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

Highlights of diagnostics and surveillance

One thing is for certain: aquatic biosecurity never stands still. Which is part of the problem, I suppose: things are always on the move – animals, vessels, marine pests and pathogens. Within the aquaculture industry there's a push to make our biosecurity systems better. But the industry also needs help: it is a huge interlinked dynamic aquatic environment out there and everyone has a role to play to protect our primary industries in the aquatic space, our environment, ecosystem services and biodiversity.

Our industry is one of farmers, growing and nurturing some of the best seafood in the world right here in New Zealand's freshwater and marine environments. We are focusing on biosecurity for many reasons. Yes, there are direct risks to the farming businesses themselves. A single pathogen can have huge implications on productivity or the ability to farm a species at all. Marine pests compete with our shellfish for food and space on the farms. For an industry worth over $500m a year and employing more than 3 000 New Zealanders, often in regional areas with fewer employment opportunities, the risks that biosecurity failures bring are worth getting serious about. But more than that, our aquatic farmers are passionate about the environment that makes the seafood special. It may be their workspace, but it is also their backyard where they swim, boat, fish and dive.

There have been challenges and there will continue to be challenges. We have seen the appearance of new to New Zealand organisms. The aquaculture industry doesn't import live animals or germplasm, so while those risk pathways don't exist, the sea doesn't have fences, and risks still make it into our waters. But the border isn't everything: we also need to think about the pathways within New Zealand.

The aquaculture industry has always had biosecurity provisions in its codes of practice, but our current initiatives are taking another look strategically at the risk profile of our sectors, the pathways within our industry, where we can set up our own internal borders and how to manage our own risks better. We've started this in our three biggest sectors – salmon, mussels and oysters. The result will be new biosecurity requirements covering facility standards, risk communication, surveillance, health monitoring, response and, importantly, stock movements. These standards will be embedded in our world-class sustainable management framework, called "A+ New Zealand Sustainable Aquaculture". Farmers will self-report on-line against all the sustainability standards, including the biosecurity requirements, and independent assessors will check adherence to the standards. We are also working towards signing the Government Industry Agreement on Biosecurity, hopefully in 2018.

But we also need help. The aquaculture sector isn't the only aquatic pathway in New Zealand. The range extensions of some of the marine pests show there are active conveyors out there and those pathways need to be managed too, preferably to a consistent national standard. There are positive initiatives already happening. Here in the Top of the South, the three regional councils have worked together to establish complementary small-scale management programmes to help prevent the Mediterranean fanworm from establishing. The Ministry for Primary Industries (MPI), the councils and the Top of the South Biosecurity Partnership have also been working together to improve the issue of hull biofouling, through education and the introduction of biosecurity requirements in new marina berth agreements. Ideally, we would also see the increased availability of sufficient suitable water space to enable international best practice in area management to be more fully implemented throughout the aquaculture sector.

What is clear through all this work is that there are many unanswered questions in aquatic biosecurity. Questions about pest and pathogen behaviour in our waters and our species, predicting effects to enable sound management decisions to be made and the need for new tools to manage some of the pathways better. This is where science comes in. While we have been well served by the science community, there hasn't been the opportunity to focus a complete research programme on aquatic pathogens and biosecurity. Until now, that is.

In September the Ministry of Business, Innovation and Employment announced over $14m of funding for a 5-year aquatic animal health and biosecurity research programme based at the Cawthron Institute in Nelson. This programme will bring to bear a range of national and international science expertise on the New Zealand scenario and species. Focusing on what can be done to address New Zealand's aquatic animal health needs and our own biosecurity risk pathways, we will see cutting-edge science put to work in detection and diagnostic methods, studying the behaviour of pests and pathogens present in this country, and developing predictive and management tools. Our capability will be enhanced in aquatic epidemiology, molecular and bioinformatic systems, fish immunology, aquatic risk assessment and decision support systems – capabilities we need in New Zealand to address new challenges as they arise.

It has taken a while to get here, but the momentum is building and we can look forward to more robust pathways and better biosecurity systems to protect the environment and our aquatic farming sector.

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Introducing the MPI Readiness and Response Services Directorate

MPI's Readiness and Response Services Directorate brings together the capabilities to effectively prepare for and manage responses, and to co-ordinate recovery and long-term management activities. We work collaboratively across the biosecurity, food, primary production and trade systems, partnering with primary industry organisations, central and local government, pest management agencies, iwi and community groups. Our work protects New Zealand's economy, environment and way of life.

Readiness and Response Services Director Geoff Gwyn says, "The Directorate was set up in December 2016 to bring together the readiness and response functions and maximise MPI's ability to manage and respond to biosecurity threats. The Directorate aims to take the best of what we do in each of the four systems and use that to improve our management of readiness, response and long-term recovery."

The primary roles of the Directorate are to:

- respond to issues and incidents via a single, clear escalation path;
- act as a single point of entry for escalating, de-escalating and transitioning responses across all regulatory systems;
- ensure alignment among groups responsible for leading the development and implementation of readiness and recovery activity across all regulatory systems;
- strengthen MPI's control and co-ordination of operational responses by working with third party suppliers;
- operate our readiness, response, recovery and long-term management activities in a consistent way across all of our systems; and
- ensure MPI meets its obligations in relation to the Government Industry Agreement (GIA) for Biosecurity Readiness and Response, and fulfils its national leadership role in pest management activities.

Directorate structure

See **Figure 1**. The Directorate fulfils MPI's readiness, response and recovery functions. The GIA Secretariat represents the combined interests of the GIA partners and is an independent body.

The Readiness Group

The Readiness Group focuses on developing systems, tools, processes and readiness to respond, both within MPI and with industry partners. The work programme includes managing the Government Industry Agreement (GIA), the National Biosecurity Capability Network (NBCN), continuous improvement and exercising, implementing the Co-ordinated Incident Management System (CIMS) and developing staff capability.

Readiness Group Manager Melanie Russell says, "Our role is to improve our overall readiness to respond in the biosecurity, food, trade, and primary production systems and build our readiness for specific threats such as foot-and-mouth disease, brown marmorated stink bug and Queensland fruit fly."

The GIA is a cornerstone agreement between MPI and primary industry partners to improve biosecurity outcomes specific to readiness and response. It plays an important role in enabling us to work better as a team to combat threats and focus our efforts to protect NZ's biosecurity. Through all of our partnerships, collectively we will be better placed to produce positive outcomes for MPI, industry and New Zealand.

The Response Group

The Response Group leads or supports responses throughout the biosecurity, food, primary production and trade systems. The group consists of three teams:

- Incident Management, to manage high risk and complex responses;
- Biosecurity Response, to manage biosecurity threats and incursions; and
- Compensation, to assess claims and provide compensation for losses that arise from exercise of powers.

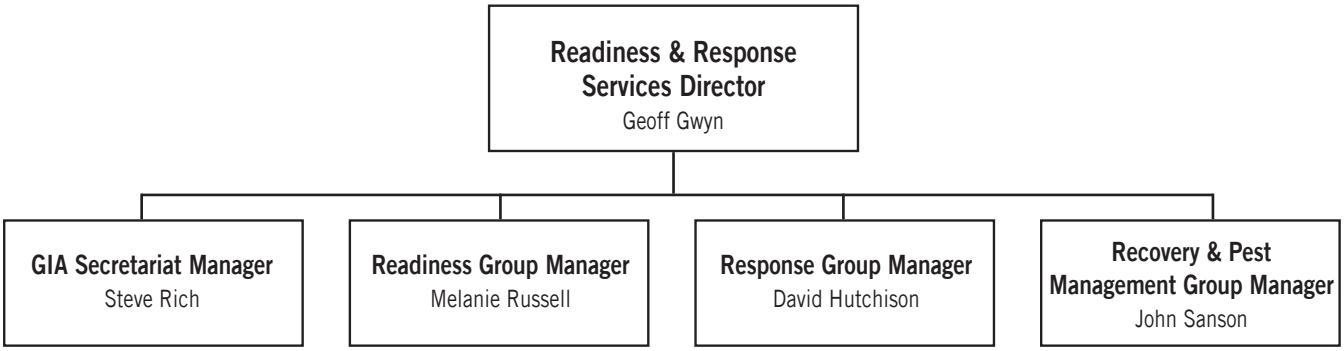

Figure 1: Structure of the Readiness and Response Services Directorate

The group works in close collaboration with the Readiness Group, providing expertise to build response capability and supporting continuous improvement. Along with the Recovery and Pest Management Group, the Response Group helps to manage recovery or long-term management of biosecurity issues.

Manager of the Response Group David Hutchison says, "Since the creation of the Readiness and Response Services Directorate in December 2016, the Response Group has managed a range of high-profile responses including myrtle rust, *Bonamia ostrea* and *Mycoplasma bovis,* as well as dealing with lesser biosecurity issues. Responses often have a high profile and there is an increasing expectation from the public, industry and ministers of the crown that responses will be timely and effective. In support of this, the Response Group has a range of dedicated, highly qualified staff who have built response capability in biosecurity and incident management, with the aim of increasing stakeholder confidence in MPI."

The Recovery and Pest Management Group

This group leads collaborative actions among government, industry and the community to develop long-term management programmes for nationally significant pests. Our programmes also focus on management of the pathways of pest spread. This usually involves a combination of research, education, behavioural change and operational activities. The group also leads and oversees pest management systems for efficient use of resources.

Manager Recovery and Pest Management John Sanson says, "The Recovery and Pest Management Group's work programmes are built around collaboration and long-term partnerships.

We provide leadership on high-profile and high-risk issues that can't be solved by one group or organisation. We take a long-term, strategic approach to find solutions to complex issues. These may be issues that emerge from a recent response, or long-standing re-emerging issues that require further co-ordination, leadership or support. Current high-profile examples include the National Wilding Conifer Control Programme, kauri dieback management, the Clean, Check, Dry campaign for freshwater pests, and national responses to eradicate established highly invasive weeds."

Directorate highlights

Since the Group was formed in December 2016, we have made significant advances to ensure MPI is ready to respond to threats to biosecurity, food, trade and primary production. We have built on and leveraged the quality of the teams' knowledge, skills and experience to create a centre of excellence for MPI response leadership. We have done this by working co-operatively with our directorate, MPI and partners."

Other highlights have included:

- responding to three significant simultaneous biosecurity threats (myrtle rust, *Bonamia* and *Mycoplasma bovis*);
- implementing a system that enables MPI to identify its resources and response expertise;
- signing up four new industry partners to the GIA;
- signing two new Operational Agreements with GIA partners; and
- controlling more than a million hectares of wilding conifers in 14 priority areas during the first year of a national eradication programme.

For more information about the Readiness and Response Directorate and our work, see **http://mpi.govt.nz/protection-and-response/** and **http://www.gia.org.nz/**

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Korea-New Zealand 2nd Animal Health and Epidemiology Workshop, 13–15 September 2017

In March 2015 the Republic of Korea and New Zealand signed the Korea-New Zealand Free Trade Agreement (KNZFTA), which came into force on 20 December 2015. The agreement is a high-quality, comprehensive agreement that has significant commercial benefits to New Zealand exporters. It marks a milestone in the bilateral relationship and plays a critical role in the future development of trade and investment between our countries.

A key part is an Agriculture, Forestry and Fisheries Cooperation (AFFC) Chapter, which facilitates collaboration in these sectors across a range of activities, including training, postgraduate scholarships and workshops. Consequently it was agreed to hold four animal health and veterinary epidemiology workshops, with the objective of sharing expertise for mutual benefit. As previously reported in *Surveillance* (Watts, 2016), the inaugural KNZFTA Animal Health and Veterinary Workshop was held in Seoul, Korea, in April 2016. It was highly successful, with each country developing an understanding of the other's biosecurity systems and the establishment of collegial relationships.

Building on this success, in September 2017 the second workshop was convened in Wellington, at Pipitea Marae, Thorndon. A substantial amount of time had been invested by both New Zealand and Korea into the planning of this workshop to ensure that the programme would be of mutual benefit to both countries' participants (**Figure 1**).

Reflecting the success of the first workshop, and the value both countries place on this co-operative activity, Korea sent a large delegation consisting of 21 veterinary and animal health experts from the Korean Animal and Plant Quarantine Agency and other organisations. The New Zealand delegation was made up of 16 staff, largely from MPI and Ministry of Foreign Affairs and Trade (MFAT) but also included representatives from Epi-interactive and Beef and Lamb New Zealand. Additionally, during the two days a large number of representatives from industry and additional staff from MPI and MFAT joined the workshop, contributing to discussion and building relationships with the Korean delegation. The workshop consisted of two days of presentations from both countries and a third day consisting of a field trip to a number of farms.

The workshop provided an opportunity for the MPI Diagnostics and Surveillance Services (DSS) Directorate to showcase its developments and innovations over the 18 months since the last workshop. This included descriptions and examples detailing our incursion investigation process, the Surveillance Evaluation Framework (SurF) (see www.mpi.govt.nz/document-vault/18091), the Surveillance Information Management System (SIMS) and its accompanying analysis and reporting functionality, and the Standard Analysis for Disease Investigation (SADI). These presentations were all well received by the Korean delegation.

The Koreans presented on a number of very impressive initiatives including the Korean Animal Health Information System (KAHIS). This is an information management system used in responses to diseases such as foot-and-mouth disease (FMD) and avian influenza (AI). It provides the ability to track all vehicles that visit livestock premises, using GPS trackers installed in the vehicles. All outbreak-related data is stored in this system, enabling rapid analysis to be undertaken. Korea has extensive experience in managing outbreaks of FMD and AI, and there is a significant benefit to New Zealand in learning from their experience.

On the field trip we took the Koreans to the Wairarapa to demonstrate some of our high-welfare production systems, including a free-range pig farm, a sheep-and-beef farm, a deer farm and a dairy farm (**Figures 2–6**). All the farmers involved provided excellent examples of the high levels of welfare and stockmanship that typifies the New Zealand primary sector.

Benefits from the collaborative approach have already been realised with the attendance of three New Zealand representatives at the Global FMD Research Alliance Meeting in Seoul in October 2017. Thanks to the collegial relationships developed during these two workshops, the group was able to arrange additional meetings with Korean colleagues to further discuss areas of potential collaboration.

We are looking forward to continuing to work with our Korean colleagues in areas of common interest for the mutual benefit of both countries' biosecurity

Figure 1: Participants in the Korea-New Zealand 2nd Animal Health and Epidemiology Workshop at Pipitea Marae

Figure 2: Group photo at Longbush Pork

Figure 3: Inspecting sheep at Glen Eden Farms

Figure 4: Tony Robinson of Whistle Crossing Farm explains deer farming in NZ

Figure 5: The group visiting a milking shed at Rotopai Farms

systems. Over the coming months we will be in discussion with them to identify areas from this workshop that we can continue to work together on. The next workshop is scheduled to be hosted by Korea in 2018, with a further workshop in New Zealand in 2019.

MPI would like to thank the leader of the Korean delegation, Dr Suk Chan Jung, Director General of the Animal Disease Control Department, APQA, MAFRA, and Dr Hachung Yoon from the Korean Veterinary Epidemiology Division for her assistance in organising the event. We would also like to thank Naya Brangenberg, Jeremy Wilhelm at Longbush Pork, Mark Guscott at Glen Eden Farms Ltd, Tony Robinson at Whistle Crossing Farm and Stewart Weatherstone at Rotopai Farms Ltd.

Reference

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Quarterly report of diagnostic cases: July to September 2017

SVS Laboratories

Bovine

Owing to the wet winter combined with calving stresses and calves being housed for longer periods, a significant number of cases of **salmonellosis** were diagnosed in both dairy cows and calves. In the Waikato region the most common serovar was again ***Salmonella* Bovismorbificans**, while elsewhere ***S.* Typhimurium** and other less common serovars were isolated. In one significant outbreak in the Waikato, six post-calving dairy cows presented with acute, foetid diarrhoea and dehydration. One cow died. Faecal cultures from four cows yielded ***Salmonella* Typhimurium phage type 42**. A less common serovar, ***S.* Emek**, was isolated from a case in Whakatane involving diarrhoea and death of five calves among a group of two-day-old dairy calves. Faecal ELISA tests also revealed a concomitant ***E.coli* K99** infection. In Whangarei**, *S.* Typhimurium phage type 101** was cultured from the faeces of four 10-day-old calves and a recently calved cow, all with dysentery.

Multifactorial causes of diarrhoea in dairy calves were found in several cases. Twenty 1-month-old dairy calves in a mob of 80 in the Rotorua district had diarrhoea, and faecal cultures yielded ***Salmonella* Bovismorbificans**. Cryptosporidia were also seen on faecal examination, giving a multifactorial diagnosis of **salmonellosis** and **cryptosporidiosis.** In another case, in Southland, faecal cultures of 1-month-old dairy calves yielded ***S.* Typhimurium phage type 9** and faecal ELISA tests revealed concomitant **bovine rotavirus** infection.

In a case illustrating the zoonotic potential of **salmonellosis**, a farming family were all affected, including two calf handlers and a young child. ***Salmonella* Bovismorbificans** was isolated from the faeces of a group of 2-week-old dairy calves with profuse diarrhoea, two of which had died.

On a Waikato dairy farm, **salmonellosis** combined with **metabolic disease** was diagnosed in two recently calved cows with profuse diarrhoea. Faecal cultures yielded ***Salmonella* Bovismorbificans**. Serum biochemistry confirmed mineral imbalances, with elevated serum magnesium (1.93 mmol/L; reference range 0.49–1.15) and resultant low serum calcium (1.67 mmol/L; reference range 2.00–2.60). These imbalances were likely underlying causal factors associated with intestinal ileus.

Three dairy cows that died on a Matamata property had shown clinical signs of dark yellow urine, pale mucous membranes and diarrhoea. Haematology on one cow confirmed dehydration, with an HCT of 0.57 (reference range 0.24–0.40), resulting in urine concentration. There was no evidence of haemolysis or *Theileria* spp. ***Salmonella* Bovismorbificans** was isolated by faecal cultures. Hence the mucosal pallor was due to the systemic vascular effects of **salmonellosis**.

Spring eczema on a Gisborne property was suspected in a steer with a swollen face and elevated liver enzymes were found in biochemical tests performed in-clinic. The steer died and fixed tissues from a necropsy were submitted. Histopathology of the liver revealed a moderate cholangiohepatitis with a mixed portal inflammatory cell infiltrate including lymphocytes and neutrophils plus biliary epithelial cell swelling and bile duct hyperplasia. The causes of spring eczema are unknown but may include the effects on the liver of sporidesmin toxicity from the the previous season, exacerbated by the greater amounts of chlorophyll in spring grass.

A 2-year-old dairy heifer on a Whangarei property presented with inappetence and pale mucous membranes. Serum biochemistry revealed severe renal failure with azotemia (urea 127.8 mmol/L, reference range 2.7–12.3; creatinine 2 404 umol/L, reference range 55–130) and hyperphosphataemia (6.85 mmol/L; reference range 1.10–2.80) with resultant metabolic acidosis (bicarbonate 15.8 mmol/L, reference range 26–34; anion gap 59 mmol/L, reference range 18–24). The heifer died 3 days later. Histopathology of the enlarged right kidney revealed marked multifocal renal infarcts and thrombosis of a renal arcuate vessel. Underlying causes of **renal thromboembolism** are bacterial septicaemia or bacterial vegetative endocarditis.

A group of twelve 10-day-old dairy calves presented with colic and diarrhoea and were doing poorly. The calves had been administered NSAIDs and antibiotics. Four died over the course of 2 weeks and one was necropsied. Histopathology revealed severe ulceration and inflammation through the reticulum, omasum, rumen and abomasum. PAS stains confirmed numerous fungal hyphae in the rumen lesions. The underlying cause of the lesion was considered to be "rumen drinking" caused by **failure of the oesophageal groove to close**. This allowed highly fermentable milk to enter the rumen, causing ruminal acidosis and ulceration and providing a portal of entry for fungi. The NSAID treatment would have exacerbated the abomasal ulceration. Management changes were discussed, including reducing stress and providing *ad lib* access to water to prevent rumen drinking.

Several autumn-calving dairy cows on a Waikato dairy farm showed vague clinical signs of decreased production and slightly pale mucous membranes. Serum biochemistry showed high globulin (67 g/L; reference range 31–54), decreased albumin (18 g/L; reference range 25–40) and mild to moderate increases in liver enzymes (GLDH 47 U/L, reference range 8–41; GGT 106 U/L, reference range 1–36). Serology and faecal evaluation for liver fluke were negative. Two weeks later one cow deteriorated and was euthanased. On-farm necropsy revealed a severe pericarditis and liver abscesses. **Hardware disease** was diagnosed and investigation revealed the palm kernel expeller (PKE) supply was contaminated by numerous metal fragments. Owing to the wet winter and lower pasture growth during early spring, higher than usual

levels of PKE had been fed to these cows. Magnets are used to decrease metal contamination, but are not completely reliable. The effects of numerous small metal fragments are seen in multiple cows, and clinical signs are more chronic and insidious than seen in the usual causes of hardware disease.

Theileriosis was seen as early as August in the Opotiki region, when a first-calving dairy cow was examined after being reluctant to move. She had pale mucous membranes and tachycardia. Haematology revealed a marked regenerative anaemia with HCT 0.12 (reference range 0.24–0.40), reticulocytes 247 x 10^9/L (reference range < 1.0 x 10^9) and ***Theileria* spp.**, together with increased band neutrophils (0.6 x 10^9/L; reference range 0.0–0.2 x 10^9) in response to tissue hypoxia.

In another case of **theileriosis**, a 3-year-old dairy cow in the Whakatane district was lethargic, with pale mucous membranes and a racing pulse. Haematology revealed an HCT of 0.11 (reference range 0.24–0.40). No *Theileria* organisms were seen on the blood smear but a PCR test for ***Theileria orientalis* Ikeda** was positive.

Ovine

In Whangarei, 35 abortions in a mob of 170 hoggets that were not vaccinated against *Toxoplasma* or *Campylobacter* prompted submission of aborted placental and fetal tissues. Histopathology revealed lesions typical of **toxoplasmosis**, including placentitis of the cotyledons (with protozoal tachyzoites) and fetal encephalitis.

Caprine

Recurrent acute diarrhoea occurred among does aged 2 and 3 years in a Waikato dairy goat herd. Faecal cultures yielded ***Yersinia pseudotuberculosis***. Two goats died and fixed tissues were submitted for histopathology, which revealed typical intestinal crypt microabscessation and a chronic colitis. With the apparently acute onset of diarrhoea, this may suggest that subclinical **yersiniosis** had been present for some time.

Equine

A yearling Thoroughbred colt showed dullness, lethargy and diarrhoea. Faecal qPCR tests were positive for generic ***Salmonella*** and ***Lawsonia intracellularis***. Faecal cultures yielded a scant growth of a *Salmonella* sp. (after 72 hours' culturing), which is still undergoing full identification.

A one-month-old Thoroughbred foal with lymphadenopathy had an enlarged inguinal lymph node. Aspirated pus from the lymph node tested positive on qPCR for ***Rhodococcus equi*** with the virulence factor VapA gene.

Avian

Five 10-day-old broiler chicks from a commercial poultry farm were submitted for necropsy after an increase mortality rate was observed on the property. Gross findings included a diffuse fibrinous peritonitis, pleurisy and pericarditis. Cultures of these tissues yielded ***Proteus mirabilis*** and ***Escherichia coli*.** Contamination during the egg-incubation stage was the most likely cause.

Feline

A 4-year-old Devon Rex cat from the Coromandel area had chronic diarrhoea. ELISA tests of faeces for *Giardia* and *Cryptosporidium* were both positive. The zoonotic potential for handlers and owners was highlighted.

Canine

A 7-year-old entire female Heading Dog had a history of unilateral nasal discharge for 6 weeks. Cytology of the discharge showed septic inflammation and a PAS-stained smear was positive for fungal hyphae. Fungal cultures yielded an ***Aspergillus* sp.**, confirming a diagnosis of nasal **aspergillosis.**

A 10-year-old female Huntaway dog was dehydrated, depressed and had congested mucous membranes. In-clinic biochemistry indicated hepatic and renal disease. A serum sample submitted for *Leptospira* serology was positive for ***Leptospira*** IgM antibodies, confirming recent **leptospirosis**. A follow-up MAT showed a positive 1:200 titre for ***L.* Copenhageni**.

Gribbles Veterinary Pathology

Bovine

A 3-week old Friesian/Angus cross calf on a farm near Te Kuiti had a 2-day history of depression and mild diarrhoea, and also developed a large swelling in the neck at the site of an antibiotic injection. On examination the calf had pale mucous membranes and petechial haemorrhages. Haematology showed a severe anaemia (haematocrit 0.06; reference range 0.17–0.47), low white blood cell count (1.1 x 10^9/L; reference range 2.6–14.6 x 10^9), with only lymphocytes seen in the differential, and thrombocytopenia (platelet count < 10 x 10^9/L; reference range 190–940 x 10^9). This was consistent with a diagnosis of **bovine neonatal pancytopenia.** The calf had been fed colostrum from cows that had been vaccinated with the BVD vaccine PregSure® (Pfizer Animal Health) in 2010. Feeding calves with colostrum from cows vaccinated with this product has been shown to be a risk factor for the development of this syndrome (Benedictus *et al.* 2016; Kasonta *et al.* 2012; Benedictus *et al.* 2014). Three other calves had died with similar symptoms before this calf was presented.

A spring-calving Friesian dairy cow developed pallor and icterus after having been moved from Feilding to north of Auckland 3 months previously. A complete blood count showed anaemia (RBC 1.48 x 10^{12}/L; reference range 5–7.7 x 10^{12}) and haemoglobin was 32 g/L (reference range 85–130); haematocrit 0.09 (reference range 0.24–0.4) with macrocytosis (MCV 62 fL; reference range 38–56). There was also evidence of regeneration (absolute reticulocytes 88.8 x 10^9/L, reference range 0–1 x 10^9); 12 nRBC/100 leukocytes, reference range 0) and numerous ***Theileria*** organisms were present (130 per 1 000 RBC). Significant changes on biochemistry included increased bilirubin (87 µmol/L; reference range 0–8) and enzymes

including GGT (60 IU/L; reference range 3–47), GLDH (115 IU/L, reference range 5–35) and AST (176 IU/L; reference range 56–130), suggesting hypoxic liver damage related to the anaemia, which was probably due to **theileriosis**.

The Gribbles Christchurch laboratory recorded 46 isolates of ***Salmonella* Brandenburg** from cattle as of the end of September. Most of these isolates were from heifers that had rotten calves causing dystocia in late gestation. Farms typically had multiple heifers affected. Most cases were from mid-Canterbury but one was a heifer that aborted on a West Coast dairy farm. Other cases have been from calves and adult cows with diarrhoea, and, interestingly, two isolates were from milk samples from cows with mastitis. One of these cows was from a farm with abortions caused by *S.* Brandenburg and the other cow had watery milk in all four quarters.

Seventy animals died during an outbreak of **salmonellosis** on a Westland dairy farm. The affected cows showed severe diarrhoea and pyrexia. ***Salmonella* Bovismorbificans** was cultured from the faeces of six affected cows.

About 10 of 600 recently calved cows on a Southland farm showed clinical signs consistent with salmonellosis. No deaths were reported but ***Salmonella* Typhimurium phage type 42** was isolated from affected animals.

In another case, 30 of 800 cows were affected by clinical signs consistent with salmonellosis over a period of 7 days on a Southland farm. ***Salmonella* Brandenburg** was isolated.

Two Friesian cows from a herd near Auckland developed a bloody diarrhoea after calving and died. Four other cows from the same herd were also diarrhoeic, pyrexic and dehydrated. Faecal culture from one of these yielded ***Salmonella* Typhimurium phage type 101**, suggesting that the cattle were suffering from **salmonellosis**.

A 7-year-old Friesian cross in Mid-Canterbury had calved 5 days before she developed diarrhoea and became dehydrated. A faecal sample was cultured and yielded a heavy growth of ***Salmonella* Bovismorbificans.**

Clinical bovine mastitis was a common history in samples received at the laboratory in this period. In one example, a 2-year-old Friesian cross heifer in Mid-Canterbury had severe clinical mastitis in two quarters. Culture of the milk yielded a heavy pure growth of ***Staphylococcus aureus.***

In another example, milk samples were received from seven mixed-age cows with **clinical mastitis** on a dairy farm on the West Coast. Milk from four of the cows yielded ***Staphylococcus aureus,*** two had ***Streptococcus uberis*** isolated, and no bacteria could be isolated from one milk sample. These two organisms are the most common bacteria we see in bovine mastitis cases, though several other bacteria are also found, less frequently, in association with this condition.

As the calving season got underway during this period, cases of **calf diarrhoea** were commonly presented for laboratory investigation. In one case, both heifer calves and bull calves between 2 days and 2 weeks old on a Mid-Canterbury farm had loose faeces, but whereas the heifer calves remained bright and maintained hydration, a number of the bull calves became dull, inappetent and pyrexic, and one died. ELISA testing of faecal samples showed evidence of both **rotavirus** and ***Cryptosporidium* spp**. in both male and female calves. Faecal culture was negative in the females, but the males yielded ***Salmonella* Typhimurium phage type 56**.

Four out of ten 3-week-old Jersey cross calves from a herd near Auckland developed diarrhoea and died. Faecal testing of one showed growth of ***Salmonella* Bovismorbificans** and a positive ELISA for ***Cryptosporidium* spp**., indicating **combined salmonellosis and cryptosporidiosis**.

Three 2–3-week-old Speckle Park calves from Northland were diarrhoeic and depressed, with variable weight loss and ocular discharges. Two died and one was euthanased. Faecal testing showed positive results for **rotavirus** and ***Cryptosporidium* spp**. The calves were being treated intensively with housing, gut immune supplements, binders, oxytetracycline, meloxicam and halofuginone. At necropsy, the forestomachs of one calf contained watery fluid with clotted material. Histopathology revealed **acute mycotic reticulitis** with hyphal or yeast-shaped fungi infiltrating the squamous mucosa. Culture of stomach contents yielded ***Candida glabrata***. This was suspected to be an opportunistic infection secondary to stress, other intestinal infections and multiple antibiotic use. Histopathology of another calf revealed **cryptosporidiosis,** with ***Cryptosporidium*** organisms on atrophied villi in the small intestine.

A farm in the Waimate area reported conjunctivitis developing in 10-day-old calves. PCR was positive for **infectious bovine rhinotracheitis virus** (**bovine herpesvirus 1**).

A 1-year-old Friesian cross heifer developed a 5-cm lump on its head after disbudding as a calf. The mass was excised and submitted for histological examination, which revealed that the lesion was inflammatory and had club colonies typical of those produced in ***Actinobacillus lignieresi*** infection (**actinobacillosis**).

Two calves born during wet weather in the Canterbury region developed non-pruritic, crusty, flaky and bumpy skin papules around the muzzle, eyes, chest and dorsum. The calves were otherwise healthy and the skin lesions were not spreading to other in-contact calves. A methylene-blue-stained smear revealed large numbers of ***Dermatophilus congolensis*** organisms. Morphology of these is so characteristic that a strong presumptive diagnosis of **dermatophilosis** can be made on examination of smears alone.

On another farm in the Canterbury region, a rising-2-year-old bull developed lesions all over the head, trunk and legs that were present for 2–3 months, after which it became acutely ill and

was euthanased. Death was attributed to an acute bacterial fibrinopurulent peritonitis. However, the skin lesions were characteristic of **dermatophilosis,** with large numbers of these filamentous bacteria present.

Eight Angus heifers from different mobs on a Northland property aborted in close succession. Histopathology of kidney, spleen, heart, skeletal muscle, lung, liver and brain from one fetus showed multifocal interstitial nephritis. **Bovine viral diarrhoea virus** and ***Leptospira*** were detected on PCR of fetal stomach contents. Since interstitial nephritis is the most consistent lesion of **leptospiral abortion,** this was considered the top differential diagnosis, but a role for BVD in this case was not ruled out.

Three 2–3-week-old dairy calves from Northland died after 12–24 hours of anorexia, bellowing, circling, recumbency and convulsions. The calves were kept in an old calf shed and had access to a paddock which, on investigation, was found to contain an old car battery that had been grazed around. Necropsy of one calf was unremarkable apart from petechial haemorrhages in the thymus and abomasum and dark faecal staining around the anus. A sample of EDTA blood contained 1.79 mg/L of lead (toxic level > 0.5), indicative of **lead toxicity** and suggesting that the calves had ingested lead from the battery.

On a Central Otago beef farm, 15 of 250 yearlings on a paddock of kale were found dead one morning. The kale had been frosted and no baleage or other supplementary feed was being fed at the time. High levels of nitrate were found in the eye fluid from four of the dead animals and in samples of the kale, supporting a diagnosis of **acute nitrate toxicity**. Samples of kale growing on nearby paddocks and being fed to other mobs were also tested, but were negative for nitrate and there were no deaths in these mobs.

Ten of 120 yearling cattle on a Southland dairy farm were noticed to be lame in both hind legs 2 weeks after starting a new diet of crop and baleage. The feet below the pasterns were swollen. These findings are typical of **ergotism**. Examination of a sample of the baleage revealed 35 ergotised ryegrass seeds per 400 grams of baleage, supporting the diagnosis. During winter there were several reports of other outbreaks of ergotism from veterinarians throughout Otago and Southland, often with large numbers of cattle affected.

Ten 2-day-old calves died over a period of 2 weeks on a Southland dairy farm after developing a severe respiratory disease. Necropsy of one showed a severe **bronchopneumonia** and ***Mannheimia haemolytica*** was isolated from the lung. Pleural fluid from this calf was positive for **bovine viral diarrhoea** (BVD) virus on PCR testing, suggesting that this calf had likely been infected with BVD virus *in utero*, making it highly susceptible to other opportunist pathogens. BVD had previously been identified as a significant problem on this farm.

Three Otago farms reported multiple cases of **humeral fractures in copper-deficient dairy heifers** over the winter. The proportion of animals affected was generally low, for example six of 150 on one farm. Liver copper concentrations in the affected heifers were 15–26 umol/kg (adequate range > 120).

During an investigation of a sudden deaths in 2-day-old calves on an Otago dairy farm, a severe fibrinous pleuritis was seen in one calf that was necropsied and ***Bibersteinia trehalosi*** was isolated from the affected tissues. This bacterium is an opportunist pathogen and may have been part of a more complex aetiology. These calves may have been excessively stressed, as they were born on a wintering pad.

A pen of calves that were less than a week old on a Southland dairy farm developed ataxia and recumbency shortly after being fed milk from the farm's milking cows. They recovered after several hours. Older calves fed the same milk were unaffected. Blood alcohol levels taken from several affected calves three hours after feeding averaged 100 mmol/L (400 mg/100 ml), which is about eight times the legal limit for drivers in New Zealand, suggesting **alcohol toxicity**. On checking the tank where the milk was stored unrefrigerated, it was found that the tank had not been cleaned before new milk was added each day, so the milk had been fermenting and producing alcohol.

A rising-1-year-old Jersey heifer on a Rangitikei dairy farm was sick for 3–4 days and straining as if trying to pass something. Other animals in the mob were in suboptimal body condition. Examination of the affected heifer revealed severe diarrhoea. Necropsy showed intense reddening of the abomasum and jejunum. Histopathology showed moderate hyperplastic abomasitis with intralesional nematodes. The small intestine was disrupted by foci of necrosis and suppurative inflammation centred on large bacterial colonies. Culture of intestinal contents yielded a moderate growth of ***Yersinia pseudotuberculosis***. These findings were consistent with **concurrent ostertagiasis and yersiniosis.**

A 3-year-old Friesian cross cow died suddenly while grazing a kale crop on a Rotorua district dairy farm. The farmer had reported red urine (red-water) in another cow several weeks prior. No other cows were reported to be ill. Necropsy showed widespread serosal petechiae and an enhanced lobular pattern in the liver. Histopathology showed massive hepatocellular necrosis. An elevated kidney copper concentration (671 µmol/kg; reference range 0–167) confirmed **copper toxicity**. Possible sources of excess copper include palm kernel expeller, copper supplementation in the water supply, mineralised drenches, copper bullets and injections. Previous liver damage caused by sporidesmin or pyrrolizidine alkaloid toxicity increases the risk of excess hepatocellular copper accumulation.

A 5-month-old calf from the Waikato region presented with a 2-day history of diarrhoea followed by death. Histopathology revealed a necrotising enterocolitis and lymphoplasmacytic interstitial nephritis, and many

endothelial cells within these regions contained intranuclear inclusion bodies. These findings were consistent with **bovine adenovirus.**

Ovine

Acute, watery diarrhoea developed in six of 900 ewes on a North Canterbury farm. The animals were on a crop and being fed baleage. Samples from one affected ewe were received and a culture for *Salmonella* spp. was negative. Histologically, sections of the intestinal tract had typical lesions of **enteric listeriosis**. This disease is most often seen in the winter, associated with feeding poor-quality baleage or silage.

When a group of mixed-age adult halfbred ewes were checked one morning 2 days after starting to graze a paddock of new ryegrass, 22 were found dead and seven were recumbent. Blood samples were collected before the recumbent animals were treated with intravenous calcium and magnesium. Six of the seven animals quickly responded to this treatment. Tests on blood collected before treatment from five of the animals showed that although magnesium and beta-hydroxybutyrate results were all within normal reference ranges, calcium concentrations were all low (0.62–0.85 mmol/L; reference range 2–3), confirming the clinical suspicion of **hypocalcaemia**.

About a week before the planned start of lambing on a Mid-Canterbury sheep farm with 3 800 ewes, abortions began to occur. There were five abortions over 5 days among mixed-age ewes in several of the mobs. One ewe died and one was unwell, but the other three appeared clinically normal after aborting. The ewes had been vaccinated against *Toxoplasma* and *Campylobacter* as two-tooths and abortion epidemics had not been a problem previously on this farm. All the ewes were receiving baleage (assessed by the veterinarian as good quality) as well as a variety of crops (rape, kale, oats and turnips), grass and hay. No gross lesions were noted in the aborted fetus examined, and heart blood was negative for *Toxoplasma* antibody by latex agglutination testing, but culture of fetal lung yielded a heavy growth of ***Listeria ivonovii***, supporting a diagnosis of ***Listeria ivonovii*** **abortion.**

When a group of two-tooth ewes began to abort on a mid-Canterbury farm, a number of fresh and formalin-fixed samples were submitted to the laboratory. Histological examination of placenta from two animals showed multifocal cotyledonary necrosis and mineralisation with intralesional protozoa. In the fetal brain there were foci of malacia in the corona radiata. The lesions were considered typical for ***Toxoplasma*** **spp. abortion.** *Toxoplasma* antibody latex agglutination tests were positive on the heart blood or thoracic fluid of six aborted lambs. High *Toxoplasma* antibody titres were also found in serum from the ewes that had aborted.

Ovine abortion due to *Campylobacter fetus* ssp. *fetus* was a common diagnosis in this period. In one example, six mature ewes from a flock of 100 in Mid-Canterbury aborted and multiple pale yellow 2–3-mm foci were seen on one placenta. The ewes were not vaccinated against *C. fetus* ssp. *fetus.* This organism was isolated from the stomach contents of two of the aborted lambs.

Ewe hoggets grazing fodder beet tops on a sheep farm in Southland developed very large goitres of the thyroid glands. These became smaller after a mineralised drench was given. Ten days later an affected hogget was necropsied and the thyroid removed and fixed in formalin. It weighed 130 g (normal size < 5). Histopathological examination of the fixed thyroid was consistent with a **colloid goitre.** These commonly develop after an animal with a goitre has been given iodine treatment.

Salmonella **Hindmarsh** was isolated in a spate of sudden deaths among multiple-bearing ewes on a sheep station in the Gisborne region. About 20 of 500 ewes died suddenly after yarding, shearing and scanning. Grossly, small quantities of khaki-coloured diarrhoea were noted in the intestines. The livers of some affected ewes had pale spots within the capsule and parenchyma. Histology showed fibrinosuppurative inflammation in the intestine. Culture of intestinal contents from two ewes produced moderate growth of *Salmonella* spp., one of which was confirmed as *S.* Hindmarsh through further testing.

A sheep dairy farm with 700 ewe hoggets reported nine hogget deaths over a 3-day period. The hoggets had arrived 2–4 weeks previously and were grazing unfertilised ryegrass pasture. Three were necropsied, and all had blue-black renal cortices and port-wine-coloured urine. Tissues from one animal were processed for histopathology. There was diffuse centrilobular hepatocellular necrosis, mild non-suppurative interstitial nephritis with intratubular haemoglobin, diffuse pulmonary oedema and neutrophilic interstitial pneumonia. These lesions were considered consistent with **leptospirosis.** The diagnosis was confirmed by PCR detection of pathogenic leptospires from the urine of one of the hoggets.

Equine

A mare on a North Canterbury farm aborted and samples of fixed fetal tissue submitted to the laboratory revealed oedema of the lung with intranuclear inclusions in bronchiolar epithelial cells and scattered syncytial bronchiolar epithelial cells. These findings are typical of **equine herpesvirus abortion**.

A 4-year-old Welsh pony cross mare was among a group of horses in the Canterbury region that were rescued by a welfare organisation. In March 2017 she had a slight neutrophilia (8.8 x 10^9/L; reference range 2.7–6.7), albumin was low at 24 g/L (reference range 27–39), globulin was elevated at 56 g/L (reference range 21–39) and CK was 417 IU/L (reference range 0–312). A faecal egg count in May revealed 50 strongyle eggs per gram of faeces. In June she was not gaining weight as well as the other rescued horses and had "cow pie" faeces. She had 200 strongyle eggs per gram of faeces and no cyathostome larvae were seen. In mid-July she presented off-feed with a painful mouth. Food would fall out of her mouth. The masseter muscles were painful and her mouth could only be opened a small way without pain.

The faeces were normal. CBC revealed a mild neutrophilia (12.9 x 10^9/L), mild eosinophilia (1.8 x 10^9/L; reference range 0–0.8 x 10^9) and increased fibrinogen at 8 g/L (reference range 1–4). Albumin had fallen to 19 g/L, globulins increased to 62 g/L, CK was markedly elevated at 20 008 IU/L, and AST was 7 535 IU/L (reference range 0–590). Two days later the eosinophil count was 6.2 x 10^9/L, neutrophil count 10.6 x 10^9/L, fibrinogen 6 g/L, albumin 17 g/L and globulins were 55 g/L. CK and AST had decreased significantly but were still elevated (6 949 IU/L and 6 637 IU/L respectively). A masseter muscle biopsy showed acute to subacute necrosis with myofibre loss. Treatment with oral prednisolone resulted in great clinical improvement. By mid-August she had a neutrophil count of 8.9 x 10^9/L but a still rising eosinophil count of 11.3 x 10^9/L. Blood selenium was low at 280 nmol/L (reference range 1 600–3 200) and faecal examination was negative for both strongyle eggs and cyathostome larvae. However, 4 days later she was found dead with about 5–10 L of black/red abdominal fluid. The jejunum and ileum were black/red and swollen; the kidneys were swollen with adhesions, and the cardiac musculature had white streaking. Histopathology showed marked eosinophilic colitis with intralesional strongyle nematodes consistent with **cyathostomes**. There was steatitis of the fat within the intestinal submucosa and around the kidney and mesentery, moderate subacute to chronic myocardial loss and fibrosis in the myocardium, and mild myodegeneration, regeneration and subtle mixed inflammation in the masseter muscle. The cause of death was thought to be the acute small intestinal lesion and suspected **intestinal necrosis**. The large intestine had a significant cyathostome burden even though faecal examination had been negative on two occasions. **Selenium deficiency** may have contributed to the muscle lesions and steatitis. The demise of this horse was likely to have been multifactorial, involving parasitism and poor nutrition.

An 11-year-old Miniature horse from Northland had intermittent laminitis. Blood testing while the horse was on a grass diet showed mild hyperglycaemia of 6.7 mmol/L (reference range 4.1–6.3) and markedly increased serum insulin of > 300 mIU/L (> 20 in a fasted individual is considered to indicate insulin resistance). These findings were consistent with **equine metabolic syndrome**.

Feline

A cat of unknown age from North Otago with a history of chronic diarrhoea failed to improve with changing diet. Culture of a faecal sample was negative for *Campylobacter* spp. and *Salmonella* spp. and ELISA tests for *Giardia* spp. and *Cryptosporidia* spp. were also negative. A faecal egg count showed that there were 1 450 **ascarid** eggs per gram of faeces, suggesting **clinical parasitism** was likely to be significantly contributing to the diarrhoea. This is a relatively uncommon laboratory finding.

A 6-month-old Birman cross cat from Mid-Canterbury with chronic diarrhoea was described as "gassy and explosive" by the veterinarian and a faecal sample was positive for ***Giardia* spp**. on ELISA testing.

In another case of feline diarrhoea, a 10-month-old Ocicat from North Canterbury had negative faecal ELISA test results for *Giardia* spp. and *Cryptosporidia* spp., and a faecal egg count was negative. However, ***Salmonella* Typhimurium phage type 56** was isolated on faecal culture. The cat was from a rural area and had presented with a very acute onset diarrhoea, anorexia and pyrexia. This type of *Salmonella* species is moderately common in both humans and a variety of animal species in New Zealand.

A 5-week-old Domestic Shorthair kitten from Auckland had chronic diarrhoea that did not respond to empirical treatment with fenbendazole or a diet change. Faecal testing showed a weak positive result for *Cryptosporidium* spp. on ELISA, and *Tritrichomonas foetus* was also detected by PCR, indicating combined **cryptosporidiosis and trichomoniasis**.

A one-year-old Ragdoll cat from the New Plymouth area developed multiple cutaneous lumps on the face after a suspected cat fight. Two lesions were biopsied and submitted for histopathology. Both had similar nodular coalescing aggregates of epithelioid macrophages and mixed inflammatory cells within the dermis and subcutis. Application of a Ziehl-Neelsen stain to the tissue revealed multiple slender acid-fast bacilli, confirming a diagnosis of **cutaneous mycobacteriosis** (feline leprosy).

Canine

A 20-month-old dog with a history of chronic ulcerative plasmacytic nasal dermatitis had been on long-term treatment with antibiotics. The dog's owner was diagnosed with a methicillin-resistant *Staphylococcus aureus* (MRSA) infection, so a swab from the dog's nose was collected and it tested positive for this organism. Sensitivity testing also showed that the isolate was resistant to cefoxitin, indicating that it was likely a **methicillin-resistant strain of *Staphylococcus aureus***.

A three-year-old Miniature Dachshund from an urban area in Mid-Canterbury presented with vomiting and diarrhoea. The dog had been fed a raw food diet. ***Salmonella* Brandenburg** was isolated from a sample of faeces. Although this species is commonly seen in ruminants, it is only rarely isolated from companion animals.

A 5-year-old male Border Collie from the Canterbury region was suspected to have developed Fanconi's syndrome subsequent to **leptospirosis**. It had a 2-week history of polyuria and polydipsia, weight loss and cystitis. There was marked glucosuria but blood glucose was normal. Urine was isosthenuric on several consecutive samples and contained protein. The kidneys were described as abnormal on ultrasound. Serum creatinine was mildly elevated (142 umol/L; reference range 48–109) and bicarbonate mildly decreased (15 nmol/L; reference range 18–27). MAT testing revealed a titre

of > 1:1600 for ***Leptospira* Tarassovi**, 1:100 for ***Leptospira* Copenhageni** and was negative for serovars Pomona and Hardjo. One month later the dog was reported to have greatly improved after treatment for **leptospirosis.** Creatinine had decreased to 113 umol/L (almost normal). Unfortunately *Leptospira* spp. serology testing was not repeated to determine whether an active infection may have been present.

A 1-year-old Shar Pei from Auckland presented with severe mange of several weeks' duration, a poor body condition score (2/9) and melaena. Faecal testing yielded a weak positive on ***Cryptosporidium*** ELISA and there were 2 600 ascarid eggs per gram of faeces. There was a mild non-regenerative anaemia (haemoglobin 116 g/L; reference range 120–180), an inflammatory leukogram with neutrophils 16 x 10^9/L (reference range 3.6–11.5) and mildly increased BUN, reflecting gastrointestinal haemorrhage (16.8 mmol/L; reference range 2.5–9). Combined **cryptosporidiosis and nematode parasitism** was diagnosed.

A four-year-old Greyhound from Waikato became anorexic and was found recumbent with marked icterus two days later. The dog was subsequently euthanased. At post-mortem examination icterus was confirmed, along with multifocal haemorrhages within the gastrointestinal tract, lungs, epicardium, renal capsules and retroperitoneal space. PCR on urine was positive for ***Leptospira* spp.** Histopathology showed haemorrhages in multiple organs, multifocal renal tubular necrosis and regeneration, and hepatocyte dissociation with mitotic activity, typical of **leptospirosis**.

A 7-year-old male neutered Maltese Terrier cross in Taranaki presented with itchy skin, bilateral hindlimb paresis and luxating patellas. Non-steroidal anti-inflammatories were prescribed for presumed degenerative joint disease. Over the next few days the dog developed weakness, intention tremor and intermittent *petit mal* seizures. Treatment included sedation, antibiotics, fluid therapy and dexamethasone but despite an apparent improvement overnight the dog died the following day. Tissues were collected at necropsy for histopathology. There was severe chronic diffuse lymphoplasmacytic and granulomatous meningoencephalitis with oedema and astrogliosis. The nature and distribution of the lesions was consistent with **granulomatous meningoencephalomyelitis (GME)**, a sporadic disease of the CNS of predominantly young-to-middle-aged small-breed dogs. The aetiology is unknown. Several infectious agents have been investigated but none confirmed. Immunohistochemical studies showing many CD3+ T lymphocytes and MHC II macrophages suggest an immune-mediated disorder.

Caprine

In a herd of 300 Saanen goats from Northland, some were diarrhoeic. Ten kids had died and 11 more were also showing neurological signs including seizuring and recumbency. Post-mortem examination of one 6-week-old kid showed a purulent meningeal exudate. Histopathology confirmed a cerebral abscess containing Gram-positive bacteria, and ***Streptococcus oralis*** was cultured from the site, indicating a **streptococcal meningoencephalitis**, probably caused by septicaemia although the underlying cause was not identified.

Camelid

A 9-year-old llama from near Auckland was bright and alert but had an inguinal mass, and oedema of the associated hind limb. Histopathology of biopsies from the mass demonstrated aggregates of small lymphocytes, neutrophils and proliferating lymphoid mononuclear cells in association with necrosis, haemorrhage and oedema. The diagnosis was **lymphoma**. This may be the most common form of neoplasia in camelids; it occurs most commonly as a multicentric disease involving the abdominal cavity, thoracic cavity or peripheral lymph nodes.

Cervine

Two cases of **malignant catarrhal fever** (MCF) were seen at the Gribbles Palmerston North laboratory in red deer during this winter period. In one case, a valuable red stag from a Ruapehu farm was off-colour and anorexic and was found dead the following day. It was in good body condition and had blood coming from the nose and rectum. Multiple tissue samples were collected at necropsy. Histology revealed lymphoplasmacytic vasculitis and perivascular inflammation in brain, heart, lung, liver and kidney, compatible with the effects of **ovine herpesvirus type 2**.

Another case occurred in a five-year-old red stag from a herd of 100 in Central Hawke's Bay. The stag lost weight over several days before being found dead. Lymphoplasmacytic and necrotising arteritis was seen in the kidney, heart, lymph node and intestine, confirming the diagnosis. MCF in deer has a seasonal peak in winter. Stressors such as transport, feed change, and concurrent disease may contribute to susceptibility.

Porcine

Four 10-week-old piglets on a small lifestyle farm in Otago were found dead 2 days after purchase. Examination of the pen they were housed in revealed that they had been drinking water from a container that had previously contained monensin. Necropsy of one piglet showed no gross lesions but histopathological examination of the skeletal muscle showed a severe myopathy consistent with **monensin toxicity.**

All six recently-purchased 8-week-old piglets on a small lifestyle farm in Otago died. They exhibited diarrhoea and pyrexia before death. ***Salmonella* Typhimurium** was isolated from the faeces of one of the affected piglets.

Avian

A kakariki (*Cyanoramphus* sp.) of unknown age from the Nelson region suddenly died. The bird was in good body condition. Necropsy revealed multiple small yellow nodules in the liver,

so **yersiniosis** was suspected. A Gram stain of liver tissue showed large numbers of Gram-negative rods and ***Yersinia pseudotuberculosis*** was isolated in heavy growth, confirming the diagnosis.

Yersinia pseudotuberculosis infection was also the diagnosis when eight of 200 canaries died on a Mid-Canterbury property. Initially feed contamination was suspected but deaths continued after the suspect feed was withdrawn and necropsy revealed small granulomata on the liver and spleen. *Y. pseudotuberculosis* was isolated in heavy growth from two samples of tissue.

On another property in Canterbury 60 canaries died over a period of 3 months, despite a trial of treatment with tetracycline in the drinking water. A dead bird was submitted to the laboratory for necropsy. Its keel was slightly prominent. There was almost no food in the proventriculus or gizzard. The liver and lungs were grossly normal but the spleen was massively enlarged and dark red, suggesting either a hematopoietic tumour, a protozoal infection or a bacterial infection. Imprints of the spleen and liver revealed large numbers of rod-shaped bacteria, both free and within large mononuclear cells. Culture of the liver yielded a heavy growth of ***Salmonella*** **Typhimurium phage type 1.**

Piscine

About 20 rainbow and brown trout of varying ages developed whitish ulcerated skin lesions along the dorsum. The fish were being held in a rearing pond in the Hawke's Bay region. There were no reported changes to the water supply or feeding regime, the only change being the recent arrival of a black swan on the pond. Wet preparations of the lesions and gills did not reveal any protozoa, fungi or flukes. Several fish were sacrificed for sampling and lesions were submitted for histopathology. Significant findings were ulcerative dermatitis, particularly around the dorsal fin and tail, and proliferative and necrotising branchitis. Gram staining revealed numerous slender Gram-negative rods within the lesions. These findings confirmed a diagnosis of **bacterial skin disease.** While culture was not attempted, the lesions were considered compatible with disease caused by *Flavobacterium spp.* (e.g., cold water disease, peduncle disease), among other pathogens.

New Zealand Veterinary Pathology

Bovine

Two calves on a property in the Tokoroa district died suddenly. Tissues from one 6-day-old calf were submitted after a necropsy. Examination of the small intestine revealed numerous cryptosporida along the brush border of the intestine, accompanied by numerous aggregates of small bacilli that were accumulating or lining up along the brush border of the villi. **Cryptosporidiosis**, likely complicated by the presence of **enterotoxigenic *E. coli***, was diagnosed. The calf also had evidence of a bronchointerstitial and suppurative pneumonia, which would have contributed to the mortality. Additional testing was not performed on the fresh tissues that were submitted. An ELISA is available to detect the presence of K99 antigen in faeces, but after 6 days of age it is frequently negative owing to the presence of antibodies.

Two faecal samples were submitted from a group of calves in the Bay of Plenty that had diarrhoea. A faint positive result was seen when the faeces were tested in-house by the submitting veterinarian. *Salmonella* culture revealed that one calf was positive for ***Salmonella*** **Lexington**, which has previously been detected in cattle in New Zealand, but is relatively unusual. However, clinically the behaviour of *S.* Lexington is similar to that of other serovars, causing severe diarrhoea that is sometimes accompanied by sepsis and death.

A single steer on a property in Taupo was recumbent. There were signs that it had been eating ashes from where preserved timber had been burned. The animal had a haemorrhagic abomasal mucosa, watery diarrhoea and grey-green, ashy rumenal contents. Massive amounts of arsenic (3 400 mg/kg) were found on analysis of the abomasal contents, and significant amounts of copper and chromium were also present. These elements are common components of wood preservative, and death was considered to be the result of **acute arsenic toxicity** caused by ingesting the ashes.

Salmonella **Bovismorbificans** was a common isolate from diarrhoeic calves this spring. In a typical case, a group of 1–2-week-old dairy calves in the Kaitaia district exhibited scour. Samples from four animals were submitted. Two were positive for rotavirus and a further animal was positive for coronavirus on faecal antigen ELISA. *S.* Bovismorbificans was isolated from all four calves. Other common isolates of *Salmonella* associated with calves in the spring were ***S.*** **Tymphimurium** and ***S.*** **Brandenburg**, frequently present in herds in combination with coronavirus, rotavirus and cryptosporidia.

A mature dairy cow in the Waikato district had marked respiratory stertor originating from the larynx. The cow was treated twice with antibiotics and NSAIDS and appeared to improve, but later developed more severe respiratory distress with marked submandibular lymphadenopathy. Biopsy of the inflamed tissue revealed a chronic pyogranuomatous inflammation with numerous club colonies, consistent with infection by ***Actinobacillus ligneresii***, the causative agent of **woody tongue**. While woody tongue classically involves the tongue, it is not infrequent to see it involving other soft tissues around the head and neck.

A 3-week-old calf in the Buller district was covered in scabby skin lesions that could be peeled off to reveal reddened, inflamed skin. Gram staining of exudate from beneath the scabs revealed organisms consistent with ***Dermatophilus congoliensis***, the causative agent of **rain scald.**

A mature dairy cow in the Waitomo

district had chronic mastitis that had previously been treated with amoxycillin/clavaulanic acid and oxytetracycline. A milk sample was taken and frozen, then the cow was treated with tylosin, to no effect. Culture of the frozen milk sample revealed ***Trueperella pyogenes***, which frequently forms large abcesses within the udder. This makes it difficult to achieve effective antibiotic concentrations at the site of infection, allowing infection to persist.

A 6-week-old calf in the Canterbury region had severe respiratory distress, with large areas of suppurative inflammation visible in the lungs on postmortem. Culture of the lung yielded a heavy growth of ***Trueperella pyogenes***. Histology revealed a subacute suppurative and necrotising bronchopneumonia with scattered multinucleate giant cells. **Infection by bovine respiratory syncytial virus (BRSV) with secondary bacterial pneumonia** was suspected. BRSV is an uncommon cause of respiratory disease in calves in New Zealand, but does tend to occur in small outbreaks.

Four mature dairy cows in the Waikato region died overnight on a swampy paddock with ***Poa aquatica*** **(swamp grass)**. Analysis of rumen fluid from one animal revealed the presence of cyanide, suggesting that the animals had ingested enough of this toxic plant to result in **cyanide toxicosis**.

Five dairy heifers out of a group of 90 animals in the Waikato region had spontaneous humeral fractures after calving. Serum copper levels in two of three animals tested were markedly decreased (3.1–4.6 umol/L; reference range 8–20), indicating severe depletion of copper stores and **copper deficiency**. Copper forms an essential part of lysyl oxidase, an enzyme important in the cross-linkage of collagen. Inadequately cross-linked collagen causes the formation of weakened bone, which is predisposed to fracture.

Three animals out of a dairy herd in the Rotorua district aborted. Serum samples were submitted from all three and an aborted fetus was also submitted. Bovine viral diarrhoea (BVD) virus antigen tests and *Neospora* antibody ELISA on the sera were negative, but BVD antigen ELISA testing on an ear punch from the aborted fetus was positive, suggesting that **bovine viral diarrhoea** was likely the cause of the abortion. While BVD is acknowledged to be an important cause of early embryonic death and abortion, most abortions occur relatively early in gestation and may not be detected. Late-gestation abortions often involve feti that would (if they had survived gestation) have been born persistently infected. These animals are typically antigen-positive on ELISA testing.

In another incident in the Rotorua district, tissues from an aborted fetus were submitted for histology and microbiology. Histology revealed a severe suppurative fetal pneumonia, and on this basis microbiology was actioned, resulting in the isolation of ***Trueperella pyogenes*** from the fetal stomach contents. This suggests that the cause of the abortion was a **placentitis** caused by *Trueperella pyogenes*, causing fetal pneumonia. Placentitis in cows is typically the result of bacteraemia.

A yearling heifer in the Taupo area had marked scouring, loss of condition and recumbency. On postmortem it had low fat reserves and an inflamed gut with marked thickening of the ileum. Tissues were submitted for histopathology, and microscopic examination revealed an acute bacterial enteritis with numerous small colonies of short rods lining the affected areas of small intestine. ***Yersinia pseudotuberculosis*** was cultured, confirming **enteric yersiniosis**.

A group of yearling cattle in the Auckland region had a history of poor condition. They had no scour and the parasite drench regime was considered good by the submitting veterinarian. Serum copper and vitamin B12 values were normal, but glutathione peroxidase testing on EDTA revealed levels of less than 1 000 IU/L (reference range 2 000–25 000), suggesting clinically significant **selenium deficiency**. Selenium is an important part of the enzyme glutathione peroxidase, which is expressed in the cytoplasm of many mammalian cells, including red blood cells. Decreased levels of glutathione peroxidase activity are characteristic of selenium deficiency, and persist for up to three months (the halflife of mammalian red blood cells).

A 2-year-old Galloway beef cow in Invercargill had multiple soft circular cutaneous lesions on its left hind leg, extending from the hock to the stifle. Punch biopsies of the affected tissue revealed a marked pyogranulomatous dermatitis with intralesional club colonies typical of an *Actinobacillus* or *Actinomyces* species. Staining revealed that the club colonies were Gram negative, consistent with infection by ***Actinobacillus ligneresii***. This bacterium is the causative agent of **woody tongue**, but similar infections can occur at other soft-tissue sites.

A yearling bull in Taupo exhibited a sudden loss in condition in July despite having been drenched in May with a macrocyclic lactone/levamisole combination plus vitamin B12/selenium. The animal had a moderate hypoproteinemia with hypoalbuminemia. A postmortem was performed. Histologic examination of samples revealed marked abomasal mucosal hyperplasia with numerous gastric glands containing cross-sections of nematodes, consistent with **ostertagiasis**.

A herd of 400 dairy cattle had 18 abortions in late pregnancy. Cows that were pregnant when scanned in late March were found to be empty in July, but no abortions had been observed. Bulk tank milk BVD antibody levels on this property were historically low, and this was corroborated by testing of six empty cows, only one of which had a positive antibody titre. However, testing of three aborted animals for *Neopora* revealed that two had a positive titre, suggesting that ***Neospora caninum*** may have had a role in the abortions described.

Ovine

A one-week-old lamb from a 400-head dairy sheep operation in Taupo exhibited respiratory signs and died. Necropsy

performed by the submitting veterinarian revealed a fibrinous bronchopneumonia and culture confirmed the presence of ***Pasteurella multocida.***

A 400-head ewe mob in Nelson had problems with about 2 percent of ewes aborting and some neonatal losses. The mob was not vaccinated for toxoplasmosis or campylobacteriosis. An aborted lamb submitted for necropsy showed evidence of mild goitre, suggesting a degree of iodine deficiency. In addition, numerous *Campylobacter* organisms were visible when a stained smear of stomach contents was examined microscopically, suggesting that ***Campylobacter fetus* ssp. *fetus*** was the likely cause of the **abortion**.
About 10 abortions occurred among brought-in mature ewes on a property in Carterton. A smear of stomach contents from one of the aborted fetuses was examined microscopically and contained organisms consistent with ***Campylobacter fetus* ssp. *fetus***. This finding was confirmed by isolation of this organism from an enrichment culture. **Abortion** caused by *C. fetus* ssp. *fetus* was confirmed.

A sheep property in Carterton showed a high rate of dry ewes among two-tooths on scanning, with many showing signs of reabsorption or abortion. Two mobs were 27 percent and 14 percent dry, whereas the rate among mature ewes was only 3 percent. Two two-tooth ewes were autopsied and pregnant/aborting uteri were submitted. There was fetal death and gross evidence of **endometritis**. Testing for *Campylobacter* was negative, but one of the aborted feti was positive on a screen for *Toxoplasma* antibodies, suggesting that ***Toxoplasma gondii*** was an important contributor to the reproductive problems on this property.

Caprine

A goat at a research facility in the Waikato had nervous disease, with circling and a head-tilt. Other animals were not affected. The goat was euthanased and histology revealed the presence of a chronic lymphocytic encephalitis with extensive perivascular cuffing and areas of necrosis with gitter cell formation. **Listeriosis** was diagnosed.

Equine

A month-old Thoroughbred foal in the Waikato had an acute onset of ataxia, with a stretched neck. Haematology by the referring veterinarian revealed elevated white blood cells and serum amyloid A. Gross and histologic examination of the brain and spinal cord did not reveal any lesion that would explain the clinical signs. However, the foal had **multifocal hepatic necrosis** and suppurative inflammation consistent with **bacteraemia/septicaemia.**

A young horse in Papakura had evidence of hypoproteinemia and weight loss. Faeces were submitted for PCR for ***Lawsonia intracellularis***, which was positive**. Proliferative enteropathy caused by *Lawsonia*** was diagnosed.

Alpaca

An alpaca cria from a group of five in the Southern Lakes district appeared depressed and recumbent much of the time. Clinical examination revealed that vital signs were normal but the cria was in poor body condition. Blood chemistry revealed a marked hypophosphataemia (0.49 mmol/L; reference range 1.90–3.40). **Hypophosphataemic rickets** is not uncommon in alpacas and is considered to be the result of vitamin D deficiency in most cases. Vitamin D deficiency is seasonal and is believed to be the result of insufficient sunlight exposure during winter. It tends to be more common in heavily fleeced, dark-coloured animals, which appear to have lower endogenous cholecalciferol (vitamin D3) production. (Judson *et al.*, 2008).

Porcine

Four piglets out of a litter of eight on a free-range property in the Waikato district died at about 3 weeks of age. The piglets were from a sow that was newly introduced to the property and was in quarantine. Histology on two of the piglets was performed. One animal had large regions of coalescing hepatic necrosis, with proliferation of reticuloendothelial cells in the spleen. Occasional large multinucleate giant cells were present in the spleen, and rare macrophages contained large botryoid intracytoplasmic inclusion bodies, typical of **porcine circovirus 2**. The same piglet also had a severe ulcerative enteritis with thrombosis, consistent with bacterial enteritis (most likely salmonellosis). Both piglets also had a severe interstitial pneumonia. **Postweaning multisystemic wasting disease (PMWS)** complicated by **bacterial enteritis (likely salmonellosis)** was diagnosed on the basis of histology. Since the affected litter was still in quarantine, the remainder of the litter and the sow were euthanased.

Feline

A 1-year-old domestic cat in Lower Hutt had been lethargic for two days, with inappetence and vomiting. The cat was pyrexic, with a temperature of 40.1°C, and had diarrhoea with blood and mucus. A faecal sample was submitted for parasitology and microbiology. ***Salmonella* Tymphimurium phage type 101** was isolated, suggesting that **salmonellosis** was the cause of the clinical signs.

Poultry

On a property in Nelson, 450 layers died over a period of 10 days on a property that housed 9 000 birds. Necropsy performed on seven of the dead birds by the submitter revealed a range of lesions including oophoritis and enlarged spleens, and pneumonia was seen in one bird. Spleen and lung samples were submitted for culture. Culture of the spleen revealed no significant isolates, but the lung yielded a heavy growth of ***Pasteurella multocida***, suggesting that this was the organism responsible for the deaths. **Fowl cholera** caused by *P. multocida* occurs sporadically in New Zealand but vaccines are available to help prevent outbreaks.

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Quarterly report of investigations of suspected exotic diseases

Exotic disease investigations are managed and reported by MPI Diagnostic and Surveillance Services Directorate, Wallaceville. The following is a summary of investigations of suspected exotic disease during the period from July to September 2017.

Exotic vesicular diseases ruled out

A farm veterinarian called the MPI exotic pest and disease hotline to discuss oral lesions found in three of eight poorer-doing 11-month-old heifers from a mob of 50. A digital picture forwarded by the veterinarian showed a lesion that was vesicular in appearance. The Initial Investigating Veterinarian (IIV) system was activated and an IIV attended the farm with the farm veterinarian. There was no history of lameness or salivation, and after observation and/or examination of the 50 heifers and observation of another 120 heifers on the property, vesicular disease was ruled out. Oral lesions appeared consistent with bovine papular stomatitis and this was subsequently confirmed on histopathology on a biopsy sample.

Anaemia in cattle investigated

In late autumn a veterinary clinical pathologist called the MPI exotic pest and disease hotline to discuss a submission from a spring-calving dairy herd of 500 cows, two of which presented with severe anaemia. Haematological examination confirmed a regenerative anaemia. A haemorrhagic cause had been ruled out on clinical examination. The endemic differential *Theileria orientalis* Ikeda type had been ruled out by the clinical pathologist, based on blood smear examination and PCR testing. Endemic bovine haemoplasmas that can play a role in outbreaks of anaemia (McFadden *et al.*, 2016) were ruled out by tests at the MPI Animal Health Laboratory (AHL), Wallaceville. While the original blood smear examination did not identify any exotic blood parasites, confirmatory testing was conducted to rule out exotic differentials. *Babesia* spp. and exotic *Theileria* were ruled out by a generic piroplasm PCR run at the AHL. Anaplasmosis was ruled out by cELISA and PCR testing subcontracted to an overseas laboratory. As a result the exotic disease investigation was closed, but investigation of other potential endemic causes (Parkinson *et al.*, 2010) continues.

Akabane virus and bluetongue virus ruled out

A veterinary pathologist called the MPI exotic pest and disease hotline to discuss a submission received from a veterinary practitioner. The farm vet had submitted sera for bovine virual diarrhoea virus (BVDV) antibody testing from six of 60 mixed-age cows and heifers from a Marlborough beef herd. The six cows had all delivered calves with hydrocephalus in the previous calving season. This is usually a sporadic presentation and its occurrence in six animals merited investigation. BVDV is an endemic differential. Exotic differentials include Akabane virus and bluetongue virus. BVDV was excluded by testing at the commercial pathology laboratory and sera submitted to the AHL enabled the exotic differentials to be ruled out by ELISA testing.

Exotic mycoplasmas excluded

A veterinary pathologist notified MPI of an outbreak of coughing that had commenced shortly after yarding among about 1 000 of 3 000 hoggets. The hoggets were not otherwise ill except for a slight decrease in expected weight gain. A single animal sacrificed prior to notification had microscopic lesions including lymphoplasmacytic cuffing of airways, indicating chronic airway inflammation. Agents known to cause this include *Mycoplasma* spp. Swabs taken from the noses and conjunctiva of nine animals were tested for *Mycoplasma* spp. and one swab returned confirmation with sequencing of *M. conjunctivae*. Two others were weakly positive and sequencing could not be performed. *M. conjunctivae* is thought to be widespread among sheep worldwide and is reportedly associated with keratoconjunctivitis in some cases. It is not reportedly a cause of coughing in lambs. The cause of this outbreak of coughing was not identified but exotic *Mycoplasma* spp. were excluded by PCR.

Exotic equine encephalitides excluded

A veterinarian called the MPI exotic pest and disease hotline to report a sudden onset of neurological signs in a 2-year-old racehorse. Clinical signs included severe ataxia and disorientation. The horse was euthanased owing to the severity of clinical signs. Only the one horse was affected and follow-up indicated no spread of disease. Infectious equine herpesviral myeloencephalopathy (IEHM) caused by certain strains of the endemic equine herpesvirus-1 was considered to be a possible cause. Another endemic cause is traumatic or congenital musculoskeletal syndromes (e.g., wobblers). Exotic pathogens were also included as possible differential diagnoses, including West Nile virus (WNV) and flaviviruses (e.g., equine encephalitis viruses). Although a complete postmortem was not performed, the brain was removed and sent for histopathology, and sections of brain, associated lymph node, and aqueous humour were taken for further testing. Histopathology showed lymphocytic cuffing of scattered vessels within the brain, indicative of possible encephalitis. PCR for EHV-1 was negative for all tissues, and PCR for EHV-4 was positive for lymph node only (but the significance of this to a neurological condition is probably negligible). ELISA tests for IgM for both eastern equine encephalitis virus (EEEV) and WNV were negative, as was plaque reduction neutralisation for western equine encephalitis virus (WEEV). No cause of the neurological

signs or possible encephalitis was found. Infectious endemic and exotic diseases were excluded and the investigation was closed.

Ear mites in imported dog investigated

A veterinarian called the MPI exotic pest and disease hotline to report ear mites in a puppy that had been imported from Australia one month prior. An adult dog in the household was not clinically affected. Mites were collected and sent to the PHEL, where they were identified as *Otodectes cynotis*, the common ear mite. This mite is common throughout the world. Given the import health standards for dogs, it was considered most likely that the puppy acquired the mites once it arrived in New Zealand.

Rabbit mortality investigated

A veterinarian from Auckland contacted the Incursion Investigation Team to report a high number of feral rabbit deaths in the open area near Auckland Zoo. Samples from dead rabbits tested positive for the endemic RHD strains already present in New Zealand. MPI is interested in investigating cases of high rabbit mortality because of fears that exotic strains of rabbit haemorrhagic disease virus might be brought in from Australia, where a new strain has been released.

Tularaemia excluded

A veterinary pathologist contacted MPI to report a rabbit with gross and histological lesions suggestive of tularemia, an exotic zoonotic disease caused by *Francisella tularensis*. The adult male rabbit was euthanased after a short clinical history including emaciation, dehydration and possibly respiratory signs progressing to collapse and non-response. There were several other in-contact rabbits on the property, none of which were sick. Gross lesions included a mesenteric lymphadenopathy with multifocal to coalescing cream nodules throughout the mesentery, spleen and gastrointestinal tract (especially the caecum), with lower numbers in the liver. These lesions were consistent either with a lymphoid neoplasm such as lymphoma, or an endemic bacterial disease such as *Yersinia pseudotuberculosis* (common in many NZ species). Histologically the lesions were bacterial abscesses containing bacterial coccobacilli, but these lacked the usual appearance of *Yersinia* spp. infections. No fresh tissue was available, but formalin-fixed paraffin-embedded tissues were used for DNA extraction and PCR to rule out *F. tularensis*. PCR of multiple tissues showing high levels of bacteria was negative for *F. tularensis*. Although the sensitivity of the test is not optimal, given the large numbers of organisms and adequate DNA yield, it is thought that the results represent a true negative.

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Emerging risks in the aquatic space

Biosecurity in aquatic environments has always been a challenge. Unlike neat little land parcels with physical barriers, water is a fluid environment where things move freely in a manner that is difficult to predict.

With the increasing recognition of aquaculture as a valuable industry, and challenges to sustainable harvesting of wild fisheries, there has been more focus on investigating the role of pathogens in population changes among aquatic organisms.

One of the roles of the Ministry for Primary Industries (MPI) Animal Health Laboratory (AHL) is to investigate the causes of mass mortalities or ill-thrift in aquatic animals. Often it is these investigations, brought to our attention by industry, regional councils, researchers or members of the public, that bring to light something that we might consider an emerging risk. It could be a known or unknown pathogen that starts appearing more frequently, or starts causing issues where it hasn't before, or has adverse effects that were previously unobserved. These pathogens or syndromes may not be listed by the OIE or in legislation, so they are often not considered important until they start causing noticeable losses. However, it is our job to identify where these early cases might indicate future issues. To examine these cases more closely often requires research for which funding can be a sticking point. Following are some examples.

Tail fan necrosis (TFN) in rock lobster has been reported in parts of New Zealand for some years, but to date no causative agent has been identified. In about 2000 TFN appeared in a significant proportion of one rock lobster fishery management area. However, fishers report that TFN does not seem to have spread far beyond the areas where it was first seen. In the worst-affected areas TFN is estimated to affect about 30 percent of the population before moulting occurs in early spring. Fishers' observations show a moderate fluctuation of the TFN rate from year to year but there has been no sign of an overall decline.

This syndrome first appeared and was investigated 7–8 years ago. In theory, any increase in its prevalence or spread falls under the MPI remit to examine as an emerging risk. Similar syndromes have been studied overseas but no causal pathogenic agent has been identified. Research into TFN, its causes and the means of transmission will enable us to manage it better and to mitigate its effects. To date, much remains unknown about this syndrome and more research is needed into the potential aetiological agents. This would also help explain TFN's severity and intensity.

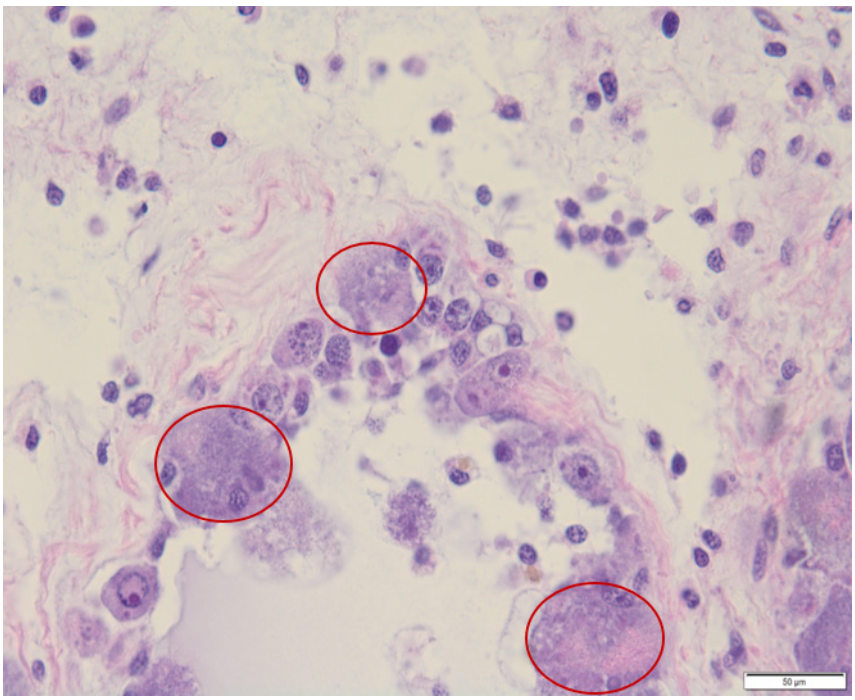

Figure 1: Areas of necrosis caused by RLO in shellfish digestive gland

Another emerging risk appears to be evident from our investigations into mass mortalities of shellfish, which are often complex, multifactorial events. Mass mortalities can be associated with extreme, abnormal or sudden changes in environmental conditions, along with the presence of one or more pathogens. These agents may on their own not be considered primary pathogens, but in combination with other factors may ultimately cause mortalities.

Since 2014, several investigations into shellfish mass mortalities have identified the presence of Rickettsia-like organisms (RLOs) (**Figure 1**). In some cases RLOs were present in every individual tested, indicating a high prevalence. RLOs have also been associated with mortality events involving multiple species in several regions of New Zealand.

To date RLOs have been seen in combination with parasites, bacterial infections, virus-like particles and even gas-bubble disease. This poses the question as to whether an RLO immunocompromises the animal and contributes to its death by other factors, or whether the RLO itself is the primary pathogen. Either way, it appears that these RLOs represent an emerging risk that needs further investigation.

These cases are both examples of aquatic animal health issues about which little is known and more research is required to understand them better.

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Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases

Exotic caprellid shrimp detected

A member of the public notified MPI of crustaceans densely fouling a recreational vessel at Orakei, in Auckland Harbour. A sample was sent to the Marine Invasives Taxonomic Service (MITS) for identification. MPI also asked for more samples be collected at the same site as an adjunct to the Marine High Risk Site Surveillance (MHRSS) programme. MITS reviewed the submissions and identified the species as *Caprella scauroides* Mayer, 1903. Caprellids are exclusively marine amphipods, commonly known as ghost or skeleton shrimps, and are common in many marine epibiotic fouling communities. Lacking any planktonic stages and being poor swimmers, caprellids essentially spend their lives clinging to various natural and artificial substrates including algae, hydroids, ascidians, sponges, tubeworms, vessels, pontoons, and marine farms. Both samples included juveniles and sexually mature life stages of both sexes, indicating an established population at Orakei.

A single caprellid found on a vessel in Nelson in 2005 was identified at the time as *C. californica* but re-examination and comparison with the Orakei specimens has determined that it is more likely to be *C. scauroides.* The morphological characteristics of the Orakei and Nelson specimens are consistent with the detailed taxonomic characteristics described by Takeuchi & Oyamada (2012). Therefore *C. scauroides* has probably been present in NZ since at least 2005.

It is not known what impacts, if any, *C. scauroides* would have on the New Zealand environment. No documented impacts are recorded in the literature to date. It is unlikely to compete with indigenous caprellids as most of these are confined to the sub-Antarctic islands. *C. scauroides* does not have a history of becoming a pest like the congeneric *C. mutica*, which has displaced native caprellids in other parts of the world (Shucksmith *et al*., 2009). *C. mutica* is established in several areas in New Zealand, for example in very high densities (184 800 per m^2) on mussel lines in the Marlborough Sounds (Willis *et al*., 2009). *C. scauroides* may compete with native organisms such as other amphipods that inhabit the same niches, and there may be subtle ecosystem effects (e.g., suspension-feeding effects or predation on settling larvae), but no such effects have yet been demonstrated. Options for response to infestations of small mobile crustaceans like *C. scauroides* are limited. Although Orakei is the only place where establishment of this species has been confirmed, it is unlikely to be restricted to this area because of its rapid reproduction and the availability of anthropogenic vectors. There are now three non-indigenous caprellids in New Zealand: *C. mutica* (discovered in 2002), '*C. californica*', (now thought to be *C. scauroides*; 2005), and *C. andreae* (2012). No attempt has been made to control other non-indigenous caprellid populations established here. As *C. scauroides* is established at this site, is likely to be established elsewhere in Auckland Harbour, and there is no evidence of invasiveness elsewhere, the decision was made not to undertake a delimiting survey or initiate control measures.

Morbidity and mortality in chinook salmon investigated

A veterinarian contacted MPI to report a low-incidence mortality (0.01 percent) over the previous 2 weeks of 18-month-old farmed chinook salmon (*Oncorhynchus tshawytscha*). These fish presented with lethargy and abnormal swimming behaviour (swimming to the surface) before dying. No external lesions were visible. Necropsy of three fish by the vet on site revealed petechial haemorrhaging, large amounts of serosanginous fluid, pale gills and swollen spleen. Kidney, heart and liver seemed normal. Two chilled kidney swabs and chilled spleen, gill and kidney tissue, in addition to some formalin-fixed tissue (gut, muscle, gill, kidney, spleen, liver and heart) were sent to MPI's Animal Health oratory for diagnostic testing. PCR ruled out infectious salmon anaemia, infectious haemotopoetic necrosis, viral haemorrhagic septicaemia, *Aeromonas salmonicida* and aquabirnavirus, but detected *Yersinia ruckeri*. Histology also was consistent with *Y. ruckeri* and observed clinical signs were also consistent with the presentation of endemic *Y. ruckeri* strains in New Zealand. Although in other countries *Yersinia* can be a cause of major mortalities, in New Zealand it more often presents as a low-lying, chronic infection with low mortality. Cytopathic effects on bacterial plates were examined further, but were no longer seen after the third passage. The *Yersinia* isolates were sent to the Aquatic Animal Health Laboratory in Geelong, Australia, for typification and were confirmed as the endemic strain.

Tuatua mortality investigated

A researcher from Waikato University contacted MPI to report low densities of dead and dying tuatua (*Paphies subtriangulata*) on a Tauranga beach. Some animals were dead and gaping; others were alive or dead with closed shells and showing no indication of burying themselves. He described it as not a mass mortality but low densities along the stretch of beach, reported on average about one affected animal every 5 m. Ten tuatua were submitted to the AHL (Wallaceville) for testing. On histology Rickettsia-like organisms (RLOs) were seen in the gills and palps of all shellfish submitted. The digestive glands also appeared damaged and RLOs appeared to be associated with this. Some other pathogens were also present: one slide showed a metazoan parasite and some bacterial colonies were also isolated from most samples. One of the dominant bacterial colonies isolated was *Vibrio splendidus,* which can be a pathogen, but it wasn't clear whether this was associated with the mortalities in this case.
As no unusual environmental conditions were reported, it would appear that these pathogens, especially the RLOs, were very likely associated with the mortality event.

RLOs in shellfish are considered to be an emerging risk and MPI is investigating these intracellular bacteria and what role they may play in the multiple shellfish mortalities that have been reported since 2013.

Sponge range extensions

The Marine Invasives Taxonomic Service (MITS) provided by NIWA reported range extensions for a non-indigenous sponge, *Raspailia arbuscular*, collected during a baseline marine survey in Wellington conducted in 2016. This species was previously only known from Stewart Island and the Milford Sound and is not common in New Zealand.

Additionally, range extensions to include Wellington were recorded for three cryptogenic and as-yet undescribed sponges:
Adocia cf n. sp. 04 (previously found in Whangarei, Auckland, Dunedin, Timaru and Bluff)

Clathria n. sp. 01 (previously found in the Kaipara harbour, Tauranga and Dunedin)
*Haliclona n. sp. (*previously found in Tauranga, New Plymouth, Picton and Lyttleton)

Range extensions were also recorded for three indigenous sponge species:
Haliclona cf. stelliderma (previously only known from Auckland, Tauranga and Picton)

Haliclona cf. brondstedi (previously only known from Whangarei)

Haliclona cf. tenacior – (previously only known from Kaipara Harbour and Tauranga).

No additional biosecurity risk was recorded. The range extensions were communicated to stakeholders via the Marine High Risk Site Surveillance reporting network.

Ascidian range extension

MITS notified MPI that the colonial ascidian *Didemnum vexillum* had been found in New Plymouth during the Marine High Risk Site Surveillance Programme. Previously this species was only known from Opua, Whangarei, Auckland, Tauranga, Wellington, Picton, Nelson and Lyttelton. The range extension was communicated to stakeholders via the Marine High Risk Site Surveillance reporting network.

Barnacles investigated

A member of the public notified MPI of a "grey concrete-looking" organism that appeared to be smothering a mussel bed on the shoreline between Orua Bay and Big Bay, Auckland. Photos submitted by the notifier showed mussels with clusters with what looked like barnacles attached to them. The Auckland Regional Council (ARC) was contacted and a staff member sent to inspect the area found a prolific growth of barnacles, but no evidence of any mortality of mussels. Samples of the barnacles were collected and submitted to MITS, where they were identified as the beaked barnacle, *Austrominius modestus*. This is species is native to Australia and New Zealand, but was introduced to Britain after World War 2, where it is considered a pest. The investigation was stood down and the results were reported to the ARCand the original notifier.

Crab intercepted

A hotel manager notified MPI of a live crustacean found in a hotel room. Photos of the crustacean were sent to an Incursion Investigator, who passed them on to an invertebrate taxonomist at Te Papa. The taxonomist determined that this was a tropical land hermit crab in the genus *Coenobita,* which lives in the tropics, including the Pacific, Indian and Atlantic Ocean coasts. They are more closely associated with the shore but venture into the coastal vegetation and urban areas that abut these ecosystems. Tracing revealed that guests who stayed in that hotel during the previous week came from New Zealand, Australia and the UK. There is one Australian species, *C. variabilis*, and therefore it is probable that it was that species. The crab may have been bought in deliberately, perhaps as a pet, or it may have hitch-hiked in the luggage of a visitor. The animal died shortly after it was found, and no further crabs were found, so the investigation was closed.

Ascidian range extension

A MPI Senior Compliance Officer reported a population of an ascidian species at the southern end of Tanutanu beach, Ahipara. Photographs were sent to an MPI Incursion Investigator, who determined that this was likely to be a range extension of the Australasian species *Pyura doppelgangera*, a sessile ascidian that lives in coastal waters of Australasia, attached to rocks or artificial structures. It is particularly common in Tasmania and has also been reported from South Gippsland, Victoria, South Australia and in the north of New Zealand's North Island. Genetic data indicates that the species is native to Tasmania and that all populations elsewhere were introduced through human activity during the period of European settlement (Teske *et al*., 2014). There are records of this species in the North Island from Cape Reinga, Kaitaia, Ninety Mile Beach, Parengarenga Harbour and Opua. In the south, it has been found at Paua Bay in Canterbury, and has also been collected off vessels berthed in both Nelson and Wellington. A search of MPI records found a 2009 survey that recorded this species at several sites in the Herekino area, including Tanutanu beach. As this species had been previously found in the same area, the investigation was closed.

Deformed snapper investigated

A member of the public notified MPI of a deformed snapper (*Pagrus auratus*) that he had caught. The notifier explained that although the fish was entire and intact, when he gutted the animal he found that there was an area where the flesh "looked as though it had been cored out". The Incursion Investigator arranged for the specimen to be sent to the AHL for examination by a fish pathologist. The gutted, fresh fish was received and examination of the area of the epaxial muscle mass revealed a 15 mm cavity lined with silvery membrane or peritoneum and devoid of contents. There was no gross sign of inflammation associated with the lesion.

The cavity was interpreted to be due to a cavitating myonecrosis caused by a previous bacterial or protozoal infection. No biosecurity risk was identified and the investigation was closed.

Crustacean investigated

The Department of Conservation notified MPI of a marine crustacean found in Golden Bay. The animal was about 100 mm long and beige to greenish in colour. It had pincers that looked like the forelimbs of a praying mantis. A specimen submitted to MITS was identified as *Heterosquilla tricarinata*, an indigenous mantis shrimp.

Northern Pacific sea star ruled out

A commercial diver inspecting the seawall under the Auckland Ferry building saw what he believed was a Northern Pacific sea star (*Asterias amurensis*). This exotic species, an unwanted organism under the Biosecurity Act 1993, is native to the coasts of northern China, Korea, Russia and Japan, but has spread to Australia, parts of Europe, the Aleutian Islands and the US. It is thought to have spread by transportation of its free-swimming larvae in ships' ballast water. It has become an invasive species in Australia and is on the Invasive Species Specialist Group list of the world's 100 worst invasive species. The diver had high level of biosecurity knowledge so the Incursion Investigator asked him to re-visit the site to collect the specimen. However, while collecting the starfish, the diver recognised that it was a replica sea star made of plastic.

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Ants: old foes and new threats to New Zealand

Our old foe the red imported fire ant (RIFA), *Solenopsis invicta* (**Figure 1**), its relative the black fire ant (*S. richteri*), and hybrids of the two, are steadily increasing their range across the US. Not only are their boundaries expanding, but they are increasingly being found at higher elevations as hybrid colonies expand their range.

Figure 1: Red imported fire ant (RIFA), *Solenopsis invicta,* nest mound in Texas (photo: V. Van Dyk)

The risk to New Zealand is further heightened by the ever-expanding range of RIFA across Asia. The first reports in Asia over the last decade were notably in Taiwan, China and Hong Kong, but RIFA has continued to spread and is now also established in Japan, with initial finds in eight major ports earlier this year.

Given the volume of imports from Asia, New Zealand must continue to be vigilant. The first and third discoveries of RIFA here were accidental rather than by surveillance. Fortunately, strong public awareness campaigns promoting the need to report unusual finds of insects via MPI's exotic pest and disease hotline prompted members of the public to report these two incursions. The second find of RIFA was the result of surveillance techniques developed from previous RIFA incursion responses. All eradication efforts were successful owing to a fast response and multi-agency co-operation in New Zealand. However, we cannot afford to relax, as other Asian countries may have RIFA without having realised it yet.

Earlier this year while attending the Imported Fire Ant and Invasive Ant Conference in Mobile, Alabama (the original incursion state of RIFA over a hundred years ago) we were introduced to a new enemy, the tawny crazy ant, *Nylanderia fulva*, also known as the strawberry or raspberry ant (**Figure 2**). This invasive ant is now found across many of the Gulf states of the USA. A highly competitive species with multiple queens and colonies of phenomenal numbers, the tawny crazy ant establishes in new locations very quickly. Like the well-known invasive Argentine ant, *Linepithema humile*, the absence of mating flights means it colonises areas by nest budding (when a queen and accompanying workers leave the current nest to form a new colony), quickly dominating the local environment. The upside of this budding behavior, however, is that it makes the ants easier to contain or eradicate.

Figure 2: Tawny crazy ant, *Nylandaria fulva* (photo: AntWeb)

Researchers have found the Argentine ant can out-compete the RIFA in as little as 3 months owing to its aggressiveness, sheer numbers and monopoly of resources (Kabashima *et al.,* 2007). Tawny crazy ants have a similar ability, which is further enhanced by squirting themselves down with their own formic acid secretion, an antidote to fire-ant venom.

If the tawny crazy ant managed to reach New Zealand, we believe it would eventually render Argentine ant (an established pest here) insignificant because of its superior invasive abilities. Tawny crazy ants prefer to nest in cool, shady areas, forming massive colonies with millions of individuals. The foragers are highly aggressive and colony resettlement is fast. The infestation is also three-dimensional, meaning that nests and foraging ants are commonly found in soil, in the ground, in structures, buildings, plants and tree canopies.

The pressure to feed such vast numbers of ants means the local environment is quickly depleted of other insect and animal life; indeed, when delimiting surveillance is carried out, the tawny crazy ant is typically the only species found in baited food traps, even where other species are still known to be present.

Tawny crazy ants are a serious problem in both urban and rural habitats in the US. They cause problems such as short-circuiting when infesting electrical equipment, generally overrun properties and have detrimental effects on many plants by farming populations of pest scale insects. Any organism too slow-moving or confined is overrun. Beehives are destroyed by these ants as they steal the larvae, causing the bees to abandon their nests; birds have to move on or be consumed. Tawny crazy ants even attack much larger animals, in particular calves and other newborn livestock. The unending quest for food results in any stationary or resting animals being subjected to foragers attacking their eyes, nostrils and open wounds. This causes loss of fur and skin around the eyes and damage to the animal's eyesight (even blindness), and ulceration around nostrils. Young animals frequently fail to thrive.

In Texas, various techniques are being developed to cope with infestations. This includes adjusting calving times to occur only before May or after October,

when ant colonies are less active in the cooler conditions. Birthing pastures are also contained and the perimeters are treated with insecticides. Treatments are carried out one month before birthing and continue monthly until the animals are old enough to rest more infrequently and thus become less prone to attack. The annual costs to farmers are expected to be huge and will continue to rise as the ant population spreads.

Various insecticides are effective against this species, including special baits developed here in New Zealand. Research is ongoing in the US, with new products and control techniques under development.

Conclusion

There is good reason to believe that the tawny crazy ant is as big a threat to our country as the red imported fire ant, if not bigger. It would cause significant environmental, agricultural and social impact to our natural heritage, primary industries and lifestyle.

It is only a matter of time before this species arrives in New Zealand. As with any potential pest, surveillance is critical and we should have a very good chance of detecting it early through the National Invasive Ant Surveillance programme (NIAS). Encouragingly, we believe we already have many of the tools needed to both detect and eradicate it. If we can find it, we can kill it!

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Exotic plant and environment investigations report: July to September 2017

The Ministry for Primary Industries Incursion Investigation team and the Plant Health Environment Laboratory (PHEL) teams investigate and diagnose suspect exotic pests and diseases in the plant and environment sectors. Investigators and scientists are based in Auckland and Christchurch. These teams provide field investigation, diagnostic testing and technical expertise on new pests and diseases affecting plants and the environment. They also have surveillance and response functions and carry out research and development to support surveillance and incursion response activities.

Horticultural pests

A photo of a suspect exotic fruit-piercing moth found in the Nelson Hospital car park in the city of Nelson was submitted to MPI entomologists. The moth was identified as a female ***Eudocima materna*** (fruit-piercing moth), which is native to northern Queensland and usually migrates south during late winter. It has previously been intercepted in New Zealand. The larvae of this moth are host-specific and the host plants are not present in New Zealand. The larvae feed on snake vine (*Tinospora smilacina*) and roundleaf vine (*Legnephora moorei*) (synonyms of *Cocculus* spp., family Menispermaceae). There are no records of any of these names in the Plant Biosecurity Index except on exotic voucher specimens of *Cocculus* from Rarotonga and China. Both species are tropical in origin and are frost-sensitive. The very specific host range of *E. materna* larvae is considered to limit this species' chances of successfully establishing. Staff operating the High Risk Site Surveillance Programme have been advised to watch in case the host plants appear in NZ.

Forest and timber pests

Borer holes and dust were seen in Chinese bamboo chopping boards on sale at a home merchandise retail store. The store's head office advised that 2 685 chopping boards were held by 11 of the 43 stores in New Zealand. All these boards were examined and 31 were found to have signs of borer beetle. The most heavily infested boards were sent to MPI and adult ***Dinoderus minutus*** were found in in them. None were found alive and some had likely only recently emerged. Infested boards were double-bagged and returned to the supplier and importer. The remaining 1 482 boards held at the importer's distribution centre were re-examined and one more was found to have signs of borer. Although *D. minutus* is an exotic species absent from New Zealand, it is not considered a high risk. The distributor has been importing bamboo chopping boards for about 10 years and a review of the MPI database of imported goods found no irregularities associated with their importation, nor any previous borer-related issues. Additionally, no recent reports had been received from members of the public who had purchased these boards. This report probably resulted from a single consignment with a low-level infestation, which is not considered an ongoing biosecurity risk. The immediate risk was managed by destroying infested chopping boards. Any ongoing risk will be managed by MPI's normal requirements for imported goods. The importer had already discussed how to improve quality control with the Chinese supplier.

A TradeMe site listed a range of unusual tree and shrub species for sale, including *Pinus* spp. considered not present in New Zealand. In all cases the scientific name of the plants was stated, an indication that the seller was acting responsibly and professionally. On checking MPI's Plant Biosecurity Index (PBI), all four species (*P. densiflora*, *P. hwangshanensis*, *P. armandii* and *P. thunbergii*) were listed as permitted imports subject to border inspection and provision of a phytosanitary certificate from the country of export. Several other plant species offered for sale were chosen at random and similarly checked against the PBI, and all were listed. This investigation concluded that there was no biosecurity risk.

Borer emergence holes were noticed in the newly laid floor of a house in Wellington. The flooring was premium-grade ash timber imported from the US. Live borer (*Lyctus planicollis/cavicollis* complex or *L. brunneus*, both of which are present in New Zealand) had previously been found in imported American ash flooring timber. In this instance no adult beetles were collected. The size of the borer exit holes was consistent with a ***Lyctus* sp**. Even though the entire house had the same flooring, only about 20 adult beetle exit holes had been seen over a 3-month period since the floor had been laid. The property owner had syringed insecticide into the holes as they became apparent. The flooring importer was unable to determine the specific consignment from which the timber had been sourced. However, examination of the current American ash timber stock found no sign of borer, and no additional reports of borer had been received from other customers who had bought the same timber. Overall, this information suggested a low borer infestation in the original imported consignment. The insecticide applied to the exit holes likely addressed any residual biosecurity risk and no further action was considered necessary.

Fruit fly

An Australian visitor noticed maggots on fresh mandarins provided as a snack food while visiting the SkyCity casino in Auckland. The visitor was a grower and exporter of table grapes in Western Australia, familiar with fruit-fly maggots, and phone discussions confirmed him to be a highly credible notifier. Traceback revealed that the fruit had been imported from Australia. Remaining fruit held by the supplier were examined and no sign of damage or fruit fly was found. No additional public reports were

received of suspect fruit fly maggots in Australian mandarins. Although the report was of maggots (not caterpillars) and they were too small to be vinegar fly (*Drosophila* spp.), it is considered most likely that the maggots were drosophilid and not tephritid fruit fly maggots.

A single live fly suspected to be a Queensland fruit fly (*Bactrocera tryoni*) was found inside a compost container in a residential kitchen in Hamilton. Photos of the specimen were requested and the notifier was advised to keep the compost container closed and double-bagged until further notice. A PHEL entomologist confirmed that the specimen was not a Queensland fruit fly and was consistent with a local, naturalised species. Specimen submission for formal identification was not required.

Insect feeding damage was found on feijoa fruit grown in the garden of a rental property. The notifier was unfamiliar with guava moth, the larvae of which are a common pest of feijoas in Auckland. The caller promised to search for guava moth images to confirm the pest was indeed guava moth and not fruit fly. When later contacted, he reported having discussed the issue with local garden centre staff and had concluded the damage was caused by guava moth, ***Coscinoptycha improbana***.

Small white insects that looked like fruit-fly maggots were seen on the outside of feijoa fruit collected from a home garden. They were identified from photos as the immature stages of springtails **(Collembola),** not fruit-fly maggots. The infested windfall fruit had been collected from beneath the tree, where they likely became infested with these insects.

A couple had found a suspected fruit fly on their guava tree but had not been able to catch or photograph it. However, they were sure it was not a Queensland fruit fly as it looked more elongated and streamlined and had black-and-yellow stripes on its abdomen. There was no association with recently imported goods or overseas travel. The notifier was able to catch a specimen a few days later and submitted it to PHEL. Interim identification ruled out fruit fly and the specimen was identified as an Australian leafroller tachinid (***Trigonospila brevifacies***). This species is present in New Zealand and of no biosecurity risk.

General biosecurity pests and contaminants

An Auckland plastic manufacturing company received a large moulding machine on a wooden pallet from a local dealer. The machine had been imported from Germany in a container. They noticed insects in the plastic surrounding the pallet (2 dead, 1 alive). A photo emailed to MPI revealed a species of wood wasp that was identified as ***Sirex juvencus***, a regulated species. An MPI Quarantine Officer visited the site and found that the container was free of any wasps (dead or alive) or evidence of habitation (nest). Only the one pallet had been shipped inside this container, but it was established that three other pieces of timber had been used as bracing inside the container,to keep the pallet secure. These pieces were inspected by the Authorised Person on site at the Transitional Facility. The pallet had an International Standards for Phytosanitary Measures Regulating Wood Packaging stamp on it but one of the 10 boards on the pallet showed signs of insect infestation (exit holes). The wasps found were adjacent to these exit holes. The pallet was wrapped on site and fumigated to mitigate any biosecurity issue.

A traveller returning from Bali found a small number of live ants in her suitcase. A sample was collected and sent to PHEL Christchurch for identification. The ants were identified as ***Monomorium pharaonis***, a species that is established in New Zealand. No further ants were found during inspection.

After a shipment of new vehicles from Australia was inspected and released at the Ports of Auckland a live huntsman spider (***Isopeda vilosa***) was found crawling on a back window. A specimen was caught and submitted to PHEL Tamaki, where the identification was confirmed. This species is present in New Zealand.

Two live centipedes were found upon opening a package in a consignment of statues from Vietnam. The centipedes were carefully destroyed and the remaining packages and the pallet were wrapped in plastic. The pallet had something concealed in it that resembled an egg mass. The centipedes were identified as ***Lithobius forficatus*** (garden centipede), a species present in New Zealand. Webbing was found but there were no insect eggs. Three ***Armadillidium vulgare*** were also found, a species of woodlouse present in New Zealand.

A caller noticed insect damage on bananas that she had purchased. The caller advised that no insects were found, only an aged exit hole. Imported bananas are routinely treated on arrival in New Zealand ports to mitigate potential biosecurity risks. The caller was advised to freeze the bananas as a precaution. A sample was submitted and checked by two entomologists, who found no invertebrates.

A customer at a pharmacy in Rolleston, near Christchurch, found two small flies in a cosmetic pressed powder compact manufactured in the US. The item was completely sealed and the flies were visible through the packaging. The specimen was determined by the PHEL entomologist to be midges (Diptera: Chironomidae) but the species was not identified. Chironomids are also known as non-biting midges and are often confused with mosquitoes.

Shoes purchased from an online store via TradeMe were sent from a warehouse in the US. On arrival they had mud in the treads and appeared to be secondhand. It was not clear whether the shoes might have been worn on a farm or in a horticultural area. Mud and other organic material is considered a high risk as it may contain seeds, nematodes and micro-organisms not present in New Zealand. The notifier was asked to double-bag the shoes and dispose of them as a precaution. A message was sent to the retailer advising them to ensure that in future only clean footwear would be sent.

A live earwig was found associated with a dragon fruit imported from Vietnam. As the earwig was discovered on the fruit soon after purchase, it was considered possibly of overseas origin. However, following submission to PHEL it was identified as the European earwig (***Forficula auricularia***), a long-established species common throughout New Zealand and absent from Vietnam.

Live ants and eggs were found around the nozzle of a cask of wine purchased from a Rotorua liquor store. At least six small black ants 1–2 mm long were seen. Specimens were identified by PHEL as ***Ochetellus glaber*** (the black house ant), a species present in New Zealand.

A packet of strawberries purchased from a supermarket in Kaitaia had white eggs on one fruit. The strawberries had been imported from Australia and undergone irradiation treatment before shipment. The eggs were non-viable and identified as ***Spodoptera litura*** (the tropical army worm), a species already present in New Zealand.

Insects were found inside a recently de-vanned container at a South Island distribution centre in Rolleston, near Christchurch. Specimens were identified by PHEL as ***Ahasverus advena*** (Coleoptera: Silvanidae), the foreign grain beetle, a species established in New Zealand.

A Dunedin car dealer received a new car that had come into the country via the Ports of Auckland. While grooming the car, the service manager found ants inside it. Despite repeated attempts, the dealer could not provide quality photos of the ants. However, from the pictures provided the ants were still able to be identified as ***Ochetellus glaber*** (the black house ant). Specimens were requested to confirm the identification but were not received as the dealer wanted to deliver the car to his customer and instead decided to fumigate the car to mitigate any biosecurity risk.

The Quarantine Officer based in New Plymouth notified Surveillance & Incursion Investigation Plant Health Team of a bulldozer imported from Dubai with much soil and gravel contamination. The bulldozer underwent a steam clean, was re-inspected at the Ports of Auckland and was subsequently released. However, on arriving in New Plymouth it was found that an old beehive was located in the engine bay. SIIPH got Border Clearance in New Plymouth to arrange treatment and re-inspection of the bulldozer at an approved Transitional Facility before release.

Ants were noticed associated with a replacement car door after the vehicle had been returned from the panelbeaters. Investigation revealed the replacement door had been imported from Europe. The number of ants suggested an ant colony within the door cavity. Worker ant specimens were collected and identified by PHEL as Argentine ant, ***Linepithelma humile***, a species well established in New Zealand.

Suspect black widow spiders and other spiders were found in a de-vanned container of non-risk goods (timber, wood packing and steel) from Adelaide, Australia. The container was at a cleaning facility and had been fumigated before the specimen was collected. Photos were sent but were not of high enough resolution for positive identification. The poisonous Australian redback spider (*Latrodectus hasseltii*) is well established in Adelaide. The genus *Latrodectus* (widow spiders) is cosmopolitan but the notorious American black widow spiders (*L. mactans* and *L. hesperus*) are unknown in Australia. Specimens were requested and sent to a specialist who believed they were the Australian redback. Although it was of the genus ***Latrodectus*** this species was not a black widow spider.

A large live brown spider was found upon opening a barrel of zinc wire imported from Finland. The notifier was advised to freeze the spider and to submit photos for identification. A PHEL entomologist identified the banded tunnel web spider (***Hexathele hochstetteri***), a species endemic to New Zealand.

New to New Zealand species

A new to New Zealand virus has been found in a fodder beet crop in Canterbury. **Beet chlorosis virus (BChV)** is a poleovirus in the same genus as beet western yellow virus (BWYV), which is present in New Zealand. BChV is known to be transmitted in the wild by aphids only, and it is unclear whether it can be spread by using infected material to propagate subsequent generations. The sample was submitted to MPI by AsureQuality in Lincoln, who received the plant from a Canterbury farmer. AsureQuality tested the plant for bacterial and fungal pathogens and detected none. MPI virologists identified BChV in the sample and suggested that there could be multiple virus species in the plant specimen, as symptoms appeared on the indicator plant but BChV is not mechanically transmissible. The second virus identified from samples was beet mosaic virus (BtMV), which is already present in NZ. The observations of an MPI diagnostician revealed that BtMV was more symptomatic than BChV and that the latter did not appear to have any visible symptoms in samples that tested positive for co-infection. The biosecurity risk and economic effects of BChV are considered to be low and not dissimilar to those of BWYV or BtMV. Integrated pest management protocols for aphids are considered to be highly effective in controlling the spread of BChV. Linked industry partners were informed of the find and of MPI's decision to close the investigation without further action.

MPI was notified that the NatureWatch website (naturewatch.org.nz) had displayed photos of an odd eumenine wasp and nest, apparently from Whangarei. The notifier advised that it looked just like a single specimen he had found in Remuera, Auckland, in 2014, and submitted at the time, but MPI was unable to confirm the identification. The notifier thought the Whangarei specimen might have been an isolated case until he saw the Whangarei specimen in November 2016 and heard another report from Kerikeri (although

his identification was based on the NatureWatch photo only). The notifier of the most recent report on NatureWatch (10 February 2017) provided a specimen from Whangarei but identification was difficult as the best key to the suspected genus dated from 1914, listed more than 120 species and had been published in Latin. The current status of this record is an unidentified member of the family **Eumenidae**, probably the same species that was reported in 2014 from Remuera (a new to NZ record), and from Whangarei in 2016. Without further specimens the status of the record remains inconclusive. The biosecurity issue was considered low to negligible and the investigation was closed. However, PHEL will continue trying to identify the species.

An Australian holidaymaker in Kerikeri, who happened to be a millipede taxonomist, noticed a mature female millipede that he considered might be a new to New Zealand species. The female millipede was found between Puketotara Stream and the Kerikeri Golf Club in May 2017. Although unable to conclusively identify it, the notifier thought it might be *Solaenodolichopus pruvoti*, a species that grows to about 30 mm long and is native to the Brisbane area in Queensland. *S. pruvoti* has also been introduced to New Caledonia (from where it was first described) and is now found in Perth, Western Australia. An earlier reported detection of *S. pruvoti* (Johns, 1962) in New Zealand had been recorded in the literature under the old name *Aulacoporus pruvoti*. The renamed species may have arrived in New Zealand relatively early in European settlement.

MPI Plant Imports (Germplasm) informed an Incursion Investigator that a Waikato plant nursery had imported about 22 000 plant tissue cultures that had been mislabelled by the exporting nursery in the Netherlands. The tissue cultures, received in 2016, had been labelled *Stachys byzantina* (under Basic requirement) but recently it was disclosed that they were *Senecio niveoaureus*, a species not listed in the Plants Biosecurity Index (PBI) and considered a new organism under the Hazardous Substances and New Organisms (HSNO) Act 1996. Imports of *Senecio* spp. are regulated to prevent entry of the plant pathogenic bacterium *Xylella fastidiosa* from all countries in Europe, but the Netherlands have a pest-free status for this species. At the time of import *S. niveoaureus* was not covered by an Import Health Standard (IHS) and could not be imported into New Zealand. MPI has since introduced measures for *X. fastidiosa* in tissue cultures (as of 1 June 2017).

S. niveoaureus Cuatrec is the currently accepted name for this taxon. There are no synonyms recorded for *Senecio* as it is a changing genus with numerous synonyms at both the species and genus level. There are no records of this species being present in New Zealand, so it is probably a new organism under the HSNO Act. Of the 22 000 plants imported since the beginning of 2016, the nursery had already sold about 16 000. The remaining 2 394 plants at the source nursery were voluntarily isolated and prohibited from sale by the nursery owner. Two other nurseries had 3 000–4 000 plants in stock. Among the three nurseries, 22 percent of the original plants were accounted for (the rest having been sold). Most plant material had been sold by retail outlets up to 16 months before MPI was notified, so it was unlikely to be recoverable. *S. niveoaureus* is a high-altitude (3 100–4 600 m) herbaceous daisy (Asteraceae) from Colombia and Ecuador and requires a cool climate. It forms clusters of rosettes with soft, densely hairy, bright silvery white "rabbit ear" leaves and has a tall inflorescence with bright yellow flowers. The nursery owner advised that in his experience *S. niveoaureus* did not thrive in New Zealand summers. The establishment risk of *S. niveoaureus* as an invasive weed is considered low. Initial investigation suggested that *X. fastidiosa* is not an issue as *S. niveoaureus* is not a host for the bacterium. A risk assessment to determine potential for establishment was requested from the MPI Risk Analysis Team. After a field visit in August 2017, samples were conclusively identified as *S. niveoaureus*. No hitchhiking pests were found and tests for *X. fastidiosa* were negative. There was no evidence to suggest that this was a deliberately misleading declaration. After consultation between internal MPI directorates and the hazardous substances and new organisms adviser it was agreed to approach the Environmental Protection Agency to initiate a process to deregulate the plant species, which may take several months to a few years. Owing to the fact that about 18 000 plants had already been sold throughout New Zealand, the nurseries holding the remainder of the plants were allowed to resume selling them. The overseas supplier of the mislabelled plants was instructed by the importers to ensure correct identification was recorded in future on export documents.

Plant diseases

One banana in a bunch purchased from a supermarket in Whakatane was found to have a black centre and red threads in the flesh. The notifier suspected that this could be squirter disease, caused by the post-harvest pathogen *Nigrospora sphaerica*. This species is present in New Zealand but not on bananas as New Zealand does not grow these commercially. The sample was too badly decayed on arrival at PHEL for any diagnostic work to be conducted. No further action was warranted and as *N. sphaerica* is not considered to pose a biosecurity risk, the investigation was closed.

A commercial grower of kale and swede observed symptoms similar to club root disease and sought advice from the Incursion Investigator. The causal agent of club root, *Plasmodiaphora brassicae*, is already present in New Zealand and not a notifiable organism. However, a sample was requested to determine whether any biosecurity risk existed. Testing by PHEL was negative for club root and the plant-parasitic nematodes. A second lot of samples was requested from the grower, who at this time reported that similar symptoms had been found on swedes a year previously on a neighbour's farm 6 km away. A second sample of kale and swede plant material including

roots, galls and soil tested positive for ***Plasmodiaphora brassicae*** . This soil-borne pathogen is widespread in New Zealand and has been reported to cause club root disease on many *Brassica* species. The farmer was informed of the outcome and advised to contact his crop scout for management advice.

A blueberry grower contacted PHEL to report that her blueberry plants were possibly affected by *Xylella fastidiosa* (Pierce's disease of grapevines) and blueberry scorch virus. She had lost about 150 of her 200 plants. The plants had been purchased about 3 years previously from a commercial grower who was no longer operating. PHEL mycologists ruled out *X. fastidiosa* by analytical testing. In the absence of any viruses or pathogens, PHEL attributed the plant death to abiotic factors and the investigation was closed.

Brown marmorated stink bug

A commercial grower saw what he thought was a brown marmorated stink bug (*Halyomorpha halys*) on a curtain in his lounge. He thought he recognised the multi-coloured antennae from a video shown at an industry meeting. However, the photo received by MPI was examined by PHEL entomologists and identified as the native pittosporum shield bug, *Monteithiella humeralis*.

Storage pests

The notifier found several live insects in a jar of coconut flour. The insects were described as reddish brown and 5–10 mm long. Although they were likely to be a common stored product pest the notifier was very interested in getting a sample identified. The insects were identified by PHEL Tamaki as the biscuit beetle, ***Stegobium paniceum,*** a common stored-product pest established in New Zealand.

Upon opening a 6 kg bag of rice purchased last year, brown insects were found crawling inside. The rice had been stored in the notifier's pantry in the original packaging. Given the time from purchase to discovery it was highly likely to be a local infestation. Photos were consistent with psocids (booklice), which the notifier believed might have come from old books in a recycling bin located near the pantry. The sample was identified as ***Liposcelis* sp.**, thought to be of local origin, but was too badly damaged to identify to species level.

The notifier reported the presence of about 50 strange-looking live weevils in a bag of cashew nuts purchased from a local Indian spice store six months earlier. He described them as very small with a black front and a light brown abdomen. A specimen was submitted to PHEL and identified as the merchant grain beetle, ***Oryzophilus mercator*.** This species is present in New Zealand and of no biosecurity risk.

A dozen ants were found in a packet of Chinese noodles purchased from a local grocer about one month previously. The individual packets of noodles were sealed but the package was not insect-proof. The noodles had been stored in the notifier's pantry and an inspection of the pantry revealed no further ants. A photo of the pest was identified as the rice weevil, ***Sitophilus oryzae***, a common stored-product pest established in New Zealand.

Seed contamination

A large online retailer was advertising Eggling brand growing kits on TradeMe. Each kit consisted of a small porcelain egg filled with growing medium and a specified variety of seeds that did not meet the Import Health Standard for seeds for sowing (e.g., strawberry seeds require 6 months in quarantine). Furthermore, no phytosanitary certificates were received so the import pathway of these seeds was not clear. The E-commerce retailer was contacted and subsequently removed the kits from sale. The retailer was told to review the Import Health Standard for Seeds for Sowing to ensure they would comply in future, and to re-ship or destroy any kits held in their warehouse.

Reference

Johns PM (1962). Introduction to the endemic and introduced millipedes of New Zealand. *New Zealand Entomologist* 3, 38–46.

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PEST WATCH: 8 July – 21 November 2017

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 Services (DSS) directorate devotes much of its time to ensuring that new organism records come to its attention, and to following up as appropriate.

This information was collected from 8 July 2016 – 21 November 2017. The plant information is held in the MPI Plant Pest Information Network (PPIN) database. Wherever possible, common names have been included. Records in this format were previously published in the now discontinued magazine Biosecurity.

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
Insect	*Liposcelis entomophila* booklouse	Inanimate host	Auckland	AsureQuality (General Surveillance)	Virtually cosmopolitan in distribution
Insect	*Platyedra subcinerea* mellow groundling	Inanimate host	Central Otago	PHEL (General Surveillance)	Believed to be native to Europe
Insect	*Glycaspis brimblecombei* red gum lerp psyllid	*Eucalyptus camaldulensis* (river red gum)	North Canterbury	Scion (General Surveillance)	
Mite	*Amblyseius lentiginosus* phytoseiid mite	*Lavandula* sp. (lavender)	Waikato	PHEL (General Surveillance)	Likely to be a predator on small insects and mites
Mite	*Cecidophyes rouhollahi* eriophyid mite	*Galium aparine* (cleavers)	Auckland	PHEL (General Surveillance)	Forms galls on the plant and deforms the leaves
Virus	Beet chlorosis virus BChV	*Beta vulgaris* (beets)	South Canterbury	PHEL (General Surveillance)	There is potential for this virus to reduce the yield of fodder beet.
Virus	Grapevine virus G	*Vitis vinifera* (grape)	Mid Canterbury	Plant and Food Research (General Surveillance)	The economic effect of this virus on grapevine is unknown.
Virus	Grapevine virus H	*Vitis vinifera* (grape)	Mid Canterbury	Plant and Food Research (General Surveillance)	The economic effect of this virus on grapevine is unknown.

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

Veterinary Diagnostic Laboratories

GRIBBLES VETERINARY PATHOLOGY

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

- HAMILTON
  Courier: 57 Sunshine Ave, Hamilton 3240
  Postal: PO Box 195, Hamilton 3240
  Tel: 07 850 0777 Fax: 07 850 0770

- PALMERSTON NORTH
  Courier: 840 Tremaine Avenue, Palmerston North 4440
  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

NEW ZEALAND VETERINARY PATHOLOGY

- HAMILTON
  Courier: Cnr Anglesea and Knox Streets, Hamilton
  Postal: PO Box 944, Hamilton
  Tel: 07 839 1470 Fax: 07 839 1471

- PALMERSTON NORTH
  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

SVS LABORATORY

- HAMILTON
  Physical Address:524 Te Rapa Road Hamilton 3200
  Postal Address:PO Box 10304 Hamilton 3241
  Tel: 0800 SVS LABS (0800 787 522) or 07 444 5101
  Email: info@svslabs.nz

To report suspected exotic land, freshwater and marine pests, or exotic diseases in plants or animals, call:

0800 80 99 66

PLANT HEALTH & ENVIRONMENT LABORATORY (TAMAKI)
Diagnostics and Surveillance Services (MPI)
Courier: 231 Morrin Road, St Johns, Auckland 1140
Postal: Freepost 120201, MPI DSS, PO Box 2095, Auckland 1140

ANIMAL HEALTH LABORATORY
Diagnostics and Surveillance Services (MPI)
Courier: 66 Ward Street, Wallaceville, Upper Hutt 5018
Postal: MPI DSS, PO Box 40742, Upper Hutt 5018

PLANT HEALTH & ENVIRONMENT LABORATORY (CHRISTCHURCH)
Courier: 14 Sir William Pickering Drive, Burnside, Christchurch 8544
Postal: Freepost 120201, MPI DSS, PO Box 14018, Christchurch 8544

New Zealand Government

Ministry for Primary Industries
Manatū Ahu Matua