurella multocida*).



Figure 77: Nasal and ocular discharge in a hen infected with *Mycoplasma gallisepticum*. (Photo: Ann Sharpe).

Infectious bronchitis is a common endemic viral infection of chickens causing respiratory and urogenital tract disease. Some strains also reportedly cause proventriculitis and pectoral myopathy. Young birds are more susceptible than older ones and the disease can be exacerbated by the presence of other pathogens (e.g. *Escherichia coli*, *Mycoplasma gallisepticum*, *Ornithobacterium rhinotracheale*) or adverse environmental conditions (e.g. high levels of ammonia, dust or in-house temperatures that are too high or too low). Infection may also cause failure to reach peak egg production, a drop in egg production or misshapen eggs. Although live and attenuated vaccines have been used for many decades to prevent infectious bronchitis, the condition still persists worldwide and results in enormous economic losses. The challenge posed by the virus appears to be related to its ability to mutate or form recombinants that are less recognised by a host's immune system. Thus new strains of infectious bronchitis virus emerge from time to time.

Mixed infections of low pathogenic avian influenza H5N2, infectious bronchitis and *Mycoplasma gallisepticum* were diagnosed in adult pheasants one week after importation from the UK. Out of the 110 birds on the premises, three died and five had severe ocular discharge. Remaining birds were culled and restrictions placed on the holding. A nearby broiler enterprise was negative for avian influenza. The H5N2 virus isolated was most closely related to a low pathogenic H5 virus isolated from a swan in the Netherlands. Low pathogenicity avian influenza viruses circulate in wild birds which act as a potential infection source for poultry.

Marek's disease caused by Marek's disease virus (MDV) accounted for 8 *per cent* of diagnoses in DAFM laboratories in 2012, and was seen in commercial broiler breeders where vaccine breakdown was suspected. MDV causes malignant tumours in the skin and internal organs resulting in mortality and immunosuppression. Vaccination failure may

result from high field challenge by very virulent MDV strains, inadequate vaccination programs, poor vaccine preparation and administration and the presence of immunosuppressive agents (e.g. infectious bursal disease virus, chick anaemia virus, mycotoxins). If the field challenge is too high, it can overcome the vaccine immunity and produce an outbreak even in older birds. Reports indicate the incidence of Marek's disease outbreaks in layers and broiler breeders over 40 weeks of age. Good cleaning and disinfection should delay the exposure of baby chicks to field challenge to allow proper development of vaccine-provided protection. Vaccination programmes must be designed according to the type of bird and field challenge. Re-vaccination may be considered under high challenge conditions.

Less commonly diagnosed conditions included avian tuberculosis, broiler ascites syndrome, predation, vent pecking, rickets, lice infestation (Figure 78), lymphoid leukosis, staphylococcal tenosynovitis, fatty liver haemorrhagic syndrome of layers and cardiohepatic syndrome in turkeys.



Figure 78: High numbers of louse (*Menacanthus* sp) eggs on the shafts of feathers taken from an emaciated rooster suffering from parasitism. (Photo: Mercedes Gomez-Parada)

Rickets was diagnosed by DAFM laboratories in pheasant chicks with high mortality rate from a number of farms which received feed from the same source. Rickets is usually seen in rapidly growing chicks. In all forms of rickets a failure of mineralisation leads to flexibility of long bones. Rickets is caused by a deficiency of calcium or phosphorus or insufficient vitamin D. The deficiency may be in the diet, due to malabsorption or a consequence of an imbalance between dietary calcium and phosphorus. Marginal or subclinical rickets may frequently go unreported but may be associated with poor chick performance, a poorer gait and an increase in bone deformities. The incidence of hypophosphataemic rickets has increased in recent years due to a tendency to keep dietary phosphorus low to reduce costs and to reduce environmental contamination by poultry litter. Bacterial infections are more common in bones with hypophosphataemic rickets.

Cardiohepatic syndrome is a fatal condition of unknown cause affecting young turkeys between two and three weeks of age. It has been suggested that the condition may be linked to stress and/or the rapid growth rates seen at this age. Typically deaths due to cardiohepatic syndrome cease after the birds reach four weeks of age. Mortality in outbreaks of cardiohepatic syndrome can be up to 50 *per cent*.

Staphylococcal arthritis and tenosynovitis may occur in birds of any age. In broiler breeders stress caused by uneven feed distribution or aggression may predispose to infection. *Staphylococcus aureus* is the most common isolate but other staphylococcal species have been recovered.

Northern Ireland

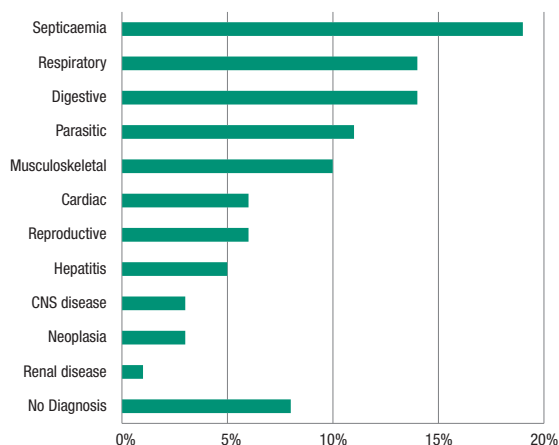


Figure 79: The most frequently diagnosed conditions on post-mortem examination in poultry in AFBI laboratories during 2012.

Septicaemia (19 *per cent*), was the most common diagnosis in post-mortem carcase submissions to AFBI (Figure 79), closely followed by respiratory (14 *per cent*) and enteric disease (14 *per cent*), while hepatic disease was the most common diagnosis in the submissions of viscera. A range of bacteria were isolated from septicaemic birds, with *Escherichia coli* the most frequent bacterium isolated both alone and in combination with other bacteria. Other bacteria isolated included *Pasteurella multocida*, *Streptococcus* spp., and *Erysipelothrix rhusiopathiae*.

For the first time since 1984, Fowl typhoid (due to *Salmonella gallinarum*) was diagnosed in a batch of 40-week old layers. There had been acute mortality in one batch of birds, half of which had died within a 48-hour period. *Salmonella gallinarum* was cultured from both the liver and spleen of all the birds examined. *Salmonella gallinarum* is a bacterium highly adapted to chickens and is of little public health significance; however in commercial flocks it is of economic significance due to bird losses, poor production and difficulty in controlling the infection. Birds can be infected from other birds (poultry or wild), contaminated machinery,

clothing, crates, via feed, insects or while in the egg due to infection passed from the mother to her chick. Fowl typhoid is mainly a disease of adult birds but high mortality can occur in chicks as either dead in shell or death of young chicks soon after hatching. Infection in adult birds may show up as a drop in feed consumption, ruffled feathers, pale shrunken combs, and possible drop in egg production or more chronically as loss of condition and severe anaemia. Eradication is best achieved with depopulation of the site, deep heat clean and disinfection. Dormant red mites can harbour the bacterium for a considerable period of time so for successful eradication of fowl typhoid any red mites also need to be controlled and eradicated.

Erysipelothrix rhusiopathiae was diagnosed in both pheasants and turkeys during 2012. *E. rhusiopathiae* is most frequently associated with turkeys, but outbreaks can occur in other avian species including chickens, ducks, geese and pheasants. In the pheasant outbreak 50 out of 1500 birds were found dead with no premonitory signs, the carcasses were congested, but hepatitis, splenitis and nephritis were detected histologically.

Occasional cases of nervous disease were examined, including a case of *Listeria monocytogenes* encephalitis in a batch of 43 one-week-old chickens. The birds were showing nervous sign, with torticollis. *L. monocytogenes* was isolated from the liver and spleen indicating septicaemia, while histological findings included acute inflammation and necrosis within the brain and bacteria could be seen within some necrotic areas.

Outbreaks of listeriosis occur sporadically in temperate regions in chickens, turkeys, and waterfowl, with young birds usually being the most susceptible. *L. monocytogenes* is found in animal faeces and soil, and some outbreaks of listeriosis in poultry have been associated with cold wet conditions underfoot either in damp litter or on ground that has been flooded.

AFBI laboratories detected several cases of Infectious laryngotracheitis (ILT or gallid herpesvirus 1) during 2012. ILT is not uncommon among backyard and pet birds, and both mild and more pathogenic strains exist, however a new infection of a previously uninfected flock by the virus can result in a sudden outbreak of severe respiratory disease with nasal discharge, coughing and gasping and high mortality. These signs may clinically mimic the presenting signs of avian influenza or Newcastle disease although histopathology and virological testing in the laboratory rapidly distinguish between the conditions. ILT transmission occurs readily from acutely infected birds, but clinically unapparent infections of trachea and trigeminal ganglion do occur with such birds acting as carriers for long periods. Other sources of infection include contaminated equipment and litter.

Diseases of Aquatic Animals

Statutory Testing

The Fish Health Unit (FHU) at the Marine Institute in Ireland and the Fish Diseases Unit (FDU) at AFBI in Northern Ireland are the reference laboratories for diseases of finfish, molluscs and crustaceans and perform surveillance programmes for diseases listed under EU Directive 2006/88/EC.

Commission Decision 2010/221/EU has granted Ireland and the UK guarantees in relation to freedom from the finfish diseases bacterial kidney disease (BKD), spring viraemia of carp (SVC) and gyrodactylosis (infestation with *Gyrodactylus salaris*, GS). The entire island of Ireland is free from these diseases and the FHU and the FDU continue to carry out regular testing in order to maintain freedom. Northern Ireland has approved zone status in respect of the listed fish diseases Infectious Haematopoietic Necrosis (IHN), Viral Haemorrhagic Septicaemia (VHS), Infectious Salmon Anaemia (ISA), *Bonamia ostreae*, *Martelliella*, SVC, BKD and GS and routine surveillance must be carried out to confirm/maintain this disease free status. Under Commission Decision 2011/187/EC, the FDU is undertaking a surveillance programme for the early detection of Ostreid Herpes virus-1 μ var in Pacific Oysters. There is also a surveillance programme underway with the aim of achieving disease freedom for Koi herpesvirus (KHV) in Northern Ireland.

Diagnostic testing

The entire island of Ireland is free of finfish diseases listed under EU Directive 2006/88/EC and Commission Decision 2010/221/EU. The FHU at the Marine Institute of Ireland and the FDU in Northern Ireland also provide a diagnostic service for the aquaculture industry, the wild fish sector, Inland Fisheries Ireland and veterinarians, in

relation to diseases currently not listed under these EU Directives or by the OIE. The FDU laboratory is accredited to ISO 17025 standards for a number of test methods, including the following range of real-time RT-PCR and PCR assays: SAV (*Salmonid alphavirus*), IHN, VHS, ISA, KHV and GS. The FHU laboratory is also accredited to ISO 17025 for a variety of test methods, including those used for testing the above listed diseases.

In 2012 over 3,000 finfish in Ireland and almost 2,000 in Northern Ireland were tested for disease pathogens either as part of surveillance programmes, diagnostic samples received into the laboratory or screening tests for the aquaculture industry. In Ireland, the majority of the finfish species tested were Atlantic salmon (*Salmo salar*, 91 per cent) and common carp (*Cyprinus carpio*) including Koi carp (5 per cent). Also, a smaller number of rainbow trout (*Oncorhynchus mykiss*), Arctic char (*Salvelinus alpinus*), pike (*Esox lucius*) and other coarse fish were also tested (Figure 80). In Northern Ireland, the finfish species tested were Rainbow trout (49 per cent), Atlantic salmon (34 per cent), Brown trout (10 per cent), common carp including koi carp (5 per cent) and roach (2 per cent).

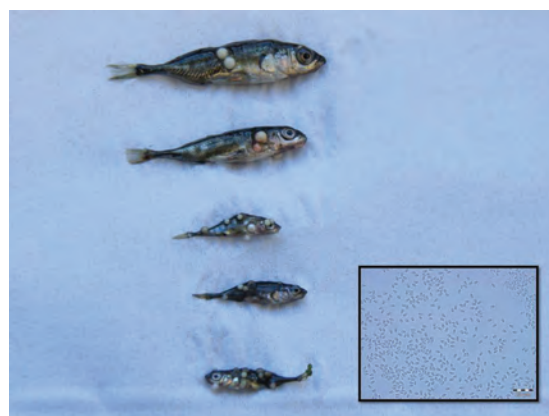


Figure 80: Three-spined stickleback (*Gasterosteus aculeatus*) with dermal cysts consistent with infection by the microsporidean parasite *Glugea anomala* (Insert: wet prep showing parasites) (Photo: Neil Ruane).

Finfish

In both Ireland and Northern Ireland, the main diseases of finfish detected during 2012 were diseases which are not listed, either under EU Directives or by the OIE.

The most significant disease to affect farmed finfish in Ireland during 2012 was amoebic gill disease (AGD), caused by the parasite *Neoparamoeba perurans* (Figure 81). The disease reappeared in 2011 not having been seen since 2005 and was again widespread in 2012, resulting in significant losses to farmed stocks of Atlantic salmon. A similar situation was observed in Scotland and a small number of cases were also reported in Norway in late 2012. AGD has been a major disease of farmed salmon in Tasmania for many years, but only occurred sporadically in other salmon farming countries without major losses being reported. Its emergence in 2011/12 as a significant disease, particularly in Ireland and Scotland, is a concern for the industry and the situation is being closely monitored by the FHU in co-operation with the industry.

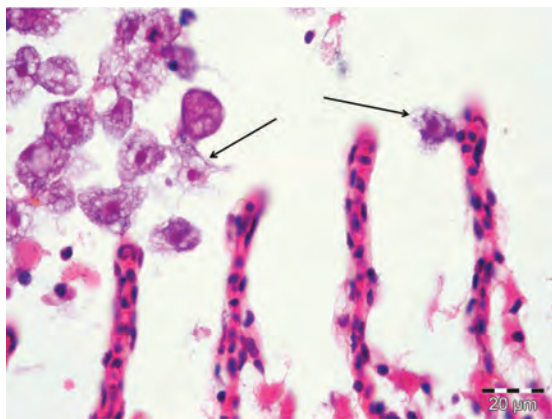


Figure 81: Gills of Atlantic salmon diagnosed with amoebic gill disease (AGD). Numerous amoeba can be seen attached and free on the gills (arrows) (Photo: Evelyn Collins).

Cardiomyopathy syndrome (CMS) was diagnosed in Ireland for the first time in farmed salmon during

2012, although the mortality levels were reported to be very low. The disease is caused by a totivirus, the piscine myocarditis virus (PMCV). CMS is primarily a chronic disease of farmed Atlantic salmon, affecting the heart tissue and resulting in major financial losses as it mostly affects large fish prior to harvesting. Although the disease was first described in Norway in the 1980's, the causative agent was only described in 2010 and research into vaccine development is still underway. The other main viral diseases are pancreas disease (PD) and infectious pancreatic necrosis (IPN), both of which saw a reduction in the number of cases reported during 2012. The bacterial disease furunculosis, caused by *Aeromonas salmonicida*, was diagnosed in a sample of brown trout, *Salmo trutta* held in Co Cork in Ireland (Figure 82). This disease is normally controlled by vaccination, however as these fish were being held for restocking purposes they were unvaccinated and therefore susceptible to infection.

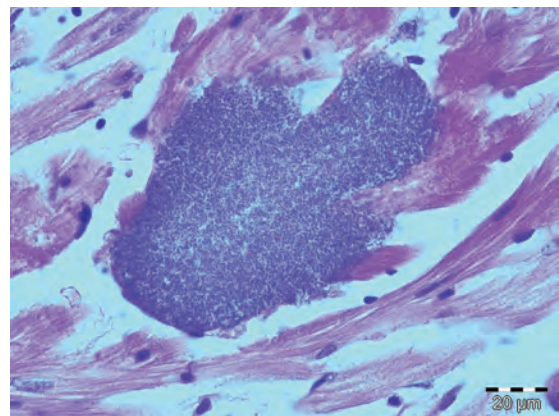


Figure 82: A large colony of *Aeromonas salmonicida* (causative agent of furunculosis) in the heart of a brown trout (Photo: Evelyn Collins).

In Northern Ireland, Finfish diseases diagnosed were pancreas disease (PD), infectious pancreatic necrosis (IPN) and amoebic gill disease (AGD). All three of these diseases are commonly diagnosed in Atlantic salmon reared in sea cages. PD and IPN are detected in the laboratory by virus neutralisation and virus isolation in cell culture, real-time PCR,

IFAT and genetic sequence analysis. *N. perurans*, the aetiological agent of amoebic gill disease, is detected in the laboratory by real-time PCR and genetic sequence analysis.

Molluscs and crustaceans

In the same period, more than 9,000 molluscs and crustaceans were tested by the FHU. In Northern Ireland, the number of molluscs and crustaceans tested by the FDU came to a total of 1,620.

In Ireland, the vast majority of the testing focused on Pacific oysters, *Crassostrea gigas* in relation to Ostreid herpes virus-1 μ var surveillance (OshV-1 μ var; (Figure 83). In 2012, the OshV-1 μ var virus was detected in a further three bays through screening as part of the surveillance programme, bringing the total of positive bays in Ireland to 26. Mortality patterns were similar to 2011 with mortality occurring later in the season (August), as water temperatures were again slow to rise. Mortality levels were also similar ranging from 15–70 *per cent* (20–40 *per cent* being the most common). The entire coast of Ireland remains free from *Marteilia refringens*, whilst the entire island coast, with the exception of eight bays, is considered free from *Bonamia ostreae* (Commission Decision 2009/177). Mortality reports in half-grown (one to two years old) and adult (three years old) Pacific oysters were received from five bays and two of these bays were confirmed positive for *Vibrio aestuarianus*, a bacterium which was also associated with mortalities in France during 2012. A number of bays were also affected by a bloom of *Karenia mikimotoi* in July, causing 60–100 *per cent* mortality in Pacific oysters with bays in the North-West being worst affected. *K. mikimotoi* is a dinoflagellate phytoplankton species known for causing ‘red tides’ in the North West Atlantic.

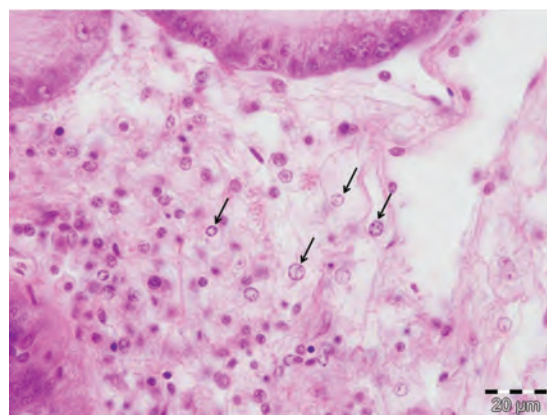


Figure 83: Pacific oyster infected with ostreid herpes virus (OshV) showing a number of cells in the connective tissue with enlarged nuclei and margined chromatin (arrows) (Photo: Evelyn Collins).

In Northern Ireland, 960 Pacific oysters (*Crassostrea gigas*) were screened for OshV-1 μ var for both surveillance programmes and research projects. OshV-1 μ var was detected in Strangford Lough for the first time during 2012 with 118 pacific oysters out of 150 testing positive by real-time PCR and confirmed by genetic sequence analysis. 120 native oysters (*Ostrea edulis*) and 90 mussels (*Mytilus edulis*) were screened for *Bonamia ostreae* and *Marteilia refringens*; both these diseases are listed by the OIE. The coastline of Northern Ireland is also designated free from *Marteilia refringens* and *Bonamia ostreae* (with the exception of Strangford Lough and Lough Foyle where *Bonamia ostreae* has been found previously). Four-hundred and fifty Green crabs were screened for White Spot Syndrome virus (WSSV) and they all tested negative by real-time PCR.

Research

IRELAND

In 2012 the Sea Change funded project *GILPAT: An Investigation into Gill Pathologies in Marine Reared Finfish* was finalised and the project report is available to download from the Marine Institute website (www.marine.ie). Through the project

it was shown that gill disease is a significant issue for the aquaculture industry. Molecular diagnostic methods were developed for a range of aquatic pathogens and it was demonstrated for the first time that the common jellyfish (*Aurelia aurita*) causes gill damage to salmon. A second project, *AQUAPLAN: Health Management for Finfish Aquaculture* was developed to help provide Ireland with a strategic plan for the management of finfish health. Through this project, a Farmed Salmonid Health Handbook was developed along with a series of disease information leaflets, all of which are available at www.marine.ie. Under the EU FP7 program, the FHU is a partner in *BIVALIFE Management of Infectious Diseases in Oysters and Mussels in Europe* which aims to improve disease diagnostics and management for European molluscan aquaculture. The FHU is also collaborating with Dublin City University on a PhD project developing a diagnostic PCR for koi herpesvirus based on the expression of miRNA's during the latency stages of infection.

NORTHERN IRELAND

The FDU are also involved in the GILPAT initiative mentioned above. The aim of this project is to increase our understanding of amoebic gill disease. *Advance Through Disease Control project (ATDC)* is managed by the Aquaculture Initiative and is supported by the European Fisheries Fund 2007-2013 and the Department of Agriculture and Rural Development. This project was started in September 2011 and is scheduled to finish in July 2013. The project is a response to the rise of mortalities and difficulties presented to oyster farming in Northern Ireland by the herpes oyster virus new variant. The objectives of the ATDC are to help seven participating oyster farmers in Northern Ireland to look at farming methods that can help them reduce mortality and maintain growth despite the threat of the herpes oyster virus new variant.

Scientific publications

FHU (IRELAND)

H. Segner, H. Sundh, K. Buchmann, J. Dourfils, K.S. Sundell, C. Mathieu, N. Ruane, F. Jutfelt, H. Toften, L. Vaughan. (2012) Health of farmed fish: its relation to fish welfare and utility as a welfare indicator. *Fish Physiology & Biochemistry* 38:85-105.

E.J. Baxter, M.M. Sturt, N.M. Ruane, T.K. Doyle, R. McAllen, H.D. Rodger. (2012) Biofouling of the hydroid *Ectopleura larynx* on aquaculture nets in Ireland: implications for finfish health. *Fish Veterinary Journal* 13:17-29.

E.J. Peeler, R.A. Reese, D.L. Cheslett, F. Geoghegan, A. Power, M.A. Thrush. (2012) Investigation of mortality in Pacific oysters associated with Ostreid herpesvirus-1 μ Var in the Republic of Ireland in 2009. *Preventive Veterinary Medicine* 105:136-143.

FDU (NORTHERN IRELAND)

E Fringuelli, A W Gordon, H Rodger, M D Welsh and D A Graham. (2012) Detection of *Neoparamoeba perurans* by duplex quantitative Taqman real-time PCR in formalin-fixed, paraffin-embedded Atlantic salmonid gill tissues. *Journal of Fish Diseases* 35: 711-724

D A Graham, E Fringuelli, H M Rowley, D Cockerill, D I Cox, T Turnbull, H Rodger, D Morris and M F Mc Loughlin. (2012). Geographical distribution of salmonid alphavirus subtypes in marine farmed Atlantic salmon, *Salmo salar* L., in Scotland and Ireland. *Journal of Fish Diseases* (2012) 35: 755-765

E Fringuelli, P D Savage, A Gordon, E J Baxter, H D Rodger and D A Graham. (2012) Development of a quantitative real-time PCR for the detection of *Tenacibaculum maritimum* and its application to field samples. *Journal of Fish Diseases* (2012) 35: 579-590

Parasitic diseases

The number of faecal samples submitted to AFBI and DAFM veterinary laboratories for parasitological examinations rose during 2012 to near the 2010 peak. Figure 84 illustrates the number of bovine and ovine faecal samples submitted for liver fluke egg examination in the years 2006 to 2012. It is likely that the wet weather, particularly towards the end of the year, and increased awareness of the potential impact of parasitic diseases, led to the increased submission levels.

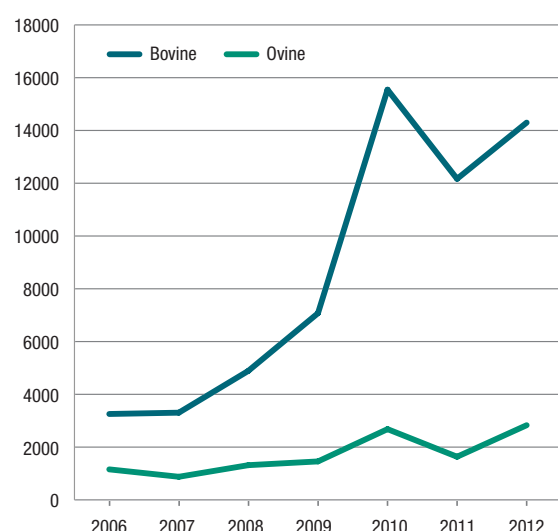


Figure 84: The number of faecal samples submitted for liver fluke egg detection to AFBI and DAFM laboratories in the years 2006 to 2012.

Liver and rumen fluke infections

During 2012, 14,297 bovine faecal samples were analysed for the presence of liver fluke eggs (3,849 by AFBI and 10,448 by DAFM). Of this, 7.5 *per cent* were positive (10.3 and 6.4 *per cent* in AFBI and DAFM laboratories respectively). This is in line with 2011 findings, and a reduction from the 2010 peak (Figure 85).

Furthermore, 14,301 bovine faecal samples were examined for rumen fluke eggs and 39.0 *per cent*

were positive (38.2 *per cent* in AFBI labs, 39.3 *per cent* in DAFM labs), representing a small rise compared to 2010 and 2011 results (Figure 85).

A total of 2,830 ovine faecal samples were analysed for the presence of liver fluke eggs (1,254 by AFBI and 1,576 by DAFM) during 2012, a dramatic 42 *per cent* increase from 2011 (Figure 84). In total, 13.8 *per cent* were positive (17.1 *per cent* in AFBI labs and 11.1 *per cent* in DAFM labs), which, represents a significant rise on the 2011 results and similar to 2010 (Figure 85).

In addition, 2,826 ovine samples were examined for rumen fluke eggs (1,250 by AFBI and 1,576 by DAFM), and 500 (17.7 *per cent*) were positive (18.1 *per cent* in AFBI labs and 17.4 *per cent* in DAFM labs). The rate of detection has decreased significantly since 2010 (Figure 85).



Figure 85: Evolution of the percentage of positive liver and rumen fluke samples detected in bovine and ovine faecal submissions in AFBI and DAFM veterinary laboratories from 2010 to 2012

Strongyles

During 2012, 14,834 bovine (4,342 by AFBI and 10,492 by DAFM) and 3,220 ovine (1,407 by AFBI and 1,813 by DAFM) faecal samples were examined for strongyle eggs. An egg count of 500 or greater *per gram* of faeces is considered to be clinically significant. Based on this criteria, 3.7 *per cent* of the bovine (3.8 *per cent* in AFBI and 3.7 *per cent* in DAFM laboratories) and 23.4 *per cent* ovine (20.5 *per cent* in AFBI and 25.6 *per cent* in DAFM laboratories) samples were found to have a significant strongyle egg burden. These are similar results to those found in 2011 and 2010.

Lungworm

2,467 bovine faecal samples (369 by AFBI and 2,098 by DAFM) were examined for the presence of lungworm larvae (primarily *Dictyocaulus viviparus*) using the Baermann technique. Ninety-three (3.8 *per cent*) were positive (12.7 *per cent* in AFBI labs and 2.2 *per cent* in DAFM labs), similar to the 4.0 *per cent* found in 2011. Figure 86 illustrates the trend in positive results by quarter and is similar to that found in previous years, with the highest percentage of positive results found in Q3.

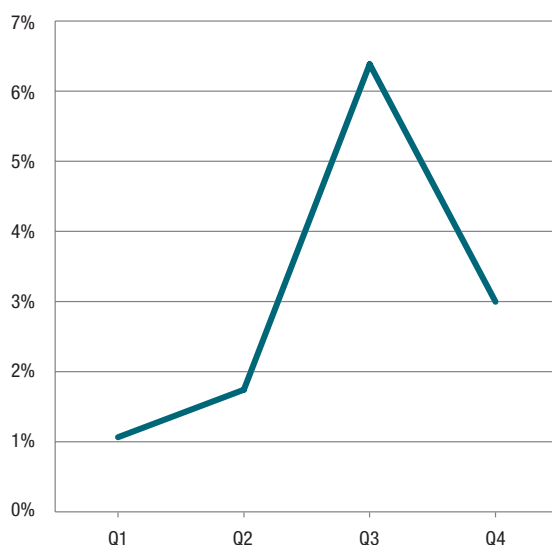


Figure 86: Percentage of bovine faecal samples positive for lungworm (primarily *Dictyocaulus viviparus*) larvae by quarter in 2012 in AFBI and DAFM laboratories.



Figure 87: Lungworm (*Dictyocaulus viviparus*) in a cow bronchus. (Photo: Colm Ó'Muireagáin)

Coccidiosis

During 2012, 12,805 bovine faecal samples (4,511 by AFBI and 8,294 by DAFM) were tested for the presence of coccidial oocysts. Of these, a 17.1 *per cent* of the samples were positive (19.6 *per cent* in AFBI labs and 15.7 *per cent* in DAFM labs). Of the positive samples 69.2 *per cent* contained low numbers of oocysts and were not considered of clinical significance. Figure 88 illustrates the results.

Similar to previous years, a much higher percentage of ovine samples presented coccidial oocysts than bovine samples. Of 3,604 ovine faecal samples tested (2,039 by AFBI and 1,565 by DAFM), 37.2 *per cent* were positive for the presence of coccidial oocysts (45.1 and 26.9 *per cent* in AFBI and DAFM laboratories respectively). As in cattle, only a small percentage of the positive samples presented a significant burden of parasites (Figure 89).

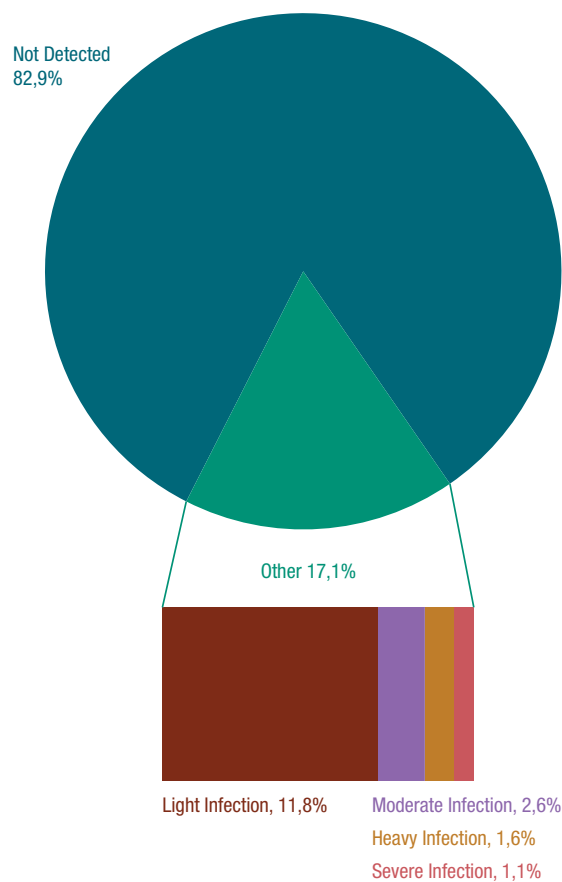


Figure 88: Breakdown of the results following the analysis of bovine faecal samples for coccidial oocysts during 2012 (n=12,805) in AFBI and DAFM laboratories.

3,604 ovine faecal samples (2,039 by AFBI and 1,565 by DAFM) were tested for the presence of coccidial oocysts during 2012. Of these 1,340 samples (37.2 *per cent*) were positive (45.1 *per cent* in AFBI labs and 26.9 *per cent* in DAFM labs). There were a far higher percentage of positive ovine samples than bovine samples, a finding that has also occurred in previous years. Figure 89 illustrates the results by severity of infection for 2012.

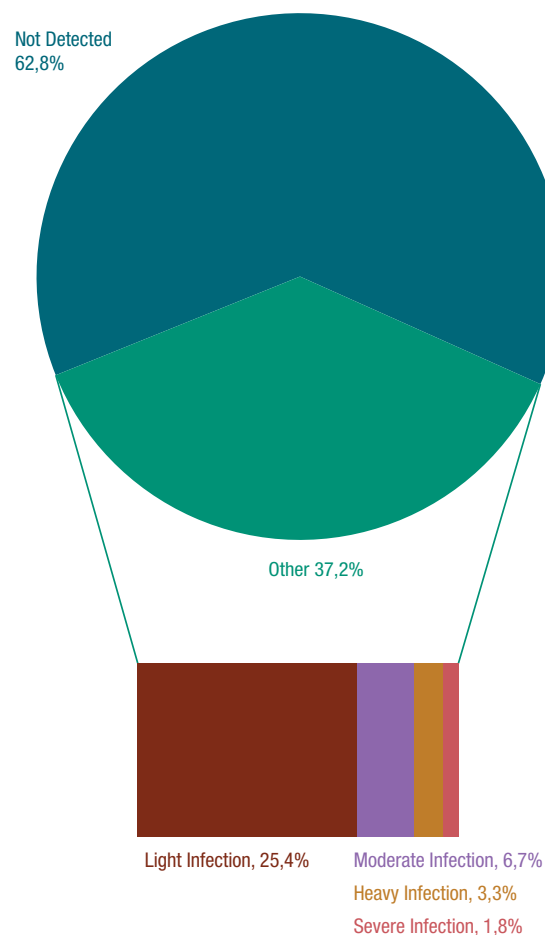


Figure 89: Breakdown of the results following the analysis of ovine faecal samples for coccidial oocysts during 2012 (n=3,604) in AFBI and DAFM laboratories.

Sheep scab

Nine outbreaks of sheep scab (*Psoroptes ovis*, Figure 90) were confirmed by laboratory testing in 2012 (four by AFBI laboratories and five by DAFM laboratories). There is some evidence that the incidence of psoroptic mange in cattle (also caused by *Psoroptes ovis*) appears to be increasing. Seven outbreaks were reported during 2012 (two by AFBI and five by DAFM laboratories).

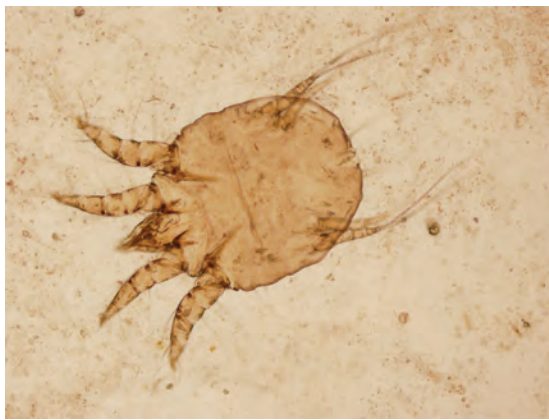


Figure 90: *Psoroptes ovis* (Photo: Cosme Sánchez-Miguel)

Anthelmintic resistance

In Northern Ireland, from September to December 2012, an unprecedented number of sheep died of acute fasciolosis. Diagnostic submissions of sheep carcasses showing severe liver damage with associated anaemia and intra-abdominal haemorrhage exceeded the previous peak season total (in 2002-03), and number of diagnoses of acute fasciolosis recorded was eight times that recorded for the same period in 2011 (as shown in Figure 57, Diseases of Sheep section). Reasons for this include the mild winter weather of 2011-2012, the high summer rainfall of 2012, and, in particular, widespread failure of triclabendazole treatment due to fluke resistance.

Diagnosis of triclabendazole resistance on individual farms is routinely offered by VSD-AFBI, and is best carried out using faecal egg count reduction, but this involves individual faecal sampling from a representative sample of sheep on two occasions, 3 weeks apart. Egg counts may be too low early in the season to give meaningful results, and even if fluke burdens are reduced or eliminated by the dose, eggs may still be released from the gall bladder for some time, giving false positive results. In response to requests for rapid confirmation of the resistance status in particular flocks, flukes collected from sheep, freshly dead at a known period of time after correctly administered triclabendazole treatment, are examined histologically for evidence of drug-induced damage to the reproductive organs (Figure 91). In many cases, where triclabendazole-resistance is well-established on the premises, the testes, ovary, uterus, vitelline follicles and Mehlis' gland of all flukes collected exhibit full structural and functional integrity, confirming the resistant status of the fluke population. However, in collections from areas where triclabendazole

resistance is currently emerging, some or many flukes show sub-lethal histological lesions in the reproductive organs which may temporarily block egg production, but the flukes themselves remain *in situ*, and in time the reproductive organs recover structure and function, as judged by histological examination. On premises where triclabendazole remains partially effective, advice is given to continue use of the drug in outbreaks of acute fasciolosis, in the hope that worm burdens may be sufficiently reduced to save at least some animals.

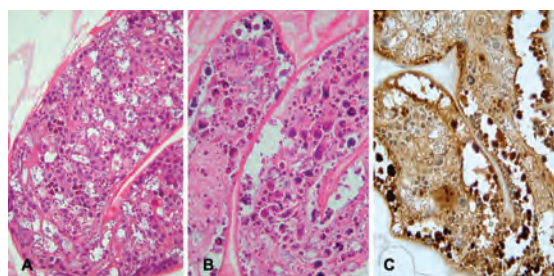


Figure 91: Diagnosis of triclabendazole (TCBZ) resistance in *Fasciola hepatica* in fluke from sheep treated with TCBZ.

A — Histological section of a testis of a TCBZ-resistant fluke.

B — Histological section of a testis of a TCBZ-sensitive fluke.

C — In situ hybridisation showing apoptosis and heterophagy in the testis of a TCBZ-treated sensitive fluke (Photo: Bob Hanna).

Proficiency testing

In addition to their own internal Quality Controls, AFBI and DAFM Veterinary Laboratories challenge their laboratory methods by participating in a number of external, independent proficiency testing (PT) schemes. Proficiency testing is organised by private companies specialised in quality controls of laboratory methods or by reference laboratories recognised as a centre of excellence in their fields by the European Union, the World Organisation of Animal Health (OIE) or other international organisations.

AFBI and DAFM Veterinary Laboratories participate in PT schemes which include microbiology culture and isolation (including samples for antibiotic sensitivity tests), immunofluorescence tests, molecular detection of pathogens and haematology (ruminant blood).

In Northern Ireland, AFBI's Veterinary Laboratories participate in an extensive number of PT schemes. Microbiology culture and detection PT schemes include detection of *Bacillus anthracis*, *Taylorella equigenitalis*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa* and antibiotic sensitivity testing. Serological PT schemes include detection of antibodies to *Mycobacterium avium subsp. paratuberculosis*, Bovine Viral Diarrhoea (BVD) virus, Bovine Herpesvirus 1, Bovine Parainfluenza type 3 virus, Bovine Respiratory Syncytial virus (RSV), Porcine Parvovirus, *Neospora*, *Chlamidophylla abortus* (EAE), *Leptospira Hardjo* and the detection of antigen to BVD, rotavirus and coronavirus. Clinical chemistry PT schemes include tissue lead and tissue copper analysis while parasitological schemes include *Trichinella spiralis* and worm and fluke egg detection.

Other PT schemes that AFBI laboratories participate in are for Aujeszky's disease serology, Enzootic Bovine Leukosis virus, Equine Infectious Anaemia, Equine Viral Arteritis, Bluetongue virus *Brucella*

abortus (CFT/SAT & iELISA), *Salmonella* serotyping, *Salmonella* serology, *Mycobacterium bovis*, BSE and Scrapie Immunoblot.

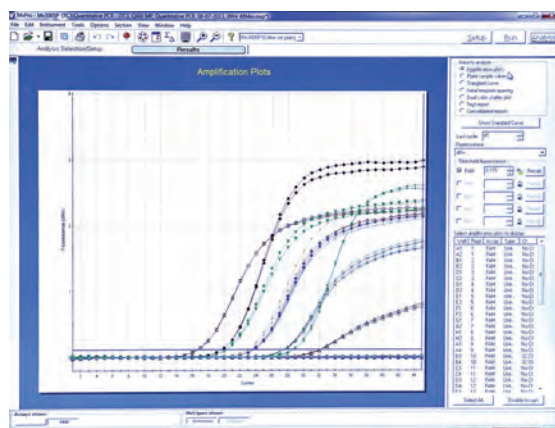


Figure 92: Detection and quantification of Avian Influenza virus by Real-Time Polymerase Chain Reaction (RT-PCR).

DAFM participate in PT schemes for tests for multiple infectious disease agents or the antibodies induced by infection including *Brucella abortus* serology (SAT/CFT and iELISA testing of blood and/or milk samples), *Salmonella* serology, Aujeszky's Disease virus, BVD virus antigen, Bovine Herpesvirus 1, Enzootic Bovine Leukosis, Equine Infectious Anaemia, Equine Viral Arteritis and John's Disease. Other PT schemes include *Salmonella* serotyping, *E.coli* O157 detection, *Mycobacterium bovis* isolation from tissue, BSE and Scrapie immunoblot testing, *Taylorella equigenitalis* isolation and identification and tissue lead and copper analyses.

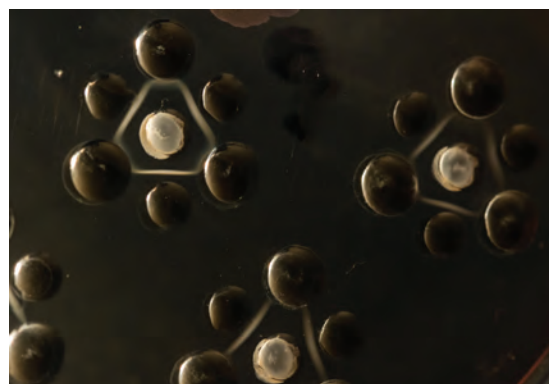


Figure 93: Agar-gel immunodiffusion (AGID) test for the detection of Enzootic Bovine Leukosis (EBL) antibodies.

Parasitology PT schemes include *Trichinella spiralis* and worm and fluke egg detection.

DAFM and AFBI Veterinary Laboratories also participate in a number of clinical chemistry PT schemes, including testing of proteins, metabolites, liver enzymes, major and trace element tests.

In addition, all of the AFBI and DAFM Veterinary Laboratories follow an internal Quality System, which includes internal quality control of sample testing.

Zoonoses

Zoonotic diseases are defined by the World Health Organisation (WHO) as 'a group of infectious diseases that are naturally transmitted between vertebrate animals and humans'. The greatest risk for zoonotic disease transmission occurs at the human-animal interface through direct or indirect human exposure to animals, their products and/or their environments. More than 60 *per cent* of the newly identified infectious agents that have affected people over the past few decades have been caused by pathogens originating from animals or animal products. The emergence of zoonotic disease is complex and multifactorial, driven by factors which include evolving ecology, microbial adaptation, human demographics and behaviour, international travel and trade, agricultural practices, technology and industry. As a result, the agriculture industry is at the front of zoonotic threat and therefore must remain vigilant at all times to prevent the spread and perpetuation of these diseases.

In 2012, DAFM and AFBI veterinary laboratories isolated and positively identified a number of zoonotic agents in the course of disease diagnostics. A few of the most common and indeed, some of the more unusual diseases are discussed below.

Toxoplasmosis

Toxoplasma gondii is a protozoan parasite that infects humans and other warm-blooded animals including sheep. Felines are the only definitive hosts of toxoplasmosis, therefore wild and domestic cats can serve as the main reservoir of infection. Toxoplasmosis is transmitted by consumption of infectious oocysts in cat faeces, through ingestion of tissue cysts in infected meat, and by transplacental transfer of tachyzoites from mother to foetus. *Toxoplasma spp.* is a significant cause of foetal death and resorption, abortion, or stillbirth in sheep and goats.

Animals that are particularly at risk of *Toxoplasma* abortion are those moved late in pregnancy to areas heavily contaminated with cat faeces, particularly common when ewes are housed in barns. In addition, congenital transmission from ewe to lamb can occur in a high percentage of healthy born lambs.

T. gondii is an important zoonosis. Toxoplasmosis is a particular concern for people with immune system dysfunction (HIV positive patients) and for pregnant women, as tachyzoites can migrate across the placenta and cause birth defects in human babies. Infection of women with toxoplasmosis may occur by the methods mentioned above but also through contact with infected materials/fluids produced in ovine abortion.

There were 117 (of 684 submitted cases) confirmed cases of ovine abortion due to *T. gondii* diagnosed on post-mortem examination in Ireland during 2012. In Northern Ireland, there were 100 cases of ovine abortion attributable to *Toxoplasma*. This confirms that toxoplasmosis remains an issue where sheep are lambing and it is a diagnosis readily considered by veterinary practitioners upon foetal loss.

Campylobacteriosis

Campylobacter jejuni is generally asymptomatic in animals, but it can cause significant gastrointestinal symptoms in humans. It is recognised as the most common cause of food-borne gastroenteritis in the world.

The symptoms appear to be most severe in young animals. In calves, signs vary from mild to moderate in severity. Isolation of *C. jejuni* from diarrhoeic faeces is not, in itself, an indication for antibiotic therapy but an indication of a zoonotic risk to anyone regularly handling that animal.

The disease is found worldwide. As with most intestinal pathogens, faecal-oral spread and food- or waterborne transmission appear to be

the principal avenues of infection. Asymptomatic carriers can shed the organism in their faeces for prolonged periods and contaminate food and water.

During 2012, DAFM laboratories isolated *Campylobacter* spp from 306 cases (10 of these cases on post mortem material) out of 4386 samples submitted from practitioners, taken from calves less than one year of age. An additional six isolates were taken from diarrhoeic sheep, whilst a further seven isolates were found in ovine foetuses. In Northern Ireland, one case of campylobacteriosis was diagnosed. In AFBI laboratories, 279 cases of salmonellosis were reported during 2012.

Listeriosis

Listeriosis is a sporadic bacterial infection that affects a wide range of animals, including humans. One of the most pathogenic species of *Listeria* is *Listeria monocytogenes*. The natural reservoirs of *L. monocytogenes* are soil and mammalian intestinal tracts, both of which contaminate vegetation. Grazing animals ingest the organism and further contaminate vegetation and soil.

In adult ruminants, encephalitis or meningoencephalitis is the most frequent form of listeriosis. Aborted foetuses and necropsy of septicaemic animals present the greatest infection hazard to handlers. People can develop fatal meningitis, septicaemia, and papular exanthema on the arms after handling aborted material. Pregnant women should be protected from infection because of danger to the foetus, with possible abortion, stillbirth, and infection of neonates. While human listeriosis is rare, mortality can reach 50 *per cent*. Most cases involve elderly patients, pregnant women, or immuno-compromised people.

In 2012 in DAFM laboratories, *Listeria* spp was isolated in 75 bovine foetuses (of 3632 submitted foetuses), and from 23 ovine foetuses (of 687 submitted foetuses) submitted to the RVLs. In Northern Ireland, AFBI laboratories identified 38 cases of *Listeria* spp through scanning surveillance

and the Veterinary Investigation Diagnostic Analysis (VIDA) in sheep and cattle during 2012. This emphasizes the need to safely handle potentially infective materials.

Cryptosporidiosis

Cryptosporidium spp. is a protozoal organisms parasitic in the intestine of mammals. It is found worldwide, primarily in neonatal calves but also in lambs, kids, foals, piglets and humans. Cryptosporidiosis is considered a cause of varying degrees of diarrhoea in very young farm animals. *C. parvum* is associated with diarrhoea in calves at 5-15 days of age. *C. parvum* is also a common enteric infection in young lambs and goats.

Domestic animals may act as a reservoir for infection of susceptible humans. *Cryptosporidium* spp is considered to be a relatively common non-viral cause of self-limiting diarrhoea in immunocompetent persons, particularly children. The infection is transmitted predominantly from person to person, but direct infection from animals and waterborne infection from contamination of surface water and drinking water by domestic or wild animal faeces can also be important. Animal handlers on a calf farm can be at high risk of infection due to cryptosporidiosis transmitted from infected calves.

In humans, cryptosporidiosis can be asymptomatic or cause watery diarrhoea, stomach cramps and stomach upset and a mild fever. Symptoms of cryptosporidiosis can appear two to ten days after infection and usually lasts about two weeks.

During 2012, *Cryptosporidium* spp. oocyst antigen was detected in the intestinal contents of 104 calves with a history of diarrhoea sampled post mortem at DAFM Regional Laboratories.. In addition, there were 1240 positive detections (out of 4637) in faecal samples submitted by veterinary practitioners to the Regional Veterinary Laboratory service. The majority of these samples were taken from diarrhoeic calves and lambs.

Q fever

Coxiella burnetii causes Q fever, which is a zoonotic bacterial infection associated primarily with parturient ruminants, especially sheep, goats and cattle. Infection in ruminants is usually subclinical but can cause infertility and sporadic late abortion with a necrotizing placentitis.

The greatest risk of transmission occurs at parturition by inhalation, ingestion, or direct contact with birth fluids or placenta. In farms, farmers and veterinarians are most at risk during calving and lambing. The organism is also shed in milk, urine, and faeces. The majority of outbreaks in people have been associated with wind dispersion of desiccated reproductive products, contaminated with *C. burnetii*, from sites where sheep, goats, or cattle are kept. Ticks may transmit the disease among domestic ruminants, but are not thought to play an epidemiologically important role in transmission of disease to humans. In humans, Q fever has a highly variable clinical presentation, ranging from a self-limiting influenza-like illness to pneumonia, hepatitis, and endocarditis.

In 2012, 20 serology positive samples were detected in 402 bovine blood samples submitted by practitioners in DAFM laboratories. Eleven samples (vaginal swabs or placentae) were submitted from sheep that had aborted and 1 sample was also taken from a nanny goat that had aborted, and all of these were negative. No cases were reported in Northern Ireland.

Salmonellosis

Salmonellosis is caused by many species of salmonellae and is characterized clinically by one or more of 3 major syndromes—septicaemia, acute enteritis, and chronic enteritis. Young calves, piglets, lambs, and foals usually develop the septicaemic form. Adult cattle, sheep, and horses commonly develop acute enteritis, and chronic enteritis may develop in growing pigs and

occasionally in cattle. Pregnant animals may abort. Asymptomatic carriers are a zoonotic risk in all host species.

The incidence of human salmonellosis has increased in recent years, and animals have been incriminated as the principal reservoir. Transmission to humans occurs via contaminated drinking water, milk, meat, and food mixes that use contaminated ingredients; poultry and eggs are particularly important sources of infection. While many other *Salmonella* species may cause disease, the more common ones are *Salmonella* Typhimurium and Dublin in cattle and *S. Typhimurium*, Dublin and Montevideo in sheep and goats.



Figure 94: Terminal gangrene in a calf's foot associated with *Salmonella* Dublin infection. (Photo: Dónal Toolan).

Salmonellosis results in irritation and inflammation of the digestive tract, which leads to symptoms such as abdominal pain, nausea, fever and diarrhoea. Salmonellosis is more likely to occur and cause serious complications in people with weakened immune systems due to such conditions as HIV/AIDS, cancer, diabetes, or taking steroid medications or undergoing chemotherapy. Others at risk include older adults, infants, children, and pregnant women.

In 2012, three-hundred and ninety *Salmonella* isolates were identified in DAFM Regional Laboratories, in samples taken from carcasses and

from other bovine submissions. Forty-four were identified as *Salmonella* Typhimurium isolates and 343 as *S. Dublin* isolates (mainly from abortions and still births). Additionally, there were 19 isolates of *Salmonella* identified in tissues of ovine origin, of which 16 were characterized as *S. Dublin*, 1 was *S. Mbandaka*, 1 was *S. arizonae* and 1 was *S. diarizonae*.

Surveillance of epizootic diseases

Bluetongue virus

In Ireland during 2012, DAFM virology division based in CVRL tested 4407 cattle for Bluetongue (BT) antibody following importation with 1545 samples (35 *per cent*) proving antibody positive. In addition 4428 cattle were tested for BT virus (BTV), all of which were negative.

Of 133 sheep and goats tested following importation for BT antibodies, 26 (20 *per cent*) were positive while none of the 234 sheep tested for BT virus following importation were positive.

During 2012, there were 11 bovine clinical investigations conducted by DAFM in live animals with 19 animals sampled by the RVLs. There were five bovine, one ovine and one caprine post-mortem investigations by the RVLs. All tests proved negative for BT virus.

In Northern Ireland during 2012 the Immunodiagnostic Branch of AFBI tested 2589 cattle following importation for BTV antibody with 784 (30 *per cent*) proving positive. A surveillance sample of 1,668 indigenous cattle was tested for BTV antibody, none of which were positive. The Virology Branch of AFBI tested 2,496 cattle and 17 sheep following importation, all of which proved negative for BT virus.

Bovine spongiform encephalopathy (BSE)

During 2012, BSE was confirmed in three animals in Ireland. All samples from positive animals were detected in the Rapid Testing Laboratories (active surveillance) and forwarded to the National Reference Laboratory (NRL) for confirmatory diagnosis. Samples from 14 clinical suspect cases (passive surveillance) were received for

confirmatory diagnosis. None of these were confirmed as positive for BSE. Table 20 shows a breakdown of the histopathological diagnoses reached for these cases:

| H&E Result | Number of Cases |
|------------------------------|-----------------|
| Listerial Encephalitis | 3 |
| CNS abscess | 1 |
| Non-suppurative Encephalitis | 1 |
| No Specific Findings | 8 |
| Eosinophilic Meningitis | 1 |
| Total | 14 |

Table 20: Histopathological Diagnoses for BSE Clinical Suspects in Irish NRL during 2012.

In Northern Ireland during 2012, AFBI confirmed BSE in one fallen bovine animal which had been identified by the active surveillance programme. There was one clinical suspect submission which was confirmed as negative for BSE by the laboratory.

Scrapie

During 2012, twelve cases of scrapie were confirmed in Ireland by the NRL. Eight of these cases were classified as classical scrapie and four were classified as atypical scrapie.

The eight confirmed cases of classical scrapie came from five flocks; all were identified through active surveillance. One flock had four cases with the remaining four flocks having only a single case each. All the atypical cases were identified through active surveillance with only one case being detected in each flock. Co-existence of classical and atypical was not detected in any flock during this year. Furthermore, all samples were tested by Discriminatory Western Blotting to differentiate between scrapie and BSE in sheep and were reported as “scrapie-like” in 2012.

One case of scrapie was confirmed in Northern Ireland during 2012. This had been identified through the active surveillance programme. Tissue was submitted to the National Reference Laboratory (AHVLA) and was confirmed as atypical scrapie. In addition, there was one scrapie suspect sheep which was confirmed as negative by the laboratory.

Foot-and-Mouth disease

There has not been an outbreak of foot-and-mouth disease (FMD) on the island of Ireland since 2001. Below is presented a case report of bullous epidermolysis in a calf in which FMD was considered as a differential diagnosis.

A two-day-old male twin calf that had bled from the navel after birth was presented to Kilkenny RVL. The bleeding had stopped spontaneously but the calf was unwilling to rise and was put down.

Gross lesions consisted of large ulcers (up to 5×3 cm) on the muzzle (Figure 97), on the dorsum of the tongue (Figure 96) and under the tip of the tongue. There was no lifting of the epithelium at the edges of the lesions. All limbs had lesions on the coronet (Figure 95); some were fluid filled swellings (up to 4 cm × 1.5 cm) and others had ulcerated. The attachment of the hoof horn to the underlying tissue of some digits had loosened but no hooves had been shed. There were no interdigital lesions. There were several areas of hairless red skin, many on pressure points such as hock, fetlock and carpus (Figure 98), but also lesions on rear surfaces of pinnae of ears and on base of tail.

FMD was considered but was ruled out on the nature and distribution of the lesions and on the fact that the dam and twin of this calf were not affected and that no animals had recently been introduced to the farm. PCR for FMD virus was negative.

Bullous epidermolysis was diagnosed on histology. It is an uncommon genetic condition in which the bonds between cells of the epidermis are defective, leading to bulla formation and ulceration. The condition is interesting because of its similarity to the lesions of Foot and Mouth Disease.



Figure 95: Bullous epidermolysis in a 2-day-old calf. Above; lesion on coronet (Photo: Dónal Toolan)



Figure 96: Ulceration of tongue and dental pad (Photo: Dónal Toolan)



Figure 97: Bullous epidermolysis; ulceration of muzzle (Photo: Dónal Toolan)



Figure 98: Bullous epidermolysis: areas of red hairless skin on carpus and fetlocks (Photo: Dónal Toolan)

A selection of diagnostic investigations

Arthritis in calves

Cork RVL investigated a dairy herd with high incidence of arthritis in two to four month-old calves and no reported cases of navel-joint-ill syndrome. Arthritis affected mainly the stifle joint and, in most cases, only one joint was involved. Attempts at sampling affected joints were unsuccessful.

Calves were fed meal and milk from cows being treated for mastitis. Milking cows were performing well; there were no respiratory symptoms or arthritis among the milking cows, only occasional cases of mastitis. Of three milk samples collected for testing, two were *Mycoplasma bovis* PCR positive.

Post-Mortem examination of a calf revealed polyarthritis characterised by fibrinosuppurative synovitis and tenosynovitis (Figure 99). Joint fluid and tissue were *Mycoplasma bovis* PCR positive. Advice was given regarding prevention and treatment and no further cases were reported.



Figure 99: Stifle joint of a calf with *Mycoplasma bovis* arthritis. Tenosynovitis (Photo: Cosme Sánchez-Miguel)

Problem caused by *Dictyocaulus viviparus* in a dairy herd

Athlone RVL investigated a dairy herd with a recurrent milk drop syndrome that had worsened on 2012, when morbidity had reached 90-100 *per cent*. Reduction in milk production lasted 10-14 days; cows recovered without treatment.

On further investigation, there was also a seasonal (grazing), concurrent, respiratory problem, characterised by increased respiratory rate, clear nasal discharge and pyrexia.

Farm parasitic control protocol consisted of worming calves with ivermectin every 4-6 weeks during their first grazing season. Yearlings were treated with Eprinex twice a year and cows were treated with Eprinex once a year. Herd owner reported no improvement after treatment of those coughing cows treated in 2012.

Prior to RVL visit, moderate levels of liver fluke antibodies were consistently present in bulk milk samples; rumen fluke eggs were found in several faecal samples and IBR serology was negative.

Test results showed no evidence of other common viruses (BVD) or infections (Q fever, *Mycoplasma bovis*). Serum Copper levels were normal. Faecal samples were positive for rumen and liver fluke eggs.

With no evidence of viral involvement, it was proposed that concurrence of respiratory signs and milk drop while at pasture were due to pre-patent hoose infection/re-infection syndrome. Non-responsiveness to Eprinex was probably due to a secondary, untreated, bacterial infection.

Furthermore, based on tests results, there was an underlying liver fluke problem which was probably causing enough immunosuppression to allow the perpetuation of mild bacterial pneumonia, secondary to primary *Dictyocaulus* infestation.

In addition, excessively frequent dosing of calves on the farm, followed by limited parasitic control in the adult dairy herd, would predispose cows to this problem.

Re-infection syndrome or acute larval migration syndrome is a less common manifestation of lungworm infestation. Clinical signs of coughing, milk drop, increased respiratory rate and pyrexia are caused by immature lungworm larvae migrating through lungs of adult cattle, symptoms apparent in the dairy herd investigated. In general, affected cows mount an immune response to migrating larvae that leads to varying levels of clinical signs, which are often very mild. However, in mild and wet weather conditions and in farms where lungworm is endemic, cows may be suddenly exposed to large numbers of larvae, leading to an exaggerated immune response and acute signs of disease (milk drop syndrome, pyrexia, increased respiratory rate and coughing), as seen in this herd. This immune response is sufficient to prevent lungworms reaching maturity; consequently, there will be no eggs or larvae detected in faecal samples and bulk milk lungworm ELISA tests will be negative, again, as was the case in this herd.

Respiratory disease in young calves

Sligo RVL investigated a dairy herd with an ongoing respiratory problem in young calves which peaked once the majority of the cows had calved.

During farm visit, deficiencies in the calf house were noted. Mainly, poor air circulation (confirmed by a smoke dispersion test performed in the shed with closed doors) and a sloped floor. The latter facilitated the pooling of urine that in turn led to the release of ammonia, which has a deleterious effect to the respiratory system.

Suggestions included measures to improve air circulation (removal of a loft above calf pens, partial removal of walls, space boarding) and placing calves in the pens less susceptible to draughts.

Problem with non-sucking calves and calf mortality

Kilkenny RVL investigated a mixed farm (75 *per cent* dairy, 25 *per cent* beef & sheep) that had problems with non-sucking calves and increased calf mortality.

Sheep were usually vaccinated against *Toxoplasma gondii* but no vaccination was carried out on 2012, when abortion rate was roughly 10 *per cent*, with *Toxoplasma* as confirmed aetiology.

The herd owner used a lambing shed for calves as they were taken off dams. Bedding in calving pens and calf sheds was a deep bedding system changed every 6-7 weeks.

Typical cases were calves not sucking, appearing slow and dopey. However, calves were standing relatively quickly after birth and not showing signs of respiratory distress.

Several calves were hypoglobulinaemic, indicating incomplete colostral transfer, some had antibodies for *Leptospira* spp and all but one had BVD antibodies. Antibodies were probably maternally derived but, as dams were not vaccinated, positive antibody titres suggested past or active *Leptospira* and BVD infections within the adult herd. *Cryptosporidium* spp. was also detected in faeces.

One cow was down on the day of the visit; the herd owner was adamant this was the only case and that there was no incidence of retained membranes or displaced abomasums.

Dry cow samples tested for calcium and iodine revealed values within normal range. Samples from pre and post-calving cows showed some marginally low levels of serum copper.

Suggestions to the herd owner included stomach tubing newborn calves, to guarantee adequate colostral intake; an active survey and control of

BVD; a *Leptospira* control programme; considering addressing marginal copper deficiencies and a review of management practices, in particular management of calving and calf pens, with regular changing of bedding, disinfection and modifications of existing facilities to minimise pathogen build up.

Abortions in a dairy herd

Limerick RVL investigated a dairy herd with an abortion problem. Animals examined were in good body condition for calving. Adult herd was vaccinated for leptospirosis and dosed twice during winter while housed.

On September 2011 there were five abortions. In most cases, only foetal membranes were found and no samples were submitted to RVL. There were no further abortions until January 2012.

After the first wave of abortions, nine cows were tested for *Neospora caninum*; they were all positive for antibodies. Two bulk milk samples were negative for *N. caninum* antibodies.

On January 2012, three foetuses, along with maternal bloods, were sent to Limerick RVL. In one case both foetal and maternal samples were positive for *N. caninum* antibodies. In another case, only maternal blood was positive for maternal antibodies. On the third case, foetus and maternal samples were negative for *N. caninum* antibodies.

All maternal bloods had inconclusive titres for *Salmonella* Dublin and no bacterial agent was isolated from any of the foetuses.

Thirteen cows were blood sampled. All samples showed BVD antibodies (no vaccination in place); three samples had antibodies for *N. caninum* and four (older cows) had antibodies for IBRgE (wild strain).

Additionally, 112 animals in the herd were tested for *N. caninum*; nine had antibodies and their family tree (dam, sisters and offspring) was detailed and

investigated. A BVD PI animal has since been identified in the farm.

It was proposed that *Neospora caninum* infection had an important role in the abortion problem and that BVD was having an immunosuppressive effect in the herd. The role of IBR was unclear as the younger population appeared to be naïve.

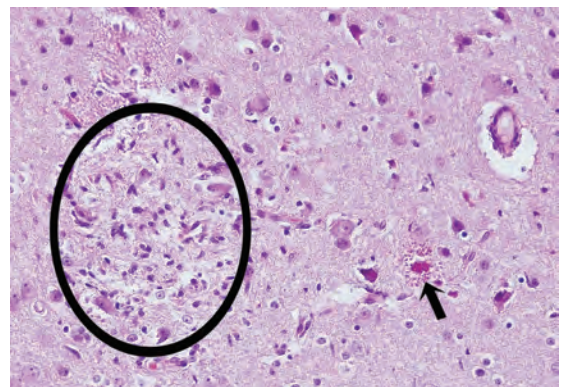


Figure 100: H&E section of bovine brain showing gliosis (circle) caused by *Neospora caninum* infection. Tachyzoites shown by arrows. (Photo: Mercedes Gómez-Parada)

Recommendations included:

1. *Neospora caninum* control programme that included testing all female population in the herd later in the year; not breeding from and culling the animals testing positive for *N. caninum* at least twice; measures to control infection (temporary isolation of aborting animals, limiting access to food and water sources of domestic and wild canids –definite hosts-)
2. BVD herd screening to determine if there are more PI animals.

Caffeine poisoning

Athlone RVL investigated cases of sudden death of store cattle. The affected animals were 9-18 months of age and weighed approximately 250-400 kgs. It was reported that some of the animals

became agitated and showed unusual signs shortly after they were fed concentrates which contained a white powder mixed in with it. Four animals died in the hours following consumption of the concentrate feed. In addition the farm dog which had licked or eaten some of the meal and white powder became incoordinated and was found dead two days later on the farm. Other animals in the herd that had ingested the concentrate ration began showing acute neurological signs progressing quickly to lateral recumbency and death. Signs described were “rolling eyes”, incoordination, muscle tremors, lip-smacking, salivation and opisthotonus. The surviving animals on the following day were agitated (constantly moving), licking compulsively and drinking a lot of water. A sample of the white powder from the bag of concentrate meal was taken, along with bloods from the affected animals and tested in the laboratory. The owner delivered two carcasses to the laboratory for post-mortem examination.

The concentrate bulk bag had a label that said ‘caffeine anhydrous’ with warning signs indicating danger. The white powder tested in the State laboratory was confirmed to be 98 *per cent* pure caffeine. Based on the history of feeding pure caffeine to the affected animals (and that animals not fed this substance were unaffected), the clinical signs exhibited and previous reports from other countries, a diagnosis of caffeine toxicity was made.

A selection of abstracts from published scientific papers

Seroprevalence of Louping Ill virus (LIV) antibodies in sheep submitted for post-mortem examination in the North West of Ireland in 2011

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² Centre for Veterinary Epidemiology and Risk Analysis, School of Veterinary Medicine, University College Dublin, Belfield, Dublin 4, Dublin, Ireland *Irish Veterinary Journal* 2011, 64:10 doi:10.1186/2046-0481-64-10 <http://www.irishvetjournal.org/content/64/1/10/> © 2011 Lorenz *et al*; licensee BioMed Central Ltd.

Blood samples were collected opportunistically at routine post-mortem examination from 199 sheep which came from 152 flocks. The location of each submitting flock was mapped. Sera were tested using a goose blood haemagglutination inhibition assay for louping ill virus. There was an animal level prevalence of 8.5 *per cent*, and a flock level prevalence of 9.8 *per cent*. The greatest proportion of seropositive animals was identified among the animals older than 24 months of age. The elevation of the land associated with positive flocks was greater than that of negative flocks. Lesions of non-suppurative meningoencephalitis were observed in three of the 199 animals.

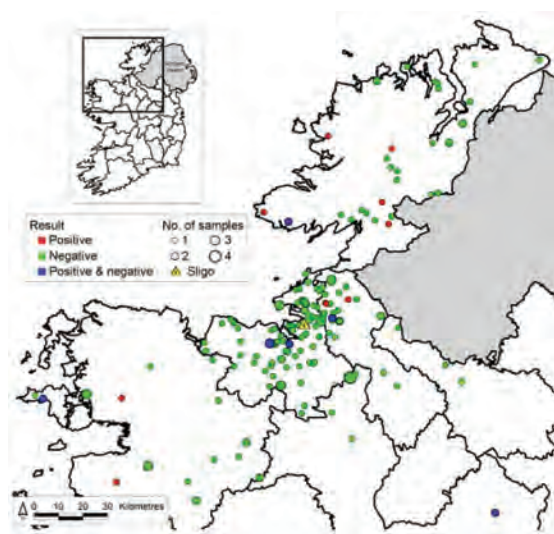


Figure 101: Location of sampled sheep flocks for a survey of seroprevalence of Louping Ill virus in the North West of Ireland

***Fasciola hepatica*: a light and electron microscope study of sustentacular tissue and heterophagy in the testis**

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In order to investigate cytolytic activity in the testis of *Fasciola hepatica*, flukes belonging to several different triclabendazole (TCBZ)-sensitive and TCBZ-resistant isolates, and wildtype flukes from field infections, were studied by light and electron microscopy with a view to identifying sites of heterophagy and macromolecular hydrolysis. At the periphery of the testis tubules in all the flukes

examined, large euchromatic nuclei, each bearing a prominent nucleolus, were seen. These were invested with a thin cytoplasmic layer, extensions of which partially enveloped and probably supported the neighbouring spermatogonia. No lateral cell boundaries were identified in this tissue, possibly indicating syncytial organisation. The tissue, considered to be analogous to Sertoli cells in vertebrate testis, was identified as sustentacular tissue. It displayed cytoplasmic features consistent with protein/glycoprotein synthesis (through a granular endoplasmic reticulum-Golgi mediated mechanism) and intracellular digestion/heterophagy (through a lysosomal system). The intracytoplasmic hydrolytic activity of the sustentacular tissue probably serves to scavenge effete cells and cytoplasmic debris, to recycle useful molecules, to promote spermatozoon maturation and possibly to aid osmoregulation within the tubules. Certain protein-containing macromolecules synthesised in the sustentacular tissue may contribute to the seminiferous fluid, or have pheromonal activity. The presence of numerous mitochondria and abundant smooth endoplasmic reticulum is consistent with facilitation of inward and outward movement of micromolecular nutrients, metabolites including excretory products and water. In the sustentacular tissue of certain flukes with dysfunctional spermiogenesis, there was increased heterophagic and cytolytic scavenging activity. The cytoplasmic residual vacuoles remaining after the release of spermatids were also identified as possible sites for lysosome-mediated intracellular digestion and osmoregulation in the testis tubules of *F. hepatica*.

Unusual mortality of Pinnipeds in the United Kingdom associated with Helical (Corkscrew) Injuries of Anthropogenic Origin

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Aquatic Mammals, 38(2), 229-240, DOI <http://dx.doi.org/10.1578/AM.38.3.2012.229>, courtesy of "Aquatic Mammals"

Between June 2008 and December 2010, 76 dead pinnipeds were found on the coast of the United Kingdom with peculiar injuries consisting of a single continuous curvilinear skin laceration spiralling down the body. The skin and blubber had been sheared from the underlying fascia and, in many cases the scapula also had been avulsed from the thoracic wall. Although previously unreported in the UK, similar distinctive lesions had been described in Canadian pinnipeds where they were referred to as corkscrew injuries. In the UK, identical injuries were seen in both native species of pinniped, with 43 harbor seals (*Phoca vitulina*) (57 *per cent*) and 26 grey seals (*Halichoerus grypus*) (34 *per cent*) affected, and seven carcasses (9 *per cent*) for which the species could not be determined. There were two apparent seasonal peaks in incidence; predominantly adult harbor seals were discovered during the summer and juvenile grey seals during the winter. Post-mortem examinations of 20 harbor seals revealed they had been alive and healthy when the injuries were sustained, with no evidence of any underlying disease or disability. Based on the pathological findings, it was concluded that mortality was

caused by a sudden traumatic event involving a strong rotational shearing force. The injuries were consistent with the animals being drawn through the ducted propellers of marine vessels and, in some cases, there was a direct correlation with the presence of work boats operating in the vicinity. This challenges the conclusions of a previous study in Canada that suggested natural predation by Greenland sharks (*Somniosus microcephalus*) was likely to be responsible for these injuries

A Selection of other peer-reviewed scientific publications by AFBI and DAFM laboratory staff in scientific journals published during 2012

D.J. Barrett. (2012) BVD eradication: lessons from a pilot scheme. *Veterinary Record* 170: 71-72

C. J. Bell, P. Blackburn, IAP Patterson, S. Ellison and H. J. Ball. (2012) Real-time PCR demonstrates a higher prevalence of *Mycoplasma bovis* in Northern Ireland compared with sandwich ELISA. *Veterinary Record* 171:402

M. McConville, R.E.B. Hanna, G.P. Brennan, H.W.J. Edgar, S. McConnell, M. McCoy, R. Castillo, A. Hernandez-Capos, I. Fairweather. (2012) Impact of compound alpha treatment *in vivo* on egg production by the liver fluke, *Fasciola hepatica*. *Veterinary Parasitology* 187: 183– 195.

P.E. Kajugu, R. E. B. Hanna, H. W. Edgar, F.L. Forster, F. E. Malone, G. P. Brennan, I. Fairweather. (2012) Specificity of a coproantigen ELISA test for fasciolosis: lack of cross-reactivity with *Paramphistomum cervi* and *Taenia hydatigena*. *Veterinary Record* 171: 502.

C. McMahon, A.W. Gordon, R.E.B. Hanna, G.P. Brennan, I. Fairweather. (2012) The effects of climate change on ovine parasitic gastroenteritis determined using veterinary surveillance and meteorological data for Northern Ireland over the period 1999-2009. *Veterinary Parasitology* 190: 167–177.

S.M. Walker, P.A. Prodöhl, E.M. Hoey, I. Fairweather, R.E.B. Hanna, G. Brennan, A. Trudgett. (2012) Substantial genetic divergence between morphologically indistinguishable populations of *Fasciola* suggests the possibility of cryptic speciation. *International Journal for Parasitology* 42: 1193–1199.

Laboratories



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Stormont (Belfast)



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