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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.

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EDITORIAL

Using iNaturalist NZ–Mātaki Taiao for biosecurity

I expect most of you have already heard of iNaturalist NZ–Mātaki Taiao. It's a popular, fun way for New Zealanders to discover and document Aotearoa's nature. It has many features that make iNaturalist NZ a useful tool in New Zealand's biosecurity toolkit.

iNaturalist NZ–Mātaki Taiao is a web and app platform, and online community, dedicated to observing nature. Photos and audio recordings of any species can be uploaded and identified using iNaturalist. We began in August 2012 as NatureWatch NZ, using funding from TFBIS (the NZ Government's Terrestrial and Freshwater Biodiversity Information System) to build a New Zealand-optimised version of the open-source iNaturalist code. When iNaturalist.org gained the ability to host country nodes, NatureWatch NZ was integrated into the global iNaturalist Network and we became iNaturalist NZ–Mātaki Taiao. New Zealand was the second country to join the iNaturalist Network, which now includes 21 countries.

At the time of writing (December 2023), 42,768 people have made 2,366,084 observations in New Zealand of 22,325 species, which have been checked by 13,970 identifiers. Over the past 20 years, iNaturalist NZ has been the second largest contributor of public New Zealand biodiversity data, after eBird NZ, on GBIF (the Global Biodiversity Information Facility). About 10,000 observations are now made on iNaturalist NZ each week, and many of these are of species not native to our country. Some of those can be important observations of regional or national pests, and occasionally there is a new-to-New Zealand record. How can we make sure that the right people see those observations promptly?

Biosecurity observations are often made on iNaturalist NZ by people who don't know the significance of what they've found. The (volunteer) identifiers on iNaturalist, in New Zealand and internationally, then identify the species as far as is possible. It's at this stage, usually a few hours after submission, that a knowledgeable New Zealand identifier notices the significance of a find and asks the observer to call the Ministry for Primary Industries on its 0800 80 99 66 hotline. Other observations that aren't new to New Zealand may still be new to a region or district. In these cases it is important that relevant people in councils, and primary industries, keep an eye on iNaturalist NZ for the pests of most concern to them.

iNaturalist has a built-in alert system that you can use to get notified whenever observations are made of particular taxa in particular places. This feature is called Subscriptions, and it's accessible on the iNaturalist NZ website.

'Subscribe to a Place' is the more useful option, as it lets you subscribe to a 'Place' and then a 'Taxon' in that place. For example, if you were interested in possible brown marmorated stink bug observations, you can subscribe to the place 'New Zealand' and the taxon 'Pentatomidae' (the stink bug family). Your Dashboard on the iNaturalist.NZ website will then include every new pentatomid observation made in New Zealand as soon as it is uploaded. You will also be emailed each week with the latest New Zealand pentatomid observations (unless you've turned off email notifications in your account settings). You can set up as many subscriptions like this as you like.

If posting observations on iNaturalist NZ is not your thing, you can make a valuable contribution to the community as an identifier. Identifications are made on the web at https://inaturalist.nz/observations/identify, and you can use the extensive filters to see just the taxa, places, times, etc. that you want to identify. For example, to see the pentatomid observations needing identification, go to https://inaturalist.nz/observations/identify?taxon_id=47742. Observations stay on the Identify page until they've been identified to species by an identifier, or until an identifier checks "It's as good as it can be" under Data Quality. While you're identifying observations, you can add many biological details like life stage and phenology. This adds value to the data for understanding the timing of species' life cycles in New Zealand.

I find the Identify page an enjoyable and useful way to practise and refine my identification skills, while also keeping an eye out for notable observations in the taxa that most interest me. There's a positive feedback cycle here. Taxa that have active and experienced identifiers tend to get more observations, as observers get encouraged by prompt identifications and comments and seek out more of these taxa.

If you're a data whiz, note that all iNaturalist data are open and available via the iNaturalist API (http://api.inaturalist.org/). You can use this to connect GIS software and data analysis software (like R) directly into the global iNaturalist database.

Observations can be added to iNaturalist NZ via the free iNaturalist app (Android or iOS), the iNaturalist.NZ website, the Seek by iNaturalist app (designed for children), or via third-party apps that incorporate iNaturalist

functionality, like Find-A-Pest. By encouraging people to observe interesting and unusual species around them, iNaturalist NZ–Mātaki Taiao makes contributions to general biosecurity surveillance in New Zealand. It complements biosecurity-specific surveillance and more directed general surveillance tools like Find-A-Pest. Collectively, the more we look, the more we find.

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ANIMALS

Quarterly report of investigations of suspected exotic diseases: July to September 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 July to September 2023.

Exotic vesicular diseases ruled out

A veterinarian in Southland called the exotic pest and disease hotline to report a case of a 3-year-old Hereford beef cow with erosions of the hard palate (**Figure 1**), an elevated rectal temperature and diarrhoea. There was one animal affected out of 25 animals in the mob and there had been no recent introductions to the farm. At the time of reporting, the veterinarian had not examined the other 41 cattle on farm, so a visit was organised to the farm to check the in-contact cattle and photograph the lesions reported. A senior veterinarian from the same practice revisited the animal. The affected animal was the only symptomatic animal on the farm; it was not lame, and the oral lesions were determined to be consistent with actinobacillosis, a common endemic condition caused by *Actinobacillus lignieresii*. The affected animal responded to antibiotic therapy. Foot and mouth disease (FMD) and other vesicular disease were excluded in this case on clinical and epidemiological grounds and the investigation was closed.

Figure 1: Erosive lesions on the hard palate of a single Hereford beef cow in a mob of 25. Photo: Georgette Wouda, Vet South

In late August, a commercial veterinary laboratory pathologist contacted the exotic pest and disease hotline to discuss a submission. A clotted blood sample for bovine viral diarrhoea (BVD) virus antigen testing had been submitted from a rising 1-year-old Hereford steer with an accompanying history of fever, diarrhoea, anorexia, drooling and oral ulceration. This is a clinical picture where, in the absence of epidemiological information, FMD is a differential. FMD is exotic to New Zealand, and the case required investigation. The duty Incursion Investigator contacted the submitting vet and obtained a history. The steer was one of ten that had arrived at the cattle-only property 11 days before clinical onset. Lameness was not a feature of its presentation. There were no other risk movements onto the farm in the two weeks before or since that movement. The remaining ten rising 1-year-olds were clinically normal. Another mob of thirty 1-month-old dairy cross calves were similarly unaffected. This clinical and epidemiological picture was consistent with the farm veterinarian's suspicion of BVD as the primary differential for the animal's presentation. BVD virus was subsequently confirmed on antigen testing. The investigation was closed.

In early September, a veterinarian contacted an Incursion Investigator to discuss a farmer-reported outbreak of oral lesions in calves. The veterinarian had not been to the farm at the time of the call but was told up to 16 calves were affected. The veterinarian suspected calf diphtheria due to *Fusobacterium necrophorum*, but the numbers reported and description of the lesions on the rostral tongue were unusual and concerned the veterinarian. Since a visit had already been arranged, the Incursion Investigator advised the veterinarian on the clinical and epidemiological information to collect at the farm visit to exclude exotic vesicular disease. The veterinarian reported that there were 11 cases over three days, among 80 up-to-4-week-old dairy replacement heifers in an eight-pen shed on the dairy platform. Cases were distributed over six pens. Eighty bull calves in an adjacent shed were unaffected. One calf-rearer was responsible for both sheds. Diphtheritic lesions were solely confined to the rostral tongue (tongue tip). Calves were afebrile, feeding normally and there were no other clinical signs such as lameness. The early cases had responded to antibiotic treatment. There were no clinical issues of concern in the dairy herd and production was as expected. Exotic vesicular disease could therefore be excluded on clinical and epidemiological grounds. Calf diphtheria remained the primary differential in this case, although management factors were considered possible contributors to the unusual lesion location. The farm veterinarian advised on feeding management and hygiene changes that led to resolution of the outbreak.

Transmissible spongiform encephalopathy ruled out in a dairy cow

A commercial veterinary pathologist called the MPI exotic pest and disease hotline to report finding lesions suspicious of bovine spongiform encephalopathy (BSE) in the brain of a 4-year-old Friesian dairy cow. The cow was found recumbent

before the expected calving date, and on clinical examination by the attending veterinarian, no external evidence of injury was identified. Treatment, including fluid therapy, administration of metabolic solutions and anti-inflammatories, took place; however, the cow failed to respond and was euthanased 48 hours later. The cow's brain had been submitted under MPI's Transmissible Spongiform Encephalopathy (TSE) scheme. This targeted surveillance programme supports New Zealand's claim of freedom from TSEs, of which BSE is the entity that affects cattle. The histological lesions in this case included equivocal vacuolation of the grey matter neuropil in the examined sections of the obex and midbrain. The lesions observed were considered equivocal because they resembled artefacts seen in autolysis of tissue samples; however, spongiotic change caused by TSEs could not be excluded. TSEs can occur via infection, genetic predisposition or by sporadic transformation of the prion proteins of the brain. The abnormal prions are then considered to recruit more prion proteins into an abnormal configuration, causing neuronal vacuolisation visible histologically as spongy clearings in the brain stem and spinal cord. New Zealand implements strict feeding restrictions that prevent ruminant-derived protein being fed to ruminants, and therefore the risk of acquisition of infective TSEs is thought to be negligible. In addition, the cow's age made it unlikely to have acquired any age-related TSE alteration as atypical BSE usually affects cattle over eight years old. Nevertheless, testing for TSEs was expedited by MPI's Animal Health Laboratory. An ELISA on the brain stem of the animal was negative for prion proteins. Fresh and fixed tissue samples were submitted for follow-up testing via Western immunoblot and immunohistochemistry at the world reference laboratory in Weybridge, United Kingdom. The results of this testing confirmed the diagnosis that this case was BSE-negative. BSE was excluded and the investigation was closed.

Enzootic bovine leukosis virus excluded in multiple cattle

A regional veterinary laboratory phoned the exotic pest and disease hotline to advise of an enzootic bovine leukosis (EBL) virus seropositive serum sample from a yearling Murray Grey bull. The bull was one of 33 animals in a cohort of yearling cattle being tested as part of prepurchase examination; the intended destination of the bulls was as service bulls for the dairy industry. The farm had no known history of EBL, and there were no clinical signs or abnormal findings on clinical examination that indicated an a priori risk of disease. The serum was submitted to MPI's Animal Health Laboratory (AHL), Wallaceville for PCR testing and a sample was sent for commercial testing with the GP51 ELISA test and found to be negative on both tests.

A livestock export coordinator notified MPI via email to advise of several seropositive cattle on pre-export testing for EBL. These healthy seropositive animals were rejected from shipping to China on the basis of this test; however, given the large numbers of cattle tested for export, some seropositive results are expected when using a test with imperfect specificity in a population of cattle free from EBL. The affected cattle were sourced from different properties in New Zealand and there were eight seropositive results among about 36,000 bovine sera tested in 2023. The sera from the eight heifers were submitted to a commercial veterinary diagnostic laboratory for testing with the more specific GP51 ELISA test and found to be negative in all cases. The false positive rate of 0.02 percent is within the expected performance of the serological test.

Mycoplasma bovis excluded as the cause of calf pneumonia

A veterinary pathologist called the exotic pest and disease hotline to report a suspected case of *Mycoplasma bovis* or severe viral disease in calves. The pathology observed was bronchointerstitial pneumonia with bronchiectasis and bronchiolitis obliterans in 2-to-3-month-old Wagyu x Friesian calves in Waikato. At least 30 calves in a cohort of 112 had died in the last month. The epidemiology team from the MPI *M. bovis* directorate was contacted, and the investigation proceeded with their involvement. A local veterinarian was contacted and authorised to conduct postmortems of any calves that died in the coming week and to collect blood samples from 60 calves for serological testing for *M. bovis*. A check of the bulk tank milk testing done on the dams of these calves found the herd was positive for the pestivirus BVD virus in the previous summer, and the herd was negative for *M. bovis* in the previous autumn and current winter testing of bulk milk samples. Tests of fresh lung samples from an affected calf were conducted with a bovine respiratory panel and were positive for *Pasteurella multocida* and *Histophilus somni*. This pattern and the BVD status of the herd confirmed the provisional diagnosis of bovine respiratory disease complex as the cause of severe pneumonia in these calves. All 60 sera collected were negative for *M. bovis* on the *M*. bovis ELISA test, and this together with the bulk tank milk information was taken as evidence that *M. bovis* was not involved in the cause of the bovine respiratory disease event observed. The unwanted organism *M. bovis* was ruled out and the case was closed.

Anthrax excluded in a steer

An MPI Verification Services veterinarian in Taranaki phoned the MPI exotic pest and disease hotline to report that a 3-year-old Angus steer was found dead in the stock truck on arrival at a meat processing plant. The veterinarian was concerned as the deceased steer had bled profusely from the nose and rectum, a common finding when cattle die from anthrax, which is caused by the exotic agent *Bacillus anthracis*. Blood samples from the carcass were submitted to MPI's AHL and molecular testing for *B. anthracis* was negative. The submitted samples also tested negative to BVD type 2, another exotic pathogen that can result in bleeding disorders of cattle. Exotic disease was excluded, and the investigation was

closed. It appears the most likely cause of death in this case was trauma to the animal during transport.

Exotic disease excluded as the cause of unusual fungal mastitis in cattle

A regional veterinary laboratory phoned the exotic pest and disease hotline to report a first case of *Scedosporium* spp. mastitis in dairy cows in New Zealand. The laboratory had received two plates of culture from a veterinary practice that was investigating a dairy herd with non-responsive mastitis. The culture plates were submitted to MPI's AHL and found to be organisms in the *Scedosporium* complex. The herd of origin comprised 453 Friesian cross cows and there was mastitis in 20 cows at the time of the notification. There was a high proportion of multiple quarter mastitis: six cows with one quarter affected, nine cows with two quarters affected, four cows with three quarters affected and one cow affected in all four quarters.

Of these cases in the mastitis mob, three cows were found to be infected with *Scedosporium apiospermum* or *Scedosporium boydii*. Milk samples from all affected quarters were collected aseptically by a local dairy veterinarian and submitted to a commercial laboratory for testing. Fungal and bacterial colonies were visible on blood agar plates. In addition to the three cows infected with *Scedosporium* spp., two cases of *Streptococcus uberis* were found. The notification of non-responsive bovine mastitis includes the possibility of a *Mycoplasma* aetiology. The MPI *Mycoplasma bovis* directorate was informed and blood samples from all 20 cows were tested with the *M. bovis* ELISA test and found to be negative. The recent winter bulk tank milk screening for this herd was also negative on *Mycoplasma* antibody ELISA testing. As a precaution, the sera from these 20 cows was also tested for EBL to ensure that bovine viral leukosis suppression of white cell function was not playing a causal role in this case. The source of the *Scedosporium* fungus to these cows was not able to be identified in this case. Two of the cows with *Scedosporium* infection had been brought into the herd in the previous autumn as non-pregnant, but high somatic cell count cows, to be milked through the winter, with the intention of getting them back in calf. The temporal pattern of infection was not determined, so whether these cows were brought in with infection and transmitted infection to other cows via milking, or whether infection was acquired in these cows through local conditions that winter could not be determined. In the two months that followed the initial investigation, seven cows were culled as non-responsive mastitis from this herd. *Scedosporium boydii* has been reported in association with mastitis internationally (Lagneau et al., 2000), and has been reported in association with sporadic clinical cases of bovine mastitis in New Zealand previously (Thomson et al., 1978), but remains an unusual cause of mastitis.

Exotic disease excluded as the cause of skin lesion outbreak in calves

A veterinarian in Waikato phoned the exotic pest and disease hotline to report about 30 calves with unusual skin lesions. Skin lesions of cattle may be caused by many things, including the exotic pathogen lumpy skin disease virus (LSDV). The affected calves were from a mob of 250 on a dairy farm with 250 heifer replacements and a milking herd of 1,000 cows. None of the other stock classes were affected, despite close contact with the calf mob. There was no history of a drop in milk production and no systemic illness was noted in the calf mob.

The veterinarian revisited the farm and was able to provide good quality photos of the lesions, which showed linear skin defects not consistent with those seen with LSDV. Exotic disease was excluded based on the epidemiology and clinical picture, and the investigation was closed. The calves recovered over the following weeks and no new cases have occurred to date. Unfortunately, samples were not collected for further testing, so an endemic diagnosis could not be reached in this case.

Unusual lesions in a calf at slaughter

An MPI Verification Services (VS) veterinarian working at a South Island slaughter premises contacted the duty Incursion Investigator to report an unusual lesion found in the heart of a bobby calf. As part of efforts to increase connection with the VS service, Incursion Investigators encourage notification of any unusual lesions, even if there is no obvious exotic differential diagnosis. In the current case, the focal lesion appeared round, white, about 5 mm in diameter and reasonably well demarcated within the myocardium (**Figure 2**). No further lesions were found on post-mortem inspection of the carcass and offal, and no further calves in the line were affected. The fixed lesion was submitted to a regional laboratory where a focal abscess, characterised by numerous degenerate neutrophils, admixed with eosinophilic cellular and karyorrhectic debris, and numerous bacterial colonies further surrounded by a proliferating fibrocollagenous stroma infiltrated with mononuclear cells, was identified on histological examination. These findings correspond with bacterial infection acquired post-partum. Exotic disease was excluded, and the investigation was closed.

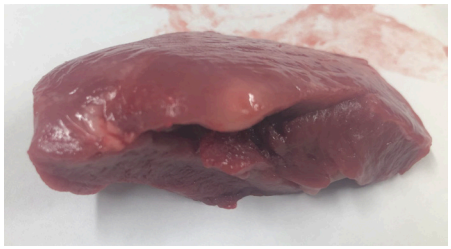

Figure 2: Pale demarcated lesion within the myocardium of a bobby calf. Photo: Nicky Taylor, MPI Verification Services

Unusual lesions in a deer at slaughter

An MPI Veterinary Technical Supervisor notified the Animal Health Incursion Investigation team of lesions in a deer carcass at a processing plant. The wild-caught deer carcass was condemned by an AsureQuality inspector due to septicaemia. Grossly, the kidneys contained generalised miliary pale foci, 1 mm in diameter (**Figure 3**). Formalin-fixed tissues (liver, lymph nodes from lungs and

trachea, kidneys) from the carcass were submitted to MPI's AHL for histopathology. These tissues showed evidence of chronic interstitial nephritis and bacteria in the tubules consistent with *Leptospira* spp. organisms. There was also evidence of parasitic helminth migration or bacterial localisation and infection in the liver, either from the alimentary tract or a systemic process. The renal lesions were consistent with leptospirosis, which is an important zoonotic disease. The notifier was alerted to this, and the investigation was closed.

In a separate notification from the same processing plant, a farmed deer was found to have variably pale neck and back muscles during processing in the boning room (**Figure 4**). Formalin-fixed muscle from affected regions was submitted to MPI's AHL for histopathology. The tissues showed extensive necrosis and chronic inflammation. There was no evidence of an acute or active bacterial myositis. It is likely that the myopathy was exertional or possibly toxic in nature. Nutritional myopathy (vitamin E/selenium deficiencies) is possible but less likely given the localised distribution of the lesions.

Figure 3: Miliary pale foci throughout the renal cortex of a deer, consistent with leptospirosis. Photo: Eun Lee, MPI Verification Services

Figure 4: Bilateral pale muscles (top centre) in the caudo-dorsal neck of a farmed deer at slaughter. For orientation, vertebrae C1 is at bottom. Photo: Eun Lee, MPI Verification Services

High pathogenicity avian influenza excluded in multiple wild bird investigations

A veterinarian from a wildlife hospital in the South Island phoned the exotic pest and disease hotline to report a small case-series of sick red-billed gulls (tarapunga, *Chroicocephalus novaehollandiae*) from different local areas that were all displaying similar clinical signs. The three affected gulls all presented over the course of one week, with orange staining on their feathers, generalised weakness, mild paralysis and an inability to use their legs. All affected birds were found at separate locations by separate people and were trying to right themselves using their wings. All three failed to recover and were either euthanased or died. Gross postmortems failed to elucidate the cause of the clinical signs. Formalin-fixed tissues were submitted to a commercial laboratory for histology. Histology revealed two of the affected birds to have mild, mononuclear and multifocal myocarditis. One of these birds also had significant areas of hepatic necrosis with haemorrhage and small areas of pancreatic necrosis, both of which could potentially be explained by trauma; however, the extensive and severe multifocal ulceration of the proventriculus that was present would be unlikely to be caused by trauma. Choanal and cloacal swabs that were collected from each bird during postmortem were submitted to MPI's AHL for exotic disease testing. Molecular testing for influenza A, exotic avian paramyxovirus type 1 viruses (agents of Newcastle disease) and West Nile virus (WNV) all returned negative results. Exotic disease was excluded, and the investigation closed without a definitive endemic diagnosis being reached.

A wildlife support centre phoned the exotic pest and disease hotline to report a neurological disease in red-billed gulls at Surfdale Beach on Waiheke Island in the Hauraki Gulf. This is the second event reported from this location this year; to date, 11 birds of this species have been treated by the centre. Two juvenile males were submitted for post-mortem examination and were found to be in good post-mortem condition. One had an empty crop and the other had white viscous material present in the crop. Both birds had enlargement of the spleen. Oral and cloacal swabs were taken and submitted to MPI's AHL to screen for avian influenza, avian paramyxovirus 1 and WNV. Histopathology on tissues collected from these two birds found both birds had internal parasitism by trematodes, and one bird had amyloidosis, secondary to the chronic parasitism. In both birds there was moderate lymphoid hyperplasia of the spleen. The postmortem and histology results did not identify a conclusive cause of death or the neurological signs. The oral and cloacal swabs were negative for avian influenza virus, avian paramyxovirus and WNV. The significant exotic viral causes of death in these birds were ruled out and the case was closed.

Avian paramyxovirus excluded in poultry

A poultry veterinarian phoned the MPI exotic pest and disease hotline to report unexpected seropositivity in a poultry flock to the avian paramyxovirus type 1 (APMV-1) hemagglutination inhibition (HI) test, which is a screening test for the exotic Newcastle disease virus (NDV). The HI testing had been done as part of routine screening through a commercial laboratory on a 60-week-old flock due for end-of-life depopulation. Twenty-nine serum samples were tested with 25 showing a titre of 1:8 or greater (4 x 1:8, 11 x 1:16, 7 x 1:64, 1 x 1:128 and 2 x 1:256). Another flock from the

same farm and shed complex (side B) had returned negative results (titres less than 1:8) in samples collected on the same day. Another sampling round was undertaken four days later with similar results (27/30 samples ≥ 1:8 in side A and 0/30 ≥ 1:8 in side B). At the same time, tracheal swabs were also taken from the same birds and these were all negative on RT-PCR for APMV-1. Due to the continued seropositivity, the unexpected and unexplained seropositive results were notified to the incursion investigation team and further testing was instigated through MPI's AHL. Further sampling was undertaken on both the seropositive flock (side A) and the negative flock adjacent (side B). These included serum samples along with tracheal and cloacal swabs from 30 birds in each flock. Furthermore, 12 birds (six from each flock) were necropsied with samples taken for histological examination. Gross post-mortem and histopathological examination showed no evidence of pathology that would be expected in pathogenic APMV (Newcastle disease) infection. In serological testing, side A returned 30/30 positive ELISA results and 29/30 positive HI results, but all sera from side B were negative to both ELISA and HI. This upheld the testing results at the commercial laboratory. All tracheal and cloacal swabs were negative to APMV-1 RT-PCR testing. Production data and feed consumption data were reviewed, with no checks in either parameter. Mortality rates over the lifetime of the flock were within the normal range. Based on the combined evidence, an exotic virulent strain of APMV-1 (NDV) was excluded. It is suspected that the seroconversion occurred as a reaction to a non-virulent APMV or similar antigen that found its way into side A but not side B. Further such events will continue to be investigated in efforts to understand more fully the endemic cause of this false seropositivity.

Salmonella Pullorum excluded in poultry

A quality systems person in a poultry company phoned the exotic pest and disease hotline to report a seropositive result on routine screening for *Salmonella enterica* serovar Gallinarum, biovar Pullorum. There was no increase in morbidity or mortality in the seropositive flock. Three of 20 breeder birds sampled from 27,000 birds in a 25-week-old breeder flock were positive on the serum agglutination test for *S.* Pullorum. Cloacal swab samples from the same 20 birds were submitted to MPI's AHL for bacterial culture and a PCR test and found to be negative for *S*. Pullorum. Pullorum disease is a cause of bacillary diarrhoea in chickens and turkeys and causes a high mortality in young birds. Its presence in flocks presents as high mortality, respiratory disease, blindness and arthritis. Serology with the serum agglutination test is the main surveillance method for this disease in New Zealand. The potential for false positive results exists and, as in this case, is resolved by more sensitive and specific pathogen isolation attempts. The unwanted organism *Salmonella* Pullorum was excluded by culture and PCR testing, in addition to the clinical history of the breeder flock.

Infectious bursal disease ruled out in poultry

The New Zealand poultry industry operates an infectious bursal disease (IBD) surveillance programme with the IDEXX FlockCheck ELISA used as a screening test, at the commercial poultry laboratories (Mulqueen and Russell, 2021). If the prevalence of reactors in an epidemiological unit is 50 percent or over on this screening test, the positive sera are submitted to the MPI's AHL for the virus-neutralisation test, (VNT). The duty Incursion Investigator is then notified of any positives on VNT. In early March, one of two layer sheds on a lower North Island layer farm had been sampled as part of the programme. Eight of 10 samples from a 30-week-old, 5,200-bird, free-range Hyline flock were positive on the ELISA test with S/P values ranging from 0.23 to 0.87. Values greater than or equal to 0.2 are positive. What a subsequent commercial laboratory investigation attributed to human error resulted in the positive sera not being submitted to AHL until late August, at which time six of the eight sera were positive on VNT. These were low positive titres of 2 x 1:8, 1 x 1:12, 2 x 1:32 and 1 x 1:96. A titre of 1:8 or more is positive. In early September, an Incursion Investigator visited the layer farm along with a surveillance programme sampler. Sera and cloacal swabs (into avian transport medium) were collected from 12 birds in the now 57-week-old flock that triggered the investigation, and from a 22-week-old flock in the second shed. At AHL, all sera were negative on ELISA and VNT while the cloacal swabs were negative on an IBD PCR (RT qPCR TaqMan). Other pertinent and useful information was the absence of health issues in the two flocks as confirmed by the farm's poultry veterinary consultant. Furthermore, the flock that had the screen positive results had been reared to 16 weeks on another property. Negative results from IBD screening at six and 14 weeks while on that property were provided to the Incursion Investigator. The positive serology from the March sampling event was attributed to non-specific immune responses. The investigation was closed.

Exclusion of highly-pathogenic avian influenza as the cause of seal deaths

In August, a Department of Conservation (DOC) representative contacted the MPI exotic pest and disease hotline, stating that six dead seals had been reported to DOC by members of the public at Ocean Beach in Hawke's Bay over one weekend. Causes of mortality in seals include starvation, trauma and infectious diseases, some of which, such as highly-pathogenic avian influenza virus, are exotic to New Zealand. A local DOC ranger confirmed the presence of six seal carcasses. Unfortunately, all six carcasses were severely autolysed and unsuitable for testing. Regular inspections of the site were begun by the ranger to try to obtain a fresh carcass. A week later the duty Incursion Investigator was contacted by the local DOC ranger to report a further 11 seal carcasses found on the same stretch of beach. The carcasses included one adult female in poor

body condition, one adult male, and eight young seals ranging from pups to subadults. All adult carcasses were unsuitable for testing due to advanced autolysis. Five seal carcasses, including one larger subadult female seal and four juvenile seals, were submitted to Massey University Wildbase Pathology Department for post-mortem examination. All five carcasses examined were found to be in poor body condition with reduced skeletal muscle mass and minimal subcutaneous and visceral fat reserves. The stomach and intestinal tracts contained only melena and a moderate nematode parasite burden, with no food or digesta present. No other abnormalities were noted on post-mortem examination. In all cases, the cause of death was attributed to starvation and emaciation, with no evidence of any other underlying disease processes. Tissue samples were taken for histopathology from two seals, including the larger female. A degree of microvesicular steatosis was found in the liver of both individuals on histological examination, which supports a diagnosis of starvation. No evidence of inflammation was found in any of the major organs, including the brain and lung. Fresh lung, brain and spleen samples were submitted to MPI's AHL from three of the seals. These tissue samples were tested for avian influenza virus, phocine distemper virus and canine distemper virus via molecular assay. All samples tested negative. These findings exclude exotic disease and provide current evidence of starvation as cause of mortality in young seals in the area. Spring is the time of year when young seals are weaned, and it is not uncommon for inexperienced juvenile seals to be unsuccessful in their foraging and to die of starvation at this time. The recent Cyclone Gabrielle weather event also severely affected Hawke's Bay and may have impacted marine fish stocks in the area. At the time of writing (October 2023), MPI continues to work in close association with DOC to monitor the situation and obtain suitable samples for further testing from affected adult seals. Mortalities have continued, with predominantly juvenile seals found to be affected, with lower numbers of adult carcasses also reported; unfortunately, all adult carcasses found to date have been unsuitable for testing.

Leporipoxvirus excluded as the cause of disease in a rabbit

A veterinary pathologist called the exotic pest and disease hotline to report a rabbit with a possible Shope fibroma on its ear. The Angora rabbit was a 9-year-old adult male that had multiple (> 50) cutaneous nodules, both benign and malignant, removed in its lifetime. A check of the animal's history revealed that a malignant rhabdomyosarcoma was removed from muscle tissue adjacent to the axillary lymph node earlier in the year. A benign trichoblastoma had also been diagnosed after resection in the past. The recently resected ulcerated mass from the rabbit's right ear had been submitted for histology. The histological diagnosis was a malignant spindle cell tumour. The main exotic cause of spindle cell tumours is Shope fibroma virus (a leporipoxvirus); however, endemic non-virus related tumours also can occur in rabbits. Shope fibroma virus is closely related to myxoma virus (also exotic to New Zealand) and provides cross protection against myxoma virus (Gumbrell, 1986; Wilks, 1992). Transmission of these viruses is possibly via biting arthropods, such as mosquitoes and fleas. These species-specific viruses have a predilection for connective tissue cells. No fresh tumour was available, but a tissue scroll from the wax block containing the fixed tissue from the ear tumour was submitted to the MPI's AHL for molecular testing. On conventional PCR testing, the sample was negative for poxvirus and parapoxvirus DNA. This molecular test result excluded both exotic viruses as the cause of the tumour and the case was stood down. This case is unique in that the animal's ongoing tumours suggest a systemic failure of immunosurveillance. Immunohistochemistry was being undertaken by the veterinary specialists to determine the cell of origin of the spindle cell tumour observed at the conclusion of our involvement in this case.

Exotic disease excluded as the cause of neurological disease in zebra

A veterinary pathologist phoned the exotic pest and disease hotline to report a neurological disease causing disease and death in four zebras. The zebras were a group of five adult male animals in a private conservancy. The initial zebra was first noticed to be unwell with initial signs of colic, developing ataxia with hindlimb weakness, which progressed until the animal was unable to rise and was euthanased a month after first becoming unwell. Three more zebras became ill 51 days after the initial case. These animals had a shorter course of disease, lasting less than two weeks and consisting of ataxia, weakness in the hind limbs and progression to recumbency. Nasal swabs, blood samples, fresh intestinal samples and a full set of tissue samples in formalin were collected from the last two cases, which were euthanased after the notification. Intestinal samples and blood samples were negative on the panel of *Clostridium botulinum* mosaic PCR tests. Serum samples were negative on WNV ELISA. Nasal swabs were negative on molecular testing for African horse sickness using reverse transcriptase qPCR, equine herpesvirus 1 PCR, and flavivirus qPCR. Whole-blood EDTA and cerebrospinal fluid were also negative on the flavivirus qPCR test. A nasal swab from one zebra was positive on conventional herpesvirus PCR and sequenced and found to be a probable equid herpesvirus 7 but its exact identity was unknown. The cerebrospinal fluid of the same animal was negative for equine herpesvirus, so it was unlikely to have been the cause of death. The provisional diagnosis clinically was botulism; however, toxins formed by *Clostridium botulinum* were not found by molecular screening in any of the intestinal samples or serum samples from these animals. The exotic viral diseases WNV, African horse sickness, and flaviviruses were excluded by molecular tests and serology. Although a herpesvirus was recovered from the nasal swab of one animal, it was not

recovered from the cerebrospinal fluid of that patient and therefore unlikely to be a neurotropic virus (therefore not considered a likely cause of the disease). The exact cause of death of four of the five zebra on this property was not determined, but exotic disease was excluded. A possible endemic cause, monensin toxicity, was not able to be ruled out. The case was stood down and arrangements were made to test the remaining zebra for herpesvirus and move him to a new home.

Brown dog tick interception and urgent measures

A groomer in Christchurch phoned the exotic pest and disease hotline to report finding a tick on a dog during grooming. It is unusual to find ticks of any species in the Canterbury region, although a few isolated populations of the endemic New Zealand cattle tick (*Haemaphysalis longicornis*) have been reported (Heath, 2016). The affected dog was a 5-year-old entire Maltese cross that had never left New Zealand. The tick was submitted to an entomologist and was identified as an engorged female brown dog tick (*Rhipicephalus sanguineus*). The brown dog tick (BDT) is exotic to New Zealand and is an unwanted and notifiable organism. Urgent measures were instigated immediately. The dog was inspected and treated for ticks by a veterinarian, with no further ticks found. The house where the dog lived, and the groomer's premises where the BDT was found, were inspected for ticks by an entomologist, and fogged with an appropriate acaricide. The groomer also maintained a breeding pack of 32 German Shepherd dogs, all of which were inspected and treated for ticks. No further ticks of any sort were found despite exhaustive searches of all places of interest. The affected dog was tested at MPI's AHL for the exotic tick-borne pathogens *Ehrlichia canis*, *Babesia* spp., *Mycoplasma haemocanis* and *Leishmania* spp. via molecular assays and serological tests, and blood slides were examined for the presence of blood-borne parasites. The tick was also tested for *Ehrlichia canis*, *Babesia* spp. and *Mycoplasma haemocanis* by molecular assays. All assays were negative confirming that this tick incursion did not concurrently introduce any of these pathogens. Proactive communication was undertaken to veterinarians throughout New Zealand, along with dog control officers in the Christchurch area, who were asked to increase their vigilance for ticks and to contact the exotic pest and disease hotline if they suspected the presence of a BDT. Sequencing of the BDT's genome at MPI's Plant Health and Environment Laboratory (PHEL) showed it is part of the tropical lineage of the *R. sanguineus* complex. The Australian, Fijian, Chinese and Laotian populations of the tropical lineage have recently been renamed as *R. linnaei* (Slapeta et al., 2022), and *R. linnaei* is considered the only species of the BDT complex present in Australia. Sequencing results also confirmed that this specimen was not related to any BDT previously detected in New Zealand, excluding the possibility that this tick could be from a local breeding population established by previous incursions. The dog's owners had returned from Australia five weeks before the BDT detection, where the tropical lineage of BDT is endemic. The owners reported having direct contact with dogs while in Australia. It appears likely that the tick infiltrated the owners' luggage and was introduced to New Zealand upon their return. This is the most likely import pathway for this BDT, and both the timeframes and the sequencing results are consistent. This case appears to be a one-off interception of a single BDT that was successfully contained due to the immediate notification by the groomer and subsequent rapid risk mitigation through urgent measures.

Brown dog tick excluded in multiple cases

A member of the public from Motueka, in Tasman district, phoned the MPI exotic pest and disease hotline to report a tick found on her dog's belly after exercising on a public walkway. Photographs were submitted and reviewed by an entomologist who identified the tick as *Haemaphysalis longicornis*, the New Zealand cattle tick. The New Zealand cattle tick is established in much of the North Island and in northern parts of the South Island including the Tasman district (Heath, 2016). The investigation was closed.

A member of the public from Tasman phoned the MPI exotic pest and disease hotline to report a tick found on her dog. She had already disposed of the tick. However, from a digital picture the notifier had taken (**Figure 5**) an entomologist was able to confirm this was a nymph stage of the New Zealand cattle tick (*Haemaphysalis longicornis*). The investigation was closed.

A member of the public called the exotic pest and disease hotline to report multiple ticks on his dog after it returned from staying at a friend's place in Taranaki. The notifier was aware of the recent incursion of brown dog tick in the South Island and was motivated to report the finding because the presence of ticks on his dog was unusual for him, and his veterinarian had not seen other cases like it. At the time of notification, the dog had returned from an appointment that afternoon at a New Plymouth companion animal practice. Multiple ticks were found on the dog and were removed, and it had been treated for ectoparasites with an oral isoaxaline product. A digital photograph of the ticks found on the dog was submitted by the notifier but was not of sufficient quality to speciate the ticks. The removed ticks were couriered to PHEL laboratory in Auckland where they were identified as *Haemaphysalis longicornis*, the New Zealand cattle tick. The exotic tick *Rhipicephalus sanguineus* was ruled out and the case was stood down.

Figure 5: A tick found by the owner of a dog in Tasman district, determined to be the New Zealand cattle tick. Photo: Sarah Lake

Positive detection of *Brucella suis* in a person with overseas exposure

The duty Incursion Investigator was notified of a positive *Brucella suis* blood culture from a person with vertebral discospondylitis, tested at a hospital in Auckland. The Medical Officer of Health advised that the patient had recently come to New Zealand from Tonga where he had been employed on a pig farm and was therefore in contact with domestic pigs. In contrast, the patient had not had contact with pigs or pork in New Zealand. Infection of the patient with *B. suis* had likely occurred historically in Tonga. The presence of the unwanted organism *B. suis* in a New Zealand hospital was not found to be a consequence of human exposure to a New Zealand animal population and the case was closed.

Brucella canis excluded in multiple investigations

A veterinary pathologist contacted the exotic pest and disease hotline to report a case of acute suppurative epididymitis in a submission from an 8-year-old pig dog. The condition had developed over about two weeks. There are several potential causes of suppurative epididymitis in dogs, including the exotic *Brucella canis* and *Brucella suis.* The Incursion Investigator followed up with the submitting veterinarian to obtain a history, and it was determined that the dog was New Zealand-born and had never travelled overseas. The dog had not been knowingly mated and to the best of the owner's knowledge had not been in contact with imported dogs. As a precaution, given it is a pig dog with contact with New Zealand feral pigs, serum was taken to rule out both *B. canis* and *B. suis*. AHL conducted rt-PCR and SAT for *B. canis* and ELISA for *B. suis* with negative results. Therefore, infection with *B. canis* or *B. suis* was ruled out and the investigation closed.

A commercial veterinary laboratory pathologist contacted the exotic pest and disease hotline to report severe, acute, necro-suppurative epididymitis in fixed testicular tissue submitted from a 6-year-old heading dog. Gram-negative bacilli were seen on special staining. *Escherichia coli* was the most likely aetiological agent. However, the exotic *Brucella* species including *Brucella canis* and *Brucella suis* were a less-likely differential. The duty Incursion Investigator obtained a detailed history on the dog from the submitting veterinarian. The New Zealand-born dog did not have contact with imported dogs. It had mated once, two years before, and sired four healthy pups. It had no contact with feral pigs or feral pig meat or offal. Exotic brucellosis could therefore be excluded on epidemiological grounds and the investigation was closed.

A veterinary pathologist from a commercial laboratory phoned the exotic pest and disease hotline to report histological findings from a dog's testicles that were consistent with *Brucella canis* infection. The thirteen-year-old imported Border Collie was suffering from prostatitis and a swollen testicle and the attending veterinarian had submitted formalin-fixed testicles following neutering, which was carried out in response to the clinical signs. Histology revealed marked testicular atrophy with interstitial fibrosis and chronic active inflammation. Histological and clinical findings such as these could occur during infection with *B. canis*. The dog was imported from England about ten years ago, after passing New Zealand's import health standards, which include testing negative to *B. canis.* The attending veterinarian arranged a revisit for the dog and collected a serum sample that was submitted to AHL and subsequently subcontracted to CSIRO in Geelong, Victoria, Australia, where it was negative to the *B. canis* tube agglutination test. This test has a sensitivity approaching 100 percent (but specificity of only 40 percent) and thus a negative result is very strong evidence that this dog is not infected with *B. canis*. Exotic disease was excluded, and the investigation closed.

An Otago-based companion animal veterinarian contacted the MPI exotic pest and disease hotline to report a case of suspected acute epididymitis in a seven-year-old Shih Tzu dog. The dog presented to the veterinarian following a seven-day history of lethargy and excessive licking of the scrotal region. Unilateral testicular swelling was identified on clinical exam. Treatment via castration and antimicrobial therapy commenced and fixed testicular tissue was submitted to a regional veterinary laboratory. On histopathological examination, findings were consistent with suppurative scrotal dermatitis, with some extension to the epididymis, rather than primary epididymitis and no bacteria were identified following special staining. Whole blood was submitted to MPI's AHL for *Brucella* genus molecular assay, and serum was subcontracted to the CSIRO Australian Centre for Disease Preparedness laboratory for *Brucella canis* serology. Both results were negative. Exotic disease was excluded, and the investigation was closed.

Lyme disease excluded in a dog

A veterinary medicine specialist phoned the exotic pest and disease hotline to report clinical findings in an imported dog that were consistent with Lyme disease, a disease caused by infection with *Borrelia burgdorferi*. The 15-year-old dog, originally from the United Kingdom, was imported to New Zealand from South Africa about one year before presentation at the vets. Current MPI import health standards do not require the testing of dogs for Lyme disease, since it is considered no vector is present. The dog presented with proteinuria, severe heart disease and a thrombus in a brachial artery. These clinical signs may be caused by many things, including age-related deterioration; however, given the dog's import history, and the potential for Lyme disease to cause clinical findings such as these, further testing was deemed appropriate. The attending veterinarian arranged a revisit by the dog and collected a serum sample that was submitted to MPI's AHL and subsequently subcontracted to the College of Veterinary Medicine at Cornell University, USA, for *B. burgdorferi* serology. The Lyme disease multiplex assay quantitatively measures three antibodies that have

been shown to correlate with acute and chronic infection stages with *B. burgdorferi*. These yielded negative results – strong evidence that this dog is not infected with *B. burgdorferi*. Exotic disease was excluded, and the investigation was closed.

Chlamydophila caviae excluded as the cause of conjunctivitis in a guinea pig

A veterinary pathologist from a commercial lab phoned the exotic pest and disease hotline to report histological findings from a guinea pig that were consistent with *Chlamydophila caviae* infection. *Chlamydophila caviae* is the causative pathogen of guinea pig inclusion conjunctivitis, a disease that is typically self-limiting and is commonly reported around the world. However, it has not been found in New Zealand. The affected guinea pig was suffering from chronic conjunctivitis and the attending veterinarian had submitted a conjunctival biopsy to their commercial lab for histology. Histology revealed a moderately hyperplastic conjunctival epithelium with multifocal erosions and moderate numbers of heterophils. The submucosa was expanded with an inflammatory infiltrate that included lymphocytes, heterophils and congested blood vessels. The histological diagnosis of an erosive, heterophilic, lymphocytic conjunctivitis was consistent with guinea pig inclusion conjunctivitis and prompted the pathologist to notify MPI. The duty Incursion Investigator contacted the attending veterinarian and arranged duplicate conjunctival swabs from the affected guinea pig and each of its three herd mates, along with the formalin-fixed tissue already at the commercial lab, to be submitted to MPI's AHL for molecular testing. All samples returned negative results for *Chlamydia* spp. Exotic disease was excluded, and the investigation closed. The guinea pig received antibiotic eye drops and made a full recovery.

Deformed wing virus excluded in sick bees

An Australian bee scientist advised a New Zealand colleague working at MPI's AHL of a provisional diagnosis of deformed wing virus B (DWV-B) from molecular testing of a bee with deformed wings that had been collected in greater Wellington. To confirm the diagnosis, the notifier was requested to undertake sequencing of the molecular fragment to ascertain the identity of this DWV. The sequencing result confirmed DWV-A was present in the bee. The bee samples were collected in February 2023 by a delegation of beekeepers who came to New Zealand seeking bee samples for varroa work, following an incursion of *Varroa destructor* into Australia. The desire of the Australian CSIRO team to improve their capability to test for the pathogens that are transmitted by varroa was the purpose for testing. *Varroa destructor* is the vector of these and many other bee viruses, enhancing transmission within and between bee colonies. Previous work by MPI's AHL, and by a group of bee scientists at Victoria University, had found no evidence for DWV-B being present in New Zealand, only DWV-A. The MPI AHL finding is published in the 2021 annual surveillance report (O'Keefe, 2021) and in the peer-reviewed literature (Lester et al., 2022). The need to undertake sequencing of qPCR fragments of deformed wing virus has been noted previously to distinguish between the two subtypes of virus. Lester et al. observed that primers can cross react between the two subtypes of this virus, used sequencing to differentiate the subtypes. Clearly, the molecular screening tests available are not discerning gene sequences that are unique to DWV-B virus and should be noted in future surveillance or diagnostic screening for these viruses.

Validated new-to-New Zealand organisms or emerging diseases

The team receives notifications of organisms not previously reported in New Zealand. The organisms in **Table 1, page 14** are not considered to be newly introduced but are the product of increased searching and new molecular tools.

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Table 1: Validated new-to-New Zealand organisms or emerging diseases: July to September 2023

Organism	Classification	Host	Isolated from	Location	Comments
Proteus terrae	New	Dog	Otitis ear swab	Auckland	Two-year-old Springer Spaniel with otitis externa. Considered incidental to disease
Canibacter oris	New	Dog	Otitis ear swab	Auckland	Two-year-old Staffordshire Bull Terrier with otitis, no other associated cases
Salmonella Champaign	New	Broll sample (animal feed)	Broll	Auckland	Broll (chicken feed) manufactured from imported wheat, report subsequently transferred to NZ Food Safety
Streptococcus penaeicida	New	Cow	Milk sample	Bay of Plenty	Milk sample taken as part of a clinical trial, not considered of primary significance
Pasteurella oralis	New	Cat	Nasal discharge	Bay of Plenty	Single case of septic rhinitis. Organism considered likely to be pathogenic in this case
Pseudomonas citronellolis	New	Dog	Nasal swab	Canterbury	Dog with nasal aspergillosis. Isolate considered likely to be a contaminant in this case
Enterococcus raffinosus	New	Cat	Bile sample	Auckland	Part of mixed bacterial growth obtained from a single case of biliary obstruction
Neisseria dumasiana	New	Dog	Tongue lesion	Auckland	Isolated from a Golden Retriever with a non-healing ulcerative lesion on the tongue (co-isolated with *Frederiksenia canicola*, below)
Frederiksenia canicola	New	Dog	Tongue lesion	Auckland	Isolated from a Golden Retriever with a non-healing ulcerative lesion on the tongue (co-isolated with Neisseria dumasiana, above)
Prevotella heparinolytica	New	Cat	Swab from an abscess	Auckland	Present with mixed bacterial growth. This organism is reportedly an oral commensal bacterium of dogs and cats
Weissella confusa	New	Dog	Otitis ear swab	Auckland	Adult male dog, isolate considered of low clinical significance
Enterobacter hormaechei subsp. *xiangfangensis*	New	Horse	Urine	Otago	Horse with a history of haematuria, isolate also shows homology with *Enterobacter hormaechei* subsp. *hoffmannii*
Enterococcus canintestini	New	Dog	Urine	Otago	French Bulldog, isolate not considered clinically significant
Streptococcus pluranimalium	New	Horse	Nasal discharge	Manawatū	10-year-old horse with a cough and rhinorrhoea, isolate not considered clinically significant

Quarterly report of diagnostic cases: July to September 2023

Gribbles

Bovine

Samples were received from a 1-year-old dairy calf that died suddenly overnight. It was the second animal to die in a group of about 100 calves on a South Canterbury dairy farm. The group was generally performing poorly and about 20 percent of the animals were obviously unwell. One sick animal examined by the veterinarian had bloody faeces. The owner had also observed blood-tinged faeces in a few other calves. A faecal sample from the dead calf contained high numbers of coccidial oocysts but because of the age of the animals (clinical coccidiosis is typically seen in calves less than eight months of age), there was uncertainty about the significance of this. However, histopathological examination of samples of fixed tissue from the dead calf revealed significant and severe colonic lesions of **coccidiosis**.

Neck lesions were investigated on two cows from different Canterbury farms. One of the cows had a 5-cm diameter mass on the right caudal neck, which appeared painful on examination. The other cow had a 10 x 4 cm lobulated mass at the top of the neck just behind the ramus of the mandible, which exuded purulent material on palpation. Both lesions were biopsied and both had lesions typical of ***Actinobacillus lignieresii*** infection on histopathological examination. This organism is best known for causing lesions in the mouth (woody tongue) but quite often causes skin lesions around the head and neck. Occasionally, many animals in the group may be affected with cutaneous head and neck lesions and this may be a sequel to superficial injuries (such as from thorns in a boxthorn hedge) introducing bacteria into the skin.

On a Waikato property, several week-old dairy calves became recumbent and were panting. Three calves died over a period of two weeks. The total serum protein concentration for one of the calves was 44 g/L, which was consistent with failure of passive transfer of maternal immunity due to inadequate colostrum ingestion (total serum protein concentrations less than 53 g/L are considered consistent with failure of passive transfer in calves of this age). Histopathological examination of fixed tissues collected at necropsy from one of the calves revealed fibrinosuppurative pleuropneumonia, epicarditis and peritonitis. ***Bibersteinia trehalosi*** was cultured from a sample of fresh lung tissue. *Bibersteinia trehalosi* is an upper respiratory tract commensal gram-negative bacillus of the family *Pasteurellaceae,* and one of several bacteria implicated in bovine shipping fever. In calves, it has been associated with **fatal pneumonia and septicaemia**. Rapid diagnosis and treatment have been reported to improve the clinical outcome in affected calves, although failure of passive transfer may have played a significant role in the fatalities in this case.

Five second-lactation dairy cows in a herd of 250 in southern Waikato died after an acute illness, which included inappetence, increased respiratory rate and hair loss. They were noted to be jaundiced at necropsy. These animals were grazing a kale crop that included weeds. Histopathological examination revealed multisystemic granulomatous inflammation in the kidney, skin, brain, heart, spleen and liver, which has been seen in hairy vetch intoxication and in **idiopathic systemic granulomatous and haemorrhagic syndrome**. These syndromes are incompletely understood but thought to be caused by small molecules (haptens) that act as immunostimulants, triggering a type IV hypersensitivity reaction on repeated exposure, stimulating a T-cell-mediated inflammatory process (Rawdon et al., 2017).

Three cows in a dairy herd in Hauraki had mastitis and milk samples were collected and sent to the laboratory for testing. Bacterial culture of all three samples yielded a pure growth of ***Nocardia* spp**. *Nocardia* are soil inhabitants that can sporadically cause **mastitis**. They are slow-growing and can sometimes be missed on routine culture at standard incubation times of 48 hours. Overseas, cases have been associated with poor hygiene during infusion of intramammary preparations at dry-off. Infection in these cases may not become clinically apparent until the early post-partum period. Climatic conditions may also play a role by increasing the environmental load of the bacteria and increasing contamination of the udder with soil during periods when conditions are muddy. Clinical cases are often poorly responsive to treatment and ultimately, culling of the affected cows frequently occurs.

A dairy cow on a South Waikato property with **mastitis** failed to respond to intramammary treatment with amoxicillin–clavulanic acid and, subsequently, lincomycin–neomycin. Bacterial culture of a milk sample yielded a pure heavy growth of ***Helcococcus ovis***. This organism has been recognised internationally as an emerging pathogen in bovine endocarditis, mastitis and metritis. Locally, *H. ovis* has been detected sporadically since 2018 by the Gribbles laboratory network. Most of these isolates have been from cases of bovine mastitis and, despite showing full susceptibility on antimicrobial sensitivity testing, they often come with a history of poor response to treatment. In the present case, the mastitis remained unresponsive to treatment and the quarter was dried off.

Six heifers died within two weeks of calving on a Wairarapa dairy farm. Clinical signs included pyrexia, mild jaundice, painful cranial abdomen and poor transition to lactation. The heifers had been on a green oat crop before calving. Biochemistry testing of a serum sample from one heifer revealed marked hypoproteinaemia

at 42 g/L (reference range 60–81), with hypoalbuminaemia of 18 g/L (reference range 27–42) and hypoglobulinaemia of 24 g/L (reference range 25–47); raised bilirubin at 71 µmol/L (reference range 0–8) and raised gamma-glutamyl tranferase (GGT) at 255 IU/L (reference range 3–47). Necropsy on the farm by the attending veterinarian revealed marked gall bladder distension and **hepatic abscessation and fibrosis,** consistent with the clinical signs and biochemistry, which were suggestive of reduced liver function exacerbated by calving and the transition period. Additionally, marked **ruminal haemorrhage** was noted. This can be seen with mycotic rumenitis but this could not be confirmed as no histopathology was done. The presumptive diagnosis was subclinical ruminal acidosis as a result of the high carbohydrate green oat crop, leading to mycotic rumenitis and subsequent embolic spread of infection to the liver. Advice was given about using a good-quality buffering forage such as hay or baleage while on such high-carbohydrate-risk crops.

Several 18-day-old calves on a Horowhenua dairy calf rearing unit developed diarrhoea and died within 24 hours of becoming sick. Bacterial culture of samples of fresh small intestine yielded ***Salmonella* Bovismorbificans**. Histopathological examination of fixed tissues revealed extensive **suppurative enterocolitis** as well as mesenteric lymphadenitis and pulmonary fibrinoid necrosis as a result of septicaemia. Increased environmental bacterial load in indoor calving and rearing areas is a risk factor for high bacterial challenge, so a review of husbandry procedures, including disinfection between groups of calves, was suggested.

On a Taranaki dairy farm, six out of 50 calves, 6–10 weeks old, became weak and died within 24 hours. The calves had been treated with an anthelmintic containing selenium two days previously, selenium prills had been applied to the paddock 10 days previously and the water troughs had added mineral mix containing selenium. Liver samples from three of the dead calves were tested for selenium. Concentrations were extremely high at 42,051 nmol/kg, 41,514 nmol/kg and 127,388 nmol/kg (reference range 850–15,000 nmol/kg), confirming **selenium toxicity** consequential to the use of multiple selenium administration methods.

On a Rangitīkei property, a rising 2-year-old steer had low growth rate, weight loss and was pyrexic with a temperature of 39.7° C. The attending veterinarian was concerned for persistent infection (PI) with bovine virus diarrhoea (BVD) pestivirus. An EDTA blood sample was submitted to the laboratory for a generic pestivirus PCR screening test. The result was reported as weak positive (target DNA was amplified; however, minimal amounts were present). This type of result can indicate either transient or persistent BVD infection. Uncommonly, this can also occur with border disease virus infection. As the steer resided on a sheep and beef property and given the clinical history, a BVD-specific PCR test was performed. This gave a negative result and the generic pestivirus PCR was repeated with a similar result to that initially reported (weak positive). This combination of results supported a diagnosis of **border disease virus infection**, though it is important to note that similar clinical signs could also occur with concurrent infections. Repeating the generic pestivirus PCR was recommended to further establish whether transient or persistent infection was present in this case. Infection with border disease virus in cattle is considered a low probability event. Direct contact with infected sheep can cause transient infection in cattle, which may often be subclinical. However persistent fetal infection, as well as abortion, can occur in pregnant cattle infected between 40 and 120 days of gestation. Border disease virus can also be transmitted from persistently infected cattle to pestivirus-naïve cattle (Braun et al., 2019). A previously confirmed case in New Zealand (Hill et al., 2012) resulted in poor conception rates in dairy heifers serviced by a persistently infected bull. Although there are only a few clinical reports in cattle, persistently infected calves have been reported with weight loss and diarrhoea, and bulls with small stature, reduced scrotal circumference and poor semen quality.

Several outbreaks of bovine **mycotic abortion** were diagnosed by laboratory testing during winter. In one of these cases, four cows and two heifers on a 500-cow Ashburton dairy farm aborted over a period of several days. In another case, ten cows from a herd of 300 in Horowhenua aborted over a period of two weeks. In both examples, the affected cows were fed grass supplemented by hay or silage. Placental histology from both cases confirmed the presence of fibrinosuppurative placentitis with vasculitis and intralesional fungal hyphae. In the case from Ashburton, microbiological culture of the stomach contents produced a pure growth of ***Aspergillus fumigatus*** and subsequently *A. fumigatus* was also detected by PCR. Fresh tissues were not tested in the Horowhenua case so the species of fungus involved in the abortion outbreak could not be ascertained.

In Canterbury, outbreaks of **salmonellosis** in young calves occurred on several farms, starting in late July. Most cases were in mid-Canterbury and involved calves less than four days of age, though calves up to two weeks of age were affected in some cases. In one case in the middle of August, there was 80 percent morbidity in a pen of 30 calves that were two or three days old. The calves were recumbent and pyrexic with watery yellow to foaming orange or bloody diarrhoea. Faecal samples from four of the affected calves were submitted to the laboratory for bacterial culture and all yielded a heavy growth of a *Salmonella* species. Subsequent typing revealed that the isolate involved was ***Salmonella* Brandenburg**. *Salmonella* Brandenburg was also confirmed in all the other cases investigated.

Ovine

On a Gisborne property, lambing rates were lower than expected at under 140 percent. The flock had been

vaccinated against *Campylobacter* spp. and *Toxoplasma* sp. infection as hoggets and had been given a combined 5-in-1 clostridial vaccine with added vitamin B12. The submitting veterinarian performed a necropsy on a lamb. It had adequate fat stores, soft kidneys and no free fluid in the body cavities. Histopathological examination of well-preserved fixed tissues revealed a suppurative placentitis and pneumonia with intralesional colonies of gram-positive bacteria. A presumptive diagnosis of **listerial abortion** was made.

In a pedigree Southdown flock in Manawatū, seven 5-week-old lambs died suddenly. Necropsy revealed jaundice, red urine and dark-coloured kidneys. Histopathological examination of fixed tissues revealed centrilobular hepatocellular necrosis and haemoglobinuric nephrosis. *Leptospira* sp. DNA was detected in the urine by PCR testing, supporting the attending veterinarian's preliminary diagnosis of **leptospirosis**. Although serological testing was not done, acute leptospiral disease and death in young livestock is typically due to infection with *Leptospira interrogans* serovar Pomona. Recent prolonged and recurrent wet weather events had allowed *Leptospira* spp. bacteria to thrive in surface water. The importance of reminding farm staff of the potential zoonotic risk, particularly through organisms being shed in urine, was discussed with the submitting veterinarian.

A 6-year-old non-pregnant South Sussex ewe on a Horowhenua property had bilateral purulent nasal discharge. She was shade-seeking, inappetent and had mild dermatitis on the muzzle and ear tips, with purple/muddy coloured sclera. Grossly, the submitted EDTA blood sample was a dark chocolate brown colour. Anaemia was confirmed with a packed cell volume (PCV) of 16 percent (reference range 22–40 percent). There was a mild regenerative response with a reticulocyte count of 71.23 x 10^9/L. Review of the blood films including a new methylene blue-stained sample revealed Heinz bodies in 60 percent of the red blood cells, with numerous erythrocyte 'ghost' cells (lysed red blood cells). These findings were consistent with marked oxidative injury to haemoglobin and cell membranes, causing a haemolytic anaemia. The dark colour of the blood was likely due to the presence of methaemoglobin as a result of oxidation of iron. Causes of oxidative injury causing anaemia in sheep include copper toxicity, zinc toxicity, ingestion of plants of the brassica or allium (onions/garlic) families and, in lambs, leptospirosis is an additional differential. The submitted serum sample was grossly haemolysed and routine biochemistry testing could not be performed. However, serum zinc, serum copper and *Leptospira* sp. microscopic agglutination (MAT) serology tests were also requested. MAT testing had a mildly increased titre for *Leptospira interrogans* serovar Hardjo (1/200). A repeat (convalescent) sample was unfortunately not submitted. The serum zinc concentration was 13 µmol/L (reference range 9–20 µmol/L). The serum copper concentration was 28 µmol/L (reference range 11–25 µmol/L). Serum copper concentrations above 27 µmol/L are considered potentially toxic, so **copper toxicity** was considered the likely diagnosis in this case.

Twelve ewes from a Tararua farm with 2,000 ewes became lethargic and died over a period of 2–3 weeks. Necropsy conducted on the farm by the attending veterinarian revealed diarrhoea and a markedly reddened small intestine, cecum and colon. Faecal samples and fixed tissue samples were sent to the laboratory. Histopathological examination of the gastrointestinal tract revealed scattered crypt abscesses and erosions on a background of changes attributed to chronic parasitism (abomasal mucosal hyperplasia and eosinophilic enterocolitis). Bacterial culture of the faeces yielded a heavy growth of ***Salmonella* Hindmarsh**, confirming an outbreak of **salmonellosis**.

Outbreaks of **polioencephalomalacia** occurred on two sheep farms in the Selwyn district during July and August. On one property, at least 10 lambs were affected and five died out of a flock of 1,200 over several days. On a second property, about fifteen 1-year-old lambs died. The lambs were reportedly on good grass. The affected lambs were depressed and drooling. They had head tilts and were poorly responsive to stimuli. Histopathological examination of the brains from lambs in both outbreaks revealed characteristic laminar cortical necrosis affecting the grey matter of the cortex. Polioencephalomalacia is commonly attributed to an induced thiamine deficiency related to dietary carbohydrate excess.

One adult ewe from a flock of 1,000 on a Marlborough sheep farm had cutaneous papules and nodules all over the body. Many of the lesions had ulcerated. A biopsy was taken and histopathological evaluation revealed sheets of neoplastic lymphocytes throughout the dermis and subcutis. **Lymphoma** is one of the more common cancers identified in sheep, along with squamous cell carcinoma and intestinal adenocarcinoma. Cases appear to be sporadic with no common genetic, viral or environmental factors identified.

On a Wairarapa property, up to 50 late-term abortions were reported in a group of mixed-age ewes though the younger two-tooth ewes were reportedly not affected. The ewes had been vaccinated against toxoplasmosis and campylobacteriosis as hoggets and boosted as two-tooths. Two aborted lambs were submitted for laboratory investigation. Bacterial culture of the abomasal contents produced a scant mixed growth, interpreted as contaminants and unlikely to be significant, from both lambs. Leptospiral DNA was not detected in samples of heart blood by PCR testing. However, histopathological examination of fixed tissues revealed marked hepatic cholestasis, suggesting a likely diagnosis of **leptospiral abortion**. There were no lesions to suggest any other causes of abortion and follow-up serology was recommended.

Ten abortions over a period of three weeks were recorded in a flock of 1,300 mixed-age ewes on a South Canterbury farm. The losses occurred mostly among two-tooth and four-tooth ewes, which had not received vaccinations against toxoplasmosis and campylobacteriosis in the current year. Histopathological examination of fixed tissues from an aborted lamb showed suppurative bronchopneumonia and mild meningitis, suggestive of a bacterial aetiology. *Toxoplasma* sp. antibody testing on fetal heart blood was negative. No bacteria were cultured from the abomasal contents but *Campylobacter fetus* subsp. *fetus* was detected in abomasal contents by PCR testing, confirming an outbreak of ***Campylobacter fetus* subsp. *fetus* abortion.**

On a Mackenzie farm, 13 mixed-age pregnant Merino ewes from a flock of 2,000 died suddenly while grazing a kale crop. The ewes had been shorn 10 days before, then moved onto the crop. Superphosphate fertiliser had been applied to the crop immediately before the ewes went on it. Necropsy of the affected ewes by the attending veterinarian on the farm revealed brownish-coloured blood. Nitrate test strips were used to test the kale stalks and showed potentially hazardous nitrate concentrations. Aqueous humour and serum samples taken from six ewes had nitrate concentrations < 5 mg/L, and nitrate toxicity was unable to be confirmed. Whole blood samples from three of the surviving ewes revealed severe regenerative anaemia with Heinz bodies in two of the three animals. Histopathological evaluation of fixed liver and kidney samples from one ewe showed centrilobular necrosis in the liver and haemoglobin in the kidney, compatible with a haemolytic crisis. The final diagnosis was brassica-associated **S-methyl cysteine sulfoxide (SMCO) toxicity**.

Over the late winter period, several South Island farms experienced multiple ovine **abortions due to *Listeria* spp**. In one case, on a North Canterbury farm, six ewes from a group of 1,400 aborted over a period of two weeks. Necropsy of one aborted fetus revealed pale foci throughout the liver. Histopathological examination of the liver revealed that these pale areas corresponded to random necrosuppurative foci, which had intralesional colonies of gram-positive bacilli. Bacterial culture of the fetal stomach contents yielded a growth of ***Listeria ivanovii***. On another farm, in Southland, several sick and scouring ewes subsequently aborted rotten lambs. No *Salmonella* sp. could be isolated but bacterial culture of fetal stomach contents, as well as uterine fluid from one of the sick ewes, yielded a growth of ***Listeria monocytogenes***.

Multiple twin-bearing 1-year-old hoggets on a farm in Rangitīkei died 12–24 hours after multiple treatments were administered. The treatments included a long-acting anthelmintic, a copper supplementation injection and vaccination against clostridial diseases. Fresh and fixed tissue samples from multiple hoggets were submitted to the laboratory for histopathological examination and measurement of copper concentrations. Copper concentrations in the samples of fresh liver were all within the normal reference range. However, histopathological examination of fixed tissues from three animals revealed that all had severe acute centrilobular hepatic necrosis, suggestive of acute toxicity. The copper concentration in a sample of fixed kidney from one of the hoggets was elevated at 190 µmol/kg (reference range 0–157), providing support for a diagnosis of **acute copper toxicity**. In cases of acute toxicity, elevated copper concentrations in the liver may not be present. Evaluation of both hepatic and renal copper concentrations (along with histopathology and history) is recommended to increase the likelihood of obtaining a diagnosis.

In Southland, one lamb from a set of twins was born lethargic and unable to stand. Its skin was covered in multifocal, discrete, raised black nodules. The lamb was euthanased and necropsied and similar nodules were found throughout the skeletal muscle, fascia, peritoneum, heart and lungs. Histopathological examination of multiple submitted fixed tissues revealed a multicentric small blue cell tumour. There are several differentials for this type of tumour, including a **primitive neuroectodermal tumour (PNET)** or a round cell tumour such as lymphoma. Both of these tumours can arise congenitally and are reported in many different species. The histomorphological features of this particular tumour suggested that a PNET was most likely. However, immunohistochemistry would be needed for a more definitive diagnosis and this was not performed.

Cervine

A 2-year-old stag on a property in the Auckland region was noted to be separated from the herd. He had a cloudy right eye and was seen circling before being found dead. A necropsy performed by the attending veterinarian on the farm revealed corneal perforation of the right eye, diffuse cerebral meningeal opacity and multiple small exudate-filled cavities within the brain. Histopathological examination of fixed tissues revealed septic panophthalmitis with extension into the periocular tissues, and multiple cerebral abscesses containing mixed gram-positive and gram-negative bacilli. Bacterial culture of a swab taken from the brain yielded heavy growth of ***Trueperella pyogenes*** and light growth of other mixed anaerobic and aerobic organisms, leading to a final diagnosis of **septic panophthalmitis and meningoencephalitis**. The penetrative ocular lesion was considered the most likely primary source of infection, with subsequent septicaemic spread to the brain.

Camelid

At a South Island wildlife park, a 19-year-old male llama had hyporexia, depression and weight loss over a period of two weeks. Earlier, haematology and biochemistry tests had been suggestive of gastrointestinal disease. There was no improvement after 10 days of treatment with omeprazole and carafate, and the decision was made to euthanase the animal. Necropsy findings included poor body condition with a body condition score of 2/5, excess

peritoneal fluid, and an irregular thickening or mass affecting the duodenum just distal to the pylorus. The thickened area of pylorus was identified as a transmurally invasive **intestinal adenocarcinoma** on histopathological examination. Reports of intestinal carcinomas in camelids are rare.

Equine

A Thoroughbred stallion of unspecified age from northern Auckland had a history of weight loss and dull demeanour. Physical examination revealed that all external lymph nodes were enlarged. Fine needle aspiration of the mandibular and prescapular lymph nodes was performed, and cytological assessment confirmed a diagnosis of **multicentric lymphoma**. In horses, most cases of multicentric lymphoma present as masses within the body cavities or in the skin on the trunk or limbs rather than a generalised peripheral lymphadenopathy, and the majority are T-cell-rich B-cell lymphomas. Affected horses may have a protracted clinical course with waxing and waning signs before developing an aggressive disseminated form of the disease.

A ten-day-old Standardbred foal on an Auckland property was initially noticed to have hyperthermia and lung stridor before developing a purulent nasal discharge. A blood culture and a bacterial culture on a nasal swab were performed and both samples yielded a pure growth of ***Staphylococcus aureus*** confirming **septicaemia** and likely bacterial rhinitis and/or pneumonia due to this organism. The isolate was susceptible to all antibiotics tested against on sensitivity testing including cephalothin, penicillin, gentamicin, enrofloxacin and trimethoprim-sulpha. Given the young age, localisation in the respiratory tract may have occurred secondary to the septicaemia although it is also possible that the infection started in the nasal cavity or lung (for example, due to inhalation of milk), with the septicaemia developing secondarily. In neonatal septicaemia, there are often additional contributing factors that may include maternal issues such as illness in the mare, difficult birthing, failure of passive transfer/inadequate colostrum intake or poor sanitary conditions after birth.

A 17-year-old pony mare on a Wairarapa property had severe pastern dermatitis on her left foreleg. Skin biopsies revealed a severe pyoderma with a superficial dermal vasculitis and occasional intravascular thrombosis, suggestive of an underlying **pastern leukocytoclastic vasculitis** with severe secondary bacterial infection. Pastern vasculitis is one of several underlying causes of equine pastern dermatitis. The pathogenesis of pastern vasculitis is poorly understood. It is thought to be immune-mediated. Lesions are often bilateral but can be unilateral and tend to affect non-pigmented skin. An ultraviolet (UV) light initiating factor is thought to be involved. Secondary bacterial infection, if present, markedly exacerbates the severity of the lesions.

Canine

A 1-year-old heading dog from a rural property in Rangitīkei suddenly became blind and was euthanased. Histopathological examination of both eyes revealed retinal detachment with multifocal nodular granulomatous and lymphocytic inflammatory infiltrates within the retina and uveal tract. Cross-sections of nematode larvae, consistent with ***Toxocara canis***, were identified within the inflammatory infiltrates of one of the eyes. Aberrant migration of *Toxocara* larvae from the small intestine to intraocular tissues, also known as **ocular larval migrans**, is a rare clinical presentation as it is usually prevented by routine regular anthelmintic deworming treatment. Bilateral involvement of *T. canis*, although not confirmed by histology, would be an extremely unusual presentation, as affected dogs more commonly display only unilateral clinical signs.

Feline

A 10-year-old domestic short-haired cat from the Auckland area had a history of poor appetite and lethargy over a period of one week, with no specific changes found on routine haematology and biochemistry blood tests. Ultrasonography revealed an enlarged mesenteric lymph node with surrounding focal peritonitis. Cytological examination of smears from a fine needle aspirate of the enlarged node revealed pyogranulomatous inflammation. ***Listeria monocytogenes*** was isolated on bacterial culture. **Mesenteric lymphadenitis** due to *L. monocytogenes* has been reported previously in a small number of feline patients in Sydney and Auckland (Fluen et al., 2019), and in all cases had a protracted clinical course but positive clinical outcome.

A 13-year-old male domestic short-haired cat from Auckland developed crusty alopecic skin lesions on the ear, nose, tail and distal limbs which fluoresced under UV light. Biopsies were taken and examined histologically, revealing severe granulomatous folliculitis and dermatitis with hyperkeratosis and numerous intralesional fungal hyphae and arthrospores compatible with **dermatophytosis**. Feline dermatophytosis is usually caused by *Microsporum canis* infection, although other dermatophytes are occasionally implicated. Dermatophytes are contagious to other cats and dogs in the household and are also a zoonotic risk.

A 6-year-old domestic long-haired cat in Manawatū had multiple swellings in the ventral chest and abdominal skin after a recent cat fight. About a week after the initial presentation, cytology of the masses was performed to rule out underlying neoplasia, which revealed pyogranulomatous inflammation and bacteria, but no tumour. After a further three weeks had elapsed with poor response to treatment with amoxycillin with clavulanic acid, further samples were collected from the cat and submitted to the laboratory for bacterial culture and sensitivity, cytology and histology. Cytological and histopathological examination both revealed an inflammatory infiltrate composed of reactive macrophages, neutrophils and multinucleated giant cells, which involved the subcutaneous adipose tissue. Intracellular cocci were present within macrophages and multinucleated giant cells. Bacterial culture yielded a pure

growth of ***Rhodococcus equi.*** This pathogen is an opportunistic, soil-borne microorganism, which has rarely been associated with cellulitis and pneumonia in cats. Although the isolate was sensitive to amoxycillin in vitro, the poor response to treatment may have partly been the result of this organism's ability to evade bactericidal mechanisms associated with phagocytosis and replicate within the cytoplasm of macrophages.

Cetacean

An adult common dolphin (*Delphinus delphis*), which was found dead in the Dargaville area, was found to have lesions in the lungs at necropsy. Histopathological examination of the lung tissues revealed a moderate, multifocal, chronic-active pneumonia associated with the presence of nematodes and larvae, which were presumed to be *Stenurus ovatus* or *Parafilaroides* sp. lungworms. **Verminous pneumonia** is a common finding in stranded dolphins.

Avian

A 6-month-old pet chicken from the Auckland region was doing poorly. Physical examination revealed nodular thickening of the skin. Cytological assessment of aspirates from the abnormal areas of skin revealed a population of small lymphocytes with moderate anisokaryosis and multiple prominent nucleoli, consistent with **cutaneous lymphoma**. In chickens, lymphoma generally has a viral aetiology attributable to an alphaherpesvirus, Marek's disease virus or one of two retroviruses (avian leukosis virus and avian reticuloendotheliosis virus). Co-infection with these viruses is common and may be seen within the same lesion. Day-old chicks can be vaccinated against Marek's disease, and while this is a core vaccine in commercial laying flocks it is not usually feasible in backyard-bred flocks, as only bulk dose (> 500 birds) vials are available.

An adult tawaki/Fiordland crested penguin (*Eudyptes pachyrhynchus*) at a wildlife rescue centre in the South Island demonstrated a painful throat and a white plaque was noted in the pharynx on clinical examination. The bird had been treated with enrofloxacin but the lesion had not resolved. Samples from the lesion were submitted for bacterial and fungal culture as a yeast infection was suspected. No fungi or yeasts were isolated but there was a heavy growth of both *Escherichia coli* and *Staphylococcus aureus.* The *S. aureus* isolate was resistant to cefoxitin so categorised as a presumptive **methicillin-resistant *Staphylococcus aureus* (MRSA)**. This has not been seen previously in a penguin at this laboratory. It is estimated that there are fewer than 3,000 breeding pairs of this species remaining.

Reptilian

Multiple eastern snake-necked turtles (*Chelodina longicollis*) displayed subdued behaviour and had abnormalities on computerised tomography (CT) examination. Multiple tissues from multiple turtles were submitted for histopathological examination. Within the liver, lungs and spleen were multiple granulomas with intralesional acid-fast bacteria. This was consistent with **mycobacteriosis**.

In two separate stranding incidents in the Auckland area, two olive ridley sea turtles (*Lepidochelys olivacea*) died. The turtles both had white stripes in multiple muscles when necropsied. Histopathological examination revealed a severe, multifocal, subacute necrotising myositis with intralesional organisms that were consistent with a ***Microsporidia* species**. This fungal infection has been seen previously in this species of turtle and is likely an opportunistic infection related to immunosuppression of the host.

Exotic

An eight-year-old male zebra, which had always been small compared with his peers, lost weight over a period of two weeks and eventually became recumbent. Examination under sedation was unremarkable apart from subnormal body temperature. Blood samples showed an elevated white cell count and hypoglycaemia. The animal failed to respond to treatment with antibiotics, anti-inflammatories and fluid therapy and was euthanased. At necropsy, there were no gross lesions. Histopathological examination of fixed tissues revealed multiple larval forms, consistent with cyathostomes, embedded in the intestinal mucosa with associated mixed, eosinophil-rich mucosal inflammatory infiltrates together with villus blunting and areas of mucosal fibrosis, confirming a diagnosis of chronic **cyathostominosis**. The zebra had been regularly drenched and no other zebras in the herd were affected, suggesting a particular individual susceptibility, but the reasons for this were not determined. There were no other specific findings that could explain any possible underlying immune suppression.

IDEXX LABORATORIES

Bovine

A beef cattle farm in Taranaki had a large number of young calf deaths. There were about 100 calves at risk, of which 22 were affected and subsequently died. The calves ranged from 3–14 days old and developed clinical signs about 3–10 days after being moved into a shed. The animals were noted to be depressed with joint swelling. Some developed eye lesions; however, there was no scouring. At postmortem, a small amount of fibrin was noted in the abdominal cavity as well as pneumonia. Pleural effusion fluid was cultured and resulted in a heavy growth of *Proteus* spp. as well as scant growth of *Staphylococcus aureus* and *Clostridium butyricum*. The *Proteus* spp. were interpreted as a possible respiratory pathogen while *S. aureus* and C. *butyricum* were considered as likely contaminants. Serum from two additional calves aged under 20 days old and showing similar signs were tested for IgG (immunoglobulin G) levels. Both calves had low IgG levels that were < 50 mg/dL. The reference for adequate IgG levels in calves is > 1,600 mg/dL (at 1–4 days old) and > 905 (at 16–20 days). These findings were interpreted as evidence of **failure of passive transfer (FPT) of immunity**. On follow-up discussions with the vet, there was concern that a tube feeder used to feed the calves was inadequately cleaned and made of very stiff material, likely causing mouth abrasions and introducing bacteria systemically. The remaining animals

were treated with antibiotics. The combination of inadequate immunity together with oral abrasions and poor hygiene were considered key factors leading to the calf losses in this herd.

A 5-month-old calf from Kaipara developed severe diarrhoea and went down. This was one of five calves on the property and the only one affected. A faecal sample was submitted for culture and faecal egg count (FEC). The strongyle egg count was 3,575 eggs/gram (epg). The faecal culture was negative for *Salmonella* and *Yersinia*. A FEC over 1,000 epg is considered significant and typically causes clinical signs such as diarrhoea at this age. **Parasitic gastroenteritis** was attributed as the underlying cause for diarrhoea in this case.

In a South Taranaki dairy farm, 30 tailenders in a mob of 230 rising 1-year olds were in poor condition with acute scours followed by sudden death. There were no casts or blood in the excreta. The faecal culture was negative for *Salmonella* and *Yersinia*. The animals had been dewormed and were not responding to antibiotic treatment and fluid therapy. The herd had been vaccinated for bovine viral diarrhoea (BVD) virus and *Theileria* was considered an unlikely differential as it had not been diagnosed on the property for years. Selenium supplementation was considered adequate. The vet was called out to the farm after five animals had died. Post-mortem examinations were done on one dead animal and one euthanased animal. On postmortem, there was watery diarrhoea and watery, blood-tinged small intestine contents. The right cranio-ventral lung lobe had pus-filled nodules. Samples from these two animals were submitted to the laboratory for BVD testing, haematology, serum selenium, *Theileria* PCR (one animal) and histopathology (one animal). Both animals were positive for BVDV antigen on ELISA tests. The serum selenium levels were within normal range at 640 and 520 nmol/L (reference range: 150–3,500). *Theileria orientalis* Ikeda PCR was negative. Haematology results showed neutrophilia, monocytosis and elevated fibrinogen, while the blood film review showed reactive lymphocytes, all supporting bacterial enteritis. Histopathology of submitted organ samples showed erosive oesophagitis, bronchopneumonia with bacteria and lymphoplasmacytic enteritis. The pneumonia was suspected to be due to secondary bacterial infection and likely a result of aspiration following development or oesophagitis, which may have been exacerbated by fluid therapy if given via a tube. The combined results in this case supported a diagnosis of **BVD infection** and likely in **persistently infected calves** (Lanyon et al., 2014).

A dairy farm in the Far North had lost 40 of 400 dairy steers over a period of one month. Similar deaths had occurred the previous year. The deaths occurred in the post-weaning age group at about three months old. Animals either died suddenly or became lethargic and then took a couple of days to die. On postmortem, pleurisy with abscessation and a small amount of pericardial fluid were noted. Various samples were submitted to the laboratory. Based on histopathology and cytology, a diagnosis of bronchopneumonia with abscessation and concurrent myocarditis, complicated by endoparasites, was made. Parasites included rumen intra-mucosal nematodes consistent with *Ostertagia* organisms and low numbers of coccidia oocysts in the small intestine. In addition, hepatocellular atrophy and serous atrophy of peri-renal fat were noted. On blood film, *Theileria* organisms were noted; however, there was no overt evidence of anaemia. Hyperfibrinogenaemia was also present, which supported ongoing inflammation. Chemistry results showed a low copper serum level of 7.0 µmol/L (reference range 8.0–20.0) and normal selenium of 750 nmol/L (reference range 150–3,500). Bacterial culture of lung tissue yielded heavy growths of *Fusobacterium necrophorum* and *Trueperella pyogenes*. The FEC had 275 strongyle epg. In this case, the deaths were considered **multifactorial** and attributed to a combination of ***Fusobacterium necrophorum*** and ***Trueperella pyogenes*** infection, **copper deficiency, poor body condition** with likely malnutrition and **endoparasites (*Ostertagia* and *Coccidia*).** In cattle, *Fusobacterium necrophorum* (calf diphtheria) is associated with oral lesions; it can be a secondary invader following mucosal damage and is also part of the respiratory tract microflora. Similarly, *Trueperella pyogenes* is part of the microflora of the respiratory tract, urogenital tract, gastrointestinal tract and skin but can be an opportunistic pathogen.

A beef farm in South Taranaki had several illthrifty calves aged four months old, in a mob of 115. The total number of calves affected was unknown. Blood and faecal samples from three calves were submitted to the laboratory. Faecal culture yielded growth of ***Yersinia pseudotuberculosis*** in all three samples. Faecal egg counts for strongyles were 75–100 epg. The blood samples were negative for BVD on PCR testing. The presence of any **strongyle** eggs in calves less than six months may be significant but is also dependent on faecal consistency and drench history. *Yersinia pseudotuberculosis* was considered the primary pathogen in these calves. Yersiniosis-affected calves may develop acute diarrhoea, which can progress to weight loss, depression, dehydration or in severe cases, death. Chronically affected calves can have clinical signs over several days or weeks, with diarrhoea, illthrift, poor growth or weight loss. Endoparasites and yersiniosis are differentials for diarrhoea in calves, especially in rising 1-year olds. In this case, the presence of strongyle eggs was interpreted as a compounding factor. Yersiniosis is a zoonotic disease and is more typically caused by *Y. enterocolitica* while *Y. pseudotuberculosis* occasionally causes human infection (Rivas, 2021).

Three calves aged 1–5 days old in a herd of unknown size in Whangārei developed hypopyon (accumulation of suppurative exudate in the anterior chamber of the eye). There were some pre-calving downer cows in the herd as well. Samples from three calves showed a low IgG level in all, with an average of < 55 mg/dL. The ranges for adequate IgG levels are

> 1,600 mg/dL (at age 1–4 days old) and > 1,450 mg/dL (at 5–10 days). The result was interpreted as **failure of passive transfer** (FPT) of immunity. Haematology on one calf showed mild neutrophilia and marked hyperfibrinogenaemia, which supported an inflammatory response. It was suspected that the calves may have developed navel ill secondary to FPT. Hypopyon was suspected to be a result of sepsis. The blood samples were negative for BVD on PCR testing. Failure of passive transfer occurs when calves fail to absorb sufficient quantities of immunoglobulin from colostrum in the first 24 hours of life. They become immunocompromised and are at a greater risk of disease and death. Intake of good-quality colostrum in the first 24-hour window period is crucial to avoid FPT.

A dairy calf in a herd of unknown size in South Taranaki became ill and developed diarrhoea over a two-week period. Serum samples were low in selenium and cobalt (vitamin B12). Selenium was 140 nmol/L (reference range 150–3,500) and cobalt was < 92 pmol/L (reference range 93–1,000). Rotavirus and coronavirus ELISA tests were negative and faecal culture was negative for *Salmonella*. **Selenium deficiency** is important to monitor in cattle and can lead to 'white muscle disease', which affects all muscles including the heart, and causes animals to become stiff and have difficulty standing. It can affect calves from 1–4 months of age and if severe enough, can lead to illthrift. In this case it was low enough to be attributed as the likely underlying cause for weight loss and illthrift. The selenium levels in the pasture provide a good indicator on whether there is adequate selenium available to livestock and whether supplementation is required. Cobalt deficiency is more important in sheep and is unlikely to be a problem in cattle. **Cobalt deficiency** leads to low vitamin B12 levels, which slow growth (Grace et al., 2009).

A herd of beef cattle in South Waikato had stillborn or aborted full-term calves affecting about 20 of 100 heifers. There was no history of *Leptospira* vaccination. Serum samples from three heifers were tested for **leptospirosis** using the microscopic agglutination test (MAT). Three serovars were tested, i.e., Hardjo, Pomona and Copenhageni. One animal tested positive for ***Leptospira* Pomona** at a titre of 1/1,600 and another tested positive for ***L.* Hardjo** at a titre of 1/800. *Leptospira* Copenhageni was negative in all three samples. Titres greater than 1/100 are considered to be of clinical significance. A post-acute (2–4 weeks later) four-fold rise in titre together with clinical signs and history would confirm the diagnosis but it was not done in this case. Leptospirosis is a zoonotic disease and is typically spread in urine. It can be fatal and can result in fever, abortion, weakness, infertility, bleeding in the kidney (dark urine) and a drop in milk production. Vaccination is key to managing this disease. The abortions in this case were attributed to leptospirosis in a naïve unvaccinated heifer herd.

A 2-year-old Jersey cow in Mid Canterbury developed acute subcutaneous abdominal and mediastinal emphysema. The cow was in respiratory distress and appeared to be in pain. There was no response to treatment and the animal was euthanased. On postmortem, the right lung had purulent exudate. Samples were submitted for culture and histopathology. Culture results yielded a mixture of opportunistic bacteria, including moderate to heavy growths of *Streptococcus* spp., *Proteus mirabilis*, *Escherichia coli* and yeasts (not *Candida*). The culture results suggested possible **aspiration pneumonia**. On histopathology of submitted lung samples a diagnosis of **necrosuppurative pleuropneumonia**, with suspect

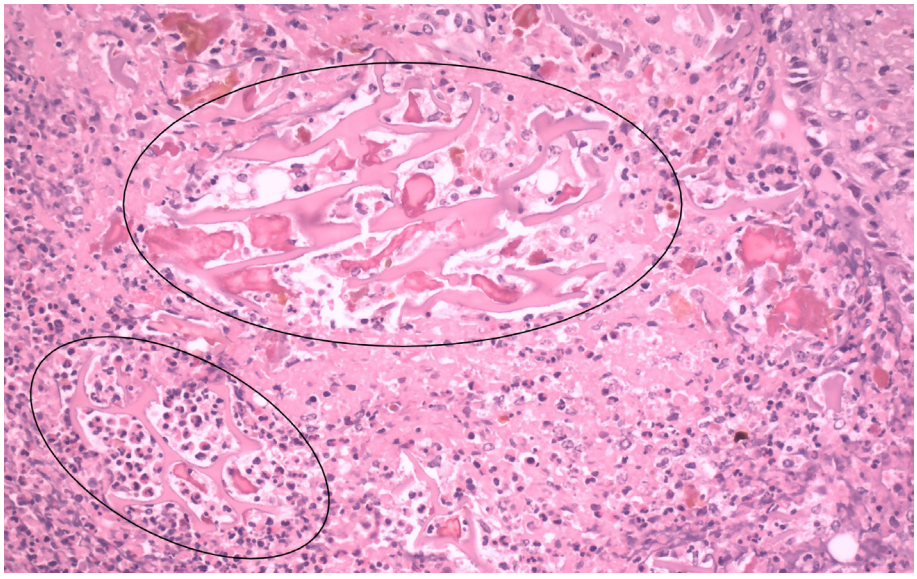

Figure 1: Necrosuppurative pneumonia with foreign material (demarcated in black) that is eosinophilic, structured and thick-walled, in bovine lung (200x magnification)

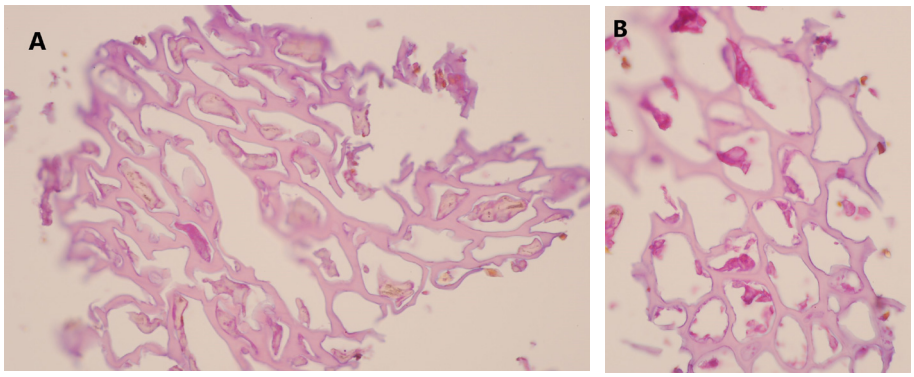

Figure 2: Palm kernel by-product. Histological sections of palm kernel by-product were processed in the absence of animal tissue, showing thick-walled diamond to hexagonal-shaped structures with yellow-orange (A) and eosinophilic (B) fragments. (200x magnification) Photo: Archive image library, courtesy of Alan Julian

aspiration pneumonia was made. The alveolar spaces contained foreign material that included bright yellow-orange fragments and pale eosinophilic, thick-walled diamond to hexagonal-shaped structures admixed with necrosuppurative exudate, haemorrhage, oedema, fibrin and desquamated cells (**Figure 1, page 22**). The foreign material was histomorphologically typical for a substance of plant origin. The structure was, however, unique and was found to match archived images of previous cases that were known to be due to aspirated palm kernel by-products (**Figure 2, page 22**). A history of supplement feeding with by-products of palm (or possibly another plant-based material) was suggested as a likely cause. 'Palm Kernel Expeller' (PKE) is a by-product of palm oil extraction and is used as a stock feed due to the high levels of crude protein and medium energy levels (Agrifeeds, www.agrifeeds.co.nz). There was no evidence of aspirated rumen content on histology. Inhalation of dry and dusty feed directly into the lungs was considered the likely cause of aspiration pneumonia in this case.

Ovine

A sheep farm in Waikato had an autumn case of suspect haemonchosis in a 6-month-old lamb. Due to concerns about endoparasites, all sheep had since been drenched regularly. About six months later, a 2–3-year-old ewe with two lambs at foot started developing wasting disease and scours. She had been drenched six days previously. Her feed intake decreased, but vitals remained normal. Serum samples were collected for mineral analysis, faecal egg count and Johne's antibody testing. The serum copper level was high at 52.7 µmol /L (reference range 11.0–25.0). Liver enzymes, AST and GGT, as well as total bilirubin were high. AST was 245 IU/L (reference range 64–225); GGT was 166 IU/L (reference range 32–70) and total bilirubin was 19 µmol/L (reference range 0–9). In addition, there was hyperglobulinaemia, hyperphosphataemia, hypocalcaemia, low bicarbonate levels and a high anion gap (metabolic acidosis) as well as azotaemia (elevated urea and creatinine). Serum zinc levels were interpreted as low at 7.8 µmol/L. Prophylactic zinc administration in anticipation of sporidesmin toxicity should produce serum zinc concentrations in the region of 20–35 µmol/L (Black, 2010). The results supported a diagnosis of **copper toxicity,** which was considered particularly important if the drenches were mineralised. Cholestatic hepatopathy was a likely secondary result. The azotaemia, metabolic acidosis and hyperphosphataemia were consistent with **renal disease**. Testing for leptospirosis was recommended and was negative. Consideration of other possible causes for pyelonephritis or nephrotoxicity included plants such as lilies and Amaranthus, or exposure to arsenic. There was no further information on the presence of nephrotoxic plants on the property and arsenic exposure was considered unlikely. The cause for renal disease was attributed to likely be probable renal tubular necrosis as a direct result of copper toxicity. Faecal egg counts were negative and the Johne's Ab ELISA test was negative.

Caprine

A milk goat herd in Taranaki had 20 of 500 goats develop scours, drying off and losing condition. A total of four animals subsequently died. Samples were submitted to the laboratory for mineral analysis, liver enzymes, bacterial culture and faecal egg counts. ***Yersinia pseudotuberculosis*** was isolated in two-thirds of faecal samples and all samples were negative for *Salmonella*. The average GGT levels in seven samples were low at 28 IU/L (reference range 31–69), which is considered a likely result of illthrift, enteritis and decreased hepatic function. Low numbers of strongyle eggs (150 epg) were present in two-thirds of faecal samples. Low numbers of coccidia oocysts were present in one-third of faecal samples. The clinical signs were attributed to yersiniosis in this herd. Outbreaks of yersiniosis can occur in naïve herds, while subclinical animals are common in chronically infected herds with established immunity. *Yersinia pseudotuberculosis* has zoonotic potential (Lãtnada et al., 2005).

Camelid

A 3-year-old male alpaca in Whanganui developed illthrift, lethargy, decreased body condition and was smaller than other alpacas of similar age but maintained a good appetite. Two alpacas with similar signs had died on the property within the previous six months. The total herd size was unknown. Vitamin A, D and E supplementation and deworming had been given to the herd. Blood and faecal samples of the affected animal were submitted to the laboratory. Blood serum chemistry results showed low copper levels at 1.0 µmol/L (reference range 5.0–17.0) and markedly low iron at < 2 µmol/L (reference range 12–27). Liver enzymes (AST and GGT) were also elevated, and there was a moderate hyperglobulinaemia and mild hypoalbuminaemia. Haematology supported the chemistry results with marked anaemia confirmed by a haematocrit of 0.12 L/L (reference range 0.25–0.45) and mild neutrophilia. Faecal egg counts were zero. The main findings in this alpaca were mineral deficiencies, particularly **copper deficiency** and **iron deficiency** with subsequent anaemia. The marked increase in globulin was a non-specific change likely associated with inflammation and/or antigenic stimulation, which was not evident in the tests conducted and could not be attributed to gastrointestinal parasites. Copper deficiency is typically associated with low levels of copper in the soil or high levels of molybdenum (Mo) or sulphur (S), which act as copper antagonists and decrease copper absorption and utilisation. Mo and S are sometimes applied to pastures used for cattle and sheep. Although the faecal egg counts were zero, in New Zealand, anaemia in alpacas is more likely to be associated with gastrointestinal parasites (Hinkson, 2015; Ministry for Primary Industries, www.mpi.govt.nz).

Equine

A 16-year-old Warmblood stallion in greater Christchurch developed lesions

on the scrotum and prepuce. Biopsies were collected for histopathology. Diagnoses of **preputial melanoma** and **scrotal squamous cell carcinoma** were made. Benign melanomas rarely occur in horses and most equine melanomas are thought to represent dermal melanocytosis. Recent studies suggest that dermal melanocytosis may be a multicentric visceral storage disease rather than a true neoplasm. Melanocytic lesions are most common in aged grey horses and have a slowly progressive course, usually with little impact on the wellbeing of the horse until they interfere with local function due to size (Rodriguez et al., 1997). In contrast, squamous cell carcinoma is a malignant epithelial neoplasm and commonly affects the external genitalia or other mucocutaneous junctions of horses. Chronic ultraviolet radiation-induced damage to epithelial cells (especially in unpigmented sites) is the probable and most important stimulus for development of these neoplasms. A link to equine papillomavirus type 2 (EcPV2) has been identified within equine genital squamous cell carcinoma and precursor lesions.

In Palmerston North, a 1-year-old Thoroughbred yearling colt presented for suspect antimicrobial-induced colitis following treatment for pneumonia. Albumin and creatinine levels were being monitored and faeces was submitted for *Salmonella* culture. The serum albumin was low at 19 g/L (reference range 27–35) and the creatinine was slightly elevated at 113 µmol/L (reference range 66–112). ***Salmonella* Typhimurium** was isolated from the faecal sample. This organism can cause diarrhoea in horses of any age and is a zoonotic bacterium. Salmonellosis is a common cause of acute enterocolitis in horses and vaccination is thought to play an important role in managing the disease. Salmonellosis typically causes acute, profuse diarrhoea, especially in young horses, and is often associated with stressful conditions such as advanced pregnancy, bad weather, transportation or treatment for other conditions.

Feline

A young feral female domestic short-haired cat in South Wairarapa developed diarrhoea. A faecal sample was submitted for a PCR diarrhoea panel. Positive PCR test results were obtained for ***Clostridium perfringens***, ***Cryptosporidium*, *Giardia* spp.** and ***Toxoplasma gondii***. Of these organisms, zoonotic potential exists for *Cryptosporidium, Giardia* and *Toxoplasma*, with the last being of particularly high risk to pregnant women. *Clostridium perfringens* is also a known pathogen causing gastrointestinal disease in cats (as well as other animals and humans) (Silva and Lobato, 2015). All four organisms are potential causes for the clinical signs and probably resulted in a compounding effect in this case.

Lagomorph

A 7-year-old male neutered New Zealand White rabbit in Auckland developed acute hindlimb paresis and ataxia. He had recently started spending time outdoors (two months' duration). Samples were submitted for *Toxoplasma* antibody titre testing and a result of 1/2,048 was obtained. This was considered a high titre result and together with the clinical presentation, suspicious for current ***Toxoplasma*** infection. In species other than cats, a second (paired) titre sample is recommended to check for rising or falling titres. A second sample was unfortunately not received in this case.

Avian

At a property in Matamata there was a slight increase in mortalities of broiler breeders aged 30 weeks and at peak egg production. Affected birds had cheesy caecal cores. The birds had been treated with anticoccidials and subsequently appeared to improve. Post-mortem examination of six culled birds revealed a caecal core in one bird. Histomoniasis was suspected but persisting coccidiosis could not be excluded on gross examination. *Heterakis* worms were not seen on post-mortem examination. Caecal samples were submitted for histopathology and necrotising typhlitis with protozoal trophozoites was diagnosed. The changes were consistent with subacute to chronic infection with the protozoal organism ***Histomonas meleagridis***. This is a classical disease of gallinaceous birds and results in caecal and liver necrosis. The life cycle of the protozoan is linked to the ascarid worm *Heterakis gallinarum* and protozoal forms of *Histomonas* are present within the ascarid eggs. Earthworms may also act as a transport host. Control should be directed against the ascarids and limiting access to earthworms. There was no evidence of coccidia organisms on histopathology and no *Heterakis gallinarum* eggs were seen.

Young chickens, about five weeks old, on a lifestyle property in Waikato, developed blood-stained faeces while maintaining a good appetite. The total number of chickens on the property is unknown. Seven birds were affected and one died suddenly. Faecal samples were submitted for egg and coccidia counts. A coccidia oocyst count of 15,000 oocysts per gram was found. **Coccidiosis** is a common condition in poultry and spreads from one animal to another via infected faeces. Infected animals are mostly subclinical, but young or immunocompromised animals can develop severe clinical signs and die. Vaccines and coccidiostats are typically used as prevention and control measures. No strongyle, ascarid, *Capillaria* or *Heterakis* eggs were seen.

A 25-year-old male pet cockatiel from Auckland was presented for an ulcerating lesion on the ventral neck. An excisional biopsy was submitted for histopathology and a diagnosis of **squamous cell carcinoma** was made. Squamous cell carcinomas of the skin can arise anywhere, are locally aggressive and frequently reoccur following inadequate excision. They tend to grow slowly and may become large if not treated.

Exotics

A pet bearded dragon (*Pogona* spp.) from Auckland had a clinical history of swollen wrists. The X-rays revealed bone degeneration and a small bone chip fracture of the distal ulna. A fine-needle aspirate sample was submitted for cytology and showed the presence of numerous negative staining rod-shaped structures on routine

(diff-quik) stain (**Figure 3**). On Ziehl–Neelsen stain (for acid-fast organisms), the structures stained positive (**Figure 4**). These findings were interpreted as being consistent with ***Mycobacterium*** spp. infection. The species was not determined. Bearded dragons are native to Australia and are popular in zoos and as pets; however, they may harbour potentially zoonotic agents, as in this case. Commercial breeders can be impacted by high numbers of mortalities as the infection spreads between animals (Chénier et al., 2022).

SVS LABORATORIES

Bovine

Seven of 100 beef cows in Waikato had late-term abortions. Histology on the fetal kidney was performed. More than 50 percent of the kidney was affected and had cortical and medullary interstitial lymphoplasmacytic inflammation admixed with tubular degeneration and necrosis. Fresh fetal calf kidney was also submitted and was positive on PCR for *Leptospira* spp. The clinician later submitted serum from five affected cows for *Leptospira* Pomona MAT testing. Three cows had titres of 1:1,600 and two had titres > 1:3,200, further adding evidence to suggest **abortions** were due to **leptospirosis**.

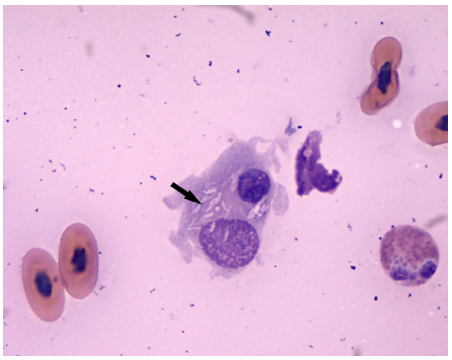

Figure 3: Negative staining rod-shaped structures (indicated by the arrow) on routine (diff-quik) stain, fine-needle aspirate of a wrist swelling in a bearded dragon. Photo: Jon Meyer

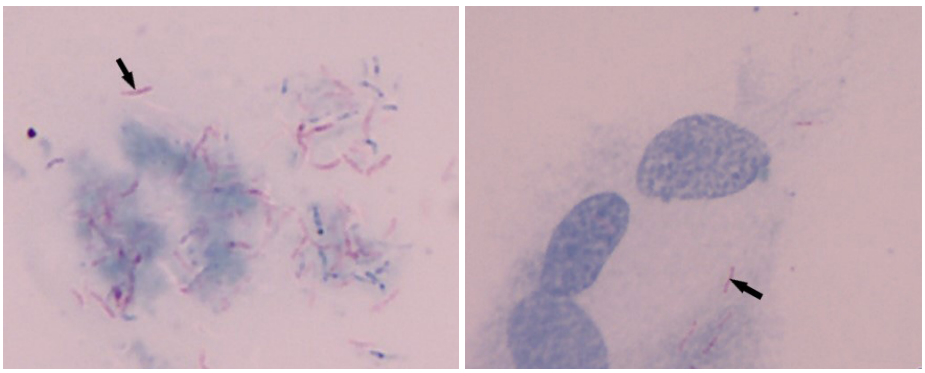

Figure 4: Positive staining organisms (indicated by arrows) on Ziehl–Neelsen stain, fine-needle aspirate of a wrist swelling in a bearded dragon. Photo: Jon Meyer

A 4-year-old, Jersey heifer in the Bay of Plenty presented with two raised, ulcerated, round skin masses that were first noticed 1–2 weeks before presentation. One mass was on the lower eyelid and one was on the contralateral side of the muzzle. Two smears, one from each site, were submitted for cytology evaluation. The smears both had granulomatous inflammation and round, 8–15 micron diameter, Periodic acid–Schiff (PAS)-positive algae with a thin, clear cell wall. Some had early endospore replication with clusters of 3–5 endospores. The lesion was most consistent with **cutaneous protothecosis**. *Prototheca* spp. are algae that are highly resistant to environmental conditions and tend to be associated with wet areas, manure and plant matter. They are PAS-positive (as seen here) and can be cultured through aerobic culture.

Two 8-month-old Hawke's Bay cattle in an unknown herd size presented with pyrexia, with one also having haemoglobinuria. Earlier deaths in this mob had not been investigated. Both animals were PCR-positive for **malignant catarrhal fever** and the PCR for ***Theileria orientalis* Ikeda** was also positive in the animal with haemoglobinuria.

About 50 percent of a mob of 400 two-week-old calves in Waikato presented with conjunctivitis. Conjunctival swabs from four animals were submitted for culture. All four samples grew *Pasteurella canis*. One animal also had a moderate growth of *Moraxella* spp. isolated. While *Moraxella bovis*, the cause of infectious bovine keratitis/conjunctivitis, is an important bacterial disease of the conjunctiva and cornea in cattle, *Pasteurella* (and other bacteria) may occasionally be the cause of mucopurulent conjunctivitis in cattle. ***Pasteurella* conjunctivitis** may occur in conjunction with severe *Pasteurella* pneumonia or septicaemia in calves.

In mid-August, a beef cow from Hawke's Bay presented with suspected grass staggers (hypomagnesaemia). Biochemistry showed mild **hypomagnesaemia** (0.45 mmol/L, reference range 0.60–1.23) and **marked hypocalcaemia** (1.03 mmol/L, reference range 2.00–2.60). Although less common in beef cattle than dairy cattle, post-parturient hypocalcaemia can occur in beef breeds, especially in older cows. Non-parturient hypocalcaemia can also occur secondary to hypomagnesaemia, anorexia (secondary to inclement weather or disease) or ingestion of oxalate-containing plants which bind calcium.

A female crossbred calf that was born as a twin was noticed to have a higher body weight than other female calves. PCR of whole blood revealed male DNA, which confirmed **freemartinism**. A freemartin results when a heifer calf and bull calf twin share a common vascular supply. The female calf is then exposed to hormones responsible for male reproductive organ development, which results in infertility. As some DNA from the male calf enters the female calf's circulation, this can be detected by PCR.

In late September, a Friesian cow from Taranaki presented with lethargy and minimal milk production two days after calving. There was tachycardia (heart rate 100 bpm, reference range 48–84). Despite supportive treatment with antibiotics and non-steroidal anti-inflammatories, the cow died the following day. Two other cows from this herd had similarly died shortly after calving and showed pale mucous membranes. No gross abnormalities were seen on a post-mortem examination. Vitreous humour

magnesium level was 1.2 mmol/L (levels < 0.55 mmol/L support death from hypomagnesaemia). On histology, there was marked extramedullary haematopoiesis in the spleen and marked haemosiderosis, suggesting increased red blood cells turnover. ***Theileria orientalis* Ikeda** was detected on PCR from the spleen and was considered the likely cause of death in this case.

Ovine

A Waikato dairy sheep farm had 15–20 abortions in a flock of 900 at-risk animals. Two fetuses at about 18–20 weeks' gestation and their respective placentas were submitted for fetal examination. The cotyledons were mottled red to tan and meconium, consistent with in utero fetal distress, was present on the surface of the fetus. The placentas were processed for PCR and were positive for ***Toxoplasma gondii***. *Toxoplasma gondii* is an obligate intracellular parasite that can cause disseminated disease and central nervous system infections, and in sheep it is an important cause of abortions. However, the effect on pregnancy depends on the stage of gestation when the infection occurs. Infection in early or mid-gestation results in fetal death with resorption or mummification. Occasionally in mid-gestation, infected lambs can survive to term but are stillborn or weak and die shortly after birth. In late pregnancy infections, the fetus can develop an immune response and is often born live, infected and immune.

Equine

An 8-year-old Cambridge mare presented with coughing, tachycardia and ventral oedema. Despite treatment, she continued to deteriorate and died. Cardiomegaly was noted on post-mortem examination. Multiple nodular masses were present in the mediastinum and extended into the thoracic inlet. Biopsies from the mediastinal masses were submitted for histology, which showed an infiltrative round cell tumour that distorted normal tissue architecture. Round cells were composed of sheets of small lymphocytes. In horses, **mediastinal lymphoma**, also known as thoracic or thymic lymphoma, is the most common thoracic neoplasm (Taintor, 2011). It has been reported in horses of all ages. General clinical signs of lymphoma include weight loss, depression, lethargy, oedema of the ventral portion of the body wall or distal limb, recurrent fever and lymphadenopathy if peripheral lymph nodes are involved. Clinical signs associated with mediastinal lymphoma additionally include dyspnoea, coughing, distension of the jugular vein and muffled heart sounds on auscultation, with evidence of pleural fluid. Severe bradycardia has also been reported in some horses due to complete atrioventricular block associated with mediastinal lymphoma; however, tachycardia was noted for this mare.

An 11-year-old Gypsy Cob stallion presented with a mass rostral to the maxillary incisors six months after a history of oral trauma. On radiographs, the mass consisted of soft tissue with areas of mineralisation. The mass had been growing rapidly over two months and was now ulcerated; therefore, the mass was removed surgically. On histology there was extensive suppurative and **necrotising osteomyelitis with numerous bacterial colonies and bone sequestra** separated by abundant fibrous tissue.

Canine

A 10-year-old, spayed female, mixed-breed dog in Waikato presented with haematuria. A urine culture was initially submitted and had heavy growths of *Proteus mirabilis* and *Staphylococcus pseudointermedius/intermedius*. The dog was given antibiotics. Urine culture was repeated one week after completing antibiotics and grew a scant growth of *Corynebacterium* spp. that was resistant to amoxicillin/clavulanic acid, ampicillin and cephalothin. This organism was a marked change from the organisms cultured three weeks earlier, which may have masked the corynebacterial infection given their heavy growths. Canine ***Corynebacterium* spp. cystitis** in urine is uncommon; however, there are reports of corynebacterial cystitis in dogs in the literature (Bailiff et al., 2005; Raab et al., 2015). Both papers noted that corynebacterial infection is often encrusting and requires surgical debridement in addition to antibiotics for resolution of infection.

A 5-year-old mixed-breed dog presented to a Whakatane district clinician for intermittent episodes of lethargy and diarrhoea over the previous six months. A faecal sample was submitted to the laboratory for culture and ***Salmonella* enterica serovar Saint Paul** was isolated. This *Salmonella* serovar has been associated with sporadic infections in people who have eaten raw vegetables.

A 1.5-year-old, male Schnauzer dog from Bay of Plenty presented for chronic, inappropriate urination. A urine sample was collected via cystocentesis for aerobic culture. On culture, a pure, heavy growth of *Mycoplasma* sp. was isolated. While **mycoplasmal cystitis** is not common, there are a few case reports in which *Mycoplasma* spp. were noted to be associated with clinical disease (L'Abee-Lund et al., 2003; Ülgen et al., 2006).

A 2-year-old female spayed Greyhound in Waikato presented with a one-week history of vomiting and diarrhoea. While the vomiting subsided, the dog still had profuse diarrhoea and was hyporexic. A faecal sample was submitted for a canine gastrointestinal panel and ***Salmonella* Montevideo** was isolated.

Avian

A lifestyle block owner in the Bay of Plenty had lost several free-range chickens over many months and two in the previous few weeks, with 10 birds remaining on the property. The birds initially presented with malodourous diarrhoea, followed by walking with a stiff/stilted gait progressing to open mouth breathing. They would then sit down, puff up and die. Tissues from one hen were submitted for histopathology. Grossly, the oviduct was thickened, up to 5x normal and other submitted tissues had firm, tan nodules on their capsular or serosal surfaces. On histology,

there was an infiltrative, poorly demarcated, epithelial neoplasm that expanded and effaced normal oviduct mucosa and muscularis. A scirrhous response was present around islands of neoplastic cells. Similar neoplastic cells were present on the serosal surface of multiple organs. The hen was diagnosed with a **reproductive/ovarian adenocarcinoma with intracoelomic adenocarcinomatosis** (metastasis). No infectious diseases were seen in the examined bird that would be a concern for the other hens on the property. The cause of death of the previously lost birds is unknown. In hens, reproductive/ovarian adenocarcinomas are grossly firm, solid, or pedunculated, multilobular and light beige (Erwood et al., 2022). The tumour can occur in an ovary, oviduct or any part of the reproductive tract. Affected hens can have normal ovarian follicles or the tumour can envelop the ovary completely. Clinical signs include weight loss and ascites. Metastasis to the lungs, liver, spleen and serosa of the coelomic cavity is common. In this case, the lesion has metastasised to the spleen, liver and intestinal serosa. Adenomas/adenocarcinomas in the ovary and oviduct are more frequent in layer hens more than two years old. Older broiler breeding females and turkeys can also develop these types of tumours, but the rate of occurrence is less than that seen in layer hens. The cause of diarrhoea was not determined as no parasites were seen on faecal egg count. However, diarrhoea can be seen with many diseases, including neoplasia.

Tortoise

A faecal sample from an 8-year-old pet tortoise (species not stated) from Hawke's Bay was submitted for a faecal egg count. The sample contained 7,050 eggs per gram of ***Oxyuris*** oocytes. While there are often no clinical signs of *Oxyuris* infection in chelonids, high burdens may cause anorexia, intussusception and in severe cases, death.

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Quarterly report of investigations of suspected exotic aquatic pests and diseases: July to September 2023

Suspected exotic caulerpa cases investigated

The Ministry for Primary Industries (MPI) received 13 notifications from members of the public representing the regions of Northland, Auckland and Wellington, reporting suspected findings of exotic caulerpa. In all cases, exotic caulerpa was able to be ruled out from images submitted to the Marine Invasives Taxonomic Service (MITS). A summary of the findings is provided in **Table 1**.

Range extension of exotic caulerpa confirmed

MPI was contacted by NIWA after coming across several 20–30 cm patches of suspected exotic caulerpa at a site near Kawau Island while conducting field work in the Hauraki Gulf. The images and samples collected were sent to MITS where taxonomists identified the algae as the non-indigenous *Caulerpa parvifolia*. Exotic caulerpa forms vast, dense mats, smothering native seagrass and bottom-dwelling invertebrates thereby altering the marine ecosystem. It spreads rapidly by asexual fragmentation in the water column, caused by storms, currents and human activities like boating, diving and fishing. It can grow below the tide from 2 m up to 30 m deep. So far, exotic caulerpa has been found in Aotea Great Barrier Island, Ahuahu Great Mercury Island, Te Rawhiti Inlet in the Bay of Islands and most recently at Waiheke Island. This latest finding marks a range extension for this species. MPI is working closely with mana whenua, regional councils, and local communities in a thorough effort to understand this algal species better and manage its spread from areas of known presence. Controlled Area Notices (CANs) are in place at Aotea Great Barrier Island, Ahuahu Great Mercury Island and Te Rawhiti Inlet to manage activities that are likely to result in its movement and help prevent the spread of exotic caulerpa. Mana whenua have also imposed rāhui in these areas with similar restrictions. The response to exotic caulerpa is ongoing and significant investment is being made in surveillance to understand where exotic caulerpa is present, and to carry out trials of methods to control it. Treatment options such as suction dredging and hand removal are being trialled and will be monitored to observe their effectiveness and the impacts on the native species. Information gathered from these trials will help build a toolbox of techniques and guidance to assist communities with future management of exotic caulerpa.

Table 1: Summary of suspected exotic caulerpa cases investigated by region, during July–September 2023

Northland	
Locality	**Taxa identified**
Karikari Peninsula	Seagrass (rimurēhia) Zostera muelleri
Taiharuru Bay	*Caulerpa flexilis* (native, see **Figure 1**)
Bland Bay, Whangaruru	Red alga (*Gigartinaceae family*)
Moturoa Island, Bay of Islands	Native *Caulerpa* (either *C. flexilis* or *C. brownii*)
Woolleys Bay Beach, Matapouri	Native *Caulerpa* (either *C. flexilis* or *C. brownii*)
Moturoa Island, Bay of Islands	*Caulerpa flexilis* (native)
Ngunguru Estuary, Tutukaka	Green alga *Ulva* sp. and seagrass *Zostera* sp. (native)
Rawhiti	A tubular *Ulva* sp.
Auckland	
Locality	**Taxa identified**
Whangaparāoa	Terrestrial plant matter
Wai o Taiki Bay	A tubular *Ulva* sp.
Snells Beach	Brown seaweed (either *Sargassum* sp. or *Carpophyllum* sp.)
Eastern Beach	Filamentous brown alga (Ectocarpaceae family)
Hekerua Bay, Waiheke Island	A tubular *Ulva* sp.
Wellington	
Locality	**Taxa identified**
Lake Ferry, Wairarapa	Freshwater plant (unknown species)

Figure 1: Native seaweed *Caulerpa flexilis*, found near Taiharuru, Northland. Photo: Kara Waetford

Unknown seaweeds investigated

A Department of Conservation ranger contacted MPI to identify a container of unknown seaweed that had been dropped off by a member of the public.

The seaweed had been collected from Papatara Bay on Motukawanui Island in Northland. Images were provided to MPI and taxonomists, who were able to identify *Colpomenia* sp. and *Ulva* sp. in the collection. Further taxonomic resolution could not be determined without analysing physical samples, but there are no biosecurity risks associated with *Ulva* sp. There is one exotic *Colpomenia* species known from New Zealand (*C. peregrina)* and one cryptogenic species (*C. claytoniae*). Additionally, *Dactylosiphon bullosus* is a third exotic species of seaweed in New Zealand that was previously considered *Colpomenia bullosa*. Taxonomists could confirm that the images did not contain *D. bullosus*, which has potential impacts on native ecosystems. The exotic *C. peregrina* is already established and widespread across Northland, and neither *C. peregrina* nor *C. claytoniae* are known to have noteworthy impacts on native assemblages. As no significant biosecurity risk was identified, the investigation was stood down.

A member of the public contacted MPI to report an unknown seaweed that had washed up at Whakatīwai, Firth of Thames, Waikato region. MITS taxonomists were able to confirm from images the seaweed was made up of species of tubular and bladed *Ulva*. This genus is commonly known as 'sea lettuce' and can be found across Aotearoa New Zealand growing widely along the coast. Further taxonomic resolution could not be determined without analysing physical samples, but as there are no biosecurity risks associated with the *Ulva* genus the investigation was closed.

A university student was looking at juvenile mussels in the intertidal zone in Waipu Cove, Auckland when they noticed green filaments of algae growing epiphytically on coralline algae. They reported this find to MPI to ensure it was not an exotic species. Images were provided by the student, which were sent to MITS, where the alga was identified as a tubular species of the *Ulva* genus. Since no biosecurity concern was found, the investigation was closed.

A member of the public contacted MPI to have a seaweed identified as they were concerned it was the non-indigenous *Undaria pinnatifida.* It was found growing on a moored vessel in Ōhiwa Harbour Te Moana-a-Toitehuatahi (Bay of Plenty). Images provided to MPI were sent to a taxonomist who identified the alga as *Petalonia binghamiae*. This species of brown seaweed is native to New Zealand and can be found commonly around the North Island, with some reports from the South Island.

A member of the public contacted MPI to report an unknown seaweed they came across while swimming in Algies Bay, Auckland. They provided images to MPI, which were sent to MITS where the seaweed was identified as likely the non-indigenous *Codium fragile*, commonly known as green sea-fingers or dead man's fingers. It could also have been *C. gracile* (native); however, taxonomic resolution to a species level could not be achieved without physical specimens. *Codium fragile* has been present in New Zealand since the 1970s and has since established itself across New Zealand. Since this species is not of concern to Northland, this investigation was closed.

Range extension of non-indigenous ascidian confirmed

MITS notified MPI of the detection and range extension of the non-indigenous solitary ascidian *Ciona savignyi* (Herdman, 1882). A sample of this ascidian was collected during Marine High-Risk Site Surveillance in Napier. The appearance of this ascidian in Napier is not surprising as it is quite well established in New Zealand, being previously found in Opua, Whangārei, Auckland, Tauranga, Wellington, Picton, Nelson, Lyttelton and Dunedin. Te Kaunihera a-rohe te Matau-a-Māui (Hawke's Bay Regional Council) was informed of the detection and the investigation was closed.

Unknown ascidian investigated

A recreational fisher caught a bright red tubular organism while fishing on a boat off the coast of Te poupouwhenua (One Tree Point), Northland. The fisher reported this to MPI and an investigation was opened to identify the organism. Images of the find were passed on to MITS who identified the organism as *Synoicum kuranui*, a native ascidian species (**Figure 2**). As no biosecurity risk was identified, the investigation was stood down.

Figure 2: Native ascidian *Synoicum kuranui* collected near Marsden Cove. Photo: Kara Gribble

Suspect exotic material investigated

A member of the public notified MPI of strange tendrils in the water at Waikawa Marina, Te Tauihu-o-te-waka (Marlborough). Two samples were collected by Marlborough District Council staff and preserved in different ways to ensure that the organism was identifiable on arrival to MITS. MITS determined that the samples were of decaying inorganic material, possibly rope or bungee cord surrounded by pollen. The council and original notifier were informed of the result, and the investigation was closed.

Unknown anemone investigated

A member of the public notified MPI about an unidentified anemone they had photographed at Army Bay, Whangaparāoa, Auckland. Photographs were sent to MITS; however, taxonomists were unable to identify the anemone. Without examining a physical sample, anemones are notoriously difficult to identify with confidence. As no samples were available for further taxonomic

assessment the investigation has been closed. The investigation will be revisited if samples become available in the future.

Unknown sea slugs investigated

A member of the public notified MPI of the presence of about 20 yellow slugs, roughly 6 cm long and 2–3 cm wide, on the rocks near a pier in Castor Bay, Auckland. An investigation was opened to ascertain if they were an exotic species. The notifier provided clear, close-up images that were passed on to MITS, who identified the sea slugs as *Dendrodoris citrina*, commonly known as the lemon doris or lemon nudibranch (**Figure 3**). This mollusc is an endemic New Zealand species that is common in the mid-to-low intertidal zone around the country. According to the identifying taxonomist, "this species has the strange habit of not seeking a pool when the tide is dropping, but simply lying where it finds itself on the substrate, as in these photos, sometimes even upside-down, and desiccating. They seem quite happy and survive until the water comes back in." A small black spherical slug in the corner of one of the images was noted and was identified as *Dendrodoris nigra*, which is also native to New Zealand. The identification of the sea slugs were passed back to the notifier and the investigation closed.

Figure 3: Endemic lemon nudibranch *Dendrodoris nigra*, observed at Castor Bay, Auckland. Photo: Lyall Style

Unknown sea snail investigated

A member of the public contacted MPI to report a large, bright-orange sea snail they found in a rock pool in the Bay of Islands. The snail was identified from images as the native *Charonia lampas*, commonly known as trumpet shell. It is New Zealand's largest species of predatory marine sea snail of the family Charoniidae. It can grow up to 24 cm and is distributed widely in the New Zealand Exclusive Economic Zone. It feeds on sea urchins and sea stars, immobilising prey with toxic saliva. Since there was no biosecurity concern, this investigation was closed.

Suspected exotic mussels investigated

Staff from an aquaculture operation contacted MPI after finding mussel shells they were concerned might be the exotic brown mussel *Perna perna*, in an aquaculture support yard in the Te Tara-o-te-Ika-a-Māui (Thames-Coromandel District). *Perna perna* is an invasive species not currently established in Aotearoa New Zealand and could compete with the native green-lipped mussels (*P. canaliculus*), cause biofouling and transmit disease. No live mussels were found at the time. Photographs of the shells were sent through to MITS, where taxonomists were able to confirm the shells were from green-lipped mussels. The results were passed back to the company and the investigation closed.

An aquaculture facility employee contacted MPI to report a mussel shell they had found in a wet chamber. They were concerned it could be an exotic species. The images of the shell as well as the specimen were sent to MITS where malacologists identified the mussel as a species within the genus *Mytilus*, likely the indigenous *Mytilus planulatus* (formerly *Mytilus galloprovincialis*, native to both New Zealand and Australia). Unfortunately, the single specimen was damaged and identification was unable to be reached. As the species was most likely to be native and no further specimens were available to progress the identification further, the investigation was closed.

Suspected cases of exotic freshwater gold clams (*Corbicula fluminea*) investigated

A member of the public contacted MPI after finding some small freshwater clams in Auckland. They were concerned they were the exotic freshwater gold clams *Corbicula fluminea*. Using images sent by the notifier along with their own samples, MITS was able to identify the clams as native Sphaeriidae or fingernail clams. Sphaeriids are tiny bivalves shaped a bit like miniature cockles. Their shells are often pale, but larger individuals may become brown as growths of biofilms or inorganic crusts form on the outer surfaces. Since there was no biosecurity threat, this investigation was closed.

MPI was notified by a member of the public after shellfish were found in Lake Rotoroa, Kirikiriroa Hamilton, in Whangamata Bay, Taupōnui-a-Tia Lake Taupō. Both notifiers provided images which were sent to MITS for taxonomic identification. A malacologist identified both cases as the native freshwater bivalve *Echyridella menziesii,* also known by its Māori names kākahi, kāeo and torewai. As this is an endemic species to Aotearoa New Zealand, these investigations were closed.

A member of the public called MPI after finding a shellfish near Korokitewao Bay, Lake Rotoiti. The clam was described as quite large, about 50 mm long, covered in a dark-brown crust at the thickest part of the shell, and gold in colour with flecks of green. The notifier went back to the location to take some photos, where other people informed him that the mollusc was actually a specimen of the endemic freshwater bivalve kākahi (*Echyridella menziesii*). As there was no further suspicion of an exotic species, the investigation was closed.

Mortality in farmed green-lipped mussels (*Perna canaliculus*) investigated

A Fishery Officer and a mussel farmer notified MPI of ongoing mortalities in farmed green-lipped mussels (*Perna*

canaliculus). Mortalities in wild blue mussels (*Mytilus edulis*) had also been observed in the area; however, no other aquatic species were reported as affected. Mortalities had occurred from the surface down to 12 m water depth and was described as patchy. At its peak, mortality was reported to have reached as much as 25–30 percent on some mussel lines. A second mussel farming operation in the same bay also reported some mortalities but not to the same extent as the initial farm, and it had resolved quickly. No unusual environmental conditions or phytoplankton blooms were reported by the farmer. However, later anecdotal reports of a bloom-like event in the area were received from an aquaculture worker. Biotoxin monitoring for New Zealand Food Safety did not raise any immediate concerns; however, these tests focus on risks to human health rather than bivalve health. Multiple sets of samples were collected of both unaffected and moribund mussels and sent to MPI's Animal Health Laboratory, Wallaceville (AHL) for disease testing. Histology and bacteriology suggested that bacteria appeared to play a role in the mortality, causing damage to the digestive glands of the green-lipped mussels. Some marine bacteria have been linked to mass mortalities in shellfish. This includes species of the *Vibrio*, especially the *V. splendidus* clade, which were detected in bacteria cultured from samples (Cheikh and Travers, 2022). However, it is likely that various predisposing factors contributed to the mortality event such as phytoplankton blooms and/or water quality factors. It is also of note that the mussels were post-spawning, an energy-demanding biological process which can reduce the effectiveness of the immune system. The mortality event was reported by the farmer to have ended around a month after the initial notification. From the testing conducted, no evidence of biosecurity risk was detected and the investigation was closed.

Disease in farmed blackfoot pāua (*Haliotis iris*) investigated

A Fishery Officer and a pāua farmer contacted MPI to report an ongoing stress event in farmed pāua. Following a period of abnormally cold weather, about 5 percent of the farmed pāua were showing signs of stress – secreting an unusual amount of mucus, losing attachment to surfaces and unable to reattach. About 1 percent mortality was estimated. An investigation was initiated to rule out an exotic or emerging disease. Fresh and frozen specimens were sent to MPI's AHL for disease testing. No evidence of disease-causing pathogens was detected; however, several bacterial colonies as well as infectious protozoans were observed growing superficially on the foot of the pāua and were likely to be causing irritation and epithelial erosion. This condition has been described in farmed pāua previously (Diggles et al., 2002). The presence of the bacterial overgrowth on the foot suggested sub-optimal water quality in the holding tanks. The facility is now looking into establishing a more robust water quality testing system. It was reported that the animals were no longer showing signs of stress and appeared to be recovering.

Range extension of non-indigenous fish, the Tasmanian blenny (*Parablennius tasmanianus*) reported

MITS notified MPI of the range extension of the non-indigenous Tasmanian blenny, *Parablennius tasmanianus*. A specimen was collected during the National Marine High-Risk Site Surveillance in Tauranga and identified by MITS. This fish has been previously found in Whangārei, Napier and Wellington. Toi Moana (Bay of Plenty Regional Council) were informed of this new record in their region and the investigation closed.

Unknown snake-like organism investigated

A member of the public notified MPI of a small snake-like organism they found inside a kahawai (*Arripis trutta*) caught in Manukau Harbour. Images of the organism were provided, and taxonomists were able to identify it as a long-finned worm eel, *Scolecenchelys breviceps*. This species is native to New Zealand waters. They are usually nocturnal, spend most of their time in sandy or muddy areas hunting invertebrates and can survive outside water for six hours. As no biosecurity risk was present, this investigation was closed.

Mass mortality of kahawai (*Arripis trutta*) investigated

A member of the public contacted MPI to report a sighting of up to 50 dead fish, likely kahawai, in Ahuriri (Napier) port area. Fishery Officers in Hawke's Bay were contacted and they informed MPI that the sighting was likely connected to a case they were involved in. Fishery Officers had seized 37 kahawai from recreational fishers who had exceeded their catch limit. The dead but relatively fresh kahawai had been released back into the waters near Napier Port as per Fisheries New Zealand protocol. This information was passed to the Hawke's Bay Regional Council and the investigation was closed.

Tail blistering syndrome in spiny rock lobster (*Jasus edwardsii*) investigated

A commercial fisher informed MPI of the occurrence of tail blistering syndrome in the red rock lobster (*Jasus edwardsii*) population of the Te Matau-a-Māui (Hawke's Bay) in mid-2022. At the time, samples were collected and analysed at MPI's AHL, and results suggested that the syndrome seen was a rapidly progressive form of shell disease affecting the tail fan, with different characteristics to those observed in tail fan necrosis. The degenerative changes in cuticle were believed to be associated with surface bacterial colonisation and their production of toxins in the epidermis. Further samples have now been examined and have corroborated these findings. Of note is the heavy microorganism biofouling seen on the cuticle and gills of all the sampled lobsters. It is thought that the toxins released by the organisms in these biofouling colonies lead to the demineralisation of the hard compounds that make up the structure of the outer cuticle. The

inflammatory response of the dermis beneath the hard outer layer possibly leads to the visible blisters. The main inflammatory cell associated with the lesions are eosinophilic granulocytes, a type of white blood cell involved in immune response. In this case, they formed large aggregates in response to the cuticle breakdown that then destroyed the epithelium affected by the toxins. These aggregates and subsequent epithelium loss result in the accumulation of haemolymph within the tissues, eventuating in the blister-like lesions. Further samples have been requested from industry to continue to build a picture of the syndrome's causative factors. However, there has been no evidence that suggests an exotic disease or parasite of biosecurity concern is behind the lesions in the rock lobsters analysed. This investigation has now been closed; however, further investigation and diagnostic analysis will be carried out once more samples become available.

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Plant health surveillance and incursion investigation report: July to September 2023

The Incursion Investigation Plant Health (IIPH) team and Plant Health and Environment Laboratory (PHEL), in the Biosecurity New Zealand branch of the 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 (July to September 2023), IIs received 159 notifications (**Figure 1**), an 18 percent decrease compared with the same period in 2022 (195). The presence of a biological risk was ruled out in 51 cases, which were stood down. Twenty-one notifications were redirected to other internal teams or external agencies responsible for managing the pest of concern. The resulting 87 cases that underwent further investigation were a 22 percent decrease on the same quarter last year (111).

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.

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, both returning residents and visitors.

Stink bug cases

Nine notifications of exotic stink bugs were investigated by IIs with no positive detections of the brown marmorated stink bug, *Halyomorpha halys.* One live exotic yellow spotted stink bug (YSSB), *Erthesina fullo*, was reported from a Transitional Facility (TF). As it could not be directly associated with recently imported goods, a site inspection was undertaken by a Quarantine Officer (QO) with no further YSSB found.

Exotic plants and seeds

There were 11 investigations into unsolicited or unauthorised imports of plants, plant material and seeds. The biological risk has been mitigated by the submission of seeds and plant material to MPI for safe destruction and in some cases, site visits to inspect and collect the risk goods.

Spider cases

There were eight notifications of suspect exotic spiders. The biological risk was mitigated by either spraying the goods with insecticides, or through inspecting the items whereby the spiders were found to be dead and posed no risk. Where webbing and nests were reported, notifiers froze them to mitigate any biological risk. Six notifications related to species that

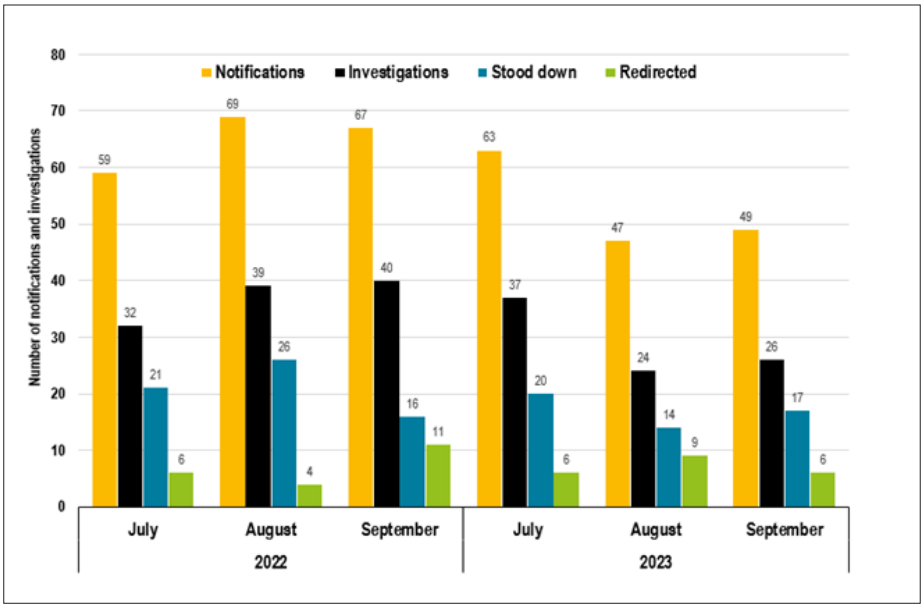

Figure 1: Plant health notifications, investigations, and other outcomes for July, August and September 2022 and 2023

Figure 2: Live banana spider *Heteropoda venatoria* found in shower trays imported from China

are already present in New Zealand. There were two investigations into exotic spiders: a live banana spider *Heteropoda venatoria* (**Figure 2**) at a business that imported shower trays from China, and a redback spider *Latrodectus hasselti* in an imported used car from Australia. In both instances, the spiders were deemed incidentally imported (hitchhikers) and were killed and disposed of as biosecurity waste.

Figure 3: Unauthorised cucamelon *Melothria scabra* seeds from Australia

Other cases of note

Live ants from Germany at a Transitional Facility

A regional QO contacted the MPI Exotic Pest and Disease hotline after a TF in Hamilton reported red ants inside the wrapping of cleared risk goods. The live ants were found in the middle layer of a single plastic-wrapped pallet of bagged sheep milk powder imported from Germany. The remaining six pallets in the consignment were inspected and released with no contamination evident. With assistance from Border Clearance Services (BCS), the pallet was isolated and ant samples taken. PHEL Entomology identified the exotic ant *Monomorium sahlbergi*, with workers, queens and pupae present. The nest appeared established within the packaging; however, milk powder contamination could not be ruled out. The product was to be used for baby formula, so fumigation was not an option. The II in consultation with the importer agreed that the risk goods be destroyed. The product was deep-buried at an MPI-approved landfill, and the importer was provided with a copy of the destruction certificate for insurance purposes.

Cucamelon seeds from Australia

A Christchurch resident contacted MPI to ask about destroying cucamelon *Melothria scabra* seeds gifted to them from an Australian family member visiting New Zealand (**Figure 3**). The family member failed to declare the seeds upon arrival at the airport. Cucamelon seeds are not allowed to be imported into New Zealand under the Import Health Standard –Seed for Sowing The notifier gave the seeds to a Christchurch-based II who destroyed them as quarantine waste.

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 nine investigations of suspect exotic borer beetles associated with wooden furniture (China and Indonesia), sawn timber (United States) and cooking utensils (China). Two live exotic borers were found in wooden consignments from China: *Lyctus sinensis* in chairs and *Stromatium longicorne* in spatulas. Dead exotic borer species were identified in two investigations: the first in sawn timber from the United States (*Neoclytus acuminatus*) and the other in coat hangers from China (*Heterobostrychus aequalis*). Biosecurity investigations indicated possible offshore treatment failure for some of the consignments and those were reported to the Target Development and Treatments teams for their follow up. Where applicable, overseas suppliers were informed of the infestations to raise their awareness to prevent this issue. In all cases, the investigators managed the risk by destroying or treating the goods.

Giant African snail at Wellington airport

A manager at Wellington domestic airport contacted the MPI Exotic Pest and Disease hotline after a baggage handler found a live suspect giant African snail (*Lissachatina fulica*) inside a domestic air can (air freight container). The giant African snail (GAS) is an unwanted and notifiable organism under the Biosecurity Act 1993 and is not present in New Zealand.

The baggage handlers inspected the surrounding area and neighbouring air cans, finding no further signs of snails. On instruction from the II, the snail (**Figure 4**) was contained and delivered to a Wellington QO who sent it to PHEL Christchurch. PHEL initially identified GAS from the images provided and on receiving the snail confirmed the GAS *Lissachatina fulica*.

Wellington airport receives international flights from Australia and Fiji. Neither country has reported GAS as present, therefore these are unlikely pathways of entry. The movement of air cans in and out of the airport was investigated by MPI's Transitional Facilities Team and the Intelligence and Targeting Team but they were unable to discover the air can movements into and across New Zealand. However, the airline was able to provide some of the movement history of the air can. It had only moved through New Zealand, Australia and Tonga, countries where GAS is not reported. All international air cans must be checked at an airport or within a TF by an accredited person for regulated pests and/or biosecurity contaminants. Considering that, and that the air can had only been used for passenger baggage, not air freight, the II concluded that the incidentally imported unwanted organism was

likely a hitchhiker on the luggage of a traveller who had visited a country where GAS is present.

The biosecurity issue was managed with the support of the airlines and BCS and the investigation has been closed. These snails are usually found associated with sea freight and this single event does not indicate an increased risk with the air can pathway. Regardless, the investigation outcome has been shared with MPI teams that manage those pathways.

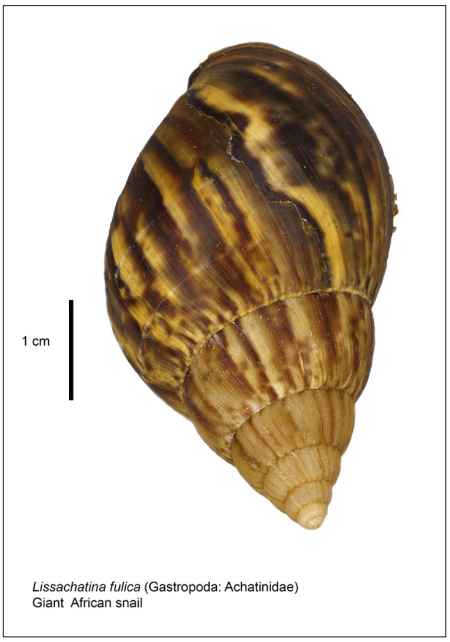

Figure 4: Giant African snail found at Wellington domestic airport

New raspberry rust fungus

In mid-April 2023, during High Risk Site Surveillance (HRSS), leaf samples of raspberry *Rubus idaeus*, were collected from a plant in an Auckland garden overhanging the public footpath. It displayed yellow-orange rust pustules on the underside of the leaves (**Figure 5**). PHEL identified the rust as a new-to-New Zealand fungus, *Aculeastrum americanum*. This rust fungus is classified as an unwanted organism under the Biosecurity Act 1993 (Official New Zealand Pest Register, ONZPR), and is listed as a quarantine pest of *Rubus* nursery stock in the Import Health Standard – Nursery Stock 155.02.06.

Aculeastrum americanum causes late yellow rust or late leaf rust of red raspberry (Luffman and Buszard, 1988; Dias et al., 2023). It shows high host specificity to red raspberry (*R. idaeus*), while other *Rubus* species, including black raspberry (*R. occidentalis* L. and *R. niveus* Thunb.) or blackberries (*Rubus* spp.), are more resistant or immune to infection (Martin et al., 2017; Luffman and Buszard, 1988). The rust infects all aerial parts of the plant and can cause premature leaf drop and defoliation, resulting in severe yield loss (Dolan et al., 2018). Infected fruit are unmarketable. Outbreaks of the late leaf rust have had severe economic impact on raspberry production in North American orchards and are hard to control (Delisle-Houde et al., 2020; Dias et al., 2023). *Rubus idaeus* is a commercially important crop in New Zealand.

The property owner informed the II that they purchased the plants about three to four years ago but could not remember from which Auckland garden centre. The plants had no tags so the II was not able to locate their origin or the variety planted. Under urgent measures, all raspberry plants were removed from the property and the topsoil was treated with a chemical application for residual propagules. Further, on advice from the II, the owner agreed not to plant any host material in or near that garden for at least three years to minimise re-infection risk. The investigation concluded that there is no direct link between the detection of *A. americanum* and recently imported host material.

Based on the above information, *A. americanum* was considered a high biosecurity issue for New Zealand that has been managed during this investigation. The overall priority assigned to acting upon this notification/investigation was assessed as urgent by the Incursion Investigation Risk Analysis. This justified immediate urgent measures to remove the unwanted organism as well as the host plant material to manage that risk.

As a result of this investigation, *A. americanum* on raspberry (*R. idaeus*) has been added as an organism of interest to the 2023/2024 HRSS programme. The biosecurity risk of the *A. americanum* detection has been addressed; therefore no further action by Biosecurity New Zealand with regards to this fungus is planned, and the case has been closed.

Figure 5: Yellow rust pustules caused by *Aculeastrum americanum* on underside of a raspberry leaf

Investigation Positive – Transferred from Biosecurity New Zealand responsibility

Aquatic plants for sale on Trade Me

A Taranaki Regional Council staff member contacted IIPH regarding two separate listings on Trade Me of the suspected National Pest Plant Accord (NPPA) plant oxygen weed, *Egeria densa*. The listings were for oxygen weed sales in Taranaki and Christchurch. From photos provided for the listings, PHEL Bacteriology and Botany was unable to make a conclusive identification, so plant samples were requested from the Trade Me sellers. The Taranaki seller, located in New Plymouth, admitted his listing was *Egeria densa*, an Unwanted Organism. The plants were incinerated and would not be sold again. The Christchurch seller provided samples and PHEL Botany identified *Myriophyllum propinquum*, a native species of aquatic plant posing no biosecurity risk. Taranaki Regional Council and the MPI NPPA coordinator were advised of the outcome.

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 or cultural values. Alternatively, the organism may have already been established and been under management by Biosecurity New Zealand and/or local authorities.

Suspect new house plant sold online

MPI was notified of an online sale of a suspect new-to-New Zealand organism Midnight Ginger (*Zingiber malaysianum*). It is not on the Plants Biosecurity Index and was described in 2002 after the inception of the Hazardous Substances and New Organisms Act 1996, making *Z. malaysianum* a suspect new organism. On questioning the origin of the plant, the seller advised that he removed the plant from a property he had leased several years earlier. The plant had only just recovered enough from being transplanted to propagate from. The seller believed the plant had been in New Zealand for some time and referred the II to staff from two botanic gardens to verify. One confirmed the plant had been available around 2004 but they did not have a specimen and the other confirmed they had purchased a specimen in 2004 but it had died. Their purchase ledger confirmed that *Z. malaysianum* 'Midnight' had been bought from a South Island commercial nursery. The nursery owner (at that time) was contacted to verify where he had sourced the plant. The nursery had changed hands and the new owners had no records to verify its origin. *Zingiber officinale* 'Midnight' had been imported in 2004 by a North Island nursery, and that poses a possible hypothesis for the entry of *Z. malaysianum* to New Zealand. That hypothesis is unable to be confirmed or disproved due to incomplete records because of the 19 years that have lapsed since the import.

The seller has been advised that Biosecurity New Zealand does not encourage the propagation or marketing of *Z. malaysianum* because the plant species has not received a new organism determination under the Hazardous Substances and New Organisms Act. The seller has been advised that he could apply for that determination through the Environmental Protection Authority. The biological risk of this plant is likely to be negligible as it is a tropical house plant that prefers a high humidity environment and is susceptible to frost, as advised by the seller.

Investigations of new-to-New Zealand organisms

There were 10 notifications related to new-to-New Zealand organisms in the following disciplines: mycology (five), nematology (one), entomology (two), bacteriology (one) and virology (one). All are presented below.

New fungus on *Coprosma* leaves

In April 2023, a *Coprosma macrocarpa* plant displaying leaf spots was sampled during HRSS in Auckland. A PHEL mycologist identified *Colletotrichum aenigma*, a new-to-New Zealand fungus from the leaves. *Colletotrichum aenigma* was erected as a new-to-science taxon in 2012 (Weir et al., 2012). The fungus has been reported as a plant pathogen causing anthracnose disease on a wide range of hosts from multiple European and Asian countries from the United Kingdom to Japan (Bragard et al., 2022). Hosts of importance to New Zealand include avocados, strawberries, apples, pear, cherries and grapes.

As it was a new-to-New Zealand detection, more sampling was done from the original *Coprosma macrocarpa* plant, other *Coprosma* plants with leaf spots and a few other plants (*Geranium* sp., *Pseudopanax lessonii*, *Euonymus japonicus*, *Nerium oleander* and *Prunus* sp.) within the initial detection site. In total nine samples were submitted to PHEL but *C. aenigma* was not detected from any of those additional samples. To eliminate the new fungus, the infected *C. macrocarpa* was excavated with the topsoil and destroyed.

New oomycete from soil

A Scion scientist isolated a suspect new-to-New Zealand oomycete from soil off a logging truck used in a pine forest in Whakarewarewa, Bay of Plenty. The scientists tentatively identified the oomycete as *Phytopythium montanum* based on DNA sequence similarity match. However, PHEL identified it as an undescribed new-to-New Zealand oomycete in the genus *Phytopythium*. Species in this genus are commonly found in water, soil or in association with plant roots and can cause symptoms of damping off, root rot and decline in susceptible plants. At this stage, host species with the potential to develop disease symptoms for this undescribed species have not been identified. As the undescribed *Phytopythium* species was isolated from soil from a logging truck, it is not possible to definitively determine its origin. It was not associated with a plant and in this instance the pathogenic nature, host range or potential impact have not been assessed. It is possible the oomycete has been in the environment for many years. In the absence of a species, its impact or host range is not known but it is considered a low biosecurity issue for New Zealand. Considering the ambiguity of this detection, no further action is warranted and the investigation has been closed.

New fungus on myrtle rust pustules

A Scion researcher reported a suspect new-to-New Zealand fungus *Verticillium leptobactrum* from myrtle rust (*Austropuccinia psidii*) pustules infecting a ramarama (*Lophomyrtus bullata*) at Mt Messenger, Taranaki. The detection originated from Scion's seasonal programme to monitor the impact and spread of myrtle rust in the North Island. Scion observed white mycelial growth amongst the myrtle rust spores. The culture was sent to PHEL for further diagnostics where it was identified as a species of genus

Leptobacillium. Some species in this genus were previously included in the genus *Verticillium*. There were no close matches to any known species, which suggested that the detection is likely to represent an undescribed species.

No species in the genus *Leptobacillium* are included in the Official New Zealand Pest Register. There is no evidence to suggest that the fungus identified in this investigation is a plant pathogen. Other *Leptobacillium* species are known parasites of rust fungi, suggesting that the isolated fungus could be a beneficial organism. Since the isolate was obtained from rust sori, it is likely that this fungus is a mycoparasite and therefore is not a biosecurity risk. Scion was advised of the identification and will communicate the result with the mana whenua of that area.

New fungus detected on squash

In mid-April 2023, root and crown plant samples of buttercup squash (*Cucurbita maxima*) exhibiting vine decline were submitted from a Gisborne grower to a Christchurch diagnostics lab for general pathogen testing as part of a project seeking to understand soil-borne disease occurrence. *Pythium tracheiphilum* was identified in May; the sequences were confirmed as *P. tracheiphilum* by PHEL Mycology and Nematology and the culture was validated in June. *Pythium tracheiphilum* has not been recorded in New Zealand and this is the first host record of *P. tracheiphilum* from squash.

Five other pathogens were detected from the sample by the Christchurch pathologist: *Fusarium graminearum, F. oxysporum, F. avenaceum, F. solani* and *Phoma exigua*. These pathogens are present in New Zealand and can cause blight, wilt and root rot. *Fusarium solani* is known to cause crown and foot rot of squash and pumpkin.

The squash was grown from seed sourced from India and Thailand where *P. tracheiphilum* is not known to be present. The seeds are germinated in an onsite nursery before being transplanted into the field. Some of the harvested squash was processed into puree or individually quick-frozen products, and the rest was exported before the identification of *P. tracheiphilum*. Previous crop rotations in the paddock where the squash was grown included lettuce, the main host of *P. tracheiphilum.* The grower could not identify the country of origin of the lettuce as it had been planted several rotations earlier. Lettuce crops are subject to multiple fungicide applications so symptoms may have been supressed in that crop. It is possible that lettuce was the source of the *Pythium*; however, there are no samples to confirm that hypothesis. The grower observed that the paddock had always had a poorer-than-average yield. Previous sampling on squash had identified *Pythium* sp. but further identification to species level had not been pursued. During the recent growing season of the squash, the region had been exposed to multiple severe weather events and at times parts of the paddock were completely submerged by flooding, providing an environment conducive for spread and infection of soil pathogens.

Pythium tracheiphilum was erected as a new-to-science taxon in Italy in 1965. It causes vascular wilt and stem rot of lettuce. It is a soil-borne pathogen that spreads through contaminated soil and plant material and has long-living oospores enabling it to survive within the soil and re-infest rotations of host crops. It has a narrow host range, including lettuce, spinach, endives, Chinese cabbage, parsnip and pine seedlings. It is known to be present in Algeria, Denmark, Italy, Netherlands, Spain, Sweden, the United Kingdom, the United States, Canada and Australia. It is unknown whether this pathogen is seed transmissible; however, previous detections consider that to be likely (Kumar et al., 2007). Symptoms are more severe in wet seasons, but losses can be minimised through management practices such as machinery hygiene and chemical applications (Kumar et al., 2007; Van der Heyden et al., 2019). There are no known trade implications to the presence of *P. tracheiphilum* in New Zealand as the phytosanitary measures are considered sufficient to meet export requirements.

Symptoms of the disease can be varied across different hosts. As this is a new host record and was found in conjunction with known pathogens of squash, it is uncertain what disease symptoms on that squash plant can be attributed to *P. tracheiphilum*. The source and spread of *P. tracheiphilum* in New Zealand are unknown. The investigation hypothesis is that a lettuce rotation was a likely source of the *Pythium* inoculum. Machinery and equipment used throughout the paddocks and extensive flooding in the region have likely exacerbated spread of the pathogen. The grower will introduce machinery hygiene practices in conjunction with their existing fungicide programmes to manage the pathogen.

New fungus on *Leucadendron* nursery plants

In April 2023, a Palmerston North nursery sent a *Leucadendron* sample displaying leaf spotting, stem lesions and root browning to a diagnostics lab for testing. In July 2023, a suspect new-to-New Zealand pathogen *Elsinoë leucospermi* was isolated from the leaf sample. The culture was sent to PHEL Mycology and Nematology for identification. PHEL completed pure culturing and used DNA sequencing to confirm the fungus as *E. leucospermi*.

Several other pathogens established in New Zealand were also isolated from the infected plants. However, the stem lesions and leaf spotting on the sample were consistent with scab disease of *Leucadendron* plants and *E. leucospermi* was considered the primary causal agent.

Elsinoë spp. are extremely slow growing in culture and can be easily overgrown by contaminants. Therefore, the diagnostics can be challenging. *Elsinoë* spp. are thought to be distributed to new areas via asymptomatic nursery material (Fan et al., 2017). *Elsinoë leucospermi* is present in Australia, the Canary Islands, Malawi, South Africa, Spain, the United States (California, Hawaii) and Zimbabwe. It is reported to cause visual cork-like scabs or lesions on South African ornamental plants *Leucadendron, Leucospermum* and

Serruria (Farr et al., 2021). In the literature consulted, there was no suggestion that *E. leucospermi* kills the host, but severe infection may result in die-back of young growth.

Leucadendron plants are a popular seller for the Palmerston North nursery and are propagated annually from the previous year's plants. As the disease has occurred for at least the past 10 years there is no link to recently imported host material. *Leucadendron* plants at the nursery are pruned between October and December the year before sale. During that period in 2022, the nursery decided to leave more leaf on the older plants to encourage winter colour. As a result, the plants were larger, closer together and had less airflow, thus creating an environment conducive to disease development. A wet and warm 2022 winter and spring, followed by heavy rain events in summer 2022/2023 likely created favourable conditions for disease expression. Disease symptoms were observed throughout the two-year-old stock during summer 2022/2023, with some varieties appearing to be more resistant than others. Only one variety of the 1-year-old stock has shown symptoms so far. The nursery reported an improvement in the stock when temperatures dropped in autumn/winter 2023.

No symptomatic stock has been sold by the nursery; however, they continued to sell visually healthy plants. Symptomatic stock at the nursery is either disposed of or treated with a fungicide and then observed for improvement. Chemical control of the fungus is generally effective when applied preventatively and disease management primarily relies on good plant health and hygiene practices coupled with resistant host material (Fan et al., 2017).

The investigation concluded that there is no direct link between the detection of *E. leucospermi* and recently imported host material. Literature discussing disease management options has been shared with the nursery for their consideration. As a result, this is considered a low biosecurity risk, with no further action by MPI.

New nematode on kiwifruit

The kiwifruit industry contacted the PHEL Mycology and Nematology team regarding unusual root knotting symptoms on kiwifruit grown in Bay of Plenty. The grower suspected symptoms were caused by nematodes. Root samples were submitted from kiwifruit grown in orchards in Bay of Plenty and Auckland (received plants from the Bay of Plenty orchard). From those samples, PHEL completed molecular diagnostics and identified a new-to-New Zealand nematode *Meloidogyne hispanica* (**Figure 6**). Morphological work was completed by a nematologist at Manaaki Whenua Landcare Research, who confirmed the ID.

Meloidogyne hispanica was first isolated in 1986 in Spain from symptomatic peach tree roots, and has since been isolated globally from Africa, Asia, Australia, Europe, and North, Central and South America (EPPO Global Database, 2021). This species of nematode is a polyphagous feeder and has been reported from a range of horticultural hosts including tomato, potato, grapevine, lettuce, fig, corn, broccoli and cucumber (University of California at Davis, 2023). There are no records of *M. hispanica* from kiwifruit overseas. *Meloidogyne hispanica* is considered a pest in the United States, given its broad host range, high reproductive and dispersal potential, and its potential to lower crop yield, crop value and impact market access (California Department of Food and Agriculture). In the orchards sampled, symptomatic kiwifruit plants were not abundant and there was no reoccurring pattern. The investigation found no association with recently imported kiwifruit.

In 1997, Knight et al. reported two species of *Meloidogyne* nematodes from kiwifruit in New Zealand, including *M. hapla* and *Meloidogyne* sp. For the *Meloidogyne* sp. record, there is no specimen or DNA-sequences available to determine a species identification, but it is possible those earlier records were *M. hispanica*.

This new-to-New Zealand nematode is believed to represent a species of nematode present in New Zealand soils for decades that is only now identifiable due to advances in molecular and morphological technologies. In collaboration with the kiwifruit industry, no further actions have been taken to manage or eradicate this nematode. Industry communicated the diagnostic findings directly to the two impacted kiwifruit growers.

New fly at residential property

In March 2023, a citizen scientist posted photographs on iNaturalist of a suspect new-to-New Zealand fly, *Medetera* sp. (**Figure 7, page 39**). The retired scientist collected three specimens, two females and one male, from their porch in Auckland and submitted these to PHEL Entomology. PHEL Entomology confirmed the fly as *Medetera* sp. in May and notified the IIPH team. Images of the male specimen were subsequently sent to Dan Bickel (Australia Museum) who identified the specimen as the woodpecker fly *Medetera grisescens* in June 2023.

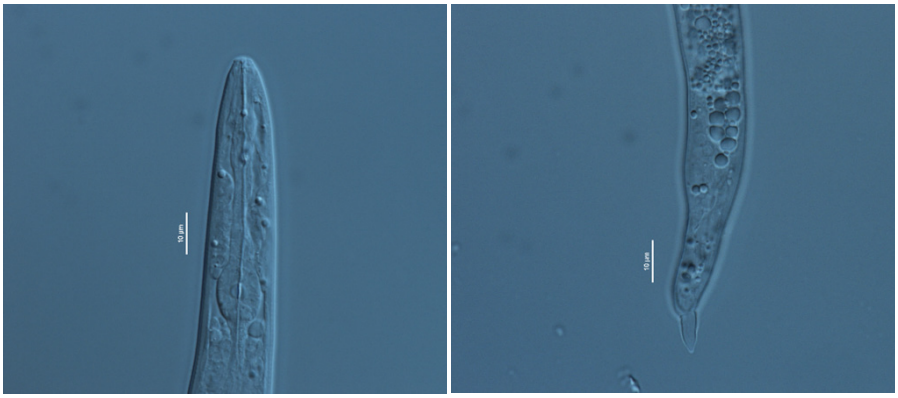

Figure 6: Nematode *M. hispanica* head (left) and tail (right). Photos: Zeng Zhao, Manaaki Whenua – Landcare Research

Further specimens, confirmed as *M. grisescens*, have been collected from two other Auckland sites, about 5 km from the initial site. As well as these detections, several unconfirmed observations of this fly are reported on iNaturalist. The earliest of these was from Katikati in August 2022, and then Palmerston North, Rotorua and additional Auckland sites.

The genus *Medetera* is in the subfamily Medeterinae of the family Dolichopodidae and only a single species from this subfamily, *Thrypticus arahakiensis*, is recorded from New Zealand (Bickel, 1992). *Medetera* can be readily identified from *Thrypticus* by wing and eye characters. Images from the unconfirmed observations posted on iNaturalist are consistent with *Medetera* and are therefore considered likely to be *M. grisescens*.

Most *Medetera* larvae are subcortical predators and live under the bark of dead or dying trees. However, the biology of the Australasian larval stage is relatively unknown and to date there are no records of any host associations for Asian and Australasian *Medetera*. The larvae of Holarctic members of this genus have been documented as predators of scolytine bark beetle larvae. Other *Medetera* species have been recorded feeding on and associated with the larvae of Scolytinae, Buprestidae, Curculionidae, Cerambycidae, Sciaridae and Cecidomyiidae; however, the hosts of *M. grisescens* are not yet known. Members of the Scolytinae include economically significant bark beetle pests of conifers in the northern hemisphere. Hence, as predators of Scolytinae, the *Medetera* are generally viewed favourably as natural biocontrol agents. As such there are no known monitoring, management or control methods currently in use for *M. grisescens* or any other *Medetera* in any of its known distributions. The investigation found that the establishment of this fly was likely, and the impact of the fly unknown. The investigation concluded a low biological risk, with no further action taken by Biosecurity New Zealand.

Figure 7: Woodpecker fly, *Medetera grisescens*. Photo: PHEL Entomology

New parasitic wasp on tree

A suspect new-to-New Zealand parasitoid wasp in the genus *Agamerion* (**Figure 8**) was detected in May 2023 on a blue gum (*Eucalyptus globulus*) tree in Mission Bay, Auckland. The wasp was originally observed by a member of the public and posted to iNaturalist. MPI was not notified at the time, but a PHEL entomologist saw the observation, visited the site and collected four male wasps. PHEL Entomology confirmed the identification as *Agamerion* sp. in June and reported it to IIPH. Species-level identification was not possible by PHEL as female specimens are required for identification and no females had been captured.

The genus *Agamerion* is noted by Gibson (2003) as known only from the Australasian region: Australia, Indonesia and Papua New Guinea. Very little is known on the biology and life history of the representatives of the genus *Agamerion*. Bouček (1988) records that some species of *Agamerion* are parasitoids of cockroach ootheca.

A site visit was conducted (13 June 2023) by IIPH and PHEL Entomology. The objective of the visit was to collect further specimens to identify the species, but no wasps were found. Consequently, IIPH and PHEL Entomology sought advice from Gary Gibson (Agriculture and Agri-Food Canada) an overseas expert in the *Agamerion* genus. Gary confirmed that the specimens captured belong to an undescribed species in the genus *Agamerion*. He also notes that the same specimens have been captured in Queensland and in the Australian Capital Territory, suggesting that this undescribed species is widespread in Australia (G Gibson, personal communication, 30 June 2023). The significance of this detection remains unknown. However, there have been no reports of this wasp causing significant impacts overseas, suggesting that these wasps are unlikely to pose a biosecurity risk. Based on the information available, the investigation concluded a low biological risk and no further action is planned by Biosecurity New Zealand.

Figure 8: A male parasitoid wasp *Agamerion* sp. Photo: PHEL Entomology

New bacterium on onion

In May 2023, onion bulbs displaying symptoms consistent with neck rot were submitted to a Christchurch laboratory for testing. The scientists isolated three potential pathogens in June 2023: two identified to genus level (*Penicillium* sp. and *Fusarium* sp.) and *Rouxiella badensis*, a bacterium that has not been reported from New Zealand. Being a suspect new-to-New Zealand organism, the Christchurch laboratory reported it to MPI. The sequences and culture were submitted to the PHEL Mycology and Nematology team, and scientists validated the identification provided earlier in July.

The II established that the onion bulbs involved in this investigation came from a commercial field in Pukekawa, south of Pukekohe. An experimental trial had been set up in the field to observe white rot and *Botrytis* infections. The field surveyor advised that the season had been very wet, so conducive to increased bacterial diseases. However, he did not think the commercial field was badly affected. The bulbs were harvested in April 2023 and a sample submitted to a

Christchurch laboratory for testing. The bacterium was not detected in that sample. The onion bulbs were stored at the site in a barn and monitored as *Botrytis* can become more pronounced with storage. The surveyors assessed the onions by cutting them in half and looking for neck rot. When rot symptoms were discovered in late May, another sample was submitted to PDL. That analysis resulted in the present report of the suspect new-to-New Zealand organism.

The commercial field was planted with onion seeds grown here in 2020, planted in the field in 2022 and the bulbs harvested in 2023. Previously the field was planted with potatoes. The next rotation will be either potatoes or barley; neither are known hosts of *R. badensis*. The II traced seeds from the same lot planted in the commercial field and requested a sample to be submitted to PHEL for bacterium testing. The seeds tested negative in August and that indicated that the bacterium was either not present in the seeds or the level of contamination was too low to detect.

The MPI Plant Exports group was consulted about any possible trade implications. No significant export consequences are likely as this bacterium is not known to be regulated by any country.

The II concluded that the bacterium, although with potential to cause onions to rot, was of low significance to New Zealand. No indication of association to recent imports was found and there are reasonable grounds to believe that the symptoms may have been driven by an unusually wet autumn. That conclusion was provided to the MPI GIA relationship manager and communicated to Onions NZ, who after further conversation with the II, accepted the investigation outcome.

New diseases on native plants

Plant and Food Research (PFR) notified MPI of three suspect new-to-New Zealand viruses isolated from native inland *Lepidium* spp. in Central Otago. The viruses reported were cabbage cytorhabdovirus 1 (CCyV-1), solanum nigrum ilarvirus-1 (SnIV-1), and several viruses in the *Mastrevirus* genus.

The virus detections were made as part of a project that aims to better understand the causes for decline of three native inland *Lepidium* plants. Inland *Lepidium* plants currently have a restricted distribution in the depleted semi-arid grasslands of central Canterbury and Otago (Allen, 2000). All inland native *Lepidium* are listed as Threatened Nationally Critical (de Lange et al., 2018). PHEL Virology validated the identifications from gene sequence data supplied by PFR.

PFR did not observe any viral-like symptoms on any of the *Lepidium* plants sampled. Additionally, PFR did not observe a direct relationship between the presence of a virus or viruses with the decline in the *Lepidium* plants.

There is limited information from the literature available about the significance of these organisms overseas. SnIV-1 is recorded as causing mild concentric rings in leaves and deformation of fruits in pepper (Orfanidou et al., 2022). However, the overall economic and environmental significance of this virus is unknown.

CCyV-1 was first identified in cabbage in the United Kingdom (Pecman, 2017). However, the study did not state what symptoms were observed on cabbage. Its significance on cabbage is unknown and there is no other information on this species.

With partial sequences only available for the *Mastrevirus* species, PHEL Virology found only 75–80 percent nucleotide identity to representatives of *Mastrevirus*. Due to the relatively low match, it was not possible to identify the *Mastrevirus* further. With the identity unconfirmed, it is not possible to make an accurate assessment on the biosecurity risk. Regardless of this, there is no evidence of any members of the *Mastrevirus* genus being a significant pest overseas.

The significance of these viruses remains unknown but is considered low to negligible due to the absence of reports of these viruses causing economic or environmental impact. In the absence of evidence of biological risk, no further action is planned by Biosecurity New Zealand.

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 brown marmorated stink bug (eight investigations reported above) and fruit flies (four 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: saw-toothed grain beetle (*Oryzaephilus surinamensis*), millipedes and flies from the genus *Sapromyza*.

Negative – Other

These investigations were negative for the presence of any biosecurity risk. The plant health team received 41 notifications that were negative for any biosecurity issues. The reports included 31 entomology cases, six for botany and four for mycology. 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 14 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 each case, such as freezing a sample for 48 hours before disposal.

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PEST WATCH: 2 August – 12 October 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 2 August – 12 October 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	*Elsinoe leucospermi* no common name	*Leucadendron* sp. conebush	Wanganui	PHEL General Surveillance	This fungus causes cork-like scabs and lesions on ornamental plants such as *Leucadendron*, *Leucospermum*, and *Serruria*.
Insect	*Agamerion* sp. no common name	Unknown Found on *Eucalyptus* sp.	Auckland	PHEL General Surveillance	An undescribed species from Australia. Other members of this genus are parasitoids.
Insect	*Medetera grisescens* woodpecker fly	Unknown Found at porch light	Auckland	PHEL General Surveillance	A widespread tramp species. Larvae of other species in this genus prey on bark beetle larvae.
Nematode	*Meloidogyne hispanica* root-knot nematode	*Actinidia deliciosa* kiwifruit	Auckland	PHEL General Surveillance	This species is polyphagous and has global distribution.

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

VETERINARY DIAGNOSTIC LABORATORIES

GRIBBLES VETERINARY PATHOLOGY

- **AUCKLAND**
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  Tel: 09 574 4701 Fax: 09 574 5304

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  Postal: PO Box 944, Hamilton 3200
  Tel: 0800 83 85 22 or 07 839 1470 Fax: 07 839 1471

- **PALMERSTON NORTH**
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  Postal: PO Box 536, Palmerston North 4440
  Tel: 06 356 7100 Fax: 06 357 1904

- **CHRISTCHURCH**
  Courier: 7 Halkett Street, Christchurch 8140
  Postal: PO Box 3866, Christchurch 8140
  Tel: 03 379 9484 Fax: 03 379 9485

- **DUNEDIN**
  Courier: Invermay Research Centre, Block A, Puddle Alley, Mosgiel, Dunedin 9053
  Postal: PO Box 371, Dunedin 9053
  Tel: 03 489 4600 Fax: 03 489 8576

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  Tel: 07 839 1470 Fax: 07 839 1471

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  Courier: IVABS Building, 1st Floor, Massey University, Tennant Drive, Palmerston North
  Postal: PO Box 325, Palmerston North
  Tel: 06 353 3983 Fax: 06 353 3986

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- **HAMILTON**
  Courier: 524 Te Rapa Road, Te Rapa, Hamilton, 3200
  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
14 Sir William Pickering Drive
Christchurch
Tel: 03 943 3209

Te Kāwanatanga o Aotearoa
New Zealand Government

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