Surveillance

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Ministry for Primary Industries
Manatū Ahu Matua



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Editor: Michael Bradstock
Technical Editors: Jonathan Watts, Lora Peacock

Correspondence and requests to receive *Surveillance* should be addressed to:
Editor
Surveillance
Ministry for Primary Industries
PO Box 2526
Wellington, New Zealand
email: surveillance@mpi.govt.nz

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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

Biosecurity and our communities: bringing science to the fore

In his editorial from last year's Annual Report, "The importance of science for biosecurity", Ian Ferguson emphasised how critical good science is to what we do at Biosecurity New Zealand and the Ministry for Primary Industries. Science is also critical for community groups involved in biosecurity on a day-to-day basis.

Ian was right to note that a biosecurity system cannot work without science, but it cannot work without involvement and work by communities and local groups either.

Making science accessible and relevant to people through the biosecurity system is a key to Biosecurity 2025, notably two Strategic Directions, a toolbox for tomorrow and smart, free-flowing information. It is recognised in the annual Biosecurity Awards, which were launched last year and have been enhanced by the addition of three new categories in 2018: Emerging Leaders, Innovation, and Science. Finalists will be announced on 12 October and winners will be announced on 12 November at a special awards dinner and ceremony in Auckland. There is more information about the awards and past winners on our website at www.mpi.govt.nz/biosecurityawards.

However, I would like to focus on Strategic Direction 1 (SD1): growing a biosecurity team of 4.7 million, and the role of science in effecting useful community involvement.

One project under the aegis of SD1 that aims to make the most of community involvement is the Biosecurity Community Champions Programme, based on the Mauao/Mt Manganui myrtle rust partnership and the Predator Free movement. This will create a community-driven programme to build engagement and awareness and develop biosecurity surveillance and response communities that can be mobilised against different threats. By encouraging members of a community to take ownership and action to protect themselves from biosecurity risks, we can help them to conserve indigenous biodiversity.

Building on the very successful community-led Predator Free Crofton Downs project, the Biosecurity 2025 team is working with the founder to develop a framework and start community pilot programmes – initially based around myrtle rust surveillance – to engage the community and provide a broader education in biosecurity.

The first pilot was launched in Crofton Downs, Wellington, in June. The other two pilot programmes are in Kawhia and the suburbs surrounding Crofton Downs, including Ngaio and Wadestown. Each of these programmes aims to raise local awareness of a serious biosecurity issue and involve members of the public in looking out for and reporting the unwanted organism concerned.

Community engagement will not yield successful results, however, unless activities are grounded in good science. To achieve this, we need widespread awareness of how scientific research can help groups choose the best activities to undertake. One example is a scientific modelling tool that enables groups to locate infected trees and apply pesticide only to infected trees; other scientific projects are covered in the latest edition of the Biosecurity2025 e-newsletter.

Applied science matters as well, because groups devoted to eradicating pests and unwanted organisms also need easy-to-use tools. Businesses that want to implement better biosecurity management need access to tools such as the myrtle rust reporter app, as well as evidence of how well their activities are working.

But science will not produce change unless more local communities are knowledgeable about it. Groups need to reach decisions on biosecurity priorities by applying science to problems, to help decide how best to use their limited resources.

Just as local groups need to engage with science, so do scientists need to engage with them. Scientists need to understand community problems, and community groups and local businesses need to learn how to apply new scientific methods, tools and research.

Many scientists are aware of biosecurity activities across different levels of the system. Local groups or individuals have initiated pest trapping and weed eradication programmes; and businesses, agencies or industry groups initiate and promote biosecurity programmes – for example, "Catch it, Snap it, Report it", a programme instigated by orchardists to watch for the exotic pest brown marmorated stink bug. Many of these activities were developed by scientists.

I am heartened by the examples I have seen of such co-operation and hope to see much more as Biosecurity 2025 progresses. I encourage the scientific community to find out more about community biosecurity groups that might benefit from your knowledge and technical know-how. For in biosecurity and biodiversity, we are stronger together.

Roger Smith
Head of Biosecurity New Zealand
Ministry for Primary Industries

International animal trade

Animal imports

The MPI Animal Imports and Animal Trade (Imports) teams are responsible for developing and amending import health standards (IHSs) that stipulate biosecurity requirements for importating live animals, germplasm and animal products. The teams also provide advice to the public and technical advice to staff at the border.

Table 1: Number of import permits issued by Animal Imports Team, 2017

Category	Product type	
Animal product	Animal feed	21
	Animal product	101
	Bee	26
	Dairy	3
	Egg	7
	Egg albumin	1
	Equine	1
	Fibre	13
	Fish	5
	Hides/skins	6
	Meat	9
	Porcine	24
	Poultry	2
	Semen extender	1
	Wool	3
	Total	**222**
Biologicals	General	355
	Restricted	196
	Total	**551**
Embryos	Bovine	19
	Laboratory animals	4
	Ovine	9
	Total	**32**
Live animals	Bovine	0
	Butterfly	5
	Camelid	9
	Caprine	5
	Dog/cat	64
	Dog/cat – quarantine	1 978
	Equine	1
	Fish	14
	Hatching eggs	7
	Insect	3
	Invertebrate	62
	Laboratory animals	40
	Marine invertebrates	9
	Ovine	8
	Rabbit	9
	Small animals	2
	Zoological	23
	Total	**2 239**
Semen	Bovine	104
	Equine	34
	Ovine	10
	Zoo animals	9
	Total	**165**
Transit	All	257
	Total permits issued	**3 466**

Some IHSs require that the animal or animal product is accompanied by a current import permit, to assist with clearance at the border. The imports teams are responsible for issuing these permits, and 3 466 of them were issued during 2017 (**Table 1**). Note that the number of permits is not necessarily related to the volume of trade: for example, a single permit might be issued for several horses.

Numbers of live animal imports in 2017 are listed in **Table 2**. These are estimates based on importers' stated intentions and may differ from the numbers actually imported.

Table 2: Live animal imports by species, 2017

Species	
Alpaca	56
Bovine	0
Fish	19 519
Caprine	24
Cat	1 969
Zoo	43
Dog	4 289
Horse	1 702
Guinea pig	19
Invertebrate	151 967
Laboratory animal	1 043
Ovine	33
Rabbit	7
Total	**180 671**

The following is a summary of new or amended import health standards issued during 2017.

Returned New Zealand animal products

This IHS was issued on 26 April 2017. It consolidates and clarifies the requirements for the return of animal products that originated from New Zealand.

Used equipment

The IHS for used equipment associated with animals or water was updated and re-issued on 28 June 2017.

Ornamental fish

The IHS for ornamental fish and marine invertebrates was updated and re-issued on 13 July 2017 to enable offshore quarantine in Australia.

Pig semen

The generic IHS for pig semen was amended and re-issued on 18 December 2017, to update requirements to incorporate recent risk-analysis decisions.

Poultry hatching eggs and specific-pathogen-free chicken eggs

This IHS was re-issued on 9 February 2018 after a very minor amendment to clarify how testing is to be carried out in post-arrival quarantine.

Semen and embryos from horses (Equidae)

The country-specific standard for equine semen and embryos was amended to update the requirements for equine infectious anaemia testing, and reissued on 18 July 2017.

Egg products

The generic standard for egg products was issued on 23 January 2018.

Exports of live animals and germplasm

Export figures for live animals and germplasm for the year 2017 are presented in **Tables 3 and 4**.

Table 3 compares live animal and germplasm exports from 2009 to 2017 and **Table 4** shows the global distribution by region of exports for 2017.

There is continued growth in poultry exports, with higher export volumes of both day-old chicks and hatching eggs than in 2016. In total, 2 787 409 day-old chicks were exported in 2017, which is an increase of almost 345 000 over 2016 (**Table 3**). Hatching-egg exports have also increased by just over 2 million on the previous year, to their highest level since 2007 (**Table 3**).

The increased trade in day-old chicks occurred in the Pacific Islands and Asia, and there was a dramatic increase in hatching-egg exports to the Pacific Islands and the Middle East. Notably, the numbers of hatching eggs exported to Asia have fallen (**Table** 4).

Table 3: Comparison of live animal and germplasm exports from 2009 to 2017

	2017	2016	2015	2014	2013	2012	2011	2010	2009
Bees (packages [kg], queen and bumble)	18 646	31 211	40 675	44 116	36 737	8 776	37 180	37 523	34 621
Bovine embryos	196	457	437	536	850	1 801	950	943	1 077
Bovine semen	1 628 656	1 253 030	1 251 776	1 596 560	1 573 105	1 160 455	1 085 082	1 073 877	1 237 044
Canine semen	200	33	47	420	9	41	12	166	56
Cats & dogs	4 164	3 507	4 045	4 278	5 980	6 151	5 873	4 247	3 999
Cervine semen	633	2 275	1 557	816	325	220	275	2 590	3 001
Equine semen	4 418	6 324	4 119	3 032	3 265	3 324	2 362	2 670	5 195
Ferrets	0	0	0	0	0	374	760	825	1 397
Live alpacas & llamas	41	80	228	200	156	456	404	198	375
Live cattle	27 306	40 506	21 186	85 732	36 573	39 636	30 499	16 150	12 847
Live deer	0	0	28	0	0	65	31	15	46
Live goats	18	1 184	0	35	0	0	979	58	190
Live horses	2 655	2 706	2 713	2 622	2 853	2 886	3 308	2 292	2 469
Live sheep	123	300	45 166	1 082	380	421	177	307	124
Ovine embryos	809	2 778	825	1 836	1 737	0	320	114	230
Ovine semen	9 569	6 492	5 049	5 518	1 877	7 271	11 819	4 954	10 374
Poultry (day-old chicks)	2 787 409	2 442 609	2 221 689	1 700 483	1 270 703	1 136 530	1 342 542	1 324 543	1 098 192
Poultry (hatching eggs)	5 705 973	3 700 891	4 076 927	3 036 075	2 536 565	2 365 466	3 173 403	5 185 128	3 860 755

Table 4: Volume of live animal and germplasm exports to various regions in 2017

	Africa	Asia	Australia	Canada	Central and South America	Europe	Middle East	Pacific Islands	United States	Total
Bee packages	240			15 203						15 443
Bees, queen & bumble		1 800		1 403						3 203
Bovine embryos			110			81			5	196
Bovine semen	269 498	68 676	110 582	2 933	514 389	579 868		2 000	80 710	1 628 656
Canine semen		2	198							200
Caprine embryos		869								869
Caprine semen									40	40
Cats & dogs	32	285	2 620	103	22	641	14	99	342	4 164
Cervine embryos				74					66	140
Cervine semen				179		91			363	633
Equine semen			4 418							4 418
Live alpacas & llamas			10			31				41
Live cattle	6	26 785						515		27 306
Live goats					18					18
Live horses	3	518	2 049			13	6	19	47	2 655
Live sheep	1	33			59					123
Other		3	25						21	55
Other birds		122	2			1				125
Ovine embryos		700	89		20					809
Ovine semen		2 015	2 187	80		3 669			1 618	9 569
Poultry (day-old chicks	1 675	1 866 166						919 568		2 787 409
Poultry (hatching eggs)		57 600					334 620	5 313 753		5 705 973
Zoo animals		1	19			6				26

This year has seen a significant reduction in live bee exports, a trend that has continued since a peak in 2014. While the demand for more bees remains, in particular from Canada, a season of poor weather in New Zealand meant fewer bees were available for export (**Table** 3).

Bovine semen exports have increased to the highest volume since 2009. It is noteworthy that the EU and Central and South America have contributed significantly to the increase (**Table 4**).

Exporters have requested access to a number of new markets for bovine embryos. Despite successful negotiation of new export certificates, bovine embryo exports have dropped to their lowest point after having being relatively static since 2014 (**Table 3**).

Live cattle exports have continued to fall since the 2014 peak of just over 85 000, averaging out more in line with the volumes in 2010, when 27 306 animals exported. The majority of the cattle continue to be exported to Asia (China), and 515 animals were exported to the Pacific Islands (Papua New Guinea) (**Table 4**).

Number of export certificates issued

During 2017 there were 61 Overseas Market Access Requirements (OMARs) or export certificates issued and notified as notices under the Animals Products Act 1999. Of these, 26 notices represent requirements for new markets, while the rest were amendments to existing OMARs.

Animal Trade (Exports) Team
Animal Health and Welfare Directorate
Regulation and Assurance
Ministry for Primary Industries
animalexports@mpi.govt.nz

Animal Imports Team and Animal Trade (Imports) Team
Animal Health and Welfare Directorate
Regulation and Assurance
Ministry for Primary Industries
animal.imports@mpi.govt.nz

Animal Health Laboratory

The Ministry for Primary Industries' (MPI's) Animal Health Laboratory (AHL) plays a vital role in protecting New Zealand's livestock and aquaculture industries nationwide from new and emerging infectious diseases.

The AHL is a high-containment facility with specialised equipment and procedures that enable us to work safely with exotic or zoonotic organisms and exotic disease investigation samples. Our staff are highly qualified and experienced in the science disciplines of pathology, virology, bacteriology, immunology, molecular biology and bioinformatics, with specialist knowledge of exotic and emerging pathogens. The AHL maintains international best practice operations, with accreditation and certification to ISO/IEC 17025, AS.NZS 2243.3 and MPI Registered Laboratory Programme and Transitional and Containment Facility regulations.

Construction of the National Biocontainment Laboratory, an $87 million investment to meet international best practice for handling organisms that cause disease in animals and humans, continues to be of great interest to stakeholders, and large numbers of local and overseas officials and industry visitors have visited the Wallaceville site.

National Biocontainment Laboratory

The National Biocontainment Laboratory project has advanced significantly since 2017 and is making good progress. With the facade and roof now completed, the building has taken on its final appearance (**Figure 1**) and the vast majority of remaining work will be taking place inside. Large air-conditioning systems and their associated ductwork, seismic bracing and control centres are being installed throughout the building. The steel-framed laboratory rooms (**Figure 2**) are being constructed over two floors before the walling system, which was specially made in the US, is assembled and installed (**Figure 3**). To ensure the laboratory meets the strict pressure regimes required for certification, the walling sheets are assembled with a special sealant that must be applied in exacting environmental conditions, which are not always easy to achieve in a Wellington winter. Transition of existing operations into the new laboratory will begin mid-2019. The on-going *Mycoplasma bovis* emergency response has highlighted how critical this facility will be in meeting New Zealand's biosecurity needs over the years to come.

Figure 1: The National Biocontainment Laboratory facade

Figure 2: First-floor steel wall framing and above-ceiling heating, ventilation and air-conditioning system

Figure 3: A ground-floor laboratory showing smooth high-gloss Arcoplast panels that are resistant to impact, corrosion and chemicals

Diagnostic testing for the biosecurity response to *Mycoplasma bovis*

In July 2017, sixteen milk and joint-fluid samples from cattle suspected to be infected with *Mycoplasma bovis* were submitted to the AHL for diagnostic testing. The samples were tested with an in-house *M. bovis* real-time PCR adapted from Rossetti *et al.* (2010). All samples were positive by *M. bovis* real-time PCR and the results were confirmed by DNA sequencing of a *Mycoplasma* genus conventional PCR product (adapted from Shoeb *et al.*, 1997 and Kuppeveld *et al.*, 1992). The samples were cultured in a *Mycoplasma* enrichment broth using methodology accredited by IANZ to NZ ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories. Growth of *Mycoplasma* was observed from all 16 samples. Representative isolates from each sample were confirmed as *M. bovis* by real-time PCR and DNA sequencing of PCR products from a conventional Mycoplasma genus PCR. The genomes of the 16 *M. bovis* isolates were sequenced using the Illumina MiSeq Next Generation Sequencer and analysed in collaboration with experts from the Molecular Epidemiology and Public Health Laboratory at Massey University. A *Mycoplasma* isolate from the infected herd was also forwarded to the Animal and Plant Health Agency, Surrey, UK, an expert laboratory in animal mycoplasma diagnostics. The isolate was confirmed as *M. bovis* by PCR-DGGE.

In the early stage of the response, to support testing of increasing numbers of samples being submitted from tracing animal movements and other surveillance programmes, a commercially-available *M. bovis* real-time PCR kit and an *M. bovis* ELISA were assessed and adopted. In addition, the conventional *Mycoplasma* genus PCR was augmented with a *M. bovis*-specific conventional PCR (adapted from Pinnow *et al.*, 2001) for PCR sequencing to confirm the presence of *M. bovis* in samples that also contained endemic *Mycoplasma* spp.

One year into the *M. bovis* response, the AHL has performed more than 50 000 PCR tests and more than 125 000 ELISA tests for *M. bovis* (**Figure 1**).

Whole-genome sequencing of 78 *M. bovis* isolates from a range of infected properties has also been performed and this data is being analysed to support better understanding of the spread of *M. bovis* between farms in NZ.

In addition to conducting testing within AHL, our staff have helped facilitate testing for *M. bovis* at other laboratories within NZ, for surveillance of bulk vat and mastitis milk and to provide commercial testing. The quality-assured laboratories were given supporting documentation to help them perform accurate testing, and their facilities and processes were reviewed by MPI staff. Inactivated whole-cell *M. bovis* and inactivated mastitis milk were provided to the laboratories, and results from their PCR tests were compared with results from the same tests at the AHL.

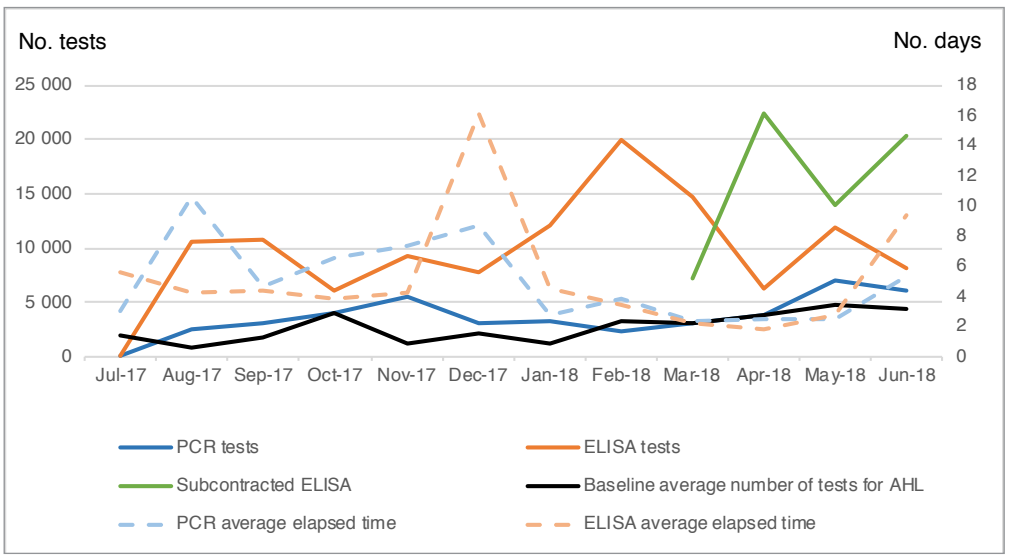

Figure 4: Monthly throughput of diagnostic tests for *Mycoplasma bovis*, July 2017–June 2018

Facilitating trade

The AHL functions as the national veterinary reference centre for New Zealand, and one of its core functions is diagnostic testing to support import and export trade. In 2017 more than 6 000 tests were performed for this purpose (**Table 1**).

Table 1: Summary of test numbers and description of work conducted by the AHL, 2017

Purpose of testing	Number of tests / accessions	Description of work
Exotic disease investigations	66 796/1 115	(1) Testing to rule out the presence of exotic pathogens (2) Identification of reptiles and amphibians that cross our borders
Cost-recovery diagnostics	1 946/147	Encompasses cost-recovered diagnostic testing and project work, much of which utilises capability not available elsewhere
Surveillance projects (Crown-funded)	13 440/186	Testing to support surveillance programmes including TSE, arbovirus and avian influenza
Import/export/trade (cost recovery)	6 414/581	(1) Import and export testing to maintain overseas trade for primary industries (2) Trade in companion animals and animal travel overseas (e.g., racehorses) (3) Quality assurance reference testing for industry partners
Artificial breeding (AB)	511/81	Specific testing to rule out presence of various pathogens, including some exotic diseases
Quality assurance	1 210/110	The AHL participates in 92 programmes of inter-laboratory proficiency testing through 11 international authorised reference partners in Australia, North America and Europe to provide assurances of our testing processes and to meet the requirements of ISO 17025

Capability

The AHL is a centre of science excellence and maintains its accreditation and certification to national and international standards. The laboratory is divided into four science disciplines: virology, immunology, bacteriology and aquatic animal diseases, each with its own team. Teams consist of expert senior scientists, scientists and technicians capable of carrying out the complex analyses and investigations presented to us on a daily basis. There are more than 450 test methods available at the AHL, many of them only available within New Zealand from the AHL. Tests range from classical and well-established techniques, for example bacterial culture, virus isolation, virus neutralisation, ELISA and microscopy/pathology, to molecular analysis and state-of-the-art technologies such as real-time PCR, Maldi-TOF, Next Generation sequencing and bioinformatics analysis. Where testing cannot be offered within New Zealand, the AHL subcontracts the work overseas to accredited reference laboratories. The AHL is constantly working to enhance diagnostic capability by implementing new or improved tests to ensure we lead the way in veterinary laboratory diagnostics in New Zealand. During 2017 tests were conducted by the AHL or subcontracted to overseas reference laboratories for a wide range of exotic microorganisms (**Table 2**).

Table 2: Tests conducted for exotic disease surveillance

Microorganism	Exotic disease investigation (no. of tests)	Scanning and active surveillance (no. of tests)
Abalone ganglioneuritis virus	0	6
Aeromonas salmonicida	3	375
Akabane virus	22	671
Alphavirus	5	5
Aphanomyces astaci	3	3
Aquabirnavirus (exotic strains)	7	16
Aquareovirus	4	4
Avian influenza (exotic strains)	35	7 567
Avian paramyxovirus (exotic strains)	37	2 649
Babesia cabelli	4	207
Babesia canis	5	5
Babesia gibsonii	5	5
Bacillus anthracis	8	8
Bluetongue virus	22	732
Borrelia	3	3
Bovine ephemeral fever	0	130
Bovine viral diarrhoea (exotic strains)	151	535
Brucella abortus	2	638
Brucella canis	3	9
Canine heartworm	1	1
Chlamydophila abortus	17	23
Classical swine fever virus	0	5
Coronavirus	17	17
Coxiella burnetii	2	2
Cytopathic fish viruses	3	392
Epizootic haemorrhagic disease virus	0	133
Equine encephalitis virus (Eastern and Western)	2	2
Equine infectious anaemia virus	4	405
Equine influenza virus	0	21
Equine viral arteritis	7	554
Ehrlichia canis	16	55
Flavivirus	5	5
Foot-and-mouth disease virus	86	86
Francisella tularemia	2	2
Infectious bursal disease virus (virulent strains)	7	60
Infectious haemopoetic necrosis virus	3	3
Infectious salmon anaemia virus	9	16
Iridovirus	0	8
Israeli acute paralysis virus	0	624
Koi herpesvirus	0	9
Leishmania	16	64
Maedi-visna virus	1	1
Melissococcus plutonius	13	13
Mycoplasma agalactiae	28	60

Continued page 10

Table 2: Tests conducted for exotic disease surveillance (continued)

Microorganism	Exotic disease investigation (no. of tests)	Scanning and active surveillance (no. of tests)
Mycoplasma leachii (bovine group 7)	32	32
Mycoplasma bovis	62 257	62 257
Mycoplasma capricolum	32	32
Mycoplasma iowae	10	10
Mycoplasma meleagridis	10	10
Mycoplasma spp.	57	157
Nodavirus	0	70
Perkinsus	150	221
Piroplasma	24	24
Porcine reproductive and respiratory virus	3	3
Piscirickettsia salmonis	0	164
Rabies virus	0	17
Ranavirus	4	9
Rhabdovirus carpio	0	5
Renibacterium salmoninarum	0	60
Salmonid alphavirus	0	16
Schmallenberg virus	22	22
Taylorella equigenitalis	0	1
Theileria equi	4	206
Treponema paraluiscuniculi	1	1
Transmissible spongiform encephalopathy	0	954
Viral haemorrhagic septicaemia virus	3	8
Yersina ruckerii (exotic strains)	8	380
West Nile virus	1	1
White spot syndrome virus	0	1

National and international connections

The AHL maintains an extensive network of national and international contacts for subcontracting tests, for access to reference material and for technical advice. In addition, technical delegations from trading partners visit the AHL to assure themselves of New Zealand's testing competence. During the year AHL experts represented NZ on the following multinational animal disease working groups:

- International Veterinary Biosafety Workgroup, a multinational group that promotes best practice in microbiological biocontainment and safety in veterinary laboratories that have national responsibility for the health of large animals, and which operate at biosafety levels 3 and 4 – Joseph O'Keefe;
- FluLabNet, an EU-organised collaborative network on influenza – Wlodek Stanislawek;
- Global Foot-and-Mouth Disease Research Alliance, a network of international laboratories that work collaboratively to improve the control and prevention of FMD – Richard Spence;
- Sub-committee of Aquatic Animal Health Standards, an Australian and New Zealand committee that provides technical advice on aquatic animal health issues in support of policy planning – Diana Jaramillo; and
- National Laboratory Task Group, an Australian and New Zealand committee that provides technical advice on animal health laboratory diagnostics in support of policy planning – Wendy McDonald.

Staffing and structure

See **Table 3**.

Table 3: Staffing and structure

Director, Diagnostic and Surveillance Services	Veronica Herrera (Wellington)
Director, National Biocontainment Laboratory Project	Joseph O'Keefe
Animal Health Laboratory Manager (Acting)	Wendy McDonald
Bacteriology and Aquatic Animal Diseases	
Bacteriology and Aquatic Animal Diseases Manager (Acting)	Richard Spence
Scientists	Diana Jaramillo, Henry Lane, Oliver Quinn, Cara Brosnahan, Sharon Humphrey
Technical staff	Rana Fathizargaran, Smriti Nair, Meredith Birrell
Immunology	
Immunology Manager (Acting)	Douglas Begg
Scientists	Rick Clough, Barbara Binney, Edna Gias, Rudolfo Bueno, Richard Swainsbury
Technical staff	Michaela Hannah, Emma Bramley, Tais Garcia, Amy Bradshaw
Technical Resource Coordinator	Judy Jenner
Biosafety Officer	Kanishka Fernando
Virology	
Manager	Hye Jeong Ha
Principal Adviser	Wlodek Stanislawek
Scientists	David Pulford, Edna Gias, Richard Hall, Della Orr
Technical staff	Mike Hansen, Ickel Marie Bueno, Sylvia Ohneiser, Maree Joyce, Harriet Sowman
Technical assistants	Barbara Black, Mary Mewett
Containment Laboratory	
Supervisor	Bryan Schroeder
Technical Assistants	Barbara Black, Mary Mewett
Quality Assurance	
Adviser	Irina Bolotovski

Staff publications in scientific and technical journals

Brosnahan CL, Humphrey S, Knowles G, Ha HJ, Pande A, Jones JB (2017). Nocardiosis in freshwater reared Chinook salmon (*Oncorhynchus tshawytscha*). *New Zealand Veterinary Journal* 65, 214–218.

Dutilh BE, Reyes A, Hall RJ, Whiteson KL (2017). Editorial: Virus Discovery by Metagenomics: The (Im)possibilities. *Frontiers in Microbiology* 8, 1710. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5596103/

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Lawrence KE, Forsyth SF, Vaatstra BL, McFadden A, Pulford DJ, Govindaraju K, Pomroy WE (2017). Cluster analysis of the clinical histories of cattle affected with bovine anaemia associated with *Theileria orientalis* Ikeda type infection. *New Zealand Veterinary Journal* 65(6), 305–312. doi: 10.1080/00480169.2017.1364180

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Wendy McDonald
Acting Animal Health Laboratory Manager
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
wendy.mcdonald@mpi.govt.nz

Animal Health Surveillance

The following tables present animal health data collected by MPI from various sources during 2017.

Table 1 is a summary of the numbers of laboratory submissions from sick farmed animals, from the major livestock and avian populations.

Table 2 lists the number of *Salmonella* serotypes by animal species diagnosed by veterinary pathology laboratories.

Table 3 presents a summary of results from the salmon surveillance programme run annually in approved establishments for the export of salmon for human consumption to Australia. No significant infectious disease was detected during this programme. Twenty salmon farms were tested and none recorded significant mortalities.

Table 4A presents a cumulative list of investigations conducted by Incursion Investigators from MPI's Biosecurity Surveillance and Incursion Investigation animal health, and aquatic and environment health teams, more than once during the period 2012–2017 that have resulted in exclusion of OIE-notifiable diseases or other selected significant exotic diseases.

Table 4B presents a list of significant investigations conducted during 2017 by MPI's Biosecurity Surveillance and Incursion Investigation animal health, and aquatic and environment health teams, into suspected exotic or emerging diseases that have been confirmed as positive. These include exotic disease or vector incursions or newly emerged diseases, occurrences of diseases in new host species, first detections of disease agents established in New Zealand, and interceptions with no resulting transmission or establishment of organisms.

Table 1: Numbers of cases and diagnoses received from veterinary pathology laboratories during 2017

Cattle	
Total sick animal cases	**17 693**
Abnormalities of reproductive system	**57**
Neospora caninum	5
Campylobacter fetus ssp. *venerealis*	0
Pestivirus infection	0
Abortion	**627**
Neospora caninum	107
Mycotic abortion	3
Pestivirus infection	15
Leptospira spp.	27
Congenital defects	**5**
Ill thrift/diarrhoea	**9 769**
Pestivirus infection	174
Gastrointestinal parasitism	11
Johne's disease - suspicious and confirmed	1 841
Trace element deficiency	316
Yersinia spp.	428
Rotavirus	569
Nervous signs	**416**
Listeria monocytogenes	7
Hepatic encephalopathy	0
Metabolic disease	31
Malignant catarrhal fever	6
Polioencephalomalacia	1
Histophilus somnus	0
Sudden death	**1 086**
Clostridium spp.	8
Respiratory disease	**624**
Sheep	
Total sick animal cases	**1 325**
Abnormalities of reproductive system	**16**
Brucella ovis	0
Abortion	**235**
Campylobacter fetus ssp. *fetus*	25
Other Campylobacter spp.	7
Toxoplasma gondii	49
Salmonella Brandenburg	21
Congenital defects	**1**
Ill thrift/diarrhoea	**499**
Johne's disease	26
Trace element deficiency	15
Gastrointestinal parasitism	57
Nervous signs	**70**
Listeria monocytogenes	5
Polioencephalomalacia	**0**
Clostridium spp.	1
Respiratory disease	**29**
Sudden death	**263**
Gastrointestinal parasitism	6
Farmed deer	
Total sick animal cases	**123**
Abortion	**1**
Streptococcus zooepidemicus	0
Congenital defects	**0**
Ill thrift/diarrhoea	**64**
Johne's disease	11
Trace element deficiency	5
Yersinia spp.	8
Nervous signs	**8**
Malignant catarrhal fever	0
Sudden death	**35**
Gastrointestinal parasitism	0
Malignant catarrhal fever	2
Horses	
Total sick animal cases	**5 204**
Abortion	**44**
Streptococcus zooepidemicus	2
Circulatory disease	**33**
Ill thrift/diarrhoea	**1 184**
Gastrointestinal parasitism	7
Nervous signs	**192**
Respiratory disease	**609**
Streptococcal infection	70
Sudden death	**28**
Pigs	
Total sick animal cases	**67**
Abortion	**2**
Ill thrift/diarrhoea	**22**
Nervous signs	**6**
Sudden death	**26**
Goats	
Total sick animal cases	**470**
Abortion	**12**
Ill thrift/diarrhoea	**244**
Gastrointestinal parasitism	2
Respiratory disease	**12**
Nervous signs	**20**
Listeria monocytogenes	2
Caprine arthritis encephalitis	1
Sudden death	**43**
Clostridium perfringens D (enterotoxaemia)	0
Gastrointestinal parasitism	0
Lamoids	
Total sick animal cases	**271**
Abortion	**7**
Ill thrift/diarrhoea	**133**
Gastrointestinal parasitism	2
Nervous signs	**17**
Respiratory disease	**9**
Sudden death	**14**
Avian species	
Total number of submissions	**723**

Table 2: *Salmonella* serotypes isolated from animals during 2017

Serotype	Avian	Bovine	Canine	Equine	Feline	Ovine	Porcine	Reptile
Salmonella Abortusequi	0	0	0	0	0	0	0	0
Salmonella Abortusovis	0	0	0	0	0	0	0	0
Salmonella Adelaide	0	0	0	0	0	0	0	0
Salmonella Agona	0	10	1	0	1	0	0	0
Salmonella Albany	0	0	0	0	0	0	0	0
Salmonella Amager	0	0	0	0	0	0	0	0
Salmonella Amsterdam	0	1	0	0	0	0	0	0
Salmonella Anatum	0	2	0	0	0	0	0	0
Salmonella Arizonae	0	0	0	0	0	0	0	0
Salmonella Banana	0	0	0	0	0	0	0	0
Salmonella Bareilly	0	0	0	0	0	0	0	0
Salmonella Bere	0	0	0	0	0	0	0	0
Salmonella Bovismorbificans	0	219	5	1	4	2	0	0
Salmonella Brancaster	0	0	0	0	0	0	0	0
Salmonella Brandenburg	0	80	5	0	3	22	0	0
Salmonella Bredeney	0	0	0	0	0	0	0	0
Salmonella California	0	0	0	0	0	0	0	0
Salmonella Choleraesuis	0	0	0	0	0	0	0	0
Salmonella Cubana	0	0	0	0	0	0	0	0
Salmonella Derby	0	0	0	0	0	0	0	0
Salmonella Dublin	0	0	0	0	0	0	0	0
Salmonella Eastbourne	0	0	0	0	0	0	0	0
Salmonella Emek	0	3	0	0	0	0	0	0
Salmonella Enterica	0	0	0	0	0	0	0	2
Salmonella Enterica ssp. Salamae	0	0	0	0	0	0	0	1
Salmonella Enteritidis	0	7	0	0	1	1	0	0
Salmonella Fresno	0	0	0	0	0	0	0	0
Salmonella Give	0	0	0	0	0	0	0	0
Salmonella Hadar	0	0	0	0	0	0	0	0
Salmonella Havana	0	0	0	0	0	0	0	0
Salmonella Heidelberg	0	0	0	0	0	0	0	0
Salmonella Hindmarsh	0	4	0	0	0	20	0	0
Salmonella Houtenae	0	0	0	0	0	0	0	0
Salmonella Hvittingfoss	0	0	0	0	0	0	0	0
Salmonella Infantis	0	5	0	0	0	0	0	0
Salmonella Johannesburg	0	0	0	0	0	0	0	0
Salmonella Kedougou	0	0	0	0	0	0	0	0
Salmonella Kentucky	0	2	0	0	0	0	0	0
Salmonella Kiambu	0	0	0	0	0	0	0	0
Salmonella Kottbus	0	0	0	0	0	0	0	0
Salmonella Lexington	0	1	0	0	0	0	0	0
Salmonella Litchfield	0	0	0	0	0	0	0	0
Salmonella Liverpool	0	0	0	0	0	0	0	0
Salmonella Livingstone	0	0	0	0	0	0	0	0
Salmonella London	0	0	0	0	0	0	0	0
Salmonella Luckenwalde	0	0	0	0	0	0	0	0
Salmonella Mana	0	0	0	0	0	0	0	0
Salmonella Mbandaka	0	3	0	0	0	0	0	0
Salmonella Meleagridis	0	0	0	0	0	0	0	0
Salmonella Minnesota	0	0	0	0	0	0	0	0
Salmonella Mississippi	1	0	1	0	0	0	0	0

Continued on page 14

Table 2: *Salmonella* serotypes isolated from animals during 2017 (continued)

Serotype	Avian	Bovine	Canine	Equine	Feline	Ovine	Porcine	Reptile
Salmonella Molade	0	0	0	0	0	0	0	0
Salmonella Montevideo	0	0	0	0	0	0	0	0
Salmonella Muenster	0	0	0	0	0	0	0	0
Salmonella Nchanga	0	0	0	0	0	0	0	0
Salmonella Newington	0	0	0	0	0	0	0	0
Salmonella Newport	0	0	0	0	0	0	0	0
Salmonella Onderstepoort	0	0	0	0	0	0	0	2
Salmonella Oranienburg	0	0	0	0	0	0	0	0
Salmonella Orion	0	0	0	0	0	0	0	0
Salmonella Paratyphi	0	0	0	0	0	0	0	0
Salmonella Poona	0	0	0	0	0	0	0	0
Salmonella Potsdam	0	0	0	0	0	0	0	0
Salmonella Pullorum	0	0	0	0	0	0	0	0
Salmonella Reading	0	0	0	0	0	0	0	0
Salmonella Rideauf	0	0	0	0	0	0	0	0
Salmonella Rissen	0	0	0	0	0	0	0	0
Salmonella Rough	0	0	0	0	0	0	0	0
Salmonella Ruiru	0	2	0	0	0	0	0	0
Salmonella Saintpaul	0	3	1	0	0	0	0	1
Salmonella Salford	0	0	0	0	0	0	0	0
Salmonella Schwarzengrund	0	0	0	0	0	0	0	0
Salmonella Senftenberg	0	3	0	0	0	0	0	0
Salmonella Singapore	0	0	0	0	0	0	0	0
Salmonella Tennessee	0	0	0	0	0	0	0	0
Salmonella Thompson	0	0	1	0	0	0	0	0
Salmonella Typhi	0	0	0	0	0	0	0	0
Salmonella Typhimurium	7	222	10	11	15	7	1	0
Salmonella Typhisuis	0	0	0	0	0	0	0	0
Salmonella Uganda	0	0	0	0	0	0	0	0
Salmonella Victoria	0	0	0	0	0	0	0	0
Salmonella Virchow	0	0	0	0	0	0	0	0
Salmonella Wangata	0	0	0	0	0	0	0	0
Salmonella Warragul	0	0	0	0	0	0	0	0
Salmonella Weltevreden	0	0	0	0	0	0	0	0
Salmonella Westhampton	0	0	0	0	0	0	0	0
Salmonella Worthington	0	0	0	0	0	0	0	0
Salmonella Yoruba	0	0	0	0	0	0	0	0
Salmonella Zanzibar	0	0	0	0	0	0	0	0
Total	**8**	**572**	**46**	**19**	**49**	**52**	**1**	**9**
Unspecified	0	5	22	7	25	0	0	3

Table 3: Salmonid surveillance during 2017

Pathogen tested for	No of farms	No of samples	No of positives
Viral cultures	20	1 920	0
Myxobolus cerebralis	10	660	0
Yersinia ruckeri	20	1 920	4*
Aeromonas salmonicida	20	1 920	0
Renibacterium salmoninarum	7	420	0

* The endemic strain of *Yersinia ruckeri* (serotype O1b) was isolated (serotyped by AAHL in Geelong, Australia)

Number of salmon farms tested	20
Number of farms reporting significant mortalities	0
Number of farms where significant infectious disease was detected through this scheme	0

Table 4a: Cumulative list of significant (*A) negative investigations of suspected exotic diseases, 2012–2017

Disease agents investigated and confirmed as negative	2012	2013	2014	2015	2016	2017	Total
Aeromonas salmonicida (fish) *B	3		2		3	1	9
African horse sickness		2					2
Africanised honeybee (*Apis mellifera scutella*)/Cape bee (Apis mellifera capensis) *B				3		1	4
Akabane virus	1	1	1	1		1	5
Anaplasmosis	5	3	2	2	1	10	23
Anthrax	1	3	4	2	4		14
Avian influenza: highly pathogenic notifiable avian influenza & Newcastle disease *B	8	4	3	5	3	3	26
Avian influenza: low-pathogenicity notifiable avian influenza *B	6	2	2	1		1	12
Avian polyomavirus *C	1	2			2		5
Babesia canis, B. gibsoni, B. felis	5	2	1	1	2	4	15
Bluetongue	6		2	4	1	1	14
Brucella abortus	3	2	2	1	1	1	10
Brucella canis	8	6	5	9	12	6	46
Brucella melitensis	2		1	1	1		5
Bovine herpesvirus type 5	1	2	2				5
Bovine theileriosis/babesiosis (exotic strains)	3	6	1			1	11
Bovine viral diarrhoea type II	2		6	1	6		15
Burkholderia mallei (glanders) & *B. pseudomallei* (melioidosis)			1	2	1		4
Canine distemper virus	1	1	2	3	1	1	9
Canine influenza				2			2
Chlamydophila abortus (enzootic abortion)	1		1		2	1	5
Contagious bovine pleuropneumonia	2	1			1		4
Ehrlichia canis	1	1	1		3	5	11
Equine piroplasmosis	2	3	2	3	1	5	16
Equine herpesvirus type 1 (abortion strains, neuropathogenic strains)	3	1	6	1	9	4	24
Equine infectious anaemia/Equine viral arteritis	14	17	4	7	11	10	63
Equine influenza	1	2	3	2	2	2	12
European foulbrood (bees) *B	4	3	7	8	6	4	32
Exotic ticks		3	3	15	11	11	43
Fish/shellfish mortality (wild or managed, marine) – exclusion of exotic & novel infectious disease agents	6	5	4	11	2	10	38
Haemorrhagic septicaemia (*Pasteurella multocida* – toxogenic strains)	7	3		1	1	1	13
Heartworm (*Dirofilaria immitis*)	2			3	1	2	8
Hydatids (*Echinococcus* spp.)	1			1	4	2	8
Infectious bovine rhinotracheitis (exotic strains)	4	1		2	1	1	9
Infectious bursal disease	2	5	1	3	1		12
Israeli acute paralysis virus (bees) *B	3	1	3	7	1		15
Leishmaniasis	2				5	6	13
Leptospira (exotic strains)	2	1	3	1		3	10
Mycoplasma bovis	3	1	4		6	2 *C	16
Mycoplasma mycoides mycoides (large colony)	2					1	3
Myxomatosis	1	2		1			4
Nosema ceranae (bees) *C	1	1	2	2	2	1	9
Ornithobacterium rhinotracheale	2	1	1	*C			4
Perkinsus marinus & *P. olseni* *C (molluscs)	1	2	2		3	6	14
Porcine reproductive & respiratory syndrome			1	2		1	4
Poxviruses (ruminants & camelids)	4	1	1	2	1		9
Psittacine herpesvirus (incl. Pacheco's disease)		2			3	1	6
Pulmonary adenomatosis virus	2						2
Q fever (*Coxiella burnetti*)	3	1	2		2		8
Rabies	1	1					2
Rinderpest	2						2
Ross River virus	1				1	2	4
Salmonella (exotic strains)	4	4	2	1	1	1	13
Small hive beetle (*Aethina tumida*) (bees) *B	1		2	1	1	2	7
Tracheal mite (*Acarapis woodi*) (bees) *B	2	1	3	9	3	2	20
Transmissible spongiform encephalopathy agents (scrapie, BSE;, chronic wasting disease, FSE) *B	3	4	3	5	1		16
Trichinella spiralis		1				1	2
Tropilaelaps clareae & *T. koenigerum* (bees) *B	3	1		4	1	1	10
Tularaemia (*Francisella tularensis*)	1			2		1	4
Viral haemorrhagic septicaemia (fish)	1		1		1		3
Viral vesicular disease	7	5	4	9	16	7	48
West Nile virus	1		4	1	3	2	11
Total	**159**	**111**	**107**	**142**	**145**	**129**	**793**

Table 4b: List of significant positive investigations of suspected exotic diseases, 2017

Disease agents/vectors investigated and confirmed as positive, and host species	Number of positive investigations in 2017
Mycoplasma bovis (cattle) *D[1]	1
Rickettsia-like organism (shellfish)[2]	6
Brown dog tick (*Rhipicephalus sanguineus*) (dog) *E	1
Paralysis tick (*Ixodes holocyclus*) (human) *F[3]	1

[1]Bingham *et al.* (2018)
[2]Williams (2017); Taylor (2017b); Taylor (2018); Pande (2017)
[3]Bingham (2018)

Notes to Tables 4a and 4b

*A The investigations listed in **Table 4A** are those that have resulted in exclusion of an OIE-notifiable disease or other significant diseases investigated more than once in the time period. This is not a definitive list of all investigations conducted. Some investigations resulted in multiple exclusions using specific laboratory methods, and these are recorded against each disease. The data were retrieved and analysed from the Notification and Investigation Manager Application database. Regular quarterly investigation reports are published in *Surveillance*: see Bingham (2017a, 2017b, 2017c, 2018), Taylor (2017a, 2017b, 2018) and Williams (2017).

*B Investigations reported here are in addition to the testing in the MPI active surveillance programmes for these disease agents. See Rich (2017) (honey bee exotic pest and disease surveillance), Stanislawek *et al.* (2017) (avian influenza surveillance), Vink (2017) (TSE surveillance) and **Table 3** above (salmon surveillance).

*C These previously exotic disease agents have become established in New Zealand, either during the year if indicated in a time column, or previously if indicated next to the disease agent name. They may remain the subject of exotic disease investigation for the purpose of describing

an emerging disease, potential new animal host species, or as suspected new incursions.

*D An MPI biosecurity response was established for this unwanted organism.

*E This was a post-border incursion of an exotic tick species capable of vectoring disease. An MPI biosecurity response resulted in eradication of the organisms.

*F This confirmed exotic tick was intercepted soon after entry to NZ. Transmission or establishment of organisms did not occur.

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Kylee Walker
Incursion Investigator
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
kylee.walker@mpi.govt.nz

Jonathan Watts
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Jonathan.watts@mpi.govt.nz

Henry Lane
Senior Scientist
Bacteriology & Aquatic Animal Diseases
Animal Health Laboratory
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Henry.lane@MPI.govt.nz

Avian influenza surveillance programme

Figure 1: Mallard ducks in wire mesh traps for banding and collection of samples at the mouth of the Kaituna River

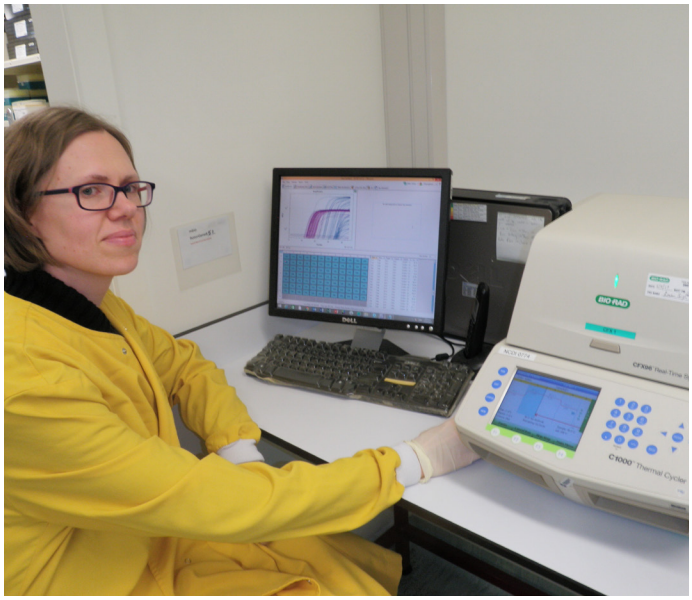

Figure 2: Senior laboratory technician MaryAnn Tuboltsev testing mallard duck samples using RT-qPCR assay

New Zealand's avian influenza surveillance programme is multi-faceted, incorporating active surveillance of resident wild birds, and enhanced passive surveillance. New Zealand has never had a case of highly pathogenic avian influenza virus (infection with influenza A virus of high pathogenicity) in wild birds or poultry (World Organisation for Animal Health, 2016).

Wild bird surveillance

New Zealand is not on a migration pathway for waterfowl as observed in the northern hemisphere, although vagrant waterfowl from Australia are occasionally encountered. New Zealand lies at the southeastern extremity of the East Asian-Australasian Flyway which was (and still is) of particular relevance for the introduction of novel avian influenza (AI) strains, especially given the spread of H5N1 across Asia since 2004. Therefore, since 2004 the Ministry for Primary Industries (MPI), in conjunction with the New Zealand Fish & Game Councils, the Department of Conservation and other stakeholders, has annually carried out surveillance for avian influenza viruses in targeted migratory and resident birds. The first 6 years of surveillance focused primarily on migratory birds, in particular the bar-tailed godwit (*Limosa lapponica*), and red (lesser) knot (*Calidris canutus*), on their arrival each year from late September to November, at Miranda, their main North Island arrival site. These birds were targeted for surveillance because of their migration pathway, along which avian influenza viruses may be present: directly from the Arctic regions of Asia and North America in the case of the godwit, and from Arctic regions via the Pacific coast of Asia in the case of the knot. However, surveillance over this period indicated that migratory birds posed a very low risk for the introduction of high-pathogenicity avian influenza viruses into New Zealand, as no avian influenza virus was ever isolated. Therefore, since 2010, surveillance has focused on resident birds, mainly waterfowl.

Since 2004, non-migratory waterfowl, predominantly mallard ducks (*Anas platyrhynchos*), have been sampled in the summer months throughout New Zealand, with a particular focus on coastal areas where they might have had contact with migratory shorebirds.

In 2017, cloacal and oropharyngeal swabs were collected from 1 175 healthy resident mallard ducks (**Table 1**). A Fish & Game banding programme provided a convenient opportunity for MPI to collect samples from ducks for avian influenza surveillance at the same time. Individual bird samples were tested by the influenza A real-time RT-qPCR TaqMan (Spackman *et al.*, 2003; Heine *et al.*, 2015). Positive or suspect samples

Table 1: Active surveillance for avian influenza viruses in wild mallard ducks, 2017

Location	Number of mallard ducks sampled	Number of samples tested (cloacal & oropharyngeal)	No. of RT/PCR positives		Number of confirmed H5 or H7 isolates
			H5	H7	
Helensville, Northland	320	640	0	0	0
Gisborne and Wairoa, Hawke's Bay	300	600	0	0	0
Mouth of Kaituna River, Bay of Plenty	320	640	0	2	1 x H7*
Lake Te Rotokare, Hawke's Bay	100	200	0	0	0
Invercargill, Southland	135	270	0	0	0
Total	**1 175**	**2 350**	**0**	**2**	**1 x H7***

*The amino acid pattern of the HA cleavage site was consistent with low-pathogenic H7 virus

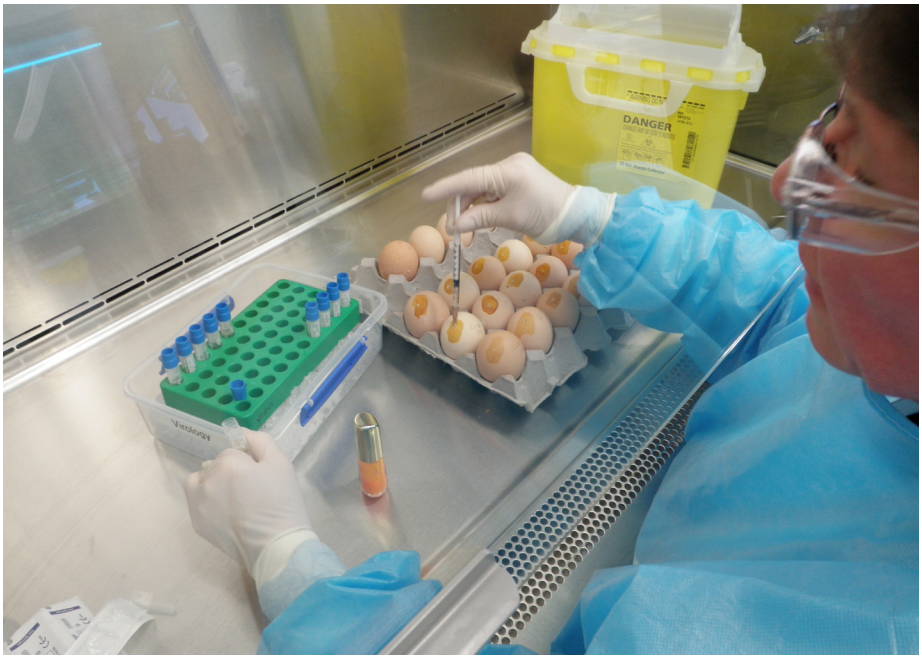

Figure 3: Senior laboratory technician Maree Joyce inoculating samples collected from mallard ducks into embryonated chicken eggs, used to obtain live avian influenza viruses

were then tested using real-time H5 and H7 RT-qPCR TaqMan (Slomka *et al.*, 2007; Sidoti *et al.*, 2010) and conventional H5, H7 RT-PCRs to obtain genomic information.

During the season influenza A RNA was detected in 860 (73.2 percent) of the cloacal or oropharyngeal samples (or both); this is one of highest percentages of AI-carrier ducks detected by this programme. Influenza subtype H7 RNA was confirmed in two samples from one North Island location, and one H7 virus was isolated and confirmed to be non-pathogenic, based on analysis of the cleavage site of the HA gene. No H5 viruses were detected.

To obtain information on the presence of AI virus subtypes other than H5 and H7 in mallard ducks in New Zealand, virus isolation was also carried out on a random selection of the remaining influenza A RT-qPCR-positive samples. A number of influenza viruses of the subtypes H3, H4, H6 and H11 were isolated.

Enhanced passive surveillance

MPI operates a 24/7 toll-free exotic pest and disease emergency hotline and receives calls relating to sick and dead wild and domestic birds from members of the public, veterinarians, regional laboratory pathologists and others. Where reports relate to native birds, they are handled collaboratively with the Department of Conservation.

Table 2: Avian mortality notifications and investigations, 2017

Month	Notifications	Investigations
January	1	1
February	4	1
March	4	2
April	0	0
May	1	1
June	0	0
July	1	1
August	0	0
September	1	1
October	1	1
November	5	4
December	0	0

A risk assessment determines the need to investigate the report further. Key information used in the profile includes:

- history of the event: numbers affected and timeline of events;
- signs observed in dying birds;
- species of bird/s affected;
- availability of fresh samples (where unavailable, follow-up is instigated);
- location; and
- epidemiological trends over space and time.

Based on the risk assessment, the investigation is either stood down or expanded to look for a potential exotic or emerging disease aetiology.

A rapid field service is in place for sample collection and submission of unexplained bird deaths (Rawdon *et al.*, 2007), using MPI-approved suppliers. A standardised investigation protocol, co-ordinated by MPI Diagnostic and Surveillance Services (DSS) at Wallaceville is applied to submissions. This includes necropsy and sample collection for histology, bacteriology and virology. The presence of avian influenza is assessed using influenza A real-time RT-qPCR TaqMan (Spackman *et al.*, 2003), with follow-up using real-time H5 and H7 RT-qPCR TaqMan assays to exclude H5 and H7 subtypes (Slomka et al., 2007; Sidoti *et al.*, 2010). Virus isolation is performed on samples that are positive in PCR assays (Stanislawek et al., 2002).

Reports on avian disease and mortality investigations are published quarterly in *Surveillance* as part of the DSS report of suspect exotic disease investigations. In 2017, 12 such investigations were conducted (**Table 2**). No H5 or H7 viruses were isolated from any of the samples submitted for these investigations, and in all cases exotic disease was excluded.

Additionally, MPI collects data from approved veterinary diagnostic laboratories on avian submissions from veterinary practitioners. **Table 3** summarises submission data from the MPI passive surveillance system (Watts *et al.*, 2016).

Table 3: Avian submissions to MPI's passive surveillance system, 2004–2017

Year	Approved veterinary diagnostic laboratory submissions	MPI notifications	MPI investigations
2004	116	30	8
2005	340	85	8
2006	360	154	24
2007	33	60	14
2008	120	37	10
2009	163	*151	7
2010	174	25	7
2011	142	19	7
2012	290	19	8
2013	664	19	6
2014	385	30	13
2015	503	45	14
2016	824	28	11
2017	723	18	12

*The aberration in the number of bird mortality reports for 2009 was due to a toxicity event in August of that year relating to grey side-gilled sea slugs (*Pleurobranchaea maculata*) in the Auckland region.

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Wlodek Stanislawek
Principal Adviser/Veterinary Virologist
Animal Health Laboratory
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
wlodek.stanislawek@mpi.govt.nz

Tom Rawdon
Incursion Investigator
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
thomas.rawdon@mpi.govt.nz

Toni Tana
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
toni.tana@mpi.govt.nz

Wildlife disease surveillance

Wildlife surveillance is an important part of New Zealand's national surveillance system for exotic and emerging pests and disease. The purpose of the Ministry for Primary Industries (MPI)'s wildlife surveillance programme is to:

- facilitate early detection of exotic and emerging diseases;
- support New Zealand's statements of freedom from specific pests and diseases;
- provide baseline information on endemic disease occurrence in New Zealand wildlife; and
- support fulfilment of New Zealand's international reporting obligations.

The MPI national exotic pest and disease notification system provides for the reporting and investigation of unusual disease events in all animals, including wildlife. The MPI pest and disease emergency hotline (0800 80 99 66) helps New Zealanders to meet their obligations under section 44 of the Biosecurity Act 1993, which requires every person to report to MPI any suspected cases caused by organisms not normally seen or otherwise detected in New Zealand. This enables the appropriate investigation of suspected cases of exotic or emerging diseases that are identified in wildlife by organisations or individuals working outside of MPI surveillance programmes.

In addition to investigating reported events, MPI undertakes annual active surveillance in wild birds for avian influenza viruses (see p. 17) and monitoring of routine disease diagnoses by veterinary diagnostic laboratories to detect possible indications of occurrence that may indicate an emerging disease requiring further investigation. MPI receives anonymised commercial laboratory summaries of cases involving feral animals, captive animals and wild native animals that meet a sick animal case criterion. Reports of particular interest are summarised in the *Quarterly review of diagnostic cases* article in each edition of *Surveillance*.

Alongside MPI's wildlife activities, causes of mortalities of threatened or critically endangered native species are monitored by the Department of Conservation (DOC), as part of a DOC contract undertaken by Wildbase Pathology at the School of Veterinary Science, Massey University, Palmerston North. Certain animals found dead in the field or in captive facilities are sent to the Wildbase laboratory for post-mortem examination by veterinary wildlife pathologists. Details of the cases examined and those investigated by MPI disease investigators over the previous year are discussed below.

Wildlife cases processed by veterinary laboratories

Records of wildlife mortality are held in the Massey Pathology and Huia Wildlife Disease databases, jointly owned by DOC and Massey University and maintained by Wildbase Pathology. Most cases involve mortalities of native birds, in particular threatened species submitted by DOC for diagnosis at Wildbase. These databases also hold some case records from surveillance activities, private veterinary laboratories and researchers. **Figure 1** shows numbers of avian cases compared to numbers of cases involving other types of wildlife from 2013 to 2017. The number of avian cases submitted in 2017 decreased slightly compared to 2016 but still comprised more than 88 percent of all submissions, with native lizards (skinks and geckos) 4 percent, tuatara (*Sphenodon* spp.) 1.5 percent, pinnipeds (NZ sea lions, *Phocarctos hookeri* and NZ fur seals, *Arctocephalius forsteri*) 2.5 percent, cetaceans (whales and Hector's dolphins, *Cephalorhynchus hectori*) 1.5 percent; and amphibians, native fish and bats < 1 percent. Other wild mammals (mustelids, rabbits and possums) totalled just over 1 percent.

As in 2016, mortalities in both juvenile and adult yellow-eyed penguins (*Megadyptes antipodes*) from coastal Otago continued to be a major concern. Many neonatal penguins were affected by diphtheritic stomatitis (Alley *et al*., 2017) during late spring, and adults succumbed to an erythrophagocytic syndrome (Gartrell *et al*., 2017) in late summer. Predation of subadult birds by mustelids and dogs was the main cause of mortality in kiwi, blue ducks/whio (*Hymenolaimus malacorhynchos*) and little penguins/korora (*Eudyptes minor*) in several regions, often following re-introduction programmes.

Disease surveillance of highly threatened species such as kakapo (*Strigops habroptilus*, black stilt (*Himantopus novaezelandiae*), hihi/stitchbird (*Notiomystis cincta*) and the endangered species and subspecies of kiwi, continued throughout the year. A small number of wild introduced birds were examined because of the interest in preventing

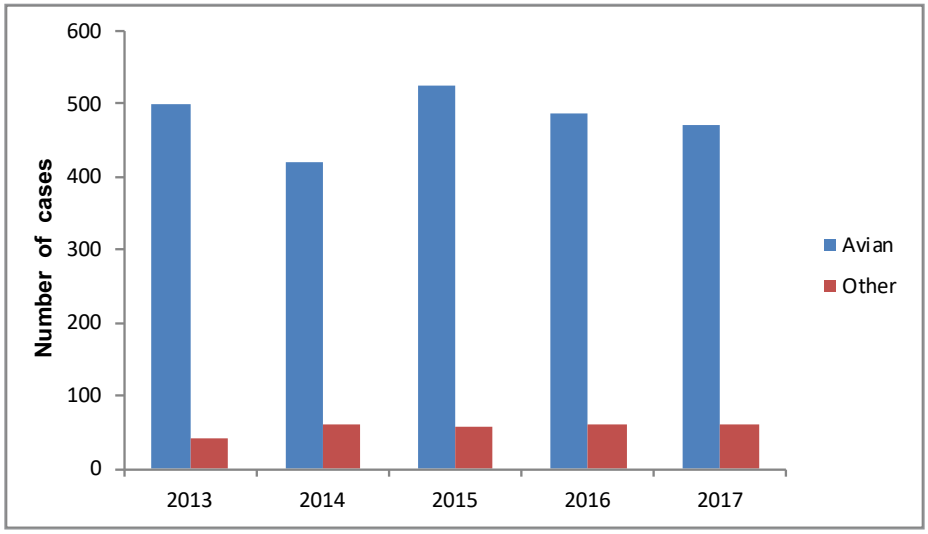

Figure 1: Number of wildlife cases in birds and other taxonomic groups recorded in the Massey Pathology Register and Huia Wildlife Diseases database, 2013–2017

transmission of diseases such as malaria, beak-and-feather disease and salmonellosis from introduced birds to native species.

The geographic distribution of avian wildlife cases examined in 2017 is shown in **Figure 2**. The highest numbers of cases submitted were from Otago. This was due to the ongoing investigation of mortalities in the highly endangered yellow-eyed penguin breeding grounds in coastal Otago. Cases from the Manawatu/Whanganui region included those from the National Wildlife Centre at Mt Bruce/ Pukaha, and Tongariro National Park. The Wellington submissions included cases from Wellington Zoo, Zealandia, Mana Island, Kapiti Island and the Chatham Islands. Waikato cases included those from Otorohanga, Mangatautari and Hamilton Zoo. The Canterbury region contains Mt Cook National Park as well as captive breeding centres for threatened species at Twizel, Willowbank and Peacock Springs. Many cases submitted from the Auckland region involved threatened species from offshore islands including Tiritiri Matangi, Motutapu and Ponui. In addition, moderate numbers of cases were submitted directly from locally administered wildlife sanctuaries situated mainly in the southern and central parts of the North Island.

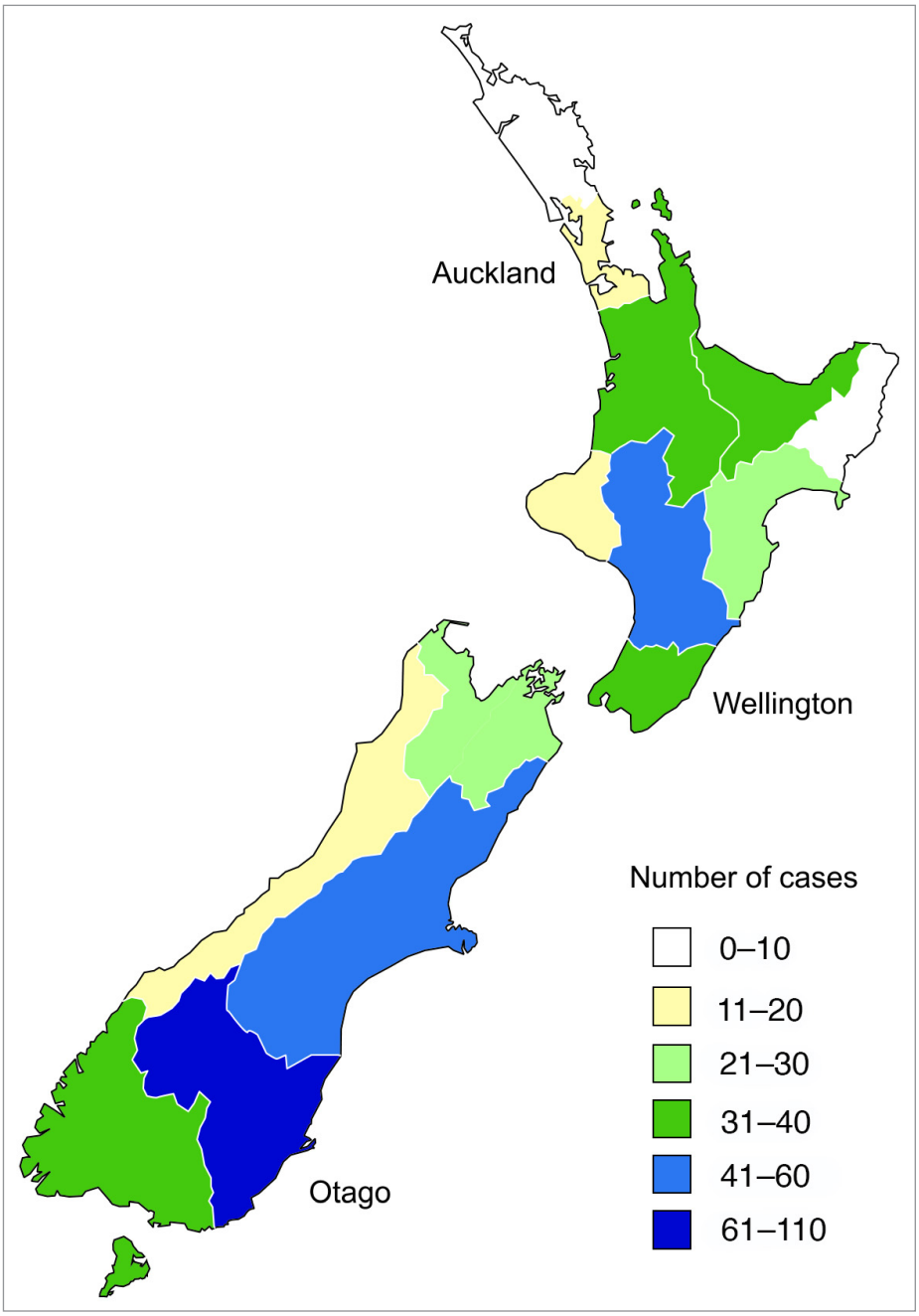

Figure 2: Number of avian cases submitted to Wildbase Pathology in 2017 by region

Wildlife cases of special interest in 2017

Mass stranding of pilot whales, Farewell Spit

On 9 February 2017, 416 long-finned pilot whales (*Globocephalus melas*) were found stranded at Puponga, near the base of Farewell Spit (S1 in **Figure 3**), at the northernmost tip of the South Island. On the following day, DOC staff and a large number of volunteers worked to refloat some of these but about 250–300 animals were already dead. On 11 February a further 200–300 whales in a second pod that included both calves and adults (**Figure 4**) stranded nearby, at S2. In total around 600–700 whales stranded, but it is not known how many individuals in the second stranding may have been counted twice, having been refloated after the first stranding. A total of 252 stranded whales died over the 4-day period and the rest were either refloated by volunteers or swam away at high tide. The strandings and refloating operations have been described by Hunter *et al.* (2017).

Twenty-five whales classified as suffering or near death were euthanased using a large-calibre firearm. These were animals that were too lethargic to swim away when the rest of the pod left. If left alive, they would likely have called in hundreds of the other whales that had successfully been refloated and were swimming just off the shore. On 12 and 13 February, four freshly dead animals were necropsied by Wildbase Pathology and DOC staff. All whales were in good body condition, with good hypaxial and epaxial muscle mass and adequate blubber thickness. No fresh prey items were present in the stomachs, but small numbers of squid beaks were seen. One

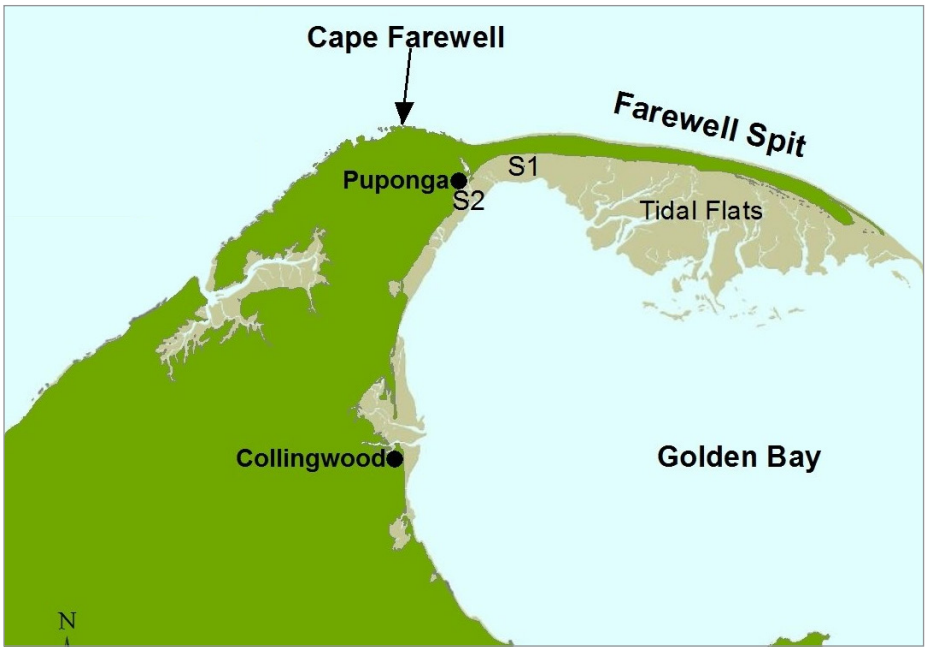

Figure 3: Map showing the two main sites (S1 and S2) at which strandings of pilot whales took place in February 2017

Figure 4: Long-finned pilot whales stranded at Golden Bay after high tide on 11 February 2017. Photo: S. Hunter

or two ulcers were present in the mucosa of the glandular portion of the stomach in all four whales; these were 20–30 mm in diameter and had smooth, raised, firm margins indicating a degree of chronicity. Small numbers of nematodes were also present in the glandular portion of the stomach. Variable amounts of white frothy fluid indicating pulmonary oedema were present in the trachea and smaller airways of the lungs, and the lung parenchmya was deep red and oozed a small amount of white, frothy fluid.

Lower jaws were removed from all four animals and no gross abnormalities were noted in the acoustic fat on the medial aspect of the mandibles or around the middle ears. The pterygoid sinuses of all four animals had a moderate burden of nematodes. The brains of these animals were not examined as the method of euthanasia would have obliterated any underlying lesions. No other obvious gross abnormalities were noted and histological evaluation of a range of tissues showed no evidence of disease.

This mass stranding is one of the largest on record in New Zealand, and the largest recorded at this site although mass strandings of pilot whales are not uncommon in Golden Bay. It is thought that, although solitary strandings are likely to be related to disease, mass strandings are more likely to be related to cetacean behaviour (Cordes, 1982; Brabryn, 1990) and are most likely the result of failure of orientation and communication, which may occur on the long, gently sloping beaches of Golden Bay. There was no evidence that anthropogenic noise (for example, that generated by seismic surveys for oil and gas exploration) caused any disruption of communication or failure of orientation that may have contributed to this mass stranding.

A lysosomal storage disease in South Island kaka

Lysosomal storage diseases have only rarely been reported in birds. They are caused by a biochemical enzyme deficiency that allows a substrate to accumulate within cells, particularly neurons, resulting in their malfunction and/or death (Jolly & Walkley, 1997). They may be inherited or acquired and are commonly manifested clinically by the onset of ataxia, inco-ordination and seizures.

In January 2017 a wild juvenile male kaka (*Nestor meridionalis meridionalis*) was found in a weak and lethargic condition in a car park at St Arnaud in Nelson Lakes National Park and taken to Natureland Zoo in Nelson for examination. It was thin, weak, unable to self-feed and had occasional seizures. It tested negative for lead poisoning. After 3 days' crop-feeding and a course

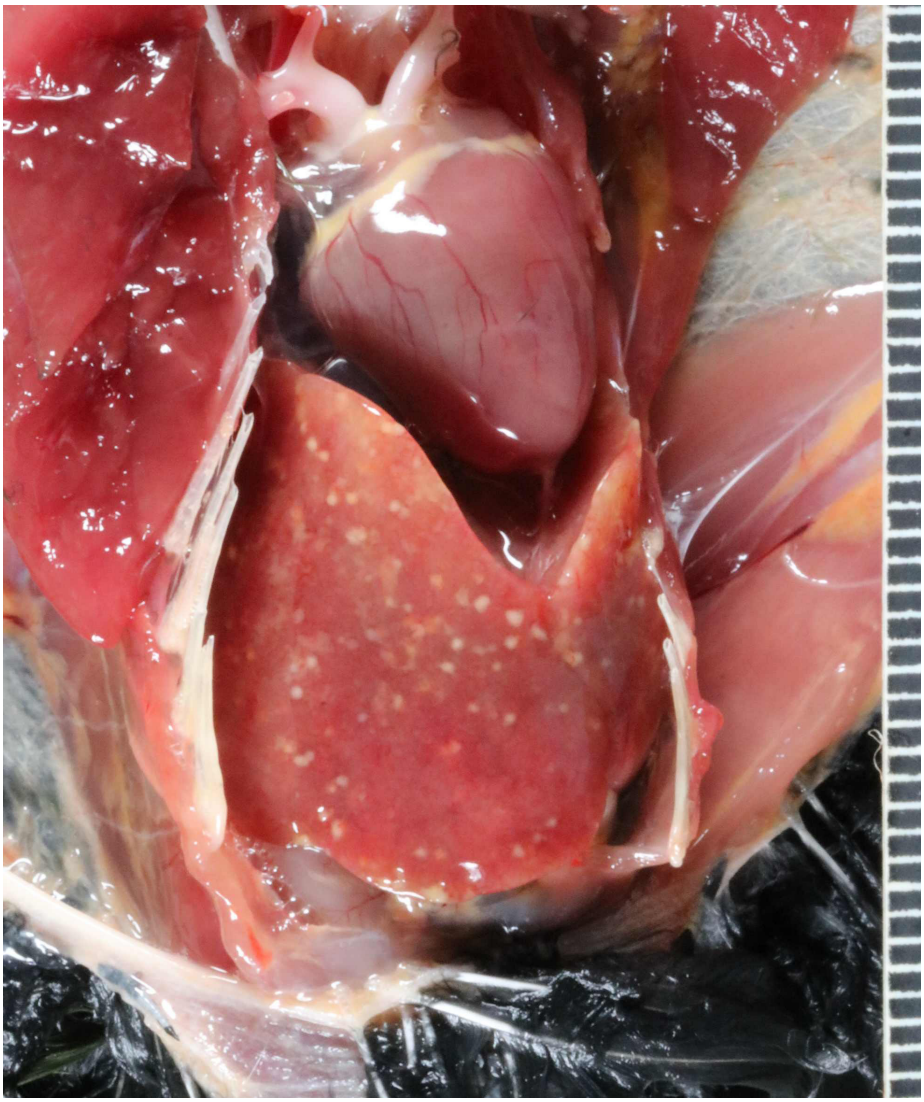

Figure 5: Diffuse pallor of the liver with numerous pin-point foci of inflammatory necrosis throughout, in a young adult red-crowned parakeet/kararikiki that died of yersiniosis. Scale bar = 1mm. Photo: S. Hunter

of antibiotics and antifungal drugs there was little improvement, so it was sent to The Nest-Te Kohanga, at Wellington Zoo, for further treatment. On arrival the bird was semi-comatose, and initially seemed to improve after being given fluids but over several days of intensive treatment it continued to deteriorate and eventually euthanasia was justified on welfare grounds.

At necropsy the bird was seen to be in poor body condition. The liver was enlarged and friable, with rounded edges and occasional white plaques on the visceral surface. A small volume of fluid was present in the pericardial sac. No other gross abnormalities were observed. A range of tissue samples were collected and processed for histopathological examination. Within the brain, the majority of Purkinje cells and numerous other neurons contained multiple small moderately discrete and mostly clear vacuoles, producing various degrees of distension of the perikaryon. Throughout the liver the hepatocytes contained moderate amounts of diaphanous cytoplasm. These changes were typical of a lysosomal storage disease as described in other animals (Hunter *et al.*, 2017).

The occurrence of this storage disease in a juvenile bird from a small, threatened population in which there is a likelihood of inbreeding, strongly suggests an inherited aetiology. Further investigations, including electron microscopy and biochemical analysis of frozen tissues, are in progress to identify the nature of the storage product.

Yersiniosis in captive endemic birds

Bacterial septicaemia caused by *Yersinia pseudotuberculosis* is a well-established cause of death in birds in New Zealand and many other countries (Cork *et al.*, 1999). Captive birds appear to be more susceptible, particularly if kept in overcrowded conditions during the winter months.

In 2017, four cases were reported in captive birds: two in juvenile kaka, one in a 2½-year-old red-crowned parakeet/kakariki (*Cyanoramphus novaezelandiae novaezelandiae*) and one in a 5-year-old tui (*Prosthemadera novaeseelandiae novaeseelandiae*). All birds had multiple inflammatory foci throughout the liver, spleen, intestine (**Figure 5**) and sometimes in the lung and kidney. Gram-negative coccobacilli were seen in these lesions and *Yersinia* was cultured from the liver. Wild birds are known to be a reservoir of infection, and surveys in the lower North Island and in Otago revealed that about 3 percent of wild birds were carriers of *Yersinia* organisms (Cork *et al.*, 1995).

Toxoplasmosis in wild birds

Two free-living kaka from Zealandia in Wellington and a little spotted kiwi (*Apteryx owenii*) from Hawke's Bay died from disseminated toxoplasmosis in 2017. Until recently this disease was unrecognised in wildlife in New Zealand but the development of improved diagnostic techniques has revealed its presence in a number of species, including kaka, wood pigeon/kereru (*Hemiphaga novaeseelandiae novaeseelandiae*), brown kiwi, paradise shelduck/putakitaki (*Tadorna variegate*) and red-crowned parakeet/kakariki (Hunter & Alley, 2014). Clinical signs have ranged from depression, anorexia and lethargy to sudden death. The gross lesions seen were also non-specific and consisted of hepatosplenomegaly, which was marked in the kiwi but less severe in the kaka. In the kiwi, protozoal

organisms were present within both hepatocytes and Kupffer cells of the liver, and within the epithelial cells and interstitial macrophages of the lungs.

Because the clinical and pathological signs are non-specific, differentiating these organisms from other protozoa such as *Plasmodium* spp. has previously relied on subtle differences in the morphology of the intracellular tachyzoites. However, more recently improved diagnostic tools such as PCR and immunohistochemistry have enabled both cystic and individual organisms to be identified in a variety of body tissues.

Notification and investigation of rabbit haemorrhagic disease virus (RHDV)

RHDV is highly contagious and causes acute and fatal disease of rabbits. The virus, a member of the Caliciviridae, is an OIE-listed disease and is on the New Zealand Unwanted Organism list. Direct transmission occurs through contact with both live and dead infected animals. Infected animals shed virus in all body secretions and wastes: urine, faeces, saliva and mucus, and in blood, and virus is present in carcasses for up to 3 months. Indirect transmission can occur through contaminated food, water, and fomites such as fur, bedding, clothing, cages and equipment. Vector-borne transmission occurs through scavenging mammals and birds (dispersing carcasses or fragments of carcasses, and excreting infectious virus particles in faeces after eating infected tissue), and insects (flies, fleas and mosquitoes). The virus can survive for up to 9 days in flies. Rabbits become infected through oral, nasal, conjunctival or parenteral (blood-feeding insects) exposure. The faeco-oral route is considered the main route of transmission.

Wild rabbits are a pest organism in New Zealand and subject to control using various mechanisms. A Czech strain of RHDV-1 has been endemic and widespread in New Zealand since it was illegally introduced into the South Island in 1997 to control wild rabbit populations on farms. In February 2017 an application to introduce a Korean strain of RHDV-1 (known as RHDV-1 K5) to enhance rabbit control was submitted to MPI for approval, to combat increased resistance in wild rabbit populations to the Czech strain. A third strain, RHDV-2, is prevalent in Europe, but was not found in New Zealand until April 2018.

Anxiety among rabbit owners that RHDV-1 K5 would similarly be released illegally, and concerns of a possible increase in pet rabbit mortality, led to an increase in notifications of suspect disease in rabbits during early 2017. There were 30 notifications of rabbit disease and death to the exotic pest and disease hotline in 2017. Two of these were related to wild rabbits. Twenty of the notifications were stood down by incursion investigators after following standard procedure, and 11 were investigated. Ten of the 11 tested were positive for the original RHDV-1 Czech strain, but all were negative for RHDV-1 K5 and RHDV-2. Of nine other wild rabbit samples from around New Zealand, eight were positive for RHDV-1 Czech strain, but all tested negative for the other strains.

Starting on 12 March 2018, RHDV-1 K5 was released by regional councils for wild rabbit control, firstly at a South Island site and then in other places. A research programme was undertaken by Landcare Research to track the spread from this new release. Testing samples from these sites detected a new strain of RHDV-2 in wild and domesticated rabbits. As of August 2018 there had been seven confirmed cases of RHDV-2 in six locations. Genomic sequences of all the RHDV-2 found to date are genetically similar, suggesting a single-source incursion. The first confirmed case of RHDV-2 was in a wild rabbit from Marlborough in early April 2018, and the same strain was also found in this region in a domestic rabbit sample collected in May (**Table 1**). The earliest cases of RHDV-2 infection, however, were in two samples collected from wild rabbits in the Bay of Plenty in December 2017, after local reports of a die-off of wild rabbits. These samples were kept in a freezer and submitted for testing after publicity requesting rabbit samples for monitoring after RHDV-1 K5 release. RHDV-1 K5 was not found in any of the domestic rabbit cases.

Table 1: Detections of RHDV-2 in New Zealand, as of 20 August 2018

Location	Rabbit source	Date collected
Molesworth Station, Marlborough	Wild	6/4/18
Bay of Plenty (n = 2)	Wild	4/12/17
Blenheim, Marlborough	Domestic	17/5/18
Orui, Wairarapa*	Wild	13/3/18
Blenheim, Marlborough	Domestic	3/6/18
Atawhai, Nelson	Domestic	17/6/18

* Mixed infection of RHDV-1 Czech strain and RHDV-2

A number of potential RHDV-2 introduction pathways exist, including illegal smuggling of infective material, importation of contaminated materials and commodities or infected animals (e.g., rabbits for laboratory use), and vectors such as biting arthropods or flies. The actual importation pathway is unknown and would be difficult to verify.

A biosecurity response was initiated after the detection of RHDV-2 and the OIE was notified of the first detection of this strain in New Zealand. The response was stood down in August 2018 after the disease was identified in the wild rabbit populations of both main islands, thus becoming endemic and impractical to eradicate, and MPI had determined that RHDV-2 does not affect native flora or fauna.

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Maurice Alley
Wildbase Pathology
School of Veterinary Science
Massey University
Palmerston North
M.R.Alley@massey.ac.nz

Stuart Hunter
Wildbase Pathology
School of Veterinary Science
Massey University
Palmerston North
S.A.Hunter@massey.ac.nz

Zhidong Yu
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Zhidong.yu@mpi.govt.nz

Janine Duckworth
Wildlife Ecology and Management
Manaaki Whenua - Landcare Research
duckworthj@landcareresearch.co.nz

John O'Connell
Incursion Investigator
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
John.O'Connell@mpi.govt.nz

Kylee Walker
Incursion Investigator
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Kylee.Walker@mpi.govt.nz

Transmissible spongiform encephalopathies (TSE) surveillance programme

New Zealand is free from the main TSEs, namely bovine spongiform encephalopathy (BSE) of cattle, classical scrapie of sheep and goats, and chronic wasting disease (CWD) of deer. The TSE surveillance and risk management measures implemented in NZ have been described in previous annual reports (e.g., Vink, 2016). Surveillance for CWD is not mandated by the World Organisation for Animal Health (OIE), but is carried out to assure NZ's trade partners of freedom from this disease.

A combination of passive and active surveillance activities are performed for the three TSEs. The passive surveillance programme consists of a targeted scheme under which veterinary practitioners submit brain material from animals showing clinical signs of neurological disease. The veterinarians and farmers are compensated for supplying the samples. Testing is performed by histopathology at accredited veterinary diagnostic laboratories. When histopathology cannot rule out a TSE diagnosis, an IDEXX TSE enzyme immunoassay (EIA) (IDEXX Laboratories Inc., Westbrook, Maine, USA) test is done at MPI's Animal Health Laboratory (AHL) (Wallaceville). **Table 1** shows the numbers of samples tested in 2017.

NZ performs type B surveillance for BSE as specified by Chapter 11.4 of the OIE Terrestrial Animal Health Code (OIE, 2017a). BSE points have been accumulated since 2005 and NZ has consistently maintained well in excess of the required 150 000 points. BSE testing in 2017 generated 21 819 BSE points and all tests were negative.

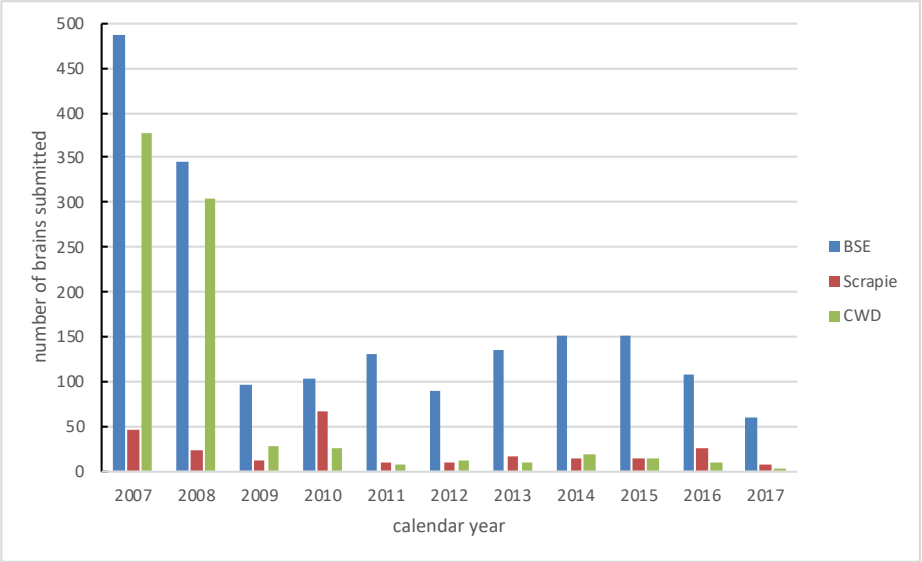

Figure 1: Numbers of brain samples tested for BSE, scrapie and CWD under the incentivised passive surveillance scheme, 2007–2017

The numbers of samples submitted under the incentivised passive surveillance programme have declined since 2005. Specifically, the number of deer submissions for CWD declined sharply in 2008 following the imposition of a maximum of two submissions per farm per year. The annual sample numbers have remained more or less stable since 2009 (**Figure 1**). Although samples are submitted year-round, there is a clear seasonal trend, with a peak from July to September (**Figure 2**). To complement the low submission numbers for classical scrapie and CWD, active surveillance has been performed since 2010. Samples from normal adult animals sent to slaughter were routinely collected from meat processing plants across the country. In 2017, 322 sheep and 320 deer were tested; these numbers were based on a sample size calculation designed to detect disease at a low prevalence in the population. All samples tested negative. The farms of origin of the sampled sheep and deer demonstrated reasonable geographic spread across the North Island as well as the South Island, which appeared to be representative of the underlying farm density (**Figure 3**).

In October 2009, the first detection of a case of atypical scrapie/Nor98 in a NZ-born sheep was confirmed (Kittelberger & McIntyre, 2009; Kittelberger *et al.*, 2010). MPI strongly supports the view of the World Organisation for Animal Health (OIE) that atypical scrapie is "clinically, pathologically, biochemically and epidemiologically unrelated to 'classical' scrapie, may not be contagious and may, in fact, be a spontaneous degenerative condition of older sheep" (OIE, 2017b), and considers it to be a negligible biosecurity risk (Vink & McIntyre, 2014). The sensitivity of detection of the prion causing classical scrapie is higher in lymphoid tissue than

Table 1: Numbers of samples tested for TSEs in 2017, by passive and active surveillance

Species	Tissue	Test type	Source of test tissue		Surveillance stream
			Routine surveillance	Imported animal	
Cattle	Brain	Histopathology	59*	-	Passive
		IDEXX TSE EIA	2	0	Passive (rule-out)
Deer	Brain	Histopathology	3	-	Passive
		IDEXX TSE EIA	0	0	Passive (rule-out)
	MRLN†	IDEXX TSE EIA	320	-	Active
Sheep	Brain	Histopathology	6	-	Passive
		IDEXX TSE EIA	0	0	Passive (rule-out)
	MRLN	IDEXX TSE EIA	322	-	Active

* This level of testing earned 21 819 surveillance points for BSE in accordance with Chapter 11.4 of the 2013 OIE Terrestrial Animal Health Code. These points are calculated from clinical suspect and fallen stock cases submitted by veterinary practitioners under the surveillance programme.
† Medial retropharyngeal lymph node

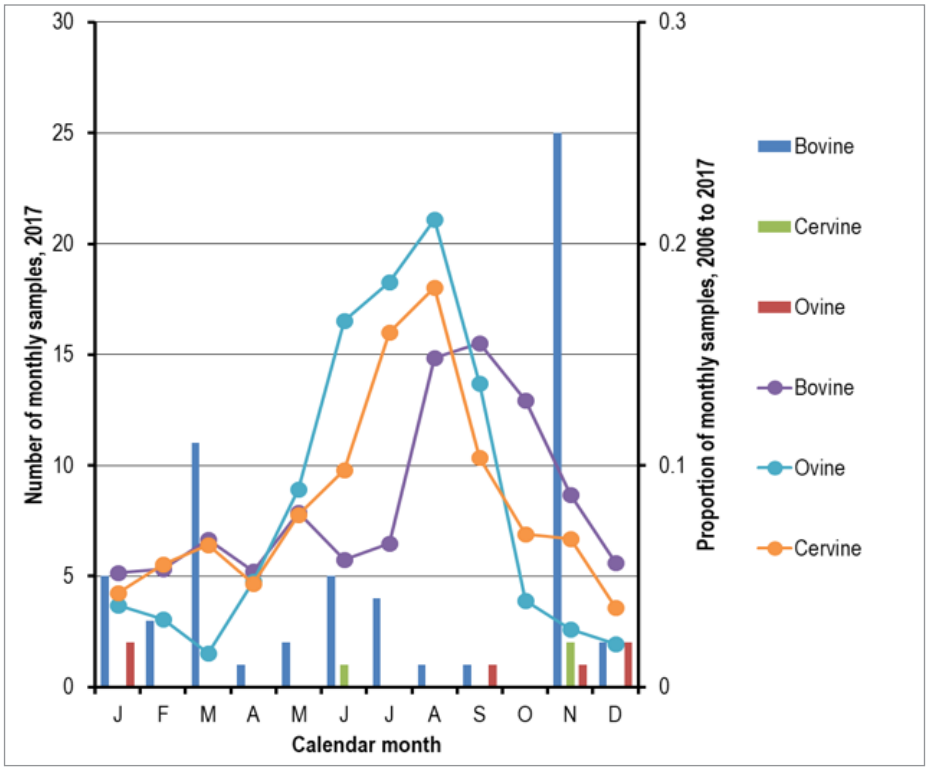

Figure 2: Numbers of brain samples tested for BSE, scrapie and CWD under the incentivised passive surveillance scheme during 2017 (left axis, bars), and trend by calendar month of samples submitted, 2007–2017 (right axis, lines)

in brain tissue, and the atypical scrapie/Nor98 prion is not detected in lymphoid tissue (Meloni *et al.*, 2012). Research at the AHL (Wallaceville) showed that testing of medial retropharyngeal lymph node (MRLN) tissue from sheep and goats with the IDEXX TSE test had high diagnostic sensitivity and specificity (Kittelberger *et al.*, 2014). As the active surveillance programme specifically targets classical scrapie, the MRLN samples of sheep and deer taken were analysed using this test.

The design and implementation of TSE surveillance will continue to be informed and refined by requirements and guidelines determined by the OIE, new knowledge, tests, standards and market access needs.

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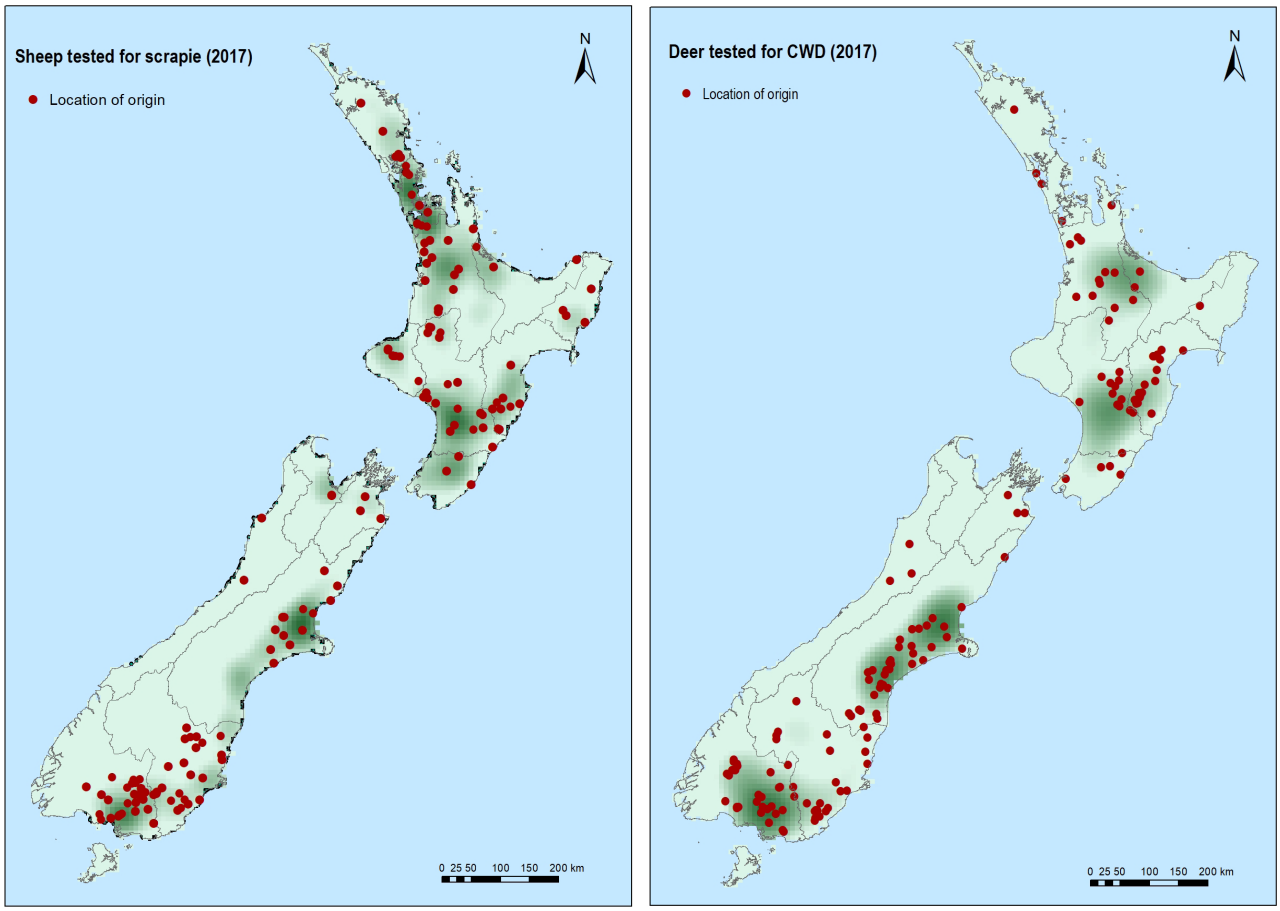

Figure 3: Locations of farms submitting sheep samples for classical scrapie (left; n = 161) and deer samples for CWD (right; n = 160) during 2017. Up to two animals were sampled per location. The underlying heatmap represents the density of farms with sheep and deer respectively (source: Agribase)

Arbovirus surveillance programme

Introduction

The arbovirus surveillance programme was instigated in 1991 to provide assurance of New Zealand's freedom from arboviruses (particularly bluetongue virus) that affect sheep and cattle. Other arboviruses of veterinary concern include epizootic haemorrhagic disease virus, Akabane virus and bovine ephemeral fever virus.

Arboviruses are taxonomically diverse but their general characteristics include infection of vertebrates. They replicate in and are spread by insect vectors in the biting midge genus *Culicoides* (Diptera: Ceratopogonidae). New Zealand is the only place in the world apart from Antarctica where the *Culicoides* genus is not present. However, there is a low likelihood that the route of introduction to New Zealand would be through windborne dispersal of the vector species *C. brevitarsis* from Australia owing to its wider distribution, high abundance and documented dispersal capability (Burgin *et al*., 2013). Studies of other arthropod incursion events suggest that *C. brevitarsis* could be blown from Australia to New Zealand in the predominant westerly winds of the region (Burgin *et al*., 2013).

In New Zealand, *C. brevitarsis* and *C. wadai* are of particular importance owing to their tolerance of cooler environments (Ryan *et al*., 1991) and are likely to establish in some parts of New Zealand.

The surveillance strategy has three components:

- an early warning system for reporting suspicious cases;
- herd testing; and
- vector surveillance.

Early warning system

The Ministry for Primary Industries maintains an exotic pest and disease hotline that enables early reporting of suspected new to New Zealand pests and diseases. This can be used to report suspicious cases of diseases in farm animals. Exotic terrestrial animal pest and disease investigations are managed by MPI's Diagnostic & Surveillance Services Directorate, Wallaceville.

Herd testing

During 2018 blood was collected from 640 cattle on 32 farms in four districts that are considered to be most favourable for survival and establishment of *Culicoides* spp. (**Figure 1**). These are the areas where cattle would most likely be infected if the vector was present. Blood samples were taken for serological testing after the possible period of virus transmission.

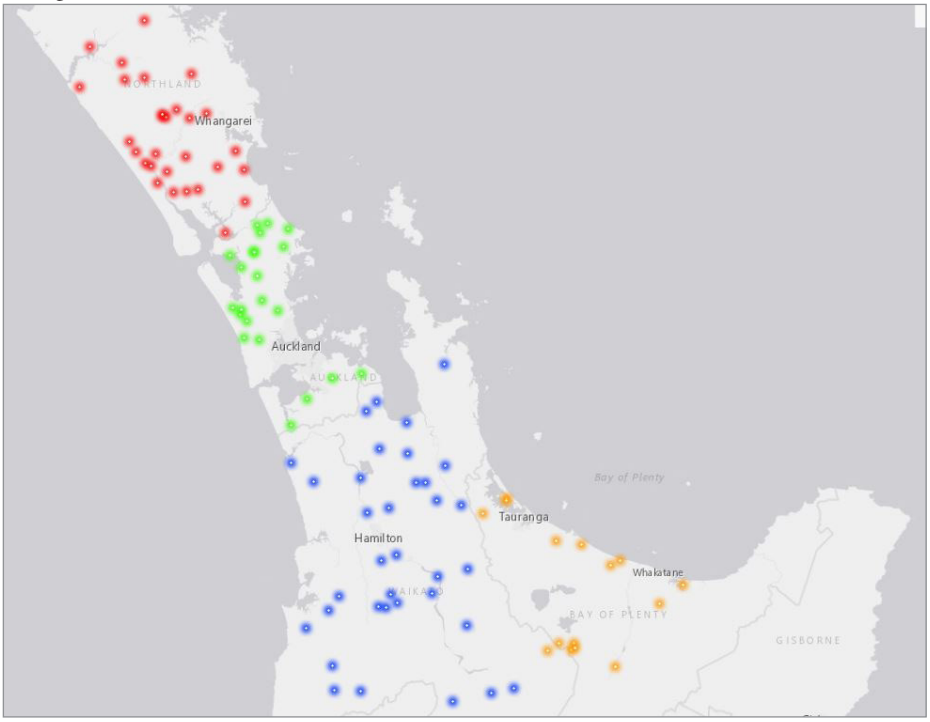

Figure 1: Animal sampling for arbovirus in 2018 (red = animals sampled from farms in Northland; green = Auckland; blue = Waikato; orange = Bay of Plenty)

Vector surveillance

Light traps for vector surveillance have been placed in areas around New Zealand where wind-blown dispersal and subsequent establishment are likely. The traps attract the winged adult midges as they fly during dawn and dusk. They also catch other insects that are of no consequence. Catches are examined under a microscope to confirm absence of *Culicoides* spp.

Twelve light traps with green LEDs (Bishop et al., 2004, 2006) were deployed this season on cattle farms. In addition, two traps containing the attractants carbon dioxide and octenol were tested for comparison. Vector surveillance was undertaken from February to April inclusive, the period during which conditions are considered most favourable for midge activity. Ideal trapping nights are when the overnight temperature does not fall below 14°C. Traps are not deployed during weeks of the full moon, whose light would compete with the light attractant. The light traps are run on three consecutive nights of each selected week.

Insect samples were processed by MPI's Plant Health and Environment Laboratories (Auckland and Christchurch) in early 2018. It was estimated that 285 464 insects were screened, but no *Culicoides* spp. were found. There were 135 native midges (Ceratopogonidae) trapped, which suggests that the traps would catch *Culicoides* species if they were present this season.

Blood test results from the 2017 surveillance season

The aim of herd testing is to detect serological evidence of exposure to bluetongue, epizootic haemorrhagic disease, Akabane and bovine ephemeral fever viruses. All 640 blood samples sent to the Animal Health Laboratory

(Wallaceville) in 2017 tested negative by ELISA for antibodies to these viruses. Results from the blood samples collected in 2018 will be confirmed in 2019.

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Lora Peacock
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Aquatic and Environment Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Lora.Peacock@mpi.govt.nz

Ben Boyd
Scientist
Plant Health & Environment Laboratory
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand Ministry for Primary Industries
Ben.Boydo@mpi.govt.nz

Sherly George
Manager, Team B Entomology
Plant Health & Environment Laboratory
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Sherly.George@mpi.govt.nz

Tais Garcia & Michaela Hannah
Senior Technicians, Immunology
Animal Health Laboratory
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Tais.Garcia@mpi.govt.nz, Michaela.Hannah@mpi.govt.nz

Douglas Begg
Team Manager, Immunology
Animal Health Laboratory
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Douglas.Begg@mpi.govt.nz

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Jonathan Watts
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Jonathan.Watts@mpi.govt.nz

Honey bee exotic pest and disease surveillance report

This report summarises surveillance activities for the year 1 July 2017 to 30 June 2018.

Honey bee exotic disease surveillance is conducted by AsureQuality Ltd on behalf of the Ministry for Primary Industries (MPI). It is a multifaceted programme consisting of:

- hive inspection and sampling;
- maintaining records of beekeepers, apiaries, hives and bee diseases in an apiary database;
- carrying out beekeeper extension and education;
- screening and investigating exotic bee disease notifications; and
- reporting on activities and findings.

Surveillance is conducted for the following exotic honey bee diseases and pests:

- European foulbrood (*Melissococcus plutonius*);
- small hive beetle (*Aethina tumid*a);
- the parasitic fly (*Braula coeca*);
- tracheal mite (*Acarapis woodi*);
- Asian mites (*Tropilaelaps clareae* and *T. koenigerum*);
- African and Africanised honey bee (*Apis mellifera scutellata*);
- Cape honey bee (*Apis mellifera capensis*);
- other exotic *Apis* species (e.g., the Asian honey bee, *Apis cerana*); and
- bee viruses such as Israeli acute paralysis virus (IAPV).

Broadly, surveillance is conducted in two ways:

- targeted – involving hive inspection and collection of samples from apiaries in high-risk areas; and
- non-targeted – involving hive inspection and collection of samples from low-risk apiaries, and screening notifications of suspected cases of exotic honey bee diseases from beekeepers.

Targeted surveillance

Nineteen geographic areas throughout New Zealand (12 in the North Island and seven in the South Island) have been classified as high-risk because they have the greatest potential for entry of exotic honey bee diseases and pests. These areas typically encompass one or more of the following: ports, airports, Transitional Facilities, cities, tourist destinations and areas of high hive concentration such as kiwifruit-growing areas. Four of these areas (Auckland, Wellington, Christchurch and Dunedin) contain sub-areas classified as "elevated-high-risk zones". Within these four areas, at least 50 percent of targeted apiaries are located in the elevated-high-risk zones.

The aim of targeted surveillance is to inspect and take samples from 350 apiaries within high-risk areas. All hives in each apiary are:

- inspected for signs of exotic bee diseases and pests, with any suspicious bees or larvae and pupae, and suspect life-stages of small hive beetle and *Braula*, being taken for laboratory testing and diagnosis;
- sampled by taking at least 80 bees from each hive and testing some for internal mites using the tracheal sectioning method; and
- tested for external mites by applying a 24-hour miticide treatment and a sticky board.

In total, 352 apiaries were inspected as part of targeted surveillance. However, samples were collected from only 351 because one apiary, in Hamilton was too weak to take bee samples from and sticky boards could not be inserted into the hives. In total, 949 sticky boards and 926 bee samples were submitted for laboratory testing (**Table 1**). All apiaries were inspected by Authorised Persons – Level 2 (AP2s).

Non-targeted surveillance

Each beekeeper supplying live bees for export is required to work through an apiary clearance process for every apiary from which they intend to supply bees. As part of the clearance process, beekeepers are required to provide a maximum of 25 bee samples from their supply apiaries. Each sample is a pooled sample of bees taken from a maximum of 16 hives, meaning that multiple samples need to be taken from apiaries that have larger numbers of hives. These are considered low-risk apiaries and the target is to collect 300 samples from such apiaries. Tests similar to those conducted on targeted surveillance samples are also conducted on export bees, except that sticky boards are not included. During the period covered by this report, 464 bee samples were collected from 333 low-risk apiaries (**Table 1**).

Each year MPI and AsureQuality Ltd receive notifications from beekeepers regarding suspected exotic bee pests, bee diseases or unusual signs in hives. AsureQuality works with MPI's Diagnostic & Surveillance Services (Wallaceville) to screen these calls and determine whether sampling is justified. This year, 16 calls were received that resulted in further investigation and, in some cases, sampling. These included calls about suspect European foulbrood, unexplained bee deaths, unusual insects found in hives, suspect small hive beetle, suspect bee poisoning, bees with dysentery, suspect Asian bees, and illegal importation of Russian beeswax. In a number of other cases, on interviewing the caller it was determined that the observed signs could be explained by endemic bee diseases or beekeeper mismanagement.

Results

All laboratory results were negative for all listed exotic pests and bee diseases, from both targeted and non-targeted surveillance (**Table 2**).

Reports

Each year, AsureQuality Ltd, on behalf of MPI, reports on exotic surveillance

Table 1: Number of samples collected during the 2017–2018 surveillance season

Type	Apiaries	Sticky boards	Bees
High-risk	351	949	926
Low-risk	333	0	464
Total	684	949	1 390

Table 2: Laboratory test results for samples collected during the 2017–2018 surveillance season

Organism	High-risk		Low-risk	
	Suspect	Positive	Suspect	Positive
European foulbrood	1	0	1	0
Small hive beetle	0	0	1	0
Parasitic fly	0	0	0	0
Tracheal mite	0	0	5	0
Asian mite	0	0	0	0
Africanised honey bee	3	0	0	0
Cape honey bee	1	0	0	0
Other exotic bee species	0	0	0	0
Total	**5**	**0**	**7**	**0**

activities in *Surveillance* and *The New Zealand Beekeeper* magazine. These reports are used to fulfil international reporting requirements with regard to New Zealand's bee health status, and for keeping New Zealand beekeepers informed about surveillance activities.

Apiary database

AsureQuality Ltd maintains an apiary database that contains information on beekeeping enterprises in New Zealand. As of 6 July 2018 there were 8 541 beekeepers managing 881 106 hives on 55 518 apiaries. New beekeepers continue to enter the industry, with 1 600 new registrations in the 12 months to July 2018, resulting in a net increase of 739 beekeepers, 5 378 apiaries and 88 339 hives. About a third of beekeepers have fewer than two seasons of experience. There is a real need to provide ongoing education about exotic disease identification, which is paramount to increasing the sensitivity of the passive surveillance programme. Educating the industry in the identification of exotic pests and diseases greatly increases the chances of finding an incursion sooner, because far more hives can be inspected by an educated industry than by targeted surveillance at high-risk sites.

It is a legal requirement that all beekeepers are registered and provide the location of their apiaries. Apiaries are geo-referenced, which enables planning of detailed disease surveys. Beekeepers are required to inspect their hives annually and report any cases of American foulbrood (*Paenibacillus larvae larvae*) and suspect exotic honey bee diseases. They must also furnish a return each year updating all apiary records and stating that their hives have been inspected.

Beekeeper extension and education

In previous years a number of articles have been written for publication in *The New Zealand Beekeeper* magazine, on surveillance issues relating to exotic honey bee pests and diseases and their relevance to the New Zealand beekeeping industry. The articles tend to cover Asian honey bee (*Apis cerana*), biosecurity risk pathways and general bee health. An overview article is published at the beginning of the field season, outlining the plan for the current season and drawing particular attention to changes from previous years. At the end of the field season a summary article is written to report on the results of surveillance activities.

During the 12-month period under review, AsureQuality Apiculture Technical Advisers (ATAs) were invited to a number of hobby clubs, beekeeping meetings and commercial beekeeper field days. ATAs take these opportunities to provide information on exotic pests and diseases. Additionally, our trading partners are increasingly requiring greater assurance of the disease-free status of exported live bees. To help provide this assurance, ATAs train Inspecting Beekeepers, who clear apiaries for export, to identify pests and diseases.

Technical development

To maintain technical development of the surveillance programme, relevant national and international literature on surveillance techniques and exotic bee diseases and pests was reviewed. Additionally, ATAs undertook a week-long trip to Australia for refresher training on exotic pests and disease identification, disease surveillance and control strategies and biosecurity implementation.

AsureQuality Ltd maintains a group of apicultural technical experts who are competent in bee disease recognition and control.

Ben Phiri
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Ben.Phiri@asurequality.com

Reports from National Pest Management Strategies: bovine tuberculosis

Objectives of the TBfree programme

The TBfree programme aims to eradicate bovine TB from New Zealand, by achieving freedom from TB in cattle and deer herds by 2026 and in possums by 2040, followed by biological eradication by 2055.

The other primary objective is to maintain annual infected herd period prevalence below 0.2 percent throughout the term of the programme.

Achieving eradication targets

Livestock disease management approaches towards the achievement of the objectives are based on:

- surveillance for TB in cattle and deer through routine on-farm tests and inspection of carcasses at slaughter premises;
- controls on the movement of cattle and deer from individual herds or geographic areas of higher TB risk, to prevent transmission of TB between herds by livestock movement;
- application of test and slaughter plans to eradicate within-herd infection; and
- control of wildlife vectors (principally possums, but in some cases ferrets), to prevent them from infecting herds.

Wildlife pest management operations required to meet the programme's objectives involve:

- intensive possum control within and around designated Vector Risk Areas (VRAs) where it is considered that TB is being maintained in possum populations;
- surveillance to determine the presence or absence of TB in possums and other wildlife;
- application of a Proof of Freedom (POF) framework in which data is compiled from possum control history, measurements of possum population density, wildlife disease surveillance and the history of wildlife-vectored infection in livestock, and then analysed to provide an estimate of the probability that the possum population is free of TB; and
- the use of POF determinations to guide decisions as to the continuation and intensity of further vector control or surveillance, including decisions to cease active management.

Summary of progress

In the two years since the programme was refreshed in 2016, TB has been eradicated from 0.43 million hectares of land, the number of infected herds has been reduced from 43 to 32 and the annual infected herd period prevalence has fallen from 0.12 to 0.11 percent (all as of 30 June 2018).

Infected herds and national period prevalence

On 30 June 2018 there were 27 infected cattle herds, compared to 49 on 30 June 2017. During the year, TB was identified in 67 cattle herds, four fewer than in 2016–2017. For deer, the number of infected herds remained at five, with no new infected herds being identified during the year.

The annual infected herd period prevalence (for cattle and deer combined) in 2017–2018 was 0.01 percent. This period prevalence is derived from the total number of infected herds at the start of the year plus new infected herds identified during the year, divided by the total number of herds in the country and expressed as a percentage. The annual period prevalence has been less than 0.2 percent for the last 4 financial years and as such meets the World Organisation for Animal Health (OIE) standard for being classified as being officially TB free – an important international milestone.

Infected cattle herds

At 30 June 2018, there were 27 infected cattle herds, compared to 49 at 30 June 2017. Of these infected herds, 85 percent were located in VRAs, 93 percent were located in the South Island and 70 percent were dairy or dairy dry herds.

Of the 27 herds infected at year-end, 18 were newly infected during the year, while nine were previously infected and remained so. For these 27 herds, veterinary assessments based on epidemiological investigations identified that 58 percent of herd infections were linked to wild-animal sources of TB, 27 percent were caused by livestock movement and 15 percent involved re-detection of residual infection.

Cattle testing and reactors

In the year to 30 June 2018, 3.1 million cattle (2.3 million dairy and 0.8 million beef) were tested with the intradermal caudal-fold tuberculin test, using Prionics Lelystad tuberculin at 3 000 IU/dose. This was 5 percent fewer than the number tested the previous year. In the same period, 6 575 ancillary serial gamma-interferon tests were conducted on cattle positive to the caudal fold test. Ancillary parallel gamma interferon tests were also performed on 11 511 cattle that tested negative to the skin test.

From all these tests 500 cattle were declared to be TB reactors and were slaughtered, compared to 799 in 2016–2017.

Tuberculous cattle

The number of tuberculous cattle (confirmed infected with TB) includes the total number of test reactors and cattle found during routine slaughter that were identified as infected by post-mortem inspection and/or laboratory tests. During 2017–2018, 41 of the 500 reactors slaughtered (8.2 percent) were confirmed as being infected with bovine tuberculosis, plus the infection was also confirmed in a further 23 cattle during routine slaughter.

Infected deer herds

At 30 June 2018, there were five infected deer herds, the same number as at 30 June 2017. All five herds were located in South Island VRAs.

Deer testing and reactors

In the year to 30 June 2018, 172 223 primary mid-cervical intradermal tuberculin tests were performed on deer. This was a 2 percent reduction on the previous year.

During this period, 802 ancillary serial

tests were conducted on deer positive to the mid-cervical test. No ancillary parallel tests were conducted on deer during 2017–2018. From all the deer tests during this period, 69 animals were declared to be TB reactors and were slaughtered, compared to 57 TB reactors in 2016–2017.

Tuberculous deer

The number of tuberculous deer (confirmed infected with TB) includes the total number of test reactors and deer found during routine slaughter that were identified as infected by post-mortem inspection and/or laboratory tests. During 2017–2018, two of the 69 TB reactors slaughtered (2.9 percent) were confirmed as being infected with bovine tuberculosis. No deer were found with bovine tuberculosis during routine slaughter.

Tuberculosis in wildlife

Tuberculous possums and occasionally other wildlife (pigs, deer, cats, ferrets, stoats, hedgehogs and hares) have been associated historically with persistent infection in cattle and deer herds in 32 separate areas of New Zealand. Areas containing wildlife maintenance hosts of TB are classified as VRAs.

Possums (*Trichosurus vulpecula*) are considered to be the main TB maintenance host and are the main wildlife vector of TB in cattle and farmed deer. However, in a number of VRAs, ferrets (*Mustela furo*) are also suspected of being TB vectors. As a result of intensive possum control since 2011, TB has been eradicated from both wild and domestic animals in about 2 million hectares of VRA.

Wildlife surveys in 2017–2018

Wildlife surveys are undertaken in a VRA to gather disease and wildlife population data in order to declare the area (or part of it) free of disease, or to delineate the extent or spread of disease in order to focus further possum control efforts. **Table 1** shows the results of wildlife surveys conducted during 2017–2018.

Table 1: Number of wild animals in 2017–2018 sampled by species, and the number found to be infected with *Mycobacterium bovis*

	Possums	Wild pigs	Wild deer	Ferrets	Others
Number sampled	2 916	2 164	251	2 636	42 stoats 8 feral cats 6 weasels
Number with TB	9	9	0	21	0

Kevin Crews
National Disease Manager
Head of TBfree Programme
OSPRI NZ Ltd
kevin.crews@ospri.co.nz

American foulbrood

American foulbrood (AFB) is a honeybee brood disease caused by the bacterium *Paenibacillus larvae larvae*. This disease of honey bees has been regulated by government since 1907. The American Foulbrood Pest Management Plan (AFBPMP), under the Biosecurity Act of 1993 and set up by Order in Council (Biosecurity Order 1998), appointed Apiculture New Zealand to oversee the AFBPMP, which is managed by the AFB Management Agency. More information can be found at www.afb.org.nz

Key features of the AFBPMP are:

- All hives must be inspected annually for the prevalence of AFB by a beekeeper who holds a Disease Elimination Conformity Agreement (DECA) and who must report on the disease status of the hives to the AFB Management Agency or its contractor, AsureQuality Ltd.
- All non-DECA beekeepers must annually submit a Certificate of Inspection issued by a DECA holder to the AFB Management Agency or its contractor, AsureQuality Ltd.
- To attain a DECA beekeepers must first pass a competency test on AFB recognition and control and then submit an AFB management plan to the Management Agency or its contractor, AsureQuality Ltd.
- Beekeepers must submit samples of bees, brood or honey for AFB testing on request.
- Random and focused inspections of suspect hives and hive equipment are carried out by Authorised Persons.
- The killing of infested colonies and destruction of contaminated hive parts is mandatory and must be reported to the AFB Management Agency or its contractor, AsureQuality Ltd.
- All apiaries must be registered on the apiary database within 30 days of being established and all beekeepers must submit an Annual Disease Return confirming that the information on the database (including disease reports) is accurate.

Hive inspection and audit programme to 30 June 2018

AsureQuality Ltd collates beekeeping and AFB disease statistics each year for the AFB Management Agency for the period 1 July to 30 June, which encompasses a full beekeeping season. During this reporting period, Authorised Persons and beekeepers reported AFB in 2 812 hives (0.32 percent of total hives) from 1 739 apiaries (3.13 percent of total apiaries). Corresponding AFB infection rates for 2016–2017 were 2 976 hives (0.37 percent) found in 1 510 apiaries.

As of 30 June 2018 there were 4 118 beekeepers with DECAs, representing 48 percent of all registered beekeepers. During this reporting period 647 new DECAs were approved. While the number of DECA holders continues to rise, the percentage of DECA holders is falling. This is mainly due to the fast increase in beekeeper numbers in recent years. These beekeepers are permitted to inspect their own hives for AFB and make reports to AsureQuality via APIWEB or on the approved forms.

There were 4 431 beekeepers who owned 61 059 hives on 7 124 apiaries that required a Certificate of Inspection as of 30 June 2018. This means they had to engage the services of an approved beekeeper to inspect and report on the AFB status of their hives.

Apiary register and statistics

There were 8 533 beekeepers owning 881 185 hives on 55 527 apiaries as of 30 June 2018, compared with 7 836 beekeepers, 811 357 hives and 50 211 apiaries at the same time in 2017. Over the last few years the industry has continued to grow, with a net increase in beekeeper numbers of 8 percent in the last year, and this has long surpassed the pre-varroa numbers. This increase represents greater numbers of both commercial and hobbyist beekeepers. The average number of hives per apiary remaining unchanged. Although the total number of hives increased, the percentage increase for the period was less than in the previous year (**Table 1**). This is possibly a result of the second consecutive below-average honey season in the North Island.

The main increases in beekeeping operations were again in the North Island, where 76 percent of the beekeepers are registered, and is largely driven by mānuka honey production, which is much more prevalent in the North Island. Apiary density is a very real concern for beekeepers, landowners and other stakeholders, as is the continual increase in hive numbers over the last decade.

David Swart
Apicultural Officer, AsureQuality Ltd
Mt. Maunganui, Tauranga
david.swart@asurequality.com

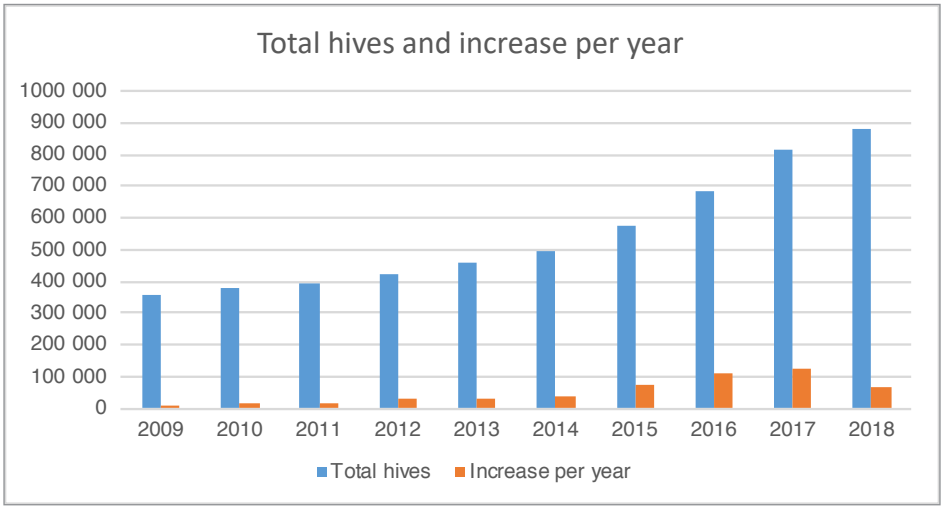

Figure 1: Total hive numbers, 2009–2018

Annual reports from industry surveillance and disease control programmes

Brucella ovis accreditation scheme 2017

Numbers of animals tested in 2017 were slightly down compared to 2016. The overall infection rate (reactors/samples tested) was 1 percent.

The infection rate should be treated with caution as it is skewed by several flocks with a > 25 percent infection rate that have had subsequent eradication tests.

As in previous years, the figure includes animals from a large number of commercial properties as well as flocks previously accredited (ram-breeder flocks and some commercial flocks). The infection rate for ram-breeder flocks will be significantly lower, but data is limited since relevant information is not always provided on laboratory submission forms.

Table 1 shows that not all flocks with reactors had any further investigation during 2017.

Some of the flocks, especially where there are only one or two reactors, may have had subsequent testing performed on the reactor samples, e.g., ELISA and/or gel diffusion, and their owners have opted not to re-test on the basis of results obtained.

Emma Sharland
Gribbles Veterinary Pathology
Palmerston North
Emma.sharland@gribbles.co.nz

Table 1: *Brucella ovis* testing and eradication, 2017

Area	Flocks with reactors *	Flocks with eradication in progress or completed
Far North & Auckland	0	0
Waikato, Waitomo & BOP	2	0
Taranaki &Wanganui	4	1
East Coast	1	1
Hawke's Bay	2	0
Manawatu & Rangitikei	1	0
Wairarapa & Wellington	4	2
Marlborough & Canterbury	1	0
Otago & Southland	8	3

*Infected flocks are those that have had *B. ovis* reactors identified but not always confirmed by further testing

Infectious bursal disease eradication programme

In 1993, a low-virulence strain of infectious bursal disease (IBD) was identified in commercial poultry in New Zealand. As a result, in 1994 an IBD eradication programme funded and supervised by industry was put into place. Both active and passive surveillance are important parts of the programme, with passive surveillance taking place both on farms and in processing plants. No cases of IBD have been confirmed in commercial poultry since 1999.

During 2017, the two private poultry laboratories screened a total of 14 045 blood samples collected under the whole-flock testing programme from commercial layer, rearing, meat-chicken and meat-chicken breeder farms.

Samples were screened using the IDEXX FlockChek ELISA.

There were 166 reactors from 45 flocks and

- 65 reactors from 40 flocks re-tested negative;
- 53 reactors from 41 flocks were not re-tested (as they had already been sent for processing);
- samples from 26 reactors in five flocks were sent for virus-neutralisation test (VNT) at Wallaceville and tested negative; and
- 22 reactors from seven flocks were re-bled and sent for VNT at Wallaceville and tested negative.

These investigations, which included blood sampling, serology, collection of bursa for histology and PCR testing all led to the conclusion that IBD was not present.

Reference

Brook M (2003). Poultry Disease Surveillance in New Zealand. *Surveillance* 30(1), 12–14..

Kerry Mulqueen
Senior Executive Officer – Technical
Poultry Industry Association of NZ
Egg Producers Federation of NZ
NZ Feed Manufacturers Association
Auckland
Kerry@pianz.org.nz

Poultry health surveillance

The following is a summary of the laboratory tests performed by the New Zealand poultry industry laboratories and MPI's Animal Health Reference Laboratory during 2017.

Table 1 is a summary of serum sample testing for major poultry diseases. **Table 2** summarises the findings of *Salmonella* serotypes isolated from poultry feed and carcass samples.

Table 1: Serological test results summary: poultry – 2017

Disease	Number tested	Number positive	Vaccination status
Avian influenza	3 182	1*	
† Newcastle disease	2 514	0	
Egg drop syndrome '76	1 857	475	(V)
Infectious bursal disease	14 045	197***	
Chicken anaemia agent	2 232	2 570	V
Avian encephalomyelitis	3 288	2 318	V
Infectious bronchitis	11 593	7 338	V
Infectious laryngotracheitis	1 531	883	V
Reovirus	495	485	
Mycoplasma gallisepticum	18 790	19	
Mycoplasma synoviae	10 030	204	
Acute *Pasteurella multocida*			
Salmonella Pullorum	8 127	1**	

V = Most vaccinated; (V) = Some vaccinated

† New Zealand has never experienced an outbreak of Newcastle disease. A subclinical enteric strain of avian paramyxovirus type 1, with an intracerebral pathogenicity index of 0.00–0.16, is endemic in this country.

* AI reactor – samples sent to MPI for confirmation test – negative

** Pullorum reactor – samples sent to MPI for confirmation test – negative

*** IBD reactors: see IBD report, p. 35

Table 2: Serotypes of *Salmonella* isolated during 2017

Salmonella isolates	Finished and feed sources	Broiler samples *
Agona		6
Anatum	2	1
Bovismorbificans		29
Derby	11	3
Fresno	1	
Infantis		12
Kentucky	1	
Livingstone		11
Mbandaka	81	
Rissen	1	2
Senftenberg	2	7
Species group B		2
Species group C		16
Typhimurium 191	1	1
Typhimurium *193*	1	
Typhimurium PT56	2	
Total positive / total tested	**103 / 3 232**	**90 / 3 894**
		2 209 are NMD samples

* Samples include environmental swabs, neck flap, caeca and whole carcass rinse birds

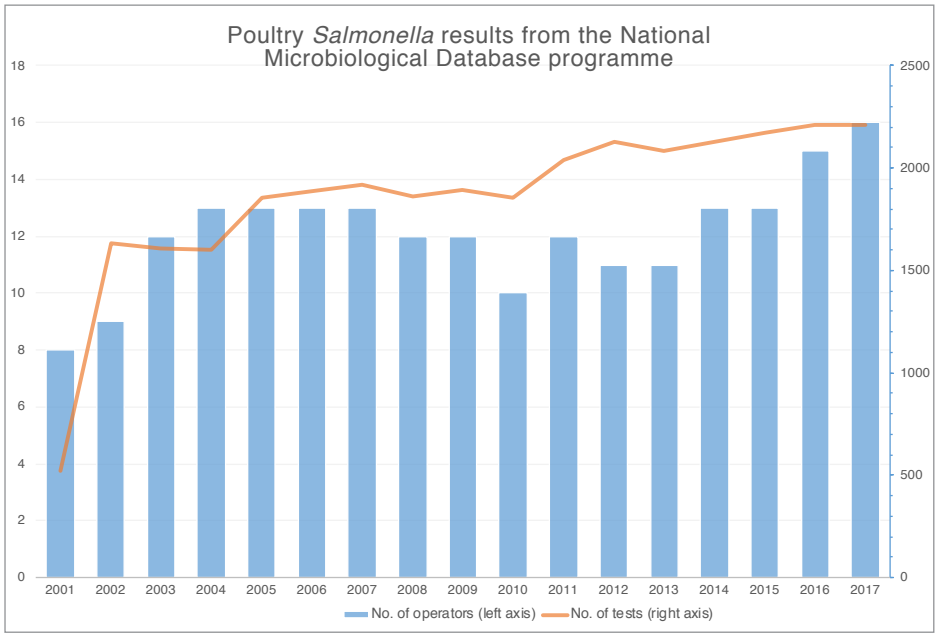

Figure 1: NMD poultry sampling for *Salmonella*, 2001–2017

Poultry salmonella testing from the National Microbiological Database programme

All primary processors of meat, poultry, game or ratites are required to take part in the National Microbiological Database (NMD) programme. Only suitably trained persons may carry out NMD sampling. Poultry carcasses are sampled at poultry slaughter plants (operators) and the samples are cultured with subsequent typing as detailed in the NMD programme.

Figure 1 shows the number of samples taken each year and test results. In 2017 samples were obtained from 16 slaughter premises. There has been no isolation of fowl typhoid (*Salmonella* Gallinarum) or pullorum disease (*S.* Pullorum).

Kerry Mulqueen
Senior Executive Officer – Technical
Poultry Industry Association of NZ
Egg Producers Federation of NZ
NZ Feed Manufacturers Association
Auckland
Kerry@pianz.org.nz

Grant Clarke
Team Manager Live Animal Export Assurance
Live Animal Export Assurance
Assurance Directorate
Regulation & Assurance Branch
grant.clarke@mpi.govt.nz

Quarterly review of diagnostic cases

SVS Laboratories

Bovine

In-calf cows from Matamata-Piako lost condition following an accidental **monensin overdose** in the feed. One cow died; an on-farm necropsy was performed and samples were submitted to the laboratory. Histopathology revealed changes in the heart muscle including myofibre necrosis, myofibre degeneration/regeneration, lymphohistiocytic infiltrations and fibrosis, consistent with **ionophore toxicity**. Changes in the lungs (alveolar haemosiderophages) and liver (periacinar congestion) were related to the resultant congestive heart failure.

The facial eczema season was as bad as ever and many properties were affected, even into mid-May. In one particularly severe case on a Bay of Plenty dairy farm, a total of 30 dairy cows died over a period of a month. The case started shortly after an interruption of the Dosatron system for zinc supplementation in the water, when the farmer applied zinc oxide powder directly to the maize silage feed and three cows died acutely and several more were depressed, with jaundice and red urine. Although zinc toxicity was suspected, serum zinc levels in several sick cows were within or below the prophylactic range. Haematology results revealed severe acute haemolysis (HCT 0.07; reference range 0.24–0.40). *Theileria* spp. were seen in some of the haemolytic cases and ***Theileria orientalis* Ikeda** was confirmed on PCR, consistent with **theileriosis**. (Other causes including zinc/copper/brassica toxicity, leptospirosis and clostridial infections had been ruled out.) In addition, in several of the blood smears further haemoplasma organisms were observed, and these were confirmed by the MPI Animal Health Laboratory (Wallaceville) to be ***Mycoplasma haemobos*** and ***M. wenyonii***, which are usually considered incidental (McFadden *et al*., 2015). Within a few days of the initial deaths, cows began to show signs of photosensitivity consistent with facial eczema (FE): serum liver enzymes were elevated, with GLDH in one cow at 2 778 U/L (reference range 8–41) and GGT at 320 U/L (reference range 1–36). The higher GLDH (compared to GGT) was considered likely due to marked bile leakage. Histology on a liver sample after postmortem revealed typical severe FE changes including prominent portal bridging fibrosis, bile ductule hyperplasia with periductular fibrosis, cholangitis and centrilobular necrosis. The early acute signs of haemolytic anaemia caused by theileriosis were considered unusual in a *Theileria*-endemic region and it is noteworthy that a high sporidesmin challenge can directly cause acute haemolysis. It is also worth considering the immunosuppressive effects of mycotoxins, which may have contributed to the cows' susceptibility to theileriosis. This case was unusual in the high number of deaths that resulted, the early acute signs of haemolytic anaemia, and the severity of the later FE cases revealed on histopathology.

A Friesian cow in South Waikato presented with pale icteric mucous membranes, ulcers in the mouth and on the nose, and bilateral conjunctivitis, with no skin lesions. Malignant catarrhal fever was the clinician's primary differential diagnosis. Biochemistry revealed marked increases in GGT (3 418 U/L; reference range 1–36) and GLDH (1 870 U/L; reference range 8–41), correlating with **sporidesmin toxicity**. Haematology revealed a marked anaemia, with a HCT of 0.15 (reference range 0.24–0.40) without the presence of *Theileria* organisms. In the absence of other causes of haemolysis (zinc, brassica toxicity, etc.), again it was considered likely that the direct action of severe acute sporidesmin toxicity caused haemolysis before the onset of skin signs.

During the facial eczema season there were also issues associated with excessive zinc prophylactic treatment. Several dairy cows on a Matamata property presented with acute anaemia and weakness. Haematology confirmed severe anaemia (HCT 0.06; reference range 0.24–0.4), high numbers of Heinz bodies and no evidence of *Theileria* spp. Serum zinc levels were tested in three of the affected cows and found to be markedly high at 310, 240 and 120 umol/L (prophylactic zinc level 20–35), confirming **zinc toxicosis**. Haemolytic anaemia can be seen at > 80umol/L and sudden death may occur at > 100. Heinz bodies indicate oxidative damage, which is seen with both zinc toxicity and brassica toxicity. The lack of Heinz bodies does not rule out oxidative damage, since these are quickly removed from circulation by the spleen. The zinc dosing regime was reviewed.

A well-conditioned 600-kg beef steer in Waitomo was moribund, with pyrexia and dark, tarry faeces. PCR tests on the faeces were positive for ***Clostridium perfringens*** alpha and beta-2 toxins (not beta toxin). Full toxin-typing to designate the *C. perfringens* by type (A to E, according to the major toxins alpha, beta, epsilon and iota) was not available at that time. In cattle, acute clostridial diseases have most commonly been reported in association with types C and D. Type C typically causes acute neurological signs (which are due to the beta toxin, not detected here) and type D is associated with acute enterotoxaemia (the pathology is mainly related to the vascular effects of the epsilon toxin.) *C. perfringens* type A should also be considered, its role in avian necrotic enteritis being well established, but more recently (particularly with the discovery of further toxins and their actions) there is increased understanding of the association of type A with cases of bovine necro-haemorrhagic enteritis and its pathogenesis (Goossens *et al*., 2017).

Bovine abortions peaked as usual during this quarter. Several cases related to feeding of spoiled silage to dairy cows, owing to the wet autumn/early winter. In one such case, abortions occurred in several dairy cows in Matamata-Piako. An in-clinic examination of the fetus and placenta showed necrosis and suppuration of the placental cotyledons (**Figure 1**). Histopathology of the relatively well-preserved placenta

confirmed cotyledonary necrosis, marked suppurative inflammatory response, and significant multifocal placental vasculitis, typically of ***Bacillus lichenifomis*** infection (Mitchell *et al*., 1986). Fetal tissues revealed a suppurative septicaemic inflammation (liver and lung). PCR on fresh placental tissue confirmed *B. licheniformis*.

In another dairy herd of 750 cows, seven abortions occurred within a month. Full fetal and placental tissues were submitted for microscopic evaluation, which revealed a confluent area of cotyledonary necrosis with marked suppurative inflammation and numerous fungal hyphae. The findings in the relatively well-preserved fetus were non-specific, a reminder of the diagnostic advantages of examining placental tissues in bovine abortion cases. The diagnosis of **mycotic abortion** correlated with the spoilage noted at the silage face, which had recently been flooded. PCR for further definitive diagnosis was therefore not requested.

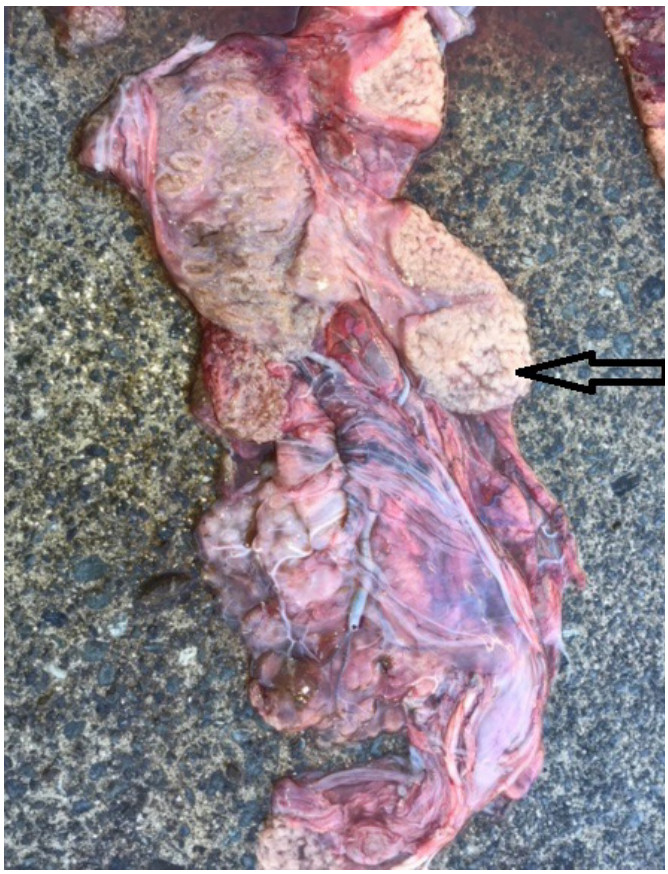

Figure 1: Necrosis and suppuration of the placental cotyledons in a case of bovine fetal abortion caused by *Bacillus licheniformis*.

Four days after **aborting**, a dairy cow in the Bay of Plenty presented with recumbency and endometritis. Biochemistry revealed a subclinical hypocalcaemia (1.92 mmol/L; reference range 2.0–2.6) and a moderate increase in creatine kinase (5 832 U/L; reference range 0–578). However, of greatest clinical significance was a very low creatinine level of 37 umol/L (reference range 55–130), indicating very poor body condition (with no evidence of Johne's disease). Hence the animal had sparse reserves for mounting an immune response (requiring both energy and protein) and thus was highly susceptible to abortifacient pathogens and too weak to rise once recumbent. This case highlights the importance of observation and management of optimal body condition in pre-calving dairy cows, as well as testing metabolic/mineral causes of recumbency.

Eight-month-old heifer calves in the Bay of Plenty presented with watery, green scour. Bacterial cultures yielded ***Yersinia eudotuberculosis***, confirming a diagnosis of **yersiniosis**. However, an underlying immunosuppressing factor was suspected and serum selenium was found to be low in four calves tested, ranging from 57 to 110 nmol/L (reference range 190–650), indicating an underlying **selenium deficiency**.

A young heifer on a Waitomo dairy farm was found dead, with evidence that she had been struggling. At postmortem, tissues were submitted to the laboratory, where histological evaluation of the brain revealed the cause of death was **polioencephalomalacia**. Other findings included multifocal villus crypt abscessation typical of **yersiniosis**, plus increased numbers of lamina propria eosinophils suggestive of a reaction to enteric ***Strongyle*** spp.

***Salmonella* Emek** was cultured from faeces of an 11-year old Friesian cow in Matamata-Piako that presented with diarrhoea and pyrexia. This organism is infrequently isolated in New Zealand. Previous isolates have been from humans, bio-waste, animal feed raw materials, a single cow case and in association with reduced hatchability of duck embryos.

A 3-year-old Friesian cross dairy cow in the Bay of Plenty presented with multiple 2-cm-diameter nodules on the body and perineum. An excisional biopsy, the cut surfaces of which were yellow-green and firm, was submitted for histopathology. Microscopically, a **mast cell tumour** was diagnosed, with abundant eosinophils causing the grossly green appearance. Bovine cutaneous mast cell tumours are usually multiple and malignant, and have a high potential to metastase in the lymph nodes, mesentery, liver, abomasum, lung or heart. Mast cell leukaemia has also been reported in some cattle.

Ovine

Fifty mixed-aged ewes on an organic farm in Waitomo were found dead. Acute **salmonellosis** was suspected and ***Salmonella* Hindmarsh** was isolated from the small intestines of two ewes.

Avian

A 5-year-old Macaw parrot from Coromandel presented with diarrhoea, and a faecal sample was submitted. A faecal egg count revealed over 10 000 epg of ***Capillaria* spp.**, giving a diagnosis of **helminthiasis**. *Capillaria* spp. may be found in the crop and oesophagus, and adult worms can embed in the lining of the intestine, compromising nutrient absorption. Gram staining of the faecal sample in this case showed a shift in the microbial population, with increased numbers of Gram-positive rods,

suggesting that the helminthiasis was causing malnutrition.

Infectious laryngotracheitis (ILT) was diagnosed after histology of tracheal and conjunctival mucosa from two chickens in an Auckland commercial poultry unit. ILT is caused by gallid herpesvirus type 1, an alpha-herpesvirus, and is one of the most important respiratory diseases of chickens. The tissues had characteristic epithelial syncytial cells with viral intranuclear inclusion bodies. ILT is an acute, highly contagious disease of chickens characterised by respiratory distress, coughing, expectoration of bloody, mucoid exudate and high mortality. Outbreaks range from highly pathogenic epizootic forms to mild enzootic disease, depending on virus virulence, and affect a wide age-range of birds (4 to 18 months). The virus is spread via aerosols of respiratory secretions. Characteristically, after herpesvirus infection recovered birds often have latent virus in the trigeminal nerve ganglion, and virus reactivation may occur with immunosuppressive conditions/stressors.

Rhodococcus equi was cultured from a chronic inguinal wound in a 5-year old domestic Shorthaired cat in Waikato. *R. equi* infections in cats may present as draining, ulcerated lesions on a limb, and cultured organisms are often multi-drug-resistant, as in this case. While more commonly associated with bronchial and gastrointestinal tract lesions in young foals, *R. equi* grows in soil that contains herbivore manure and can contaminate wounds of other animal species.

Companion animal

A cat from Hamilton was diagnosed with **lung-digit syndrom**e (metastasis of a primary pulmonary adenocarcinoma to the digits), based on clinical findings, radiographs, histology and post-mortem examination. Chest radiographs revealed a large pulmonary mass and a swelling of the metatarsal area. Lung cytology was consistent with suppurative inflammation. A wedge biopsy of the foot mass was consistent with metastasis of a pulmonary carcinoma. Metastasis of primary pulmonary tumours in the cat is unique, and is associated with metastasis to atypical locations, most notably the distal phalanges. While the weight-bearing third phalanx of a front foot is most frequently affected, in this case the metatarsals of the right hind foot were involved. The overall metastatic rate for pulmonary (adeno)carcinoma of the feet in cats is 75 percent. Affected cats present with lameness and one or more swollen, painful digits. Respiratory signs are usually absent, despite masses identified radiographically. Prognosis is grave and the mean survival time is 1–2 months. At postmortem a large pulmonary adenocarcinoma with metastasis to the metatarsals area was confirmed.

In South Waikato a 5-year-old pig dog presented with anorexia, vomiting and lethargy after a hunt. On physical examination he was icteric and dehydrated. Blood work revealed marked azotaemia (creatinine 1 105 umol/L; reference range 45–135), hyperphosphataemia, hyperkalaemia and metabolic acidosis. Muscle enzymes levels were mildly raised and liver enzymes were moderately increased, with a marked elevation of bilirubin (385 umol/L; reference range < 6.0). The haemogram confirmed dehydration. IgM antibody analysis was positive for **leptospirosis**. The wet season is an important environmental factor enhancing proliferation and survival of leptospiral pathogens.

A pet rat in Waikato died suddenly. An in-clinic necropsy revealed **lung abscessation**, cultures of which yielded ***Proteus mirabilis***. This bacterium is found in the rodent urinary tract and shed in the urine. The likely pathogenesis was considered to be a build-up of *P. mirabilius* from wet bedding in the cage, leading to inhalation of the bacterium. Attention to cage hygiene management was reviewed with the client.

Gribbles Veterinary Pathology

Bovine

A herd of 415 Friesian cows on a South Canterbury dairy farm were getting fodder beet at the rate of 2 kg/day. After an error resulted in their being offered 30 kg over 3 hours, 47 of them died. Histological examination of sections of rumen confirmed the presence of superficial rumenitis, supporting the clinical diagnosis of **ruminal acidosis**.

Fixed tissues were received from a 6-month-old calf on a North Canterbury farm. It was one of eight affected calves in a group of 150. Three of the calves had died and five were depressed and anorexic and had diarrhoea. Some had blood in their faeces. Histological examination revealed acute tubular necrosis. The calves had been grazing a paddock that was thickly littered with acorns. The renal lesions were consistent with **acorn toxicity**.

At pregnancy testing on a North Canterbury farm, 10 cows were found to have mummified fetuses. Sera were collected from the cows and tissues from the mummified fetuses were collected at slaughter. Sera from five cows were tested and four had high ***Neospora caninum*** IFAT titres (1:1 000, 1:2 000 and > 1:2 000). One was seronegative. Histological examination was performed on tissues from some of the fetuses. The tissues were poorly preserved but there were lesions suspicious of myositis in some sections of muscle and *N. caninum* was detected by PCR in two fetal tissue samples. The combined evidence suggested that these cases were ***Neospora* abortions**.

An adult dairy cow from a herd of about 600 in South Canterbury had mastitis that did not respond to antibiotic treatment. Culture of the milk revealed a pure, heavy growth of *Candida rugosa*. ***Candida rugosa* mastitis** has been reported in the literature (Scaccabarozzi *et al.*, 2011) and this organism appears to be becoming more commonly recognised as a pathogen in a number of species,

including humans. The mastitis pattern in the herd was not unusual compared to previous seasons and no further cases of *Candida* mastitis have been recorded from this property.

There were several cases of **bovine adenovirus infection** reported in Canterbury this quarter. In one case samples were received from an 8-month-old Friesian cross calf that died without any prior clinical signs being noticed. Histopathological examination of fixed tissues revealed amphophilic intranuclear inclusions in the endothelial cells of submucosal vessels in the intestine, and in the endothelial cells of capillaries between cortical tubules in the kidney. This was consistent with a systemic adenovirus infection. In another case, a group of calves with a previous history of coccidiosis included a single animal that was obviously sick and had diarrhoea. Faecal testing revealed no *Yersinia* or *Salmonella* spp., coccidial oocysts were rare and serum vitamin B12 and selenium levels were normal, but bovine adenovirus was detected by PCR.

Two of eight calves on a mid-Canterbury dairy farm died. One of these had had a high positive result on a **bovine viral diarrhoea virus (BVD)** antigen ELISA test and was suspected to be persistently infected. The six remaining calves were tested using a pooled PCR test for BVD, and the pool was positive. Individual testing was then undertaken using a BVD antigen ELISA test. Three of the six had high positive results, indicating likely persistent **BVD infection**. The remaining three calves tested negative.

***Salmonella* Brandenburg abortion** was diagnosed in several outbreaks of bovine abortion in heifers in Canterbury this quarter. This organism was isolated from the fetal stomach contents and/or fetal lung in each case.

As cows were dried off at the end of lactation during this quarter we saw a number of cases of ***Staphylococcus aureus* mastitis** in dairy cows after teat sealants had been used. In one case from Westland seven milk samples were received from six cows (two different quarters were sampled from one animal.) There were no significant isolates from two of the seven samples but *S. aureus* was isolated from the other five.

A dairy farm near Whangarei with 350 Friesian Jersey cross cows had eight abort 7 weeks prior to the planned start of calving. The herd was being fed mouldy silage. Multiple fixed tissues and fetal stomach contents were submitted from the most recent case. Histopathology of the placenta revealed a severe diffuse acute necrosuppurative placentitis with haemorrhage, vasculitis and intralesional branching septate even-walled fungal hyphae. There were no significant findings on histopathology of the spleen, lung, skeletal muscle, heart, kidney, liver and brain. ***Aspergillus fumigatus*** was detected by PCR of the fetal stomach contents. *Mortierella wolfii* and *Ureaplasma diversum* were not detected. **Fungal placentitis** was considered to be the likely cause of the abortion, probably originating from the mouldy silage, which has been an increasingly common cause of bovine abortions as the season has advanced.

Blood was received from two Jersey cows from Taranaki. They showed depression, anorexia and ileus, and one animal had a scour. Both were polycythaemic owing to dehydration and both had lymphopenia caused by stress. Culture of the faeces of the scouring animal was negative for the most common bacterial pathogens. The animals had serum GDH concentrations of 1 606 and 1 441 U/L (reference range 5–35), serum AST concentrations of 5 234 and 6 795 U/L (reference range 56–130), serum GGT concentrations of 202 and 231 U/L (reference range 3–47) and bilirubin concentrations of 22 and 72 umol/L (reference range 0–8). Kidney samples from two dead animals had copper concentrations of 677 and 2 104 umol/kg (reference range 0–157). These results indicated **chronic copper toxicity**. The animals were being fed large amounts of palm kernel because the drought in Taranaki before Christmas made hay and other supplementary feed derived from grass unavailable. They were also being supplemented with minerals including copper.

In another case, a sick cow of unspecified breed and age in Taranaki was depressed, lethargic and inappetant, and had slightly enlarged submandibular lymph nodes. Haematological evaluation showed no significant changes. Biochemical changes included increased GDH of 1 672 U/L (reference range 5–35), AST of 6 444 U/L (reference range 56–130), GGT of 327 U/L (reference range 3–47) and bilirubin of 138 umol/L (reference range 0–8). Serum copper concentration was 69 umol/lL (reference range 8–20). These results also indicated **chronic copper toxicity**.

An outbreak of **acorn toxicity** was diagnosed on a Manawatu farm this autumn. Eight of 180 seven-month-old calves became depressed and ill-thrifty over the course of a week and five of the affected calves died. There was a history of access to oak trees prior to the onset of illness. Three affected calves had serum creatinine concentrations of 801–1 538 μmol/L (reference range 39–181) and urea concentrations of 52.4–104.9 mmol/L (reference range 2.7–1.9). Histology on the kidney of an affected calf confirmed severe tubular necrosis with regeneration and fibrosis, consistent with a toxic insult.

Two of a group of 30 one-month-old Hereford calves on a South Taranaki farm died on the same day. The first was found dead in the morning and the second was observed circling before dying a few hours later. The calves were reared on milk powder and meal in a shed with flaking lead-based paint. Post-mortem examination of the second calf was unremarkable. Histologically, there was renal proximal tubular degeneration and necrosis suggestive of a toxic insult. The mucosa of the tongue had areas of necrosis, spongiosis and neutrophilic inflammation, interpreted as irritant contact lesions. There were

subtle degenerative changes in the cerebral cortex. All of these changes were compatible with, but not pathognomonic for, **lead toxicity**. The diagnosis was confirmed by finding a liver lead concentration of 32.1 mg/kg (toxic level > 10 mg/kg).

A herd of 150 rising-1-year-old Hereford cross beef calves was investigated for multiple ongoing outbreaks of diarrhoea, ill-thrift and occasional deaths over a period of several months. At least five affected calves died. Investigations including faecal egg counts, bacterial cultures, BVD serology and trace element testing were initially non-diagnostic. Subsequently, samples from two affected calves had zinc concentrations of 150 and 156 µmol/L (reference range 12–18.5), suggesting a possible diagnosis of **zinc toxicity**. The diagnosis was confirmed by histological evidence of pancreatic degeneration, necrosis, atrophy and fibrosis, along with transmural duodenal oedema, in one of the affected calves.

About 350 mixed-age Friesian cross cows from a 700-cow Bay of Plenty herd developed areas of scabbing and erythema on the heels, between the claws and dew claws. The cows were not lame. Biopsies taken from some of the lesions revealed a non-specific crusting and hyperplastic dermatitis with eosinophils and mixed bacteria. Dermatophilosis and bovine digital dermatitis were ruled out through cultures and histology. Further history indicated that the cows had been subjected to footbaths containing formalin at more than twice the recommended concentration. The lesions improved once the formalin was removed. The final diagnosis was **formalin-induced irritant contact dermatitis**.

Seventeen of 50 rising-1-year-old dairy heifers from Waipukurau were found dead in a paddock containing chewed shoots of the known nephrotoxic plant **redroot pigweed** (***Amaranthus retroflexus***). Histopathology was performed on the kidney of one of the affected heifers and revealed extensive necrosis of tubular epithelial cells. This finding was compatible with an acute toxic insult.

Nine of 350 spring-calving dairy cows aborted. There was a history of feeding poor-quality baleage. Histopathology on three placentas revealed a necrosuppurative placentitis with vasculitis and thrombosis. Fungal organisms were readily identified in two of the three placentas. These findings were compatible with **mycotic abortion**.

Five of 100 rising-1-year-old dairy heifers from Manawatu were found dead or ill. Histopathology revealed the presence of basophilic intranuclear inclusion bodies within endothelial cells in the ileum, kidney and lymph nodes, with associated inflammation. These findings were compatible with **bovine adenovirus** and this was the most likely cause of death. Bovine adenovirus is ubiquitous, but can cause certain disease syndromes, including diarrhoea and sudden death in weaner cattle.

A dairy cow from Thames became recumbent during calving and was not responsive to treatment for metabolic disease. She had tachycardia and was lethargic, polydipsic and ataxic. At gross post-mortem examination the kidneys contained black or tan areas, which histologically were wedge-shaped areas of haemorrhage and necrosis consistent with **renal infarcts**. These can occur secondarily to septicaemia, ascending bacterial infection or thromboembolism. Infectious agents were not found in this case, even after special staining.

Eight dairy cows in a herd of 300 from Northland aborted over a 3-week period. One was found to have retained fetal membranes. Three cows had ***Neospora caninum*** serological titres > 1:2 000 by IFAT, consistent with a diagnosis of ***Neospora*** **abortion**.

Ovine

Outbreaks of lamb deaths caused by severe **enteric parasitism** were diagnosed on several lower North Island farms during autumn 2018. In one case, 20 out of 300 lambs died on a Tararua farm. On post-mortem examination, affected lambs had distended gall bladders and faecal staining down the hocks. Histological evaluation of the gastrointestinal tract revealed evidence of severe parasitism, including nodular mucosal hyperplasia of the abomasum, marked villus blunting in the small intestine, and nematode stages in the lumen. Culture of intestinal contents was negative for *Salmonella* spp.

In another case, two of 150 Dorper lambs died and several developed diarrhoea on a Hawke's Bay farm. Histology again showed severe parasite-related changes and nematode stages in the lumen. A faecal egg count detected 2 500 **strongyle** eggs and 400 ***Nematodirus*** spp. eggs per gram of faeces and *Salmonella* spp. culture was negative.

A 4-year-old Suffolk ram from a group of six in Northland was weak and had been losing weight over a period of months. A faecal sample showed a very high copy number (> 106) of ***Mycobacterium avium*** **ssp.** ***paratuberculosis*** genomes by PCR, consistent with a diagnosis of **Johne's disease**.

Caprine

Three of a group of 30 angora goats on a mid-Canterbury farm died after showing neurological signs including opisthotonus and head tilt. Samples were received from one of the dead goats, which was 9 months old. The goat had a faecal egg count of 2 800 strongyle eggs per gram, suggesting a significant worm burden. Histological examination of the medulla revealed multiple, small, often confluent areas of intense neutrophil infiltration, focal aggregates of histiocytes, cuffing of vessels by lymphocytes, and neutrophilic and lymphocytic infiltration of the meninges. The cerebellum and midbrain also had occasional focal areas of neutrophil infiltration and there was a mild meningeal infiltrate of lymphocytes and neutrophils over the cerebral cortex. Additional examination of Gram-stained sections showed numerous small Gram-

positive bacteria in the neutrophilic foci. The lesions were considered typical of **encephalitic listeriosis**. The causative organism, ***Listeria monocytogenes***, is common in soil, and cases of listeriosis quite commonly occur in animals on pasture. The bacteria can be incorporated in silage or balage and may proliferate if these feeds are not properly ensiled. In these circumstances, outbreaks of listeriosis may occur.

Cervine

Five of 600 weaner deer from the lower North Island area were sick and lame. A necropsy on one of the deer revealed hindlimb foot abscesses and large amounts of putrid brown fluid in the right thoracic cavity. Histopathology on the affected lung tissue revealed a severe necrosuppurative pleuropneumonia with intralesional coccobacilli and filamentous bacteria. Culture of the thoracic fluid yielded a heavy growth of ***Trueperella pyogenes***. The presence of filamentous bacteria on histology also raised the suspicion of *Fusobacterium* spp. involvement, although an anaerobic culture was not performed to isolate this. Cases of ***Fusobacterium/Trueperella* pleuropneumonia** are reported in deer following a bacteraemia from another point-source of infection. In this case, the foot abscesses were considered the likely origin.

Two weaner deer in a group of unknown size from South Canterbury died over a weekend and then two more were found dead 2 days later, with an additional animal found to be moribund. There was no evidence of diarrhoea. The animals had not been vaccinated against *Yersinia* spp. infection. Histological examination of tissues from two of the affected animals showed multifocal superficial neutrophilic enteritis with intralesional bacteria in the small intestine and increased neutrophils in the liver (the latter finding was considered to be consistent with a peripheral neutrophilia.) The findings were consistent with the suspected clinical diagnosis of intestinal **yersiniosis**. ***Yersinia pseudotuberculosis*** was isolated from two samples of faeces from the affected animals.

Camelid

An adult female alpaca was presented with a clinically apparent anaemia (pale mucus membranes). It was from a farm in Waikato that had a known history of abamectin-resistant haemonchosis. Serum biochemistry showed a marked hypophosphataemia of 0.19 mmol/L (reference range 1.35–2.8), mild hypocalcaemia (1.93 mmol/L; reference range 2.14–2.49), moderate hypoalbuminaemia (24 g/L; reference range 34–44) and vitamin D3 concentration of < 10 nmol/L. There is no laboratory-established reference range for serum vitamin D3 in alpacas, but Gerspach (2010) gives a reference interval of 50–200. Haematological examination showed a marked regenerative anaemia with a PCV of 0.09 (reference range 0.21–0.41) and an absolute reticulocyte count of 473 x 109/L (which equated to 14 percent reticulocytes). A faecal egg count revealed 200 **strongyle** eggs per gram. Larval culture showed that all counted larvae were ***Haemonchus* spp**. The alpaca was treated with anthelmintics and a blood transfusion but died. At autopsy it was in good body condition. The blood was thin and light red (consistent with severe anaemia) and the mucosa of the C3 stomach was slightly thickened and reddened (interpreted as gastritis related to the haemonchosis). No nematodes were seen in the stomach contents. The anaemia may have been due to a combination of **haemonchosis and hypophosphataemia**. Hypophosphataemia is commonly seen in alpacas in the winter as a result of low vitamin D levels caused by reduced sunlight. It can cause rickets and hypophosphataemic anaemia.

A 3-year-old male stud alpaca from New Plymouth developed fever, generalised skin thickening and crusting, ventral subcutaneous oedema from the brisket to the scrotum, and superficial lymph node enlargement. It was initially treated for suspected fight-wound infections but gradually deteriorated and was euthanased. Histological evaluation revealed a neoplastic angiocentric round-cell infiltrate in the skin, lymph nodes, spleen, liver and lungs, consistent with disseminated **lymphoma**. A number of published studies suggest that lymphoma is one of the more common tumour types in camelids (e.g., Cebra *et al*., 1995 and Valentine & Martin, 2007).

An adult female alpaca from Auckland was reported to have "sunburn" on her ears and face. Serum chemistry revealed GGT of 828 IU/L (reference range 12–27) and GLDH of 560 IU/L (reference range 2–19), consistent with a diagnosis of photosensitisation related to hepatic sporidesmin damage or **facial eczema**.

A month-old cria was pyrexic and losing weight. A severe azotaemia was noted on in-house testing at the practice laboratory of the attending veterinarian (details not available) and the cria was euthanased. Histopathology of multiple organs revealed multifocal tubular necrosis and tubulitis with intraluminal crystals, consistent with **oxalate nephrosis**. This is usually due to ingestion of oxalate-containing plants such as dock. Oxalate absorption through the gastrointestinal tract can be increased in some circumstances (e.g., altered gut flora) and oxalate nephrosis can also be induced by pyridoxine deficiency.

A recently retired 12–14-year old male stud alpaca presented with several cyst-like nodules over the dorsum. Cytological examination of smears made from a fine-needle aspirate revealed vast numbers of stained and unstained keratinised squames in a thick proteinaceous background containing amorphous basophilic debris. No nucleated cells or infectious agents were found. Findings were consistent with a follicular cyst and, given the history of multiple nodules, a presumptive diagnosis of **multiple follicular cysts** was made.

Porcine

Four 6-week-old male Large White pigs on a semi-commercial piggery in

Wanganui developed nervous signs and died in 1 day. Clinical signs included stargazing, paddling and inability to stand. Toxicity caused by incomplete mixing of feed was suspected. Gross post-mortem examination was unremarkable. The most significant histological findings were in the brain, where there was perivascular eosinophilic and lymphohistiocytic inflammation and subtle degeneration of cortical gyri. These changes are strongly associated with **salt toxicity**, which can be a secondary effect of water deprivation but in this instance was thought to have been the result of excessive salt intake caused by improperly mixing the feed.

Equine

A Standardbred horse of unknown age on a Canterbury farm had multiple proliferative lesions around the mouth. They had been present for 6 months. One lesion was removed and found to be a **viral papilloma**.

A pony from Northland had areas of dull or scabbed mucosa on the lips of her vulva. Histopathology of biopsies from the lesions revealed areas of epidermal hyperplasia and dysplasia, including cells with viral cytopathic change as well as areas of invasion and solar elastosis. These changes were consistent with **squamous cell carcinoma** related to ultraviolet radiation and likely **papilloma virus** infection.

A four-year-old Thoroughbred from Auckland had poor stamina and on clinical examination was found to have congestive heart failure with a grade 6/6 systolic murmur in the aortic region of auscultation. At necropsy the heart was hypertrophied and the aorta appeared distended. A pocket of purulent exudate was found just above the aortic valve, and the valve leaflets were coated with fibrin. Histopathology revealed **aortic valvular and mural endocarditis** with Gram-negative intralesional bacteria. Endocarditis is typically secondary to a bacteraemia. Reported causes in horses include *Escherichia coli*, *Actinobacillus equuli*, *Streptococcus equi* and *Pseudomonas aeruginosa*.

A 27-year-old Thoroughbred horse from Auckland had a long, curly coat and poor muscle tone. Serum chemistry revealed an equine ACTH concentration of 78.9 pg/mL (the upper reference limit between June and January is 29), consistent with a diagnosis of **pituitary pars intermedia dysfunction**.

An 18-year-old Icelandic gelding in Canterbury had a history of papillomatous masses on the penis. These had been present for many years but were becoming more extensive. A biopsy was collected and histopathological examination revealed multiple papillary fronds of proliferating keratinocytes lined by thick crusts of parakeratosis and supported by a core of oedematous fibrovascular connective tissue. The keratinocytes showed mild dysplastic features including loss of nuclear polarity, karyomegaly and nucleolar prominence. There were scattered, enlarged cells with abundant grey fibrillar cytoplasm and/or smudgy nuclear contents. There was also multifocal spongiosis, erosion, ulceration and neutrophilic crusting accompanied by numerous bacteria. The cytopathic changes confirmed a diagnosis of **viral papilloma** and it was considered possible that the aetiology was **equine papillomavirus type 2**, which can present as persistent penile papillomatosis and can also be found in penile squamous cell carcinomas (Knight *et al*., 2011a & b). It was therefore considered that there was potential for malignant transformation.

Avian

A mass was removed from the foot of a canary at a Christchurch veterinary practice. Histologically, the epidermis of the skin had a proliferative mass with large cytoplasmic inclusions typical of **avian poxvirus infection**.

An adult lovebird from an Auckland zoological collection was found dead. At necropsy, numerous abscess-like nodules were found within the liver and lungs. Histopathology showed necrotising and granulomatous hepatitis with intralesional acid-fast bacilli, as well as pneumonia. The lesions were consistent with **mycobacteriosis**, which is generally caused by *Mycobacterium avium-intracellulare* complex or *M. genavense*. The organisms are usually ingested and infect the intestinal tract before disseminating to other organs.

Several bantam chickens from Auckland had multiple crusted facial lesions. Histopathology of skin biopsies showed heterophilic and granulomatous dermatitis with surface cocci and clumps of keratin with large cytoplasmic inclusions. This was consistent with **avian poxvirus** with secondary bacterial infection. Cutaneous avian poxvirus infections are common on the face or legs. The virus can also cause proliferative lesions in the mouth and upper digestive or respiratory tracts.

One hundred of 700 juvenile quail in South Auckland died suddenly. Birds submitted for necropsy had variably extensive deposits of chalky-white material over the heart, liver and air sacs and their kidneys were light tan with frequent ureteral distension by white material. Histopathology revealed heterophilic tubulointerstitial nephritis with bacteria, urate tophi and ureteral squamous metaplasia. Squamous metaplasia was also seen in the tongue, nasal cavity and sinuses. The diagnosis was **vitamin A deficiency** leading to urolithiasis, ascending renal infections and visceral gout.

Canine

Two dogs from Wanganui were diagnosed with **dermatophytosis** (ringworm) during May. One was a 7-year-old spayed female Border Collie and the other was a 4-year-old spayed female Mastiff. Both had chronic raised crusty red skin lesions on the muzzle and distal forelimbs. The Mastiff developed lesions soon after moving house and a second dog in the home had similar lesions that resolved. Biopsies were taken in both cases and revealed pyogranulomatous furunculosis with intralesional fungal hyphae and arthrospores. Canine dermatophytosis is predominantly associated with *Microsporum canis* infection but can also be caused by *M. gypseum*, *Trichophyton mentagrophytes* and other dermatophytes.

Dermatophytes have significant contagious and zoonotic potential.

A 4-year-old Miniature Schnauzer from Hamilton presented with a chronic history of diarrhoea that became haemorrhagic in the later stages. Histopathology of the caecum revealed a transmural lymphohistiocytic typhlitis with numerous 10–30-um intralesional endosporulating organisms morphologically compatible with *Prototheca* spp. Numerous organisms were also present in the mesenteric lymph node. Shortly after diagnosis the dog developed ocular symptoms and was euthanased. **Protothecosis** is a rare, sporadic disease caused by a saprophytic alga. Disease in dogs usually affects the large intestine, eyes and central nervous system and is invariably fatal.

A 2-month-old Rottweiler puppy from Auckland had anorexia, vomiting and diarrhoea. It developed a marked increase in ALP, total bilirubin, urea, creatinine, phosphorus and potassium, and isosthenuria was found on testing at the attending veterinarian's practice laboratory (values not supplied). A urine sample was positive by PCR for *Leptospira* spp. and the puppy had a serum antibody titre of 1:800 to *L.* Copenhageni by MAT, consistent with a diagnosis of **leptospirosis**.

A year-old Cavalier King Charles spaniel from Christchurch had diarrhoea for several weeks. The diarrhoea was mucoid with a small amount of fresh blood. The dog was otherwise well with a normal temperature and was eating and drinking normally. Haematology and biochemistry were normal and no *Salmonella* spp. or *Campylobacter* spp. were detected on faecal culture. ELISA tests for *Giardia* spp. and *Cryptosporidium* spp. were negative. However, a faecal egg count revealed 100 ***Trichuris* spp**. eggs per gram. It was considered likely that whipworm infection was contributing to the diarrhoea in this dog.

Feline

A year-old Domestic Shorthaired cat from Christchurch presented with a history of waxing and waning lethargy, inappetence, right forelimb lameness, and left and right prescapular lymphadenopathy over several months. It was partially responsive to antimicrobials and non-steroidal anti-inflammatory drugs. Serology was negative for both feline immunodeficiency virus and feline leukaemia virus. Initial radiographs revealed abnormal radiolucency in the distal right ulna and the same was found in the proximal right humerus on repeat radiographs 2 months later. A Jamshidi bone needle was used to collect a core of bone from the proximal right humerus. The core was rolled onto slides for cytology, then put in formalin for histopathology, and a swab was collected for microbiology. Cytology revealed occasional areas with small numbers of neutrophils that were often degenerate and contained intracytoplasmic rod-shaped bacteria (**Figure 2**). Histopathology revealed large areas of necrosis, fibrin and haemorrhage that were multifocally infiltrated by dense aggregates of degenerate neutrophils and macrophages (**Figure 3**). Rare neutrophils contained short intracytoplasmic Gram-negative rods. Microbial culture isolated a pure growth of *Salmonella* sp., which was typed as ***Salmonella* Typhimurium phage type 56**. The diagnosis was **septic osteomyelitis** caused by *S.* Typhimurium. *Salmonella* spp. are an uncommon cause of bacterial osteomyelitis in cats. In this case, bacteraemia with haematogenous spread and localisation in the metaphyseal regions of multiple bones (metaphyseal osteomyelitis) was considered the likely explanation for the waxing and waning lameness, lymphadenopathy and partial response to antimicrobials. Bacterial osteomyelitis typically requires several weeks to months of antimicrobial treatment. The patient responded very well to 8 weeks of antimicrobial treatment, but relapsed a few days after treatment ended and a longer course of treatment is planned.

A month-old kitten of unknown sex from Wellington died suddenly after being slightly sleepy the day before. It had had an episode of diarrhoea, thought to be dietary, about 2 weeks previously. At necropsy it was noted to be slightly jaundiced. There was a small amount of abdominal fluid, which was a modified transudate with small numbers of degenerate neutrophils and macrophages, many of which contained rod-shaped bacteria. Histological examination showed hepatocellular necrosis, focal

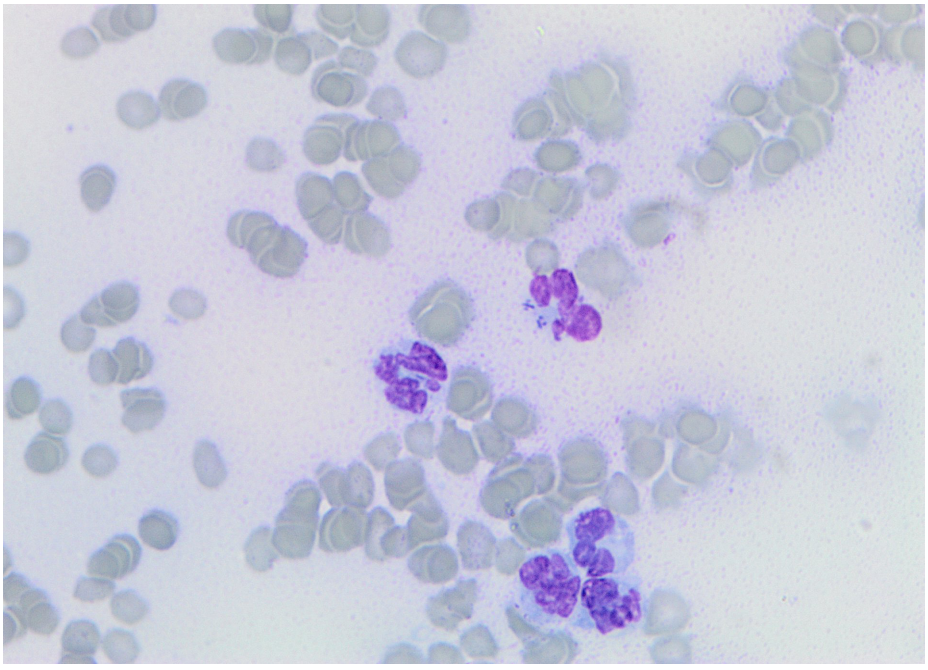

Figure 2: Cytology of the core biopsy from the proximal right humerus, showing degenerate neutrophils with intracytoplasmic rod-shaped bacteria

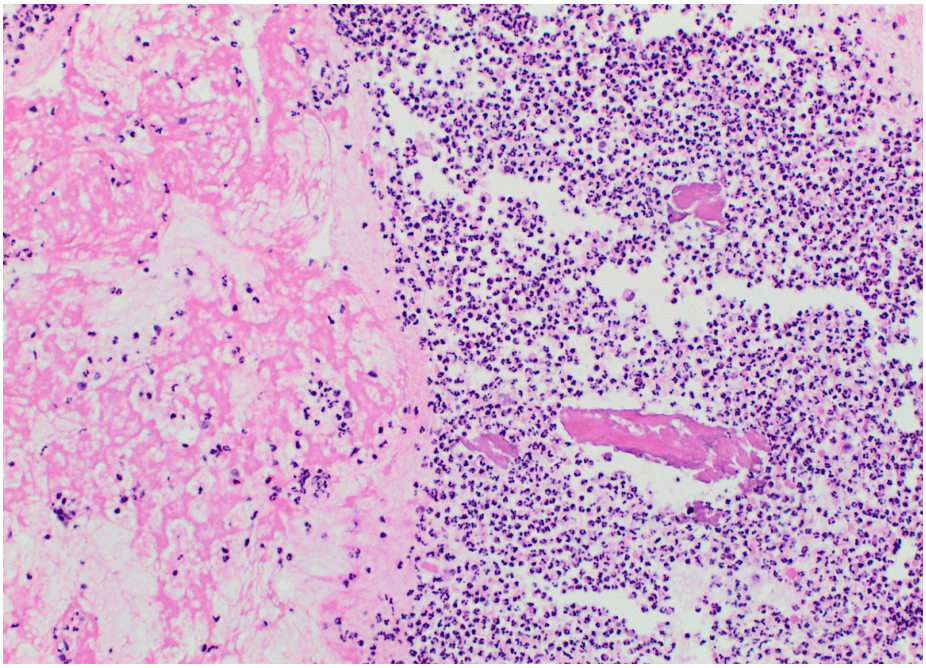

Figure 3: Areas of necrosis and fibrin (left) with surrounding neutrophilic infiltrates (right) and necrotic bone

myocardial necrosis and focal areas of necrosis within a mesenteric lymph node. Intralesional bacteria were seen within these organs. ***Salmonella* Bovismorbificans** was identified on bacterial culture of the abdominal fluid, confirming a diagnosis of **salmonellosis**.

A 2-year-old neutered male Siamese cat from Wanganui was presented for veterinary treatment and found to have septic **peritonitis**. Fluid samples and biopsies were collected to investigate the cause. The peritoneum and mesenteric adipose tissue were disrupted by pyogranulomatous inflammatory infiltrates with colonies of bacterial cocci embedded in brightly eosinophilic radiating material (Splendore-Hoeppli phenomenon). Culture of the peritoneal fluid produced a moderate growth of bacteria of the ***Staphylococcus intermedius*** group and a diagnosis of **staphylococcal botryomycosis** was made. Botryomycosis, also known as bacterial pseudomycosis or granular bacteriosis, is an uncommon manifestation of certain bacterial infections. *Staphylococcus* spp. are most commonly implicated, followed by *Pseudomonas* spp. and a number of other bacteria. Lesions are most commonly subcutaneous but internal and systemic disease has been reported. Predisposing factors include cutaneous trauma and immunosuppressive diseases.

A year-old female Domestic Shorthaired cat had a chronic diarrhoea of the large intestine, with clinical signs including increased frequency and urgency of defaecation, discoloured greenish faeces, house-soiling, inappetence and lethargy. On clinical examination the anus appeared inflamed. A faecal egg count was negative, as were ELISA tests for *Giardia* spp. and *Cryptosporidium* spp., but ***Salmonella* Typhimurium phage type 56** was isolated from a faecal sample and this was considered to be clinically significant.

Lagomorph

A 5-year-old Lop cross rabbit from Christchurch had a unilateral chronic purulent discharge from the right tear duct. Dentition was normal. Culture of a swab from the duct yielded a heavy pure growth of a bacterium identified as probably an ***Actinobacillus* sp**. by conventional methods and MALDI-TOF.

New Zealand Veterinary Pathology

Bovine

All 30 of a mob of 3-week-old Friesian calves in Southland were affected with minor scouring, with one death and one acutely moribund calf that was sacrificed for post-mortem examination. The necropsy revealed haemorrhagic and oedematous abomasal mucosa, with serosal reddening of the rest of the intestinal tract. Histopathology of the abomasum revealed extensive mucosal necrosis with neutrophilic inflammation and large bacilli deep in the mucosa. A histological diagnosis of **necrosuppurative abomasitis** was made, with a presumptive aetiological diagnosis of **clostridial abomasitis**. The more common organisms isolated from these types of lesions are *Clostridium septicum* (braxy) and *C. sordelli*. Although the precise pathogenesis is uncertain, injury to the abomasal mucosa is suspected to be an initiating factor.

A single 3-year-old cow from the Bay of Plenty presented with a deep proliferative lesion in the prescapular area, which was about 20 cm long and contained a sinus tract. Golden purulent material containing granules was able to be expressed. A sample submitted for histopathology revealed multiple granulomas with central filamentous bacteria surrounded by Splendore-Hoeppli material. A presumptive diagnosis of **actinobacillosis** was made.

One animal in a mob of 230 dairy cows in Taranaki was found dead and another was recumbent. Serum biochemistry of the latter revealed moderate hypocalcaemia (1.62 mmol/L; reference range 2.00–2.60) with concurrent hypermagnesaemia (2.46 mmol/L; reference range 0.49–1.15). A diagnosis of **hypocalcaemia/milk fever** was made. The concurrent hypermagnesaemia may have been due to supplementation (not confirmed) or the action of parathyroid hormone (PTH). Hypocalcaemia results in increased production of PTH to increase serum calcium but this also has the potential to

elevate magnesium levels by increasing intestinal absorption, renal resorption, and release of Mg^{2+} from bone.

Two Friesian cows from Waikato developed proliferative crusting skin lesions. One cow spontaneously recovered but the other 2.5-year-old showed progressive deterioration. The lesions initially developed on the back and neck, becoming generalised (see **Figures 4 and 5**). Histopathology of a skin biopsy revealed a thick, superficial crust of inflammatory debris and squames infiltrated with numerous organisms with morphology typical of ***Dermatophilus* sp**. The underlying dermis contained a moderately severe, mononuclear to eosinophilic inflammatory infiltrate. A histological diagnosis of **chronic dermatophilosis** was made, and there was subsequently an excellent clinical response to oxytetracycline treatment. Routine trace-element testing later revealed that the herd was selenium deficient, with four representative animals (not including the cow described in this case) having serum selenium levels ranging from < 50 to 110 nmol/L (reference range 150–3 500) and three of which had levels below 85. **Selenium deficiency** is a potential cause of immune suppression and may have been a contributing factor to the development of such florid and widespread cutaneous lesions.

Figures 4 and 5: Friesian cows with proliferative crusting skin lesions caused by chronic dermatophilosis. Photos: Dr. Cecilia Van Velsen.

Johne's disease was a common diagnosis by ELISA testing during this quarter, typically presenting with loss of condition and scouring in cows usually 2–4 (occasionally up to 6) years old, with no inappetance or anorexia noted. In some cases, a sudden drop in milk production was seen. These cases most commonly were from the Waikato, but also from Taranaki, Hauraki Plains, Canterbury, Northland, Southland, Bay of Plenty, Manawatu and Wairarapa. In cases where serum biochemistry was tested, common findings included mild to moderate hypoalbuminaemia (19–25 g/L; reference range 23–38), mild hypocalcaemia (1.93–1.98 mmol/L; reference range 2.00–2.60) and decreased creatinine (21–64 µmol/L; reference range 55–130). These common changes may be seen with any debilitating disease where diarrhoea causes loss of albumin or other protein, or decreased intake absorption. This is often accompanied by pseudohypocalcaemia, where total calcium is decreased by low albumin but the ionised calcium level usually remains normal. Low creatinine is common in animals with poor body condition caused by decreased muscle mass.

From a mob of 100 mixed-age dairy cows in Waikato, six presented with recumbency, hypothermia, constipation and decreased rumen movement. The mob had recently been put on maize and fodder beet, with no calcium supplementation. Serum biochemistry from a representative animal revealed marked **hypocalcaemia** (0.81 mmol/L; reference range 2.00–2.60) and **hypophosphataemia** (0.45 mmol/L; reference range 1.10–2.80). Such severe hypocalcaemia was compatible with **stage 3 milk fever**, with the hypophosphataemia likely contributing to clinical signs in these animals.

There were many cases of abortion attributed to **neosporosis** this season.

For example, over a 3-month period there were 18 abortions on a Waikato dairy farm with about 450 at-risk animals. The aborted fetuses had not previously been located but in the latest case a mummified fetus was present in the vaginal canal. It was too severely mummified for useful histopathology, but serology of the dam revealed a positive titre for ***Neospora caninum*** (> 1:600). On another Waikato farm there were nine abortions in dairy cows. Samples from one aborted fetus were examined histologically and revealed multiple small foci of inflammation in the heart, lung and brain, accompanied by occasional small areas of necrosis in the brain. This pattern of inflammation is typical of neosporosis, and was supported by a maternal antibody titre for ***Neospora caninum*** of > 1:600.

A Bay of Plenty farm had 100 out of 200 nine-month-old meat-breed calves affected by chronic ill-thrift, with conjunctivitis, polyuria, weakness, anorexia and skin lesions targeting white areas typical of photosensitisation. Fifteen animals died. Serum biochemistry on two affected calves showed marked elevations in GGT (780 and 1 018 IU/L; reference range 0–36) suggestive of **facial eczema** as a cause of **hepatopathy** and **photosensitisation**. This was supported by histological findings of moderate to marked hepatic portal fibrosis and bile ductule proliferation. There was also elevated urea (20.3 and 21.4 mmol/L; reference range 2.7–12.3) and histological evidence of **nephrosis** consistent with a toxic insult such as superphosphate or acorn toxicity. Both animals showed significant electrolyte imbalances, with hyponatraemia of 104 and 113 mmol/L (reference range 132–152), hypochloraemia of 69 and 71 mmol/L (reference range 96–104) and severe **hyperkalaemia** of 8.4 and 9.9 mmol/L (reference range 3.9–5.8). These changes were likely predominantly a result of renal failure. Acidosis (not confirmed) would contribute to the severity of hyperkalaemia, which could explain death in some animals caused by **bradycardia**.

A dairy farm in Wairarapa had five abortions in a week. The fifth abortion was at 7 months' gestation in a Friesian cross cow. Fixed and fresh fetal tissue samples and maternal serum were submitted for evaluation. Histopathology of the lung revealed large colonies of bacteria, and pure cultures of ***Trueperella pyogenes*** were isolated from the fresh lung and liver samples. **Abortion** caused by *T. pyogenes* is usually sporadic, and while it may occur at any point during gestation it is more common in the second half. Infection is generally presumed to be due to an episode of maternal **bacteraemia** with subsequent localisation to fetal membranes and the fetus. Owing to the sporadic nature of such abortions, it is possible the other cases from this farm may have had unrelated causes.

Ovine

A Bay of Plenty farm was experiencing repeated episodes of weight loss and general fading of 6–9-month-old sheep, with some deaths. Complete blood count and faecal egg counts were performed on two randomly selected sheep. A significant **strongyle** burden was identified (1 900 and 2 150 epg) and both animals showed marked **anaemia**, with haematocrits of 0.18 and 0.12 (reference range 0.27–0.45) with mild **hypoalbuminaemia** of 18 and 19 g/L (reference range 21–41). Overall these findings indicated that **endoparasitism** was likely a major contributor to weight loss and deaths in these animals.

Caprine

A 2-year-old goat from Kapiti presented with bilateral retropharyngeal abscesses that were clinically suggestive of caseous lymphadenitis. Culture of multiple swabs from the lesions isolated a light growth of ***Dermatophilus congolensis***, and no other organisms. **Dermatophilosis** is characteristically a superficial skin infection with crust formation that may be exacerbated by secondary bacterial infections; on rare occasions it may be associated with subcutaneous abscesses or lymphadenitis.

Equine

An 11-year-old Clydesdale cross gelding from Waikato presented with lethargy and swelling of the masseter muscles. The horse had access to avocado trees that were in fruit. Serum troponin I was markedly elevated at 3 096 ng/L (reference range 0–95), indicating myocardial damage and leading to a presumptive diagnosis of **avocado toxicity**, although other causes of myocardial injury such as ionophores, infection and spontaneous cardiomyopathy could not be entirely excluded. The masseter-muscle swelling may have been related to ischaemic myopathy of the head muscles associated with avocado toxicity, although head oedema secondary to cardiomyopathy may have been contributing. Ingestion of avocado leaves or fruit has been associated with myocardial necrosis in a range of mammals and birds, including horses. Mastitis may also be induced in lactating animals.

A 5-year-old pony mare presented with acute colitis. Culture of a rectal swab isolated ***Salmonella*** **Typhimurium**. This is one of the most commonly isolated serovars in cases of equine enteric salmonellosis.

Feline

A single Domestic Shorthaired cat from Auckland had a history of intermittent pyrexia, with development of severe diarrhoea and an inflammatory leukogram. Faecal culture isolated ***Salmonella*** **Saintpaul**, which has previously been reported in cats with diarrhoea. This serovar has also been associated with outbreaks of salmonellosis in native birds, geckos and skinks. There is potential for zoonotic infection, although serotype Saintpaul is considered a relatively uncommon cause of salmonellosis in humans.

A 2-year-old domestic cat from Taranaki had a prior history of azotaemia and active urinary sediment. Urine specific gravity showed minimally concentrated urine (1.025), consistent with a degree of renal injury. Serology for ***Leptospira*** **Ballum** was strongly positive (1:1 600).

The maintenance hosts for this serovar are mice, rats and hedgehogs, and the cat in this case frequently caught mice, which were considered to be the most likely route of exposure. Clinical disease caused by to *Leptospira* infection is not commonly reported in cats so it is possible that the renal injury was due to other, unknown causes in this case.

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Quarterly report of investigations of suspected exotic diseases

Exotic disease investigations are managed and reported by the MPI Diagnostic and Surveillance Services Directorate (DSS), Wallaceville. The following is a summary of investigations of suspected exotic disease during the period from April to June 2018.

Exotic vesicular diseases ruled out

A veterinarian contacted MPI via the exotic pest and disease hotline to report suspected vesicular disease in a bull near Auckland. The 2-year old bull was the only one of nine in the same paddock to be affected. It had reportedly been off-colour for several weeks, and when examined on the day of the notification there was an ulcerated lesion containing a loose epithelial flap in the left rostral nasal cavity, resembling a newly-erupted vesicle (**Figure 1**). The farmer had been present for the morning veterinary examination, but was leaving town for several days thereafter. The Asurequality Initial Investigating Veterinarian (IIV) service was activated in the late afternoon, immediately following the notification. Given the locations of available IIVs and logistics of crossing Auckland at rush hour, the absence of the farmer, the need of mustering equipment or dogs, and the relatively low risk of exotic disease, it was decided to delay the visit until the following morning. By then, a local farmer and dogs had been enlisted, and an IIV met the farm vet at the gate. The bulls were mustered, and disease was confirmed to be present in only the one bull. A nasal septal swelling was noted, and cytological scrapings and biopsies were obtained by the IIV. Cytology and histology confirmed the presence of pyogranulomatous inflammation, with histologically-evident club colonies and sulphur granules consistent with *Actinobacillus ligniersii* (woody tongue), which is endemic in New Zealand. The ulceration was considered likely to be a secondary lesion from chronic nasal irritation. The cause of the lesions was confirmed to be woody tongue disease, and the investigation was closed.

Anthrax ruled out

A veterinarian contacted MPI to request exclusion of anthrax from two mixed-age dairy cows that had died acutely, presenting with a bloody discharge from the mouth and anus. A whole-blood sample in EDTA was collected from the cows and blood smears were made. No organisms consistent with *Bacillus anthracis* were observed after staining with polychrome methylene blue. No historic cases of anthrax (> 50 years ago) had occurred in the same region. No further acute deaths occurred on the property. Anthrax was excluded as a cause of the clinical signs observed.

A veterinarian contacted MPI to request exclusion of anthrax after an adult bull died acutely and was found with bloody discharge from various orifices. The herd was in the central North Island, a region that historically has not experienced anthrax. Whole blood in EDTA was collected and smears were made of the bloody discharge from samples submitted to MPI's Animal Health Laboratory (AHL), Wallaceville. No organisms consistent with *B. anthracis* were observed after staining with polychrome methylene blue. The blood

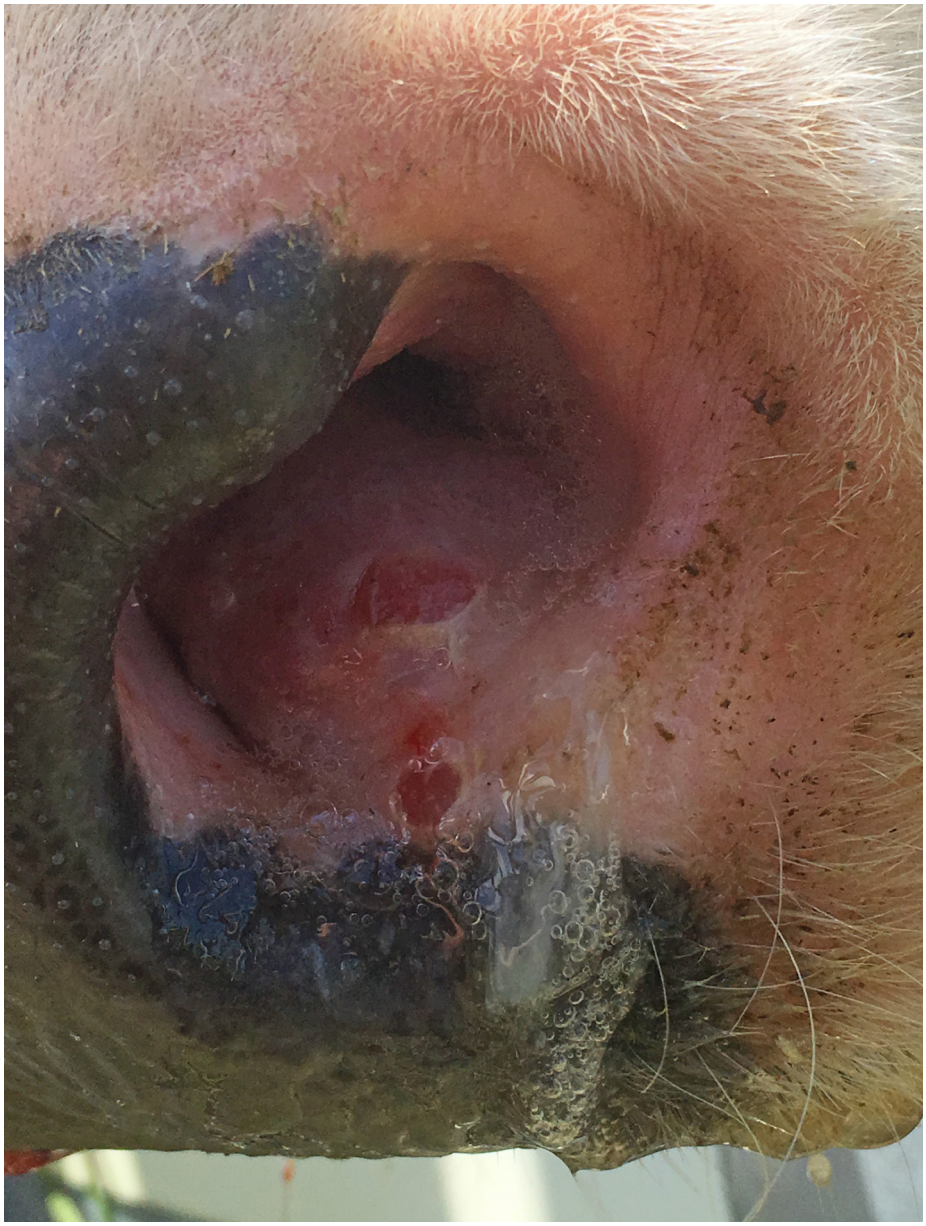

Figure 1: Multifocal ulceration in the left nostril of a bull, with epithelial flaps resembling ruptured vesicles
Photo: Elissa Moppet

samples were negative for *B. anthracis* from culture and by molecular assay. Molecular assay also excluded type 2 bovine viral diarrhoea virus. Bacterial culture of the blood for 4 days under aerobic, anaerobic and 5 percent CO_2 atmospheric conditions was negative. No further deaths occurred on the property. Exotic disease was excluded as a cause of the clinical signs observed and the investigation was stood down.

The owner of a lifestyle section in Blenheim called MPI to report that one of 10 cattle had died suddenly overnight. A second animal was recumbent and thrashing, and was euthanased. Both animals were found by a stream. The owners had no regular veterinarian and were not willing to pay for a farm visit. Anthrax is a cause of sudden death in cattle, and has not been reported in New Zealand since 1954. Other exotic diseases such as babesiosis can also cause sudden death in cattle. Since the disease involved more than one animal, a veterinarian was dispatched to the property to investigate and perform an autopsy on the fresher animal. Autopsy revealed that both animals were in poor condition (2.5 and 3.5 out of 6), with watery gut contents and a friable yellow liver in the fresher carcass. The more autolysed carcass was not autopsied. Further investigation indicated that nitrate in the grass in the shade near the stream was at toxic levels. Samples were not available to determine nitrate level in the dead animals, but nitrate toxicity was considered the most likely cause of death. Anthrax was ruled out by diagnosis of exclusion in this case, and the investigation was closed.

Calf ill-thrift investigated

A veterinarian called the exotic pest and disease hotline after disbudding a mob of 4–5-month old calves in which two were pyrexic with severe mucopurulent ocular and nasal discharges and weight loss. One was showing neurological signs and had superficial ulceration/erosions under the tongue. No foot lesions were identified. Exotic vesicular disease was excluded on clinical and epidemiological grounds, and blood samples were collected to help make an endemic diagnosis. Haematology of affected animals indicated a mild inflammatory leucogram, and serum biochemistry identified raised bilirubin, serum GLDH, AST and GGT, indicative of moderate hepatocellular damage with cholestasis. Testing for bovine viral diarrhoea virus gave negative results by antigen ELISA. A presumptive diagnosis of hepatogenous (secondary) photosensitivity such as facial eczema was made. The neurological signs were considered the result of hepatic encephalopathy. Exotic disease was excluded and the investigation stood down.

Brucella abortus excluded

A veterinary pathologist phoned the exotic pest and disease hotline to report a 3-year-old Friesian bull with bilateral orchitis. On clinical examination the testes were determined to be hard and fibrosed, although no testicular tissue was collected from the bull. *Brucella abortus* was listed as a differential diagnosis by the veterinarian. There was no history of reproductive failure in the herd where the bull had been used. A routine surveillance exclusion was made by serological testing of serum collected from the bull. The serum was negative using the complement fixation test (CFT negative; < 1/4 dilution).

Babesia bovis excluded

A veterinary pathologist called the exotic pest and disease hotline to report a suspect exotic organism from the examination of a blood smear from a clinically anaemic 3-year-old dairy cow in a 270-cow Waikato dairy herd. While there were red blood cell inclusions consistent with endemic *Theileria orientalis* types (Ikeda, Chitose and Buffeli), there were also inclusions that looked consistent with the exotic *Babesia bovis*. An EDTA blood sample from the cow was submitted to the AHL, where a piroplasm semi-nested PCR test was positive. Following sequencing this was attributed to *T. orientalis* and more specifically the presence of more than one of the known New Zealand *T. orientalis* types. There was no indication of any DNA other than *Theileria* DNA being present. This was supported when a generic *Babesia* PCR test subcontracted to an overseas laboratory confirmed the absence of *B. bovis*. Exotic disease was ruled out and the investigation closed.

Equine viral arteritis and equine infectious anaemia ruled out

A veterinary pathologist informed MPI of a 23-year-old pony that died after a short non-pyrexic illness, with clinical findings including weight loss, submandibular lymph node enlargement, and pale mucous membranes. Routine haematology had identified a severe anaemia and an inflammatory leucogram, but fibrinogen was normal. The horse was New Zealand-bred and had not travelled overseas. Equine viral arteritis (EVA) and equine infectious anaemia (EIA) were excluded after negative results in the virus-neutralisation test (VNT) and agar-gel immunodiffusion test (AGID) respectively, carried out at the AHL (Wallaceville). The involvement of equine piroplasms including *Theileria*, *Babesia* and *Anaplasma phagocytophilum* was excluded after assessment of blood films and specific molecular assays. Exotic disease was excluded and the investigation was stood down.

A veterinarian informed MPI of a 7-year-old Thoroughbred gelding with lower-limb oedema affecting three limbs. The horse had been vaccinated about 4 weeks earlier against strangles (caused by *Streptococcus equi*). It was not pyrexic and was otherwise clinically normal. The horse had a history of episodes of lower-limb oedema over a number of years. Routine haematology and biochemistry had identified a mild anaemia and low albumen. The horse had been imported into New Zealand from Hong Kong 2 years previously. EVA and EIA were excluded after negative results in the VNT and AGID

respectively, carried out at the AHL (Wallaceville). The involvement of equine piroplasms including *Theileria*, *Babesia* and *Anaplasma phagocytophilum* was excluded after assessment of blood films. Exotic disease was excluded and the investigation was stood down.

Sarcocyst in alpaca investigated

A veterinary pathologist notified MPI of possible exotic sarcocyst disease in an imported adult female alpaca. The alpaca was noted to have palpable masses on the neck during border inspection when imported in March 2017. These masses grew over the next 8 months (**Figure 2**), and in November biopsies were sent to the notifying pathologist. These biopsies indicated eosinophilic myositis, which has been reported as an aberrant reaction to *Sarcocystis* spp. Because the alpaca came from Australia, exotic *Sarcocystis* spp. were investigated as a possible cause. Owing to progressive disease, the alpaca was euthanased and further tissue samples were obtained. Post-mortem examination revealed widespread distribution of small discrete pale intra-muscular cysts measuring up to 10 mm long within intercostal muscles and larger muscle bellies, and fewer (up to half-a-dozen) swollen muscle bundles containing multifocal to well-demarcated coalescing pale green caseous areas of necrosis that were confirmed histologically to be eosinophilic myositis and myonecrosis, rarely containing fragments of sarcosyst. PCR with sequencing confirmed the agent as *Sarcocystis aucheniae*, which is known to be already present in NZ. The Animal Imports team was consulted as part of this investigation, and indicated that *S. aucheniae* and *S. lamacenis* were considered as organisms of potential concern in the 2010 Risk Analysis but were discounted as preliminary hazards owing to evidence that they were already present in New Zealand (Mason & Orr, 1993). The agent is widespread worldwide in the alpaca community, and although the original definitive host is unknown, dogs are thought to be capable of acting as a definitive host. The cause of eosinophilic myositis in this case was determined to be an endemic sarcocyst species, and the investigation was closed. Eosinophilic myositis has been attributed rarely to sarcocysts, but this is the first known case where speciation confirmed a species type.

Figure 2: Alpaca with cervical swellings – this view of the dorsal neck shows at least three distinct swellings within the muscularis of the neck. Histopathology showed that these were eosinophilic myositis caused by *Sarcocystis aucheniae*.

Exotic pig diseases excluded

A pig hunter who had been hunting in the Wanganui area called the exotic pest and disease hotline to report skeletal muscle from a feral pig affected with multiple white cystic lesions measuring 2–5 mm. *Trichinella spiralis*, *Cysticercus cellulosae* and *Sarcocystis* are considered to be differential diagnoses. Fresh and formalin-fixed samples of the muscle were submitted to the AHL for histopathology and *Trichinella* testing. *T. spiralis*, which is known to occur in New Zealand at low prevalence, was ruled out by the trypsin digest test. Histology identified muscle lesions consistent with *Sarcocystis* spp., including the size, shape and eosinophilic reaction within the lesions. *C. cellulosae*, which is exotic to New Zealand, was excluded. *C. cellulosae* is the name given to the larval stage present when skeletal muscle is infested with the cyst stage of the human tapeworm, *Taenia solium*. Exotic disease was excluded and the investigation stood down.

Brucella canis excluded

MPI was told by a pathologist that a dog was showing signs of epididymitis, where canine brucellosis was a differential diagnosis. The epididymis, surgically removed along with the testes, was determined to be negative to *Brucella canis* by PCR.

A member of the public phoned MPI to express concern that his dog, imported 6 months earlier from Uruguay, might be infected with *B. canis*. Import health standards for New Zealand include screening for *B. canis*. The dog, a 9-year-old spayed female poodle, began showing signs of lameness and discomfort within a few months after importation. *B. canis* is an exotic bacterium that can cause chronic reproductive tract inflammation and less commonly can cause other ailments in dogs. It is zoonotic and the notifier was concerned for his children. Previously, samples from the dog had been sent overseas for serum testing, unbenownst to MPI, and the results were as follows: *B. canis* card test was negative, but rapid slide agglutination test was positive initially, with negative results on the 2-mercaptoethanol RSAT, a follow-up test with greater specificity. Following notification to MPI, repeat tests were considered useful because of the equivocal initial result and the owner's continuing concern. Blood was re-tested by card test at the AHL (Wallaceville) and by AGID test at an overseas laboratory. Both tests were negative. Such results 6 months after the most recent possible exposure to *B. canis* strongly suggest that this dog was neither carrying nor infected by *B. canis*. The dog's lameness was considered to be from a non-exotic possibly degenerative condition, and the owner's mind was put to rest. The investigation was closed.

Canine influenza confirmed in quarantine

The duty Incursion Investigator was notified of a possible outbreak of respiratory disease in dogs associated with canine influenza virus (CIV) in an Auckland quarantine facility for dogs and cats. Nasal swabs were collected from three affected dogs and the aetiological agent confirmed as CIV by PCR and DNA sequencing. It was later determined that the virus had entered New Zealand via an American dog incubating the disease and exposed in kennels before being imported into New Zealand. Before the diagnosis in New Zealand, one infected dog had been released from the quarantine facility. This dog was returned to the facility and kept in quarantine with the other affected dogs. Only one indirect exposure had occurred while the dog had been released. This dog never developed clinical signs and was negative for CIV in two nasal swabs tested by PCR 7 days apart.

All dogs from the facility were released subsequent to testing of deep nasal swabs by PCR, about 4 weeks after the last clinical signs of respiratory disease had been observed. Thus canine influenza was successfully controlled with no release of the virus into the general dog population. New Zealand remains free of canine influenza.

Canine leishmaniasis excluded

A senior MPI scientist notified the Incursion Investigation team of a 5-year-old male Bulldog that tested weakly positive for *Leishmania* by IFAT. The titre was 1:160, which prevented planned export of semen from the dog. It had been imported from the Netherlands at 12 months of age, and in 2017 had tested negative for antibodies to *Leishmania* spp. Follow-up IFAT testing at another laboratory was negative, and a PCR test of whole blood was negative for *Leishmania* spp. From these results the initial test was considered a non-specific reaction, and the investigation was closed.

An MPI veterinarian reported via the exotic pest and disease hotline that an 8-year-old male Coonhound in post-border quarantine had a skin lesion that could indicate canine leishmaniosis. The lesion was an area of inflammation about 30 mm in diameter with a mild serous-mucopurulent discharge present, and was located in the mid-dorsal part of the neck. Although canine hotspot dermatitis was considered to be the most likely diagnosis, canine leishmaniosis was a possible differential. Blood was tested and determined to be negative for canine *Leishmania* based on both IFAT and PCR tests. The lesion was successfully treated with antibiotics.

An MPI veterinarian reported via the exotic pest and disease hotline that an 11-year-old male Samoyed in post-border quarantine had clinical signs that could indicate canine leishmaniosis. The clinical signs observed were mild and non-specific, and included diarrhoea, a rectal temperature of 39°C and the presence of midge-like insects in the coat. However, blood tested negative by IFAT and PCR for *Leishmania* and the investigation was closed.

Canine distemper excluded

A veterinarian from an animal shelter phoned MPI to report that histology of an unvaccinated puppy showed possible canine distemper virus (CDV) infection, with widespread viral inclusions present in the central nervous system. The 5-week old puppy was in a quarantine area that had chronic diarrhoea disease. Other adjacent litters had diarrhoea and ill-thrift, and six adjacent puppies were euthanased. Two of these underwent autopsy and histology, but showed no lesions consistent with canine distemper. Pooled faeces from the puppies in the original litter, plus blood serum from two, tested negative for CDV by PCR and VNT. Brain and liver were also negative by PCR for CDV. Fresh tissues were not available from the pup with the CDV-like inclusions, but fixed tissues tested negative for CDV by PCR. However, fixation can affect the sensitivity of PCR tests, so other diagnostic techniques are being pursued to identify of the viral-like inclusions, but so far have been slow-moving and unrewarding. The disease appeared to be confined to this one puppy, and is therefore unlikely to be a wild-type CDV strain. The investigation was closed.

Canine heartworm excluded

A veterinarian emailed MPI to report that an imported dog had been diagnosed with a high-grade heart murmur. The dog had been imported from the US 1 year prior to diagnosis, in accordance with MPI Import Health Standards, and had tested negative for heartworm (*Dirofilaria immitis*) at the time. However, no test is 100 percent reliable and it was considered reasonable to rule out the agent again in light of the heart murmur. Serum tested negative by heartworm antigen ELISA, and EDTA blood was negative by Knotts test for circulating microfilaria. Canine heart disease is not typically associated with adult male *D. immitis* worms, so these negative tests mean it is very unlikely that heartworm was the cause of the murmur. Heartworm infection was excluded and the investigation was closed.

Leptospira canicola excluded

A serum sample from a bull intended to supply semen for export was submitted to the AHL (Wallaceville) for routine export testing. The bull produced a non-negative, significant titre in a MAT test for the exotic *Leptospira* Canicola MAT, although the animal had no health issues. The serum sample and a repeat sample from the same bull were sent to an overseas reference laboratory, where the both samples tested negative to *L.* Canicola. The investigation was closed.

Ehrlichia canis excluded

An MPI veterinarian reported via the exotic pest and disease hotline a 5-year-old female terrier that had clinical signs of haematuria in post-border quarantine. The dog had had a history of tick infestation and lymphadenopathy several years before this report while in South Africa, the country of origin. *Ehrlichia canis* was considered a possible differential diagnosis, but was excluded by a IFAT test.

West Nile virus excluded

An avian veterinarian in Auckland contacted MPI to report neurological signs in a small flock of swans. Up to four swans were affected within the same week, showing head-bobbing and unsteady gait, which progressed to death. The clinical signs were thought to be distinctly different from botulism. West Nile Virus (WNV) is an exotic cause of neurological disease in birds. Endemic causes include botulism and various toxins, including lead. Lead toxicity was ruled out in live swans at the veterinary clinic. Choanal and cloacal swabs and serum from four swans were submitted for PCR rule-out of exotic viruses including WNV, avian influenza virus, avian paramyxovirus (Newcastle disease) and generic flavivirus. All these tests were negative. Histopathology at Massey Wildbase showed non-inflammatory, degenerative lesions in the brainstem and cerebellum, consisting of vacuolar changes in some neurons. These changes were not consistent with an infectious cause, but were more likely due to a toxic injury. Further work is ongoing, but identification of toxins is often unrewarding and no quick results are expected. Exotic causes of neurological disease in waterfowl and poultry were excluded, and the investigation was closed.

Avian mortalities investigated

A DOC ranger from Alexandra phoned MPI to report that a member of the public had found a mass mortality of 30–40 dead black-billed gulls (*Chroicocephalus bulleri*) near a breeding site on the Clutha River. There were no obvious signs of the cause, and the reason for a similar event a few years ago years was never established owing to advanced autolysis of the birds. Autopsies were conducted at Massey University Wildbase as part of a pre-existing agreement, and it was established that starvation was the most likely cause of this mortality event, with no evidence of infectious disease or toxin. The investigation was closed.

A pigeon breeder called the pest and disease hotline to report pigeon deaths over a period of 6–8 weeks, which he believed might be due to salmonellosis. Clinical signs included inactivity, loss of appetite, weight loss, loss of flight, and watery droppings, leading to death. The breeder had been treating his birds with metronidazole (dose unknown), to no effect. An avian expert was engaged to assist with diagnosis and rule-out of exotic agents such as pigeon rotavirus (emerging in Australia) and pigeon paramyxovirus. The notifier was located in a rural area and was not actively engaged with a local vet, making shipping and autopsy of dead birds a difficult option. Instead, faeces were sent to the avian expert, and these were found to contain very high levels of the hairworm *Capillaria* spp. (18 300 and 28 000 eggs per gram in two samples). This is a well-known cause of diarrhoea and wasting in pigeons. Exotic agents were ruled out by diagnosis of exclusion, and the investigation was closed.

Rabbit mortalities investigated

A rabbit breeder reported the death of about 30 adult and young rabbits. A total of 53 rabbits had been on his farm over the previous 2–3 weeks. Death was typically sudden (over 12–24 hours) after a brief period of lethargy and/or inappetence. The breeder had not vaccinated for rabbit haemorrhagic disease (RHD) virus. After a freshly dead rabbit was submitted to the breeder's veterinarian, post-mortem examination revealed blood-tinged fluid around the nose and mouth, petechial haemorrhages in the trachea, congested lungs, and blood-tinged fluid in the thoracic cavity and epicardial sac. A fresh liver sample was submitted to Landcare Research, where PCR and sequencing confirmed the presence of the New Zealand RHD virus Type 1 field strain. Exotic disease was excluded and the investigation was closed.

A South Waikato lifestyle block owner called the exotic pest and disease hotline to report finding two dead rabbits on her property over 2 days. There was no evidence of their having been shot, and after checking with her neighbours she was satisfied that no poison had been laid in the area. The caller had concerns

about RHD virus. As the two rabbits had already been disposed of, the caller was asked to notify MPI if she found another dead rabbit. A month later another dead rabbit was found. A liver sample was submitted to Landcare Research where it was tested by PCR for RHD virus Type 1 field strain, the Type 1 K5 strain, and Type 2 (which was at that time believed to be exotic). The rabbit tested negative for all strains so exotic RHD was ruled out and the investigation was closed.

Rabbit haemorrhagic disease virus Type 2 confirmed

The exotic pest and disease hotline received a call from Landcare Research to advise of a presumptive positive result for RHD virus Type 2 (RHDV-2), based on PCR testing and sequencing from a dead rabbit found on a South Island property. RHDV-2 was at that time considered to be exotic to New Zealand. A researcher had been monitoring the impact of an earlier, intentional release of the Korean strain (K5) of RHDV-1. Samples provided to the AHL were submitted to an overseas OIE reference laboratory for RHD, where RHDV-2 was confirmed by two diagnostic methods (RHDV-typing ELISA and real-time PCR) and the MPI response team was notified.

Acarapis woodi excluded

A Waikato beekeeper called the exotic pest and disease hotline to report the sudden and unexplained death of most of the bees in one of his hives. The notification was referred to an AsureQuality Apiculture Technical Adviser (APTA), who discussed the presenting signs and management of the colony with the beekeeper. There were no shivering bees at the hive entrance, nor any other unusual behaviour pointing to an endemic or exotic viral infection. The clinical signs were suggestive of a poisoned hive, though it would be unusual for just one hive to be affected. The exotic tracheal mite (*Acarapis woodi*) could present signs that would be similar to a poisoned hive; but again, it would be unlikely for just one hive to be affected. A sample of bees was submitted to the PHEL (Tamaki) for examination by an entomologist. No tracheal mites were identified and the exotic disease investigation was closed. A month later the beekeeper reported that the hive had mostly recovered.

A beekeeper called the exotic pest and disease hotline to report bee mortality in several of his bee colonies. He had fed his bees with an organic product containing sugar syrup and apple cider vinegar just before the mortality event. As part of general surveillance for bee exotic agents, a sample of bees was tested for tracheal mites (*Acarapis woodi*). All bees tested were negative for tracheal mites, and while one external mite, *Caliphis* sp., was detected, this species is common on honey bees and beehives in ew Zealand and is most likely phoretic on bees. Thus exotic agents were excluded. The involvement in the organic product as a potential cause of bee mortality was not determined.

A laboratory manager received a sample of dead bees and phoned MPI to report that he suspected exotic disease or toxicity. The apiary in Rangitikei reportedly lost 60 of its 80 hives. An investigation was opened, which was supported by AsureQuality apiary experts. Tracheal mite (*Acarapis woodii*) is an exotic cause of hive deaths, and endemic agents such as toxins and the microsporidial fungal agent *Nosema ceranae* can also cause bee deaths. *N. ceranae* was detected at an unprecedented level, 2.8 million spores per bee (the pathogenic level is considered to be 1 million spores per bee; the species was confirmed by qPCR). Tracheal mite was excluded by the PHEL (Tamaki). The cause of death was considered to be excessive levels of *N. ceranae*, which overgrow in the intestines of bees, reducing nutrient uptake and causing diarrhoea and death. Toxin testing for about 60 analytes including fipronil showed no significant residues. The investigation was closed.

Two commercial beekeepers in the Murchison area phoned MPI separately to report large numbers of hive deaths in their apiaries over a 1-week period in January. The hives were within bee-flying distance of each other, so the bees could all have been exposed to the same point source. Exotic causes of bee mortality can include tracheal mites (*A. woodi*), and endemic causes of hive deaths can include paralysis virus, *Nosema ceranae*, *N. apis* and toxins such as industrial pesticides. AsureQuality apiculture experts were engaged to assist in the investigation. Samples of dead and live bees were obtained from both affected properties and tested for the agents listed above, and by a toxin panel that could detect 60 common compounds. Tests were negative for tracheal mite, and the levels of other pathogens were considered unremarkable. All six samples from the first property and four of six samples from the second property contained fipronil at levels considered high enough to explain the bee deaths. Fipronil is acutely toxic to bees and wasps, and is used by apiculturists to kill wasps that can invade hives, as well as by members of the public bothered by wasps. This incident was considered a fipronil toxicity case, and was reported to the Environmental Protection Authority and widely reported in mainstream news media.

European foulbrood excluded

There were a number of cases of suspect European foulbrood during this period. For example, a bee scientist reported that larvae in a diseased hive in Waikato had signs consistent with European foulbrood (EFB), caused by the exotic bacterium *Melissococcus plutonius*. Samples of affected larvae were collected and sent to the AHL (Wallaceville) for testing and EFB was excluded by PCR testing. In another case, an apiary advisory officer reported that larvae in a diseased hive in Canterbury had signs consistent with EFB. Once again, testing at the AHL (Wallaceville) excluded EFB by PCR testing.

A bee researcher called the exotic pest and disease hotline to report two hives

(out of 50 at the research apiary site) with brood changes consistent with a potential aetiology of EFB. Uncapped brood were discoloured, with a yellow, sometimes chalky appearance. Samples from both affected hives were submitted to the AHL (Wallaceville), where molecular testing for both EFB and American Foulbrood (AFB, an endemic disease) returned negative results. Brood changes were considered to be the result of parasitic mite syndrome (varroa). Exotic disease was excluded and the investigation was closed.

An AsureQuality apiculture officer called the exotic pest and disease hotline to report a hive with brood changes consistent with a potential aetiology of EFB. Some of the uncapped brood had a yellow discolouration and there was evidence of damaged brood, likely the result of parasitic mite syndrome (varroa). Brood samples were submitted to the AHL (Wallaceville), where molecular testing for EFB and AFB gave negative results. Brood changes were considered the result of parasitic mite syndrome, where viral infections such as sacbrood are exacerbated by varroa infection. Questioning of the beekeeper confirmed that varroa control in the autumn had been delayed. Exotic disease was excluded and the investigation was closed.

A beekeeper called MPI via the exotic pest and disease hotline to report a single hive (of six on the property) with changes to the uncapped brood, consistent with a potential aetiology of EFB. About 10 percent of the uncapped brood were no longer the typical white-to-cream colour, but had a tan discolouration and watery cell contents. Capped brood appeared unaffected. Brood samples were submitted to the AHL (Wallaceville) for exclusion of exotic disease. Molecular testing for EFB was negative but testing for the endemic agent AFB was positive by PCR. Brood changes were consistent with an early stage of AFB infection so the hive was destroyed under the direction of an AsureQuality Apiculture Officer. Exotic disease was excluded and the investigation was closed.

Africanised honey bees ruled out

A bee expert called the exotic pest and disease hotline to report that an inspector had encountered unusually aggressive bees. The bees were less aggressive on a visit the next day. Africanised honey bees were suspected, and a sample of bees was sent to the PHEL (Tamaki). Morphological examination and molecular testing confirmed the bees were *Apis mellifera*, the common European honey bee, and the investigation was closed.

Cape honey bee ruled out

An AsureQuality Apiculture Officer called the exotic pest and disease hotline to report that an apiary inspector had found a suspicious-looking bee during a routine inspection at an Auckland apiary. A bee was found that was about half the size of the common European honey bee and had a completely black abdomen. The description was consistent with the exotic Cape bee (*Apis mellifera capensis*) so the bee was submitted to the PHEL (Tamaki), where morphological and molecular assessments were undertaken. Testing confirmed the bee to be the common European honey bee (*Apis mellifera mellifera*). An exotic bee incursion was ruled out and the investigation closed.

Small hive beetle ruled out

A commercial beekeeper called the exotic pest and disease hotline after finding three small maggots (about 4–8 mm long) in a hive. The other 20 hives at the apiary were checked but no further maggots were seen. All hives were strong, with large numbers of bees and healthy brood. The maggots were sent to the PHEL (Tamaki) and determined to be larvae of the soldier fly, *Hermetia illucens*. These larvae are decomposers, breaking down organic substrates and returning nutrients to the soil. Exotic disease was excluded and the investigation was stood down.

A hobbyist beekeeper called the exotic pest and disease hotline to report suspect small hive beetles in her hive. The two beetles examined were identified by an entomologist at the PHEL (Tamaki) as *Epuraea antarctica* and a darkling beetle that could not be identified to species because of damage to the specimen. Both species are present in New Zealand and are not of concern to apiarists.

Brown dog ticks ruled out

A dog owner in Auckland called the MPI pest and disease hotline to report finding ticks on her dog over the previous few days, and was concerned about the possibility they could be brown dog ticks (BDT), *Rhipicephalus sanguineus*. She was asked to send samples of the ticks to the PHEL (Tamaki) but opted to take them to her local veterinarian instead. The veterinarian was confident in ruling out the brown dog tick, saying that the specimens were consistent with the endemic cattle tick, *Haemophysalis longicornis*. Cattle ticks have frequently been reported on dogs in New Zealand, particularly as owners have become more aware of the potential threat of the exotic BDT. It was assumed that in this case, the veterinarian's identification was correct and they would have notified MPI if this had been an exotic species. The investigation was closed.

A dog owner in Nelson phoned MPI to report finding a tick on her dog, which she worried might be the brown dog tick (*Rhipicephalus sanguineus*), an Unwanted Organism. The dog had no travel history. The tick was sent to the PHEL (Tamaki), where it was identified as the cattle tick *Haemophysalis longicornis*. The investigation was closed.

A member of the public in Nelson phoned MPI to report finding many tiny, tick-like organisms on her dog, which a local vet said could possibly be brown dog ticks (*Rhipicephalus sanguineus*). Ticks were collected and sent to the PHEL (Tamaki), where PCR testing indicated a 100 percent match to the endemic NZ cattle tick (*H. longicornis*). The investigation was closed.

A veterinarian contacted MPI to report finding a single small tick on the ear of a New Zealand dog that had been away with its owner on holiday in Wellington.

The tick was submitted to MPI's PHEL (Christchurch) and identified as the New Zealand cattle tick (*Haemophysalis longicornis*). Exotic ticks were excluded and the investigation was closed.

Exotic ticks investigated

A holidaymaker recently returned from California in the US called the exotic pest and disease hotline to report finding a tick on his person. The un-engorged tick was submitted to the PHEL (Tamaki.), where it was identified by its morphology and by molecular assay as *Dermacentor variabillis*, the American dog tick, which is an Unwanted Organism under the Biosecurity Act 1993. When he arrived in New Zealand, border biosecurity staff had inspected his luggage and fumigated it after finding ticks. No further ticks were found. Establishment was prevented and the investigation was closed.

A member of the public called the exotic pest and disease hotline to report a tick found embedded in her husband's skin after he returned from Germany. The nymphal-stage tick was identified as *Ixodes ricinus* by an entomologist at PHEL (Tamaki), based on morphologic examination and molecular analysis. This species is exotic to New Zealand but has a large geographical distribution throughout temperate climates from North Africa through Europe to Scandinavia. It is mainly found in woodland, forest and grasslands, has a large number of natural hosts including mammals, birds and reptiles, and frequently bites humans. *I. ricinus* is a vector of human diseases including Lyme disease, tick-borne encephalitis virus, human granulocytic ehrlichiosis, and tularaemia, and animal pathogens including *Babesia* spp., *Anaplasma* spp., and louping-ill virus.

Reference

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Paul Bingham
Team Manager
Biosecurity Surveillance & Incursion Investigation (Animal Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
paul.bingham@mpi.govt.nz

Marine surveillance annual report

This annual report includes summary information for the Marine High Risk Site Surveillance (MHRSS) national programme and the Marine Invasive Taxonomic Service (MITS) for the winter and summer periods between June 2017 and March 2018.

The targeted surveillance programme for non-indigenous marine species focuses surveillance activities at 11 high-risk ports and associated marinas around the country (**Figure 1**). Surveillance is designed to detect the presence of non-indigenous and potentially invasive marine flora and fauna, including selected species that have documented impacts internationally and would likely affect our environment or economy if they were to establish in New Zealand. The programme also aims to monitor changes in the distribution of established non-indigenous or pest species at these high-risk locations, and to inform regional marine biosecurity. The majority of marine pests targeted are listed in the New Zealand Register of Unwanted Organisms (https://www.mpi.govt.nz/protection-and-response/finding-and-reporting-pests-and-diseases/registers-and-lists/) under the Biosecurity Act 1993. These include primary target species that have never been recorded in New Zealand (Northern Pacific sea star *Asterias amurensis*, European shore crab *Carcinus maenas*, the marine aquarium weed *Caulerpa taxifolia*, Chinese mitten crab *Eriocheir sinensis* and Asian clam *Potamocorbula amurensis*) and secondary target species that are present in localised locations around New Zealand (Australian droplet tunicate *Eudistoma elongatum*, Asian bag mussel *Arcuatula senhousia*, Mediterranean fanworm *Sabella spallanzanii* and the clubbed tunicate *Styela clava*). All unidentified suspect samples collected during surveillance activities are sent for identification to MITS, a marine taxonomic clearing house funded by MPI and operated by the National Institute for Water and Atmospheric Research (NIWA). All of these identifications are subsequently entered into the marine non-native species database for future reference. The data are accessible at: www.marinebiosecurity.org.nz

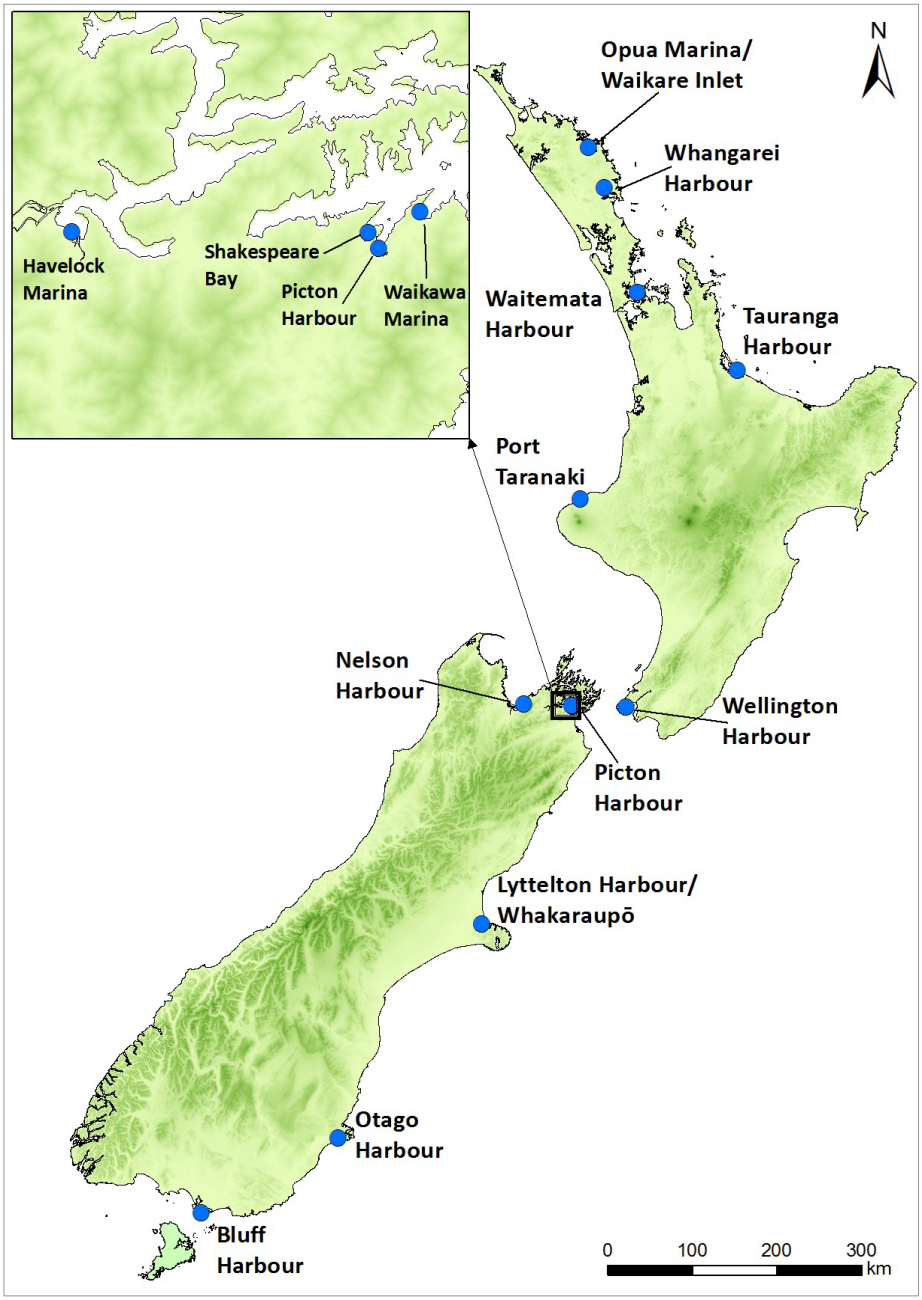

Figure 1: Locations of the 11 high-risk sites covered by the Marine High Risk Site Surveillance programme

Sample collection

In total, 2 928 sites were surveyed during the 2017 winter sampling period (June to September) and 2 915 sites during the summer sampling period (November 2017 to March 2018). These figures represent 100.6 percent and 100.4 percent of the target number of sites, respectively. Habitats sampled included soft and hard surfaces such as mud and gravel bottoms, rocky shores and artificial structures including marina pontoons, pilings, moorings, jetties and vessel berths. Sampling techniques used included epibenthic sled tows, crab box traps, crab condos and diver and shore searches (**Table 1**). No primary target

Table 1: Sampling methods used for high-risk sites surveyed in 2017–2018
Representative list of non-indigenous species that are likely to be detected with each sample method. Species in **bold** have been detected using this method during the present or previous surveillance programmes.

Method	Target species	Non-target species	Habitat	Spatial coverage	Effectiveness
Epibenthic sled tows	***Arcuatula senhousia*** *Asterias amurensis* ***Eudistoma elongatum*** *Potamocorbula amurensis* ***Sabella spallanzanii*** ***Styela clava***	***Acentrogobius pflaumii*** ***Chaetopterus* sp.** ***Charybdis japonica*** *Didemnum* sp. *Grateloupia turuturu* *Hypnea* sp. ***Pyromaia tuberculata*** ***Theora lubrica*** ***Tritia burchardi*** ***Undaria pinnatifida***	Subtidal soft sediments Particular focus on known shellfish beds (for *Asterias*) and areas next to public access (e.g., wharves, boat ramps, marinas for *Caulerpa*, *Sabella*).	Narrow width but 100-m tow length and high replication enables a reasonably large area to be sampled (ca 3 500m^2 per location).	Reliable sample collection including asteroids, infaunal and epifaunal bivalves and polychaetes and macroalgae, as well as some crab and fish species.
Crab (box) traps	*Asterias amurensis* *Carcinus maenas* *Eriocheir sinensis* ***Styela clava***	*Acentrogobius pflaumii* ***Charybdis japonica*** ***Pyromaia tuberculata***	Adjacent to wharf pilings and other artificial habitats. Shores and shallow subtidal habitats, breakwalls and saltmarsh, with a focus on habitats with complex physical structure.	Area sampled depends on dispersion of bait odour. High replication possible.	Quick to deploy and recover, so high replication is possible. Effectively samples other species of crabs (e.g., *Hemiplax hirtipes*, *Notomithrax* spp. and *Ovalipes catharus*) and echinoderms (e.g., *Patiriella regularis, Coscinasterias muricata*). Also samples a wide range of fish species. Biofouling species may also be incidentally captured with this method if attached to mobile organisms attracted to the traps (e.g., *Styela clava* attached to masking crabs).
Crab condos	*Carcinus maenas* *Eriocheir sinensis*	*Acentrogobius pflaumii* ***Charybdis japonica*** ***Metapenaeus bennettae*** *Pyromaia tuberculata* ***Tritia burchardi***	Intertidal and shallow subtidal banks of rivers. Particular focus on brackish-water habitats with complex physical structure (e.g., saltmarsh or fringing vegetation).	High replication possible. Availability of suitable estuarine habitat may limit deployment.	Effectively samples other species of crabs (e.g., *Austrohelice crassa*, *Hemiplax hirtipes*). Higher rates of detection of crabs than baited traps in some conditions.
Diver searches	***Arcuatula senhousia*** *Asterias amurensis* *Carcinus maenas* ***Eudistoma elongatum*** ***Sabella spallanzanii*** ***Styela clava***	***Amathia verticillata*** ***Botrylloides giganteum*** ***Chaetopterus* sp.** ***Charybdis japonica*** ***Clavelina lepadiformis*** ***Didemnum* sp.** ***Grateloupia turuturu*** *Hypnea* sp. *Pyromaia tuberculata* ***Undaria pinnatifida***	Wharf piles, marina piles and pontoons and other artificial structures; intertidal and shallow subtidal reefs.	Good: large numbers of piles or areas of hard substratum can be searched in detail.	Feasibility dependent on water currents, weather, water clarity and safety issues for divers.
Shoreline searches	*Asterias amurensis* ***Arcuatula senhousia*** *Carcinus maenas* *Eriocheir sinensis* ***Eudistoma elongatum*** ***Arcuatula senhousia*** ***Sabella spallanzanii*** ***Styela clava***	***Charybdis japonica*** ***Clavelina lepadiformis*** ***Didemnum* sp.** ***Grateloupia turuturu*** ***Hypnea* sp.**	Sloping sandy shorelines, intertidal rocky reefs and areas where drift material is likely to accumulate. Wind direction on preceding days is a useful guide to where material may accumulate.	Wide: can cover long stretches of intertidal habitat quickly.	Used effectively in delimitation studies of *Styela*. Access to intertidal areas may be limiting.

species were found during the survey period at any high-risk sites, but at least one of the four secondary target species was found in eight of the ports surveyed (**Table 2**).

Number of specimens collected by the MHRSS and sent to MITS

Eighty-four specimens were sent to MITS for identification; with 40 and 44 specimens being collected from the winter and summer rounds respectively. Suspect specimens found at high-risk sites represented 13 taxonomic groups and included 20 non-indigenous species (**Table 3**).

Eight species recorded range extensions during the MHRSS surveys. The colonial ascidian *Didemnum vexillum* was found in Port Taranaki during the winter survey and has been previously recorded in Opua Marina/Waikare Inlet, Whangarei, Tauranga, Wellington, Nelson, Picton, Lyttelton and Otago harbours. The solitary ascidian *Ciona savignyi* was found in Picton Harbour in the winter survey and in Whangarei[1], Tauranga and Otago harbours in the summer surveys.

[1] *Ciona savignyi* was first detected in Whangarei during the winter 2016 MHRSS survey but no sample was collected. Thus, the summer 2017–2018 detection and identification by MITS represents the formal confirmation of the range extension of this non-indigenous species into Whangarei Harbour.

This species has been previously recorded in Whangarei, Nelson and Lyttelton harbours. The hydroid *Ectopleura larynx* was found in Nelson Harbour during the winter survey and has been previously recorded in Whangarei, Waitemata, Tauranga and Picton harbours.

All of the following species were found in the summer surveys. The amphipod *Caprella scauroides* was found in Whangarei Harbour and was first found in New Zealand in the Waitemata Harbour during the 2016–2017 summer survey. The colonial ascidian *Botrylloides giganteum* was found in Opua Marina/Waikare Inlet and has been previously recorded in Whangarei, Waitemata and Tauranga harbours. The colonial ascidian *Clavelina lepadiformis* was found in Lyttelton Harbour and has been previously recorded in Wellington, Nelson and Picton harbours. The crab *Charybdis japonica* was found in Tauranga Harbour and has been previously recorded in Opua Marina/Waikare Inlet, Whangarei and Waitemata harbours. The nudibranch *Polycera hedgpethi* was found in Tauranga Harbour and has been previously recorded in Opua Marina/Waikare Inlet, Picton and Lyttelton harbours.

Specimens collected by other MPI programmes and sent to MITS

MITS also received 31 samples that were collected and submitted as part of MPI investigations into exotic marine organisms, generally after reports via the MPI exotic pest and disease hotline. For all submissions to MITS, 216 specimens were identified. Identifications of samples submitted as part of MPI investigations into exotic marine organisms were completed rapidly, with non-urgent samples identified in 5 1/2 days and urgent samples taking 1 day on average,

Text continues page 61

Table 2: Marine high-risk sites surveyed in 2017–2018, and non-indigenous species found

Location	Sampling round	Target number of sites	Actual number of sites	Target species	Non-target species
Ōpua	Winter 2017	248	248	*Eudistoma elongatum, S. clava*	*Charybdis japonica, Metapenaeus bennettae, Pyromaia tuberculata, Theora lubrica, Tritia burchardi*
	Summer 2017–2018	248	250	*E. elongatum, S. clava*	*Botrylloides giganteum, Didemnum vexillum, M. bennettae, P. tuberculata, T. lubrica*
Whāngārei	Winter 2017	243	246	*Arcuatula senhousia, Sabella spallanzanii, S. clava*	*C. japonica, D. vexillum, Limaria orientalis, M. bennettae, P. tuberculata, T. lubrica, T. burchardi*
	Summer 2017–2018	243	244	*A. senhousia, E. elongatum, S. spallanzanii, S. clava*	*Acentrogobius pflaumii, Arenigobius bifrenatus, Ascidiella aspersa, Caprella scauroides, Celleporaria nodulosa, C. japonica, Ciona spp., D. vexillum, Jassa slatteryi, L. orientalis, M. bennettae, Paralepidonotus ampulliferus, P. tuberculata, Symplegma brakenhielmi, T. lubrica, T. burchardi*
Auckland/ Waitemata	Winter 2017	486	489	*A. senhousia, S. spallanzanii, S. clava*	*C. japonica, L. orientalis, M. bennettae, P. tuberculata, S. brakenhielmi, T. lubrica, T. burchardi, Undaria pinnatifida*
	Summer 2017–2018	486	488	*S. spallanzanii, S. clava*	*Amathia verticillata, C. nodulosa, C. japonica, Ciona spp., Ectopleura* spp., *L. orientalis, M. bennettae, Okenia pellucida, Omobranchus anolius, P. tuberculata, S. brakenhielmi, T. lubrica, T. burchardi, U. pinnatifida*
Tauranga	Winter 2017	243	243	*S. clava*	*A. verticillata, D. vexillum, P. tuberculata, T. lubrica*
	Summer 2017–2018	243	245	*S. clava*	*A. verticillata, C. japonica, Ciona spp., D. vexillum, Ectopleura* spp., *Polyandrocarpa zorritensis, Polycera hedgpethi, T. lubrica, U. pinnatifida*
New Plymouth/ Port Taranaki	Winter 2017	243	242	None	*D. vexillum, T. lubrica, U. pinnatifida*
	Summer 2017–2018	243	244	None	*D. vexillum, P. tuberculata, T. lubrica, U. pinnatifida*
Wellington	Winter 2017	243	244	None	*D. vexillum, T. lubrica, U. pinnatifida*
	Summer 2017–2018	243	243	None	*Clavelina lepadiformis, D. vexillum, Halisarca dujardinii, T. lubrica, U. pinnatifida*
Picton & Havelock	Winter 2017	243	245	*S. spallanzanii, S. clava*	*Ciona* spp., *C. lepadiformis, T. lubrica, U. pinnatifida*
	Summer 2017–2018	243	245	*S. clava*	*C. lepadiformis, D. vexillum, Ectopleura* spp., *T. lubrica, U. pinnatifida*
Nelson	Winter 2017	243	243	*S. clava*	*Ciona* spp., *C. lepadiformis, Ectopleura* spp., *Grateloupia turuturu, T. lubrica, U. pinnatifida*
	Summer 2017–2018	243	252	*S. clava*	*A. verticillata, Ciona* spp., *C. lepadiformis, D. vexillum, Ectopleura* spp.
Lyttelton	Winter 2017	243	245	*S. clava*	*Caprella mutica, Ciona* spp., *D. vexillum, T. lubrica, U. pinnatifida*
	Summer 2017–2018	243	247	*S. spallanzanii, S. clava*	*C. mutica, Ciona* spp., *C. lepadiformis, D. vexillum, Ectopleura* spp., *T. lubrica, U. pinnatifida*
Otago	Winter 2017	243	244	*S. clava*	*A. aspersa, D. vexillum, U. pinnatifida*
	Summer 2017–2018	243	244	*S. clava*	*D. vexillum, U. pinnatifida*
Bluff	Winter 2017	225	226	None	*U. pinnatifida*
	Summer 2017–2018	225	226	None	*U. pinnatifida*

Table 3: Specimens collected and identified by MITS from each sampling locality, 2017–2018

Non-indigenous species are in BOLD. Range extensions are in BLUE		
Location	**Taxonomic Identification**	
	Taxonomic group	**Species**
Ōpua	Decapod	*Halicarcinus whitei, Ogyrides delli*
	Ascidian	***Botrylloides giganteum***
Whāngārei	Annelid	***Paralepidonotus ampulliferus,*** *Salmacina australis*
	Amphipod	*Aora* aff[1]. *typica,* ***Caprella scauroides****,* ***Jassa slatteryi****, Paradexamine pacifica, Stenothoe moe*
	Ascidian	***Ascidiella aspersa****, Aplidium powelli, Botrylloides leachii,* ***Ciona savignyi****,* ***Diplosoma listerianum****, Pseudodistoma opacum,* ***Symplegma brakenhielmi***
	Barnacle	*Notomegabalanus decorus*
	Bryozoan	***Celleporaria nodulosa***
	Decapod	*Alpheus novaezealandiae, Heterosquilla koning*
Auckland/ Waitematā	Ascidian	*Aplidium phortax, B. leachii, Didemnum incanum, Polycarpa zeteta*
	Bryozoan	***Amathia verticillata, C. nodulosa***
	Nudibranch	***Okenia pellucida***
Tauranga	Alga	*Pterocladia* sp.[2]
	Annelid	*Acromegalomma suspiciens*
	Ascidian	*Asterocarpa humilis, B. leachii,* ***C. savignyi****, Microcosmus squamiger, Pyura* sp.[3]
	Decapod	***Charybdis japonica****, Ebalia tuberculosa*
	Nudibranch	***Polycera hedgpethi***
New Plymouth/ Port Taranaki	Ascidian	***Didemnum vexillum****, Lissoclinum notti*
	Decapod	*Brachyura*[4]
Wellington	Alga	*Bacillariophyceae*[5]*, Callithamnion* sp.[6]*, Callophyllis angustifrons, Cladophora* sp.[5]*, Codium fragile, Ectocarpaceae*[5]*, Grateloupia* sp.[7]*, Polysiphonia* sp.[5]
	Ascidian	***Clavelina lepadiformis****, Didemnum* sp. [6] ***D. vexillum****, L. notti*
	Bivalve	*Ennucula strangei*
	Decapod	*Pterygosquilla schizodontia*
	Fish	*Gnathophis habenatus*
	Sponge	***Halisarca dujardinii***
Picton/Havelock	Ascidian	***C. savignyi***
Nelson	Alga	***Grateloupia turuturu****, Myriophyllum triphyllum,*
	Ascidian	*Botrylloides* cf.[8] *magnicoecum*
	Decapod	*Heterosquilla tricarinata*
	Hydroid	***Ectopleura larynx***
Lyttelton	Ascidian	*B. leachii,* ***C. lepadiformis***
	Echinoderm	*Allostichaster polyplax*
	Hydroid	***Ectopleura crocea***
Otago	Ascidian	***C. savignyi***
Bluff	Annelid	*Chloeia inermis*
	Fish	Apopterygion oculus
	Other	Mollusc eggs[9]
	Sponge	***Polymastia*** **cf.**[8] ***aurantia***

[1] Indicates a specimen that is similar to the named species, but is morphologically different to a degree that suggests it is a closely related yet unnamed species (i.e., requires further investigation).
[2]Identified to genus using morphological features. As it is an indigenous genus further taxonomic determination not required.
[3]Only identified to genus as sample was damaged.
[4]Sample was the final larval stage (megalops), precluding further taxonomic identification.
[5]Species determination not possible because the preservation method was not conducive to molecular sequencing.
[6]Cryptogenic species.
[7]Molecular sequencing required for species determination.
[8]cf. (Latin for confer = compares with) indicates that a specimen resembles the named species very closely, but has certain minor features not found on the type specimen/s. Whether it is a different population of the named species or a different species altogether would require more research into the species' population variations.
[9]Further identification not possible.

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

Exotic catfish, Bay of Plenty

The Bay of Plenty Regional Council called the MPI pest and disease hotline to report a single suckermouth catfish (*Hypostomus plecostomus*) caught in a trammel net in a stormwater system at Papamoa, a suburb of Tauranga. Photos of the specimen were provided to MPI, and a fish taxonomist at Te Papa confirmed the identification. Suckermouth catfish (also known as plecostomus or "pleco") are able to withstand the temperature ranges in New Zealand, and therefore there is a possibility of this species becoming established. It would have no obvious natural predators here, owing to its armour-like scales and sharp spines on the dorsal and pectoral fins. Suckermouth catfish have not been found here in the wild, and their potential as a pest species is unclear. Although only a single specimen was found, a delimiting survey of the Papamoa stormwater system was undertaken using nets, traps and electric fishing to establish the size and extent of a possible breeding population. No further catfish were found, so it may have been a single specimen that had escaped or been discarded; however, the Bay of Plenty Regional Council and Tauranga City Council will continue to monitor the area. The fish was submitted to Te Papa for preservation and dissection to determine the sex and reproductive status. Given the lack of evidence of a breeding population, the investigation was stood down.

Bonamia in Bluff oysters

A member of the Bluff oyster fishing industry called the MPI pest and disease hotline, concerned that pustules on an oyster he had caught might be due to a *Bonamia* infection. The oyster was preserved in ethanol and sent to the MPI Animal Health Laboratory (AHL), where molecular testing confirmed the presence of *B. exitiosa*, the endemic species of *Bonamia* known to be present in the Bluff oyster fishery, which is monitored on a regular basis. The parasite was found in the heart tissue, indicating that the pustules were almost certainly due to a *B. exitiosa* infection. Fishers have reported that oysters have generally been in poor condition this year, mainly as a result of a large spawning event and poor feeding conditions caused by frequent storms, which would make them prone to infection. Since no exotic pathogens were found the investigation was closed.

In another case at Bluff, a fisher called the MPI pest and disease hotline about some oysters in his catch that appeared unhealthy, with blisters on them. He sent samples to the MPI AHL for diagnostic testing, which ruled out *Bonamia ostreae* but did find *B. exitiosa*, which was likely the cause of the lesions. Since this disease is endemic to New Zealand, the investigation was closed.

Shellfish mortality event, Okura Estuary

MPI was notified of a large number of shellfish deaths in the estuary at Long Bay-Okura Marine Reserve, Auckland. This was the third such event there in the previous 18 months. Samples were submitted to the MPI AHL for diagnostic testing, which was unable to identify a single cause of the mortalities. Histology showed the presence of some common parasites, though none that were exotic or so prevalent as to be the primary cause of death. Histology also showed some haemocytosis, which is a non-specific immune response with many different causes, including the resorption of gonad, which happens in animals that remain unspawned at the end of summer, although it can also be a stress reaction. The gills in some cases were affected with both parasites and particulate organic matter, which could have been compromising the animals' ability to feed by damaging the gills.
Bacteriology showed the presence of common marine environmental bacteria. Although some bacteria have pathogenic

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respectively. Identification of MHRSS samples was completed in 11 days on average.

Additional resources for the MHRSS and MITS programmes

Annual reports and the New Zealand Marine Pest Identification Guide are available to read and download from https://marinebiosecurity.org.nz/surveillance/ and https://marinebiosecurity.org.nz/speciesid/ respectively. Information collected from marine biosecurity surveillance programmes has been uploaded and made available via the Marine Biosecurity Porthole webpage (www.marinebiosecurity.org.nz), which houses data from these MPI-funded programmes, MITS identifications and other verified observations. Anyone with an interest in marine biosecurity can access recent information on what has been recorded in New Zealand waters: where and in many cases when it was reported. The website enables users to view sites surveyed, examine distribution records for individual species and download the data for further analysis. It also provides information about significant marine pests, updates on current marine biosecurity projects and access to a variety of past reports that have been commissioned by MPI or completed by NIWA, and all are available to download.

Abraham Growcott
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Aquatic and Environment Health), Diagnostic and Surveillance Services Directorate, Biosecurity New Zealand
Ministry for Primary Industries
Abraham.Growcott@mpi.govt.nz

Chris Woods
Scientist, National Institute of Water and Atmospheric Research
Chris.Woods@niwa.co.nz

Serena Cox
Scientist, National Institute of Water and Atmospheric Research
Serena.Cox@niwa.co.nz

Graeme Inglis
Principal Scientist, National Institute of Water and Atmospheric Research
Graeme.Inglis@niwa.co.nz

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effects, they are usually only secondary. However, bacterial growth was not significant, nor did it show any one type of bacteria as being dominant. Hence the results did not show evidence of an infectious process as the cause of the mortality event, and the investigation was closed.

Diseased gurnard, Mangawhai

A recreational fisher called the MPI pest and disease hotline to advise that while long-line fishing at Mangawhai he had caught a gurnard (*Chelidonichthys kumu*) with hard white lumps on its flesh and skin. The notifier had also caught snapper, kahawai and five other gurnard during the same fishing session, none of which showed any signs of infection. He had already filleted and frozen the fish, but sent the fillets and frames to the MPI AHL for histological testing, which showed white cysts encapsulating digenean trematodes (parasitic flatworms). Each cyst contained a single worm, and there were about 100 cysts present. These parasites are a common occurrence in gurnard, and laboratory staff had seen them before. As there was no biosecurity risk, the investigation was closed.

Mussel mortality, Havelock

A mussel farmer used the MPI pest and disease hotline to report a mortality event in mussels, some of which had empty, open shells while others had gaping shells with shrivelled flesh inside. The farmer suspected a disease. Five mussels with tissue in them were collected and sent to the MPI AHL for examination. Four of them were very autolysed and showed signs of post-mortem change. One was in good condition but there was no histological evidence of any significant pathogens. An encysted metacercarian trematode was found in one mussel but this is not unusual and was unlikely to have been the cause of the mortality event. Bacteriology also showed nothing unusual: bacterial isolates were common marine species often seen in shellfish. It is most likely that an environmental event (e.g., heavy freshwater flushing or storm, prolonged high water temperatures, or an algal bloom) had immunocompromised the animals and ultimately caused their demise. The mortalities are no longer occurring, and hence the investigation was closed.

Tuatua mortality, Mt Maunganui

Researchers from Waikato University in Tauranga used the MPI pest and disease hotline to report many dead tuatua (*Paphies subtriangulata*) along 200 m of a Mt Maunganui beach. The bivalves were partly embedded in or lying on top of the sand. Ten specimens were submitted to the MPI AHL for histopathology, bacteriology and ruling out of exotic diseases. Histopathology indicated large multifocal accumulations of brown cells (also known as ceroid bodies) in all specimens. Brown cells are enigmatic but appear to be involved in metabolite accumulation and detoxification (Zaroogian & Yevich, 1993). No pathogen was found, but brown cells are thought to indicate cellular stress, so a toxic or environmental insult could not be ruled out. There were also basophilic inclusions that were likely to be from the brown cells or *Rickettsia*-like organisms. Bacteriology revealed *Vibrio* spp., which are common marine bacteria that can also be associated with disease. The very light mixed bacterial growth in this case suggests that bacterial infection was unlikely to be a primary cause of mortality. These results revealed no clear diagnosis, which is common with shellfish mortalities because they are often multi-factorial. The results were relayed to the notifier and the investigation stood down.

Reference

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Michael Taylor
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Aquatic and Environment Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
michael.taylor@mpi.govt.nz

Plant health surveillance & incursion investigation annual report

Surveillance is an integral component of New Zealand's multi-layered biosecurity system and it includes incursion investigation. The team responsible for surveillance is the first line of defence against unwanted pests and diseases that breach the border. Incursion investigators respond to these breaches, gather information to validate the report and manage the immediate risk. When the incursion investigation team cannot mitigate the risk, a larger biosecurity response may be initiated.

Targeted surveillance

Surveillance enables New Zealand to demonstrate that it is free of pests and diseases that otherwise would close access to overseas markets. As part of that process, the Plant Health team undertakes the fruit fly, gypsy moth and high risk site surveillance programmes (for which annual reports are presented in this issue of *Surveillance*).

Passive surveillance

Passive or general surveillance relies on members of the public, industry groups, plant health professionals and scientists to report suspect plant pests and diseases that are not present in New Zealand. It provides a mechanism for people to report pests like ants and brown marmorated stink bugs (BMSB) that are associated with imports and require urgent measures to manage the biological risk. Passive surveillance also enables established but previously unrecorded pests and diseases to be reported and managed, and provides information about New Zealand's pest and disease status. During the year, the Plant Health team managed 1 260 notifications through passive surveillance (**Figure 1**). Notable investigations are reported quarterly in *Surveillance* and investigations for the final quarter are presented below.

Of the 1 260 notifications, investigations into 677 cases (54 percent) were evaluated by MPI Incursion Investigators and immediately stood down because no biological risk was found. The remaining 583 (46 percent) were further investigated to determine the magnitude of the risk. A small number of notifications (55; 4 percent) were redirected to agencies with management responsibility for the particular pest concerned. These included pest plants listed in the National Plant Pest Accord (NPPA) that are unwanted organisms and banned from sale, propagation and distribution throughout New Zealand. The NPPA-listed plants are typically managed by regional councils and local authorities, for example a report in a Papamoa waterway of Salvinia (*Salvinia molesta*), a perennial aquatic fern that forms floating mats on still waters and swamps. Examples of other redirected reports were maggots reported in ice-cream (Food Safety Authority) and a suspected exotic mosquito (Auckland District Health Board).

Most reports (936) were provided by the general public and 367 of these (39 percent) were investigated further. However, the relative proportions of notifications from other sectors that required further investigation was much higher (government 60 percent, industry 71 percent, biosecurity service providers 73 percent and the science community 97 percent), indicating how the background and experience of those sectors contributed to the significance of their reports. Similarly, more than a third of the cases reported by biosecurity service providers and the science community proved to be real biosecurity incursions, which again confirmed their effectiveness.

Post-border surveillance is complicated by the diversity of plant species present in New Zealand (about 25 000) and other associated organisms. Real or suspected incursions are reported from diverse environments including towns, cities, farms orchards, parks and reserves and Transitional Facilities (MPI-approved facilities for receiving imported goods). Given the complexity and number of reports to be processed and the number of actual incursions found, it appears that MPI's expenditure in this area is well justified.

Often it is necessary to take urgent measures to promptly contain and manage the biological risk at hand, and usually that is enough. When the issue is more widespread, urgent measures are used to provide local control while further actions are considered and that may lead to a wider response.

Figure 2 shows the outcomes of the 583 investigations, of which 322 (55 percent) were negative, thereby ruling out suspected unwanted or notifiable organisms.

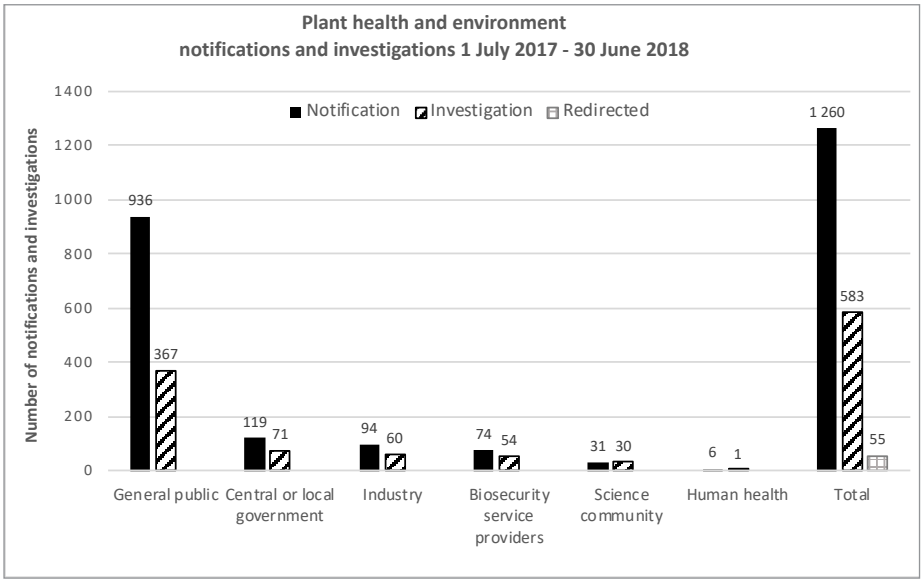

Figure 1. Notifications to and investigations by the Plant Health Team for the year ended 30 June 2018

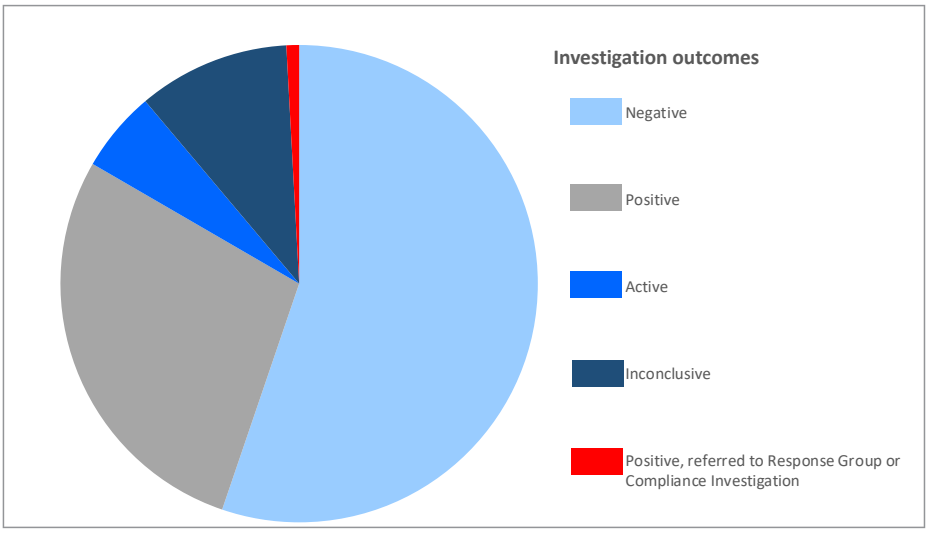

Figure 2: Outcomes of further investigations to determine whether there was a biosecurity issue in initial reports, for year ended 30 June 2018

Confirmation of a biological risk transpired for the 164 reports investigated that were categorised as positive. Of the remaining three categories, 10 percent were inconclusive, meaning it was not feasible to determine the presence or absence of a biological risk and further investigation was not warranted. Active investigations were those that were still being investigated at the end of the reporting period. The remaining five positive investigations were transferred to other areas of MPI for further action and of those, three transitioned to a biosecurity response. One such example was confirmation of the invasive weed great willowherb (*Epilobium hirsutum*), found growing in several areas in Canterbury and not previously recorded as present in New Zealand.

Although the effort invested in passive and active surveillance is well justified, there is further potential for improvement. The Biosecurity 2025 Direction Statement acknowledges that all New Zealanders have a role to play in protecting our biosecurity. Raising public awareness will help the public to recognise biosecurity issues and report them to the exotic pest & disease hotline.

Plant health and environment investigations: some examples from April to June 2018

Incursion Investigation and Plant Health and Environment Laboratory (PHEL) teams based in Auckland and Christchurch provide field investigation, diagnostic testing and technical expertise on new pests and diseases. They also have surveillance and response functions and carry out research. Following are some recent cases of note.

General biosecurity pest and contaminants

Several carpenter ants (*Camponotus* sp.) were found 20 metres from a Christchurch business premises and appeared to be directly associated with a nearby shipping container that held a kinetic sculpture being returned from Victoria, Australia, for repair. All species of *Camponotus* are Unwanted Organisms under the Biosecurity Act 1993 so immediate action was taken to find and destroy them. The area surrounding the ant detection was sprayed using a residual insecticide, and attractant and toxic baits were deployed. Hundreds of ants had been observed around the perimeter of the container, so it was fumigated with methyl bromide to prevent the establishment of carpenter ants on site. Follow-up inspection to check the treatment's efficacy was conducted after 4 weeks. It was determined that imported vehicles were transitioning through the location, which included a panel-beating business, frequently enough to warrant continued surveillance, and the site was added to the 2018–2019 summer National Invasive Ant Surveillance (NIAS) programme. Further searching over a 50 m radius from the original detection site found another exotic ant, *Tapinoma melanocephalum* (ghost ant) and again ant baits were deployed to mitigate this risk. Inspection revealed seeds, plant material, invertebrates and soil, both inside and under the container. Consequently, the container was directed to an MPI border clearance Transitional Facility (TF) and underwent a complete decontamination, after which it was inspected and released by MPI staff. The case was reported to the MPI TF audit team for follow-up. No *Camponotus* spp. are known to be established in New Zealand, though the environment is considered favourable. The literature suggests that if they became established here the economic impact could be significant and nest establishment would likely result in damage to wooden structures. The ongoing NIAS surveillance this season will determine the efficacy of the trap and treatment.

During repair, an item of electronic equipment imported from the US that had been left outdoors in the Coromandel area for the past 12 months was found to be contaminated with several insect cocoons. Specimens submitted to MPI were identified as the wool carder bee, *Anthidium manicatum*, and its nest. This exotic solitary bee was first found in New Zealand in 2006 and has become established throughout the North and South Islands. There was no evidence to indicate whether the nest originated from New Zealand or the US. Live mites also found with the nest were identified as *Sennertionyx manicati*, a species known to live in association with the wool carder bee. There was no biosecurity issue as the bee and mite are already present in New Zealand.

Forest and timber pests

Borer holes were discovered in a wooden baseball bat that was part of a set purchased as a Christmas gift from a Wellington department store. Four adult male and female beetles were identified by PHEL as the African powderpost beetle, *Lyctus africanus*. This species is not present in New Zealand but occurs throughout Africa, Madagascar and Asia, and has been introduced to Europe. Despite the name, it is unclear whether *L. africanus* is of African or Asian origin. It is regarded as one of the most destructive pests of timber and timber products, including plywood, and can infest dried roots and tubers. The Australian parent company instructed its New Zealand department stores to remove the bats from sale and inspect them for wood dust and borer exit holes. There were no further reports of borer activity but nevertheless the stores also arranged for all the wooden bats to be collected and destroyed. As a further precautionary measure, a Wellington pest-control service treated the loft and garage of the residence where the infested bat had been stored.

Fresh borer holes and dust were found in bamboo fly swats from China that were purchased from a giftware shop, and the detection was reported to MPI. Beetles and larvae were obtained by cutting open the swats, and were identified as the bamboo powderpost beetle, *Dinoderus minutus*, also known as the bamboo borer. This species is a regulated pest and an Unwanted Organism. It is a tropical species found in Asia and is a pest of bamboo, cane, and occasionally dry stored foods. The handles of the swats were encased in a thin plastic film that obscured the bamboo until the insects bored through it and revealed the wood underneath. All remaining fly swats were immediately withdrawn from sale nationwide, contained and recalled to distribution centres in Auckland and Christchurch. The importer chose to destroy rather than fumigate them, using steam sterilisation and deep burial. The fly swats had been declared as made of plastic, which was why the consignment had not been fumigated or inspected on arrival. Staff at all stores were asked to check other goods for borer damage and to contact MPI if any more fly swats were returned by customers. The importer advised that it was not due to receive any further consignments from the supplier involved, and would not use them again.

Yellow spotted stink bug (YSSB)

Over a 5-week period from early November 2017, three separate detections of live *Erthesina fullo*, commonly known as the yellow spotted stink bug (YSSB), were reported via MPI's exotic pest and disease emergency hotline. YSSB is known to enter New Zealand via pathways such as shipping containers, vehicles and machinery. These finds were identified by PHEL and were all associated with vehicles and vehicle parts imported from Japan. They were reported from a Wellington private residence (non-reproductive female), a car dealership in Invercargill (adult female), and a car distribution centre in Auckland (adult male). In the latter two cases, the vehicles were inspected by MPI Quarantine Officers, fumigated using methyl bromide and inspected before being released to the owners. Surrounding areas at the Auckland site were also searched. No further YSSB were found.

E. fullo is a large shield-shaped bug with a wide host range that includes stonefruit, apples and pine trees, all species of economic importance to New Zealand. Information about YSSB is scarce as it is not known to be established outside its native range, so its potential impact on New Zealand is uncertain. The biology of YSSB is similar to that of the brown marmorated stink bug (BMSB, *Halyomorpha halys*) and therefore the YSSB may pose a similar risk. Detections of YSSB are treated in a similar way to BMSB and in the three cases described above the biosecurity issue was suitably managed to mitigate the risk of establishment. Given the increased vigilance for BMSB, it is likely that YSSB will continue to be detected. YSSB fact sheets were distributed to the car yards to help increase awareness.

Seed contamination

An importer who received seeds ordered on-line through an overseas website realised they had been incorrectly imported and contacted MPI. The importer submitted the seeds to MPI, who destroyed them by heat treatment. Calls to the exotic pest & disease hotline reveal that a growing number of people unwittingly and illegally import plant seeds through e-commerce. The Biosecurity 2025 programme has a number of priority audiences including businesses and individuals who purchase goods online via overseas websites. This programme will focus on better online purchasing behaviour, both at point of purchase and when overseas packages are received.

Carolyn Bleach
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Plant Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Carolyn.Bleach@mpi.govt.nz

National Invasive Ant Surveillance Programme Annual Report 2018

Introduction

The National Invasive Ant Surveillance programme (NIAS) detects newly established exotic ant species in New Zealand and provides information on range extensions of species already known to be established. Ants are widely dispersed through human activity and commonly intercepted in air and sea cargo including fresh produce, timber, sea containers and personal baggage. They are major urban pests, invading homes and businesses where food is readily available. They also threaten natural biodiversity by displacing native invertebrate species and encouraging horticultural pests.

High-risk sites for ant entry are determined by pathway and site risk analyses undertaken annually. High-risk sites include seaports, airports, sea container storage and repair sites and Transitional Facilities that receive international freight. Sites are then scheduled to be surveyed from mid-summer to early autumn each year.

Materials and methods

The identified risk sites are surveyed by ground teams co-ordinated by AsureQuality Ltd. Small plastic pottles, alternately baited with carbohydrate (sugar solution) (**Figure 1**) or protein (peanut butter, oil and sausage meat) are placed in grid formation (**Figure 2**). Additional pottles are used to collect live ants found by visual inspection. Pottles are left out at each site for about 2 hours under favourable environmental conditions to maximise the number of foraging ants collected before the bait dries out and becomes less attractive.

For a second year in a row, dome-type ant traps (a long-term trapping system) were used on a trial basis at the Ports of Auckland. These traps consist of a base section containing a glycol-filled capture chamber coated with Teflon and three types of attractive baits (honey, peanut butter and shrimp paste), with a plastic dome cover over the top (**Figure 3**). Ants attracted to the baits fall into the capture chamber and are preserved in the glycol. The general principle is the same as with a pitfall trap but the capture chamber is raised and housed in a unit that can be deployed on hard surfaces (i.e., no ground excavation is required). These traps can be left deployed for a period of days or weeks before being retrieved and contents examined. Work has been ongoing to modify the design of the dome trap through 3D printing to improve operational deployment in the field (Ross, 2018).

Twenty-two dome traps were deployed in the multi-cargo area of the Ports of Auckland for 7 days (13–20 February 2018), giving an effective total of 154 trap-days. This was done to test the practical application of these traps for further use in the NIAS programme. The multi-cargo area is a known hot spot for exotic ant activity (FBA Consulting, 2017) and is also the type of environment the dome traps were designed to monitor. Pottle surveillance was also undertaken in the area where the traps were deployed, to compare the performance of dome traps and pottles.

Figure 1: NIAS carbohydrate pottle deployed at Ports of Auckland, with local *Iridomyrmex suchieri* workers foraging on bait

Figure 2: The typical environment in a port area surveyed during NIAS

Figure 3: Dome trap deployed on Jellicoe Wharf, Ports of Auckland

GPS locations and associated data are recorded on hand-held data loggers. All samples are tracked electronically from the field to identification in the laboratory. Pottles and dome traps are sent to the Flybusters Consulting diagnostic laboratory for initial identification. Suspect exotic ant specimens are sent to MPI's Plant Health and Environment laboratory (PHEL), Tamaki, for validation of ID. Once an exotic ant find has been validated, an investigation is initiated to track down and eradicate nests near the location of the original find.

Results

In the 2018 season, 43 808 pottles were deployed nationally, with 15 pottles recording exotic ants (**Table 1**). Of these, six detections were confirmed from active established nests (**Table 2**). Two dome traps caught exotic ghostants, *Tapinoma melanocephalum*, none of which were confirmed to be from active, established nests.

Pottle deployment varies from year to year owing to variations in site selection and weather. Weather significantly affects ant distribution, behaviour and the number and size of nests. The environmental factors to which ants are sensitive include air and soil temperature, rainfall and soil moisture deficit. Accordingly, favourable conditions during the lead-up to the surveillance period have been implicated as a cause of increased interceptions: the presence of more nests means more interceptions are likely (Gunawardana *et al.*, 2013; Browne *et al.*, 2012; Porter, 1988).

The weather from winter 2017 to summer 2018 was considered to be good for supporting ant populations. In particular, the mild winter would have encouraged ant activity and nest expansion in early spring. Summer was more variable, with hot dry periods slowing ant activity, followed by higher-than-average rainfall and temperatures in January and February resulting in a surge of ant activity. It was observed that some tropical species of ant present in New Zealand such as *Pheidole megacephala* had a bumper year, with large populations throughout Auckland by late summer.

Table 1: Ant detections during NIAS, 2018

Species found	Location
Paratrechina longicornis	Port Nelson
Tapinoma melanocephalum	Port Nelson
Trichomyrmex destructor	CentrePort, Wellington
Paratrechina longicornis	Port of Tauranga
Paratrechina longicornis	Port of Tauranga
Paratrechina longicornis	Port of Tauranga
Tapinoma melanocephalum	Ports of Auckland
Tapinoma melanocephalum	Opua Marina, Northland
Tapinoma melanocephalum	K.A. Gibson premises, Christchurch
Trichomyrmex destructor	Port of Timaru
Paratrechina longicornis	Hilton Haulage premises, Christchurch
Trichomyrmex destructor	Hilton Haulage premises, Christchurch
Monomorium sp.	Hilton Haulage premises, Christchurch
Monomorium dichroum	Port Otago
Trichomyrmex destructor	Port Otago

Table 2: Ant nests detected during NIAS, 2018

Location	No of nests found
Port Nelson	2
Opua Marina	1
K.A. Gibson premises, Christchurch	1
Hilton Haulage premises, Christchurch	1
Port of Timaru	1

Five exotic species were recorded in pottles (**Table 1**), including *Tapinoma melanocephalum* (ghost ant) *Paratrechina longicornis* (crazy ant), T*richomyrmex destructor* (Singapore ant), *Monomorium dichroum* and *Monomorium* sp. All these ants and their associated nests were destroyed. The 2018 season demonstrates the value of early intervention in preventing the establishment and spread of exotic ant species in New Zealand.

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Lora Peacock
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Aquatic and Environment Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
lora.peacock@mpi.govt.nz

Adam Ross
Graduate Programme
Biosecurity Surveillance and Incursion Investigation (Aquatic and Environment Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Adam.Ross@mpi.govt.nz

Mark Twaddle
AsureQuality Limited
Mark.Twaddle@asurequality.com

Paul Craddock
Operations Manager
FBA Consulting
paul@FBAconsulting.co.nz

Deirdre Nagle
Surveillance Manager, Biosecurity
AsureQuality Limited
Deirdre.Nagle@asurequality.com

National Fruit Fly Surveillance Programme 2017–2018

New Zealand's National Fruit Fly Surveillance Programme (NFFSP) entails seasonal monitoring for the presence of economically important fruit flies, using lure traps placed at high-risk locations throughout the country. This programme was initiated in the mid-1970s to detect fruit-fly incursions in time to eradicate them, and to provide direct evidence that New Zealand is free of this pest.

There are currently about a hundred species of tephritid fruit fly listed on the MPI website as regulated organisms. The absence of economically important pests enables host produce to be produced without use of control measures, and exported without treatment, thus facilitating market access. As an indication of how important this is, horticultural exports in 2017 earned $5.1 billion, of which 80 percent came from plants that are potential fruit-fly hosts (Horticulture New Zealand, 2017).

Use of the three fruit-fly lures, cuelure, trimedlure and methyl eugenol, in the NFFSP enables a broad range of species in the genera *Bactrocera* and *Ceratitis* to be covered, particularly Mediterranean fruit fly (*C. capitata*), Queensland fruit fly (*B. tryoni*) and Oriental fruit fly (*B. dorsalis*).

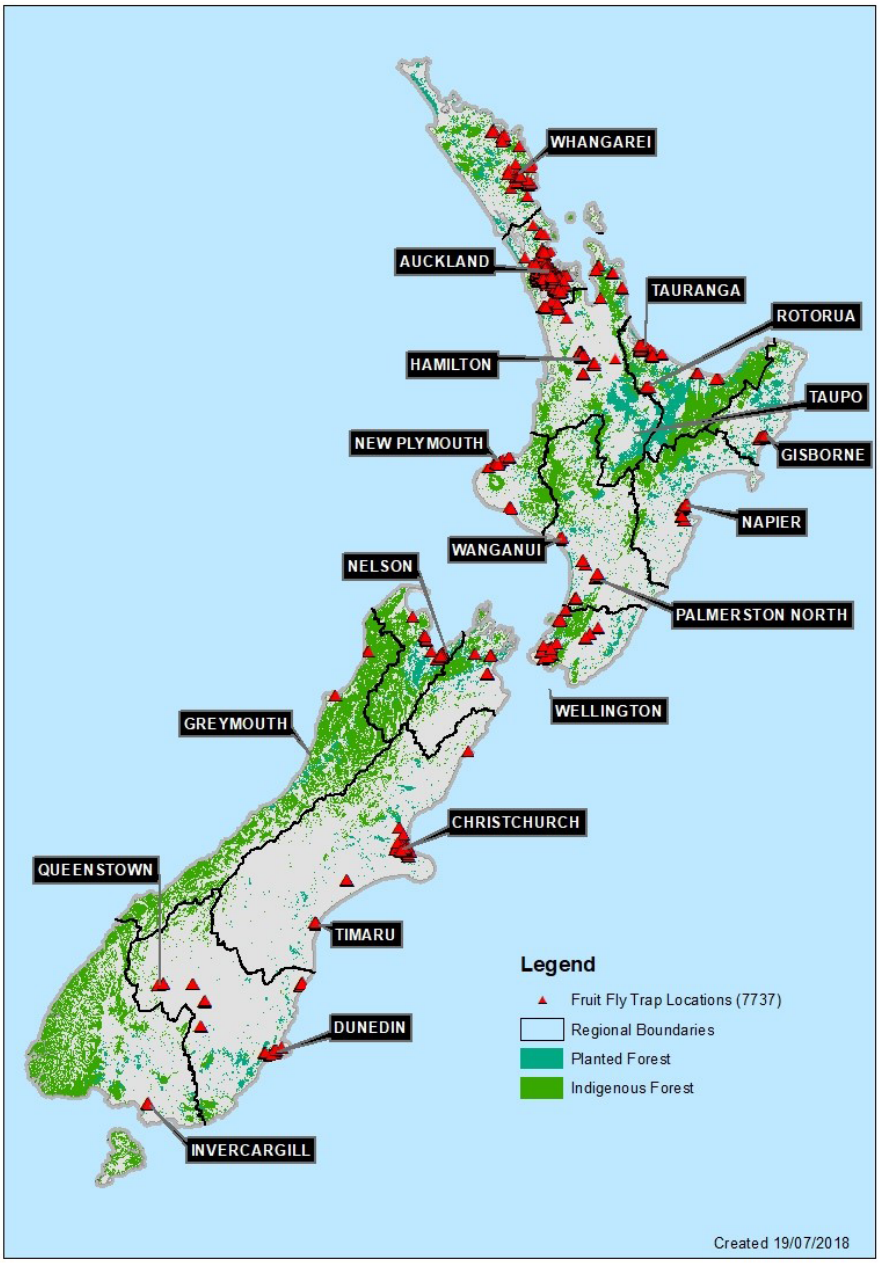

Figure 1: Map of New Zealand showing distribution of trap sites for fruit fly surveillance, 2017–2018

Since 1989 there have been 10 detections of economically important fruit flies via the National Fruit Fly Surveillance Programme: seven in Auckland and three in Whangarei. Prompt investigation of these events resulted in the detection of an establishing population of *C. capitata* in 1996 and another of *B. tryoni* in February 2015. These detections resulted in prompt, sustained action to eradicate and prevent establishment of the flies. Intensified surveillance in the other cases did not yield further flies, and it was concluded that these cases probably arose from discarded infested fruit brought in by travellers from overseas. Of these non-establishing detections, five were *B. tryoni*, one was *B. passiflorae*, one was *B. papayae* (now considered to be *B. dorsalis*), and one, in 2016, was *B. tau*.

AsureQuality has conducted fruit-fly surveillance for MPI for nearly 20 years, and prior to that as part of the former Ministry of Agriculture and Fisheries and Ministry of Agriculture and Forestry. In all, 7 737 fruit-fly

Table 1: Numbers of traps and trap runs by region, 2017–2018 season

Region	Number of trap runs	Number of traps
Auckland/ Northland	71	5 006
Waikato/Bay of Plenty	18	672
Lower North Island	28	928
Upper South Island	20	757
Lower South Island	12	374
Total	**149**	**7 737**

traps were serviced fortnightly in 149 individual "trap runs" by AsureQuality staff, covering urban localities exposed to international traffic and/or centres of horticultural production. A trap run is a set of typically about 52 traps (but varies from seven to 104) that are serviced by a trained trapper (**Table 1**). Traps with cuelure and trimedlure are placed in 400 x 400 m grids, while those with methyl eugenol, which has a wider effective sampling area, are placed in 1 200 x 1 200 m grids. Traps are placed according to a ranking system based on host status, with fruiting host trees given top priority. Separations and placements reflect practice in other countries (e.g., Australia and the US) and lure attractiveness. An example of a run in south Auckland is shown in **Figure 2**.

Commercial pheromone-impregnated lures and plastic strips impregnated with dichlorvos insecticide are used in Lynfield traps. Each trap is inspected every 13–15 days. Suspect flies are collected and submitted to entomologists at the Plant Health and Environment Laboratory (PHEL) for identification.

Figure 2: A grid made up of cells overlaid on a map, showing runs of Queensland and Mediterranean fruit fly traps (yellow and blue) and Oriental fruit fly traps (red) in south Auckland

MPI specifies start and end dates for trapping, and the season runs for longer in northern districts, reflecting the warmer climate. The trapping season covers months when population development and flight activity can be predicted (Stringer *et al.*, 2013). In 2017–2018, trapping occurred from 2 October to 2 July.

Traps are placed so that they are protected from direct sunlight, wind and dust, and are typically located at least 1.3 m above the ground, in an area of dappled light within the foliage (**Figure 3**). To avoid the possibility of interference between lures, the traps are placed at least 3 m apart, and also at least 3 m from any other insect trap (e.g., for codling moth or gypsy moth).

Trappers are required to submit for identification any fly 3–15 mm long. Suspect flies are sent to the diagnostic laboratory within 2 working days of checking the trap. Records of nil catches are also kept, to confirm that traps have been checked. New traps are used at the start of each season, and all traps and lures are destroyed within 2 weeks after the end of the season. Trappers attend refresher courses every year on trap servicing, where they are also updated on any changes of procedure.

MPI operates the programme to a quality assurance regime that covers documentation, training and auditing. Auditing includes checks on chemicals in lures and insecticide strips, checking traps throughout the season, and monitoring performance against key service indicators (KSIs). This ensures that the programme remains effective even when detections of fruit flies are rare, one-off events.

Results

There were 2 819 submissions to PHEL involving a total of 6 869 suspect flies, compared with 5 624 in 2016–2017. **Table 2** provides a breakdown of submissions by region. The Auckland and Northland regions recorded the most submissions – 4 014 (58 percent).

Figure 3: Fruit fly trap containing cuelure for Queensland fruit fly

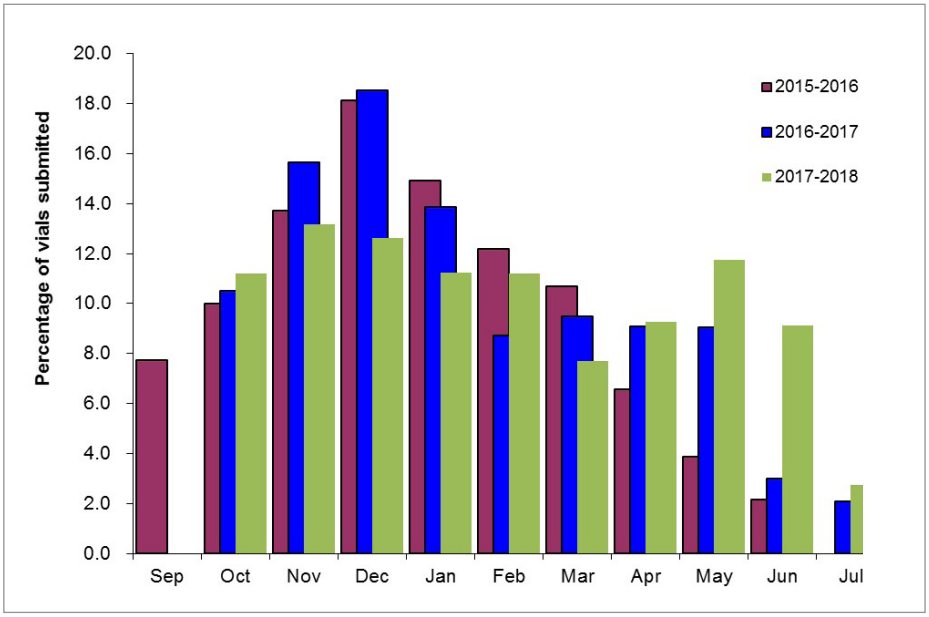

Figure 4: Fruit fly sample submissions by month and year

Table 2: Numbers of suspect submissions by region, 2017–2018 season

Month	Auckland/ Northland	Waikato/Bay of Plenty	Lower North Island	Upper South island	Lower South Island	Total
Oct 2017	440	39	105	125	60	769
Nov 2017	258	30	116	357	143	904
Dec 2017	283	32	98	281	172	866
Jan 2018	354	41	77	143	157	772
Feb 2018	478	80	66	83	62	769
March 2018	333	14	49	64	70	530
April 2018	454	15	59	54	54	636
May 2018	643	34	55	46	30	808
June 2018	584	42	0	0	0	626
July 2018	187	2	0	0	0	189
Total	**4 014**	**329**	**625**	**1 153**	**748**	**6 869**

The number of suspect sample submissions followed a similar pattern to previous years (**Figure 4**), with most submissions from October to February, but the total number during the same period this season was fewer than in 2016–2017. This was likely the result of above-average temperatures during this season. An increased number of submissions from April to July was also noted and may have been caused by the warm autumn causing increased fly activity for the time of year. Another cause may have been new trappers acting cautiously by submitting more suspect samples than might be expected from more experienced trappers.

Quality assurance checks were carried out to evaluate the performance of both lures and trappers. Analysis of the lures revealed that they contained more than MPI's minimum requirement of 90 percent of the manufacturer's declared content of 2 000 mg active ingredient per lure. Marked specimens placed in traps enabled the trappers to be audited throughout the season. Altogether 91 marked specimens were planted, of which 70 (77 percent) were collected and submitted to the lab. Follow-up action was taken to trace the other 21 by re-checking traps, providing feedback to trappers and conducting further tests of performance. Full records were kept and it was concluded that KSI targets were met for the season.

Each season trap placements are reviewed in three surveyed areas – this time in Ashburton, Timaru and Oamaru. It was found that the present grids in Ashburton and Oamaru were adequate, but that waste-transfer and green-waste facilities north of Timaru were not covered. This gap will be addressed next season by relocating some traps from another area that is well covered, and by establishing three new sites around these facilities.

In conclusion, the 2017–2018 programme met its objectives. No new fruit-fly incursions were recorded, and quality assurance demonstrated that the trapping network was effective.

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National Saltmarsh Mosquito Surveillance Programme 2017–2018

In March 2018 the National Saltmarsh Mosquito Surveillance Programme (NSP) detected the exotic mosquito species *Culex (Culex) sitiens* Wiedermann 1828 at Parakai, 43 kilometres northwest of Auckland, at the south end of Kaipara Harbour. No other exotic mosquito species were detected by the NSP during the season, which runs from 1 July to 30 June in respective years. Post-border surveillance for exotic saltmarsh mosquitoes addresses the risk of exotic mosquitoes evading or bypassing border surveillance and reaching suitable habitat. Therefore ports of first entry and Transitional Facilities are high-priority locations for surveillance. High-quality habitats more remote from ports and Transitional Facilities are also included in the NSP because exotic species would also likely be detected there as younger generations of an emerging and dispersing population. Parakai was considered an unlikely location as it is not close to any international port or Transitional Facility, and was possibly not the point of entry. Investigations are ongoing.

Figure 1: NSP field officers undergoing sampling training in Australia

Figure 2: Mosquito sampling in brackish water habitat, Australia

Continued from page 70

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Rory MacLellan
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Plant Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Rory.MacLellan@mpi.govt.nz

Kerry King
Surveillance Coordinator
AsureQuality Ltd
Kerry.King@Asurequality.com

Achieving and maintaining NSP field officer competence requires periodic re-training in places where many high-risk species are actually present. Accordingly, during the 2017–2018 season all NSP field officers attended a re-training programme in Australia to interact with high-risk mosquito species in their native habitat. The training was designed to ensure officers could recognise the mosquitoes and the diversity of habitats used, and to further develop other field skills. Such training is a requirement of the NSP agreement between Mosquito Consulting Services NZ Unit Trust and MPI. The opportunity to participate in international training is also invaluable for keeping NSP officers highly motivated. (**Figures 1 and 2**).

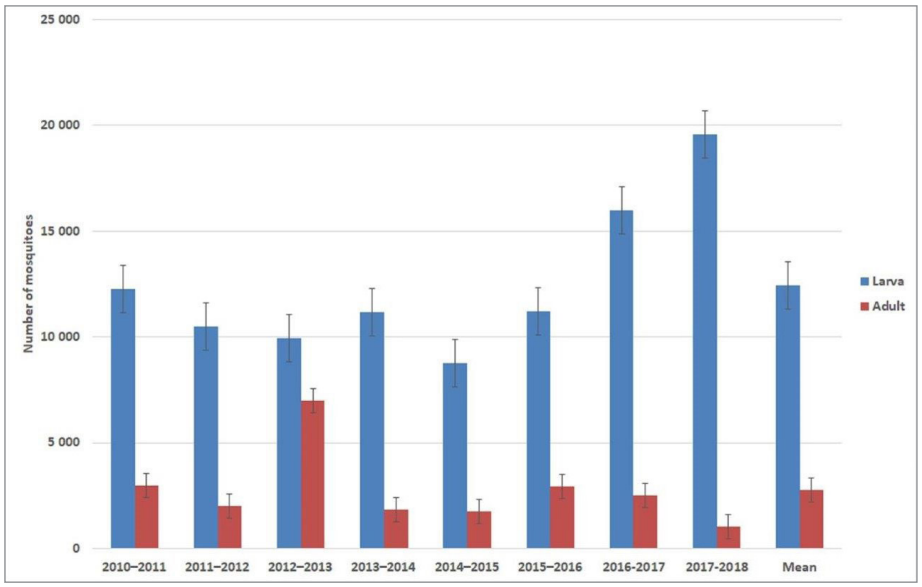

Figure 3: 1 July 2017 to 30 June 2018 NSP collection totals, with mean and SD bar

During the season the NSP detected 11 mosquito species including one exotic species. In all, 19 588 larvae and 1 038 adult mosquitoes were collected and identified to species level (**Tables 1 & 2**).

This season, significantly more mosquito larvae (19 588) were collected than in any previous year – far more than the long-term (2010–2018) annual mean of 12 424 (s.d. = 3 596) (**Figure 3**). The increase largely came from new NSP sampling locations adjacent to high-risk Transitional Facilities in Auckland and Tauranga, and from enhanced surveillance in those places as part of the *Cx. sitiens* investigation. The detection of an exotic species is a positive outcome from changes introduced to NSP methodology in 2016, which resulted in increased returns from mosquito sampling.

Table 1: Larval mosquitoes identified, 2017–2018

Aedes antipodeus	2 116
Culex pervigilans	16 940
Coquillettidia irucunda	0
Aedes notoscriptus	9
Culex quinquifasciatus	19
Aedes subalbirostris	380
Culiseta tonnoiri	0
Aedes australis	41
Coquillettidia tenuipalpis	0
Opifex fuscus	67
*Culex sitiens**	16
Total	**19 588**

* Exotic species

Table 2: Adult mosquitoes identified, 2017–2018

Aedes antipodeus	242
Culex pervigilans	484
Coquillettidia irucunda	28
Aedes notoscriptus	134
Culex quinquifasciatus	31
Aedes subalbirostris	113
Culiseta tonnoiri	1
Aedes australis	0
Coquillettidia tenuipalpis	4
Opifex fuscus	1
Total	**1 038**

Darryl McGinn
Mark Disbury
Mosquito Consulting Services (NZ)
PO Box 30719
Lower Hutt 5040
Wellington
Darryl.McGinn@mcspty.com
Mark.Disbury@mcspty.com

High risk site surveillance annual report 2017–2018

High Risk Site Surveillance (HRSS) is a Ministry for Primary Industries (MPI) surveillance programme designed to monitor post-border risk pathways, primarily targeting trees, shrubs and wood. The main objective of HRSS is to detect new plant pests and diseases that may pose a biosecurity risk, negatively impacting native forests, urban trees, plantation forests and other trees.

Methods

The HRSS programme identifies high-risk sites by considering entry pathways and associations with international travellers, cargo and mail. Sites are selected by taking into account information from which the risk of exposure can be estimated, such as volumes of traffic and time since arrival; and by associated activities such as opening sealed containers and inspecting imported vehicles. The programme surveys seaports, airports, Transitional Facilities (where containers are stored and/or devanned), tourist venues and other facilities used by international visitors, such as golf courses. Relative risk and the level of detection probability targeted are calculated using a new computer program that has been developed by MPI, the NZ Forest Owners' Association (NZFOA), Scion, AgResearch and the Australian Centre for Excellence in Biosecurity Risk Analysis (CEBRA). The purpose of this program is to improve allocation of surveillance resources; further details are provided below.

Risk Site Areas (RSAs) are established where there are clusters of high-risk sites, for example in parts of the North and South Islands that are near international seaports, airports and associated infrastructure with attendant biosecurity risks. Within RSAs, surveillance transects are assigned by identifying suitable areas of potential host vegetation from aerial photographs. Each RSA is furnished with sufficient transects to meet predetermined target levels of probability of detection. Along each transect, trained and experienced field surveyors thoroughly inspect trees, shrubs and woody material for signs of leaf damage, trunk cankers, rots, insect boring and tracking, fungal fruiting bodies, etc., that may indicate the presence of biosecurity risk organisms. Suspect samples are collected and submitted to an MPI-approved laboratory for identification. New records are validated by MPI. Where there is a possibility of a new pest or disease that might need further investigation, a report is lodged via the MPI exotic disease and pest hotline (0800 80 99 66) for further action. Validated records are lodged in MPI's Plant Pest Information Network (PPIN) database and reported quarterly in *Surveillance*. Each transect therefore provides a discrete, repeatable quantam of surveillance activity. Field surveyors also have discretion to take samples outside transects where a biosecurity issue is suspected. All sample locations are recorded in a geographic information system (GIS) database in case further action is required.

HRSS field work is administered by AsureQuality, whose staff carry out surveillance in the Taranaki region, and by SPS Biosecurity, whose staff do field work throughout the rest of New Zealand. HRSS methods are further detailed in Stevens (2011).

HRSS data recording is fully electronic, which improves efficiency and reduces errors. Data also accompanies sample submissions to the Scion Forest Health Reference Laboratory (FHRL). Digitising information has also enabled improved communication and information sharing: for example, diagnosticians are able to access transect data while examining samples.

In early May 2017, HRSS staff were deployed in a major MPI-led response to a myrtle rust incursion, so there were delays in achieving other targets around that time. However, a concerted effort by field staff meant all targets were achieved by the end of the season, in early June 2018.

Over the last 3 years representatives of MPI, NZFOA, Scion, AgResearch and CEBRA have been working together to produce a new risk-based model, which has helped to improve allocation of surveillance effort this season. The model is based on Bayesian network analysis and optimally allocates surveillance resources to areas where they are most needed. The model identifies significant pathways and potential establishment sites for exotic organisms and then calculates the exposure risk for each pathway. It maps exposure risk throughout New Zealand using GIS software. Exposure risk is assessed using knowledge gained from detailed pathway surveys. Information on the location of host species and estimates of establishment likelihood using climate models are used to map establishment risk. Then these results and information about the surveillance methods (including cost and effectiveness) are used in an optimisation model to allocate surveillance resources across the country, by method and required effort. The model provides estimates of maximised surveillance sensitivity within the constraints of a predetermined budget, thus improving detection probabilities and improving MPI's management options when incursions are detected. The new model includes new risk pathways and spreads the risk more widely across the urban landscape. This means a large number of new transects had to be set up in new areas, and in order to meet budgetary requirements this process has been spread over 2 years. In all, 1 060 new transects were established in 2017–2018, and 579 are to be established in 2018–2019.

Results

Field surveillance

To co-ordinate submissions and diagnostics reports for the 2016–2017 annual report, the decision was made to cut off reporting at the end of May 2017. There were 50 submissions after 31 May in the 2016–2017 season and these submissions have been included in the figures for this season.

Table 1: Calculated regional effort compared with actual effort in 2017–2018

Biological region	Calculated apportionment of effort (percent)	Actual effort expended on transect inspections (percent)
Auckland	40	39
Canterbury	11	11
Bay of Plenty	9	11
Waikato	9	5
Wellington	8	7
Other regions	23	27

During the season 930 RSAs were surveyed and 6 992 transect inspections were completed. Surveillance priorities were adjusted to compensate for demands from the myrtle rust response and to enable output from the new model to be implemented. For Round 1, transects containing myrtle rust host species were prioritised for inspection, and in these transects, both myrtle rust hosts and other species were inspected. During Round 2, there was less need to conduct myrtle rust inspections, so transects were added in 125 new RSAs recommended by the new model. During Round 3, more transects were added and extra sites associated with tourist visits were inspected.

Table 1 shows, for the five biological regions most at risk, the biosecurity risk calculated by the model compared to the actual effort expended in each region. The model shows that Auckland has the country's highest biosecurity risk, which presumably is directly related to the volume of passengers and goods entering the country and being unloaded there.

The programme inspected 1 182 different plant species during the 2017–2018 season and 57 percent of the plants inspected were native species. This year 231 049 plants were inspected. This meant that on average 33 plants were inspected per transect.

Diagnostics

Most diagnostic input to the HRSS programme was provided by Scion's Forest Health Reference Laboratory (FHRL), including entomology and mycology. MPI's Plant Health & Environment Laboratory (PHEL) provided virology, bacteriology and nematology services and validated new to New Zealand records.

Samples submitted consisted of both damaged plant material and suspect organisms such as insects or fungal fruiting bodies. From June 2017 to June 2018 the diagnostic labs received 791 submissions, from which 935 identifications were made (some submissions yielded more than one species to be identified.) Most of the submissions were insects (40 percent) and 29 percent involved fungi. **Table 2** shows the percentages of submissions for the last 5 years, and shows that the proportion of fungal samples has nearly doubled in that time. The remaining 31 percent of samples yielded inconclusive results at first but were studied further to rule out other causes. About 3 percent of the identifications were of bacteria, viruses or nematodes, and no cause was identified in 25 percent of all samples. In the case of these latter samples, the signs seen were caused by environmental factors or old damage where the causal organism was no longer present, or the field surveyors were encountering hosts they had not seen before.

Of the organisms identified, 59 percent (332) were identified to species. Of the 41 percent (230) that could not be identified to this level, 23 percent (127) were identified to genus. The programme yielded four new to New Zealand records and 156 new host or new distribution records. The new to New Zealand records have been evaluated for risk and will be published in the Surveillance Pest Watch tables once they have been validated. All identifications made by FHRL were completed or fully evaluated for risk within 15 days after submission, and 86 percent of insect identifications were completed within that time. The MPI PHEL laboratory received 94 submissions.

Table 3 summarises sample numbers received and lists "significant" identifications (species new to New Zealand, new host associations and new distribution records) from 2013 to 2018. Also listed are numbers of species regarded as significant by MPI's Plant Pest Information Network (PPIN).

Table 2: Summary of identifications carried out by FHRL and PHEL, 2013–2018

Sample type	2013–2014 (percent)	2014–2015 (percent)	2015–2016 (percent)	2016–2017 (percent)	2017–2018 (percent)
Entomology	61	61	52	42	40
Mycology	16	18	26	34	29
Inconclusive or other	23	21	22	24	31
Total	**100**	**100**	**100**	**100**	**100**

Source: Saavedra Roman *et al.*, 2018

Table 3: Diagnostic trends, 2013–2018

Type	2013–2014	2014–2015	2015–2016	2016–2017	2017–2018
Submissions	860	651	841	843	791
Diagnostic outcomes	1 154	896	1 109	1 117	935
New to NZ species found	2	0	7	9	4
Species significant to PPIN	153	135	159	164	156
Significant detections (percent of total submissions)	18	21	20	20	20

Source: Saavedra Roman *et al.*, 2018

Conclusion

The percentage of significant detections has remained constant over the last 5 years. Detection of new to New Zealand species is a key measure of the effectiveness of this surveillance programme. MPI is considering this in regard to the detection of significant

pests and diseases and how the programme contributes to developing relationships with stakeholders via Government Industry Agreements (GIAs) and with the Department of Conservation.

MPI has continued to use a modelling approach to ensure optimal deployment of resources, and used an updated model for the first time in 2017–2018. The model and its results will be evaluated once it is fully implemented, to assess the benefits.

The myrtle rust response was challenging for HRSS owing to competition for surveillance resources. However, several significant benefits were identified: for example, the programme provided an immediate reference point for the myrtle rust response, by using existing transects and HRSS experience for the delimiting survey. It has also raised the question of future development, important plants and their threats, and the need to further consider priorities.

The HRSS programme will be changing over the next few years. As well as implementing the new model, the NZFOA will be implementing a new Forest Biosecurity Surveillance (FBS) programme, which will take over work previously done as part of the HRSS. In response the HRSS has made some adjustments during this season and MPI is considering its further development.

References

Saavedra Roman M, King K, Sopow S, Bennett S (2018). High Risk Site Surveillance: Annual Report from Suppliers 2017–2018. Unpublished report.

Stevens P (2011). High Risk Site Surveillance Annual Report 2010–2011. *Surveillance* 38(3), 72–74.

Paul Stevens
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Plant Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Paul.Stevens@mpi.govt.nz

Gypsy Moth Surveillance Programme annual report 2017–2018

Gypsy moth, *Lymantria dispar*, is a severe defoliator of trees with a wide host range and is regarded as a high-impact economic and environmental pest. A major outbreak of gypsy moth in New Zealand could severely impact forestry, horticulture, tourism and amenity plantings in urban parks and gardens. There could also be impacts on the indigenous flora.

In response to the growing risk from increased trade, in 1992 the Gypsy Moth Surveillance Programme (GMSP) was developed to provide early warning of incursions, to enable eradication and provide direct evidence that New Zealand is free of this pest. To achieve this, the GMSP conducts seasonal monitoring with pheromone traps placed on favoured hosts at high-risk locations for gypsy moth, such as around sea ports and container depots. In addition to the trapping programme a public communication programme is carried out, using letters, leaflets, cards and reports to promote the biosecurity message about this unwanted species.

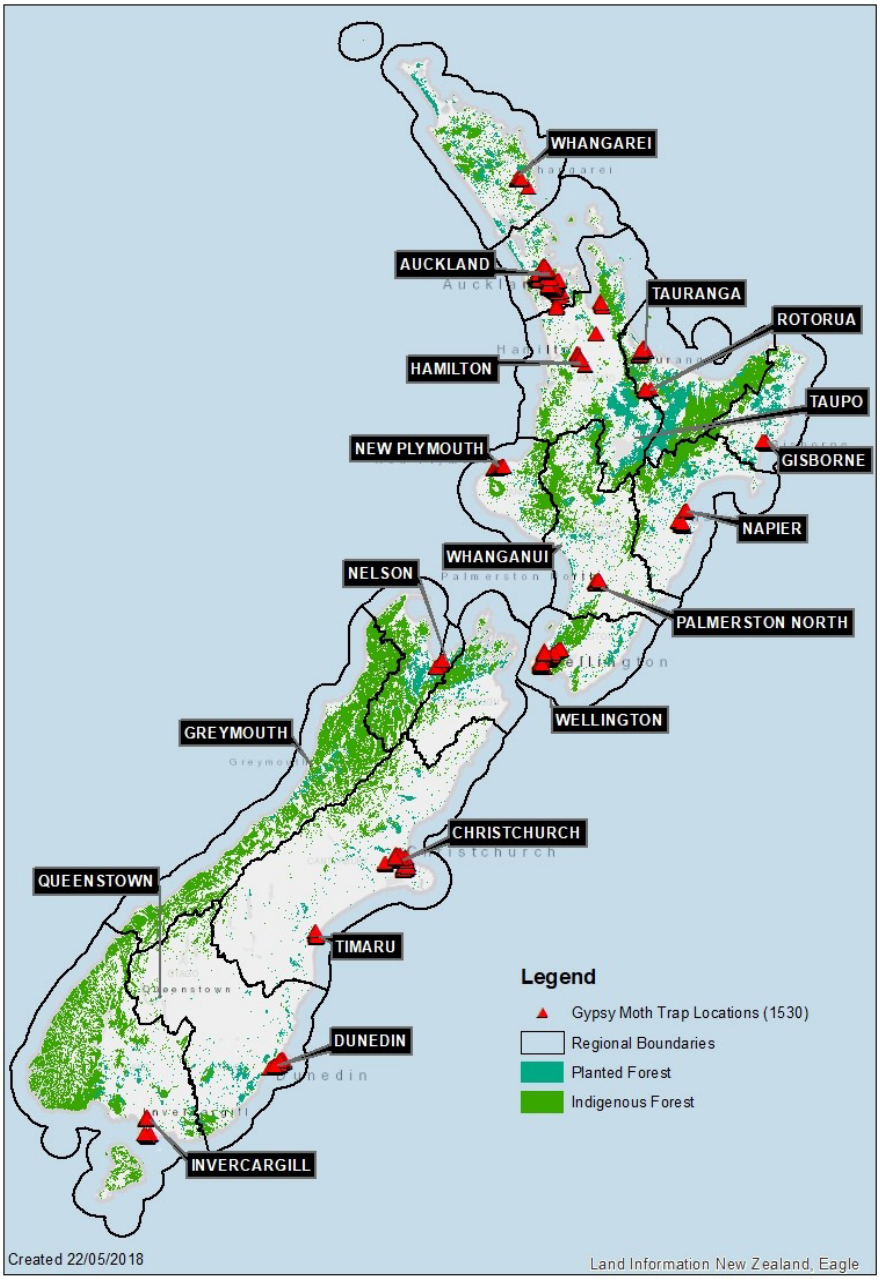

Figure 1: Map of New Zealand showing distribution of trap sites for gypsy moth surveillance, 2017–2018

AsureQuality, as a provider of biosecurity services, has delivered the GMSP under contract for almost 20 years.

Trapping

The surveillance season runs from late spring to late autumn and about 1 500 pheromone traps are deployed. Traps are placed in grids that cover the high-risk areas identified by MPI. Each cell in the grid measures 750 x 750 metres and contains a single pheromone trap for the duration of the season. The minimum size of each grid is two adjoining cells, to provide a greater opportunity of attracting moths into the effective sampling area of the traps. In coastal areas a buffer zone consisting of a line of traps is used to intercept any moths that might fly to land from nearby vessels. The distribution of surveillance locations throughout New Zealand is shown in **Figure 1**, and an example of a grid overlying a topographical map is shown in **Figure 2**.

Within each cell in a grid, a host tree as close to the grid centre as possible is selected for trap placement. A hierarchical ranking of the most suitable host trees is used. The traps are attached to the trunk or a branch of the selected tree, 1.3–2 metres above the ground. Rarely, if nothing else is available, an artificial structure may be used. Green delta traps (**Figure 3**) with two sticky internal sides are used, and are labelled "Gypsy Moth Trap", displaying the MPI and AsureQuality logos and a freephone contact number. Each trap contains disparlure, the main sex pheromone of the gypsy moth. New traps are used at the start of each season and lures are replaced once during the season, after they have been in the field for 12–14 weeks. Used traps and lures are destroyed at the end of the season. To avoid the possibility of interference, traps are not placed in trees bearing other pheromone traps, e.g., for fruit flies.

Quality assurance measures include system documentation and having trappers attend annual refresher courses. Lures are independently tested and

calibrated before each season and traps are replaced immediately if they are missing or damaged. There are periodical audits, updates and improvements, and comprehensive records are kept.

Results

The trapping season ran from 23 October 2017 to 27 April 2018. The number of traps per run ranged from four to 83 (mean = 42.5), with a total deployment of 1 530 traps. A trap run is a series of traps within a defined geographic area that are serviced by one trapper every 13–15 days. Suspect moths are submitted to Scion entomologists for identification to family level. Scion is the New Zealand forestry Crown Research Institute and authority on forest biosecurity.

During the season there were 20 228 trap site visits and 249 suspect moths were submitted for identification. Most submissions (46 percent) came from he Auckland/Northland region and included 115 suspect moths (**Table 1**). The greatest number of submissions (22 percent) occurred during January (**Figure 4**; **Table 1**).

The percentages of sample submission events by month are shown in Figure 4. The majority of submissions (57 percent) were received from November to January inclusive. The number of samples submitted usually diminishes in autumn (April and May). However, this season there was a decrease in submissions during February, which may have been due to the 149 percent increase in average rainfall during this time. There was also an increase in submissions during April, possibly the result of a number of new staff acting cautiously by submitting more suspect samples than might be expected from more experienced trappers.

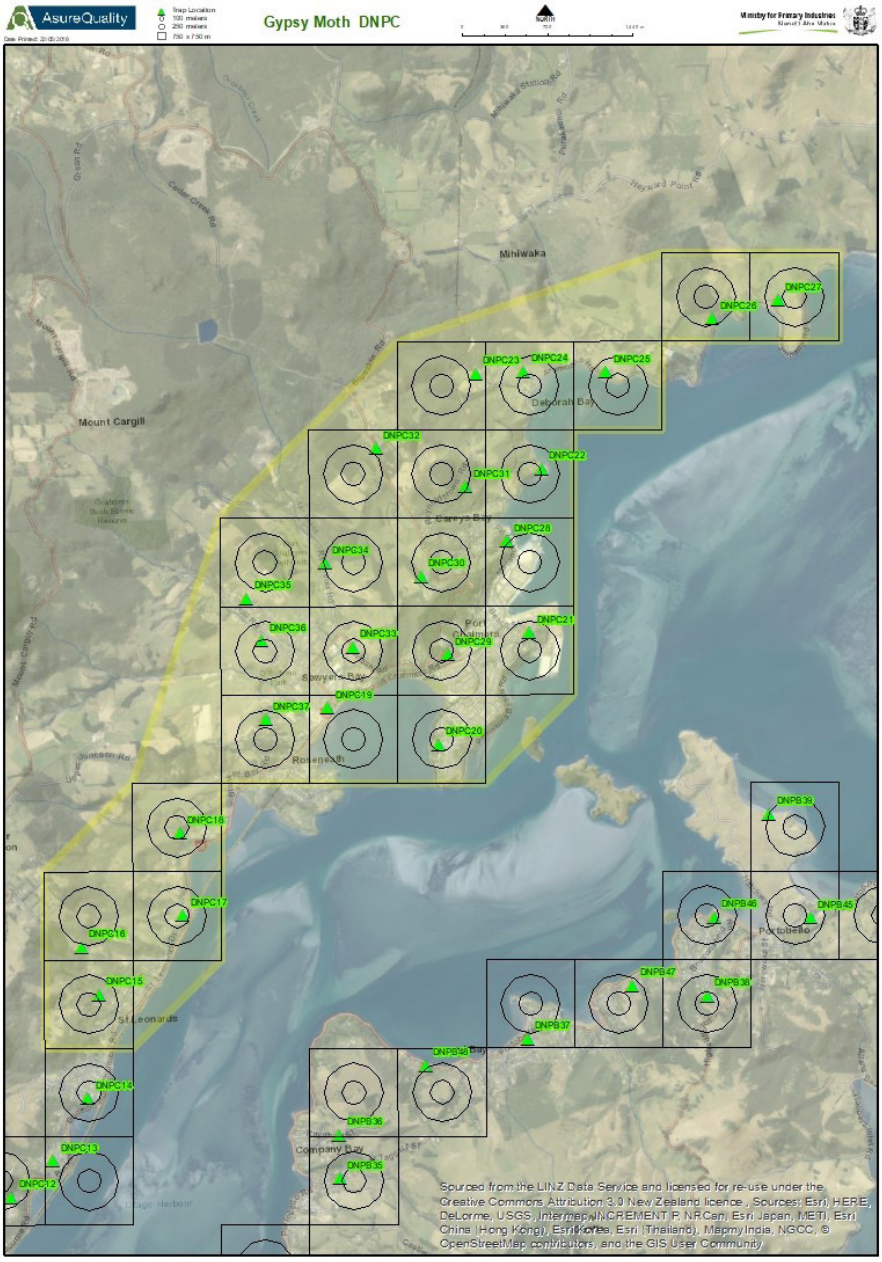

Figure 2: Example of a trapping grid overlying a topographical map, Port Chalmers, Otago. Each cell within the grid measures 750 x 750 metres

Table 1 shows the number of suspect moths submitted each month by region. The Auckland/Northland region provided the most submissions, in December, January and April. There was also an unexplained spike in the South Island in February, with all other areas being fairly consistent in the remaining months. Overall the number of sample submissions this season increased by 67 percent over 2016–2017.

No gypsy moths were found during the season. Moth specimens submitted

Table 1: Numbers of suspect moths submitted during the 2017–2018 surveillance season, by region

Region	October 2017	November 2017	December 2017	January 2018	February 2018	March 2018	April 2018	Total
Auckland/ Northland	1	9	19	36	6	16	28	115
Waikato/Bay of Plenty	0	3	7	2	3	5	7	27
Lower North Island	3	18	10	12	1	7	5	56
South Island	8	15	7	5	13	2	1	51
Total	**12**	**45**	**43**	**55**	**23**	**30**	**41**	**249**

Figure 3: Checking a gypsy moth pheromone trap attached to a tree

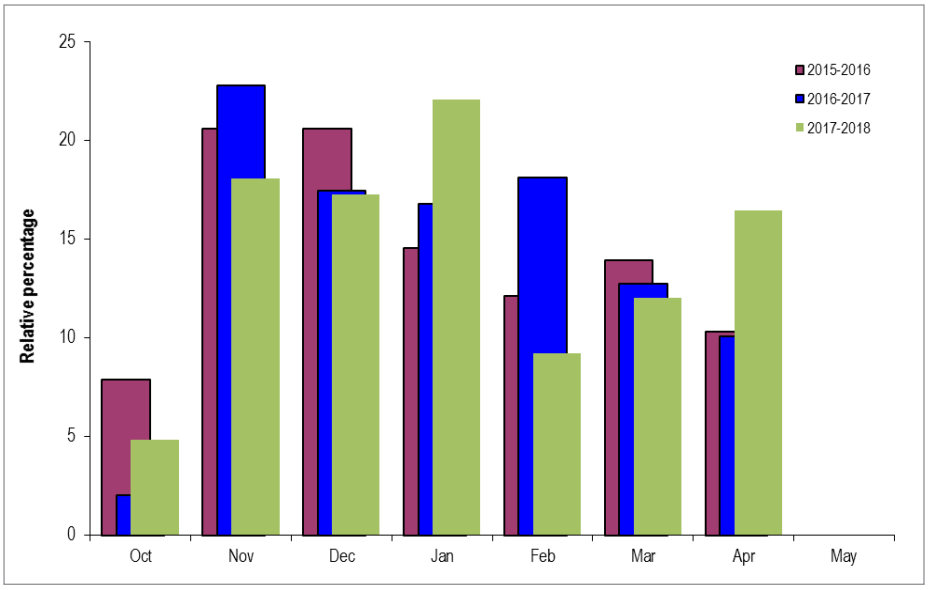

Figure 4: Percentage of suspect gypsy moth sample submissions by month

were mainly (157; 63 percent) members of the family Noctuidae. Other moth families seen in this year's samples include: Geometridae 21 (8 percent), Oecophoridae 3 (1 percent), Crambidae 3 (1 percent), Arctiidae 2 (1 percent), Xyloryctidae 1 (< 1 percent) and Hepialidae 19 (8 percent). Forty-three specimens from other moth families made up the remaining 17 percent.

Key Service Indicator targets were all met for the programme during the season. Gypsy moth lures were tested for their levels of disparlure, the major sex pheromone of the gypsy moth. Three new lures tested contained 470, 436 and 396 µg and three unused lures left over from 2016 contained 371, 377 and 489 µg. It was concluded that all these lures would be adequate for monitoring male gypsy moth as they met the minimum requirement of 275 µg.

Marked look-alike gypsy moth samples were planted in some traps throughout the season to test the efficacy of the trappers in recognising and submitting real gypsy moths. Altogether 38 marked specimens were planted, of which 34 (89 percent) were successfully collected and submitted to the lab. With the four cases where marked specimens were not submitted, follow-up action was taken which included re-checking traps, providing feedback to trappers and conducting further tests of performance. These records are kept and reported to MPI together with follow up actions that are taken.

During each season, as part of the programme a review is conducted of trap placement in three of the areas surveyed – this time in Timaru, Rotorua and Hawke's Bay. This year's review revealed that there were some Transitional Facilities outside the boundaries of each grid, but they were mainly engaged in export business and did not pose an entry risk for gypsy moth. Therefore no changes were made to the current grid and trap placement.

The 2017–2018 GMSP met its objectives. No new incursions of gypsy moth were recorded. Large numbers of samples were collected and identified, and the sampling programme was scientifically robust. The programme also met all quality assurance requirements.

Acknowledgements

MPI would like to thank AsureQuality and Scion for their contribution to this report.

Rory MacLellan
Senior Adviser
Biosecurity Surveillance and Incursion Investigation (Plant Health)
Diagnostic and Surveillance Services Directorate
Biosecurity New Zealand
Ministry for Primary Industries
Rory.MacLellan@mpi.govt.nz

Kerry King
Surveillance Coordinator
AsureQuality Ltd
Kerry.King@Asurequality.com

Pest watch: 24 May–24 July 2018

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 23 May to 24 July 2018. 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
Chromist	*Nothophytophthora amphigynosa* no common name	In soil	Waikato	Scion (General Surveillance)	First described in 2017
Fungus	*Aspergillus egyptiacus* no common name	Inanimate host	Auckland	PHEL (General Surveillance)	Found from environmental samples and not associated with any plant disease
Fungus	*Phaeoacremonium viticola* no common name	*Vitis vinifera* grape vine	Marlborough	PHEL (General Surveillance)	Isolated from symptomatic vines
Insect	*Carposina neurophorella* moth	Caught in light trap	Auckland	Landcare Research (General Surveillance)	This species occurs in Australia and is associated with Casuarina spp.
Insect	*Haplonyx* sp. weevil	*Eucalyptus* sp.	Auckland	Plant & Food Research (General Surveillance)	Generally lives on Eucalyptus; larvae develop in flower and fruit buds
Mite	*Eharius chergui* phytoseiid mite	*Marrubium vulgare* common horehound	Hawke's Bay	PHEL (General Surveillance)	Considered a predatory species
Spider	*Dolomedes facetus* fishing spider	on water surface	Northland	PHEL (General Surveillance)	Present in Australia, Indonesia, Samoa & Vanuatu. Feeds on aquatic arthropods and small fish.

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

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

SVS LABORATORY

- HAMILTON
  Physical Address: 524 Te Rapa Road, Hamilton 3200
  Postal Address: PO Box 10304, Hamilton 3241
  Ph: 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

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Biosecurity New Zealand
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