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Inside this issue:

Honey bee pest and disease survey of Rēkohu/Wharekauri/Chatham Island, Rakiura/Stewart Island and Aotea/Great Barrier Island
Vehicles and machinery as a vector for arrival of exotic ants
Plant health surveillance and incursion investigation report





Surveillance

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Surveillance is published as the Ministry for Primary Industries' authoritative source of information on the ongoing biosecurity surveillance activity and the health status of New Zealand's animal and plant populations in both terrestrial and aquatic environments. It reports information of interest both locally and internationally and complements New Zealand's international reporting.

Contents

EDITORIAL

New Zealand's aquatic animal health surveillance system – national and international perspectives 3

ANIMALS

Reports from Ministry for Primary Industries

Honey bee pest and disease survey of Rēkohu/Wharekauri/Chatham Island, Rakiura/Stewart Island and Aotea/Great Barrier Island 4

Quarterly reports: January to March 2023

Quarterly report of investigations of suspected exotic diseases 7

Quarterly review of diagnostic cases 20

MARINE AND FRESHWATER

Reports from Ministry for Primary Industries

Quarterly reports: January to March 2023

Quarterly report of investigations of suspected exotic aquatic pests and diseases 33

PLANTS AND ENVIRONMENT

Report from Asure Quality

Vehicles and machinery as a vector for arrival of exotic ants 38

Reports from Ministry for Primary Industries

Quarterly reports: January to March 2023

Plant health surveillance and incursion investigation report 40

PEST WATCH 49



EDITORIAL

New Zealand's aquatic animal health surveillance system – national and international perspectives

New Zealand places significant importance on biosecurity: it helps protect our native flora and fauna, whenua and freshwater and marine environments, as well as our culture, livelihoods and health. A key component of all biosecurity systems is effective surveillance – strong surveillance systems underpin pest and disease prevention, early detection, emergency response and ongoing management.

New Zealand has a robust general surveillance system for both terrestrial and aquatic animals including a well-publicised hotline, sophisticated laboratory services and an established data management system. Our understanding of New Zealand's aquatic animal health status relies on the effectiveness of this general surveillance system.

MPI recently established a dedicated Aquatic Health team in the Biosecurity Surveillance and Incursion Investigation group, which works in close collaboration with the newly established Aquatic Animal Diseases team at the MPI Animal Health Laboratory, Wallaceville. A primary function of the Aquatic Health team is the management of New Zealand's general surveillance system for aquatic animals. A core role is responding to aquatic reports from the MPI exotic pest and disease hotline, including case and data management. Biosecurity New Zealand established its Surveillance Information Management System in 2014, bringing together our previous databases, and continues to amass a substantial dataset of information on the presence or absence of both exotic and endemic organisms. These data and other components of the general surveillance system underpin New Zealand's aquatic animal health knowledge and reporting.

In recognition of the growing importance of aquatic animal health and the need for a strategic approach to its management worldwide, the World Organisation for Animal Health (WOAH) developed the Aquatic Strategy 2021–2025, which addresses four objectives: standards, capacity building, resilience and leadership. WOAH is actively implementing this strategy, as demonstrated by its June 2023 regional training workshops. These workshops aim to help WOAH Delegates better understand their WOAH roles and responsibilities for terrestrial and aquatic animal health management, biosecurity, and disease emergency response and preparedness. At the Asia and the Pacific workshop on aquatic animal health, participants from New Zealand collaborated with WOAH National Focal Points for Aquatic Animals from over 30 countries in our region.

While the role of WOAH is setting international terrestrial and aquatic animal health standards, there are significant benefits to members from working collaboratively to discuss policies relating to animal health. For this reason, WOAH members from the United States, the United Kingdom, Canada, Australia and New Zealand recently joined to create an aquatic working group to help ensure the adoption of risk-based and scientifically justified standards that are both implementable and the least trade-restrictive.

MPI's Animal Health Laboratory is New Zealand's national reference veterinary laboratory, providing laboratory support for exotic and emerging disease investigations of both terrestrial and aquatic animals. It undertakes export testing, diagnostic research (including test validation and development) and provides diagnostic support for MPI's surveillance programmes. With the increasing interest in aquaculture and aquatic animal health comes increasing aquatic animal submissions to AHL and to New Zealand's network of private laboratories. In 2022, Biosecurity New Zealand established a 6-month pilot project (between spring 2022 and autumn 2023) to acquire anonymised data from aquatic animal submissions to private laboratories in New Zealand. This pilot will develop a better picture of the quantity and scope of all aquatic animal submissions, to aid in building a comprehensive national baseline of aquatic animal disease incidents.

This 6-month pilot mirrors the Animal Health Surveillance programme – an MPI programme which was established in 2003 and includes all production animals (for example, sheep and cattle). In that programme, MPI receives anonymised data from commercial veterinary laboratories every month. The data are analysed and have helped to identify changes from normal that could indicate a significant change in an endemic disease. We hope the aquatic pilot will mirror the success of its terrestrial counterpart. Our overall goal is to help identify opportunities for improvements to New Zealand's general surveillance system, demonstrate our increased understanding of New Zealand's aquatic animal health status and help to underpin export certainty.

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ANIMALS

Honey bee pest and disease survey of Rēkohu/Wharekauri/ Chatham Island, Rakiura/Stewart Island and Aotea/Great Barrier Island

Global populations of the western honey bee (*Apis mellifera*) are under serious threat from an array of stressors, with pests and pathogens making a substantial contribution (Steinhauer et al., 2018). The parasitic mite *Varroa destructor* is one of the most significant pests of honey bees, but other invasive pests and diseases, such as the *Tropolaelaps* sp. mites, have the potential to cause additional or even greater harm.

The pest and disease status of managed honey bee colonies in New Zealand has been well documented (Hall et al., 2021; McFadden et al., 2014; Mondet et al., 2014). Honey bee populations in the country remain free from a number of agents including *Melissococcus plutonius* (the bacterium and causative agent of European foulbrood), *Acarapis woodi* (tracheal mites), *Aethina tumida* (small hive beetle), *Israeli acute paralysis virus* (IAPV), *Acute bee paralysis virus* (ABPV); additionally, there are no other *Apis* species of bees present (Ministry for Primary Industries, 2023). Strong border and surveillance activities are in place to ensure that these organisms do not arrive.

Despite biosecurity efforts, *V. destructor* arrived in the North Island of New Zealand in 2000, and later spread to the South Island in 2006 (Iwasaki et al., 2015). American foulbrood has been thought to be present in New Zealand since the 1880s, with official identification of the bacterial agent *Paenibacillus larvae* being made in 1907 (Hopkins, 1905; Hopkins, 1911). Both organisms have spread throughout much of the country, but little is formally reported about their status on more remote offshore islands where beekeeping activities occur.

Remote islands provide unique environments and physical isolation, potentially creating refuge for managed honey bee



Figure 1: A frame of capped honey from a Chatham Island hive, as held by local beekeeper Mana Cracknell. Photo: Richard Hall, MPI



Figure 2: Managed honey bees (Apis mellifera) on Chatham Island. Photo: Richard Hall, MPI



Figure 3: On Chatham Island, local beekeeper Mana Cracknell (left) works with Hayley Pragert (MPI; middle) and local beekeeper Michele Andersen (right) as they inspect a frame and collect samples for the bee health survey. Photo: Richard Hall, MPI



Figure 4: On Chatham Island, Hayley Pragert (MPI) works alongside local Chatham Island beekeepers Mana Cracknell and Michele Andersen to perform honey bee colony sampling as part of the bee health survey. Photo: Richard Hall, MPI



Figure 5: Hayley Pragert (standing) and Richard Hall (kneeling) collect samples of bees with local beekeeper Jacques Goussard at his apiary on Aotea/Great Barrier Island. Photo: Jacques Goussard

populations that may therefore have fewer pests and diseases. We were interested in determining the pest and disease status of managed bee colonies on islands around New Zealand. We inspected and sampled hives in apiaries on Rēkohu/Wharekauri/Chatham Island (n = 11), Rakiura/Stewart Island (n = 2), and Aotea/Great Barrier Island (n = 11). Samples were collected in May 2018 (Chatham, Stewart) and in October 2018 (Great Barrier). Collection and testing methods have been previously described in Hall et al. (2021). During hive inspections, we collected samples of live bees and ethanol-preserved bees (**Figures 1–5**) and tested these at MPI's Animal Health (Wallaceville) and Plant Health and Environment (Auckland) laboratories for a diverse range of honey bee pests and diseases.

Aotea/Great Barrier Island colonies were found to have pest and disease profiles similar to that of the North and South islands of New Zealand (**Table 1**). This is unsurprising, given the proximity of Aotea/Great Barrier Island to the North Island, and the known anthropogenic movement of honey bee colonies back and forth. Aotea/Great Barrier Island is just 15 kilometres from the North Island at the closest point, and a regular weekly ferry service connects the island to the Auckland metropolis.

Table 1: Surveillance of managed *Apis mellifera* colonies on remote islands around New Zealand for viruses and parasites known to affect honey bees. Methods used for detection are described in Hall et al. (2021)

	Rēkohu/ Wharekauri/ Chatham Island	Rakiura/ Stewart Island	Aotea/Great Barrier Island	New Zealand status*
Number apiaries surveyed	11	2	11	–
Viruses				
Black queen cell virus (BQCV)	7	1	6	Present
Chronic bee paralysis virus (CBPV)	Not detected	Not detected	Not detected	Present
Deformed wing virus A (DWV-A)	Not detected	Not detected	11	Present
Deformed wing virus B (DWV-B)	Not detected	Not detected	Not detected	Not present
Kashmir bee virus (KBV)	Not detected	Not detected	2	Present
Sacbrood virus (SBV)	Not detected	Not detected	9	Present
Acute bee paralysis virus (ABPV)	Not detected	Not detected	Not detected	Not present
Moku virus	Not detected	Not detected	8	Present
Parasites				
Nosema apis	9	Not detected	9	Present
Nosema ceranae	Not detected	Not detected	8	Present
Lotmaria passim	11	2	8	Present
Varroa destructor	Not detected	Not detected	3	Present

*As described in: Hall et al. (2021) and Surveillance 48 (3) 2021.

Honey bee colonies on Rēkohu/Wharekauri/Chatham Island were found to have unique pest and disease profiles (**Table 1**). We found no *V. destructor* or symptoms of American foulbrood during our hive inspections. Results from Rakiura/Stewart Island were similar, as we did not observe *V. destructor* or American foulbrood in those colonies. It is remarkable to note that both islands appear not to have *Sacbrood virus* (SBV), *Kashmir bee virus* (KBV), *Deformed wing virus A* (DWV-A), *Moku virus* or *Chronic bee paralysis virus* (CBPV), despite these being present on the much larger North Island and South Island of New Zealand (Hall et al., 2021). With co-operation from beekeepers on Rēkohu/Wharekauri/Chatham Island, we acquired additional samples to test for the presence of *P. larvae*. Four beekeepers sent honey samples to our laboratory for microbiological culture for *P. larvae*, and all samples were found to be negative.

The Chatham Island archipelago is over 800 kilometres to the east of New Zealand, and now has a regional pest management strategy and plan to exclude unwanted organisms (Chatham Islands Council), such as varroa and American foulbrood. The movement of used beekeeping equipment or honey bees to the islands is not permitted. We understand that there may be over 300 managed honey colonies present in the Chatham Islands. The Rakiura/Stewart Island colonies were populated by import of colonies from the Chatham Islands, so it is unsurprising that they shared a similar pathogen and pest profile.

The unique pest and disease status of managed honey bee colonies on Rēkohu/Wharekauri/Chatham Island underscores the importance of the regional pest management plan, strategy and biosecurity protections that are set in place by their local authority, the Chatham Islands Council. There are very few known *A. mellifera* populations in the world that would have such an absence of pests or diseases. The colonies on Rakiura/Stewart Island are likely to have a higher degree of risk from nearby honey bee colonies in the South Island, being just 30 kilometres distant, and with daily ferry crossings between the islands. There are no formal pest management plans or biosecurity protections in place for honey bees on Rakiura/Stewart Island.

With permission from the beekeepers involved in this work, we have placed all these remote island samples into our national archival honey bee collection (Hall et al., 2022), stored at -80°C. The samples can be made available to researchers through an application process.

The recent incursion of *V. destructor* into New South Wales in Australia in June 2022, one of the last remaining countries on earth that did not have varroa, now underscores the importance and rarity of populations of bees that are free from this pernicious pest. Rēkohu/Wharekauri/Chatham Island, and to an extent, Rakiura/Stewart Island, have honey bees that will be of international interest due to their unique pest and disease status.

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Quarterly report of investigations of suspected exotic diseases: January to March 2023

Exotic pest and disease investigations are managed and reported by MPI's Diagnostic & Surveillance Directorate. The following is a summary of investigations of suspect exotic and emerging pests and diseases during the period from January to March 2023.

Exotic vesicular diseases ruled out in cattle

A veterinarian called the exotic pest and disease hotline on the discovery of dairy cows with both mouth and foot lesions that were difficult to attribute to a common cause. There was one 4-year-old cow with mouth lesions, and 14 lame cows. Pictures of the mouth and feet lesions were examined urgently by the MPI Incursion Investigation team. There were no vesicles or lesions that resembled healing ruptured vesicles. The 300-cow, spring-calving Waikato farm had no significant drop in milk production, and no recent visits from overseas people. Exotic vesicular disease was excluded on the above clinical and epidemiological grounds. The cow with mouth lesions was suspected to have an *Actinobacillus lignieresii* infection, and the farm veterinarian reported that the lesions responded to streptomycin therapy. The lame cows had lesions consistent with white line disease and digital dermatitis. Molecular screening of the 15 affected animals found no evidence of bovine viral diarrhoea virus (BVD), and there was no evidence of facial eczema on blood chemistry. The importance of digital dermatitis as a significant cause of morbidity in cattle in this case was evident, as there had been 36 lame cows in the past seven months. The case was closed following the diagnosis and treatment of the affected cattle.

In a second case, a veterinarian in North Otago phoned the MPI exotic pest and disease hotline to report oral and nasal lesions in a 3-year-old dairy cow. The notifying veterinarian phoned out of caution as a farm worker had arrived from overseas two months before. The cow had bilateral serosanguinous nasal discharge, erosive lesions on the hard palate and nasal mucosa, and multifocal proliferative lesions on the nasal planum (**Figure 1**). The clinical signs were first noticed by the farmer seven days before the notifying veterinarian's visit. The cow had a temperature of 38.1°C, there were no lesions on the feet or udder, and no evidence of lameness. No other cows were affected in the herd of about 400, there had been no increase in the number of lame cows in the herd, and there had been no decrease in milk production. The herd had recently tested positive to BVD virus antigen via a molecular assay on a bulk milk sample. The veterinarian was able to provide good-quality photographs of the nasal lesions, which were determined not to resemble foot-and-mouth disease. The photographs, epidemiology and clinical history allowed exotic vesicular disease to be excluded. In order to achieve endemic disease diagnosis, blood samples were taken for a sick ruminant panel, BVD antigen and antibody serological testing, and a nasal swab was taken for an infectious bovine rhinotracheitis (IBR) molecular assay. Fresh and fixed biopsies of nasal lesions were taken for culture and histopathology. BVD antigen and antibody serological testing was negative, the IBR molecular assay was negative and the serum biochemistry results indicated chronic inflammation. The fresh tissue biopsy cultured a mixed bacterial growth. Histopathology of the lesional biopsies found multiple coalescing aggregates of macrophages and plasma cells surrounding dense clusters of neutrophils and bacterial colonies embedded in Splendore-Hoeppli material. The finding of severe, chronic, focally extensive, pyogranulomatous dermatitis and cellulitis with club colonies confirmed a diagnosis of actinobacillosis and treatment with streptomycin was initiated by the notifying veterinarian. Exotic disease was excluded and the investigation was closed.



Figure 1: Serosanguinous nasal discharge and lesions on the nasal planum of a dairy cow at two different angles. Photos: Andrew Muir

In a separate case, a veterinarian in the upper South Island phoned the MPI exotic disease hotline to report five bulls with unusual clinical signs, including facial swelling and hypersalivation. Hypersalivation can arise from many causes, but of most concern are exotic vesicular diseases such as foot-and-mouth disease. The affected bulls were from a mob of 25, and one of the five had died before the notifying veterinarian's involvement. The remaining four bulls presented with weight loss, swelling around the

face, hypersalivation, anorexia and lethargy. No lesions of the oral mucosa were identified in any of the affected bulls, and all four were afebrile. The veterinarian had examined the bull's feet and no other lesions of concern were found. The rest of the mob were reported to be healthy. The veterinarian was able to provide good-quality photos and a thorough history. The appearance of the lesions and the absence of any other clinical signs in the mob allowed vesicular disease to be excluded on clinical and epidemiological grounds. One of the remaining four affected bulls had received a course of streptomycin before MPI's involvement, but it did not respond to this treatment and was subsequently euthanased on animal welfare grounds. A full postmortem was carried out. The veterinarian reported finding an enlarged submandibular lymph node and an inflamed larynx, as well as multiple raised lesions throughout the laryngeal tissue (**Figure 2**). On antemortem inspection, no lesions were evident within the oral cavity of this affected bull. The gross appearance of the lesions was consistent with actinobacillosis. Small outbreaks of actinobacillosis such as this are not uncommon; however, the anatomical localisation of these lesions within the pharyngeal and oesophageal tissues without corresponding oral lesions is unusual, and a definitive diagnosis was pursued. The veterinarian collected samples for histopathology. Histology revealed moderate pyogranulomatous inflammation with multifocal nodules of abundant neutrophils and macrophages centred on colonies of bacteria with Splendore-Hoeppli material. These findings are highly suggestive of infection with *Actinobacillus lignieresii*, and it is likely that the clinical signs observed in these bulls were due to actinobacillosis. However, other less likely organisms producing similar lesions include *Actinomyces bovis*, *Staphylococcus*, *Streptococcus*, *Trueperella*, *Pseudomonas* and *Pasteurella*. The remaining three bulls were treated with an extended course of streptomycin and made full recoveries. Exotic disease was excluded and the investigation closed.

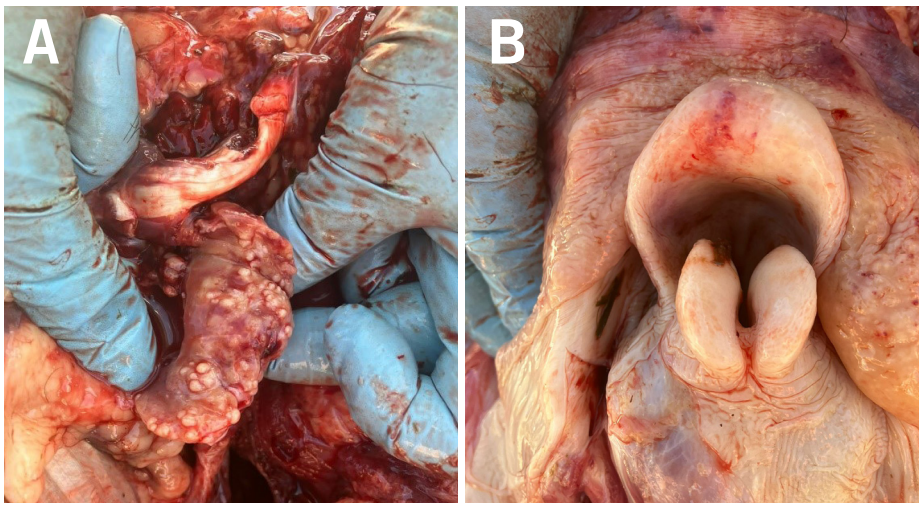


Figure 2: Gross postmortem findings from one of the affected bulls with facial swelling and hypersalivation showing (A) raised nodular lesions within the soft tissue adjacent to the distal oesophagus, and (B) a large unilateral soft tissue swelling adjacent to the larynx. Photos: Grace Boardman

Bovine viral diarrhoea (BVD) virus type 2 excluded in a heifer

A veterinary pathologist notified the incursion investigation team of a case of a two-year-old Hereford heifer with a BVD infection and also thrombocytopenia, low packed cell volume, low numbers of red blood cells, a regenerative anaemia, with anisocytosis and poikilocytes. The submission form indicated the heifer had had haemorrhages in the anterior chamber of the eyes. The heifer was one of three bovines present in a Warkworth petting zoo. Examination of a blood smear found it negative for *Theileria*. Sera from the affected animal and cohort were submitted to the MPI Animal Health Laboratory, Wallaceville (AHL), for molecular testing to determine the type of BVD virus present. Reverse transcriptase PCR tests were used to distinguish the type of pestivirus infecting the heifer, which was determined to be BVD type 1, infecting only the affected animal. The two in-contact heifers were negative for BVD antigen. The affected animal died, meaning re-sampling was not possible. Given the presentation, persistent BVD type 1 infection was considered the likely cause of death. The exotic virus BVD type II was excluded and the case was closed.

Lumpy skin disease excluded in a bull

A Waikato veterinarian phoned the MPI exotic pest and disease hotline to discuss an unusual skin condition in an 18-month-old bull that had been reported to him by a beef farmer. The bull presented with dramatic lesions that were extensively distributed, 3–5 cm in diameter, raised, crusty and circumscribed (**Figure 3**). Lesions were first noticed 2–3 months previously and the bull had been treated with oxytetracycline antibiotics without resolution. The bull was in good body condition, weighing heavier than the mob's average, and had gained weight as expected. There was no sign of ill health or skin disease in any other bulls. Photographs taken by the farmer were forwarded to an Incursion Investigator (II) and further distributed for opinion from subject matter experts. Dermatophilosis due to infection with *Dermatophilus congolensis* was considered the most likely cause due to the appearance of the lesions and the fact it had not resolved under treatment with tetracyclines (not as effective as some other antibiotics, e.g., procaine penicillin). Due to the unusually severe presentation, further work-up was done. As part of the MPI-funded investigation, the veterinarian took biopsy samples and submitted them to a regional commercial veterinary laboratory where histological appearance



Figure 3: Severe case of dermatophilosis in an 18-month-old Friesian bull

confirmed dermatophilosis. A bovine viral diarrhoea PCR test returned a negative result, ruling BVD out as a cause of immune compromise. It was not revealed why this bull should be so severely affected by dermatophilosis while none of its paddock mates were. The highly contagious exotic differential lumpy skin disease, transmitted by biting insects, was ruled out and the case was closed.

Anthrax disease excluded in calf deaths

A veterinarian in Hauraki Plains phoned the MPI exotic pest and disease hotline to report the sudden death of eight calves over a two-week period. Sudden death in cattle may be caused by many things, including the exotic agent *Bacillus anthracis* (the cause of anthrax). Endemic differentials for this presentation include clostridial disease and acute toxicity. The notifying veterinarian reported that the calves presented with lethargy, shaking, hypersalivation, occasional seizuring and progressive recumbency. Once clinical signs started, the calves quickly progressed to lateral recumbency, non-responsiveness and ultimately death. Anthrax typically presents with multiple animals found suddenly dead with haemorrhage from multiple orifices, and often occurs in association with earthworks or other disruptive soil events which aerosolise spores. Anthrax was able to be excluded based on the clinical findings and epidemiology of this case, and the vet proceeded to perform a postmortem on the most recently euthanased calf. There were no significant findings grossly or histopathologically, and the brain appeared histologically normal, making some common endemic causes of this clinical picture, such as polioencephalomalacia, lead toxicity, salt toxicity or meningitis, unlikely. Further to this, serum lead levels from three affected calves were below toxic concentrations allowing lead toxicity to be excluded. The BVD antigen ELISAs were negative for five calves, and blood biochemistry and haematology from affected calves failed to elucidate a cause for the clinical signs. The deaths ceased, and a diagnosis was unable to be reached; however, an acute-acting toxin that causes death too rapidly for histological changes to develop was suspected. Examples of these in New Zealand include cardiac glycosides (such as foxglove), tutu, oleander, yew, sodium fluoroacetate (1080), cyanide-containing plants, ionophores, levamisole and blue-green algae. The history was unable to implicate or absolve many of these agents, and no diagnosis was reached. Exotic disease was excluded and the investigation was closed.

New species of *Nocardia* bacterium confirmed in a bovine milk sample

A veterinary pathologist from a commercial laboratory phoned the exotic pest and disease hotline to report a possible novel bacterium isolated from milk culture. The laboratory had used matrix adsorption laser desorption ionisation-time-of-flight mass spectrometry (MALDI-TOF) but had not been able to speciate it definitively. The *Nocardia* species usually found in bovine mastitis internationally are *N. asteroides, N. otitidiscaviarum,* and *N. nova* (MVM, no date) but in New Zealand only *N. asteroides* is recorded in the Te Mana Rauhi Taiao or Environmental Protection Authority list of microbes present in New Zealand: https://www.epa.govt.nz/assets/Uploads/Documents/New-Organisms/Website-lists/List-of-microbes-present-in-New-Zealand.-15-June-2022.pdf).

The use of MALDI-TOF methods has increased our ability to quickly discriminate between different *Nocardia* species. In the early 2000s, with isolates of *N. veterana* for example, even 16S rRNA gene sequencing could not distinguish between it and *N. kruczakiae* – two distinct species (Conville et al., 2004). The bacterial isolate identified by MALDI-TOF at the regional laboratory was submitted to MPI's AHL for confirmation of identification. Classical bacteriology performed at AHL was most consistent with *N. veterana*. As expected, the 16S rRNA sequence was 99 percent similar to several other species of *Nocardia*, but only *N. veterana* gave a similarity of 100 percent. Worldwide, *N. veterana* was first reported as a cause of bovine mastitis in Brazil in 2013 (Condas et al., 2013). This case probably represents identification of a pre-existing agent due to use of new technologies rather than detection of a novel agent. This case also represents the finding of a first species of this type of environmental organism from a complex of a previously difficult-

to-discriminate bacterial genus. It is unlikely that this discovery is a true finding of a new organism. Rather, it is probable that laboratory technology now allows the differentiation of bacterial species that were previously described as being part of the *N. nova* complex.

Unusual lesions reported at the abattoir

An MPI Verification Services (VS) veterinarian phoned the MPI exotic pest and disease hotline for a second opinion concerning a lesion in the soft tissue over the mandible of a culled dairy cow in a consignment of 48 cows for slaughter (**Figure 4**). The VS vet subsequently examined the oral cavities and feet of the rest of the mob during slaughter. No other lesions were found, and the gross appearance of the lesion was not indicative of any exotic differentials, but more likely an endemic infectious agent. Multiple biopsies were taken from the lesion and submitted for histology at a regional commercial veterinary pathology laboratory where they were reported as most consistent with an inflammatory lesion, the underlying cause of which was most likely *Actinobacillus lignieresii,* the agent responsible for woody tongue.

A VS veterinarian in Southland contacted the incursion investigation team after seeing unusual lesions in the neck of a cow at slaughter. The lesions affected just one animal and consisted of a roughly fist-sized area of walled-off fibrosis, within which were hundreds of 2–3 mm round, smooth, free-floating spherules (**Figure 5**). Some of the spherules were attached to the surface of the lesion, and histology showed that they were composed of well-differentiated mature keratinising epidermis with dermal supporting tissue containing sebaceous and apocrine glands with scattered hair bulbs and follicles. These changes are consistent with a dermoid cyst/sinus, which arises from entrapped ectodermal tissue during embryonal development. This is an interesting incidental finding, and cases like this contribute to our understanding of normal endemic lesions found at slaughter.



Figure 4: Lesion on the jaw of a culled dairy cow.



Figure 5: Dermoid cyst in a mature cow at slaughter, with miliary spherules composed of epithelial components and debris.
Photo: Kristy Motz, MPI Verification Services

Dermatobia hominis myiasis confirmed in a person from overseas

An MPI Plant Health and Environment Laboratory (PHEL) entomology technician contacted Incursion Investigators following a request from a medical professional for assistance in identifying a larva taken from a patient. A 28-year-old New Zealand resident had recently returned from a visit in Uruguay. The patient presented at a medical facility with a boil-like lesion on her buttock that discharged fluid from a central opening. A larva visible in the opening was grasped and gently extracted using forceps. The travel history and clinical presentation suggested the presence of a larva of the human botfly, *Dermatobia hominis* (Diptera: Oestridae), and this was subsequently confirmed when the larva was submitted to the MPI PHEL Christchurch. From time to time, human cases of this parasite are found in New Zealand, and a previous report is available (O'Connell et al., 2019). While *Dermatobia hominis* is a significant parasite of cattle in Latin America, it does not pose a biosecurity threat to New Zealand, as the humidity and temperature requirements cannot be met for the completion of its lifecycle in soil. The investigation was closed.

Unusual presentation of endemic pasteurellosis in commercial pigs

A veterinary pathologist contacted the exotic pest and disease hotline to report sudden death in 4 to 5-month-old finishing pigs as part of a commercial operation in Canterbury. Five pigs had died suddenly within a three-week period and histology of tissues showed multifocal suppurative hepatitis with intralesional bacteria, and lung oedema consistent with a terminal septicaemia. *Pasteurella multocida* had been grown from tissues, resulting in concern that this agent was causing septicaemia when it usually causes pneumonia. On further history, it was found that this herd had been caesarean-derived and that pigs in the herd were probably naive to this endemic *Pasteurella* species. Due to the unusual epidemiology of this event, confirmation of the original culture identification was sought at MPI's AHL. The bacterial cultures were confirmed as *Pasteurella multocida* type A. At the same time, the exotic serotypes that cause haemorrhagic septicaemia, Asian serotype B:2 and African serotype E:2, were excluded by molecular typing. This case constitutes an unusual presentation of an endemic disease entity and adds to our understanding of the epidemiology and pathology of *P. multocida* in different types of commercial enterprises.

Brucella canis excluded in a dog

A veterinary pathologist from a commercial veterinary laboratory phoned the MPI exotic pest and disease hotline to notify that brucellosis could not be ruled out in a 6-year-old Rottweiler. The dog had presented to a veterinarian with acute orchitis and scrotal oedema, which was treated by castration and antibiotic therapy. Fixed testicular tissue was submitted to the commercial veterinary laboratory for histology. Microscopic examination of the tissue revealed a severe inflammatory lesion of the epididymis, the nature of which suggested a bacterial infection rather than sterile granuloma and no evidence of neoplasia. Large numbers of gram-negative rods mixed with neutrophils were visible within epididymal ducts, which indicated this was most likely an *Escherichia coli* infection but *Brucella* spp. could not be ruled out. Slices from the wax block of the fixed tissue were submitted to MPI's AHL where they tested negative to a *Brucella* genus real-time PCR test and the investigation was closed.

Trypanosoma evansi excluded in a dog bound for export

An MPI AHL laboratory scientist notified the duty II of seropositivity to *Trypanosoma evansi* in a 12-year-old Jack Russell terrier when tested before export to South Africa. The positive card agglutination test result meant the dog did not comply with import requirements for South Africa, which require both a negative card agglutination test and Giemsa blood smear for *T. evansi*. The Giemsa blood smear was negative. *Trypanosoma evansi* is an unwanted and notifiable organism in New Zealand. It causes the disease known as surra, and there has never been a case here. It is a protozoan blood parasite, usually transmitted by certain types of biting flies, and widely distributed in many parts of the tropics including North Africa, the Middle East, Asia, the Far East, and Central and South America. Three weeks after the initial sampling the dog was re-bled and blood samples were submitted for follow-up testing at the WOAH (World Organisation for Animal Health) reference laboratory, the Institute of Tropical Medicine, Antwerp. In these tests, the card agglutination test and Giemsa smear were both negative, allowing the exotic disease investigation to be stood down, and the dog was able to travel to South Africa. The positive test result from the first sample was considered likely to be a false positive due to an unspecified cross-reaction.

Canine distemper excluded in a dog

A Christchurch companion animal practitioner contacted the exotic pest and disease hotline to report a presentation where canine distemper virus (CDV) was on his differential list. CDV is classified as a notifiable organism in New Zealand, and suspected cases should be referred to MPI, as was done in the present case. A 7-year-old spayed female Huntaway had presented in early January with anorexia. Pancreatitis was suspected and the dog initially responded to symptomatic treatment. However, she developed a change in temperament, becoming more aggressive. She also exhibited a reluctance to open her mouth, increased salivation, and later a purulent nasal discharge along with hyperkeratosis of the nostrils. These signs are consistent with CDV. The dog had received a canine distemper virus booster four weeks before the onset of clinical signs, so an adverse event related to vaccine-derived CDV exposure was possible. With the dog's condition deteriorating, the owner elected to have it euthanased. MPI funded a necropsy and subsequent histopathological examination which revealed a multi-organ lymphoid malignancy. Any involvement of CDV – either wild type or vaccine type – was excluded when a range of fresh tissues were submitted to MPI's AHL where they tested negative for CDV on PCR. The investigation was closed.

Heartworm disease excluded in an imported dog

A veterinary clinical pathologist contacted the exotic pest and disease hotline to report a case where the exotic filarial parasite *Dirofilaria immitis* (canine heartworm) was a differential diagnosis. A complete blood count had been requested by a companion animal practitioner in the case of a 2-year-old spayed female Golden Retriever with a history of coughing. The dog had been imported from Canada six months before. The complete blood count revealed a mild neutrophilia of 17.2 X 10^9/L (reference range 3.6–11.5), a mild monocytosis of 3.4 X 10^9/L (reference range 0.2–1.5), and a marked eosinophilia of 16.8 X 10^9/L (reference range 0.1–1.5). Imported dogs are subject to guidelines (see Dog and Cat Import Health Standards: https://www.mpi.govt.nz/dmsdocument/1574-Cats-and-dogs-Import-Health-Standard), which include antigen testing and heartworm prophylaxis treatment. Nevertheless, given the import history, coughing and eosinophilia, canine heartworm disease was considered a possible cause of disease and was investigated. The duty II requested fresh EDTA and serum samples from the dog. Testing for *Dirofilaria immitis* was negative in an antigen ELISA test conducted at MPI's AHL and a microfilarial filtration test conducted at an overseas laboratory. These results must be interpreted bearing in mind that the earliest that heartworm antigen and microfilaria can be detected is about 5 and 6.5 months post-infection, respectively. Furthermore, the antigen ELISA detects proteins released by the reproductive tract of mature female *Dirofilaria immitis*. Infestations with male-only larvae will not be picked up by the antigen ELISA. Infestations with low numbers of female larvae or immature female larvae may result in delayed antigenemia. However, the clinician reported that the dog was responding to treatment that did not include steroids or heartworm treatment, providing more evidence for the non-involvement of canine heartworm in this case. The investigation was closed.

Transmissible venereal tumour excluded in a dog

A veterinarian phoned the MPI exotic pest and disease hotline to report the finding of a vulvar lesion on an imported dog, resembling a transmissible venereal tumour (TVT). The dog, an 8-year-old female French Bulldog, came to New Zealand from Hawaii in 2018. A biopsy of the lesion from the dog's vulva was submitted to a veterinary pathology laboratory for histology and was found to be an ulcerated cutaneous plasma cell tumour. The majority of canine cutaneous plasma cell tumours are benign. Most are cured by simple excision, although a few recur. Metastasis to distant skin sites has been rarely reported, and probably reflects cases of multiple myeloma with skin involvement. If a monoclonal gammopathy or hypercalcaemia are detected, the dog is much more likely to have multiple myeloma (Valli et al., 2017). The exotic canine cell line that is the transmissible agent of TVT was excluded by histology, and the case was stood down.

New species of *Mycobacterium* in a cat

A veterinary pathologist from a regional commercial veterinary laboratory notified MPI of an unusual *Mycobacterium* species that was identified by molecular techniques in tissues from a domestic cat.

The organism was identified by molecular techniques performed on a smear of fresh tissue submitted from a recurring lesion on the bridge of the nose on a 13-year-old Birman cat from Wellington. Cytological examination revealed neutrophilic inflammation with necrosis. Earlier histological findings from a suspected mycobacterial granuloma at the sameanatomical location, examined two years previously had found acid-fast organisms following Ziehl–Neelsen staining.

The recent smears had been submitted to the AgResearch infectious disease laboratory where DNA was extracted and tested negative by *Mycobacterium bovis* complex PCR testing. The same DNA extract spiked with *Mycobacterium bovis* generated a signal, indicating that there was not inhibition of the PCR by the material in this extract. The 16S rDNA PCR product was submitted for sequence analysis and found to be 99 percent (446/447) identical over 447 contiguous DNA bases to the 16S product from a *Mycobacterium palustre* isolate. The next best match was 99 percent identical to PCR products from *M. paraense* isolates. *Mycobacterium palustre* was first described relatively recently in a Finnish study and is considered potentially pathogenic since it has been isolated from the lymph nodes of a human and from pigs (Torkko et al., 2002).

This is a first report of *M. palustre* being detected in a cat in New Zealand; however, cats are susceptible to a wide range of fastidious mycobacterial species that can produce lesions that are virtually impossible to distinguish from each other without molecular verification. Improved molecular techniques are leading to the identification and speciation of opportunistic mycobacterial organisms that were not possible in the past, and it is likely this current find is a result of those improved techniques.

Exotic disease excluded in a neurological cat

An SPCA veterinary nurse called the MPI exotic pest and disease hotline to report that a moribund feral cat had been brought into the SPCA shelter that morning with unexplained neurological disease, which was considered to be possibly botulism. A postmortem was carried out that afternoon and the cause of death was found to be obstructive urolithiasis. Botulism in animals is due to consumption of preformed toxins from the bacterial species *Clostridium botulinum*. In the case of cats, this is due to the consumption of contaminated meat. In cats presented to the SPCA, the possibility of feral cats scavenging protein is high. Botulism often affects the cat in a characteristic way. It often starts with weakness in the rear legs and, within 24 hours, this weakness progresses to include the front legs and muscles of the head and face. In this instance the animal was prostrate and weak in the hind legs, hence the suspicion of botulism. The cause of disease was confirmed as obstructive urolithiasis and the case was closed.

Babesia excluded as the cause of anaemia in an imported cat

A veterinarian at an Auckland referral centre for companion animals phoned the exotic pest and disease hotline to report a possible case of babesiosis in an imported cat. The cat was a 3.5-year-old female, domestic short-hair imported into New Zealand in July 2022 from Dubai. The cat was an adopted orphan so the early history of this animal was unknown to the present owner. The clinical presentation was a severe regenerative anaemia, with a packed cell volume (PCV) of 9 percent, hyperglobulinaemia, thrombocytopenia, with a history of lethargy and loss of weight. There was a polyclonal gammopathy detected by electrophoresis, and high globulins, high bilirubin and high alanine aminotransferase (ALT) apparent on serum biochemistry, indicating an insult to the liver. The preliminary screening by the referral centre had ruled out feline leukaemia virus and feline coronavirus (FCoV) as potential causal agents. A blood smear and EDTA blood samples were submitted to MPI's AHL for cytology and molecular testing for piroplasms. On the blood smear there was evidence of a regenerative anaemia with fine round structures associated with red blood cells that indicated possible infection with *Mycoplasma haemofelis.* Molecular testing for *M. haemofelis*, *M. haemominutum*, and *M. turicensis* and blood piroplasms for *Ehrlichia* or *Babesia* spp. were negative. An infectious cause of disease was not discovered in this case, and the likely cause of the anaemia was considered to be immune-mediated haemolytic anaemia.

The cat received a xenotransfusion of blood from a dog and was treated orally with prednisolone and doxycycline and made a steady

recovery. Before discharge from the hospital, the ALT and bilirubin levels normalised and the level of red blood cells in circulation almost doubled (PCV 16 percent), indicating a strong response to therapy. A month after discharge, and on continual corticosteroid and doxycycline therapy, her packed cell volume improved to 36 percent and the patient gained 2 kg in weight. A month after the gradual reduction, then cessation of corticosteroids, the patient regressed with a reduction in PCV and rise in liver enzymes. The diagnostic findings together with clinical findings and response to therapy confirmed the diagnosis of immune-mediated haemolytic anaemia. The known exotic haemoparasites of felines were excluded and the case was closed.

Highly pathogenic avian influenza (HPAI) excluded

Case 1. Red-billed gull deaths

A Department of Conservation (DOC) ranger called the exotic pest and disease hotline to notify an II of a sudden mortality event involving 14 tarāpunga/red-billed gulls (*Chroicocephalus novaehollandiae scopulinus*) on the Oamaru waterfront. The notifier collected three of the freshest carcasses, which were then autopsied by a commercial pathology laboratory. Surveillance sampling by molecular assays for exotic viral diseases, including avian influenza, Newcastle disease virus, and West Nile virus (WNV) were all negative. The gulls were determined to be in adequate nutritional condition with moderate autolysis. One bird was determined to have sustained traumatic injuries, the other two had broken bones but these were determined to have been sustained postmortem. Full tissues were taken for histopathology, and all three birds had evidence of liver inflammation resembling a bacterial hepatitis. Unfortunately due to the autolysis, liver culture of all three birds yielded heavy mixed growth consistent with postmortem bacterial overgrowth. The cause of death was not evident, although hepatic changes indicated an underlying bacteraemia might have been present, and one bird had evidence of antemortem blunt trauma. Exotic disease was excluded. The area is frequented by people, so it is possible that human interaction resulted in the mortality reported with the gulls in this case. The mortality event did not continue past the one event, and the investigation was closed.

Case 2. Disease in a red-billed gull

A veterinarian phoned the exotic pest and disease hotline to report that an unwell tarāpunga/red-billed gull had been dropped at the clinic in Northland and was displaying clinical signs consistent with avian influenza. The bird was dropped anonymously at the clinic and no history was available, such as where it had come from or if other birds were affected. The reported clinical signs included flaccid paralysis, incoordination, lack of wing-muscle tone and an inability to use its legs. These clinical signs may be attributed to a range of endemic causes, such as avian botulism or another toxicity; however, given the lack of epidemiological information for this case, laboratory diagnostics were required to exclude exotic disease. Given the severity of the clinical signs the gull was euthanased. A full postmortem was carried out, which failed to elucidate the cause of death, and samples were collected for exotic disease testing. Molecular testing for influenza A, exotic avian paramyxovirus type 1 viruses (Newcastle disease virus), and WNV all returned negative results across a range of sample types. Exotic disease was excluded and the investigation closed.

Case 3. Black-billed gull mortality

A wildlife rehabilitator called the exotic pest and disease hotline to notify disease investigators about a mortality event in a colony of tarāpuka/black-billed gulls (*Chroicocephalus bulleri*) nesting in the Māngere Bridge area in Ambury Regional Park. The deaths were first noticed in January. Of a colony of 500 adults and 200 juvenile birds, 160 were estimated to have died within two weeks. The mortality affected primarily black-billed gull juveniles; other species of waterbird in the area were unaffected. Dead birds were collected by Ambury Park rangers and were dispatched to veterinary pathology laboratories for examination. Samples were taken which allowed molecular exclusion of avian influenza virus, Newcastle disease virus, and WNV through testing at MPI's AHL. Autopsies carried out on dead birds indicated a parasitic enteritis was present, with high numbers of flukes within intestines and parenchymal organs (liver, pancreas, spleen) of affected birds. Speciation of the flukes is in progress, and a publication is planned in order to document this event in the scientific literature. Trematode (fluke) burdens are known to increase with a high level of primary hosts, in this case, gulls. The lifecycle includes two intermediate hosts, one of which is the New Zealand mudsnail, *Zeacumantus subcarinatus*. Fredensborg et al. (2006) compared shorebird distributions and densities to trematode prevalence and found the two were related. It is considered possible that in a large, dense colony of shorebirds there might be a higher density of trematodes (Fredensborg et al., 2006), which the juveniles would potentially have lower resistance to. The black-billed gull is listed as an 'at risk-declining' species and is an endemic native of New Zealand.

Case 4. Mass mortality in waterfowl

A multi-month mortality event in Lake Horowhenua was investigated twice this summer – first in late December, and again in February when numbers of dying waterfowl increased dramatically. The initial notification was by a veterinarian from a wildlife hospital who phoned the MPI exotic pest and disease hotline. The veterinarian reported that regional council staff had picked up two karoro/black-backed gulls (*Larus marinus*) and one pūtangitangi/paradise shelduck (*Tadorna variegata*) from Lake Horowhenua in various stages of weakness and inability to fly. One of the black-backed gulls had died on the way to the hospital and the other two birds had been euthanased on humane grounds on arrival. Choanal and cloacal swabs

were taken and submitted to MPI's AHL for exotic disease testing. All samples were negative on molecular tests for avian influenza virus and avian paramyxovirus type 1 virus (Newcastle disease virus), allowing the initial exotic disease investigation to be closed. Gross necropsy examination of the birds found no obvious abnormalities, and in conjunction with the presenting clinical signs and the historical detection of avian botulism from this location (Bingham, 2022), a provisional diagnosis of botulism was made. Unfortunately, over the summer, increasing mortalities were reported. MPI's Incursion Investigation team and AHL frequently seek to test for botulism as part of avian disease events, but testing can present logistical and sample quality issues.

A decision was made to use this ongoing outbreak to help validate and refine sample collection, and in early February, a veterinary II and veterinary pathologist from MPI visited Lake Horowhenua where carcass recovery was underway following a mass mortality event of birds and eels. Over two days, around 1,000 bodies were collected as part of the local botulism response plan. A kuihi/Canada goose (*Branta canadensis*) and a tuna/longfin eel (*Anguilla dieffenbachia)* that had both been euthanased within the previous hour were necropsied and sampled, and two dead pūtangitangi/paradise ducks were chilled and transported back to the laboratory for necropsy and sampling.

Nine samples were tested for *Clostridium botulinum* toxins. These included a liver and gut content sample each from the Canada goose, both paradise ducks and the eel as well as a maggot that was found on the goose. The *Clostridium botulinum* neurotoxin C mosaic reverse transcriptase (RT) PCR tests returned positive results for the Canada goose liver sample, a maggot that was found on the goose and liver and gut contents samples from the eel. The *C. botulinum* non-toxin non-hemagglutinin gene (NTNH) PCR tests were suspicious on goose liver, and eel gut contents and liver. Collectively these molecular test outcomes confirmed the presence of clostridial bacteria that have the gene for production of the C and D neurotoxins in the respective animals and their tissues.

Laboratory confirmation of the clinical presentation of botulism was useful in the current case, especially with presence of toxin-forming bacteria present in the maggot, which highlights a transmission cycle and the risks of leaving rotting carcasses lying around for new bird hosts to get infected from. With the carcass collection, the change of season and significant rainfall events the botulism outbreak reached a natural end, although reoccurrence next summer is possible.

Case 5. Mass shorebird mortality

A person working for a shorebird conservation centre phoned the exotic pest and disease number to report a mortality event at the Miranda Stilt Ponds on the Firth of Thames. The mortality event escalated quickly, going from an estimated fewer than 50 birds in the first week to over 100 birds per week in the second and third weeks. The major clinical signs included weakness of the neck, paresis of the wings, and some birds with the unusual clinical sign of oral haemorrhages. Photographs and videos of the affected birds showed signs that were consistent with botulism, but the presence of birds with oral haemorrhages was confusing, and the scale of mortality increased the level of concern of an unusual disease being present. Species affected included mostly rakiraki/mallard (*Anas platyrhynchos*), but the disease also affected some kuruwhengi/Australasian shovelers (*Spatula rhynchotis*), tete moroiti/grey teal (*Anas gracilis*), and poaka/pied stilt (*Himantopus leucocephalus*). In an effort to increase animal welfare and reduce the botulism toxin cycle of the waterway, birds with hopeless, serious and terminal muscle impairment were euthanased when discovered by the rangers, and dead birds were removed several times each week.

To confirm the diagnosis of botulism and look for underlying factors in the event, fresh carcasses were obtained and submitted to a regional laboratory for necropsy and sample collection. Samples included one mallard, an Australian shoveler, two grey teal and a pied stilt. The birds were determined to be in good body condition, with no lesions indicating inflammatory or necrotising infectious disease. Swabs of the cloaca and choanal tissues in avian transport medium were submitted to MPI's AHL for exotic disease molecular testing. Botulism testing showed that the liver and gut content of the mallard, and the gut content of the grey teal were positive on the *Clostridium botulinum* neurotoxin C mosaic RT-PCR test. A cloacal swab from the mallard was positive to both generic avian influenza (AI) and avian paramyxovirus 1 (APMV-1) screening assays on RT-PCR. Further sequencing of the avian influenza isolate indicated it was subtype H5; the consensus sequence for the HA gene had the highest nucleotide similarity to an H5N2 isolate previously found on the Hauraki Plains in 2020. Phylogenetic analysis of the AI nucleotide sequence indicated it was not a new introduction, and it was classified as low pathogenic AI based on the cleavage site of an amino acid. The APMV-1 isolate recovered was also partially sequenced. The F gene partial sequence had the highest similarity to non-pathogenic vaccine APMV-1 isolates reported in other countries. Non-pathogenic AI and APMV strains are routinely detected in New Zealand's shorebirds as part of New Zealand's Avian Influenza Surveillance Programme, the results of which are reported annually (Stanislawek et al., 2022). In this investigation the viruses found were confirmed to be low pathogenic variants similar to those previously detected during surveillance. A diagnosis of botulism was supported, and the deaths continued until a heavy rain event which flushed the environment. The case was closed.

Case 6. Wild dove mortality

An Auckland-based wildlife rehabilitator contacted MPI disease investigators about a mortality event among hand-fed wild spotted doves (*Spilopelia chinensis*). Three birds from the flock of about 40 were noticed dead on a single day, with 1–2 further deaths noticed per day

in the week thereafter, for a total of about 15. Causes of bird deaths can include exotic viral diseases such as avian influenza. As a precaution, investigation of the cause of the deaths was pursued to rule out the important exotic viral diseases of birds. Three dead birds were frozen, then sent to a commercial veterinary laboratory for autopsy. Autopsy with histology showed that two of the three birds had lesions within the gastrointestinal system, including the crop. Histologically, these were consistent with ulcerative and proliferative viral plaques with inclusions suspected to be Bollinger bodies, indicating poxvirus infection. Gram-negative bacteria were found within macrophages of two birds, including in the circulation, and multifocally associated with fibrin within the liver and the renal cortex. Molecular testing for highly pathogenic avian influenza, WNV, and avian paramyxovirus were all negative for the brain, lung and kidney samples collected in viral transport medium. The cause of the mortality was likely to be the diphtheritic form of avian pox, a combination of endemic infectious agents including poxvirus and bacterial septicaemia. The mortalities ceased, and the investigation was closed.

Case 7. HPAI excluded and psittacosis confirmed in pigeons

A staff member working at the Department of Corrections called the exotic pest and disease hotline to notify MPI of a mortality event of feral pigeons, *Columbia livia domestica,* at a North Island Corrections facility and a possible association with a psittacosis outbreak in humans at the facility. Pigeons are a typical host and natural reservoir of *Chlamydia psittaci*, the etiological agent of avian chlamydiosis. Feral pigeons in urban areas are a potential risk for zoonotic disease, and New Zealand has a widespread distribution of *C. psittaci* in native and non-native birds (Gedye et al., 2018).

A staff member of the facility was hospitalised with pneumonia and had tested positive to *C. psittaci*. An additional eight staff and inmates in the same building had experienced respiratory symptoms consistent with psittacosis but had not been tested. A zoonotic cause of disease was suspected in the workplace, and the medical officer of health (MOH) had been involved. The pigeon investigation was conducted in collaboration with the MOH.

A history was obtained, and it was revealed that pigeons had been dying at the facility at a rate of about five per day and that efforts had been underway to clean the prison environment. This included the use of high-pressure water blasting. It was suspected that the process of cleaning and water blasting had caused the aerosolisation of *C. psittaci* and other pathogens, resulting in increased human and avian exposure.

Dead pigeons from the prison were submitted to a commercial veterinary pathology laboratory for necropsy and sampling. The important foreign avian viral diseases, avian influenza and avian paramyxovirus, were excluded by molecular testing of cloacal and oropharyngeal swabs, brain and lung tissue.

Autopsy of 14 pigeons was carried out by a veterinary pathologist and included gross examination, parasitology and histology as well as molecular testing for *C. psittaci.* Grossly, all birds examined were in good body condition and apart from signs of dehydration there were no abnormalities seen in the organs. Twelve birds had signs of cervical trauma, indicating that direct human interaction had caused the death of these birds. Histology did not reveal significant abnormalities. Evidence of a virulent chlamydial infection causing morbidity was not seen grossly or histologically in the examined birds. A PCR test for *C. psittaci* was negative for cloacal and choanal swabs and faeces. Given the suspicion that the respiratory disease outbreak in the people was caused by exposure to the pigeons and their excreta at the facility it was decided to make another attempt to detect *C. psittaci* in the birds.

Another batch of dead birds was collected and three fresh birds were sampled for testing. This time, *C. psittaci* was detected by PCR in cloacal swabs, faeces, liver, spleen and lung. This molecular detection of *C. psittaci* added more evidence to the possibility that the human pneumonia outbreak was caused by exposure to the pigeon excreta.

The presence of the aetiological agent of a relatively neglected zoonotic disease was demonstrated in this case and were communicated to the local MOH. The pigeon deaths were determined to be traumatic in origin. Exotic disease was excluded and the investigation was closed.

Exotic viral diseases excluded in an avian mortality event

A DOC ranger called the exotic pest and disease hotline to report six sick and two dead birds at Okupu, Great Barrier Island in the Hauraki Gulf. There were six birds behaving unusually (five tūturiwhatu/ New Zealand dotterel (*Charadrius obscurus*)); one pateke/brown teal (*Anas chlorotis*) and two birds found dead (pateke/brown teal and one rakiraki/mallard). Three sick dotterels were sent to a wildlife veterinarian in Auckland for treatment where two of them subsequently died and one recovered to be released a few days later. Tissue samples were collected at necropsy from the dead birds and nasopharyngeal and cloacal swabs from the survivor. These were sent to MPI's AHL where the exotic avian diseases avian influenza, APMV-1 and WNV were excluded by molecular testing. *Clostridium botulinum* molecular testing was carried out on liver and intestinal contents from the dead dotterels with negative results; however, the sensitivity of this test is not very high and given the behavioural signs and epidemiology, avian botulism remained the most likely cause of the outbreak.

Exotic disease excluded in little blue penguin mortality

A zoo veterinarian phoned the MPI exotic pest and disease hotline to notify a cluster of mortality events in kororā/little penguin (*Eudyptula*

minor). Several penguins had been found dead overnight on the Kāpiti Coast and a DOC ranger had presented a weak, emaciated penguin with a badly injured eye that died after admission. Given the reports of several other birds having died, an investigation was opened into a possible mortality event. Gross postmortem examination of the submitted penguin found signs of starvation, with a body condition score of 1/9 and a body mass of only 585 g, with an empty gastrointestinal tract. There were no other grossly remarkable features apart from the traumatic injury to the eye. The presence of multiple ovarian follicles indicated this was a young adult female.

Samples were collected and submitted to MPI's AHL where highly pathogenic avian influenza and avian paramyxovirus type 1 were excluded by molecular testing of choanal and cloacal swabs. Bacterial culture work was carried out on swabs from the liver, heart and lung with heavy mixed growth consistent in all samples. The pathology to the eye was attributed to trauma and desiccation of the cornea.

Histology findings supported the diagnosis of emaciation and starvation with a significant underlying fluke/endoparasite burden. Bursal lymphoid depletion and atrophy was also present. No other penguins were collected and there were no further deaths reported. Exotic avian viral diseases were excluded, and the case was closed.

Exotic disease excluded as the cause of waterbird mortality

A veterinarian phoned the exotic pest and disease hotline to report around 10 dead ducks and swans at a lake in Northland. The birds displayed flaccid paralysis and an inability to fly before death. Although endemic disease can cause similar clinical signs, some exotic diseases such as avian influenza can present in a similar way. One freshly dead bird was available and a postmortem was carried out. The gross pathology failed to determine the cause of death, and samples were collected for exotic disease testing. Molecular testing for influenza A, exotic avian paramyxovirus type 1 viruses (Newcastle disease virus), and WNV all returned negative results across a range of sample types. Based on the clinical presentation and epidemiology, as well as the poor water quality of the lake, it is likely that avian botulism was the cause of this mortality event. Further to this, a bird mortality event occurred at the same lake the year before and was investigated by MPI, with avian botulism determined to be the likely cause then. Exotic disease was excluded and the investigation closed.

Exotic disease excluded in black-backed gull mortality event

A member of the public phoned the exotic pest and disease hotline to report seeing around 10 dead karoro/black-backed gulls (*Larus dominicanus*) while walking along the local river near Waimate the previous day. The notifier agreed to return to the site to gather further information on the state of the birds; however, on his return he could not locate the carcasses. One sick gull remained and was captured and taken for medical attention, but subsequently died. A postmortem was carried out and histopathology revealed that multiple blood vessels within the lung contained luminal bacteria, and in some areas, there were also bacteria in the adjacent lung parenchyma. Further to this the gall bladder appeared to have an area of haemorrhage and bacterial proliferation and some bile ducts in the liver contained bacteria. These findings suggest that a bacterial infection was the likely cause of this gull's death. Given the lack of further deaths and an endemic diagnosis in the only bird available for sampling, exotic disease was stood down on epidemiological grounds and the investigation closed.

Exotic disease excluded as the cause of death in tui

A member of the public phoned the exotic pest and disease hotline to notify that three tui (*Prosthemadera novae-zealandiae*) were found dead on the side of the road in an Auckland suburb. The birds were collected and submitted to a pathologist where cloacal and oropharyngeal swabs were taken and submitted to MPI's AHL where they were negative for avian influenza and avian paramyxovirus on molecular testing. Gross necropsy examination revealed all three birds had peracute haemocoelom present, a sign consistent with blunt force trauma. Given the roadside location the birds were found and the gross necropsy findings it is likely these tui were playfighting in flight, as they are notorious for, and were struck by a vehicle.

Exotic disease excluded in the deaths of three tui

A DOC ranger reported three dead tui found near the botanical gardens in Napier. The three birds were frozen and submitted to MPI's AHL for postmortem and toxicology. The most significant findings at postmortem were evidence of haemorrhage into the coelomic cavity, and base of the heart, as well as pulmonary haemorrhage and oedema. Exotic disease was able to be excluded based on the gross findings. One bird had blood within the oropharynx and this is suspected to have arisen from the pulmonary haemorrhage. There was a recent history of brodifacoum bait being placed in the area. Kidney and liver samples were submitted to Landcare Research for brodifacoum testing and found to be below 0.001 µg/g for all three birds. It was subsequently discovered that a second anticoagulant was laid at the site near where the birds were found (diphacinone), but there was insufficient samples left of the organs to allow a toxicology test to be conducted. The susceptibility of birds to rodenticides is variable. Lethal doses may be as low as 0.005 ug/g (Stadler et al., 2021). The clinical signs and proximity to bait stations meant exposure to rodenticide anticoagulants likely contributed to the death of these birds. Brodifacoum was able to be excluded as a contributing cause in this case, but a second anticoagulant may or may not have been involved. The need for broad screening for actives when testing for rodenticide anticoagulants was realised in this

case. Results were communicated to the Napier DOC staff that notified the case and the case closed.

Avian pox confirmed in a blackbird

A wildlife centre reported to the exotic pest and disease hotline a suspected avian pox case in a blackbird (*Turdus merula*) brought to a Hawke's Bay shelter. The bird had lesions on the base of the beak and skin. It was euthanased and the lesion confirmed as avian pox on histopathology. Avian pox viruses can be sporadic or epidemic. Avian pox occurs worldwide, except in the Arctic and Antarctica, and is more common in warmer climates. Infection occurs in many songbirds, finches, bobwhite quail, turkeys, raptors (infected occasionally), and domestic poultry. Disease is rare in wild waterfowl. Young birds can be more severely infected. Avipoxviruses are large, enveloped, double-stranded DNA viruses that infect and replicate in epithelial cells. There are at least 10 strains of virus, often named after the species of origin. In New Zealand the risk of avipoxvirus is only of significant interest when it infects psittacine birds because psittacine pox virus can have a high expected mortality rate, and New Zealand has multiple populations of native naive psittacine birds. Transmission between birds is enhanced by mosquitoes as primary vectors. The lesions in the current case were the dry cutaneous form, visible as wart-like growths on the featherless parts of the bird. Close contact between birds can lead to virus transmission through skin abrasions, ingestion of contaminated feed or water, or inhalation. Avipoxviruses are highly resistant in the environment and pose a risk to avian populations if they are contained in that environment. Avipoxviruses do not infect people. This case was confirmed as an endemic disease and stood down.

Exotic ticks excluded in multiple investigations

Possible sightings of unusual ticks are taken seriously by IIs, in part because of the serious human and animal health consequences that new tick species may bring. New Zealand is fortunate in having only one established population of ticks in domestic animals – the New Zealand cattle tick, *Haemaphysalis longicornis*. However, this tick can appear similar to other tick species, and we strive to formally identify all unusual tick detections. In the cases below, ticks were discovered on unusual hosts or in unusual numbers but were determined to be *H. longicornis*.

Case 1. A dog owner called the exotic pest and disease hotline after finding four engorged ticks on her dog. Although the dog routinely visited parks with bushy areas, the person had never noticed ticks on her dog before and was concerned about how to control them. Exotic ticks such as the brown dog tick (*Rhipicephalus sanguineus*) are of concern, because if established they would allow transmission of tick-borne illnesses. Photographs of the ticks were sent to MPI's PHEL scientists, where the ticks were identified as *H. longicornis*, the endemic New Zealand cattle tick. The ticks were determined to be non-exotic, and the investigation was closed. The owner was advised that her vet could supply her dog with acaricidal products if ticks continued to be a problem.

Case 2. A member of the public from Rotorua phoned the MPI exotic pest and disease hotline to report having found a tick on their newly purchased puppy. An excellent photograph of the tick was submitted and reviewed by an entomologist. It was confirmed as *H. longicornis*, which is known to be endemic in the area and the exotic tick investigation was closed.

Case 3. A member of the public from north Waikato phoned the MPI exotic pest and disease hotline to notify that they had found a brown tick on their dog. While it would not be unusual to find the endemic NZ cattle tick in this area, a photo was reviewed by an entomologist, but the tick could not be definitively identified. A specimen was collected and dispatched with the help of a local veterinary clinic to the MPI PHEL where it was identified as an adult female *H. longicornis*.

Case 4. A woman in Auckland took her dog to Bethell's Beach and upon returning home, found three ticks on her dog. She phoned the MPI exotic pest and disease hotline and provided photographs of the ticks. The photographs were of sufficient quality to allow the identification of the ticks as *H. longicornis*.

Case 5. A member of the public from Taradale, Napier, contacted the exotic pest and disease hotline concerned that a tick that she found on her dog could be an exotic tick. Following submission of digital photographs, and their review by a subject matter expert, the tick was determined to be an unfed adult female of the endemic New Zealand cattle tick. Napier is within the known distribution area of this tick.

Case 6. A member of the public phoned the exotic pest and disease hotline to report finding a tick on their dog on the Kāpiti coast. After consulting the internet they had become concerned that the tick might have been the exotic brown dog tick (*Rhipicephalus sanguineus*). The tick was collected by the duty II, and a subject matter expert was able to positively identify the tick as the endemic New Zealand cattle tick.

Case 7. A veterinarian phoned the exotic pest and disease hotline to report that a client had found three ticks on their dog in Kaiapoi, Christchurch. The dog had not travelled out of the region in the recent past. It is unusual to find NZ cattle ticks in the South Island's cooler areas and the vet was concerned that the tick may be the exotic brown dog tick (*R. sanguineus*). The tick was submitted to entomologists at the MPI PHEL where it was identified as the endemic New Zealand cattle tick and the investigation was closed. The property the dog lived on bordered a deer farm, and it is possible the tick was introduced to the area by stock movement from areas where *H. longicornis* is more commonly found. However there have been confirmed records of *H. longicornis* in the Canterbury region (Heath, 2016) and *H. longicornis* is predicted to become more widely distributed

and more numerous as climate change progresses (Heath, 2020), so an endemic population in this area cannot be excluded.

Case 8. A member of the public phoned to advise she had found a tick on her dog. The owner and patient were residents of Hamilton, and the owner was surprised to find a tick as her dog lived mostly indoors. The tick was removed from the dog and photographed to identify the anterior morphological features. Images of the tick were sent to the MPI entomologist at the MPI PHEL and the species of subclass Acari confirmed to be a *H. longicornis*, known to be present in the Waikato region. The possibility of an exotic introduced tick such as brown dog tick was ruled out and the investigation closed.

Case 9. Finally, a person in Waikato notified MPI after finding two brown-coloured ticks on herself which appeared different from the ticks she had previously found on her dog. She obtained photographs of the ticks and the ticks were identified presumptively as *H. longicornis* via the photographs. The ticks had unfortunately been disposed of before notification, so their identification could not be verified by direct inspection. The risk of an exotic tick was excluded via photographs, and the investigation was closed.

Common dolphins negative for SARS-CoV-2

A researcher investigating a mass stranding of common dolphins/aihe (*Delphinus delphis*) off Aotea/Great Barrier Island on Auckland Anniversary weekend found weak, non-repeatable evidence of severe acute respiratory syndrome coronavirus 2 SARS-CoV-2 RNA on two swabs. Buccal and blow hole swabs had been taken on five animals and submitted to an Auckland pathology laboratory routinely in accordance with international stranding protocols. Two of the swabs tested were initially reported positive but were then confirmed negative on retest with a different machine. Dissection of the dolphins revealed lesions in the lungs which were sampled for histopathology. The false positive viral findings generated concern and disposal of the animals was postponed until the status of coronavirus infection could be confirmed by MPI's AHL. Frozen lung tissues, lung tissue in RNAlater® reagent, buccal, blowhole, tracheal and bronchial swabs from eight dolphins were submitted for molecular testing. The RNA of SARS-CoV-2 was not detected in any of these tissues or swabs by RT-PCR. The animals were released to Iwi for disposal once the concern about zoonotic disease had been addressed. The lung lesions in three animals were confirmed histologically to be a severe chronic active parasitic infection causing bronchopneumonia. The differential diagnoses for lungworm in dolphins include *Stenurus ovatus* and *Parafilaroides* spp. The important zoonotic disease SARS-CoV-2 was excluded by molecular and histological findings and the case was closed.

New Zealand origin confirmed for bees found at a port

A port controller called the exotic pest and disease hotline to report a swarm of bees in the Southport docks, within Bluff Harbour in Southland. A sample of bees was submitted to PHEL laboratory in Auckland to rule out the possibility that this swarm could have been an exotic species such as Africanised honey bees, and also to exclude the possibility of exotic diseases such as tracheal mite *Acarapis woodi.* The bees were determined to be European honeybees (*Apis mellifera*) such as are found throughout New Zealand and were negative for tracheal mites. The port controller reviewed the video surveillance footage of the suspected railway cars and confirmed that the source of the bees was likely to be a shipment of logs that came via railway cars that had originated within the South Island, rather than an incursion via a port container. The bees were not an incursion on shipping containers from overseas and the case was closed. The swarm was removed from the dock by a beekeeper and rehomed.

European foul brood excluded as the cause of brood disease in three hives

An apiary inspector phoned the exotic pest and disease hotline to report a possible case of European foul brood (EFB) in a trio of Taranaki hives, near the port, and belonging to one retired beekeeper. The visual appearance of discoloured capped brood and characteristic ammonia scent was considered consistent with disease from EFB. Samples were urgently submitted to MPI's AHL for molecular testing for EFB and American foul brood (AFB). The agent of EFB (*Melissococcus plutonius*) was ruled out by molecular tests of the 16S RNA and SoDA genes. *Paenibacillus larvae*, the cause of the endemic but unwanted disease AFB was ruled out using molecular tests of the 16S RNA and ftsZ target probes.

The pungent smell of the brood in this case suggested a possible bacterial aetiology so further samples of brood and comb were submitted for general bacterial culture, which was performed in aerobic, carbon dioxide and anaerobic conditions. *Bacillus* species, *Bacillus chungangensis* and *Enterococcus faecalis* were isolated and identified in the brood and comb samples. *Bacillus thuringiensis*, *Bacillus* spp., *Enterococcus faecalis* and *Serratia marcescens* were identified in bee larvae. The main exotic cause of bee brood death was excluded and the case was closed. An inspection of the third hive at the same apiary site found significant parasitism by *Varroa destructor*. The varroa mite, as an ectoparasite of the honeybee, prefers living in the sealed brood cells (Yang et al., 2021) and thus, bees are more likely to become hosts of mites in the pupal stage. This parasitism of bee brood is the most significant disease of *Apis mellifera* and the most likely cause of disease in this case.

Small hive beetle excluded as the cause of hive disease

A beekeeper phoned the exotic pest and disease hotline to report the

presence of numerous small white larvae in one of his hives and he was concerned they could be the larvae of the small hive beetle (*Aethina tumida*). The hive, one of three on the property, was observed to have died several days earlier due to varroa mite infestation, and when the beekeeper returned to clean the hive out, he noticed the unusual larvae. The other two hives were unaffected. No adult beetles were found and photos of the larvae were provided to the duty II. The photos were sent to an entomologist at MPI's PHEL who determined these were not the larvae of *A. tumida* and were likely the larvae of a species from the fly family Phoridae. Concurrently, the photos were referred to a consultant bee expert who subsequently contacted the beekeeper for further information and was able to report that the epidemiological and clinical picture was not consistent with *A. tumida*. An incursion of small hive beetle was excluded and the investigation was closed.

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Quarterly review of diagnostic cases: January to March 2023

SVS Laboratories

Bovine

In January, milk culture from a **bovine mastitis** case from Waikato yielded a pure scant growth of **methicillin-resistant *Staphylococcus aureus*** (MRSA). In February, MRSA was also isolated from a mastitic milk sample from a cow in Bay of Plenty.

An 8-month-old heifer from South Waikato presented with watery diarrhoea. When examined by the veterinarian, the animal was extremely dehydrated and hypothermic (35.7°C, reference range 37.8–39.2) and was therefore euthanased. On postmortem examination, there was mild haemorrhage in the duodenum and ileum. On histology, there was a **necrotising and neutrophilic abomasitis** and enterocolitis, with numerous bacilli associated with the areas of inflammation. A PCR for bovine viral diarrhoea virus on the serum sample was negative. A faecal sample had small numbers of coccidia and 200 strongyle eggs per gram. Culture of the faeces was negative for *Yersinia* but yielded ***Salmonella* Typhimurium**.

In mid-March, a veterinarian examined a sick cow which had access to acorns. **Renal failure** due to **acorn toxicity** was suspected and a serum sample was sent to the laboratory. A severe azotemia (creatinine 954 µmol/L, reference range 55–130; urea 81.5 mmol/L, reference range 2.7–12.3) confirmed the diagnosis.

In late March, an adult Jersey cow from Northland presented with jaundice and tachycardia. The animal had passed red urine the day before, and 10 other animals from the herd also had red urine in the previous two weeks. The animals were being fed turnips and were not being supplemented with zinc for facial eczema protection. Blood samples were sent to the laboratory and there was a marked anaemia with a haematocrit of 0.12 L/L (reference range 0.24–0.40) and a haemoglobin level of 34 g/L (reference range 85–130), which with the clinical jaundice supported **haemolytic anaemia and haemoglobinuria** as a cause of the red urine. On microscopic examination of a blood smear, occasional *Theileria* were seen on red blood cells. *Theileria orientalis* Ikeda was detected by PCR. On chemistry, the enzyme GGT was markedly elevated at 1,984 U/L (reference range 1–36), which indicated severe biliary damage. No other tests were requested. Severe biliary damage in late summer is most often caused by sporidesmin toxicity (facial eczema), which can also cause haemolytic anaemia in severe cases. However, severe anaemia can also occasionally cause marked increases in liver enzymes due to hypoxia; therefore, it is not clear if the main cause for the anaemia was *Theileria* or sporidesmin toxicity in this case.

Ovine

In early March, a sheep farm in Hawke's Bay saw increased mortality in lamb hoggets, losing about 10 percent of animals over a one-to-two month period. Microscopic agglutination tests for *Leptospira interrogans* serovar Hardjo on five animals were negative, whereas titres for *Leptospira interrogans* serovar Pomona varied from 1:200 to 1:3,200, confirming exposure. Similarly, increased mortality was seen at another sheep farm in Hawke's Bay with 1–2 deaths per week over the previous month. Serology for *Leptospira interrogans* serovars Pomona and Hardjo on two euthanased animals were negative, but a *Leptospira* PCR on kidney was positive, confirming **leptospirosis**.

Cervine

In late March, a veterinarian in Hawke's Bay was called to investigate increased mortality in deer. Nine animals had died (size of herd not stated). A sick animal from the same herd had red urine and was anaemic and the veterinarian suspected leptospirosis. A microscopic agglutination test (MAT) yielded a titre of greater than 1:3,200 for ***Leptospira interrogans* serovar Pomona** and a titre of less than 1:25 (negative) for *L. interrogans* serovar Hardjo, further supporting the initial diagnosis of leptospirosis.

Equine

A 9-year-old Thoroughbred gelding from Canterbury presented with severe neurological signs that included muscle tremors, partial vision loss and ataxia with no muscle weakness. The horse responded to treatment with steroids and DMSO (dimethylsulfoxide), but neurologic signs recurred when the medication was stopped. The week before the gelding was euthanased, it developed severe head shaking, especially in the sunlight. The horse was euthanased due to a poor long-term prognosis and the clinician performed a postmortem examination. Mixed fixed tissues, including the brain and major organs, were submitted to the laboratory. On gross examination of the fixed tissues, the cerebellopontine angle was filled with a brown to grey mass that formed fronds with a similar appearance to the choroid plexus that extended onto the surface of the leptomeninges. The lateral and fourth ventricles were mildly to moderately dilated (hydrocephalus), and the brain stem had a focus of haemorrhage visible on gross examination. Histologically, the cerebellopontine angle mass was composed of branching and arboriform papillae, which were lined by a single layer of epithelial cells. Epithelial cells were cuboidal with moderate amounts of eosinophilic cytoplasm. Nuclei were mostly round with finely stippled basophilic chromatin with 0–1 nucleoli. Mitoses were rare. The neoplastic papillae were supported by a fibrovascular stroma. Evidence of oedema was seen in the leptomeninges and in the Virchow–Robbins spaces. Given the histologic findings, the most likely cause of this horse's clinical signs was a **choroid plexus papilloma (CPP)**

with **secondary hydrocephalus-like change and cerebral oedema**. In general, tumours of the equine central nervous system are rare with the exception of adenomas of the pars intermedia of the pituitary gland. CPP is a rare, slow-growing, benign, intracranial tumour of the choroid plexus. In domestic animals, they are seen primarily in dogs, while sporadic-to-rare occurrences have been noted in cats, cattle and goats. In horses, there are at least three such tumours reported in the literature, and each was clinically associated with incoordination and ataxia. In this case, the ventricles were mildly to moderately dilated (hydrocephalus-like change). In animals with hydrocephalus, cerebral oedema can develop, and this was presumed to be secondary to the CPP.

A 12-year-old Waikato gelding had nodular, firm, tan thickenings of the nictitating membrane. The third eyelid was surgically excised and submitted to the laboratory in fixative. Microscopically, the mucosal epithelium had architectural distortion and was thickened up to 50x normal due to short, broad papillary structures, irregular and atypical rete pegs (in situ neoplasm) and nests of well-differentiated, neoplastic, squamous epithelial cells that did not communicate with the overlying mucosa. Nuclear atypia was present. The neoplastic cells had distinct cell margins and moderate-to-abundant eosinophilic cytoplasm with occasional dyskeratosis. Nuclei were round to oval with moderate anisokaryosis. Mitoses were regularly present at up to eight per 400x field and occasionally included atypical forms. Neoplastic squamous epithelial cells were also present within dilated lymphatic vessels. The biopsy was consistent with the clinically suspected **squamous cell carcinoma (SCC)** but had evidence of **lymphatic invasion** (metastasis). SCC is the most common tumour of the eye and adnexa in horses, with the nictitating membrane and the limbus being the most common ocular sites, followed by the eyelids. SCC is a locally aggressive neoplasm that often invades the surrounding tissues. While metastasis is rare, it was seen in this case. Metastasis is more likely to occur late in the course of disease, as suspected here.

A 6-month-old foal from Waikato presented with nasal discharge, consolidated lungs on imaging and very dull demeanour. A transtracheal wash was submitted to the laboratory for cytology and culture. Cytology showed a lightly mucinous background with numerous cells consisting almost exclusively of degenerate neutrophils, with only occasional respiratory epithelial cells and macrophages. Large cocci were present, often in the background and occasionally within neutrophils; **septic inflammation** was diagnosed. Culture had a heavy growth of both ***Escherichia coli*** and ***Staphylococcus aureus*** and no anaerobic organisms were isolated. Sensitivities showed that the *E. coli* was multidrug-resistant, being resistant to ceftiofur, chloramphenicol, ciprofloxacin, enrofloxacin, erythromycin, gentamicin, marbofloxacin, penicillin, rifampin, tetracycline, ticarcillin and trimethoprim/sulfamethoxazole. It had an intermediate sensitivity to amoxicillin/clavulanic acid. The *S. aureus* was resistant to gentamicin, penicillin, tetracycline, trimethoprim/sulfamethoxazole and was sensitive to ceftiofur and enrofloxacin.

A 6-month-old Waikato foal presented with septic physitis with a sequestrum. Suppurative material was noted at surgery and a swab was taken; a heavy growth of ***Rhodococcus equi*** was isolated. The bacterium was resistant to ceftiofur, penicillin, tetracycline, and trimethoprim sulfamethoxazole and had intermediate sensitivity to doxycycline. Haematogenous spread with resultant joint sepsis is a common co-morbidity associated with *R. equi* pneumonia (Ruocco et al., 2020).

Canine

A 12-year-old male, castrated small-breed dog from Whangamatā presented with clinical signs suggestive of adrenal-associated endocrine disease. Urine was submitted for urine cortisol-to-creatinine ratio and normetanephrine and metanephrine assessments. The UCCR was 4.3, suggesting a normal pituitary-adrenal axis (Smiley and Peterson, 1993). The urine was then referred for urinary catecholamine levels and the dog had a urinary normetanephrine:creatinine (N:C) ratio of 921 µmol/molcrn and a urinary metanephrine:creatinine (M:C) ratio of 39 µmol/molcrn.

While our laboratory does not have a reference interval for the N:C ratio in dogs, according to Salesov et al. (2015) healthy dogs have a N:C ratio of 26–123 whereas those with a phaeochromocytoma have a N:C ratio of 467–12,472. The M:C ratio is 12–65 in healthy dogs and 134–4,576 in dogs with a phaeochromocytoma. In this case, the N:C ratio is consistent with a phaeochromocytoma, whereas the M:C ratio would fit within the reference range. In previous studies, the N:C ratio has been considered more accurate. Therefore, it was felt that these results fit with a phaeochromocytoma. The left adrenal gland lesion was submitted. The adrenal gland biopsy received was 30 x 20 x 18 mm and had a yellow/tan, nodular, firm mass that expanded into or effaced the adrenal medulla and infiltrated and compressed the adrenal cortex. The tumour was a well-demarcated, densely cellular, multilobulated neoplasm composed of polygonal cells arranged in nests and packets, often palisading along a fine fibrovascular stroma. Mitoses were infrequent at 0–1 per 40x field. Neoplastic cells invaded vessels. Based on urine chemistry and adrenal gland histology, a diagnosis of **pheochromocytoma** was confirmed. Pheochromocytoma is the most common neoplasm arising in the adrenal medulla of dogs. The lesion is usually seen in middle-aged dogs with no breed or gender predilection. The tumours arise from the catecholamine-secreting chromaffin cells of the adrenal medulla, and are either adrenaline-secreting, noradrenaline-secreting, or both. Although the normal adult medulla secretes predominantly adrenaline, pheochromocytomas tend to produce

mainly noradrenaline. The lesions may be benign or malignant; malignant pheochromocytomas invade through the adrenal capsule and into adjacent structures or metastasise to distant sites. In this case, there was evidence of vascular invasion.

At a recheck six weeks following a triple tibial osteotomy in a 1-year-old female spayed American Staffordshire Terrier, two small puncture wounds were seen on the stifle area. A small swelling burst during cleaning and a sample was taken for culture which revealed a **methicillin-resistant *Staphylococcus aureus* (MRSA).**

Feline

A 13-year-old male neutered cat from Taranaki presented with weight loss, anorexia and depression. Serum biochemistry showed repeated mild elevation in lipase (up to 46U/L; reference 0–26). An exploratory laparotomy was performed, and the pancreas had multiple firm, tan nodules that were composed of cuboidal to columnar cells arranged in tubules or ducts with scattered cyst formation. Cystic ducts were filled with brightly eosinophilic material. Adjacent pancreatic tissue had regular vacuolar degeneration and/or a 'starry night' appearance with dropout of exocrine cells. The adjacent adipose tissue had scattered foci of necrosis and inflammation. Adipocytes exhibited a loss of cellular detail (fatty necrosis) and were replaced by eosinophilic amorphous to globular or basophilic finely granular mineral. The cat was diagnosed with an **exocrine pancreatic ductal adenocarcinoma** with steatitis. Pancreatic adenocarcinoma is a rare lesion found in middle-aged to older cats. Cats will often present with palpation of an abdominal mass or after a short history of weight loss, anorexia, vomiting or icterus. Bloodwork may have neutrophilia or elevated liver enzymes. Cats can develop alopecia as a paraneoplastic syndrome. While pancreatic adenocarcinoma usually forms solitary masses, it can also be multifocal or diffusely infiltrative, with the last being the case for this cat. Metastatic disease is present in up to 80 percent of cats at diagnosis with extension into the small intestine and distant metastases to the liver being the most common presentation. Nodal and pulmonary metastases are also common. Prognosis without treatment is poor to grave (Dedeaux et al., 2018).

A 1-year-old male, neutered domestic short-haired cat from Waikato presented with increased inspiratory effort and a 24-hour history of inappetence and lethargy. On physical examination the cat had a thoracic effusion that was sampled and submitted for cytology and retroviral serology. The effusion had a total protein of 34 g/L (reference interval 0–25) and a nucleated cell count (NCC) of 34.4 x10^9/L (reference interval 0–1.5), which were almost exclusively composed of lymphocytes. The lymphocytes had an increased number of intermediate-sized cells and there were occasional mitoses present in this population of cells. A diagnosis of **lymphoma** was made cytologically. The cat was **FeLV (feline leukaemia virus) antigen-positive** by RIM serology and was antibody-negative for FIV (feline immunodeficiency virus). FeLV is an oncogenic, immunosuppressive lentivirus (family Retroviridae) that replicates in haematopoietic and lymphatic tissues. It is associated with suppression of haematopoiesis, dysmyelopoiesis and lymphoma/leukaemia. Most FeLV-associated lymphomas are lymphoblastic T-cell lymphomas that arise in the mediastinum/thymus.

Lagomorph

A 4-year-old male, neutered Flemish Giant rabbit had a 2-cm diameter subcutaneous-to-dermal mass surgically excised from the right thorax. The mass was exophytic and elevated the overlying alopecic epidermis. The surrounding tissues were gelatinous. Microscopically, the lesion was composed of islands and branching trabeculae neoplastic epithelial cells. The tumour was most consistent with a **trichoblastoma**. This is one of the three most common skin tumours in rabbits (von Bomhard et al., 2007) and it is derived from, or recapitulates, primitive hair germ. In other domestic species these are considered benign in their behaviour and adequate surgical excision is the treatment of choice.

Avian

A bird of unknown age and sex from the Auckland area presented with poor body condition scores. Submitted fixed tissues included liver, gastrointestinal tissues, enlarged peripheral nerves and an eye with a yellow to grey iris. Histology showed variably-sized clusters of lymphocytes that effaced or distorted normal tissue architecture in the liver, air capillaries, pancreas, kidney and peripheral nerves. The proventriculus mucosal lamina propria and serosa, and the enteric lamina propria, muscle layers and myenteric plexus were expanded by neoplastic lymphocytes. The iris of the eye was also infiltrated by lymphocytes with scant amounts of eosinophilic cytoplasm and small, round, hyperchromatic nuclei to large lymphocytes with small amounts of eosinophilic cytoplasm and large, irregularly round nuclei with dense chromatin and indistinct nucleoli. Mitoses were not numerous but were regularly present. The bird was diagnosed with a lymphoid proliferation consistent with **Marek's disease virus (Gallid herpesvirus-2).** This diagnosis was preferred over other neoplastic, viral-associated lymphoid proliferations due to the involvement of the submitted peripheral nerves. Invasion into the neural tissues is not usually seen with avian lymphoid leukosis (Type C retrovirus).

A 19-year-old male pet cockatiel from Waikato presented with a growth between the right leg and cloaca that was crusty and had abnormal feathering around the mass. The lesion was biopsied and submitted for histology. The tissues were consistent with feathered skin that had a dermal neoplasm consisting of sheets, ribbons and nests of well-differentiated squamous cells that variably communicated with the overlying ulcerated epidermis and occasionally formed keratin pearls. Well-differentiated squamous cells were lined by reserve cells and had moderate-to-marked anisocytosis and anisokaryosis. Mitoses were

regularly present at 0–4 per 400x field. The neoplasm was supported by a fibrovascular to myxomatous stroma with scattered neutrophils. The lesion was diagnosed as a **squamous cell carcinoma (SCC)**. Squamous cell carcinomas tend to be slow growing and can arise anywhere in the skin; chronic inflammation/irritation or metaplasia may predispose birds to this tumour. Metaplasia can occur in birds with a vitamin A deficiency, which is not uncommon in psittacine birds fed a diet supplemented with seeds or that has seeds as the main food source, as seeds are often deficient in vitamin A. In pet birds, SCC is diagnosed most commonly in cockatiels, Amazon parrots and budgerigars. In general, it is locally aggressive and tends to recur.

Gribbles Veterinary Laboratories

Bovine

A small group of Friesian cross heifer calves on a small lifestyle farm property in Canterbury were placed into a paddock that held a burn pile containing waste timber. Within a few days of being placed in this paddock, four of the calves were found dead and two were sick with signs of abdominal disease and pain. Arsenic poisoning was suspected and the remaining calves were removed from the paddock. Fresh liver was collected for testing from one of the dead calves and the arsenic concentration was 16.2 mg/kg. Arsenic levels greater than 4 mg/kg in the liver or kidney support a diagnosis of toxicity (Parton et al., 2001). The diagnosis was acute **arsenic toxicity,** which was likely to be the result of the calves having ingested ashes from tanalised wood in the burn pile.

A group of thirty 6-month-old Wagyu cross calves on a northern Waikato property had a history of scouring and lethargy and one died. Faecal samples were collected for laboratory testing. Bacterial culture yielded ***Yersinia pseudotuberculosis*** and there were also significant numbers of **strongyle** eggs and **coccidia** present, leading to a diagnosis of **combined strongyle parasitism, coccidiosis and yersiniosis.**

Four rising 1-year-old Hereford cross calves died on a Waikato farm after developing respiratory signs characterised by coughing, hypersalivation and dyspnoea. Numerous adult lungworms were observed within airways at necropsy. Histopathological examination of the lung tissue revealed widespread bronchointerstitial pneumonia with abundant eosinophils and macrophages, type II pneumocyte hyperplasia and intralesional nematode adults and larvae, confirming the diagnosis of **dictyocauliasis** (lungworm infection).

On a Canterbury property over a period of 4–6 weeks, several animals in a group of 6-month-old Friesian cross dairy calves became ataxic and showed other neurological signs, particularly when stressed, although most animals seemed to recover. However, two animals subsequently became recumbent and later died. Necropsy findings on these animals were unremarkable but histopathological examination of fixed brain tissue revealed a severe laminar cortical necrosis typical of **polioencephalomalacia** (PEM). Potential causes of PEM include vitamin B1 deficiency (even with a recent history of supplementation), sulphur toxicosis, and possibly water deprivation/sodium ion toxicosis (salt poisoning). When there is a history of adequate vitamin B1 supplementation, PEM has also been associated with altered ruminal flora (from a recent change in diet or pasture quality) producing the enzyme thiaminase, thus reducing the availability of thiamine to be absorbed in the gut.

In another case, two weaner beef calves from a group of unspecified size on a Ruapehu farm developed neurological signs of blindness and stargazing, progressing to recumbency. One calf responded to treatment with vitamin B1 (thiamine) and the non-steroidal anti-inflammatory drug meloxicam. The other calf did not respond to treatment and died. The brain was removed from the dead calf and examined histologically, revealing the characteristic laminar necrosis and degeneration of **polioencephalomalacia**. In New Zealand, PEM is most often attributed to an induced thiamine deficiency caused by a change in diet.

Two adult dairy cows on a South Canterbury farm developed severe mastitis and died. A sample of mammary gland was collected from one of the affected cows and submitted for histopathology and bacterial culture. Histopathological examination revealed severe haemorrhagic and necrosuppurative mastitis with intralesional bacteria. Bacterial culture yielded a heavy growth of predominantly ***Escherichia coli,*** confirming a diagnosis of **coliform mastitis**. *Escherichia coli* is an environmental organism that can act as an opportunist pathogen, causing sporadic mastitis cases or small mastitis outbreaks. Teat damage, contaminated environments, overmilking and compromised immunity are potential risk factors for infection. In severe cases, death may occur due to endotoxic shock.

An adult Friesian–Hereford cross cow on a farm in Marlborough developed proliferative and crusting lesions on the non-pigmented skin of the udder. Histopathological examination of a biopsy from the affected area revealed a proliferation of neoplastic keratinocytes consistent with **squamous cell carcinoma.** Given the location, the neoplasm was likely to have been solar-induced.

A newly acquired calf that arrived on a Northland property was noticed to be lethargic and anorexic with very pale mucous membranes. A blood sample was obtained and testing revealed that the calf was markedly anaemic with a haematocrit of 0.06 L/L (reference interval 0.24–0.4) and a haemoglobin concentration of 20 g/L (reference interval 85–130). There were about 60 *Theileria* organisms per 1000 red blood cells. A PCR test was positive for ***Theileria orientalis*** **Ikeda**, consistent with a diagnosis of anaemia due to **theileriosis**.

A 6-month-old crossbred beef calf from a property near Kaitaia was noticed to be unwell and lethargic and a veterinarian was called

to examine the animal. Clinical examination revealed hypothermia (body temperature was 36°C) and gingival ulceration. A bovine viral diarrhoea virus (BVDV) antigen ELISA (enzyme-linked immunosorbent assay) test on a serum sample had a high positive result, supporting the suspected diagnosis of **BVDV persistent infection**.

A 6-month-old Friesian calf on a property in North Waikato was recumbent, obtunded, hypothermic (body temperature 36.5°C), tachycardic and tachypnoeic. The calf was euthanased and necropsy showed no obvious gross abnormalities. Serum biochemistry, haematology and blood lead evaluations on samples collected antemortem showed no significant abnormalities. Histopathological examination of fixed tissue samples showed intranuclear viral inclusions, consistent with **bovine adenovirus** infection. Adenoviruses are common and most calves are exposed. Infections with adenoviruses usually result in haemorrhagic diarrhoea but can sporadically cause fatal generalised infections, or pneumonia and enteritis, especially in immunocompromised animals such as those that are young, or that have other infections such as BVDV.

On a farm near Te Awamutu with 380 cattle, a 2-year-old Jersey bull had a persistent fever of 41°C for five days. The fever was unresponsive to antibiotics. After corneal opacity and neurological signs developed, a blood sample was submitted for **ovine herpesvirus-2** PCR testing. The PCR test was positive, confirming the clinically suspected diagnosis of **malignant catarrhal fever**.

Three pieces of fixed tissue taken from a lump on the face of a beef steer on a North Waikato property were submitted for histopathological examination as the farmer wanted to rule out the possibility that it was some type of cancer. On histopathological examination, there was pyogranulomatous dermatitis and cellulitis with aggregates of neutrophils surrounding colonies of bacteria embedded in bright eosinophilic radiating material (Splendore-Hoeppli reaction), consistent with **actinobacillosis**. Actinobacillosis is an infection of the soft tissues caused by the bacterium ***Actinobacillus lignieresii***. It is most commonly observed in the tongue and oral cavity (woody tongue) but can also occur at other sites including the skin, lymph nodes, respiratory tract, gastrointestinal tract and mammary glands. Infection is thought to occur when this commensal of the gastrointestinal and upper respiratory tract gains access to deeper tissues following trauma or abrasions.

On a farm near Thames, an adult dairy cow of unspecified age that had initially been diagnosed with cellulitis of the left hindquarter, failed to respond to treatment with amoxicillin and developed a large swelling in the left quadriceps region. A veterinarian was called to revisit the animal and a large volume of serosanguinous fluid was drained from the swelling, which was suspected to be a possible haematoma. A sample of the fluid was submitted to the laboratory to rule out infection. This yielded a heavy growth of ***Helcococcus ovis*** and a moderate growth of ***Trueperella pyogenes*** indicating an **abscess**. *Helcococcus ovis* was first described as a novel bacterium in 1999 after it was isolated from multiple tissues on postmortem examination of a ram as well as from a separate case of subclinical mastitis in a ewe. Since then, it has been recognised as an emerging pathogen in bovine endocarditis, mastitis and metritis and has been associated with infections in various tissues of other species including humans. Interestingly, it is commonly detected in co-infection with *Trueperella pyogenes*. Locally, *H. ovis* has been recorded on 21 occasions through the Gribbles laboratory network since 2018. Most of these have been cases of bovine mastitis but have also included five instances of abscessation in cattle, sheep and goats. In many cases, the organism was isolated in pure heavy growth but co-infection with *T. pyogenes* has occurred in six cases.

A 2-year-old Jersey cow from a North Otago dairy farm developed multiple raised circular cutaneous masses, predominantly on the head and neck. The masses were often alopecic and sometimes ulcerated. An excisional biopsy that included two of the masses was submitted for histopathological examination. Infiltrating along the dermis were two densely cellular, moderately circumscribed neoplasms composed of sheets of neoplastic lymphocytes, consistent with **cutaneous lymphoma**. At least four different forms of lymphoma in cattle have been described: calf/multicentric, thymic, cutaneous and enzootic. The first three forms occur sporadically with the cutaneous form most typically affecting cattle aged 2–3 years. Lesions may regress and reappear, with eventual progression to visceral organs and the blood (leukaemia). Enzootic bovine leucosis, which was *not* suspected in this case, is associated with bovine leukaemia virus infection in adult cattle (peak incidence is between 6 and 8 years of age) and may affect the abomasum, heart base, uterus and other organs.

A 5-year-old Friesian cow from a North Otago farm collapsed shortly after milking and died. This cow had collapsed the previous week when she was also noticed to have diarrhoea, but she had responded to treatment with intravenous calcium and magnesium. No significant findings were noted on necropsy and evaluation of the aqueous humour for calcium, magnesium and nitrate concentrations showed no abnormalities. Histopathological examination of the heart revealed multifocal loss of about 20 percent of cardiomyocytes with replacement fibrosis and infiltrates of low numbers of mononuclear inflammatory cells. Additionally, there was mild hepatic passive congestion and pulmonary oedema. On further discussion with the submitting veterinarian, it was noted that monensin was being added to a mineral mix. Inadequate mixing by the farmer, even at the correct dose rates, may have resulted in some cattle getting larger than recommended doses of the ionophore, as monensin could settle out of the mix. The clinical, pathological and epidemiological evidence was strongly supportive of a diagnosis of **ionophore toxicity** due to **monensin**.

On a Manawatū contract grazing property, five animals from a group of one hundred 9-month-old heifers developed acute severe watery diarrhoea and two died. Necropsy revealed reddening of the small intestines. On histopathological examination, despite marked mucosal autolysis of the intestinal samples, intranuclear viral inclusion bodies were observed in the submucosal blood vessels, consistent with **bovine adenovirus** (Vaatstra et al., 2016). Similar viral inclusions were seen in endothelial cells in the kidney and mesenteric lymph node. Cattle of this age are particularly susceptible to this disease and risk factors may include lower night temperatures heading into autumn, particularly when there is tight feed or grazing pressure.

A four-year-old Friesian cow on a Wairarapa property died following acute severe epistaxis. Necropsy revealed jaundice, a lung abscess and fibrosis of the lung tissue. The cows had been strip-grazing turnips with ad lib access to pasture. The pasture had a high count of *Pithomyces chartarum* (the cause of facial eczema) fungal spores at 200,000/g. The cows had been given a zinc bolus to give some protection from sporidesmin toxicity (facial eczema). Histopathological examination of the fixed tissues revealed an encapsulated **lung abscess** and multifocal suppurative inflammation within the bronchi. In the liver, small to medium-sized bile ducts had epithelial degeneration and sclerosis, typical of **turnip toxicity** rather than sporidesmin toxicity (Collett, 2014). Additionally, there was centrilobular congestion. Bacterial erosion of pulmonary blood vessels from the abscess was the likely cause of the epistaxis. In cattle, such abscesses can originate in the liver (as a result of ruminal invasion following subclinical acidosis) with septic emboli spreading haematogenously to the lung. However, liver abscessation was not observed in this case. No other cows showed signs of turnip toxicity and it was possible that this cow had preferentially grazed the crop rather than the concurrently available pasture. Nevertheless, it was recommended that liver enzyme concentrations be tested in several of the other cows to investigate for subclinical toxicity and that serum zinc levels for facial eczema prophylaxis be monitored in light of the high pasture spore counts. Alternatively, other forage in the form of baleage could be provided until pasture spore counts decreased.

A dairy cow on a property near Oamaru died following a short period of recumbency. Necropsy revealed fibrinous peritonitis. A full range of tissues was examined histopathologically, revealing severe necrotic **abomasal ulceration** with marked bacterial colonisation and diffuse peritonitis. Underlying causes of abomasal ulcers in lactating dairy cows are multifactorial, involving stress factors that can increase the production of acid in the abomasum. Other contributing factors may include periods of inappetence or ischaemic damage (for example, from the use of non-steroidal anti-inflammatory drugs or abomasal volvulus).

An 18-month-old heifer died on a property near Whanganui after being treated a few days previously for pneumonia. Histopathological examination of a range of fixed tissues confirmed acute severe suppurative **bronchopneumonia** as well as evidence of multi-organ **septicaemia.** Although bacterial cultures were not completed in this case, typical causal bacteria for this type of presentation include *Mannheimia haemolytica*, *Pasteurella multocida*, *Histophilus somni* and *Bibersteinia trehalosi*. Stress factors or preceding viral respiratory infections usually play some role in increasing susceptibility to infection with these bacteria, which are often part of the normal bovine nasopharyngeal flora.

Ovine

Clinical parasitism was a common problem in this quarter. In one case, a group of sheep in Canterbury were doing poorly and faecal egg counts were high with a mean faecal egg count of 7,000 eggs per gram of faeces. **Haemonchosis** was suspected as some animals had pale mucous membranes. Larval culture revealed that 46 percent of the 16,880 larvae recovered were *Haemonchus* species with 24 percent *Cooperia* species, 24 percent *Trichostrongylus* species, 4 percent *Teladorsagia* species and 2 percent *Chabertia/ Oesophagostomum* species. The moist and warm late summer weather may have favoured parasite larval development this season.

A 13-year-old Romney ewe from rural Auckland had a large haematoma in the jugular area and the attending veterinarian had concerns for some sort of coagulopathy. Haematological examination of a blood sample revealed a marked leukocytosis with a white blood cell count of 714 x 10^9/L (reference interval 4–10 x 10^9/L). There was a predominance (692 x 10^9/L or 97 percent) of atypical intermediate-to-large round mononuclear cells, consistent with a **leukaemia.** The morphology of the cells suggested either lymphoid leukaemia or the leukaemic phase of a lymphoma.

On a Southland property, 1,890 Romney lambs that were 4–6 months old were drenched with a compounded mineral mix containing copper sulphate and sodium selenite. Within the next couple of days, 1,604 (85 percent) of the lambs died. Liver and kidney samples were collected from five of the dead lambs for copper and selenium testing. The concentration of selenium in the livers of the dead lambs ranged from 107,000 to 261,000 nmol/kg (liver selenium levels > 15,000 nmol/kg are considered toxic), confirming a case of **acute selenium toxicity** in these lambs, most likely from an improperly compounded mineral mix.

A warm, wet summer resulted in suspected or confirmed outbreaks of **leptospirosis** in lambs in the lower North Island. For example, on one Wairarapa farm, in a group of 800 lambs, 10–15 died each day over a period of several days. Many of the dead lambs were grossly jaundiced. In another case, at least 60 of 1,000 lambs on a Rangitīkei farm died acutely, some with evidence of jaundice and red-tinged urine. Although urine PCR tests for leptospirosis were negative in both these outbreaks, histopathological

examination revealed hepatocellular necrosis as well as haemoglobin in the kidney, consistent with a haemolytic crisis and compatible with a diagnosis of leptospirosis. Follow-up serology on some of the affected farms revealed high MAT (microscopic agglutination test) titres to *Leptospira* serovar Pomona.

On a Tararua district farm, at least 20 of a group of 2-year-old ewes developed diarrhoea and 10 died within two weeks after being shorn and drenched. One affected ewe was euthanased. Postmortem examination of this animal revealed dehydration and watery intestinal contents. Histopathological examination of the small intestine revealed changes compatible with a bacterial enteritis (neutrophilic inflammation and crypt abscesses with associated bacteria). ***Salmonella* Hindmarsh** was isolated from an enriched culture of a sample of faeces, confirming an outbreak of enteric **salmonellosis.**

A 4-year-old ewe on a North Canterbury farm developed illthrift and died. A necropsy performed by the farmer revealed multiple white foci throughout the liver. Histopathological examination of a sample of the liver revealed multifocal infiltrates of neoplastic lymphocytes effacing the hepatic parenchyma, consistent with **lymphoma**. Spontaneous lymphoma is an uncommon diagnosis in sheep. Most lymphomas in sheep are multicentric with lymph nodes, spleen and liver being the organs most commonly affected. Lymphoma has not been reported to be associated with any viral aetiology in New Zealand.

On a Canterbury property, a number of 6-month-old store lambs developed neurological signs of stargazing, spasm and lateral recumbency with 2–3 lambs found dead each morning for several days. The lambs had been shorn two weeks earlier. Histopathological examination of submitted brain tissue revealed laminar cerebral cortical neuronal necrosis, neuropil vacuolation and microgliosis indicative of **polioencephalomalacia.** Causes of this disease relate to thiamine (vitamin B1) deficiency or increased bacterial thiaminase production within the gut, which can occur with diets high in fermentable carbohydrates or recent alterations in rumen flora. Other inciting factors may include high sulphur intake, cobalt deficiency and use of the coccidiostat amprolium (which was not administered in this case).

Caprine

A five-year-old Alpine goat on a North Auckland property had been losing weight for two months, had pasty faeces, pale mucous membranes, tachycardia and increased gut sounds. Significant findings on serum biochemistry, haematology and faecal parasitology testing included marked hypoalbuminaemia of 18 g/L (reference interval 35–43) suggesting a protein-losing enteropathy; a mild non-regenerative anaemia with haematocrit of 0.19 L/L, (reference interval 0.2–0.4) and haemoglobin concentration of 68 g/L (reference interval 80–140) suggesting chronic disease or recent blood loss; and 3,200 strongyle eggs per gram of faeces, suggesting an underlying cause of **nematode parasitism**. Generally, most goats do not develop a resistance to endoparasites as they age and mature but rather, they remain susceptible to significant parasite burdens if there is not adequate parasite management.

Equine

A Standardbred mare of unspecified age in the Canterbury region had a two-year history of irregular oestrous cycles, excess uterine fluid and pregnancy loss and was examined by a veterinarian as part of a work-up to investigate her reproductive problems. Samples submitted to the laboratory included uterine smears for cytology, a guarded swab from the uterus for bacterial culture and sensitivity testing and uterine biopsies. Cytological examination of the uterine smears revealed a moderate mononuclear inflammation and the presence of myriad pleomorphic yeast organisms, seen both free in the smear background and also within the cytoplasm of some of the macrophages. Bacterial culture of the uterine swab yielded a heavy growth of a yeast identified by MALDI-TOF MS as *Pichia kudriavzevii*, which is synonymous with *Candida krusei*. Histopathological examination of the uterine biopsies revealed severe, widespread and multifocal chronic inflammatory changes with infrequent periglandular fibrosis (grade III). However no fungal elements or yeasts were identified in the sections examined. Despite the lack of observed yeast organisms in the uterine biopsy sections, the cytology and culture results supported a diagnosis of **fungal endometritis**. This is an uncommon and often opportunistic infection, which can result in reduced pregnancy rates in affected mares.

A fixed biopsy was received from an ulcerated mass on the third eyelid of a 13-year-old horse on a Canterbury property. Histopathological examination revealed an increased number of elastic fibres typical of ultraviolet (UV) light exposure as well as a haemangiosarcoma which was also likely to have been induced by UV exposure. Complete surgical excision is often curative for these lesions.

Abdominal fluid from a 5-month-old Thoroughbred colt in Waikato was submitted to the laboratory for culture after in-clinic diagnostics indicated the presence of a septic peritonitis and uroperitoneum. The colt had a previous history of bronchopneumonia due to *Rhodococcus equi* as well as an abscess in the left inguinal area, which had been treated six weeks before. At exploratory laparotomy, abundant, dark-orange peritoneal fluid with small flakes of purulent material was found. The omentum was haemorrhagic and thickened and a 20 x 30 cm firm mass was located behind an enlarged right kidney. Adhesions were present between the mesentery of the small colon, the omentum and the mass, which had the appearance of an abscessed lymph node. Due to the grave prognosis, the colt was euthanased. Culture of the fluid yielded a heavy growth of *R. equi* confirming a diagnosis of **peritonitis** due to this organism. ***Rhodococcus equi*** is a common cause of bronchopneumonia in foals. It can also cause infections at extrapulmonary sites including lymphadenitis,

peritonitis, hepatitis, nephritis, ulcerative enterotyphlocolitis, uveitis, septic arthritis, osteomylelitis and abscesses in various tissues. Studies suggest these extrapulmonary manifestations are common in foals with *R. equi* pneumonia, although they may not always be obvious clinically. Extrapulmonary infections can also manifest several weeks after the bronchopneumonia has been treated and resolved.

Porcine

On a Maramarua property with a history of high stocking density but no recent drenching, a faecal egg count on a sample of faeces from an unwell 4-month-old pig contained 4,550 **ascarid** eggs per gram of faeces as well as moderate-to-large numbers of **coccidia** (oocysts). Any ascarid eggs in the faeces of pigs under five months of age can be clinically significant.

Canine

A 1-year-old dog in Auckland had a three-day history of diarrhoea. A faecal sample was collected and sent to the laboratory to screen for common enteric pathogens. A faecal egg count for worm parasites was negative but an ELISA test for ***Giardia* sp.** was positive and bacterial culture yielded a ***Campylobacter*** species as well as ***Salmonella* Livingstone** confirming **combined salmonellosis, campylobacteriosis** and **giardiasis.** Although *Salmonella* Livingstone is an uncommon isolate in humans with only one case reported in 2022, it was the most common type reported in dogs in 2022 with 23 cases according to New Zealand surveillance data provided by the Institute of Environmental Science and Research (ESR) [funded by the Ministry for Primary Industries with the co-operation of the diagnostic laboratories].

A 2-year-old working Huntaway dog in the Rangitīkei district was anorexic and lethargic. Ultrasound examination indicated free fluid in the retroperitoneal space and a hyperechoic renal pelvis. Biochemistry testing showed markedly increased concentrations of serum creatinine (479 µmol/L, reference interval 48–109) and urea (43 mmol/L, reference interval 2.5–9), with mild hyperglobulinemia of 40 g/L (reference interval 19–35) and marginal hypoalbuminemia of 31 g/L (reference interval 33–44). There were also mildly decreased concentrations of sodium (139 mmol/L, interval range 141–153) and chloride (83 mmol/L, reference interval 104–123), with marginally elevated potassium (5.6 mmol/L, reference interval 4–5.4 mmol/L). Haematological examination showed a moderate neutrophilia of 21.9 x 10^9/L (reference interval 3.6–11.5 x 10^9/L), with mild toxic changes in the neutrophil cytoplasm and a few reactive lymphocytes. No urinalysis results were available. The marked azotaemia was concerning for renal insufficiency and given the inflammatory leukogram and presence of retroperitoneal fluid, differentials included trauma (with urine leakage or haemorrhage), pyelonephritis or renal abscess, or neoplasia such as lymphoma. Leptospirosis has also been associated with renal failure and perirenal fluid accumulation in dogs. Paired serological testing for leptospirosis was performed using MAT tests on serum samples collected at initial presentation and two weeks later (results in **Table 1**), which confirmed active **leptospirosis** (with serovar Pomona) as the cause of the acute kidney injury. Two weeks after initiating treatment, the azotaemia had resolved and the dog was reported to be doing well clinically.

A 12-year-old dog in Manawatū-Whanganui had severe diarrhoea, lethargy and weight loss. Biochemistry testing performed using an in-clinic analyser revealed hyponatraemia with a serum sodium concentration of 124 mmol/L (reference interval 138–160), and hyperkalaemia with a serum potassium concentration of 6.4 mmol/L (reference interval 3.5–5.8) giving a Na:K ratio of 19.4 (reference interval 27–40), raising concern for hypoadrenocorticism (Addison's disease). A sample of faeces was submitted to the laboratory for a panel of tests for common causes of diarrhoea, along with a serum sample to further investigate the possibility of Addison's disease using a test for basal cortisol. The serum cortisol concentration was 396 nmol/L (reference interval 30–100 nmol/L), helping exclude Addison's disease. ELISA tests for *Giardia* sp. and *Cryptosporidium* sp. were negative. The faecal egg count revealed a significant worm burden with 3,075 *Trichuris* sp. eggs per gram of faeces. **Whipworm infection (*Trichuris vulpis*)** can present with diarrhoea, inappetence, anorexia, dehydration, weight loss and weakness, as well as a decreased Na:K ratio. These signs can resemble those of Addison's disease. Whipworms produce lemon-shaped eggs (bipolar-plugged), which can remain infective in the environment for several years. Infections in dogs are typically subclinical, but high worm burdens can result in haemorrhagic colitis and **pseudo-Addison's disease**. The pathophysiology behind the electrolyte changes in severe whipworm infection is not well understood but may involve increased intestinal loss of sodium, together with a loss of bicarbonate resulting in an acidosis-mediated hyperkalaemia.

Feline

An 8-year-old male, neutered domestic long-haired cat from Hawke's Bay developed a 5-mm diameter, 8-mm deep ulcerated lesion on the right nasal planum. A biopsy of the lesion was submitted to the laboratory for histopathological examination, which revealed granulomatous inflammation

Table 1: Paired serological testing results for leptospirosis

Leptospira interrogans serovar	Initial titre	Convalescent titre
Pomona	1/50	> 1/3200
Hardjo	1/200	1/400
Copenhageni	< 1/25	1/400
Tarassovi	< 1/25	< 1/25

with numerous intralesional yeasts measuring 4–8 microns in diameter with thick capsules. The yeasts were clearly visualised on periodic acid-Schiff (PAS) stained sections. Occasional narrow-based budding was observed, consistent with a diagnosis of **cryptococcosis.** Cryptococcosis is the most common systemic mycosis of cats. Most cases are caused by *Cryptococcus neoformans* or *C. gattii*, with rare cases caused by other species (for example, a New Zealand case involved *C. laurentii*). Infection is typically acquired from the environment, particularly bird droppings, soil or decaying organic material. The initial site of infection is often the nasal cavity, but the oral cavity, lungs or gastrointestinal tract may also be involved. Cryptococcosis has zoonotic potential.

A four-year-old female, domestic short-haired cat living in South Wairarapa developed a fever of 40.5°C and had a non-healing wound on the right hind leg that burst open repeatedly despite over a month of antibiotic treatment. Biopsies were collected from various sites within the wound and histopathological examination revealed severe pyogranulomatous dermatitis and cellulitis associated with large colonies of tangled bacterial filaments. Gram and Fite's acid-fast stained sections revealed gram-positive, beaded, filamentous bacteria with occasional acid-fast staining. These findings were considered compatible with **nocardiosis**. *Nocardia* sp. bacteria occasionally cause relapsing infections in cats. The organisms are found in soil, organic material, vegetation, and water and are typically inoculated traumatically. Zoonotic transmission is possible, particularly to immunocompromised people.

Cetacean

Necropsy of multiple common dolphins (*Delphinus delphis*) from a stranding event on the Auckland coast showed that many had lung lesions, some of which were associated with grossly visible lungworms. On histopathological examination there was a severe chronic-active bronchopneumonia with many **lungworm** parasites present. Some of the dolphins also had a **secondary bacterial pneumonia** involving short, gram-negative bacilli but bacterial culture was not performed so these organisms were not specifically identified. Lungworms (*Stenurus ovatus* and *Parafilaroides* sp.) are commonly seen in necropsies of this species of dolphin.

Avian

Faeces from a captive pigeon (*Colomba livia*) from the Auckland area were submitted to the laboratory for parasitological examination and were found to contain moderate-to-large numbers of **coccidia** (likely *Eimeria* species) oocysts as well as moderate numbers of ***Capillaria* sp**. eggs. Both organisms can be associated with diarrhoea and weight loss in pigeons (Sood et al., 2018).

On a farm in South Canterbury, a number of 3-month-old pheasants were dying acutely. Fixed tissues were submitted from one of the dead birds and histopathological examination revealed a massive infestation of coccidia in much of the intestine, consistent with a diagnosis of clinical **coccidiosis**.

A juvenile kererū (*Hemiphagia novaseelandiae*) was presented to a Christchurch wildlife clinic in a moribund state and was euthanased. At necropsy, granulomas infiltrating the choana and extending into the nasal cavity and nasopharynx were identified. Histopathological examination revealed a severe subacute to chronic heterophilic and necrotising rhinitis with intralesional fungal hyphae. The fungi had characteristics consistent with ***Aspergillus* sp**. confirming a diagnosis of **aspergillosis.**

Piscine

A black mudfish/waikaka (*Neochanna diversus*) from a captive breeding group was euthanased due to a jaw lesion. Histopathological examination showed that the oral mucosa, skin and gills had moderate, multifocal areas of epidermal hyperplasia and mononuclear inflammation with intramucosal and subcutaneous parasites (presumptive ***Ichthyophonus* sp.**). *Ichthyophonus* was previously thought to be a fungus but is now classified as a protist within the class Mesomycetozoea. It has been isolated from freshwater and saltwater fishes worldwide. Infections may be subclinical or range from mild to severe disease with external ulcers, extensive tissue and organ damage, and heavy mortality (Bruno et al., 2006).

Exotics

A meerkat from a South Island zoological park had a history of neurological signs, including seizures, which became increasingly severe and the animal was euthanased. Histopathological examination of fixed tissues revealed a lymphohistiocytic meningitis and myocarditis as well as a suppurative uveitis. PCR testing of fresh tissues confirmed infection with ***Toxoplasma gondii***, the agent responsible for **toxoplasmosis**. *Toxoplasma gondii* is an obligate intracellular protozoan parasite that affects a wide range of species, although meerkats are thought to be particularly susceptible to infection. Cats are the definitive host for *T. gondii,* shedding oocysts in their faeces. Infection of intermediate hosts is via contaminated soil, food or water, uncooked meat, or congenital infection via the transplacental spread of tachyzoites. In the zoological park environment, infection in animals such as this meerkat is presumed to occur via the ingestion of contaminated feed, hunting of other infected intermediate hosts such as rodents or as a result of feral cats accessing the enclosure.

IDEXX Laboratories

Bovine

A cohort of 8-month-old heifer calves from a Matamata-Piako property were investigated for illthrift, having poor coat condition and ringworm lesions. Zinc supplementation was provided in the water. Serum samples from six calves showed elevated zinc levels, ranging from 19.8 to 73.1 µmol/L, and an average of 44.9 µmol/L (reference interval 11–20). Zinc levels for facial eczema prophylaxis should be 20–35 µmol/L; a level above this range reflects increasing risk of **zinc toxicity** (Black, 2010). High dietary zinc levels can impair copper absorption (Grace et al., 2010), but serum copper

was within normal limits for all animals tested.

Multiple submissions were received from a farm in Taranaki that had high zinc levels detected in the bulk milk tank testing. A serum sample was submitted from a 5-year-old dairy cow that was pale and off milk for one week. The serum zinc level was 141.7 µmol/L (reference interval 11–20). GGT was also high in this cow at 42 IU/L (reference interval 0–36), indicating hepatic injury. Additional samples from 15 cows showed that 13 of the animals had high zinc levels with a mean of 39.0 µmol/L and a range of 13.9–67.7 µmol/L (reference interval 11–20) These results indicated **zinc toxicity**.

On a Palmerston North property, a 6-month-old dairy calf presented with jaundice and a postmortem examination revealed hepatic necrosis. Kidney and liver copper levels were 209 and 5,625 µmol/kg (reference intervals 0–157 and 95–2,000, respectively), confirming **copper toxicity**. Liver samples from twelve other calves in the mob showed most animals had excess copper levels with a range of 1,688–6,010 and an average of 2,993 µmol/kg. Copper toxicity can lead to hepatic necrosis and a haemolytic crisis, with secondary pigmentary nephropathy.

A Waikato property had approximately 20 of 100 at-risk calves die (exact ages were not provided) during a storm. The mob had been losing condition for a few days, and one calf was scouring and pyrexic (40.5°C). Faecal samples from two animals revealed a significant burden of **strongyles** with 900 and 1,075 eggs/g. ***Yersinia pseudotuberculosis*** was also isolated from one sample and may have been a contributing factor to illness when combined with the stress of endoparasitism and inclement weather.

Three adult cows of varying ages died in Matamata-Piako, showing skin lesions consistent with photosensitivity. The cows were on grass and a turnip crop, with zinc supplementation in water and via a lick block. Serum samples from ten cows were submitted, including two with skin lesions and another 'sick' cow (results in **Table 2**). These findings suggested that zinc supplementation was likely inadequate for **facial eczema** prophylaxis (target range is 20–35 µmol/L), and the elevation of GGT and GLDH in some animals suggests facial eczema was involved. Nonetheless, grazing turnips can also cause **hepatogenous photosensitisation** (often with GLDH more markedly increased than GGT), and in one animal a different cause of skin lesions was likely with normal liver enzymes. Three animals were also noted to have mild **copper deficiency**.

A 6-month-old Jersey bull calf in rural New Plymouth died with respiratory signs and no lungworms noted at postmortem. Seven calves from the same mob died. Lung samples were submitted for histopathology and microbial culture. Based on histopathology, a diagnosis was made of acute fibrinosuppurative and necrotising **bronchopneumonia** with intralesional bacteria. Microbial culture results revealed heavy growth of ***Edwardsiella tarda*** and moderate growth of a mixed bacterial population. *Edwardsiella tarda* is associated with aquatic environments but can be an opportunistic pathogen in mammals. It has also been reported to cause enteritis and septicaemia in cattle.

Faecal samples from three calves in Northland were submitted for culture and parasitology. One sample had ***Salmonella*** **Emek** isolated, another sample had heavy growth of ***Yersinia pseudotuberculosis*** and the remaining sample had no *Salmonella* or *Yersinia* isolated. Salmonella Emek is one of the less commonly isolated *Salmonella* serotypes identified in cattle. Parasitology results revealed a moderate **strongyle** count of 175–325 eggs/gram and low numbers of **coccidia** (1+).

A 5-year-old dairy cow in north Waikato had profuse malodorous bloody diarrhoea. On faecal culture ***Salmonella*** **Typhimurium** was isolated. Salmonellosis in adult cattle typically presents sporadically as chronic diarrhoea and loss of condition

Table 2: Mineral and enzyme levels in the serum of ten cows

Animal	Selenium (nmol/L)	Copper (µmol/L)	Magnesium mmol/L)	GGT (IU/L)	Zinc (µmol/L)	GLDH (IU/L)
3 (skin lesions)	570	12.5	1.01	**484 H**	11.2	**> 250 H**
199 (skin lesions)	510	9.1	0.96	28	12.3	27
284 (sick)	660	9.6	0.83	**141 H**	13.9	**43 H**
67	480	10.1	0.85	27	11.5	11
40	550	9.9	0.72	26	9.8 L	9
H37	440	12.7	0.98	**55 H**	11.9	**75 H**
28	390	**7.9 L**	0.90	14	**10.3 L**	13
159	410	**7.2 L**	0.95	18	**8.7 L**	9
49	480	8.0	1.14	20	**8.8 L**	17
105	540	**7.8 L**	0.85	21	9.0 L	30
Mean	503	9.5	0.92	83	10.7	> 48
Reference range	150–3,500	8.0–20.0	0.62–1.15	0–36	11–20	8–41

Bold = out of reference range. H = High (above reference range). L = Low (below reference range).

in the carrier animal/s, compared with outbreaks of severe diarrhoea in calves. On blood film, ***Theileria*** was also identified, which was considered a possible incidental finding as anaemia was not indicated in the history.

A calf (exact age was not indicated) was brought from the South Island to Northland and developed 'shipping fever' after arrival, as well as dermatophytosis. It was given an anthelmintic within two weeks of arrival but was not growing well, had scours and mild lung sounds. Faecal samples were submitted for culture and ***Salmonella*** **Bovismorbificans** was isolated. This is the most common *Salmonella* serotype isolated in cattle.

A mob of Wagyu cross calves under 6 months old in north Waikato had clinical signs of illthrift and chronic cough. Samples from five animals were submitted for PCR testing and all five tested positive for ***Theileria orientalis*** **Ikeda**. It is not known whether these animals were newly introduced to the area.

A heifer at a dairy farm in north Waikato had an abortion. Serum was submitted for ***Neospora caninum*** IFAT. The titre was 1:2,000. This was interpreted as strong evidence of recent *Neospora* infection and a likely cause for the abortion, particularly if the **abortion** occurred within the last three weeks (the time period between the abortion event and sampling was not indicated).

Serum samples from three dairy cows in Taranaki were tested for infectious bovine rhinotracheitis (IBR). The herd had a history of respiratory signs, such as coughing, that were spreading to animals of various ages. All three animals tested positive on **IBR antibody** ELISA testing. This indicates exposure to IBR virus but does not exclude other possible causes of coughing such as primary respiratory bacterial pathogens.

A 4-year-old cow in Waikato had bled out of the milk vein and there was concern that a blood transfusion might be needed. A full blood count was done on a sample collected about 24 hours later and **mild blood loss anaemia** was confirmed. If the sample had been taken very soon after the blood loss, the severity of the anaemia may have been underestimated.

Ovine

A farm in south Taranaki had lost 40 out of 600 replacement lambs from early January to the end of February, with an average of 10 losses per week. The lambs were given a 5-in-1 vaccine at tail docking and were drenched in January and February. Postmortems revealed no specific findings. All dead lambs were in good condition with no external signs of disease. Samples were received from a freshly dead lamb including faeces (for faecal egg count), abomasal fluid (for worm count), fresh liver (for selenium and copper levels) and formalin-fixed samples. The brain was examined under UV light and did not fluoresce but on H&E stain, however, neuronal degeneration was noted in the cerebral cortex, consistent with **polioencephalomalacia.** The most likely cause is thiamine deficiency and less likely differentials are lead poisoning and water deprivation. In addition, chronic gastroenteritis and mild, non-specific chronic myocarditis were also present. **The faecal egg count** was high with 2,275 eggs/gram (epg). A count of 500 epg is considered high enough to warrant treatment, although levels as low as 100–200 epg in young sheep (< 2 years old) can have economic impacts. Larval culture revealed 100 larvae that were all presumptive ***Strongyloides*** species. Liver copper and selenium levels were within normal range.

Cervine

A deer herd in rural Queenstown had a history of fertility issues in 2022. Two sets of blood samples were submitted for copper, selenium and iodine. Set 1 was from the rising 2-year-olds (10 samples) and set 2 was from the older animals (nine samples). Although the mean copper value (9.3 µmol/L) was within the adequate range (8.0–20.0 µmol/L), low levels were present in 8 of 19 individual animals. Of the eight animals with low copper levels, two were from the rising 2-year-olds and six were from the older group, indicating **copper deficiency** in more than half of the cohort of older animals. Although no reference range is available for serum selenium in deer, the levels were all ≥ 150 nmol/L and considered adequate when compared to the accepted level for cattle (> 150 nmol/L). The iodine level was tested on a pooled sample and was 28 ug/L. No reference range is available for blood iodine levels in deer. Copper deficiency has been linked to skeletal abnormalities, osteochondrosis and enzootic ataxia in farmed red deer, which would indirectly affect fertility due to decreased mobility (Audigé et al., 1995).

Equine

An 11-year-old female Thoroughbred cross horse in Manawatū-Wanganui was reportedly 'off' for the previous six months, showing lethargy, grumpiness and being stiff to ride. The diet was changed with no effect. The horse worsened over a period of two-to-three weeks and blood samples were submitted to Massey University equine hospital for selenium testing. The blood selenium was low at 610 nmol/L (reference range 1,600–3,200), indicating **selenium deficiency**. Soil selenium levels are low in many parts of New Zealand, resulting in low selenium levels in grass, hay and haylage. The main source of selenium for horses naturally is in forage; therefore they can become selenium-deficient over time if not supplemented appropriately.

Canine

An 11-year-old neutered male Scottish Terrier from Auckland had an erosive lateral toe lesion that was not responding to treatment. There was erosion of the bone of all phalanges. Fine needle aspirate revealed a possible mast cell tumour. Fresh and formalin-fixed samples were submitted. Histopathology revealed a **squamous cell carcinoma**, possibly of nail bed origin. Microbial culture resulted in a heavy growth of ***Corynebacterium ulcerans***. Toxigenic strains of *C. ulcerans* are occasionally found in animals and may represent a rare source of infections for humans. Cytology of the regional lymph node revealed lymphocytic proliferation consistent with lymphoid hyperplasia.

A female Bearded Collie dog of unknown age from the Lower Hutt area had a history of icterus

with elevated liver enzyme values. Serum samples were submitted for *Leptospira* titres late February, with a 1/800 titre detected for ***Leptospira copenhageni***, while negative for other *Leptospira* serovars. Another sample was submitted in mid-March and the titre for *L. copenhageni* remained unchanged at 1/800. This was interpreted as an unlikely acute infection, but rather that the dog had previous infection or exposure a few months previously.

A 6-year-old female spayed Labradoodle from Auckland had a history of diarrhoea. Faeces was submitted for a PCR diarrhoea panel that was positive for **Cryptosporidium**. This is a potential zoonotic agent. The faecal sample was also positive for ***Clostridium perfringens***, which may be the primary pathogen or a secondary opportunistic pathogen in this case.

Feline

A 7-year-old female, domestic short-haired cat from central Waikato developed a cat-bite abscess in the fat pad that was non-responsive to an antibiotic course of two weeks. Excision samples were submitted for microbial culture and sensitivity. ***Mycobacterium smegmatis*** was identified using the Bruker Maldi Biotyper® method. Empirical treatment with doxycycline, fluroquinolones or clarithromycin (usually in conjunction with surgical debridement) is often attempted (Greene, 2006) in these cases.

Faecal samples from a cat in Queenstown were submitted with no clinical history for a diarrhoea PCR panel. The PCR test results were positive for ***Cryptosporidium*, feline coronavirus** and ***Giardia* spp**. A positive *Cryptosporidium* and *Giardia* PCR result is supportive of active infection if the animal is showing clinical signs, although animals may be subclinical and be a source of environmental contamination, as well as being a zoonotic risk. Feline coronavirus (FCoV) is a common viral infection in cats. A positive FCoV PCR result is considered meaningful and suspicious for a chronic shedding carrier if it continues to be positive on a weekly faecal sample for four consecutive weeks. About 5–10 percent of FCoV-infected cats will develop feline infectious peritonitis.

Lagomorph

An older stray rabbit was presented for desexing through a rescue organisation in south Taranaki. The uterus appeared abnormal macroscopically and was submitted for histopathology. A diagnosis of **uterine adenocarcinoma** was made. This is the most commonly reported neoplasm in intact female rabbits with an increased risk with age.

A 3-year, 8-month-old female spayed Mini Rex rabbit from the Auckland district had a head tilt of sudden onset but was otherwise well. Serum was submitted for **Toxoplasma** titre and there was a high titre result of 1:2,048. This was interpreted as being suspicious for clinical disease.

Avian

A biopsy collected from a duck in greater Wellington had round dermal interdigital lesions, about 1 cm in diameter. On histopathology, a diagnosis of **poxvirus dermatitis** with secondary superficial bacterial and fungal dermatitis was made. This was a dry form of poxvirus infection. There is no specific treatment, but prophylactic vaccines are available for some bird species like fowl and turkey.

Faecal samples from 22 wild birds in the Te Anau district were pooled and submitted for culture. *Salmonella* was isolated in five samples with ***Salmonella* Mississippi** identified in one and ***Salmonella* Saintpaul** identified in four. In Tasmania, human cases of *Salmonella* Mississippi infection have been reported as common (Ashbolt and Kirk, 2006).

Exotics

Bite wound swabs from a 2-year-old male turtle in Auckland were submitted for microbial culture and sensitivity. The following were isolated: heavy growth of ***Citrobacter freundii***; mixed growth of anaerobic organisms and a moderate mixed growth of aerobic organisms. *Citrobacter freundii* is often associated with reptiles and is a recognised turtle pathogen, typically associated with underlying immunocompromise and/or poor husbandry (Henriksen, 1972).

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Quarterly report of investigations of suspected exotic aquatic pests and diseases: January to March 2023

Mediterranean fan worm (*Sabella spallanzanii*) detected on vessel hulls

The Top of the South Marine Biosecurity Partnership (TotS Partnership) notified Biosecurity New Zealand (BNZ) after Mediterranean fan worms *Sabella spallanzanii* were found on two vessel hulls in the Marlborough Sounds. An investigation was opened to assist the TotS Partnership as they are actively working to exclude this marine pest from the Sounds. This species was first detected in Lyttelton in 2008 but has spread to many areas of Aotearoa New Zealand. It is a biofouling pest that competes strongly with native fauna, but eradication from New Zealand is not feasible. However, detections in new areas are monitored, and regional councils may consider removing new populations to help suppress this species locally. Samples of *S. spallanzanii* were collected from one of the vessels and sent to the Marine Invasive Taxonomic Service (MITS) for analysis of reproductivity. It was determined that the samples were mature and ready to spawn. These results were passed on to the TotS Partnership who were managing the detection. Both vessels have since received biofouling treatments and the investigation was closed.

Range extension of colonial ascidian (*Symplegma brakenhielmi*) reported

Northland Regional Council notified BNZ after what appeared to be the exotic colonial ascidian *Symplegma brakenhielmi* was photographed by commercial divers under a wharf in Houhora (**Figure 1**). This species was first detected in 2015 in Whāngarei and is now well established in both Whāngarei and Auckland. It had recently been confirmed from Rawhiti in the Bay of Islands in 2022. MITS was able to confirm the ascidian as *S. brakenhielmi* from a photograph



Figure 1: The colonial ascidian *Symplegma brakenhielmi.* Photo: Brett Sutton

taken by the divers. This is the first time *S. brakenhielmi* has been detected north of the Bay of Islands. Its potential impact on native species in New Zealand is unknown, but it appears to pose a low biosecurity risk.

Range extensions of Australian droplet tunicate (*Eudistoma elongatum*) reported

Northland Regional Council contacted BNZ after divers reported the growth of the Australian droplet tunicate (*Eudistoma elongatum*) in Mangonui Harbour. This exotic colonial ascidian has been present in New Zealand since 2005 and is widespread throughout Northland and Auckland, although it had not been recorded from Mangonui or the wider Doubtless Bay area. The two colonies of *E. elongatum* were removed by the divers and photographs were submitted to MITS, who were able to confirm the ascidian as *E. elongatum*.

A member of the public contacted BNZ to report a large number of tubular, jelly-like organisms that had washed up in Opito Bay in Kerikeri Inlet, Northland. Using the provided photos, MITS was able to identify the organisms as *E. elongatum*. Two further sightings of *E. elongatum* reported on the iNaturalist website were also confirmed from the Kerikeri area during this investigation. These are the first confirmed detections of *E. elongatum* from the Kerikeri Inlet. This species is an established pest in Northland, including the Paihia/Russell area 11 km south of Opito Bay, so detection of this species in Kerikeri Inlet was not unexpected. Details of the notifications were passed on to the Northland Regional Council and will be uploaded to the Marine Biosecurity Porthole.

Flatback mangrove goby (*Mugilogobius platynotus*) reported

Four recent sightings of the flatback mangrove goby (*Mugilogobius platynotus*) in the Matapouri Bay estuary were seen by BNZ on the iNaturalist website. This exotic fish is a recent arrival to New Zealand (Roberts and Stewart, 2022) and BNZ is monitoring new sightings. The images were sent to MITS, who confirmed the sightings as *M. platynotus*. These reports provide further evidence that a population of *M. platynotus* is established within the estuary in Matapouri. Information on the detections was passed on to the Northland Regional Council and Treaty partners in the area.

Milky-white flesh syndrome in snapper (*Pagrus auratus*) and trevally (*Pseudocaranx dentex*) investigated

NIWA notified BNZ after becoming aware of an apparently widespread issue occurring on the east coast of Northland and Auckland concerning Australasian snapper (*Pagrus auratus*) and white trevally (*Pseudocaranx dentex*). NIWA had been contacted by both recreational and commercial fishers, who reported white, soft, and mushy flesh occurring in 10–50 percent of wild-caught snapper (**Figure 2**), and a smaller number of trevally. The condition was later named milky-white flesh syndrome. Recreational fishers who spoke to NIWA had noted its sporadic presence over the past ten years, indicating it was not uncommon around spawning time, but that populations always seemed to recover. Concerns were now being raised around the apparent increasing prevalence and persistence of the issue. Discussions on recreational fishing forums and social media pages reflected similar observations. An investigation was opened to determine if an exotic disease, or another infectious cause was associated with the syndrome.



Figure 2: A snapper with milky-white flesh syndrome. Photo: Moana New Zealand

Samples were collected over several months and sent to MPI's Animal Health Laboratory, Wallaceville (AHL) for analysis. Samples consisted of both apparently healthy and affected snapper from within the Hauraki Gulf, and apparently healthy fish from the Bay of Plenty, where this condition had not been reported. AHL performed macroscopic assessment, general aquatic bacteriology and histology on the samples. While samples of affected trevally were also sought, only one was able to be collected due to the population reportedly being in deeper waters at the time.

The laboratory analysis did not find evidence of a septic or infectious (viral, bacterial, fungal or protozoal) cause for the changes in muscle condition in the affected fish; however, nutritional deficiencies were noted. Gross examination found affected fish to be in poor body condition (**Figure 3**), and their abdominal cavities were absent of healthy viscera. At a cellular level, degenerative muscle changes were observed, as well as liver atrophy with an absence of polysaccharides, and the presence of macrophage aggregates associated with the breakdown of fat and connective tissue cells. These observations suggested the affected fish had undergone a prolonged period of starvation. Evidence of iron accumulation was also seen in the livers of affected snapper, which was attributed to chronic starvation, tissue breakdown (releasing iron from cells) and poor haemostasis of iron in the body and tissue.

Internal helminth parasites were frequently observed in both affected and apparently healthy fish and were not thought to be associated with the syndrome. No evidence was found of myxosporean parasites such as *Kudoa* spp., which have been linked to mushy flesh in other fish species (Whitaker and Kent, 1991).



Figure 3: A snapper in poor body condition, associated with milky-white flesh syndrome. Photo: Moana New Zealand

Overall, the investigation did not find any evidence to link exotic diseases or infectious agents with the milky-white flesh syndrome seen in these fish. The results of the laboratory analysis were shared with Fisheries New Zealand who are further investigating the drivers behind the syndrome.

Mortalities of anchovy-like fish investigated

Two cases of fish mortalities involving anchovy-like fish (species not identified but likely *Engraulis* sp. or *Sardinops* sp.) were reported to BNZ.

The first case was reported by a member of the public and occurred in an estuary in Tapu on the Coromandel Peninsula. The second case was reported by a Department of Conservation (DOC) ranger, along with a concerned member of the public, from the Okura Scenic Reserve in Karepiro Bay. In both cases, about 100 dead fish were reported in the shallows and/or washed ashore. No other fish or aquatic organisms appeared to be affected in either case.

The events were investigated to rule out exotic diseases as the cause for the mortality. In particular, Pilchard herpesvirus (PHV) was investigated

as a potential cause of the mortality. PHV is a disease that affects *Sardinops* spp. and has been associated with a mass mortality in Australia and New Zealand in 1995 (Jones et al., 1997).

Samples were collected from both cases and sent to AHL for testing; however, due to the small size of the fish and their rapid decomposition, both submissions of fish were unsuitable for histology and bacterial culture by the time they arrived at the laboratory. Testing for PHV and pilchard orthomyxovirus was able to be completed and came back negative.

While no official cause for either of these mortality events could be determined, small fish such as *Engraulis* sp. or *Sardinops* sp. are also popular prey for larger fish and other mortality events have been linked to the smaller fish stranding or becoming trapped in estuaries or shallow water to escape predators. Rough weather had occurred shortly before the fish mortality at Tapu was reported and may have also played a role.

The results were communicated back to each of the notifiers. No further mortalities were reported from either area and with no further samples to progress with testing, the investigations were closed.

Microsporidian parasites detected in butterfish (*Odax pullus*)

A recreational fisher notified MPI after catching a butterfish in Kaikoura and finding multiple yellow rice grain-like bodies in the fish fillet. Samples were submitted to AHL and were found to be a microsporidial infestation of the fish. Microsporidians are common parasites of finfish and are not considered a biosecurity risk. The results were reported back to the notifier and the investigation was closed.

Tumours in a kahawai (*Arripis trutta*) investigated

Two recreational fishers separately contacted BNZ after they each caught a kahawai (*Arripis trutta*) that had a lump near its tail. The first report was a single fish that came from near Matiu/Somes Island (Wellington Harbour), and the notifier was aware of other fishers that had also caught kahawai with similar lumps in Wellington Harbour. The second report came from Army Bay on the Whangaparaoa Peninsula (Auckland). In this case, they had caught three kahawai but only one fish had a lump near its tail. Samples were collected from both cases and sent to AHL for analysis.

The mass on the Matiu/Somes Island kahawai was identified as a malignant neoplasm originating from the scale pockets of the fish. This tumour type is unique to fish and arises from the stromal cells that scales develop from. Generally, these types of tumours are benign. However, malignant variants do occur and, in this case, there was clear evidence of local invasion, confirming a locally malignant nature. In contrast, the mass on the Army Bay kahawai was found to be a non-invasive soft tissue sarcoma originating from the perivascular wall of the fish. This kind of tumour generally spreads quite slowly and is commonly found in fish. Soft tissue sarcomas can be very vascular and may appear fluid- or blood-filled, and this is consistent with the description of the lump provided by the fisher.

The results were communicated back to each of the fishers, and the investigation closed.

Mass mortality of jack mackerel (*Trachurus novaezelandiae*) investigated

A member of the public notified BNZ of a mass mortality event involving over 1,000 jack or yellowtail/horse mackerel that were found washed ashore on the high tide mark of Omamari Beach, Northland. The Northland Regional Council and local hapū were informed of the situation and an investigation was opened to determine if an exotic disease could be a factor in the event. Mackerel samples were collected from the beach and sent to MPI's AHL for testing. Unfortunately, the difficult access to the location and length of time the fish had been dead meant that the samples were decomposing by the time they arrived at the laboratory and were unsuitable for testing. Mātauranga Māori of the hapū revealed that schools of baitfish such as jack mackerel are often driven onto the beach by pursuing predators, and this is a probable explanation for this incident. As no biosecurity risks were identified, and no further samples were available for testing, the investigation was stood down.

White cysts in snapper (*Pagrus auratus*) investigated

A recreational fisher in greater Auckland contacted BNZ to report finding white lumps inside a snapper (*Pagrus auratus*). They described the lumps as white plastic-like balls around the ribcage of the fish. Reports like this have been received several times in the past. However, to ensure they were not of biosecurity concern, an investigation was opened and images were sent to MPI's AHL. Based on photographs the team at AHL were able to identify the lumps as likely to be cysts containing intermediate life stages of a parasitic cestode or trematode. These are common parasites of fish. As this is not a biosecurity concern, the investigation was stood down.

Range extension of Japanese mantis shrimp (*Oratosquilla oratoria*) reported

A member of the public contacted BNZ after finding what they suspected to be a Japanese mantis shrimp (*Oratosquilla oratoria*) in Raglan Harbour, Waikato. This invasive species is known to be present in some areas of Northland and Auckland, and in Whitianga on the Coromandel Peninsula, but had not been detected from Raglan Harbour. The notifier provided pictures, which were sent to MITS who confirmed the identification as *O. oratoria*. This represents a large range extension for the species, with the closest sighting on the west coast of New Zealand in the Kawau Parua Inlet in southern Kaipara Harbour, over 140 km north of Raglan. This range extension was communicated to the Taranaki Regional Council and added to the Marine Biosecurity

Porthole database before the investigation was stood down.

Decline of wild Pacific oysters (*Crassostrea gigas*) investigated

Auckland Council contacted BNZ after a member of the public reported a rapid decline of the wild Pacific oyster (*Crassostrea gigas*) population in the Manukau Harbour. The decline was described as particularly noticeable on the coastline between Green Bay and Titirangi Beach, as well as on the Māngere Bridge/Ambury Farm coast. An investigation was initiated to rule out if any exotic or emerging diseases were associated with the decline. Twenty-one oysters were collected by the Auckland Council and sent to MPI's AHL for analysis. Laboratory testing did not determine a clear cause for the oysters' decline. Histological examination showed some evidence of an increased inflammatory response within the connective tissues and digestive glands. However, no clear cause for the inflammation was apparent.

A non-specific inflammatory response in the connective tissues of bivalves is a common finding and may be associated with various causes. For example, bacterial and viral agents, toxins, chemicals, physical and environmental stressors, or parasites may all stimulate this form of immune response. As no exotic disease was detected, the investigation was stood down.

Farmed Pacific oyster (*Crassostrea gigas*) mortality investigated

An oyster farm contacted BNZ as they had recently noticed high numbers of oyster mortalities during a harvest from a farm in Coromandel Harbour. An investigation was opened to test oysters for exotic disease as a cause for the mortality, and samples were sent to MPI's AHL. Bacterial culture yielded light mixed growth and was not considered significant. Molecular testing for *Bonamia* spp., *Marteilia_refringens*, Ostreid herpesvirus-1 and *Mikrocytos mackini* were all negative. Histology did not detect any *Haplosporidia* or other visible pathogens. There was evidence of a mild non-specific inflammatory response in the connective tissues and digestive glands that was of uncertain significance. This is a common response in shellfish and could be associated with multiple factors, including physical and environmental stressors, toxins, chemicals, bacterial and viral agents, or parasites. The results were communicated to the notifier and as no biosecurity risks were identified nor additional mortalities reported, the investigation was closed.

Undaria pinnatifida detections investigated

A scientist contacted BNZ regarding a sighting of the invasive kelp *Undaria pinnatifida* in Eastbourne, Wellington. *Undaria* is a prolific seaweed, growing from spores that drift on ocean currents and attach readily to the hulls of ships. This species can grow quickly and can outcompete native fauna that grow on similar substrata. The seaweed was first found in Wellington in 1987 and is still common in the area. However, an investigation was opened to confirm it was not a new exotic seaweed of similar appearance. Pictures of the seaweed were sent to MITS, who confirmed the species as *U. pinnatifida*. As this seaweed is well established in Wellington and has been detected frequently over the past several years, the investigation was stood down.

A recent sighting of *U. pinnatifida* in Clifford Bay on the Marlborough coast was found by BNZ on the iNaturalist website. This seaweed has established in many parts of New Zealand over the past 30 years, including in the nearest ports in Picton and Wellington, but had not been recorded from Clifford Bay before. An investigation was opened to verify the sighting. The pictures and iNaturalist link were sent to MITS, who confirmed the species as *U. pinnatifida*. The detection was communicated to the Marlborough District Council and uploaded to the Marine Biosecurity Porthole before the investigation was stood down.

Suspected *Caulerpa* investigated

The BNZ Caulerpa Response team was notified of a potential sighting of an exotic *Caulerpa* seaweed at Ōrere Point in Auckland. The exotic *Caulerpa* species (*C. brachypus and C. parvifolia*) were first detected in 2021 in the waters near Great Barrier Island (Aotea) and Great Mercury Island (Ahuahu), and a response was initiated by BNZ, including the issuing of a Controlled Area Notice to minimise the spread of these invasive species. As the potential sighting was from outside the known range of exotic *Caulerpa*, an investigation was initiated and images of the seaweed were sent to MITS. The seaweed was identified as a species from the *Ulva* genus, which are commonly found New Zealand wide, and the investigation was closed.

Eel deaths investigated

A member of the public notified BNZ of two dead eels (*Anguilla* sp.) in the Ahuriri Estuary in Napier. No samples could be collected for testing, but a few days later, DOC passed on two additional notifications of multiple dead eels and crabs sighted in Pandora Pond, which is on the southern fringe of Ahuriri Estuary. Details of the notifications were shared with Hawke's Bay Regional Council. Their pollution team were able to confirm that all three of the notifications coincided with an industrial pump failure in the area. This failure had caused water to overflow into storm drains and affected water quality. The council reported that the issue had been fixed, which should resolve the water quality issues. While no samples were able to be obtained for disease testing, the timing of the eel deaths suggested that they were most likely a result of the pump failure, and the associated water quality issues following the stormwater overflow. The investigation was closed, and the outcome communicated back to DOC and the original notifier.

Suspected koi carp (*Cyprinus carpio*) investigated

A member of the public contacted BNZ regarding a potential sighting of koi carp in Rotorua. The notifier indicated that their grandchild had collected the fish from a local waterway and

released it into their private pond. Koi carp are considered established in Auckland and Hamilton; however, they are not known to be established in the Rotorua area and therefore the fish was collected and sent to MITS for identification. The fish was identified as *Carassius auratus*, the common goldfish. While goldfish are not managed under the region's pest management plan, they do possess invasive characteristics and so the detection was shared with the Bay of Plenty Regional Council.

Mass mortality event at Lake Ōmāpere reported

A staff member of Massey University contacted BNZ after a Trustee of Lake Ōmāpere reported a mass mortality event at the lake to him. The event involved waterfowl, eels and molluscs and about 1,200 affected animals were reported. Incursion Investigators from both the Animal Health and Aquatic Health teams were involved, and samples were requested to be sent to MPI's AHL for testing. Unfortunately, weather conditions in the region prevented the collection of suitable samples for testing. Data collected during the investigation seemed to be consistent with poor water quality, but if mortalities occurred again, further attempts would be made at that time to obtain suitable samples to rule out exotic disease. MPI and Northland Regional Council agreed on future steps should another mortality event occur at the lake, and the investigation was stood down.

Mass mortality of fish and eels reported

A member of the public notified BNZ of a mass mortality of fish and eels in the Kaipara River. The notifier also described a red/brown/orange discoloration in the water. MPI had issued a public health warning around that time, due to an algal bloom in the Kaipara Harbour. Severe weather events prevented the collection of any fish or eel samples for disease testing, or water samples for algal monitoring. The notifier was advised to call BNZ again if further mortalities occurred, and the investigation was closed.

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Koi carp

PLANTS AND ENVIRONMENT

Report from AsureQuality

Vehicles and machinery as a vector for arrival of exotic ants

Over the past 30 years, New Zealand has experienced consistent growth in the importation of new and used motor vehicles and machinery, both small and large, from international origins. While vehicle and machinery imports are vital to New Zealand's economy, they present some biosecurity risks, which are managed by the Ministry for Primary Industries/Manatū Ahu Matua (MPI). All vehicles are subject to MPI's multi-layered biosecurity system and must comply with the Vehicles, Machinery and Parts Import Health standard (11 August 2021) (https://www.mpi.govt.nz/dmsdocument/30224-Vehicles-Machinery-and-Parts-Import-Health-Standard). However, despite these precautions, some invasive ants still manage to find their way to New Zealand concealed in these items (**Figure 1**).

Vehicles and machinery offer a suitable environment for structure-infesting ant species, as they typically feature many cavities and crevices suitable for ant nests in the internal structures. Engines and other infrastructure systems (e.g., pipes and wiring) can provide warmth, as well as allowing access throughout the vehicle. The metal and plastic structure of the vehicle retains heat, providing a warm, dry nest location. Vehicles may also carry or collect debris, dirt and other contaminants that provide suitable nesting material and food.

The Import Health Standard requires regular inspection at the place of origin to detect and manage infestations. However, imported vehicles may remain stationary for long periods at their place of origin before being shipped to New Zealand. This increases the probability of ants entering vehicles and establishing nests that escape detection and pest management efforts. Once the vehicle is moved onto the shipping vessel, ants will typically stay hidden. This environment, combined with the cryptic nature of some species, means that nests of ants can often be present in vehicles and remain undetected during shipping.

If detection and management efforts overseas or during shipping are not successful, ants can still be detected at the border or post-border level. At the border, trained MPI Quarantine Officers may spot infestations during arrival inspections (in which case, direct treatment occurs), or infestations may be noted post-border during later cleaning and preparation for sale by the vehicle importer (when the internal structure of the vehicle may be disassembled) and are reported via the general surveillance system. If undetected, ants can leave the vehicle at the destination port and establish nests in nearby suitable habitat, such as light poles, barriers, buildings, and gardens. Ants are very resourceful foragers, feeding on a wide variety of resources (including rubbish and decomposing organic materials), which contributes to their invasive potential. To manage this risk, MPI has a targeted National Invasive Ant Surveillance programme at ports and 'high risk' Transitional Facilities around the country (Peacock et al., 2022).

Examples of post-border detections of ants in vehicles include several common invasive species such as the ghost ant (*Tapinoma melanocephalum*), carpenter ant (*Camponotus* sp.) and white-footed ant (*Technomyrmex* sp.) found in caravans from Australia in 2019 and 2021.



Figure 1: Live and dead ants behind the trim of a new SUV vehicle. Photo: Brett Rawnsley



Figure 2: Ant nest featuring eggs, larvae and pupae in the rubber door trim of an imported used car. Photo: Paul Craddock

Additionally, *Camponotus* sp. was found in an imported damaged car and *Technomyrmex* sp. in a tractor in 2020 and 2021, respectively. It should be noted that ants may be present in any kind of vehicle and have been found in brand-new and used vehicles, wrecked vehicles imported for parts, caravans, and agricultural and construction equipment (**Figure 2**).

Most infestations of ants have been found on vehicles entering the country through Auckland, as the Ports of Auckland is the primary port for most vehicle transport vessels arriving in New Zealand. The Auckland region is therefore, a major hub for distribution and sale of imported vehicles, with its many motor industry distribution and transport businesses undertaking this type of work. This causes an additional biosecurity risk, as vehicles may be moved from location to location around New Zealand following importation, without ant nests being discovered. This results in an increased potential for an undetected infestation of ants in New Zealand, and the origin of this spread may not be obvious or in a place traditionally considered high risk for exotic ant arrivals.

This summary underlines the importance of ongoing pre-border, border and post-border vigilance for high-risk invasive ants concealed in vehicles and machinery. It also highlights the need for MPI to continue to engage with the motor vehicle industry, particularly vehicle and machinery importers and distributors involved in the sale and distribution of vehicles, parts and machinery to raise awareness, and report biosecurity issues, including ants, found during their work. Members of the public can do their part by notifying any suspect exotic ants through MPI's general surveillance system https://www.mpi.govt.nz/biosecurity/how-to-find-report-and-prevent-pests-and-diseases/report-a-pest-or-disease/.

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Report from Ministry for Primary Industries

Plant health surveillance and incursion investigation report: January to March 2023

The Incursion Investigation Plant Health (IIPH) team and Plant Health and Environment Laboratory (PHEL), in the Biosecurity New Zealand branch of Ministry for Primary Industries, investigate and diagnose suspect exotic pests and diseases in the plant and environment sectors. Incursion Investigators (IIs) and scientists are based in Auckland, Rotorua and Christchurch. These teams provide field investigation, diagnostic testing and technical expertise to detect and report new pests and diseases affecting plants and the environment. They support surveillance and response functions, including carrying out research and development for better diagnostic tools and processes to manage biosecurity risks.

This quarter (January to March 2023), IIs received 295 notifications (**Figure 1**), a 5.7 percent decrease compared with the same period in 2022 (313). The presence of a biological risk was ruled out in 67 cases that were stood down. Forty-four notifications were redirected to other agencies responsible for managing the pest of concern. The resulting 184 cases that underwent further investigation were a decrease on the same quarter last year (206).

The complexity of the biosecurity risk associated with some investigations cannot be managed under urgent measures by the IIPH team. In those cases, the investigations are transferred to the Biosecurity New Zealand Readiness and Response group, and with the assistance of the IIs and PHEL, response options are considered to eliminate, reduce or contain the threats and potential impacts. This transition enables joint decision-making for potential responses to pests and diseases, with Government Industry Agreement (GIA) partners, industry (non-GIA), government agencies and Treaty partners.

Positive – Biosecurity response initiated

These investigations resulted in a biosecurity response to manage residual biological risk from the investigation.

Black-grass plants in wheat paddock

The IIPH team were notified in late January of suspected black-grass (*Alopecurus myosuroides*) growing in a wheat paddock near Ashburton. The property was being surveyed by the Foundation for Arable Research as part of a herbicide resistance project. Photos and samples were provided to a weed expert at AgResearch for identification and to a scientist at PHEL Bacteriology & Botany; both confirmed *A. myosuroides.* Black-grass is an unwanted organism under the Biosecurity Act 1993. It is invasive in arable crops and its presence has trade implications for the arable industry. Two separate incursions are under Biosecurity New Zealand management.

The black-grass had already dropped seeds, preventing low-impact urgent measures such as roguing the plants to mitigate the risk. The II discovered that the paddock had been sown with linseed the previous growing season. Further investigation revealed that the linseed was associated with a previous black-grass incursion and was likely also the source of this infestation. As the incursion related to an ongoing black-grass response, the investigation was transitioned to the Readiness and Response group to manage.

Investigation Positive – Urgent Measures prevent establishment

These investigations found organisms that were not known to be present in New Zealand under circumstances that enabled treatments to be applied and biosecurity mitigation confirmed. They typically involve imported goods and containers and travellers to New Zealand.

Stink bug cases

During this quarter, IIs investigated 20 notifications of exotic stink bugs including suspected brown marmorated stink bugs (BMSB) (*Halyomorpha halys*) with six positive identifications (including three live insects and seven dead insects). Incidences of live single BMSB were reported in a parcel from the United States and from passengers travelling

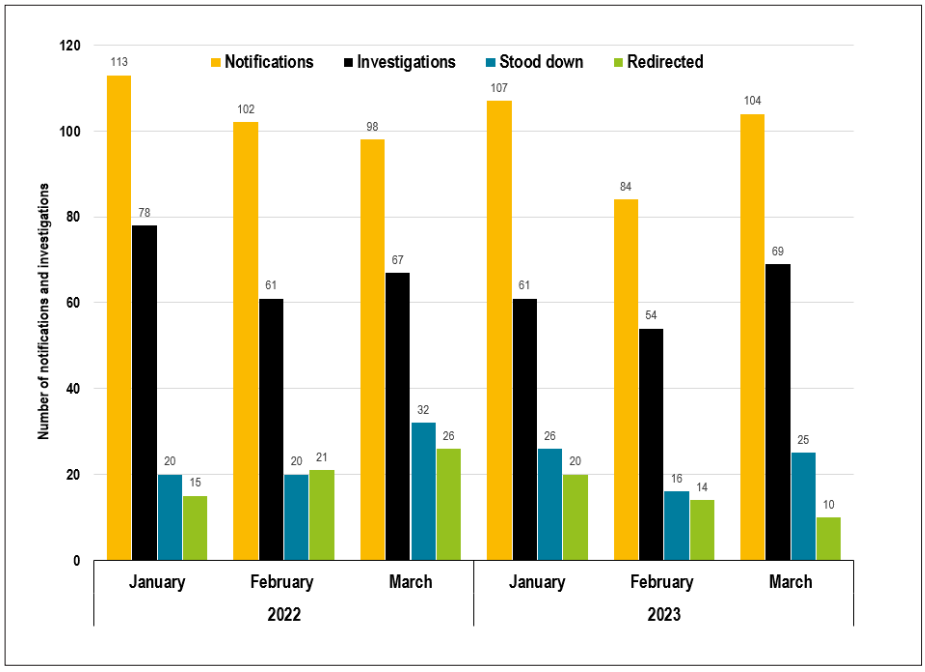


Figure 1: Plant health notifications, investigations and other outcomes for January, February and March, 2022 and 2023

from Japan and Switzerland. Three investigations associated with imported vehicles identified a single exotic yellow spotted stink bug (*Erthesina fullo*) in each vehicle and a dead bug in imported pallets. An exotic dead mottled stinkbug (*Rhaphigaster nebulosa*) was found in new machinery parts from Belgium. In all the stink bug cases, the biological risk was mitigated by tracing the origin of the goods, inspecting the goods and the sites, distributing educational material and, where possible, notifying the overseas supplier of the detections.

Spider cases

There were eleven notifications of suspect exotic spiders. The biological risk may be mitigated by spraying the goods with insecticides, inspecting the items and identifying the life state. Some of the spiders were dead when found and posed no risk. Where webbing and nests were reported, notifiers froze them to mitigate any biological risk. One spider was not able to be identified and the other eight notifications related to species that are already present in New Zealand: white-tailed spider from the genus *Lampona*, nursery-web spider *Dolomedes minor*, the false katipo *Steatoda capensis* (two notifications), vagrant spiders from the genus *Uliodon* (three notifications), and the cupboard spider *Steatoda grossa*. There were two investigations of an exotic species of huntsman spiders: *Heteropoda venatoria* at a Transitional Facility that processes new imported tyres, and a species of Sparassidae found associated with a passenger's clothing from Australia. In both instances, the spiders were isolated hitchhikers and disposed of as biosecurity waste.

Exotic plants and seeds

There were 25 investigations into unsolicited or unauthorised imports of plants, seeds and plant material. The biological risk was mitigated by the submission of seeds and plant material to MPI sites for safe destruction and in some cases, site visits to inspect and collect risk goods. In other instances of suspect illegal imports, investigations were referred to the Biosecurity New Zealand Compliance Investigation team.

Incidental mushroom strain sold

The notifier reported a suspect illegal strain of oyster mushroom being sold at an Auckland supermarket. A sample provided to PHEL was identified as a hybrid between two *Pleurotus* species: *Pleurotus ostreatus* and an undescribed *Pleurotus* species, currently known as *Pleurotus* sp. OB. The II contacted the supermarket to trace the mushrooms and confirm the supplier's contact information. Communication with the supplier and review of import documentation determined the oyster mushrooms likely originated from a June 2022 import from China. Local contamination was ruled out as the supplier does not propagate from local mushrooms. The oyster mushroom spawn had been imported under a valid *P. pulmonarius* import permit. Despite measures implemented in 2019 by the exporter to reduce cross contamination, it appears the hybrid mixed with the *P. pulmonarius* consignment so was considered an incidentally imported organism.

The supplier had sold the oyster mushrooms between October and November 2022 to 19 supermarkets; thus a recall was not feasible. The supplier confirmed they destroyed all product implicated with this investigation. The Plant Imports team were consulted and agreed with the investigation outcome.

Other cases of note

Termites in boat

In October 2022, the IIPH team was notified of an active termite infestation on a trimaran in a Kerikeri boatyard. The vessel arrived in New Zealand in late 2019 and had been stored at the boatyard since 2020 due to COVID-19-related border closures. The owners were preparing the vessel to sail to the Pacific islands when termite damage was found in the deck. The decking area was immediately secured with plastic wrap and work halted while specimens were sent for identification. The specimens were identified by PHEL Entomology as a species of *Incisitermes,* a genus not present in New Zealand.

During the investigation, the II discovered that in 2018 the vessel had been treated in Fiji for a termite infestation, although the species involved was not identified. In November 2022, the owners were presented with options to manage the incursion and they opted to remove and destroy the infested decking while supervised by the II and then to leave New Zealand by mid-2023.

Due to the time of year and weather conditions, the risk of alate (reproductive) flights was considered low; however, a knockdown spray and localised heat treatment were used to mitigate the infestation when



Figure 2: Damage caused by *Incisitermes* sp. on structural beams of a trimaran

found. During the eradication process, evidence of termite damage was observed from the port (left) side outrigger through to the centre of the front crossbeam deck (**Figure 2**). A large network of tunnels, suspected to be feeding galleries, were found within the structural crossbeam. Infested timber was removed from the vessel and incinerated onsite, along with loose scrap timber that was underneath the vessel.

The boatyard owners agreed to undertake regular surveillance of the site. A fact sheet for *Incisitermes* sp. was provided for education and monitoring purposes. On the vessel owner's request, the Animal & Plant Health Treatments team provided information on potential rebuild techniques and termite-resistant materials. The termite history of this vessel has been recorded for biosecurity purposes should the vessel return to New Zealand.

Caterpillars in wooden beads from Australia

Live caterpillars were found inside a wooden bead on a new skirt purchased on the West Coast. The skirt, made in China, had been imported from Australia. Specimens submitted to PHEL Entomology were identified as *Chilo suppressalis*, an unwanted organism that is not present in New Zealand. This species is a serious pest of rice and feeds on sorghum, maize, sugarcane and many wild grasses. An II contacted the retailer and requested the product line be checked for sign of caterpillars, but none was found. The wooden beads are treated by the manufacturer in a high-temperature environment to kill any organisms before being attached to garments. It is likely the contamination occurred in Australia, where the pest is recorded.

Mantis from Australia

A live mantis was reported by an express freight company worker at their facility near Auckland Airport. The mantis was found on the netting of a unit containing various inanimate goods (documents, new apparel, footwear, electronic devices and auto parts) imported from Australia. The unit and the area around it were inspected and no other mantises were found. The mantis was identified as a male *Tenodera australasiae* (purple-winged mantis), a species not present in New Zealand (**Figure 3**). This species is widespread in Australia, New Guinea and the Molucca Islands, and has established in Hawaii. It could establish in New Zealand if given the opportunity (Ramsay, 1990). The biosecurity risk was mitigated with the destruction of the mantis.



Figure 3: Male purple-winged mantis

Dodder in basil seeds

A member of the public in Te Aroha reported suspected golden dodder *Cuscuta campestris* growing among their potted basil *Ocimum basilicum* (**Figure 4**). From images, a PHEL botanist identified the weed as a *Cuscuta* sp., with a high probability of it being *C. campestris*, an unwanted organism that is established in the Waikato. The plant was requested by the II to confirm the species. However, on receipt at PHEL, the plant had deteriorated and a species level identification was not possible. The basil plant, dodder plant and soil were disposed of by the II as quarantine waste. Half a packet of unused basil seeds was inspected by the PHEL botanist and no contamination found. It is possible there was only one dodder seed in the packet, or the contamination came from another source (e.g., potting soil or the environment). As a precaution, the seed company and seed importer were notified of the detection in the basil seeds. The importer advised the II that 20 kg of basil seeds had been imported from France in 2021, and 2 kg was available for analysis. The II arranged a seed purity analysis test but no further seed contaminate of any kind was found. The Department of Conservation and Waikato Regional Council were informed of the investigation outcome for their ongoing surveillance.



Figure 4: Dodder *Cuscuta* sp. growing in a potted basil plant

Investigation Positive – Urgent Measures limit harm

These investigations resulted in the detection of organisms that were not known to be present in New Zealand. In some circumstances, treatments could be applied to retrievable items (usually recent imports). There may be some residual risk associated with items that could not be retrieved.

Wood borers

There were 11 notifications of suspect exotic borer beetles associated with bamboo chimes, torches and boards (Indonesia and China), wooden crates (Malaysia), wooden furniture (India and Vietnam) and pallets (unknown country of origin). Four investigations involved exotic species: the bamboo tiger longhorn beetle *Chlorophorus annularis*; the bamboo borer *Dinoderus minutus* and other species in the family Bostrichidae, Corylophidae and Anthocoridae; an exotic longhorn beetle (tribe Clytini); and the powder-post beetle *Lyctus africanus*. Biosecurity investigations established offshore treatment failure for some of the consignments and reported those non-compliances to the Target Development and Treatments teams. Where applicable, overseas suppliers were informed of the infestations. In all cases, the risk was mitigated by IIs arranging to have the goods treated or destroyed.

Note that in 2021 an incursion investigation concluded that *D. minutus* is established in New Zealand after a population was found in a bamboo hedge in Northland. The find resulted in its unwanted organism status being revoked. Regardless, if *D. minutus* is detected in recently imported plant products, the IIPH team investigates the detection to mitigate risk of further spread.

Beetle on bananas from Ecuador

A Transitional Facility worker in Christchurch contacted MPI after finding a live shield bug on the outer packaging of bananas from Ecuador. Staff inspected the box and surrounding area and found no further insects. The specimen was collected and identified by PHEL Entomology as a male *Brachyplatys subaenus*, first recorded in Ecuador in 2020, but not known to be present in New Zealand. As no other bugs were found, it was deemed an incidentally imported individual amongst the packaging used to protect the bananas in transport.

Ants inside a container

Border Clearance Services notified the IIPH team of two live ants found near a de-hired container in Tauranga. The container had been devanned and cleared at another Transitional Facility. The facility overseeing the cleaning of the container found the live ants during this process. The ants were captured, and the container was thoroughly inspected and cleaned. The specimens were identified by PHEL Entomology as the green tree ant (*Oecophylla smaragdina*), an unwanted organism that is not present in New Zealand. Tracing confirmed the container contained non-risk items that have no natural association with the ants. Further investigation found the ants were found externally within the plug of the reefer unit and may have been in situ for some months. With no further ants found, they were considered incidentally imported pests. The two Transitional Facilities were added to the National Invasive Ant Surveillance programme for the 2024 season.

Philodendron tortum tissue culture from Thailand

A nursery owner reported freshly imported tissue culture of *Philodendron tortum* for sale at a Tauranga plant market. *Philodendron tortum* tissue culture is not listed on the Plants Biosecurity Index (PBI) and is therefore not eligible for importation. The PBI is a list of species that have been assessed by MPI for biosecurity risks, and measures have been identified in an Import Health Standard to manage the risks.

The seller thought *P. tortum* was synonymous with *Philodendron bipinnatifidum* or *Thaumatophyllum bipinnatifidum*, and both are eligible for import. The importer was advised *P. tortum* is a species with no synonyms (Soares and Mayo, 2001) and it is not a cultivar, synonym, or common name of *P. bipinnatifidum* or *T. bipinnatifidum*. Correct botanical nomenclature is therefore an essential requirement for the accurate and safe importation of plants to New Zealand.

Biosecurity New Zealand does not encourage the propagation, trade or marketing of *P. tortum* as this plant species has not received a new organism determination under the Hazardous Substances and New Organisms Act 1996. To import a plant species under an alternative name not listed on the PBI, an application to MPI for a synonym assessment is required before the plant material arrives in New Zealand.

The importer voluntarily surrendered the plants for destruction, and they were destroyed with the approval of the Chief Technical Officer. Plant Imports are monitoring future imports of these species to ensure compliance.

Investigation Positive – Transferred from Biosecurity New Zealand responsibility

Chilean needle grass, Aviemore

A member of the public notified the IIPH team of suspect Chilean needle grass (*Nassella neesiana*) heavily contaminating a campsite in the Mackenzie District. Chilean needle grass is an unwanted organism under the Biosecurity Act 1993. The notifier had removed multiple seeds from their clothing at the campground. On returning home the notifier found a single seed embedded in their dog's fur. The notifier took a photo and disposed of the seed before contacting MPI. A photo was provided to the PHEL botanist but was unsuitable for an identification. Chilean needle grass is listed on the National Pest Plant Accord; therefore, MPI Pest Management and Environment Canterbury were informed of this unverified detection.

Investigation Positive – no action taken

These investigations revealed organisms that were not previously known to be present in New Zealand, but further action was not required. Typically, they included cases where the II's risk assessment indicated that a potentially new-to-New Zealand organism (or a newly described indigenous or native organism) had become well established and was considered unlikely to damage economic, environmental, social and cultural values. Alternatively, the organism may have already been established and been under management by Biosecurity New Zealand and/or local authorities.

Exotic butterfly found at International Mail Centre

IIPH was notified of a suspect exotic butterfly found within the International Mail Centre in Auckland. The butterfly had been found alive by NZ Post staff and had been contained before being submitted to MPI Border Clearance Services, who contacted the Department of Conservation for identification to ensure it was not a species managed under the Trade In Endangered Species Act 1989. A lepidopterist identified the species as a yellow-edged giant owl (*Caligo atreus*) (**Figure 5**) and the identification was validated by PHEL Entomology. This species occurs in North and South America and is not present in New Zealand. It is a regular addition in butterfly houses globally because of its relative ease to breed and long life compared with other butterfly species. The lepidopterist considered it was unlikely that the butterfly would have survived coming to New Zealand either naturally or in an aircan/sea container. It is also a large butterfly so would have been easily spotted had it been found as a hitchhiker on mail. BCS considered the possibility that the butterfly had originated from a nearby containment facility and the case transitioned to the IIPH team for investigation. The containment facility was contacted, and it was verified that the yellow-edged giant owl is a species they regularly import. The total number of current butterflies cannot be confirmed as when they die, staff cannot always find them so auditing is based on the numbers that arrive. The containment facility had been audited a few weeks before the discovery of the butterfly. This audit included inspection of the enclosure, which was fit for purpose. The II spoke to the Verification Services (VS) team that oversees the facility approval and was advised the facility had passed the audit. There were no records of near misses that would indicate any escape events, and the facility was considered fit for purpose and no immediate risk was apparent. The investigation concluded that the source of the butterfly is unknown. The biosecurity risk was mitigated as the butterfly was contained and destroyed.



Figure 5: Exotic butterfly *Caligo atreus* found at the International Mail Centre

Investigations of new-to-New Zealand organisms

There were seven notifications related to new-to-New Zealand organisms in the following disciplines: mycology and bacteriology (5), and entomology (2). All are presented below.

New weevil on wattle

In late December 2022, a citizen scientist found a suspect new-to-New Zealand weevil *Epamoebus ziczac* (**Figure 6**) on a Sydney golden wattle *Acacia longifolia* in Auckland. The specimen was submitted to PHEL Entomology, who validated the identification. The submitter subsequently detected the weevil on *A. longifolia* in multiple Auckland locations, including the central business district, Point Chevalier, Onehunga and Mount Albert.

The family Curculionidae is commonly referred to as the true weevils and includes some 83,000 species. The genus *Epamoebus* includes four species that are native to Australia, and *E. ziczac* has been recorded from Western and South Australia, and Tasmania (Pullen et al., 2014). No literature was found on the biology of *E. ziczac*; however, Balcuinas et al. (1995) suggested it is phytophagous. In a Japanese border study, *E. ziczac* was detected on cut flowers from seven plant genera, suggesting the weevil may be a plant generalist (Genka & Yoshitake, 2018). The weevil was found only on *A. longifolia* in New Zealand, although host specificity was not conducted. *Epamoebus ziczac* may serve as a biocontrol agent in New Zealand if it could control or inhibit the invasive weed *A. longifolia* (Weedbusters: Sydney golden wattle). The weevil does not pose a known biosecurity risk and no further investigation was warranted.



Figure 6: New weevil *Epamoebus ziczac*. Photo: S. Thorpe

New fungus on turkey oak tree

During high-risk site surveillance (HRSS) in Auckland, soil and leaves were sampled from a mature turkey oak tree (*Quercus cerris*). The turkey oak was exhibiting leaf scorch symptoms that were impacting most of the tree, which had fluid-filled trunk cankers (**Figure 7**). PHEL Mycology & Nematology (M&N) isolated a new-to-New Zealand fungus *Tubakia dryinoides* from the leaves of the turkey oak, and a *Phytophythium* species from the soil sample. The genus *Tubakia* includes over 20 species which are known to be endophytic or pathogenic in leaves and twigs, causing leaf spots, blotch (scorch) and necrosis (Zhang et al., 2021; Zhu et al., 2022). Braun et al. (2018) described *T. dryinoides* and noted the ability of the fungus to cause conspicuous leaf symptoms. *Tubakia* species infect trees belonging to the family Fagaceae, including *Castanea* (chestnut), *Castanopsis* (chinquapin oak), *Fagus* (beech), *Lithocarpus* (stone oak) and *Quercus* (oak). *Tubakia dryinoides* has been isolated from fagaceous hosts in Asia (*Castanea crenata*, *Quercus acutissima*, *Q. aliena* var. *acutiserrata*, *Q. glauca* and

Q. phillyraeoides) and Europe (*Fagus sylvatica* and *Quercus robur*). While *T. dryinoides* is the causal agent of the leaf scorch symptoms observed in the turkey oak, no literature was found to suggest that *T. dryinoides* would be the primary cause of tree death overseas. As a foliar pathogen, *Tubakia* species can cause severe defoliation, but only minor growth losses are reported in hosts (Brazee, 2018). In New Zealand, *T. dryina* and *T. suttoniana* (Manaaki Whenua–Landcare Research, 2022) are known to induce similar leaf lesions and defoliation. Given the morphological similarities of *T. dryina* and *T. dryinoides*, DNA from four New Zealand collections of *T. dryina* in the International Collection of Microorganisms from Plants was analysed to determine if *T. dryinoides* was present in New Zealand before this detection. Further sequencing confirmed that one record is *T. dryinoides*; this specimen was isolated from *Quercus robur* in Cornwall Park, Auckland, in 2005. This finding supports the hypothesis that *T. dryinoides* has been present in New Zealand for at least 18 years and was previously identified as *T. dryina* based on morphology and before the reclassification as *T. dryinoides*. As the symptoms induced by both *T. dryina* and *T. dryinoides* are similar, the biological risk of *T. dryinoides* is considered negligible and no further action was taken.



Figure 7: Turkey oak tree exhibiting leaf scorch symptoms

New bacteria on orchid

PHEL Bacteriology & Botany reported the soft rot bacteria *Dickeya fangzhongdai* from the molecular analysis of *Erwinia chrysanthemi* isolates collected in 1991. The bacteria were isolated from an orchid (*Phalaenopsis* sp.) in Tauranga exhibiting water-soaked spots on the leaves. At the time it was identified as *E. chrysanthemi* and stored in the International Collection of Microorganisms from Plants. Until this report, this species was not previously recorded as present in New Zealand. As this detection predates the commencement of the HSNO Act 1996, this species is not considered a new organism. The *Dickeya* genus was described in 2005 through the reclassification of the former strains of *E. chrysanthemi* into six *Dickeya* species. Recently, the genus has undergone phylogenetic changes as more species and subspecies are described, including *Dickeya fangzhongdai* in 2016. Overseas, this species is an emerging bacterial pathogen causing bleeding canker necrosis in *Pyrus pyrifolia* (pear) and soft rot diseases in *Phalaenopsis* spp. (orchids), *Allium cepa* (onions) and *Allium fistulosum* (spring or Welsh onions). Bleeding cankers are the most common symptom on pear tree trunks. In the initial stage of the disease there are no obvious symptoms on the surface of the bark, but during disease development the bark turns brown. Tree sap mixed with bacteria oozes from the bark and oxidises to to a red colour. On onions, symptoms include chlorosis, maceration of leaves, browning and plant collapse. There is no information available on the distribution of this species in New Zealand. This organism has not been detected from any surveillance programme or reported by industry groups as causing a disease of concern. Given that the only two isolates identified belong to the same geographical location (Tauranga), it is likely that its distribution in New Zealand is restricted. Although this organism is a known pathogen overseas and therefore presents a biosecurity issue, there is no evidence at this time to suggest that the biosecurity risk profile has changed since its detection in 1991.

New rust on *Fuchsia* plant

Fungal rust symptoms on the underside of the leaves of a single *Fuchsia* sp. plant were observed during HRSS in Henderson, Auckland (**Figure 8**). A sample was submitted and PHEL M&N identified the fungus *Pucciniastrum circaeae*, the first record for the country. This fungus has a worldwide distribution: Canada, Europe, Asia and Chile (Farr and Rossman, 2022). The host range includes *Circaea* spp., *Fuchsia* spp. and *Abies* spp. (Farr and Rossman, 2022), with the fungus alternating between members of these plant genera depending on the climate. In colder areas, *Abies* spp. act as an alternative host in early spring when plants from the other two genera have no leaves. In New Zealand the fungus will probably not need to alternate between hosts and is therefore less likely to infect *Abies* spp. Pathogenicity testing of *P. circaeae* on *Fuchsia* x *hybrida* (Italy) and *Fuchsia magellanica* (Chile) confirmed the fungus causes leaf rust on the hosts (Garibaldi et al., 2012; Ferrada et al., 2020). The studies showed the fungus does not kill the plant but reduces photosynthesis and causes premature leaf drop. This is common for rust fungi as they are obligate pathogens that require the host plant to remain alive. Other *Pucciniastrum* species recorded on *Fuchsia* species around the world are *P. epilobii* and *P. pustulatum* (Farr and Rossman, 2022). Based on the 33 vouchers in the New Zealand Fungarium collection, members of the following congeners have been recorded on *Fuschia* spp. in New Zealand: *P. epilobii*, *P. pustulatum* and *Pucciniastrum* sp. (Manaaki Whenua–Landcare Research, 2022), all of which cause very similar symptoms on the host. Five most recently collected vouchers of *Pucciniastrum* on *Fuchsia* have been sequenced. Four were *P. pustulatum* and one appears to require assignation to a new species hypothesis under *Pucciniastrum*. During the present investigation, another rust sample was collected from a *Fuchsia* sp. at Meadowbank, Auckland and submitted to PHEL

M&N for identification. Diagnostics showed that the infection on the sample was also caused by *P. circaeae*. The submitter confirmed that the rust disease has been present on that host for at least the past five years.



Figure 8: Fuchsia plant with new rust symptoms

New fungus from dogwood leaves, Auckland

A scientist from PHEL Mycology & Nematology (M&N) reported a new fungus *Discula destructiva* from dogwood (*Cornus florida*) leaves exhibiting leaf spot symptoms that were collected as part of HRSS in Auckland. This fungus causes dogwood anthracnose disease on dogwood trees and was first reported on Pacific dogwood trees in the north-western United States in the 1970s (Byther and Davidson, 1979). The fungus causing the disease was described as a species in 1991 (Redlin, 1991). There are no records of *D. destructiva* from New Zealand. DNA sequence analysis of the current fungus confirmed that no sequence match was found in the PHEL M&N sequence database or any published sequences from New Zealand. This fungus is not listed as an unwanted or notifiable organism in New Zealand, and the regulatory status is not assessed in the Official New Zealand Pest Register. *Discula destructiva* has been recorded from various dogwood species from Canada, Germany, Italy, Switzerland, the United Kingdom and the United States (EPPO, 2022). So far, this fungus has been found associated only with dogwood species. Worldwide, there are no records of this fungus causing disease on any other plant genus. Based on the available information, *D. destructiva* appears to be restricted to dogwood species that are not native to New Zealand. In the United States, a significant proportion of dogwood populations have been killed by this disease in severe infections. The fungus may attack dogwood species in New Zealand and may affect healthy seedling production in plant nurseries. There is no information available to suggest that this fungus is a threat to any economically significant agricultural or horticultural crops. Based on the available information, the biosecurity risk associated with this fungus appears to be low. A Plant Pest Information Network report was generated to record the presence of this fungal species in New Zealand and the Official New Zealand Pest Register will be updated.

New-to-science mite on *Olearia lineata*, Invercargill

During HRSS in Invercargill, new-to-science mites were found inside leaf galls made by the gall gnat (Cecidomyiidae) on *Olearia lineata*. PHEL Entomology advised that the most probable taxonomic position of the mites is under the genus *Suskia*, which is a monotypic (single) taxon. Members of the single species *Suskia mansoni* are endemic to New Zealand and found in association with *Myrsine australis*. *Suskia mansoni* mites are phytophagus and can cause distortion in the host leaves (Lindquist, 1986). As the mites of the new *Suskia* taxon (**Figure 9**) are endemic to New Zealand and found on an endemic host, no further action was warranted.



Figure 9: New mite *Suskia* sp.
Photo: Qinghai Fan, PHEL Entomology

New fungus from hemp leaves

In January 2023, a medicinal cannabis grower contacted MPI PHEL regarding wilt symptoms observed on their hemp (*Cannabis sativa*) plants (**Figure 10**). Of 850 plants growing outdoors, about 12 percent had minor wilt symptoms; these plants were grown from seed sourced in New Zealand. Due to a requirement to hold a licence to work with *Cannabis* samples, Hill Laboratories isolated the fungi on behalf of PHEL and submitted pure cultures to PHEL M&N for further testing. PHEL M&N identified that these cultures represented nine species of fungi. A new-to-New Zealand fungus *Stemphylium drummondii* was identified and the Incursion Investigation team was notified in March. All the other fungi detected are present in New Zealand, including two species of *Fusarium* (*F. praegraminearum* and *F. heterosporum*) that may have contributed to the wilt symptoms. Additionally, *S. vesicarium*, *Alternaria alternata*, *A. arborescens* and *Epicoccum* sp. were isolated from the hemp leaves and these fungi are known to cause leaf spot symptoms in plants. *Stemphylium vesicarium* has been associated with hemp seeds and leaf spot blight on adult cannabis plants in Canada (Roberts and Punja, 2022).

Broadly speaking, fungi in the genus *Stemphylium* are endophytes, saprobes and plant pathogens with a worldwide distribution. *Stemphylium* fungi spread through spores, seeds, contact with infected plant tissue and soil; little is known about their host specificity (Brahamanage et al., 2018). The fungus *S. drummondii* (syn. *S. spinaciae*) was first isolated from *Phlox drummondii* plants with leaf spot disease in Germany in 1983 (Nirenberg and Plate, 1983). A study conducted in China



Figure 10: *Cannabis sativa* leaves showing yellowing and mechanical damage associated with leaf lesions. Photo: Hill Laboratories

found *S. drummondii* causing minor leaf spotting on healthy spinach plants (Zhou et al., 2011). The pathogen was reported as a new species, *S. spinaciae*, at the time but was later synonymised with *S. drummondii* based on DNA sequence analysis (Woudenberg et al., 2017). In research yet to be published, scientists from Cornell University isolated *S. drummondii* from minor leaf spots (in both incidence and severity) on hemp.

Given that *Stemphylium* species cause leaf spots, it is unlikely that *S. drummondii* caused or contributed to the wilt symptoms observed on the hemp plants. It is more likely that the symptoms were caused by a synergistic interaction of fungi and abiotic factors. An abnormally wet spring and summer created conducive conditions for fungal growth. As *S. drummondii* has been reported from spinach plants overseas, Plant Exports was consulted and advised there were no adverse impacts on spinach exports. GIA partners Vegetables NZ, New Zealand Plant Producers Incorporated and Hort NZ were also notified.

Investigation of suspect high-impact pests – Negative

These cases involved reports of suspect high-impact pests or diseases that were investigated by IIs but there was no biosecurity risk. Most notifications were of suspected BMSB (10 investigations, as reported above) and fruit flies (13 investigations). Exotic fruit flies were ruled out by identification of individuals from photos or dead specimens submitted to PHEL. The following species have been mistakenly reported as exotic fruit flies: the common vinegar fly *Drosophila melanogaster* and *Drosophila* sp.; a native hover fly belonging to family Syrphidae, *Prosochaeta prima*; the predatory fly *Pygophora apicalis* (two investigations); a drone fly *Eristalis tenax* and a flesh fly belonging to the family Sarcophagidae.

Negative – Other

These investigations were negative for the presence of any biosecurity risk. The plant health team received 77 notifications that were negative for any biosecurity issues. The reports included 64 entomology cases, seven for botany, five for mycology, and one involving virology. In each case, a biosecurity issue was not established. Regardless and often as a precautionary measure, the IIs took steps to mitigate residual risk.

Inconclusive

These investigations were stood down because results or absence of results meant the presence or absence of a biological risk could not be determined, but it was decided that further investigation was not warranted. Most of the 20 notifications received by IIPH this quarter were closed because IIs could not obtain specimens for identification, or the specimens submitted to PHEL were in too poor a condition for analysis. Biological risk in all cases was mitigated by a range of measures appropriate to the case, such as freezing a sample for 48 hours before disposal.

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Brown marmorated stink bug (BMSB)

PEST WATCH: 11 February – 21 April 2023

Biosecurity is about managing risks: protecting New Zealand from exotic pests and diseases that could harm our natural resources and primary industries. MPI's Diagnostic and Surveillance (D&S) Directorate devotes much of its time to ensuring that organisms that may be new to New Zealand come to its attention and are appropriately investigated.

This information was compiled from notifications to MPI of suspected new to New Zealand organisms. The list includes organism records validated and entered in to the MPI Plant Pest Information Network (PPIN) database from 11 February – 21 April 2023. Wherever possible, common names have been included.

To report suspect new pests and diseases to MPI phone 0800 80 99 66.

Validated new-to-New Zealand reports

Type	Organism	Host	Location	Submitted by	Comments
fungus	*Discula destructiva* dogwood anthracnose	*Cornus florida* flowering dogwood	Auckland	PHEL High Risk Site Survey	The fungal causative of dogwood anthracnose disease.
mite	*Suskia sp.* no common name	*Olearia lineata* small-leaved tree daisy	Southland	PHEL High Risk Site Survey	An undescribed species. The genus *Suskia* includes only one other known species.

If you have any enquiries regarding this information, please contact surveillance@mpi.govt.nz

VETERINARY DIAGNOSTIC LABORATORIES

GRIBBLES VETERINARY PATHOLOGY

- **AUCKLAND**
  Courier: 37–41 Carbine Road, Mount Wellington, Auckland 1060
  Postal: PO Box 12049, Penrose, Auckland 1642
  Tel: 09 574 4701 Fax: 09 574 5304

- **HAMILTON**
  Courier: 20a Maui Street, Pukete, Hamilton 3200
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  Postal: PO Box 3866, Christchurch 8140
  Tel: 03 379 9484 Fax: 03 379 9485

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  Postal: PO Box 10304, Hamilton, 3241
  Ph: 0800 SVS LABS (0800 787 522) or 07 444 5101
  Fax: 07 444 5102
  Email: info@svslabs.nz

To report suspected exotic land, freshwater or marine pests, or exotic diseases in plants or animals, ring

0800 80 99 66

or use the on-line reporting tool ONIT https://report.mpi.govt.nz/pest/

Animal Health Laboratory – Wallaceville
66 Ward Street
Upper Hutt
Tel: 04 526 5600

Plant Health and Environment Laboratory – Tamaki
231 Morrin Road
St Johns
Auckland
Tel: 09 909 3568

Plant Health and Environment Laboratory – Christchurch
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Tel: 03 943 3209

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