An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

afbi
AGRI-FOOD & BIOSCIENCES INSTITUTE

All-Island Animal Disease Surveillance Report

2024

This document has been compiled in collaboration with:

- Department of Agriculture, Food and the Marine of Ireland (DAFM)
- Agri-Food & Biosciences Institute, Northern Ireland (AFBI)
- Animal Health Ireland (AHI)

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Introduction

We are delighted to present another All-Island Animal Disease Surveillance Report. Our joint introductions to these reports typically focus on the disease threats that our scanning surveillance systems are set up to detect. These threats continue, needless to say. However, while we continue our vigilance for clear and present dangers like highly pathogenic avian influenza, and imminent threats like bluetongue, it seems appropriate to recognise also the people who underpin this system. By that we don't just mean the vets, scientists and support staff in our laboratories in both jurisdictions, but also the private veterinary practitioners and animal keepers who select and submit the caseload that enables us to conduct this annual surveillance work. While we strive to solve the immediate animal health or production loss they are facing through *post mortems* and laboratory tests, we recognise this is a partnership that provides us with the raw material that we base our disease surveillance data on. We thank them for their collaboration and look forward to continuing it. We must pay special tribute to the contributors from the AFBI and DAFM who compile this report year after year, in particular Cosme Sánchez-Miguel and Aideen Kennedy as editors. This report is produced entirely from within existing resources of both organisations, from data compilation and analysis through to design and distribution, and it is a mammoth task. We truly appreciate the input of all involved.

This system of scanning surveillance is shared by other countries in this part of the world, and both of our organisations are active members of the European Veterinary Surveillance Network, which brings together organisations who operate similar surveillance systems in the UK and Europe. DAFM hosted the 15th annual EVSN conference in Backweston in September 2025 and the 16th meeting moves to Belfast in September 2026. We look forward to another chance to meet colleagues with similar roles and interests from nine participating organisations, and the lively discussions and information exchange that are a feature of these annual events.

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1st November 2025

Preface

This All-Island Animal Disease Surveillance Report (AIADSR) marks the nineteenth edition of our annual report on animal disease surveillance, and the twelfth to be produced in collaboration with our partners at the Agri-Food and Bioscience Institute (AFBI), Northern Ireland, and Animal Health Ireland (AHI).

For the sixth consecutive year, we have relied primarily on R and LaTeX for data analysis and report compilation. These tools continue to serve as ideal platforms for processing, visualizing, and formatting complex datasets. For a second year, we've embraced Quarto—a modern, versatile evolution of R Markdown from Posit—which allows us to simultaneously undertake the data analysis, produce the tables and charts, insert images and compile all in a PDF document and HTML webpage with identical content. We trust that this approach helps showcase the surveillance efforts of the various institutions contributing to this report.

While the AIADSR is primarily aimed at Private Veterinary Practitioners, it is designed to serve a broader audience, providing essential animal health surveillance insights to a wide range of stakeholders. As in previous editions, we've made a concerted effort to present the data in an accessible manner, featuring numerous tables, vibrant charts, and photographs to clearly convey the information collected by the Veterinary Laboratory Service (VLS) of the Department of Agriculture, Food and the Marine (DAFM), Animal Health Ireland and The Agri-Food and BioSciences Institute in Northern Ireland.

The content presented here offers a representative snapshot of the critical animal disease surveillance work being conducted by the Veterinary Laboratory Services (DAFM), The Agri-Food and BioSciences Institute (AFBI), and Animal Health Ireland (AHI) across the island of Ireland.

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The 2024 All-Island Animal Disease Surveillance Report (AIADSR) is the result of the collective efforts of a dedicated team from the Veterinary Laboratory Service (VLS) at the Department of Agriculture, Food and the Marine (DAFM) in Ireland, the Agri-Food and Bioscience Institute (AFBI) in Northern Ireland, and Animal Health Ireland (AHI). Alongside the veterinary officers, an invaluable network of colleagues, including laboratory technicians, clerical staff, and laboratory attendants, has provided essential support, making this report possible.

We would like to extend my sincere thanks to all those who contributed, both directly and indirectly, to the 2024 AIADSR. In particular, our gratitude goes to Aideen Kennedy (Kilkenny RVL) current editor, Marie Claire McCarthy (ex-Cork RVL), and Ian Hogan (Limerick RVL) for their efforts in coordinating various sections of the report, offering invaluable advice, and meticulously proofreading the text. We also wish to thank Maria Guelbenzu and Liam Doyle from AHI, as well as Siobhan Corry and her team at AFBI, for their collaboration in this report.

Lastly, we wish to acknowledge the continuos support of Mícheál Casey (Director of the Regional Veterinary Laboratories) and our colleagues at the Cork Regional Veterinary Laboratory, Jim O'Donovan, Mercedes Gómez-Parada, and Ciara Hayes, whose encouragement and assistance have been vital throughout this project.

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Part I.

Cattle

1. Overview of Bovine Diseases

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1.1. Introduction

The Department of Agriculture, Food and the Marine (DAFM), through its laboratory network carries out part of its surveillance role by gathering data from carcass and clinical sample submissions made by farmers through the network of private veterinary practices. Data presented in this section relates to the most-common causes of death diagnosed in bovine carcasses submitted for *post mortem* examination during 2024. The data reflects those cases where the private veterinary practitioner has deemed it appropriate for the farmer to submit a carcass for post-mortem examination and where the farmer has then taken the time to travel to the laboratory.

During 2024, 2316 bovine carcasses, excluding foetuses, were submitted for post-mortem examination. The submitting herds have been categorised as *Dairy*, *Beef/suckler* and *Other* depending on their type (as defined in DAFM's Animal Health Computer System, the database used to manage animal welfare and disease monitoring and control). The *Other* category includes feedlot, dealer and herds whose dominant enterprise is neither dairy, beef, nor suckler.

Information Note

It should be noted that the examining pathologist can only assign one cause of death to each animal submission. In some cases, more than one system may be affected by disease e.g. a calf may have gross lesions of enteritis and pneumonia or joint ill and enteritis. If the lesions are not considered to be linked, as they might be in the case of a systemic infection (sepsis), then the pathologist assigns the cause of death to the condition considered to be the most significant.

1.2. Neonatal Calves (birth to one month of age)

The most commonly diagnosed causes of death in this group are presented in Table 1.1 and Figure 1.3.

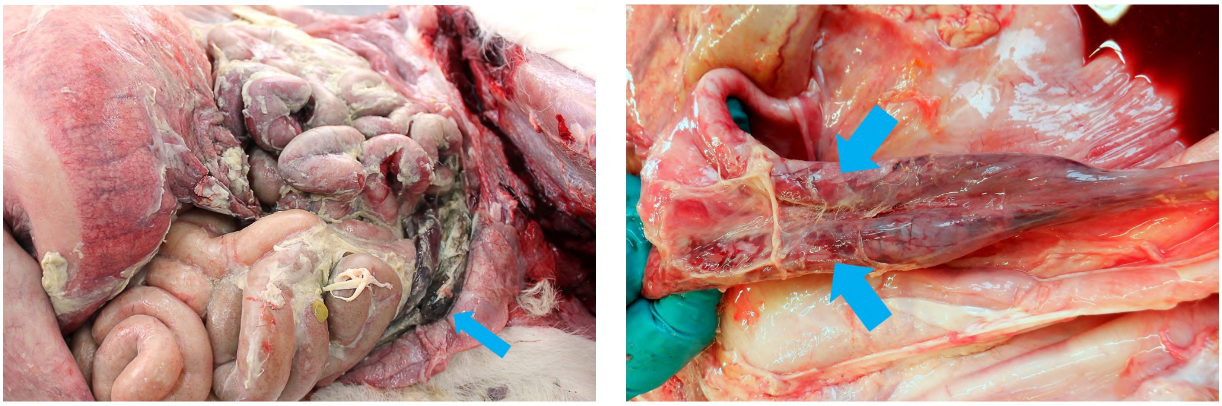
Gastrointestinal tract (GIT) infections continue to be the most diagnosed cause of death in calves in 2024 at 28.5 *per cent* overall (Table 1.1 and Figure 1.3) which is marginally higher on the 2023 overall figure of 25.6 *per cent*. A closer look at the 2024 findings indicates that the rate of GIT infections for dairy calves was 32.8 *per cent*, the same rate as for 2023. While for the beef/suckler category the figure was lower compared to dairy at 26 *per cent*, it also represents an increase in gastrointestinal infection rate in beef/suckler which stood at 19.4 *per cent* in 2023.

Gastrointestinal infections are discussed in more detail in the chapter on neonatal enteritis (Section 4.1).

Table 1.1.: Conditions most frequently diagnosed on *post mortem* examinations of bovine neonatal calves in 2024 (n= 606).

Category	Beef/Suckler	Dairy	Other	Total	Percentage
GIT system infections	87	81	5	173	**28.5**
Systemic infections	65	36	3	104	**17.2**
Respiratory system infections	36	44	2	82	**13.5**
Navel and joint ill complex	29	22	0	51	**8.4**
GIT ulcer, perforation and peritonitis	22	20	3	45	**7.4**
Hereditary and developmental abnormalities	21	14	2	37	**6.1**
GIT torsion and obstruction	16	10	3	29	**4.8**
Other	18	4	2	24	**4.0**
Diagnosis not reached	9	4	2	15	**2.5**
Nutritional and metabolic conditions	9	6	0	15	**2.5**
Clostridial disease	7	2	0	9	**1.5**
Integument and musculoskeletal conditions	7	2	0	9	**1.5**
Trauma	6	1	0	7	**1.2**
Urinary tract conditions	5	1	0	6	**1.0**

Note:
Categories that have less than five cases have been included in the 'Other' category.



(a) Fibrinous peritonitis and omphalitis

(b) Omphalitis

Figure 1.1.: Fibrinous peritonitis (a) as a result of a infection in the umbilical arteries (omphalitis, arrow). Photo: Cosme Sánchez-Miguel. (b) Swollen umbilical arteries (omphalitis) with deposition of fibrin (navel-ill). Photo: Aideen Kennedy.

Colostrum feeding

Colostrum feeding is crucial to ensure the survival and health of young calves. Calves are born with low levels of antibodies, and it is essential that they receive the antibody-rich colostrum from their dam in the first few hours of life. This is a vital step in reducing the incidence of neonatal calf disease and death. Colostrum status can also markedly affect overall calf performance in the first weeks and month of life.

As was the case in 2023, systemic infections were the next most common diagnosis after GIT infections. Such infections were associated with 17.3 *per cent* of the neonatal calf deaths. A systemic infection spreads via the hematogenous route and typically affects many organs. The most common systemic infections seen in neonatal calves are *E. coli* septicemia but *Salmonella spp.* and *Pasteurella spp.* infections are also found.

Colostrum management plays a vital role in calf health. Ensuring that the calf gets an adequate volume of high-quality colostrum in the first hours of life is an important management practice. Diseases associated with poor colostrum intake include systemic infections, navel ill/joint ill (Figure 1.1), and respiratory infections.

In 2024, systemic infections were marginally more common in beef calves than dairy calves (19.4 *per cent* beef/suckler, 15 *per cent* dairy). While the rate in the beef sucker category was a marginal increase on 2023 (17.7 *per cent*), the 2024 figure of 15 *per cent* for dairy is markedly down on the 2023 rate of 22 *per cent*.

For beef/suckler there was a marginal increase in respiratory system infections (12.7 *per cent* in 2023 versus 10.6 *per cent* in 2024). The increase was more marked in dairy (10.6 *per cent* in 2023 versus 17.8 *per cent* in 2024).

Regarding navel ill and joint ill complex, there was a marginal drop in the rate for beef suckler (10.6 *per cent* in 2023 versus 8.4 *per cent* in 2024), however, again, a marked increase was seen in dairy (2.1 *per cent* in 2023 versus 8.9 *per cent* in 2024).

(a) Internal hydrocephalus

(b) External hydrocephalus

Figure 1.2.: Accumulation of abnormal amounts of cerebrospinal fluid in the cranial cavity. This accumulation can occur in the cerebral ventricles (internal hydrocephalus (a)) or under the meninges (external hydrocephalus, green arrow,(b)). Note also cleft lip in this calf (green arrow) Photos: Cosme Sánchez-Miguel.

Autolysis (decomposition) of tissues

Autolysis of tissues reduces the sensitivity of most tests. In some cases, poor preservation may render the carcass completely unsuitable for laboratory examination. It is vey important, therefore, to ensure delivery of carcasses to the laboratory as soos as possible after they are discovered.

In the hereditary and developmental abnormality category, 37 cases (6.0 *per cent*) were recorded in the birth-to-one-month age category, an increase on 2023 (4.9 *per cent*).

Typically, such abnormalities may be circulatory in origin such as septal defects detected in the heart, gastrointestinal (mostly atresia), neurological such as congenital hydrocephalus (Figure 1.2) or abnormalities of the genito-urinary system.

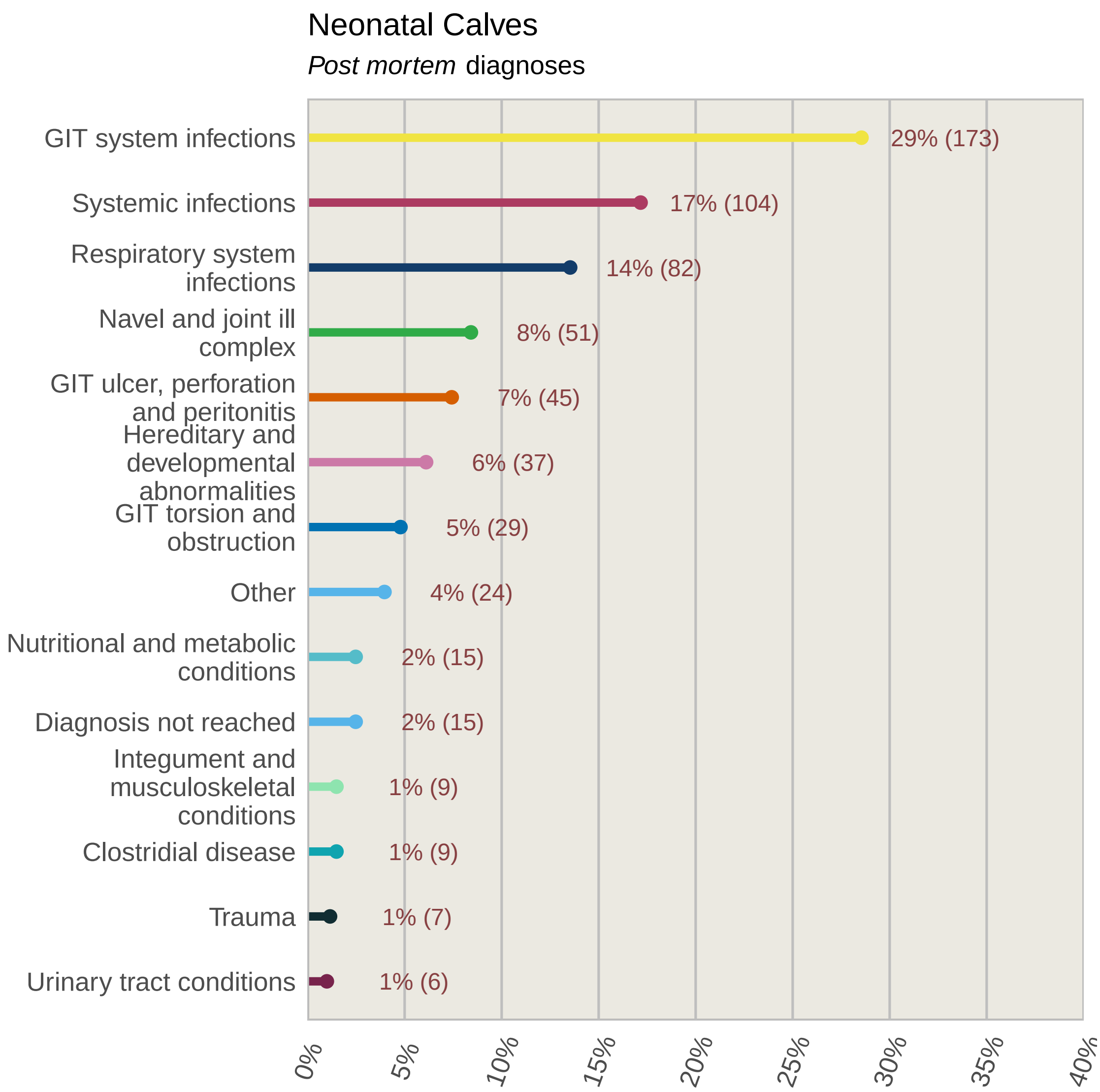


Figure 1.3.: Conditions most frequently diagnosed on *post mortem* examinations of bovine neonatal calves in 2024 (n=606). Note: Categories that have fewer than ten cases have been included in the 'Other' category. The absolute number of cases is between brackets.

1.3. Calves (one to six months of age)

The most frequently diagnosed causes of death in this group are presented in Table 1.2 and Figure 1.5.

Respiratory infections were, by a considerable margin, the most common cause of mortality in the one-to-six-month-old calf age category in 2024. At 33.6 *percent* (33.7 *percent* beef/suckler and 32.6 *percent* dairy), though the figure was marginally reduced on 2023 (38.8 *percent*). The aetiology is discussed in more detail in the chapter *bovine respiratory disease* (Section 2.1).

Gastro-intestinal infections (11.9 *per cent*) were the second most diagnosed cause of death in 2024, slightly down on 2023 (14 *per cent*).

GIT ulceration with or without perforation was diagnosed in 60 (8.6 *per cent*) calves. In such cases, the herdowner often does not notice any unusual clinical signs prior to death and on *post mortem* examination a perforated abomasal ulcer with acute peritonitis and toxic shock are found.

Gastrointestinal torsions (Figure 1.4) were diagnosed in 59 cases (8.5 *per cent* of the total). Again, the history provided in such cases often describes the calves being found dead unexpectedly, with no prior clinical signs.

Table 1.2.: Conditions most frequently diagnosed on *post mortem* examinations of calves (1-6 months old) in 2024 (n= 696).

Category	Beef/Suckler	Dairy	Other	Total	Percentage
Respiratory system infections	134	86	14	234	**33.6**
GIT system infections	41	39	3	83	**11.9**
GIT ulcer, perforation and peritonitis	31	28	1	60	**8.6**
GIT torsion and obstruction	38	20	1	59	**8.5**
Systemic infections	33	16	3	52	**7.5**
Clostridial disease	31	11	6	48	**6.9**
Diagnosis not reached	16	10	1	27	**3.9**
Nutritional and metabolic conditions	10	15	2	27	**3.9**
Other	16	7	1	24	**3.4**
CNS conditions	11	11	1	23	**3.3**
Navel and joint ill complex	10	3	0	13	**1.9**
Liver disease	7	2	0	9	**1.3**
Poisoning	2	6	1	9	**1.3**
Summer Scour Syndrome	2	7	0	9	**1.3**
Urinary tract conditions	5	1	1	7	**1.0**
Integument and musculoskeletal conditions	4	2	0	6	**0.9**
Tick-Borne Fever	6	0	0	6	**0.9**

Note:
Categories that have less than five cases have been included in the 'Other' category

(a) Intestinal volvulus

(b) Intestinal volvulus

Figure 1.4.: Severely dark red, distended intestinal loops with gas and fluid due to an Intestinal volvulus (a and b) in a weanling. Photos: Aideen Kennedy.

Systemic infections were recorded in 52 cases (7.5 *per cent*). Systemic infections in this age group are typically bacterial pathogens such as *Salmonella Dublin* or *Typhimurium*, *Mannheima haemolytica*, *Histophilus somni* , *Pasteurella multocida* or *Trueperella pyogenes*.

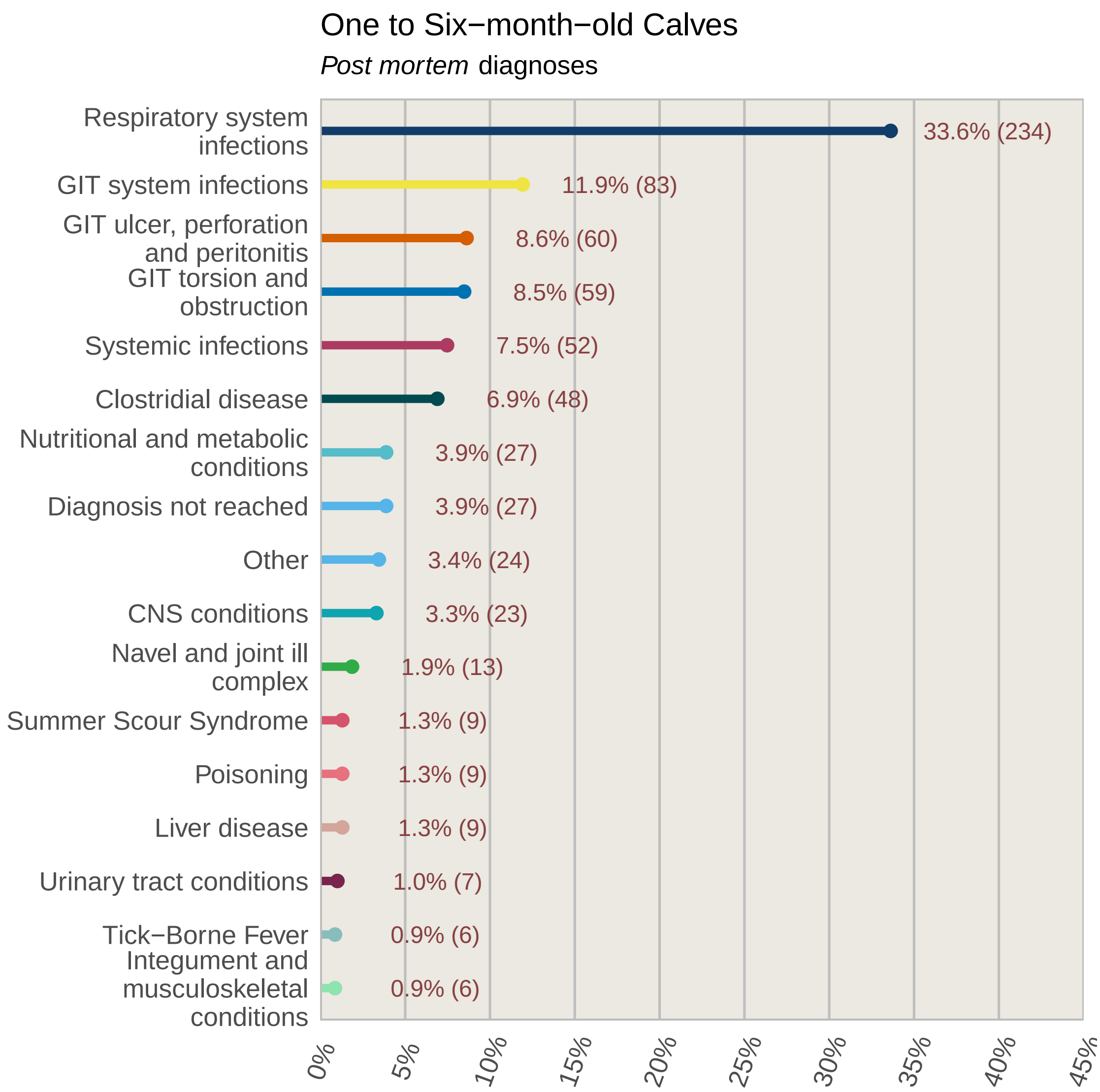


Figure 1.5.: Conditions most frequently diagnosed on *post mortem* examinations of calves (1–6 months old) in 2024 (n=696). Note: Categories that have fewer than five cases have been included in the 'Other' category. The absolute number of cases is between brackets.

1.4. Weanlings (six months to one year of age)

The most frequently diagnosed causes of death in this group are presented in Table 1.3 and Figure 1.6.

A total of 561 cattle in this age category (6–12 months old) were examined in 2024. Respiratory infections were the most common cause of mortality in 2024. Overall, 40.1 *per cent* of deaths were caused by respiratory disease (39.6 *per cent* beef/suckler, 41 *per cent* dairy).

> Clostridial diseas
>
> Clostridial disease are usually rapidly fatal and in severe outbreaks, many animals may die suddenly. Vaccination with a multivalent clostridial vaccine is a safe and reliable strategy for preventing clostridial disease.

Gastrointestinal infections accounted for 114 (20.3 *per cent*) of the deaths in this age category, a rate marginally higher than 2023 at 19.8 *per cent*.

Clostridial disease was the third most common diagnosis in this age category (67 cases, 11.9 *per cent*). This is an increase on 2023 (6.2 *per cent*). The clostridial diseases typically diagnosed include blackleg caused by *Clostridial chauvoei* (Figure 1.7) or *Clostridium perfringens* enterotoxaemia.

Table 1.3.: Conditions most frequently diagnosed on *post mortem* examinations of weanlings (6-12 months old) in 2024 (n= 561).

Category	Beef/Suckler	Dairy	Other	Total	Percentage
Respiratory system infections	131	84	10	225	**40.1**
GIT system infections	53	56	5	114	**20.3**
Clostridial disease	47	15	5	67	**11.9**
Other	17	8	0	25	**4.5**
CNS conditions	11	5	1	17	**3.0**
Liver disease	11	4	1	16	**2.9**
GIT ulcer, perforation and peritonitis	9	6	0	15	**2.7**
Diagnosis not reached	6	6	1	13	**2.3**
Nutritional and metabolic conditions	11	1	0	12	**2.1**
Trauma	6	5	0	11	**2.0**
Cardiac and circulatory conditions	7	2	0	9	**1.6**
GIT torsion and obstruction	6	2	0	8	**1.4**
Summer Scour Syndrome	3	4	1	8	**1.4**
Systemic infections	5	3	0	8	**1.4**
Integument and musculoskeletal conditions	4	2	1	7	**1.2**
Poisoning	4	2	0	6	**1.1**

Note:
Categories that have less than five cases have been included in the 'Other' category.

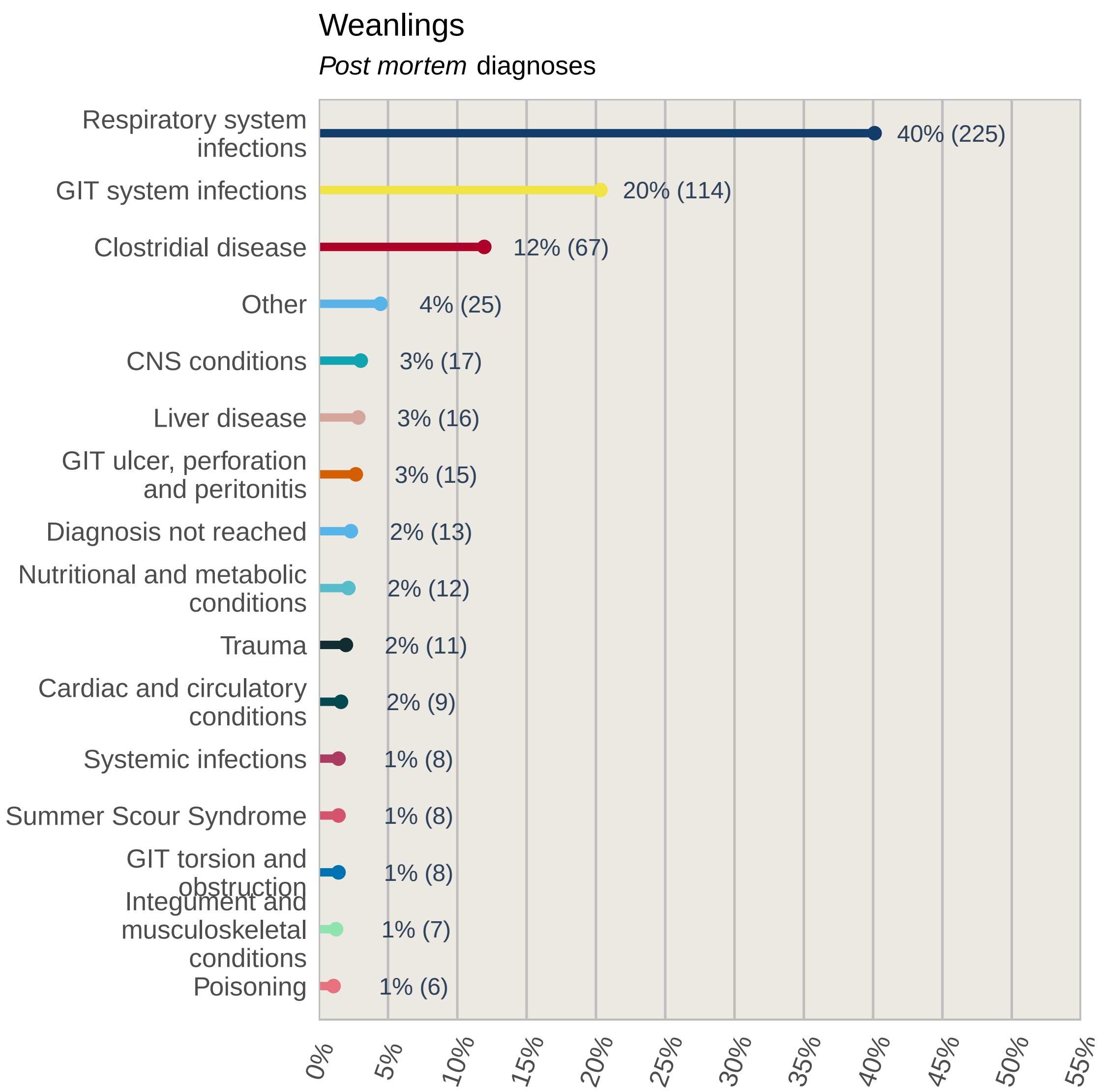


Figure 1.6.: Conditions most frequently diagnosed on *post mortem* examinations of weanlings (6–12 months old) in 2024 (n=561).Note: Categories that have fewer than five cases have been included in the 'Other' category. The absolute number of cases is between brackets.

Table 1.4.: Conditions most frequently diagnosed on *post mortem* examinations of adult cattle (over 12 months old) in 2024 (n=455).

Category	Beef/Suckler	Dairy	Other	Total	Percentage
Respiratory system infections	36	25	3	64	**14.1**
GIT ulcer, perforation and peritonitis	24	18	3	45	**9.9**
GIT system infections	22	20	2	44	**9.7**
Nutritional and metabolic conditions	23	13	0	36	**7.9**
Diagnosis not reached	17	18	0	35	**7.7**
Cardiac and circulatory conditions	10	23	1	34	**7.5**
Other	21	8	1	30	**6.6**
Liver disease	19	9	1	29	**6.4**
CNS conditions	10	12	0	22	**4.8**
GIT torsion and obstruction	7	13	1	21	**4.6**
Systemic infections	10	9	1	20	**4.4**
Clostridial disease	11	3	1	15	**3.3**
Reproductive Tract Conditions	8	3	0	11	**2.4**
Integument and musculoskeletal conditions	5	4	1	10	**2.2**
Poisoning	8	2	0	10	**2.2**
Mastitis	2	7	0	9	**2.0**
Tumour	4	2	1	7	**1.5**
Urinary tract conditions	6	1	0	7	**1.5**
Johnes Disease	3	1	2	6	**1.3**

Note:
Categories that have less than five cases have been included in the 'Other' category.

(a) Clostridial myositis

(b) Clostridial myositis

Figure 1.7.: Dark purple/black, necrotic muscle with rancid odor and gas bubbles (emphysema) in the gluteal muscle of a weanling with blackleg (clostridial myositis, *Clostridium chauvoei*). Photos: Cosme Sánchez-Miguel.

1.5. Adult Cattle (over 12 months of age)

The most frequently diagnosed causes of death in adult cattle are presented in Table 1.4 and Figure 1.8.

A cause of death was not established in 30 (6.6 *per cent*) of adult cattle carcasses examined during 2024. This may have been the result of autolysis affecting the quality of the *post mortem* examination or, as in the case of some metabolic conditions such as hypomagnesaemia, because the gross pathological changes may be minimal and biochemistry tests become increasingly unreliable with time at *post mortem*.

Respiratory infections were associated with 64 (14.1 *per cent*) of the deaths of adult cattle submitted during

2024, a marginal reduction on the rate for the previous year (16.2 *per cent*), but still the most common cause of mortality in adult cattle. The rate of respiratory disease was slightly higher in beef suckler compared to dairy (14.6 *per cent*, 13.1 *per cent* respectively).

Regarding gastrointestinal disease, GIT ulcer/perforation/peritonitis was the most common cause of death in 2024 accounting for 45 of the deaths of adult cattle (9.9 *per cent*). (Figure 1.9).

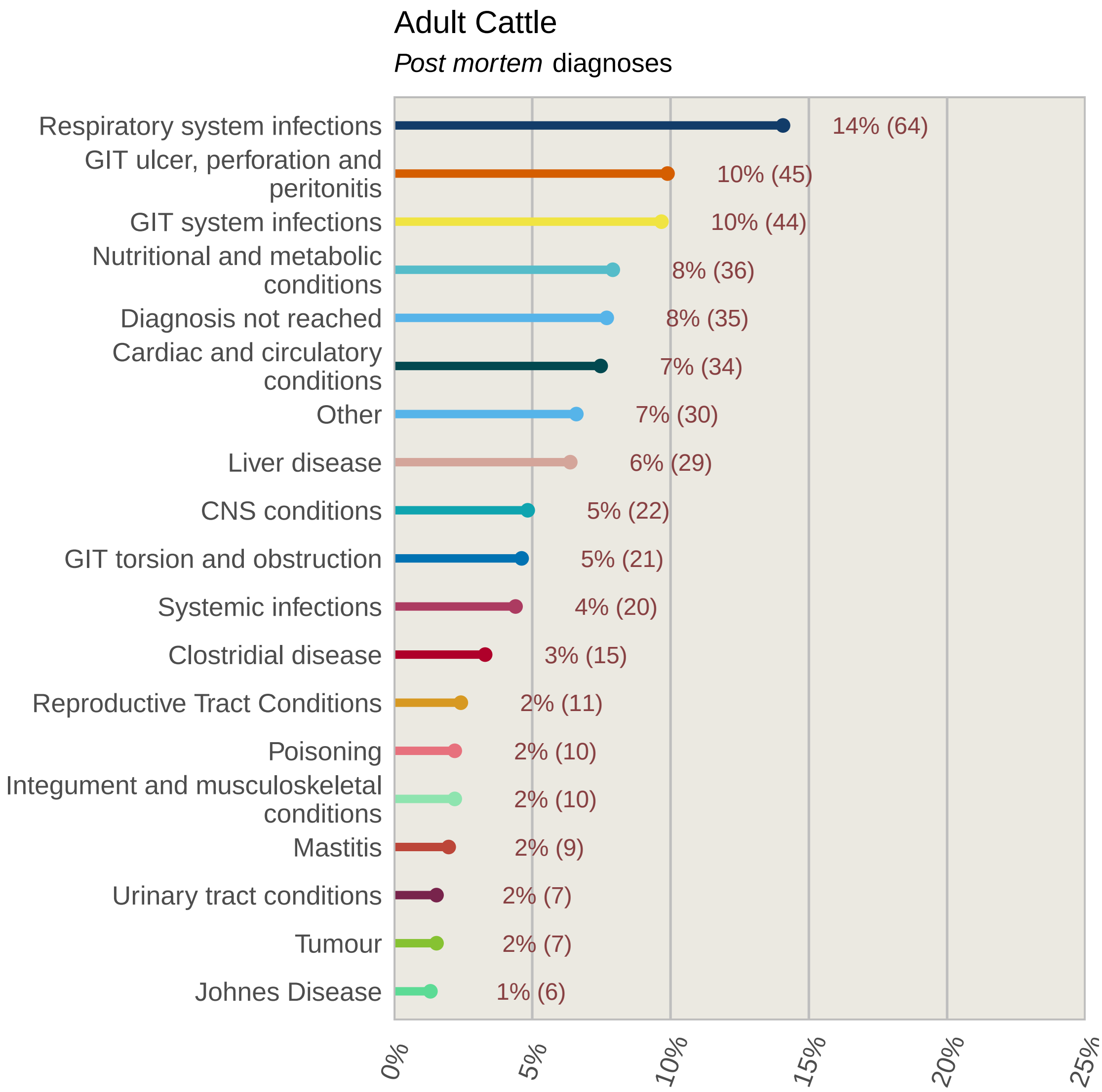
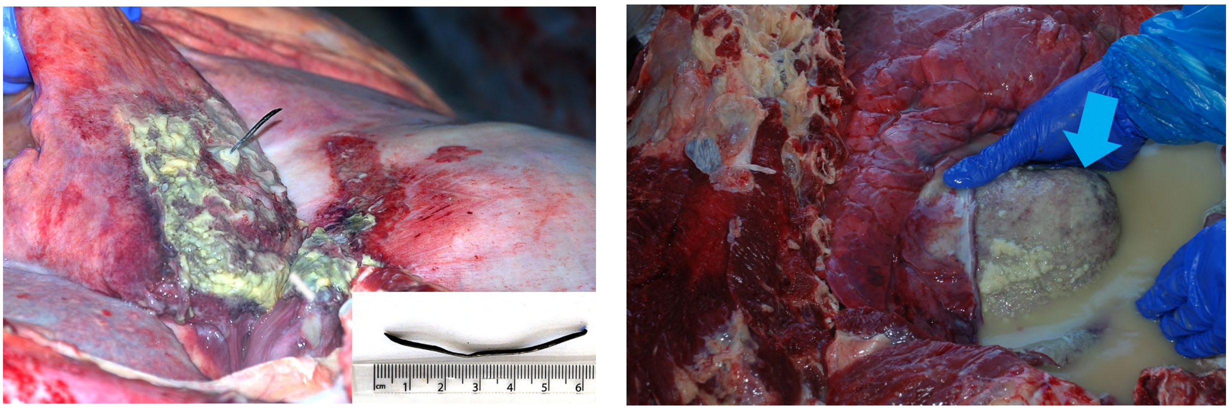


Figure 1.8.: Conditions most frequently diagnosed on *post mortem* examinations of adult cattle (over 12 months old) in 2024 (n=455). Note: Categories that have fewer than five cases have been included in the 'Other' category. The absolute number of cases is between brackets.

GIT ulcer/perforation/peritonitis was very closely followed by GIT system infection in terms of the number of deaths, 44 deaths recorded in this category or 9.7 *per cent* of the total deaths.

Nutritional/metabolic conditions were diagnosed in 36 (7.9 *per cent*) of cases presented during 2024, this is a marginal increase over 2023 (6.0 *per cent*). The nutritional/metabolic category includes conditions such as ruminal acidosis, hypomagnesaemia, hypocalcaemia, fatty liver and bloat.

Cardiac and circulatory conditions were the next most common cause of death in adults. A total of 34 deaths were recorded under this heading, a rate of 7.5 *per cent*, a marginal increase over the 2023 figure of 6.9 *per cent*.



(a) Traumatic reticuloperitonitis (b) Traumatic pericarditis

Figure 1.9.: Perforation of the wall of the reticulum by a pice of wire (traumatic reticuloperitonitis or hardware disease) (a) leading to traumatic pericarditis (b) (arrow). Photos: Cosme Sánchez-Miguel.

Clostridial disease was diagnosed in 15 adult cattle (3.3 *per cent*), a slight drop on 2023 (3.9 *per cent*) with the majority of cases seen in beef/suckler cattle.

CNS conditions were diagnosed in 22 cases (4.8 *per cent*), an increase compared to the rate of CNS conditions found in 2023 (1.7 *per cent*). In 2024, CNS conditions were more likely to be seen in Dairy (6.2 *per cent*) than beef/suckler (4.1 *per cent*).

There was a total of 10 cases (2.2 *per cent*) of poisoning submitted to the laboratory service in 2024, this is a reduction on the 2023 figure (3.2 *per cent*). Poisoning was more likely to be diagnosed in beef/suckler (3.2 *per cent*) than dairy (1 *per cent*).

2. Bovine Respiratory Disease

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2.1. Overview of Bovine Respiratory Disease

Bovine Respiratory Disease (BRD) pneumonia continues to be a very significant diagnosis in all aged bovines submitted to the laboratories for postmortem examination. It is the most frequently diagnosed condition in all bovines aged over one month. Between 30 and 40 *per cent* of animals aged one month to one year had respiratory disease recorded as their diagnosis in 2024. 14 *per cent* of neonatal calves (0–1 month) and 14% of adult cattle (greater than 1 year) had respiratory disease recorded as their diagnosis.

The factors that influence the occurrence of respiratory disease are similar to other animal disease i.e. the interaction of host, environment and pathogen. For example an animal with a high parasite burden in a poorly ventilated shed will be more likely to favour the colonisation of the lower respiratory tract by viruses and bacteria. Many causative agents of respiratory disease are normal inhabitants of the upper respiratory tract and sub-optimal host immunity and environment will favour the establishment of disease. In many animals diagnosed with BRD multiple agents are detected as similar predisposing conditions to their establishment are present. In addition, the infection by one agent will frequently predispose to infection by another e.g. RSV predisposing to *Pasteurella spp*. infection.

BRD can have both high mortality and high morbidity and have serious consequences on herd health. It can also exert longer term effects and in unresolved or partially resolved cases of BRD, the lifetime production of animals can be negatively impacted. This also has potentially serious consequences/impacts on the usage of anti-microbials/anthelmintics on the affected animals, and environmental consequences due to extended times to slaughter and reduced productivity.

Pneumonia outbreak

Colostral immunity, environmental, and management, critically affect the outcome of pneumonia in a herd. Stress, shared air spaces, mixing age groups in the same air space, and lack of hospital pens, serve to exacerbate pneumonia problems in herds. Veterinary involvement should be aimed at effective management in the face of an outbreak, couple with investigations to enable long-term strategies to prevent future outbreaks. Isolation of sick animals, vaccination, housing modifications or alterations in management, should form part of the strategy of disease management in the herd.

Accurate diagnosis of BRD as the cause of illness or reduced productivity and detection of the aetiological agents involved can drive interventions and prevention strategies. A definition of the type/category of pneumonia seen in affected animals is important when considering potential causative agents and mitigation measures (Table 2.1 and Table 2.2).

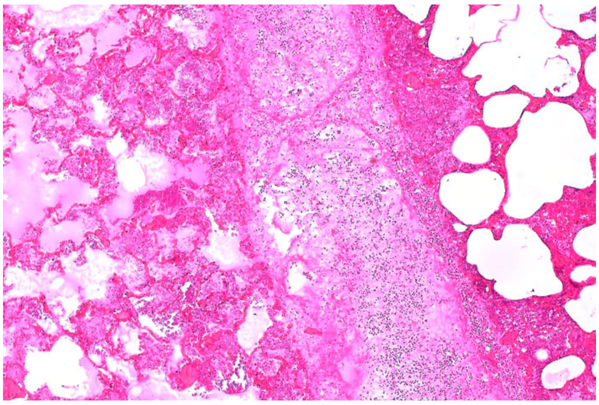
Table 2.1.: Number of cases by a broad aetiology in the diferent group ages. (n=602).

Aetiology	Neonatal (0-1 month old)	Calves (1-6 months old)	Weanling (6-12 months old)	Adult Cattle (over 12 months old)	Total
Bacterial	56 (70.9)	153 (65.4)	116 (51.6)	36 (56.2)	**361 (60.0)**
Parasitic	0 (0.0)	37 (15.8)	61 (27.1)	11 (17.2)	**109 (18.1)**
No agent identified	13 (16.5)	27 (11.5)	22 (9.8)	12 (18.8)	**74 (12.3)**
Viral	10 (12.7)	17 (7.3)	25 (11.1)	5 (7.8)	**57 (9.5)**
Fungal	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0)	**1 (0.2)**

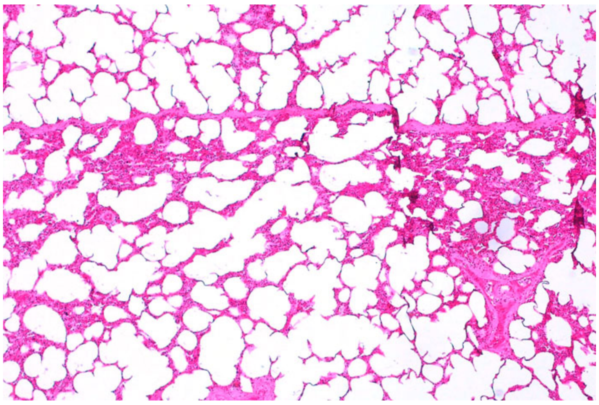
(a) Fibrinous pleuropneumonia

(b) Fibrinous pleuropneumonia

Figure 2.1.: Severe diffuse fibrinous pleuropneumonia (a) and (b) associated with *Mannheimia haemolytica* detection. Photos: Maresa Sheehan.



(a) Fibrinous pleuropneumonia



(b) Unaffected lung

Figure 2.2.: Hematoxylin and Eosin (H&E) stained section demonstrating a severe fibrinous and suppurative inflammatory response in a case of fibrinous pleuropneumonia (a) and unaffected lung (b) for comparison. Photos: Maresa Sheehan.

2.2. Frequently seen pneumonia types in cattle for *post mortem* examination.

Fibrinous pleuropneumonias: these can occur in all aged animals. They can occur in adult dairy cows, frequently during the transition period. The clinical history can be of acute onset of disease. The pneumonias seen are

Table 2.2.: Number of cases and relative frequency of the top ten pathogenic agents detected in BRD cases diagnosed on *post-mortem* examination across all age categories (n= 602).

Organism	No. of cases	Percentage
Dictyocaulus spp	109	**18.1**
Histophilus somni	94	**15.6**
Mannheimia haemolytica	90	**15.0**
No agent identified	74	**12.3**
Mycoplasma bovis	57	**9.5**
Pasteurella multocida	57	**9.5**
RSV	39	**6.5**
Other minor organisms	38	**6.3**
Trueperella pyogenes	19	**3.2**
Bibersteinia trehalosi	7	**1.2**
IBR virus	7	**1.2**
BVD virus	5	**0.8**
PI3	2	**0.3**
Salmonella dublin	2	**0.3**
Fungal	1	**0.2**
Pasteurella spp	1	**0.2**

Table 2.3.: Number of cases and relative frequency of the top ten pathogenic agents detected in BRD cases diagnosed on *post-mortem* examination by herd category across all age groups (n= 602) in 2024.

Organism	Dairy	Beef/Suckler	Other	No. of cases	Percentage
Dictyocaulus spp	39	67	3	109	**18.1**
Histophilus somni	36	51	7	94	**15.6**
Mannheimia haemolytica	39	45	6	90	**14.9**
No agent identified	39	30	5	74	**12.3**
Mycoplasma bovis	21	35	1	57	**9.5**
Pasteurella multocida	17	35	5	57	**9.5**
RSV	16	23	0	39	**6.5**
Other minor organisms	14	24	0	38	**6.3**
Trueperella pyogenes	6	13	0	19	**3.2**
Bibersteinia trehalosi	3	4	0	7	**1.2**
IBR virus	0	5	2	7	**1.2**

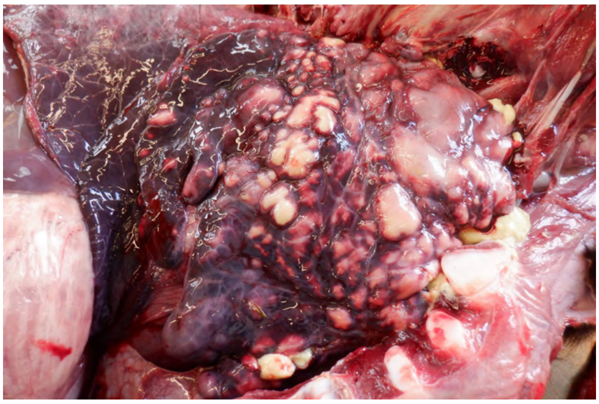
frequently very severe and extensive and have had a poor response to treatment. *Mannheimia haemolytica* (Figure 2.1) and *Histophilus somnus* are commonly detected from these cases.

Chronic bronchopneumonia with classic cranio-ventral lobe involvement and multifocal abscessation and consolidation are classically encountered in animals under one year of age that have chronic ill-thrift. The gross and histopathological findings frequently suggest a chronic active pneumonia with signs of chronicity including abscessation (Figure 2.3),fibrosis and bronchiectasis (Figure 2.2). *Pasteurella multocida*, *Truperella pyogenes* and *Mycoplasma bovis* (distinctive multifocal areas of caseous necrosis can be seen in these cases) are among the aetiological agents frequently detected.

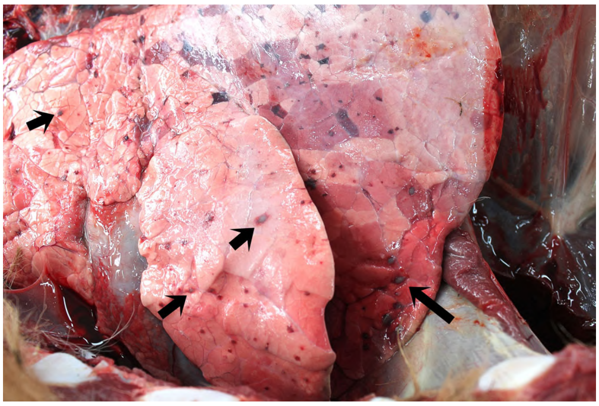
Embolic pneumonia refers to random multifocal nodules caused by septic emboli characterised by firm white foci surrounded by a halo of congestion that may develop into small abscesses (Figure 2.3b). They are originated by embolism or bacteremia from the heart (endocarditis), liver (hepatic abscess into the caudal vena cava), jugular veins (thrombophlevitis), navel (omphalophlebatis), hoof (chronic hoof infections) and uterus (metritis). The organisms isolated are suppurative in nature, *T. pyogenes*, *Streptococus spp*, etc.

Table 2.4.: Count and percentage by age goup of the general specific organisms detected in BRD on *post mortem* examination (n=602) in 2024.

Aetiology	Neonatal (0-1 month old)	Calves (1-6 months old)	Weanling (6-12 months old)	Adult Cattle (over 12 months old)	Total
Histophilus somni	11 (13.9)	39 (16.7)	43 (19.1)	1 (1.6)	**94 (15.6)**
Mannheimia haemolytica	15 (19.0)	38 (16.2)	21 (9.3)	16 (25.0)	**90 (15.0)**
No agent identified	13 (16.5)	27 (11.5)	22 (9.8)	12 (18.8)	**74 (12.3)**
Bibersteinia trehalosi	2 (2.5)	1 (0.4)	3 (1.3)	1 (1.6)	**7 (1.2)**
IBR virus	0 (0.0)	1 (0.4)	3 (1.3)	3 (4.7)	**7 (1.2)**
Mycoplasma bovis	6 (7.6)	28 (12.0)	21 (9.3)	2 (3.1)	**57 (9.5)**
Pasteurella multocida	7 (8.9)	26 (11.1)	19 (8.4)	5 (7.8)	**57 (9.5)**
BVD virus	5 (6.3)	0 (0.0)	0 (0.0)	0 (0.0)	**5 (0.8)**
RSV	4 (5.1)	14 (6.0)	20 (8.9)	1 (1.6)	**39 (6.5)**
Other minor organisms	13 (16.5)	17 (7.3)	6 (2.7)	2 (3.1)	**38 (6.3)**
PI3	0 (0.0)	1 (0.4)	1 (0.4)	0 (0.0)	**2 (0.3)**
Salmonella dublin	1 (1.3)	0 (0.0)	0 (0.0)	1 (1.6)	**2 (0.3)**
Trueperella pyogenes	1 (1.3)	5 (2.1)	4 (1.8)	9 (14.1)	**19 (3.2)**
Dictyocaulus spp	0 (0.0)	37 (15.8)	61 (27.1)	11 (17.2)	**109 (18.1)**
Fungal	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0)	**1 (0.2)**
Pasteurella spp	1 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)	**1 (0.2)**



(a) Pulmonary multifocal abscessation



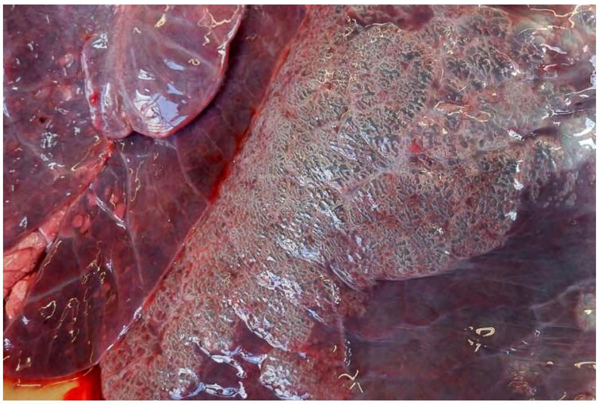
(b) Embolic pneumonia

Figure 2.3.: Chronic bronchopneumonia with multifocal abscessation (a). Photo: Maresa Sheehan. Multifocal pulmonary emboli (arrows) in a cow with vegetative endocarditis. Photo: Cosme Sánchez-Miguel

Granulomatous pneumonia, less common, is characterised by the formation of granulomas, discrete nodules within the lung parenchyma. These granulomas consist of aggregates of macrophages, surrounded by a rim of lymphocytes. They are normally seen in fungal pneumonia and as a result of TB (*Mycobacterium bovis*)

2.3. Parasitic Bovine Respiratory Disease

Bronchointerstitial pneumonias typically have a more caudal distribution, are rubbery on palpation, are emphysematous and over-inflated (Figure 2.4). These are the lesions seen typically associated with viral, parasitic (lungworm) and allergic (fog fever) pneumonias.



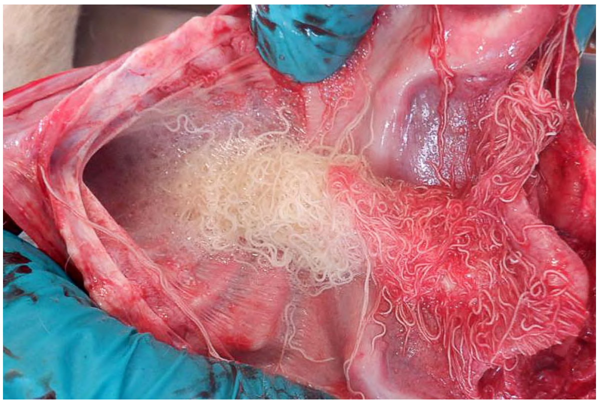
(a) Groundglass emphysema

(b) Groundglass emphysema

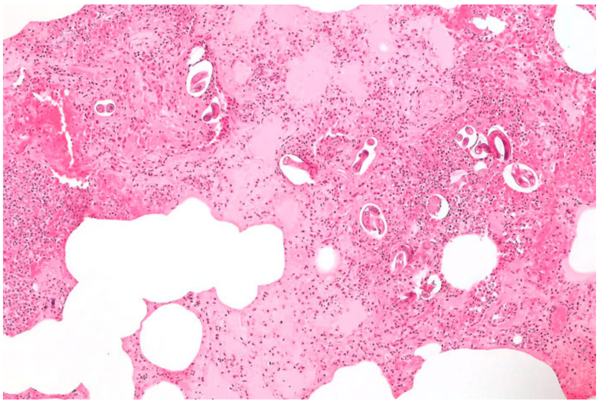
Figure 2.4.: Bronchointerstitial pneumonia with caudal overinflation and groundglass emphysema (a) and (b). Photos: Maresa Sheehan.

Histopathological findings include damage to bronchiolar epithelium, type II epithelialisation and hyaline membrane formation.

Dictyocaulus viviparous (lungworm) is the most commonly diagnosed respiratory pathogen, RSV is the most commonly detected viral agent from respiratory cases see Table 2.2



(a) Lungworm in the airway



(b) Lungworm, H&E stained section section

Figure 2.5.: Clumps of lungworm larvae in the airway (a) and H&E stained cross-section of the lung tissue (b) of lungworm in the airways. Photos: Maresa Sheehan.

This is a significant cause of disease in grazing cattle. The disease is described as a *parasitic or verminous bronchitis*. Clinical disease usually results when dairy or beef cattle with poor immunity, typically first grazing season (FGS) dairy calves, ingest larvae from pasture. Animals can acquire a dangerous level of infection even after only one day of grazing a contaminated pasture.

It is more common to see disease in the second half of the grazing season, commonly following high rainfall, when pastures have large numbers of larvae (those that have survived from previous grazing combined with those deposited by infected cattle). However, it is important to be always on the lookout for clinical signs of hoose, as disease may sometimes occur as early as May.

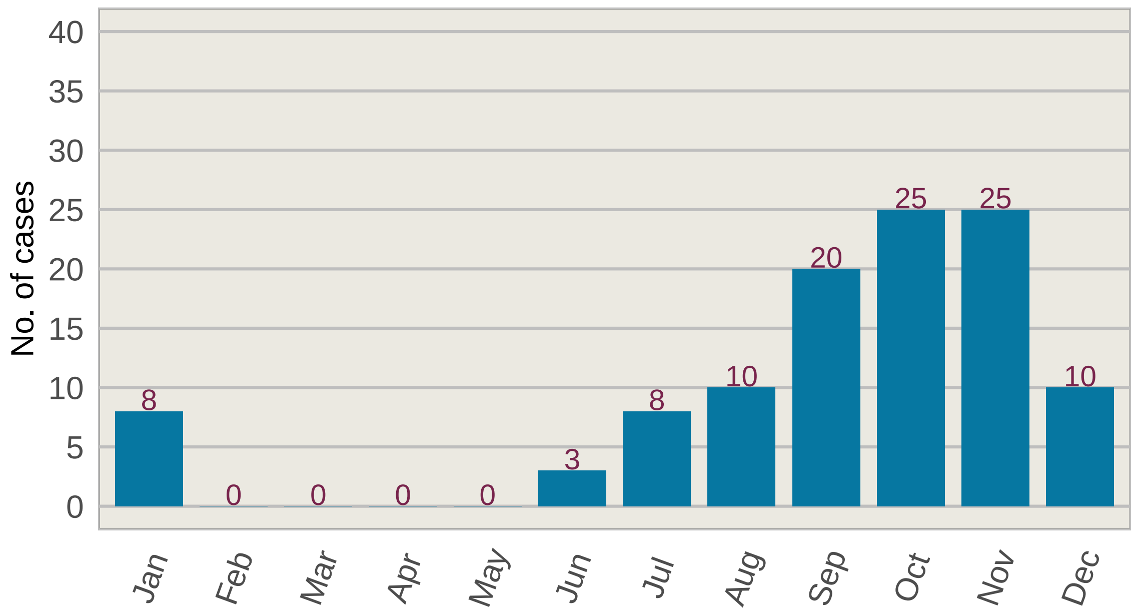


Figure 2.6.: Number of diagnoses of parasitic pneumonia by month during 2924 (n=109).

Hoose can occur in adult cattle in two distinct ways, resulting in animals with broadly similar clinical signs.

Animals with little or no immunity - the disease will be similar to that in calves, where adult hoose worms occur in the airways (Figure 2.5) and larvae can be found in faeces. This is known as Patent Infection. Lack of, or low levels of immunity can result from inadequate exposure to infection on pasture over the previous six months or more. There are several potential reasons for this, including housing of animals, grazing on newly sown pastures and intensive anthelmintic treatments.

The second way it occurs is in animals with some immunity to lungworm. If these animals are exposed to heavy larval challenge from pasture they may develop severe coughing and a drop in milk production, resulting from the destruction of migrating worms in the lungs by the immune response (Reinfection Syndrome). Hoose larvae are not detectable in the faeces of the majority of these animals (*Animal Health Ireland-Lungworm-The Facts*[1]).

The gross and histopathological lesions seen are those described above for a bronchointerstitial pneumonia. Additional features of bronchointerstitial pneumonia associated with lungworm infection may include the gross and microscopic visualisation of lungworms in the airways and the presence of increased numbers of eosinophils in the inflammatory exudate.

[1] https://animalhealthireland.ie/assets/uploads/2021/06/PC-Lungworms-2021.pdf?dl=1

3. Bovine Abortion

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3.1. Introduction

Bovine abortion, stillbirth and perinatal mortality are common issues in cattle populations worldwide. A widely accepted definition of abortion is foetal death after 42 days and before 260 days' gestation. Stillbirth is defined as birth of a dead, full term (i.e. more than 260 days in gestation) calf. Perinatal mortality encompasses death of a calf during parturition or up to 48 hours afterwards, so there is some overlap between this and stillbirth. These distinctions can be important factors when considering the aetiology of these conditions.

An abortion rate of 3–5 *per cent* may be considered 'normal'. Above this, or if a number of abortions occur within a herd over a short space of time, investigation is warranted. Laboratory-based diagnostics play a vital role in the diagnosis and mitigation of abortion, stillbirth and perinatal mortality issues. However, they are only one part of the investigative process, which should also include thorough history taking, assessment of cow management and environment and peripartum management, as appropriate. Although the findings reported here are primarily the results of testing for infectious disease, it is important to note that not all foetal or perinatal death is due to infectious agents. There are a wide range of non-infectious causes, including dystocia, dam nutrition, plant and mycotoxin ingestion, hormonal, physical and genetic factors.

> Key Points
>
> A general abortion screen is applied to all submissions, other tests including PCR and Histopathology are applied at the discretion of the attending vet depending on the history and *post mortem* examination. The likelihood of a positive result is maximised when a foetus, placenta and maternal bloods are submitted for *post mortem* exam.

3.2. Protozoal pathogens

Neospora caninum is the principal protozoal pathogen associated with bovine abortion, stillbirth and perinatal mortality. It is one of the most common causes of both sporadic foetal deaths and abortion storms in cattle and may be the most diagnosed abortifacient internationally (Mee, Jawor, and Stefaniak 2021).

The life cycle is indirect with canines and bovines the definitive and intermediate hosts respectively. Dogs become infected from eating the afterbirth or remains of an aborted foetus from an infected cow. Cows and heifers can be infected through ingestion of oocytes in feed or water contaminated with dog faeces. Once infected they will remain infected for life and any calf produced may possibly also be infected. The major route through which infection is maintained in a herd is vertical with infection passing from dam to calf in utero.

A PCR test for Neospora was introduced to the VLS in January 2023 and is carried out on swabs of brain tissue. Positive results were recorded in 8.6 *per cent* of tests (Table 3.1).

Control focuses on identification of infected animals, protecting cattle feed from contamination with dog

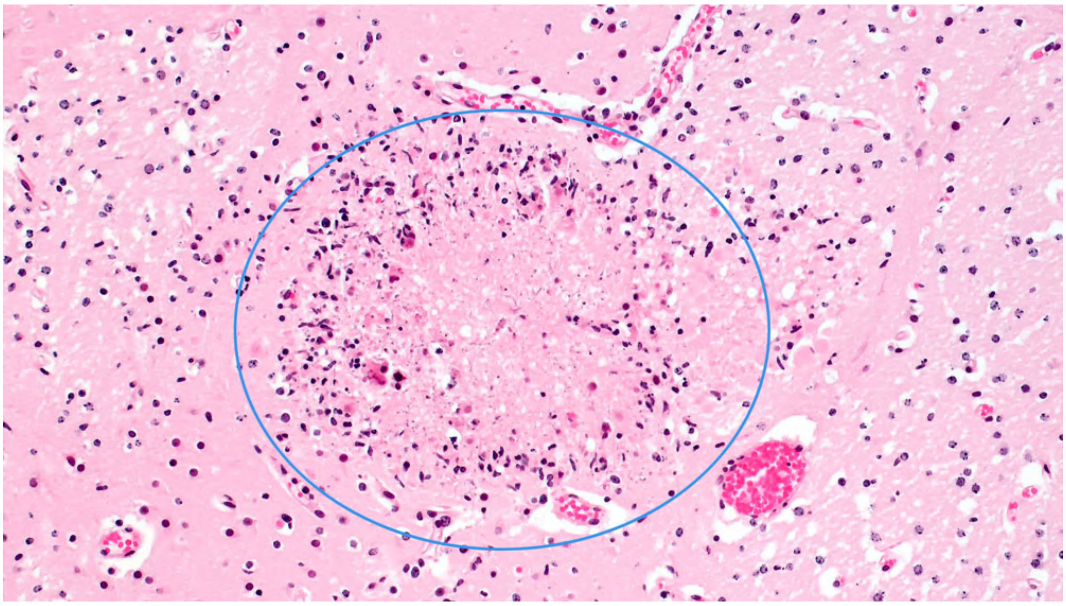

Figure 3.1.: Protozooal encephalitis: focal neuropil necrosis surrounded by non-suppurative infiltration (circled) in a foetal brain. Photo: Mercedes Gómez-Parada

Table 3.1.: Frequency of detection of *Neospora caninum* in 2024.}

Pathogen	Total No. Tests	No. Positive	Percentage Positive
Neospora caninum	895	77	**8.6**

faeces and preventing access of dogs to aborted foetuses and placentas. It is recommended that female offspring from Neospora infected cows should be neither retained nor sold for breeding purposes.

Screening for *Neospora caninum* in the cow:

- Antibodies are at their highest about 10 to 4 weeks before calving.
- Usefulness of individual milk testing is reduced as many cows are dry when antibodies are highest.
- Any animals negative on a pre-breeding or pre-purchase blood test should be retested ten to four weeks before calving (ideally over two pregnancies) to confirm that they are free of infection.
- Serum samples from precolostral calves are useful for determining infection in suspect cows, due to the efficiency of transplacental transmission.
- Antibodies to *Neospora caninum* fluctuate at various stages of the reproductive cycle and blood tests may give negative results at certain times in infected animals.

Zoonotic risks

Many of the pathogens that cause abortion in cattle can also cause serious disease in humans. Some can even be shed during apparently normal parturition.
Appropriate protective measures, including personal protective equipment and disinfection, should be put in place. This refers not only to aborted and stillborn cases, but when assisting any calving.

Table 3.2.: Frequency of detection of non-*Salmonella* bacterial species in routine cultures carried out on bovine foetal material in 2024.

Culture Result	No. Positive Culture Results from Beef/Suckler Herds	Positive Culture Results as a Percentage of Total Culture Results from Beef/Suckler Herds	No. Positive Culture Results form Dairy Herds	Positive Culture Results as a Percentage of Total Culture Results from Dairy Herds	No. Positive Culture Results from Other Herds	Positive Culture Results as a Percentage of Total Culture Results from Other Herds	Total No. Positive Culture Results	Positive Culture Results as a Percentage of Total No. of Culture Results
No Significant Growth	236	54.9	572	59.3	28	58.3	836	57.9
Coliforms	74	17.2	115	11.9	4	8.3	193	13.4
Trueperella pyogenes	26	6.0	85	8.8	5	10.4	116	8.0
Bacillus licheniformis	29	6.7	63	6.5	1	2.1	93	6.4
Streptococcus spp.	17	4.0	21	2.2	2	4.2	40	2.8
Listeria monocytogenes	9	2.1	22	2.3	2	4.2	33	2.3
Aspergillus spp.	7	1.6	21	2.2	0	0.0	28	1.9
Other minor organisms	9	2.1	14	1.5	2	4.2	25	1.7
Yeasts and Fungi	8	1.9	11	1.1	0	0.0	19	1.3
Bacillus spp.	3	0.7	11	1.1	1	2.1	15	1.0
Streptococcus spp	3	0.7	6	0.6	2	4.2	11	0.8
Salmonella spp. (other than S. Dublin)	1	0.2	8	0.8	2	0.0	9	0.6
Staphylococcus spp.	4	0.9	4	0.4	0	0.0	8	0.6
Yersinia pseudotuberculosis	0	0.0	6	0.6	0	0.0	6	0.4
Listeria spp.	2	0.5	2	0.2	1	2.1	5	0.3
Pseudomonas spp.	1	0.2	2	0.2	0	0.0	3	0.2
Campylobacter jejuni	0	0.0	1	0.1	0	0.0	1	0.1
Histophilus somnus	0	0.0	1	0.1	0	0.0	1	0.1
Pasteurella multocida	1	0.2	0	0.0	0	0.0	1	0.1
Total	430	-	965	-	48	-	1443	100.0

3.3. Routine Culture Results (excluding *Salmonella spp.*)

Coliform abortions were the most common culture result at over 13 *per cent*, they have the potential to cause sporadic abortions however detection does not mean causation as their presence may be due to enviromental contamination. *Trueperella pyogenes* was next most common bacteria identified at eight *per cent* and can also be the cause of sporadic abortions. These organisms usually get to the placenta and foetus by way of the cow's circulatory system. While these bacteria may not cause disease symptoms in the cow, the foetus appears to be more susceptible, in large part because of its immature immune system. *Aspergillus* species was the most common fungal pathogen identified in almost two *per cent* of cases. Fungal abortions typically occur from four months to term and are most common in winter. Control involves avoiding mouldy feed.

Significance of some of the isolates can be difficult to interpret, some like coliforms may be the result of faecal or environmental contamination of the sample. Others maybe secondary pathogens which had the opportunity to cross the placenta due to compromised immunity.

Abortion investigation

Abortion is an important cause of production loss in the livestock industry. All on-farm abortions should be investigated, as effective control measures for abortions require prompt and accurate diagnosis.

Table 3.3.: Number of *Salmonella*-positive cultures as a percentage of total *Salmonella* cultures carried out on bovine foetal material in 2024.

Herd Type	Total No. of Cultures	No. Positive Cultures	Percentage Positive
Beef/Suckler	350	**1**	0.29
Dairy	829	**18**	2.17
Other	38	**0**	0.00
Total	1217	**19**	1.56

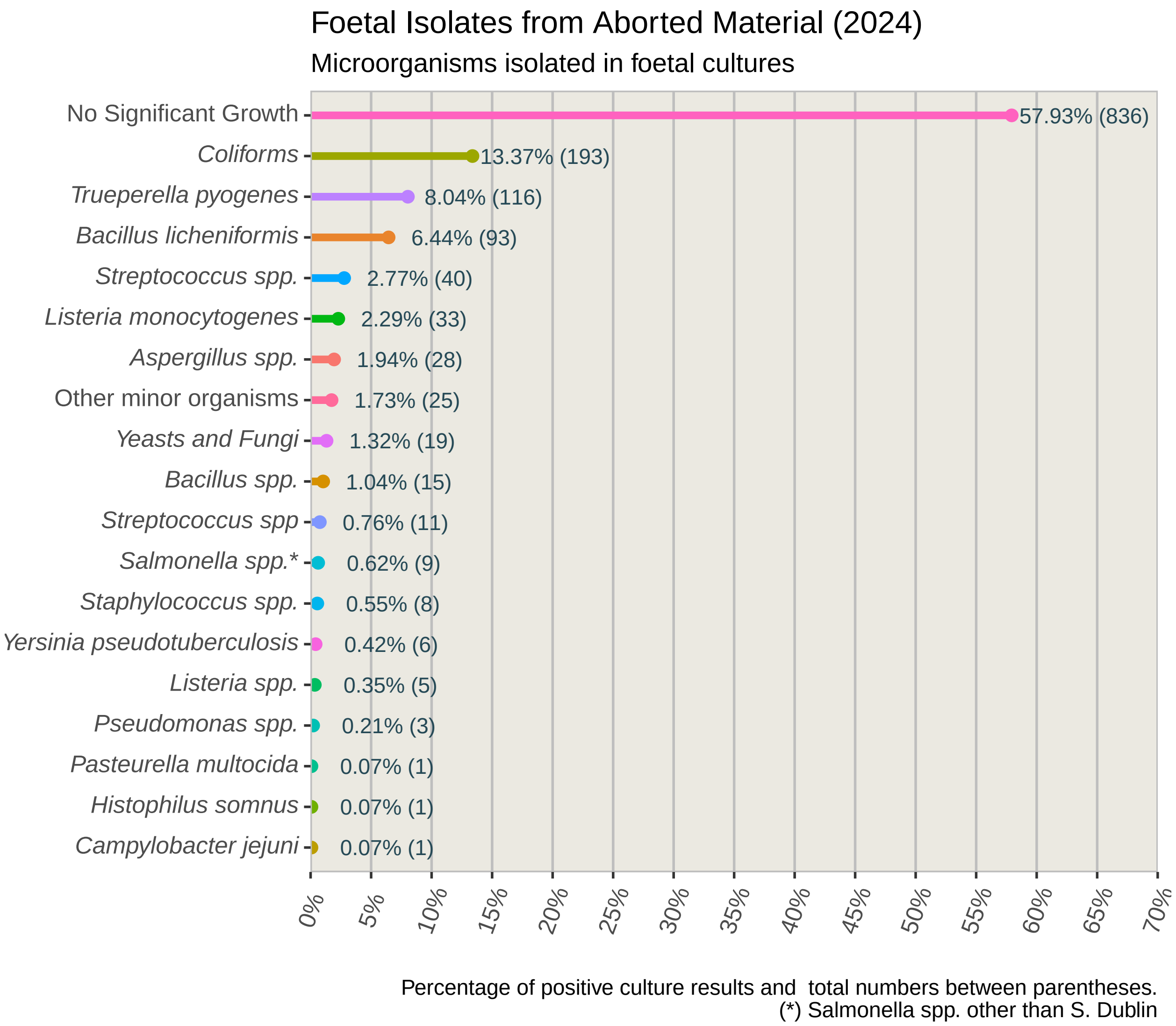

Figure 3.2.: Foetal isolates from aborted material(foetal cultures) in 2024.

3.4. *Salmonella* Culture Results

Salmonella culture involves a different process to routine culture, and so the results are considered separately here. 1217 *Salmonella* culture results were recorded, of these, 19 (1.56 *per cent*) were positive. The figure was 3.3 *per cent* in 2023 and represents a continuing decline in positive cultures over the last number of years. Various factors such as biosecurity, vaccination and other disease control programmes have indirect benefits on prevalence. The Figure 3.3 shows the the annual distribution of *Salmonella* Dublin plotted over the distribution of foetal submissions in 2024.

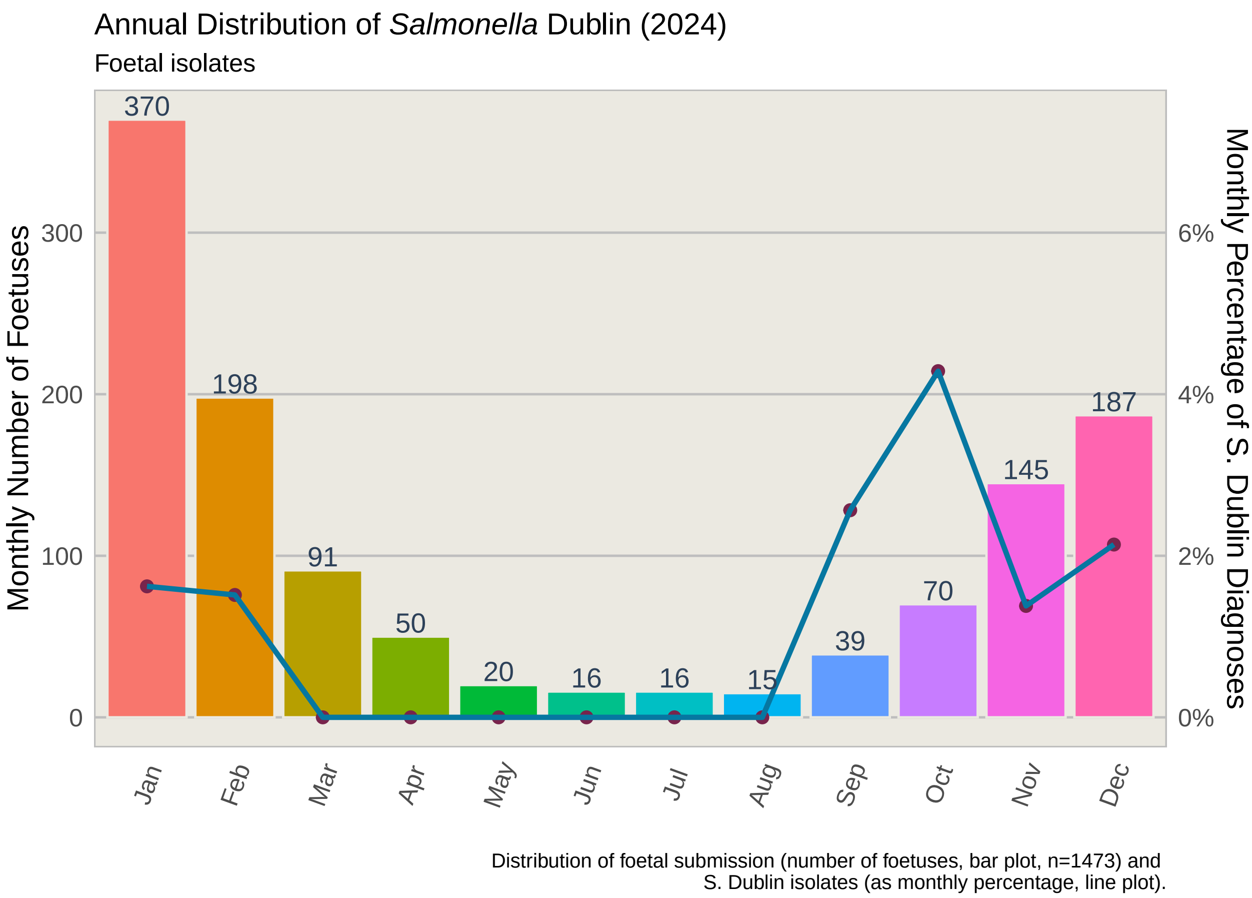

Figure 3.3.: Annual Distribution of *Salmonella* Dublin abortion in foetal submissions during 2024.

3.5. *Leptospira spp.*

Leptospira pathogens were detected by PCR in 1.02 *per cent* (23 out of 2245 examined samples) from 2021 to 2024. A positive PCR result indicates the bacteria reached the uterus, suggesting a strong link between presence of *Leptospira* and abortion. However, some cases could be missed due to the limit of detection of the method and the non-systematic testing of all organs e.g. placenta (Grégoire et al. 2020)

3.6. Bacterial PCR results

PCR can allow detection of specific pathogens not usually identifiable through routine culture methods. Swabs taken from various tissues are submitted for a bespoke Bovine Abortion PCR Test which includes seven bacteria (Table 3.4) and one virus BHV-4 (Table 3.5).

The most common bacterial pathogens identified via PCR (Table 3.4) were *Listeria monocytogenes* at 5.2 *per cent* , *Coxiella burnetiid* at 3.1 *per cent* , *Salmonella* spp at 2.6 *per cent* and *Anaplasma phagocytophilum* (Tick-borne fever) at 1.9 *per cent*.

Coxiella burnetii can be shed by infected cows during normal parturition, so its presence alone cannot be considered conclusive proof that it was the cause of foetal death. This finding must be considered alongside histopathology of the placenta, individual animal serology and herd history in evaluating its significance.

C. burnetii can cause a zoonotic disease called Q-Fever, and it is important that appropriate protective measures are taken by anyone assisting calvings in infected herds and not to drink unpasteurised milk.

Table 3.4.: Frequency of detection via PCR of selected bacterial agents in bovine foetal material during 2024.

Pathogen	Total No. Tests	No. Positive	Percentage Positive
Anaplasma phagocytophilum	968	18	**1.9**
Campylobacter fetus	967	3	**0.3**
Chlamydia spp.	967	9	**0.9**
Coxiella burnetii	987	31	**3.1**
Leptospira pathogenic serovars	968	3	**0.3**
Listeria monocytogenes	966	50	**5.2**
Salmonella spp.	968	25	**2.6**

Table 3.5.: Frequency of detection via PCR of viruses in foetal material in 2024.

Virus	Total No. Tests	No. Positive	Percentage Positive
BHV-1	59	0	**0.0**
SBV	168	3	**1.8**
Pestivirus	187	0	**0.0**
BTV	137	0	**0.0**
BHV-4	1072	26	**2.7**

3.7. Viral PCR Results

Note

Please note sampling and testing for abortifacient viruses are from targeted calves due to observed deformities or from herd history.

Viruses associated with bovine foetal death (Table 3.5) include Bovine herpesvirus-1 (BHV-1), Schmallenberg virus (SBV)(Figure 3.4), Pestivirus-bovine virus diarrhoea virus (BVD), Bluetongue virus (BTV) and bovine herpesvirus-4 (BHV4). The greater number of BHV-4 tests carried out reflects its inclusion in the Bovine Abortion PCR package mentioned above. The role of BHV-4 in reproductive disorders of cattle is currently unclear and often works in synergy with other pathogens.

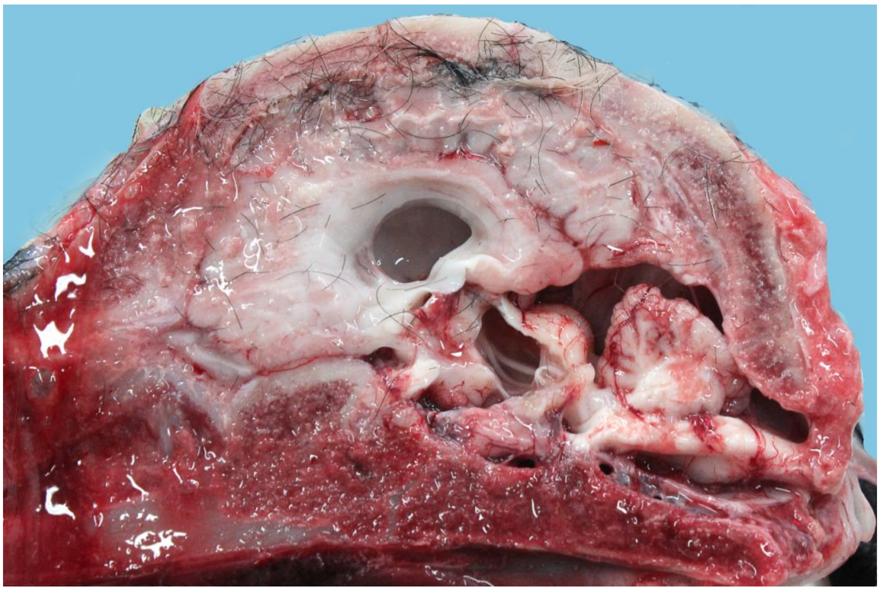

Figure 3.4.: SBV infection in pregnant animals can lead to the development of hydranencephaly in the foetus. Photo: Cosme Sánchez-Miguel.

4. Bovine Neonatal Enteritis

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4.1. Overview

Several infectious agents have been associated with diarrhoea in calves less than four weeks old (Figure 4.1). Frequently combinations of these agents can occur with the co-infections often appearing more severe. Animal Health Ireland's website provides several useful *Calf Care*[1] information leaflets including management of the scouring calf.

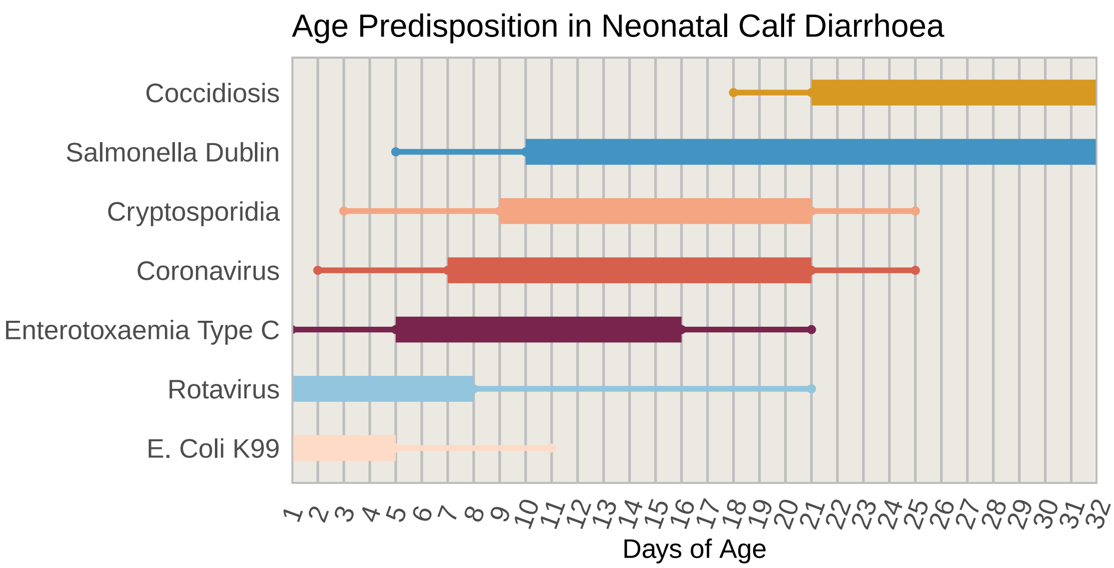


Figure 4.1.: Agent and age predisposition in neonatal calf diarrhoea, the thick area represents the most likely period of disease.

To facilitate appropriate management and prevention, accurate identification of the underlying aetiological agent is required. Many of the agents however are only transiently present which hinders diagnosis, therefore ideally submissions of carcasses for postmortem along with samples from multiple untreated animals in the early stages of the disease, and representative of the herd problem should be submitted. Non-infectious causes of diarrhoea should also be considered such as nutritional or management problems. Failure of passive transfer of immunoglobulins is a key risk factor in developing neonatal enteritis, and investigations of outbreaks should always include an assessment of passive transfer.

It should also be noted that some of the pathogens causing neonatal enteritis pose a potential zoonotic risk.

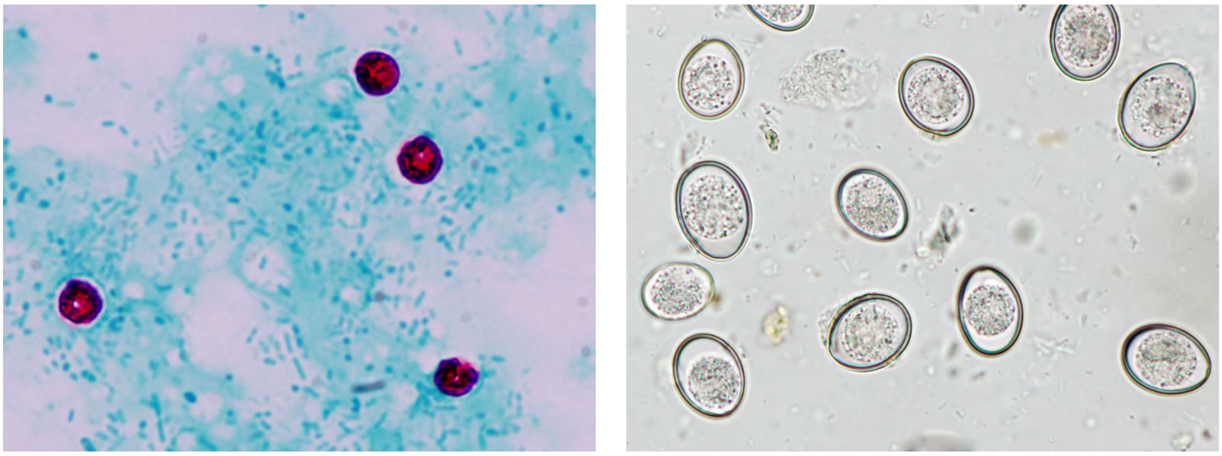
[1] https://animalhealthireland.ie/programmes/calfcare/

Table 4.1.: Number of tests and relative frequency of enteropathogenic agents identified in faecal samples of calves up to one month of age in 2024.

Organism	No. of Tests	Positive	Percentage
Rotavirus	1149	277	**24.1**
Cryptosporidia	1182	197	**16.7**
Campylobacter jejuni	1022	133	**13.0**
Giardia	829	44	**5.3**
Coronavirus	1144	42	**3.7**
E.Coli K99	905	31	**3.4**
Salmonella Dublin	1128	17	**1.5**

4.2. Rotavirus

Rotavirus remained the most prevalent agent detected in neonatal enteritis cases in 2024. It was detected in 24.1 *per cent* of samples, an increase from the 21.3 *per cent* reported in 2023 (Figure 4.3). Calves are most susceptible to rotavirus enteritis between one and three weeks of age (Figure 4.1). Adult animals are the primary source of rotavirus infection for calves. The severity of clinical signs depends on many factors including the immune status of the calf. Diarrhoea usually lasts between four to eight days. Fever can be present and the calves are usually dull and reluctant to drink. Rotavirus targets the villi in the upper small intestine causing shortening and fusion of villi which results in malabsorption leading to diarrhoea. Death may ensue due to acidosis, dehydration and starvation. Control is directed towards preventative measures such as hygiene and adequate colostrum management; specific control measures include vaccination of cows pre-calving, a method which is extremely reliant on the transfer of immunity via colostrum.



(a) Cryptosporidia spp.   (b) Coccidia spp.

Figure 4.2.: Cryptosporial oocysts (a) in the faecal sample on modified Ziehl-Neelsen staining in a neonatal calf. Coccidial ocysts (b) in a neonatal calf with enteritis (sugar flotation). Photos: Cosme Sánchez-Miguel.

4.3. *Cryptosporidium parvum*

Cryptosporidium parvum (Figure 4.2a) was detected in 16.7 *per cent* of samples in 2024, a similar level to that reported in 2022. The parasite causes damage to the epithelial cells of the lower small intestine resulting in mild to severe enteritis. Transmission between animals is by the faecal-oral route, often via a contaminated environment. Affected calves excrete large numbers of oocysts which are highly resistant and can survive in the environment up to several months under favourable conditions. Control of the parasite is best achieved by strict maintenance of good calf housing hygiene practices and avoiding mixing animals of different ages. Ammonia-based disinfectants are most effective. Affected animals should always be isolated from healthy animals. Calf rearing houses should be cleaned on a regular basis, and an all in all out policy should be used. The use of drugs such as halofuginone lactate may also be useful. A vaccine has recently become available . In addition to causing disease in animals, *Cryptosporidium spp.* have the potential to cause zoonotic disease especially in immunocompromised people.

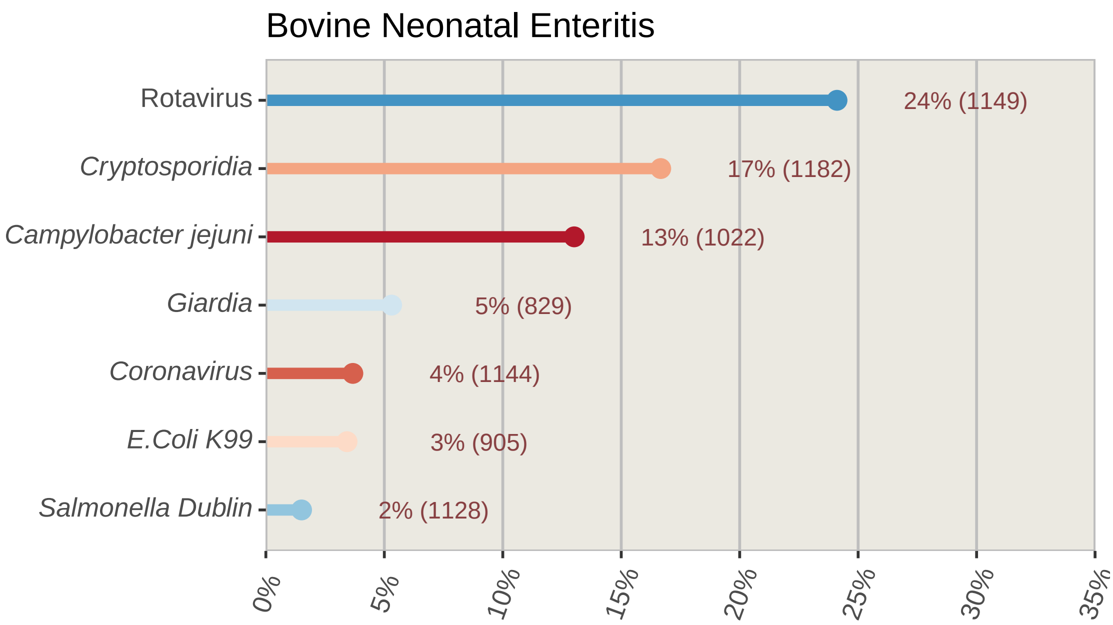


Figure 4.3.: Relative frequency of enteropathogenic agents identified in calf faecal samples (neonatal enteritis package) tested in 2024. Percentage of positive results. Total samples examined varies with the agent, see Table 4.1 .

4.4. *Escherichia coli* K99

E. coli K99 is an enterotoxigenic *E. coli* (ETEC) and is an important cause of neonatal enteritis in very young calves, typically less than three days of age as ETEC adhesin receptors are only present on enterocytes for a few days. These strains of *E. coli* preferentially colonise the lower small intestine and produce toxins that cause secretion of water and electrolytes from the intestinal mucosa, resulting in rapid dehydration.

E. coli K99 was detected in 3.4 *per cent* of samples, the percentage prevalence of *E. coli* K99 would likely be higher if testing for this enteric pathogen was restricted to animals less than one week old. Control by vaccination of cows pre-calving is common; this is again reliant on good colostrum management. Maintenance of a hygienic environment to prevent build-up of pathogenic *E.coli* strains is also important.

4.5. *Salmonella enterica* subspecies *enterica* serovar Dublin

Salmonella was again detected at low levels in this age group (1.5 *per cent*). Enteritis with septicaemia is the usual syndrome in newborn calves. When systemic disease occurs it is typically in immunodeficient calves. Illness may be acute, with depression, fever, and death in 24–48 hours. Neurologic signs and pneumonia may be seen. Again, it is a potential zoonosis.

4.6. *Campylobacter jejuni* and *Giardia*

Campylobacter jejuni was detected in 13 *per cent* of samples in 2023. The significance of *Campylobacter jejuni* as a cause of calf/ lamb enteritis is doubtful; however, *C. jejuni* is a common cause of gastroenteritis in humans.

Giardia spp. an intestinal protozoan parasite was detected in 5.3 *per cent* of samples. In recent years giardiosis

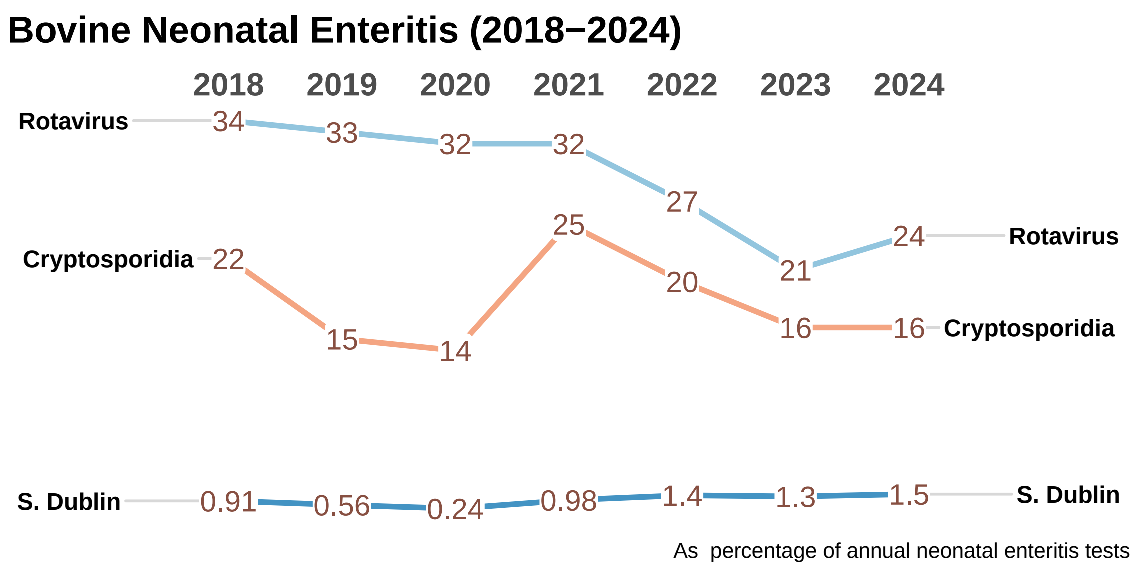


Figure 4.4.: Trends in the incidence of Rotavirus, *Cryptoporidia spp.* and *Salmonella* Dublin enteritis in calves less than one month of age.

has been recognised as a potential cause of enteritis in calves. The route of transmission is faecal-oral. *Giardia spp* are potentially zoonotic and standard hygiene measures should be advised.

> Colostrum feeding
>
> Colostrum feeding is crucial to ensure the survival and health of young calves. Calves are born with low levels of antibodies, and it is essential that they receive the antibody-rich colostrum from their dam in the first few hours of life. This is a vital step in reducing the incidence of neonatal calf disease and death. Colostrum status can also markedly affect overall calf performance in the first weeks and month of life.

4.7. Coronavirus

Coronavirus was detected in 3.7 *per cent* of cases in 2023. Calves typically show clinical signs of the disease between five and 30 days of life. Clinical signs begin approximately two days after exposure and continue for three to six days. Typically, coronavirus infection causes profuse watery diarrhoea, suckling reflex is weak, and dehydration can develop rapidly. Decreased food intake, fluids, and electrolyte loss can result in dehydration, metabolic acidosis, and hypoglycaemia.

4.8. Coccidiosis

Eimeria spp. (Figure 4.2b) typically cause clinical disease in calves from three weeks to nine months of age, therefore coccidiosis will feature in other chapters in this report. Seventeen *per cent* of samples from calves under one month of age (n=534) tested positive for coccidia (Table 4.2), a decrease compared to 21 *per cent* in 2023. The damage to the gut lining in heavy infections in non-immune calves leads to diarrhoea, dehydration, dysentery, tenesmus, loss of condition, and deaths can occur.

These organisms are host specific i.e. coccidia from one animal cannot affect another species. Therefore birds do not transmit coccidiosis to cattle. There are over a dozen *Eimeria* species that can infect cattle, but only three species are considered to be pathogenic: *Eimeria bovis*, *E. zuernii* and *E. alabamensis*. Due to the potential presence of many non-pathogenic species of coccidia in faecal samples from calves, caution should be exercised when interpreting positive results. Diagnosis is based on the clinical history, the age of the animal and faecal sampling.

Table 4.2.: Number of tests and relative frequency of cocidiosis agents identified in faecal samples of calves up to aproximatly one month of age in 2024.

No. of Tests	Positive	Percentage
524	90	**17**

It is important to remember that the absence of oocysts is not evidence of the absence of pathogenic coccidia. Peak of clinical signs may not coincide with peak oocyst shedding. Multiple animals should be sampled when coccidiosis is being investigated. Clinical signs of diarrhoea may proceed oocyst output and/ or may continue after the number of oocysts decrease.

Important Points in Neonatal Enteritis

- Multiple faecal samples from untreated calves early in the course of infection.
- Feeding an adequate quantity of good quality colostrum is essential for calves to develop immunity to enteropathogens.
- Maintaining hygiene of calf rearing facilities is imperative to reduce environmental contamination and breaks the transmission cycle of enteropathogens
- Many of the pathogens affecting this age group pose a potential zoonotic risk.

5. Zinc Sulphate Turbidity Test

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The Zinc Sulphate Turbidity (ZST) test is a useful diagnostic tool used to evaluate the quality of colostrum ingested by neonatal calves and to ensure successful passive transfer of immunity. This test works by adding a zinc sulphate solution to a serum sample from the calf, which causes immunoglobulins (primarily *IgG*) to precipitate, creating turbidity. The degree of turbidity, measured in ZST units, reflects the concentration of immunoglobulins present in the serum.

Immunoglobulins are essential antibodies that calves must acquire through colostrum within the first few hours of life. This passive transfer of immunity is crucial as calves are born without significant levels of antibodies and rely on colostrum to provide the necessary immunity against pathogens during their early life. Adequate colostrum intake is typically defined as a ZST value of greater than 20 units, indicating sufficient immunoglobulin levels.

ZST Interpretation

A ZST value of 20 units or greater is considered optimal, a value between 19 and 12.5 units is considered adequate but sub-optimal, and values of 12 units or below are considered inadequate.

In practice, the ZST test is utilised to identify calves at risk of Failure of Passive Transfer (FPT), which occurs when serum *IgG* concentrations are insufficient. FPT can lead to increased morbidity and mortality due to increased susceptibility of calves to infections during the neonatal period including septicaemia, enteritis and pneumonia.

Optimal management practices for colostrum feeding include ensuring that calves receive 10–12 *per cent* of their body weight in high-quality colostrum within the first two hours of birth. The colostrum should be harvested from cows within the first few hours post-partum, as *IgG* concentrations decline rapidly subsequently. Additionally, good hygiene should be practiced during colostrum collection and storage to prevent bacterial contamination, which can interfere with the absorption of immunoglobulins.

Table 5.1.: Zinc Sulphate Turbidity Test Results in Master.

Status	No. of samples	Mean	Percentage
Diagnostic Samples			
Optimal	248	29.9	**52**
Adequate	115	16.2	**24**
Inadequate	115	8.0	**24**
Carcass Samples			
Optimal	68	26.9	**23**
Adequate	83	15.4	**28**
Inadequate	143	5.8	**49**

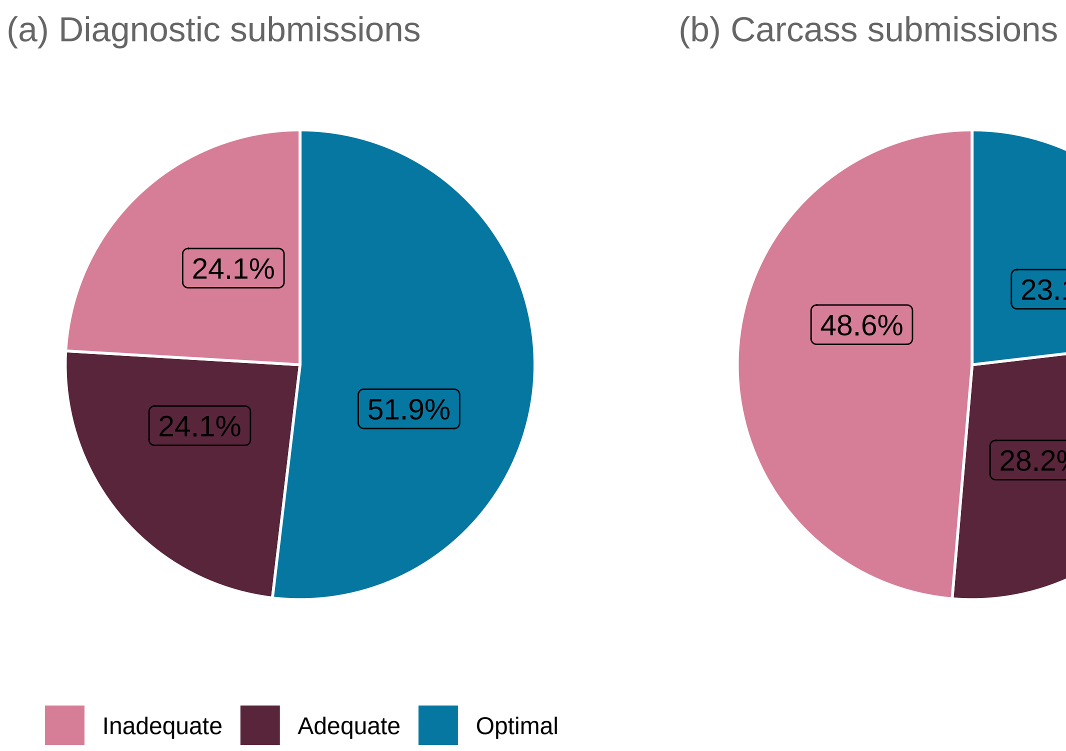

Figure 5.1.: Results of ZST from bovine blood samples obtained from diagnostic (a) and carcases (b) submissions to RVLs in 2024 (n=446).

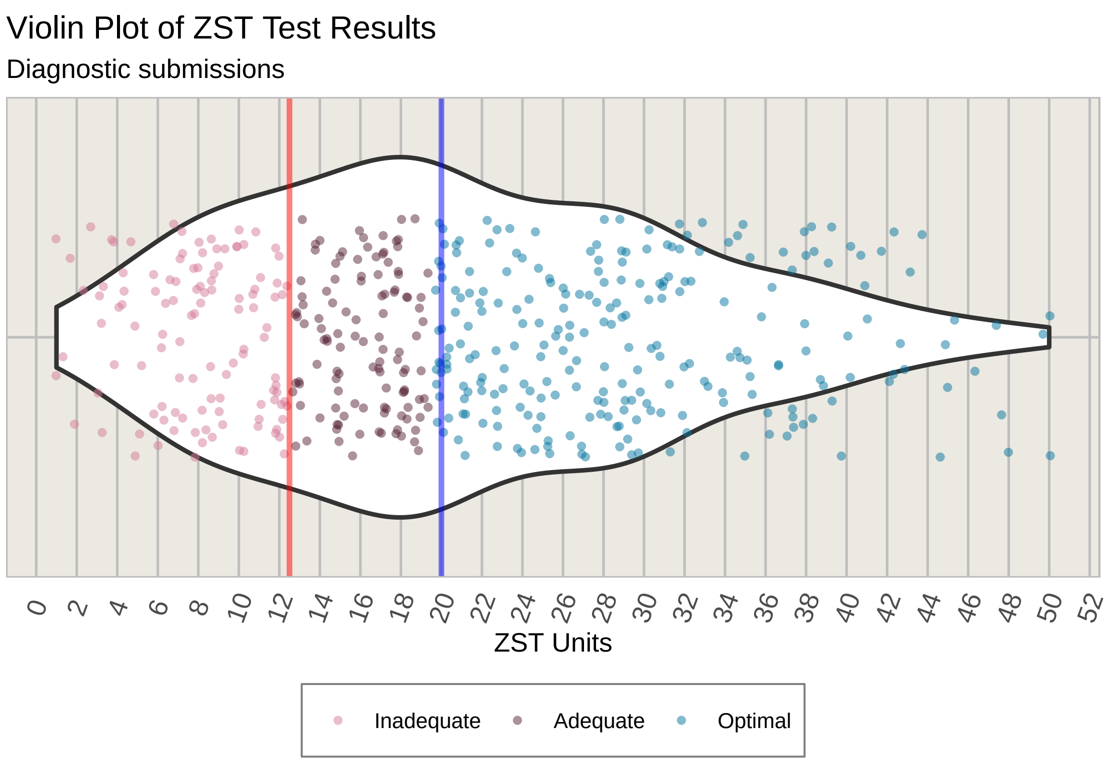

Figure 5.2.: Distribution of ZST test results during 2024. Optimal colostral immunity is defined as greater than 20 units (blue line), adequate between 12.5 and 20 units and inadequate less than 12.5 units (red line). The width of the white area at each point of the x-axis is proportional to the number of samples returning a ZST result of that value (n=478).

The ZST test, therefore, serves as an indirect but effective measure of colostrum intake and quality and serves as a guide for farmers and vets to ensure neonatal calves receive the necessary antibodies to support early immune function. Results of ZST testing carried out by RVLs on diagnostic (postal) and carcass submissions during 2024 are demonstrated in Figure 5.1, (a) and (b), and Figure 5.2.

A single ZST test provides limited information on the efficacy of colostrum management practices within a herd. To best determine whether there is adequate transfer of passive (colostral) immunity, it is recommended that multiple samples, up to twelve, are taken from two to 10 day old healthy calves.

One-day-old calves are not suitable for ZST testing as circulating levels of immunoglobulin peak 36 hours after colostral ingestion. The ZST test is also not useful in calves older than 14 days old as the test does not distinguish between colostral and endogenous immunoglobulins. Testing healthy calves is preferable as immunoglobulin concentration levels decrease during illness due to antigen binding and/or loss through kidney/intestine. In dehydrated calves, ZST levels can be increased due to haemoconcentration.

Benefits of Colostrum

- Provides essential immunoglobulins and immune factors to calves to reduce their susceptibility to infectious diseases.
- Contains considerably more fat than milk, essential for maintaining body temperature in new-born calves.
- Contains essential fat-soluble vitamins that cannot be absorbed across the placenta.
- Acts as a heat source when fed at the correct temperature (approx. 38.5–39 °C).
- Hydrates the calf, increases blood volume and improves circulation resulting in improved survival.

6. Clostridial Diseases in Bovine and Ovine

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6.1. Aetiology

Clostridia are anaerobic, sporulating, gram positive bacteria that produce toxins. They are ubiquitous and able to survive for prolonged periods on land under extreme weather conditions and they can be benign inhabitants of the intestinal tract of animals. Predisposing conditions are needed for clostridial infections to occur, i.e., a deep wound or traumatic injury that compromise the skin or an alteration of the gastrointestinal tract microbiota due to a change in diet. When these conditions are met, the bacteria produce toxins which are responsible for the pathology caused by these bacteria.

They are responsible for non-communicable infectious diseases that from a pathogenic point of view can be grouped into three categories: histotoxic clostridia which produce exotoxins at sites other than the alimentary tract, enterotoxaemia's and other alimentary tract infections and neurotoxic clostridia. See table Table 6.1 for main clostridial diseases detected in RVL's during 2024.

6.2. Transmission

- **Neurotoxic**: *C. botulinum* enters the body through ingestion of preformed toxin, toxins in feed can be caused by direct growth of *C. botulinum* in feeds or contamination of feeds with toxin containing carrion, while other less common routes of entry are through a wound or toxins produced by growth and infection of the alimentary tract. The entry of *C. tetani* into the body usually occurs through wounds deep enough to create an anaerobic environment, allowing clostridia to proliferate and produce toxins. Castration, tail docking or placement of ear tags can provide a portal for entry.

- **Enterotoxic**: Young animals on high planes of nutrition (lush grass, cereal crops, grain) or subject to abrupt changes in diet (change of pasture, introduction of concentrates), are predisposed to developing this condi-

Table 6.1.: Main clostridial diseases detected in RVLs during 2024

Clostridial Disease	Causative Agent	Species affected
Histotoxic		
Blackleg	*C. chauvoei*	Mainly cattle
Malignant Oedema	*C. septicum, C. sordellii, C. chauvoei, C. novyi*	Cattle and sheep
Black Disease	*C. novyi*	Cattle and sheep
Enterotoxaemic		
Pulpy Kidney Disease (PKD)	*C. perfringens*	Mainly sheep
Enterotoxaemia (excl. PKD)	*C. perfringens, C. sordelli, C. septicum*	Cattle and sheep
Neurotoxic		
Botulism	*C. botulinum*	Mainly cattle

Table 6.2.: Clostridial disease diagnosed in bovine carcasses in 2024 (n= 139).

Disease	No. of Cases	Percentage
Blackleg	109	**78.4**
Clostridial Enterotoxaemia	17	**12.2**
Black Disease	6	**4.3**
Botulism	6	**4.3**
Malignant Oedema	1	**0.7**

tion. Stress may also induce intestinal upset, ultimately leading to an intestinal dysbiosis which favours this disease. Enterotoxaemia accounts for most of the clostridial deaths diagnosed in ovine animals submitted to RVL's in 2024 (109 cases). See Table 6.3

(a) Blackleg: clostridial myositis

(b) Blackleg: pericarditis

Figure 6.1.: Necrohaemorrhagic inflammation and emphysema (a) in a weanling calf with clostridial myositis (blackleg). Fibrinous epicarditis (b)(arrow) occasionally associated with blackleg. Photos: Cosme Sánchez-Miguel.

- **Histotoxic**: Malignant oedema (*C. septicum*, *C. novyi*, *C. sordellii*, *C. chauvoei*) affects sheep and cattle and its route of entry is similar to *C. tetani*, i.e. deep wounds or intramuscular injections that produce anaerobic conditions. Blackleg (*C. chauvoei*) (Figure 6.1a and Figure 6.1b) is a condition that occurs following ingestion of spores that migrate to musculature and proliferate releasing toxins when conditions are favourable, i.e., trauma. Blackleg accounts for most of the clostridial deaths detected in bovine animals submitted to RVL's in 2024 (111 cases). See Table 6.2 and Figure 6.2 which shows peak detection of cases in August. This is a large increase in the numbers of cases detected in 2023 (n=63). Black disease (*C. novyi*) or infectious necrotic hepatitis and bacillary haemoglobinuria (*C. haemolyticum*) are closely associated to parasitic co-infection, usually *Fasciola hepatica*, which creates anaerobic conditions favourable to the development and production of clostridial toxins.

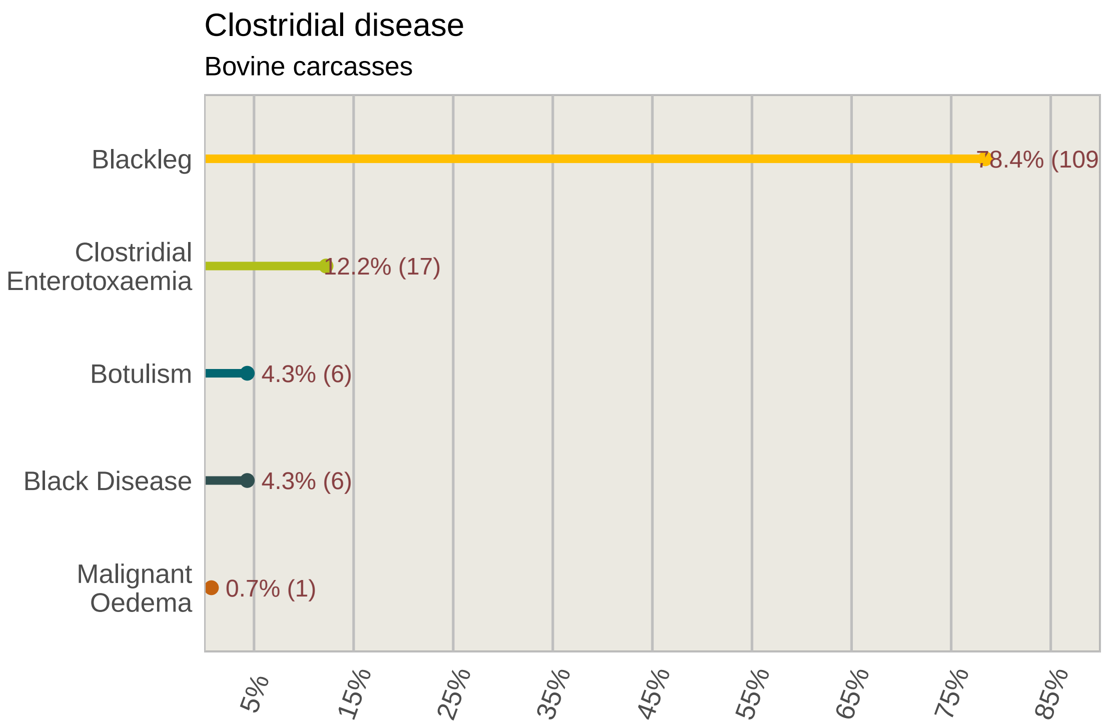


Figure 6.2.: Clostridial disease diagnosed in bovine carcases in 2024 (n=139).

6.3. Clinical signs

- **Neurotoxic**: In the case of *C. tetani*, spastic paralysis or convulsions may be observed, while in *C. botulinum* infections, the paralysis is flaccid.

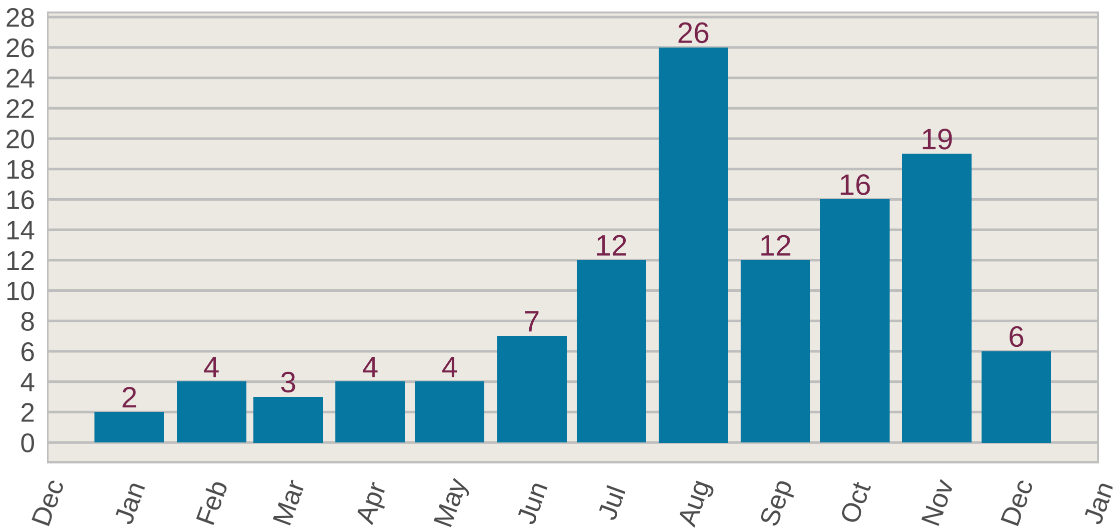


Figure 6.3.: Occurrence of blackleg diagnoses in RVLs in 2024, by calendar month (n=115).

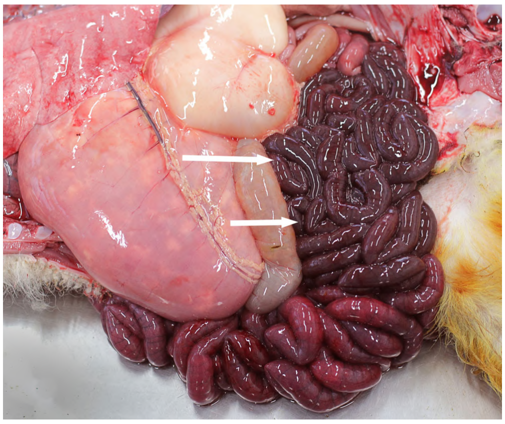
- **Enterotoxic**: Typical presentation is hyperacute; however, animals may be found dead without warning. Clinical signs include bloating, fever, dullness, staggering, opisthotonus, convulsions and recumbency. Sub-acute forms of enterotoxaemia take the form of mild enteritis, where toxaemic action is low and these animals usually recover within 3–4 days.

- **Histotoxic**: Typical clinical signs of malignant oedema are oedema and subcutaneous emphysema, fever, recumbency and acute death. Animals infected with blackleg present with swelling and emphysema of the affected muscle areas, fever, recumbency and acute death. In both bovine bacillary haemoglobinuria

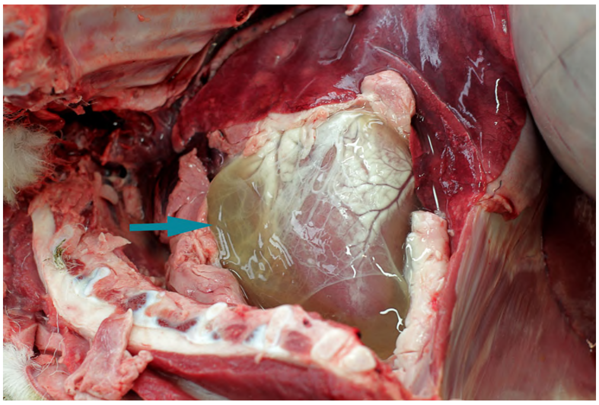
Table 6.3.: Clostridial disease diagnosed in ovine carcasses in 2024 (n= 121).

Disease	No. of Cases	Percentage
Clostridial Enterotoxaemia	75	**62.0**
Pulpy Kidney Disease	35	**28.9**
Blackleg	6	**5.0**
Black Disease	3	**2.5**
Braxy	1	**0.8**
Malignant Oedema	1	**0.8**

and infectious necrotic hepatitis there may be jaundice of the mucous membranes. in cases of bacilary haemoglobinuria the urine may be blood tinged.



(a) Enterotoxaemia



(b) Pericardial effusion

Figure 6.4.: Hemorrhagic enteritis (a) in a lamb with *C. perfringens* endotoxaemia type C. (b) Pericardial effusion (arrow) with gelatinous fibrin in a lamb with *C. perfringens* type D enterotoxaemia. Photos: Cosme Sánchez-Miguel.

6.4. Gross Lesions

- **Neurotropic**: In the case of *C. tetani*, *C. tetani* and *C. botulinum*, it is difficult to find characteristic lesion at necropsy. For *C. tetani*, the entry wound may be the only visible change and for *C. botulinum*, the discovery of suspicious feedstuffs in the stomachs may be the only signal of potential toxicity.

- **Enterotoxaemia**: Rapid decomposition and bloating are common signs at necropsy. Exudates are usually present in all cavities; pericardial (Figure 6.4b), pleural and abdominal. In the case of *C. perfringens* type D (pulpy kidney), there is obvious degeneration of the renal parenchyma and focal symmetrical encephalomalacia is the most prominent lesion seen in chronic cases. Gross lesions may include herniation of the cerebellar vermis and multifocal, bilateral, symmetric brownish areas in the internal capsule, thalamus and cerebellum. Other findings include, glucosuria, pericardial haemorrhages, abomasitis (braxy) and haemorrhagic enteritis (Figure 6.4a).

- **Histotoxic**: In cases of blackleg and malignant oedema there are characteristic changes to the musculature and subcutaneous tissues respectively. In blackleg infections, the muscles are dark red to black in colour, a sweet odour similar to rancid butter is omitted. The centre of the lesions are usually dry, friable and filled with gas bubbles. In cases of malignant oedema, there is haemorrhage and subcutaneous oedema and emphysema. In cases of bacillary haemoglobinuria, pathognomonic features are a large, usually single area of necrosis delineated by a hyperaemic rim, typically seen at the livers diaphragmatic surface. Other common features are blood tinged urine and faeces, petechial haemorrhages and subcutaneous oedema. In black disease, the liver is swollen, grey-brown in colour and shows characteristic yellow necrotic areas approx. 1–2cm in diameter, that are bordered by areas of hyperaemia. There is haemorrhagic subcutaneous oedema of the ventral regions of the carcass and straw or blood tinged fluid accumulation in body cavities.

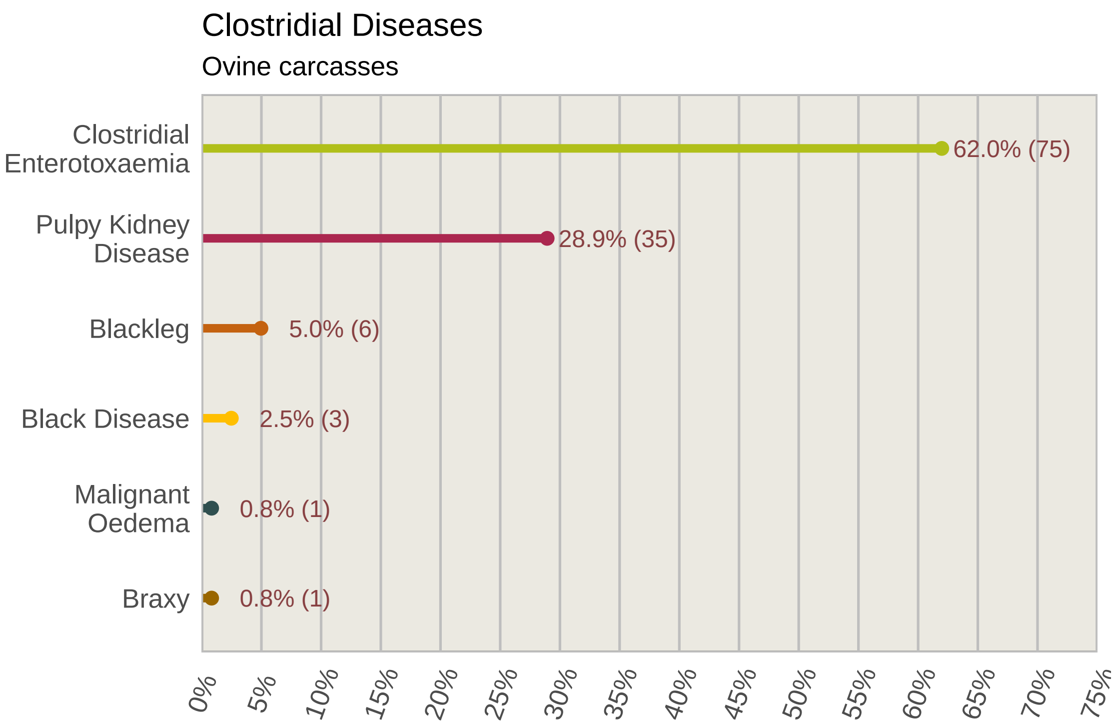


Figure 6.5.: Clostridial disease diagnosed in ovine carcases in 2024 (n=121).

6.5. Diagnosis

Isolation of the bacteria does not confirm a diagnosis; detection of toxin is confirmatory.

- **Neurotropic**: For *C. tetani* clinical signs compatible with the disease and recent trauma are usually sufficient to confirm a diagnosis. In *C. botulinum*, sensitivity of toxin detection is poor so failure to detect toxins does not rule out a diagnosis.
- **Enterotoxaemia**: Clinical signs, necropsy findings and detection of toxins (α, β and ϵ).
- **Histotoxic**: Clinical signs, necropsy findings and fluorescent antibody technique on impression smears of tissues.

6.6. Prevention and control

Vaccination of all at-risk animals is the basis of prevention and control of these diseases. A vaccination schedule of two vaccines given 4weeks apart followed by a booster vaccination at the end of the first year is generally recommended. Other control measures include the following:

- **Neurotropic**: For *C. tetani*, good hygiene during routine procedures such as tagging and castration. For *C. botulinum*, avoid chicken litter on pasture land or other direct or close contact. Check fields for animal carcasses prior to cutting and ensile for at least one month to ensure sufficient fermentation.
- **Enterotoxic**: Proper nutritional management to avoid digestive upsets/imbalances. Incorporate buffer substances to the animals' diet. Vaccination of pregnant animals at least 30 days before delivery, to ensure successful passive transfer of immunity to newborn lambs.
- **Histotoxic**: In the case of malignant oedema, hygiene during shearing and injection administration. For *C. novyi*, liver fluke control.

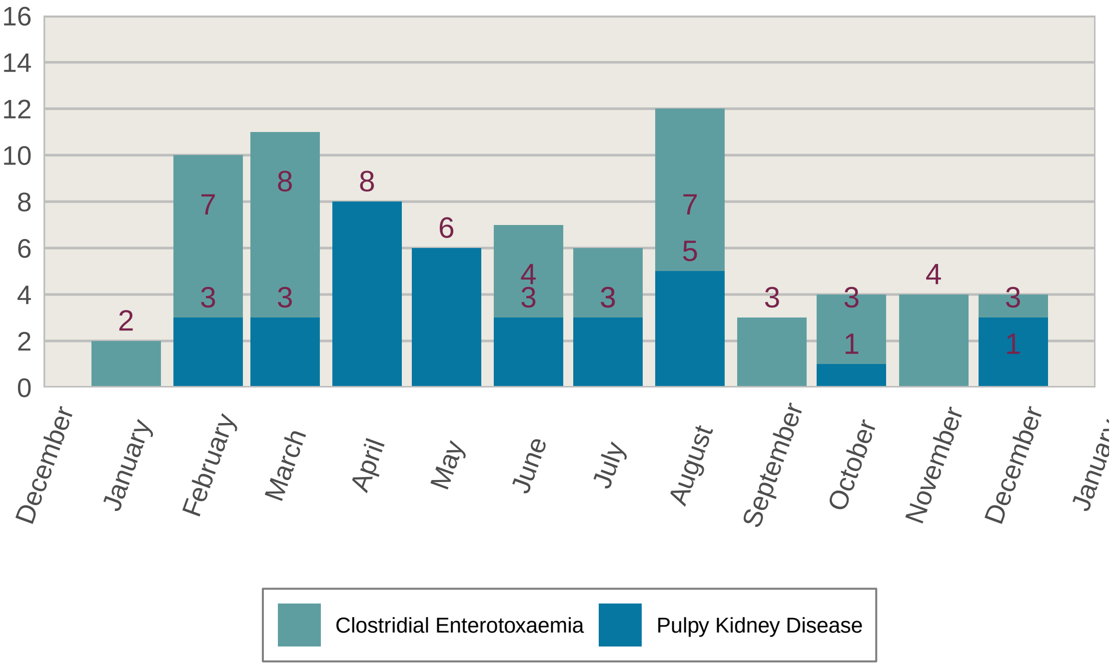


Figure 6.6.: Occurrence of diagnosis of Clostridial Enterotoxaemia and Pulpy Kidney disease in RVLs in 2024, by calendar month (n=110).

6.7. Neurotoxic clostridial disease

Botulism

Six cases of botulism were diagnosed in cattle in 2024. Cases are usually linked with the spreading of poultry litter on pasture or the inclusion of carrion in forage. Clinical signs are related to a progressive muscle weakness or flaccid paralysis. There are no specific gross lesions observed on *post mortem*. Diagnosis is based on history, clinical signs and exclusion of other potential causes of weakness/recumbency. To confirm a diagnosis, testing for toxins of *C. botulinum* is carried out, however sensitivity is low to moderate depending on sample quality, so failure to detect toxins does not exclude a diagnosis.

7. Bovine Mastitis

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7.1. Overview

Mastitis is a highly prevalent disease characterised by inflammation of the parenchyma of the mammary gland, predominantly caused by bacterial pathogens, with considerable economic and welfare implications for the dairy industry. Bovine mastitis is classified based on the duration of infection and the degree of inflammation. Clinical mastitis is associated with visibly abnormal milk (watery with flakes or clots present) often accompanied by swelling, heat, pain and redness of the udder. In severe cases, milk and mammary gland changes are accompanied by systemic signs of illness. In contrast, subclinical mastitis is characterised by a lack of apparent local or systemic inflammation. Instead, subclinical mastitis manifests as a decline in milk production accompanied by an increased somatic cell count (SCC). As a result, subclinical mastitis represents a diagnostic challenge for farmers and vets.

Mastitis pathogens are broadly categorised as *contagious* or *environmental*, depending on their mode of transmission and the reservoir of infection. Contagious mastitis is spread between cows primarily during the milking process with infected mammary glands acting as the reservoir of infection. *Staphylococcus aureus*, *Streptococcus agalactiae* and *Mycoplasma bovis* are important contagious mastitis pathogens. In contrast, with environmental mastitis, the predominant reservoir of pathogens is a contaminated environment. Common sources of these pathogens include faeces, bedding and soil. As a result, it is impossible to eliminate environmental pathogens as they are ubiquitous in the cow's environment and can only be controlled through improved hygiene and cleanliness of cows and their surroundings. The predominant environmental mastitis pathogens are coliforms including *E. coli*, *Klebsiella spp.* and *Enterobacter*. *Streptococcus uberis* and *Streptococcus dysgalactiae* are also considered to be environmental mastitis pathogens but can be transmitted between cows at milking. *E. coli* infections tend to occur immediately before and after calving and thus, housing conditions and management practices of parturient cows should be optimised to minimise exposure to coliforms.

Judicious use of antimicrobials is essential for successful mastitis treatment programs. By identifying the causal pathogen through culture of mastitic milk samples, antibiotic therapy can be targeted with an associated

Table 7.1.: Relative frequency of mastitis isolates in milk samples submitted to RVLs in 2024 (n= 2166)

Result	No. of cases	Percentage
Contaminated	572	**26.4**
No Significant Growth	447	**20.6**
Staphylococcus aureus	396	**18.3**
Streptococcus uberis	221	**10.2**
E. coli	205	**9.5**
Other Isolates	128	**5.9**
Non-aureus Staphylococci	77	**3.5**
Bacillus spp.	66	**3.0**
Streptococcus dysgalactiae	34	**1.6**
Trueperella pyogenes	13	**0.6**
Streptococcus agalactiae	7	**0.3**

Table 7.2.: Relative frequency of most common mastitis isolates in the *Other Organisms* group in milk samples submitted to RVLs in 2024 (n= 2166)

Result	No. of cases
Other	35
Pasteurella multocida	12
Enterococcus faecalis	11
Pseudomonas spp	8
Aerococcus viridans	7
Klebsiella spp	7
Aeromonas hydrophilia	6
Pantoea spp	6
Proteus spp	6
Aerococcus spp.	5
Enterococcus faecium	5
Fungal spp.	5
Klebsiella pneumoniae	5
Streptococcus spp	5
Unidentified Organism	5

reduction in antibiotic use without compromising cow welfare.

Recent changes to EU legislation to address growing issues with antimicrobial resistance have had considerable implications for mastitis therapeutics (*Regulation EU 2019/6*). Prophylactic and metaphylactic use of antimicrobials associated with blanket dry cow therapy has been restricted, with farmers required instead to implement selective dry cow strategies. Additionally, high priority critically important antimicrobials can no longer be used for first line mastitis treatment or prophylaxis. The control of mastitis is therefore becoming more dependent on preventative measures, rapid detection of clinical cases, identification of involved pathogens and targeted antimicrobial treatment. Milk culture and sensitivity testing services are available through DAFM laboratories and several private laboratories AHI Cellcheck Partner Laboratories[1].

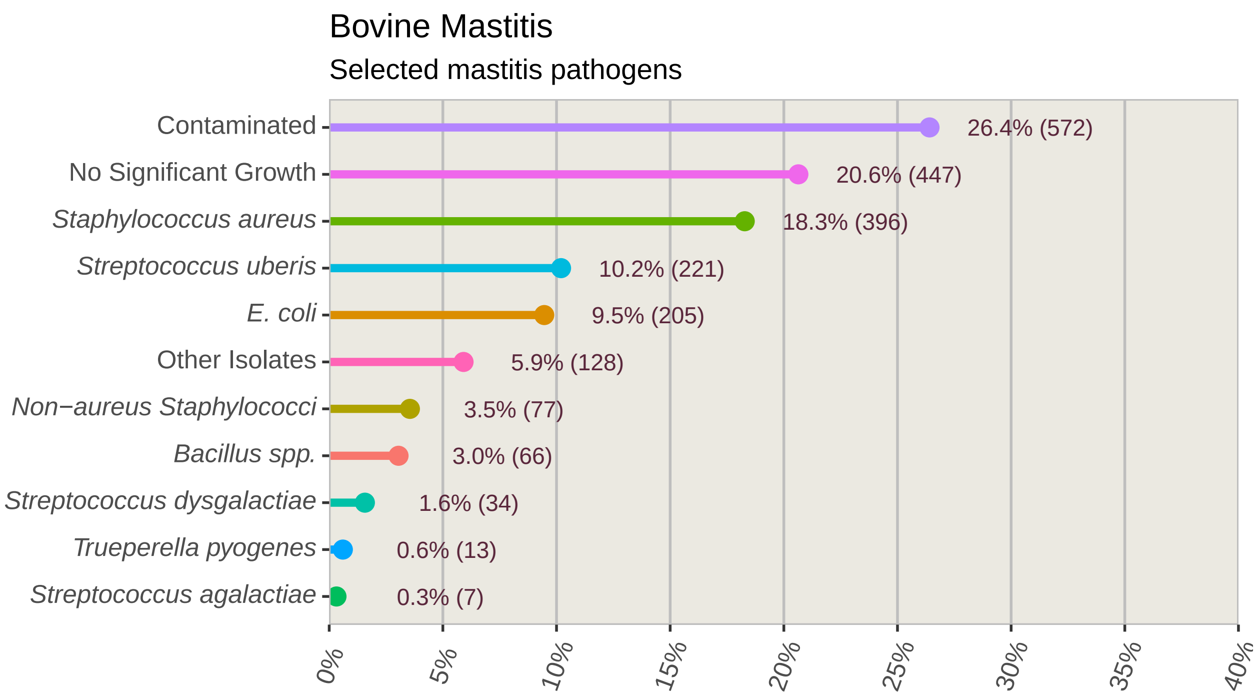

Figure 7.1.: Relative frequency of mastitis isolates in milk samples submitted to RVLs in 2024 (n=2166).

[1] https://animalhealthireland.ie/assets/uploads/2021/05/20201104-CCK-Lab-Listing.pdf

7.2. Milk submissions in 2024

Mastitis culture was performed on 2166 milk sample submissions during 2024. The relative frequency of detection of the most common mastitis pathogens is outlined in Table 7.1 and Figure 7.1.

7.3. Contaminated samples

In 2024, 26.4 *per cent* of milk samples were classified as *contaminated*. Samples are considered contaminated when there is no predominant organism, and there may be several dissimilar bacterial colony types. Contaminants include skin and environmental bacteria that enter the sampling container due to improper sampling technique or by using non-sterile sampling containers. By implementing stringent aseptic techniques during sample collection, the incidence of contamination can be minimised, allowing for accurate identification of mastitis causing pathogens and targeted therapeutic interventions.

Quality of milk samples

The quality of milk samples taken for laboratory examination is extremely important. An aseptic technique for sample collection is a necessity. Contaminated samples lead to misdiagnosis, confusion and frustration.

7.4. *Staphylococcus aureus*

In 2024, *S. aureus* was the most frequently isolated mastitis-associated pathogen in milk sample submissions, accounting for 18.3 *per cent* of isolates. This marks a slight slight decrease in its detection frequency compared to 2023 (22 *per cent*) but is broadly consistent with the overall trend of *S.aureus* detection observed between 2018 and 2024 (Figure 7.2).

S. aureus is a highly contagious mastitis pathogen associated with substantial economic losses due to decreased milk yield, increased culling rates and veterinary costs. Transmission between cows primarily occurs during milking through contaminated equipment and suboptimal hygiene practices. Once *S. aureus* infection becomes established in a herd, it can be difficult to eradicate due to its ability to induce chronic subclinical infections, with persistently high SCCs with intermittent clinical flare-ups. Several *S.aureus* virulence factors allow this pathogen to evade the immune response and contribute to antimicrobial resistance. Chronically infected cows should be identified, segregated and culled to prevent transmission within the herd.

7.5. No significant growth

When there is a lack of colonies or only a few varied colony types, milk culture results are classified as having "no significant growth". In 2024, 20.6 *per cent* of milk submissions showed no growth, indicating an absence of bacteria or the presence of bacteria below detectable levels. Several factors could explain this outcome: the cow's immune system may have resolved the infection, sampling may have taken place after antibiotic treatment, improper sample handling or transport could have decreased the number of viable pathogens or samples may have been taken after milking or there may be intermittent pathogen shedding. To increase the chances of detecting clinically relevant pathogens, it is essential to collect samples aseptically before milking.

7.6. *Streptococcus uberis*

S. uberis was the second most frequently detected mastitis-associated pathogen in 2024, accounting for 10.2 *per cent* of isolates in milk sample submissions. These findings broadly align with those of previous years, albeit at a slightly lower detection rate than in 2023 (12.1 *per cent*). *S. uberis* is an environmental pathogen, commonly found in organic matter, including bedding, soil and faeces. Its ability to thrive in various environments makes it a persistent challenge for dairy farmers, particularly in poorly managed or dirty environments. This bacteria spreads to uninfected cows through environmental contact. As a result, maintaining a clean and dry lying environment for cows is essential to reduce transmission between cows. New infections with *S. uberis* can occur at any stage of lactation or during the dry period. However, the early dry period represents the period of greatest risk of *S. uberis* infection, as the cessation of daily milking eliminates daily flushing of the mammary gland, heightening the risk of mastitis. Cows in the early stages of lactation are also susceptible to new infections, due to the stress and immunosuppressive effects of parturition.

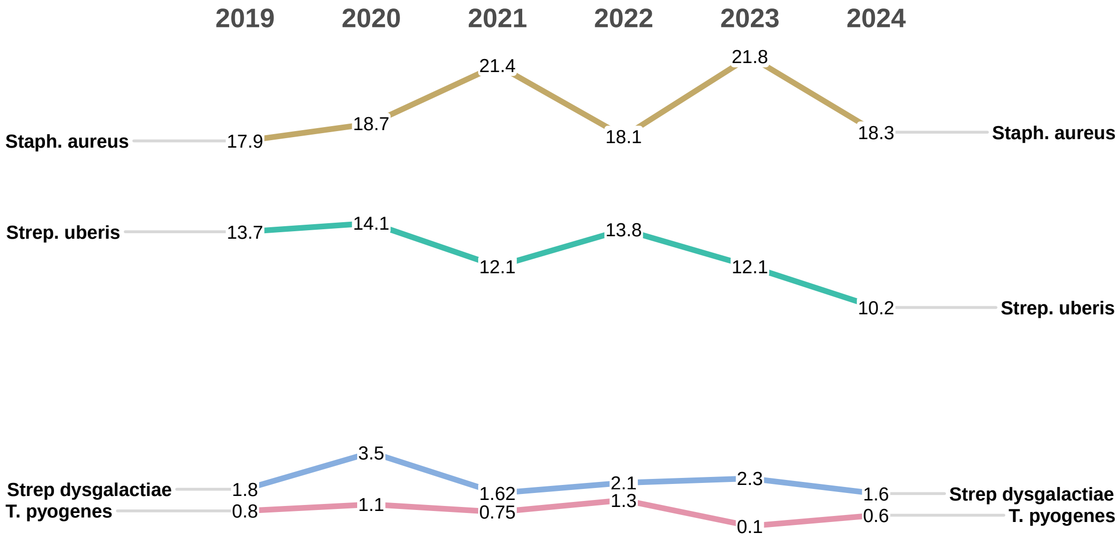

Figure 7.2.: Mastitis-associated organisms isolated in milk based on bovine milk samples submitted to RVLs between 2018 and 2024.

7.7. *Escherichia coli*

E. coli was cultured in 9.5 *per cent* of milk submissions during 2024, in line with results from the previous year (10 *per cent*). *E. coli* is an important environmental mastitis-associated pathogen, characterised by sudden onset and potentially severe clinical signs. *E. coli* is pervasive in dairy environments, particularly in faeces, bedding and other organic materials. *E. coli* mastitis can manifest suddenly with varying severity of clinical signs. Severe infections are commonly associated with systemic illness with affected cows potentially exhibiting fever, inappetence, localised udder inflammation and a significant drop in milk production. The greatest risk period for *E. coli* mastitis is during the early and late phases of the dry period with infections typically remaining subclinical until the postpartum period. Interpreting a positive *E. coli* culture result requires careful consideration to differentiate true infection from contamination. Clinical signs, SCC and environmental factors should be used in conjunction with culture results to inform a diagnosis of coliform mastitis.

7.8. Non-*aureus staphylococci* (NAS)

During 2024, Non-*aureus Staphylococci* species were isolated in 3.5 *per cent* of milk sample submissions. Non-*aureus Staphylococci* (NAS) are a heterogenous group of bacteria that, unlike *Staphylococcus aureus*, are coagulase-negative and are increasingly recognised as significant pathogens in bovine mastitis. NAS species are generally considered to be less virulent than *S. aureus* but these opportunistic pathogens can still cause subclinical and clinical mastitis. NAS species may also play a role in development of antimicrobial resistance.

7.9. Other mastitis pathogens

Mastitis-associated pathogens detected at low relative frequencies in 2024 include *Streptococcus dysgalactiae* (1.6 *per cent*), *Bacillus* species (3 *per cent*), *Trueperella pyogenes* (0.6 *per cent*), and *Streptococcus agalactiae* (0.3 *per cent*).

Milk Sample Collection for Bacteriology: Sampling Technique

1. Take the sample before milking and before any treatment is given.
2. Label the tubes prior to sampling with name/creamery number/herd number, cow number, quarter and date.
3. Using a hand or paper towel brush any loose dirt, straw or hair from teat or underside of the udder. Washing should be avoided if possible. However, if teat is soiled it should be washed and carefully dried with paper towels.
4. Put on gloves.
5. Soak a number of cotton wool balls in alcohol.
6. Clean teat thoroughly with alcohol soaked cotton wool or the medicated wipes until it is thoroughly clean.
7. Remove cap from sampling tube. Place cap on a clean surface with closing side up. Hold open tube at an angle of 45° (holding it straight up will allow dust etc. to fall inside). Using your other hand, discard first few streams of milk on to the ground before collecting three or four streams in the tube.
8. Replace cap on sampling tube.
9. If you feel that some contamination has occurred, discard sample and use a new tube.
10. Place labelled tube in a fridge and cool to 4°C. This is very important.
11. Sample should be taken to the laboratory as quickly as possible. If sample is handed to milk tank driver for delivery, ensure that it is placed in a cool box.
12. If sample is not going to a laboratory immediately, it must be refrigerated until delivery

8. Bovine Parasites

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8.1. Overview

This chapter will focus on internal parasites only, in particular on those affecting the digestive tract. For parasitic disease of the airways and lungs, please refer to the chapter on bovine respiratory disease.

Parasitic disease in grazing livestock is still a significant contributor to diminished performance due to both subclinical and clinical disease. Ongoing climate change may lead to altered parasite seasonality or even the loss of seasonality, as well as the introduction of exotic parasites. Hence, regular parasite monitoring remains an integral part of herd health management. To aid in this, the RVL network provides parasite testing on both clinical samples submitted by farmers through their PVP as well as from *post mortem* samples. *Post mortem* examinations also provide a unique opportunity to diagnose parasitic diseases through gross and histological examination.

Conventionally, parasite control was focused on the use of antiparasiticides. However, due to the increasing emergence of resistance, particularly against anthelmintics, new management strategies have been developed and keep evolving. Grazing management to prevent the buildup of parasite contamination and the protection of refugia to maintain non-resistant parasite populations are just a few examples of strategies being used in recent years.

8.2. *Trichostrongylidae*

The members of the Trichostrongylidae family that affect cattle belong to the genera *Cooperia*, *Ostertagia*, *Haemonchus*, and *Trichostrongylus*. Of these, *Ostertagia ostertagi* and *Cooperia oncophora* are the two main pathogenic species for bovines in Europe.

These affect mainly the gastrointestinal tract and cause parasitic gastroenteritis. Common symptoms include diarrhoea, anorexia, weight loss and hypoproteinaemia with variation in severity of symptoms and even death in severe cases. The severity of clinical signs depends on a range of factors, including parasite burden and the host's immune status.

Of particular interest is *Ostertagia ostertagi*, which affects the abomasal mucosa of the host. This parasite

Table 8.1.: Number of bovine faecal samples tested for Trichostrongylidae eggs in 2024 and results by percentage (n=3892).

Result	No. of samples	Percentage
Negative	2885	**74.1**
Low (50-200 epg)	514	**13.2**
Medium (200-700 epg)	252	**6.5**
High (>700 epg)	241	**6.2**

Table 8.2.: Number of bovine faecal samples tested for Nematodirus eggs in 2024 and results by percentage (n=3892).

Result	No. of samples	Percentage
Negative	3841	**98.7**
Low (50-200 epg)	26	**0.7**
Moderate (200-700 epg)	23	**0.6**
High (>700 epg)	2	**0.1**

typically presents with two distinct syndromes. *Type 1* ostertagiasis which usually occurs during late summer and autumn. The classical symptoms of weight loss and diarrhoea occur due to recent infection by *O. ostertagi*. *Type 2* ostertagiasis occurs when larvae that have become dormant (hypobiotic) or inhibited in development during the larval stages emerge from the glands weeks or months later, causing diffuse diarrhoea. This syndrome is usually very challenging to treat. Routinely, faecal samples are examined using the McMaster method (limit of detection 50 eggs per gram of faeces) to assess the parasite burden in an animal.

Figure 8.1 presents the percentage of positive samples submitted throughout the year. The rise in positive samples from July through to November can be explained by a buildup of pasture challenge throughout the grazing season.

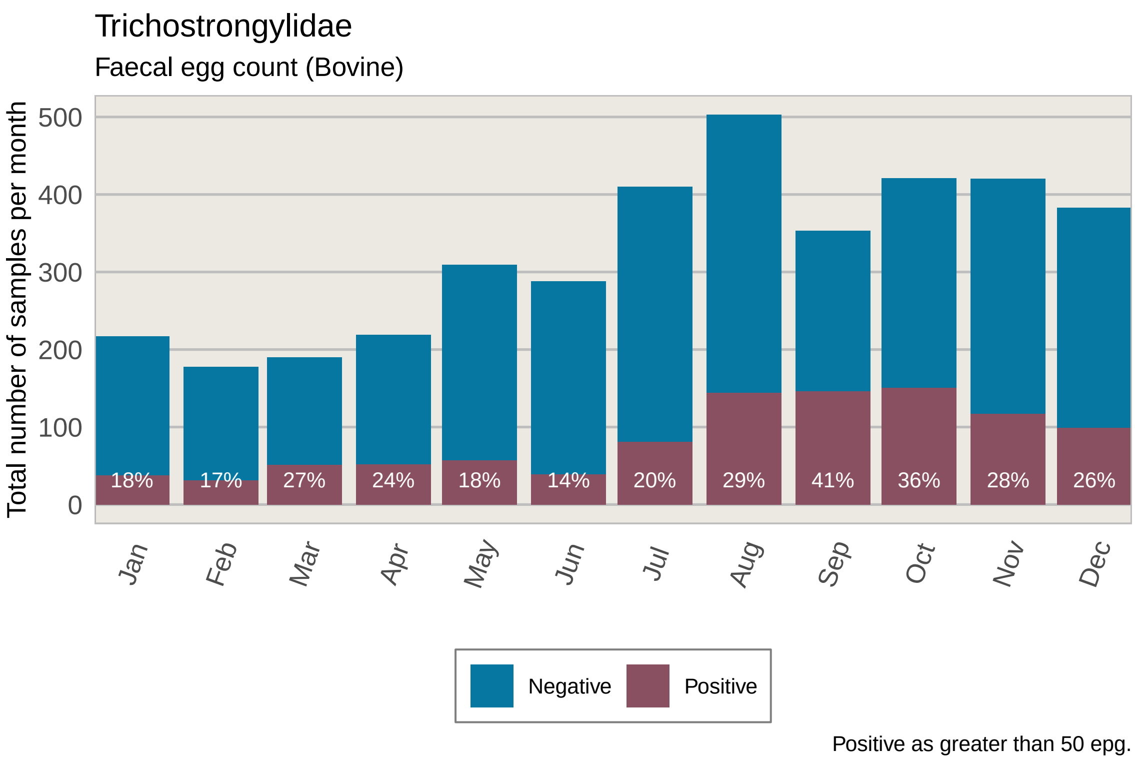


Figure 8.1.: Stacked count of bovine faecal samples (all ages) tested per month for Trichostrongylidae during 2024. The percentage in each bar represents positive samples (n=3892).

8.3. *Nematodirus spp.*

Nematodirus spp. is considered a parasite mainly significant in sheep. However, in exceptional circumstances and high pasture burdens, it has been described as causing clinical disease in calves. However, as in previous years, the number of positive samples for Nematodirus spp. in bovine samples was low in 2024.

Table 8.3.: Number of bovine faecal samples submitted in 2024 (all ages) for detection of coccidial oocysts and results by percentage, (n=4101).

Result	No. of samples	Percentage
Not Detected	3195	**78**
Light Infection	719	**18**
Moderate Infection	87	**2**
Severe Infection	58	**1**
Heavy Infection	42	**1**

8.4. Coccidia spp

Coccidia spp. belong to protozoan parasites and live intracellularly (Figure 8.3). In cattle, they affect enterocytes where they develop and finally burst to release oocytes. Clinical disease presents as diarrhoea, dehydration, tenesmus and dysentery. Young calves from approximately four weeks of age are mainly affected. Stocking density as well as pasture and shed contamination are the main risk factors.

The three most important species affecting bovines are *Eimeria alabamensis*, *Eimeria bovis* and *Eimeria zuernii*, with the latter two being the main species in calves and weanlings.

When submitting samples for coccidiosis, it is essential to consider that clinical signs of diarrhoea may precede oocyst output and/or may persist after the number of oocysts decreases. It is always advised to sample multiple animals in an affected group.

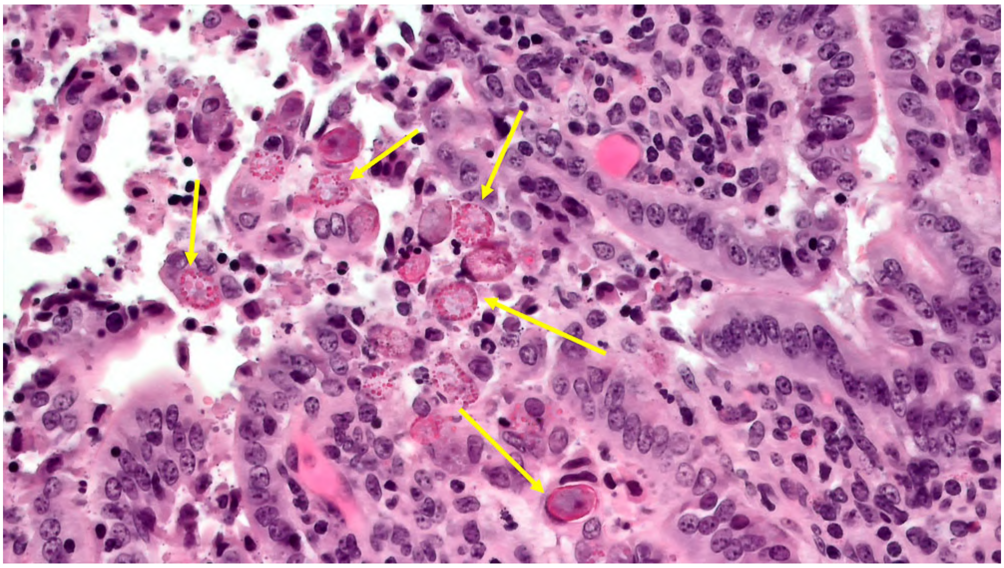


Figure 8.2.: Coccidial development stages (Arrows) in enterocytes in the jejunum of a calf. Photo: Rebecca Froehlich-Kelly.

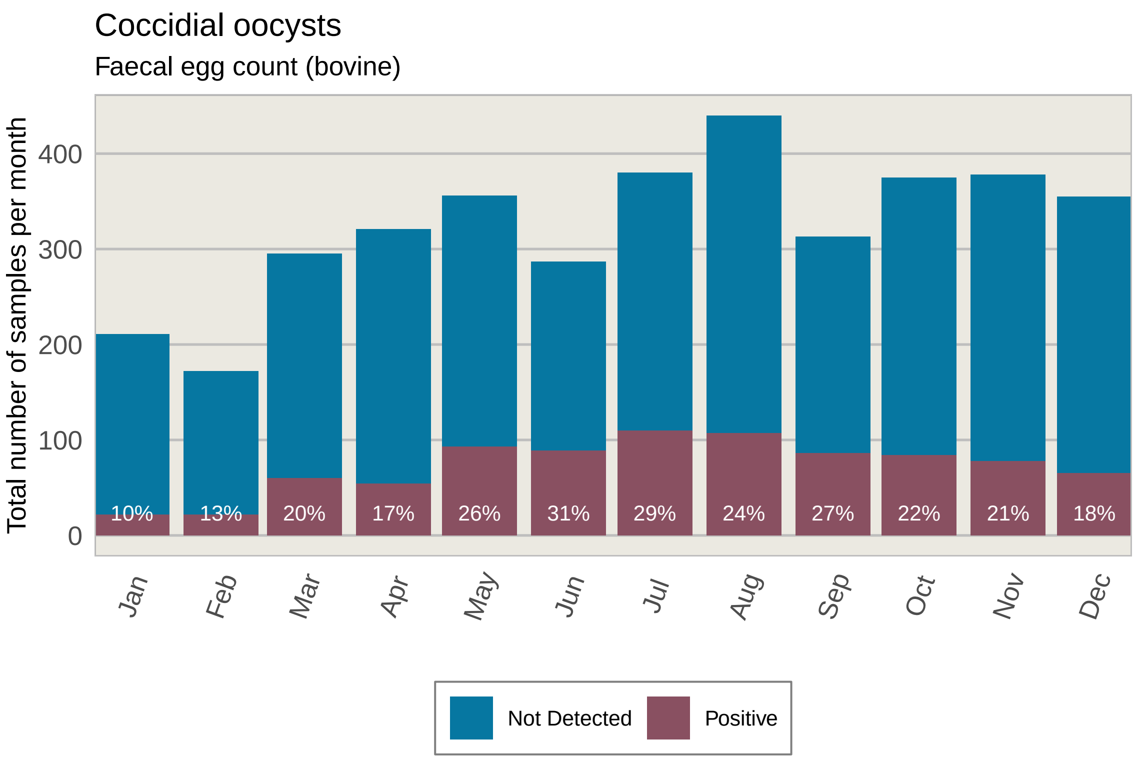
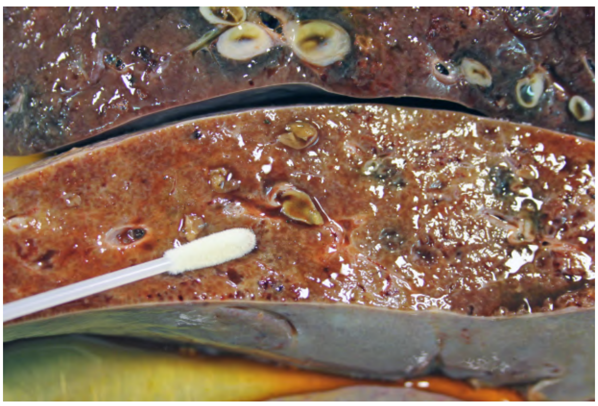


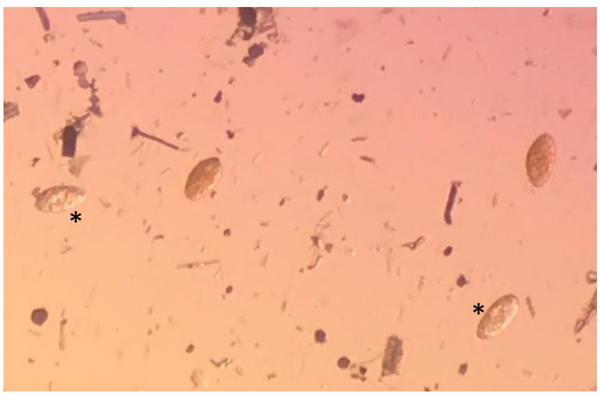
Figure 8.3.: Stacked number of bovine faecal samples (all ages) tested for coccidial oocysts in 2024. The percentage in each bar represents the number of positives (n=4101).

8.5. Liver Fluke and Rumen Fluke

Two species of trematodes are prevalent on the island of Ireland: the liver fluke *Fasciola hepatica* (Figure 8.5) and the rumen fluke *Calicophoron daubneyi* (Figure 8.8).



(a)



(b)

Figure 8.4.: Adult Fasciola hepatica (a) in the bile ducts in a bovine liver. Photo: Aoife Coleman. Microscopic appearance (b) of liver fluke and rumen fluke(*) eggs. Photo: Ryan McGirr.

Eggs of both parasites can be detected in faecal samples using the sedimentation or sugar floating technique, and they can be distinguished from each other by their appearance.

When sampling for liver fluke, it is essential to consider that egg shedding can be intermittent and typically occurs in low numbers. Hence, multiple samples of cohort animals are advised.

Table 8.4.: Number of bovine faecal samples submitted in 2024 (all ages) for detection of liver fluke eggs and breakdown of positive and negative results (n=3422).

Result	No. of samples	Percentage
Liver fluke eggs not detected	3309	**97**
Liver fluke eggs detected	113	**3**

Liver fluke

In contrast to sheep, *Fasciola hepatica* causes predominantly chronic disease in cattle. Typical signs of fasciolosis in cattle are ill thrift and poor performance. Moreover, sequelae to parasitic hepatitis can occur e.g. secondary photosensitisation or oedema (*bottle jaw*).

The number of faecal samples testing positive for liver fluke eggs remains low. In 2024, liver fluke eggs were detected in approximately three *per cent* of samples, similar to previous years.

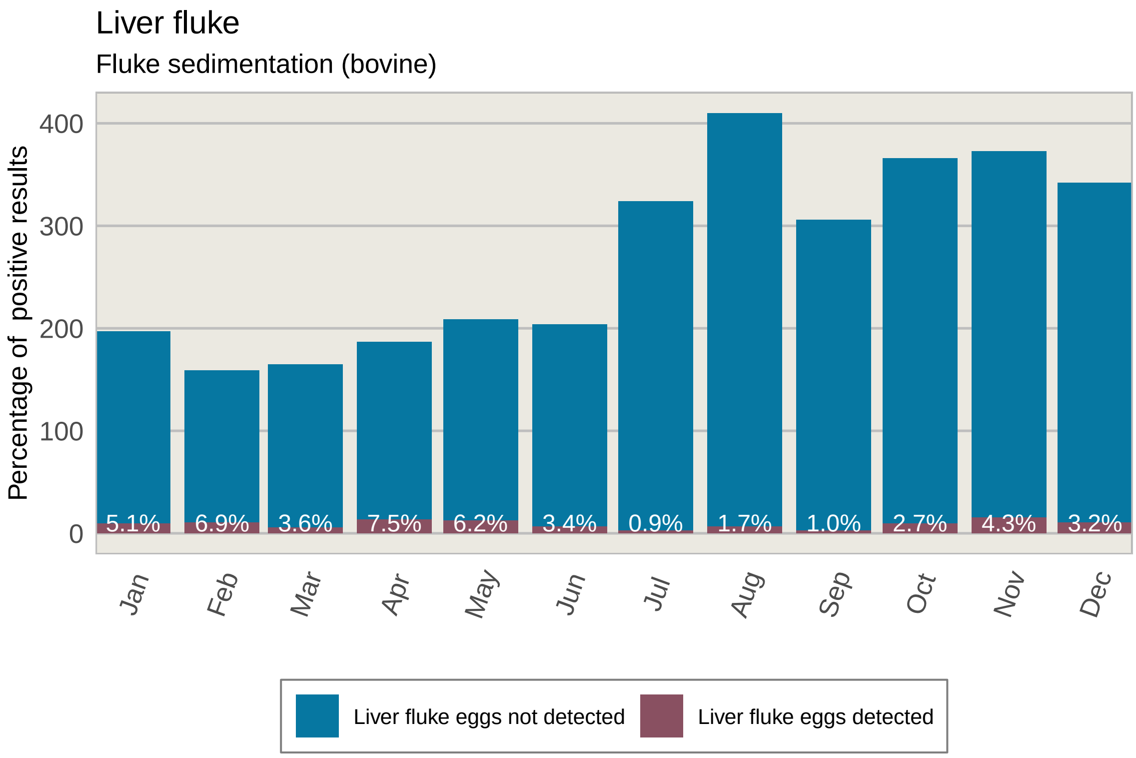


Figure 8.5.: Stacked number of bovine faecal samples (all ages) tested for liver fluke in 2024. The percentage in each bar represents the number of positive samples per month (n=3422).

In the treatment of fasciolosis, it is essential to consider that flukicides have efficacy against different larval stages. There is increasing evidence of developing resistance to certain actives, which needs to be carefully considered when choosing the appropriate flukicide.

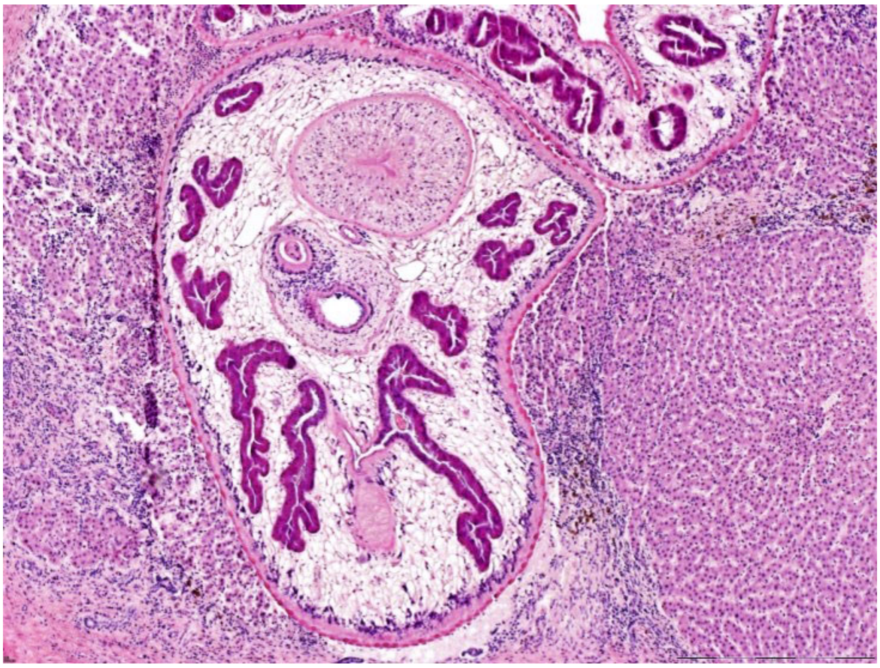
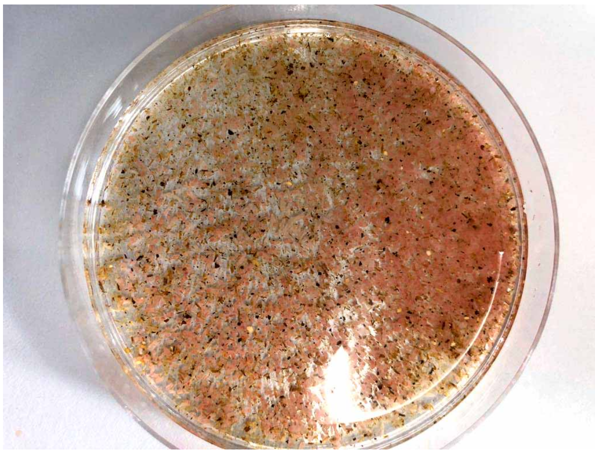


Figure 8.6.: Photomicrograph: Adult *Fasciola hepatic* in a section of liver. Photo: Rebecca Froehlich-Kelly

Paramphistomosis

The prevalent rumen fluke species in Ireland is *Calicophoron daubneyi*, which has been widely detected in the last decade in submitted faecal samples as well as carcases.



(a)

(b)

Figure 8.7.: Rumen fluke larvae in a case of larval paramphistomosis: (a) macroscopic, (b) microscopic. Photos: Anne-Marie Flaherty

The primary clinical disease caused by this parasite is attributed to its larval migration through the duodenum towards its target, the rumen. The occurrence of larval paramphistomosis has been reported in several cases throughout recent years in Ireland, and severity and even mortality can be significant. Clinical signs include ill-thrift, diarrhoea, weight loss and anorexia. Hence, rumen fluke should always be considered as a possible cause of disease in sheep, goats or younger cattle both on pasture and shortly after removal from pasture.

There is currently no licensed treatment for rumen fluke in Ireland. However, literature suggests the efficacy of oxyclozanide against the parasite. Treatment should be only sought in cases of suspected clinical disease; routine treatment for rumen fluke is not recommended.

Table 8.5.: Number of bovine faecal samples submitted in 2024 (all ages) for detection of rumen fluke eggs and breakdown of positive and negative results (n=3422).

Result	No. of samples	Percentage
Rumen fluke eggs not detected	2174	**64**
Rumen fluke eggs detected	1248	**36**

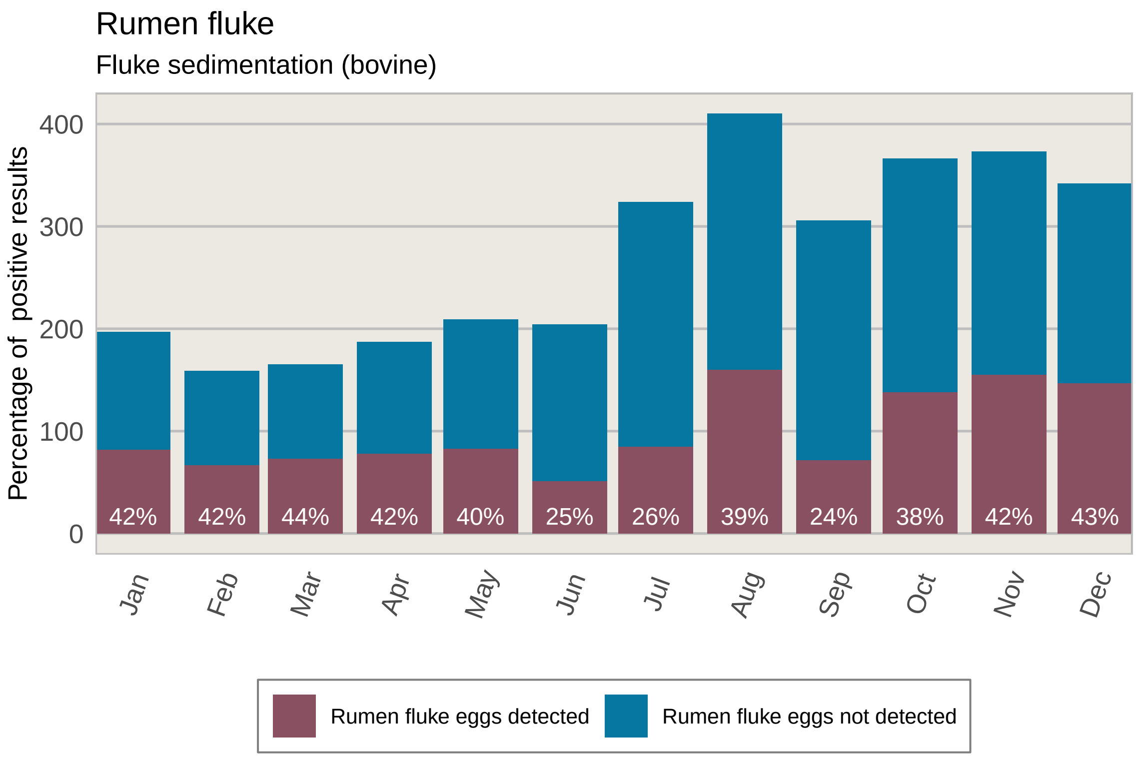


Figure 8.8.: Stacked count of bovine faecal samples (all ages) tested for rumen fluke in 2024. The percentage in each bar represents positive samples (n=3422).

Part II.

Sheep

9. Ovine Diseases

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9.1. Overview

In 2024, the national sheep population was estimated as 3.64 million, representing a decrease of 2.8 *per cent* from 2023 values (Table 9.1).

During 2024, 1407 ovine carcases were submitted to the Regional Veterinary Laboratory service for post-mortem examination. This consisted of 590 adult sheep (older than 12 months of age) and 817 lambs (under 12 months of age). This represents an increase in total ovine carcase submissions compared to 2023 (n=1334).

As the range of diagnoses is age dependent, the *post mortem* results in this section are presented by age category. Conditions have been grouped into broader diagnostic categories according to the affected system to facilitate presentation and comparison with previous reports

9.2. Lambs (under 12 months of age)

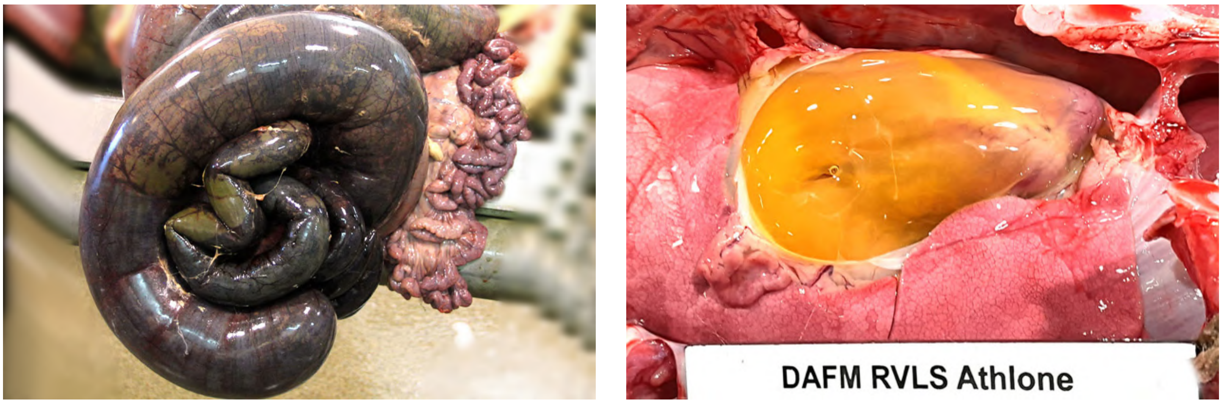
Within the categorisation lamb mortality almost a quarter (24.2 *per cent*) of cases were classified as gastrointestinal tract (GIT) infections (n=198). Within this category parasitic gastronenteritis was common, with a bias towards *Strongles*, *Coccidosis* and *Haemonchus Contortus*.

The diagnosis of GIT torsions or obstructions (Figure 9.1a) accounted for 33 cases (four *per cent*), while ulceration, perforation or foreign body accouted for 1.7 *per cent* of cases (n=14).

Table 9.1.: Number of Sheep

Description	2022 (Dec) '000	2023 (Dec) '000	2024 (Dec) '000	Change 2023-2024 '000	% of Change
Total Sheep	4018	3741	3637	-104	-2.8
Breeding Sheep	2752	2657	2584	-73	-2.8
Ewes: 2 years and over	2075	2042	2003	-39	-1.9
Ewes: under 2 years	592	532	502	-30	-5.6
Rams	86	83	79	-4	-4.9
Other Sheep	1266	1084	1053	-31	-2.8

Note:
CSO, 2024: All estimates based on provisional data



(a) Caeco-colonic torsion

(b) Fibrinous effusion

Figure 9.1.: Caeco-colonic torsion in a lamb (a) and (b) Fibrinous pericardial effusion in a lamb associated with *C.perfringes* type D (ϵ toxin). Photos: Aoife Coleman.

Clostridal diseases are a significant cause of mortality in young sheep, accounting for 12.5 *per cent* of the total number of cases in the category (n=102).

> Parasite control programs should be focused on an encompassing approach, considering the host, the environment, the parasitic agent, pasture management, the use of faecal egg counts, and the utilisation of effective treatments.
> It is imperative that we emphasise the importance of sustainable ecto- and endo-parasitic control in the national flock.

Clostridal enterotoxemia (Pulpy Kidney Disease) is caused by *Clostridium perfringes* type D with associated ϵ toxin production. There can be variations in the clinical presentation ranging from peracute/acute typically in rapidly thriving young lambs on an excellent plane of nutrition or associated with dietary change or stress in unvaccinated sheep.

This can present as sudden death or vague neurological signs in affected animals; pericardial effusion (Figure 9.1b) is a common gross lesion found on *post mortem* examination. Outbreaks can occur with multiple cohorts affected. The subacute or chronic form of disease is called focal symmetric encephalomalacia (FSE), typically involving older sheep. Where described clinical signs include blindness, ataxia and head pressing, presenting as a more advanced disease course.

> Vaccination for clostridial diseases remains extremely important in disease control programmes

Respiratory and systemic infections account for 10.5 *per cent* and 20.4 *per cent* respectively of diagnoses applied in lambs. *Bibersteinia trehalosi* featured prominently in lambs. *Bibersteinia trehalosi* is a recognised cause of septicaemia in sheep typically in weaned lambs. Risk factors include poor weather, change of pasture or feed, overcrowding, poor ventilation, handling, and transport. Sudden death with no premonitory signs can occur.

There are two distinct syndromes of pasteurellosis: septicaemia & pneumonia.

> Prevention of Pasteurellosis in sheep focuses on the application of the first principles of disease prevention. Control of biosecurity, use of a vaccine program, and reduction of physiological stress from poor ventilation, overcrowding and rapid dietary changes.
> Additional points to address include the co-morbidity of other conditions such as parasitic burdens, tick-borne diseases and dietary deficiencies.

Table 9.2.: Conditions most frequently diagnosed on *post mortem* examinations of lambs in 2024 (n=817).

Disease	No. of Cases	Percentage
GIT system infections	198	**24.2**
Systemic infections	167	**20.4**
Clostridial disease	102	**12.5**
Respiratory system infections	86	**10.5**
Nutritional and metabolic conditions	43	**5.3**
Diagnosis not reached	36	**4.4**
Other	34	**4.2**
GIT torsion and obstruction	33	**4.0**
GIT ulcer, perforation and peritonitis	21	**2.6**
Liver disease	19	**2.3**
CNS conditions	17	**2.1**
Tick-Borne Fever	17	**2.1**
Navel and joint ill complex	12	**1.5**
Poisoning	12	**1.5**
Integument and musculoskeletal conditions	10	**1.2**
Trauma	10	**1.2**

Note:
The 'Other' grouping is a combination of multiple minor categories that have less than eight cases.

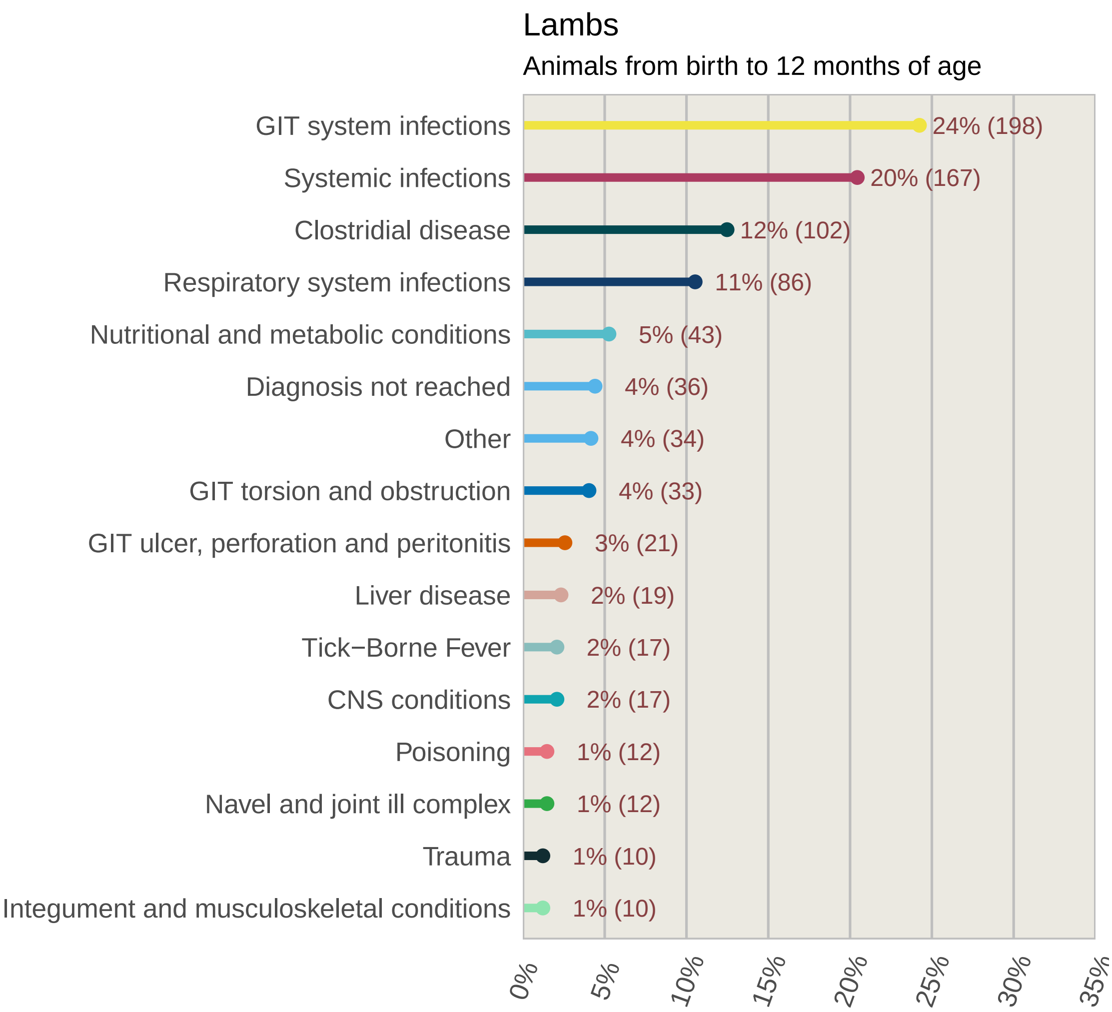


Figure 9.2.: Conditions most frequently diagnosed on *post mortem* examinations of lambs in 2024 (n=817). Only categories with n value greater than 8 are shown. Note: the 'Other' grouping is a combination of multiple minor categories that have less than eight cases.

9.3. Adult sheep (older than 12 months of age)

Within the adult sheep (n=590) categorisation, liver disease was the most prominent diagnosis, accounting for over 15 *per cent* in adult sheep submitted to the laboratory service in 2024.

Both acute and chronic liver fluke are represented in relatively equal denominators, accounting for over 90 *per cent* of cases in the liver disease group in adult sheep.

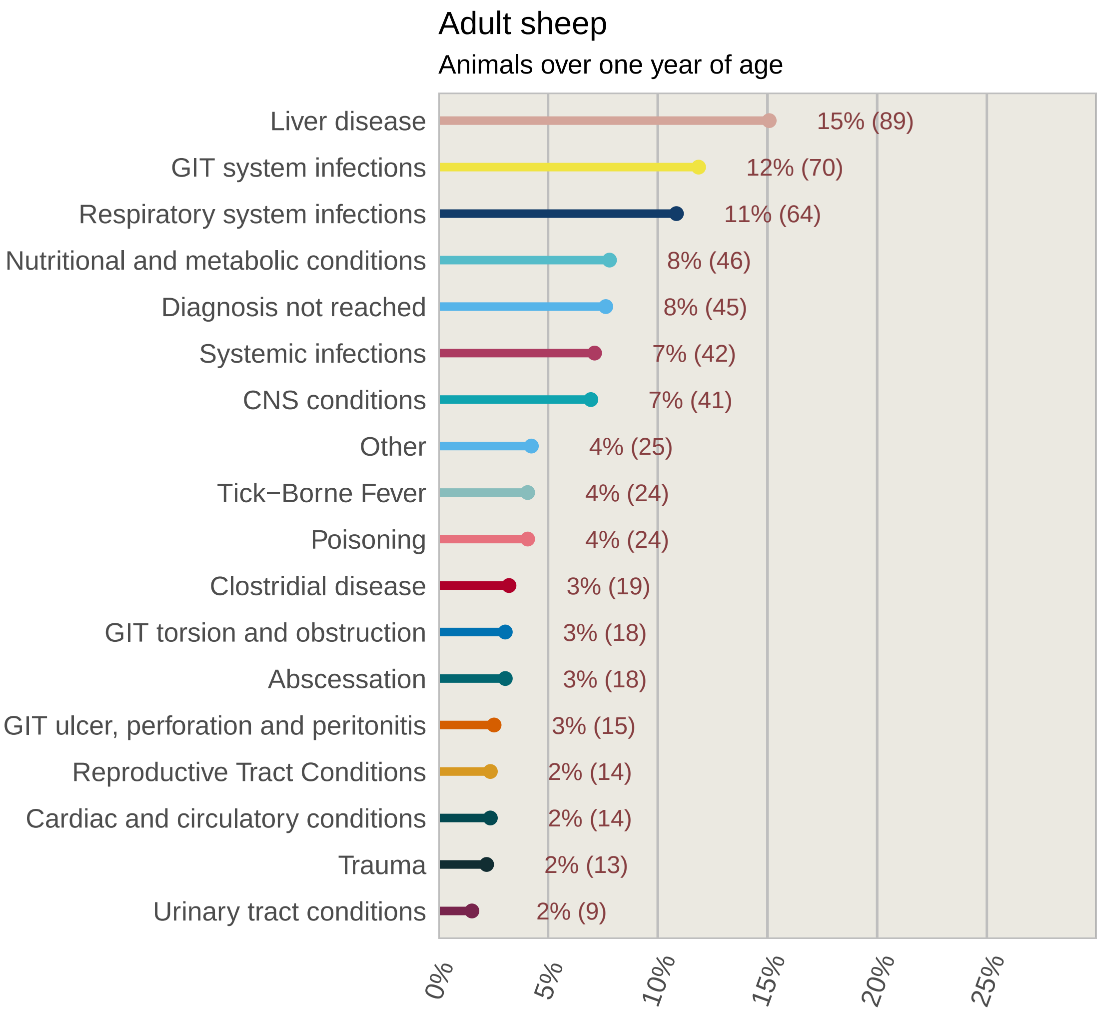


Figure 9.3.: Conditions most frequently diagnosed on *post mortem* examinations of adult sheep (over one year of age) in 2024 (n=590). Note: the 'Other' grouping is a combination of multiple minor categories that have less than eight cases.

Cases of poisoning/toxicity in lambs and adult sheep amounted to twelve and twenty-four cases respectively in 2024. It is important to note that multiple animals may be affected in these outbreaks on farm and all may not be submitted for *post mortem* examination. Copper poisoning was the most common in 2024.

In sheep copper poisoning can present as two differing syndromes: acute and chronic. Factors which can influence copper absorption and risk include the animals age, variation in inherent susceptibilities of differing sheep breeds, diet, management systems, intercurrent disease/stress and dietary antagonists.

Table 9.3.: Conditions most frequently diagnosed on *post mortem* examinations of adult sheep (over one year of age) in 2024 (n=590). Note: the Other grouping is a combination of multiple minor categories that have less than eight cases.

Disease	No. of Cases	Percentage
Liver disease	89	**15.1**
GIT system infections	70	**11.9**
Respiratory system infections	64	**10.8**
Nutritional and metabolic conditions	46	**7.8**
Diagnosis not reached	45	**7.6**
Systemic infections	42	**7.1**
CNS conditions	41	**7.0**
Other	25	**4.2**
Poisoning	24	**4.1**
Tick-Borne Fever	24	**4.1**
Clostridial disease	19	**3.2**
Abscessation	18	**3.0**
GIT torsion and obstruction	18	**3.0**
GIT ulcer, perforation and peritonitis	15	**2.5**
Cardiac and circulatory conditions	14	**2.4**
Reproductive Tract Conditions	14	**2.4**
Trauma	13	**2.2**
Urinary tract conditions	9	**1.5**

(a) Haemoglobinuric nephrosis

(b) Jaundiced carcass tissues

Figure 9.4.: Haemoglobinuric nephrosis (a) secondary to haemoglobinaemia from acute intravascular haemolytic crisis caused by copper toxicosis. Photo: Cosme Sánchez-Miguel. Jaundiced carcass tissues (b) in an ewe with copper poisoning: Photo Aoife Coleman (b) Photo: Aoife Coleman.

Copper is stored in the liver and when this has reached it saturation capacity, it's release into the blood stream causes a haemolytic crisis (Figure 9.4), liver and kidney dysfunction, anaemia, jaundice, weakness and mortality.

Plant poisoning is diagnosed across both lambs and adult sheep typically in the summer and autumn. Shrubs and plants found to have been ingested include *Pieris* spp. (Figure 9.5a), *Rhododendron* spp., and *Laurel* spp.

Grayanotoxins are the toxic component in *Pieris* species and *Rhododendron* species (fig-rhododendron), affecting sodium channels, impacting cardiac and skeletal musculature with nervous system involvement also reported. Clinical signs reported can include sudden death, colic, pain, bruxism, vomiting in sheep and goats and nervous signs. Vomiting considered pathognomonic (Payne and Murphy 2014)

(a) *Pieris spp.*

(b) *Rhododendron rhododendra*

Figure 9.5.: Pieris spp. leaves found in the rumen of a ewe. (a) Photo: Aideen Kennedy. Fragments of Rhododendron leaves (*Rhododendron rhododendra*) found in the rumen of sheep that died after ingesting lawn clippings. Photo: Cosme Sánchez-Miguel.

Laurel (*Prunus laurocerasus*), is a potentially toxic cyanogenic plant (Payne and Murphy 2014) Cyanide, the fatal component of cyanogenic plants, prevents effective oxygenation of tissues resulting in hypoxia/anoxia and death. Access to laurel hedges from animals breaking into gardens or inadvertent disposing of hedge clippings to farm animals are often cited in clinical history of these cases. The microflora and environment in the rumen facilitate the breakdown of cyanogenic glycosides. (Kennedy et al. 2021; Radostits OM 2007; and Pickrell JA 2013)

10. Ovine Abortion

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10.1. Overview

While spontaneous abortion can occur in sheep, an abortion rate in excess of two *per cent* may suggest an infectious cause and veterinary investigation is warranted. The main focus of laboratory investigations when presented with aborted lambs is to determine if an infectious abortion causing agent is present. The importance of submission of the foetus plus the placenta, when available, should be stressed. International studies have reported investigations that included placental tissue samples were more than twice as likely to have a diagnosis compared to investigations without placenta (Clune et al. 2021).

In 2024, 498 ovine post abortion specimens (foetuses and/or foetal membranes) were submitted to the Regional Veterinary Laboratory service for examination. As with previous years, toxoplasmosis and enzootic abortion of ewes (EAE) represented the most frequently diagnosed primary pathogens in cases of ovine abortion. Schmallenberg virus (SBV) tends to circulate in a cyclical pattern and 2024 saw the reappearance of SBV in cases of ovine abortion. The remaining diagnoses were largely attributed to bacterial pathogens.

Figure 10.1.: Diffuse placentitis in a ovine abortion caused by *T. gondii*. Photo: Aideen Kennedy.

10.2. *Toxoplasma gondii*

Of the 266 post abortion specimens tested for *T. gondii* using PCR (n=266), 36 were positive (13.5 *per cent*)(Table 1.1). Combining the results from PCR and serum agglutination tests performed on foetus submissions (n = 324),

Table 10.1.: Ovine foetuses examined by Toxoplasma PCR in 2024 (n=266).

PCR Result	No of Cases	Percentage
No Pathogen detected	227	85.3
Positive	36	13.5
Inconclusive	3	1.1

Table 10.2.: Toxoplasma PCR and Toxoplasma serology (Agglutination Test) test results in 2024 (n=324).

Result	No of Cases	Percentage
Negative	270	83
Positive	54	17

Note:
A sample was deemed positive when either
one or both tests results were positive.
Inconclusive results were categorised as Negative.
Cut-off for serology equal or greater than 1/32

a total of 17 *per cent* of samples were positive for *T. gondii* in 2024 (Table 1.2). This represents a decrease from the 21.5 *per cent* that were positive in 2023.

Toxoplasma gondii is a protozoan parasite. Cats serve as the main reservoir of infection. Cats can become infected following the ingestion of tissue cysts (in rats/ mice). Oocysts can remain viable in the environment for months. Generally, cats develop immunity after the initial infection and usually only shed oocysts once in their lifetime.

Following ingestion of oocysts by the sheep, there is a phase of rapid division and dissemination throughout the body, which may result in necrosis in various organs e.g. brain, liver myocardium. Infection is most serious in pregnant animals exposed for the first time. In pregnant ewes, tachyzoites spread to the cotyledons, causing necrosis. Tachyzoites may also spread to the foetus, causing necrosis in multiple organs.

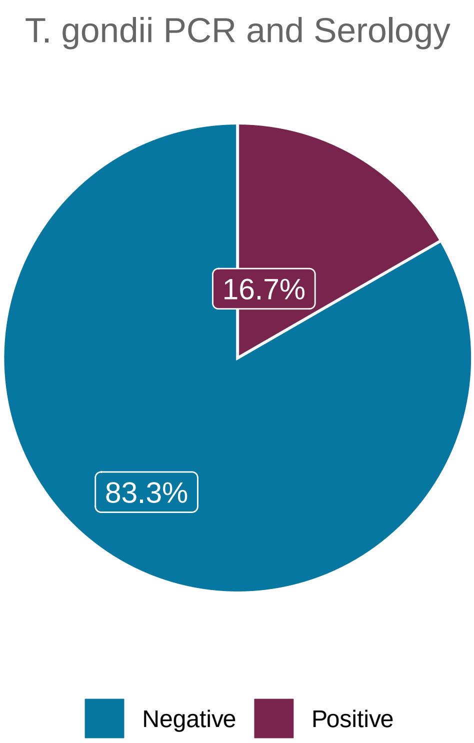

Figure 10.2.: Pie chart showing the *Toxoplasma gondii* PCR and serology (Agglutination Test) test results in ovine foetuses in 2024.

Table 10.3.: Percentage of *Chlamydophila abortus* PCR results in ovine foetuses in 2024 (n=267).

PCR Result	No of Cases	Percentage
Positive	49	**18.4**
No Pathogen detected	206	**77.2**
Inconclusive	12	**4.5**

Characteristic changes to the placenta include dark red cotyledons speckled with white foci. Toxoplasmosis is not passed from sheep to sheep. Once immunity has developed the sheep is unlikely to abort again.

Prevention involves avoiding feed/ water contamination with cat faeces. Rodent control can be useful. A vaccine is available. *Toxoplasma gondii* is a zoonotic agent of greatest risk to immunocompromised people and pregnant woman.

Submission of placenta and blood samples

To allow use of full range of tests, the submission of fresh placenta (including at least one cotyledon) with all foetuses – and where posible blood samples from aborted ewes- is of great importance. Likewise, the submission of samples from a number of ewes greatly enhances the probability of a defenitive diagnosis being reached. A negative result from a single ewe is insufficient to rule out infectious abortion in a flock.

10.3. *Chlamydydia abortus* (EAE)

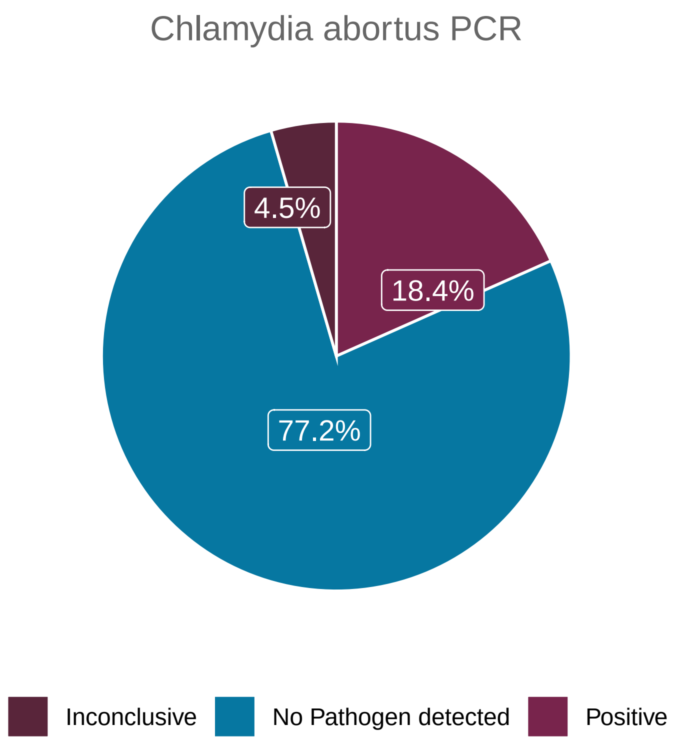

Figure 10.3.: Pie chart showing the *Chlamydophila abortus* PCR test results in ovine foetuses in 2024.)

Chlamydia abortus is the causative agent of enzootic abortion of ewes (EAE). 18.4 *percent* of ovine foetuses tested for EAE by PCR were positive (Table 10.3 and Figure 10.3). The disease typically enters a flock through the purchase of an infected animal. When infected animals abort, large numbers of chlamydiae are shed in the placenta and uterine fluids resulting in environmental contamination. Infection is typically by ingestion. Non-pregnant female sheep, including newborn lambs, can pick up the infection from an aborting ewe and the organism will remain latent until the next pregnancy and then become active, causing the animal to abort. Ewes infected in late pregnancy do not typically abort as there is a lag period between infection and manifestation of reproductive

Table 10.4.: Combined frequency of detection of selected secondary abortion agents on routine foetal culture of ovine foetuses in 2024 (n=498).

Organism	No of Isolates	Percentage
No Significant Growth	285	**57.2**
Coliforms	103	**20.7**
Streptococcus spp	13	**2.6**
Listeria spp	10	**2.0**
Trueperella pyogenes	10	**2.0**
Bacillus licheniformis	9	**1.8**
Other	9	**1.8**
Staph. spp	8	**1.6**
Salmonella dublin	5	**1.0**
Salmonella spp	5	**1.0**
Campylobacter fetus	3	**0.6**
Campylobacter spp	3	**0.6**
Yeasts and Fungi	3	**0.6**
Acinetobacter lwoffii	2	**0.4**
Actinomyces spp.	2	**0.4**
Aspergillus spp	2	**0.4**
Bibersteinia trehalosi	2	**0.4**
Campylobacter jejuni	2	**0.4**

Note:
Categories that have less than two cases have been included in the 'Other' category.

failure. These ewes are likely to abort in the following pregnancy. Abortion generally occurs 2–3 weeks prior to expected lambing.

Zoonotic implications

- Many of the ovine abortifacient pathogens are zoonotic, and thus can cause infection in humans.
- In particular pregnant women and immunocompromised people should avoid contact with ewes during the lambing season.

It is advisable to isolate ewes that abort for three weeks, destroy placentae and disinfect pens. Keep pregnant ewes away from infected pens and don't use aborted ewes to foster replacement ewe lambs. Ewes that have aborted because of EAE are considered immune to further abortions from the same cause, but these ewes may be persistently infected, and may excrete the organism, potentially allowing infection of naïve animals. Vaccines are available. *Chlamydia abortus* is a zoonosis and appropriate advice should be provided to people in contact.

10.4. Other Organisms

Routine foetal culture was performed on 498 ovine post-abortion submissions during 2024 (Table 10.4). In many cases, no significant bacterial growth was reported (57.2 *per cent*). Coliforms were detected in approximately 20.7 *per cent* of cases, but the clinical significance of their detection in many cases was uncertain. *Listeria spp* and *Trueperella pyogenes* were detected in 2 *per cent* of samples, with similar numbers of Salmonella cases detected.

Campylobacter abortion caused by *Campylobacter fetus fetus* or *Campylobacter jejuni* was identified in very small numbers in 2024. It is also a potentially zoonotic agent. The initial source of infection is faeces of domestic livestock (e.g. about 10 *percent* of cattle faeces are positive for Campylobacter), dogs and wildlife, including birds. Ingestion of food or water contaminated with the bacteria gives rise to a primary infection during pregnancy. Abortion usually occurs in the last third of pregnancy and large abortion storms may occur. The ewes do not become ill and typically do not abort from this cause in subsequent pregnancies.

Ingestion of food or water contaminated with the bacteria gives rise to a primary infection during pregnancy.

Abortion usually occurs in the last third of pregnancy and large abortion storms may occur. The ewes do not become ill and typically do not abort from this cause in subsequent pregnancies.

10.5. Schmallenberg virus (SBV)

Schmallenberg virus (SBV) is a viral disease that primarily affects ruminants. SBV tends to circulate in a cyclical pattern and 2024 saw an increase in the numbers detected in ovine abortions. SBV PCR was conducted on 73 submissions in 2024 and 12 *per cent* were positive (Table **??** and Figure 10.6).

(a) Arthrographosis

(b) Brachygnathia

Figure 10.4.: Arthrographosis (a) and (b) brachygnathia inferior in a newborn lamb affected with Schmallenberg virus. Photo: Come Sánchez-Miguel.

SBV is transmitted by the Culicoides species of biting midges. The severity of disease varies among different species and ages of animal. If naive pregnant animals are infected it can cause abortions from the early stages of pregnancy and a range of congenital deformities that primarily affect the central nervous and musculoskeletal system and may be variable in severity. The most susceptible stages of pregnancy for foetal deformities are Day 25–50 in sheep.

(a) Reduced spinal cord

(b) Microencephalia

Figure 10.5.: Reduced diameter (blue arrow) of the spinal cord (a), and microcephalia (b) (left CNS) in a new born lamb affected with Schmallenberg virus compared to a normal newborn lamb (green arrow (a) and right CNS (b)). Photos: Jim O'Donovan.

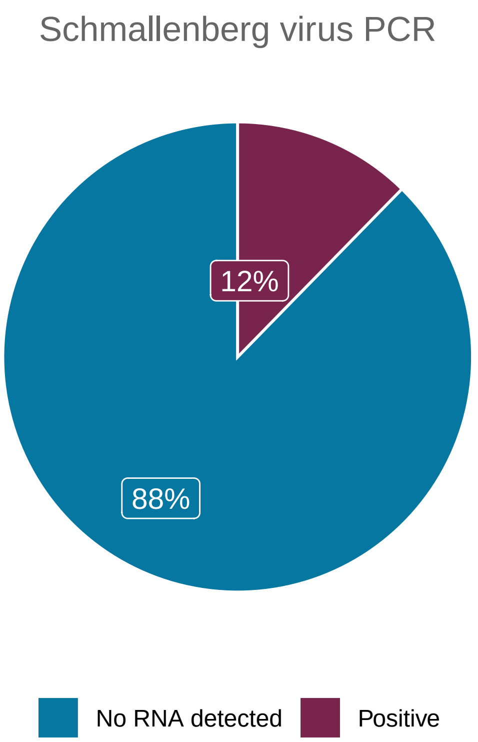

Figure 10.6.: Pie chart showing the Schmallenberg virus PCR test results in ovine foetuses in 2024.

Deformities commonly include arthrogryposis (bent limbs, fixed joints, Figure 10.4 (a)), scoliosis, torticollis (twisted neck, spine), brachygnathia (short jaw, Figure 10.4 (b)), hydranencephaly [cerebral hemispheres absent to varying degrees and remaining cranial cavity is filled with cerebrospinal fluid] and microencephalia (Figure 10.5 (a)) and resuction in the diameter of the spinal cord (Figure 10.5 (b)).

These deformities are not pathognomic and congenital deformities may occur due to other conditions, most notably Bluetongue. Farmers and vets are advised to be vigilant and to refer any birth deformities in sheep or cattle to the nearest Regional Veterinary Laboratory for investigation.

11. Ovine Parasites

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11.1. Trichostrongyles

Like cattle, sheep are regularly exposed to roundworm challenge at pasture. In situations where the pasture is heavily contaminated with infective nematode larvae, this may lead to the development of a condition known as parasitic gastroenteritis (PGE). This is especially the case where the host animal has little or no prior exposure to these larvae (e.g. lambs). Subclinical infections are the most common form of the disease and this is associated with reduced live weight gain. When clinical disease does occur, it is characterised by a range of clinical signs such as diarrhoea, anorexia and sudden weight loss, and death in some cases.

It is important to note that in situations where *Haemonchus contortus* is the dominant roundworm causing the parasitic infection that diarrhoea is not a characteristic feature. Instead, clinical signs which may resemble an acute liver fluke challenge, will be characterised by anaemia, weakness and the presence of bottle jaw. In severe infections, death can occur.

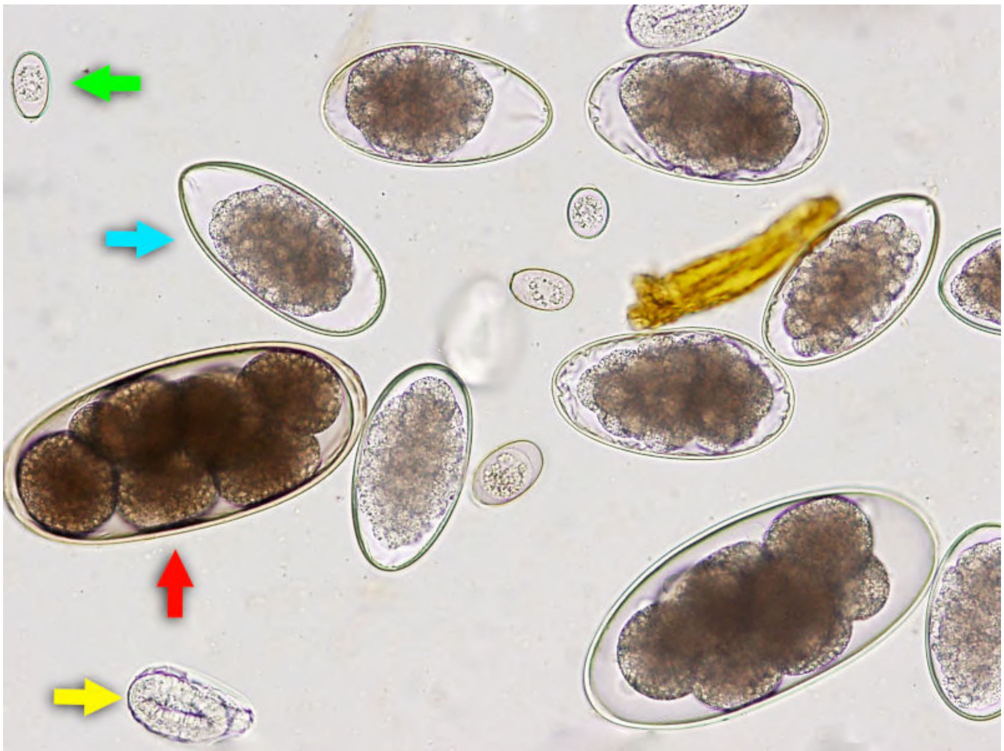

Figure 11.1.: Modified McMaster faecal egg counting. Microscopic apperance of parasitic eggs and oocysts in a faecal sample : *Trichostrongyles* (blue arrow), *Nematodirus* (red arrow), larvared *strongyloid* (yellow arrow) eggs, and coccidial oocysts (green arrrow). Phto Cosme Sánchez-Miguel.

Table 11.1.: Number of ovine faecal samples tested for Trichostrongylidae eggs in 2024 and results by percentage (n=2440). The ranges assume the absence of H. contortus in the faecal sample.

Result	No. of samples	Percentage
Negative	838	**34**
Low (50-250 epg)	482	**20**
Medium (250-750 epg)	426	**18**
High (>750 epg)	694	**28**

There are still relatively few, easily accessible diagnostic tools available to farmers that can be used to gauge potential parasite challenge in sheep at pasture. Although a clinical presentation of scouring and poor live weight gain in sheep at pasture may suggest a significant parasite challenge, these are still non-specific indicators. One such tool that is available are faecal egg counts (FEC) whereby the egg output of stomach/gut worms such as *Teladorsagia circumcincta*, *Trichostrongylus spp.*, *H. contortus*, *Nematodirus battus* and *Cooperia* spp. are counted and expressed as eggs per gram (EPG) of faeces. As the eggs produced by female Nematodirus worms are distinctly different in appearance to the others listed above, their count is reported separately. Thus, laboratory FEC reports have a single entry for strongyle eggs which includes a total count of all morphologically similar roundworm eggs (i.e., *T. circumcincta*, *Trichostrongylus* spp., *H. contortus* and *Cooperia spp.*), in addition to a separate *Nematodirus* egg count.

As FEC are expressed as a ratio, anything that changes the volume of faeces produced will alter their value. For example, in cases of diarrhoea animals may have reduced FEC as a result of the dilution effect from the increased faecal volume, whereas in cases of inappetence the volume of faeces produced will be reduced and the FEC will be consequently increased. It is also important to recognise that there is not a direct relationship between the total worm burden of an individual animal and their FEC value. Another important consideration is the ratio of male/female worms, as a parasitic infection with a large proportion of male worms may lead to a reduced FEC value.

In the case of *N. battus*, where much of the pathogenic effects are due to the larval stages, farmers should not rely on faecal egg counting alone as a basis for deciding when to treat. The ineffectiveness of faecal egg counting with regard to diagnosing *N. battus* infections is further compounded by the fact that this nematode is a poor egg producer. As a result, it is difficult to estimate the adult worm burden based on faecal egg counting.

Notwithstanding all of this, the use of FEC is still a useful aid for producers to use when deciding on whether or not to treat a group of sheep for gastrointestinal parasitism, provided other factors such as current animal performance, age, prior treatment history and grazing history are factored in.

The number of faecal samples that were categorised as either medium or high burden (46 *percent*) is similar to last year's figure of 45 *percent*. Although it is beyond the scope of this report to fully interrogate these figures, it may simply reflect a selection bias. Other potential, more noteworthy reasons include anthelmintic treatment failure or a lack of anthelmintic treatments in the first instance. Either way, it is important that producers regularly faecal sample those at-risk categories, such as lambs, over the course of the grazing season so that anthelmintic treatments can be used in a more targeted and sustainable fashion.

Table 11.2.: Number of ovine faecal samples tested for Nematodirus eggs in 2024 and results by percentage (n=2440).

Result	No. of samples	Percentage
Negative	2185	**89.5**
Low (50-150 epg)	120	**4.9**
Moderate (>150-300 epg)	81	**3.3**
High (>300 epg)	54	**2.2**

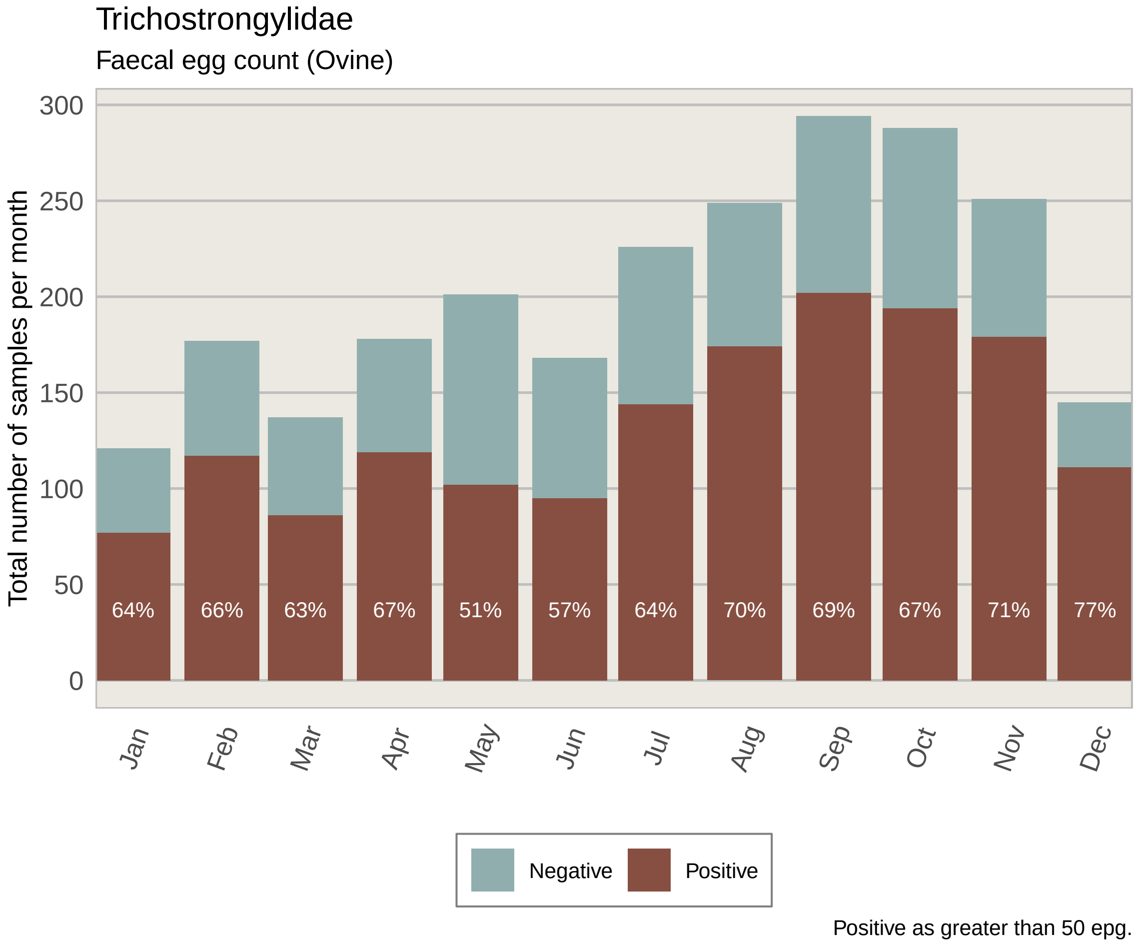

Figure 11.2.: Stacked count of ovine faecal samples (all ages) tested per month for Trichostrongylidae during 2024. The percentage in each bar represents positive samples (n=2440).

11.2. Nematodirus

Nematodirus battus can give rise to a severe disease in lambs, typically six to twelve weeks of age, which is characterised by scouring, dehydration and even death. The life cycle of *N. battus* is dissimilar to that of other roundworms in that it takes almost a year before the egg hatches releasing the infective third-stage larvae. Although hatching of eggs can also occur at different times of the year (e.g. autumn), there is typically a mass hatch of eggs in late spring or early summer (April–June) leading to a build-up of infective larvae on pasture. Infection is characterised by profuse diarrhoea, dehydration and weight loss.

Based on this year's data, the greatest number of positive samples occurred in early summer. This is to be expected given the typical annual pattern of egg hatching. It is important to recognize that although *Nematodirus* eggs were not detected in 89.5 *percent* of samples it still does not preclude this roundworm from being responsible for disease in certain cases given that much of the pathology is attributed to the larval stages of this roundworm.

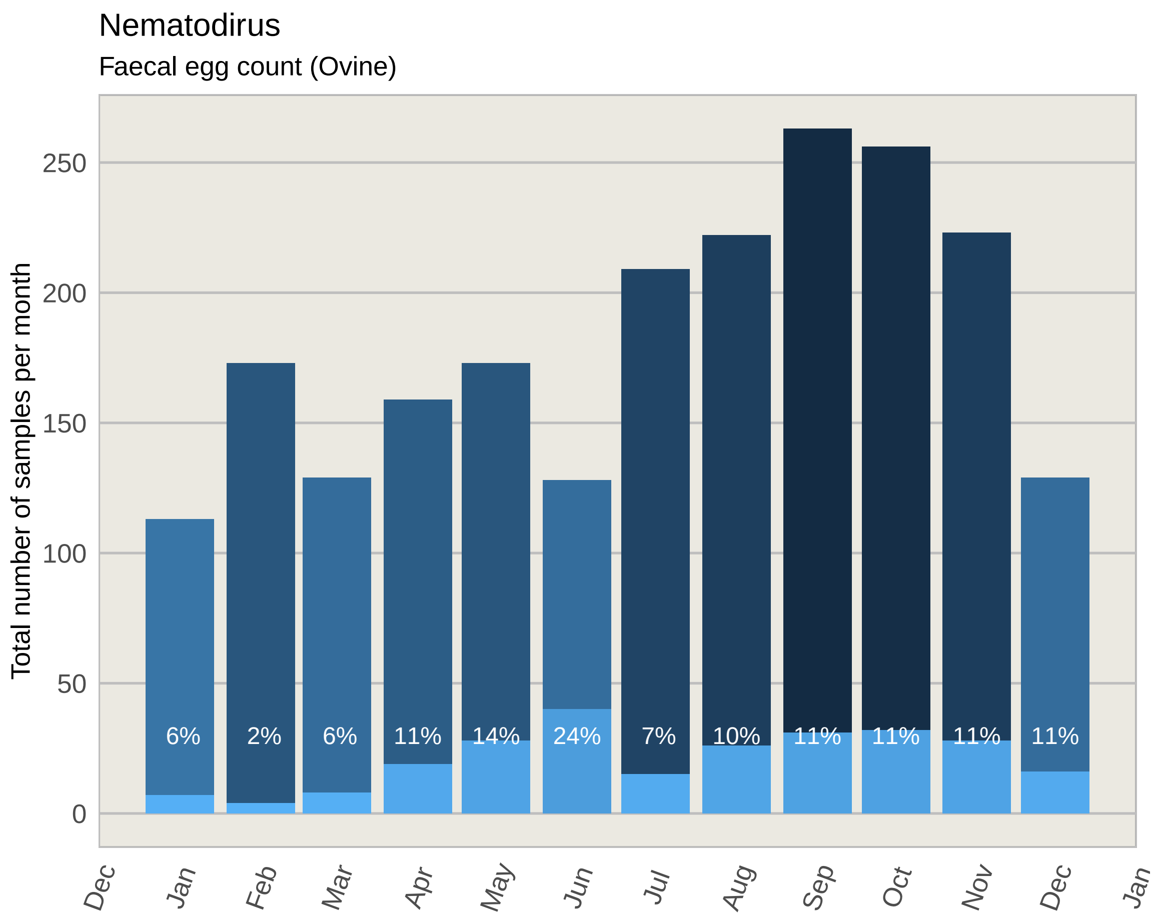

Figure 11.3.: Count of ovine faecal samples exmined for Nematodirus eggs in 2024. The percentage in each bar represents the number of positive samples per month n=(2440).

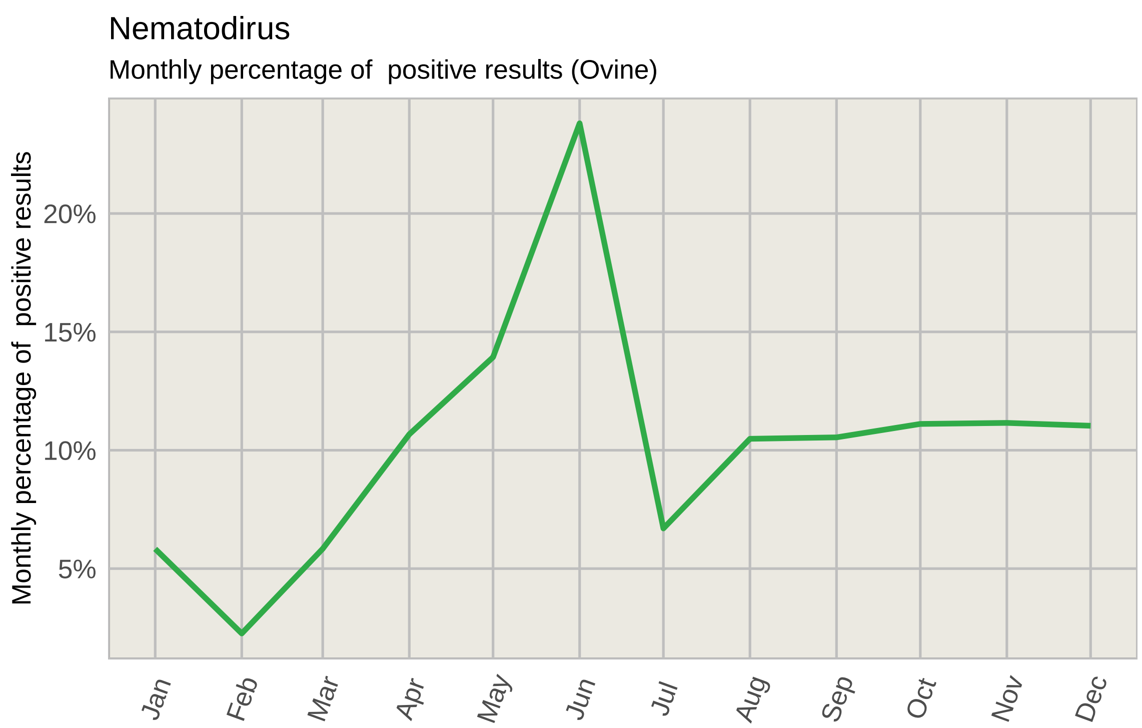

Figure 11.4.: Percentage of ovine faecal samples testing positive for Trichostrongylidae eggs in 2024 (n=2440).

Benzimidazoles (white drenches) remain the treatment of choice for *Nematodirus* infections and are effec-

Table 11.3.: Number of bovine faecal samples submitted in 2024 (all ages) for detection of coccidial oocysts and results by percentage, (n=2459).

Result	No. of samples	Percentage
Not Detected	1341	**55**
Light Infection	684	**28**
Moderate Infection	247	**10**
Heavy Infection	111	**5**
Severe Infection	76	**3**

tive against both larval and adult stages. The use of this anthelmintic class as the first-choice treatment option will also help to reduce the exposure of other worms such as *Trichostrongylus* and *Teladorsagia* to the other anthelmintic classes (e.g., macrocyclic lactones) at a point in the grazing season when treatment for these may not be necessary.

11.3. Coccidiosis

Although there are a number of *Eimeria* spp. that may affect lambs, the two most important species are *Eimeria ovinoidalis* and *E. crandallis*. Clinical signs of disease include diarrhoea, tenesmus and acute weight loss. When a large group of lambs are affected, typically growth rates across the entire group are affected (subclinical disease), with a smaller cohort exhibiting signs of clinical disease.

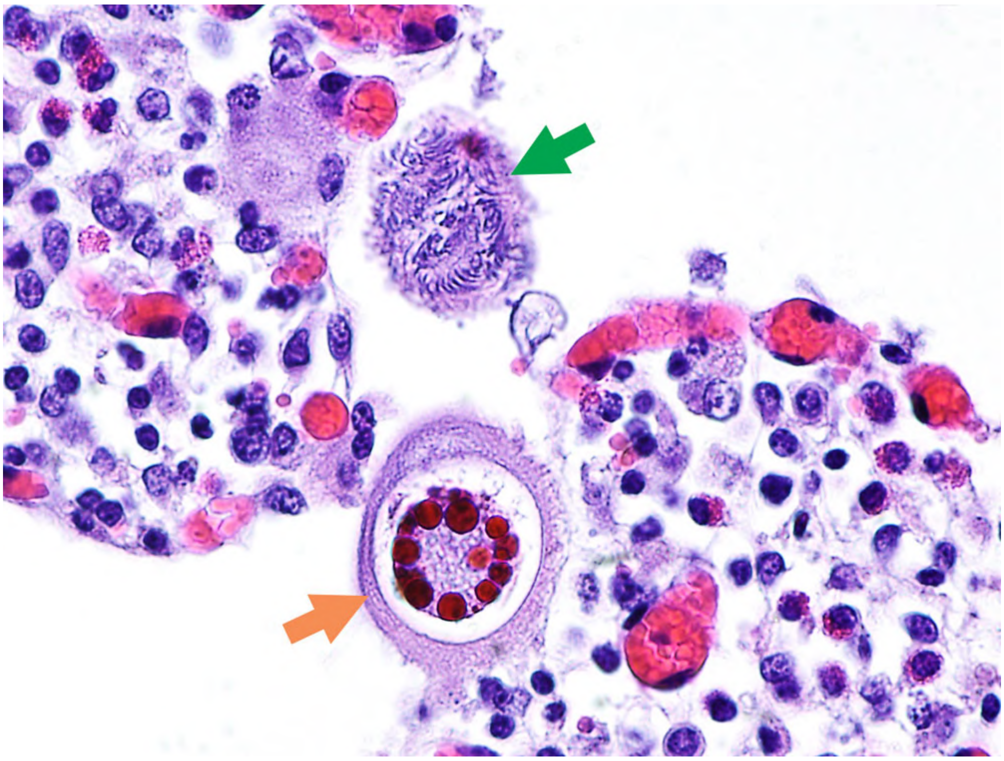

Figure 11.5.: Microscopic photography of the intestinal villi of a sheep with coccidiosis showing merozoites diferenciated into gametes (gametocyte maturation), the orange arrow points to a macrogamete and the green arrow to a microgamete. Photo: Cosme Sánchez-Miguel.

In addition to animal age, other risk factors for the development of this condition include areas on farms that tend to be heavily stocked (e.g. around water or feed troughs) as well as concurrent disease and any stress-inducing events (e.g. dietary changes, weaning).

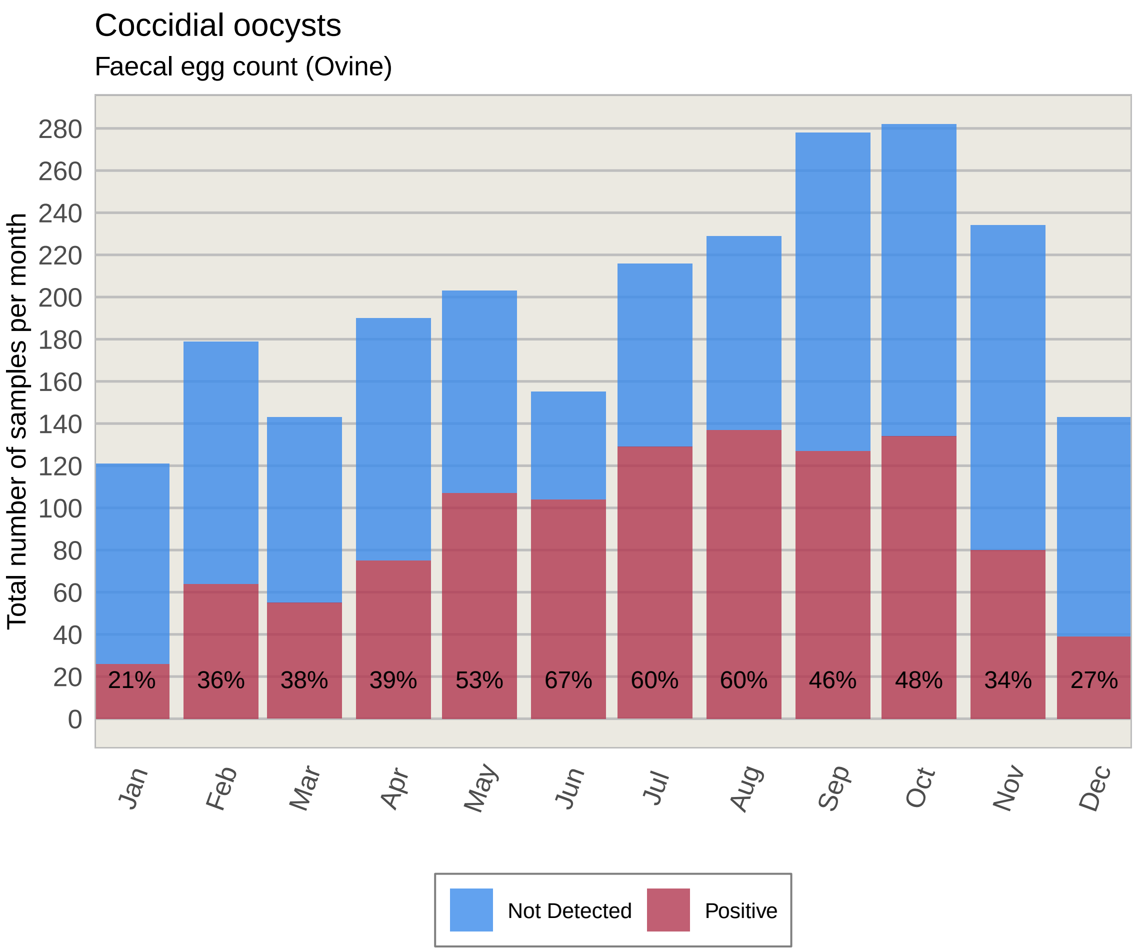

Figure 11.6.: Stacked number of ovine faecal samples (all ages) tested for coccidial oocysts in 2024. The percentage in each bar represents the number of positives (n=2459).

Although many faecal samples did not have coccidial oocysts detected in them, these results must be carefully interpreted as peak oocyst shedding in faeces is not always coincident with clinical signs of disease. Conversely, in cases where large numbers of oocysts are detected in a sample, results must similarly be viewed with caution as some species of coccidia are far more pathogenic than others and the presence of their oocysts in faecal samples may be far more noteworthy than that of other less pathogenic species. To overcome some of these shortcomings in relation to the diagnosis of coccidiosis, it is advised to sample multiple animals within the same group and take into account the risk factors outlined above.

11.4. Liver fluke and rumen fluke

The number of samples positive for liver fluke in sheep ranged from 2–26 *percent*, depending on the month of sampling, with a greater percentage of positive samples occurring from January to March.

In contrast to cattle where liver fluke infection tends to be mainly a chronic disease, infection in sheep may also result in more acute clinical signs, causing sudden death in cases of heavy challenge. It should be always borne in mind that the finding of liver fluke eggs in any faecal sample is always a significant result.

The identification of liver fluke eggs in faecal samples has long been used as the standard tool for the diagnosis of liver fluke infection. Detection of fluke eggs in faecal samples can be performed by either a sedimentation technique, whereby faecal samples are mixed with water and allowed to sediment, or by a flotation method using zinc sulfate solution. Given the fluctuations that can occur in fluke faecal egg output over a 24-hour period and considering the poor sensitivity of dung sampling if small quantities of faeces are examined, it is important that several animals within a grazing group are sampled, and an appropriate quantity of faeces is collected (5–10g *per*

Table 11.4.: Number of bovine faecal samples submitted in 2024 (all ages) for detection of liver fluke eggs and breakdown of positive and negative results (n=2314).

Result	No. of samples	Percentage
Liver fluke eggs not detected	2065	**89**
Positive liver fluke eggs	249	**11**

animal) to get an accurate diagnosis. Note that only patent infections will be detected using the above methods (i.e. ≥8 weeks *post-infection*).

National liver fluke forecast

Please take note of the annual Department of Agriculture, Food and the Marine (DAFM) national liver fluke forecast which is released in early November and advises farmers of the predicted risk of disease caused by liver fluke infection in their livestock over the winter period. This forecast is produced by DAFM in collaboration with Met Éireann, UCD, Teagasc and Animal Health Ireland (AHI) and is based on meteorological data gathered between May and October each year by Met Éireann.

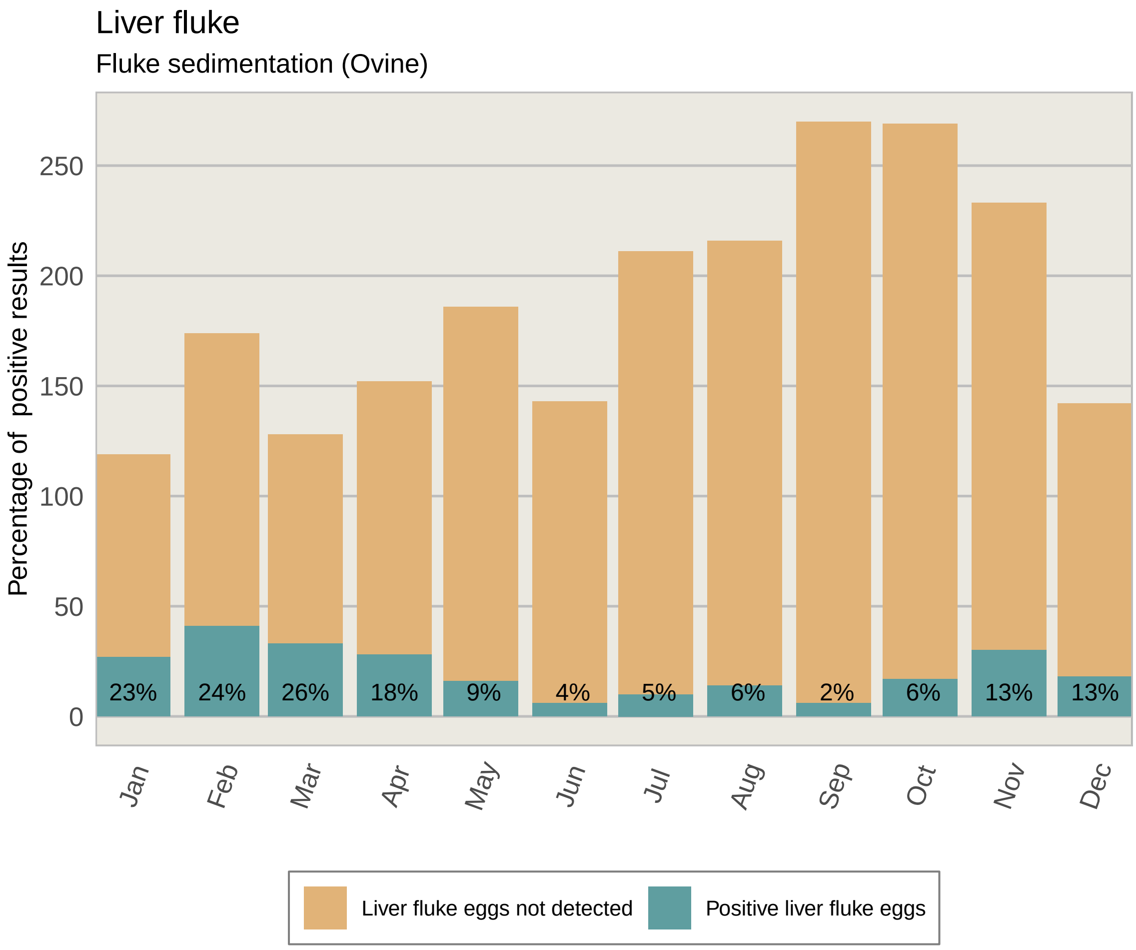

Figure 11.7.: Stacked number of ovine faecal samples (all ages) tested for liver fluke in 2024. The percentage in each bar represents the number of positive samples per month (n=2314).

Although there has been a large increase in the diagnosis of rumen fluke infections over the 15 years or so in the UK and Ireland, clinical disease remains rare (generally seen in young cattle or sheep of any age). Nonetheless, when they do occur the associated losses can be significant. Clinical signs such as severe diarrhoea and sudden weight loss (or death in some cases) are due to the pathology caused by the juvenile stages.

The figure for this year's rumen fluke-positive samples (23 *percent*) is the same as last year where 23 *percent* of samples were also positive for rumen fluke eggs. These figures appear to reflect the expansion of this species

Table 11.5.: Number of ovine faecal samples submitted in 2024 (all ages) for detection of rumen fluke eggs and breakdown of positive and negative results (n=2314).

Result	No. of samples	Percentage
Rumen fluke eggs not detected	1783	**77**
Positive rumen fluke eggs	531	**23**

of trematode in Irish livestock.

> Liver fluke
>
> Please note that control of liver fluke must always be given precedence as detection of its presence is always significant.

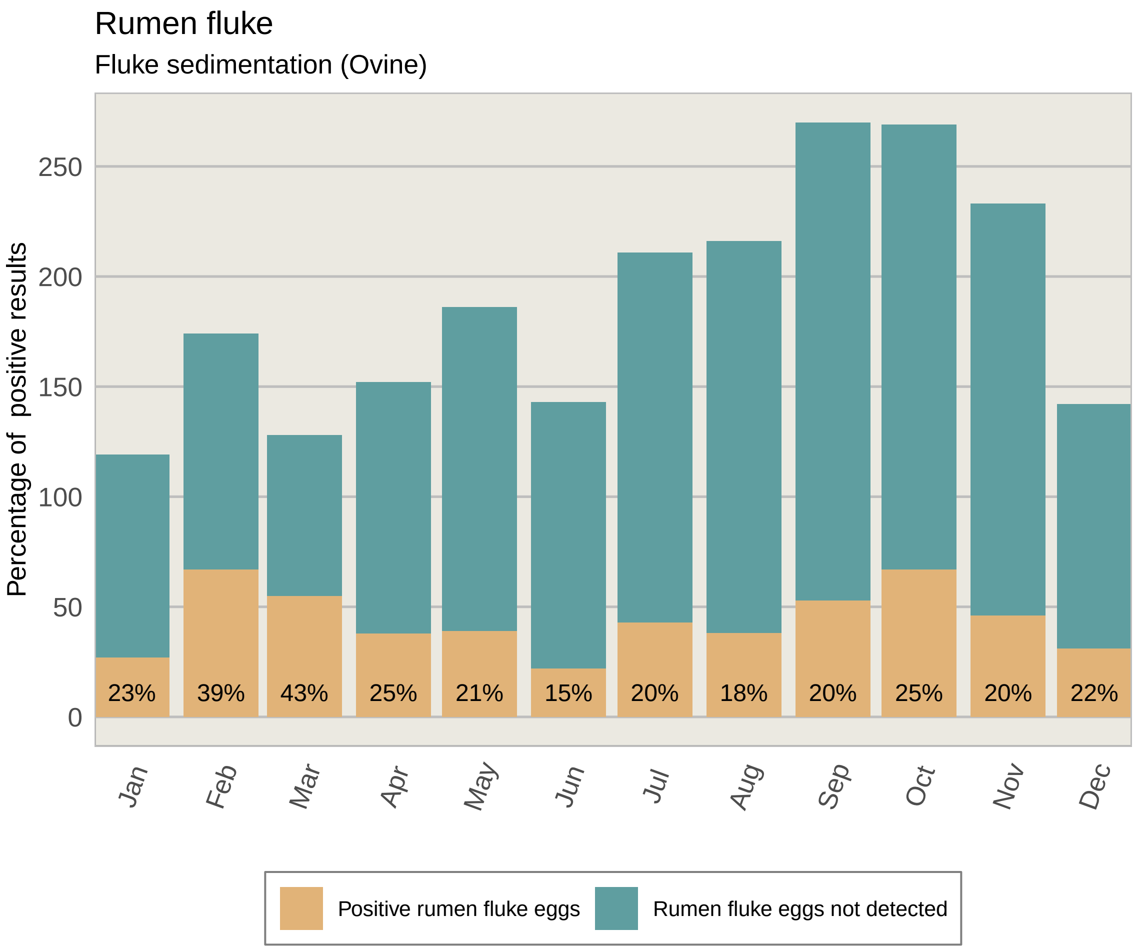

Figure 11.8.: Stacked count of ovine faecal samples (all ages) tested for rumen fluke. The percentage in each bar represents positive samples (n=2314).

Part III.

Porcine, Avian and Wildlife

12. Porcine Diseases

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12.1. Overview

In 2024, DAFM laboratories conducted necropsy examinations on 105 pig carcasses, while a further 2031 non-carcass diagnostic samples from pigs were submitted for a range of tests. These submissions supported veterinary disease investigations and surveillance activities on Irish pig farms. Overall submission levels were lower to those recorded in 2023. As in previous years, pigs submitted for necropsy were predominantly piglets and weaners and were almost exclusively sourced from intensive, large-scale pig production units.

Table 12.1.: Conditions most frequently diagnosed on *post mortem* examinations of pigs in 2023 (n= 105).

Diagnosis	Total Number	Percentage
GIT Infections	27	**25.7**
Bacteraemia/septicaemia/toxaemia	16	**15.2**
Respiratory Infections	14	**13.3**
No Diagnosis	13	**12.4**
Arthritis	12	**11.4**
Other	11	**10.5**
Meningitis	6	**5.7**
Abortion	3	**2.9**
Endocarditis	3	**2.9**

Note:
Categories that have less than two cases have been included in the 'Other' category

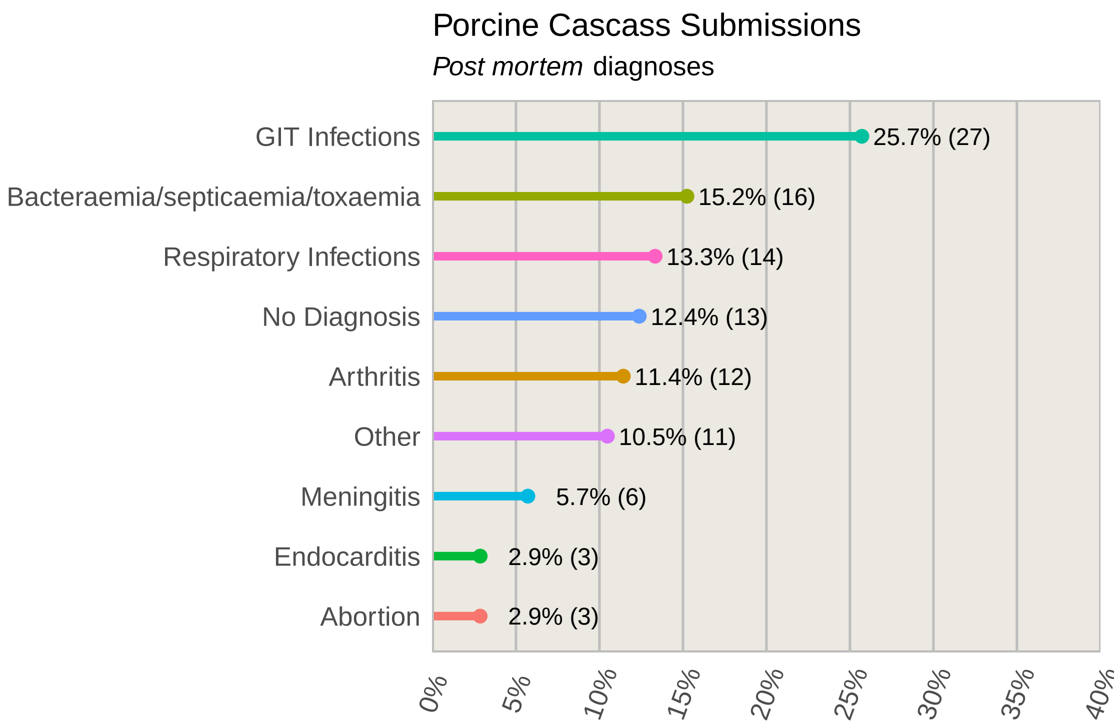


Figure 12.1.: Conditions most frequently diagnosed on *post mortem* examinations of pigs in 2023 (n=105). Note: Categories that have less than two cases have been included in the 'Other' category. The absolute number of cases is between brackets.

Post mortem **Diagnoses.**

The most common disease diagnoses identified from pig necropsy submissions in 2024 are outlined above. This dataset reflects only the diagnoses made in pigs submitted to DAFM laboratories and does not represent the overall incidence of disease within the wider pig population, as a range of factors influences decisions to submit animals for necropsy (Table 12.1 and Figure 12.1)

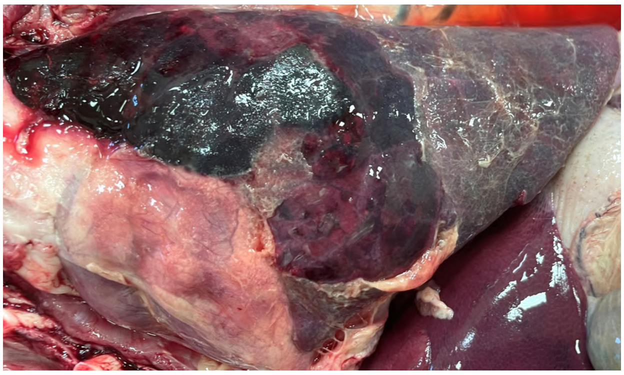
Gastrointestinal infections were the most frequently diagnosed disease category in pig carcasses submitted to DAFM laboratories in 2024, accounting for 25.7 *per cent* of diagnosed cases and occurring more commonly in neonatal pigs. Multiple pathogens can cause neonatal diarrhoea in pigs, and it is common for more than one agent to be involved in outbreaks on affected farms.

Pneumonia/Pleuropneumonia

Respiratory infections ranked third among the most frequently diagnosed disease categories in pig *post mortem* examinations conducted at DAFM laboratories in 2024, accounting for 13.3 *per cent* of all diagnoses. All porcine respiratory disease investigations at DAFM laboratories undergo comprehensive bacterial, viral, and histopathological examination to establish the underlying aetiology.

Respiratory disease in pigs is most often multifactorial, involving multiple pathogens; therefore, thorough diagnostic investigation of appropriate cases is essential to ensure diagnostic accuracy.

Porcine Respiratory Disease Complex (PRDC) describes a syndrome resulting from the interaction of infectious and non-infectious factors. Intensive rearing and housing systems represent a significant risk factor for pneumonia outbreaks following the introduction of infectious agents into a group. PRDC is associated with lesions detected at slaughter—pleurisy being the most common reason for pig carcass detention or condemnation in Ireland—as well as increased mortality and reduced growth performance. Non-infectious predisposing factors also play a role and include suboptimal environmental conditions, high stocking densities, stress, seasonal effects, genetic background, and production flow systems (all-in–all-out versus continuous flow).



(a) Pleuropneumonia

(b) Fibrinous pericarditis

Figure 12.2.: Severe diffuse pleuropneumonia (a), characteristic of *Actinobacillus pleuropneumonia* (APP). (b) Marked fibrinous pericarditis ("bread and butter" appearance) associated with *Glaesserella parasuis*. Photos: Sara Salgado

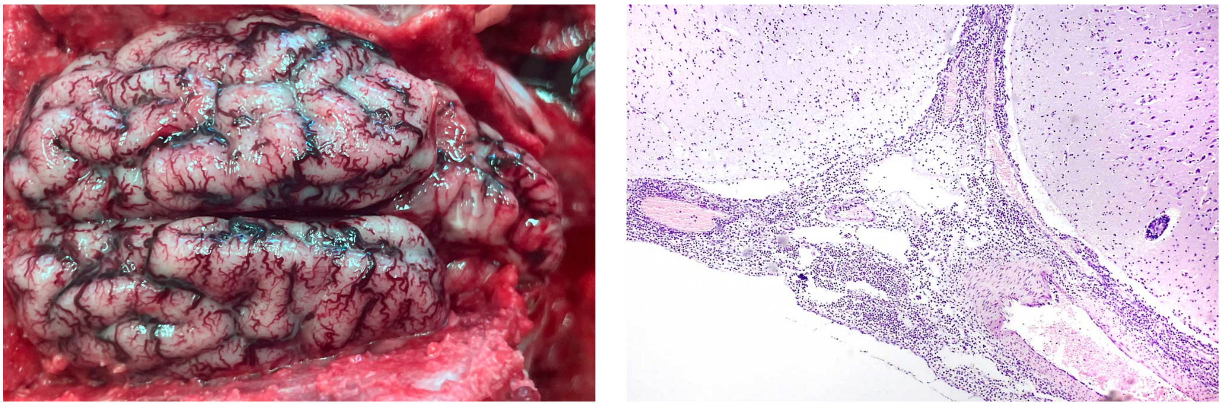
The most commonly identified bacterial pathogens in pneumonia cases were *Actinobacillus pleuropneumoniae*, *Pasteurella multocida*, and *Mycoplasma hyopneumoniae*. Viral agents, including influenza virus, porcine reproductive and respiratory syndrome virus (PRRSV), and porcine circovirus type 2 (PCV2), were also detected as components of this multifactorial disease process.

A porcine bacterial respiratory pathogen multiplex PCR assay is performed at the Cork BTL laboratory. In 2024, 46 samples were tested for *Actinobacillus pleuropneumoniae*, *Haemophilus parasuis*, and *Mycoplasma hyopneumoniae*. Detection rates were 56.52 *per cent* for *Glaesserella (Haemophilus) parasuis* (Figure 12.2b), 6.52 *per cent* for *Actinobacillus pleuropneumoniae* (Figure 12.2a), and 13.04 *per cent* for *Mycoplasma hyopneumoniae*. Concurrent testing of *post mortem* pneumonia submissions using both routine bacterial culture and PCR provides the optimal approach for detecting bacterial respiratory pathogens. Some pathogens are fastidious and do not readily grow in artificial media, while prior antimicrobial treatment may further inhibit bacterial culture. Nevertheless, bacterial isolates remain essential for antimicrobial susceptibility testing.

Streptococcus suis

Streptococcus suis is an important porcine pathogen that commonly causes meningitis (Figure 12.3), septicaemia, endocarditis, and arthritis, particularly in *post-weaned* pigs. It is also a zoonotic organism. Up to 35 serotypes have been identified.

Piglets are colonised early in life, and *S. suis* is considered a normal commensal of the upper respiratory tract, from which it can be readily isolated, particularly from the tonsils. Disease is typically diagnosed presumptively based on herd history, clinical signs, and gross *post mortem* findings, with definitive confirmation achieved through bacterial culture.



(a) *Strep. suis* meningitis (b) Suppurative meningitis

Figure 12.3.: Marked cerebral congestion (a) and moderately cloudy meninges. Photo: Sara Salgado. (b) Histological section of a pig brain tissue showing suppurative meningitis. Photo: Cosme Sánchez-Miguel.

Salmonella spp.

Commercial pig producers are required to have a documented Salmonella (Figure 12.4)control program in place on their farms, and slaughtered pigs are routinely screened for Salmonella antibodies throughout the year. Results from this surveillance are fed back to both the slaughter plants and the farm of origin. However, the serological testing currently performed at the factory level does not identify the specific Salmonella strains (serotypes) that may be present.

(a) Ulcerative colitis (b) Ulcerative colitis

Figure 12.4.: Severe diffuse ulcerative colitis (a) in a pig with enteritis caused by *Salmonella typhimurium*. Photo: Cosme Sánchez-Miguel. (b) A close-up view of the intestinal mucosa replaced by a yellow fibrin necrotic membrane. Photo: Sara Salgado.

Identification of the Salmonella serotype is essential for the development of an effective on-farm control program. For this reason, herdowners are encouraged to participate in the funded Salmonella TASAH program established by Animal Health Ireland (AHI). This program provides on-farm bacteriological testing to detect and identify Salmonella strains where present. The results are used to develop farm-specific Salmonella control plans, which are drawn up by the nominated private veterinary practitioner (PVP) in agreement with the herdowner.

> National Disease Emergency Hotlines
>
> ASF is a notifiable disease and PVPs are reminded to notify DAFM if they suspect presence of the disease by contacting their local RVO or the National Disease Emergency Hotline at 1850 200 456

13. Poultry Diseases and Surveillance

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13.1. Avian Influenza Surveillance

Avian influenza type A is a contagious disease caused by viruses which are naturally found in, and which are adapted to, populations of wild birds. Avian influenza viruses can also affect poultry and mammalian species (depending on the virus subtype) including wild mammals, rodents, pigs, cats, dogs, horses, humans, and more recently cattle and small ruminants.

Based on the severity of the disease Avian Influenza is divided into low pathogenic (LPAI) and high pathogenic (HPAI) strains. LPAI may present with mild or no clinical signs in poultry. On the other hand, HPAI strains can cause severe clinical signs such as respiratory signs, reduced food intake, diarrhoea, and nervous signs; and in some cases, HPAI strains can cause sudden death with no other symptoms. In layers, drop in egg production and/or poor egg quality has been reported.

Avian Influenza viruses are classified into subtypes based on two surface proteins, haemagglutinin (HA) and neuraminidase (NA). There are approximately 16 HA subtypes and 9 NA subtypes which are used to identify avian influenza viruses e.g. H5N8, H5N6 etc. All HPAI are notifiable to the European Commission and the World Organisation for Animal Health (WOAH) within 24 hours of confirmation of the disease. These notifiable subtypes can be associated with acute clinical disease in chickens, turkeys, and other birds. Other subtypes such as LPAI H6- are not notifiable under the legislation, however they still can cause losses in production.

Active surveillance:

DAFM carries out two types of active surveillance for avian influenza.

a) Avian influenza serology testing in poultry through the national Poultry Health Programme (PHP). The Poultry Health Programme is a DAFM surveillance programme to support trade in poultry, and to comply with EU regulations, including *Regulation (EU) 2016/429*, *Regulation (EU) 2035* of 2019 and Commission Delegated *Regulation (EU) 2020/688*. The PHP includes testing for *Mycoplasma* and *Salmonella*, and , to increase Avian Influenza surveillance, samples are also tested for AI by AGID/ELISA. In 2024, 8000 poultry samples were tested for AI by this method through the PHP (Table 13.1).

b) Avian influenza H5 and H7 serology testing of poultry under the EU Poultry Surveillance Scheme. Ireland's avian influenza surveillance programme is based on representative sampling, which considers criteria in *Annex II of Commission Delegated Regulation (EU) 2020/689* at a level reflective of *Annex I of Commission Decision 2010/367/EU*.Testing is carried out by newly accredited AI ELISA test which detects all Avian Influenza strains including H5 and H7.

In 2024, 6560 samples were tested as part of this programme. There were some positive detections by serology in re-homed layers last year, however, after a follow- up investigation birds tested negative; therefore, circulation of Avian Influenza could not be confirmed. The categories sampled for the EU Poultry Surveillance Scheme include:

- Broilers Free Range
- Broiler Breeders
- Layers Free Range
- Layers Non-Free Range
- Fattening Turkeys
- Turkey Breeders
- Fattening Ducks
- Fattening Geese

Passive surveillance:

1. Passive surveillance of wild birds.

Wild bird surveillance for avian influenza in Ireland is risk based. It is implemented as a passive surveillance scheme, as dead, moribund or sick birds are reported to DAFM by members of the public or the National Parks and Wildlife Service (NPWS) by ringing the Avian Influenza Hotline (076 1064403) or the after-hours number (1850 200456). Sick or dead birds can also be reported to DAFM directly using the Wild Bird-Avian Check App[1], which can be accessed via smart phones, tablets, PCs and laptops. The birds are collected by trained personnel and submitted to the Regional Veterinary Laboratories (RVL) for sampling. Samples are then submitted to the Central Veterinary Research Laboratory (CVRL) where Avian Influenza testing is carried out.

A list of species of wild birds to be targeted for surveillance for avian influenza is provided by the Commission Implementing *Decision 2010/367/EU* in accordance with the scientific opinion provided by EFSA. This list is amended according to the demographics of each country. See list here: List of Target Species for Avian Influenza Surveillance[2].

In 2024, 111 wild birds were tested by passive surveillance; from those 2 buzzards were confirmed Highly pathogenic H5N1 positive.

2. Passive surveillance of poultry and other captive birds

Avian influenza is a notifiable disease in Ireland, meaning that anyone who suspects that an animal/bird may have the disease is legally obliged to notify DAFM.

Following notification through the Regional Veterinary Office (RVO), an official investigation will be carried out by DAFM, directed by the competent authority (National Disease Control Center) with official samples submitted to the CVRL for testing. In addition, flock owners and PVPs are encouraged to engage with their Regional Veterinary Laboratory to aid with diagnosis of other avian disease conditions.

In 2024, there was no confirmed cases of Avian Influenza in poultry or captive birds (Table 13.1).

13.2. Avian *Mycoplasma spp.* Surveillance

Active surveillance

The Poultry Health Programme (PHP) operated by DAFM includes surveillance for poultry mycoplasmosis. Mycoplasmas in poultry, whilst of no public health concern, can present significant problems both commercially and

[1] https://aviancheck.apps.rhos.agriculture.gov.ie/report
[2] https://www.gov.ie/en/publication/50ce4-avian-influenza-bird-flu/

Table 13.1.: Avian influenza surveillance testing during 2024 in Ireland.

Programme	No Animals tested	Non- notifiable AI subtypes	Notifiable H5/H7 subtypes
Poultry Health Programme (PHP) (ELISA)	8000	0	0
Poultry -H5 and H7-EU Surveillance (HI) (a)	6560	0	0
Poultry - AI ELISA (diagnostics)	244	NA	0
Wild birds (PCR)	111	0	2 x (H5N1 HPAI-buzzard)
Poultry (PCR) (b)	119	0	0
Captive birds (PCR) (b)	85	0	0

[a] HI: Haemagglutination Inhibition test for H5 and H7;
[b] Poultry-PCR: includes individual animals and pooled swabs from different animals

potentially for bird welfare. Therefore, poultry are screened for *Mycoplasma Gallisepticum* and-or *Mycoplasma Meleagridis*.

Mycoplasma gallisepticum (MG): This mycoplasma is associated with a chronic respiratory disease. Typically, it is slow in onset and can result in significant commercial losses in production. This mycoplasma can infect chickens, turkeys and game birds. Ducks and geese can also become infected particularly when associated with infected chickens.

Mycoplasma meleagridis (MM): With this mycoplasma vertical transmission in the egg can be a significant factor. It is a disease of breeding turkeys with clinical disease possible in the progeny chicks. Respiratory symptoms are the main cause of economic loss.

The DAFM Poultry Health Programme seeks to provide a surveillance platform for MG and MM in commercial flocks. As part of this programme breeding flocks of both turkeys and chickens are routinely tested for serological evidence of MG or MM (turkeys only). The plan for each poultry subgroup varies but typically flocks are subject to serological testing at pre-movement (from rearing), exports, at point of lay, and during production (Typically every 12 weeks).

The frequency of sampling is set out in the *Council Directive 2009/158/EC* of 30 November 2009 on animal health conditions governing intra-Community trade in, and imports from third countries of, poultry and hatching eggs' , and the *EU commission Decision 2011/214/EU*. The sample size is based on a representative sampling strategy: 60 birds per house in houses of 1000 birds or more, with design prevalence of 5 *per cent*.

In 2024, 28020 and 1620 serum samples were screened for *M. gallisepticum* and *M. meleagridis*, respectively, at the CVRL as part of DAFM PHP programme (Table 13.2).

Passive surveillance

In addition to *M. meleagridis* and *M. gallisepticum*, *Mycoplasma synoviae* is also tested as a part of passive surveillance. The 3 serotypes are notifiable diseases in Ireland, meaning that anyone who suspects that an animal may have the disease is legally obliged to notify DAFM.

Beyond disease reporting, DAFM operates a network of Regional Veterinary Laboratories (RVLs), strategically located around the country. Farmers and private veterinary practitioners (PVPs) submit large numbers of samples from sick animals to the laboratories every week. Farmers are encouraged to report suspicions of my-

Table 13.2.: Official Sampling for Poultry Health Programme and EU AI surveillance during 2024 in Ireland

Type of submissions	Test	Number of tests	Positive
National-Poultry Health Programme	M. gallisepticum SPAT	28020	0
	Avian Influenza AGID/ELISA	8000	0
	M. meleagridis SPAT	1620	0
	Salmonella arizonae 'H' SAT	1380	0
EU-Poultry AI Surveillance Programme	Avian Influenza	6560	0

coplasma infection to their local Regional Veterinary office, and to make use of their local Regional Veterinary Laboratory to aid with diagnosis of disease conditions.

13.3. Avian Salmonella Surveillance

Every year, DAFM carries out the EU Salmonella Surveillance by collecting samples on-farm and confirming detected serotypes by culture. The programme is as follows:

- In at least one flock of broilers on 10 *per cent* of commercial broiler premises with at least 5000 birds.
- Three times per production cycle for all flocks on all broiler breeder premises.
- In at least one flock per year per layer holding comprising at least 1000 birds.
- Once a year in at least one flock on 10 *per cent* of holdings with at least 500 fattening turkeys.
- Once a year in all flocks with at least 250 adult breeding turkeys between 30 and 45 weeks of age.
- All holdings with elite, great grandparent and grandparent breeding turkeys.

In 2024, 1465 samples collected from farms by DAFM were analysed; of these, *Salmonella spp.*. were detected; in 1 broiler farm (*S. Mikawasima* from 1 flock) and in one layer flocks (*S. Agama*) (Table 13.3).

13.4. Newcastle Disease and pigeon PMV1

Newcastle Disease (ND) is a notifiable disease that affects poultry and it is caused by virulent strains of Avian Avulavirus 1 -AAvV-1- (also called Avian Paramixovirus type 1 -APMV1- or PMV1). A similar variant, Pigeon AvV-1 (PPMV1) infects pigeons and other wild birds. AAvV-1 infections may be presented as a wide range of clinical signs depending on the strain virulence from lethargy and mild respiratory signs to egg drop production, neurological signs, and sudden death.

Every year, samples from suspected cases and carcasses from poultry are submitted to the CVRL and RVLs for ND testing.

In 2024, 152 birds were tested for PMV1 PCR. These included Exports (parrots, falcons, cockatiels), and poultry. There were not detections of PMV1 in 2024 (Table 13.4).

Table 13.3.: Number of official on-farm poultry samples Salmonella spp. detection results in 2024.

Flock / bird type	Number of samples tested	Number of samples with Salmonella spp. detected	Number of samples with Salmonella spp. Not Detected
Broiler	110	1a (0.9%)	109
Broiler Breeder	812		812
Layer	476	1b (0.2%)	475
Layer breeder	2		2
Turkey	48		48
Turkey Breeder	10		10
Parent Broiler Breeder Rearing	5		5
Other (pullets)	2		2
Total	1465	2 (0.1%)	1463

[a] S. Mikawasima
[b] S. Agama

Table 13.4.: Paramyxovirus- 1 (PMV-1) testing during 2024 in Ireland.

Number of birds	Exports (parrots, falcons, pigeons)	Wild birds	Poultry Diagnostics	Results
152	73	0	79	Negative

13.5. Other Pathogen Detections

Beyond the active and passive surveillance for important notifiable diseases, DAFM carries out testing of other notifiable and non-notifiable diseases that have significant economic impact. Suspect and healthy animals (for monitoring purposes in this case) from backyards and commercial flocks are tested. PVPs submit swabs directly to the CVRL (Table 13.5) and carcasses of animals are submitted to the RVLs where they are sampled.

In 2024 the pathogens most detected in poultry backyards were Marek's Disease Virus (28) and from those 14 were confirmed as MDV wild strain, followed by Infectious Bronchitis Virus (16), and Infectious laryngotracheitis (6), however these tests do not differentiate vaccine from wild type strains. Other pathogens detected were *M. synoviae*(11) and *M. gallisepticum* (9) in backyard flocks.

Table 13.5.: PCR testing of submitted samples (PVP and RVL submissions) in 2024. This table does not include the pathogens detected as part of surveillance programs or farm investigations for Class A diseases.

Pathogen	Burds tested (n)	Positive birds (n)
Avian pneumovirus	15	0
Infectious Bronchitis	70	16
Chlamydia psittaci	7	0
Infectious laryngotracheitis *	28	6
Mycoplasma synoviae	58	11
Mycoplasma gallisepticum *	57	9
Marek's Disease Virus	77	28 (14 wild strains confirmed)

Note:
This table does not include the pathogens detected as part of surveillance programmes or farm investigations for Class A diseases.
These tests do not differentiate between vaccine and wild type strain
* Notifiable diseases

13.6. Main case reports in poultry

The primary diseases identified in avian submissions detected at DAFM have been bacterial and viral infections (mainly due to *Escherichia coli*, *Enterococcus spp.*, *Pasturella multocida* and MDV), endo- and ecto-parasitism, some pathological associated with husbrandy, such as cannibalism, pododermatitis and gout, metabolic diseases and neoplasms.

Colisepticaemia

Colisepticaemia is caused by *Escherichia coli* and results in significant economic losses worldwide. This disease complex (also referred to as salpingitis/peritonitis/salpingoperitonitis syndrome and egg peritonitis syndrome) was the most common cause of death in poultry submissions and was diagnosed in a wide variety of enterprises, including layer hens, broiler breeders, broiler chickens, and chicks affected with yolk sacculitis. Lesions were usually expressed as mild to severe fibrinous celomitis involving internal organs (Figure 13.1; and Figure 13.2), and histologically associated with heterophil infiltration, intravascular thrombi and intralesional bacterial aggregates. Sero-fibrinous cellulitis and ingluvitis were also observed in severe infection.

Figure 13.1.: Colisepticaemia: Ten-day-old broiler. Moderate to severe diffuse thick yellow-white fibrinous collection within the coelomic cavity, abundantly covering the liver and the heart. Tissues cultured *E. coli* positive to serotype 078:K80. Photo: Sebastian Mignacca

Several factors, such as intercurrent bacterial or parasitic diseases and non-infectious factors (e.g., adverse environmental conditions), are often linked to *E. coli* infection, suggesting that salpingitis/peritonitis are often the result of opportunistic infection. Live vaccines (e.g., Newcastle disease or IB) and nutritional deficiencies may increase susceptibility. Outbreaks in some flocks could be the consequence of vent pecking. Disease is generally the result of ascending infection via the cloaca, and *E. coli* is typically isolated in pure growth from the reproductive tract. Pathogenic strains may also invade from the respiratory tract following infection with other respiratory pathogens. Moreover, sequestered colonies in sites such as the intestine, nasal passages, air sacs or reproductive tract may be a latent source of infection. Birds are continuously exposed to contaminated faeces, water, dust, and the environment, and yolk sacculitis is usually associated with egg contamination in the hatchery or infection during hatching. On-farm control measures include a rigorous sanitation program, good litter management, control of dust and ammonia levels, and minimising sources of stress, parasitism, and viral infections.

In some cases, *E. coli* isolates also tested positive for O78:K80 antiserum. O78:K80 serotype, together with O2:K21 and O1, mainly contributes to the formation of avian pathogenic *E. coli* (APEC) outbreaks.

Figure 13.2.: Colisepticaemia: a one-month-old broiler. Diffuse moderate splenic congestion, with yellow-white miliary round foci subcapsular and throughout the parenchyma. Photo: Sebastian Mignacca

Enterococcus spp. infection

During 2024, broilers and broiler chicks in good or moderate condition, but affected by lameness and increased mortality, were also submitted. On *post mortem* examination, they also exhibited fibrinous or fibrous pericarditis and necrosis of the head of the femur (Figure 13.3). Culture from liver, pericardial sac, and bone marrow yielded *Enterococci spp.*

Figure 13.3.: Necrosis of head of femur due to *Enterococcus cecorum* infection: 10-d-o broiler. Chondronecrosis and osteomyelitis by *E. cecorum* infection, resulting in head of femur fracture after disarticulation from the socket (right). Healthy bone and joint on the left. Photo: Sebastian Mignacca

Diseases associated with enterococci in poultry, although worldwide in distribution, are relatively uncommon, and the growth of the causative bacteria in the laboratory is difficult. However, it has recently been shown that early mortalities in flocks, which are often attributed to *poor chick quality*, are in some cases due to this infection. *Enterococci* can be isolated from the environment, including hatcheries, and can be associated with septicaemia. *E. faecium* has been recovered from endocarditis in chickens, and *E. cecorum* has been obtained from bacterial chondronecrosis and osteomyelitis in broilers. Clinically, lameness and swellings affecting primarily tarsometatarsal joints and feet are observed, and differential diagnoses include joint infection due to *Staphylococcus aureus*, *Mycoplasma synoviae*, avian reovirus, and mineral imbalance in the diet, especially in growing animals and layer hens.

Pasteurella multocida infection (fowl cholera)

Fowl cholera is a highly contagious disease affecting several avian species, including chickens, turkeys, and waterfowl, and is caused by *Pasteurella multocida*.

Disease was sporadically diagnosed in backyard hens and in one free-egg layer hen flock, with concomitant colisepticaemia (Figure 13.4). Birds are usually present with increased mortality, coelomitis, and enteropathy, with or without signs of septicaemia.

Figure 13.4.: Fowl cholera associated with colisepticaemia: two-month-old hens. Very poor body condition, severe diffuse feather loss, and severe faecal staining of the vent with diarrhoeic white-yellow material mixed with blood-tinged mucus. Photo: Sebastian Mignacca

An interesting case involved an outbreak with high mortality in a turkey flock, in which avian influenza (AI) was initially suspected. However, virological tests for AI were negative. *P. multocida* was isolated from *post mortem lesions, and the diagnosis of fowl cholera was reached. The consistent finding on* post mortem* examination of submitted turkeys was pulmonary oedema with fibrinous serositis.

Fowl cholera can range from acute septicaemia to chronic and localised infections, whilst the morbidity and mortality may be up to 100 *per cent*. The route of infection is oral or nasal with transmission via nasal exudate, faeces, contaminated soil, equipment, and people. Reservoirs of infection may be present in other species such as rodents and cats. Predisposing factors include high density and concurrent infections such as respiratory viruses. Lesions of *P. multocida* infection in poultry vary in type, extent, and severity, depending on the species of bird, immune status, and stage of the disease; older birds are more susceptible than younger ones. Biosecurity plays an important role in its control, and depopulation for a few weeks should be considered when other measures are ineffective.

Erysipelas

Scattered mortality in four-month-old free-range turkeys from a group of 250 was attributed to *Erysipelothrix rhusiopathiae*. On *post mortem* examination, animals were in excellent body condition and had mild faecal staining of the vent with bright yellow faecal material. After opening, they had scattered small yellow-cream soft collections (up to 3mm) within the coelomic cavity. The small intestine, colon, and rectum were diffusely moderately distended and filled with abundant yellow-orange mucous content, while the coeca were bilaterally mildly gassy. Coelomatic viscera were moderately congested, with friable parenchyma, and scattered petechiation within the coronal sulcus of the epicardium were also seen. Histological findings were consistent with bacteria/septicaemia, and *E. rhusiopathiae* was cultured from the majority of organs.

E. rhusiopathiae, the causative agent of erysipelas, infects a wide range of poultry and has been isolated from many mammalian species and fish. In layers, erysipelas seems to be an emerging disease in farms changing from cage to free-range, organic and barn housing systems. Sources of infection are contaminated soil, litter and water, dead animals, rodents, wild birds and pigs. Biting insects, like the poultry red mites, may act as vectors and reservoirs. Erysipelas seems to affect layers at an older age (43–73 weeks). Acute mortality is the first clinical sign of infection in laying hens, and lethargy, diarrhoea, swollen heads, and lack of coordinated movement can also be observed. A chronic form of bacterial infection primarily occurs in turkeys that have been vaccinated against erysipelas, and joint ill and endocarditis can be seen. Usually, carcasses are in good condition and correctly muscled, although ecchymosis may be visible in subcutaneous fat and thigh muscles, while internal organs (i.e., liver, spleen, and kidneys) become enlarged. Removal of dead birds and other possible sources must support the treatment. In countries where vaccination is available, emergency vaccination is not a practical solution for producing layer flocks, but after an outbreak, the first 3–5 replacement flocks should be vaccinated.

> Zoonotic disease
>
> Erysipelas is a zoonosis, and the bacteria usually infects humans via cuts in the skin.

Gallibacterium anatis infection

Gallibacterium anatis was cultured from liver, trachea, coelomic fibrinous exudate and cloaca of backyard hens on a few occasions. Although this bacterium is a typical inhabitant of the respiratory and reproductive tract, under favourable conditions, it can cause reproductive and systemic diseases.

Megabacteria infection

An adult ornamental hen submitted for *post mortem* examination had abundant yellow-orange gelatinous clots within the coelomic cavity, and the viscera were diffusely congested. The proventriculus was diffusely severely enlarged, with hypertrophied proventricular glands; its mucosa was covered with abundant milky-viscous secretion and had focally extensive linear erosions of the koilin layer at the proventricular-ventricular junction. Histologically, a multifocal lymphoplasmacytic proventriculitis (Figure 13.5) associated with heavy luminal infection with megabacteria was observed.

Macrorhabdus ornithogaster (formally known as megabacteria) is a large microorganism. They have at various times been called bacteria, fungi, and lactobacilli, but are now considered a microscopic class of their own. Megabacteria typically cause a weight-loss syndrome with bulky, soft, dark faeces containing poorly digested food. However, the bird's appetite is usually increased. The course of the disease usually lasts more than one month, although sudden death after acute vomiting episodes does occur. In many instances, megabacteria were seen in the faeces of clinically healthy birds, whereas wasted, thin birds had no megabacteria in their droppings but large numbers in their stomachs.

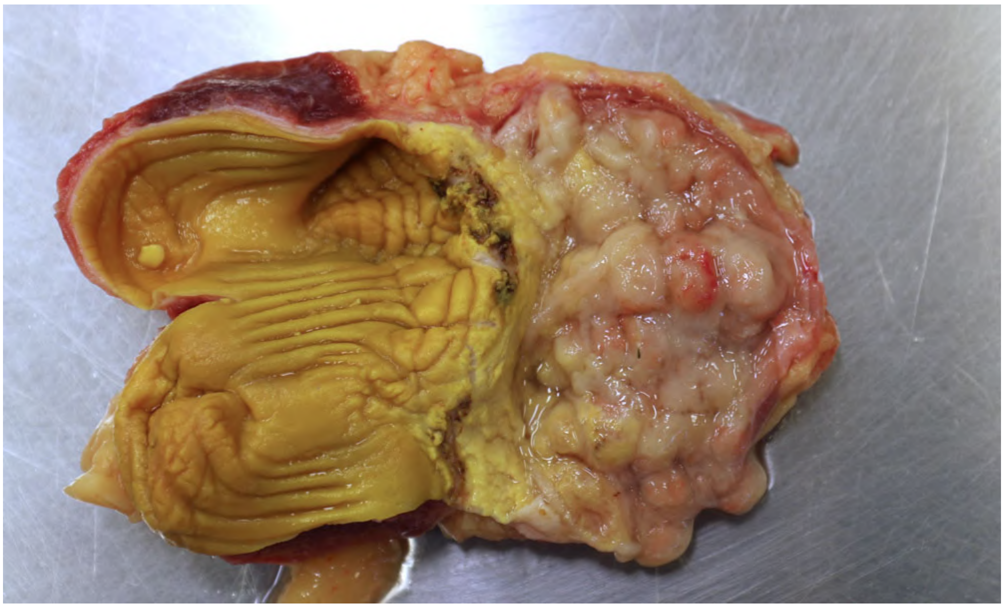

Figure 13.5.: Proventriculitis due to *Macrorhabdus ornithogaster* (formally megabacteria): adult pet hen. Proventriculus diffusely severely enlarge with hypertrophied proventricular glands and mucosa covered with abundant milky-viscous secretion; Focally-extensive linear erosions of the gizzard koilin layer at the proventricular-ventricular junction also evident. Photo: Sebastian Mignacca

Brachyspira spp. infection

Since mid-2022, Dublin RVL has run a survey on selected avian samples submitted for *post mortem* examination. The study includes only whole avian carcass submissions. During necropsy, faecal pools (up to five adult animals for each submission) are tested for *Brachyspira spp.*, *B. intermedia*, *B. pilosicoli*, and *B. hyodysenteriae*.

By the end of December 2024, occasional submissions tested positive, and *B. intermedia* was the most commonly identified species, while *B. hyodysenteriae* has never been detected. Positive submissions were more often from free-range egg layer hens, backyard poultry, and sporadic exotic and ornamental poultry. On the other hand, broiler breeders have consistently tested negative.

The history included weight loss, increased mortality, decreased production, pale eggshells, dehydration, and changes in dropping. On *post mortem* examination, intestinal contents ranged from normal to dark or pale and mucoid, and mild to severe segmental gassy intestine, mainly in the ceca and colon. Histological changes ranged from mild to multifocal lymphoplasmacytic typhlitis, or multifocal severe necrotising typhlitis associated with mixed bacterial aggregates. In some cases, numerous slender filamentous bacteria were clearly seen within the lamina propria of the caecal mucosa in sections stained with Warthin-Starry (although this technique was often unrewarding). To note that often positive submissions had intercurrent diseases (bacteriemia, parasitism, gout), and it is uncertain if *Brachyspira spp.* represented either a primary or secondary agent.

The genus *Brachyspira* includes nine officially recognised species, several of which are pathogenic to mammals and birds. Avian intestinal spirochaetosis (AIS) is a gastrointestinal disease in poultry caused by the colonisation of the caeca and/or colon-rectum by *B. pilosicoli*, *B. intermedia*, and *B. alvinipulli*. AIS primarily affects layer hens and broiler breeders older than 15 weeks.

Clinical signs (mainly induced by *B. pilosicoli*) can range from asymptomatic to severe disease, leading to increased mortality rates. Mild to moderate disease could result in a 6–10 *per cent* reduction in egg production, delayed onset of lay, reduced growth rates, decreased egg quality, faecally stained eggs, and changes in the animal dropping. Systemic infection results in increased flock mortality, and it is infrequently observed. Wild birds are typically asymptomatic.

Marek's disease

Poultry submissions showing gross lesions indicative of Marek's disease (enlarged spleen, thickened sciatic nerve, multifocal pale firm masses within muscle and internal organs), then confirmed by histological examination and PCR, were received during the year. In the majority of cases, the history was non-specific, such as depression, weight loss, anorexia, and diarrhoea, and almost always a *concomitant* disease (bacterial or parasitic) was also present, confirming the virus's immunosuppressive role.

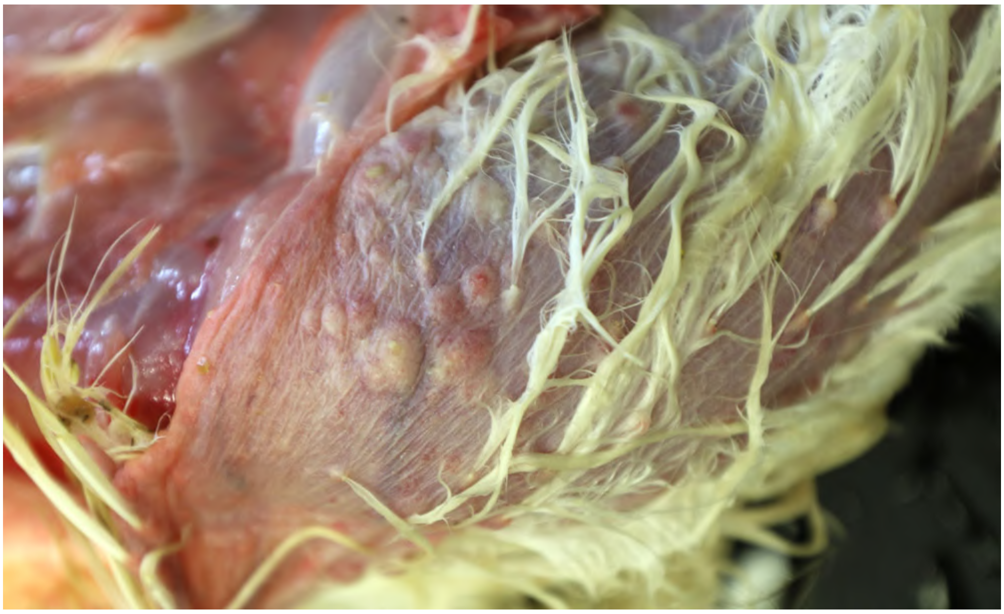

Figure 13.6.: Skin infiltration due to Marek's disease. a month-old broiler breeder. Multifocal to coalescing well delineated firm prominent, occasionally ulcerated, foci (2x2x2mm-5x5x5mm) within the leg skin. Photo: Sebastian Mignacca

An α-herpesvirus causes Marek's disease and usually affects birds older than four weeks of age. In infected flocks, it can present in different ways. In the acute form, its incidence is frequently 10–30 *per cent* or higher. Mortality can increase rapidly over a few weeks and then cease or can continue at a steady or falling rate over several months, and predisposes to secondary infections. Affected birds are often paralysed, and the bursa may be enlarged or atrophied. Histologically, the lesions consist of T-cell neoplasms, and there may be infiltration into multiple organs, including the skin (Figure 13.6), muscle, proventriculus, eye, brain, and peripheral nerves. Due to its highly contagious nature and ability to survive for long periods, both within the host and in the environment, its eradication is difficult. Affected animals shed the virus constantly, and some birds may be latently infected. Control is mainly based on preventive vaccination and improved management practices. However, depopulation should be considered when other measures are ineffective.

Intestinal nematodes (*Heterakis spp.* infection)

Several submissions had segmental moderate-to-severe enlargement of the small and/or large intestines. After the opening, a variable number of free small, round, elongated white-grey worms (around 0.5 mm) within the intestinal lumen were seen (Figure 13.7. *Heterakis spp.* infection typically causes only mild pathology and does not significantly affect bird performance. However, a high parasite load could lead to illness. In addition, this parasite carries *Histomonas meleagridis*, the cause of histomonosis in poultry.

Histomonosis

On a few occasions, *Histomonas spp.* infection was detected in broiler breeders. History reported high mortality, and coccidiosis was suspected. Birds were in moderate body condition and had mild faecal staining of the vent. On *post mortem* examination, the small intestine was multisegmentally filled with loose content, while the coeca were

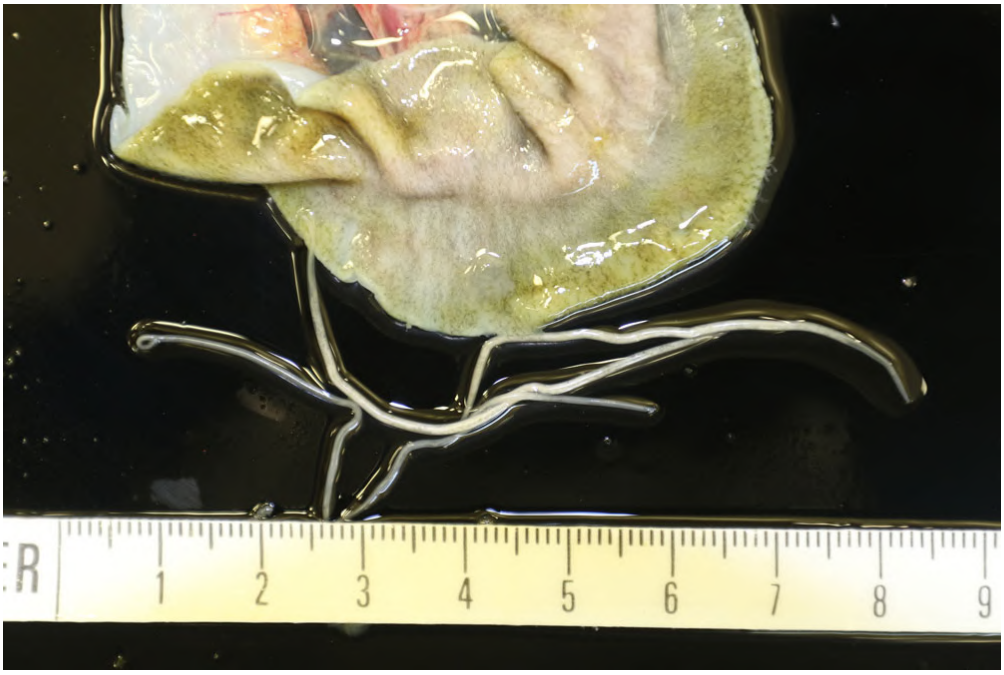

Figure 13.7.: *Heterakis spp.* infection: adult hen. Four individuals of long round white-grey worms (*Heterakis spp.*) within the small intestine. Photo: Sebastian Mignacca

diffusely moderately dilatated and had moderate to severe wall thickening and a large amount of brown-yellow to brown-red caseous necrotic debris within their lumen (so-called *cecal core*). Hepatic parenchyma had moderate-to-severe, multifocal-to-coalescing, circular, black-red-brown, depressed foci (2x5x5mm/4x4x4mm) throughout. Histologically, a severe necrotising typhlitis and a severe necrotising and granulomatous hepatitis associated with *Histomonas spp.* were seen. Moreover, *H. meleagridis* was detected by PCR from the coeca material.

H. meleagridis, the etiological agent of histomonosis, is a poultry parasite primarily detrimental to turkeys. Characteristic lesions occur in the liver and ceca, with mortalities in turkeys often reaching 80–100 *per cent*. Chickens and other gallinaceous birds can be susceptible, but the disease was considered primarily subclinical until recently; they can also serve as carriers and reservoirs. Since 2015 there is no approved products to combat the disease. However, there are some antihistomonal compounds derived from plants. Turkeys and chickens exhibit a level of resistance to reinfection after recovery from infection. Direct transmission within a flock is thought to occur via cloacal drinking, which transfers materials from the vent region into the ceca via waves of reverse peristalsis. *H. meleagridis* is also carried by *Heterakis spp.*.

Ectoparasitism

External parasitic infections were often observed in fowl, wild and zoo birds. Usually, birds report worsening body condition and feather loss, and small, motile red and brown parasites are present within the feathers. Carcasses showed diffuse pallor and may have had hepatic histological changes consistent with anaemia/hypoxia.

Notably, some of the detected species (e.g., *D. gallinae*) can survive for up to 34 weeks without feeding, and humans are also bitten by them, which causes small red lesions and intense itching. Other ectoparasites occasionally reported included *Goniocotes gallinae* (fluff louse), a common chewing louse in chickens. They are found within the body, in the feather fluff on the bird's back, abdomen, and vent, and the female lays eggs in clusters near the base of the feather. As with other lice, heavy infestation led to lethargy, decreased appetite, reduced laying, weight loss, skin redness and scabs, feather pulling, bald spots, and dull, rough, ragged-looking feathers.

Cannibalism and vent pecking, pododermatitis, gout and miscellaneous

Husbandry related conditions such as feather and/or vent pecking, cannibalism, and pododermatitis were observed in some submissions.

Lesions ranged from moderate feather and/or vent pecking or fatal cannibalism with faecal and blood staining of the feathers around the vent, wounds, scars and necrotic debris within the cloaca, and intestinal segments protruding out of the orifice. Carcasses also showed generalised severe pallor of the comb, muscles, and viscera, large fresh blood clots in the celomatic cavity, and the large intestine and part of the small intestine were missing. Cohorts often had a large amount of feather fragments within the alimentary tract.

Cannibalism has been reported in all the enterprises. Stress and overstocking are usually associated with this issue, but outbreaks are often more severe in large flocks of free-range or aviary birds. It may be reduced by selecting less cannibalistic strains of poultry, avoiding early onset of lay, providing high perches from an early age and nests that minimise visibility of the cloaca during laying, ensuring an adequate diet, reducing stress, providing attractive foraging material, and removing affected or ill thrifty birds.

On the other hand, uni- or bilateral pododermatitis appears to be triggered by litter conditions; it could also be influenced by dietary factors (methionine and biotin deficiency, altered protein digestibility, high levels of unsaturated fats) and enteric health. Wet litter, high or low litter pH, and high ammonia can also contribute to its pathogenesis, especially in housed animals or during winter. Pododermatitis is usually painful and can lead to bacterial infection, and a weekly inspection is recommended to detect early lesions. Applying fresh litter, switching bedding from straw to wood shavings, installing slats under the drinkers, providing smooth walking surfaces, and managing litter and ventilation could be beneficial.

Severe, sudden egg drop was linked to an issue with the water pipeline and consequent decreased water intake in a free-range egg layer flock. The farmer also noted pale eggs with poor shell quality. Hens were dehydrated, with paler organs; kidneys were also enlarged and had slightly prominent renal tubules. Multifocal to coalescing, mild to moderate, poorly demarcated, yellow-grey, small, oval, flattened areas (up to three mm) within the proventricular mucosa were also present in some birds. Histologically, some tissues contained multifocal tophi, strongly suggestive of gout (Figure 13.8).

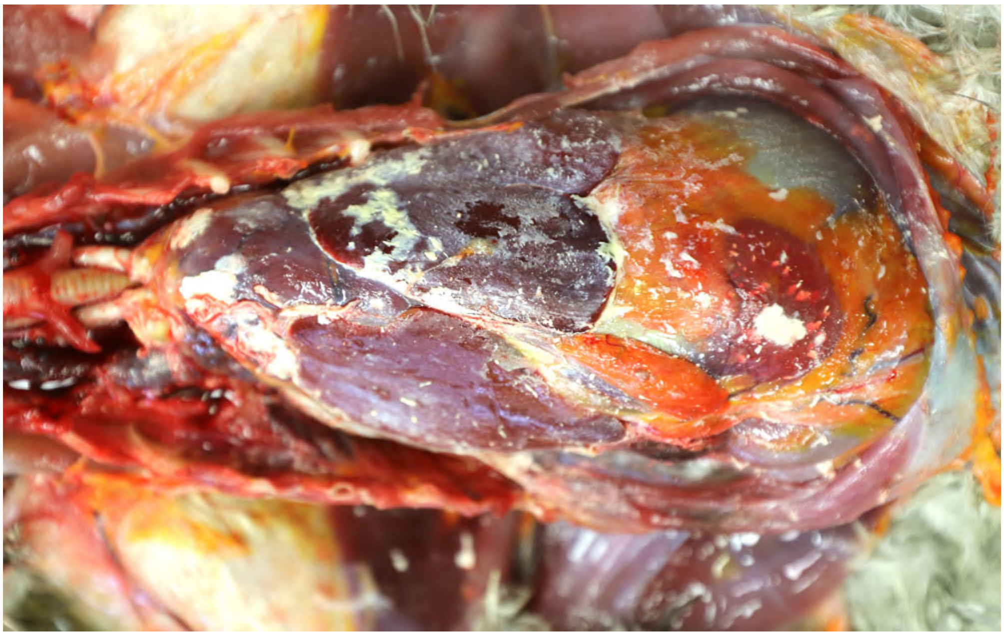

Figure 13.8.: Gout: four-year-old guinea fowl (*Numida meleagris*). Multifocal mildly rugged celomic surface, with multifocal mild to moderate chalky aggregates within the surfaces of the Glisson capsule. Severe dehydration and chalky aggregates within the joints, skeletal muscles, epicardium, mesentery, gizzard, oviduct, and parietal coelom were also seen. Photo: Sebastian Mignacca.

Visceral gout most often occurs secondary to dehydration, renal failure, or metabolic disturbances, of which there are many causes, including urolithiasis. Other causes of visceral urate deposition include nephrotoxicity due to excess dietary protein or calcium, mycotoxins, heavy metals such as lead, certain antibiotics, nephrotropic strains of infectious bronchitis virus, avian nephritis virus (astrovirus), and Type A influenza, Cryptosporidia and Eimeria species, Vitamin A or B12 deficiency, treatment with sodium bicarbonate and water deprivation/dehydration. In birds, gout development is also influenced by exposure to cold and dampness. Moreover, dehydration may result from overheating chicks in the hatchery or from prolonged time spent there. In this case, gout was interpreted as the consequence of the reduced water intake. Interesting, another few cases in exotic birds were likely linked to stress and captive management.

One case was a five-year-old male gyrfalcon (*Falco rusticolus*) from a large bird of prey facility, where about five birds with similar signs/lesions (lime-green faeces without urates and foul-smelling, and straw-coloured ascites in the coelomic cavity) were recorded over the last two years. During *post mortem* examination, an abundant diffuse green-grey pasty faecal material within the vent and cloaca, and multifocal elongated flat well-delimited yellow-brown plaques (1x4mm/3x5mm) within the oral cavity were seen (Figure 13.9). The coelomic cavity was severely distended by abundant, turbid, thick yellow-orange fluid, while the liver was enlarged and had an ochre-yellow colour. Severe systemic amyloidosis was diagnosed based on the *post mortem* findings.

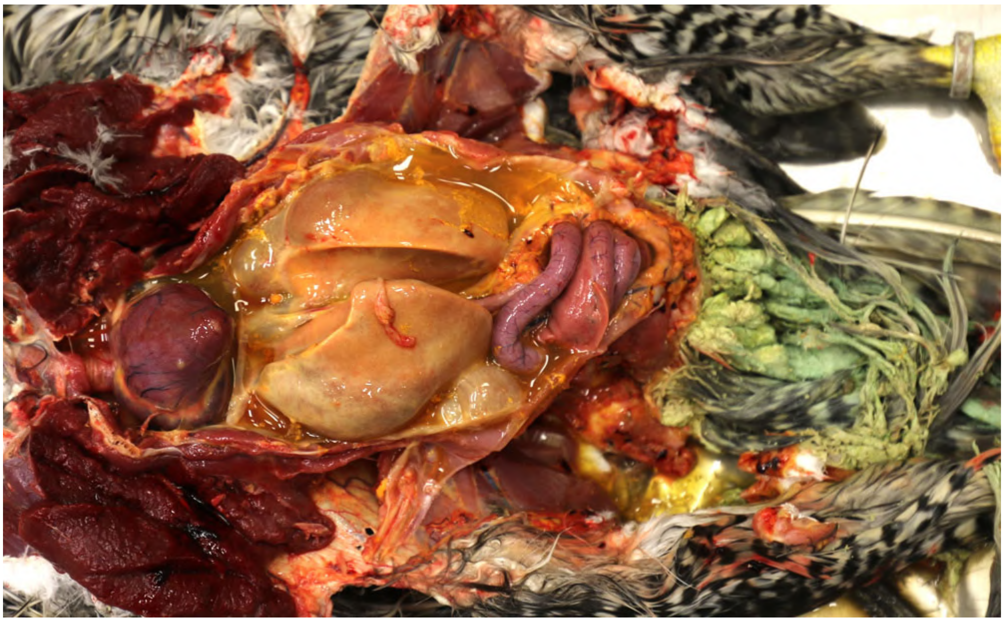

Figure 13.9.: Amyloidosis: five-year-old gyrfalcon (*Falco rusticolus*). Abundant diffuse green-grey pasty faecal material within the vent and cloaca. Coelomic cavity severely distended with turbid tick yellow-orange fluid mixed with scattered multifocal creamy yellow-orange debris. Liver mildly firm, with diffuse severe ochre-yellow parenchyma. Photo: Sebastian Mignacca.

The aetiology of amyloidosis in raptors is poorly understood. It is a disorder primarily affecting the liver, although the spleen, kidneys, and even the brain can be involved. The condition is characterised by the deposition of amyloid within the parenchyma. Amyloid deposition appears to be stimulated by chronic disease characterised by antibody-antigen interactions. However, several cases of amyloidosis in falcons with no previous history or evidence of disease have been encountered. It is therefore possible that subclinical disease might also stimulate amyloid deposition. Nutrition or nutritional management may also play an important role (e.g., many amyloidosis cases involved falcons that underwent dietary changes, such as the removal of a main food item, several weeks before the onset of disease). Therapeutic management of amyloidosis is still in its infancy. Therefore, special attention should be paid to prevention, focusing on hygiene and stress avoidance. Some success has been achieved by removing the ascitic fluid, administering glucose and ascorbic acid, and providing general support therapy.

Another case linked to captive management involved an ibis (*Threskiornis melanocephalus*) that had worsening condition and inappetence over the previous few weeks. Macroscopically, its gizzard mucosa was diffusely severely wrinkled, and the lumen was filled with several little/medium-sized stones, moderately smooth glass fragments, and a metallic snake-shaped earring (4x2cm) well hooked to the mucosa (Figure 13.10a). The ingesta within the intestinal segments was very scant. In this case, the foreign body could have represented a painful and mechanical obstacle leading to a lower feed intake and death.

Moreover, another captive ibis (*Threskiornis melanocephalus*) euthanised and submitted for *post mortem* examination had bilaterally large, irregular scars covered with brown-black-yellow necrotic, dry debris located dorsomedially at the axilla. History reported that the lesions were also present the previous year, but they recovered well, only to reappear a few months later, making the bird unable to express its normal behaviour and worsening its body condition (Figure 13.10b). Histologically, a severe necrotising histiocytic and heterophilic dermatitis associated with coccobacilli was observed. Based on the anamnesis and *post mortem* findings, a final diagnosis of feather-destructive behaviour and/or wing web dermatitis of the prepatagium and axilla was made.

(a) Traumatic ventriculitis

(b) Dermatitis of the prepatagium and axilla

Figure 13.10.: Traumatic ventriculitis: adult ibis (*Threskiornis melanocephalus*). Gizzard filled with several little/medium size stones, moderately smooth glass fragments, and a metallic snake-shape earring (4x2cm) well hooked to the mucosa. (b) Feather destructive behaviour/wing web dermatitis of the prepatagium and axilla, and (a) brown-black-yellow necrotic dry debris, located dorso-medially at the axilla of the same ibis. Photos: Sebastian Mignacca.

This pathology of pet and captive birds is a frustrating syndrome that is difficult to manage and resolve. The potential aetiologies are complex and poorly understood, although hypersensitivity, self-induced or hormonal prepatagial feather loss, or excessive moisture of the wing web may initiate the early events. Chronic cases can result in scarring leading to prepatagial contracture, habitual self-mutilation, and recurrent secondary infections. Grossly, it appears a moist, exudative dermatitis of the ventral prepagium and axillary areas with loss of downy and contour feathers. Multifocal areas of skin are ulcerated with inflammatory exudates found on the surface or at the margins of the affected area. One or both wings can be affected. There does not appear to be a sex predilection. African grey parrots appear to be overrepresented, although the condition has been observed in other species as well.

Breast myopathies

In late spring 2024, an unusual increase in the number of submissions observed at the Dublin RVL regarded cases of breast myopathies (BMs) in regularly slaughtered Ross 308 broilers.

BMs in broilers are described worldwide, and the most common types are considered wooden breast (WB), white striping (WS), and spaghetti meat (SM).

Macroscopically, the submitted muscles had WB, WS, and SM. Histologically, multifocal myofiber necrosis, infiltration of necrotic fibres by macrophages, multifocal perivascular lymphoid cell infiltrates, and fat deposits were observed (Figure 13.11).

BMs in broilers are a consequence of the fast growth resulting from the increasing demand. The most accepted aetiology of BMs is decreased oxygenation of the pectoral muscles, with consequent muscle anoxia leading to decreased ability to dispose of lactic acid and $C0_2$. WS is considered overall very common, but its prevalence is likely much higher because the condition may not be visible during processing and cooking. However, WB has a rubbery texture that may cause aversion among consumers. SM has a striking visual difference and a different texture, with a slight effect on nutritional value and negative technological properties for further processing. The severity and appearance of SM could be increased by water chilling (rather than air chilling), mechanical procedures such as plucking, defeathering, and deboning, and gas stunning (rather than electrical stunning).

Decreasing growth rate and/or slaughtering at a younger age (1 or 2 days earlier) could minimise myopathy (this seems more for WS, but may worsen SM).

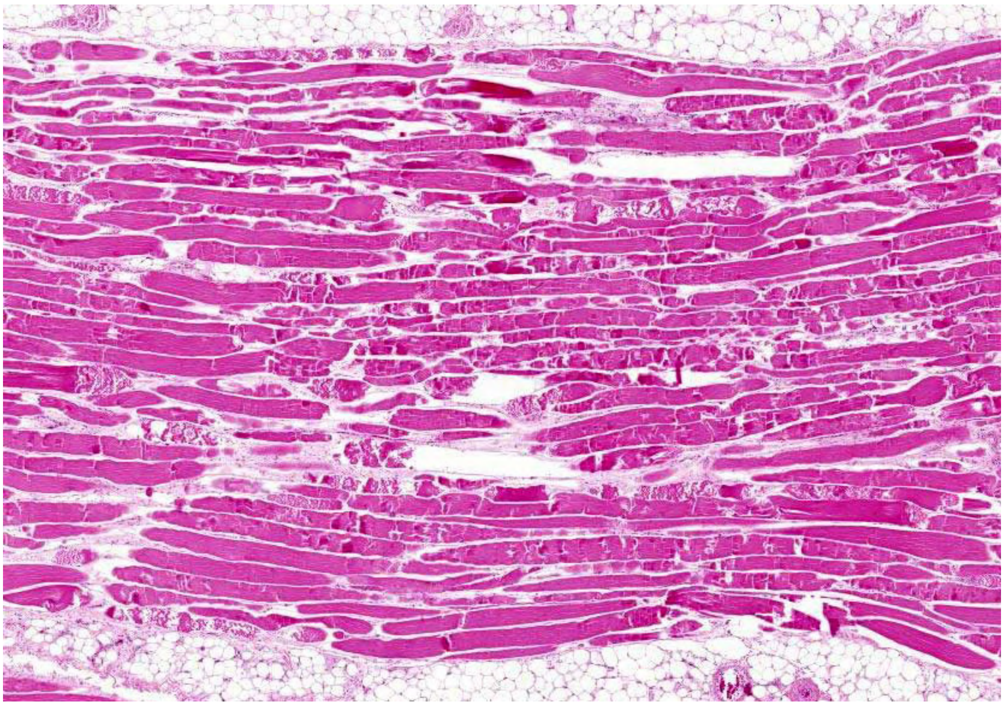

Figure 13.11.: Breast myopathy: broiler: Pectoral muscle showing aundant adipose infiltration and multifocal severe myonecrosis (Hematoxylin and Eosin). Photo Ann Sharpe.

Fatty liver haemorrhage syndrome

Sporadically, submitted tab egg layers and broiler hens had diffuse abundant adipose deposits within the coelomic cavity associated with pathological findings within the liver (severe diffuse blood clots on the parietal surfaces, focal extensive severe rupture of the parenchyma and capsula, and enlarged and yellow-ochre organ). Histologically, animals had changes consistent with fatty liver haemorrhage syndrome (FLHS). FLHS is a metabolic disorder likely resulting from a combination of nutritional, hormonal, genetic, and environmental factors, and most often affects table-egg layers.

Neoplasms

Case reports of adult hens, usually backyard hens, have been observed occasionally throughout the year. Usually, history reports respiratory distress, sneezing, and ill thrift with subsequent spontaneous death or euthanasia. Lesions usually consisted of firm cream-grey single medium-sized globular masses, to disseminated or large cauliflower-like masses (up to 8x7x7cm) within the abdominal cavity and attached to the peripheral viscera and the distal oviduct, and were likely of oviductal origin. Adenocarcinomas and leiomyoma were the commonest tumour types diagnosed in these cases.

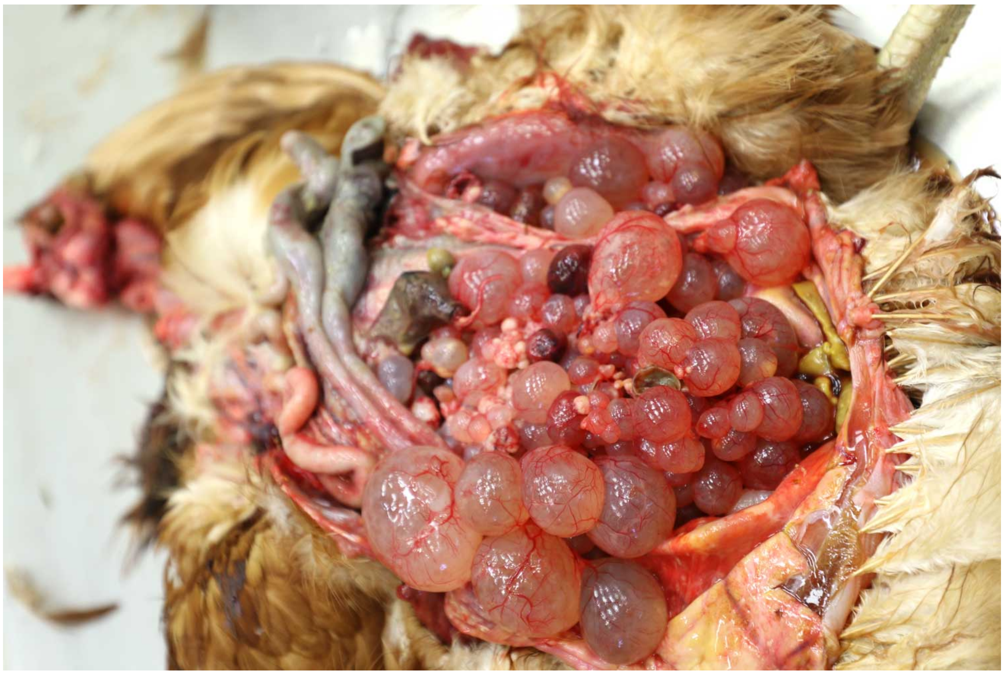

Figure 13.12.: Tumour (cystadenocarcinoma – large-cyst type): Adult back yard tab layer hen. Large bunch of turbid fluid-filled multi-sized cysts (0.5x0.5x0.5cm – 2x2x2cm) occupying almost entirely the celomic cavity. Photo: Sebastian Mignacca.

Adenocarcinomas of the female reproductive tract are frequent in older laying hens with high rates of ovulation, whilst leiomyomas are benign neoplasms of smooth muscle and are a frequent incidental necropsy finding in older laying hens and broiler breeders.

Miscellaneous cardiovascular lesions

Finally, pathologies of the heart and the large blood vessels at its base were also sporadically observed. They mainly affected old zoo and pet birds and were characterised by cartilaginous metaplasia of the aorta and ruptures of large vessels due to mycotic infections.

Other sporadic diagnoses observed throughout 2024 included mainly less common bacterial infections, aspergillosis, mycoplasmosis (*M. gallisepticum* and *M. synoviae*), adenovirus infection, lymphoid leukosis, Gumboro disease, and trichomoniasis, among others.

Selection of cases for post mortem examination

Effective case selection for diagnosis, particularly from large poultry operations, is crucial. Birds submitted should represent typical cases of the disease observed on the farm, rather than random selections. The above cases highlight the importance of strong sampling skills by private veterinary practitioners, continuous communication and feedback from them, and good cooperation with farmers to ensure accurate and reliable diagnoses.
In the few cases where avian submissions remained undiagnosed or inconclusive, the primary issue was the poor condition of the samples upon arrival. This included carcasses in advanced decomposition, insufficient ice packed with the carcass during shipping, inadequate packaging, or delays caused by couriers.
Unfortunately, despite *post mortem* examinations, some submissions still resulted in inconclusive findings regarding the cause of mortality.

14. Wildlife Surveillance

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DAFM's Veterinary Laboratories examined several wildlife species in 2024 as part of DAFM's wildlife disease surveillance exercises. In addition, throughout 2024 DAFM laboratories have assisted NPWS and An Garda Síochána by providing forensic evidence and expert support in investigations of wildlife crime. The systems required to provide forensic evidence to support criminal investigations have been improved and are continuing to evolve.

In one example, skin tissue from a wild animal was retrieved from a crime scene. The evidence was photographed, documented and sampled by RVL staff. The skin samples were confirmed by DNA speciation and hair morphology analysis techniques to have come from a protected species indicating that illegal hunting had occurred. The development of new techniques and collaboration with international forensic laboratories involved in wildlife evidence analysis is essential to ensuring that wildlife crime can be fully investigated when it occurs in Ireland.

Radiograph from a wild bird was submitted for examination to RVLs on the suspicion that a crime may have occurred and to rule out accidental or deliberate poisoning. The location of the gunshot reveals that the bird had been shot in flight which narrowed the location of the crime scene (Figure 14.1). Ballistic evidence retrieved from the carcase and information on the type of weapon used and the likely range at which the gunshot had been discharged was provided to assist responsible authorities with their investigation.

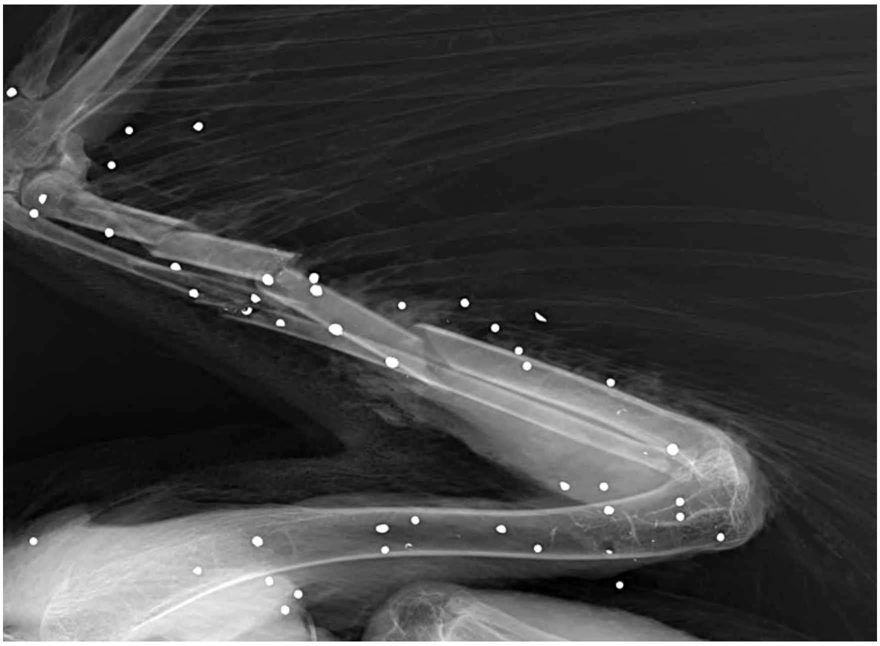

Figure 14.1.: Radiograph of a raptor showing multiple radiopaque lead pellets in the wing of the bird. Photo: Shane McGettrick

In 2024, NPWS submitted over 90 birds to DAFM veterinary laboratories, including buzzards, barn owls, short-eared owls, kestrels, peregrine falcons, white-tailed eagles, sea eagles, a red kite and a hen harrier. Some birds were submitted only for Avian Influenza testing and others were submitted for the RAPTOR (Recording and Addressing Persecution and Threats to Our Raptors) programme. The RAPTOR Programme is a collaboration between the National Parks and Wildlife Service (NPWS), the State Laboratory and the Regional Veterinary Laboratories and has been running since 2011. It is a mechanism for managing suspected wildlife crimes and disease surveillance in raptors and birds of special interest. There are several components to this programme including x-rays, post-mortem examination and toxicology testing. All birds were tested for avian influenza (AI) and if test positive to AI no further testing of samples was conducted. If there was an AI negative test result and where preservation allowed, samples were collected at post-mortem and were submitted to the State Laboratory for toxicology testing. Tests carried out on these samples in the State Laboratory include alpha chloralose, beta chloralose, brodifacoum, bromadiolone, carbofuran, chlorophacinone, coumatetralyl, diclofenac, dicumarol, difenacoum, difethialone, diphacinone, flocoumafen, flunixin, meloxicam, methiocarb, methiocarb sulfoxide, nitroxinil, strychnine and warfarin. The sample for testing is extracted from the matrix and subjected to liquid chromatography tandem mass spectrometry, which is a common analytical technique used for confirmatory analysis for the presence of analytes in biological matrices.

Rodenticides were the most frequently detected toxin in the raptors examined in 2024. There are no definitive toxicity thresholds for Second Generation Anti-Coagulant rodenticides in the liver tissue of birds of prey. In the absence of comprehensive trial data, there is no direct way to associate the oral toxicity of a pesticide with the resulting residue levels in liver tissue. There is variation in toxicity between the various rodenticides, and for any given rodenticide, there is considerable variation between species, and even between individuals within species, in the residue levels found in birds suspected of dying from rodenticide poisoning. Brodifacoum, Bromadiolone, Difenacoum, Difethialone & Flocoumafen (all Second-Generation Anti-Coagulant Rodenticides) have very low predicted no effect concentration for oral intake by birds i.e. a minimal amount of the pesticide will have an unacceptable effect on birds. Second Generation Anti-Coagulant Rodenticides are two hundred to six hundred times more toxic than First Generation Anti-Coagulant Rodenticides. In general, gross evidence of haemorrhage in the carcase at postmortem examination is used to infer the significance of the detection of the rodenticide in the death of the bird (Figure 14.2). Nitroxynil was identified in the crop contents of a white-tailed sea eagle found dead in Connemara, Co Galway. The upper GIT was relatively empty indicating recent inappetence. In the absence of conclusive gross pathology or identification of other toxins, the presence of nitroxynil in the crop was considered significant in the case as nitroxynil is a toxic substance and its presence in the crop indicated that it had been consumed. Nitroxynil was also detected in samples of liver, gizzard and kidney from a white-tailed sea eagle found dead in the midlands. Nitroxynil was also found on bait recovered at the scene. DNA testing was used to identify the source of the bait, and this information was very useful in the investigation of the case by An Garda Síochána and NPWS.

Figure 14.2.: Red kite (Milvus milvus). Toxicology testing detected high levels of brodifacoum in the liver and the gizzard contents which consisted of a whole undigested mouse. Photo: Sebastian Mignacca

Carbofuran was detected in the crop and gizzard contents of a white-tailed Sea Eagle found dead in Co. Tipperary. Remnants of a bird were present in the crop and bones in the gizzard. Carbofuran is a banned toxic insecticide which has been shown to be toxic to much wildlife, but particularly to birds. Predatory birds can be poisoned by prey that recently consumed carbofuran. Like several birds of prey, as white-tailed sea eagles may feed on carrion, they are very susceptible to poisoned baits.

Parasitic glossitis was found in several buzzards submitted to DAFM veterinary laboratories. In these cases, the buzzards were generally in moderate to poor body condition. The tongue and the ventral surface of the oral cavity were covered with yellow-brown necrotic material (Figure 14.3). Histopathology of the lesion revealed a severe ulcerative and histiocytic glossitis with intramucosal nematodes, parasitic eggs and bacteria. These parasites were identified as mainly *Capillaria spp.*, with occasional tapeworm and *Cyathostoma spp.* eggs.

Figure 14.3.: Buzzard (Buteo buteo) with parasitic glossitis. Photo: Sebastian Mignacca

Avian intestinal spirochaetosis (AIS) is a gastrointestinal disease in poultry (mainly layer hens and broiler breeders over the age of 15 weeks) caused by the colonisation of the caeca and/or colon-rectum by *Brachyspira pilosicoli*, *Brachyspira intermedia* and *Brachyspira alvinipulli*. Wild birds are typically asymptomatic, but its potential role in the maintenance and/or transmission to free-range or back yard poultry flocks is unknown. Since mid-2022 Dublin Regional Veterinary Laboratory have conducted a survey on selected avian samples submitted to the Dublin RVL. Faecal samples collected at postmortem examination are tested using PCR for *B. intermedia*, *B. pilosicoli*, and *B. hyodysenteriae*. To date none of the above Brachyspira species have been detected in raptor faecal samples.

NPWS submitted four hares for postmortem examination. They had been recovered from a roadside in the west of Ireland. All four hares suffered severe traumatic injuries and mutilation including multiple fractures, haemorrhage and skin wounds, resulting in death. Investigations were undertaken by the NPWS as dog attacks were suspected.

Echinococcus multilocularis is a zoonotic tapeworm that infects the red fox as a definitive host, other definitive hosts include cats and dogs. There are a number of forms of human echinococcosis, but alveolar echinococcosis is more frequently caused by *Echinococcus multilocularis* and is a serious parasitic zoonosis. People affected show symptoms of fatigue, weight loss, abdominal pain, general malaise and signs of hepatitis or hepatomegaly. In untreated patients, the disease can develop to a severe form resulting in liver failure. The adult tapeworm passes eggs into the intestine, which are excreted in the faeces and ingested by intermediate hosts (mice, voles and shrews typically) which can then infect the definitive hosts. Zoonosis occurs when man is the intermediate host.

The island of Ireland is considered free from *E. multilocularis* and therefore it is a requirement under the EU Pet Travel Scheme (PETS) that all dogs entering the country are treated with an anthelmintic effective against *Echinococcus spp.* prior to entering the country. Ireland must provide scientific evidence to the EU of our *E. multilocularis* free status, therefore DAFM undertakes an annual survey of wild fox population from across the country to assess the prevalence of this parasite. In 2024, 399 foxes were sampled and tested using PCR and all were negative for *Echinococcus multilocularis*.

Part IV.

Miscellaneous

15. Mycobacterial Disease: TB and Johnes Disease

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15.1. Introduction

Bovine tuberculosis (bTB), caused by *Mycobacterium bovis*, and Johne's disease (JD), caused by *Mycobacterium avium* subspecies *paratuberculosis* continue to pose significant challenges to animal health and livestock farming in Ireland. Furthermore, *M. bovis* is recognised as the primary cause of zoonotic tuberculosis infections in people. The Department of Agriculture, Food, and the Marine's (DAFM) role in monitoring and control of mycobacterial disease aims to protect both human and animal health and acts as an important support to Irish agri-food activity and trade.

Figure 15.1.: Tuberculous lesion in bovine lymph node in preparation for histopathological examination. Photo: DAFM bTB NRL.

15.2. Bovine tuberculosis

Bovine tuberculosis is a chronic granulomatous disease of cattle, usually characterised by lesions in pulmonary and lymph node tissue. While any member of the *Mycobacterium tuberculosis* complex (MTBC) may cause bTB, in Ireland, the infection is almost exclusively associated with *M. bovis*. Furthermore, M. bovis is also associated with TB infections in wildlife species such as badgers and deer, other domestic and exotic species and, occasionally, humans. Nowadays, overt clinical disease is relatively rare in cattle, in large part due to the success of the national bTB eradication programme (ERAD). Nevertheless, in 2024, ERAD reported an overall herd incidence of just under six *per cent* and thus, bTB still presents a significant challenge to the Irish dairy and beef farming sectors though loss of production and restrictions on trade in affected herds.

The National Reference Laboratory for bovine tuberculosis (bTB NRL) is operated by the Bacteriology and Parasitology division at the DAFM laboratory complex at Backweston. The main function of the bTB NRL is to support the activities of the national bTB eradication programme (ERAD) in its efforts to reduce and eliminate bTB from the national herd by providing diagnostic support and advice to veterinary colleagues.

The majority of samples processed by the bTB NRL represent tissue submissions from suspect bTB lesions detected at routine *post mortem* abattoir inspection. The bTB NRL received 7926 bovine samples from abattoirs during 2024. Of these, 6299 represented lesions detected in cattle previously deemed free from bTB at their previous herd test (these are known as *slaughter check* lesions). The remainder included samples from singleton (n = 545) and inconclusive (n = 294) tuberculin skin test animals as well as samples from bTB positive animals submitted for special investigation (n = 468) or strain type (n = 206) testing.

Table 15.1.: Summary of diagnostic results for samples submitted for bTB testing to the National Reference Laboratory for bovine tuberculosis in Ireland during 2024.

Species*	**Samples submitted (n)**	**Mycobacterium bovis positive (%)**	**Nontuberculous Mycobacteria positive (%)**
Bovine (slaughter check)	6300	3065 (48.7%)	7 (0.1%)
Bovine (diagnostic)	199	30 (15.1%)	10 (5%)
Badger	1946	545 (28%)	281 (14.4%)
Cervine	48	22 (45.8%)	6 (12.5%)
Alpaca	19	16 (84.2%)	0 (0%)
Porcine	10	3 (30%)	1 (10%)
Ovine	7	3 (42.9%)	0 (0%)
Feline	5	3 (60%)	0 (0%)
Caprine	2	0 (0%)	0 (0%)
Vulpine	2	0 (0%)	0 (0%)
Canine	1	0 (0%)	0 (0%)
Primate	1	0 (0%)	0 (0%)

* Bovine (slaughter check) samples represent lesions detected at routine post-mortem exam at slaughter of animals previously deemed free of bTB. Samples from the other species as well as the bovine (diagnostic) samples represent samples submitted from regional veterinary laboratories, private veterinary practices or laboratories. Note that some diagnostic sample submissions comprised of two or more tissue samples which were tested separately, in such cases the overall result was reported and included in this summary.

All samples submitted from abattoirs are examined for the presence of a gross lesion. Samples with no visible lesion (NVL) on gross examination are submitted for mycobacterial culture. Prior to 2023, all samples with a gross lesion were submitted for histopathological examination: those with a definitive positive (i.e., TB granuloma) or negative (i.e., actinobacillosis, neoplasia or parasitic lymphadenitis) diagnosis required no further testing whereas those with an inconclusive diagnosis (e.g., non-specific granuloma) were submitted for culture. Between June 2023 and May 2024, all samples with an inconclusive histopathological diagnosis were submitted for *Direct TB PCR* testing instead of culture. Since May 2024, all samples with lesions are submitted for Direct TB PCR testing. The Direct TB PCR test is based on the method developed by the EU-RL and uses two targets specific to the *Mycobacterium tuberculosis* complex (MTBC), namely *IS6110* and *mpb70*, as well as a target specific to *Rhodococcus equi* (ChoE). The test was extensively validated at the bTB NRL and shows comparable sensitivity and specificity to culture for lesioned tissue. The incorporation of Direct TB PCR testing into the diagnostic workflow resulted in significantly decreased turnaround times meaning that greater than 90 *per cent* of herd owners receive their results within five weeks of slaughter.

The bTB NRL also received 2240 submissions for diagnostic investigation during 2024. The majority of samples were submitted by the RVLs (n = 2079; 92.8 *per cent*) with the remainder comprising a small number of suspect porcine lesions detected at *post mortem* abattoir inspection and diagnostic samples submitted by PVPs. Of these, 1946 (86.9 *per cent*) were samples submitted from badgers, 199 were bovine diagnostic samples (i.e., incidental findings at *post mortem* of bTB negative animals or *post mortem* of TB positive animals submitted to RVLs rather than to an abattoir), 48 were from deer and 19 from alpacas.

Table 15.1 presents a summary of the diagnostic test results for samples submitted for bTB confirmation during 2024. Just under half of all slaughter check samples were positive for *M. bovis* with generally lower prevalence in diagnostic sample submissions (with the exception of feline and alpaca submissions). Nontuberculous mycobacteria (NTM) were isolated from less than one *per cent* of bovine slaughter check samples but were more prevalent in other submission types, particularly in badgers (14.4 *per cent*) and deer (12.5 *per cent*). Seventeen badgers (less than one *per cent*) were positive for the *M. bovis* BCG vaccine strain. This strain was not found in any other species and these findings are likely due to the vaccination programme though this will be confirmed using whole genome sequencing. It should be noted that these results do not reflect prevalence of bTB in the wider animal population, rather, they represent prevalence within a subset of suspected bTB cases.

Whole genome sequencing (WGS)

Whole genome sequencing (WGS) is increasingly being used by the Backweston laboratories as a tool to aid in characterising the phylogeny and genetic make-up of various bacterial species. It's main utility within the bTB NRL is in building a phylogenetic database of bTB isolates which will help to inform the overall epidemiological picture of *M. bovis* infection in Ireland and aid in outbreak investigations at farm, local and regional level. While WGS allows for the highest resolution of discrimination between different strains of *M. bovis*, its usefulness as an epidemiological tool is very much dependant on the quality and comprehensiveness of the underlying database. To this end, the bTB NRL continues to build its *M. bovis* WGS database and, in 2024, 1020 sequences were added. The bTB NRL *M. bovis* WGS database currently comprises approximately 5300 sequenced isolates, of which approximately 83 *per cent* are of bovine origin, approximately 13 *per cent* were isolated from badgers and the remainder comprising isolates from species such as deer, alpaca and other domestic and exotic animals.

15.3. Johne's Disease

Johne's disease (JD) is a progressive, chronic granulomatous disease affecting the intestinal tract of ruminants caused by *Mycobacterium avium* subspecies *paratuberculosis* (MAP). Clinical signs include diarrhoea, weight loss, lethargy, submandibular oedema, and death. Latency is a common feature of the disease, and although exposure to infection commonly occurs early in life, clinical signs are most frequently manifested between two to five years of age.

Figure 15.2.: Thickening and corrugation of the illeum associated with Johne's disease in a three-year-old cow with a history of weight loss. Photo: Aideen Kennedy

The Irish Johne's Control Programme (IJCP) is managed by Animal Health Ireland and provides knowledge

Table 15.2.

Table 15.3.: Summary of diagnostic results for samples submitted for MAP testing to the National Reference Laboratory for Johne's disease in Ireland during 2024.

	Serology			Culture	
Species	**Samples (n)**	**MAP ELISA positive**	**MAP ELISA suspect**	**Samples (n)**	**MAP culture positive**
Bovine	1762	213 (12.1%)	12 (0%)	223	38 (17%)
Caprine	1	0 (0%)	0 (0%)	2	1 (50%)
Ovine	47	6 (12.8%)	0 (0%)	17	1 (5.9%)

and tools to farmers to help prevent infection entering their farm, or, where it is already established, to mitigate spread and to reduce and ultimately eliminate infection from the herd. For more information see the Animal Health Ireland webpage[1].

Diagnosis of JD is challenging as definitive diagnosis often relies on histopathological examination. However, a number of diagnostic tests, when used along with appropriate interpretation of clinical signs and herd health history, are available to aid in diagnosis at animal and herd level. Serological testing for antibodies to MAP infection is conducted using an enzyme linked immunosorbent assay (ELISA) and is used to screen animals and herds for exposure to MAP. The specificity of MAP ELISA is affected by tuberculin testing and exposure to other mycobacteria while sensitivity may be lower in subclinically infected animals. Despite these limitations MAP ELISA offers a low cost, short turnaround time test which can identify animals suitable for further testing. Bacterial culture of faecal or tissue samples is considered the gold standard *ante mortem* test to determine the presence of MAP. However, intermittent or absent shedding mean that sensitivity is low in the early stages of infection and furthermore, turnaround testing time may be up to six weeks. Faecal or tissue samples may also be tested for the presence of MAP using targets specific to the MAP genome. Although this test has a much shorter processing time than culture, it is affected by the same limitations of culture.

Most of the diagnostic work for JD is carried out by commercial laboratories approved by the IJCP and is supported by the NRL for Johne's disease, operated by the DAFM Bacteriology and Parasitology division. The NRL for JD also provides diagnostic support to the RVLs and to PVPs and in 2024, processed 1810 samples for MAP ELISA testing and 242 samples for culture, the majority of which were from bovine animals. A summary of these results is present in Table 15.2

[1] https://animalhealthireland.ie/programmes/johnes-disease/irish-johnes-control-programme-ijcp-information/

16. Toxicology

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16.1. Lead poisoning

As part of DAFM's disease surveillance role the Veterinary Laboratory Service provides diagnostic support for suspect toxicities and investigates incidents. Lead incidents, involving poisoning or excessive exposure, are important animal health and food safety concerns, especially where milking cows or animals close to finishing weight are exposed. Risk management measures include removing animals from the source of lead, blood sampling and bulk tank milk monitoring, as required.

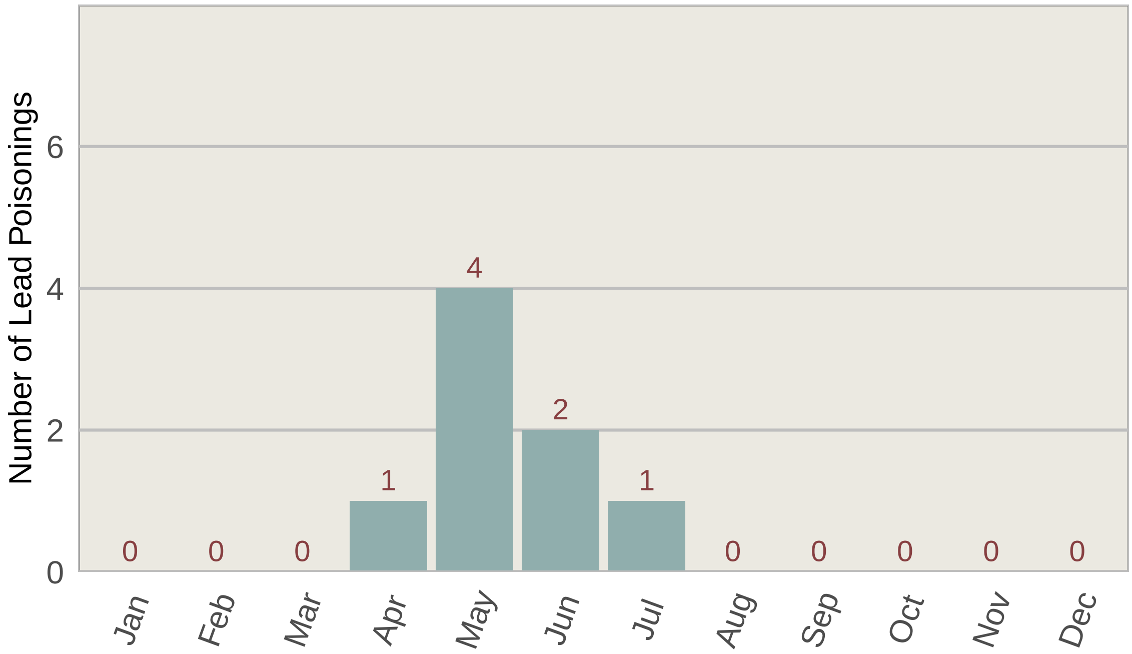

Figure 16.1.: Number of fatal lead toxicity cases in cattle by month in 2023 (n = 18)

In 2024 Lead poisoning was confirmed in eight separate herds, identified from the submission of carcases or clinical samples to the laboratory. This represents a decrease compared to the previous year when 13 confirmed cases were recorded. All eight cases in 2024 were diagnosed in cattle, mostly during spring and summer after turn out to pasture (Figure 16.1). None of these cases involved milking cows and most cases were reported in cattle older than one year. For the main, poisoning arose from discarded batteries to which animals had access, and one case resulted from access to mortar used on a boundary wall originating from a small historic mine. Animals usually presented with clinical signs of acute lead poisoning i.e., sudden death or blindness, staggering, head pressing and convulsions followed by death or subacute lead poisoning i.e., blindness, teeth grinding, dullness with death or survival after several days. All follow up actions determined that there was no risk to the food chain.

Part V.

Animal Health Ireland

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17. Bovine viral diarrhoea (BVD) Eradication Programme

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Since the beginning of 2021, animals with an initial positive or inconclusive Bovine Viral Diarrhoea (BVD) virus result that are not subject to re-test, or are negative on re-test at least 21 days later, are considered suspect. A confirmed case is considered persistently infected (PI) with BVD virus as defined by the OIE Bovine Viral Diarrhoea. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals, 2021[1], having an initial positive or inconclusive result by PCR or antigen capture ELISA which is again positive or inconclusive on a subsequent test at least 21 days later and without a subsequent negative result.

In 2024, just over 2.33 million calves were born. As in previous years, compliance with the tissue tag testing requirement remained very high, with results available for over 99.6 *per cent* of calves. Only 0.019 *per cent* of animals tested returned a positive or inconclusive (BVD+) result, corresponding to an overall animal-level prevalence of 0.007 *per cent* when considered against the national cattle population.

Herd prevalence also continued its downward trend, with only 0.24 *per cent* of Ireland's 83,000 breeding herds recording a suspect or confirmed BVD case in 2024 (Figure 17.1). At county level, Carlow and Longford were completely free of BVD in 2024, with Carlow having maintained freedom since 2022. Dublin, Kildare and Wexford each recorded only one or two suspect herds during 2024 (Figure 17.1). When all herds are considered (approximately 109,000), herd-level prevalence stood at 0.18 *per cent*. By year end, just a small number of suspect animals remained alive across twelve herds, with most counties free of any cases. Updated programme results are available on a weekly basis at AHI webpage[2].

Herds where a positive result is disclosed are restricted immediately for both moves in and out to reduce the risk of infected animals leaving the herd and spreading the virus. A series of requirements must be completed before the restriction may be lifted and these include an initial four-week period of herd restriction (increased from 3 weeks previously), beginning on the date of removal of the suspect animal(s), to allow circulation of any additional transient infections to diminish or cease. After this period, the restrictions will be lifted following completion of each of the following three measures by a trained private veterinary practitioner (PVP) nominated by the herd owner and funded by DAFM. These are completing an epidemiological investigation, carrying out a full herd test, and vaccinating all female breeding animals. By the end of 2024, close to 36000 animals had been blood tested and just over 36k had been vaccinated.

[1] https://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/3.04.07_BVD.pdf
[2] https://animalhealthireland.ie/programmes/bvd/programme-results/

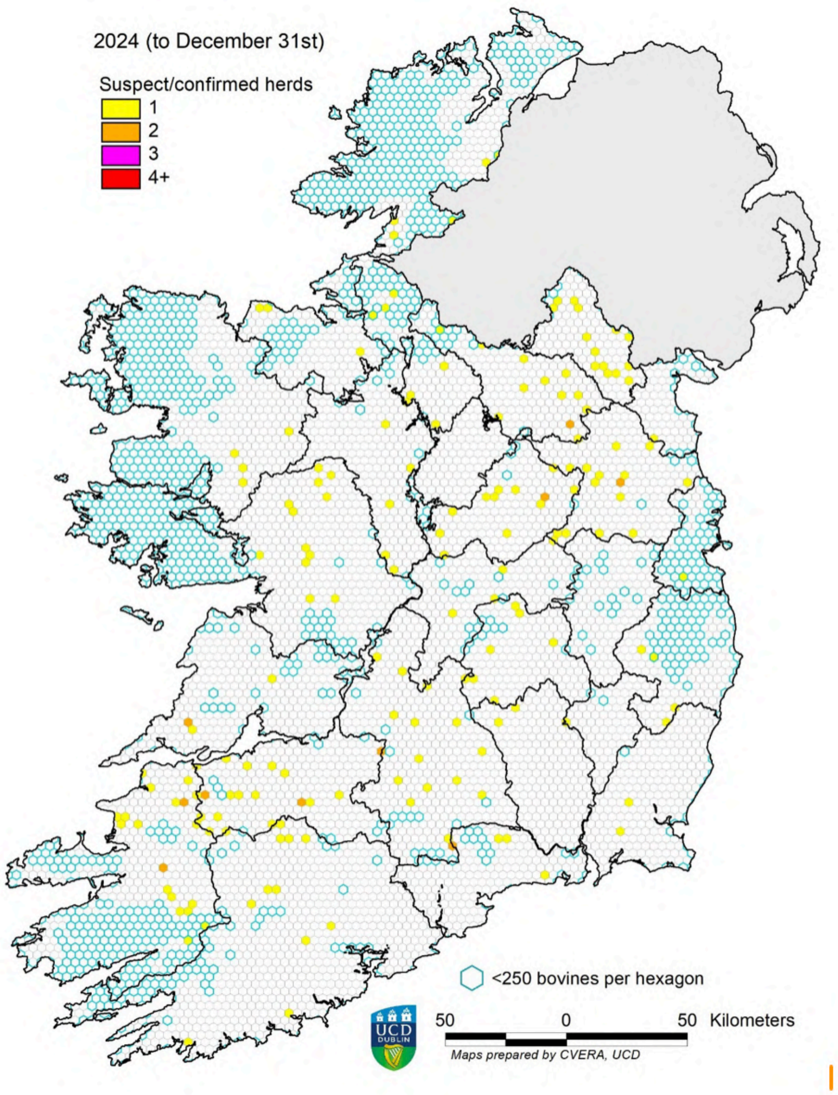

Figure 17.1.: Map showing distribution of herds with a suspect or confirmed BVD suspect animals born in 2024 up to the 31st December. Each hexagon represents an area of approximately 10km2.

17.1. Negative herd status (NHS)

Herds qualify for negative herd status (NHS) by meeting the following requirements:

1. Existence of a negative BVD status for every animal currently in the herd (on the basis of either 'direct' or 'indirect' results);
2. Absence of any suspect or confirmed animal(s) from the herd in the 18 months preceding the acquisition of NHS.

Achieving Negative Herd Status (NHS) represents both a key programme milestone and an economic advantage for farmers, as laboratories using RT-PCR methods offer reduced testing costs to herds with NHS.

By the end of 2024, more than 96 *per cent* of breeding herds had achieved NHS, with a further 2,700 herds ineligible solely due to a small number of untested animals. The status of almost all animals (99.7 *per cent*) in the 83,000 breeding herds in Ireland is now known, including a decreasing number of animals born before the start of the compulsory programme in 2013 that have neither been tested nor produced a calf. At the end of 2024, there were only 78 of these animals in 13 herds. The majority of these animals are in beef herds.

The number of animals born since January 2013 that do not have a valid BVD test result and are, therefore, not compliant with the requirements of the legislation has reduced to just over 10,000 at the end of 2024. The majority of these have never been tested, while a small number have had an initial empty result and not been retested. Most of these animals are 2024-born (88 *per cent*), with smaller numbers from preceding years.

During the last year DAFM has issued letters to these herds and the BVD Helpdesk has also made contact, informing them of the need to test these animals.

Preparing for post-eradication of BVD: In anticipation of achieving freedom from BVD, the BVD Technical Working Group (TWG) has reviewed and considered the available methods for monitoring freedom from BVDV infection in a post-eradication scenario.

Tissue testing of calves remains the best strategy to identify and remove persistently infected calves as soon as possible. However, it is also expensive. In other European countries, bulk tank milk (BTM) serology, youngstock check tests (YSCT), first lactation check tests (FLCT) and abattoir tests are commonly used tools to substantiate freedom from the virus. In order to assess these methods and provide guidance to the BVD TWG and Implementation Group, the Irish IBR model was adapted to the Irish BVD situation. The model, which is a regional model based on County Kerry, reproduces the herd structure, management practices and transport patterns of the entire cattle population without being dependent on continuous livestock registry data.

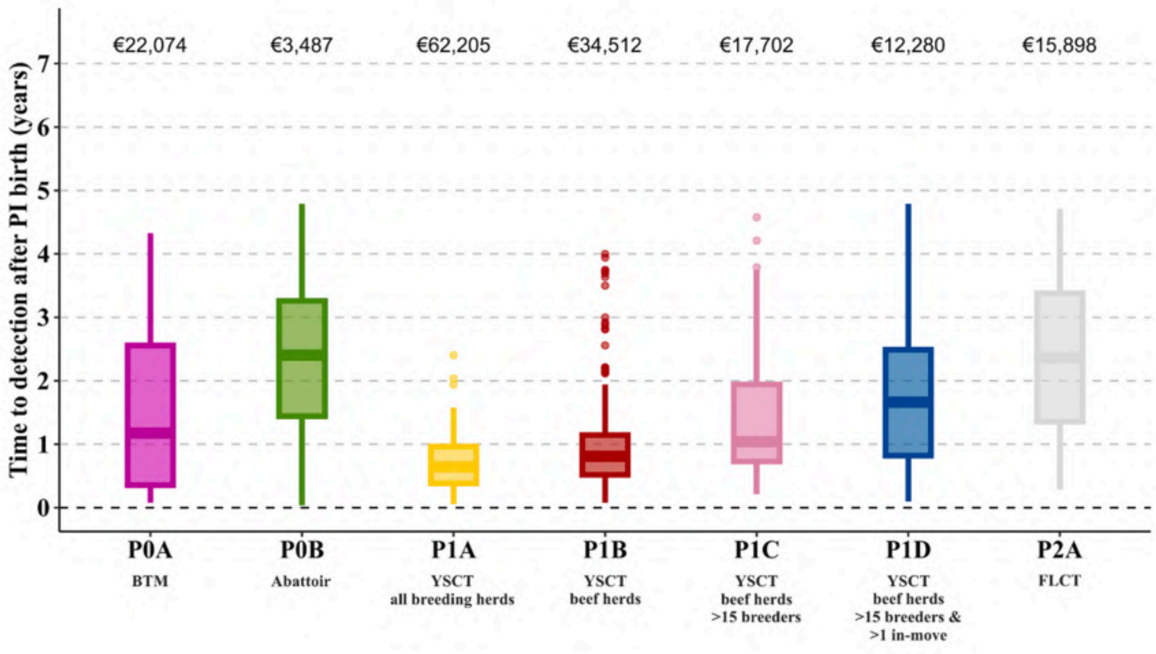

Figure 17.2.: Distribution of detection times (boxplot) for different individual surveillance options and associated mean annual costs in County Kerry (values at top).

The different testing protocols and combinations of those were applied to the modelled cattle population in County Kerry and the time to detection of a PI birth and the mean annual cost were calculated (Figure 17.2). The trade-off between increase in costs per shortened time to detection provides guidance to choose an appropriate surveillance strategy for programmes looking to monitor freedom. The results have been published in the Agricultural Systems Journal (Brock et al. 2024).

18. Infectious Bovine Rhinotrachetis (IBR) Eradication Programme

María Guelbenzu Gonzalo
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Animal Health Ireland (AHI)

The results of the Infectious Bovine Rhinotracheitis (IBR) testing carried out as part of the National Beef Welfare Scheme (NBWS) 2023 were analysed by Animal Health Ireland (AHI) during 2024. This was a scheme introduced by the Department of Agriculture, Food and the Marine (DAFM) to enhance animal health and husbandry on Irish suckler farms. The scheme in 2023 supported farmers in meal feeding suckler calves in advance of and after weaning, and in testing for the presence of Infectious Bovine Rhinotracheitis (IBR) in their herds.

AHI had a key supporting role in the scheme, producing articles and leaflets for farmers explaining how to access and understand the results, training vets to provide the most appropriate advice to the scheme participants, training Teagasc Beef advisors, being present at agricultural shows to speak on IBR and carrying out the analysis of results.

18.1. Highlights

- The NBWS findings highlight that 48.8 *per cent* of tested herds and 11.4 *per cent* of tested animals gave a positive result for IBR, indicating that exposure to IBR is widespread in Irish beef herds.
- The level of disease found is much lower than previous studies, which estimated that up to 90 *per cent* of beef herds were infected.
- 30 *per cent* of the herds had a low prevalence (less than 20 *per cent*), making them candidates to pursue freedom of disease under an IBR control programme.

18.2. IBR testing as part of the NBWS 2023

In total, 10,659 beef breeding herds submitted one or more samples through the NBWS IBR testing programme. This constitutes approximately 20 *per cent* of the entire Irish beef herd population.

To determine the herd-level IBR status, a 'snapshot' test was performed. The snapshot required the sampling of 20 randomly selected animals over 9 months old. The samples were collected by local practicing veterinarians and submitted to one of the participating laboratories for IBR gE antibody testing. Herds were classified as IBR-positive if at least one animal within the herd tested positive for IBR antibodies.

Results

Study herds: In total, blood samples were received for 10,659 beef herds and individual test results were available for 189,404 animals. Of those herds, 6,455 herds (60.5 *per cent* of all NBWS IBR participating herds) had complete records or only a single result missing. A total of 126,028 individual tests results were available. Only results for herds with complete records or a single result missing are included in the following analysis.

Representativeness of study herds and animals

The distribution of herd types in NBWS herds was compared with the distribution of all beef breeding herds in Ireland (Figure 18.1). Beef suckling to weanling (BSW) herds, which maintain a herd of cows and raise calves from birth to weaning, are by far the most represented herd type in both populations. Based on this assessment, the herds surveyed in the NBWS appear to be a representative subset of all beef breeding herds in Ireland in terms of herd type composition.

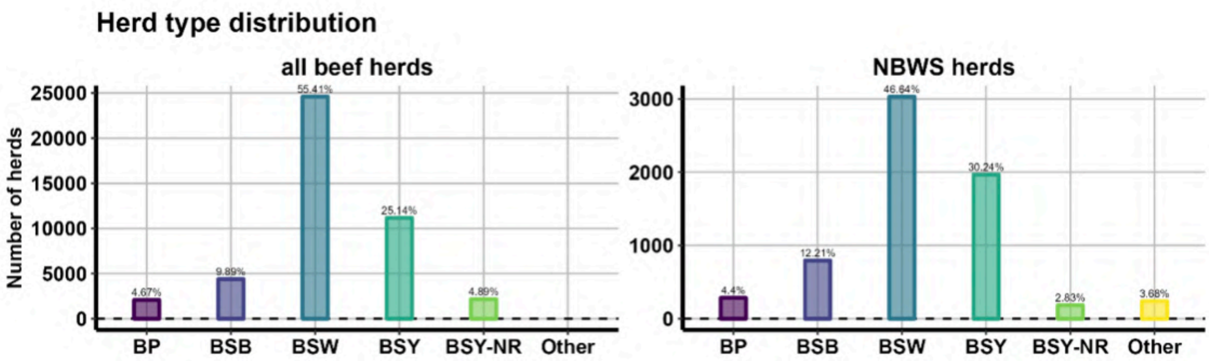

Figure 18.1.: Herd type distribution. Five different subtypes of beef herds have been identified in Ireland, which are consistent with recognised production systems which differ in their management characteristics including when animals are sold for further production. Beef suckling to weanling (BSW) producers maintain a herd of cows and raise calves from birth to weaning, with the majority sold as weanlings at autumn sales during September and October while a proportion of female calves is kept as heifer replacements. The beef suckling to youngstock (BSY) subtype is similar to BSW, including retaining a proportion of females as replacements, with the key difference being that calves are kept for a longer period, to allow weaned calves to gain weight prior to sale. These animals are usually yearlings (12–20 months of age) by the time they leave their birth herd. Non-rearing suckling to youngstock (BSY-NR) herds are a variation of the BSY herd type, with the difference that female calves are sold after weaning and replacement bred females are purchased. The suckling to beef (BSB) herds follow the full beef production cycle, from birth through to the age of slaughter. Finally, representing only a small proportion of the beef sector in Ireland, beef pedigree (BP) herds are an important source of pedigree breeding stock to other commercial cattle producers in both the dairy and beef sectors.

However, when the herd size distribution was compared between NBWS herds and the overall population of beef herds, some differences were observed. While the overall distribution of herd sizes was roughly consistent, NBWS herds tended to be larger on average (mean herd size: all beef herds - 49.2 animals vs. NBWS herds - 81.7 animals). This was mainly due to small herds (0–20 animals) being underrepresented in the NBWS sample.

Prevalence estimation

Among the 126,028 study animals, 14,371 returned a positive result, resulting in an animal-level apparent prevalence of 11.4 *per cent* (95 *per cent* CI: 11.2 *per cent* - 11.6 *per cent*) (Table 18.1). The majority of animals were negative (87.8 *per cent*), while 0.8 *per cent* yielded inconclusive results. At the herd level, our data indicated a herd-level apparent prevalence of 48.8 *per cent* (95 *per cent* CI: 47.6 *per cent* - 50.0 *per cent*).

For the 6,445 study herds, the distribution of the snapshot within herd prevalence is shown in Figure 18.2. In 51.3 *per cent* of tested herds no positive animal was detected. In a further 15 *per cent* of study herds, the snapshot within-herd prevalence was less than 10 *per cent*. Overall, around 30 *per cent* of tested herds has a prevalence below 20 *per cent*. Herds with a prevalence of less than 20 *per cent* are considered of low prevalence and good candidates to pursue freedom, as they contain low numbers of positive animals.

Table 18.1.: Animal-level and herd-level apparent prevalence.

	Animal-level results		Herd-level results	
IBR status	**Number of animals**	**Percentage**	**Number of animals**	**Percentage**
Negative	110,592.0	87.8%	3,056.0	47.3%
Positive	**14,371.0**	**11.4%**	**3,150.0**	**48.8%**
Inconclusive	1,065.0	0.8%	249.0	3.9%
Total	125,028.0	-	6,455.0	-

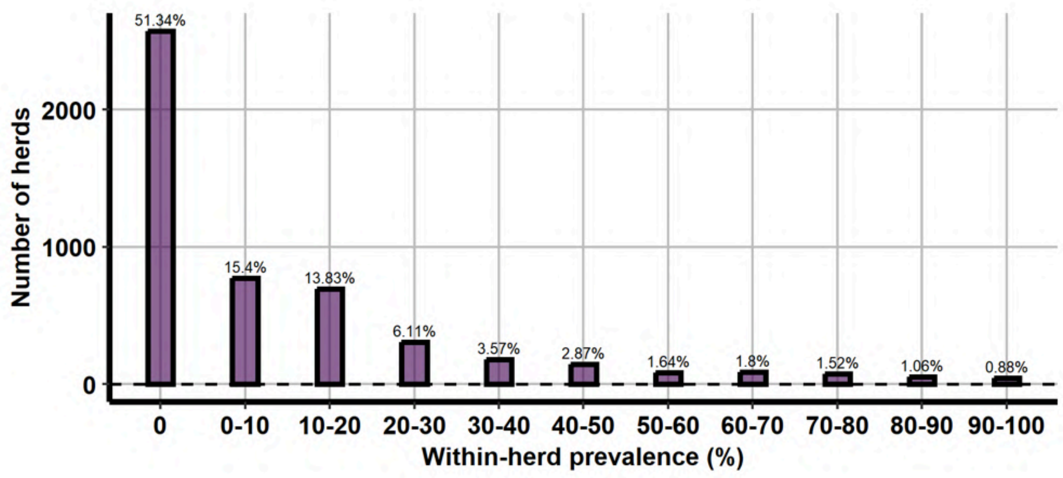

Figure 18.2.: Snapshot within-herd prevalence (% of samples testing positive per herd).

Age-related apparent prevalence

For all positive herds (n = 3,150) we show the age-related prevalence in Figure 18.3. As expected from previous studies, the proportion of seropositive animals was higher in older animals (e.g. 40 *per cent* of all animals greater than nine years old tested in seropositive herds returned a positive IBR antibody test).

18.3. Discussion

This analysis show that IBR is still widespread in the Irish beef cattle sector, but at a lower prevalence than previously reported. While previous studies found significantly higher prevalence rates [Barrett et al. (2018); Cowley et al. (2011); Sayers et al. (2015)), the current analysis shows that 49 *per cent* of herds are affected, suggesting a decrease. This drop in prevalence could be due to various factors such as improved biosecurity measures, vaccination strategies, or changes in farming practices that have contributed to a reduction in IBR transmission within herds.

Notably, 30 *per cent* of infected herds had relatively low infection rates (below 20 *per cent* of within herd prevalence). This suggests that targeted interventions in these herds could quickly control the disease and potentially aid in its eradication. It also indicates that more herds than previously thought may be able to achieve IBR-free status under an IBR control programme.

In this study, a snapshot testing strategy was used to assess the herd-level IBR antibody status. This involved testing a random sample of up to 20 animals from each of the 10,650 beef breeding herds participating in the NBWS. If the NBWS testing approach were extrapolated to the national herd, the approximately 27 *per cent* of beef herds which have with 20 or fewer animals would undergo full herd testing through the snapshot, with a high proportion anticipated to return negative results.

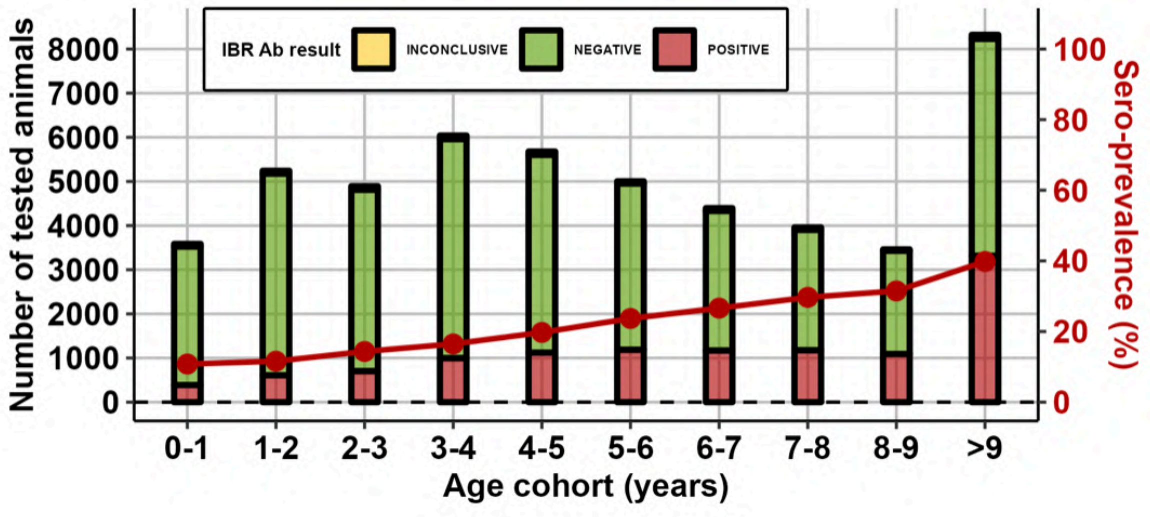

Figure 18.3.: Age-related prevalence, showing number of animals tested and their results (bars, left axis) and the percentage of each age cohort testing positive (line, right axis) for herds returning one or more ELISA positive or inconclusive results.

18.4. Conclusion

IBR remains a significant concern within the Irish beef cattle sector. The analysis of IBR testing results under the NBWS, provides a comprehensive study of the prevalence associated with IBR infection in Irish beef herds. The findings highlight a herd-level prevalence of 48.8 *per cent* and an animal-level prevalence of 11.4 *per cent*, indicating that IBR remains endemic in the population. While these prevalence rates reflect a reduction from previous studies, they underscore the persistent challenge posed by the disease.

These results have now been published in the Irish Veterinary Journal (Brock et al. 2025).

19. Irish Johne's Control Programme (IJCP)

Liam Doyle
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Animal Health Ireland (AHI)

19.1. Objectives of the IJCP

The objectives of the IJCP are as follows: These may be subject to change as new programme structures are implemented:

- Enhance the ability of participating farmers to keep their herds clear of Johne's disease (JD).
- Assist participating farmers to reduce the level of infection in their herds, where present.
- Provide additional reassurance to the marketplace in relation to Ireland's efforts to control Johne's disease and the sustainability of Irish cattle production.
- Improve calf health, farm biosecurity and sustainability in participating farms.

19.2. Programme delivery

AVPs

There are currently 501 AVPs trained and participating in the IJCP.

VRAMP

Figure 19.1 below shows VRAMP completions for the years 2019 to 2024 inclusive. In the 2024 programme year, 214 Veterinary Risk Assessments (VRAMPs) have been completed in both beef and dairy herds. Figure 19.1 also shows that 2,049 herds have not completed a VRAMP in 2024. This large proportion of non-completed VRAMPs (91 *per cent*) is due largely to the JDIG (Implementation Group) decision to suspend VRAMP completion from September 2024. Since the majority of VRAMPs are completed in the last quarter of the programme year, suspension of this activity in September 2024 impacted significantly on completions.

Whole Herd Test (WHT)

At the end of the programme year for 2024, 512 Whole Herd Tests (WHT) have been completed in both beef and dairy herds (23 *per cent*). A total of 247 herds in the Test Negative Pathway (TNP) were not required to complete a WHT in 2024 (11 *per cent*) and 258 herds started a WHT but did not complete it (11 *per cent*) (Figure 19.2). A total of 1,246 herds did not start a WHT in 2024 (55 *per cent*). The number of herds not starting a WHT in 2024

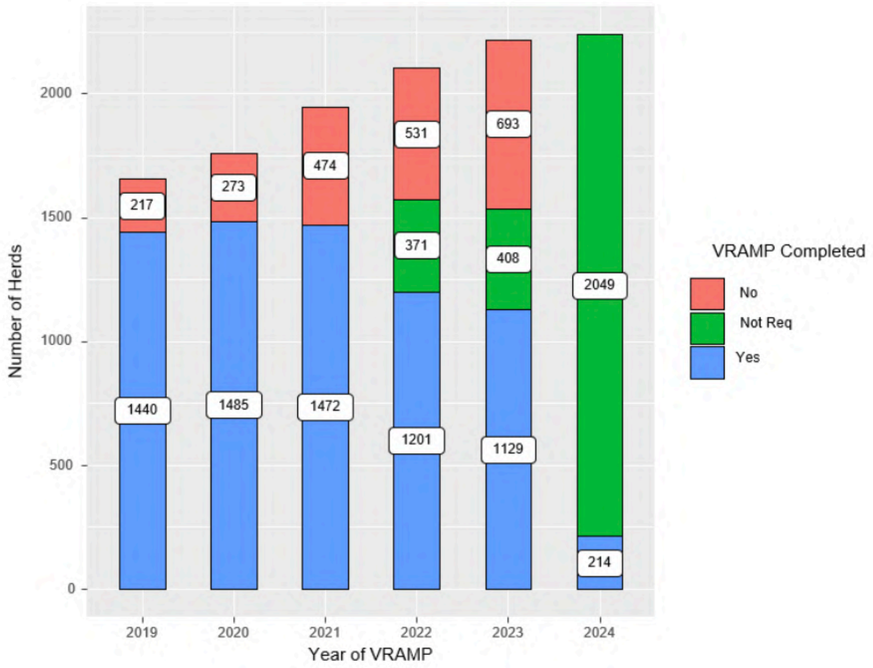

Figure 19.1.: Number of herds per year categorised by VRAMP completion status.

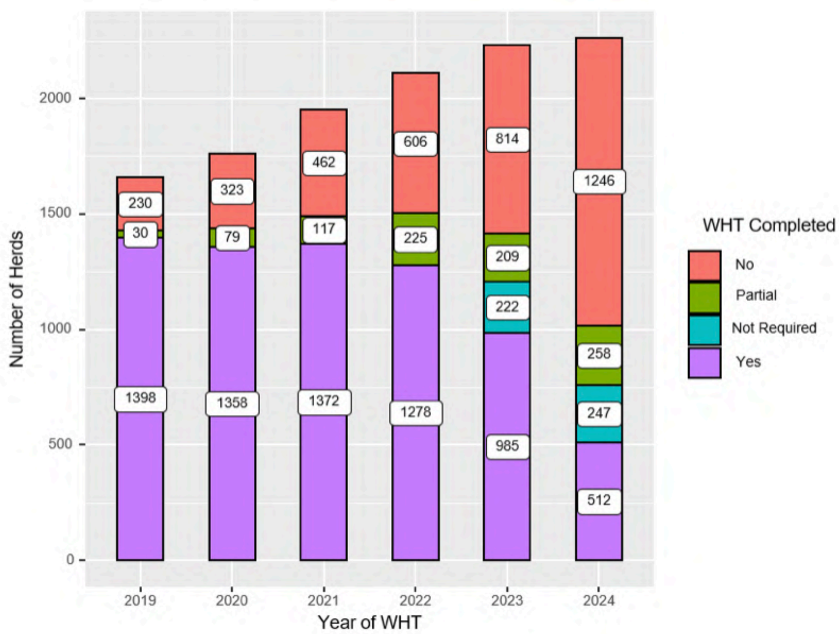

Figure 19.2.: Number of herds per year categorised by WHT completion status.

was greater than 2023 (1246 vs 814; Figure 19.2). The failure to start a WHT in this group of 1246 herds could be related to reduced AVP contact, stemming from the decision to suspend VRAMP completion in September 2024.

WHTs are carried out using either milk or blood ELISA tests. The proportion of testing using milk ELISA has increased in the past few years due to the increase in herdowners utilising milk recording in their herds. The total number of ELISA tests (milk and blood) carried out in 2024 was 130,845(2023 – 194,440) made up of 43,722 (33 *per cent*) blood ELISA tests and 87,123 (67 *per cent*) milk ELISA tests. With blood ELISA tests there was 1,327 positive results (3.0 *per cent*) and 2,735 positive milk ELISA tests (3.1 *per cent*). With blood ELISA tests there was disclosure of 406 inconclusive results (0.9 *per cent*) and 2,110 inconclusive milk ELISA tests (2.4 *per cent*) (Table 19.1).

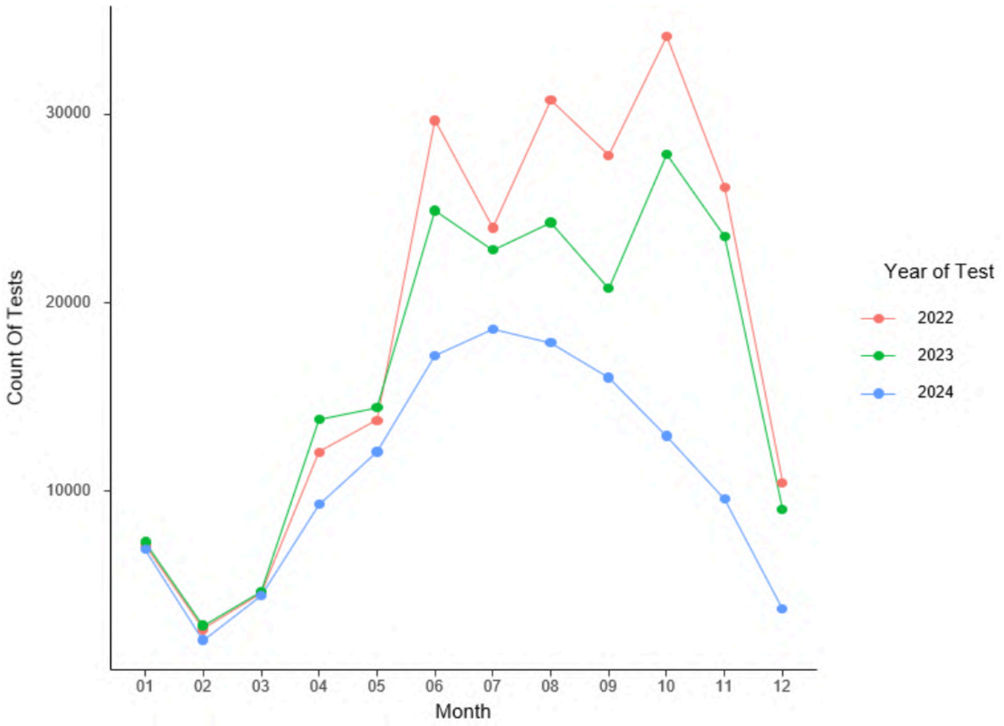

Figure 19.3.: Line chart showing combined total of blood and milk ELISA tests per month in 2022, 2023 and 2024.

Table 19.1.: IJCP ELISA testing conducted during 2024.

Test	Sample	No of tests	Negative	Positive	Inconclusive
ELISA	Blood	43,722 (33%)	41,989	1,327 (3%)	406 (0.9%)
ELISA	Milk	87.123 (67%)	82,278	2,737 (3.1%)	2,110 (2.4%)
Total ELISA	Milk + Blood	130,845	124,267	4,062	2,516

Figure 19.3 shows the combined total of blood and milk ELISA tests per month carried out in 2022, 2023 and 2024. The pattern shows a reduced level of testing in 2024 compared with 2022 and 2023.

Ancillary testing of faecal samples (by PCR)

In 2024, ancillary testing of all animals was carried out following ELISA test-positive results in herds where infection has not already been confirmed (i.e., absence of previous faecal-positive result). Table 2: IJCP ancillary testing conducted during 2024.

Table 19.2.: IJCP ancillary testing conducted during 2024.

Year	Test	Sample	No of tests	Negative	Positive	Inconclusive
2024	PCR	Faeces	1,786	1,605	164 (9.2%)	17

In 2024 there were a total of 1,786 ancillary PCR tests carried out of which 164 (9.2 *percent*) were positive (Table 19.2). This positivity rate is increased relative to 2023 when it was 7.6 *percent*.

Figure 19.4 shows the monthly count of ancillary PCR tests carried out for each of the years 2022 to 2024. In years before 2024, the bulk of the ancillary testing has been carried out in the final quarter of the year, however, in 2024, a reduced level of testing was completed. This could be explained in part by the policy change where only positive ELISA results were faecal ancillary sampled, leading to an overall reduction in their number.

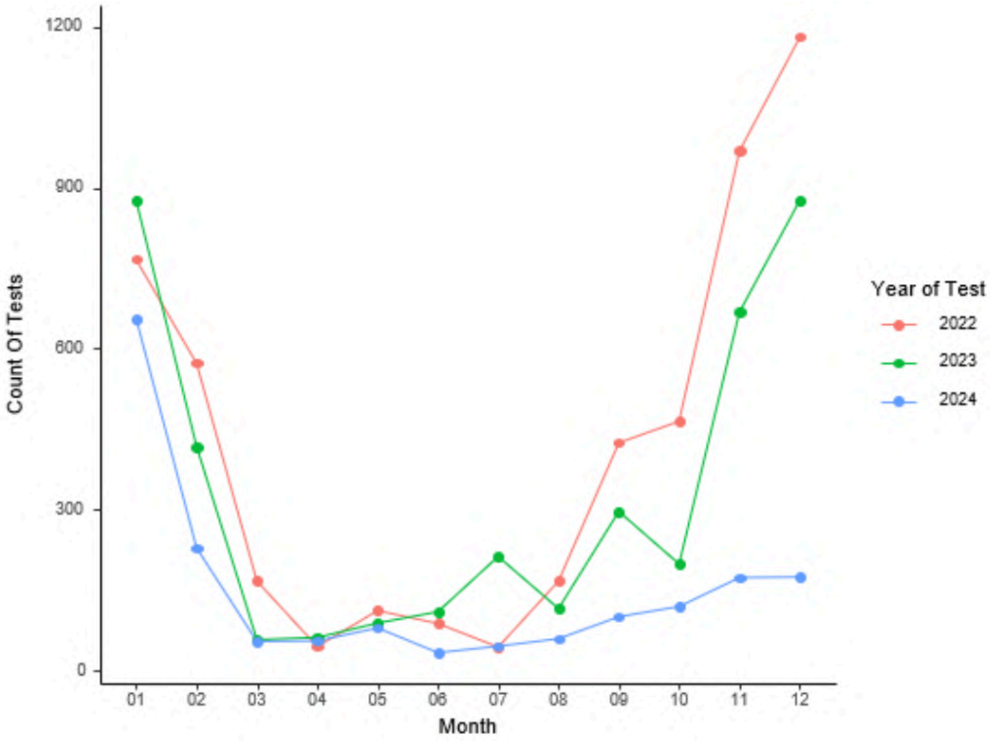

Figure 19.4.: Monthly count of ancillary PCR tests per year 2022 to 2024.

Targeted Advisory Service on Animal Health (TASAH)

The number of JD TASAH investigations completed per year, up to 2024:

- 2019 – 68
- 2020 – 88
- 2021 – 84
- 2022 – 97
- 2023 – 92
- 2024 - 75

MAP (Mycobacterium avium subspecies paratuberculosis) Bulk Tank Milk (BTM) testing summary

The use of BTM testing is a valuable and cost-effective method for monitoring and controlling diseases. For Johne's Disease, since 2019, national surveillance of dairy herds has been conducted by the Department of Agriculture, Food and Marine (DAFM) to detect MAP antibodies using BTM samples. Two rounds of testing are performed each year, during spring and autumn. Results are shown up to 2024 (12 rounds of testing) (Figure 19.5).

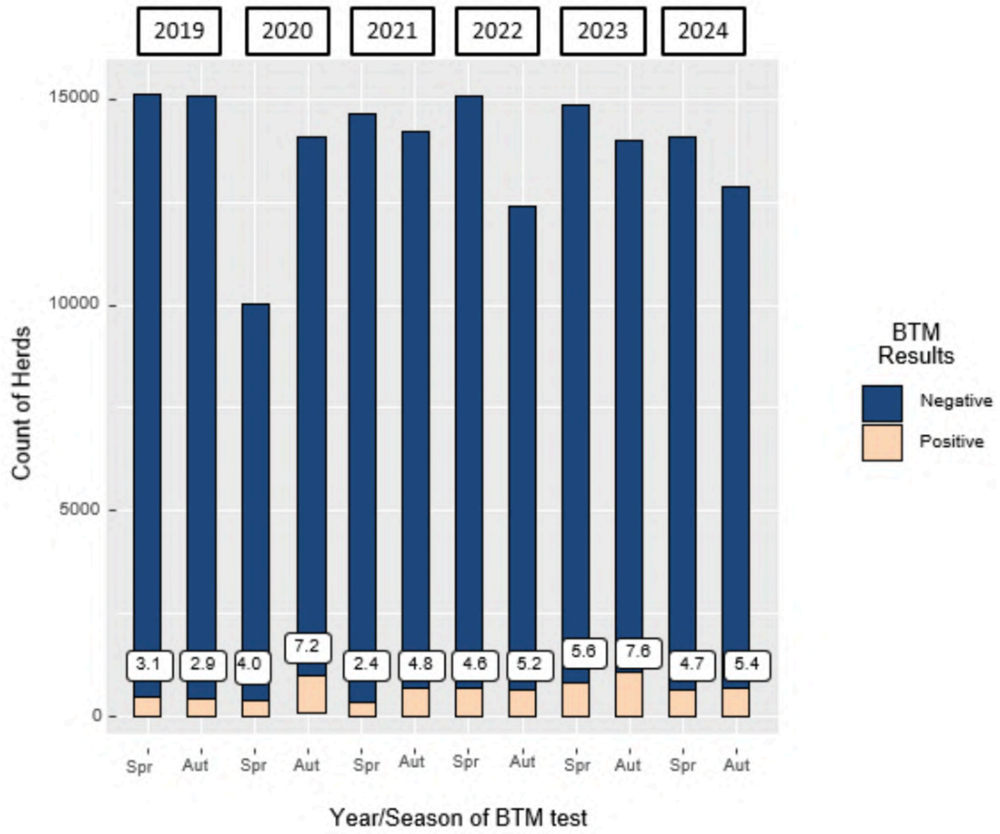

Figure 19.5.: MAP BMT testing each Spring and Autumn 2019 to 2024 inclusive

The findings reveal a limited occurrence of antibody detection (two *per cent* – seven *per cent* of herds per testing round), which is considerably lower than the estimated overall infection prevalence in the population at a herd level (30 *per cent*).

This disparity arises due to the fact that the proportion of cows with antibodies in positive herds falls below the threshold necessary to consistently yield a positive result in bulk tank testing.

As a result, a negative outcome offers little assurance that a herd is infection-free. However, a positive result is useful for case detection, suggesting that the level of infection present is at the upper end of the national profile.

Of the 17,552 herds tested across any of the 12 sampling points, 4,613 tested positive at least once.

Figure 19.6 shows that of the 4,613 BTM positive results disclosed in the period 2019 to 2024 3,116 are herds which have disclosed once during that period. The other 1,497 BTM positive herds (4,613-3,116) have disclosed more than once in the period 2019 to 2024 inclusive.

These BTM positive herds are informed by a letter from DAFM of their positive results and encouraged to join the IJCP. Testing of samples will continue with a round each spring and autumn.

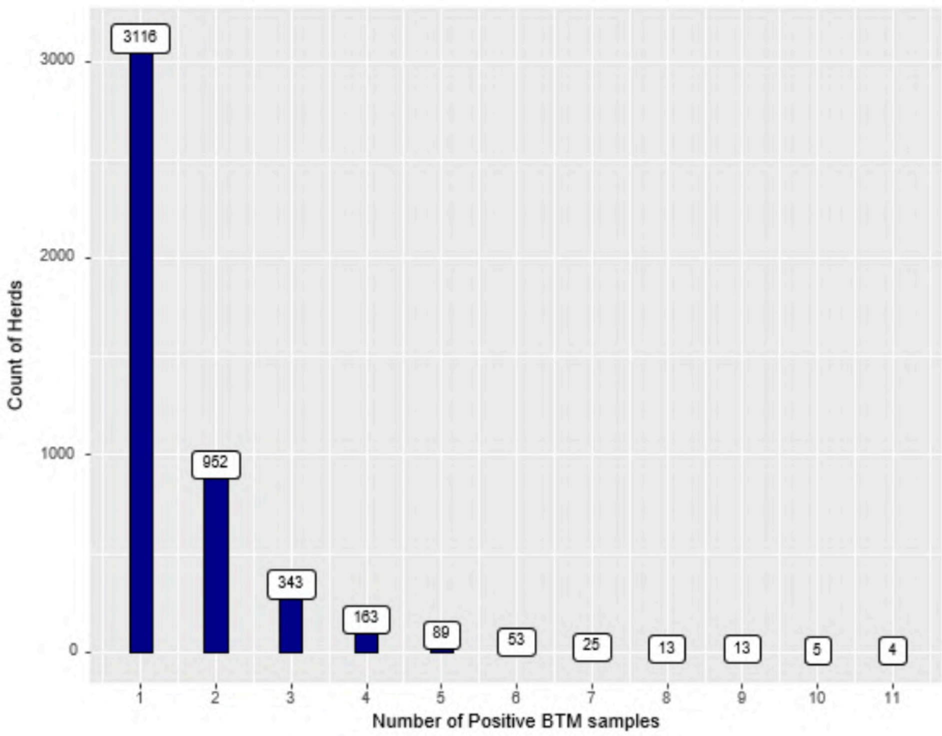

Figure 19.6.: Herd count distribution of number of positive BTM samples from national surveillance in the period 2019 to 2024 inclusive

Part VI.

Agri-Food and Biosciences Institute

AGRI-FOOD
& BIOSCIENCES
INSTITUTE

20. Bovine Diseases, AFBI

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20.1. Neonatal Calves (0–1 month old)

Neonatal enteritis remains the most frequently diagnosed cause of death in calves up to one month of age accounting for 34 *per cent* of cases (Table 20.1 and Figure 20.1). Common infectious causes of diarrhoea recorded included *E. coli*, *Salmonella* Dublin, rotavirus, coronavirus, coccidia and *Cryptosporidium*. Inadequate colostrum intake, stress and poor hygiene are important predisposing factors which contribute to the severity of scour outbreaks. Rotavirus is a common cause of diarrhoea in both dairy and beef suckler herds and it usually affects calves from about four days to two weeks. Rotavirus was detected in 36 cases (19 *per cent* of the enteric infections). Coronavirus may produce an enteritis similar to that caused by rotavirus. Twenty cases of enteritis due to coronavirus were recorded in 2024. Transit of calves through markets increases the likelihood of exposure to *Salmonella*. One case of enteritis due to *Salmonella Dublin* was recorded in 2024. Five cases of BVDV infection were recorded in neonatal calves less than one month old in 2024. Pathogenic *E. coli* infections usually cause watery diarrhoea in very young calves from about 15 hours to three days of age. Four cases of diarrhoea due to *E. coli* were recorded with two of these presenting with the *E. coli* K99 antigen. This is a marked reduction on 2023 and 2022 when 31 cases (17 of which were *E. coli* K99) and 20 cases (eight of which were *E coli* K99) were recorded respectively. Fifty-six cases of enteritis due to the protozoan parasite *Cryptosporidium* were diagnosed in 2024, similar to the 52 cases recorded in 2023 and higher than the 36 cases recorded in 2022 and the 39 cases which were recorded in 2021.

(a) Schmallenberg virus infection (b) Osteomyelitis. *S.* Dublin

Figure 20.2.: *Schmallenberg* virus infection (a) in a newborn calf. Note the cerebellar aplasia (absence of the cerebellum) (black star) and hydranencephaly (blue arrow). (b) Osteomyelitis of the 7th cervical vertebra in a three-week-old calf (white arrow). Necrotic material impinges on the spinal cord. *Salmonella Dublin* was isolated. Photos: Seán Fee.

Nutritional and metabolic conditions were the next most frequently diagnosed group of conditions. Hypogammaglobulinaemia due to inadequate absorption of colostral antibody was recorded in 76 cases and was the most frequently recorded nutritional/metabolic condition (accounting for 85 *per cent* of the diagnoses in this

Table 20.1.: Conditions most frequently diagnosed in calves less than one month old submitted to AFBI for *post mortem* in 2024 (n= 548).

Category	No. of cases	Percentage
Enteric infections	185	**33.8**
Nutritional / metabolic conditions	89	**16.2**
Respiratory diseases	77	**14.1**
Septicaemia / toxaemia	65	**11.9**
Navel ill / Joint ill	51	**9.3**
Central nervous system	20	**3.6**
Other diagnoses	18	**3.3**
Heart / circulatory system	9	**1.6**
GIT torsion /obstruction	8	**1.5**
Skeletal conditions	8	**1.5**
Peritonitis	8	**1.5**
Diagnosis not reached	7	**1.3**
Urinary system	3	**0.5**

category) followed by six cases of ruminal acidosis and five cases of ruminitis. Good husbandry practices are important to optimise ruminal health. These include using standardised feeding regimes, feeding calves at the same time each day, feeding the correct volume of milk at a consistent temperature, preparing milk replacer according to the manufacturer's instructions and mixing thoroughly at the advised temperature. Calves should be in an unstressed state when fed and should not be moved, handled or dehorned immediately prior to feeding. Feeding bucket fed calves through teats should help with closure of the oesophageal groove. Clean water should be available to calves at all times.

Respiratory tract infections were the next most frequently diagnosed cause of mortality in neonatal calves accounting for 14 *per cent* of cases. *Mycoplasma bovis* was the most frequently diagnosed bacterium causing respiratory disease being recovered in 22 of the 77 cases (29 *per cent*) of respiratory infections, followed by *Pasteurella multocida* which was detected in 12 of the 77 cases (16 *per cent*) of neonatal respiratory infections. *Mannheimia haemolytica* was detected in five cases, there were four cases of pneumonia due to *Histophilus somni* and *Trueperella pyogenes* was detected in one case. PI3 was the most frequently diagnosed viral respiratory pathogen (four cases) and two cases of BRSV infection were recorded. Aspiration pneumonia accounted for two cases (three *per cent* of respiratory infections). Cases of aspiration pneumonia occur most frequently after inappropriate technique when drenching or passing a stomach tube, but cases may also occur if weak or acidotic calves inhale regurgitated stomach contents.

Death due to septicaemic or toxaemic conditions represented 12 *per cent* (65 cases) of deaths in neonatal to one-month-old calves. Colisepticaemia was the major cause of death in this group accounting for 46 cases (71 *per cent* of the septicaemic / toxaemic conditions) , emphasising the need for good hygiene in calving pens and neonatal calf areas, adequate disinfection of the umbilicus of new-born calves and adequate feeding of good quality colostrum to new-born calves in the first six hours of life. Six cases of salmonellosis due to *Salmonella Dublin* were diagnosed in neonatal calves in 2024 (Figure 20.2b).

In one case a three-week-old calf which was euthanased on farm was submitted for *post mortem* examination. The calf was one of four calves which had presented similarly with ataxia, progressing to paresis of front and hind limbs. Intestinal contents were very fluid consistent with enteritis. *S. Dublin* was cultured from intestine, and coronavirus and rotavirus were detected. There was thick fibrinopurulent material in a shoulder and carpal joint. There was osteomyelitis of the 7th cervical vertebra with necrotic material impinging on the spinal cord. *Salmonella Dublin* was isolated from a swab of this lesion.

Young calves less than three-months-old are in one of the highest risk groups for acquiring *Salmonella* infections. To reduce the risk of infection good calving pen management and hygiene is of critical importance. Regular disinfection of the calving pen is important, bedding should be clean, the number of cows present in the calving pen should be minimised and importantly the calving pen should not be used as a sick bay. Calves should receive adequate colostrum, colostrum should not be pooled, and calves should be reared in a clean hygienic environment at an appropriate stocking density and away from adult animals and older calf groups. One case of systemic pasteurellosis was recorded in neonatal calves in 2024.

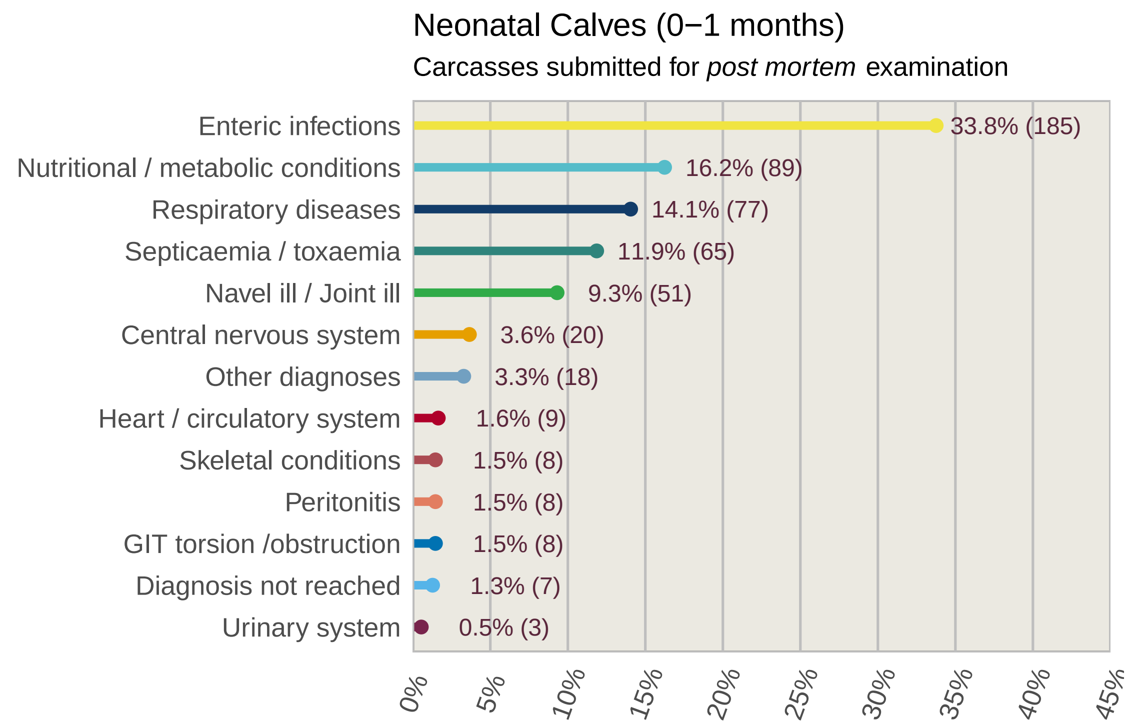


Figure 20.1.: Conditions most frequently diagnosed in calves less than one month old submitted to AFBI for *post mortem* in 2024 (n=548). The absolute number of cases is between brackets.

Navel-ill accounted for 9 *per cent* of diagnoses at *post-mortem* examination of neonatal calves (51 cases) emphasising the need for good calving pen hygiene and the importance of dipping/spraying of the navel.

Gastrointestinal obstructions and / or torsions (Figure 20.3a) represented one *per cent* of the cases recorded in neonatal calves. Four cases of intestinal atresia were recorded, and atresia was the most frequently recorded condition in this category. All cases were recorded in calves from several hours to seven days old and most cases had a history of abdominal distension. The atresia blocked the jejunum in all cases.

(a) Torsion of the abomasum

(b) *Ruminal acidosis*

Figure 20.3.: Torsion of the abomasum (a) in a four-week-old calf. The abomasum is blackened and gas filled. (b) Cereal rich ruminal contents in a case of ruminal acidosis in a young heifer. Photos: Seán Fee.

20.2. Calves 1–5 months old

As was the case in previous years, respiratory tract infections and pneumonia (Table 20.2 and Figure 20.4) were the most commonly recorded causes of death in calves from one to five months of age and were recorded in 50 *per cent* of the 407 cases in this age group. Bacterial respiratory infections were most frequently diagnosed. *My-*

Table 20.2.: Conditions most frequently diagnosed in calves one to five months old submitted to AFBI for *post mortem* in 2024 (n= 407).

Category	No. of cases	Percentage
Respiratory diseases	204	**50.1**
Enteric infections	40	**9.8**
Nutritional / metabolic conditions	39	**9.6**
Other diseases	28	**6.9**
GIT ulcer / perforation	20	**4.9**
Septicaemia / toxaemia	13	**3.2**
GIT torsions /obstruction	13	**3.2**
Peritonitis	12	**2.9**
Urinary diseases	10	**2.5**
Cardiovascular diseases	9	**2.2**
Clostridial diseases	8	**2.0**
Neurological diseases	6	**1.5**
No diagnosis reached	5	**1.2**

coplasma bovis was detected in 63 cases of pneumonia. While *Mycoplasma bovis* can and does cause pneumonia by itself, it is also important because of its effects on immune function within the lung and it can predispose to respiratory infections caused by other bacteria. The main transmission route to young calves is via milk, from individual cows or from bulk milk, and once infection is established in a calf, further spread may occur to cohort calves by respiratory secretions and aerosols. Arthritis due to *Mycoplasma bovis* was recorded in a number of these pneumonic calves. Typically, one or multiple joints were swollen with suppurative contents and confirmation was based on detection of *Mycoplasma bovis* nucleic acid by PCR. *Pasteurella multocida* was detected in 31 cases and there were 23 cases of pneumonia due to *Mannheimia haemolytica*. There were ten cases of pneumonia due to *Histophilus somni* and also ten cases of pneumonia due to *Trueperella pyogenes*. Parasitic pneumonia due to lungworm was recorded in eight cases in 2024, a reduction from the 20 cases recorded in 2023 and the 17 cases in 2022. BRSV was the most commonly recorded viral respiratory infection (six cases) followed by three cases of IBRV and one case of PI3 infection.

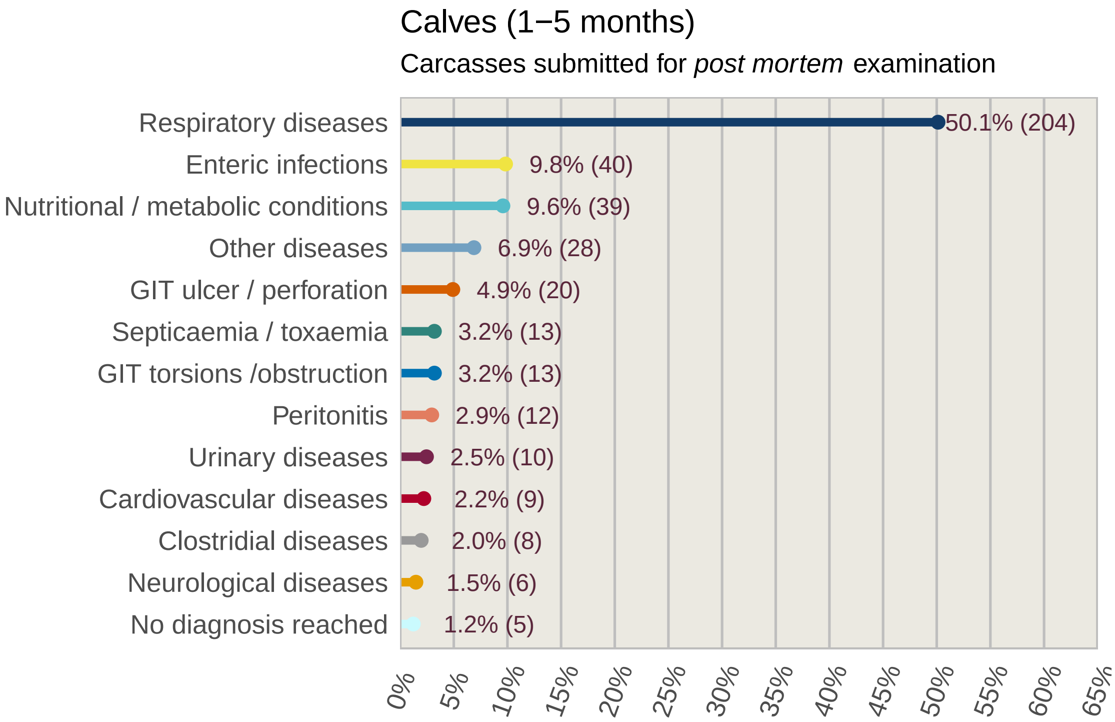


Figure 20.4.: Conditions most frequently diagnosed in calves one to five months old submitted to AFBI for *post mortem* in 2024 (n=407). The absolute number of cases is between brackets.

Table 20.3.: Conditions most frequently diagnosed in weanlings calves six to twelve months old submitted to AFBI for *post mortem* in 2024 (n= 144).

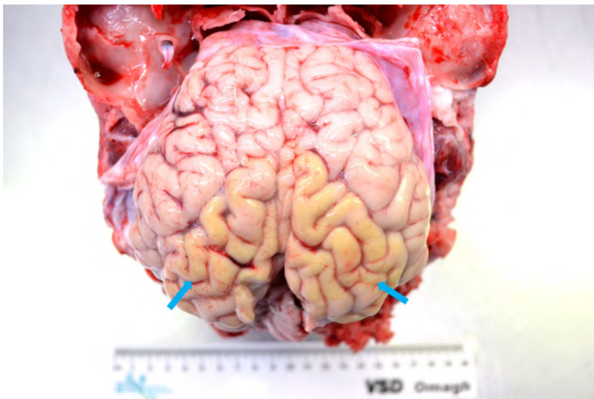
Category	No. of cases	Percentage
Respiratory diseases	61	**42.4**
Clostridial diseases	22	**15.3**
Other diseases	19	**13.2**
Enteric infections	16	**11.1**
Cardiovascular diseases	8	**5.6**
Gastrointestinal ulcers, torsion and obstruction	5	**3.5**
Nutritional / Metabolic conditions	5	**3.5**
Neurological diseases	3	**2.1**
Liver disease	3	**2.1**
No diagnosis reached	2	**1.4**

Infections of the gastrointestinal tract represented the second most important group of diagnoses at ten *per cent* of diagnoses in this age group. Coccidiosis (13 cases) and cryptosporidial infection (four cases) were the most frequently recorded enteric infections. Coccidiosis may occur in contaminated conditions such as damp, dirty straw bedding indoors or around feeding and drinking troughs contaminated with faeces outdoors. Diarrhoea is sometimes accompanied by straining and blood may frequently be observed in the faeces. Veterinary advice on treatment should be sought, and attention should be paid to the hygiene of calf pens and the cleanliness and positioning of feeding troughs. There were two cases of enteritis due to *Salmonella Dublin* and two cases of BVDV infection. One case of parasitic gastroenteritis was recorded and one case of fungal rumenitis was recorded.

Thirty-nine cases of nutritional or metabolic conditions were recorded with the most frequent being ruminal acidosis (29 cases) and there were seven cases of bloat.

Significant non-infectious conditions of the gastrointestinal tract included ulcers, perforations, torsions and obstruction. There were eleven cases of gastrointestinal torsion. Gastrointestinal torsion may occur subsequent to increased or decreased gastrointestinal motility which in turn is affected by nutritional changes and upsets, gas accumulation and bloat, carbohydrate overload and acidosis (Figure 20.3b). Eight cases of perforation of the abomasum were recorded and a further ten cases of abomasal ulceration were recorded. The causes of abomasal ulceration and perforation are non-specific and include calf stress as well as husbandry and nutritional factors.

Eight cases of clostridial myositis (blackleg) were recorded in one- to five-month-old calves.



(a) Cerebrocortical necrosis

(b) BVDv infection

Figure 20.5.: Cerebrocortical necrosis (CCN) (a) affecting the cerebral cortex of a four-month-old calf (affected discoloured brain is indicated by blue arrows). (b) Buccal ulceration due to BVDV infection in a six-month-old calf. Photos: Seán Fee

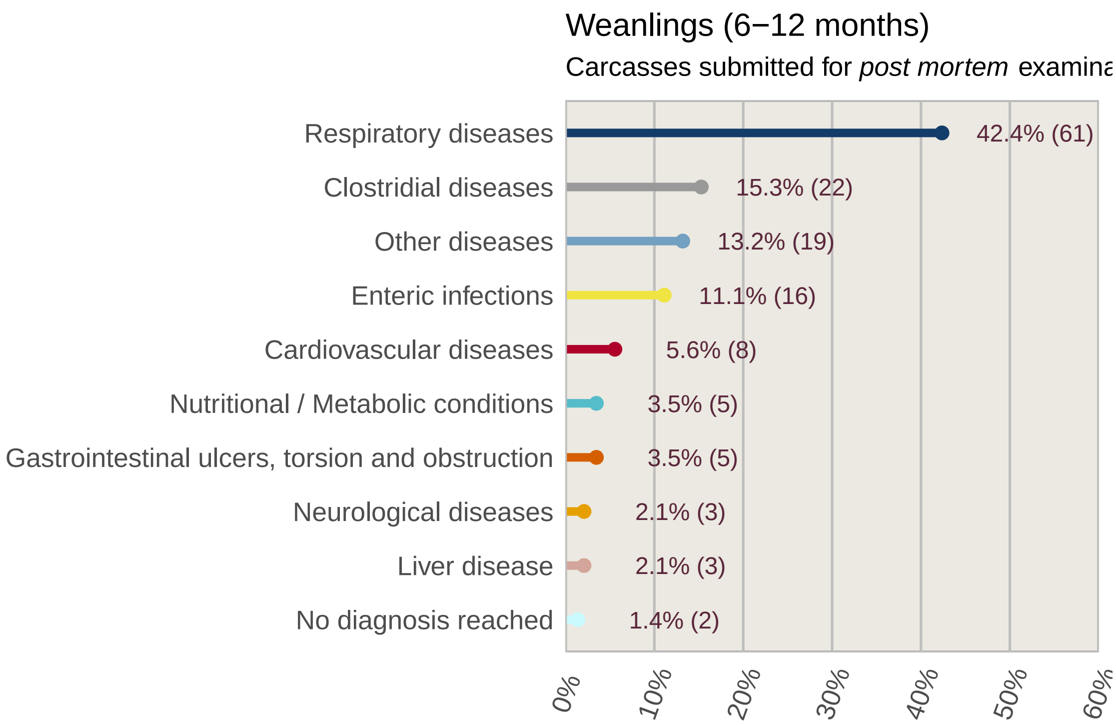
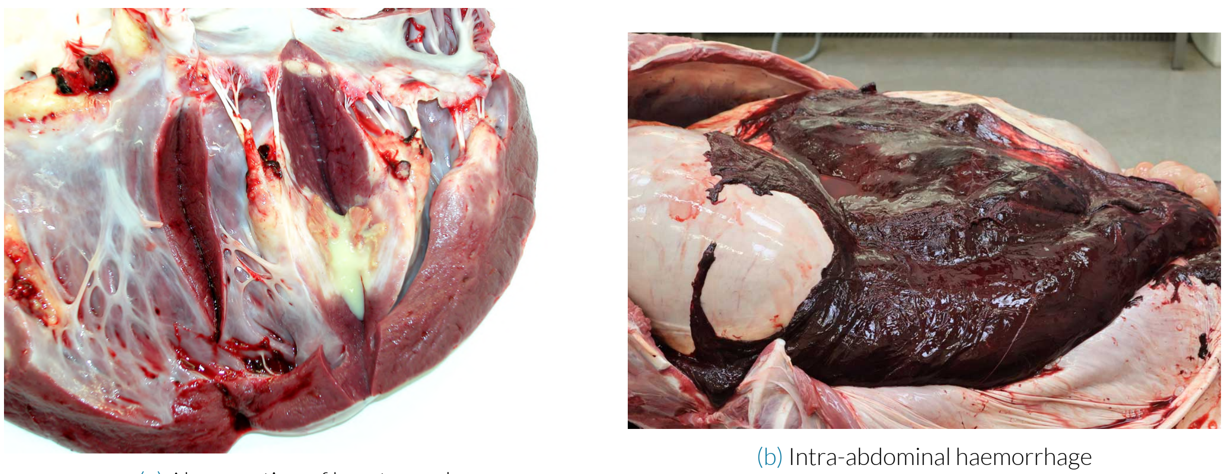


Figure 20.6.: Conditions most frequently diagnosed in weanlings calves six to twelve months old submitted to AFBI for *post mortem* in 2024 (n=144).The absolute number of cases is between brackets.

20.3. Weanlings 6–12 months old

Pneumonia was the main cause of death (Table 20.3 and Figure 20.6) in older calves (from six to 12 months old) followed by deaths caused by clostridial infections and gastrointestinal infections. Bacterial infections were again the most frequent recorded cause of respiratory infections. *Mycoplasma bovis* was detected in 17 cases representing 28 *per cent* of respiratory diagnoses, *Pasteurella multocida* was detected in ten cases (16 *per cent* of respiratory diagnoses), and Mannheimia haemolytica in five cases. Four cases of pneumonia due to *Histophilus somni* and to *Trueperella pyogenes* were recorded. Parasitic pneumonia due to lungworm infection was recorded in seven cases which represented a decrease on the number of hoose cases in 2023 when 21 cases were detected and in 2022 when 19 cases were detected. Respiratory infections caused by viruses were detected in five cases (eight *per cent* of respiratory infections) with BRSV (three cases), PI3 (one case) and IBRV (one case) detected.



(a) Abscessation of heart muscle

(b) Intra-abdominal haemorrhage

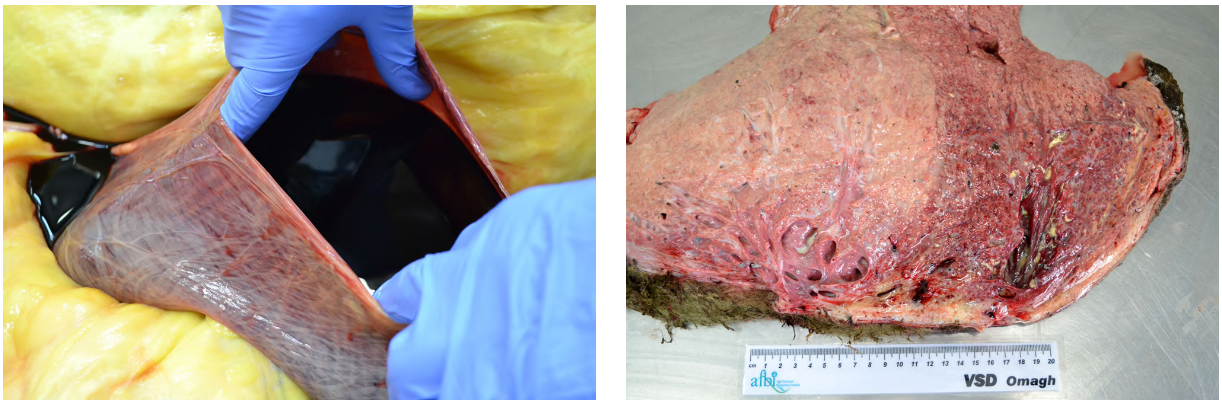
Figure 20.7.: Abscessation of heart muscle (a) in a nine-month-old heifer. (b) Intra-abdominal haemorrhage in a one-year-old bull following surgical castration. Photos: Seán Fee.

Twenty-two cases of clostridial disease were recorded (15 *per cent* of diagnoses in this age group) with most of these being cases of blackleg (19 cases or 86 *per cent* of the clostridial infections recorded). Two cases of botulism were recorded, and one case of Black disease was diagnosed.

Gastrointestinal infections represented 11 *per cent* of cases (16 cases) recorded in weanlings. Just under half of these were cases of parasitic gastroenteritis (seven cases). As in both 2023 and 2022 there was one case of BVDV/Mucosal disease in 2024 (Figure 20.5b).

20.4. Adult Cattle (older than 12 months)

As has been the case in previous years respiratory infections (Table 20.4 and Figure 20.10) were the most frequently diagnosed cause of death in adult cattle (older than 12 months old). *Mycoplasma bovis* (14 cases) and Mannheimia haemolytica (14 cases) were the most frequently reported respiratory pathogens (each pathogen was recorded in 18 *per cent* of respiratory infections in adult bovines). Six cases of pneumonia due to *Trueperella pyogenes* were diagnosed in 2024 and four cases of pneumonia due to *Pasteurella multocida* were recorded. Five cases of parasitic pneumonia (hoose) due to the nematode *Dictyocaulus viviparous* were recorded in 2024, down a little on the ten cases of hoose which were recorded in 2022 and the seven cases recorded in 2023. Hoose may occur in older cattle grazing contaminated pasture where anthelmintic regimes or grazing practices are not conducive to acquiring protective immunity at a younger age. Pneumonia due to tuberculosis was recorded in two diagnostic submissions. In one case three cows which presented dull and in recumbency before death were submitted for *post mortem* examination. Tuberculosis was diagnosed in two of the cows, one of which presented with multifocal lesions of caseous necrosis throughout the lungs whilst in the other tuberculous cow there was a more suppurative pneumonia. Lesions typical of tuberculosis were present in mediastinal lymph nodes. Histopathology of lung and lymph node in both cows was consistent with tuberculosis and *Mycobacterium bovis* was cultured from both cows. Six cases of viral respiratory infection were detected comprising four cases of IBRV infection and two cases of BVDV.



(a) Copper toxicity

(b) Toxic mastitis

Figure 20.8.: Haemoglobinuria and jaundice (a) due to copper toxicity in a two-year-old heifer. (b) Red purple mammary tissue (to the right in the photograph) in a case of toxic mastitis due to suboptimal drying off technique in a four-year-old dairy cow. Photos: Seán Fee.

Diseases of the heart and circulatory system (38 cases) accounted for 11 *per cent* of the conditions recorded in cattle older than 12 months. Eleven cases of death due to haemorrhage and blood loss were recorded. Arterial rupture was recorded in two of these cases with rupture of a branch of the aorta recorded in one cow and rupture of a mammary artery recorded in another case. Haemorrhage from the uterus of a cow which had undergone a caesarean section was diagnosed in one case and in another case, there was fatal haemorrhage from a tear in a prolapsed uterus. The next most frequently reported cardiovascular diagnosis was vegetative endocarditis (eight cases). Thrombosis of the caudal vena cava was recorded in five cases. Thrombosis of the caudal vena cava is an occasional complication of liver abscessation and liver abscessation is predisposed to by repeated bouts of ruminal acidosis. There were three cases of pericarditis due to penetrating reticular foreign bodies, two cases of myocarditis and two cases of babesiosis.

Thirty-three cases of liver disease were recorded in cattle aged over 12 months in 2024 (nine *per cent* of

Figure 20.9.: Corrugated appearance (towelling) of small intestinal mucosa in a case of Johne's disease affecting a three-year-old cow. Photo: Seán Fee.

Table 20.4.: Conditions most frequently diagnosed in adult cattle (older than 12 months) submitted to AFBI for *post mortem* in 2024 (n= 348).

Category	No. of cases	Percentage
Respiratory infections	78	**22.4**
Cardiac / circulatory system	38	**10.9**
Other diagnoses	34	**9.8**
Reproductive / mammary conditions	33	**9.5**
Liver disease	33	**9.5**
Nutritional / metabolic conditions	22	**6.3**
Diagnosis not reached	21	**6.0**
Clostridial disease	19	**5.5**
Enteric infections	16	**4.6**
GIT ulceration / perforation / foreign body	13	**3.7**
Poisoning	10	**2.9**
Nervous system infections	10	**2.9**
Skeletal conditions	10	**2.9**
Peritonitis	9	**2.6**
Intestinal or gastric torsion / obstruction	2	**0.6**

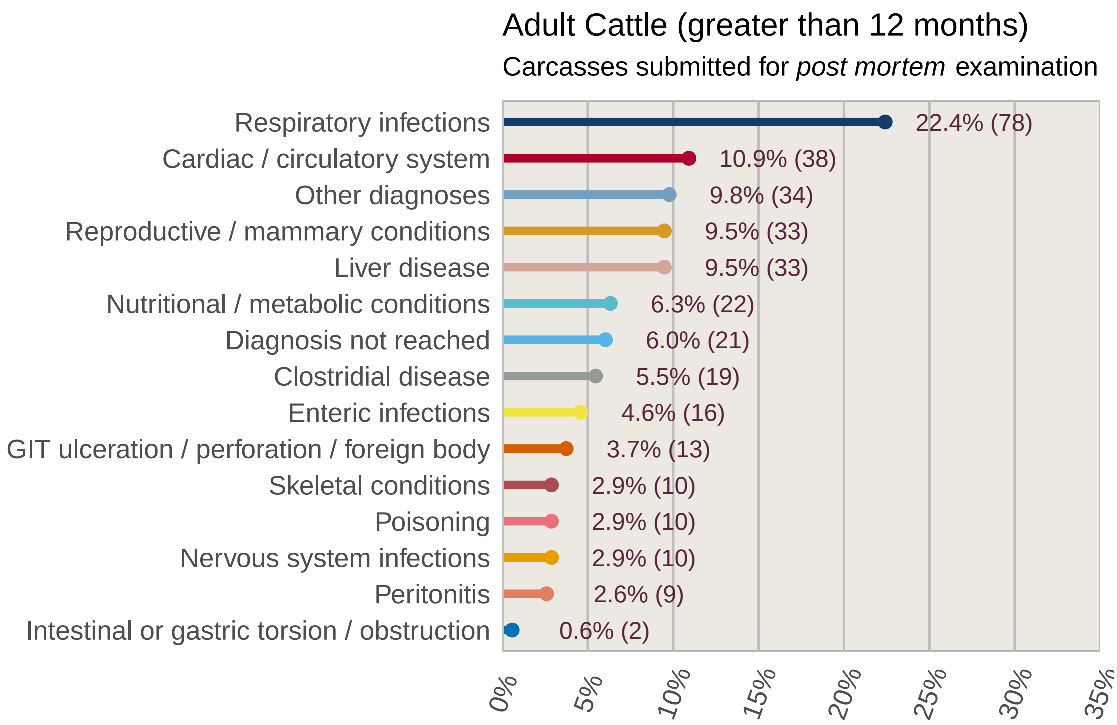


Figure 20.10.: Conditions most frequently diagnosed in adult cattle (older than 12 months) submitted to AFBI for *post mortem* in 2024 (n=348). The absolute number of cases is between brackets.

cases in adult cattle). Liver fluke infestations (seven cases) and hepatic abscessation (six cases) were the most common conditions of the liver recorded.

Thirty-three cases of reproductive and mammary disease were recorded in adult cattle (nine *per cent* of cases in adult cattle). Mastitis was the most frequently diagnosed problem in this category (19 cases representing 58 *per cent* of cases within this category). A sharp rise in deaths of dairy cows from toxic mastitis (Figure 20.8b) due to infections occurring at drying off was detected in the Autumn. In one County Tyrone case four cows from a batch of 13 cows which were dried off, died four to five days later. Two cows were submitted for *post mortem* examination and toxic mastitis was present in multiple quarters of each cow. In a separate County Armagh case six cows died within eleven days of drying off. One of the cows aborted five days after drying off and died five days later. When examined at AFBI there was toxic mastitis in multiple quarters. Insufficient attention to hygiene and cleanliness at is likely to have been a significant factor in these and in other similar incidents examined. Among other cases of reproductive tract disease in 2024 there were three cases of a ruptured uterus, two cases of uterine prolapse and one case of uterine torsion.

Nutritional and metabolic conditions accounted for 22 cases (six *per cent* of the cases in adult cattle). The main conditions encountered included ruminal acidosis (eight cases), hypomagnesaemia (four cases), hypocalcaemia (four cases), and two cases of ketosis.

Clostridial disease was responsible for five *per cent* of deaths in adult cattle in Northern Ireland. Blackleg was the most commonly diagnosed clostridial disease in adult cattle (ten cases), followed by botulism (seven cases) and black disease (two cases).

21. Bovine Respiratory Diseases, AFBI

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Bovine respiratory disease (BRD) continues to be an extremely important cause of morbidity and mortality in cattle. It is a multifactorial condition involving a combination of viral, bacterial, and parasitic pathogens. The overall impact of BRD is difficult to establish given the presence of subclinical disease, which may not have visible effects but can decrease productivity over time. Regardless, the annual cost to the agricultural economy is extremely large. It is one of the most common diagnoses in carcasses or samples submitted to AFBI (Table 21.1 and Figure 21.1).

For clinical cases, aetiological diagnosis cannot be determined on clinical signs alone due to the vast array of agents involved and similar clinical presentations. Therefore, *post mortem* examination (PME) is a vital resource to reach the specific diagnoses, allow tailored treatment and prevention strategies, and improve farm business profits which are under ever increasing financial pressures. However, it is important to acknowledge that often, the inciting agent in chronic pneumonia cases may have been replaced by secondary invaders.

The bovine respiratory tract is host to a large commensal microbiome which includes opportunistic pathogens such as *Mannheimia haemolytica*, *Pasteurella multocida*, and *Histophilus somni*. Respiratory disease manifests when host, environmental, and pathogen factors create a favourable environment for disease for example poor host immunity, poor environmental ventilation, or respiratory epithelium damage from triggering agents such as viruses. The multifactorial nature of infectious respiratory disease in cattle is often referred to as the Bovine Respiratory Disease Complex (BRDC), acknowledging that bovine respiratory disease is a syndrome with many contributing factors.

Table 21.1.: Relative frequency of the different aetiological agents identified in cases of pneumonia diagnosed during *post mortem* by AFBI in 2024 (n= 253).

Category	No. of cases	Percentage
Mycoplasma bovis	98	**38.7**
Pasteurella multocida	46	**18.2**
Pasteurella haemolytica	35	**13.8**
Dictyocaulus viviparus	20	**7.9**
Trueperella pyogenes	18	**7.1**
Histophilus somnus	14	**5.5**
Bovine Respiratory synthical virus BRSV	10	**4.0**
Parainfluenza virus 3	4	**1.6**
Infectious Bovine Rhinotracheitis (IBR)	4	**1.6**
Mycobacterium bovis	3	**1.2**
Bovine Viral Diarrhoea (BVD)	1	**0.4**

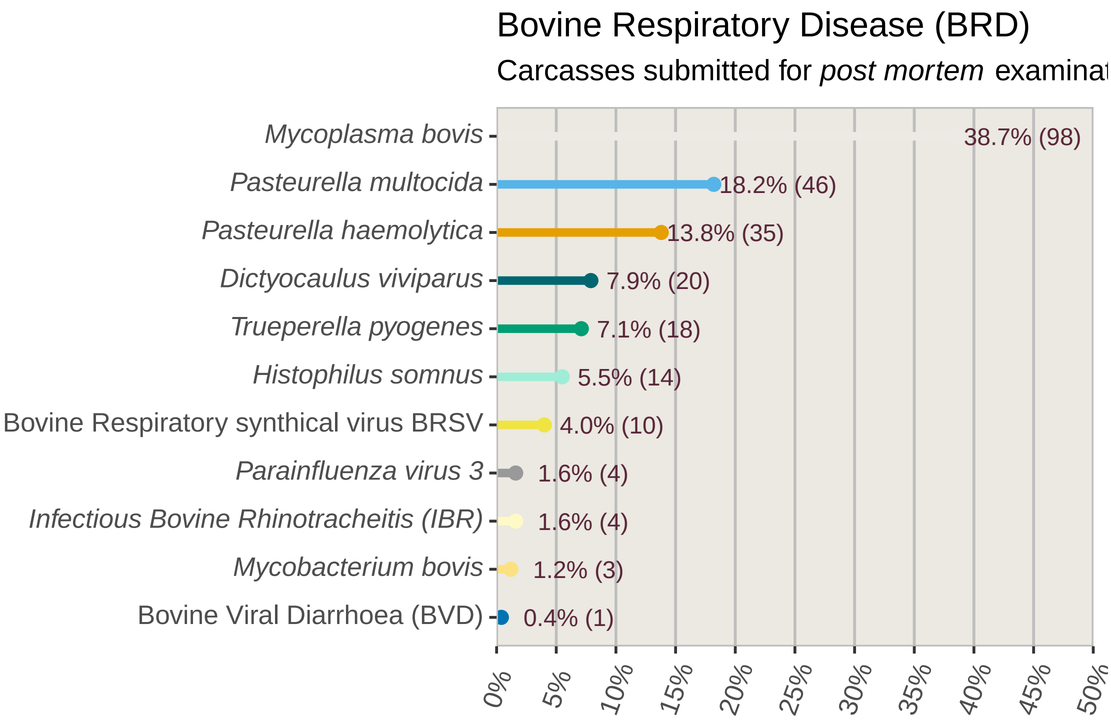

Figure 21.1.: Relative frequency of the different aetiological agents identified in cases of pneumonia diagnosed during *post mortem* by AFBI in 2024 (n=253). The absolute number of cases is between brackets.

(a) Caseonecrotic bronchopneumonia

(b) Lung cut surface

Figure 21.2.: Caseonecrotic bronchopneumonia caused by *Mycoplasma bovis* in a 3-month-old calf. (a) Cranioventral reddening (consolidation). (b) Cranioventral lung cut surface revealing multifocal, pale, dry, friable nodules of caseous necrosis. Photos: Seán Fee.

Mycoplasma bovis remains the most common pathogen detected in carcasses submitted in 2024 affecting 38.7 *per cent* of cases which is slightly less than the 39.3 *per cent* of cases in 2023. Infection with *Mycoplasma bovis* classically appears during gross *post mortem* examination as a cranioventral, caseonecrotic bronchopneumonia with foci of caseous necrosis arising within bronchioles and histopathogy of lung tissue (Figure 21.2a Figure 21.2b and Figure 21.3). In affected cattle, *Mycoplasma bovis* can also cause concurrent polyarthritis, otitis media, and is proposed to be linked to a necrotizing myocarditis of the papillary muscle. In adult cattle, this bacterium has been linked to mastitis and infertility. Transmission is via exposure to secretions of the respiratory tract, genital tract, and the mammary gland. AFBI offers PCR testing for *Mycoplasma bovis*, and a positive PCR result should be interpreted alongside gross findings, histological findings, and clinical presentation as the bacteria can be present without causing disease. Antibiotic treatment for *Mycoplasma bovis* is often unrewarding due to the presence of carrier animals, and the bacterium's lack of a cell wall and ability to exist in biofilms. A commercial vaccine is available, which is often used in combination with management changes to reduce transmission and reduce prevalence.

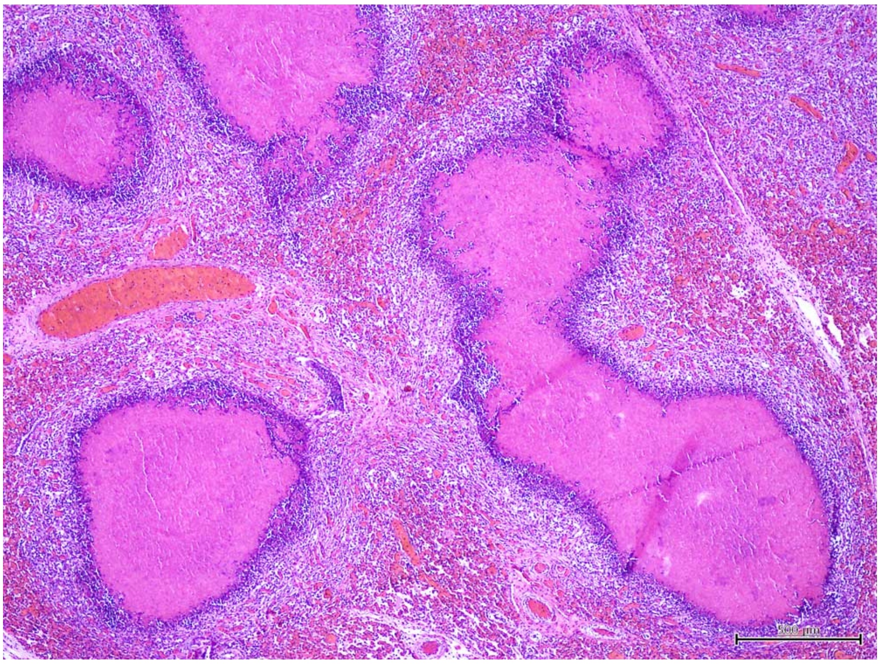

Figure 21.3.: Haematoxylin and Eosin-stained histological image of the above cranioventral lung (Figure 21.2a and Figure 21.2b) revealing a caseonecrotic focus within a bronchiole (*Mycoplasma bovis*). Photo: Seán Fee

Compared to 2023, there is an increased proportion of *Mannheimia haemolytica* and *Pasteurella multocida* infections in 2024 (32 *per cent* in 2024 vs 22.8 *per cent* in 2023). *Pasteurella multocida* and *Mannheimia haemolytica* are members of the *Pasteurellaceae* family and have similar gross appearances at *post mortem* examination. They present as cranioventral, fibrinous, lobular bronchopneumonia with coagulative necrosis and a variable fibrinous pleuritis. They often present acutely and frequently result in the death of the animal. Both bacteria are often opportunistic secondary invaders, following infection by the common respiratory viruses such as Infectious Bovine Rhinotracheitis Virus (Figure 21.4a), Parainfluenza Virus 3, Bovine Respiratory Syncytial Virus, and Bovine Viral Diarrhoea Virus (BVDV). Effective antibiotic treatment requires early detection and administration prior to advanced coagulative necrosis developing. Prevention involves vaccination alongside improved management and husbandry to minimize stress and improve host immunity.

(a) Infectious Bovine Rhinotracheitis

(b) Bovine Tuberculosis

Figure 21.4.: Infectious Bovine Rhinotracheitis infection (a) in a three-week-old calf. Tracheal epithelial necrosis overlain by a fibrinonecrotic membrane. (b) Bovine Tuberculosis caused by *Mycobacterium bovis*. Two cut sections of lung with typical caseating granulomas within the pulmonary parenchyma caused by *Mycobacterium bovis*. Two cut sections of lung with typical caseating granulomas within the pulmonary parenchyma. Photos: Seán Fee

Bovine Tuberculosis continues to be diagnosed in cases submitted for *post mortem* examination (Figure 21.4b), although more commonly Bovine Tuberculosis is diagnosed at AFBI in histological examination of lymph nodes from suspect cases submitted from abattoirs.

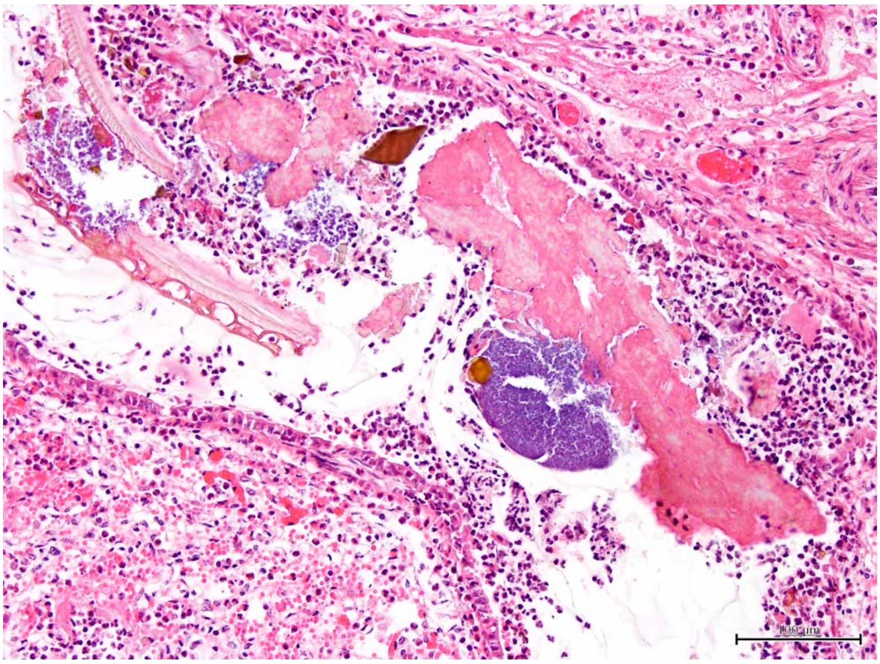

Figure 21.5.: Aspiration pneumonia in a ten-day-old calf. Haematoxylin and Eosin-stained histological image of a terminal bronchiole containing plant material admixed with cellular debris, fibrin, and bacterial colonies. Photo: Seán Fee

There are also occasional, miscellaneous diagnoses which occur such as aspiration pneumonia (Figure 21.5).

Vaccination of youngstock against the variety of BRDC pathogens remains one of the main methods of prevention of BRDC alongside improved colostrum and environmental management.

21.1. Parasitic Pneumonia in Cattle

Dictyocaulus viviparous is the only adult nematode known to infect cattle and cause a verminous pneumonia. It particularly infects cattle in cool, wet, seasonal climates such as those experienced in Northern Ireland. Primary infections tend to occur in first grazing season calves which have not been previously exposed or developed immunity. Infection tends to occur late in the grazing season when calves have been turned out for between 3–5 months. The second clinical presentation of lungworm is termed 'reinfection syndrome' which occurs when partially immune adults are turned out to pastures with high numbers of infective larvae. Most animals will undergo infection and develop immunity, although if there is a high larval challenge severe respiratory disease and death can occur.

The life cycle involves cattle ingesting infective third stage larvae from the pasture which penetrate the intestine and migrate to the lungs where they undergo moults to fifth stage larvae within bronchioles, and finally becoming adults within larger airways. These adults lay larvated eggs which rapidly hatch, and larvae are coughed up, swallowed, and passed onto pasture. This cycle occurs over 21–30 days and adult nematodes can persist within cattle over winter months to infect the pasture in subsequent grazing seasons.

The manifestation of disease depends on the infection stage, the host immunity, and the ingested larval burden. Clinical signs in naïve calves includes tachypnoea, dyspnoea, coughing, and sudden death. Gross findings during *post mortem* examination include adult nematodes in the caudal bronchi, trachea and lower airways accompanied by a frothy exudate. Histologically, there is eosinophilic catarrhal bronchitis/ bronchiolitis and an eosinophilic granulomatous alveolitis. Occasionally, adult worms, eggs, and larvae are observed in histological sections, although this is not always the case (Figure 21.6) and nematodes can be particularly difficult to visualize without multiple lung sections.

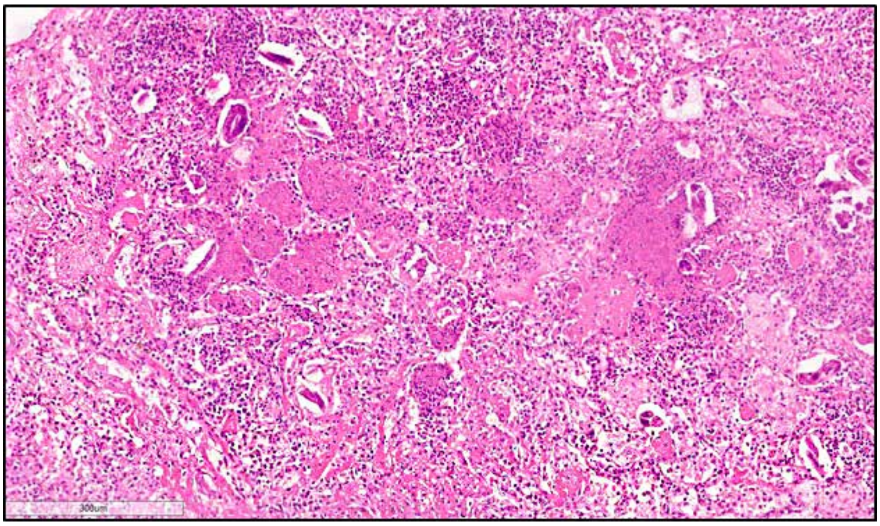

Figure 21.6.: *Dictyocaulus viviparus* infection in a young bullock. Haematoxylin and Eosin-stained histological image of lungworm larvae within the pulmonary parenchyma and associated eosinophilic and neutrophilic inflammation. Photo: Lauren McFarland.

AFBI utilizes Baermann technique to identify lungworm larvae in submitted faecal samples for lungworm diagnoses in live animals. However, it is important to consider that the result will only be positive after the adult *Dictyocaulus viviparous* are patent and producing larvae from approximately 25 days *post-infection*. In 2024, there were two peaks in cases diagnosed during August and October, whereas in 2023 there was a single peak covering the months of August to October. Overall, lungworm was diagnosed in 20 cases in 2024 which is less than the 46 cases diagnosed in 2023, although it is still the fourth most common diagnosis in pneumonia cases in 2024 at 7.9 *per cent* of cases. The decrease in cases in 2024 is likely influenced by the drier summer compared to previous years and increasing awareness of vaccination or pre-turnout anthelmintic treatment.

Treatment against *Dictyocaulus viviparous* involves use of anthelmintics, there has been a recent publication of potential resistance of *Dictyocaulus Viviparus* to Macrocyclic Lactones in dairy calves in the UK (Campbell et al. 2024). Regardless of emerging resistance, live attenuated vaccine remains one of the only options for preventing parasitic bronchitis. On farms with no previous history of lungworm, preventing introduction of the parasite by using treatment and quarantine of bought in animals is vital.

22. Bovine Mastitis, AFBI

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Mastitis is characterized by inflammation of the mammary gland; this inflammation is a pathophysiological response to traumatic injury or invasion of the glandular tissues by microorganisms (usually bacteria). Given the ubiquitous nature of on-farm microorganisms, mastitis cannot be eradicated but must be controlled to acceptable levels. Clinical and subclinical mastitis are very common and costly to the cattle industry. Financial losses are linked to decreased production with reduced milk yields, treatment costs, increased somatic cell counts creating milk quality penalties, and increased culling rates.

Infectious mastitis can be divided based on the source of the infection as either contagious or environmental. Contagious mastitis tends to be spread during milking between individuals and is reduced by good milking routine management. Environmental mastitis originates from the environment where the cows are housed such as the bedding and this form of mastitis is increasing in prevalence across the UK.

AFBI carries out individual and bulk milk sample testing for bacterial culture and sensitivity, and somatic cell count to provide information on the pathogens involved in individual cases and the level of subclinical mastitis within a herd. This allows appropriate treatment use and is increasingly important to avoid the use of critically important antibiotics and prevent the practice of blanket dry-cow antibiotic therapy.

In 2024, 493 isolates were cultured from submitted mastitic milk samples. The significance of the cultured microorganism depends on the cell count, the level at which the organism is isolated and whether there is a pure culture. Isolation of three or more species of microorganism in a submitted sample is suggestive of sampling contamination. Sampling contamination is most often linked to poor sampling technique, inadequate storage, and prolonged storage prior to culture. Interpretation of culture results when investigating mastitis outbreaks should be alongside the clinical picture. Often it is the clinical pattern of mastitis across a herd, for example when the mastitis events occur within a lactation cycle, which is most informative as to the overall origin of the pathogens involved at a herd level.

Escherichia coli, a coliform bacterium, was the most frequently isolated organism in 2024, in 32.7*per cent* of

Table 22.1.: Pathogens isolated in milk samples submitted to AFBI in 2024 (n= 493).

Category	No. of cases	Percentage
E.coli	161	**32.7**
Streptococcus uberis	91	**18.5**
Staphylococcus species	55	**11.2**
Staphylococcus aureus	53	**10.8**
Streptococcus dysgalactiae	46	**9.3**
Enterococcus species	25	**5.1**
Bacillus licheniformis	21	**4.3**
Trueperella pyogenes	10	**2.0**
Yeast	9	**1.8**
Corynebacteria	9	**1.8**
Bacillus cereus	8	**1.6**
Pasteurella multocida	4	**0.8**
Klebsiella pneumoniae	1	**0.2**

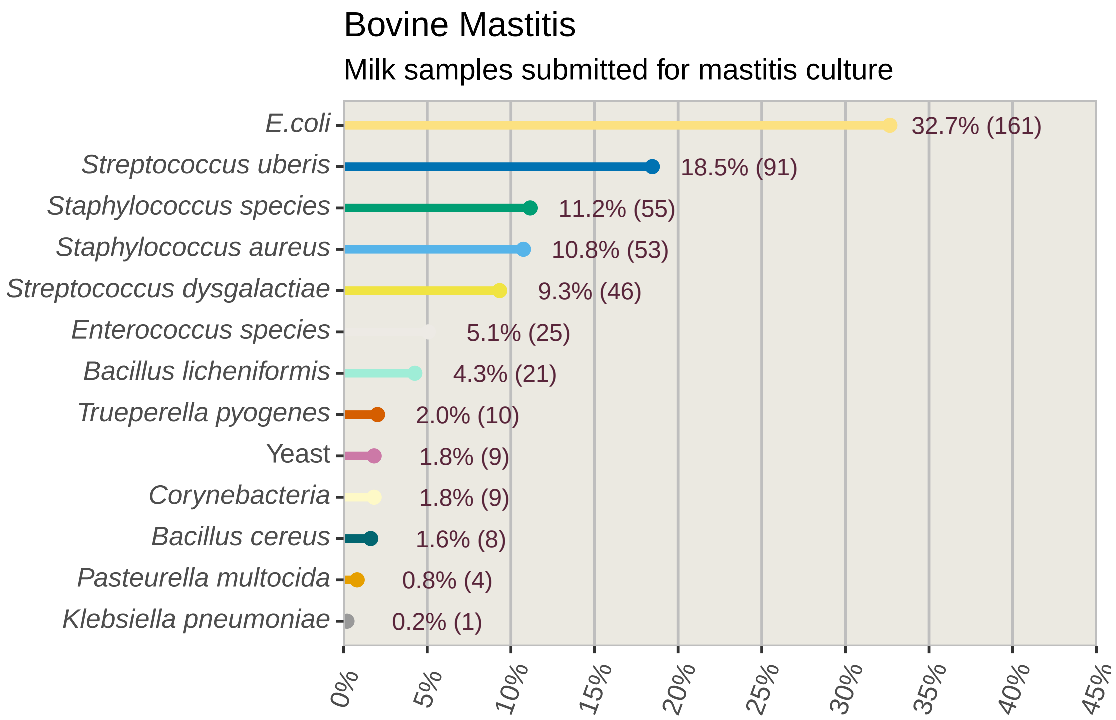
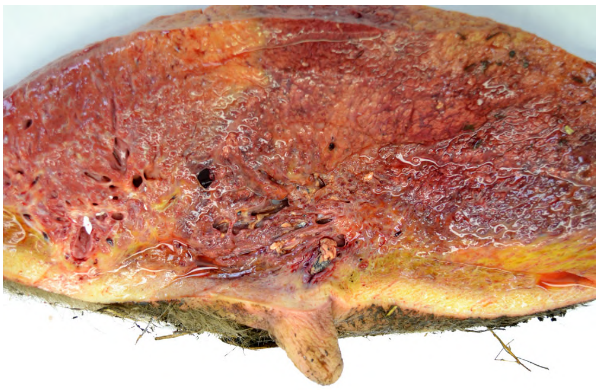
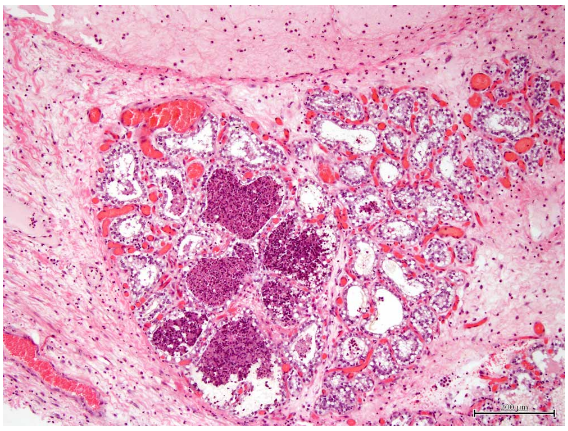


Figure 22.1.: Pathogens isolated in milk samples submitted to AFBI in 2024 (n=524). The absolute number of cases is between brackets.

cases (Figure 22.2a). This is similar to the 37.2*per cent* of cases where *Escherichia coli* was isolated in 2023. *E. coli* is the most prevalent environmental opportunistic pathogen causing mastitis in cattle and risk factors include poor hygiene, wet humid conditions, inclement weather, overcrowding, and stage of lactation. *E. coli* is a common cause of toxic mastitis, pure culture is most significant in animals with corresponding clinical signs (Figure 22.2b).



(a) Toxic mastitis



(b) H&E-stained slide of the mammary gland

Figure 22.2.: Toxic mastitis in a dairy cow (a). Multifocal reddening of the cut surface of the mammary gland with intraductal suppurative material. (b) Haematoxylin and Eosin-stained slide of the mammary gland demonstrating neutrophilic infiltrates within acini. *Escherichia coli* was cultured from the tissue. Photos: Seán Fee.

Streptococcus uberis was the second most frequently detected pathogen in 2024 at 18.5 *per cent* in comparison to 26.3 *per cent* in 2023. Although it is an environmental pathogen, it can survive in a diverse range of environments and it can be difficult to treat if chronic infection develops. *Staphylococcus aureus* causes contagious mastitis which, typically spreads from cow to cow via the milking equipment or milker's hands. It was identified in 10.8 *per cent* of samples submitted in 2024 compared to 11.4 *per cent* in 2023. This bacterium often causes subclinical mastitis, and treatment can be difficult due to the ability of cows to become chronic carriers.

Streptococcus dysgalactiae is both a contagious and environmental pathogen detected in 9.3 *per cent* of samples in 2024 compared to 6.7 per cent in 2023. The prevalence of this pathogen has been rising over the last few years.

23. Bovine Abortion, AFBI

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Of the 306 bovine abortions AFBI examined in 2024, an infectious agent was identified in 42.8 *per cent* of submissions, and this reflects that non-infectious causes such as anomalies in the foetus or maternal factors such as fever or malnutrition, may also induce pregnancy loss. Examination of the dam, the placenta and the foetus with maternal serology provides the greatest opportunity to obtain a diagnosis.

Bacterial agents comprised 86.3 *per cent* of infectious diagnoses, with *Trueperella pyogenes* , *Bacillus licheniformis* , *E.coli* and *Salmonella* spp. the most frequently diagnosed infectious agents occurring in 30.7 *per cent* of all bovine abortion submissions.

Parasitic and viral infections were also detected in abortion cases, with *Neospora caninum* and Bovine Viral Diarrhoea (BVD) virus being detected. Abortion associated with Schmallenberg virus was diagnosed in three cases, while five abortions were associated with ankylosis and hydrocephalus, but no viral agents were detected.

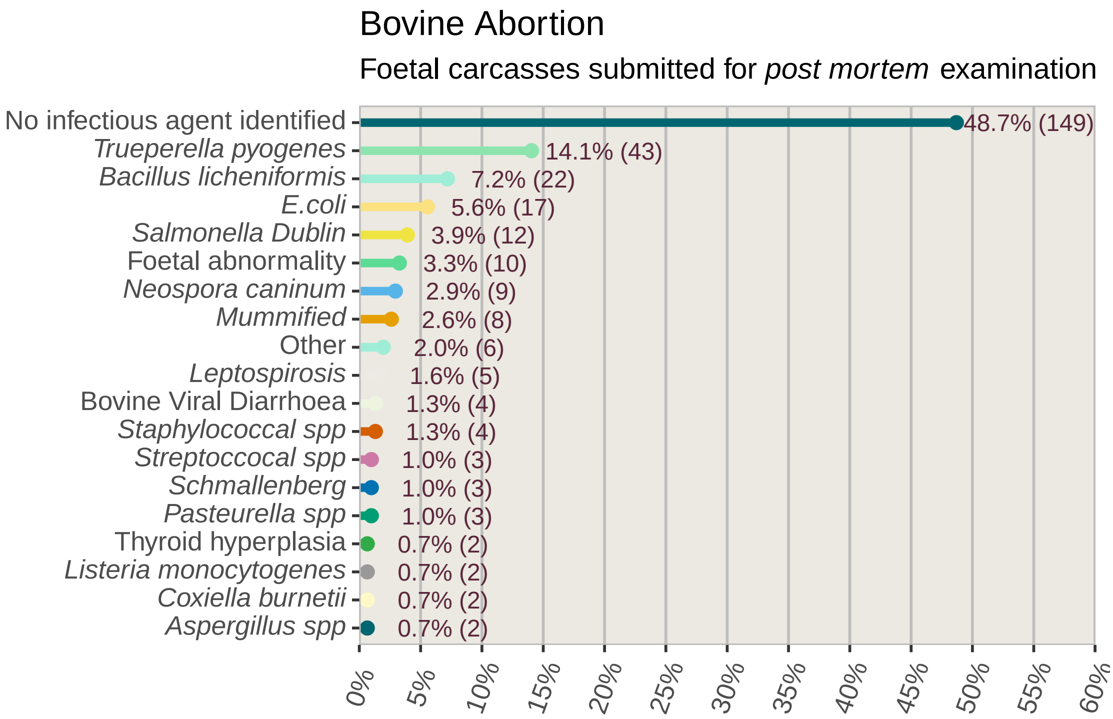

Figure 23.1.: Relative frequency of the identified infectious agents of bovine abortion from submitted foetal *post mortems* in 2024 (n=306).

24. Zinc Sulphate Turbidity Testing, AFBI

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The Zinc Sulphate Turbidity (ZST) test is used to evaluate the quantity of immunoglobulins absorbed from colostrum in neonatal calves and lambs. Due to the structure of ruminant placenta, immunoglobulins are not transferred to the foetus in-utero and the neonate relies on colostrum feeding to provide passive immunity, until its own immune system develops. Inadequate absorption of these immunoglobulins is known as failure of passive transfer (FPT). FPT can lead to increased morbidity and mortality due to the inadequate immune system of affected young animals allowing for easier entry of infectious diseases such as diarrhoea, septicaemia and pneumonia. These diseases can directly affect both the neonate and the farm by reducing average daily weight gain and increasing costs due to treatment of associated diseases.

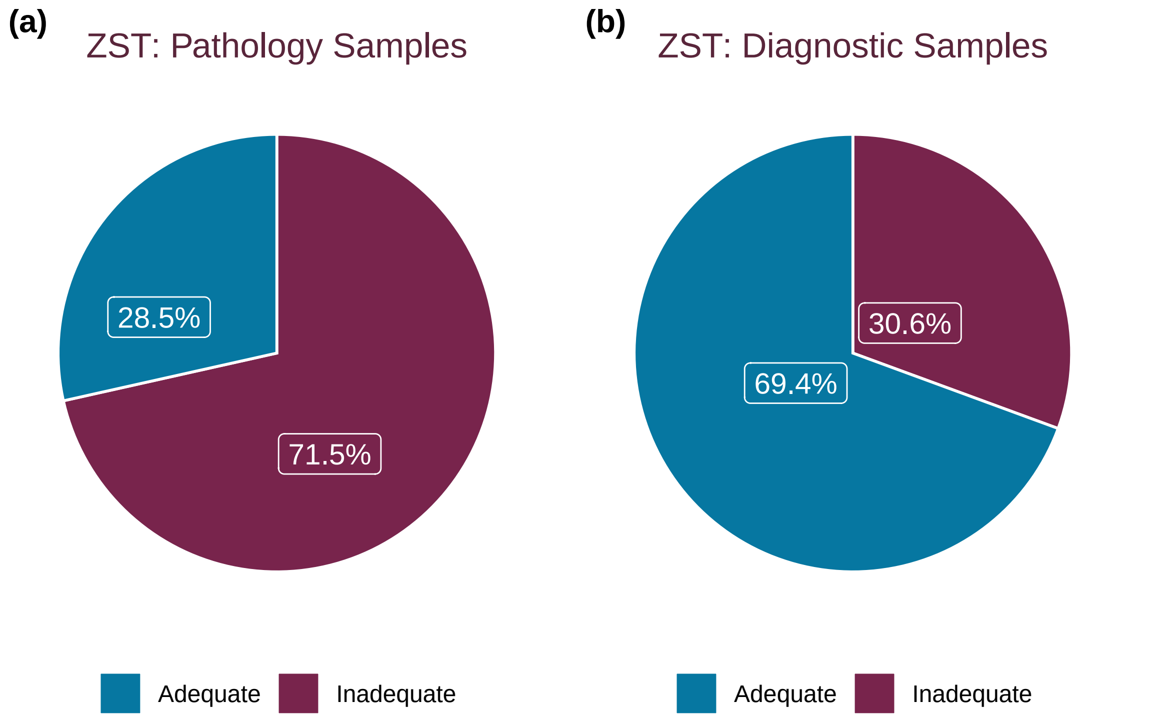

Figure 24.1.: Results of Zinc Sulphate Turbidity tests performed by AFBI in 2024 from bovine calf serum samples taken (a) at *post mortem* (n=172) and (b) submitted as diagnostic samples (n=539). Adequate colostral immunity is defined as greater than or equal to 20 units.

ZST testing is carried out on blood samples and indirectly measures the concentration of immunoglobulins in serum, particularly *IgG*. Turbidity of the sample is assessed following a salt precipitation reaction. The turbidity is proportionate to the concentration of immunoglobulins and is measured via colorimetry.

AFBI carries out ZST testing on samples submitted by veterinary surgeons and on samples collected from examinations of carcasses in our *post mortem* facilities, from animals up to two weeks of age. A ZST result of above 20 is classified as adequate absorption of immunoglobulins, while anything below this is inadequate and indicates failure of passive transfer. However there have been opinions that the cut off value of 20 is too high (Hogan et al. 2015) hence it may be of benefit to consider the values 12–19 to be suboptimal.

In 2024, 711 bovine serum samples were tested (Figure 24.1 and Figure 24.2), consisting of 539 diagnostic samples (submitted by vets) and 172 samples from AFBI *post mortems*. This is the highest number of ZST samples tested in a year over the past three years, with only 502 samples tested in 2023. This relates to an increase in submission of diagnostic samples by nearly 200, which may be due to increased knowledge regarding the importance of ZST testing in calf health investigations.

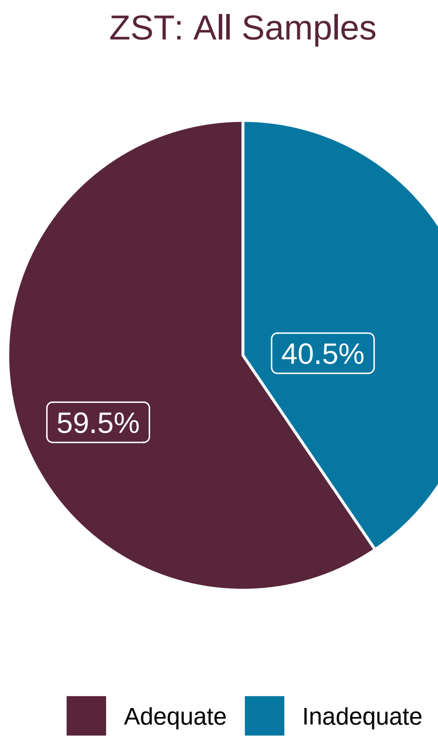

Figure 24.2.: Results of Zinc Sulphate Turbidity tests performed by AFBI in 2024 from bovine calf serum samples (n=711). Adequate colostral immunity is defined as greater than or equal to 20 units.

Of the samples submitted from *post mortem* carcasses, 71.5 *per cent* were classified as inadequate, similarly in 2023 72 *per cent* of *post mortem* samples were inadequate. However, only 30.6 *per cent* of diagnostic samples were inadequate in 2024 demonstrating the correlation between FPT and increased neonatal mortality, as more calves that have died had a lower ZST, compared to those tested on farm. In 2023 45 *per cent* of ZST diagnostic samples were inadequate, compared to 30.6 *per cent* in 2024 indicating an increase in adequate samples. If considering a ZST value of less than 12 as inadequate compared to less than 20 units 20 *per cent* of bloods would be inadequate and 20 *per cent* would be suboptimal, with values between 12 and 20, in 2024.

Of all samples submitted 59.5 *per cent* were adequate, which is reversed from the previous 2 years with only 47 *per cent* of ZST samples receiving an adequate result in 2023. This indicates an improvement in colostrum feeding to calves on NI farms in 2024, however there is still improvement required.

Testing to assess ZST should be done on a batch of roughly 10 healthy animals aged between 2 and 10 days old. Animals that are a day old or less are inappropriate to test as colostral antibodies don't peak until 36 hours after ingestion, while those over 2 weeks aren't suitable as endogenous immunoglobulins can give a falsely elevated result. Sick animals can also have a falsely elevated ZST due to dehydration, or falsely lowered ZST due to antigen binding or protein loss through the kidneys and GIT.

ZST testing is an important part of disease investigations in young ruminants, but this should also be incorporated with other on farm investigations including assessing colostrum quality along with feeding quantity, method and hygiene. FPT can occur due to inadequate volume, quality or prolonged period to colostrum feeding, hence it is recommended calves are fed 10 *per cent* (approximatly three liters) of their bodyweight, of >50g/L colostrum within 2 hours of birth (AHDB)[1]. Other investigations should include farm hygiene, neonatal calf management and calf housing along with diagnostic testing, including *post mortems*.

[1] https://ahdb.org.uk/knowledge-library/3-qs-of-feeding-colostrum

25. Bovine Neonatal Enteritis, AFBI

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Bovine neonatal enteritis, most frequently seen as diarrhoea, is the most common cause of mortality in neonatal calves worldwide. This is also supported in submissions to AFBI, with enteritis being the most common diagnosis in calves less than 1 month old (Table 20.1 and Figure 20.1). Diarrhoea can lead to dehydration, electrolyte abnormalities and metabolic acidosis which can require intensive treatment such as fluid therapy, electrolyte replacement and antibiotics. It has a marked economic impact due to treatment costs, morbidity and mortality, but it can also have long term effects by reducing daily weight, time to first calving and reduced milk production in dairy heifers.

There are multiple pathogens which can cause neonatal diarrhoea including viral, bacterial and protozoal parasites as seen in Figure 6.1. Other pathogens not included in the table include coccidia and *Salmonella* sp. The pathogens can work individually or as part of a co-infection causing more severe disease and increased mortality (Blanchard 2012). It is worth noting that some of these agents including *Cryptosporidium* and *Salmonella* sp. can be zoonotic, so strict hygiene measure should be followed in all calf diarrhoea cases.

The causative agent of diarrhoea cannot be determined from clinical signs or gross *post mortem* examination hence further testing is always required. The results included in Table 25.1 and Figure 25.2 are inclusive of faecal samples submitted from vets and samples taken from carcasses in AFBI *post mortem* facilities. It is important to note that certain factors can affect results such as autolysis, time from the beginning of disease and antibiotic treatment prior to sampling. Some pathogens are only present transiently and diarrhoea may continue following clearance due to the damage caused to the intestines, hence negative samples don't always negate the pathogen has been present. It is best to submit recently sick untreated carcasses/faecal samples for testing. A good history is also important as with all submissions, this should include other test results, prior treatment along with information on farm practices and history.

25.1. *Cryptosporidium sp.*

Cryptosporidiosis, also known as Crypto, is the most common cause of diarrhoea detected in neonatal calves with a positive result in 35 *per cent* of samples tested in 2024 (Table 25.1 and Figure 25.2). *Cryptosporidium* has been the highest detected pathogen in faecal samples from neonatal calves for several years, with 35 *per cent* samples also testing positive in 2023. *Cryptosporidium* parvum is a protozoal organism that causes watery diarrhoea in calves with subsequent dehydration. The pathogen is shed in high numbers via oocysts in the faeces from infected calves or adult cattle (asymptomatic carriers). It can survive well in cool moist environments, being resistant to many disinfectants and temperatures. Calves are infected by ingesting a small number of oocysts in the first days

Table 25.1.: The frequency of common enteropathogenic agents identified in calf faecal samples tested by AFBI in 2024.

Organism	No. Tested	Positive	Percentage
Cryptosporidium species	404	143	**35.4**
Rotavirus	248	63	**25.4**
Coronavirus	248	28	**11.3**
Escherichia coli K99	151	7	**4.6**

of life which invade intestinal cells in the distal small and large intestines, with clinical disease occurring 3–5 days after infection. Confirmation of *Cryptosporidium* infection at AFBI involves faecal flotation and Giemsa staining of faecal samples or demonstration of the organism's presence on fixed intestinal tissue. There are multiple methods of preventing infection now available including environmental decontamination, use of halofuginone and use of vaccination in the dams.

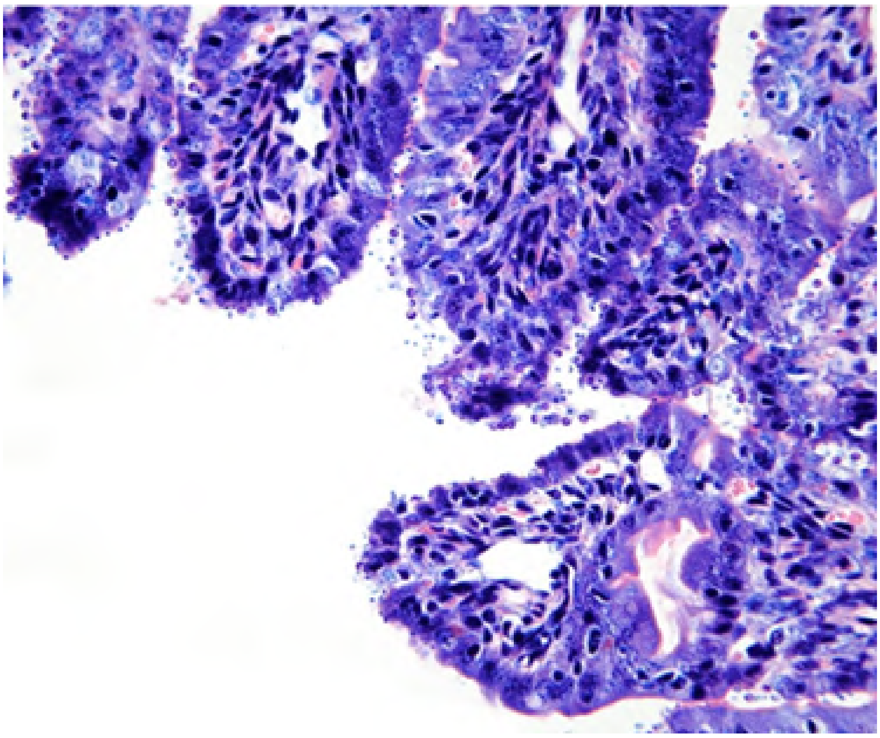

Figure 25.1.: Histopathology of the gut wall showing adhered cryptosporidium organisms. Photo: Bob Hanna.

The first vaccination for *Cryptosporidium* infection was released in 2024 in the UK. It involves vaccination of the dam in the third trimester up to three weeks prior to calving. This leads to the dam producing specific antibodies in the colostrum to protect against *Cryptosporidium* infection in the neonate, via passive immunity. The efficacy of the vaccine relies on sufficient transitional milk feeding of the calves for at least the first five days of life, with a first feed of three liters of colostrum within six hours of birth (NOAH, 2025)[1].

The treatment of cryptosporidiosis used to be limited to supportive treatments including nutritional support, fluid and electrolyte replacement. However, licensed products for use in *Cryptosporidium* infections, to reduce diarrhoea and *Cryptosporidium* oocyst shedding, are available including those containing halofuginone and paromomycin. Both treatments recommend use within 24 hours of diarrhoea commencing and advise a prolonged treatment period of seven or five days respectively (NOAH, 2025)[2].

[1] https://www.noahcompendium.co.uk/?id=-482988
[2] https://www.noahcompendium.co.uk/?id=-482988

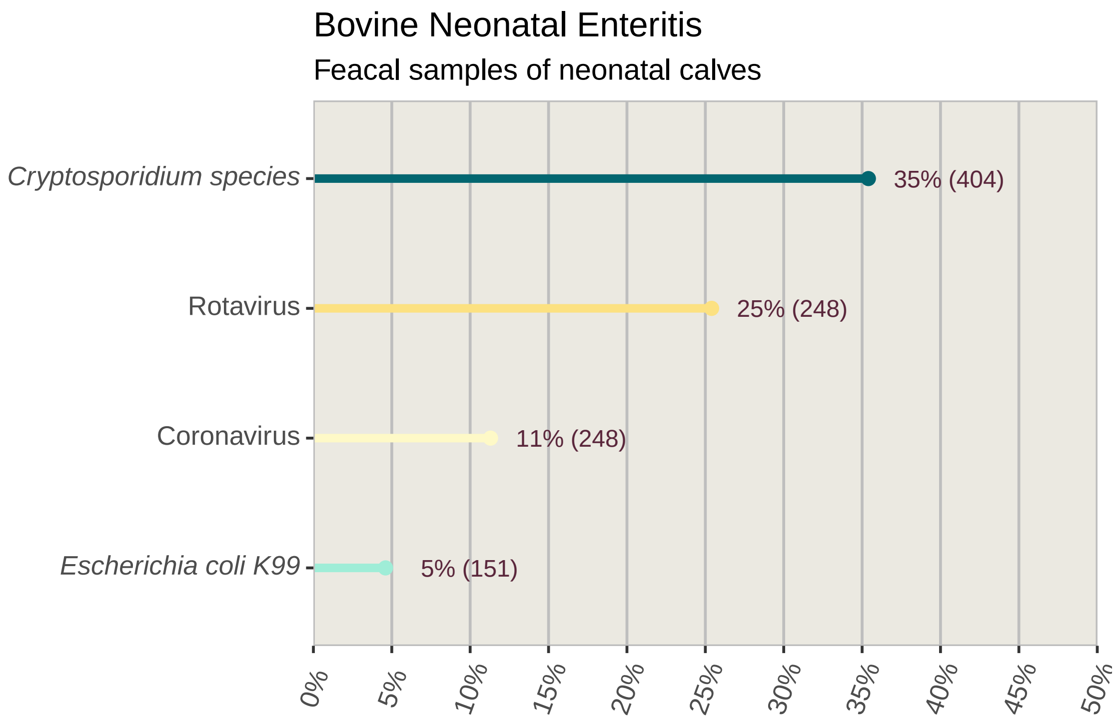

Figure 25.2.: Frequency of common enteropathogenic agents identified in calf faecal samples tested by AFBI in 2024. Total sample tested varies with the agent (between parentheses. Total tests=1051).

25.2. Rotavirus

Rotavirus is the 2nd most common cause of neonatal diarrhoea in calves in 2024 with 25 *per cent* of samples testing positive (Table 25.1 and Figure 25.2). Rotavirus is a viral cause of diarrhoea infecting calves aged less than three weeks of age, with diarrhoea lasting between four to eight days. The virus damages the villi of the proximal small intestine causing malabsorption, leading to pale yellow diarrhoea. The main source of infection is shedding by adult animals, hence it is important to note that rotavirus can be shed in the faeces of healthy calves also. There is no specific treatment except supportive therapies. Prevention is the main method of control including hygiene and dam vaccination prior to calving which also relies on good colostral feeding of the claves (Gomez and Weese 2017).

25.3. Coronavirus

Coronavirus was detected in 11 *per cent* of samples in 2024 and was detected in 14 *per cent* of samples in 2023, however less than eight *per cent* of samples tested positive in 2021 and 2022. Coronavirus is a viral cause of diarrhoea in calves aged five to 30 days old with diarrhoea lasting for roughly 3 to 6 days. Coronavirus has also been associated with diarrhoea in older cattle, known as Winter dysentery, and respiratory disease. Similarly to rotavirus it damages the villi throughout the intestines leading to malabsorption and subsequent diarrhoea. Coronavirus can be shed, to a lesser extent than rotavirus, in the faeces of healthy calves. Treatment and prevention are the same as rotavirus including vaccination of the dam prior to calving, appropriate colostrum management and hygiene (Gomez and Weese 2017).

25.4. *E. coli* K99

E. coli K99 is a type of *E. coli* which has fimbrial antigens used to attach to the epithelial cells of the small intestine. However, the attachment factors are only present on immature villi cells, hence disease is usually seen in the first week of life. Once attached a toxin is produced which causes an influx of fluid into the intestines and this can lead to calves dying from dehydration and electrolyte imbalances even before diarrhoea is seen. In AFBI *E. coli* K99 was detected in five *per cent* of samples using ELISA to detect the K99 attachment factor. This means that the bacteria can be detected even if the bacteria dies following the use of antibiotics. All samples submitted from ruminants less than two weeks of age are tested for this pathogen. Similarly to the other pathogens control and prevention involves vaccination of the dam prior to calving, appropriate colostrum management and hygiene.

Case Study

A two-week-old calf was submitted for *post mortem* examination after a 24 hours history of diarrhoea. The carcass had marked bilateral enophthalmos, yellow liquid diarrhoea and umbilical abscessation. Testing revealed a very high level of *Cryptosporidium* oocysts as well as positive results for rotavirus, coronavirus and *E. coli* K99. This indicates that diarrhoea cases are often multifactorial which can increase severity. The ZST in this case was eight units, which is inadequate and indicates failure of passive transfer. This meant the calf had a lowered immunity to infections. This is a reminder that all investigations into bovine neonatal diarrhoea should include testing for bacteria, parasites, viruses and ZST. However, not all diarrhoea is caused by infectious agents and non-infectious problems such as nutrition and management can also lead to diarrhoea in neonatal calves.

26. Bovine Parasites, AFBI

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Parasitic gastroenteritis

Ostertagia ostertagi, *Cooperia oncophora* and *Trichostrongylus* spp. are parasitic nematodes which can cause gastroenteritis in cattle. The main source of infection for calves is *L3* larvae of *O. ostertagi* on the pasture, derived from eggs shed earlier in the year by older cattle harbouring infection that they acquired the previous year. Infection with *Trichostrongylus sp.* and *C. oncophora* is usually acquired from *L3* larvae on the pasture that have survived from the previous autumn due to mild over-winter conditions. In calves, cycles of autoinfection in the summer and early autumn (June to September) are associated with *Type 1* parasitic gastroenteritis (PGE: persistent watery diarrhoea and weight loss up to 100 kg). Later in the season, from September onwards, L4 larvae of *O. ostertagi* become hypobiotic in the abomasal lining and will give rise to next year's crop of adult worms. Maturation of these worms is associated with *Type 2* PGE (intermittent diarrhoea and anorexia in yearling calves in spring, with shedding of eggs on early pasture). Diagnosis of PGE is carried out by Faecal Egg Counts (FEC) on diarrhoeic faeces samples, and ideally several individual samples (up to 10) should be submitted from each group of scouring calves. Samples with a FEC of 500 eggs per gram (epg) and greater indicate clinically significant PGE.

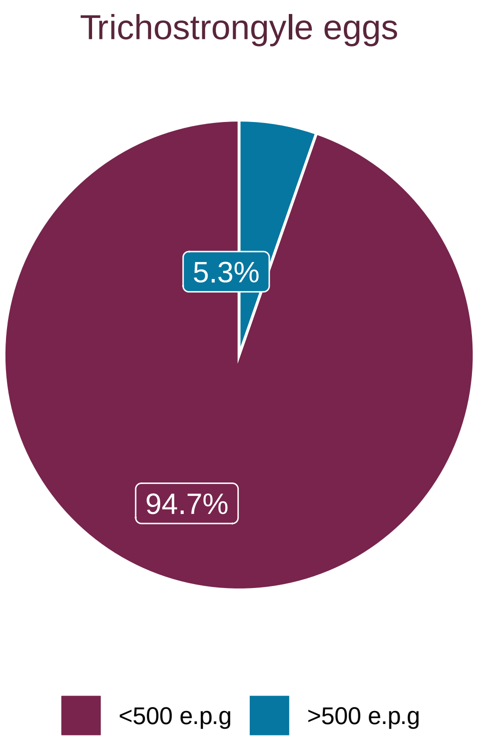

Figure 26.1.: Relative frequency of detection of trichostrongyle eggs in bovine faecal samples examined by AFBI in 2024 (n=1781).

In 2024, 5.3 *per cent* (number of samples examined, n =1781) of bovine faeces samples submitted to AFBI for parasitological examination had a FEC ≥500epg (Figure 26.1), compared to 6.4 *per cent* of samples examined in 2023, 13.2 *per cent* of samples examined in 2022, 4.0 *per cent* of samples submitted in 2021 and 5.1 *per cent* of samples submitted in 2020. The peak period for clinically significant gastrointestinal nematode infection was autumn (perhaps corresponding with incidence of *Type 1* PGE in calves having reached the limit of anthelmintic cover by long-acting products administered early in the year). The reasons for these year-to -year differences are likely to be climatic variation between the years and perhaps changing anthelmintic usage.

Control of PGE in calves is usually carried out using anthelmintic drugs which may be administered therapeutically (to treat calves when scouring and immediately eliminate clinical signs of infection) or prophylactically. In the latter situation, calves are usually grazed until July, then treated with a long-acting anthelmintic to reduce faecal egg output and avoid subsequent rise in infective larvae on pasture. Anthelmintic treatment would normally be repeated at housing, but when using long-acting products, care should be taken not to inhibit the normal development of immunity. Whilst at present resistance of cattle nematode parasites to commonly used anthelmintic drugs is not a major problem in Northern Ireland, it is advisable for stockholders to be aware of best practices for sustainable use of anthelmintics on their premises. Up-to-date guidelines regarding sustainable control of parasitic worms in cattle is provided by the COWS initiative[1].

Liver fluke

In 2024, *Fasciola hepatica* incidence was 6.9 *per cent* (n = 1604) in bovine faecal samples submitted to AFBI (Figure 26.3 a), compared to 4.0 *per cent* in 2023, 3.8 *per cent* in 2022, 7.0 *per cent* in 2021 and 6.0 *per cent* in 2020. It is likely that this reflects the availability of the infective metacercarial cysts on pasture in the late autumn and early winter of 2023. This, in turn, relates to the influence of rainfall and surface moisture in the preceding 6 months on the abundance and spread of the intermediate host, *Galba truncatula* (Figure 26.2), and the development of the fluke infective stages within it. The risk of fluke infection each year, based on climatic data, is predicted by AFBI staff and published in the farming press in October.

Figure 26.2.: *Galba truncatula* snails on a water layer of mud. Photo: Bob Hanna

Pathogenesis of liver fluke depends on the number of metacercariae ingested and the stage of parasite development within the liver. The acute phase of infection, which is rarely symptomatic in cattle, occurs while parasites migrate through the hepatic parenchyma. Fluke eggs are not present in faecal samples during this phase, and diagnosis of infection rests on blood testing for evidence of liver damage. The chronic phase of infection corresponds to the presence of adult parasites in the bile ducts, leading to characteristic calcification of ducts and the pipestem liver appearance visible on *post mortem* examination. Fluke eggs are present in faecal samples at this stage, and diagnosis is often confirmed by ELISA testing to demonstrate fluke coproantigens in the faeces. Liver fluke infection, fasciolosis, has major economic implications for livestock productivity due to the resulting morbidity and mortality. Carcases that have been infected by liver fluke have poorer conformation and lower cold weight than those free of liver fluke. When clinically significant fasciolosis has been diagnosed in a herd by examination of representative faecal samples by FEC or coproantigen testing (10 individual samples is recommended for each

[1] https://www.cattleparasites.org.uk/

group of cattle sharing common pasture), treatment is usually recommended using any of several products containing anthelmintic active against the mature flukes (e.g. clorsulon, oxyclozanide, albendazole, nitroxynil), bearing in mind the relevant withdrawal periods. Triclabendazole, while active against all stages of fluke including the early migrating immatures, may not be fully effective on many farms, particularly where sheep are also kept, due to the widespread occurrence of fluke resistance to the drug. It is important to treat infected cattle prior to turn-out in spring, to prevent pasture contamination with fluke eggs.

Rumen fluke

Adult *Calicophoron daubneyi* flukes (also known as paramphistomes) (Figure 26.4a) are found in the reticulum and rumen and are generally well tolerated, even with heavy burdens. Any pathogenic effect is usually associated with the intestinal phase of infection, where immature flukes, hatched from ingested metacercariae, attach to the duodenal mucosa before migrating to the forestomachs; diarrhoea, anorexia and rectal haemorrhage may be noted.

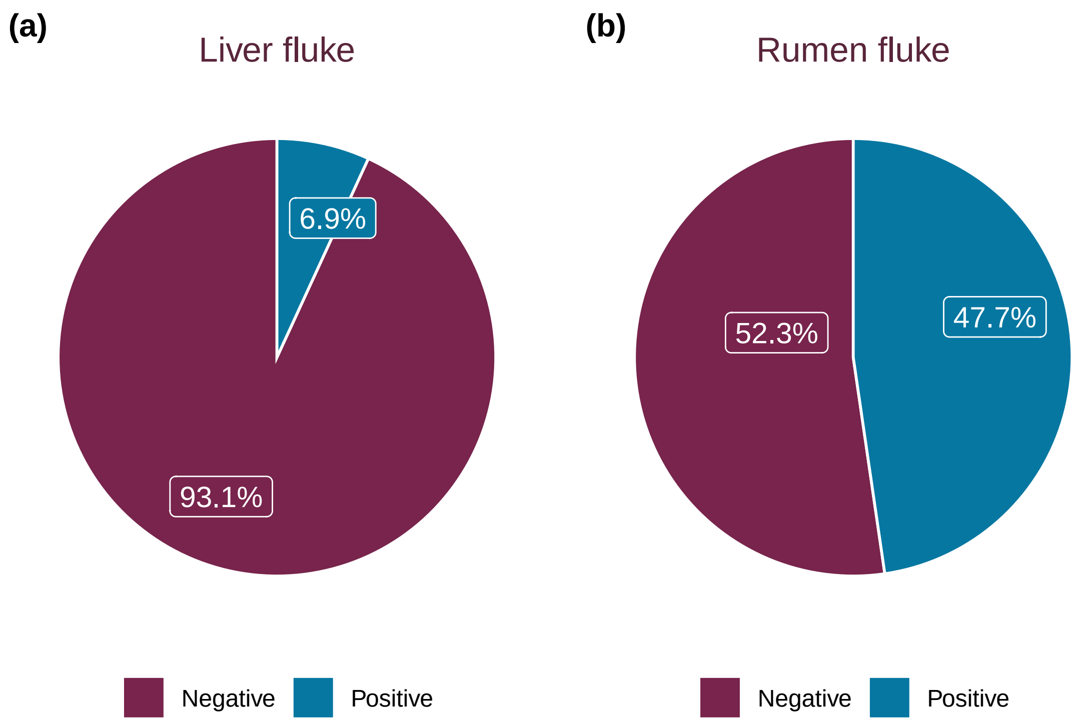

Figure 26.3.: Relative frequency of detection of (a) liver fluke eggs (n=1604) and (b) rumen fluke eggs (n=1606) in bovine faecal samples examined by AFBI in 2024.

Young animals at pasture in late summer or autumn may be affected if the climatic conditions earlier in the year, or localised flooding, have favoured population build-up of the snail intermediate host, *Galba truncatula* (the same as for *F. hepatica*). However, most animals with rumen fluke eggs detected in their faeces show few, if indeed any, clinical signs of disease. Incidence of positive bovine faecal samples in 2024, at 47.7 *per cent* (n=1604, Figure 26.3 -b), shows an increase compared with that in 2023 (42.8 *per cent*), 2022 (46.4 *per cent*) and 2021 (43.0 *per cent*). In previous years, the incidence of paramphistomosis was higher (in 2020, 48.5*per cent* and in 2019, 52.6 *per cent*).

In faecal examinations, the eggs of *C. daubneyi* can be distinguished from those of *F. hepatica* by their characteristic clear appearance (Figure 26.4b). Treatment of animals for paramphistomosis is not usually considered necessary, although occasional reports, mainly anecdotal, have indicated an improvement in condition and productivity of dairy cattle following administration of oxyclozanide in response to positive FEC diagnosis. In the event of acute outbreaks of clinical infection in calves, the use of oxyclozanide is indicated.

(a) *Calicophoron daubneyi*

(b) Liver and rumen fluke eggs

Figure 26.4.: Adult *Calicophoron daubneyi* (a) in the rumen of the dairy cow. (b) Liver and rumen fluke eggs in a faecal sample. Photos: Bob Hanna.

Coccidiosis

Calves are usually infected by ingesting oocysts from contaminated environments. Coccidiosis can cause significant economic losses to farmers due to reduced performance and mortality in younger animals. During 2024, coccidian oocysts were seen in 26.6 *per cent* of bovine faecal samples examined (n=1779, Figure 26.5), with 6.1 *per cent* in the moderate or high categories. This is slightly higher than in previous years (25.1 *per cent* in 2023, 21.5 *per cent* in 2022, 21.0 *per cent* in 2021 and 21.6 *per cent* in 2020, with less than 6 *per cent* in the moderate or high categories each year). The relatively low level of oocysts in the moderate or high categories is often because the peak of oocyst shedding from the infected animals had passed before the samples were collected.

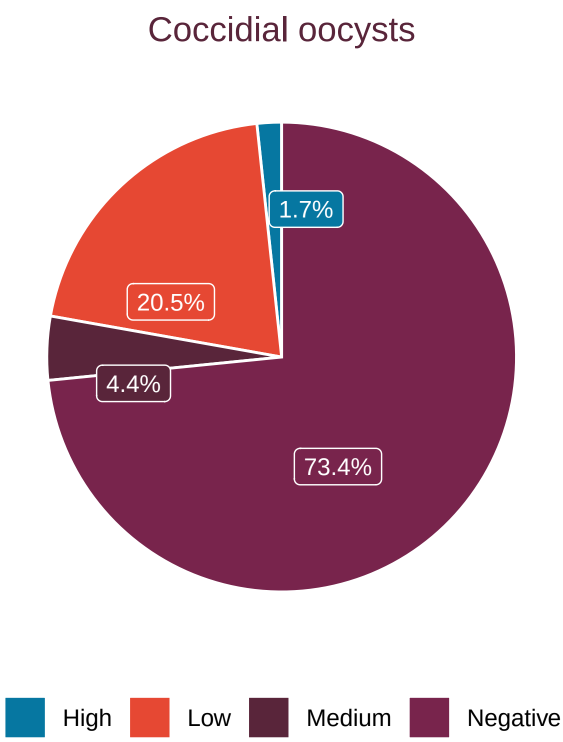

Figure 26.5.: Results for bovine faecal samples tested for coccidial oocysts during 2024 (n=1779).

Examination of the faeces for oocysts of coccidians is an important element of diagnosis, and it may be significant to distinguish the species of parasite present (usually based on the dimensions of the oocysts) and thus predict the likely pathogenicity of the infection. In cattle, coccidiosis caused by *Eimeria zuernii*, *E. bovis* and *E. alabamensis* usually affects calves under one year old, but occasionally yearlings and adults are infected if they have not experienced infection in early life. Disease occurs following a massive intake of oocysts from the environment, and this would be associated with large numbers of animals sharing unhygienic yards, or where animals congregate at pasture round water troughs and feeders.

The parasitic infection attacks the caecum and colon, producing severe blood-stained diarrhoea (dysentery) with straining. Massive asexual multiplication of the parasite takes place, and following a sexual phase, oocysts are shed in the faeces in large numbers for a short period of time. After this, the host animal develops substantial immunity to the species of coccidian with which it was infected. However, subclinically infected animals often have a low level of intermittent shedding of oocysts and can act as a reservoir of infection for younger naive individuals.

Environmental conditions must be appropriate for development of the oocysts to the infective stage. The presence of moisture is essential for this to occur, and the speed of development of the oocysts depends on temperature but typically takes 2–4 days.

Prevention of coccidiosis in cattle is based on good management practices, in particular the avoidance of wet underfoot conditions in houses and at pasture. Food troughs and water containers need to be moved regularly to avoid local build-up of oocyst numbers, and bedding should be kept dry. Avoidance of stress, especially due to overcrowding, is important for prevention of coccidiosis in young animals, and adequate uptake of colostral antibodies will also help prevent overwhelming coccidial infection.

Dictyocaulus viviparus (lungworm)

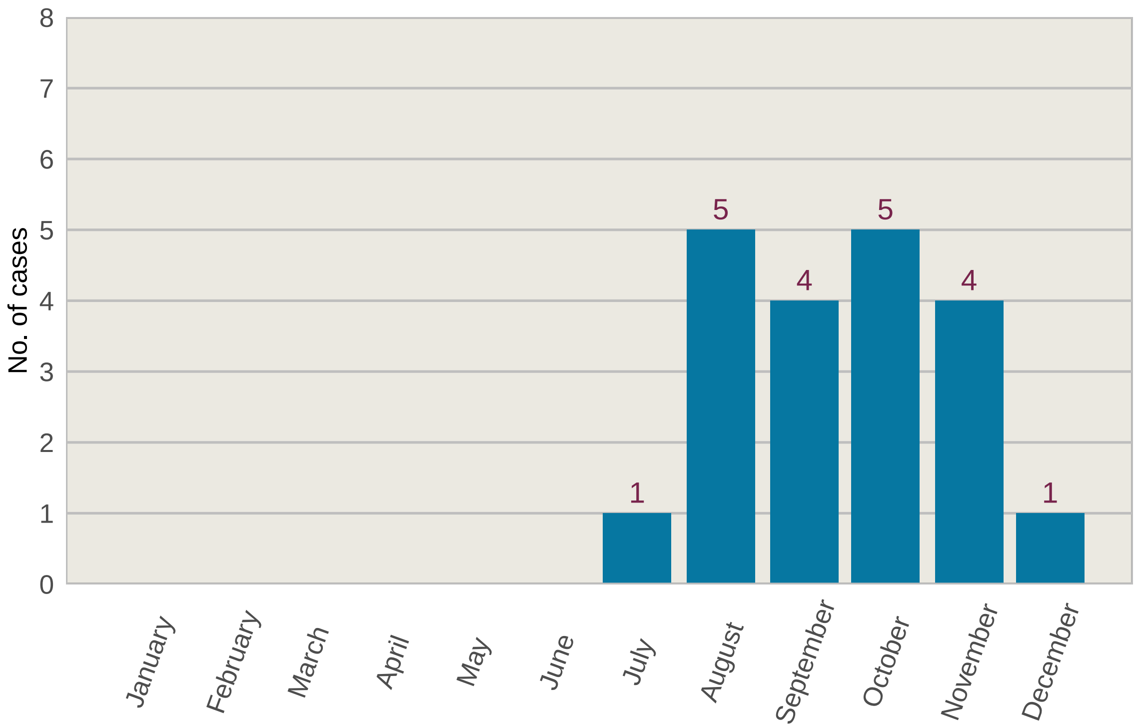

Figure 26.6.: Number of lungworm cases diagnosed during *post mortem* by AFBI per month in 2024, (n=20).

Bovine lungworm *Dictyocaulus viviparus* is the cause of parasitic bronchitis (husk/hoose) in cattle. The disease is characterised by coughing and respiratory distress and typically affects young cattle during their first grazing season, following which the surviving animals usually develop a strong immunity. Occasionally, if an older animal with acquired immunity is suddenly exposed to a massive larval challenge from a heavily contaminated field, severe clinical signs may result. Amongst 253 *post mortem* diagnoses of pneumonia in 2024, where the aetiological cause was identified, 20 cases (7.9 *per cent*) involved *D. viviparus* infection, a significant decrease compared to the levels reported in 2023 (12.3 *per cent*) and 2022 (13.0 *per cent*). Amongst 328 faecal samples examined for lungworm larvae in 2023, 83 (25.3 *per cent*) were found to be positive whereas, in 2024, 35 of 195 faecal samples examined for lungworm were found to be positive (17.9 *per cent*). The peak incidence of lungworm infection was in August to November (Figure 26.6) In recent years there has been a tendency for lungworm infection to occur in older cattle because treatment with long acting anthelmintics during the first grazing season has prevented calves from being sufficiently exposed to lungworm infection to develop immunity.

27. Johne's Disease, AFBI

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Johne's disease (JD) or paratuberculosis is a disease of ruminants primarily, which occurs worldwide, commonly in cattle, and to a lesser extent in sheep and goats. The disease classically presents as severe wasting of body condition and diarrhoea (Figure 20.9), leading eventually to death, but such severe clinical cases are relatively infrequent and represent the very tip of the JD iceberg. Substantial insidious economic losses in JD infected herds result from decreased productivity, increased infertility, increased incidence of mastitis, increased incidence of lameness and decreased lifetime production caused by premature culling. There is no effective treatment for JD, which adversely impacts animal welfare and significantly increases greenhouse gas emissions from infected animal groups.

The causative agent is *Mycobacterium avium* subspecies *paratuberculosis* (Map), a resilient, slow growing acid-fast bacterium. The effects of this slow growth are that the disease has a very long incubation period, and the immune response of an infected animal is also slow. This represents a challenge for diagnostics, and current available methods perform poorly until later in the course of the infection. Map is known to survive for longer than 1 year in the environment. Transmission is primarily by the faecal-oral route, and ingestion of Map by susceptible animals via oral uptake of contaminated milk, water, feed products or from the environment. Neonates are most susceptible to the infection. Vertical transmission in utero is also well established in cattle. Progression of infection is usually promoted by stress. Shedding of Map in faeces will usually precede overt clinical signs of disease in an infected individual, propagating the disease cycle by facilitating spread of the causative agent to susceptible animals.

During 2024, 9370 blood and milk samples were submitted to AFBI for Map antibody (ELISA) testing. Of the bovine samples screened, 881 (9.48 *per cent*) were positive, with a further 162 (1.74 *per cent*) returning inconclusive results.

1647 faecal samples were submitted to AFBI for Map PCR screening. Map was identified in 267 of the 1568 (17.03 *per cent*) bovine samples tested. Map infection was also confirmed in 2 of 21 caprine faecal samples tested, and 1 of 47 ovine faecal samples tested.

The Northern Ireland Johne's Disease Control Programme for Dairy Herds is a voluntary programme managed by Animal Health & Welfare NI (AHWNI). The programme complies with the requirements of the Red Tractor Farm Quality Assurance Scheme. It is compulsory for all participants in the programme to undertake a standardised Veterinary Risk Assessment and Management Plan (V-RAMP). These are delivered by approved veterinary practitioners who have undergone AHWNI training. By the end of 2024, 264 veterinary practitioners had been trained to deliver V-RAMPs. During 2024, 1114 V-RAMPs were carried out and uploaded to AHWNI.

28. Northern Ireland BVD Eradication, AFBI

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An industry led eradication programme for Bovine Viral Diarrhoea (BVD) managed by Animal Health and Welfare Northern Ireland (AHWNI) has been operating voluntarily in Northern Ireland since 2013, turning compulsory in March 2016.

The programme aims to remove BVD persistently infected (PI) cattle from the population through:

- Testing of all new-born calves including those stillborn calves for the presence of BVD virus, primarily using ear notch samples taken at the time of ear tagging.
- Identification of cattle with non-negative BVD results and isolation of high infectious risk animals.
- Improving stakeholder knowledge of BVD and awareness of biosecurity principles through a continuous flow of information.
- Private veterinary practitioner involvement through the provision of herd test information, advice to herd owners and follow-up testing.
- Restrictions on the movement of non-negative animals (and a voluntary abattoir ban on the slaughter of BVD Positives).
- Voluntary removal of BVD Persistently Infected cattle.

In November 2023 BVD became a notifiable disease in Northern Ireland. This enhancement to the BVD eradication programme allows new infections and outbreaks to be identified at an early stage.

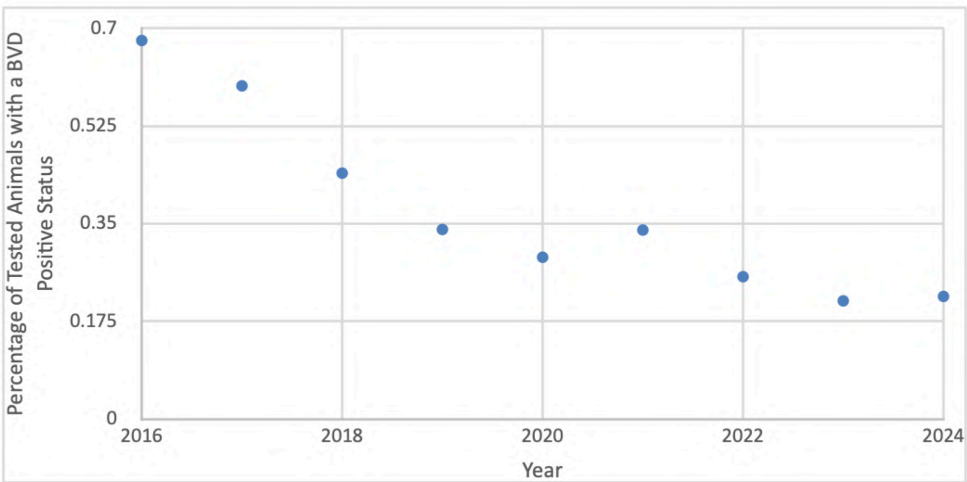

Figure 28.1.: Annual Incidence of animals disclosing as BVD Positive.

519,189 calves born in 2024 were tested for BVD virus. Of these, 1141 (0.22 *per cent*) were BVD positive or inconclusive (Figure 28.1). This reflects an overall reduction in BVD incidence of 68 *per cent* since the start of

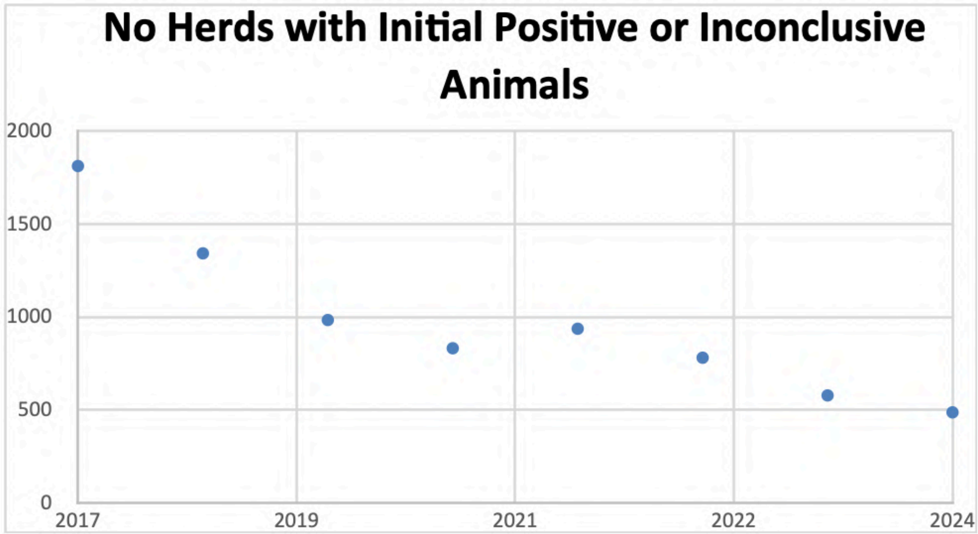

Figure 28.2.: Annual Number of Herds Disclosing with BVD Positive or Inconclusive Animals.

the compulsory BVD eradication programme (March to December 2016). However, it also reflects no substantial change in the incidence of BVD compared to 2023, highlighting the need for additional control measures.

Related to this, the number of testing herds that had BVD positive or inconclusive animals disclosed in 2024 was 487 compared to 1813 in 2017 (Figure 28.2).

Special thanks and acknowledgment to Sam Strain and Sharon Verner from AHWNI for providing data and figures.

29. Ovine Diseases, AFBI

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29.1. Overview

In 2024, the total number of sheep recorded in Northern Ireland was 1,969,023, with 930,447 breeding ewes, and this represented a four *per cent* decrease in total numbers and breeding ewes compared to 2023.

In 2024 a total of 659 ovine carcasses were submitted to AFBI for *post mortem* examination, and this was comprised of 393 lambs aged up to 12 months old, and 266 sheep aged older than 12 months. These figures represent a significant increase from 441 total carcass submissions in 2023, and are the highest number of submissions in several years, despite the overall reduction in sheep numbers, possibly reflecting higher market values.

Parasitic disease was by far the most commonly diagnosed disease condition in sheep of all ages in 2024; this has been the most important diagnosis in lambs up to 12 months of age for many years, however in 2024 it overtook respiratory disease as the most commonly diagnosed disease condition in sheep over 12 months as well.

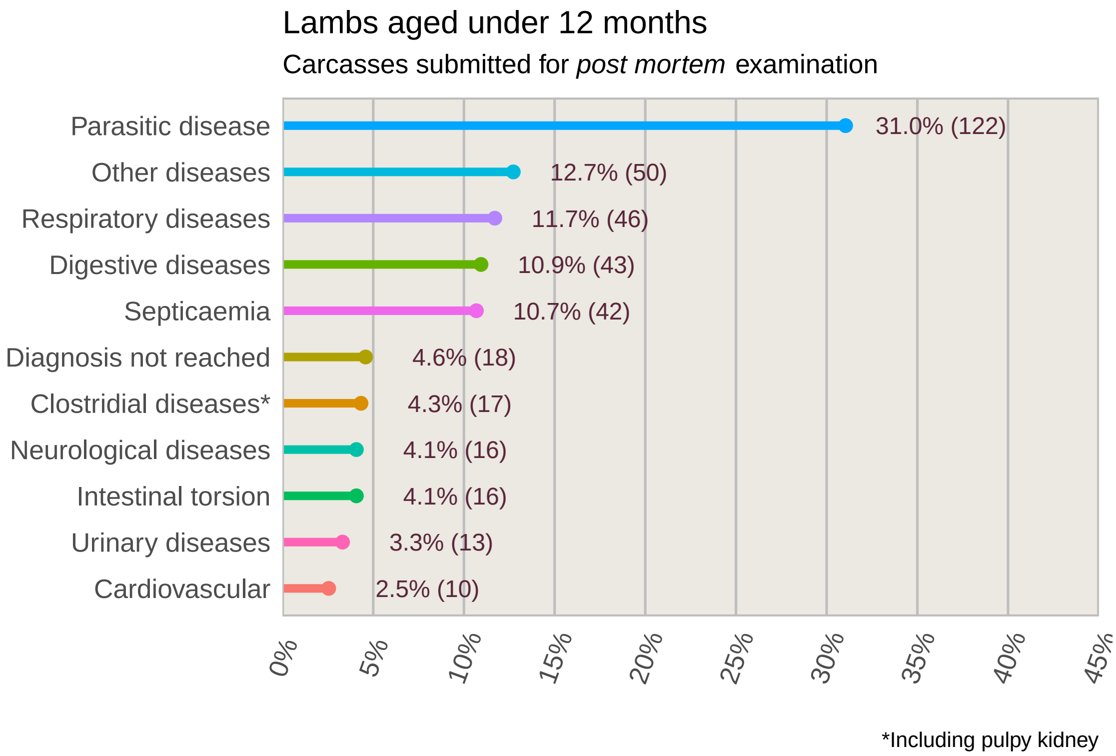

Figure 29.1.: Conditions most frequently diagnosed in small ruminants aged under 12 months submitted for *post mortem* by AFBI in 2024. (n=393). The absolute number of cases is between brackets.

29.2. Lambs aged 12 months and under

In agreement with previous years, parasitic disease, at 31 *per cent* of submissions, was by far the most important diagnosis in lambs of under 12 months of age.

As in recent years, *Haemonchus contortus* continues to be diagnosed in Northern Ireland, with a total of 11 cases (nine *per cent* of parasitic total). Haemonchus infection causes profound anaemia in lambs, often with scour which may be blood-stained. Animals succumb rapidly, and numerous losses can occur in affected flocks. 45 *per cent* of parasitic cases were due to PGE, including *Nematodirus*, and 28 *per cent* were due to coccidiosis. Cryptosporidiosis was also an important cause of disease in young lambs.

Respiratory disease was also an important cause of death in this cohort (11.7 *per cent* of submissions); the most frequent bacterial cause being *Mannheimia haemolytica* (26 *per cent*). Four lambs under 12 months were diagnosed with *Jaagsiekte* (Ovine Pulmonary Adenocarcinoma, OPA); OPA is most commonly diagnosed in older sheep, usually more than two years old, due to the long incubation period, however less commonly disease may be seen in sheep as young as six months old. Affected younger sheep may be the progeny of dams with advanced pathology resulting in early infection of the neonatal lamb, and although transmission is primarily aerosol through infected respiratory droplets, the virus is also transmitted via colostrum and milk.

Septicaemia was diagnosed as the cause of death in 10.7 *per cent* of submissions, and this included Colisepticaemia and Septicaemic Pasteurellosis.

Clostridial diseases, including Pulpy Kidney, at 4.3 *per cent* of all submissions in 2024 have remained at similar levels in recent years, despite the availability of effective vaccines.

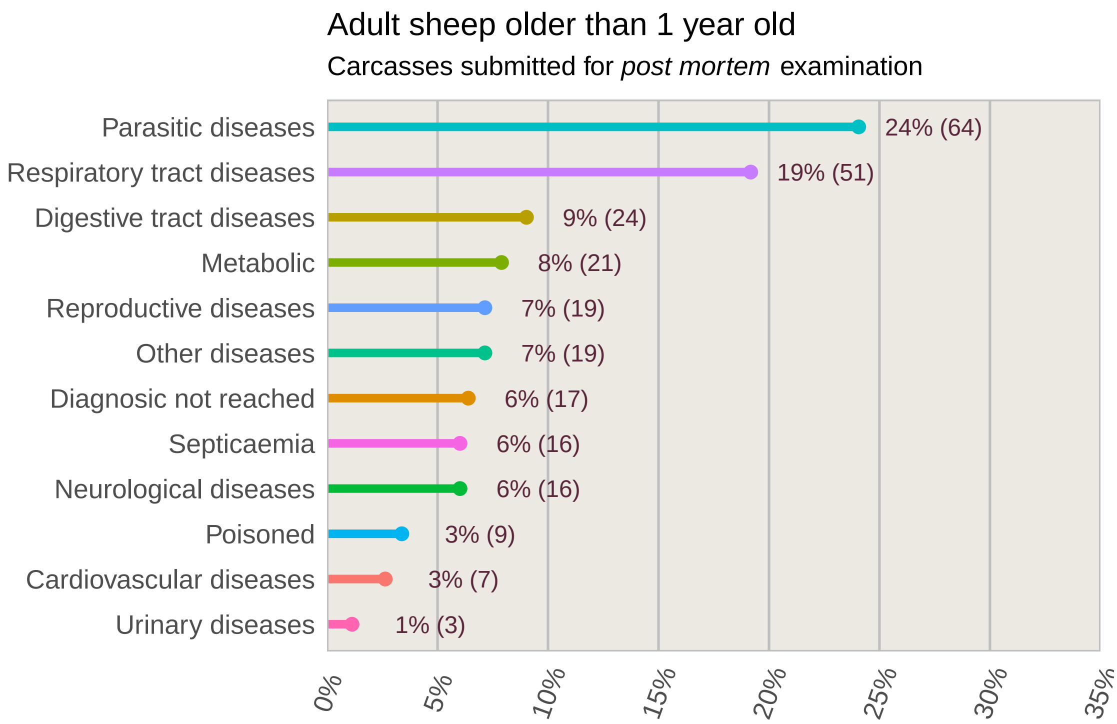

Figure 29.2.: Relative frequency of the different aetiological agents identified in cases of parasitic disease of small ruminants over 12 month of age diagnosed during *post mortem* by AFBI in 2024 (n=266). The absolute number of cases is between brackets.

29.3. Sheep aged over 12 months.

In 2024 parasitic diseases accounted for the most frequently recorded cause of deaths in submissions from sheep aged over 12 months; 45 *per cent* of these were due to parasitic gastroenteritis, and 40 *per cent* were due to acute, subacute or chronic fasciolosis. Six *per cent* of parasitic disease diagnoses were due to *Haemonchus contor-*

tus. More detailed consideration of ovine parasitic disease, found at AFBI, is available in the Section 31 of this report.

Respiratory disease has consistently been an important cause of mortality in this age category; Similarly to lambs aged up to 12 months, pneumonia due to *Mannheimia haemolytica* was the most commonly recorded bacterial cause of respiratory disease (22 *per cent*). Accounting for 30 *per cent* of the recorded respiratory disease diagnoses was Ovine Pulmonary Adenocarcinoma (OPA, Jaagsiekte).

OPA, considered one of the sheep *iceberg diseases*, a group of chronic infectious diseases with an insidious course resulting in significant effects on flock productivity and animal health and welfare, is a contagious lung tumour of sheep caused by *Jaagsiekte* sheep retrovirus. In infected sheep, normal lung tissue is replaced by tumour cells, which produce large amounts of fluid resulting in significantly reduced lung function and chronic weight loss and wasting. The incubation period can be many months to years, and clinical disease is often not seen until ewes are 3–4 years old, during which time spread is likely to be occurring. The disease is common, but likely to be under-diagnosed as few sheep deaths are investigated. Definitive diagnosis is through *post mortem* examination and histopathology; sheep do not make an appreciable antibody response so serological diagnosis is not possible. Currently ultrasound scanning of the lungs to detect early changes associated with tumour growth is the best option for early diagnosis and can be used in conjunction with a routine cull ewe *post mortem* screen to establish the presence of the disease in a flock and individuals. Given the highly infectious nature of the disease and quite rapid spread within affected flocks' close attention to the possibility of the presence of the disease in flocks is necessary and a flock health planning approach is often the most successful way of first raising awareness and allowing early intervention.

Digestive tract disease accounted for 9 *per cent* of recorded diagnoses in adult sheep, and this category includes acidosis (25 *per cent*), torsion (33 *per cent*), dosing gun injuries (12.5 *per cent*) and Johne's Disease (8 *per cent*). Metabolic disease, including pregnancy toxaemia and fatty liver, and hypocalcaemia accounted for 7.9 *per cent* of diagnoses in adult sheep.

30. Ovine Abortion, AFBI

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In 2024 a total of 141 cases of abortion and stillbirth were investigated by AFBI; this represents a fall in the number of submissions from 2023 (159 submissions), however as in previous years, *Chlamydia abortus* (35 cases, 27.8 *per cent*) and *Toxoplasma gondii* (27 cases, 21.4 *per cent*) were the most frequently detected pathogens; other less frequently diagnosed causes included *Listeria monocytogenes* (10 cases, 7.9 *per cent*), *Campylobacter* spp. (7 cases, 7.6 *per cent*), *E Coli* (6 cases, 4.8*per cent*) and *Trueperella pyogenes* (4 cases, 3.2 *per cent*). In two cases, Schmallenberg virus was detected. This is the first time that this virus has been diagnosed as a cause of abortion in sheep in Northern Ireland since 2018; in the first case the lamb was born with arthrogryposis into a flock which had had several lambs born with similar limb deformities. In 27 cases (21.4 *per cent*), no infectious agent was identified.

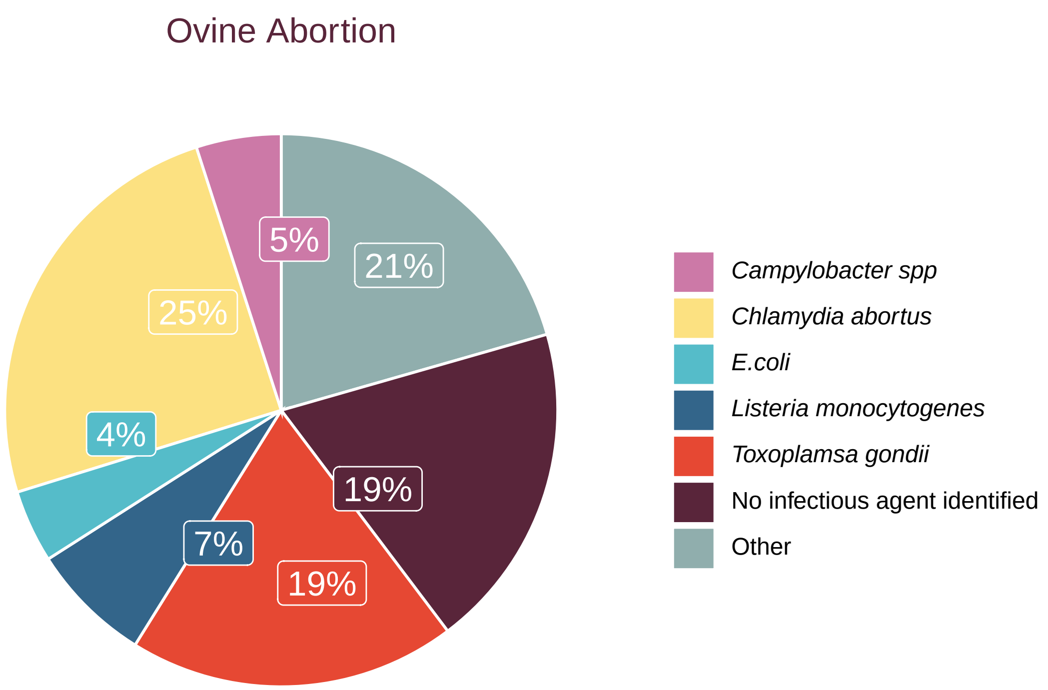

Figure 30.1.: Relative frequency of the identified infectious agents of ovine abortion from submitted foetal *post mortems* in 2024 (n= 141). Note: Categories with 5 or fewer cases have been included in the 'Other' category. The absolute number of cases is between brackets.

Investigation of abortion in a flock is warranted when the abortion rate exceeds two *per cent*, and to maximise the diagnostic outcome, the submission should include the foetus, placenta and maternal blood sample. In an outbreak situation further submissions may be required, as more than one agent may be involved. All aborted sheep should be isolated and aborted material destroyed, and the zoonotic potential of many of the agents that cause abortion in sheep must be acknowledged, with particular risk posed to pregnant women, who should avoid all contact with lambing sheep and the clothing of those handling them.

Table 30.1.: Relative frequency of the identified infectious agents of ovine abortion from submitted foetal *post mortems* in 2024 (n= 141).

Diagnoses	No. of cases	Percentage
Chlamydia abortus	35	**24.8**
No infectious agent identified	27	**19.1**
Toxoplamsa gondii	27	**19.1**
Listeria monocytogenes	10	**7.1**
Campylobacter spp	7	**5.0**
E.coli	6	**4.3**
Mummified foetus	5	**3.5**
Trueperella pyogenes	4	**2.8**
Foetal abnormalities	4	**2.8**
Leptospirosis	3	**2.1**
Disease not listed	3	**2.1**
Staphylococcus species	2	**1.4**
Schmallenberg	2	**1.4**
Emphysematous foetus	2	**1.4**
Streptococcus species	1	**0.7**
Salmonella Dublin	1	**0.7**
Fungal	1	**0.7**
Dystocia	1	**0.7**

30.1. *Chlamydia abortus*

Chlamydia abortus is the agent responsible for Enzootic Abortion of Ewes (EAE). Infection of susceptible sheep is through contact with infected vaginal discharges and aborted material, and abortion often does not occur in the current pregnancy but frequently remains latent until the subsequent pregnancy when abortion occurs. Infected sheep are usually not sick and will abort fresh dead or weak live lambs during the last three weeks of gestation. Ewes that have aborted or delivered full term dead or weak live lambs should be isolated, and ewe lambs should not be fostered onto aborted ewes as these may become infected and subsequently abort. Effective vaccination is available, and all replacement ewes should be vaccinated at least four weeks prior to mating.

In some flocks control of EAE is attempted by the prophylactic use of long acting oxytetracycline during the pre-lambing period. Whilst useful in the face of an outbreak or abortion storm, this method has limitations for routine control and serves to increase antibiotic usage in a way that is difficult to justify.

30.2. *Toxoplasma gondii*

Infection of susceptible sheep with *Toxoplasma gondii* occurs through ingestion of infected cat faeces, often in contaminated feed or bedding, and outcomes depend on when in gestation infection occurs; infection in early pregnancy may result in early embryo loss and increased return to service or increased barren rate; infection in mid pregnancy results in abortion or birth of weak live lambs near term, frequently alongside a mummified foetus.

Diagnosis is by histopathology of foetal tissues, particularly brain, and foetal serology, if sampled prior to receiving colostrum. Blood sampling of the ewe alone is not sufficient as a positive result merely indicates past infection not that the current abortion is due to toxoplasmosis.

Effective vaccination is available and should be administered 4 weeks prior to breeding.

31. Ovine Parasites, AFBI

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Parasitic gastroenteritis

The nematode parasites mainly responsible for causing parasitic gastroenteritis in sheep in Northern Ireland are *Teladorsagia circumcincta*, *Trichostrongylus* spp., *Cooperia* spp. (all of which produce trichostrongyle-type eggs) and, in young lambs, *Nematodirus battus*. Faecal samples from sheep are examined in the Parasitology laboratory, AFBI, for trichostrongyle eggs, *Nematodirus* eggs, and for coccidial oocysts (Figure 31.1).

Figure 31.1.: *Nematodirus* eggs (A), trichostrongyle egg (B) and coccidian oocyst (C) in a faecal sample. Photo: Bob Hanna.

The number of trichostrongyle eggs detected is consistently higher in sheep when compared to cattle (Figure 31.2 and Figure 26.1). There may be several reasons for this, such as inherent resistance, age profile of the animals sampled, type of pasture grazed and the fact that it is more common for sheep to be out wintered than cattle. Further, the number of ovine samples tested each year is smaller than the number of bovine samples. It is likely that sheep farmers are more selective in the submission of samples, which therefore are more likely to contain worm eggs. However, the data may also point towards a greater focus on parasite control in cattle herds and suggests that this is an area which requires further attention amongst sheep producers.

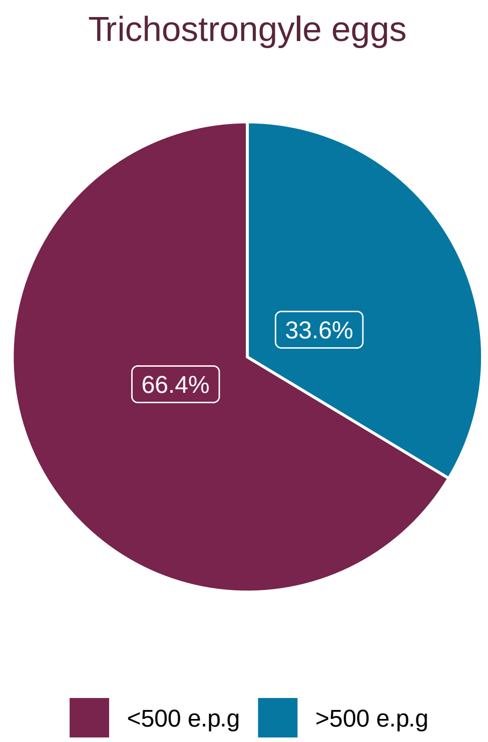


Figure 31.2.: Relative frequency of detection of Trichostrongyle eggs in ovine faecal samples examined by AFBI in 2024 (n=779).

The per centage of ovine samples containing ≥500 trichostrongyle eggs per gram, which increased from 28.0 *per cent* in 2021 to 32.3 *per cent* in 2022, and showed a further increase to 34.9 *per cent* in 2023, declined slightly in 2024 to 33.6 *per cent* (number of samples examined, n=779; Figure 31.2). Peak faecal egg counts (FECs) occurred in late summer and autumn (corresponding to parasitic gastroenteritis in lambs at pasture). It has been found that the rates of diagnosis for *Teladorsagia* and *Trichostrongylus* are tending towards a uniform year-round distribution, suggesting consistent levels of larval survival throughout the year, with extension of the traditionally expected seasonal windows of transmission. Changes in the temporal and spatial distribution pattern of nematode parasites that cause parasitic gastroenteritis in sheep can be related to recent changes in local temperature and rainfall, with year-on-year prolongation of conditions suitable for worm egg and larval development and enhanced over-winter survival of infective larvae.

Anthelmintic resistance testing throughout the province has indicated that worm resistance to benzimidazoles, levamisole, avermectins and milbemycin is 81 *per cent*, 14 *per cent*, 50 *per cent* and 62 *per cent*, respectively, amongst sheep flocks tested, with *Trichostrongylus* the most resistant worm genus. As yet, no significant resistance has been recorded against the newer anthelmintic categories, the amino-acetonitriles (orange drenches) and the spiroindoles (purple drenches). On particular farms, the resistance status of nematode populations in groups of sheep can be determined by submission of ten individual faecal samples prior to treatment (pre-treatment samples) followed by a further ten individual samples (ideally from the same sheep) at a pre-determined period after anthelmintic treatment (post-treatment samples). Comparison of FECs in the pre- and post-treatment samples will enable determination of anthelmintic efficacy. Advice on sample submission and interpretation of findings is available from the Parasitology laboratory, AFBI.

Farmers' responses to questions relating to the management of emerging anthelmintic resistance on their premises have revealed that the published SCOPS guidelines have not been widely adopted in practice, and that there is a need for improved stockholder education and closer interaction with informed veterinary practitioners, sheep advisers and laboratory staff. The latest edition of the SCOPS (Sustainable Control of Parasites in Sheep) guidelines is accessible here[1].

[1] https://www.scops.org.uk

Nematodirus

Nematodirosis can be a significant cause of diarrhoea in sheep, particularly in young lambs. Development to the *L3* larval stage takes place within the egg, and in the case of *Nematodirus battus* (the most significant species seen in Ireland), a prolonged cold period is usually required before hatching from the egg occurs. It is common therefore that large numbers of *L3* larvae appear in April, May and June on those pastures where lambs have grazed the previous year. When lambs are weaned and are beginning to eat more grass, these *L3* larvae are ingested (Figure 31.4) If enough larvae are taken in, severe clinical disease can result. Faecal egg counts of more than 200 characteristic *Nematodirus* eggs per gram are considered clinically significant in sheep, and in late spring and early summer, deaths of lambs due to enteritis are common.

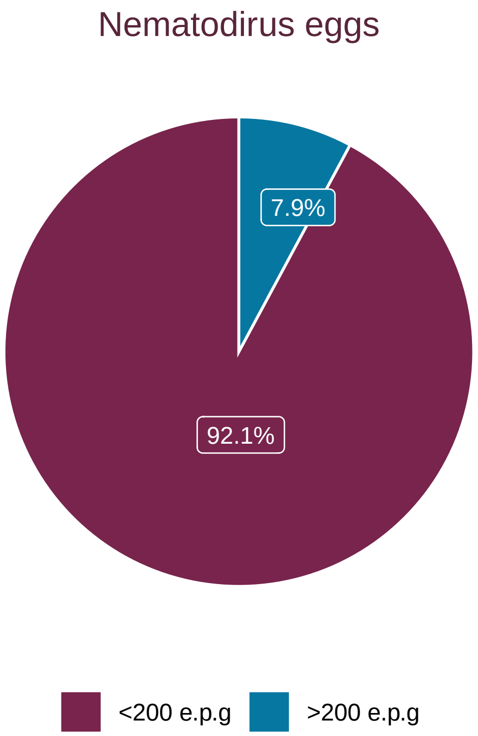


Figure 31.3.: Relative frequency of detection of *Nematodirus* eggs in ovine faecal samples examined by AFBI in 2024 (n=777).

It is advisable that any carcases are submitted to VSD for *post-mortem* examination to determine if the cause of enteritis is nematodirosis, other nematode infection, coccidiosis or bacterial infection, since this information is necessary to inform appropriate treatment. Of 777 faecal samples examined for *Nematodirus* eggs in 2024, 7.9 *per cent* were found to contain ≥200 epg (Figure 31.3), an increase on the levels recorded in 2023 (6.3 *per cent*), and approaching the levels found in 2022 (8.7 *per cent*) and 2021 (9.0 *per cent*). The levels recorded in recent years are markedly higher than the level recorded in 2019 (4.6 *per cent*), and there may be a trend towards earlier emergence of *L3* larvae on pasture, coinciding with warmer spring conditions.

A limited study has revealed that in Northern Ireland, anthelmintic resistance in *Nematodirus battus* populations to benzimidazoles, levamisole, avermectins and moxidection is present in, respectively, 36*per cent*, 50 *per cent*, 33 *per cent* and 75 *per cent* of flocks tested. Benzimidazole administration, on a therapeutic or prophylactic basis, remains the preferred treatment option, and the timing of dosing is guided by annual prediction of the peak egg hatching period, calculated by AFBI parasitologists using climatic data. In recent years, a trend is emerging for a second autumnal peak in *Nematodirus battus* infection in sheep. The reason for this appears to be flexibility in the hatching behaviour of the eggs, with a significant proportion hatching in autumn, in response to climatic change.

Figure 31.4.: *L3* larva of *Nematodirus*. Photo: Bob Hanna.

Haemonchus

Haemonchosis is an important gastrointestinal worm infection of sheep and goats in regions where conditions of high humidity coincide with high temperature. The larvae of *Haemonchus contortus* (*Barber's pole worm*) hatch and mature in faeces on the ground before migrating to fresh grass for intake by grazing animals. This migration requires warm moist conditions, and the larvae are quite susceptible to desiccation and low temperatures. In the British Isles, outbreaks of haemonchosis may occur in the summer months if rainfall is sufficient to enable the larvae to survive on pasture. Most cases are reported from the south, and the disease is only occasionally reported in Northern Ireland. However, global warming could mean that the incidence of haemonchosis might increase here.

In 2023, following the particularly wet conditions of mid-summer, an unusual increase in the number of cases of *Haemonchus* diagnosed by abomasal worm counts was noted (14 cases), and the trend continued in 2024 (20 cases). Prior to 2023, the maximum number of *Haemonchus* cases recorded in a single year was 5 in 2021. Typically, dead lambs submitted for *post mortem* examination showed signs of severe scour, often with fly-strike, and invariably there was severe anaemia. Indeed, clinical diagnosis of haemonchosis in the field relies on the observation of very pale mucous membranes, including the conjunctivae of the eyes. Faecal egg counts on samples submitted to the laboratory from flocks where haemonchosis is suspected show high levels of strongyle-type eggs. However, since strongyle eggs cannot easily be differentiated on a species basis, these counts represent the combined output of *Cooperia*, *Haemonchus* and *Ostertagia/Telodorsagia* infections. If worms persist in lambs, particularly after dosing with benzimidazole (*white drench*), anthelmintic resistance may be an issue on the premises, and administration of moxidectin, together with an iron-containing tonic, may be advisable. The main risk for lambs in the next grazing season is from hypobiotic larvae that may remain in the replacement stock reared this year. Early-season anthelmintic dosing of replacement stock can help to reduce the risk of pasture contamination for naïve lambs, while careful attention to quarantine and dosing of bought-in stock is essential.

Coccidiosis

In 2024, as in previous years, coccidial oocysts were detected more frequently in sheep than in cattle faeces samples. Of the sheep samples examined in 2024, 68.0 *per cent* (n=778) were positive for oocysts (compared to 65.4 *per cent* in 2023, 68.8 *per cent* in 2022, 63.0*per cent* in 2021 and 69.2*per cent* in 2020), but only 32.0 *per cent* exhibited moderate or high levels (Figure 31.5). However, as with infections in cattle, the oocyst count may not accurately reflect the pathological significance of the infection because the peak of shedding may have passed before samples were collected, and because there is variation in the pathogenicity of the various species of *Eimeria* involved.

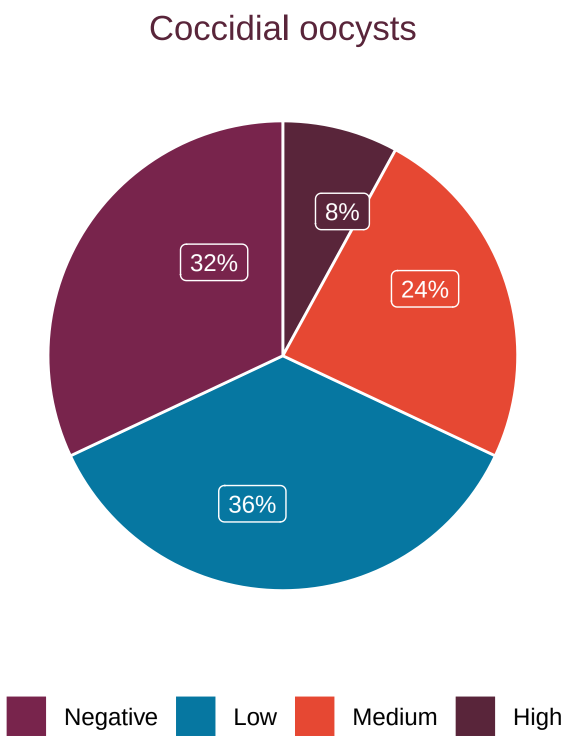


Figure 31.5.: Results for ovine faecal samples tested for coccidial oocysts during 2024 (n=778).

Coccidiosis is an insidious disease and is frequently associated with poor thrive in lambs and calves as well as with more serious clinical disease. In sheep, the important pathogenic coccidians in Northern Ireland are *E. crandallis* and *E. ovinoidalis*. As in calves, infection can cause severe diarrhoea, often with blood, and the caecum and colon are the main parts of the intestine affected. If the animals recover, chronic damage to the intestine can lead to malabsorption problems later, with associated failure to thrive. During the acute phase of the disease the integrity of the intestinal lining is disrupted (Figure 31.6), and deaths may result from septicaemia caused by ingress of bacteria through the damaged intestine wall.

Lambs are usually affected between four and seven weeks of age, and outbreaks of disease are usually associated with intensive housing or grazing of ewes and lambs in unhygienic and wet conditions. Adult sheep, especially ewes in the periparturient period, often shed low numbers of oocysts, and these can be the primary source of infection for lambs, although oocysts on the pasture can survive over-winter and infect naive animals in springtime. Feeding of concentrates in stationary troughs around which high concentrations of oocysts build up, can be a precipitating factor.

Prevention of coccidiosis in sheep, as in cattle, is based on good management practices, in particular the avoidance of wet underfoot conditions in houses and at pasture. Food troughs and water containers need to be moved regularly to avoid local build-up of oocyst numbers, and bedding should be kept dry. Avoidance of stress, especially due to overcrowding, is important for prevention of coccidiosis in young animals, and adequate uptake of colostral antibodies will also help prevent overwhelming coccidial infection. Lambs with severe scouring will need supportive rehydration. It is always advisable to avoid grazing young and older lambs together, and if possible young lambs should not be grazed on pasture that has carried ewes and lambs in the past 2–3 weeks.

While prophylactic treatment of ewes around the lambing period with anticoccidial drugs such as toltrazuril or decoquinate can help reduce pasture contamination by oocysts, it should be remembered that the promotion of natural immunity in young animals needs to be safeguarded by strategic dosing and by the choice of a product that controls disease while permitting development of immunity. The timing of treatment of lambs should be adjusted depending on the management practice (indoor, outdoor, pasture etc.) and the history of disease occurrence in previous years. Treatment is usually given to lambs as soon as diarrhoea is seen in several individuals. If it is delayed until most lambs are affected, recovery time can be prolonged due to intestinal damage.

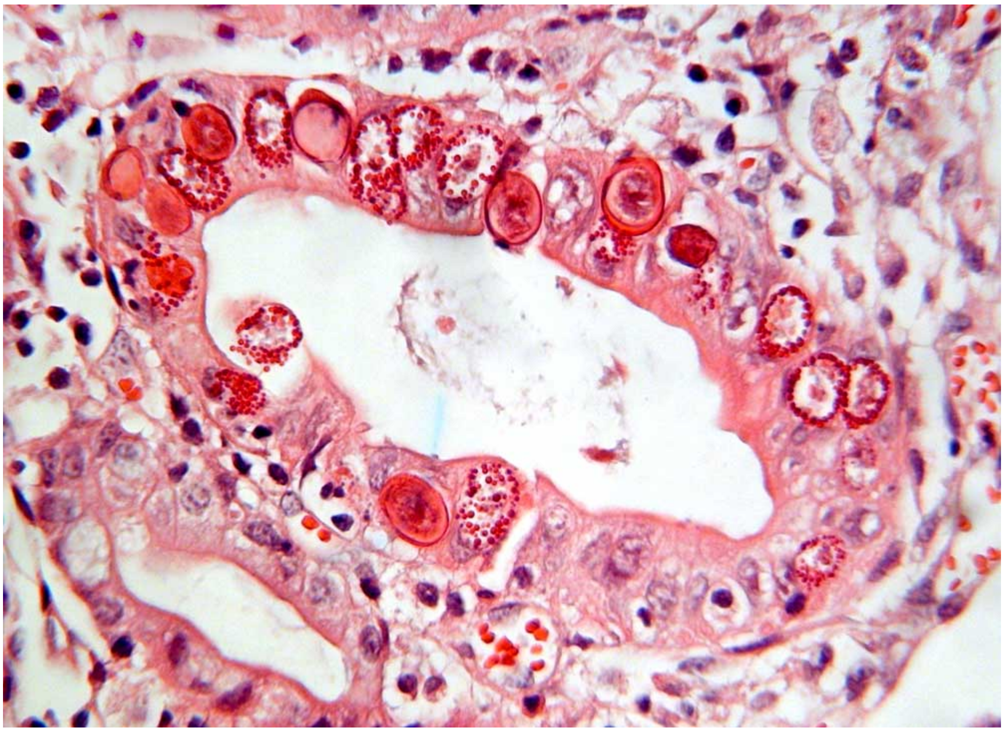


Figure 31.6.: Histopathology section of coccidiosis in the gut wall of a lamb. Photo: Bob Hanna.

Liver fluke and Rumen Fluke

In the ovine faecal samples examined in 2024, rumen fluke eggs and liver fluke eggs were detected in 28.1 *per cent* and 12.8 *per cent* respectively of 690 faecal samples examined (Figure 31.7 (a) and (b)). The per centage with liver fluke eggs detected therefore, while showing a significant increase on the figure for 2023 (7.8 *per cent*), remained less than the figure for 2022 (19.5 *per cent*) and 2020 (17.1 *per cent*). The percentage of faecal samples positive for rumen fluke eggs in 2024 (28.1 *per cent*) also showed an increase on the figure for 2023 (24.3 *per cent*), and continued an increasing trend compared to the figures recorded in 2022 (20.2 *per cent*), 2021 (26.0 *per cent*) and 2020 (24.1 *per cent*). Bearing in mind that the molluscan intermediate host (*Galba truncatula*) is the same for both types of fluke, the perceived decrease in liver fluke incidence compared to rumen fluke incidence is difficult to explain. It is likely that the findings may reflect local climatic differences or changes in stockholder behaviour in sample submission between 2020 and 2024. The possibility of intra-molluscan competitive effects between liver fluke and rumen fluke larval stages has yet to be researched fully. There is increased awareness of triclabendazole resistance in flukes in Northern Ireland, resulting in a shift towards control of F. hepatica by use of alternative products (containing for example closantel) to kill adult fluke in sheep and cattle in late winter and early spring. Of the available drugs, only oxyclozanide has proven efficacy against rumen fluke.

Liver fluke disease can occur in either acute or chronic forms. The acute form occurs in sheep in the autumn and early winter of those years when the climatic conditions from April to September have favoured the breeding and resulting population expansion of the intermediate host. Disease is caused by the migration of large numbers of immature flukes through the liver, frequently resulting in fatal haemorrhage (Figure 31.8a).

Chronic liver fluke disease is more common than the acute form and occurs in both sheep and cattle, usually during the winter and spring, although infection can persist throughout the year (Figure 31.8b). Chronic fluke infection can cause a reduction of 30 *per cent* in the growth of fattening animals and can also predispose to metabolic conditions and infectious diseases such as salmonellosis and clostridial infection. Cattle and sheep in fluke-affected areas should be fully vaccinated against clostridial disease.

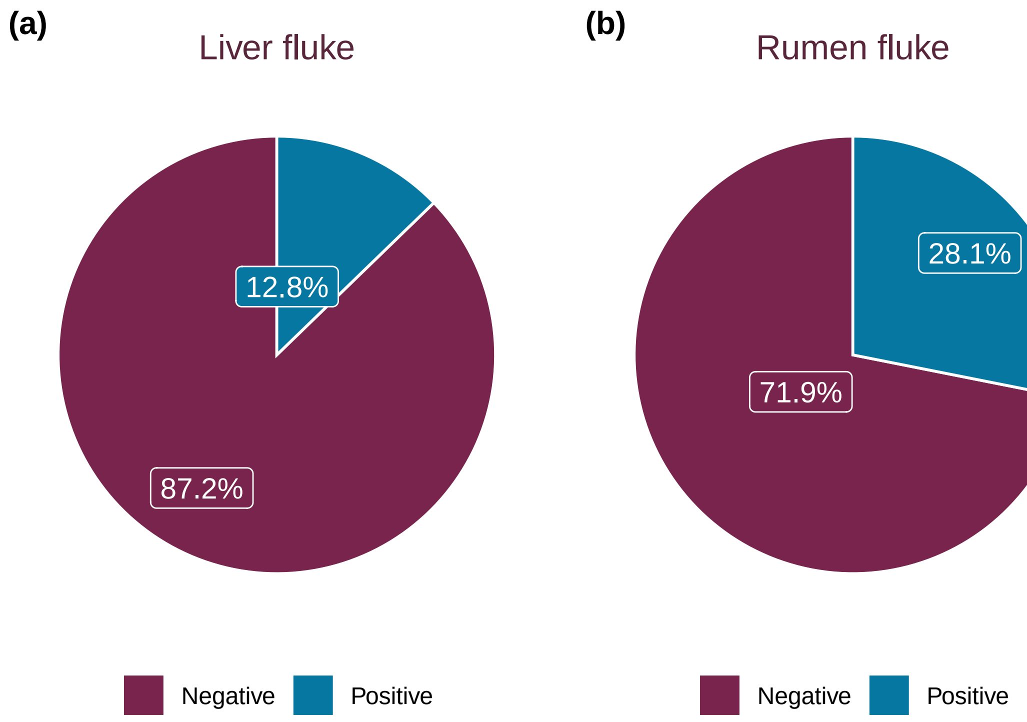
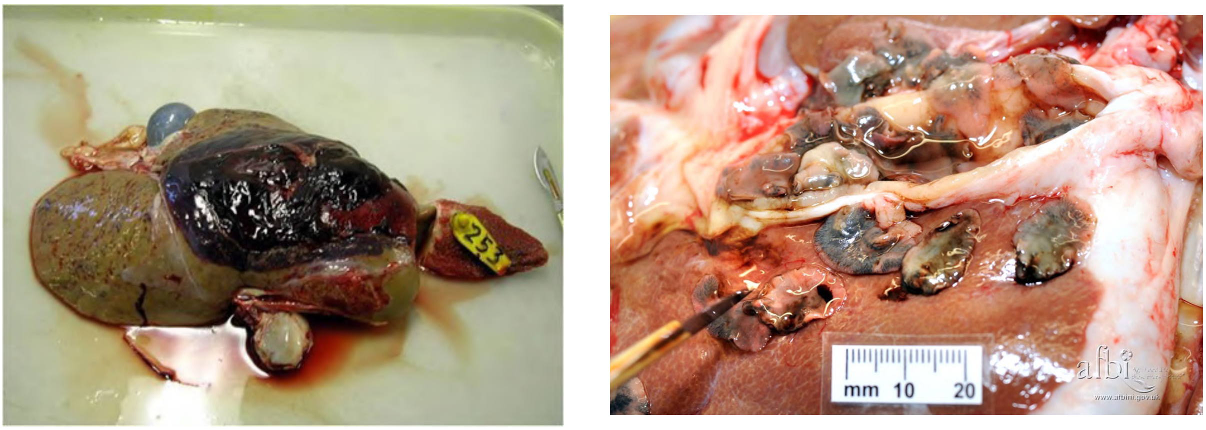


Figure 31.7.: Relative frequency of detection of (a) liver fluke eggs (n=690) and (b) rumen fluke eggs (n=690) in ovine faecal samples examined by AFBI in 2024.



(a) Liver haemorrhages

(b) Adult liver fluke

Figure 31.8.: Liver haemorrhage in acute fasciolosis (a). Adult liver fluke in the main bile duct of a sheep (b). Photos: Bob Hanna.

All sheep farmers should review their fluke control measures in autumn. Access to snail habitats (wet and poorly drained areas) should be reduced or sheep taken off the potentially infected land and housed or moved to new clean pasture. However, in most cases, control will be based on the strategic use of anthelmintics, employing a product effective against the life cycle stages likely to be present in the flock or herd at the time of treatment.

Resistance to fluke treatments is a continuing problem in Northern Ireland. On some premises, products containing triclabendazole (the only flukicide currently licensed in UK and Ireland that is effective against the immature stages of liver fluke) have been used almost exclusively for many years. On such farms it is likely that triclabendazole-containing products will now be less effective in controlling fluke infection, and for treating acutely ill animals. The effectiveness of anthelmintic treatment on individual farms can be checked by taking dung samples three weeks after treatment, from approximately ten animals in each affected group, and submitting them for laboratory examination. Further information is available from the Parasitology laboratory, AFBI.

Treatment of chronic (adult) infections in cattle as well as sheep during the winter and/or early spring is important to help reduce pasture contamination with fluke eggs, and this is particularly relevant if triclabendazole is no longer effective in controlling fasciolosis on the premises. Use of an anthelmintic with activity mainly against adult flukes (closantel, nitroxynil, albendazole, oxyclozanide) is likely to be appropriate in these circumstances. However, the flukicide programme used must be on a 'know-your-farm' basis and no one set of recommendations will cover all flocks or herds.

Adult rumen flukes are less damaging to sheep and cattle than liver flukes, but heavy infections of immature worms may cause diarrhoea, ill-thrift and, exceptionally, death in young animals. Heavy burdens of adult rumen flukes have been reported to result in poor productivity in dairy or meat-producing animals, but few scientific studies have been completed. Liver flukes, particularly in acute infections, are potentially a much more serious risk to the welfare and productivity of sheep than rumen flukes, and the choice of which flukicides to use must reflect this. Oxyclozanide is the only locally available flukicide with proven efficacy against immature and adult rumen flukes, but treatment should be first aimed with liver fluke in mind and only then, if need be, for rumen fluke.

Further information on fluke disease in cattle and sheep may be found on the AFBI website[2].

[2] www.afbini.gov.uk

32. Porcine and Avian Diseases, AFBI

Note

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32.1. Porcine disease

The total pig numbers recorded in the June 2024 Agricultural census was 692,091 a decrease of one *per cent* from June 2023. DAERA, Department of Agriculture, Environment and Rural Affairs[1]. A small number of highly productive businesses make up a large proportion of the Northern Ireland pig industry. Whilst most of the pig medicine is carried out by a few specialist pig veterinarians there are also many pigs kept on smaller holdings as farm pigs or even as pets and these animals may be seen by any veterinary practice. Septicaemia and neurological diseases made up the majority of conditions diagnosed in pig submissions for *post mortem*.

Bacterial infections due to *Streptococcus spp.*, *E. coli and* Salmonella* species were common diagnoses. Neurological conditions were predominantly due to suppurative meningitis, particularly of young pigs. Neonatal bacterial suppurative meningitis (NBSM) is an important clinical entity in pigs with *Streptococcus suis* commonly isolated. Most pigs carry *Streptococcus suis* in their upper respiratory tract and development of bacteraemia will depend on several factors including the virulence of the strain present, stress factors such as high stocking density and mixing of groups and concurrent infections and diseases.

African Swine Fever Alert

African Swine Fever Alert: African Swine Fever (ASF) is a highly contagious viral disease of pigs which can cause a high mortality rate. It is a notifiable epizootic disease. African Swine Fever is spreading in Europe and all those involved in pig production should be aware of the disease and their role in preventing its spread. Anyone who suspects ASF must immediately alert DAERA. Further information on ASF is available on the DAERA website[a].
DAERA also has an epizootic hotline available: **0300 200 7840**.

[a] https://www.daera-ni.gov.uk/

32.2. Case Reports

Mulberry Heart Disease

Lesions suggestive of vitamin E/selenium deficiency were detected in a 12-15-week-old female piglet presented following sudden death. Gross *post mortem* examination revealed multiple to coalescing foci containing central haemorrhage circumcised by a white border in the left ventricular myocardium. There was also evidence of an umbilical abscess. Histology of the heart revealed severe myocardial degeneration and necrosis, mild lymphohistiocytic myocarditis, myocardial mineralisation and haemorrhage. This is also known as Mulberry heart and is

[1] https://www.daera-ni.gov.uk/publications/agricultural-census-northern-ireland-2024

often a disease of young fast-growing pigs with a dietary deficiency which can be related to low protein, excess selenium antagonists, or the presence of vitamin A or mycotoxins.

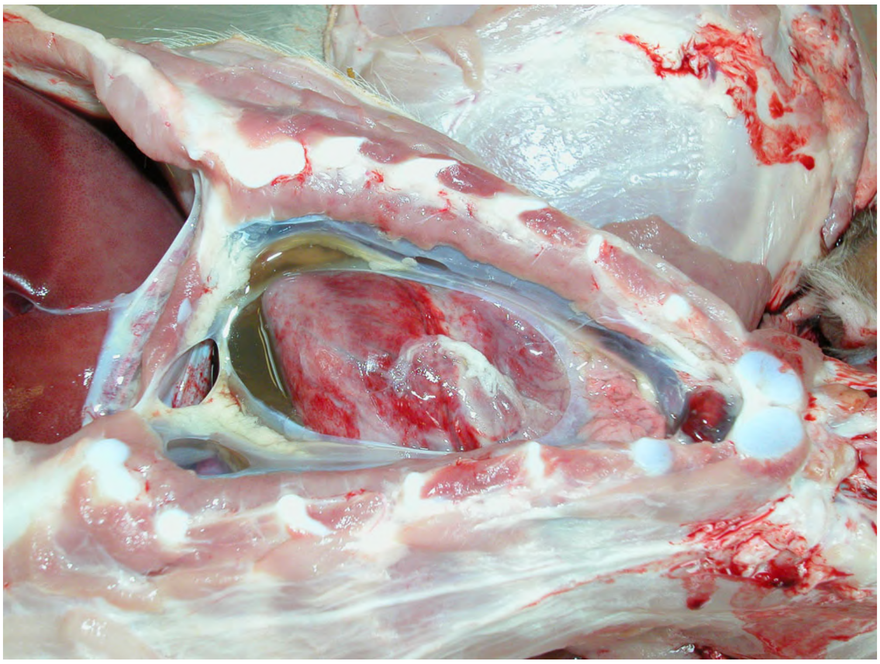

Figure 32.1.: A case of Mulberry heart disease in a pig. Photo: Séan Fee.

Vegetative endocarditis due to *Streptococcus suis*.

A four-month-old pig was submitted for *post mortem* following sudden death. On *post mortem* examination a severe endocarditis of the pulmonary valve was evident resulting in narrowing of the lumen. A haemopericardium and an ascites was also present. *Streptococcus suis* was cultured at a high level throughout the carcase, including from the affected valve.

32.3. Avian Disease

AFBI receives avian submissions every year not only from commercial and backyard farms for disease diagnosis, but also from the PSNI for the investigation of wildlife crime as well as submissions from the Department of Agriculture, Environment and Rural Affairs (DAERA) for the investigation of notifiable and epizootic disease in domestic and wild birds.

Bird Flu Alert

Avian Influenza is a notifiable disease. Poultry keepers (including backyard poultry, game birds and pets) should remain vigilant for any signs of the disease in their animals. If a notifiable disease is suspected in a domestic or wild bird contact the DAERA Helpline on **0300 200 7840** or your local DAERA Direct Regional Office. Failure to do so is an offence.
More information can be found in the DAERA website[a].

[a] https://www.daera-ni.gov.uk/ai

Submissions consist of either single carcases, batches of up to six birds from a flock or diagnostic samples such as faeces or swabs taken on farm by private practitioners or DAERA vets. Total poultry numbers on farms in June 2024 decreased by eight *per cent* from 2023 levels with 23.7 million birds recorded. Total number of laying birds saw an increase of four *per cent* whilst broiler numbers decreased by 14 *per cent* and other poultry decreased by 21 *per cent* compared to June 2023. (DAERA Agricultural census of Northern Ireland 2024).

Whilst most of the commercial poultry medicine is carried out by a few specialist poultry veterinarians there are also many birds kept in backyard flocks and these animals may be seen by any veterinary practice.

32.4. Case Reports

Red mite infestation

Sudden deaths in laying hens occurred and three birds were submitted for examination. All three carcases had numerous mites present amongst the feathers, especially under the wings and along the back. There were numerous live mites (identified as *Dermanyssus gallinae*) present in the transport bags. The birds, which were in-lay, were anaemic and rather dehydrated.

Erysipelas infection

Six hens near the end of their lay were submitted for *post mortem* following a mortality rate of six to eight hens per day. There were no findings of significance on gross *post mortem*, but bacteriology identified *Erysipelothrix rhusiopathiae* in a septicaemic pattern in all birds. Histology confirmed a severe bacterial septicaemia with evidence of fibrinoid necrosis in the spleen with intralesional bacteria and lesions associated with a bacterial septicaemia in the lung and liver. *E. rhusiopathiae* is a bacterium that can live in the environment for long periods and infects birds through breaks in the skin, across mucous membranes or by mechanical vectors. Birds can act as a carrier and shed it in faeces or nasal/oral secretions and other animals such as rodents can also be involved in the spread of infection to poultry.

Histomoniasis

Seven laying hens were submitted from a commercial poultry farm with an ongoing mortality. On *post mortem* examination dry, inspissated caecal cores with thickening of the caecal wall were present in four of the birds and three of these birds had circular pale or red target like lesions of the liver. Histology of the caecal lesions showed that extensively the mucosa was effaced by debris and fibrin and where remnants of mucosa remained the lamina propria was expanded by a chronic inflammatory cell infiltrate with inflammatory cells infiltrating the submucosa and intermuscular connective tissue of the muscularis. Histology of the liver showed coalescing areas of parenchymal necrosis, with occasional lacunae containing pale eosinophilic structures. The gross findings and the accompanying histopathological changes are consistent with Histomoniasis infection, also known as Blackhead. Histomoniasis is a parasitic disease caused by the protozoan *Histomonas meleagridis*. Transmission occurs via ingestion of eggs of the caecal worm *Heterakis gallinarium* containing the *H. meleagridis* protozoa or by ingestion of earthworms containing *Heterakis* eggs. Histomoniasis can cause disease in most gallinaceous birds such as chickens, turkeys and partridges with turkeys very susceptible to the disease where mortality rates in outbreaks can reach 100 *per cent*.

Botulism outbreak

A botulism outbreak occurred in a free-range flock of commercial laying hens. Affected hens were dull and lethargic. Some were unable to stand and exhibited progressive flaccid paralysis, particularly of the head and neck. They exhibited lateral or sternal recumbency (Figure 32.2) and sat with their beak between the slats. Their vents were soiled with green diarrhoea and their eyes were closed. They had ruffled feathers that easily epilated when lifted. They exhibited a 'limberneck'. *Post mortem* examination of five birds revealed that one bird (Bird A) had a perforated gizzard. No significant gross abnormalities were detected in any of the other four birds. This, along with the presenting clinical signs alerted veterinary investigators to test samples for botulism. Group III botulinum neurotoxins were detected by a monoclonal antibody-based ELISA in a pooled serum sample and in one of the caecal samples. Gastrointestinal tract samples and environmental samples tested positive by ELISA for Group

III botulinum neurotoxins following culture indicating the presence of *Clostridium botulinum* Group III spores. Although rare in layers, botulism should be considered whenever a clinical picture of progressive flaccid paralysis is present without gross contributing findings. Serum taken from live birds showing clinical signs is the preferred diagnostic sample. In cases of botulism, it can be difficult to identify the source of *Clostridium botulinum* spores or toxins responsible for an outbreak. Ingestion of preformed toxin by cannibalisation of carcases can occur, as well as toxicoinfection associated with the caecal colonisation of *C. botulinum* and in situ production of botulinum neurotoxins. Prompt investigation to determine toxin type is necessary to determine if there is any risk to public health. Botulism is not a notifiable disease in Northern Ireland, and no statutory action is taken in confirmed or suspected cases of botulism. Cases of group III (*types C* and *D*) botulism neurotoxicity are very rare in people, with only 15 cases or suspected cases of botulism *type C* and one outbreak of botulism *type D* reported. However, due to the severity of this disease, voluntary measures were put in place by the farmers to prevent potential sources of food chain contamination. Dirty eggs were withheld from the food chain. As the birds were near the end of lay, the flock was culled three weeks after the last clinical case.

Figure 32.2.: Chicken infected by botulism in sternal recumbency and unable to rise. (photo supplied by on farm veterinarian).

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A. R packages

The analysis, construction of graphics and visualisation of data for this 2022 *All-Island Animal Disease Surveillance* report have been conducted by using the R programming language, R version 4.2.2 (2023-02-21) (R Core Team 2021), and Quarto[1] integrated development environment of Poxit](https://posit.co/).

Extensive use of the collection packages of the tidyverse universe[2] (Wickham et al. 2019,) and the LaTeX[3] systems were utilised in this report for formatting and typesetting the final HTML and LaTeX documents.

Most of the data analysis was carried out with the packages included in *tidyverse* (Wickham 2022b); the charts were plotted using the package *ggplot2* (Wickham 2016) and the tables constructed with *kableExtra* (Zhu 2021) and *finalfit* (Harrison, Drake, and Ots 2021).

Many other R packages and LaTeX packages were also used in the preparation and compilation of this report, for further information see the references above.

[1]https://quarto.org/
[2]https://joss.theoj.org/papers/10.21105/joss.01686
[3]https://www.latex-project.org/