



Biosecurity New Zealand

Ministry for Primary Industries
Manatū Ahu Matua

Surveillance

Ministry for Primary Industries reporting on New Zealand's Biosecurity Health Status

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Inside this issue:

Animal health surveillance and incursion investigation
National fruit fly surveillance programme annual report
Poultry health surveillance

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



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EDITORIAL

Relying on every Kiwi to play their part

Welcome to the *Surveillance* 2023 Annual Report. This year is a milestone 50th anniversary for *Surveillance* which has been in continuous publication since its inception in 1974. This edition provides information on the biosecurity surveillance activities undertaken by MPI and many others throughout New Zealand who are working every day to protect the health status of our animals and plants in both the terrestrial and aquatic environments. As well as protecting the health of these populations, this work is critical to maintaining ongoing market access for our primary products, which is so crucial to the performance of the New Zealand economy.

Any incursion has the potential to harm animal, human or plant health, social or cultural values, or the economy. It is critically important that MPI is well prepared to respond promptly and effectively, thus minimising the impact of both an incursion and the measures taken in response. On considering our structure, we identified that the system would function more effectively if the readiness activities were brought closer to surveillance and incursion investigation, the Plant Health and Environment Laboratory (PHEL) and the Animal Health Laboratory (AHL), as readiness requires input from the expertise present in all these teams. As a consequence, the Diagnostics & Surveillance Directorate has now become the Diagnostics, Readiness & Surveillance Directorate. The benefits of this change are already becoming apparent as we prepare to meet the risk of a highly pathogenic avian influenza incursion. Our teams are busy preparing plans and talking with the poultry industry, and as this editorial is being written, a delegation from MPI that includes a surveillance team member along with representatives from the poultry industry has been in the United Kingdom on a fact-finding mission to inform the measures we are developing for a potential incursion.

Throughout this period of change, it's important to note that there are no changes to our surveillance and incursion investigation functions. The breadth and extent of the work that has been described in this annual report continues in 2024 as it had in 2023. We hope that you will enjoy reading about the excellent work that has been completed across New Zealand.

It is important to remember, that despite all the work that teams within MPI and in other organisations across New Zealand do every day, New Zealand's ongoing biosecurity relies on every Kiwi to do their part also.

Whether that means being aware and careful when you travel overseas to ensure you don't bring something home with you that could put our biosecurity at risk, or calling MPI on our hotline 0800 80 99 66 whenever you suspect an exotic pest or disease is present, we all have an important part to play in protecting our way of life.

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ANIMALS

Annual reports from Ministry for Primary Industries

International animal trade

Risk analysis

The Ministry for Primary Industries (MPI) Animal Risk Assessment team¹ has the primary function of developing science- and evidence-based biosecurity risk assessments that support the development and review of Import Health Standards (IHSs), which govern how risk goods (animals and animal products) are to be safely imported into New Zealand.

The team produces risk analyses that assess the biosecurity risks and potential effects on human health and the New Zealand environment and economy that may be associated with the importation of risk goods and propose risk management options, when appropriate.

The team also provides science advice and risk assessments to support post-border activities including surveillance, animal disease emergency readiness, incursion response and risk advice for the Government Industry Agreement partners. The team works with internal and external stakeholders to identify and characterise emerging biosecurity issues that involve terrestrial and aquatic animals and evaluates and proposes risk management options.

Risk analyses may be import risk analyses (IRAs), rapid risk analyses (RRAs), supplementary risk analyses (SRAs), risk reviews (RRs) or technical advice. Analyses produced by the team for the period July 2023 to June 2024 are summarised below.

Supplementary import risk analysis: Cooked duck eggs and duck egg products (September 2023)

This supplementary analysis provided a scientific analysis of the biosecurity risks associated with cooked duck eggs and duck egg products. The analysis will help to add cooked duck eggs and duck egg products as eligible

commodities in the current import health standard for egg products.

Import risk analysis: Zoo tapirs (May 2024)

This analysis supported the development of an IHS for Brazilian and Malayan tapirs from Australia, the European Union, Malaysia, Singapore, Thailand and the United Kingdom.

Technical advice: Likelihood of foot and mouth disease spreading and being maintained in New Zealand wildlife (February 2024)

This advice supported the policy and decision-making on the management of wildlife in the event of a foot and mouth disease (FMD) incursion in New Zealand. The FMD-susceptible New Zealand wildlife assessed in this advice includes feral pigs, wild deer, feral goats, tahr, chamois and feral sheep.

Other technical advice

The Animal Risk Assessment team provided the following risk advice and technical advice to support decision-making and IHS development within MPI:

- options for risk management of *Brucella canis* via importation of pregnant dogs (July 2023);
- biosecurity risks of scrapie in imported sheep and goat milk (July 2023);
- biosecurity risks associated with importation of orange roughy (*Hoplostethus atlanticus*) from Mauritius (September 2023);
- biosecurity risks associated with the use of animal origin imported ingredients (beef/pork extract, peptones, pancreatic enzymes and pepsin powder) for the production of animal vaccines (October 2023);
- bovine spongiform encephalopathy (BSE) risks associated with bulk importation of commercially produced chondroitin for cattle feed supplement (October 2023);

- biosecurity risks associated with importation of dried sea cucumber for human consumption (October 2023);
- thermal processing requirements for fish meal (October 2023);
- biosecurity risks associated with the importation of probiotics for livestock feed (October 2023);
- inactivation of Cache Valley virus and epizootic haemorrhagic disease virus (October 2023);
- efficacy of sodium acetate-acetic acid-formalin fixatives in managing the biosecurity risk of intestinal parasites and faecal samples (October 2023);
- biosecurity risks of heat-treated bovine serum albumin (December 2023);
- biosecurity risks associated with bovine origin meat extract in culture media used in animal vaccine production (December 2023);
- heat inactivation of bovine serum (February 2024);
- degree of filtration required to remove bacteria, mycoplasmas and viruses from bovine serum (March 2024);
- biosecurity risks of biofertiliser transmitting atypical BSE (April 2024);
- exotic virulent strains, vertical transmission and tests for *Babesia gibsoni* in dogs (May 2024);
- biosecurity risks associated with gene-edited porcine kidney fibroblast cells (May 2024); and
- biosecurity risks of scrapie in goat semen (June 2024).

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¹ As of 1 July the Animal Risk assessment team has become the Animal and Aquatic Risk team in the Biosecurity Import and Export Standards Directorate.

Animal imports

The MPI Animal Imports team² is responsible for developing and amending import health standards (IHSs) that stipulate biosecurity requirements for importation of

Table 1: Number of import permits issued by Animal Imports team

Stock	Product type	No
Animal products	Animal products mixed	258
	Bee	26
	Dairy	2
	Egg	13
	Fibre	8
	Fish	17
	Hides/skins	2
	Meat (other)	5
	Pig meat	20
	Wool	3
	Total	354
Biologicals	Biological products, micro-organisms and cell cultures	388
	Total	388
Embryos	Bovine	8
	Ovine	6
	Total	14
Semen	Bovine	61
	Canine	1
	Cervine	1
	Equine	4
	Ovine	9
	Total	76
Live animals	Butterfly pupae and eggs	2
	Dogs/cats	1,871
	Donkeys	1
	Goats	1
	Hatching eggs	16
	Horses	24
	Invertebrates	34
	Laboratory animals	21
	Ornamental fish and marine invertebrates	11
	Rabbits	2
	Sheep	1
	Zoo animals	7
	Total	1,991
Transit live animals	All	112
Total permits issued		2,935

live animals, germplasm and animal products. The team provides advice to the public and technical advice to staff at the New Zealand border.

Some IHSs require that the animal or animal product is accompanied by a current import permit to assist with clearance at the border. The Animal Imports team is responsible for issuing these permits, and 2,935 permits were issued during 2023 (**Table 1**). 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 2023 are listed in **Table 2**. These are estimates based on importers' stated intentions and may differ from the numbers actually imported.

The following is a summary of new or amended IHSs issued during 2023.

Import Health Standard: Giant River Prawns (*Macrobrachium rosenbergii*)

This IHS was issued on 23 November 2023 and specifies the requirements for importing giant river prawns (*Macrobrachium rosenbergii*) from Thailand and Israel. It revokes the IHS for Freshwater Prawns from Hawaii. The risk management measures are based on the Supplementary Import Risk Analysis: Freshwater Prawn (*Macrobrachium rosenbergii*) Broodstock from Thailand and Israel.

Table 2: Live animal imports by group

Species	Number of exports
Aquatic – ornamental fish and marine invertebrates	631,762
Avian hatching eggs	411,840
Butterfly eggs and pupae	69,065
Cats	1,456
Dogs	3,087
Donkeys	7
Horses	1,337
Goats	15
Invertebrates	8,712
Laboratory animals – mice and rats	144
Rabbits	4
Zoo animals	9

Import Health Standard: Zoo Rhinoceroses

This IHS was issued on 29 May 2023 and specifies the requirements for importing white rhinoceroses (*Ceratotherium simum*) and black rhinoceroses (*Diceros bicornis*) from Australia, the European Union, Singapore, South Africa, the United Kingdom and the United States into zoo containment in New Zealand. The IHS replaces two previous import standards from Australia and South Africa. The risk management measures are based on an updated biosecurity risk assessment.

Import Health Standard: Egg Products

This IHS was issued on 26 April 2023 and replaces the standard issued in 2019. This standard includes measures for high pathogenicity avian influenza and Newcastle disease while removing specific measures for Angara disease. Additionally, shelf-stable processed foods containing egg were moved from this standard to the IHS Specified Animal Products to allow for better alignment of food products.

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² As of 1 July the Animal Imports team has become the Animal and Animal Products team and Animal Approvals and Advice team, both in the Biosecurity Import and Export Standards Directorate.

Exports of live animals and germplasm

Export volumes

Export figures for live animals and germplasm for 2023 are presented in **Tables 3 and 4**. **Table 3** compares live animal and germplasm exports from 2014 to 2023, and **Table 4** shows the global distribution by region, of exports for 2023.

Exports of cats and dogs continue to increase, with 6,011 animals being exported in 2023 (**Table 3**). Over 70 percent of the cats and dogs are exported to Australia. Exports to Central and South America have almost doubled compared with previous years; however, volumes are still low, with fourteen animals traveling to destinations in this region in 2023 (**Table 4**, page 8).

The export of livestock by sea ceased in April 2023, and the export figures reflect the fact that most of the live cattle exported to China in previous years were exported by sea. The total volume of live cattle exported in 2023 at 28,686 animals is over 80 percent lower than in 2022 (**Table 3**).

The small ruminants (sheep and goats) are exported by air and 2023 saw an

increase in the export of goats, with 3,778 animals being exported to China (**Table 4**), an increase of 80 percent over exports in 2022 (**Table 3**).

Despite export volumes being unpredictable, exports of poultry genetics (day-old chicks and hatching eggs) continue an upward trend and the export of 6,184,941 hatching eggs in 2023 represents an increase of 30 percent over 2022 (**Table 3**). Most poultry are exported to the Pacific islands and southeast Asia (**Table 4**).

Number of export certificates agreed

During 2023 there were 33 Overseas Market Access Requirements (OMARs) or export certificates agreed to, issued and notified as notices under the Animal Products Act 1999. Of these, ten notices represent requirements for new markets, while the rest were amendments to existing OMARs.

Continuous improvement in animal exports

Following the tragic loss of the livestock export vessel, the *Gulf Livestock 1*, in September 2020, an independent report (the Heron Report) was completed and recommended several changes to the procedures involved in exporting cattle from

New Zealand. These changes were the initial basis of MPI's Continuous Improvement Programme (CIP) for livestock exports by sea. The CIP aimed to improve welfare standards during the export process and ensure the animals were well prepared for their journey, experienced lower levels of stress while on the vessel, and were well managed post-arrival.

One of the key outputs of the CIP was the comprehensive update of the 'Livestock Export by Sea: Guidance for Cattle'. These guidelines also aligned New Zealand requirements with current standards set by the World Organisation for Animal Health (WOAH) and the Australian Standards for the Export of Livestock (ASEL). Significant modifications were made in consultation with an industry working group, many targeting the more vulnerable animals on the vessels, including young, small, or pregnant animals.

Before the cessation of the export of livestock by sea in April 2023, which was announced by the Minister of Agriculture Damien O'Connor in April 2021, MPI formed a new Continuous Improvement in Animal Exports (CIAE) team, located within the Animal Exports team, to ensure world-leading

Table 3: Comparison of live animal and germplasm exports from 2014 to 2023

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Bees (packages [kg], queen and bumble)	44,116	40,675	31,211	18,646	31,906	26,849	20,246	17,466	16,960	33,338
Bovine embryos	536	437	457	196	222	313	190	87	115	178
Bovine semen	1,596,560	1,251,776	1,253,030	1,628,656	1,525,086	1,546,061	1,219,442	1,539,988	1,761,932	1,540,742
Canine semen	420	47	33	200	129	177	144	288	300	216
Caprine semen	1,266	300	4,439	40	5,556	2,000	11,300	500	23,300	9,070
Cats and dogs	4,278	4,045	3,507	4,164	4,349	4,099	2,488	3,610	4,837	6,011
Cervine embryos	108	203	199	140	264	247	294	208	527	615
Cervine semen	816	1,557	2,275	633	1,803	1,826	4,108	1,286	260	1,773
Equine semen	3,032	4,119	6,324	4,418	3,086	2,856	3,281	1,224	808	970
Live alpacas and llamas	200	228	80	41	126	75	112	141	22	14
Live cattle	85,732	21,186	40,506	27,306	17,319	39,489	104,147	121,666	153,722	28,686
Live deer	0	28	0	0	0	0	0	0	0	0
Live goats	35	0	1,184	18	757	3,919	5,840	2,381	2,027	3,778
Live horses	2,622	2,713	2,706	2,655	2,999	2,898	2,424	2,322	2,355	2,379
Live sheep	1,082	45,166	300	123	239	50	42	1,433	39	195
Ovine embryos	1,836	825	2,778	809	200	200	903	908	1,230	480
Ovine semen	5,518	5,049	6,492	9,569	3,960	12,068	2,933	7,967	6,230	4,646
Poultry (day-old chicks)	1,700,483	2,221,689	2,442,609	2,787,409	2,838,496	2,990,774	2,364,147	2,411,356	3,427,550	3,189,406
Poultry (hatching eggs)	3,036,075	4,076,927	3,700,891	5,705,973	3,563,890	5,628,060	4,770,293	4,031,850	4,754,240	6,184,941

Table 4: Volume of live animal and germplasm exports to various regions in 2023

	Africa	Asia	Australia	Canada	Central and South America	Europe	Middle East	Pacific Islands	United States	Total
Bovine embryos	0	0	178	0	0	0	0	0	0	178
Bovine semen	377,020	7,499	193,318	505	595,505	339,467	0	500	26,928	1,540,742
Canine semen	0	0	190	0	0	26	0	0	0	216
Caprine semen	0	9,070	0	0	0	0	0	0	0	9,070
Cats and dogs	40	414	4,373	117	14	601	23	101	328	6,011
Cervine embryos	0	0	210	57	0	0	0	0	348	615
Cervine semen	0	0	265	0	0	191	105	0	1,212	1,773
Equine semen	0	0	890	0	0	0	0	0	80	970
Live alpacas and llamas	0	0	0	0	0	14	0	0	0	14
Live cattle	0	28,686	0	0	0	0	0	0	0	28,686
Live goats	0	3,778	0	0	0	0	0	0	0	3,778
Live horses	0	294	2,037	0	0	26	0	0	22	2,379
Live sheep	0	123	0	0	31	41	0	0	0	195
Ornamental birds	0	189	2	0	0	0	0	0	0	191
Other	0	1	60	0	0	0	0	0	2	63
Ovine embryos	0	0	0	12	21	0	0	0	447	480
Ovine semen	237	0	0	216	3,108	0	0	0	1,085	4,646
Poultry (day-old chicks)	0	1,841,199	0	0	0	0	0	1,348,207	0	3,189,406
Poultry (hatching eggs)	0	1,991,444	30,060	0	0	0	0	4,125,097	38,340	6,184,941
Zoo animals	0	1	2	0	0	0	0	0	0	3
Bees (packages [kg], queen and bumble)	0	0	0	33,338	0	0	0	0	0	33,338

animal welfare standards for other species of animal exported by sea or air. The CIAE team will continue to work closely with stakeholder groups exporting other species of animals to ensure New Zealand maintains its global reputation as a trusted food producer and that animal welfare remains at the forefront of live exports.

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* Following MPI's Improving our Efficiency change process, which resulted in a new structure from 1 July 2024, the Animal Health (Endemics) team and the Animal Exports (Regulations) team have been merged into a single Animal Health & Exports team. A separate Export Process Team has been created to continue the work of the continuous improvements in animal exports.



Animal Health Laboratory annual report

Introduction

The Ministry for Primary Industries (MPI) Animal Health Laboratory (AHL; Wallaceville, Upper Hutt) operates as New Zealand’s central veterinary reference diagnostic laboratory. It provides internationally accredited diagnostic methods that contribute to investigations of transboundary animal disease, surveillance and trade. The scope of our work is broad, covering a wide range of host species and their associated pathogens including terrestrial and aquatic species, domesticated, feral and wild. The unique range of capability at this laboratory is a strategic asset for the protection of animal industries from new and emerging disease threats. Vital to our success is the scientific expertise of our staff, who come to us from across New Zealand and the world, and maintain active connections with veterinary experts worldwide. The past year has been eventful and has allowed us to build our capability in aquatic animal disease, improve methodologies in genomics, progress implementation of our high-throughput diagnostic capability and strengthen our capability in the diagnosis of high-risk zoonotic pathogens. In addition, we have contributed to the field of

biosafety through a range of activities including international presentations and publications. This report documents some of our key work in 2023 and documents how we are delivering on our objectives to protect New Zealand.

Facilitating trade

One of the core functions of the AHL is diagnostic testing to support international trade by our primary industries. In 2023, more than 10,500 tests were performed to directly support exports and imports (Table 1).

Capability

The AHL carries out tests for known or suspected infectious animal diseases that could have a serious effect in New Zealand. The laboratory maintains its accreditation and certification to national and international standards. The staff are divided into seven teams, six of which support diagnostics directly: Mammalian and non-mammalian virology, immunology, bacteriology, aquatic animal diseases and genomics. Teams consist of expert scientists and technicians capable of carrying out the complex analyses and investigations presented

daily to the AHL. The Assurance, Biosafety and Containment team is responsible for managing the new biocontainment laboratory.

We have more than 450 test methods available and, within New Zealand, many of them are only available at this laboratory. Tests range from the classic, well-established techniques, such as bacterial culture, virus isolation, virus neutralisation, ELISA, microscopy and pathology, to molecular analysis and other state-of-the-art technologies such as matrix-assisted laser desorption/ionisation (MALDI-TOF) and next-generation sequencing. If a test is not available 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 2023, we conducted tests for a wide range of microorganisms, exotic disease investigations and other programmes, including managed surveillance programmes, e.g., transmissible spongiform encephalopathy (TSE) and avian influenza and export testing (Table 2).

Table 1: Summary of test numbers and description of work conducted by the Animal Health Laboratory, 2023 (calendar year)

Purpose of testing	Number of tests	Number of accessions	Description of work
Exotic disease investigations	26,242	466	Testing to rule out the presence of exotic pathogens; identification of reptiles and amphibians that cross New Zealand's borders
Cost recovery diagnostics	578	46	Cost-recovered diagnostic testing and project work, much of which utilises capability not available elsewhere
Surveillance projects (Crown-funded)	22,603	608	Testing to support surveillance programmes including transmissible spongiform encephalopathy (TSE), arbovirus, <i>Bonamia</i> and avian influenza
<i>Mycoplasma bovis</i> surveillance	8,062	1,397	Testing for the <i>Mycoplasma bovis</i> programme
Import and export trade (cost recovery)	10,744	873	Import and export testing to support overseas trade for primary industries Overseas trade in companion animals Animal travel overseas (e.g., racehorses) Quality assurance reference testing for industry partners
Artificial breeding (AB)	43	10	Specific testing for AB purposes to rule out the presence of various pathogens, including some exotic diseases
Quality assurance	6,117	292	The AHL participated in 64 programmes of inter-laboratory proficiency testing through 10 international authorised reference partners in Australia, North America and Europe to demonstrate our technical competence and to meet the requirements of ISO/IEC 17025 standard

Table 2: Tests conducted by the Animal Health Laboratory for exotic disease surveillance, 2023 (calendar year)

Microorganism	Disease investigation (number of tests)	Scanning and active surveillance (number of tests)
Abalone herpesvirus	16	0
Adenovirus	56	0
Acute bee paralysis virus	0	191
African horse sickness virus (AHSV)	51	0
African swine fever virus	6	0
Akabane virus	0	640
American foulbrood (<i>Paenibacillus larvae</i>)	71	0
<i>Anaplasma</i>	4	0
Anguillid herpesvirus	12	0
<i>Aphanomyces</i>	20	0
Avian influenza (and other influenza) virus	646	11,639
Avian paramyxovirus	2,037	0
<i>Avibacterium paragallinarum</i>	24	0
<i>Bacillus anthracis</i>	8	0
Black queen cell virus	0	142
Bluetongue virus	0	640
<i>Bonamia exitiosa</i>	305	0
<i>Bonamia ostreae</i>	300	188
Bovine ephemeral fever (BEF) virus	0	652
Bovine herpesvirus type 1 (IBR)	94	0
Bovine papular stomatitis virus	28	0
Bovine viral diarrhoea (exotic strains) virus	130	0
<i>Brucella</i> (generic)	157	0
<i>Brucella abortus</i>	42	0
<i>Brucella canis</i>	30	0
<i>Burkholderia pseudomallei/mallei</i>	2	0
<i>Campylobacter fetus</i>	2	0
Canine herpesvirus	23	0
Caprine arthritis encephalitis (CAE) virus	60	0
<i>Chlamydiaceae</i> (generic)	162	0
Chronic bee paralysis virus	0	142
Classical swine fever virus	6	0
<i>Clostridium botulinum</i>	407	0
<i>Corbicula</i> spp.	0	1,981
Deformed wing virus	0	142
<i>Dirofilaria immitis</i> (canine heartworm)	1	0
<i>Ehrlichia canis</i>	9	0
Enzootic bovine leukosis (EBL) virus	41	0
Epizootic haemorrhagic disease virus	0	640
Equine herpesvirus	93	0
Equine infectious anaemia virus	7	0
Equine viral arteritis virus	24	0
Flavivirus	342	711
Foot and mouth disease virus	0	402
<i>Francisella tularensis</i>	2	0
Fungal species	54	0
Generic piscirickettsia	22	0
Yeast species	6	0

Continued p12

Note that the numbers presented in **Table 2** are the total numbers of tests conducted by the AHL, categorised by the disease agent being tested for. These numbers may differ from those presented in other surveillance programme annual reports in this edition. Such discrepancies may be due to various factors including (but not limited to) programme reports generally reporting the number of farms or cases screened rather than the number of tests conducted, programmes conducting testing other than by the AHL, and the AHL conducting testing other than for a surveillance programme.

Our role in the *Mycoplasma bovis* response

Over the seven years since *Mycoplasma bovis* was first detected in New Zealand, the *M. bovis* eradication programme has worked hard to reduce the risk of missing any infection in our New Zealand cattle herds.

The AHL's diagnostic functions and expertise are essential to all phases of the programme and fundamental to the goal of eradicating *M. bovis*.

Activities that the AHL teams undertook in 2023 were:

- diagnostic PCR testing for *M. bovis*;
- confirmatory and validation testing of suspect positive samples screened by contracted laboratories;
- screening of samples for all potential new high-risk cases;
- culturing *M. bovis* strains, genomics and curating the reference collection;
- monitoring and oversight of contracted laboratory quality assurance and business processes;
- providing scientific expertise and fostering the capability of contracted laboratories; and
- providing scientific expertise and advice to the *M. bovis* programme.

In 2023, a total of 8,062 *M. bovis* samples were tested by the AHL (**Figure 1**), compared with about 9,846 tests performed in 2022. The monthly testing turn-around time from

receipt to reporting ranged from 2 to 10 working days.

In addition to testing at the AHL, three other New Zealand laboratories were contracted by MPI to undertake surveillance ELISA testing for the programme. In 2023, over 173,000 *M. bovis* samples were tested by all laboratories involved in the *M. bovis* eradication programme.

New Aquatic Animal Diseases and Genomics teams

In 2023, AHL established two new teams in genomics and in aquatic animal diseases to strengthen our biosecurity and animal health diagnostic capabilities.

The Genomics team comprises a manager, three wet-lab staff and two bioinformaticians, each bringing expertise essential to advancing our genomic capabilities. Our genomics capability includes a range of sequencing technologies such as Sanger sequencing MinION sequencing and MiSeq sequencing. These technologies allow us to address various questions related to pathogens beyond merely confirming the presence or absence of known pathogens. Specifically, they enable us to:

- determine the origin and variant subtype of pathogens; and
- identify unknown pathogens and non-specific aetiologies of mortality.

Our team has recently developed an avian influenza genomic characterisation method using MinION sequencing. This advancement exemplifies our commitment to leveraging cutting-edge genomic tools to enhance our diagnostic and biosecurity measures. By integrating advanced sequencing technologies, we are better equipped to address complex pathogen-related questions, ultimately contributing to more effective biosecurity measures and improved diagnostic accuracy.

The Aquatic Animal Diseases team comprises a manager, three scientists and one technician on a permanent basis, with expertise in aquatic and molecular techniques to identify biological threats to our aquatic animal species. This includes:

- timely identification of exotic or unwanted organisms from freshwater or marine environments;
- responding to local, regional and national incursions of pests and diseases in aquatic environments; and
- continuous development of scientific capabilities to meet biosecurity diagnostic requirements, as well as exports of aquatic animals.

In the last year the team has been involved in the identification of two unwanted species of *Corbicula* sp. (freshwater invasive clams), using

molecular techniques and new methodologies including targeted environmental DNA testing. With the increase in public awareness of the aquatic environment, we also respond to aquatic investigations and long-term responses of pest management. The Aquatics Animal Diseases team ensures Biosecurity New Zealand has the capability to support the growth of New Zealand’s aquaculture industry, recreational fisheries, as well as protect taonga species and aquatic (animal) wildlife species.

Establishment of WOAHP Bee Disease Reference Laboratory

In June 2023, the General Assembly of the World Organisation of Animal Health (WOAH) designated the MPI Animal Health Laboratory as an international reference laboratory for two diseases of honey bees: American foulbrood of honey bees (infection with *Paenibacillus larvae*), and varroosis of honey bees (infestation with *Varroa* spp.) (Figure 2). Both of these diseases place a significant health burden on managed colonies of honey bees (*Apis mellifera*) in New Zealand and internationally. These WOAHP reference laboratory designations are a first for New Zealand, which now joins a list of 35 countries that together host more than 290 WOAHP reference laboratories. The only other countries in the world that host a bee disease laboratory are France and Germany. This makes our designation special for the Southern Hemisphere and the Asia-Pacific region.

The purpose of a WOAHP reference laboratory is to provide international scientific and technical leadership on the diagnosis and control of veterinary diseases, to provide training to other countries and laboratories, and to undertake active research and scientific study on the nominated pest they specialise in. WOAHP reference laboratories also provide a central international point for fielding scientific and technical requests, and providing expert advice to WOAHP. A full description of the Terms of Reference is available on the WOAHP

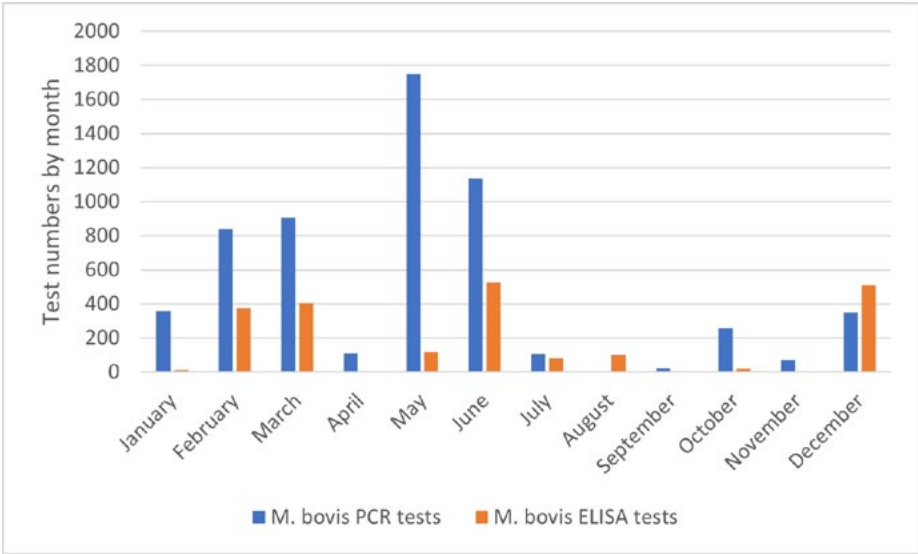


Figure 1: Monthly throughput of *M. bovis* tests at the Animal Health Laboratory for 2023

Table 2: Tests conducted by the Animal Health Laboratory for exotic disease surveillance, 2023 (calendar year) (continued from p10)

Microorganism	Exotic disease investigation (number of tests)	Scanning and active surveillance (number of tests)
Hairy shaker disease (border disease)	100	0
Herpesvirus	217	0
Infectious bursal disease virus	202	35
Kashmir bee virus	0	191
<i>Lactococcus garvieae</i>	8	20
Leishmania	1	0
Lumpy skin disease virus	114	0
Lyme disease (generic)	2	0
Malignant catarrhal fever virus	66	0
<i>Marteilia refringens</i>	36	0
European foulbrood (<i>Melissococcus plutonius</i>)	60	0
<i>Mikrocytos mackini</i>	36	0
<i>Mycoplasma</i>	2,050	0
<i>Mycoplasma</i> (specific species)	202	0
<i>Mycoplasma bovis</i>	8,062	0
Neospora	2	0
New Zealand rickettsia-like-organism 1	14	0
New Zealand rickettsia-like-organism 2	14	0
Nosema	0	30
Ostreid herpesvirus	390	0
Pan coronavirus	62	0
<i>Pasteurella multocida</i>	27	0
<i>Perkinsus olseni</i>	260	0
Pestivirus	182	0
Phocine distemper virus and canine distemper virus (Morbillivirus)	99	0
Pilchard herpesvirus	12	0
Piroplasm	115	0
<i>Piscirickettsia salmonis</i>	4	0
Porcine reproductive and respiratory syndrome virus	530	0
Pox virus	50	0
Q fever (Coxiella burnetii)	6	0
Rabies virus	1	0
Sacbrood virus	0	142
<i>Salmonella Pullorum</i>	21	0
Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)	50	0
<i>Tenacibaculum maritimum</i>	6	0
Transmissible spongiform encephalopathy (TSE)	1	829
<i>Trypanosoma evansi</i>	2	0
Vesicular stomatitis virus	5	0
<i>Xenohalotia californiensis</i>	123	402

website (<https://www.woah.org/en/what-we-offer/expertise-network/reference-laboratories/>).

Countries seeking to have a WOA reference laboratory must submit an application to WOA, focusing on a specific WOA-listed disease

or pest. An international panel of WOA experts then meet to consider the application. If the application is endorsed by the experts, it is then submitted to the WOA General Assembly (held in May each year) of all 182 member nations for their

consideration. The WOA General Assembly makes a final decision as to whether the applicant country will be awarded the reference lab designation.

Over the past decade, the MPI Animal Health Laboratory has developed substantial scientific and diagnostic expertise in honey bee science and diagnostics, alongside significant honey bee pest and disease expertise across the wider Diagnostics, Readiness and Surveillance directorate, with experts in the Plant Health and Environment Lab (PHEL) and the Biosecurity Surveillance & Incursion Investigation (BSII) group. All of this expertise formed the basis of our application to WOA.

Since AHL's designation, we have undertaken international support activities, with particular support for Australia, where New South Wales sustained an incursion of *Varroa destructor*. We have hosted several delegations of honey bee scientists and officials, and provided our expertise and networks to assist these partners (Hall and Pragert, 2023; Australian Honey Bee Industry Council, 2023). We also published a genomic study of 169 isolates of *Paenibacillus larvae* collected from around New Zealand (Binney et al., 1923). This genomic resource now represents nearly one-third of all known global sequence information about American foulbrood (PubMLST, 2023). Our laboratory has also provided diagnostic and technical support to New Caledonia, the Wallis and Futuna Islands, and Chinese Taipei.

Development of diagnostic capability for lumpy skin disease

Lumpy skin disease (LSD) has recently emerged as a significant threat to cattle and buffalo herds in Southeast Asia, having spread to Indonesia in 2022. This poses a serious risk to Australia and New Zealand due to their geographic proximity.

LSD, caused by the lumpy skin disease virus (LSDV) of the genus *Capripoxvirus* (CaPV), is a transboundary disease notifiable to WOA. LSD affects a narrow range of hosts, including cattle, water buffaloes and some wild ruminants.

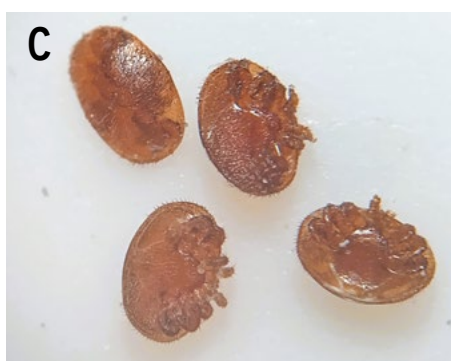
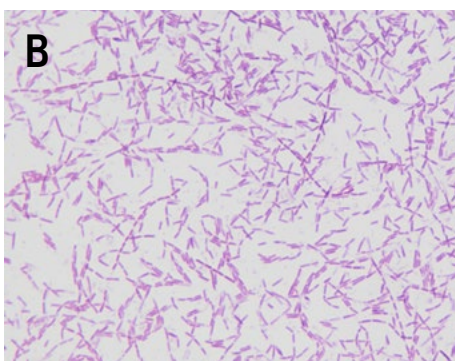
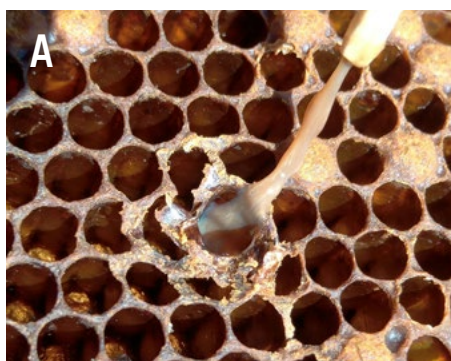


Figure 2: (A) A honey bee larva from a colony with American foulbrood (an infection with *Paenibacillus larvae*) showing the characteristic symptom of 'roping out' when a matchstick is inserted into the cell (Photo: Richard Hall, MPI). (B) Gram-stain of *Paenibacillus larvae* in microbiological culture (Photo: Jonathan Foxwell, MPI). (C) Adult female *Varroa destructor* parasitic mites of honey bees, shown by microscopy. These mites are visible to the naked eye and are about 1.5mm wide (Photo: Richard Hall, MPI)

It is characterised by distinctive lesions of hard nodules on the skin and mucous membranes, including internal organs.

Biting insect vectors play an important role in the transmission of LSDV among susceptible species. LSDV can be transmitted mechanically by arthropod vectors that carry the virus on their proboscis, infecting animals while feeding on their blood.

New Zealand remains free from LSD, and its introduction could halt the export of cattle products, resulting in substantial financial losses to the industry. One possible route of LSDV introduction to New Zealand is through infectious vectors accidentally carried in passengers' clothing and luggage entering the country via air and seaports.

Although the clinical presentation of nodular skin lesions in LSD is almost always diagnostic, milder forms of the disease can be mistaken for other conditions, such as pseudo-lumpy skin disease (bovine herpesvirus 2 infection), pseudocowpox (parapoxvirus), bovine papular stomatitis (parapoxvirus), insect bites, photosensitisation and urticaria. Therefore, rapid and reliable laboratory diagnostics are critical for swift response actions to a potential introduction of LSD to limit the spread of the disease.

In response to this looming threat, in 2023 the Animal Health Laboratory developed a suite of advanced diagnostic tools to enable rapid and accurate detection of LSDV. These tools include:

- **Polymerase chain reaction** AHL has validated a duplex quantitative real-time PCR method targeting the G-protein-coupled chemokine receptor (GPCR) gene. This method allows for the simultaneous detection and differentiation of wild-type and vaccine strains of LSDV. Preferred samples for PCR testing include whole blood, skin nodules, scabs, ocular, nasal and oral fluids, as well as semen.
- **Virus isolation in cell cultures** The laboratory maintains permissive cell lines such as MDBK (Madin-Darby bovine kidney) and OA3.Ts (ovine testis) cells for the isolation and propagation of LSDV. Samples suitable for this method include skin nodules, scabs and crust.
- **Nanopore sequencing** AHL has also developed a nanopore sequencing approach using the MinION platform. Sequencing of the envelope protein gene allows differentiation between wild-type and vaccine strains of LSDV, while the ORF91 sequence enables discrimination between closely related viruses such as goatpox

virus (GTPV) and sheepox virus (SPPV).

These advancements in diagnostic capabilities are crucial for swift response actions aimed at containing the spread of LSD. By implementing these diagnostic tools, we can proactively safeguard livestock and mitigate the economic impact of potential outbreaks.

New Zealand's first High Biosafety Laboratory

The High Biosafety Laboratory (HBL) was established within the Animal Health Laboratory to enhance New Zealand's capacity to respond to high-risk zoonotic threats. Zoonotic diseases are infections caused by viruses, bacteria, fungi, parasites and prions that are transmitted between species. Although New Zealand is free from many high-risk zoonotic diseases, we remain at risk. A major factor in effectively controlling an outbreak of infectious disease is to have access to rapid and reliable laboratory diagnostic results.

The HBL is the only laboratory in New Zealand equipped to safely perform diagnostic testing for zoonoses that pose the greatest public health risk. These are considered high risk due to their epidemic potential, their ability to cause life-threatening disease, and the lack of robust control measures. According to the World Health Organization (WHO), these high-risk zoonotic diseases include:

- Ebola virus disease;
- Hendra virus disease;
- Marburg virus disease;
- Lassa fever; and
- Nipah virus disease.

The HBL is a state-of-the-art laboratory equipped with advanced technology and stringent safety protocols to handle high-risk pathogens securely and efficiently (**Figure 3**).

The HBL is operated by a multidisciplinary team of experienced, highly trained and safety-conscious scientists and technicians. The HBL team is the most important contributing factor to the effectiveness



Figure 3: The unique biosafety and biocontainment features of the High Biosafety Laboratory

and safety of laboratory procedures. Regular scenario-based trainings using mock specimens and recreating realistic environments during training keep the team members engaged and prepared for potential outbreaks of high-risk zoonotic diseases.

The HBL joins the list of high-level biosafety facilities around the world that place an emphasis on preparedness for future epidemics and disease outbreaks affecting both humans and animals. Through stimulating collaborations with human and veterinary health agencies, we envision the HBL becoming a vital part of New Zealand's biosecurity

infrastructure, providing frontline diagnostic testing to keep the country free of potential high-risk exotic diseases.

Establishment of high-throughput PCR capability

Automated (robotic) high-throughput diagnostics will likely play an important role in the next large-scale exotic animal disease response that the AHL contributes to. We have been preparing for this eventuality through successful bids to purchase robotics. Since the end of 2023 we have had all necessary equipment

onsite and installed in our PC3+ laboratory (**Figure 4**).

Veterinary diagnostics often rely on detection of both antibodies and genetic material. This requires two types of test – a serological one and a molecular one, respectively. We purchased different robotics suites to perform these two separate procedures.

For small-scale diagnostic work, testing can be performed manually by our skilled laboratory team. However, when scaling up to large numbers (as would be expected in a large exotic disease response), the efficiency of manual work decreases just as the possibility of error increases. The benefit of robotics is that they can perform the same steps ad infinitum accurately, which means that they can increase efficiency and reliability at higher sample volumes. This also reduces the likelihood of our staff sustaining repetitive strain injuries.

In 2024 and beyond we will develop our workforce capability for managing the robotics and building our readiness.

Animal Health Laboratory goes green with My Green Lab® certification

AHL has embarked on a transformative journey towards sustainability by signing up to the My Green Lab® certification programme. The programme aims to bring about a meaningful reduction in the environmental footprint of the laboratory.



Figure 4: (A) ELISA Robot – The Explorer G3 Workstation; (B) PCR Robots – Hamilton Star and Starlet

Table 3: Animal Health Laboratory participants in multinational animal disease working groups

Working group	AHL member
Sub-Committee on Animal Health Laboratory Standards	Clive Pigott
Sub-Committee on Aquatic Animal Health	Tim Hewison
International Veterinary Biosafety Workgroup	Joseph O'Keefe, Richard Spence
Biosafety Level 4 Zoonotic Laboratory Network (affiliate)	Joseph O'Keefe, Richard Spence
World Organisation for Animal Health (WOAH) Biological Standards Commission	Joseph O'Keefe
UN FAO Reference Laboratory Network for SARS-CoV-2 in Animals	Hye Jeong Ha
Global Foot-and-Mouth Disease Research Alliance	Clive Pigott
WOAH Biosafety Research Road Map Working Group	Joseph O'Keefe

Table 4: Animal Health Laboratory management structure

Team	Manager
Director, Diagnostics and Surveillance*	Veronica Herrera (Wellington), Fleur Francois (Wellington)
Animal Health Laboratory Manager	Joseph O'Keefe
Assurance, Biosafety and Containment	Richard Spence
Aquatic Animal Diseases	Andrea Barcelo
Bacteriology and Mycology	Bede Busby
Genomics	Michelle McCulley
Immunology	Clive Pigott
Mammalian Virology	Hye Jeong Ha
Non-mammalian Virology	Anastasia Chernyavtseva

* Diagnostics, Readiness and Surveillance as of 1 July 2024

My Green Lab certification is considered the gold standard for laboratory sustainability best practices around the world. It is recognised by the UN Race to Zero campaign (Climate Champions, 2024) as a key measure of progress towards a zero-carbon future. My Green Lab's mission is to build a global culture of sustainability in science to transform the industry into a global leader on environmental sustainability.

Laboratories are traditionally known for their high resource consumption, with statistics indicating they use ten times more energy than equivalent office spaces, consume four times more water, and generate 5.4 billion kilograms of plastic waste annually on a global scale. AHL's participation in the My Green Lab® programme comes as a proactive response to these challenges, with the laboratory estimating an annual disposal of 780kg of plastic waste, leading to 2,808kg of CO_{2eq} emissions during production and decomposition phases.

The AHL's sustainability strategy under the My Green Lab® programme

encompasses multifaceted approaches, including reducing water and energy consumption, optimising waste management practices, enhancing procurement efficiency and integrating green chemistry alternatives in laboratory testing.

Central to these efforts is the AHL's newly formed Green Team, which comprises passionate environmental advocates tasked with evaluating the feasibility and implementation of sustainable solutions. The AHL Green Team's dedication reflects a collective commitment to fostering a culture of environmental responsibility within the laboratory and contributing to a better tomorrow for the local, national and global environment and its inhabitants.

National and international connections

The AHL maintains extensive national and international networks linking us to leading animal disease experts and reference laboratories worldwide, enabling us to access expertise on a

wide range of veterinary pathogens. This facilitates the subcontracting of diagnostic testing and provides access to reference material and scientific advice. In addition, technical delegations from trading partners periodically visit the AHL to assure themselves of New Zealand's testing capabilities.

During 2023, AHL staff represented New Zealand on a number of multinational animal disease working groups (Table 3).

Staffing and structure

See Table 4.

Staff publications

AHL staff names are in bold.

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Animal health surveillance and incursion investigation annual report

Overview

New Zealand's biosecurity has three main components: pre-border, border and post-border. Post-border biosecurity is the main focus of the Ministry for Primary Industries' (MPI's) Surveillance and Incursion Investigation (S&II) teams. The objectives of New Zealand's post-border pest and disease surveillance system are:

- to provide early detection of exotic or emerging pests and diseases;
- to provide assurance of country freedom from specified pests and diseases;
- to monitor and document baseline patterns of endemic pest and disease occurrence in New Zealand;
- to support the fulfilment of New Zealand's international reporting obligations; and
- to report on surveillance activities to domestic animal health stakeholders.

The Animal Health S&II teams conduct both scanning and targeted surveillance for exotic, emerging and zoonotic diseases of domestic animals and wildlife. Scanning surveillance programmes, such as the exotic pests and disease notification system and the regional veterinary diagnostic laboratory programme, are in place. There are also targeted programmes for the following: diseases of honey bees, arboviruses, avian influenza, transmissible spongiform encephalopathies and wildlife diseases.

The teams that carry out this work comprise qualified veterinarians from New Zealand and overseas, and include veterinarians registered with the Veterinary Council of New Zealand. They work in close collaboration with scientists from both MPI's Animal Health Laboratory (AHL) (Wallaceville) and the two Plant



Figure 1: MPI's Surveillance Team (Animal Health) and Incursion Investigation Team (Animal Health) at Wallaceville. From left: Mark Eames, Lynsey Earl, Harry Taylor, Maryna Sokolova, Loren Bryant, Kelly Buckle, Paul Bingham, Lia Missena, Jonathan Watts, Wendy McDonald (Manager of S&II Group), Baukje Lenting. (Absent: Daniel Green, Caleb King, John O'Connell, Toni Tana, Ben Phiri, Nelly Marquetoux, Craig Pritchard)

Health and Environment Laboratories (PHELs) in Auckland and Christchurch. In addition, they have strong links to other expert groups nationally, such as within Massey University's School of Veterinary Science and the commercial veterinary laboratories, and internationally. There is a diverse range of expertise in the S&II team, with many of the members also having pursued additional training in the areas of epidemiology, clinical disciplines and pathology (Table 1).

This report highlights some of the teams' accomplishments in 2023. The year saw the teams achieve their main objective of conducting surveillance and incursion investigations, but also included numerous activities and interactions with stakeholders. Examples include, but are not limited to, presentations and publications, operational research projects, providing technical support and advice to all of MPI and the quarterly publication of *Surveillance*.

Team composition

In January 2023 the greater S&II (Animal Health) team was split into two teams along functional lines (Surveillance and Incursion Investigation). The two teams manage the post-border exotic and emerging pest and disease surveillance system where it applies to birds, terrestrial animals, marine mammals and bees. Table 1 lists team members (Figure 1).

Notifications and investigations for 2023

Animal-related calls to MPI's exotic pest and disease hotline (0800 80 99 66) are received by a call centre then forwarded to the duty Incursion Investigator (II). Following discussion with the notifier, the duty II assesses whether to open an investigation, or stand the notification down if they can exclude exotic, new or emerging disease (Tana, 2014). For an example case study see O'Connell (2020).

In 2023, the Animal Health Incursion Investigation team received 388

Table 1: Members of the Animal Health Surveillance Team and Animal Health Incursion Investigation teams as at publication of this report. The S&II team split in January 2023 into two teams.

Name	Function	Role	Qualifications	Years with the team*
Paul Bingham	Across both Surveillance and Incursion Investigation	S&II Principal Adviser	BVSc MVS (Hons I) MANZCVSc (Epidemiology)	21
Maryna Sokolova	Surveillance	Team Manager	DVM MVSc (Epidemiology and Public Health)	1
Toni Tana	Surveillance	Principal Adviser	BVSc (Distinction) MANZCVS (Epidemiology) MVS (Distinction) (Epidemiology)	18
Jon Watts	Surveillance	Principal Adviser	BVSc MANZCVS (Epidemiology)	14
Craig Pritchard	Surveillance	Senior Adviser	BVSc MBA	4
Lynsey Earl	Surveillance	Senior Adviser	BVSc MVS (Hons) MANZCVS (Epidemiology)	9
Craig Pritchard	Surveillance	Senior Adviser	BVSc MBA	4
Ben Phiri	Surveillance	Senior Adviser	BVM MVs PhD	7
Nelly Marquetoux	Surveillance	Senior Adviser	DVM MSc PhD	6
Lia Missena	Surveillance	Adviser	BSc (Hons) DVM	1
Baukje Lenting	Surveillance	Senior Adviser	BVSc MVSc (Zoo Animal and Wildlife Health) MANZCVS (Avian Health)	2024 start
Kelly Buckle	Incursion Investigation	Team Manager	DVM MPVM MVSc (Hons) DACVP (Anatomic Pathology)	11
Caleb King	Incursion Investigation	Senior Incursion Investigator	BVSc MVS (Hons)	16
John O'Connell	Incursion Investigation	Senior Incursion Investigator	MVB MVPHgmt MANZCVS (Epidemiology)	10
Mark Eames	Incursion Investigation	Incursion Investigator	BVSc	4
Harry Taylor	Incursion Investigation	Senior Incursion Investigator	BVSc MSc	3
Daniel Green	Incursion Investigation	Incursion Investigator	BVSc	1
Loren Bryant	Incursion Investigation	Senior Incursion Investigator	BAppSc BvSc	1

*or previous equivalent team within MPI or MAF

notifications, of which 213 were investigated. During an investigation the duty II works closely with MPI's AHL scientists and their international network of laboratories to carry out testing to exclude exotic pests and diseases, and to work up new and emerging conditions. **Figure 2**, (next page) shows the numbers of notifications and investigations per month in 2023 and **Figure 3**, (next page) shows notifications and investigations by host species. **Figure 4**, (page 21) shows location of notifications. Notification numbers typically peak in late summer and spring. In 2023, investigations accounted for 26,242 exotic disease tests carried out at the AHL (see AHL

annual report, page 9). Outcomes of these investigations are summarised in this edition of *Surveillance* in the animal health surveillance report tables 4a and 4b (pages 28–29). Full reports on incursion investigations are presented in each issue of *Surveillance* in the quarterly report of investigations of suspect exotic diseases.

Technical projects
Calf ulcerative stomatitis investigation

Notifications of calf ulcerative stomatitis (CUS) (O'Connell, 2017) continued, with nine notifications in the calendar year. CUS presents in 3 to 6-month-old dairy or dairy-

cross calves as illthrift, diarrhoea and gastrointestinal tract ulceration. Up to 10 percent of a mob can be affected, with calves generally recovering over 4–6 weeks. Epidemiological and/or pathological investigations of notifications continue to exclude both exotic and endemic infectious agents such as bovine viral diarrhoea virus. In a project led by John O'Connell, investigation into the cause of CUS continues in collaboration with farmers, their veterinarians and veterinary pathologists. John O'Connell gave an update to the Dairy Cattle Vet Stream at the 2023 New Zealand Veterinary Association (NZVA) conference in Wellington.

Similar clinical and epidemiological presentations are seen in dairy-origin calves in a number of overseas countries. As part of ongoing information sharing, an online meeting was held in late 2023 with overseas veterinarians investigating those presentations.

Bovine disease surveillance quarterly report

In 2022 Jon Watts initiated the 'Bovine disease surveillance quarterly report'. As part of the S&II Animal Health Surveillance Programme, we collect anonymised data on all sick bovine cases seen by the veterinary diagnostic laboratories: Awanui (formerly Gribbles), SVS and IDEXX.

These data can provide valuable information for veterinarians, both on the clinical presentations (presenting signs) (**Figure 5**, page 22), and the diagnoses achieved (aetiological diagnoses), furthering understanding of disease patterns at both the regional and national level.

By analysing the past three years' data for any quarter, veterinarians may understand what diseases to expect in the same quarter of the current year, assuming similar climatic conditions. Additionally, this analysis may assist in identifying emerging diseases in a timely way.

Subscriber numbers increased significantly through 2023. Work commenced on including reports on endemic diseases; this commenced in March 2024. Subscription to the report

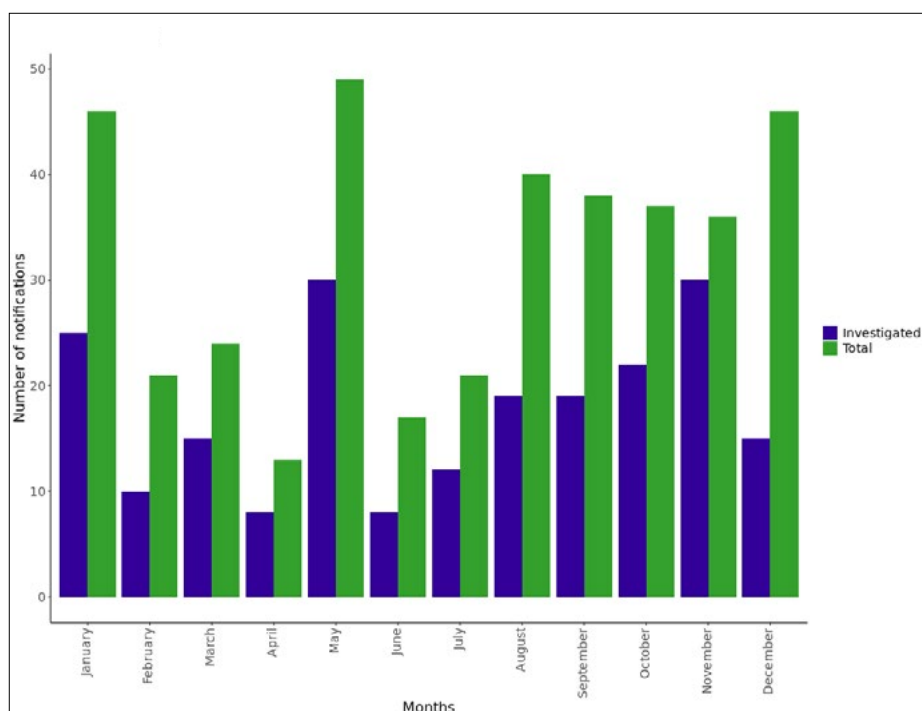


Figure 2: Number of notifications and investigations by month in 2023. Data are based on date of notification. Notifications (blue) are cases that have been investigated further; green bars represent the total number of notifications

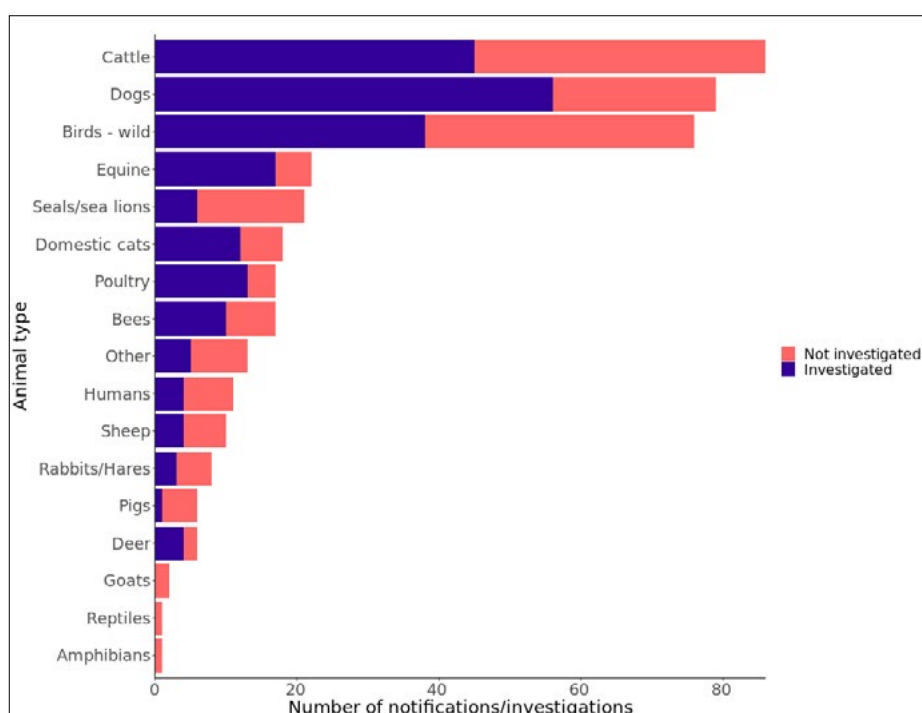


Figure 3: Number of notifications (total bar length), investigations (blue bars) and notifications not investigated (red bars) by animal type in 2023

is free and can be completed via the MPI website <https://www.mpi.govt.nz/news/subscribe-to-mpi/>

Initial investigating veterinarian programme

Initial Investigating Veterinarians (IIVs) are a network of veterinarians managed on behalf of MPI by AsureQuality, a state-owned enterprise and provider of food

quality assurance and biosecurity services. John O'Connell is the MPI technical adviser to the IIV programme. The IIV network consists of about 30 veterinarians throughout New Zealand, drawn from AsureQuality's own staff and from private practice. Rosters are maintained to provide a 24/7 service as first responders during suspect vesicular investigations. The role of

IIVs is to undertake an immediate farm visit and to collect clinical and epidemiological information under direction from an Incursion Investigator. IIVs are familiar with the endemic diseases of New Zealand livestock and receive face-to-face and online training in the epidemiology and clinical signs of exotic diseases and the investigation process. A face-to-face workshop was held in March 2023 for North Island IIVs with a new module being added to the online content.

Small hive beetle project

Small hive beetle (SHB, *Aethina tumida*) is a pest of honey bees that is exotic to New Zealand. The SHB surveillance project aimed to add to the pre-existing apiculture surveillance programme, which looks for exotic pests and disease of bees in sentinel hives across New Zealand. The small hive beetle surveillance project is an Animal Health, Environment Health, Surveillance Engagement and PHEL effort to enhance beekeeper surveillance motivation and capability. This project started in 2021 to assess the use of SHB traps by local beekeepers. If they discover any suspicious organisms during routine monitoring and checks, they are required to report these to Biosecurity New Zealand as soon as possible. The SHB project relies on voluntary beekeepers to maintain traps for small hive beetle in their apiaries. The purpose of the project is to undertake surveillance for SHB while educating beekeepers on the exotic beetle, how to detect an incursion and how to report it, to provide an incentive for beekeepers to inspect their beehives regularly, and to share their knowledge of SHB with other beekeepers.

The project finished in April 2023, with a summary report outlining the project's success of no SHB reported, three project findings, beekeeper feedback and future recommendations. The Surveillance and Engagement team worked closely alongside the Animal Health Surveillance team to produce a 2023 project report for the SHB (Figure 6). Awareness of bee health and biosecurity was enhanced among

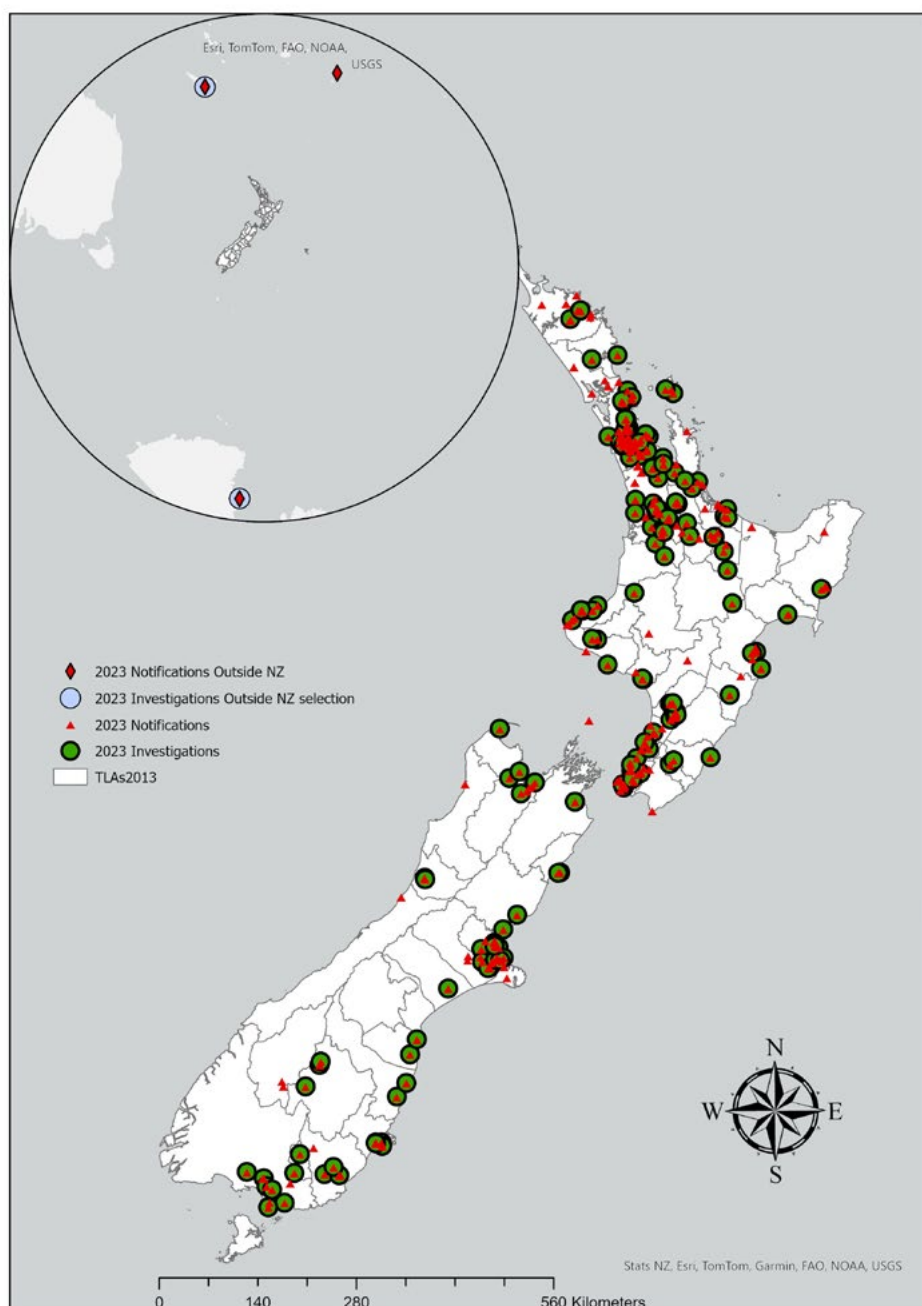


Figure 4: Point locations of notifications to the Inursion Investigation team, and investigations undertaken to rule out exotic, new and emerging diseases or pests of animals. Red triangles falling outside notifications resulted where multiple investigations were undertaken from one notification or where a notifier's location differed from the location of the investigated disease event. The three international points represent a high pathogenicity avian influenza investigation in a skua in Antarctica, poultry disease in New Caledonia, and a parasite in a human in Tonga

enrolled beekeepers. In 2023 feedback from participants was generally positive, with a few comments on the merit and importance of the project. Participants found the traps relatively straightforward to install and monitor. It was reported that the traps could be moved between apiaries and hives with ease. However, some participants noted that the trap vents were often propolised and closed completely by the bees. There was suggestion of using either disposable traps or traps made with a more

robust material that can be dismantled for cleaning. The reported ease of installation, monitoring, maintenance and positive feedback of the SHB traps could suggest a healthy appetite for participants to continue their participation in the project.

Wildlife surveillance programme

Passive wildlife disease surveillance was continued in 2023 through the wildlife disease surveillance contracts with the New Zealand Centre for

Conservation Medicine, Auckland Zoo; Te Kōhanga The Nest, Wellington Zoo; the South Island Wildlife Hospital, Christchurch; and The Wildlife Hospital, Dunedin. In December 2023, a new contract was signed with BirdCare Aotearoa, an avian rehabilitation centre in Auckland. A subproject was added to the contract with The Wildlife Hospital in Dunedin during the period September to December 2023 for the sampling of wild birds admitted to the hospital for high pathogenicity avian influenza (HPAI). Education and engagement work continues to be an important stream of the wildlife programme, and included supporting Massey University final year veterinary students in their wildlife special topics week. See page 46 for more information on the wildlife surveillance programme.

Operational guidelines for surveillance during a foot and mouth disease outbreak

New Zealand has never had a case of foot and mouth disease. The economic consequences of an outbreak would be significant, making this disease one of the country's largest biosecurity threats. As part of the ministry's preparedness Paul Bingham and Eve Pleydell drafted new operational guidelines for establishing foot and mouth disease surveillance at the start of a biosecurity response.

Operational guidelines for surveillance during a highly pathogenic avian influenza disease outbreak

New Zealand has never had a case of HPAI. Since it first emerged in 1996 and then re-emerged in 2003, the H5N1 HPAI strain and its variants have resulted in millions of bird deaths worldwide, including deaths in both wildlife and commercial poultry. Only New Zealand, Australia and the Pacific islands remain free of the virus. HPAI and H5N1 in particular represent a significant concern to New Zealand wild and farmed bird populations. As part of the ministry's preparedness for HPAI, Nelly Marquetoux and Paul Bingham drafted new operational guidelines for establishing HPAI disease surveillance at the start of a biosecurity response.

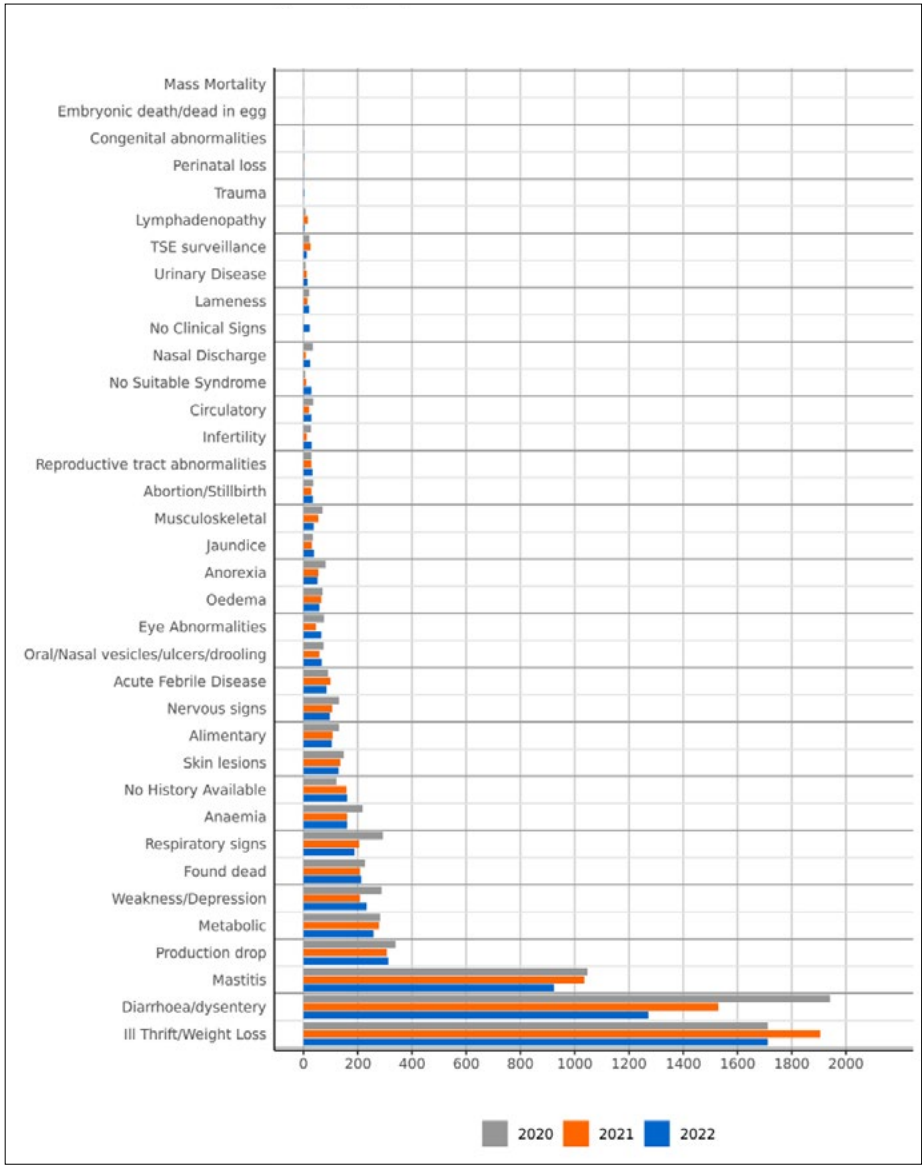


Figure 5: The presenting signs (syndromes) for the October–December period (fourth quarter), at a national level, for 2020, 2021 and 2022. These may indicate results for the same period in future years



Figure 6: First two pages of the *Small Hive Beetle Surveillance Project Report 2023*

Milestones and leadership roles

Achievements and other opportunities

Lia Missena and **Daniel Green** were admitted into the Massey School of Veterinary Science Master of Veterinary Studies programme.

Harry Taylor was admitted into the Massey School of Veterinary Science PhD programme.

Leadership roles

Toni Tana is the nominated New Zealand Focal Point for both Animal Disease Notification and Wildlife, for the World Organisation for Animal Health (WOAH). She also serves on the Secretariat of the WOAH Pacific Wildlife Health Network.

Caleb King continued as the treasurer and was appointed vice-president of the NZVA's Dairy Cattle Veterinarians Special Interest Branch committee.

Lynsey Earl continued her role until June 2023 as President of the Australia New Zealand Veterinary College New Zealand Network Committee.

Ben Phiri continued as an invited guest editor for the journal *Frontiers in Veterinary Science* for the research topic 'Developments in animal health surveillance'.

Kelly Buckle stepped down as President of the New Zealand Society for Veterinary Pathology, a role she has held since 2015. She also continued as a member of the American College of Veterinary Pathology's Test Item Writers Group, part of the American College of Veterinary Pathologists (ACVP) Examination Committee, a role she has held since 2018. She is a member of the NZVA's Wildlife Society Special Interest Branch Committee.

Harry Taylor continued as Treasurer of the Wildlife Society of the NZVA, a role he has had since 2019.

Stakeholder communications

Stakeholder communication and engagement are critical parts of New Zealand's animal health surveillance system. Developing strong relationships between our team and

those in associated livestock and other animal sectors is important to encourage timely notification of

suspect exotic and emerging diseases via the MPI exotic pest and disease hotline. **Table 2** outlines the activities

undertaken in 2023, which were focused on engagement with potential animal health notifiers.

Table 2: MPI 2023 engagement activities to enhance animal health exotic disease notifications

Month	Activity	Target Sectors	Target Audience
February	Modules given to Young Farmers, Junior Young Farmers, AgriKids Regional Finals, including Biosecurity New Zealand-related modules	Beef, Dairy, General, Goats, Lifestyle Blocks/Smallholders, Poultry, Sheep	Farmers/owners/managers, members of the public
	NZVA: Avian influenza information promoted to vets via email	Poultry, Wildlife	Veterinarians – private
	Young Farmers Regional Champions Animal Health Laboratory Tour	Beef, Dairy, General, Lifestyle Blocks/Smallholders, Pigs	Farmers/owners/managers
March	<i>Hoofprint</i> magazine: Article on FMD rule out/MCF investigation	Beef, Dairy	Veterinarians – private
	Initial Investigating Veterinarian Workshop (North Island)	Beef, Dairy, General	AssureQuality, veterinarians – private
April	New Zealand Veterinary Pathologists Conference	Companion Animals, Dairy, Equine, General	Other, veterinary specialists
May	Massey University: Biosecurity Disinfection Practical	General	Students
	Wildlife Rehabilitators Conference: Presentation on avian influenza	Wildlife	Wildlife rehabilitators
	Apiculture New Zealand: Field Day	Bees	Farmers/owners/managers, Industry bodies/external agencies, hobby beekeepers
June	AssureQuality Meat Inspectors Conference (North Island): Presentation on Surveillance and Incursion Investigation	Beef, Dairy	AssureQuality, meat inspectors
	Discussion on Ischaemic Teat Necrosis with Coastal Vets Opunake and a client	Dairy	Farmers/owners/managers, veterinarians – private
	NZVA Conference: MPI information stand and transmissible spongiform encephalopathies (TSE) leaflets to vets	Beef, Dairy, Deer, Sheep	Veterinarians – industry, veterinarians – private
	AssureQuality: Presentation to meat inspector supervisors (South Island)	Beef, Dairy	AssureQuality, meat inspectors
	NZVA Conference: Update on Calf Ulcerative Stomatitis (CUS)	Dairy	Veterinarians – industry, veterinarians – private
July	Apiculture Inspector (AP2) Refresher Training	Bees	AssureQuality, industry bodies/external agencies
	Young Farmers, Junior Young Farmers, AgriKids National Finals, including Biosecurity New Zealand-related modules	Beef, Dairy, General, Lifestyle Blocks/Smallholders, Poultry, Sheep	Farmers/owners/managers, members of the public
	Massey University: 5th Year Production Tracking Vet Student Talks	Beef, Dairy, General	Students, veterinarians – private
	MPI: published Small Hive Beetle Surveillance Project Report	Bees	Farmers/owners/managers, industry bodies/external agencies
	Massey University: Wildlife Special Topic Vet Student Talks/Workshop	Wildlife	Students
August	Supergrad Waikato Vets	Beef, Dairy, General	Veterinarians – private
	Online presentation on Ischaemic Teat Necrosis at veterinarians' request	Dairy	Veterinarians – private
September	NZVA: TSE leaflet published in online newsletter (<i>VetNews</i>)	Beef, Dairy	Veterinarians – private
	NZVA: TSE leaflet published in Dairy Cattle Veterinarians branch email	Dairy	Veterinarians – private
	Gribbles (now Awanui) Laboratory: publication of TSE leaflet in newsletter (<i>Paws, Claws & Udder Things</i>) and Awanui website and Facebook page	Beef, Dairy, Deer, Goats	Veterinarians – private
	Avian Influenza Symposium	Poultry, Wildlife	Central or local government, hunters, industry bodies/external agencies, Iwi/Māori, MPI Animal Health, researchers, veterinary specialists
	MPI: Verification Services Webinar	Beef, Dairy, General, Sheep	Verification Services staff
October	MPI: presentation to Biosecurity Partnerships Policy team	General	Central or local government
	South North Island Beekeeping Inc. Spring Field Day	Bees	Farmers/owners/managers, industry bodies/external agencies

Continued next page

Table 2: MPI 2023 engagement activities to enhance animal health exotic disease notifications (continued)

Month	Activity	Target Sectors	Target Audience
November	MPI: Presentation on the work of an Incursion Investigation (II) veterinarian	General	Central or local government
	Development of high pathogenicity avian influenza (HPAI) reporting factsheet	Poultry	Central or local government, industry bodies/external agencies
	Sheep Dairy Vets Discussion Group	Dairy sheep	Industry bodies/external agencies, researchers, veterinarians - private
	HPAI Disease Management: Surveillance Workshop	Lifestyle blocks/smallholders, Poultry, Wildlife	AssureQuality, central or local government, industry bodies/external agencies, MPI Animal Health, Verification Services staff, veterinarians - industry
December	Massey University: 5th Year Student Talks	General	Students, veterinarians - private
	MPI: Presentation to greater Business, Tech, & Information Systems team	General	Central or local government

Science engagement and original research

As part of their role in New Zealand's biosecurity system, the Animal Health Surveillance and Incursion Investigation teams investigate unusual or emerging syndromes and exclude exotic disease. Notifications come from stakeholders such as veterinarians, farmers, industry representatives, university researchers and others. Presentations and feedback on investigations are an essential part of ensuring that stakeholders maintain confidence in the value of engaging with MPI about suspect exotic or emerging diseases, pests or syndromes.

Following is a list of presentations, peer-reviewed papers and other publications produced in 2023.

Presentations at veterinary meetings and conferences, 2023

Bingham P (2023). Farm level economic impact estimator of disease. New Zealand Veterinary Association Conference, Wellington.

Buckle K, Schmidt L, Harvey C, White M, Nicol V, Bennett J (2023). Juvenile black-billed gull (tarāpuka) mortality investigation: Schistosomiasis. New Zealand Veterinary Association Wildlife Conference, Auckland.

Buckle K (2023). Journey to the centre of the crypt: A *Mycoplasma bovis* saga. New Zealand Society for Veterinary Pathology Annual Conference, Palmerston North.

O'Connell J (2023). Calf ulcerative stomatitis update.

New Zealand Veterinary Association Conference, Wellington.

Tana T (2023). Avian mortality events – investigation case studies. 6th Cycle Training of WOAHC Focal Points for Wildlife in Asia and the Pacific with Regional Networking Workshop, On line.

Peer-reviewed scientific papers

Binney BM, Pragert H, Foxwell J, Gias E, Birrell ML, Phiri BJ, Quinn O, Taylor M, Ha HJ, Hall RJ (2023). Genomic analysis of the population structure of *Paenibacillus larvae* in New Zealand. *Frontiers in Microbiology* 14:1161926. doi: 10.3389/fmicb.2023.1161926.

Butcher RG, Lenting B, Clarke AS, Buckle K, Gans C (2023). Jejunal intramural haematoma in a captive African lion (*Panthera leo*). *Veterinary Record Case Reports* 11(1), e556.

Hempstead MN, Waghorn TS, Gibson MJ, Sauermann CW, Ross AB, Cave VM, Sutherland MA, Marquetoux N, Hannaford R, Corner-Thomas RA, Sutherland IA (2023). Worms and welfare: Behavioural and physiological changes associated with gastrointestinal nematode parasitism in lambs. *Veterinary Parasitology* 324:110056. doi: 10.1016/j.vetpar.2023.110056.

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Morris RS, Bingham PC (2023). Japanese encephalitis virus: Epidemiology and risk-based surveillance approaches for New Zealand. *New Zealand Veterinary Journal* 71(6), 283–294.

Phiri BJ, Pragert H, Taylor B, Hall RJ (2023). A four-decade profile of apicultural demographics and production in New Zealand, 1980–2020. *Journal of Economic Entomology* 116(2) 342–351. doi: 10.1093/jeet/toad031.

Wierenga JR, Grimwood RM, Taylor HS, Hunter S, Argilla LS, Webster T, Lim L, French R, Schultz H, Jorge F, Bostina M, Burga L, Swindells-Wallace P, Holmes EC, McInnes K, Morgan KJ, Geoghegan JL (2023).

Total infectome investigation of diphtheritic stomatitis in yellow-eyed penguins (*Megadyptes antipodes*) reveals a novel and abundant megrivirus. *Veterinary Microbiology* 286, 109895.

Other publications in 2023

Foxwell J, **Watts J**, **Green D** (2023). Animal health surveillance data annual report. *Surveillance* 50(3), 23–27.

Hall RJ, Pragert H, **Phiri BJ**, Reiter Y, Fan QH (2023). *Small hive beetle surveillance project: project report*. Ministry for Primary Industries. ISBN No: 978-1-991087-26-3.

Marquetoux N (2023). Transmissible spongiform encephalopathies surveillance programme annual report. *Surveillance* 50(3), 45–47.

Marquetoux N, **Watts J**, **Bingham P**, **Compton C** (2023). Salmonellosis in dairy cattle: a national case-control study to identify risk factors for outbreaks. *Proceedings of the Dairy Cattle Veterinarians of the NZVA 2023*, 73–76.

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Animal health surveillance data annual report

The following tables present animal health data collected by MPI from various sources during 2023.

Table 1 is a summary of the numbers of laboratory submissions from the major livestock and avian populations. For illustrative purposes a selection of presenting syndromes is provided

in some instances, with examples of corresponding diagnoses.

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 in Australia. In all, 16 salmon production sites were tested across 25 sampling events.

Table 1: Numbers of cases and diagnoses received from veterinary pathology laboratories during 2023

Cattle	Count
Total sick animal cases	18,402
Abnormalities of reproductive system	149
<i>Neospora caninum</i>	5
<i>C. fetus</i> subsp. <i>venerealis</i>	0
Pestivirus infection	14
Abortion	422
<i>Neospora caninum</i>	60
Mycotic abortion	7
Pestivirus infection	5
<i>Leptospira</i> spp.	11
Congenital defects	17
Illthrift/diarrhoea	10,627
Pestivirus infection	141
Gastrointestinal parasitism	532
Johne's disease	3,425
Trace element deficiency	243
<i>Yersinia</i> spp.	566
Rotavirus	143
Nervous signs	286
<i>Listeria monocytogenes</i>	2
Hepatic encephalopathy	0
Metabolic disease	20
Malignant catarrhal fever	14
Polioencephalomalacia	13
<i>Histophilus somnus</i>	0
Sudden death	796
<i>Clostridium</i> spp.	5
Respiratory disease	656

Lamoids	Count
Total sick animal cases	251
Abortion	3
Illthrift/diarrhoea	108
Gastrointestinal parasitism	20
Nervous signs	13
Respiratory disease	4
Sudden death	20

Sheep	Count
Total sick animal cases	2,117
Abnormalities of reproductive system	465
<i>Brucella ovis</i>	27
Abortion	166
<i>Campylobacter fetus</i> subsp. <i>fetus</i>	14
Other <i>Campylobacter</i> spp.	2
<i>Toxoplasma gondii</i>	34
<i>Salmonella</i> Brandenburg	39
Congenital defects	2
Illthrift/diarrhoea	758
Johne's disease	29
Trace element deficiency	38
Gastrointestinal parasitism	322
Nervous signs	86
<i>Listeria monocytogenes</i>	2
Polioencephalomalacia	7
<i>Clostridium</i> spp.	0
Respiratory disease	56
Sudden death	342
Gastrointestinal parasitism	88

Farmed deer	Count
Total sick animal cases	127
Abnormalities of reproductive system	1
<i>Streptococcus zooepidemicus</i>	0
Congenital defects	0
Illthrift/diarrhoea	58
Johne's disease	6
Trace element deficiency	7
<i>Yersinia</i> spp.	6
Nervous signs	9
Malignant catarrhal fever	0
Sudden death	55
Gastrointestinal parasitism	0
Malignant catarrhal fever	1

Avian species	Count
Total number of submissions	1,125

Pigs	Count
Total sick animal cases	68
Abortion	4
Illthrift/diarrhoea	11
Nervous signs	3
Sudden death	7

Horses	Count
Total sick animal cases	6,899
Abortion	45
<i>Streptococcus zooepidemicus</i>	2
Circulatory disease	38
Illthrift/diarrhoea	1,064
Gastrointestinal parasitism	123
Nervous signs	143
Respiratory disease	694
Streptococcal infection	80
Sudden death	16

Goats	Count
Total sick animal cases	543
Abortion	6
Illthrift/diarrhoea	329
Gastrointestinal parasitism	148
Respiratory disease	16
Nervous signs	15
<i>Listeria monocytogenes</i>	0
Caprine arthritis encephalitis	2
Sudden death	18
<i>Clostridium perfringens</i> D (enterotoxaemia)	0
Gastrointestinal parasitism	3

Table 2: *Salmonella* serotypes isolated from animals during 2023

Serotype	Avian	Bovine	Canine	Cervid	Equine	Feline	Other	Ovine	Reptile
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Typhimurium	4	113	11	1	12	15	1	7	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Bovismorbificans	0	91	2	0	2	1	1	3	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Hindmarsh	0	0	1	0	0	0	0	54	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Brandenburg	0	20	3	0	0	0	0	10	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Give	0	27	2	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Livingstone	0	0	17	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Emek	0	11	0	0	0	1	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Enteritidis	0	5	3	0	1	1	0	2	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Saintpaul	2	2	5	0	1	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Thompson	0	0	7	0	0	1	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Ruiru	0	4	0	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Agona	0	1	2	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Mbandaka	0	2	0	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Montevideo	0	0	2	0	0	0	0	0	0
<i>Salmonella enterica</i>	1	0	0	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Amsterdam	0	1	0	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Infantis	0	0	1	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Mississippi	1	0	0	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Ohio	1	0	0	0	0	0	0	0	0
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Reading	0	0	0	0	0	0	0	0	1
<i>Salmonella enterica</i> subsp. <i>enterica</i> serovar Stanley	1	0	0	0	0	0	0	0	0
Unspecified	5	4	3	0	5	2	1	0	6
Total	15	281	59	1	21	21	3	76	7

Table 3: Salmonid surveillance during 2023

Pathogen tested for	No of farms*	No of samples†	No of positive pools
Viral cultures	16	1,500	0
<i>Myxobolus cerebralis</i>	3	180	0
<i>Yersinia ruckeri</i>	16	1,500	0
<i>Aeromonas salmonicida</i>	16	1,500	0
<i>Renibacterium salmoninarum</i>	5	300	0
*25 sampling events in total † Tested in pools of five.			
Number of salmon farms tested			16
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, 2018–2023

Disease agents investigated and confirmed as negative	2018	2019	2020	2021	2022	2023	Total	Disease agents investigated and confirmed as negative	2018	2019	2020	2021	2022	2023	Total
<i>Aeromonas salmonicida</i> (fish) *B	1	2	4	2	0	1	10	Dourine <i>Trypanosoma equiperdum</i>	0	0	1	0	0	0	1
African horse sickness virus	0	1	0	0	0	2	3	Eastern equine encephalitis virus	0	0	0	0	0	1	1
Africanised honeybee (<i>Apis mellifera scutella</i>) and Cape bee (<i>Apis mellifera capensis</i>) *B	3	1	0	0	0	1	5	<i>Echinococcus</i> spp. (hydatid disease)	2	0	1	7	1	2	13
Akabane virus	0	1	1	1	0	0	3	<i>Ehrlichia canis</i>	1	0	2	7	1	1	12
Anaplasma phagocytophilum	0	0	0	0	1	0	1	Enteric redmouth (<i>Yersinia ruckeri</i> – exotic strains) (fish)	2	3	1	3	0	1	10
Anaplasmosis (causes of)	0	0	0	2	0	0	2	Equine piroplasmosis (all causes of)	4	0	9	7	9	3	32
<i>Aphanomyces invadans</i> (epizootic ulcerative syndrome of fish)	0	1	2	1	0	1	5	Equine herpesvirus-1 (abortifacient strains, neuropathogenic strains)	1	2	1	2	3	2	11
Aujeszky's disease (pseudorabies) suid herpesvirus-1	0	1	1	0	0	0	2	Equine infectious anaemia virus and equine viral arteritis virus	6	2	9	8	6	2	33
Avian adenovirus	0	0	0	0	1	0	1	Equine influenza virus	1	1	0	3	0	0	5
Avian circovirus	0	0	0	0	1	0	1	Exotic ticks	5	8	5	16	17	21	72
Avian influenza virus: highly pathogenic notifiable avian influenza & Newcastle disease virus *B	6	10	8	14	23	48	109	<i>Fascioloides magna</i>	0	0	0	0	1	0	1
Avian influenza virus: low-pathogenicity avian influenza *B	1	0	0	0	20	37	58	Fish, shellfish and crustacean mortality (wild or managed, marine) – for exclusion of exotic and novel infectious disease agents not otherwise listed	16	20	16	14	0	19	85
Avian polyomavirus	0	0	0	0	1	0	1	<i>Francisella tularensis</i> (tularemia)	0	2	2	0	1	1	6
<i>Babesia canis</i> , <i>B. gibsoni</i> and <i>B. felis</i>	0	0	0	1	2	1	4	Infectious bovine rhinotracheitis virus (exotic strains)	0	1	0	0	0	0	1
<i>Bacillus anthracis</i> (anthrax)	7	3	1	1	2	2	16	Infectious bursal disease virus	2	4 *C	3	3	4	4	16
Bluetongue virus	0	1	2	0	2	0	5	Israeli acute paralysis virus (bees) *B	0	3	1	1	0	0	5
<i>Borrelia burgdorferi</i> (Lyme disease)	0	0	0	0	1	2	3	Jaagsiekte sheep retrovirus (pulmonary adenomatosis virus)	1	0	0	0	0	0	1
Bovine herpesvirus-5	0	0	0	0	1	0	1	Japanese encephalitis virus	0	0	0	0	1	2	3
Bovine leukaemia virus	0	0	3	7	5	4	19	<i>Leishmania</i> spp.	3	0	1	2	2	0	8
Bovine theileriosis and babesiosis (exotic strains)	2	0	0	0	2	0	4	<i>Leptospira</i> (exotic strains)	2	0	0	0	1	0	3
Bovine viral diarrhoea virus type 2a	0	1	0	1	2	3	7	Louping ill virus	0	0	0	1	0	0	1
<i>Brucella abortus</i>	1	3	0	4	1	1	10	Lumpy skin disease (LSD) virus	0	0	3	1	1	5	10
<i>Brucella canis</i>	6	4	6	7	9	12	44	Maedi-visna virus	0	0	0	1	0	0	1
<i>Brucella melitensis</i>	1	3	0	0	0	1	5	<i>Melissococcus plutonius</i> (European foulbrood) (bees) *B	6	5	3	6	1	3	24
<i>Brucella suis</i>	0	2	1	6	1	8	18	<i>Mycobacterium ulcerans</i>	0	0	0	1	0	0	1
<i>Burkholderia mallei</i> (glanders) and <i>B. pseudomallei</i> (melioidosis)	0	0	0	1	0	1	2	<i>Mycoplasma haemocanis</i>	0	0	0	1	1	0	2
Canine distemper virus	3	3	2	11	9	7 *D	28	<i>Mycoplasma mycoides</i> subsp. <i>mycoides</i> (contagious bovine pleuropneumonia)	0	0	0	1	2	1	4
Canine influenza virus	2	0	1	2	4	0	9	<i>Mycoplasma bovis</i>	Under response	0	0	2	3	2	7
Canine transmissible venereal tumour	0	0	0	0	0	1	1	Exotic <i>Mycoplasma</i> spp. (excluding <i>M. bovis</i> and <i>M. mycoides</i>)	0	0	0	0	1	3	4
<i>Chlamydomyxa abortus</i> (enzootic abortion)	1	1	6	0	1	0	9	Myxoma virus (myxomatosis)	1	1	0	1	0	0	3
Coccidioidomycosis	0	0	0	1	0	0	1								
<i>Coxiella burnetii</i> (Q fever)	1	4	0	0	0	0	5								
Deformed wing virus B	0	0	0	0	0	1	1								
<i>Dirofilaria immitis</i> (heartworm disease)	2	1	1	1	1	2	8								

Table 4a: (continued)

Disease agents investigated and confirmed as negative	2018	2019	2020	2021	2022	2023	Total
<i>Onchocerca cervicalis</i>	0	0	0	0	1	0	1
<i>Pasteurella multocida</i> – toxigenic strains (cause of haemorrhagic septicaemia)	1	2	2	0	1	1	7
Peste des petits ruminants virus (PPRV)	0	0	0	1	0	0	1
<i>Perkinsus marinus</i> (molluscs)	6	5	7	7	0	3	28
Phocine distemper virus	0	0	0	0	1	6	7
Porcine reproductive & respiratory syndrome virus	2	2	4	2	1	1	12
Poxviruses (exotic, excl. LSD)	1	0	0	2	0	1	4
Psittacine herpesvirus (incl. Pacheco's disease)	0	0	0	0	2	0	2
<i>Psoroptes ovis</i> (sheep scab)	0	0	0	1	0	0	1
<i>Psychrobacter</i>	0	0	0	0	1	0	1
Rabies virus	0	5	2	2	0	0	9
Ranavirus	0	0	0	0	5	0	5
Rinderpest virus	0	0	0	0	0	0	0
Ross River virus	0	3	0	0	0	0	3
<i>Salmonella</i> (exotic strains)	2	2	2	1	1	2	10
Small hive beetle (<i>Aethina tumida</i>) *B	3	2	2	1	1	1	10
Swine fever viruses (African and classical swine fever viruses)	2	3	5	3	2	1	16
Tracheal mite (<i>Acarapis woodi</i>) (bees) *B	5	5	4	6	1	3	24
Transmissible spongiform encephalopathy agents (scrapie, BSE, chronic wasting disease, FSE) *B	2	0	0	1	1	2	6
<i>Treponema paraluisclunuli</i> (rabbit syphilis)	0	0	0	2	0	0	2
<i>Trichinella spiralis</i> (trichinosis)	1	0	0	0	0	0	1
<i>Tropilaelaps clareae</i> and <i>T. koenigerum</i> (bees) *B	1	2	1	1	0	0	5
<i>Trypanosoma evansi</i> (surra)	0	0	0	0	0	1	1
Viral haemorrhagic septicaemia (fish)	0	1	3	1	0	1	6
Viral vesicular disease	7	3	16	20	24	16	86
West Nile virus	1	3	3	5	14	21	47
Total	124	129	150	208	202	262	1,075

Table 4b: Significant positive investigations of suspected exotic diseases, 2023

Disease agents/vectors investigated and confirmed as positive, and host species	Number of positive investigations in 2023
<i>Dermatobia hominis</i> myiasis in a human (Buckle, 2023a) *A	1
<i>Rhipicephalus sanguineus</i> in a dog (Buckle, 2023a) (Buckle, 2023c) *A	2
<i>Brucella suis</i> in a human (Buckle, 2023c) *A	1
<i>Leishmania</i> spp. in a dog (Buckle, 2024) *A	1

Biosecurity is about managing risks: protecting New Zealand from exotic pests and diseases that could harm our natural resources and primary industries.

Tables 4a and **4b** present results from investigations by MPI's Biosecurity Incursion Investigation (animal health) and Aquatic Health and Environment Health teams.

Table 4a shows results for the period 2018–2023 that have resulted in exclusion of WOA–notifiable diseases or other significant exotic diseases. **Table 4b** is a list of significant investigations conducted during 2023 into suspected exotic or emerging diseases that have been confirmed as positive. These include:

- exotic disease, vector incursions or newly emerged diseases;
- occurrences of diseases in new host species; and
- interceptions with no resulting transmission or establishment of organisms.

The MPI Surveillance and Incursion Investigation teams devote much of their time to ensuring that organisms that may be new to New Zealand come to their attention and are appropriately investigated. Information in **Table 4c** was compiled from notifications to MPI of suspected new-to-New Zealand organisms or suspected emerging diseases.

Asterisks in these tables (*A, *B, etc.) refer to the notes that follow.

Notes to Table 4a

*A The investigations listed in Table 4a are those that have resulted in exclusion of a WOA–listed disease or other significant diseases investigated once or more in the 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 Buckle (2023 a, b); Buckle (2024).

*B Investigations reported here are in addition to testing in the MPI active surveillance programmes for these disease agents.

*C An MPI biosecurity response was established for this unwanted organism. Positive cases identified in the response are not included in the total.

*D Canine distemper virus was excluded in six Kekeno/New Zealand fur seal (*Arctocephalus forsteri*) mortality event investigations.

Notes to Table 4b

*A There is sufficient evidence to support that the individuals confirmed positive on testing for these organisms were exposed outside of New Zealand. Further investigation found no evidence of other cases or establishment of the organism within New Zealand.

Table 4c: Validated new-to-New Zealand organisms or emerging diseases: April – December 2023*

Organism	Host	Isolated from	Location	Reference	Comments
<i>Bordetella trematum</i>	Dog	Otitis ear swab	Canterbury	Buckle, 2023b	Dog with otitis externa. Cultured as part of mixed growth. Clinical significance unclear.
<i>Aeromonas media</i>	Dog	Surgical wound	Otago	Buckle, 2023b	Cultured from a swab of a surgical wound in a farm dog.
<i>Mycoplasma nasistruthionis</i>	Ostrich (<i>Struthio camelus</i>)	Oral swab	Auckland	Buckle, 2023b	No associated clinical signs of disease. The ostriches were New Zealand-born.
<i>Schaalia hyovaginalis</i>	Dog	Swab taken from discharging sinus	Canterbury	Buckle, 2023b	Isolated as part of a mixed bacterial growth from the discharging sinus of dog that had undergone stifle surgery. Clinical significance unclear. Isolate perished prior to validation and could not be revived.
<i>Proteus terrae</i>	Dog	Otitis ear swab	Auckland	Buckle, 2023c	Two-year-old Springer Spaniel with otitis externa. Considered incidental to disease.
<i>Canibacter oris</i>	Dog	Otitis ear swab	Auckland	Buckle, 2023c	Two-year-old Staffordshire Bull Terrier with otitis.
<i>Salmonella Champaign</i>	Broll sample (animal feed)	Broll	Auckland	Buckle, 2023c	Broll (chicken feed) manufactured from imported wheat, report subsequently transferred to NZ Food Safety.
<i>Streptococcus penaeicida</i>	Cow	Milk sample	Bay of Plenty	Buckle, 2023c	Milk sample taken as part of a clinical trial, not considered of primary significance.
<i>Pasteurella oralis</i>	Cat	Nasal discharge	Bay of Plenty	Buckle, 2023c	Single case of septic rhinitis. Organism considered likely to be pathogenic in this case.
<i>Pseudomonas citronellolis</i>	Dog	Nasal swab	Canterbury	Buckle, 2023c	Dog with nasal aspergillosis. Isolate considered likely to be a contaminant in this case.
<i>Enterococcus raffinosus</i>	Cat	Bile sample	Auckland	Buckle, 2023c	Part of mixed bacterial growth obtained from a single case of biliary obstruction. Clinical significance unclear.
<i>Neisseria animaloris</i> **	Dog	Tongue lesion	Auckland	Buckle, 2023c	Isolated from a Golden Retriever with a non-healing ulcerative lesion on the tongue (co-isolated with <i>Frederiksenia canicola</i> , below).
<i>Frederiksenia canicola</i>	Dog	Tongue lesion	Auckland	Buckle, 2023c	Isolated from a Golden Retriever with a non-healing ulcerative lesion on the tongue (co-isolated with <i>Neisseria animaloris</i> , above).
<i>Prevotella heparinolytica</i>	Cat	Swab taken from an abscess	Auckland	Buckle, 2023c	Present with mixed bacterial growth. This organism is reportedly an oral commensal bacterium of dogs and cats.
<i>Weissella confusa</i>	Dog	Otitis ear swab	Auckland	Buckle, 2023c	Adult male dog, isolate considered of low clinical significance.
<i>Enterobacter hormaechei</i> subsp. <i>xiangfangensis</i>	Horse	Urine	Otago	Buckle, 2023c	Horse with a history of haematuria, isolate also shows homology with <i>Enterobacter hormaechei</i> subsp. <i>Hoffmannii</i> .
<i>Enterococcus canintestini</i>	Dog	Urine	Otago	Buckle, 2023c	French Bulldog, isolate not considered clinically significant.
<i>Streptococcus plurimalium</i>	Horse	Nasal discharge	Manawatū	Buckle, 2023c	10-year-old horse with a cough and rhinorrhoea, isolate not considered clinically significant.
<i>Campylobacter fetus</i> subsp. <i>testudinum</i>	Bull	Preputial wash	Waikato	Buckle, 2024	No associated clinical signs of disease. Sample taken prior to planned export.
<i>Kluyvera cryocrescens</i>	Kea (<i>Nestor notabilis</i>)	Crop wash	Auckland	Buckle, 2024	Considered incidental. Found in conjunction with organism below.
<i>Acinetobacter calcoaceticus</i>	Kea (<i>N. notabilis</i>)	Crop wash	Auckland	Buckle, 2024	Considered incidental. Found in conjunction with organism above.
<i>Neisseria dumasiana</i>	Dog	Otitis ear swab	Manawatū	Buckle, 2024	Cultured as part of a mixed bacterial growth, considered a canine oral microflora commensal.
<i>Microbacterium paraoxydans</i>	Mare	Uterine sample	Auckland	Buckle, 2024	Mare experiencing reproductive issues. Clinical significance unclear.
<i>Peptostreptococcus canis</i>	Dog	Swab taken from an abscess	Canterbury	Buckle, 2024	Found associated with heavy <i>Bacteroides</i> sp. culture in a 9-year-old spayed female Labrador.
<i>Filifactor villosus</i>	Cat	Oral swab	Canterbury	Buckle, 2024	Cat with mandibular swelling. Clinical significance unclear. Cat responded to antimicrobial therapy.
<i>Paenarthrobacter ilicis</i>	Dog	Otitis ear swab	Otago	Buckle, 2024	Cultured as part of a mixed bacterial growth.
<i>Fusobacterium russi</i>	Cat	Swab taken from an abscess	Auckland	MPI, Unpublished	Isolated from cat bite abscess on Siamese cat.
<i>Austrobilharzia terrigalensis</i>	Black billed gull (<i>Larus bulleri</i>)	Intestine and parenchymal organs (liver, pancreas, spleen)	Auckland	MPI, Unpublished	Identified in association with a wild bird mortality event. Found in association with parasitic enteritis and in multiple parenchymal tissues (liver, spleen and pancreas) in affected birds. Other exotic diseases were excluded including high pathogenicity avian influenza, West Nile virus, and Newcastle disease.

* All identifications were validated at MPI's Animal Health Laboratory, Wallaceville except for *Austrobilharzia terrigalensis*, which was validated by Dr Jerusha Bennett, University of Otago.

** Notice of correction: In *Surveillance* (Buckle, 2023c), *N. dumasiana* should be *N. animaloris*.

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Animal health (endemic diseases) annual report

Overview

The Animal Health (Endemic Diseases) team (the team) was created in 2021 within the Animal Health and Welfare Directorate to fill a gap in MPI’s operations, which have not included endemic animal diseases, other than emerging diseases or those causing human foodborne illnesses, since the late 1990s.

The team’s vision is to reduce the impact of endemic animal diseases in New Zealand. Outcomes sought by the team were increased awareness of endemic animal diseases, improved animal health and better environmental and human health outcomes from improved animal health and farm productivity. The team planned to achieve these outcomes by working in partnership with internal and external stakeholders, collecting, analysing and distributing information and data, and strategically focusing on diseases of highest impact.

The team had a busy and fruitful year, continuing projects aligned with the team’s outcomes and undertaking ad hoc projects to assist with cyclone response coordination efforts. Some of the highlights included the animal health pilot project implemented on the Chatham Islands and the opportunity to assist affected communities following Cyclone Gabrielle. The team achieved its overarching goal of ‘making a difference’.

Team composition

All team members (Table 1) are qualified overseas veterinarians, registered within New Zealand. Skill sets include large and small animal practice, poultry, wildlife, verification services, laboratory management, exotic and endemic disease outbreak preparedness and response, and national disease control and surveillance.

Table 1: Qualifications and experience of senior team members

Name	Role	Qualifications	Years with MPI
Colin O’Connor	Team Manager	BVSc	19
Kerushini Govender (Kat)	Principal Adviser	BVSc, MSc, MANZCVS	7
Justin Mercier	Senior Adviser	DVM	11
Fanny Leduc	Principal Adviser (secondment)	DMV	5

Strategically focused projects

National voluntary bovine viral diarrhoea (BVD) control project

The team conducted a farmer survey and an objective assessment in 2021 that showed that BVD ranked in the top three diseases/conditions of concern to cattle farmers. For this reason, the team embarked on the national voluntary BVD control project.

Drivers for BVD control include:

- Economics: BVD is estimated to cost NZ\$150 million in production losses and \$40 million in control expenses annually (BVD Free New Zealand, 2020). Modelling determined a cost: benefit ratio of 1:1.8 at a national level for a regulated control programme (Han, 2020);
- Environmental: Controlling BVD in badly affected herds could reduce greenhouse gas emissions by up to 11 percent per unit output (Statham et al., 2020);
- Animal welfare: BVD causes abortions, stillbirths, birth defects and the birth of persistently infected calves that are often poor doers and highly susceptible to other infections;
- Feasibility: Reliable diagnostic tests that are technically feasible. Whole-herd culling is not required to control BVD;
- Support: There is strong support for BVD control from farmers, stakeholders, veterinarians and industry; and
- International reputation: BVD has been successfully eradicated

from multiple European countries (Lindberg et al., 2006).

The team designed a broad, three-phase framework for the BVD project. Phases one and two are about building capability for a disease control programme. These phases include the formation of a government–industry framework, producing new educational on-farm management tools, conducting BVD surveillance, data management, database capability and control strategies. Phase three is the implementation of the programme nationally and the evaluation of its effectiveness, with feedback for continuous improvement.

Workstreams within this framework that were achieved during 2023 included the formation of the BVD subcommittee under the Endemic Disease Forum (see below), production of BVD educational material and an on-farm BVD management tool, and a BVD pilot project on the Chatham Islands.

Chatham Islands animal health pilot project

The team undertook an instructional trip to the main Chatham Island to deploy an animal health pilot project. The project was developed following a survey of the Chatham Island farmers to understand their animal health concerns. Concerns identified were drench resistance, internal and external parasites and bovine viral diarrhoea. The project was designed to be scalable, that is, to apply the principles and some operational aspects to other areas in New Zealand.

The team held three information and demonstration sessions on BVD and worm management on the island. They also travelled to multiple farms to have

one-on-one discussions with farmers about their concerns on BVD and animal health, and to conduct sampling for BVD testing, together with the subcontracted veterinarian.

The team met with Mayor Monique Croon, who was completely supportive of the team's initiative on the island. The farmers' feedback was extremely positive and indicated that they would like to continue working with the team on BVD control and other animal health issues.

Partnerships

Endemic Disease Forum (EDF)

While consulting with numerous stakeholders on BVD, it was clear that to be more efficient, the team could save time and resources by discussing endemic disease matters at once with multiple stakeholders in the room. With this idea in mind the EDF was formed.

The EDF is an operational reference group comprising representatives from MPI, farmer representative groups, industry bodies, existing disease control programmes, the veterinary profession and the private sector. Members of the forum are committed to achieving a vision of healthy animals and a healthy planet by reducing the impact of endemic diseases in New Zealand livestock.

One of the outcomes of the EDF this year was to develop a BVD subcommittee to progress the national voluntary BVD control project. The BVD subcommittee, co-led by the Animal Health (Endemic Diseases) team, has representatives from Federated Farmers, Beef + Lamb NZ, Dairy NZ, Deer Industry NZ and the New Zealand Veterinary Association (NZVA). The BVD Subcommittee aims to include these representatives through the whole process of consultation, development and implementation of a New Zealand-suitable BVD control strategy. The mission of the subcommittee is "to enable farmers to eliminate BVD from New Zealand".

Veterinarian liaison cyclone response

The team was involved in the cyclone

response group together with NZVA, Veterinary Council New Zealand (VCNZ), Massey University and others and was tasked with:

- conducting a post-flooding endemic disease risk analysis;
- creating a farmer information sheet on high-risk diseases;
- assessing animal health risks associated with feed ;
- creating a disease and condition risk matrix; and
- exploring the need for animal leptospirosis surveillance post-flooding.

Following the reports of increased leptospirosis cases in humans post flooding, Massey University approached MPI to assist with awareness about the risks of leptospirosis. The team played an instrumental role in collaborating with Massey University and the NZVA to host a leptospirosis awareness webinar that included experts within the field. The webinar had a large attendance and was very well received.

A follow-on from this webinar was the creation of a leptospirosis survey for veterinarians to gain more information about animal cases post-flooding.

Beef measles

The animal health team was approached by Verification Services (VS) to assist with follow-up, risk assessment and investigation of all suspect and positive detections of *Cysticercus bovis* cysts from meat processing plants. *Cysticercus bovis* is endemic in New Zealand, although the prevalence is very low. Cysts rarely cause problems for the infected animal. However, they are a food safety risk as they can lead to the infection of humans who eat undercooked contaminated meat. Cysts in meat can also pose a risk to overseas market access requirements.

The team agreed to partner with New Zealand Food Safety to assess and record these cases. During the 2022/23 season, there were seven positive *C. bovis* cases that were followed up. No cases resulted in farm visits or surveillance listing.

Surveillance

During the team's objective assessment to prioritise diseases, the lack of endemic disease prevalence data was highlighted as a gap. One of the aims of the team was to bridge this gap by following the principles of surveillance, which are to collect data from new and existing data sources, analyse the data, disseminate the information using an electronic platform and take action through extension and control programmes. The team met these objectives through the following projects.

BVD

Historical information indicated that 45 percent to 55 percent of beef farms and 15 percent to 25 percent of dairy farms were infected with BVD (BVD Free New Zealand, 2020). The team required more recent and up-to-date data of BVD prevalence in New Zealand. These data will be used as a baseline and for comparison once control measures are implemented.

Conducting active planned surveillance for BVD is the best option; however for efficiencies, other options were explored such as the use of existing data sources. The team was able to use stored *Mycoplasma bovis* samples to test for BVD following permission granted by each farmer. A total of 228 farms were serologically tested through this project (**Figure 1**, next page).

Active BVD surveillance was conducted on 11 of around 20 commercial cattle farms on the Chatham Islands during the Animal Health pilot project (**Figure 2**).

North Island weather event (Vets on Farm project)

The team worked with the NZVC on the North Island weather event (flooding and Cyclone Gabrielle) 'Vets on Farm' project that was conducted over 2023/24. A number of endemic diseases were included in the panel of tests that were offered to and conducted on 288 farms over Northland, Coromandel, Tairāwhiti, Hawke's Bay, Tararua, Manawātū and Wairarapa. Further testing and return veterinarian visits to discuss herd

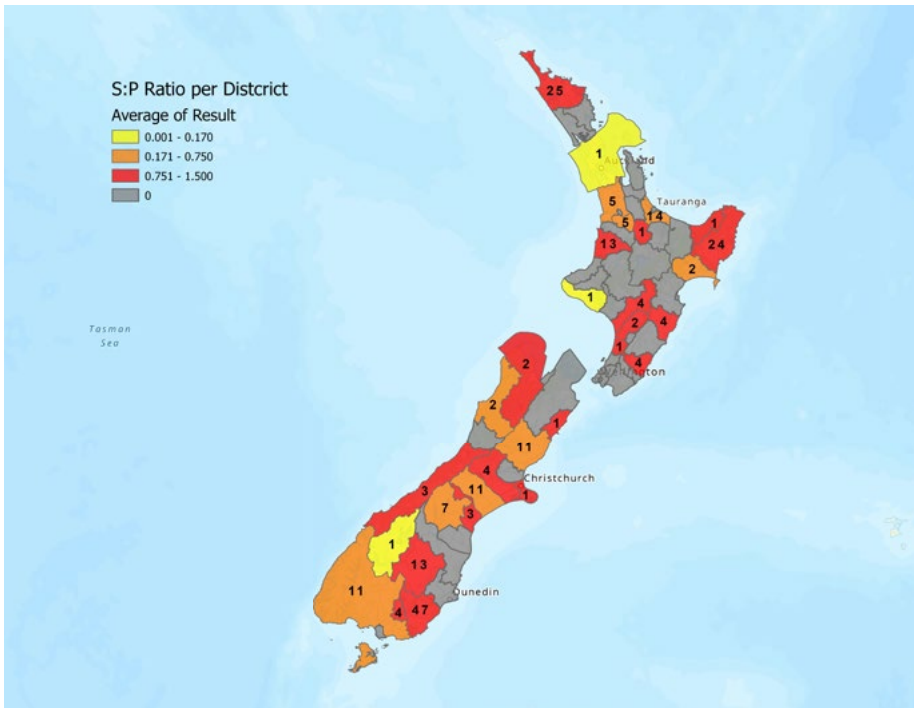


Figure 1: the number of farms tested for *Mycoplasma bovis* per territorial authority. The colour indicates the average serological titre of farms per territorial authority. Yellow: low level exposure to BVD virus (past exposure or vaccination); Orange: medium (suspect) level exposure to BVD virus (recent exposure or vaccination); Red: high level exposure to BVD virus (recent exposure or active BVD virus infection)

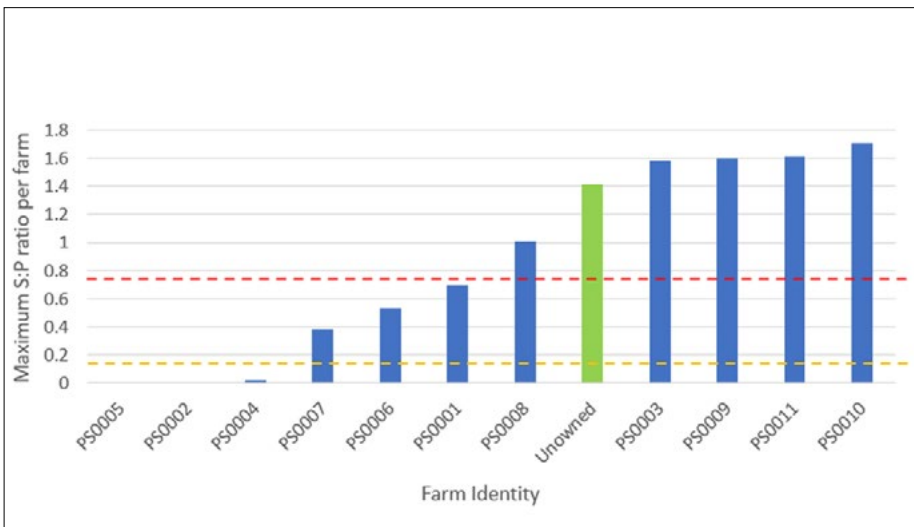


Figure 2: Maximum serological titre per farm. Farms with at least one animal with an S/P ratio above 0.75 (yellow dashed line) are likely to have had recent exposure or active BVD virus infection

health planning will continue into 2024.

Endemic Disease Dashboard (Edd)

The team decided that the best way to disseminate endemic disease information to farmers, veterinarians, and other animal health professionals, would be via an electronic platform.

The dashboard will host endemic disease data on a heat map. It will include impact information, on-farm control measures, useful

resources and links, and disease summary information.

The dashboard is not an exhaustive source of information. It is a conversation starter and reference point for everyone involved in managing animal health. It aims to help farmers and animal health professionals make informed decisions about endemic diseases.

The dashboard has gone through the approval, design, navigation, development, coding and review

processes. The aim is to launch the dashboard in mid-2024.

Milestones and leadership roles

Achievements

Kerushini Govender achieved the New Zealand Certification in Project Management (Level 4).

Leadership roles

Colin O'Connor is part of the Food and Agriculture Organisation of the United Nations Committee on Agriculture's Sub-Committee on Livestock.

Kerushini Govender became the Western Pacific Region (New Zealand) Council member for the International Society for Infectious Diseases.

Science engagement and original research

Presentations at veterinarian meetings and conferences

Govender K, Mercier J (2023).

Chatham Islands Animal Health Pilot Project. New Zealand Veterinary Association Conference, Wellington.

Govender K (2023). *National bovine viral diarrhoea (BVD) voluntary control project.* New Zealand Veterinary Association Conference, Wellington.

O'Connor C (2023). *The relationship between animal health and livestock emissions.* Online Workshop on the relationship between animal health and livestock emissions: Queens University, Belfast.

Peer review scientific papers

Colin O'Connor reviewed the Food and Agriculture Organisation of the United Nations draft paper on Livestock Production Systems: status, trends, and drivers of change.

Operational research

Kerushini Govender was part of MPI project teams for two operational research projects during 2023:

- Understanding New Zealand's Veterinary Capacity for National Disease Programmes (Biosecurity New Zealand)
- Survey of *Yersinia* in Pig Carcasses and Tonsils at Processing (New Zealand Food Safety).

References

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Han J-H (2020). Establishment of optimal control strategies to eliminate bovine viral diarrhoea in New Zealand. PhD thesis. Massey University, Manawātū, New Zealand.

Lindberg A, Brownlie J, Gunn GJ, Houe H, Moennig V, Saatkamp HW, Sandvik T, Valle PS (2006). The control of bovine viral diarrhoea virus in Europe: today and in the future. *Revue Scientifique et Technique* 25(3), 961–979.

Statham J, Scott H, Statham S, Acton J, Williams A, Sandars D (2020). Dairy cattle health and greenhouse gas emissions pilot study: Chile,

Kenya and the UK. *Global Research Alliance on Agricultural and Greenhouse Gases*. <https://globalresearchalliance.org/wp-content/uploads/2020/10/Dairy-Cattle-Health-and-GHG-Emissions-Pilot-Study-Report.pdf>.

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* Following MPI's Improving our Efficiency change process, which resulted in a new structure from 1 July 2024, the Animal Health (Endemics) team and the Animal Exports (Regulations) team have been merged into a single Animal Health and Exports team. A separate export process team has been created to continue the work of the continuous improvements by the Animal Exports Team.



Avian influenza surveillance programme annual report

New Zealand's official status

New Zealand is free from high pathogenicity avian influenza (HPAI). New Zealand's claim of historical country freedom from HPAI is based on Articles 1.4.6 and 10.4.3 of the Terrestrial Animal Health Code (the Code) (Anon., 2024a). Addressing the specific requirements detailed in Article 1.4.6 2b of the Code:

- New Zealand has never had an occurrence of HPAI;
- HPAI has been notifiable for at least the past 10 years;
- an early detection system is in place for all susceptible species;
- an ongoing awareness programme is in place to encourage reporting of suspect cases of HPAI;
- measures to prevent the introduction of HPAI are in place;
- no vaccination against HPAI has been carried out; and
- infection with HPAI is not established among wild birds in New Zealand.

There has never been a case of HPAI in New Zealand wildlife, although endemic low pathogenicity influenza viruses circulate in New Zealand wild birds, with resident waterfowl acting as a reservoir for these viruses (Stanislawek et al., 2002; Stanislawek et al., 2020, Stanislawek et al., 2024).

Epidemiology of avian influenza in New Zealand

New Zealand lies at the southeastern extremity of the East Asian–Australasian migratory bird flyway (**Figures 1 and 2**). However, given New Zealand's geographical isolation, relatively few migratory shorebirds reach the country from the northern hemisphere, and only three such species occur in significant numbers: the bar-tailed godwit (*Limosa lapponica*), the red (lesser) knot (*Calidris canutus*), and the ruddy turnstone (*Arenaria interpres*).

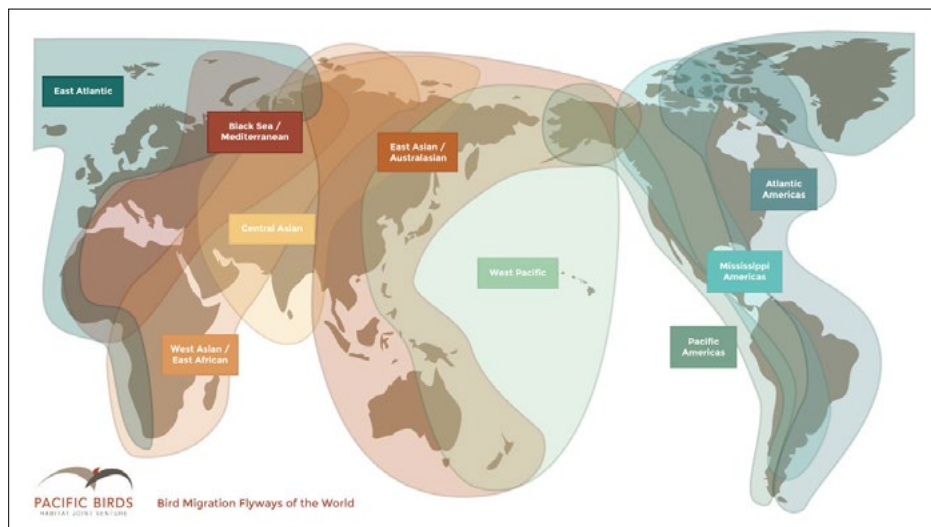


Figure 1: The nine major migratory bird flyways of the world. World's flyway map, Pacific Birds Habitat Joint Ventures with information sources from International Wader Study Group/Pacific Birds Habitat Joint Ventures, Copyrighted, All Rights Reserved - Used by permission, <https://www.fws.gov/media/worlds-flyway-map>



Figure 2: The East Asian–Australasian flyway. Source: Adrian Riegen, Pūkoro Mirinda Shorebird Centre brochure. From <http://www.teara.govt.nz/en/map/7218/the-east-asian-australasian-flyway>

These species make up 90 percent of the about 200,000 migratory shorebirds that visit New Zealand each year (Williams et al., 2006). Most godwits are believed to fly here directly from Alaska, while red knots have stopovers along the Asian coast as they migrate from the Siberian Arctic. Additionally, small numbers of other waders such as the Pacific golden plover (*Pluvialis fulva*) and red-necked stint (*Calidris ruficollis*) migrate to New Zealand via several stops in the Pacific. These birds share summer breeding grounds in the Arctic regions of Siberia and Alaska with species from Eurasia and the Americas (Figure 2) (Stanislawek et al., 2024).

Pelagic (ocean-ranging) seabirds such as petrels and albatrosses, which breed on and around the New Zealand coast during the southern hemisphere summer, also migrate to maritime regions of the northern Pacific associated with Japan, Russia and Alaska, with some travelling as far as the west coasts of North and South America (Bulach et al., 2010; Staislawek et al., 2024).

On arrival, these migratory birds, if infected, could introduce avian influenza viruses (AIVs) by shedding into the environment they share with resident shorebirds, gulls and waterfowl – the main natural reservoir for AIVs. In Eurasia and the Americas, the movements of migratory wild birds (mostly ducks and geese) have contributed to the spread of avian influenza viruses across and between continents, as is well documented for HPAI (Gilbert et al., 2006, Caliendo et al., 2022).

But unlike what happens elsewhere, waterfowl do not migrate to or from New Zealand, except for occasional vagrants from Australia and the Pacific islands (Williams et al., 2006). This creates a unique epidemiological situation, whereupon endemic AIVs circulate and evolve exclusively in their resident waterfowl reservoir, with no recent external influx of new viruses (Stanislawek et al., 2024). This has been demonstrated by genomic analyses of circulating subtype H5 and H7 AIVs in New Zealand. The H5 and H7 isolates appear to have

undergone an extended period of genetic isolation, as they both formed monophyletic HA groups. The H5 viruses were most closely related to H5 viruses circulating in North American wild birds, whereas the H7 viruses formed a sister cluster relationship with wild bird viruses of the Eurasian and Australian lineages, with most recent common ancestors dating three to four decades back (Stanislawek et al., 2024).

Avian influenza surveillance by MPI

Wild bird surveillance

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 carried out annual surveillance for AIVs in targeted migratory and resident birds. The first six years of surveillance focused primarily on migratory birds, in particular the bar-tailed godwit and red knot, from late September to November, at Pūkoro Mirando, their main North Island arrival site on the Firth of Thames. These birds were targeted for surveillance because of their migration pathway, along which AIVs 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 pose a very low risk for the introduction of high pathogenicity AIVs into New Zealand. Since 2010, surveillance has focused on resident waterfowl.

Starting in 2004, non-migratory waterfowl, predominantly mallards (*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 2023, cloacal and oropharyngeal swabs were collected from 1,277 healthy resident mallards from sites in the central North Island (Tables 1 and 2). An annual Fish & Game banding programme provides the opportunity for MPI to collect samples from ducks for avian influenza surveillance (Figures 3 and 4, next page). 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 were then tested using influenzas H5 RT-qPCR and H7 RT-qPCR TaqMan (Slomka et al., 2007; Hoffman et al., 2016) and conventional RT-PCRs to obtain genomic information on H5, H7 and other AIVs (Hoffmann et al., 2001) (Table 1).

The prevalence of AIV in the total number of samples collected across all four locations was 56.5 percent, with important variations between locations. The highest prevalence was recorded at the mouth of Kaituna River, Bay of Plenty (71.3 percent), followed by Te Awamutu area (68.4 percent), Parakai Springs, Northland (49.4 percent), and the Paeroa area, Waihou River (37.2 percent) (Table 1). The prevalence of AIV tends to fluctuate across sites and from year to year for a given site. In 2023 we observed a lower

Table 1: RT-qPCR and virus isolation results for AIV and APMV-1 samples collected from mallards, 2023

Sampling site	Number of ducks sampled (oral/cloacal swabs)	Number positive by Inf A RT-qPCR*	Number positive by AIV H5 RT-qPCR	Number positive by AIV H7 RT-qPCR	Number positive by APMV-1 RT-qPCR*
Parakai Springs, Northland	320	158	0	0	69
Paeroa area, Waihou River, Hauraki Plains	320	119	0	0	48
Mouth of Kaituna River, Bay of Plenty	320	228	0	0	29
Te Awamutu area, Waikato	317	216	0	0	16
Total	1,277	721	0	0	162

* Only selected samples from positive influenza A and APMV-1 RT qPCRs were used for virus isolation

Table 2: Virus isolation results for AIV and APMV-1 from positive influenza A and APMV-1 RT-qPCR samples collected from mallards, 2023

Sampling site	Number of ducks sampled (oral/cloacal swabs)	Number of AIV isolates/subtypes ¹	Number of H5 isolates	Number of H7 isolates	Number of APMV-1 isolates ^{1, 2}
Parakai Springs, Northland	320	1 x H4N6 1 x H11N2	0	0	3 x APMV1
Paeroa area, Waihou River, Hauraki Plains	320	1 x H4N6	0	0	2 x APMV1
Mouth of Kaituna River, Bay of Plenty	320	2 x H3N8 1 x H4N6	0	0	1 x APMV1
Te Awamutu area, Waikato	317	0	0	0	3 x APMV1
Total	1,277	6	0	0	9

¹ Only selected samples from positive influenza A and APMV-1 RT qPCRs were used for virus isolation.

² only low pathogenicity APMV-1 strains were recovered – these do not cause Newcastle disease in poultry.



Figure 3: Sylvia Ohneiser, Senior Technician from Animal Health Laboratory, MPI, Biosecurity New Zealand, collecting a sample from a mallard at the Parakai Springs, Northland



Figure 4: Fish & Game Bay of Plenty officer, Matthew McDougal (left), examined and banded trapped ducks that are also sampled for the MPI avian influenza survey. Matthew is the leader for organising and supervising duck trapping in this area, for wildlife management purposes

AIV prevalence in wild ducks (56.5 percent) compared with 69.9 percent in 2022. Longitudinal fluctuations in AIV prevalence are also apparent in samples from ducks collected in the Te Awamutu area; in 2020 the prevalence was just 16.3 percent, versus 68.1 percent in 2023.

No samples tested positive for H5 or H7 by the relevant RT-qPCR. The absence of virus subtypes H5 or H7 in the samples could be due to several factors, including a lower prevalence of these viruses compared with the number of samples collected at these locations or true absence of such viruses, in relation with the unique epidemiology of these viruses in New Zealand because of our geographical isolation.

Despite the lack of detection of the H5/H7 viruses, the situation can change if migratory birds in contact with these viruses in other parts of the world bring the viruses to New Zealand resident birds. This is possible because of recent changes of some of the H5 viruses (e.g., HPAI clade 2.3.4.4b) that have broadened their infectivity to other bird species including sea birds (Verhagen et al., 2021).

Virus isolation was also conducted on 74 randomly selected influenza A RT-qPCR-positive samples and 6 AIVs were isolated (**Table 2**).

Although this surveillance is focused mainly on AIVs, avian paramyxoviruses (APMV) were also targeted, as pathogenic strains of APMV-1 are important pathogens causing Newcastle disease – a high mortality poultry disease – in other countries. New Zealand has never had an outbreak of Newcastle disease in poultry, although non-pathogenic strains of APMV-1 are common in New Zealand, particularly in waterfowl (**Tables 2 and 3**).

MPI's Animal Health Laboratory, Wallaceville (AHL) follows standard procedures implemented for New Zealand's wild bird avian influenza surveillance programme. Virus isolation is carried out in embryonated chicken eggs that are specific-pathogen-free (i.e., free of AIV

and APMV-1). Haemagglutinin and neuraminidase subtyping of any AIV isolated is determined using specific conventional RT-PCR and genomic sequencing of the PCR product (Hoffman et al., 2001; Phipps et al., 2004).

Enhanced passive surveillance

MPI has an emergency exotic pest and disease hotline number (0800

80 99 66) that is free to call for any person in New Zealand at any time. Calls to this number from members of the public, veterinarians, regional laboratory pathologists, Department of Conservation staff, Fish & Game officers and others include reports of sick or dead birds, including wildlife, farmed and pet birds. Cases that relate to native birds are handled collaboratively with the Department of Conservation. A risk assessment determines whether it is necessary to investigate the report further. Information used in the assessment 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 collecting and submitting samples in cases of unexplained bird deaths (Rawdon et al., 2007), using approved suppliers. A standardised investigation protocol co-ordinated by MPI's Incursion Investigation team (Animal Health) is applied to submissions. This includes necropsy and sample collection for histology, bacteriology and virology. The presence of AIV is assessed using the influenza A real-time RT-PCR TaqMan test (Spackman et al., 2003), with follow-up on positive samples using real-time H5 and H7 RT/PCR TaqMan assays to exclude H5 and H7 subtypes (Slomka et al., 2007; Hoffman et al., 2016). 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 Diagnostics, Readiness & Surveillance Directorate's report on investigations of suspect exotic disease. In 2023, 96 avian disease and mortality notifications were received; of these, 39 investigations were opened that included avian influenza as a differential diagnosis (**Tables 3 and 4**). Infection with HPAI was ruled out in all samples collected for these investigations. Low pathogenicity avian influenza (LPAI) was, however, detected by real-time RT-qPCR test in two of these samples pertaining to avian disease and mortality.

The first detection of LPAI was during the investigation of a mass avian mortality event at Miranda Stilt Ponds on the Firth of Thames. The majority of affected birds were mallards (*Anas platyrhynchos*), but other affected species included Australian shoveller (*Spatula rhynchotis*), tētē moroiti or grey teal (*Anas gracilis*), and poaka or pied stilt (*Himantopus leucocephalus*). The clinical signs described by the rangers included weakness of the neck, paresis of the wings and haemorrhages in the mouth in some of the birds. The

Table 3: Avian mortality notifications and investigations, 2023

Month	Notifications	Investigations
January	12	5
February	6	1
March	6	4
April	5	1
May	10	2
June	4	3
July	2	1
August	7	2
September	7	0
October	4	4
November	15	11
December	18	5
Total	96	39

Table 4: Avian submissions to MPI's passive surveillance system 2005–2023

Year	Approved veterinary diagnostic laboratory submissions	MPI notifications	MPI AI investigations
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
2018	785	39	8
2019	1,407	35	10
2020	864	57	8
2021	1,187	35	12
2022	1,475	66	26
2023	1,125	96	39

* The aberration in the number of bird mortality reports for 2006 was generated as a result of public interest following intensive media reporting – see McFadden et al. (2007).

** 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 greater Auckland.



Figure 5: International Egg Commission (IEC) biosecurity poster distributed to PIANZ and EPF members

liver and gut content of one mallard and the gut content of a grey teal were PCR-positive for *Clostridium botulinum* neurotoxin C, indicating the presence of clostridial bacteria in those samples. One cloacal swab from the same mallard was also positive to both avian influenza (AI) and avian paramyxovirus 1 (APMV-1) by RT-PCR. Partial sequencing and phylogeny indicated that the isolate was a low pathogenic virus of subtype H5, most closely related to an H5N2 virus previously found in another mallard on the Hauraki Plains in 2020, and not a recent introduction. Further details

of this investigation can be found in Buckle (2023a).

The predominant cause of mortality in this event was botulism. But, it is possible that low pathogenic avian influenza and paramyxoviruses could have played a role in increasing the morbidity in these populations, even if they do not represent a major health burden for the birds. Monitoring the genetic characteristics of these viruses when they are prevalent in avian populations experiencing morbidity and mortality is part of the One Health and Biosecurity mandates of the Ministry for Primary Industries.

This case highlights the importance of screening a proportion of affected birds when confronted with large mortality events.

The second LPAI detection arose from a red-billed gull/tarāpunga (*Chroicocephalus novaehollandiae*) found by a member of the public with neurological signs in May 2023 in Lyall Bay, Wellington. The bird was brought into the care of Wellington Zoo's The Nest Te Kōhanga, where diagnostic testing was handled conjointly with MPI to exclude an exotic disease. The bird tested PCR-positive to Influenza A and sequencing identified the virus as subtype H6N2. The H6 subtypes are low pathogenicity viruses known to circulate in New Zealand, which have not been to date associated with bird mortality or morbidity events. Genomic analyses showed a 95 percent similarity to another H6N2 avian influenza subtype detected in wild mallards in 2005. This was the first detection of avian influenza in a New Zealand native bird and was notified to the Department of Conservation as such, even though toxicity remains the likely differential in this case. Further details on this case can be found in the wildlife disease surveillance report in this edition (see page 46) and in the corresponding quarterly report of exotic investigations (Buckle, 2023b).

Poultry industry surveillance

Surveillance for AI within the New Zealand poultry industry is multifaceted, being supported by multiple surveillance streams including pre-export testing, commercial flock health plans and MPI's general surveillance system. The industry is made up mostly of large companies involved in the chicken breeder, meat and layer sectors, along with a small number of specialist operators raising and marketing other species such as turkeys and ducks. It is a highly regulated industry with specialist veterinary oversight and careful monitoring of poultry health parameters.

AI surveillance has both targeted (active) and general (passive)

elements. Targeted surveillance involving sampling for pre-export testing is predominantly within the export breeder sector, but also extends to the export meat (broiler) sector. General surveillance underpins all sectors and is built on comprehensive veterinary flock health plans, as well as careful monitoring and reporting of any unusual morbidity or mortality events. Any suspect cases of exotic disease including AI are reported via MPI's exotic pest and disease hotline. These cases are followed up by Incursion Investigators working together with MPI's AHL and specialist poultry veterinarians. Neither LPAI nor HPAI has ever been detected in the New Zealand commercial poultry flock as a result of these surveillance activities.

The industry is supported by two stakeholder bodies (Poultry Industry Association of New Zealand (PIANZ) and the Egg Producers Federation (EPF)) with a vision to remain a trusted, economic and safe source of food for consumers, while meeting or exceeding the high regulatory standards imposed by MPI (<http://www.pianz.org.nz>). One of the key roles of PIANZ and EPF is engagement and education across the industry. This includes dissemination of information to poultry farmers on good biosecurity practices (**Figure 5**, previous page), as well as posters detailing the warning signs and reporting requirements whenever there is suspicion of an exotic disease such as AI (Stanislawek et al., 2020).

Historic active surveillance has been undertaken in the commercial chicken sectors (Rawdon et al., 2010), and in the other poultry species, including turkeys, ducks, quail, pheasants, partridges and guinea fowl (Frazer et al., 2009; Frazer et al., 2010). The surveys found no evidence of active infection with either H5 or H7 AI subtypes (freedom sampling to ensure 95 percent probability to detect the disease if present above a 5 percent farm-level prevalence within each sector).

Imported poultry hatching eggs must meet the requirements of an MPI import health standard (IHS). Breeder

birds in donor flocks must meet the IHS requirement to demonstrate that the flock is free of AI when hatching eggs are imported. Further testing is conducted during post-arrival quarantine; see below under 'Import Health Standards'.

AI surveillance is also undertaken to meet trading partners' requirements for the export of table eggs, hatching eggs and day-old chicks. Testing is covered in the poultry health surveillance annual report (see page 79). During the period covered by the 2023 report, 4,842 AI tests were conducted. Of these, 39 returned a positive result using a screening test, but all were negative in confirmatory testing.

Poultry veterinarians are supported by three poultry pathology laboratories that conduct laboratory tests for the commercial poultry industry and are audited to the NZS ISO/IEC standard 17025:2005 'General requirements for the competence of testing and calibration laboratories' by International Accreditation New Zealand (<http://www.ianz.govt.nz/>). The laboratories are also recognised under the MPI-recognised laboratory programme (<https://www.mpi.govt.nz/legal/approved-organisations-and-people/animal-products-act-recognised-agencies-and-persons/recognised-laboratory-programme/>).

Poultry veterinarians can also use the commercial veterinary diagnostic laboratory network for disease investigation. As part of MPI's passive surveillance system (Tana, 2014), MPI has contracts with New Zealand's three commercial veterinary diagnostic laboratory companies to provide surveillance data and maintain minimum operational and technical quality assurance requirements. Audits are regularly conducted by MPI to ensure compliance with contractual requirements.

Import Health Standards

Import risk analysis (IRA) is a scientific discipline that transparently accommodates known facts, knowledge gaps and uncertainty (Vose, 2008; Anon., 2024b). MPI uses IRA

to identify pre-border hazards such as pathogens that may be associated with imported animals, and to assess the likelihood and consequences of introducing those hazards. IRA also informs control measures to manage the identified risks and helps communicate the risks to others (Cobb and MacDiarmid, 2014).

New Zealand's IHSs for poultry products include sanitary measures for HPAI in poultry meat, egg products, and all strains of AI in poultry hatching eggs. For example, duck and turkey meat must be derived from birds kept in a country or zone free from HPAI since hatching, or for 21 days before slaughter for export, with current surveillance requirements from the Code being met, to claim freedom from HPAI. At present, there is no IHS for chicken meat and importation is not allowed. Otherwise, poultry products must be cooked in accordance with the Code recommendations for inactivation of AIVs in meat. For a fuller description of the IHSs that include measures for AI see Watts et al. (2016).

Conclusion

New Zealand is free from HPAI. Internationally, waterfowl play a pivotal role in the epidemiology of AI and are responsible for its movement globally via overlapping migratory flyways. New Zealand is not on a migratory pathway for waterfowl, with only occasional vagrants arriving from Australia. IHSs are in place to effectively manage the risks associated with live birds and poultry products. MPI maintains active surveillance in wild birds, which enables characterisation of the endemic viruses (Stanislawek et al., 2024), and also operates the passive surveillance system, which enables rapid detection of HPAI should it ever occur (Tana, 2014). The New Zealand poultry industry maintains veterinary supervision of poultry flocks, monitoring changes in production parameters that could indicate disease. Awareness of AI is maintained within the industry. Dedicated poultry veterinary diagnostic laboratories provide services to the poultry industry for investigation of suspected

disease events or for testing to meet export standards.

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Honey bee exotic pest and disease surveillance annual report

This report summarises surveillance activities for the year 1 July 2023 to 30 June 2024.

The National Apiculture Surveillance Programme is implemented by AsureQuality Ltd on behalf of the Ministry for Primary Industries (MPI). It is a multifaceted programme consisting of:

- hive inspection and sample collection;
- screening and investigating notifications for exotic honey bee pests and diseases;
- beekeeper engagement and biosecurity awareness activities; and
- reporting of surveillance activities and findings.

Surveillance is conducted for any pest or disease of honey bees that is exotic to New Zealand with a focus on the following:

- European foulbrood (*Melissococcus plutonius*);
- small hive beetle (*Aethina tumida*);
- the parasitic fly (*Braula coeca*);
- tracheal mite (*Acarapis woodi*);
- Asian mites (*Tropilaelaps clareae* and *T. mercedesae*);
- African and Africanised honey bee (*Apis mellifera scutellata*);
- Cape honey bee (*Apis mellifera capensis*); and
- other exotic *Apis* species (e.g., the Asian honey bee, *Apis cerana*).

All the pests and organisms listed above are classified as unwanted organisms in New Zealand (MPI, 2024). Of these, European foulbrood, small hive beetle, tracheal mite and *Tropilaelaps* spp. are listed in Chapters 9.3, 9.4, 9.1 and 9.5, respectively, of the Terrestrial Animal Health Code of the World Organisation for Animal Health (WOAH) (WOAH, 2024).

Broadly, surveillance is conducted by:

- inspecting hives and collecting samples for laboratory testing from

apiaries in high-risk zones;

- testing samples from low-risk apiaries;
- inspecting hives under the National American Foulbrood Pest Management Plan (AFB PMP); and
- screening notifications of suspected cases of exotic pests or diseases of honey bees.

High-risk zone inspection and sample collection

Nineteen geographic areas throughout New Zealand (12 in the North Island and seven in the South Island) have been classified as high-risk zones because they are the likely entry pathways for exotic honey bee diseases and pests. Monitoring these areas means that any exotic disease or pest that enters New Zealand can be detected early before it has a chance to spread and establish. The high-risk zones include ports, airports, Transitional Facilities, cities, tourist destinations and areas with a high concentration of hives such as those with honey bee-pollinated crops. Four of the zones (Auckland, Wellington, Christchurch and Dunedin) contain sub-zones classified as ‘elevated high-risk zones’, in which at least 50 percent of the apiaries (collections of hives) are targeted for surveillance. Overall, the programme aims to inspect and take samples from a minimum of 350 apiaries within high-risk areas. Every hive in the selected apiaries is:

- inspected for the presence of exotic honey bees, pests and diseases;
- sampled by taking at least 80 adult honey bees;

- screened for exotic bees, small hive beetle and *Braula* spp. by collecting suspicious organisms resembling them; and
- sampled for external mites by applying a 24-hour miticide treatment and inserting a sticky board at the bottom of the hive to capture mites killed by the miticide.

These tasks are carried out by Authorised Persons Level 2 (AP2s), also known as apiary inspectors, subcontracted by AsureQuality.

During the period covered by this report, 350 apiaries were inspected in high-risk zones. From these apiaries, 713 sticky boards and 681 honey bee samples were submitted to the laboratory for exotic pest and disease screening (Table 1).

Low-risk honey bee samples

Each beekeeper supplying live honey bees for export is required to work through an apiary clearance process by providing up to 25 samples for laboratory testing from their supply apiaries. For surveillance purposes these are considered low-risk apiaries and the target is to collect 300 samples from them. Bees from a maximum of 16 hives are pooled into one sample, meaning that more samples are taken from apiaries with larger numbers of hives. Tests similar to those conducted on samples from high-risk zones are also conducted on export honey bees, except that sticky boards are not included. During the report period, 599 honey bee samples were collected from 491 low-risk apiaries (Table 1).

Table 1: Number of inspections conducted and samples collected during the 2023/24 surveillance season

Type	Apiaries inspected	Apiaries sampled	Sticky boards	Bee samples
High-risk	350	348	713	681
Low-risk	na	491	na	599
AFNPMP inspections*	3,562	na	na	na
Total	3,912	839	713	1,280

* AFB PMP = American Foulbrood Pest Management Plan

Table 2: Notifications and laboratory investigations during the 2023/24 surveillance season

Notification	Location	Results
Visual diagnosis based on photos	Russell	Likely caused by varroa, and/or possibly starvation.
Suspect tracheal mites or poisoning	Motueka	Sampled and tested for tracheal mites and evidence of poisoning. Tests were negative for tracheal mite and a specific poisoning agent could not be identified.
Suspect EFB (European foulbrood)	Clinton	Sampled and tested for EFB. Tests were negative for EFB.
Suspect external mites	Auckland	Suspected of being pollen-feeding mites endemic to New Zealand and confirmed via laboratory identification (MPI PHEL).
Suspect EFB	Hamilton	Sampled and tested for EFB disease. Tests were negative for EFB.
Bee paralysis	Papamoa	Visually diagnosed as chronic bee paralysis.

American Foulbrood Pest Management Plan inspections

All AFB Authorised Persons under the AFB PMP Management Agency are trained not only to detect American foulbrood (AFB), a disease earmarked for eradication in New Zealand (AFB PMP, 2021), but also to identify exotic pests and diseases. Training is conducted jointly by MPI and the AFB PMP every winter. Once the inspectors have conducted their fieldwork, apiary inspection information is shared between the two organisations. During the period covered by this report 3,562 apiaries were inspected under the AFB PMP.

Laboratory testing

Samples of honey bees, suspicious insects and sticky boards are screened using entomological methods at the MPI Plant Health and Environment Laboratory (PHEL), Auckland. They include the thoracic disc method, wash method and sticky board test. The molecular assay for screening environmental DNA to detect tracheal mites was added to the range of diagnostic tests recently and has eased the screening process. When there is suspicion of infection with microbes such as bacteria, fungi or viruses, samples are collected and submitted to MPI’s Animal Health Laboratory, Wallaceville for screening.

Notifications

Each year MPI andASUREQuality Ltd work together screening notifications from beekeepers

regarding suspect exotic bee pests or diseases and unusual signs in hives. Some notifications are resolved over the phone while others require further investigation. A summary of notifications received during the period of this report is presented in **Table 2**.

Beekeeper engagement and biosecurity awareness

During the period of this report, a variety of activities were conducted to engage with beekeepers and raise biosecurity awareness. The bee biosecurity visual identification guide and fact sheets produced under the ApiWellbeing project have been well received by the beekeeping community. Electronic versions of the two documents are available on MPI’s public webpage (MPI, 2023).

Apiculture demographics

It is a legal requirement that all beekeepers are registered and provide details of their apiaries such as location and number of hives. This information is updated annually when beekeepers submit a return to confirm that their hives have been inspected for *Paenibacillus larvae larvae* (the causative agent of AFB), as legally required. As of 1 June 2024, there

were 8,592 beekeepers registered in New Zealand, managing 541,263 hives on 53,355 apiaries. This represents a decline in the demographics during the past 12 months as shown in **Table 3**.

Technical development

ASUREQuality Ltd maintains a group of apicultural technical experts who are competent in honey bee pest and disease recognition and control. The experts periodically attend refresher training on exotic pest and disease identification in a real-life setting. This typically involves attending a practical training workshop or course in Australia on identification of specific pathogens such as the small hive beetle. These experts supervise the inspectors and oversee the implementation of surveillance activities. For field work, all inspectors receive face-to-face training annually that includes obligations under the Biosecurity Act 1993, hive inspection techniques and identification of exotic pests, exotic diseases and AFB. The training material is available online for the inspectors to freely access it and revise at their convenience between the annual training sessions.

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Table 3: Changes in apiculture demographics between 2022/23 and 2023/24 surveillance seasons

Detail	2022/23	2023/24	Change (percent)
Beekeepers	9,344	8,592	-8.0
Apiaries	56,980	53,355	-6.4
Hives	601,500	541,263	-10.0



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Wildlife disease surveillance annual report

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

- facilitate early detection of exotic and emerging pests and 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.

New Zealand's wildlife pest and disease surveillance programme is multi-faceted and encompasses surveillance of native and non-native species, including feral wildlife.

The MPI national exotic pest and disease notification and investigation system provides for the reporting and investigation of unusual disease events in all animals, including wildlife. The exotic pest and disease emergency hotline (0800 80 99 66) helps New Zealanders meet their obligations under section 44 of the Biosecurity Act 1993, which requires every person to report to MPI any organism 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 to detect changes in occurrence that may indicate an emerging disease requiring further investigation (see page 36). MPI also monitors routine disease diagnoses by veterinary wildlife hospitals, veterinary diagnostic laboratories



Figure 1: Facilities contributing to MPI's wildlife surveillance programme 2023–2024. Map: MPI Spatial Intelligence

and a wildlife rehabilitation centre. All wildlife case summaries received by MPI are sick animal cases and are anonymised. Reports of particular interest seen by the veterinary diagnostic laboratories are summarised in articles reviewing diagnostic cases in each quarterly 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 (part of the School of Veterinary Science at Massey University, Palmerston North). Animals found dead in the field or in captive facilities are sent to the Wildbase laboratory for postmortem by veterinary wildlife pathologists.

Wildlife hospital surveillance

Since 2020, MPI has maintained wildlife disease surveillance contracts with four wildlife hospitals across New Zealand:

- New Zealand Centre for Conservation Medicine, Auckland Zoo;
- Te Kōhanga The Nest, Wellington Zoo;
- the South Island Wildlife Hospital, Christchurch; and
- The Wildlife Hospital Dunedin.

Collectively, these hospitals see over 1,500 sick or injured wildlife cases per year. Following are summaries provided by the wildlife hospitals, with a selection of cases seen under the contract during the period 1 January to 31 December 2023 (Figure 1).

New Zealand Centre for Conservation Medicine, Auckland Zoo

Auckland Zoo's New Zealand Centre for Conservation Medicine (NZCCM) provides veterinary care for the region's endangered native wildlife, as well as on-site zoo animals. The wildlife cases seen at the zoo are primarily avian and range from kākāpō (*Strigops habroptila*), takahē (*Porphyrio hochstetteri*), kiwi (*Apteryx* spp.), little blue penguin/kororā (*Eudyptula minor*) and other New Zealand native birds to reptiles and mammals – sea turtles, skinks and the occasional New Zealand fur seal/kekeno (*Arctocephalus forsteri*). Veterinarians at the NZCCM also collaborate with DOC to attend offsite wildlife emergencies and provide veterinary advice for in situ conservation programmes. Once animals have been medically stabilised they are sent to local wildlife rehabilitation centres or SEA LIFE Kelly Tarlton's Aquarium to build their fitness before release.

In the 2023 calendar year, 98 wild animals were admitted to the NZCCM. These included:

- 68 birds;
- 20 ectotherms (including nine

stranded sea turtles and several striped skinks; (*Oligosoma striatum*) as part of a salvage project); and

- 10 mammals (mostly pest species but also four New Zealand fur seal/kekeno).

At the beginning of the year, the NZCCM received several brown teal/pāteke (*Anas chlorotis*) and New Zealand dotterels/tūturiwhatu (*Pluvialis obscura*). The birds presented with paresis and were unable to stand. Some died shortly after arrival, and further avian mortalities were reported in the area. In collaboration with MPI and DOC, an investigation was undertaken to establish a cause. The clinical presentation, response to treatment, exclusion of other neurological diseases, and the absence of gross postmortem and histological changes indicated botulism as the most likely cause. Environmental conditions in the area were favourable for the accumulation of *Clostridium* spores and botulinum toxin in decaying organic matter and invertebrates (including the buildup of large amounts of dying *Caulerpa* algae), which supported this diagnosis. Antemortem swabs as well as postmortem tissues were collected in viral medium and tested by PCR at MPI's Animal Health Laboratory (AHL, Wallaceville) for exotic agents, including avian influenza and exotic paramyxovirus type 1 virus. PCRs for the detection of toxin-producing-capable strains of *Clostridium botulinum* were negative, but due to the limitations of the test, this does not exclude botulism as the cause of death.

At the end of the year, abnormal numbers of New Zealand dotterels/tūturiwhatu were found dead on a beach north of Auckland. In collaboration with MPI and DOC these birds were brought to the NZCCM for postmortem and histology was performed. Tests at AHL for paramyxovirus, West Nile virus and avian influenza all returned negative results. The birds were in poor body condition and gastrointestinal ascarid nematodiasis was present,

but a definite cause of death could not be determined.

Two Australasian bittern/matuku-hūrepo (*Botaurus poiciloptilus*) presented to the NZCCM around the same time. They arrived in very poor body condition and without any obvious traumatic injuries. One bird died during hospitalisation, and postmortem and histology confirmed starvation and kidney failure as the cause of death. The second bird recovered well with intensive supportive treatment and was successfully released again in a suitable wetland area.

The NZCCM undertakes disease research on New Zealand fur seals/kekeno in the Auckland region in collaboration with MPI, DOC and the Hauraki Gulf Forum, to increase understanding of the causes of mortality in New Zealand fur seals and to remain vigilant for exotic disease such as high pathogenicity avian influenza (HPAI). Two juvenile seals that were found dead in the Auckland area were presented to the NZCCM for postmortem and diagnostic sampling. On presentation, the seals were severely decomposed and therefore unsuitable for histology. Finding dead seals that are still suitable for testing is challenging as most are severely decomposed when they are found. Despite this limitation, starvation and high burdens of internal parasites were found to have contributed to the mortality of these seals. Another young fur seal/kekeno presented to the NZCCM was poorly responsive and severely emaciated, and because of its severe state, it was euthanased on arrival. Postmortem revealed that it had a perforated stomach and severe associated peritonitis as well as multiple parasite infections including cestode cysts in the abdomen, trematodes in the intestine, nematodes in the stomach and protozoal cysts (presumptive *Sarcocystis* spp.) in the skeletal muscle. Mycobacterial infection was excluded on histology.

In 2023 the NZCCM admitted five olive ridley sea turtles (*Lepidochelys olivacea*), two green sea turtles (*Chelonia mydas*) and one hawksbill

turtle (*Eretmochelys imbricata*) that were found stranded. The olive ridley turtles arrived at the hospital severely debilitated and moribund, and died or were euthanased shortly after admission despite intensive treatment. As per previous years, gross postmortem and histology showed severe fungal pneumonias and generalised necrotising myositis of skeletal muscle associated with the presence of microsporidia.

As part of the NZCCM's ongoing collaboration with the takahē and kākāpō recovery groups, one kākāpō underwent extended treatment for aspergillosis that had been started in 2022. A takahē that had sustained a third eyelid injury was successfully treated and returned to the wild. As per routine protocol, these individuals and seven kākāpō that were temporarily housed during translocation were tested for chlamydia and for psittacine beak and feather disease (PBFD) by PCR; all tests were negative.

All birds that stay in the NZCCM hospital are tested for chlamydia using conjunctival/choanal/cloacal swab samples and psittacine species are tested for PBFD. All birds tested negative in 2023.

Te Kōhanga The Nest, Wellington Zoo

Te Kōhanga The Nest (TKTN) at Wellington Zoo provides veterinary care for both resident animals at the zoo and sick and injured native wildlife admitted for treatment (**Figure 2**). In 2023, 96 percent of wildlife cases seen by Te Kōhanga were avian species, with the remaining patients including native reptiles, common bullies/toitoi

(*Gobiomorphus cotidianus*) and a stranded olive ridley sea turtle.

Trauma was the most common reason for presentation, with 90 percent of cases attributed to anthropogenic causes including introduced predator attacks, window strike, vehicle strike and fishing line entanglement. The most common comorbidity was lead toxicosis, with kākā (*Nestor meridionalis*), Australasian harriers/kāhu (*Circus approximans*) and New Zealand falcons/kārearea (*Falco novaeseelandiae*) treated for the disease during this period.

Patient intake protocols were updated to screen species from families known to be affected by HPAI overseas for clinical signs consistent with HPAI and implement targeted disease surveillance. In May, a red-billed gull/tarāpunga (*Chroicocephalus novaehollandiae*) presented with neurological signs including ataxia and paresis. After discussion with an MPI Incursion Investigator, samples were taken to test for avian influenza, avian paramyxovirus 1 and West Nile virus at MPI's AHL. The bird tested positive for an H6 subtype of avian influenza, and negative for the other two viruses. H6 subtypes are low pathogenic avian influenza (LPAI) viruses that are sporadically recovered from wild mallards (*Anas platyrhynchos*) in New Zealand (Stanislawek et al., 2018), and which have not been linked to mortality or morbidity events in New Zealand birds. This is the first occasion that an avian influenza virus was isolated from a native bird, and further details on the case have been previously presented in Buckle (2023b). While the bird initially responded well to supportive care, its

clinical improvement plateaued, and it was ultimately euthanased. The cause of the neurological signs could not be confirmed on postmortem; however, toxicity remains the likely differential diagnosis, e.g., alphachloralose. Several other species including little penguin/kororā, sooty shearwater/tītī (*Ardenna grisea*), fairy prion/tītī wainui (*Pachyptila turtur*) and brown teal/pāteke were tested for HPAI at AHL and were negative for avian influenza.

A cluster of shorebirds and waterfowl were admitted as a result of an environmental toxicity event on the Kāpiti Coast in late summer. Botulism and algal bloom toxicity were the most likely differential diagnoses. Several species including brown teal/pāteke, royal spoonbills/kōtuku ngutupapa (*Platalea regia*), white-faced heron/matuku moana (*Egretta novaehollandiae*), red-billed gulls/tarāpunga, pied shag/kāruhiruhi (*Phalacrocorax varius*) and New Zealand scaup/pāpango (*Aythya novaeseelandiae*) were treated with intensive nursing and supportive care. The mortality rate was around 40 percent, with birds that presented in emaciated body condition and/or demonstrating profound neurological signs requiring euthanasia or quickly succumbing to disease. Infectious disease testing was performed by a commercial veterinary laboratory and exotic disease testing was performed by AHL, ruling out avian influenza, Newcastle disease and chlamydiosis.

Other cases of interest include an adult North Island brown kiwi/kiwi-nui (*Apteryx mantelli*) that presented with a chronic ulcerative dermatitis and cellulitis associated with a tracking band. *Proteus mirabilis*, *Enterococcus faecalis* and *Macrococcus* spp. were cultured from the site, and the kiwi was successfully treated with systemic enrofloxacin, along with analgesia and supportive care.

A juvenile kererū (*Hemiphaga novaeseelandiae*) presented with poor body condition, dyspnoea and ulcerative skin disease. The bird was euthanased and a postmortem was performed, revealing pneumonia and extensive replacement of lung tissue by a fungal granuloma attributed to



Figure 2: Patients in care at Te Kōhanga The Nest (A) North Island brown kiwi/kiwi-nui. (B) Brown teal/pāteke. Photos: Te Kōhanga The Nest

an *Aspergillus* sp. Histology of skin biopsies were consistent with avipox infection with secondary bacterial and fungal infection.

Avian malaria was identified on postmortem histology of a little blue penguin/kororā chick, and in an adult kererū on antemortem blood film.

Yersinia pseudotuberculosis was isolated from the liver of a sick kākā that was euthanased after presenting in emaciated body condition during the winter.

South Island Wildlife Hospital

The South Island Wildlife Hospital is a small wildlife hospital adjacent to the Willowbank Wildlife Reserve in Christchurch. In 2023 the hospital had 551 avian patients from 73 species and one reptile, a southern grass skink (*Oligosoma* aff. *polychroma* Clade 5). The hospital treats native and some introduced fauna from Marlborough to Oamaru and the West Coast of the South Island.

Seventy-four percent of the avian patients seen by the hospital in 2023 were cases of trauma from human-animal interactions, including hit by cars, window strike and cat- and dog-inflicted trauma. The single reptile case for 2023 was treated for trauma caused by a cat.

Six kea (*Nestor notabilis*) and five Australasian harriers/kāhu were diagnosed with lead toxicity in 2023. This is a lower number than usual, partly because of difficulty retrieving sick kea in Arthur's Pass and difficulty in obtaining in-house blood lead test kits.

Avian malaria was highly suspected or confirmed in two little penguins/kororā, four spotted shags/kawau tikitiki (*Phalacrocorax punctatus*), a black shag/māpunga (*Phalacrocorax carbo*), two Fiordland crested penguins/tawaki (*Eudyptes pachyrhynchus*) and a little owl/ruru nohinohi (*Athene noctua*) (Figure 3). The cases where avian malaria was highly suspected were brought to the hospital for postmortem after being found dead in the wild, where histological findings were

suggestive of malaria but post-mortem autolysis prevented confirmation of the diagnosis.

From January to March 2023, 14 birds were presented with clinical signs consistent with botulism, including three southern black-backed gulls/karoro (*Larus dominicanus*), three grey duck/pārerā (*Anas superciliosa*), six paradise shelduck/pūtangitangi (*Tadorna variegata*), one royal spoonbill/kōtuku ngutupapa and one Australasian shoveler/kuruwhengi (*Spatula rhynchotis*).

A little owl/ruru nohinohi arrived emaciated and moribund. It died overnight and granulomatous lesions were observed in the lungs on postmortem, which were confirmed with histology as avian mycobacteriosis.

An adult female and a juvenile Okariko brown kiwi/rowi (*Apteryx rowi*) from Motuara Island presented with very painful, excoriated, crusting dermatitis around the cloaca that was consistent histologically and clinically with cutaneous capillariasis (Figure 4).

Three juvenile Antipodean albatrosses/toroa (*Diomedea antipodensis*), of which two presented with starvation and kidney failure, were admitted for treatment. Both initially responded to treatment but the first relapsed into kidney failure and was euthanased, while the second went on to be successfully released. The third developed severe bacterial pododermatitis and after episodes of vomiting developed a fatal bronchopneumonia. An incidental finding in this case was a mature cataract.

Seabird starvation appeared slightly increased compared with the previous year. Fifty-three starvation cases included two juvenile Australasian gannets/tākapu (*Morus serrator*), nine little blue penguins/kororā, three Fiordland crested penguins/tawaki, three juvenile yellow-eyed penguins/hoiho (*Megadyptes antipodes*), an adult Salvin's mollymawk/toroa (*Thalassarche salvinii*), thirty-four spotted shags/kawau tikitiki and others. Three more spotted shags/kawau tikitiki were treated for

starvation in 2023 than 2022 and ten more than in 2020.

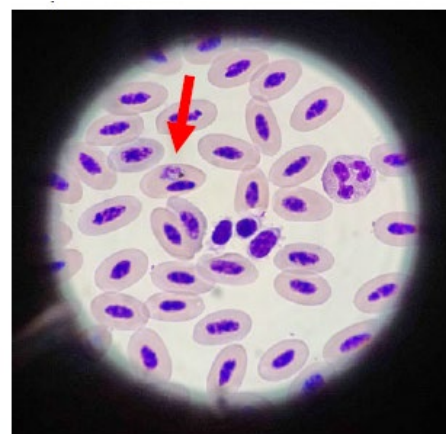


Figure 3: Avian malaria in red blood cells in a blood smear from a little owl/ruru nohinohi. Photo: South Island Wildlife Hospital



Figure 4: Cloaca of an Okariko brown kiwi/rowi with cutaneous capillariasis. Photo: South Island Wildlife Hospital

The Wildlife Hospital Dunedin

The Wildlife Hospital Dunedin is a veterinary facility based at Otago Polytechnic that specialises in the treatment of native wildlife in New Zealand. Its case load is 99 percent avian species (92 different species) with the remaining 1 percent a mixture of marine mammals (New Zealand sealion/pakake (*Phocarcos hookeri*) and New Zealand fur seal/kekeno) and reptiles. The hospital has been operational since January 2018 and in that time has admitted and treated more than 3,900 patients.

In the period from 1 January to 31 December 2023, a record number of 755 patients were admitted to hospital. Trauma accounted for 48 percent of cases and medical cases 52 percent. This comprised diseases, orphaned chicks, storm-wrecked birds, tick paralysis and toxicity presentations.

Diphtheritic stomatitis in yellow-eyed penguin/hoiho chicks

During the 2023 yellow-eyed penguin/hoiho breeding season, 178 chicks were admitted to hospital for treatment of diphtheritic stomatitis (DS) lesions and/or respiratory disease syndrome. The success rate for treating DS infection was once again higher this season compared with previous seasons, in large part due to more rapid response from field teams in bringing chicks to hospital for treatment rather than attempting treatment out in the field. Once again no mortalities associated with DS were reported this season, a promising trend in management of this syndrome. A novel megrivirus has been isolated from chicks with DS and research is ongoing to determine if the agent is contributing to this disease.

Respiratory distress syndrome in yellow-eyed penguin/hoiho chicks

The unexplained respiratory disease in yellow-eyed penguin/hoiho chicks that was first observed in 2019, now called respiratory distress syndrome (RDS), has been seen annually since then and was observed again in 2023. However, due to more intensive intervention of young chicks, the mortality rate was significantly lower in 2023. A new potential clinical sign associated with RDS was observed – collapsed ribcages in older chicks (10+ days of age). Severe respiratory signs and the increased pressure this causes in the ‘thoracic’ cavity might be causing this rib cage collapse. There is reference to ‘chest retractions – with skin and ribs pulling in when breathing’ described in human RDS (Nationwide Children’s Hospital, 2022). Investigation is ongoing to see if this new clinical sign is linked to yellow-eyed penguin/hoiho RDS. All but one of the chicks



Figure 5: A northern royal albatross/toroa undergoing endoscopy of the gastrointestinal tract. Photo: The Wildlife Hospital Dunedin

that presented with collapsed rib cages survived and as they grew older the shape of the rib cage normalised. A novel gyrovirus has been isolated in yellow-eyed penguins/hoiho with RDS; however, it has also been found in healthy birds which makes antemortem diagnosis of this disease difficult. Research is ongoing in this area.

Northern royal albatross/toroa with hypophosphatemia and liver insufficiency

An adult northern royal albatross/toroa (*Diomedea sanfordi*) presented after being seen to be ataxic with decreased mentation at the Taiaroa Head breeding colony on the Otago Peninsula. On clinical exam she showed significant neurological deficits including lack of awareness of surroundings and lack of defensive/aggressive behaviour towards humans in close proximity, which is unusual for the species. She also displayed intention tremors and bilateral paresis of the legs. Melaena was noted, suggesting possible starvation or upper gastrointestinal (GI) haemorrhage as well as potential liver disease. Initial in-house lab results showed hypophosphatemia, possibly starvation-related, and elevated aspartate transferase (AST). A complete blood count was normal apart from slightly low packed cell

volume. Blood lead testing showed insignificant blood lead levels. X-rays were unremarkable. Endoscopy of the gastrointestinal tract (**Figure 5**) showed no foreign bodies and no inflammation of the oesophagus and proventriculus. A more comprehensive liver panel was run on blood submitted to a commercial veterinary laboratory, which showed that AST remained elevated but otherwise results were not conclusive for liver disease. Hepatoprotective medication: silymarin (milk thistle), colchicine and ursodeoxycholic acid, as well as phosphate supplements were prescribed, and IV fluid therapy was administered. Repeat biochemistries every 3–4 days showed slow improvement of phosphorus levels and decreasing AST. Over a period of two weeks the bird improved with supportive care, and once biochemistries were normal she was released back to the breeding colony and her chick at Taiaroa Head. She was resighted multiple times during the following months suggesting that treatment had been successful. No conclusive cause for the hypophosphatemia and liver disease was found but potential differential diagnoses include malnutrition, a gastrointestinal obstruction, hepatotoxins, mycotoxins and infectious causes.

New wildlife surveillance initiatives

Enhanced passive HPAI Surveillance

As part of MPI's increased surveillance for HPAI (see page 36) and in collaboration with The Wildlife Hospital Dunedin, testing for HPAI was initiated in October 2023 in individuals presented to the hospital that were from species in taxonomic families known to be affected by HPAI overseas. Cloacal and choanal swabs were collected from 21 birds from October to December. Species included red-billed gulls/tarāpunga, southern black-backed gulls/karoro, Australasian harriers/kāhu, Otago shags/matapo (*Leucocarbo chalconotus*) and yellow-eyed penguins/hoiho. PCR analysis performed at MPI's AHL was negative for HPAI for all samples. Surveillance for HPAI will continue at The Wildlife Hospital Dunedin in 2024.

BirdCare Aotearoa

For 2024, a new wildlife disease surveillance contract has been signed with BirdCare Aotearoa, an avian rehabilitation centre and charitable trust in Auckland. In 2023, BirdCare Aotearoa admitted 4,655 patients consisting of 180 different species. The most common species were mallards, rock pigeons (*Columba livia*), Eurasian blackbirds (*Turdus merula*), house sparrows (*Passer domesticus*) and song thrushes (*Turdus philomelos*). Forty-five of the admitted species were non-native and 135 of the admitted species were native. Most patients were from the Auckland region but one patient came from Bay of Plenty, three from Waikato and one from Northland.

Wildbase

For 2024, a new wildlife disease surveillance contract has been signed with Wildbase Hospital at Massey University's Manawātū campus in Palmerston North. Wildbase Hospital treats injured and sick native birds, reptiles and bats from all over Aotearoa New Zealand. From 2002 to September 2023, Wildbase Hospital treated 6,775 native wildlife patients including 6,471 birds, 281 reptiles and 23 bats. Of these, 571 patients were from endangered species (DOC

2021 classifications – Nationally Critical, Nationally Endangered or Nationally Vulnerable) and 1,670 were from threatened species (DOC 2021 classifications – all At-Risk categories).

MPI investigations

Every year, multiple calls are made to MPI's exotic pest and disease hotline about wildlife health events, particularly mass mortalities. These notifications are managed by MPI's Animal Health Incursion Investigation team, which investigates whether the incident could be due to the presence of an exotic pathogen. In 2023, MPI received 113 notifications for wildlife species and 48 of these led to further investigation. The following is a summary of some of the notable 2023 investigations in wild and captive wildlife species (more details about these investigations can be found in the *Surveillance 2023* and 2024 quarterly reports of diagnostic cases (Buckle, 2023a; Buckle, 2023b; Buckle, 2023c; Buckle 2024)).

Avian mortality events

During 2023, MPI's Animal Health Incursion Investigation team received 76 notifications of avian disease or mortality events compared with 59 in 2022 (28.8 percent increase). Thirty-eight of these were opened as investigations for exotic avian diseases (50 percent), which looked primarily for evidence of HPAI, Newcastle disease or West Nile virus. This is an increase of 26 percent from 2022 (30 investigated) and could be attributable to the increased awareness and media attention covering the HPAI H5N1 spread globally and hence, hypervigilance by the notifiers. Exotic disease was excluded as a cause of mortality in each of these 38 investigations via an assessment of the clinical, pathological and/or epidemiological features. In 32 cases this was supported by diagnostic laboratory testing at MPI's AHL (Buckle, 2023a; Buckle, 2023b; Buckle, 2023c; Buckle, 2024). The seasonal pattern of notifications was also different to 2022 as there were more avian notifications in the spring and summer months compared with greater numbers in the autumn and winter months of 2022.

The 26 bird species involved in 2023 investigations included:

- Australasian shoveler (*Anas rhynchos*);
- Black swan (*Cygnus atratus*);
- Black-billed gull (*Chroicocephalus bulleri*);
- Blackbird (*Turdus merula*);
- Brown teal (*Anas chlorotis*);
- Canada goose (*Branta canadensis*);
- Eastern bar-tailed godwits (*Limosa lapponica*);
- Feral pigeon (*Columba livia*);
- Golden pheasant (*Chrysolophus pictus*);
- Grey teal (*Anas gracilis*);
- House sparrow (*Passer domesticus*);
- Little blue penguin (*Eudyptula minor*);
- Mallard (*Anas platyrhynchos*);
- Myna (*Acridotheres tristis*);
- New Zealand dotterel (*Charadrius obscurus*);
- Ostrich (*Struthio camelus*);
- Paradise shelduck (*Tadorna variegata*);
- Pied stilt (*Himantopus leucocephalus*);
- Red-billed gull (*Chroicocephalus novaehollandiae*);
- Red-crowned kakariki (*Cyanoramphus novaezelandiae*);
- Skua (*Stercorariidae*);
- Sooty shearwater (*Ardenna grisea*);
- Southern black-backed gull (*Larus dominicanus*);
- Swan (*Cygnus* spp.);
- Tui (*Prosthemadera novaeseelandiae*); and
- Wild spotted doves (*Columba chinensis*).

The 38 avian investigations were located across 24 territorial authorities (**Figure 6**, next page) and 82 percent of these occurred in the spring and summer months (November through to March). Three events were reported to have resulted in the deaths of more than 150 birds (160, > 1,000 and > 250 birds). The most probable causes of these larger mortality events were botulism (two events) (Buckle, 2023a),

and parasitic enteritis (one event) (Buckle, 2023a).

Of the 38 cases investigated, a definitive cause for the mortalities was not able to be determined in seven cases. The following causes of death were either confirmed or suspected based on epidemiological, clinical or pathological features: botulism was confirmed by testing in four cases and was likely in four more cases; parasitism was suspected as the cause of death or noted as an underlying factor in two cases; avian poxvirus was confirmed in two cases, one of which also had a concurrent bacterial septicaemia; there were two cases of bacterial infection causing death; two cases of misadventure – hit by a car while playing/fighting and striking overhead powerlines, five cases of suspected toxicity, two cases of human-induced trauma, five cases of starvation, one case of psittacosis (*Chlamydia psittaci*), one case of avian malaria (*Plasmodium* spp.) and one case of suspected pheasant ataxia (Buckle, 2023a; Buckle, 2023b; Buckle, 2023c; Buckle, 2024).

During two investigations, LPAI was detected. In the first case a mallard (*Anas platyrhynchos*) that was submitted for necropsy and testing from a mortality event in Miranda, Firth of Thames, returned a positive result to both the screening assays for influenza A RT-PCR and avian paramyxovirus-1 (APMV-1). Further sequencing of the avian influenza isolate indicated it was an H5 subtype and was confirmed as having the highest nucleotide similarity to an H5N2 isolate previously found on the Hauraki Plains in 2020. The APMV-1 isolate was also partially sequenced and had the highest similarity to non-pathogenic vaccine APMV-1 isolates reported from other countries (Buckle, 2023a). LPAI and non-pathogenic APMV strains are routinely detected in New Zealand's shorebirds as part of the Avian Influenza Surveillance Programme, the results of which are reported annually (Stanislawek et al., 2022).

In the second case, a New Zealand native red-billed gull (*Chroicocephalus novaehollandiae*) was found in

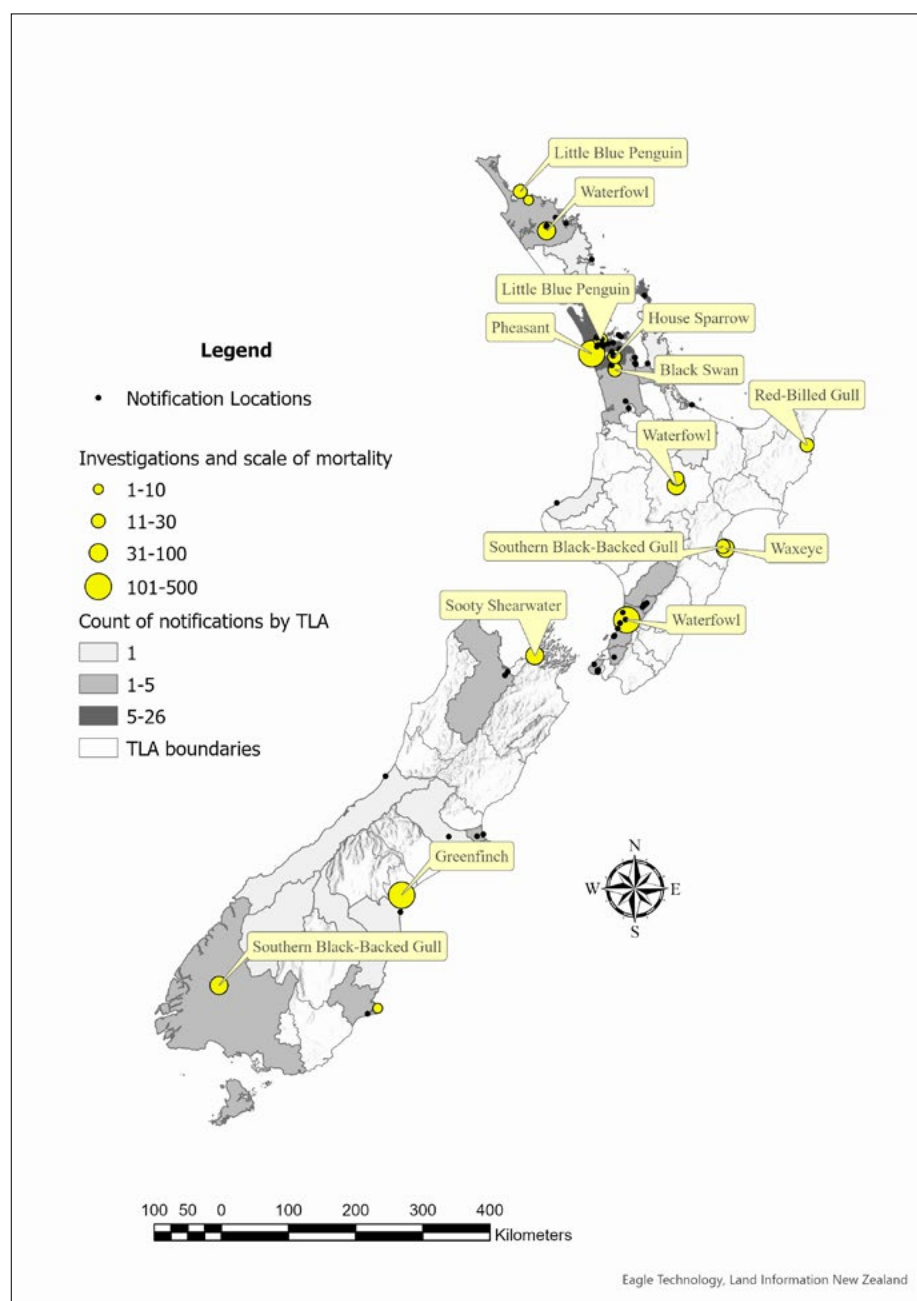


Figure 6: Number of notifications (grey shading) of avian mortality events that MPI received per territorial land authority (TLA) in 2023 along with the locations (yellow circles) and scale (diameters of circles) of each of the 38 avian mortality investigations that MPI's Incursion Investigation team assisted with in 2023. For mortality events involving 10 or more birds, the species of bird is shown. The black dots represent all notifications (both those investigated and those not investigated).

Lyall Bay, Wellington, exhibiting neurological signs. Swabs were collected and submitted for testing at MPI's AHL and returned positive results for influenza A virus RT-PCR and a negative result for APMV-1 RT-PCR. The influenza A was typed as an H6N2 subtype, an LPAI virus known to circulate in New Zealand's wild birds. As this was the first detection of influenza A H6N2 in a native New Zealand bird, DOC was notified (Buckle, 2023b).

Seal mortality events

During 2023 there was a large spike in

the number of notifications reporting mortality events in New Zealand fur seals/kekeno (*Arctocephalus forsteri*) from various coastal locations (Figure 7). In 2022 there were seven notifications of seal mortalities and three of these were investigated further. In 2023, a total of 20 notifications were reported and six of these were investigated further. Summaries for two of these are outlined below.

In August 2023, two notifications were received by MPI of New Zealand fur seal mortality events, primarily of

juvenile animals, from Ocean Beach in Hawke's Bay. MPI works with DOC to investigate these events with MPI's primary role being the exclusion of exotic diseases as the cause of death. If the carcasses are fresh, samples can be taken and tested for avian influenza virus (HPAI), seal morbillivirus (phocine distemper or PDV) and, in some cases, canine distemper virus (CDV). In many of these events, no fresh carcasses were available for diagnostic-quality samples to be collected and exotic disease rule-out relied on the epidemiological and clinical characteristics of the event. However, five fresh carcasses, four juvenile seals and one subadult seal, were available for postmortem from Ocean Beach, Napier (Buckle, 2023c). All five seals were in poor body condition, had reduced skeletal muscle mass and minimal subcutaneous and visceral fat reserves. All seals had empty stomachs and intestinal tracts and no pathological signs of infectious disease was found. In all cases, the cause of death was attributed to starvation with no evidence of any other underlying disease process. Spring is the time of year when young seals are weaned, and it is not uncommon for inexperienced juvenile seals to be unsuccessful in their foraging. Cyclone Gabrielle also severely affected Hawke's Bay and may have impacted marine fish stocks and seal survivability (Buckle, 2023c).

In September 2023 another report was made of seal mortalities again at Ocean Beach in Hawke's Bay. Due to advanced autolysis, no carcasses were suitable for further testing. Further notifications were made via DOC and members of the public of similar sightings of dead seals in the Auckland, Bay of Plenty, Wellington and Kaikōura areas. There was also greater public awareness as there was media coverage. Predominantly, juvenile seals were affected, with lower numbers of adult carcasses reported. Advanced autolysis of the carcasses made gathering of samples suitable for testing extremely challenging. DOC and MPI began a monitoring programme at key sites in the affected districts to determine the scale of the mortality events and the demographic affected.

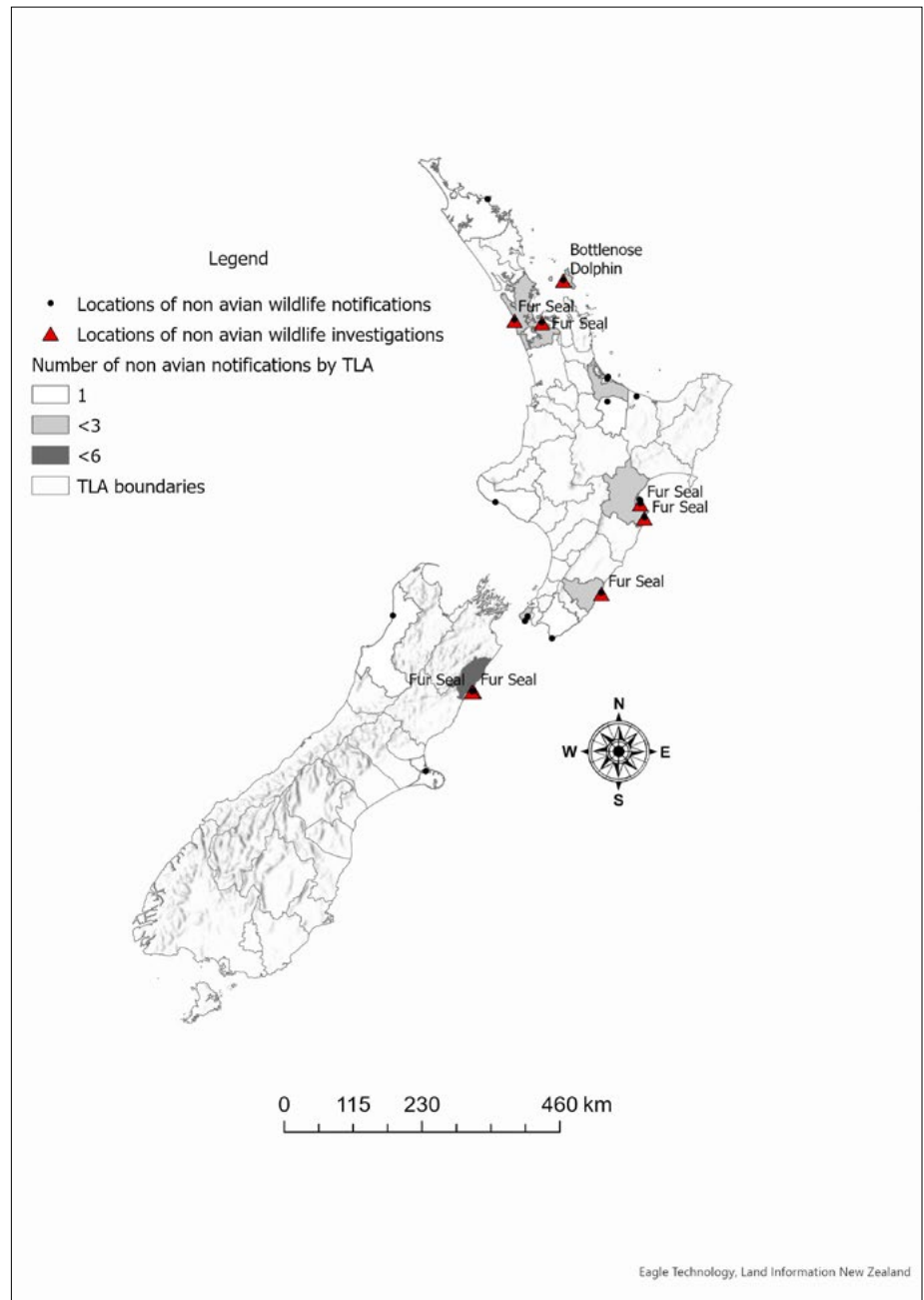


Figure 7: Number of notifications (grey shading) of mammalian mortality events that MPI received per territorial authority (TLA) in 2023 along with the locations (red triangles) of mortality investigations that MPI's Incursion Investigation team assisted with. The black dots represent all notifications (both those investigated and those not investigated).

This will assist in determining the normal pattern of mortality in the later winter and early spring months and enable DOC and MPI to identify unusual or unprecedented increases in deaths. DOC rangers visited seal colonies and recorded findings such as number of live seals present, location, number dead, state of decomposition, and if possible, age, class and sex. In total, necropsies were performed on four juveniles and two subadult seals from Hawke's Bay, one adult male from Bay of Plenty, one adult male from Wairarapa and a stillborn pup, two juveniles, one subadult male

and one adult female in Kaikōura. With the exception of the stillborn pup, all autopsied seals were found to be in poor body condition with reduced skeletal muscle mass and minimal subcutaneous and visceral fat reserves. In all cases, the cause of death was attributed to starvation and emaciation, with no evidence of any other underlying disease processes. In addition, nasal swabs from six animals were tested. These tissue samples and swabs were tested for HPAI virus, PDV and CDV via molecular assay. All samples tested negative for exotic disease agents (Buckle, 2023c).

Other notable wildlife and exotic animal investigations

In January a researcher contacted MPI about a mass stranding of common dolphins (*Delphinus delphis*) off Great Barrier Island. There was weak, non-repeatable evidence of severe acute respiratory syndrome coronavirus 2 SARS-CoV-2 RNA on two swabs taken from the oral cavity and blowholes from five of the dead dolphins.

Postmortems were conducted at the cetacean pathology unit, Massey University Auckland, and revealed lesions in the lungs. Samples, including fresh and frozen tissue and swabs, from eight dolphins were sent to MPI's AHL. RT-PCR was conducted on the tissue and swabs and no RNA of the SARS-CoV-2 virus was detected so the case was closed. The animals were then released to local Iwi for disposal once the concern about zoonotic disease had been addressed. After histological examination of the lung tissue at a regional veterinary laboratory, it was identified that a parasitic infection had caused a bronchopneumonia. *Stenurus ovatus* and *Parafilaroides* species are both known to infect dolphins and would be differential diagnoses in this case (Buckle, 2023a).

MPI was notified of the death of four adult zebras from a herd of five in a private conservancy over a period of around six weeks in July/August 2023. Clinical signs consisted of colic, developing ataxia with hindlimb weakness, which progressed until the animals were unable to stand and became recumbent and were euthanased. Samples were taken for testing post-mortem and the exotic viral diseases West Nile virus, African horse sickness, and flaviviruses were excluded by molecular tests and serology. Samples were also tested for *Clostridium botulinum* on a mosaic PCR with a negative result. A nasal swab from one zebra was positive on conventional herpesvirus PCR. Sequencing identified that this was most likely equid herpesvirus (EHV) 7 but the exact identity could not be ascertained. The cerebrospinal fluid of the same animal was negative for equine herpes virus, so EHV was unlikely the cause of death.

Clinically the provisional diagnosis was botulism although toxins formed by *Clostridium botulinum* were not found by molecular screening in any of the intestinal or serum samples. The exact cause of death of the zebra on this property was not determined, but exotic disease was excluded. A possible endemic cause, monensin toxicity, was not able to be ruled out (Buckle, 2023c).

Part of the work of the Incursion Investigation team involves supporting the characterisation and understanding of unusual or novel pathogens believed to originate within New Zealand. In May a zoo veterinarian contacted the incursion investigation team to assist with characterisation of a *Mycoplasma* species detected in oral swabs from three newly acquired 7-month-old ostriches (*Struthio camelus*). The birds were showing no clinical signs of disease, and the rest of the resident flock were also normal. Swabs taken from the birds were submitted to MPI's AHL where species-specific molecular tests were conducted, with negative results, for *Mycoplasma iowae*, *M. meleagridis*, *M. gallisepticum* and *M. synoviae*. One swab from the juvenile birds and two swabs from adult female birds all returned a positive result on a *Mycoplasma/Acholeplasma* genus molecular test and subsequent sequencing showed highest similarity (99.5 percent) with *Mycoplasma nasistruthionis*. *Mycoplasma nasistruthionis* is one of two recently classified species of *Mycoplasma* having been isolated from ostriches with respiratory disease in South Africa and Namibia (Spergser et al., 2020). The confirmation of *M. nasistruthionis* in two of five New Zealand-born ostriches without clinical signs constituted a baseline surveillance find and the investigation was closed (Buckle, 2023b).

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Transmissible spongiform encephalopathies surveillance programme annual report

Transmissible spongiform encephalopathies (TSEs) are a group of neurodegenerative diseases caused by the proliferation in the central nervous system of an altered form of a normal intracellular protein called a prion. The main TSEs of interest in New Zealand are bovine spongiform encephalopathy (BSE), which affects cattle; classical scrapie (sheep and goats); and chronic wasting disease (CWD) (deer and elk/wapiti). New Zealand is free from these diseases.

Aims of TSE surveillance

This programme is designed to ensure early detection of any TSE incursion, and to ensure early containment and successful eradication.

The TSE surveillance and risk management measures implemented in New Zealand have been described in previous annual reports (McIntyre, 2009). Surveillance for CWD is not mandated by the World Organisation for Animal Health (WOAH) but is carried out to assure New Zealand's trade partners of freedom from this disease. Surveillance for scrapie and BSE are in accordance with the corresponding chapters in the Terrestrial Code.

How the programme works

TSE surveillance combines passive and active surveillance activities. Passive surveillance is carried out for all three TSEs through a targeted scheme under which veterinary practitioners submit neurological material (brain and spinal cord) from animals showing clinical signs of neurological disease. Veterinarians and farmers are compensated for supplying the samples. Submissions to the programme occur year-round, with a seasonal increase in submissions from August to October. The TSE surveillance programme is supported by ongoing awareness, targeting the livestock industry and the veterinary profession with regular training of

veterinarians about BSE, scrapie and CWD and their surveillance.

As a country with a negligible BSE risk, New Zealand has been performing surveillance type B, as specified by Chapter 11.4 of the WOAH Terrestrial Animal Health Code (WOAH, 2019a). The principle of this surveillance was to achieve a desired level of targeted BSE surveillance of the cattle population in a country via the accumulation of surveillance points. The point system now comes to an end after the adoption of a new BSE chapter by WOAH in May 2023 (WOAH, 2023). However, the rationale of BSE surveillance remains unchanged, i.e., targeting cattle with clinical signs of the clinical spectrum of BSE for ruling out the disease in this population.

In addition to the targeted surveillance, active surveillance for classical scrapie and CWD has been carried out since 2010 to complement the small numbers of submissions made to the passive scheme for sheep and deer. As part of this programme, medial retropharyngeal lymph nodes are routinely collected for testing from clinically healthy adult animals sent to meat processing plants across the country. The required sample size (340 sheep and 340 deer per year) is designed to detect disease at

a low prevalence in the population. A maximum of two animals can be collected from any one farm to help ensure that the sampled population is geographically representative.

Spinal cord tissues of cattle, deer and sheep collected during passive surveillance are tested at the MPI Animal Health Laboratory, Wallaceville (AHL), using the EU-approved Herd Check BSE-scrapie ELISA rapid test (IDEXX Laboratories Inc., Westbrook, Maine, USA). Lymph nodes from deer and sheep collected under the active surveillance scheme are tested using the same test at MPI's AHL. Moreover, brains collected by veterinarians under the passive surveillance scheme undergo histopathological examination at accredited veterinary diagnostic laboratories for additional exclusion of TSE-specific lesions and to provide an alternative diagnosis where possible.

Results

In total, 761 cases from all species had samples collected by both passive and active TSE surveillance in New Zealand in 2023. All tests were negative (Table 1).

The level of passive surveillance of the cattle population achieved in 2023 would have been eligible for 25915.7 BSE points under the old WOAH Code requirements, corresponding to 65

Table 1: Number of samples collected in 2023 for TSE screening, by passive and active surveillance

Surveillance Stream	Tissue	Test type	Species	Number
Passive	Brain	Histopathology	Cattle	67
Passive	Brain	Histopathology	Goats	1
Passive	Brain	Histopathology	Deer	5
Passive	Brain	Histopathology	Sheep	6
Passive	Spinal cord	Rapid Test IDEXX	Cattle	65
Passive	Spinal cord	Rapid Test IDEXX	Goats	1
Passive	Spinal cord	Rapid Test IDEXX	Deer	5
Passive	Spinal cord	Rapid Test IDEXX	Sheep	5
Active	MRLN*	Rapid Test IDEXX	Deer	340
Active	MRLN*	Rapid Test IDEXX	Sheep	335

*Medial retropharyngeal lymph node

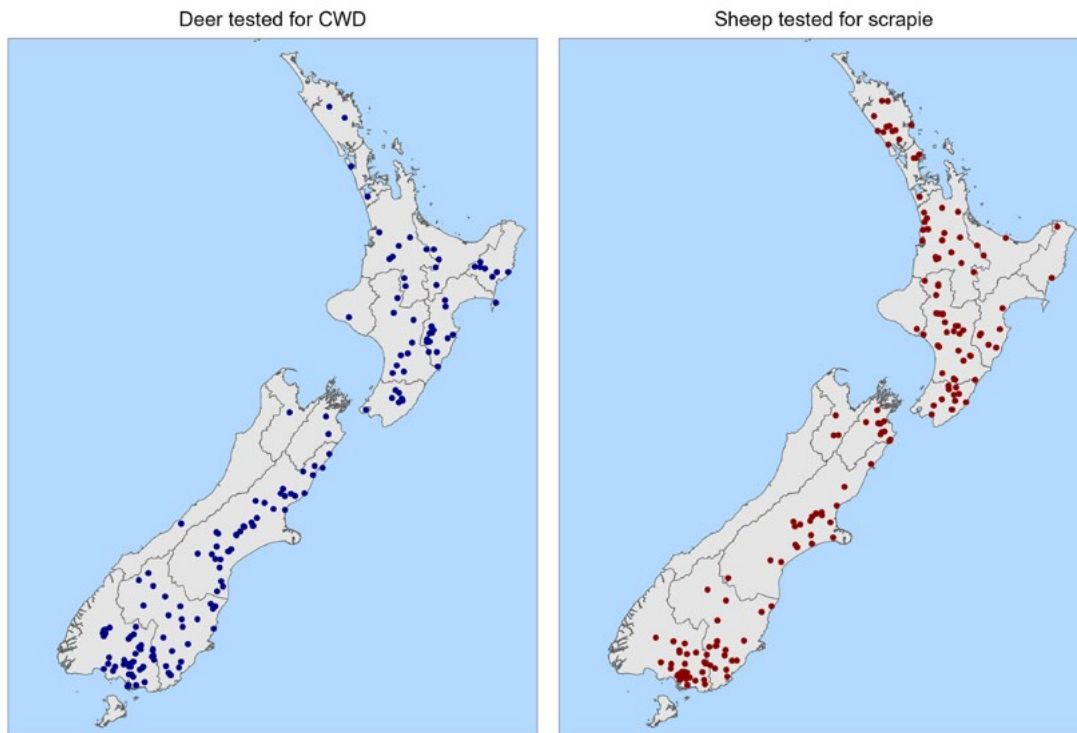


Figure 1: Locations of farms screened through active surveillance for chronic wasting disease (CWD) (left) and classical scrapie (right), 2023

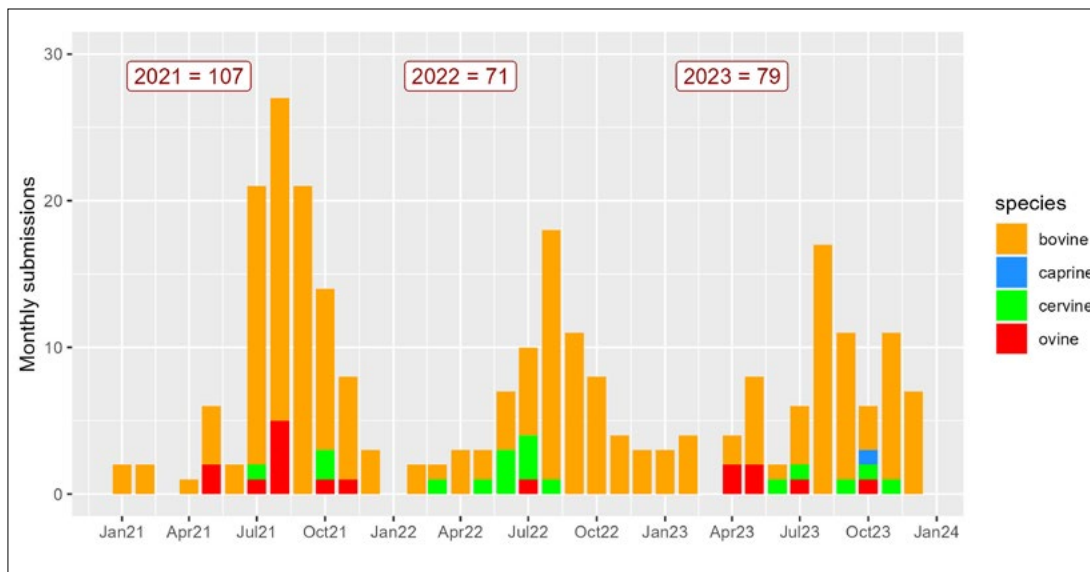


Figure 2: Passive surveillance through the incentivised scheme: monthly numbers 2021–2023 (total numbers submitted each year are shown at top)

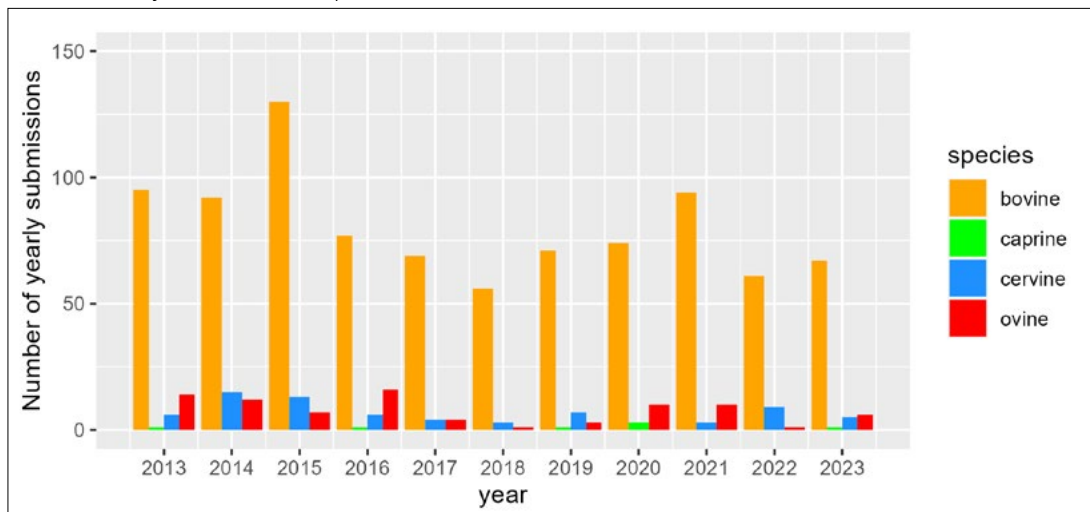


Figure 3: Annual number of cases submitted to the TSE passive surveillance scheme, 2013–2023

spinal cords of cattle tested by rapid ELISA test.

For active surveillance of scrapie and CWD in slaughter premises, the sampling distribution was widespread throughout New Zealand and thus reasonably representative of the population at risk (**Figure 1**, previous page).

Trends in TSE passive surveillance

The passive surveillance scheme for TSE focuses on submissions of clinically suspect animals (or fallen cattle) from veterinarians. Although these occur year-round, there is a clear seasonal trend, with a peak from August to October each year (**Figure 2**, previous page).

The number of samples submitted to this programme varies year to year. (**Figures 2 and 3**, previous page).

Trends in TSE active surveillance

In October 2009, the first detection of a case of atypical scrapie/Nor98 in a New Zealand-born sheep was confirmed (Kittelberger and McIntyre, 2009; Kittelberger et al., 2010). MPI strongly supports WOA's view 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" (WOAH, 2019b). Accordingly, MPI considers atypical scrapie to be a negligible biosecurity risk (Vink and McIntyre, 2014). The sensitivity of detection of the prion causing classical scrapie is higher in lymphoid tissue than in brain tissue, and the atypical scrapie/Nor98 prion is not detected in lymphoid tissue (Meloni et al., 2012). Research at MPI's AHL has shown that testing of medial retropharyngeal lymph node tissue (MRLN) from sheep and goats with the IDEXX TSE test has high diagnostic sensitivity and specificity towards classical scrapie (Kittelberger et al., 2014). This research is the basis for currently using MRLN for active surveillance in sheep and deer.

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Arbovirus surveillance programme annual report

Introduction

Since 1991, the Ministry for Primary Industries (MPI) has operated an arbovirus surveillance programme 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, bovine ephemeral fever virus and Japanese encephalitis.

Arboviruses are taxonomically diverse but their general characteristics include infection of vertebrates. They replicate in and are spread by insect vectors of 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. Although the probability is low, it is possible that the route of introduction to New Zealand could be through windborne dispersal of the vector species *C. brevitarsis* from Australia, where it is widely distributed and abundant on the east coast and has a 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 and are likely able to establish in northern parts of New Zealand.

The surveillance programme has three components:

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

Early warning system

MPI maintains a 24/7 exotic pest and disease hotline that enables

early reporting of suspect new-to-New Zealand pests and diseases. This can be used to report suspicious cases of diseases in farm animals (Tana, 2014). Exotic terrestrial animal pest and disease investigations are managed by MPI's Diagnostic, Readiness & Surveillance Directorate, Wallaceville. Results of suspect cases are reported annually in this section of the annual report.

Herd testing

During 2024, blood was collected from 655 cattle from 131 farms in the mid-to-upper North Island (**Figure 1**). These regions are considered the most favourable areas for survival and establishment of *Culicoides*, and where cattle would most likely be infected if the vector was present. Blood samples are taken annually for serological testing after the possible period of virus transmission (Wilson et al., 2008). The aim of sampling is to detect serological evidence of exposure to the diseases named above.

Vector surveillance

Light traps for vector surveillance are placed in areas where wind-blown dispersal and subsequent establishment are likely. The traps are designed to attract the winged adult midges as they fly during dawn and dusk. They also catch other insects that are of no significance. Catches are examined under a microscope to detect any *Culicoides* species present. Twelve light traps, with carbon dioxide and octenol as attractants to mimic the scent of animals and green LED lights for visual attraction (Ritchie et al., 1994; Bishop et al., 2006), were deployed this season on sentinel cattle farms. Vector surveillance is undertaken in February and March, 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. The light traps are run on three consecutive nights of each selected week.

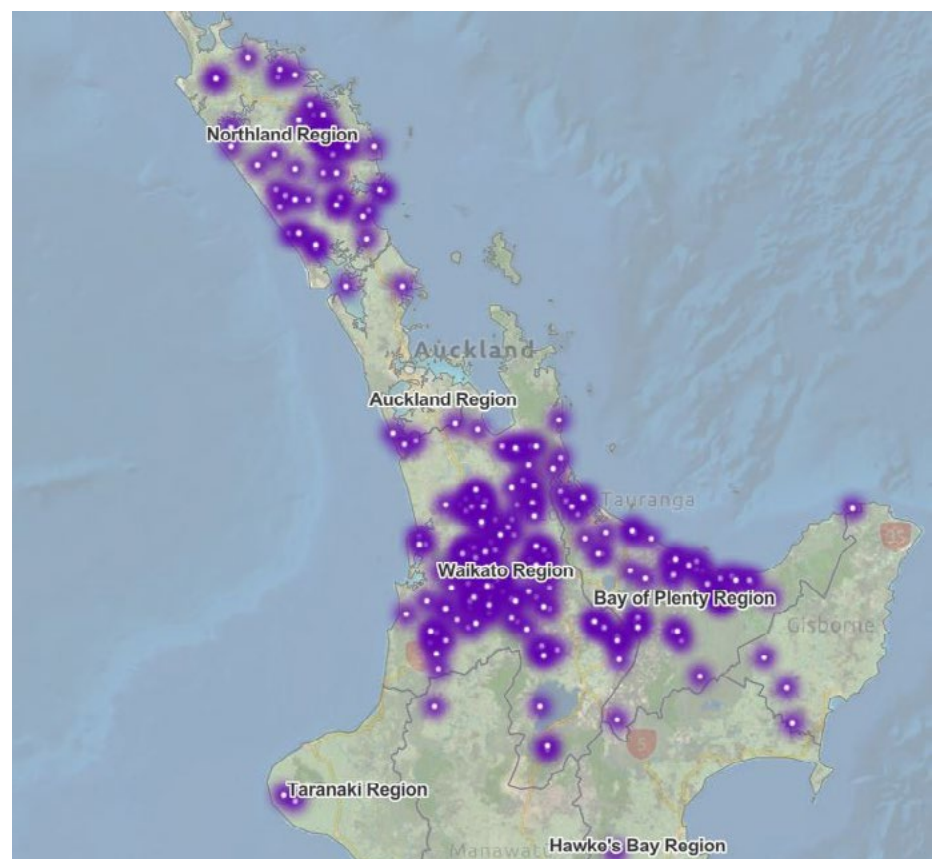


Figure 1: Location of 131 farms sampled for cattle

Blood test results

All 655 blood samples sent to MPI's Animal Health Laboratory (Wallaceville) tested negative by ELISA for antibodies to bluetongue, epizootic haemorrhagic disease, Akabane and bovine ephemeral fever viruses and by default, JEV. (A West Nile virus ELISA that cross-reacts with other flaviviruses was used.)

Light-trap results

Insect samples were processed by MPI's Plant Health and Environment Laboratories in Auckland and Christchurch during early 2024. The bycatch of 169,754 insects was screened from 12 traps. Unlike last year when trapping was curtailed by Cyclone Gabrielle, 119 samples were collected over a 10-week period due to good weather for the season, with only one trap having a malfunctioning CO₂ cylinder. No *Culicoides* were found but 3,220 native ceratopogonid midges were trapped. These results suggest that the traps would have caught *Culicoides* midges if they had been present.

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Mycoplasma bovis eradication programme annual report

Introduction

On 21 July 2017, samples were taken from South Island dairy cattle that were experiencing clinical disease consistent with *Mycoplasma bovis* infection and results confirmed the presence of *M. bovis*. Following this detection, a national response was initiated by the Ministry for Primary Industries (MPI) to define the extent of *M. bovis* infection in New Zealand and contain its spread. Government and industry bodies announced the decision to eradicate *M. bovis* from New Zealand on 28 May 2018. The three goals of the *M. bovis* eradication programme are to:

- eradicate *M. bovis* from New Zealand;
- reduce the impact of the disease and the eradication programme for everyone affected by *M. bovis*; and
- leave New Zealand's biosecurity system stronger.

The programme to date shows good progress towards the goals set when programme partners (the Governance Group) DairyNZ, Beef + Lamb NZ and MPI agreed on the path to eradicate *M. bovis* from New Zealand. The successes so far have been possible thanks to the commitment of farming communities, industry partners and MPI to protect New Zealand's biosecurity.

From 1 July 2023 to 30 June 2024, two dairy farms infected with *M. bovis* (labelled Confirmed Properties or CPs) were detected, both in Canterbury. The first of these was identified through bulk tank milk screening and the second was identified through testing of farms in proximity to CPs.

As of June 2024, all detected, infected cattle have been culled and there are no active CPs in New Zealand. Twice-monthly screening of all commercially supplying dairies commences in July 2024 and will run until the end of September 2024. This has shown to be a good time for the programme to identify infected dairies, if present.

Given this, further infected farms may still be detected.

Network surveillance

Cattle and milk movements on and off CPs are traced as part of determining the spread of *M. bovis* infection. Sources of tracing data include the National Animal Identification and Tracing system, on-farm investigation reports, Animal Status Declarations, written records of cattle movements, transport documents, financial records, reports from field staff and a cattle census from the CP. Groups of cattle on these farms are subject to herd-level serological testing using a commercial *M. bovis* ELISA kit (ID Screen® *Mycoplasma bovis* Indirect ELISA; IDVet, Grabels, France).

Farms that are owned or managed by someone who also owns a CP, and farms in proximity to a CP, are also required to undergo sampling and testing. Cattle moved from CPs during their period of infection risk that have never contributed to the commercial milk supply are directed to slaughter at a meat processing plant, where a tonsillar swab is collected for real-time polymerase chain reaction (RT-PCR) testing and a blood sample is collected for ELISA testing.

A 'case' of *M. bovis* is defined as a place where the herd-level serology is positive at two different times for at least one live cattle group and/or a place from which one or more samples collected from cattle (tonsillar swab, nasal swab or milk sample) test positive for *M. bovis* by RT-PCR with sequencing to *M. bovis*.

Case Review Project

The Case Review Project is a retrospective epidemiological study of the data and information for properties confirmed as having been infected with *M. bovis* in New Zealand. By reviewing historical data, the programme is better able to understand connections between farms and apply more sophisticated tracing tools to investigations. Reviews

are undertaken by a multidisciplinary team of programme epidemiologists, analysts and advisers in line with a detailed policy and specification that includes assurance and approval.

The study is important to the programme as it enables the following activities:

- identifying the links between properties to help identify potential residual risk;
- triggering follow-up sampling on farms where infection could remain to provide assurance that network surveillance has been effective and delimiting the outbreak is complete to the best of our knowledge;
- providing evidence to inform the design of a cost-effective, risk-based approach to surveillance and optimise efforts to shorten the tail of the outbreak;
- telling the story of the world's first *M. bovis* eradication programme; and
- forming a major contribution to the development of a robust statement of absence capable of withstanding international scrutiny once eradication is achieved.

A little over half (52 percent) of 265 case reviews, prioritised according to genetic clade type, risk of spread and absence of a known source, have been completed. As a result, 282 farms have been sampled. No infection has been confirmed to date.

Sequence type 29

In September 2022, a strain of *M. bovis* novel to New Zealand was detected on a dairy farm in Canterbury. Bulk tank milk (BTM) surveillance detected infection on the farm in April 2022 and it has since been depopulated, cleaned and disinfected, and restocked with cattle. Imported bovine semen is the most plausible source of the novel strain. MPI is investigating bovine semen imported before the current import health standard for *M. bovis* genetic material was implemented.

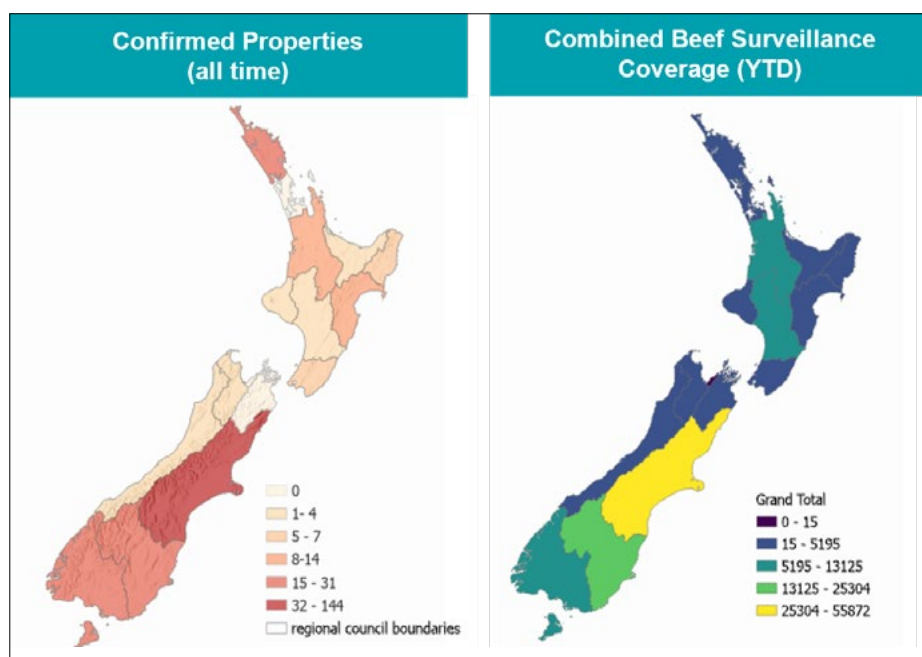


Figure 1: Number of confirmed properties by regional council for the outbreak to date (left map) and total number of samples collected through NBCS from 1 July 2023 to 27 June 2024 (right map)

The risk of transmission via imported semen is considered very low when it is collected and processed according to MPI's requirements.

Bulk tank milk surveillance

Every dairy farm in New Zealand supplying milk for commercial processing has a BTM sample tested at least monthly using the *M. bovis* ELISA kit. Dairy farms that produce a BTM sample for which the ELISA S/P ratio (the quantity of antibodies in a sample relative to a positive control) is greater than or equal to 30, and farms where the S/P ratio is greater than or equal to 20 in two consecutive samples, are followed up with on-farm blood sampling and herd-level serology. The average monthly rate of detection is very low, with less than 0.3 percent of dairy farms requiring on-farm blood sampling after BTM testing, and more than 95 percent of these are subsequently confirmed to be negative for *M. bovis*.

In July 2022, the programme increased the frequency of BTM screening to twice monthly for July, August and September (early spring lactation) to avoid missing infection. This was based on findings from a latent class analysis that found that the diagnostic sensitivity of the ELISA was highest when milk samples were tested in

early lactation. This also coincides with the introduction of heifers to the milking platform and the return of the milking herd from winter grazing, both of which can be the source of infection to dairy farms.

Twice-monthly screening in 2023 detected one infected dairy farm. Twice-monthly screening from July to September 2024 will occur to ensure every opportunity is taken to detect infection.

National beef and dry stock cattle surveillance

National beef and dry stock cattle surveillance (NBCS) screens non-lactating cattle across the country using the *M. bovis* ELISA kit. Blood samples are collected from beef cattle slaughtered at meat processing plants ('meat processing plant surveillance'), from cattle before entry to a feedlot, and from beef cattle breeding herds and dairy heifers ('on-farm beef and drystock cattle surveillance'). NBCS is designed to oversample from regions with the greatest history of infection. Canterbury, Otago, and Southland have been targeted based on risk (**Figure 1**).

One CP has been identified through NBCS to date. The property would have been identified through network surveillance had it not been identified

through NBCS. The feedlot was confirmed as infected in 2018. After a process of depopulation, cleaning, disinfecting and fallowing, the feedlot was cleared of infection in early 2023 and subsequently began to restock. The feedlot aggregates cattle from multiple sources within the North and South islands, and while the risk of re-infection remains low, the property is testing all cattle before they enter the site. Before depopulation of this feedlot, resident cattle were sampled on induction for NBCS. Post-depopulation, all groups are sampled and must test negative on their source property before entering this feedlot. This surveillance stream is intended to continue until at least March 2025. This result continues to provide the programme with confidence that *M. bovis* is not widespread in the non-dairy population.

Farms all over New Zealand are eligible for sampling under NBCS. From 1 July 2023 to 27 June 2024, 110,925 samples have been collected through meat processing plant surveillance, 48,352 samples through on-farm beef and drystock cattle surveillance, and 43,282 samples through the repopulation sampling of the feedlot.

Genomic analysis of *M. bovis* isolates in New Zealand

Where *M. bovis* can be grown, the programme aims to get at least one whole genome sequence from each CP. It has been more successful at culturing *M. bovis* from samples collected from recently detected CPs, compared with those detected earlier. When more than one isolate is available for a CP, at least two whole genomes will be sequenced.

Whole genome sequence data are available for 126 of 281 CPs (45 percent). Sequences for all but one of the CPs are sequence type 21 (ST-21). ST-21 is the original incursion strain and sequences belong to one of four clades. The genetic similarity of ST-21 sequences supports the hypothesis that in the original incursion, clonal expansion followed a single *M. bovis* introduction

(or a small number of closely related introductions) in about 2015. It is estimated from tracing cattle movements and genomic analysis that this incursion happened 2–3 years before the first detection of *M. bovis* in New Zealand in 2017.

All ST-21 isolates obtained since spring 2020 belong to Clade 2. This result suggests that disease control activities have been successful at removing infection caused by Clade 1, 3 and 4 isolates from the national herd.

For the incursion that was identified in 2022, *M. bovis* ST-29 has been isolated from cows only on one farm. As stated above, imported bovine semen is the most plausible source of this novel strain.

Transition of the programme from MPI to OSPRI

From 1 November 2023, MPI contracted out the long-term surveillance phase of its operations for the programme to disease management agency OSPRI. This change is the start of transitioning the

whole programme to a management agency, as it moves towards its goal of eradication of *M. bovis* from New Zealand by 2028. As the estimated 10-year eradication plan passes its half-way mark, the move to OSPRI signals the next logical step – ending the active management of *M. bovis* and transitioning to its monitoring and response. If this ambitious target is met, New Zealand will be the first country in the world to successfully eradicate the disease. This arrangement will remain in place until a proposed National Pest Management Plan (NPMP) comes into effect, anticipated to be late 2024. If approved, an NPMP will provide legislative authority for a management agency to carry out the programme's services, including enforcement.

Conclusion

The programme is six years into the 10-year eradication plan. With no active CPs, good progress is being made; however, the outcome of twice-monthly BTM screening in 2024 will be key to identifying any undetected infection. BTM and NBCS data are currently contributing to

our confidence of absence and the programme seeks to optimise these surveillance streams to maximise the amount of confidence that can be achieved before 2028.

Animal disease eradication programmes present an enormous challenge. They can be very distressing for farmers, industry and responders. The response to *M. bovis* has provided many lessons for Government and cattle industries on how to better prepare for and respond to large-scale outbreaks of livestock diseases. These include the need for sustained investment in readiness and traceability systems and the continued importance of on-farm biosecurity.

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Antimicrobial resistance (AMR) annual report

Team overview

The Antimicrobial Resistance (AMR) team was established in early 2023 and is part of the Agricultural Compounds and Veterinary Medicines (ACVM) Programmes and Appraisals team.

The AMR team's core function is to update and implement actions of the New Zealand Antimicrobial Resistance Action Plan as these relate to animals and plants. The AMR team works closely with the Ministry of Health (MoH) and other organisations to align strategies and priorities.

The team is focused on:

- updating the New Zealand Antimicrobial Resistance Action Plan with the Ministry of Health;
- delivering the MPI animal and plant sector AMR Implementation Plan;
- surveillance and monitoring of AMR in bacteria associated with animals and plants;
- regulatory control of antibiotics for use in animals and plants;
- reporting of sales of antibiotics used in animals and plants;
- stewardship, training and awareness education for industry sectors, veterinarians, farmers, growers and educators; and
- audits of antibiotic supply, use and stewardship, and the relevant regulatory controls.

The team comprises four veterinarians and two scientists at New Zealand Food Safety head office in Wellington (five) and the Ministry for Primary Industries (MPI) Centre in Auckland (one).

New Zealand Antimicrobial Resistance Action Plan

The 2017 [New Zealand Antimicrobial Resistance Action Plan](#) is currently being updated by MPI in conjunction with the Ministry of Health. This new plan, once implemented, will cover five years of activities to reduce the

impacts of AMR on humans, animals, plants and the environment with a focus on One Health. The work programmes that sit within the MPI AMR team all support and align with the objectives of the NZ AMR action plan:

- Awareness and understanding;
- Surveillance and research;
- Infection prevention and control;
- Antimicrobial stewardship; and
- Governance, collaboration and investment.

The New Zealand Antimicrobial Resistance Action Plan is overseen by the New Zealand AMR Governance Group, which has representatives from MoH, MPI and the Ministry for the Environment (MfE). This body meets three times a year to provide alignment between MPI and MoH, agree priorities in the Action Plan, and advise and assist with any roadblocks.

New Zealand animal and plant sectors' Antimicrobial Resistance Implementation Plan

New Zealand Food Safety has developed an animal and plant sector AMR Implementation Plan to continue the MPI AMR work programme aligned with the objectives in the second New Zealand Antimicrobial Resistance Action Plan. The Implementation Plan provides the animal and plant health sectors' priority activities, desired outcomes, measurable targets within relevant timeframes and identifies the facilitating and supporting organisations for each activity.

For more details of the AMR team's work programme, including the animal and plant sectors' AMR Implementation Plan, AMR surveillance, the antibiotic reassessment programme and antibiotic sales analysis reports see the MPI website: <https://www.mpi.govt.nz/animals/veterinary-medicines-acvm/antimicrobial-resistance/>.

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Annual reports from national pest management strategies

Bovine tuberculosis

Delivery of the TBfree programme

TBfree New Zealand Limited, a wholly owned subsidiary of OSPRI NZ Limited, is the management agency for the National Pest Management Plan for Bovine Tuberculosis (*Mycobacterium bovis*) pursuant to section 100 of the Biosecurity Act 1993 and clause 6 of the Biosecurity (National Bovine Tuberculosis Pest Management Plan) Order 1998. This report covers the period 1 July 2022 to 30 June 2023.

The objectives of the TBfree programme are:

- Eradication of bovine TB from New Zealand by 2055 with milestone objectives of:
 - TB freedom in cattle and deer by 2026;
 - TB freedom in possums by 2040;
- Containment of disease in cattle and deer to a national infected herd period prevalence of no more than 0.2 percent until such time as bovine TB is eradicated.

Components of the TBfree programme

To meet the objectives of the TBfree programme, OSPRI delivers an integrated range of services, including:

- livestock disease management that includes TB testing and diagnostics, disease surveillance through carcass inspection at slaughter premises, case management, and controls on livestock movement;
- wildlife pest management operations through a possum control programme in Vector Risk Areas (VRAs, described below) and wildlife surveillance to determine the presence of TB in possums or other wildlife;
- an annual review of areas across New Zealand where there is a risk of transmission of TB from wildlife

This report is extracted and adapted from the official OSPRI annual report, available at <https://www.ospri.co.nz>

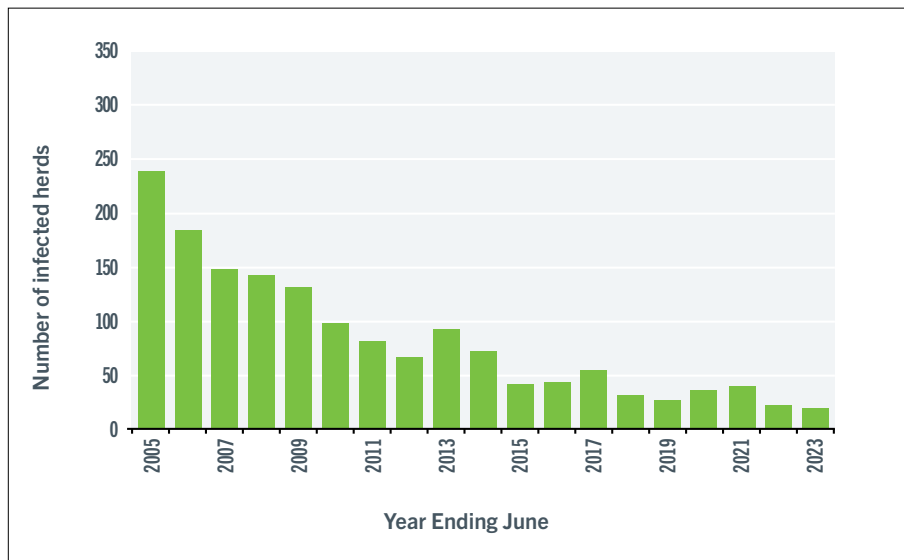


Figure 1: Number of infected cattle and deer herds at 30 June

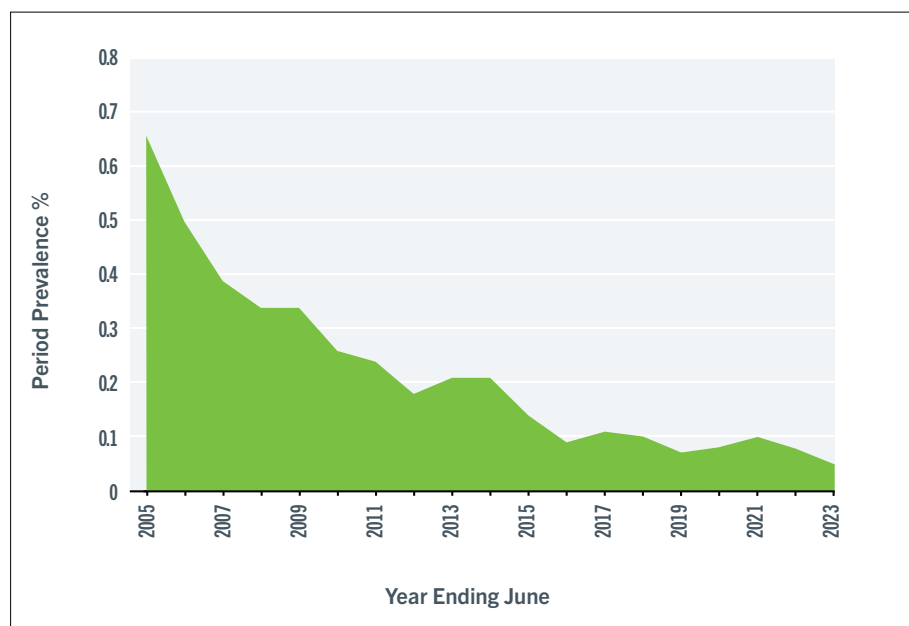


Figure 2: Annual infected herd prevalence (cattle and deer)

- vectors to obtain an estimate of the probability that any specific possum population is free of TB;
- a research and development programme to support the control and eradication of TB in wildlife and livestock;
- support for farmers while eradicating infection within their herds;
- local farmer-led committees that communicate the TBfree programme, activities and operations to farmers; and
- a range of further communications and extension activities to farmers, stakeholders and other affected parties.

Table 1: Disease metrics over three different time periods for cattle and deer herds located in Vector Free Areas (VFA) and Vector Risk Areas (VRA)

Vector area status	Infected herd period prevalence percent			Herd breakdown rate per 1000 herds			Infected herd clearance percent		
	1992/93	2002/03	2022/23	1992/93	2002/03	2022/23	1992/93	2002/03	2022/23
Period									
VFA	1.3	0.15	0.01	6.8	0.73	0.08	68	83.3	43
VRA	14.9	3.8	0.34	50.3	13.21	0.99	32	58.5	52
Total	3.6	0.91	0.05	13.4	3.3	0.19	42	61.4	50

How we find TB

Under the TBfree programme, New Zealand is divided into Disease Control Areas, each having their own frequency requirements for livestock TB testing (see below). The other method used to detect TB in livestock is identifying lesions suspicious of TB as part of routine carcass inspection at slaughter.

An overview of pest operations management

New Zealand is divided into Vector Risk Areas (VRAs), where local wildlife populations have been or remain infected with TB, and Vector Free Areas (VFAs), where TB freedom has

been achieved or the disease was never suspected to be present.

The plan objective is to eradicate TB from all wild animal populations on land within VRAs, and to monitor for and if necessary, control TB in wildlife in VFAs.

Recent progress of the TBfree programme

See Figure 1, previous page.

Infected herd period prevalence

The annual infected herd period prevalence (for cattle and deer combined) on 30 June 2023 was

0.05 percent (Figure 2, previous page, Table 1).

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 herds in the country and expressed as a percentage. The annual period prevalence has been less than 0.2 percent for the last nine financial years; annual period prevalence is one of the standards that the World Organisation for Animal Health requires for official TB freedom.

Infected herds have reduced over time

The maps in Figure 3 show how the numbers of infected herds (beef, dairy

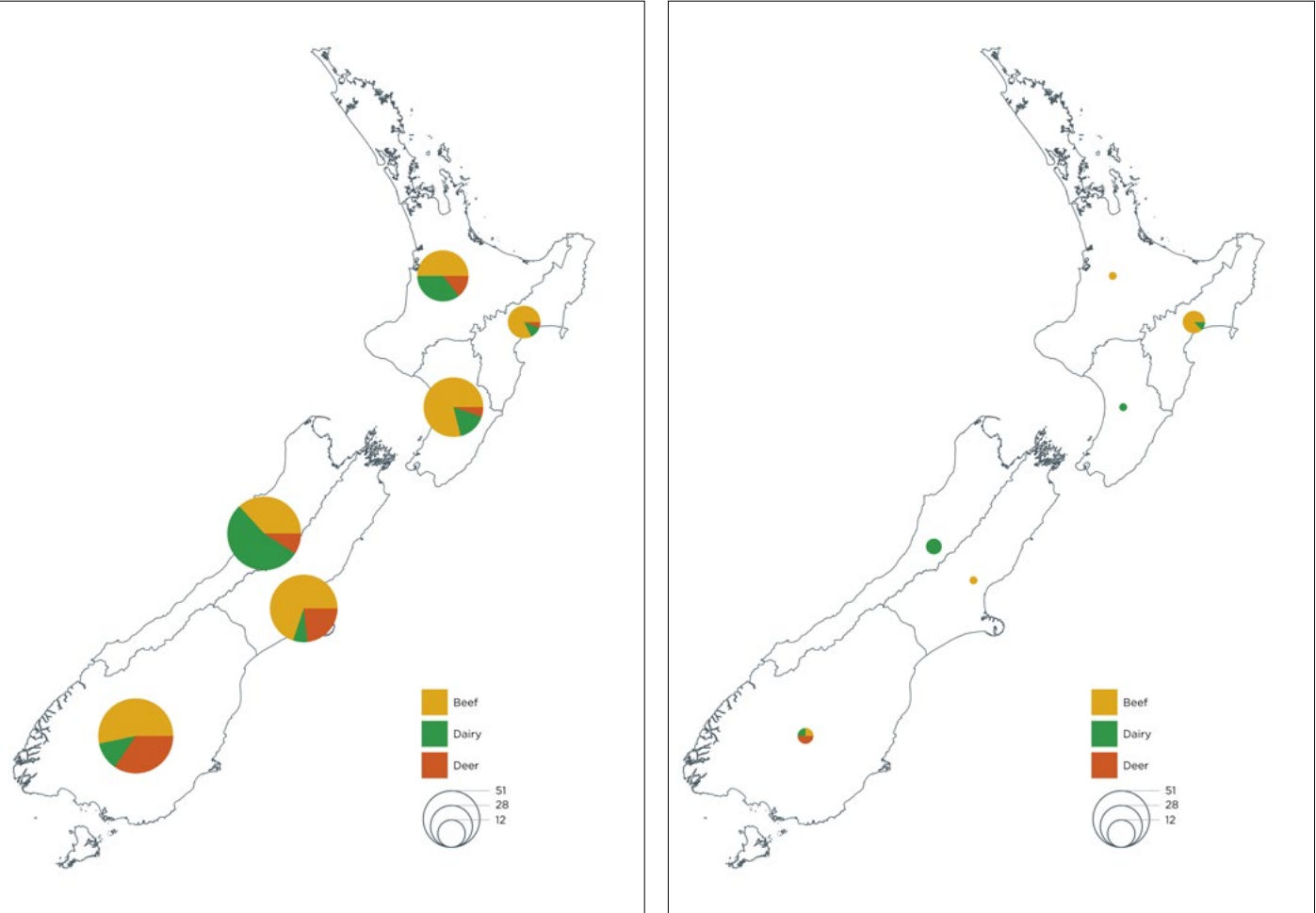


Figure 3: Infected herds 2003 (left) and 2023 (right)

and deer) have significantly decreased over a twenty-year period.

Livestock disease management

An effective livestock disease management programme is a key part of OSPRI’s TB control and eradication effort and includes:

- disease surveillance through routine on-farm TB testing and post-mortem inspection of cattle and deer at slaughter;
- TB diagnosis through approved laboratory testing;
- effective case management of infected herds; and
- restricting the movement of at-risk livestock either at area or herd level.

Our response to a diagnosis of TB

If TB is diagnosed, a Restricted Place Notice under section 130 of the Biosecurity Act 1993 is placed on the herd. This restricts any movement of stock from the herd (except to slaughter) without a permit. This on-farm biosecurity process limits any spread of the disease through cattle or deer movement from that time on.

The infected herd is case managed by an OSPRI team. Case management involves tracing any livestock movements into and out of the herd before diagnosis. Any livestock

identified as having moved out of the herd will be TB tested in their destination herd.

OSPRI uses both livestock movement information and DNA analysis of the TB organism to help determine whether TB has been introduced by livestock movement, or by contact with infected wildlife, or whether it was possibly residual within the herd.

An important aspect of case management is working with the farmer to understand the cause of the disease and supporting the farmer in managing their herd through to TB freedom as quickly as possible. A herd cannot be declared free of TB until it has had at least two clear whole-herd tests at a minimum of six months apart.

A key part of OSPRI’s TB Plan is the restriction of livestock movement from infected herds and from designated Movement Control Areas where the TB risk from wildlife is considered high.

Infected cattle herds

On 30 June 2023 there were 17 infected cattle herds (0.024 percent of all cattle herds), compared with 23 infected cattle herds on 30 June 2022, a reduction of 26.1 percent.

Of the 17 infected cattle herds:

- by type: 59 percent (10) were beef dry or beef breeding herds; 41 percent (7) were dairy or dairy dry herds;

- by location: 59 percent were in the North Island; 41 percent were in the South Island:
 - 47 percent of all herds were in Hawke’s Bay (8);
 - 18 percent were in Hari Hari (3); and
 - 35 percent were across other locations.

Figure 4 (next page) shows the change in infected herd numbers since June 2005 by vector area status (VFA – Vector Free Area; VRA – Vector Risk Area). The annual number of infected herds is expected to trend down towards zero over the next four years.

The cattle herd breakdown rate per 1,000 herds (new infected herds divided by total herds x 1,000) for 2022/23 was 0.17, and the cattle herd clearance rate was 51 percent. These rates compare with a herd breakdown rate of 0.24 per 1,000 herds, and a clearance rate of 56 percent in 2021/22.

During the year there were 35 existing and newly infected status herds, 19 fewer than in 2021/22. In total, 94 cattle had confirmed TB test results during 2022/23 (83 were positive test reactors and 11 were identified at cull). This compares with a total of 79 tuberculous animals in the 2021/22 year.

The sources of infection for existing and newly TB infected cattle herds this year are summarised by area status (VRA or VFA) in Table 2.

Table 2: Sources of infection for cattle herds in the 12 months to 30 June 2023

	Cattle introduced from known infected herds	Cattle introduced from undetected infected herds	Residual herd infection	Contact with infected wild animal	Source yet to be determined
Newly infected herds in VRA	0	0	0	2	0
Newly infected herds in VFA	0	2	0	2	0
Existing infection	0	1	4	23	1
All infected herds	0	3	4	27	1

Table 3: Numbers of TB tests and reactors, 2019–2023

Test	2019/20	2020/21	2021/22	2022/23
Primary tuberculin tests	3,000,154	2,736,154	2,158,569	2,051,263
Primary test-positive cattle ancillary serial tested	4,174	3,536	3,402	2,875
Ancillary parallel tests	9,394	12,452	12,104 ¹	8,725
Total reactors slaughtered	401	506	450	367
Total reactors confirmed positive	84	62	73	83

¹ The ancillary parallel tests on cattle in 2021/22 were incorrectly stated as 7,766 in the 2022 report.

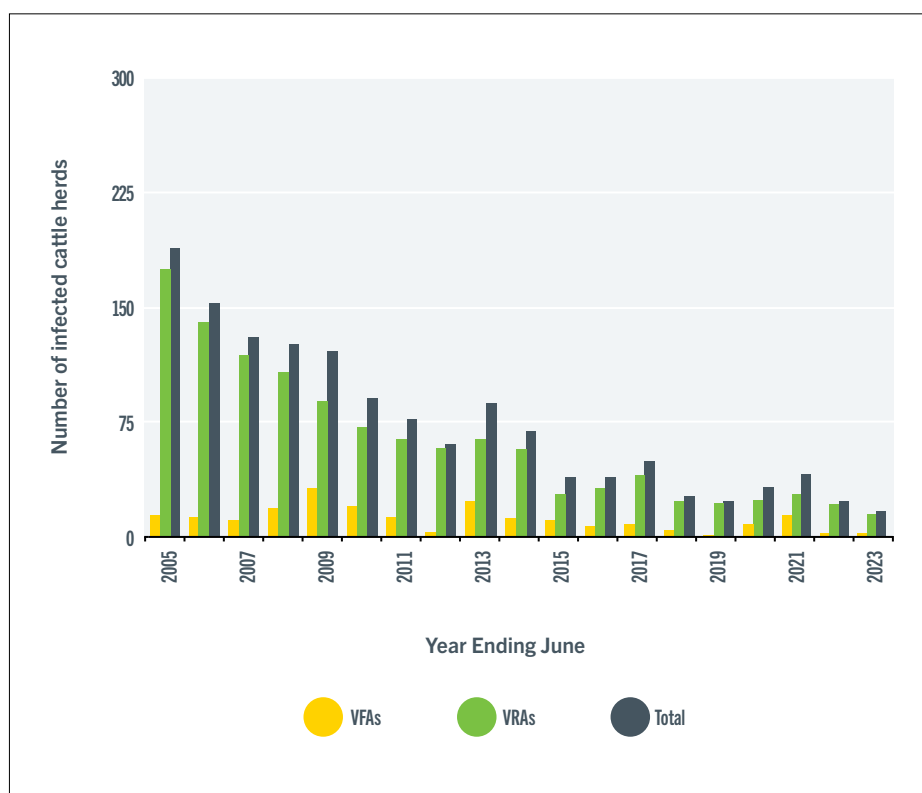


Figure 4: Number of infected cattle herds on 30 June 2023

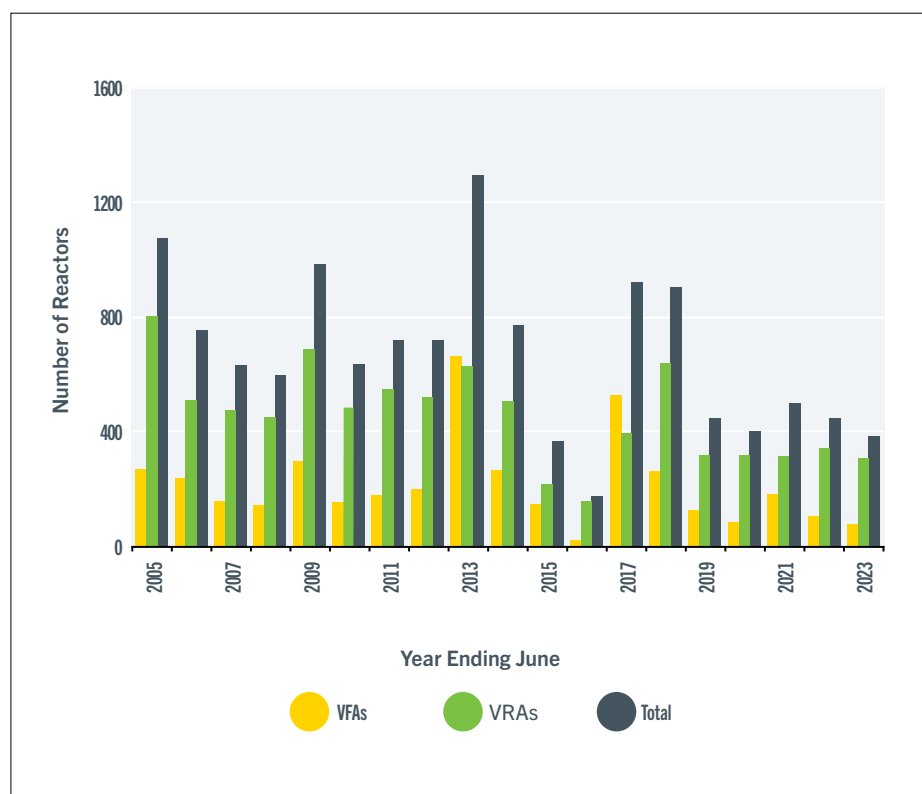


Figure 5: Number of cattle reactors 2005–2023

Cattle testing and reactors

Cattle testing data are summarised in **Table 3** (previous page), which compares the number of TB tests carried out on cattle and the number of reactors to tests, for the past four reporting periods (years).

In the year to 30 June 2023, about 2 million cattle were tested using the intradermal caudal-fold tuberculin test (primary skin test). This is about 107,000 fewer than the number of cattle tested in the previous year.

Serial ancillary (blood) tests were carried out on 2,875 cattle that had a

positive reaction to the primary skin test. In addition, ancillary parallel gamma interferon blood tests were performed on 8,725 cattle that tested negative to the primary skin test for TB.

After a decrease in primary tuberculin tests (skin tests) from 2019/20 to 2021/22, test numbers stabilised this year. In past years, tests have been reduced in areas associated with a low wildlife risk. Post-movement tests from previously infected herds, and herds from high-risk regions, will be introduced once the upcoming new data system is implemented. This will target our surveillance programme where the most disease risk resides to introduce cost efficiencies.

Figure 5 shows the trend in cattle reactors from 2004/05 to 2022/23 by VRA and VFA.

Tuberculous cattle

The number of tuberculous (confirmed infected with TB) cattle includes the total number of cattle (both TB test reactors and cattle found during routine slaughter) with gross TB-like lesions, or otherwise identified as infected following PCR assay or culture of *Mycobacterium bovis* from tissues.

During 2022/23, 83 (22.6 percent) of the 367 reactors slaughtered showed visible TB lesions or had lesions sampled that were confirmed as being infected with *M. bovis*.

Bovine tuberculosis was also identified in eleven cattle during routine slaughter (0.4 per 100,000 cattle slaughtered, based on 2.77 million cattle slaughtered in 2022/23).

Figure 6 (next page) illustrates the long-term trend for TB found in cattle from 2004/05 to 2022/23 by area status (VRA – Vector Risk Area; VFA – Vector Free Area) and shows the overall decline in the number of TB cattle, despite variable spikes in 2008/09 and 2012/13.

This trend mirrors that for reactors.

Infected deer herds

On 30 June 2023, there were two infected deer herds (0.10 percent of all deer herds), compared with one herd on 30 June 2022. **Figure 7** (next

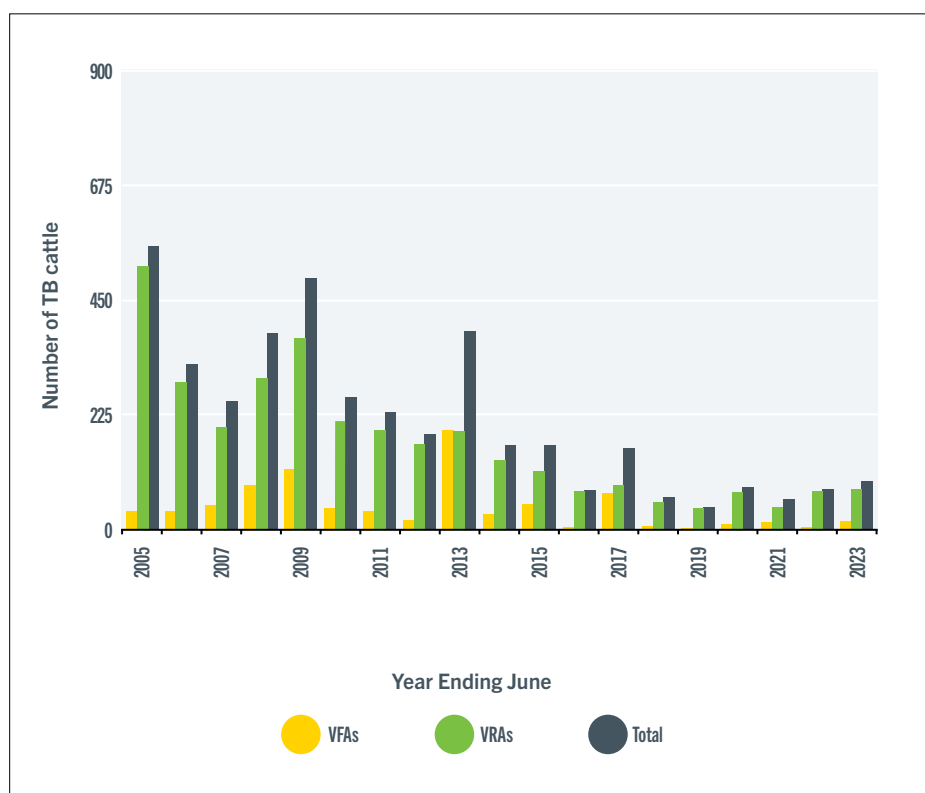


Figure 6: Number of tuberculous cattle 2005-2023

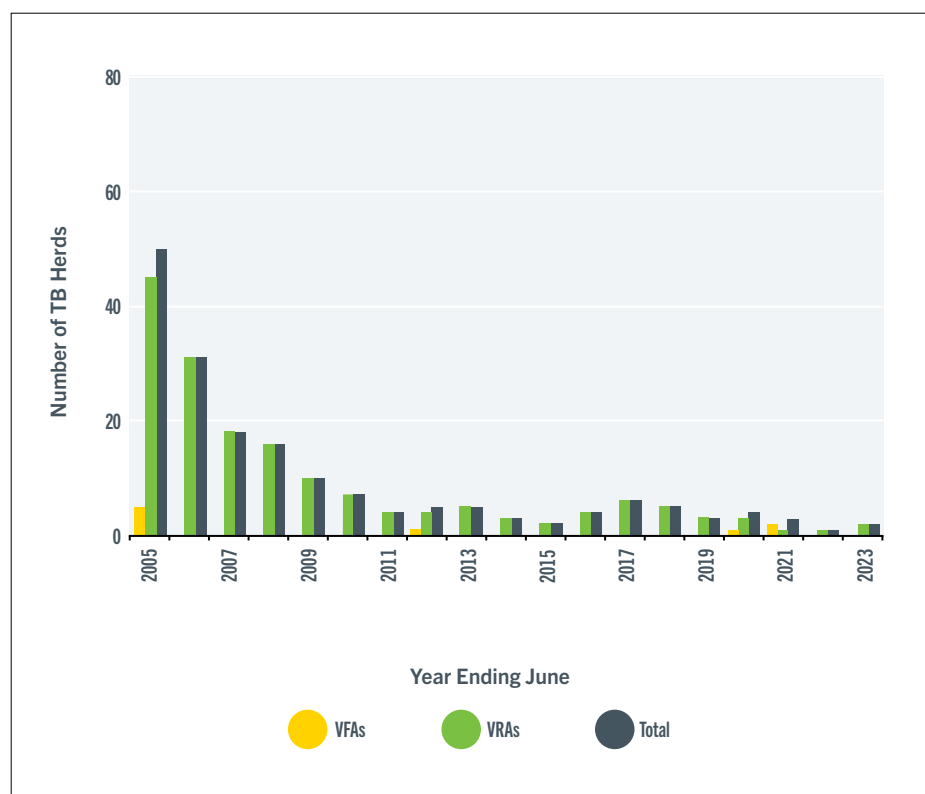


Figure 7: Number of infected deer herds 2005-2023

Table 4: Deer TB test results for 2019-2023

Deer testing	2019/20	2020/21	2021/22	2022/23
Primary tuberculin tests on deer	170,671	146,666	137,550	110,895
Primary test-positive deer ancillary serial tested	955	1,005	459	333
Ancillary parallel test-positive deer	0	0	0	0
Total deer reactors slaughtered	114	56	10	11
Total positive TB deer reactors	3	2	0	4

page) shows the change in the number of infected deer herds between June 2005 and June 2023 by area status (VRAs and VFAs).

The deer herd breakdown rate per 1,000 herds (new infected herds divided by total herds x 1,000) for 2022/23 was 1.04, and the deer herd clearance rate was 33 percent. During the year there were three existing and newly infected status deer herds, showing no change from the 2021/22 year. Sources of infection for these three herds were:

- two newly infected herds in VRA with source being: one residual infection and one contact with infected wild animal; and
- one existing infection with the source being contact with infected wild animal.

Deer testing and reactors

Deer testing data are summarised in **Table 4**, which compares the number of TB tests performed and the number of reactors to tests in 2019/20, 2020/21, 2021/22, and 2022/23. In the year to 30 June 2023, 110,895 primary mid- cervical intradermal tuberculin tests (skin tests) were performed on deer compared with 137,550 in the previous year.

Serial ancillary (blood) tests were carried out on 333 deer that were positive to the primary skin test compared with 459 ancillary parallel tests performed on deer in 2021/22. As a result of these tests, 11 deer were de--clared as reactors and were slaughtered. On slaughter, four animals with TB lesions were found.

Figure 8 (next page) shows the trend in deer reactors from 2004/05 to 2022/23 by area status (VRA – Vector Risk Area; VFA – Vector Free Area).

There has been a significant decrease

Table 5: Total cattle and deer herds and infected herds by Disease Control Area type

	Movement Control Areas	Special testing areas (annual and biennial)	Surveillance Areas	New Zealand
Total herds at June 2023	2,310	13,053	58,218	73,581
Cattle and deer infected herds during 2022–2023	25	9	4	38

in primary tuberculin tests (skin tests) for deer over the past few years. This reflects the decision to no longer TB test deer on farms in the lower-risk surveillance areas and instead rely

on slaughter surveillance. This is due to the low risk associated with deer farming practices and the high proportion slaughtered.

Tuberculous deer

The number of tuberculous deer includes the total number of deer (including reactors and deer found during routine slaughter) with gross TB-like lesions, or otherwise identified as infected following PCR assay or culture of *Mycobacterium bovis* from tissues.

During 2022/23, eight deer were confirmed to be infected, four during testing and four on slaughter. Figure 9 shows the trend in the number of tuberculous deer from 2004 to 2023 by area status.

TB surveillance and monitoring programme

Areas of New Zealand are categorised into Disease Control Areas (DCAs), with different types of TB testing regimes based on the risk of infection:

Movement Control Areas (MCA) are implemented to minimise the risk of TB spread through the uncontrolled movement of infected livestock from areas considered at greatest risk of vector-related infection. All cattle or deer over three months of age that move from, or within, an MCA must have been negative to a pre-movement test within 60 days before being moved.

Special Testing Areas (STA) and *Surveillance Areas* are defined geographical areas where the frequency of cattle and deer testing is determined by the area’s risk, or the need to obtain surveillance data for Proof of Freedom purposes.

As TB is progressively reduced or eradicated in each area, the definition and boundary of each DCA is reviewed, and testing requirements are amended in accordance with the residual disease risk.

Disease Control Area changes

On 1 March 2023 the size of the Upper

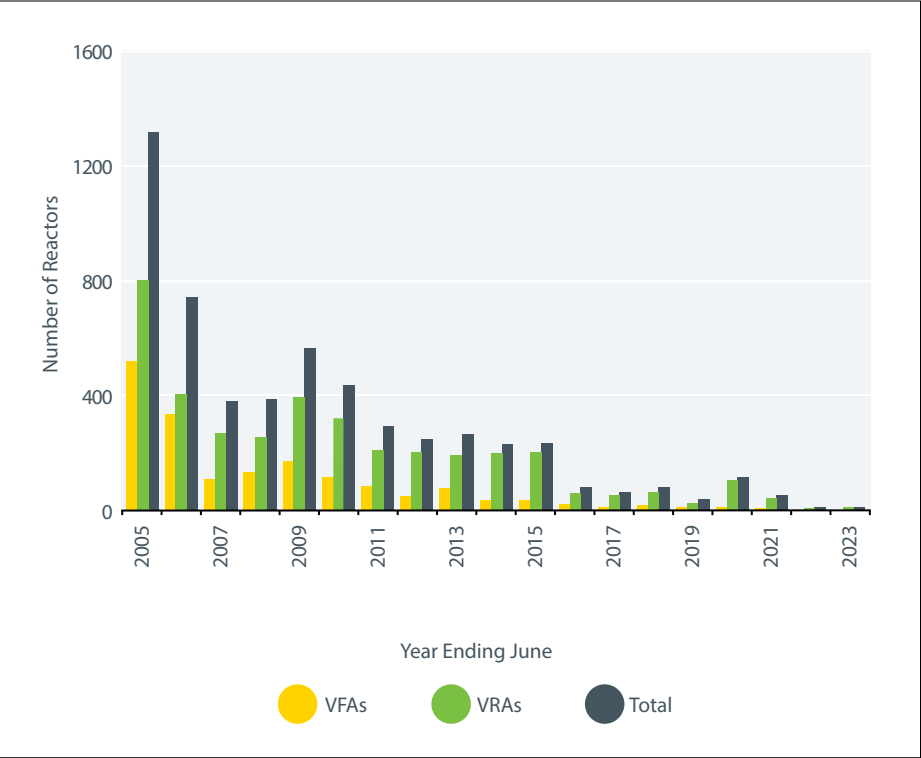


Figure 8: Number of deer reactors 2005–2023

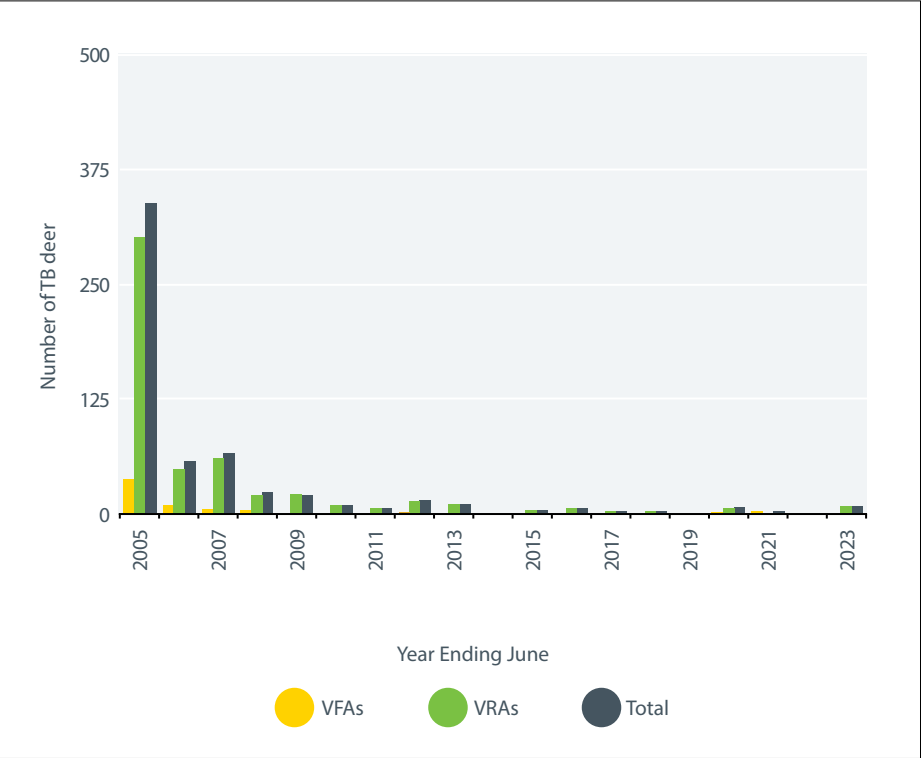


Figure 9: Number of tuberculous deer 2005–2023

South Island Movement Control Area was reduced. With significant areas having had limited infection for a considerable time, it was considered there is reduced risk/likelihood of infection in livestock caused from vector-related infection. The reduced areas include a portion of North Canterbury to the south of Kaikōura and significant portions of the West Coast (about 1 million hectares) affecting herds from south of Hokitika to the Paparoa Range.

This change is predicted to result in 683 herds no longer requiring pre-movement testing and the age of animals required to be tested increasing from 3 months up to 12 months of age. It is expected that these changes will bring about a reduction of about 60,000 pre-movement tests in the affected areas.

In other areas of New Zealand, the frequency of testing and age categories of stock to test has been changed for 22 areas. The impact of changes in these areas is expected to be testing reductions affecting 635 herds.

The numbers of cattle and deer herds and infected herds by Disease Control Area type (MCA and STA) are shown in **Table 5** (previous page).

The DCA map (**Figure 10**) shows which testing regime an area is under on 30 June 2023 and the changes that were made this year.

Wildlife disease management

Contact with TB-infected wildlife – mostly possums – is the main cause of livestock TB in New Zealand. Possum control, along with surveys for TB in other wildlife species, is the largest component of the TBfree programme.

Possum control operations are designed to reduce possum population densities to prevent further transmission of TB between possums and from possums to livestock.

Eradication of TB is achieved by reducing the possum density to a very low and even level (about one possum per 10 hectares) for a period of at least five years.

This low density means the disease is unable to be maintained within possum populations and will subsequently disappear both from possums and eventually other wildlife.

Figure 11, Table 6 and Figure 12 (next page) show, respectively, the areas of wildlife control undertaken, and the breakdown of hectares and spend for ground and aerial wildlife control operations delivered in 2022/23. Not all control activities planned for 2022/23 were completed; \$4.8 million of work will be carried over to the next financial year.

Wildlife surveys

An important aspect of the TBfree programme is surveying wildlife to detect whether TB is still present after a period of sustained possum control. This involves trapping or culling possums and other sentinel species such as pigs and ferrets, followed by post-mortem examination and analysis. The results are used to help determine whether freedom from TB within designated areas has been achieved, or if further control work

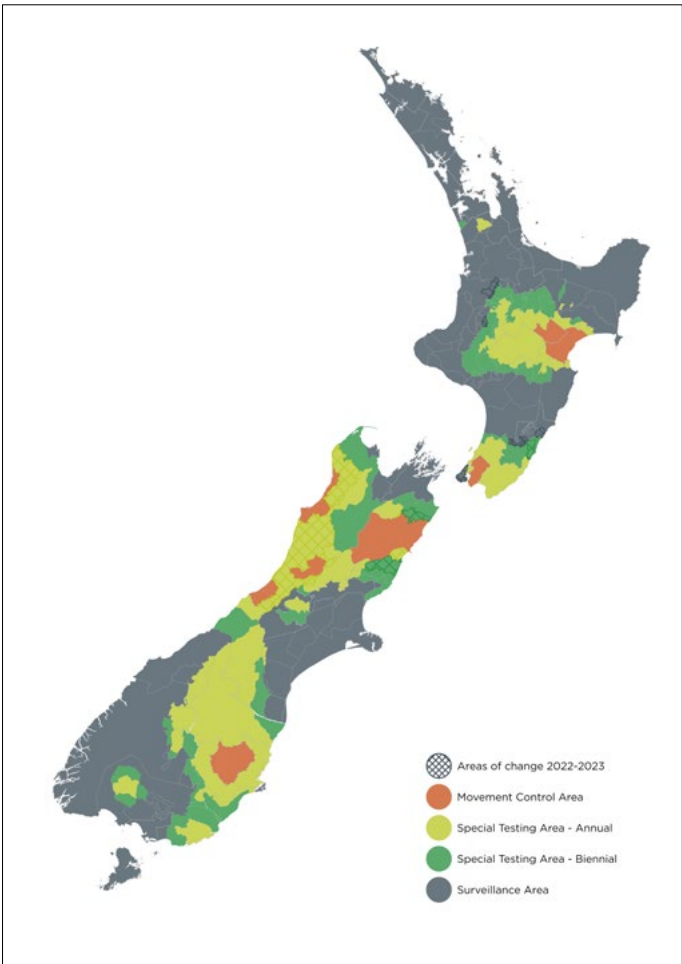


Figure 10: Disease Control Areas on 30 June 2023

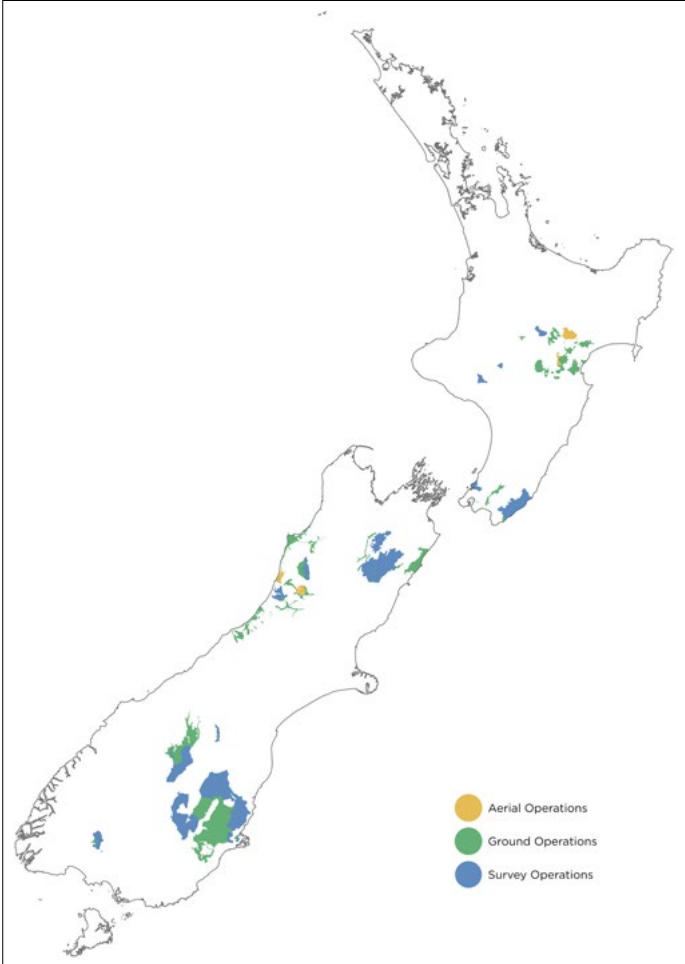


Figure 11: 2022/23 wildlife control

Table 6: Breakdown of national ground and aerial control operations by area and spend

	Total hectares	Spend
Ground Operations (including surveillance)	2,313,199	\$20,682,500
(percent)	(82)	(66)
Aerial Operations	509,717	\$10,834,528
(percent)	(18)	(34)
Total	2,822,916	\$31,517,028

Table 7: Number of wild animals in 2022/23 sampled by species, and the number and percentage found to be infected with *Mycobacterium bovis*

	Possums	Wild pigs	Wild deer	Ferrets	Others
Number sampled	618	833	5	695	1
Number with TB	0	3	0	9	0
Percent with TB	0	0.36	0	1.29	0

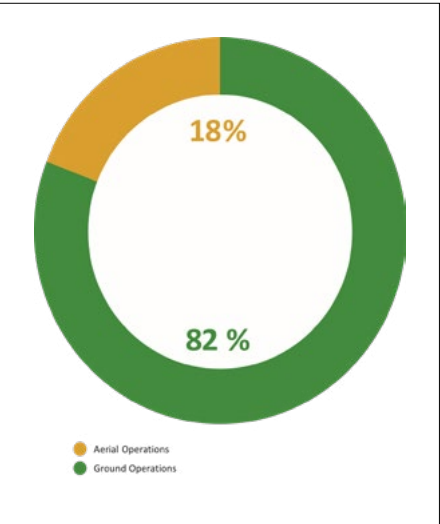


Figure 12: Area proportion of ground and aerial control operations

is needed. Few – if any – TB-infected possums or other wildlife are expected to be found in these surveys, as significant possum control effort has already been undertaken.

Wild animals sampled in 2022/23 and the number and the percentage that were TB positive are shown in **Table 7**.

We have a focus on protecting herds in nine high-risk areas

The 2020 health check of the TBfree Plan, carried out by OSPRI and its funders and stakeholders, gave clarity on where to prioritise resources and effort as the country works to achieve zero infected herds by 2026.

2020 health check recommendations implemented

OSPRI has continued to implement the lessons from the 2020 TB health check report, which recommended a change in approach to:

- prioritise control in previously uncontrolled source areas of TB (which may include carrying out essential work earlier than planned); and
- protect herds by controlling buffer zones around them until source areas are fully controlled.

Nine risk areas

The health check identified nine areas that pose the highest risk to achieving the 2026 target of sustainable eradication of TB from cattle and deer herds. To safeguard these areas, we are:

- prioritising pest control operations and wildlife disease surveys;
- increasing assistance to farmers to support their compliance with disease control and traceability obligations;
- increasing efforts to gain access to land for control operations;
- using targeted testing;
- investing in applied research and technology to find cost-effective methods that can be put into operation quickly; and
- bringing forward operations when

possible, using existing reserves and short-term funding.

Figure 13, (next page) shows operations activity in the nine risk areas for the 2020/21, 2021/22 and 2022/23 years. This includes ground and aerial operations, surveying and monitoring. Due to phasing of control programmes or previous control activity, some high-risk areas did not receive pest control activity these years.

Reduction of Vector Risk Areas

Meeting the TB Plan’s objectives requires progressive reduction in size of Vector Risk Areas – where TB is thought to be present in possums and other wildlife – and the prevention of wildlife TB becoming established in Vector Free Areas.

Process for Vector Risk Area reduction

For an area to have its Vector Risk Area status revoked, an expert, independent review panel must agree that the evidence indicates a very high probability of freedom from TB in the possum population. This decision is mainly based on:

- qualitative data on the area’s TB history, the effectiveness of possum control and the results of wildlife surveys;
- quantitative data that include the outputs from a Spatial Possum Model and Bayesian-based software (Proof of Freedom utility) that indicates there is 95 percent probability that TB has been eradicated from the possum population;
- a risk assessment that evaluates the risks and potential costs of making a wrong decision.

This year’s Vector Risk Area reductions

In 2022/23, the Chief Executive of TBfree New Zealand Limited approved the revocation of Vector Risk Area status for nine Vector Control Zones totalling about 194,068 hectares. This consisted of reductions of 144,293 hectares in the upper South Island

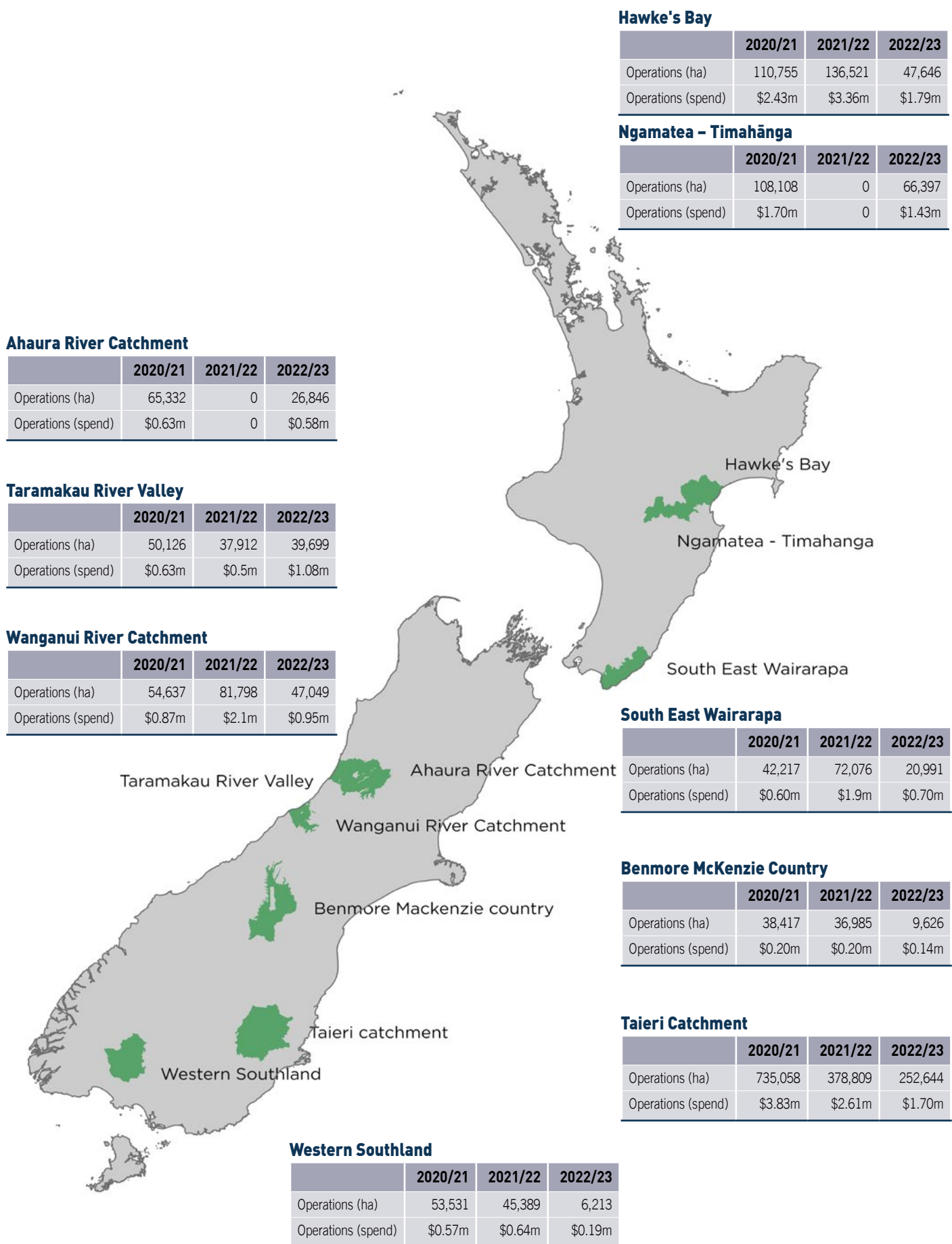


Figure 13: Operations (ha) includes aerial and ground operations, surveillance and performance monitoring) and spend carried out in the nine high-risk areas between 2020/21 and 2022/23.

(seven Vector Control Zones), and 49,774 hectares in the lower South Island (two Vector Control Zones).

Hectare change

The total Vector Risk Area reduction since 2011 is 3.76 million hectares over 286 Vector Control Zones. Another 6.29 million hectares of Vector Risk Area remain in New Zealand as of 30 June 2023.

Figure 14 shows the total Vector Risk Area reductions by 2023 since 2011.

Figure 15 shows the area target dates for eradication of TB from possums.

Table 8 details the nine Vector Control Zones that achieved cancellation of Vector Risk Area status during 2022/23.

Table 8: Cancellation of Vector Risk Area status from nine Vector Control Zones

VCZ	Area in hectares
Anatori Paturau	5,397
Cobb Tasman	53,124
Cobb West Coast	37,687
Kahurangi Tasman North	36,928
Kahurangi National Park	324
Kahurangi Point	5,093
Paturau	5,740
Upper South Island Total	144,293
Horn Range	22,920
Southern Nevis	26,854
Lower South Island Total	49,774
NZ revocation total	194,068

We have aligned research and development to applied science and use of technology

Driving efficiency and reducing costs

The focus for research over the past year has been on finding more efficient and cost-effective ways to undertake vector monitoring and disease testing and diagnostics, working closely with technology providers. In addition, we continued our efforts to find an alternative to 1080 and repellents that would provide our operations teams more flexibility when working in areas with deer and taonga species such as kea (**Figure 16**, next page).

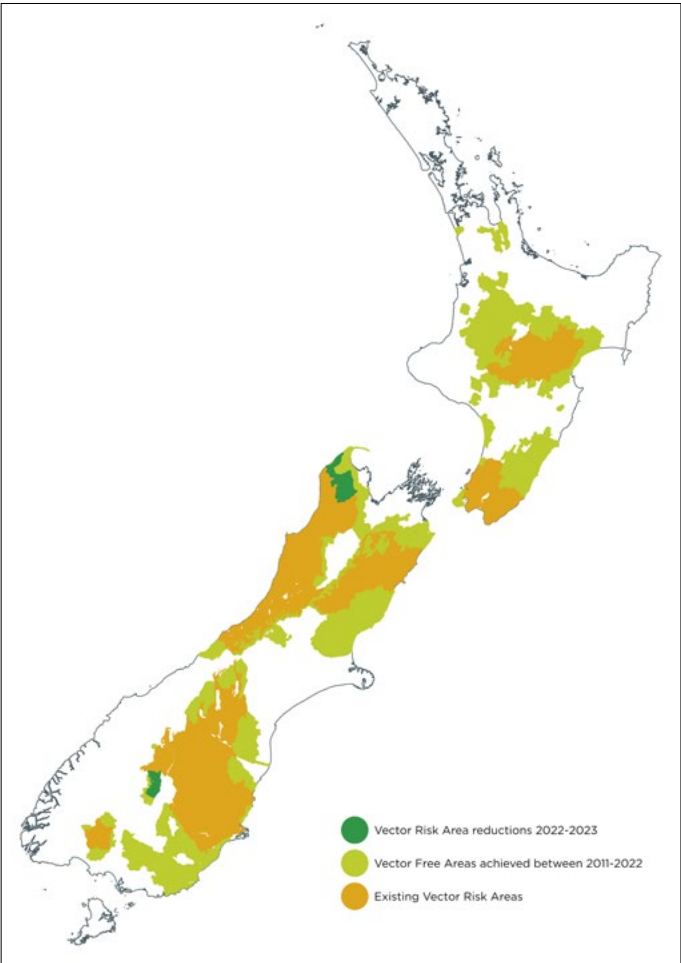


Figure 14: 194,068 hectares were declared free of TB infection in 2022/23. There are 6.29 million hectares left to declare TB-free by the 2040 target date

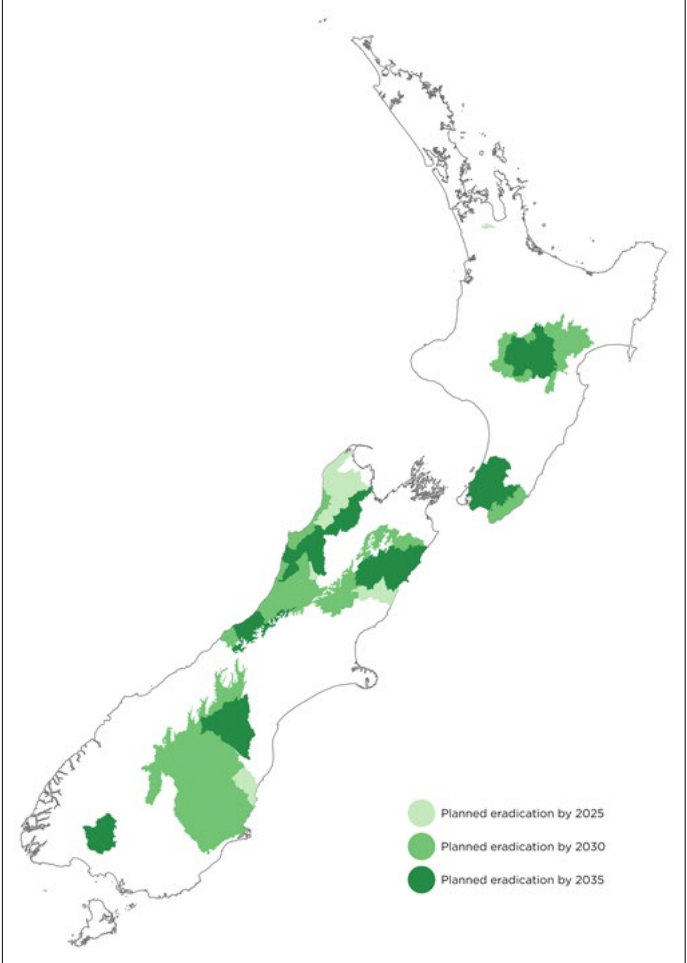


Figure 15: Area target dates for eradication of TB from possums

Research Strategy 2020-2025 Roadmap

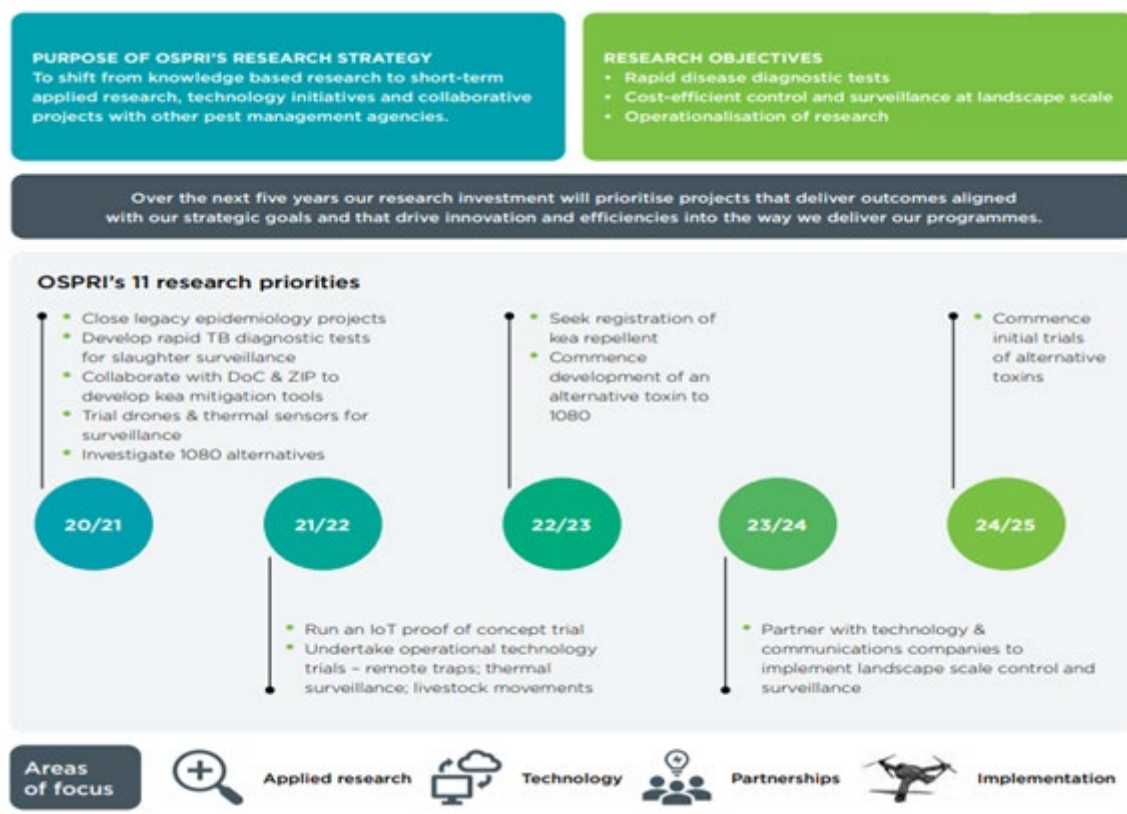


Figure 16: Research Strategy 2020–2025 road map

Research and development carried out this year

Table 9: R&D projects July 2022–June 2023

Objectives	Result	Benefits
Research objective 1: rapid disease diagnostic tests		
Rapid diagnostic tools to test for TB in samples	An alternative PCR test, validated in trials last year, will be utilised in our ongoing granuloma TB surveillance programme and we are progressing with a final year of nanopore technology trials following further successful development of the technology for identifying TB in samples.	Both the GeneXpert and nanopore technology trials support OSPRI's continuing push towards cost reduction, efficiency and increased accuracy in diagnosis and surveillance of TB in livestock.
Research objective 2: cost-efficient control and surveillance at landscape scale		
Long-life surveillance cameras	Ongoing development of lures and cameras has continued and we now have a possum monitoring tool which can be deployed in the bush for months at a time without requiring servicing.	The goal is to be able to leave long-life lures in the bush for years to provide post-control possum density monitoring, thereby helping us to determine the likelihood that disease has died out in the possum population or whether further control is required.
Research objective 3: operationalisation of research		
Kea mitigation	Trials using anthraquinone and D-pulegone repellents are continuing, and new bait/repellent formulations are being explored.	These techniques will enable us to undertake operations in kea country, primarily the West Coast outside mast years (years when forests produce a large seed crop, which usually results in increased predators). Ongoing research and results will make this progressively easier.
Bait development	An alternative toxin to 1080 that is less harmful to non-target species, especially birds, is being investigated. This project is now being progressed with a University of Canterbury PhD student working on chemical structures that will achieve the best results.	Improved bait formulations and alternatives to 1080.

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American foulbrood annual report

American foulbrood (AFB) is a contagious honey bee brood disease caused by the bacterium *Paenibacillus larvae larvae* (**Figure 1**). It has been under legislative control since 1906. The current regulations controlling AFB in New Zealand are in the Biosecurity (National American Foulbrood Pest Management Plan) Order 1998. These regulations were made under the Biosecurity Act 1993.

The Minister for Biosecurity has appointed Apiculture New Zealand to be the management agency for the National American Foulbrood Pest Management Plan. More information can be found at www.afb.org.nz.

The American Foulbrood National Pest Management Plan imposes the following key legal obligations on beekeepers:

- to ensure that apiaries where beehives are situated for more than 30 consecutive days are registered with The Management Agency;
- to ensure that all beehives are inspected at least once per year by a beekeeper whom The Management Agency recognises as being competent to inspect beehives for AFB;
- to notify cases of AFB to The Management Agency within seven days of detection; and
- to ensure that all honey bees, bee products and appliances associated with a case of AFB are destroyed within seven days.

The Management Agency is responsible for educating beekeepers in AFB recognition and best husbandry practices, monitoring and auditing beekeeper compliance with its regulatory obligations, and undertaking enforcement actions.

Reported incidence of AFB, June 2023 – May 2024

There were 3,030 AFB cases (representing 0.56 percent of colonies) notified to The Management Agency

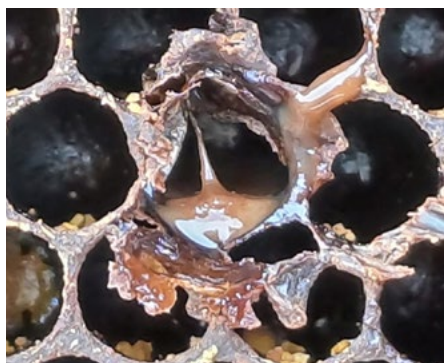


Figure 1: 'Pupal tongue', definitive sign of American foulbrood. Photo: Murray Rixon

in the 12 months to 31 May 2024. As a percentage of total colonies, this figure is slightly higher than the 3,449 AFB cases (representing 0.55 percent of colonies) notified in the 2022/23 season.

The slight increase in the percentage of hives affected by AFB continues to be due to the 11 percent decline in the number of registered colonies in New Zealand to 541,263, down from 608,607 a year earlier.

During this reporting period The Management Agency completed targeted surveillance inspections on 6.7 percent of apiaries (3,562 apiaries) and found 19.7 percent of the reported cases of AFB (596 cases).

Apiary register and statistics

The number of beekeepers in the industry has declined to 8,592 as of 1 June 2024, due to an economic

contraction in the commercial sector. The contraction has been exacerbated by the reduction in colony numbers among the remaining beekeepers. Beekeepers owned 53,355 apiaries and 541,263 colonies as of 1 June 2024 (**Figure 2**).

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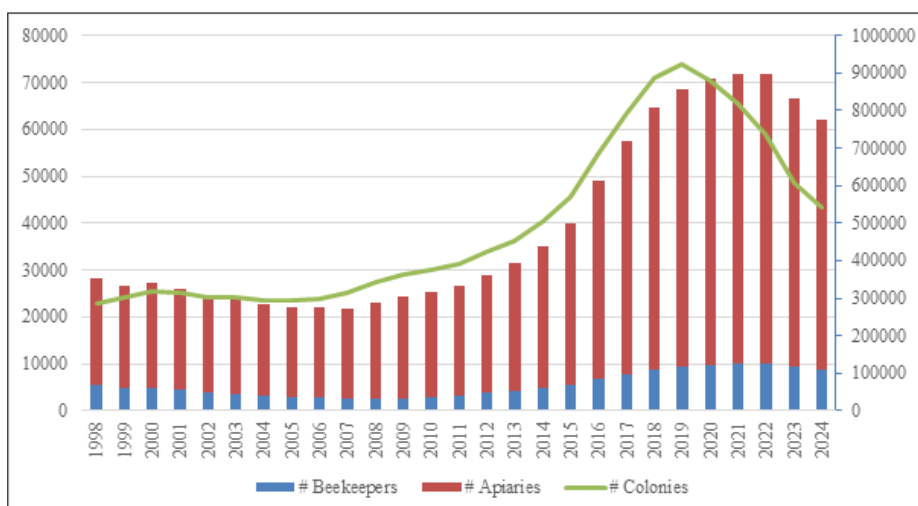


Figure 2: Beekeeper, apiary and colony statistics (1998–2024)

Annual reports from industry surveillance and disease control programmes

Brucella ovis accreditation scheme 2023

The *Brucella ovis* accreditation scheme is a voluntary scheme where the costs of testing are paid by participating farmers and the testing and certification are administered by veterinarians. It is primarily used by pedigree (stud) flocks to prevent sale of infected rams. Numbers of animals tested in 2023 were slightly fewer compared with 2022 (**Table 1**). The overall infection rate (reactors/samples tested) was 1.0 percent, which is a reduction compared with 2022's 1.8 percent.

The infection rate should be treated with caution as it is skewed by several flocks with a greater than 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 with non-accredited flocks as well as flocks previously accredited (ram-breeder flocks and some commercial flocks). The infection rate for accredited ram-breeder flocks will be significantly lower, but data are limited since relevant information is not always provided on laboratory submission forms.

Table 1 also shows that not all flocks with reactors had any further investigation during 2023.

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

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Table 1: *Brucella ovis* testing and eradication, January – December 2023

Area	Flocks with reactors*	Flocks with eradication in progress or completed
Far North and Auckland	3	0
Waikato, Waitomo and BOP	5	0
Taranaki and Whanganui	7	1
East Coast	7	4
Hawke's Bay	4	0
Manawātū and Rangitikei	4	3
Wairarapa and Wellington	0	0
Marlborough and Canterbury	2	0
Otago and Southland	3	2

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



Infectious bursal disease surveillance programme annual report

In 1993, a case of infectious bursal disease (IBD) was identified in commercial poultry in New Zealand. As a result, an IBD eradication programme funded and supervised by the poultry industry was put into place in 1994. Both active and passive surveillance are important parts of the programme. Passive surveillance takes place continually, both on farms and in processing plants, while active surveillance ensures flocks undergo serological screening annually. Serum reactors in the IDEXX FlockChek ELISA run by the commercial laboratories are referred to the Ministry for Primary Industries' (MPI's) Animal Health Laboratory (AHL) at Wallaceville for the virus-neutralisation test (VNT). MPI's Incursion Investigation team, in collaboration with the AHL, carries out an investigation if serum reactors cannot be resolved by VNT testing. From 1999 to July 2019 no cases of IBD were confirmed in commercial poultry (Ryan et al., 2000; Mulqueen, 2019).

In June 2019, serological surveillance identified a layer chicken farm in the South Island of New Zealand that was positive for antibodies to IBD. MPI initiated an investigation that subsequently confirmed the presence of IBD virus serotype 1 (IBDV-1) and found infection on a second epidemiologically linked farm (Tana et al., 2023). Subsequently, a response was initiated that successfully eradicated IBDV-1.

During 2023, the three commercial poultry laboratories screened 23,771 blood samples collected under the whole-flock IBD testing programme and export testing. Samples were screened using the IDEXX FlockChek ELISA.

In total, there were 910 ELISA reactors in flocks. These flocks were retested and 102 ELISA reactors were subject to further investigation and/or VNT/PCR testing and were resolved as negative.

MPI investigations

In 2023, three commercial poultry farms were investigated by the MPI incursion investigation team arising out of serum reactors on the industry surveillance programme.

Two investigations were of layer flocks and one was of a broiler flock. Investigation in these cases included as appropriate:

- assessment of health and production parameters;
- a review of the testing history of the flock under investigation and other flocks on the property; and
- further serology using either ELISA or VNT.

In all three cases IBD Type 1 was ruled out (Buckle, 2023; Buckle, 2024).

Bursal lesion surveillance for IBDV at slaughter

IBDV causes lesions in the bursa of Fabricius that can be detected on visual examination; therefore, slaughter plant surveillance of broilers starts with a visual assessment of the bursa. Any abnormal bursae are collected and split, with half of each bursa collected being preserved in formalin and the other half stored frozen. If fewer than 10 abnormal bursae are found, further bursae are collected to make up a sample size of 10 from that flock. The formalin-fixed bursae are then sent to a regional veterinary laboratory for histological examination by a pathologist. When histological changes suggestive of IBD viral infection are observed in the bursa of Fabricius, the MPI incursion investigation team is informed and the corresponding stored frozen bursae are submitted to MPI's AHL for molecular testing. In circumstances where unusual lesions or patterns of disease are seen, this process may vary.

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Poultry health surveillance annual report

The tables presented here summarise results of laboratory testing carried out by the New Zealand poultry industry laboratories during 2023 and reported to the Poultry Industry Association of New Zealand (PIANZ). **Table 1** summarises serological test results.

Table 2 summarises the findings of *Salmonella* serotypes isolated from finished and raw feed sources, and poultry and environmental samples, which include those from breeder, broiler and layer farms, and hatcheries.

In addition to the testing detailed in **Table 2**, all primary processors of poultry birds (meat chickens: broiler chicken, small breed and poussin) are required to take part in the National Microbiological Database testing programme. Poultry samples are collected by suitably trained personnel. There were 2,066 birds tested for *Salmonella* as part of this programme in 2023 with nil detections. Additional surveillance for *Salmonella* Enteritidis was implemented in 2021 through on-farm sampling and a portion of this is included in this report. A number of laboratories that carry out *Salmonella* testing do not report results to PIANZ so these tests are not reported in this table.

Table 1: Serological test results summary: poultry – 2023

Disease	Number tested	Number positive	Vaccination status*
Newcastle disease†	4,778	58‡	–
Egg drop syndrome	3,024	139	(V)
Chicken anaemia	1,280	1,029	(V)
Avian encephalomyelitis	1,842	1,229	V
Infectious bronchitis	2,977	2,267	(V)
Avian leukosis virus p27 antigen	–	–	–
Reovirus	1,129	1,049	V
Infectious laryngotracheitis	1,250	863	(V)
<i>Mycoplasma gallisepticum</i> ¶	9,726	259	(V)
<i>Mycoplasma synoviae</i>	6,801	725	(V)
<i>Salmonella</i> Pullorum	5,474	6#	–
<i>Salmonella</i> Group B	–	–	–
<i>Salmonella</i> Group D	–	–	–
Infectious bursal disease	23,771	480§	–
Avian influenza	4,842	39Δ	–

* V = All 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.

‡ Investigated by MPI

Export reactors, samples sent to MPI

¶ Export *M. gallisepticum* reactors followed up by MPI. Domestic reactors followed up with PCR

§ IBD test volume includes 798 reactors that were adsorbed and retested. 102 out of 480 reactor samples sent for VNT testing at MPI. 23 flocks with reactors awaiting rebleed.

Δ Samples tested for export sent to MPI for confirmation test – negative

Table 2: Serotypes of *Salmonella* isolated during 2023

<i>Salmonella</i> isolates	Finished and raw feed sources	Broiler and environmental samples
Adelaide	2	0
Agona	0	4
Amsterdam 15+	0	0
Bovisorbicans	0	0
Braenderup	0	0
Emek	0	0
Cubana	0	0
Derby	0	0
Emek	0	1
Enteritidis	0	16
Give	2	6
Frenso	0	0
Group E	0	0
Group B	0	0
Havana	0	0
Idikan	0	0
Infantis	2	0
Liverpool	0	0
Livingstone	0	0
Mbandaka	2	29
Rissen	0	0
Ruiru	0	0
Senftenberg	0	1
<i>Salmonella</i> sp. (untypable)	0	0
Stanley	0	0
S. species Grp B	0	0
Thompson	0	3
S. species Grp C	0	0
S. species Grp E	0	0
Typhimurium	0	11
Total samples tested	2,182	34,505
Total positive	8	71

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Quarterly report of investigations of suspected exotic diseases: April to June 2024

Exotic vesicular diseases ruled out

A veterinarian in Taranaki rang the MPI exotic pest and disease hotline to report a rising 2-year-old Friesian dairy heifer exhibiting vesicular oral lesions. The veterinarian provided high-quality digital photographs (**Figure 1**) and a detailed history. The heifer had been singled out by the stock manager due to its lighter appearance and overall unwell demeanour compared with the rest of the herd. Upon examination by the veterinarian, the heifer was salivating and had a swelling under the jaw, with a normal body temperature. The tongue was firm, with 2–15 mm diameter, ulcerated nodular lesions that became more severe caudally. Although exotic disease was considered unlikely, it was considered prudent to test the Initial Investigating Veterinarian (IIV) system and collect more information. An IIV was dispatched to the farm and performed a comprehensive exotic disease investigation. The herd of 96 heifers was observed in the paddock, with no signs of salivation or lameness detected. Eight randomly selected heifers were examined more closely, all displaying normal rectal temperatures and no oral or foot lesions. A thorough interview with the stock manager regarding recent movements of people, stock and equipment revealed no concerning entry pathways. Based on the clinical



Figure 1: Tongue of a heifer with raised ulcerated nodular lesions. Exotic vesicular disease was excluded and biopsy confirmed actinobacillosis as the cause of lesions

Exotic pest and disease investigations are managed and reported by the Ministry for Primary Industries' (MPI's) Diagnostic & Surveillance Directorate¹. The following is a summary of investigations of suspect exotic and emerging pests and diseases during the period from April to June 2024.

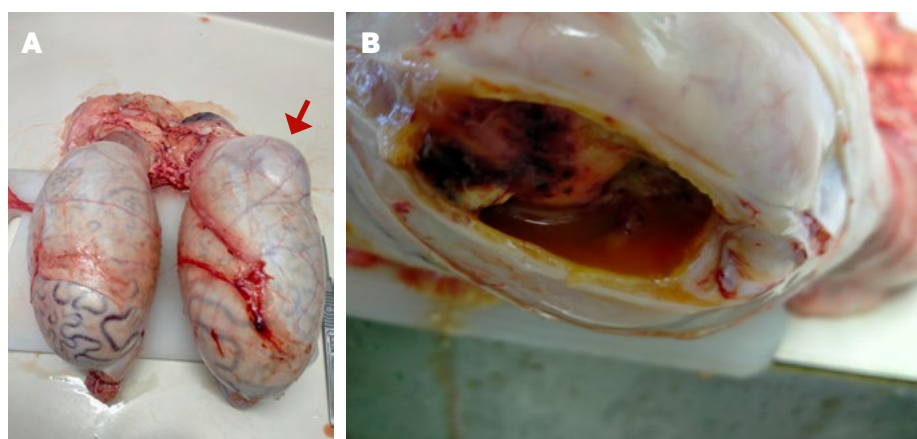


Figure 2: A. Raised testicular lesion affecting the right testicle (arrow). B. Yellow, low-viscosity fluid within the cut surface of the lesion. Photo: Jayne Roiri, MPI Verification Services

and epidemiological findings, the exotic disease investigation was stood down. A biopsy was taken from the oral lesions and submitted to a regional commercial laboratory, where histopathology confirmed granulomatous inflammatory centres containing characteristic 'club' bacterial colonies, confirming the clinical suspicion of actinobacillosis cause by *Actinobacillus lignieresii*.

Brucellosis excluded in two cattle

A lower North Island veterinarian contacted the MPI exotic pest and disease hotline to report a testicular swelling found in a rising two-year-old (R2) Angus bull during routine fertility testing. The bull was from a line of 28 R2 bulls and was the only affected animal. Out of an abundance of caution an exotic disease investigation was opened to exclude the exotic disease *Brucella abortus*, which is considered absent in New Zealand and may cause orchitis and epididymitis in bulls. Serum was submitted to MPI's Animal Health Laboratory (AHL, Wallaceville) where serological testing for *B. abortus*

was negative. Having failed fertility testing, the affected bull was sent for slaughter at the farmer's request, where the swelling was incised and found to contain thin yellow fluid (**Figure 2**). A sample of the lesion was submitted to a regional laboratory for histopathology. Chronic, multifocal epididymitis was confirmed, with no evidence of bacterial involvement. A traumatic origin to the lesion was considered possible. Exotic disease was excluded, and the investigation was closed.

A central North Island veterinarian contacted the MPI exotic pest and disease hotline to report a firm epididymal lesion found in an R2 Angus bull. The bull was from a line of four bulls and was affected in isolation. An exotic disease investigation was opened to exclude the exotic disease *B. abortus*. Serum was submitted to MPI's AHL where serological testing for *B. abortus* was negative. Exotic disease was excluded, and the investigation was closed.

¹As of 1 July the Diagnostic and Surveillance Directorate became the Diagnostics, Readiness and Surveillance Directorate

Anthrax excluded in sudden death of a cow

An MPI Verification Services (VS) veterinarian in Hawke's Bay phoned the MPI exotic pest and disease hotline to report the sudden death of a beef cow in the holding pens at a meat works. The rest of the mob of 41 animals from the same farm were unaffected and appeared healthy. The veterinarian was concerned as the affected cow had evidence of haemorrhage from the nose, ears and anus, a common finding when cattle die from anthrax, which is caused by the exotic agent *Bacillus anthracis*. Blood samples from the carcass were submitted to AHL and molecular testing for *B. anthracis* was negative. Further to this, the affected animal was not from a region where historic anthrax cases have been reported previously, making exposure to infective spores extremely unlikely. Endemic causes of sudden death in cattle can include clostridial diseases and metabolic issues, but the cause of this event was not determined and the investigation was closed.

Enzootic bovine leukosis excluded in a dairy cow

A veterinary pathologist notified the MPI exotic pest and disease investigation team to report a bovine case where enzootic bovine leukosis (EBL) caused by bovine leukaemia virus (BLV) could not be excluded as the cause of a hepatic round cell tumour on histopathology. Lymphoproliferative disease in cattle can be sporadic or due to EBL. Sporadic bovine leukosis is typically diagnosed by age and organ involvement, with the multicentric (lymph node) form in calves, thymic lymphoma in yearlings, and cutaneous lymphoma in older cattle, though it is rare in cattle over three years old. EBL, likely exotic to New Zealand, occurs in cattle older than three years, primarily as circulating lymphocytosis/leukaemia. About 10 percent of infected cattle develop neoplasia, usually presenting as multicentric with lymph node and multiple internal organ involvement, including atypical tissues like the abomasum,

heart, uterus, brain and eyes. Further questioning of the veterinarian involved revealed the cow was a young dairy cow (< 3 years old) with nodular and ulcerated cutaneous lesions (**Figure 3**), making EBL due to BLV less likely and sporadic bovine leukosis a plausible explanation. Additional testing confirmed this: a formalin-fixed liver tissue sample submitted to MPI's AHL tested negative for EBL by qPCR, closing the exotic disease investigation.



Figure 3: Cutaneous lesion (red circle) in a young cow with round cell neoplasia

Adenovirus confirmed associated with lesions in a calf

A veterinary pathologist from a regional commercial veterinary laboratory notified the incursion investigation team about an unusual disease presentation of viral inclusions in a calf in Canterbury. The pathologist had observed what appeared to be intranuclear inclusion bodies in renal medullary tubular epithelial cells of a sick weaner calf. Such lesions could be consistent with viral infection and are an unusual finding. The calf was part of a mob suspected of having drench resistance and it had a high faecal egg count. It was euthanased for illthrift and diarrhoea and autopsied.

The inclusions were believed most likely to be incidental, but inclusion bodies are rarely seen in cattle tissues so were considered worthy of further examination. A sample of tissue from the wax block was submitted to MPI's AHL where herpesvirus PCR was negative and pan-adenovirus PCR was positive. Sequencing showed 99 percent identity to bovine adenovirus 10. Adenovirus type 10 is widespread in the ocular and nasal secretions and faeces of normal cattle but is only rarely reported as a cause of disease in New Zealand cattle (Vaatstra, 2011).

Bluetongue excluded in Otago station sheep

A veterinarian phoned the MPI exotic pest and disease hotline to report an unusual case presentation in Merino ewes grazing near a lake on an Otago station. The mixed-age Merino ewes showed clinical signs of photosensitivity every year, with ewes developing oedema of the head and neck within days of introduction to the same 2,000-acre block. In the current event, at least 90 affected ewes in a flock of about 2,000 ewes had oedema, erythema and crusting of the muzzle, eyelids, ears, vulva and distal limbs (**Figure 4**, next page). The mucosal discoloration of the gums and pallor of the tongue was severe – described as grey, blue or purple. Their eyelids were so swollen their vision was impaired and the vulvas were often bruised on the worst-affected ewes because they were recumbent. The rectal temperatures of affected animals were normal. On removal from the paddock, the clinical signs would subside. On postmortem there was severe distension of the subcutaneous space with the accumulation of a serous fluid in that space between the skin and underlying muscle tissue. Cattle grazing in the same extensive paddock appeared unaffected. Photographs of the affected sheep were clinically indistinguishable from bluetongue, so collection of serum, EDTA blood and a range of fixed tissues for histology was organised. Blood samples (both serum and EDTA), fresh liver, spleen and lung were submitted to MPI's AHL and tested by the competitive ELISA (cELISA) and molecular testing



Figure 4: Sheep with bluetongue-like lesions, showing crusting and erythema of the periorbital and perinasal skin (top photos) and erythema of the interdigital space (bottom photo). Photos: Vanessa Love, Veterinary Centre Ranfurly

(bluetongue qPCR TaqMan) and found to be negative for both bluetongue virus and antibodies to bluetongue virus. The history of correlation between onset of clinical signs and introduction to this particular block each year suggests a plant or algae exposure is causing the vasculitis observed on histology and consequent alteration in haemodynamics observed in these animals. A review of the literature on plants that are known to cause alteration to blood vessels and lymphatic systems of mammals was undertaken, and cross-matched with plant species reported in the South Island region where the outbreak occurred. A provisional diagnosis of exposure to *Panicum miliaceum* (broomcorn millet) was made. *Panicum miliaceum* is known to occur in the South Island and causes clinical signs in sheep consistent with those described in this outbreak (Badiei et al., 2009). Clinical disease in cattle

caused by *P. miliaceum* has not been reported, meaning the reported history of this adverse event was consistent with *P. miliaceum* exposure. The actual exposure to this plant cannot be confirmed at this time as weather conditions, including significant snowfall, precluded investigation of such a large area. The provisional information was provided to the notifying veterinarian and pathologists involved. Bluetongue was excluded, and the investigation was closed.

Exotic disease excluded as the cause of keratitis outbreak in goats

A veterinarian in the North Island rang the MPI exotic pest and disease hotline to report an outbreak of bilateral keratitis affecting four of five goats in a non-breeding mixed-age goat herd during late summer. Corneal swabs from one affected goat had previously been submitted to a

regional laboratory where they were negative on *Mycoplasma conjunctivae*, *Moraxella* and *Chlamydophila pecorum* PCR. The clinical presentation was of bilateral corneal oedema with intact corneal epithelium, which appeared non-painful (blepharospasm, epiphora and ocular discharge were lacking) (Figure 5). Exotic causes of corneal oedema include bluetongue virus and *Chlamydophila abortus*, although any cause of anterior uveitis can theoretically cause this, including many endemic causes. The goats had a small amount of nasal discharge but were otherwise normal and bright. No other animals on the property appeared affected. Corneal swabs, serum and whole blood samples from three affected goats were submitted to MPI's AHL. All swab and blood samples were negative on herpesvirus, bluetongue virus, *Mycoplasma/Acholeplasma*, and *Chlamydia* PCR. Serological testing for bluetongue virus and *Chlamydophila abortus* was negative. *Pithomyces chartarum*, the fungal species responsible for facial eczema in New Zealand ruminant species, was isolated from one of three corneal swab samples. Seasonal corneal oedema, distinct from infectious keratoconjunctivitis, has been identified in sheep, goats and camelids in New Zealand. While the aetiopathogenesis has not been proven it has been suggested that exposure



Figure 5: Corneal oedema in a goat, linked to exposure to *Pithomyces chartarum*. Photo: John Makin, Warkworth Vets

to *P. chartarum* may be implicated in the condition (H Hunt, Massey University, personal communication, 12 March 2024). Exotic disease was excluded, and the investigation was closed. Further work on this syndrome is being carried out by Massey University, and a publication is planned.

Unusual lesions in abattoirs

An MPI VS veterinarian at a Taranaki abattoir phoned the MPI exotic pest and disease hotline to report a 6-year-old Friesian cow presented for slaughter with multiple unusual granulomatous and cystic lesions seen throughout the skeletal muscles. Photographs (**Figure 6**) were reviewed, and it was determined that the lesions looked suspiciously like a severe presentation of sarcocystosis, but *Cysticercus bovis* could also not be excluded on the gross appearance. Samples of the muscle were submitted to MPI's AHL for histological examination. Lesions were associated with areas of chronic inflammation with extensive centres of mineralisation. A clear cause for the lesions was not apparent as sarcocysts or other parasites were not seen; however, the appearance of the lesions macroscopically and on histology was most suggestive of the chronic stages of eosinophilic myositis caused by parasite-related inflammation.



Figure 6: Multifocal pale expansile lesions in line with diaphragmatic muscle fibres, considered likely to be from infection with *Sarcocystis* spp. Photo: MPI Verification Services

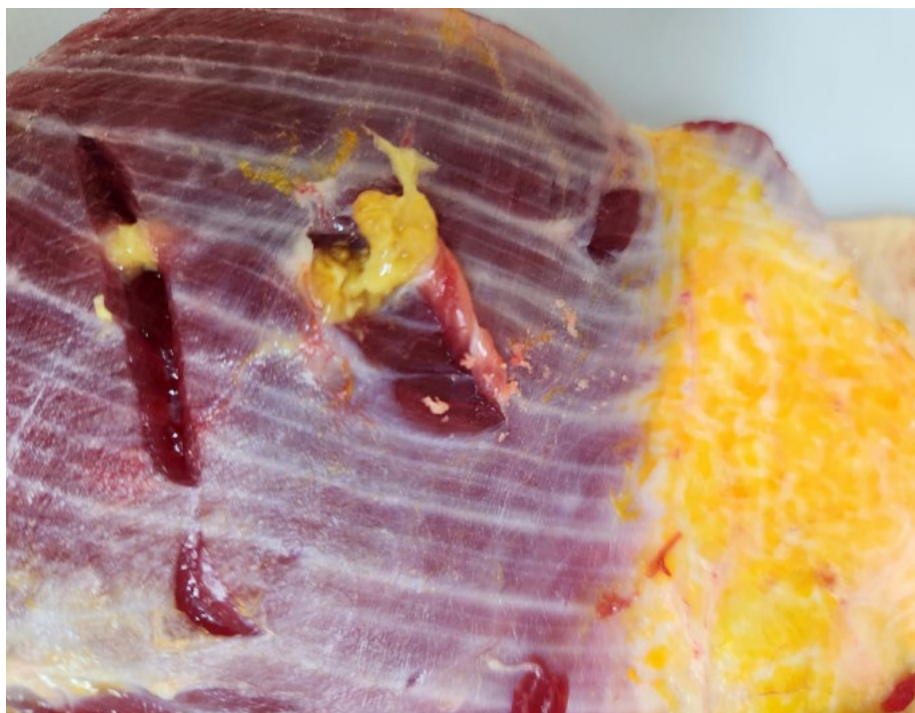


Figure 7: Unusual lesions found in a carcass at slaughter. Histology demonstrated chronic inflammatory lesions. Photo: Chris Steel, MPI Verification Services

An MPI VS veterinarian on the West Coast contacted an Incursion Investigator to report multiple unusual lesions found in bovine muscle at slaughter (**Figure 7**). The lesions, initially suspected to be sarcocyst parasites localised in skeletal muscle, were submitted to MPI's AHL for histological examination. The histology findings revealed lesions associated with chronic inflammation and necrosis with dystrophic mineralisation. However, the exact cause of the lesions was not apparent. No *Sarcocystis* or other parasites were

observed, and special stains did not reveal any bacterial, fungal, parasitic or protozoal organisms. Dystrophic mineralisation, associated with localised tissue breakdown and the accumulation of mineral salts within the lesions, can lead to progressive calcification, potentially obscuring evidence of the initial cause.

An MPI VS veterinarian contacted the Incursion Investigation team to seek help diagnosing the cause of a deer spleen with unusual dark-coloured mass-like lesions. Specimens were submitted for histology and found to be siderotic plaques. These lesions are not related to an infectious process or disease, but are likely a consequence of ageing and hypertension in mammals.

Porcine reproductive and respiratory disease virus excluded in pigs

A veterinarian rang the MPI exotic pest and disease hotline to report stillbirths and neonatal mortality affecting all of five farrowing sows on a backyard pig farm over the preceding month. One of the affected litters also had mild diarrhoea. The veterinarian had been advised to notify MPI by a veterinary pathologist as the clinical signs resembled those caused by the exotic disease porcine reproductive and respiratory syndrome virus



(PRRS). A disease investigation was opened and based on clinical signs, PRRS and porcine coronaviruses including porcine epidemic diarrhoea virus (PED) and transmissible gastroenteritis virus (TGE) were tested for. In addition, African swine fever virus, classical swine fever virus, West Nile virus (WNV), Japanese encephalitis virus (JEV) and swine influenza virus were excluded for completeness.

Pigs were free range and mixed together in paddocks. Initial samples tested included two sow serum samples and fresh tissue from three piglets that had died when less than 4 days old. All PCR testing was negative. Serum was negative for exotic diseases except for PED, with both sows positive on PED S1-FMIA Luminex assay, and one sow was positive on PED IFA. The positive PED serology was surprising, and prompted a rebleeding trip. Investigators also used the trip to interview the farmer and to gather relevant epidemiological information about pig movements and risk factors. Sows (n = 15 of 30), 7-week-old piglets (n = 7) and 5-week-old piglets (n = 4) were bled. Oral, faecal and environmental samples were obtained from these pigs as well as 21 piglets less than 10 days old. All oral, faecal and environmental samples were negative on pan-coronavirus PCR and serum samples were negative on PED IFA; however, most sows were positive (n = 12) or suspicious (n = 3) via PED S1-FMIA Luminex assay, and most 5-week-old piglets were suspect positive (n = 3) via PED S1-FMIA Luminex assay. The remaining piglets were negative on PED S1-FMIA Luminex assay. A final sampling trip was arranged about one month following the second rebleed, allowing examination of serological titre changes. Pigs were rebled as it was possible, with piglets (n = 3), sows (n = 8) and 5-month-old pigs (n = 3) rebled. Oral and faecal samples were obtained from the aforementioned individual pigs, and six piglets less than 10 days old. All serology assays were negative for these final samples, and oral and faecal samples taken were once again PCR-negative. PED

is considered absent in New Zealand, and neither the PED IFA test nor the S1-FMIA Luminex assay have been validated on New Zealand swine. The results from this investigation were surprising and prompted discussion, including expert opinions sought from makers of the assays and New Zealand pig veterinarians.

Exotic diseases of international importance, including PRRS and others, were excluded. No evidence of PED circulation on this farm was found from all the three rounds of sampling over a 6-month period, and initial positive antibody levels dropped to undetectable levels over that period. The investigation into this farm was closed. Results and outcomes of this investigation were communicated with NZ Pork, the statutory industry board that works to support New Zealand's commercial pig farmers. Follow-up work is needed to understand the sensitivity and specificity of PED serology in New Zealand pigs. No circulation of the virus was found and it is possible that the serology represents cross-reactivity.

Flaviviral encephalitis excluded in an outbreak of equine disease

A veterinarian from greater Wellington phoned the MPI exotic pest and disease hotline to report a case series of horses with unusual clinical signs. In the last two weeks the veterinarian had been called to horses with apparent colic that were depressed, lethargic and with decreased gut sounds. Seven horses 3–21 years old and from six different properties were reported. Four of the seven horses had elevated rectal temperatures. Because of the unusual and possibly neurological nature of this apparent regional outbreak, it was considered prudent to exclude exotic diseases causing neurological signs in horses, predominantly a flaviviral cause such as WNV, JEV and Murray Valley Encephalitis virus. Three horses were euthanased after they became recumbent. Two brains were examined by histology, and encephalitis was not present, making a viral cause of disease less likely. One

horse was taken to Massey University for postmortem and found to have a distended colon and caecum. Small black seeds were present in the colonic content and clinical signs were consistent with *Datura stramonium* toxicity; however, the seeds were partially digested and could not be formally identified. Serum was submitted from the seven horses plus two additional horses that developed clinical signs following notification. One of nine horses was positive on Flavivirus ELISA testing. The seropositive mare was a recent import to New Zealand from Queensland, having arrived pregnant in March 2024. A repeat blood sample was taken from this mare and confirmed as positive on antibody ELISA testing. It is likely that the exposure to Flavivirus occurred in Australia. Testing of other horses in the same case series showed them to be antibody ELISA negative for Flavivirus, indicating that this was not causative of the clinical signs. Horses are dead-end hosts for flaviviruses, and do not carry sufficient virus in their bloodstream to cause them to be a risk for horse-to-horse or horse-to-human transmission. The potential exotic viral cause of this case series was excluded by serology, post-mortem examination and histology of neurological tissue, and the case was closed.

Equine infectious anaemia excluded

A veterinary pathologist from a regional veterinary laboratory rang the MPI exotic pest and disease hotline to report concerns around equine infectious anaemia virus (EIA) as a differential diagnosis in a case of equine anaemia. Whole blood in EDTA from a 2-year-old Warmblood gelding had been submitted to the laboratory by a South Island equine veterinarian for haematology and blood film examination. The affected horse was New Zealand-born and bred and had never travelled overseas. The horse had a two-month history of weight loss, urticarial skin lesions and vasculitis that had partially responded to therapy with oral prednisolone before a more acute episode of illness. The acute episode was characterised

initially by multifocal oral ulcerations. Antimicrobial and anti-inflammatory treatment was initiated; however, the horse failed to respond and over the course of around five days facial swelling, ventral oedema, distal limb oedema, petechial haemorrhage, hyphema, epistaxis and haematochezia developed, along with severe anaemia (12 percent packed cell volume, range for horses 37–42 percent) and thrombocytopaenia with neutrophilia. Nodular cutaneous lesions were identified affecting the muzzle, ventral abdomen and inguinal regions. Due to deterioration, the horse was euthanased at the owner's request and a postmortem was carried out. Whole blood and fresh tissue, including liver, spleen and lung, all tested negative for *Anaplasma phagocytophilum*, African horse sickness virus, piroplasm and equine viral arteritis virus by PCR at MPI's AHL. Serological testing for EIA, *Babesia caballi* and *Theileria equi* was negative. Significant findings on histological examination included necrotising, haemorrhagic dermatitis and cellulitis with leukocytoclastic vasculitis. Vascular congestion with increased neutrophils was present and a subacute-to-chronic, mild, membranous glomerulonephropathy was evident on sections of kidney. These findings alongside the history were consistent with purpura haemorrhagica, a type III hypersensitivity disease of horses caused by the deposition of immune complexes on the walls of small vessels leading to vasculitis, or renal vessels leading to glomerulonephritis. Purpura haemorrhagica is commonly associated with *Streptococcus equi* subsp. *equi* infection, *Corynebacterium pseudotuberculosis* infection or after vaccination with *S. equi* M protein (SeM), but has been diagnosed in association with various other agents less frequently (Hunyadi and Pusterla, 2016). Exotic disease was excluded, and the investigation was closed.

Exotic avian paramyxovirus excluded in commercial poultry

A poultry veterinarian contacted the MPI exotic pest and disease hotline to report commercial laying hens that

had tested positive for Newcastle disease virus (NDV) on routine end-of-lay serology testing. Newcastle disease is caused by virulent strains of avian paramyxovirus 1 (APMV-1). Virulent and moderately virulent strains of APMV-1 are not known in New Zealand and are classified as unwanted and notifiable organisms. Low virulence APMV-1 strains are known to be present in wild birds in New Zealand and are not notifiable (Stanislawek et al., 2002). Production and mortality data were reviewed over the lifetime of the flock and were within normal limits, supporting the hypothesis that the serology result was the result of cross-reaction. The positive assays were haemagglutinin inhibition, which had been performed on 71-week-old hens, with two of 12 hens testing low positive at 1:16 dilution. As part of investigating this aberrant result, serum, palatine (choanal) and cloacal swabs were taken from a further 12 birds at 73 weeks old and submitted to MPI's AHL, with swabs in viral transport medium. All PCR testing was negative. Repeat serological testing showed 10 out of 12 birds had low-to-moderate positive titres on NDV ELISA, consistent with previous positive NDV serology results attributed to cross-reaction (Buckle, 2023). NDV was excluded on molecular, clinical and epidemiological grounds. The positive serological results were considered the result of cross-reaction following exposure to endemic avirulent APMV. Further such events will continue to be investigated in efforts to understand more fully the endemic cause of this false seropositivity.

A pathologist from a commercial veterinary laboratory phoned the exotic pest and disease hotline to report mortality and unusual clinical signs on a poultry farm, with histology suggesting a viral aetiology. The disease outbreak involved one shed, containing around 4,000 chicks about six weeks old, with affected chicks becoming ataxic, depressed, weak and dying. Some birds were observed hock walking and mortality doubled for several days. Although there are many possible endemic causes for this clinical picture, exotic diseases such

as highly pathogenic avian influenza (HPAI), APMV and WNV may also cause similar clinical signs. Five dead birds were collected for post-mortem examination and exotic disease testing. Molecular testing for influenza A, exotic avian paramyxovirus type 1, and WNV all returned negative results. Histology revealed a mild mononuclear encephalitis with multifocal neuronal necrosis in the grey matter, and widespread perivascular and perineural mononuclear infiltrates including myocarditis, enteric leiomyositis and interstitial pancreatitis. The distribution and nature of these lesions, alongside the signalment and clinical picture, is suggestive of infection with avian encephalomyelitis virus. Avian encephalomyelitis virus is an endemic disease, and confirmation of this diagnosis is the responsibility of the affected poultry company. Exotic disease was excluded and the investigation closed.

Infectious bursal disease excluded in commercial poultry

In May 2024, as part of the Poultry Industry Association of New Zealand (PIANZ)-operated infectious bursal disease (IBD) surveillance programme, two of three sheds on a layer farm in Waikato had positive ELISA results in nine out of ten 28-week-old birds in one shed and one out of ten 28-week-old birds in another shed. Virus neutralisation testing (VNT) of samples from these sheds, conducted at MPI's AHL, yielded seven positive results with low titres ranging from 1:12 to 1:192. The farm did not have any signs of increased mortality, abnormal growth, feed or water intake or production issues. Following protocol, a rebleed of both sheds was conducted. The rebleed results showed all birds in one shed tested negative on ELISA, while the other shed had one ELISA-positive sample, which when subsequently tested by VNT returned a low titre of 1:4 (positive > 1:8). Positive results due to cross-reaction are usually low positive and short lived, as in this case. This allowed the IBD investigation to be stood down, and the false positive

results were attributed to non-specific immune responses.

Exotic disease excluded in backyard poultry

A member of the public called the MPI exotic pest and disease hotline to report a mass mortality event in chickens (*Gallus domesticus*). Overnight, 18 four-week-old chicks from a flock of 51 had died. A veterinarian was sent to the property to collect swabs for avian influenza and Newcastle disease. Fresh tissues from the bursa of Fabricius and spleen were collected to rule out IBD. Samples were submitted to MPI AHL Wallaceville for molecular testing and found to be negative for avian influenza, Newcastle disease and infectious bursal disease. The cause of mortality was diagnosed on histology as coccidiosis and the case was closed.

In a second case, a veterinarian from Auckland rang the MPI exotic pest and disease hotline to report the sudden death of eight mallards (*Anas platyrhynchos*) at a residence in Auckland. The owner of the ten pet ducks found eight dead one morning and the remaining two with signs of generalised weakness, limp necks, flapping, lateral recumbency, bradycardia and swollen metatarsals. Because of deteriorating health, one of the sick ducks was euthanased and submitted to Massey University School of Veterinary Science – Tāwharau Ora's pathobiology department for necropsy. The findings included a moderate, diffuse hepatic hemosiderosis, bilateral pododermatitis and bilateral otitis media. Some of the tissues were noted as poorly preserved, therefore the diagnosis was relatively open, but the list of differentials in this case included lead toxicity, alpha chloralose poisoning, HPAI, botulism and bacterial septicaemia. Cloacal and choanal swabs were sent to MPI's AHL and were negative for avian influenza subtype H5 RT-qPCR, avian influenza subtype H7 RT-qPCR and APMV-1 (class I and II) RT-PCR. One sample tested weakly positive on the influenza A RT-PCR but unfortunately no amplification of the product was possible, therefore sequencing could

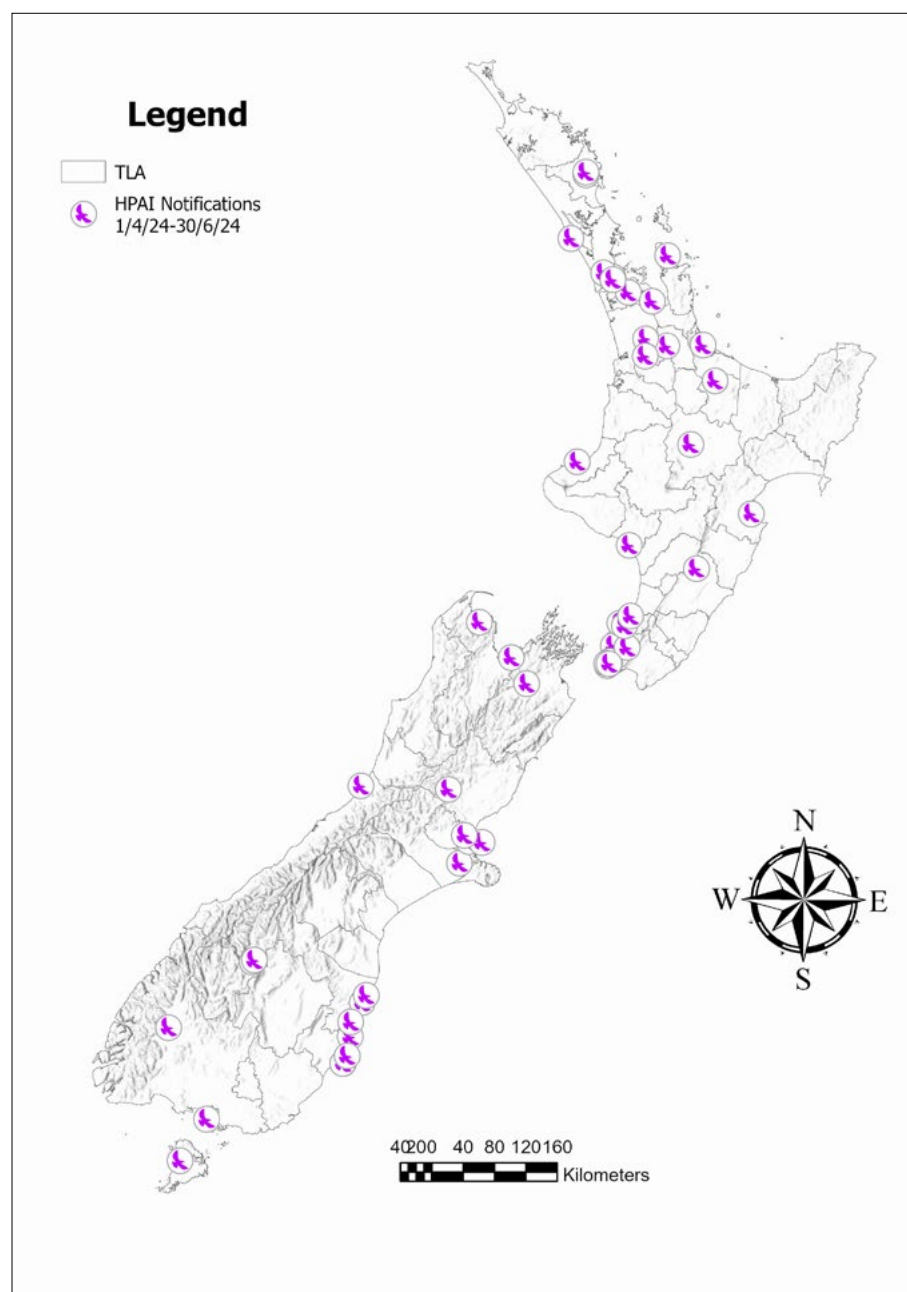


Figure 8: Locations and species of HPAI notifications from the current quarter. All are wild birds, except for one backyard chicken flock and two domestic duck cases. Of the 41 notifications, 12 met the threshold for investigation, and these are summarised in Table 1. TLA = Territorial land authority. Map: Paul Bingham, MPI

not be conducted. This result is likely to be low pathogenicity avian influenza (LPAI) and is considered an incidental finding in this case. LPAI is commonly found in wild birds, especially mallards, in New Zealand (Stanislawek et al., 2024). The bird was tested for lead in the blood with a result of 1.1 ppm. In waterfowl, blood lead levels above 0.4 ppm reflect abnormal exposure to lead and levels above 1ppm are consistent with acute poisoning (Pain et al., 1993), the most likely cause of this disease outbreak. Alpha chloralose toxicity

was also possible but less likely due to haemosiderosis not being a classic finding. As exotic avian disease was ruled out as a cause of death, this investigation was closed.

In a third case, a veterinarian called the MPI exotic pest and disease hotline to report a Muscovy duckling (*Cairina moschata*) with a respiratory disease. Swabs were taken from the choanal slit and cloaca and tested for HPAI, *Chlamydia* and *Mycoplasma gallisepticum* and found to be negative. The important exotic disease HPAI was excluded and the case closed.

Table 1: Summary of wild bird disease investigations for April to June 2024

Case	Region	Species	Number affected	Clinical signs	Exotic disease assays	Endemic diagnosis
1	Southland (Lake Te Anau)	Paradise shelducks (pūtangitangi, <i>Tadorna variegata</i>)	50–60	Found dead	HPAIV, NDV	No histological lesions in three examined birds. Poisoning believed likely.
2	Wellington	Shearwater (<i>Ardenna</i> spp.)	1	Neurological signs	HPAIV	Starvation evident on autopsy and histology.
3	Southland	Sooty shearwaters (tītī, <i>Ardenna grisea</i>)	30	Found dead	HPAIV	Five tītī autopsied, no lesions present on histology. Cause of death undetermined.
4	Southland (Rakiura/ Stewart Island)	Sooty shearwaters (tītī, <i>A. grisea</i>)	10,000	Found dead along beaches	HPAIV, NDV	Five tītī autopsied, lesions suggested trauma and myopathy, likely to be stormwrecked juveniles.
5	Wellington	Black-backed gulls (karoro, <i>Larus marinus</i>)	7	Found dead in an estuary	HPAIV, NDV	Three autopsied gulls had no lesions on autopsy or histology. Low-pathogenic avian influenza (H11N1 found in one gull, not considered related to disease).
6	Otago	Black stilt (kakī, <i>Himantopus novaezelandiae</i>)	3	Weakness, not able to stand, and flopping to their sides	HPAIV	Unknown, possibly endemic viral cause.
7	Wellington	Black-backed gulls (karoro, <i>L. marinus</i>)	6	Found dead	HPAIV	Not determined.
8	Canterbury	Black-backed gulls (karoro, <i>L. marinus</i>)	34	Found dead	HPAIV	Multifocal hepatitis present in two examined birds, acute toxicity considered possible.
9	Canterbury	Black-backed gulls (karoro, <i>L. marinus</i>)	34	Found dead	HPAIV	Multifocal hepatitis present in two examined birds, acute toxicity considered possible.
10	West Coast	Southern giant petrel (pāngurunguru, <i>Macronectes giganteus</i>)	1	Found dead	HPAIV, NDV	Not determined.
11	Wellington	House sparrows (<i>Passer domesticus</i>)	30	Found dead	HPAIV	Four sparrows autopsied, presence of grain in stomach and hepatonecrosis on histology, suggesting poisoning.
12	Otago	Black-backed gulls (karoro, <i>L. marinus</i>)	40–50	Found dead along a beach	HPAIV, NDV	Five autopsied birds had grain in their stomachs, suggesting poisoning.

Avian influenza excluded as the cause of multiple wild bird mortality events

The Animal Health IncurSION Investigation team continues to receive increased numbers of notifications of avian mortality events in wild birds, as was also the case last quarter. Due to the increased numbers of investigations, these are shown in a map (Figure 8) and summarised in Table 1 with five example narratives provided in which HPAI virus and other exotic avian diseases such as ND virus were excluded.

Case 1. In early April, a member of the public reported finding 50–60 dead paradise shelducks (pūtangitangi, *Tadorna variegata*) on the shores of

Lake Te Anau to the MPI exotic pest and disease hotline. A Department of Conservation (DOC) biodiversity ranger also reported collecting 56 duck carcasses. The duty IncurSION Investigator requested the assistance of an experienced wildlife veterinarian to collect appropriate samples for investigation. The wildlife veterinarian examined all 56 shelducks, mostly adult females in good body and postmortem condition. Cloacal and choanal swabs were collected for exotic avian virus testing, and necropsies were performed on three birds, with fresh and fixed tissue and gut samples taken. No abnormalities were found on gross examination. PCR testing at MPI’s AHL returned negative results to avian influenza or avian paramyxovirus, and the exotic disease investigation

was closed. It was believed the ducks were likely victims of a targeted poison drop, either directly targeted or as unintended bycatch in an attempt to control Canada geese.

Case 2. A zoo veterinarian phoned the exotic pest and disease hotline to request avian influenza testing on a sick shearwater (*Ardenna* spp.) that had been taken to the zoo by a concerned member of the public. The affected bird had reportedly shown neurological signs before euthanasia, including weakness, inability to fly and ataxia. Although endemic disease can cause similar clinical signs, exotic diseases such as HPAI can present in a similar way, and fresh liver from the dead bird was submitted to MPI’s AHL for exotic disease testing. Molecular testing for influenza A returned

negative results. On gross postmortem, the bird was noted to be in poor body condition and histology revealed a reactive liver with mild intra-hepatic bile stasis. These gross and histological findings are consistent with anorexia and poor nutrient intake, leading to starvation. Exotic disease was excluded and the investigation closed.

Cases 3 and 4. In early May, a member of the public phoned the exotic pest and disease hotline to report seeing 30 dead sooty shearwater (tītī, *Ardenna grisea*) on the coast south of Invercargill. Samples obtained from dead birds were negative for HPAI. One week later, a DOC ranger contacted the MPI exotic pest and disease hotline to report a mass mortality event of sooty shearwater (*Ardenna grisea*) in Mason Bay on the west coast of Stewart Island. Although it is an expected and annual occurrence for muttonbirds to wash up dead in Stewart Island at this time of year (May), the ranger reported a ten-fold increase in the number of dead birds (a rate of around 1,000 birds is considered normal). Many other bird species (black-backed gulls, oystercatchers, terns, etc.) were noted in normal numbers in the area and appeared in good health. Ten birds were collected for submission to MPI's AHL for necropsy and testing to rule out HPAI and Newcastle disease. Five birds were selected as suitable for post-mortem examination. Of note was the saturation of the birds' feathers, which suggests they were inundated and submerged in water for a prolonged period. This may have been associated with a reported severe storm in the weeks before, when the birds were likely trapped out in open water. The overall body condition of the birds was good but there was evidence of a period of fasting likely due to the inability to feed adequately. A significant finding was acute to subacute degeneration of the pectoral muscles, likely suggestive of exertional rhabdomyolysis. There was evidence of extensive bruising of the soft tissue over the flanks and pectoral muscles in one bird that may have been suggestive of storm wrecking. It is also reasonable to conclude that the severe weather and high winds could have led to the birds overexerting

themselves to try to survive at sea. APMV-1 (class I and II) RT-PCRs and avian influenza A RT-PCRs were conducted on all 10 birds, with negative results. The combination of the time of year and reports of a severe weather event in the days and weeks leading up to the mass mortality and the post-mortem findings make storm wrecking the likely cause of these deaths. Furthermore, an anecdotal report of severe weather causing adult birds to abandon the nest and juvenile birds to be forced to either starve or search for food on their own added to the suspicion of weather causing this mortality event. As exotic avian disease was ruled out, this case was closed.

Case 5. A member of the public called the MPI exotic pest and disease hotline to describe seeing seven dead black-backed gulls and one sick gull along the shoreline in a bay in the Pāuatahanui Inlet, Porirua. An Incursion Investigator visited the site to collect samples but all of the birds had been removed, possibly by a local bird rehabilitation group. A couple of hours later the notifier called the investigator as she had found more dead birds in the Porirua Harbour area, Titahi Bay. The Incursion Investigator collected three freshly dead black-backed gulls and these were submitted for necropsy and sampling to rule out the exotic avian diseases HPAI and Newcastle disease. Many species of birds in sufficient numbers were noted in the area behaving normally and showed no signs of illness. The necropsy results showed that all three gulls were in reasonable body condition but the gastrointestinal tracts were empty, likely due to a short period of starvation before death. There was no clear cause of death noted but there was no evidence of an infectious aetiology. Cloacal and choanal swabs were taken at necropsy and these were tested by APMV-1 (class I and II) RT-PCR and influenza A PCR. One sample tested positive on the influenza A PCR so was followed up by genome sequencing and was identified as LPAI subtype H11N1. This subtype has been previously found in wild birds in New Zealand (Stanislawek et al.,

2024) and is unlikely to be of clinical significance in this case. As exotic avian disease was ruled out, this case was closed.

Unusual bacterial species excluded from a penguin

A commercial veterinary pathologist contacted the duty Incursion Investigator to report that a general bacterial culture of a liver sample from a deceased hoiho (yellow-eyed penguin, *Megadyptes antipodes*) had yielded what appeared to be *Pasteurella canis* as identified by MALDI-TOF. The deceased yellow-eyed penguin had been necropsied at Wildbase Pathology, Massey University, and samples were submitted to a commercial lab for culture due to histology suggesting sepsis as the cause of death. *Pasteurella canis* has not previously been identified in New Zealand, and is known to cause disease in various species overseas. The isolate was referred to AHL for identification where the isolate was identified as *Pasteurella multocida*, confirmed by phylogenetic analysis of the isolate, sequencing the 16S rRNA gene (99.2 percent BLAST homology to *P. multocida*) and MALDI-TOF mass spectrometry with a score of 2.25. *Pasteurella multocida* is the causative pathogen of fowl cholera, explaining the pathological findings in this yellow-eyed penguin, and is not exotic to New Zealand. Exotic disease was excluded, and the investigation was closed.

Exotic serovar of *Salmonella* confirmed in a human case

A reference human laboratory rang the MPI exotic pest and disease hotline to report a case of *Salmonella enterica* subsp. *enterica* serovar Gaminara, cultured from a human in Waikato. *Salmonella* Gaminara has been identified sporadically in New Zealand, associated with imported products and travellers returning from overseas. The duty Incursion Investigator followed up with the Health New Zealand–Te Whatu Ora Health Protection Officer (HPO) in charge of the case. The patient had

presented to hospital several weeks previously with clinical symptoms including profuse watery diarrhoea, abdominal pain and vomiting, consistent with salmonellosis but had since recovered following treatment. The HPO reported that no overseas link had been identified in this case. The patient ate out regularly; they had a flock of backyard chickens and ducks with which they were in regular contact, and the eggs were used for home consumption. Overseas, *Salmonella* Gaminara has been isolated from birds and reptiles (Yang, 2023), swine (Bonardi et al., 2019), and in salmonellosis outbreaks in people (Parish, 1998). The finding was recorded, and no further action was taken.

Exotic parasitic brain worm excluded in a person

A Health New Zealand–Te Whatu Ora medical microbiology and pathology laboratory manager phoned the MPI exotic pest and disease hotline to report the detection of a suspected *Angiostrongylus cantonensis* nematode in a sample of cerebrospinal fluid (CSF) of a human patient with eosinophilic meningitis. *Angiostrongylus cantonensis*, commonly known as rat lungworm, while not present in New Zealand, is found in Australia and the Asia–Pacific region with a changing geographical distribution, increasing in prevalence in southeast Australian dogs and humans. The patient had no confirmed history of overseas travel so there was concern this may have been acquired locally, suggesting endemicity. Serum and CSF specimens were sent to a parasitology reference laboratory. CSF PCR for *Angiostrongylus* DNA was negative. *Angiostrongylus* serology for antibodies present in the CSF was also negative. However, *Angiostrongylus* serology performed on a serum specimen collected during the acute phase of the illness was positive. The serology can cross-react with other tissue nematodes. There is one published case of gnathostomiasis acquired in New Zealand; this can also present as an eosinophilic meningitis. To strengthen the diagnosis, further

convalescent serum would have been needed to be collected from the patient to look for an increase in antibody levels, and to test for gnathostomiasis; however, the patient was lost to follow-up and no further testing was possible.

Exotic tick confirmed with overseas origin

A veterinarian rang the MPI exotic pest and disease hotline to report finding a tick on themselves immediately upon return from an overseas hiking trip to Scotland. The tick was submitted to an entomologist and identified as an engorged *Ixodes ricinus* nymph. The notifier confirmed no other ticks had been found upon checking their person and belongings, and confirmed their only pet, a cat, was up to date for prophylactic flea-and-tick treatment. *Ixodes ricinus* is considered unable to establish in an indoor environment, therefore in conjunction with the established information, onward transmission risk was deemed negligible. The investigation was closed and no further action taken.

Babesia confirmed in a dog in Canterbury and transferred to Response

A veterinary pathologist from a regional veterinary laboratory rang the exotic pest and disease hotline

to report the presence of intra-erythrocytic haemoparasites on a canine blood smear (**Figure 9**). The blood had been submitted by a veterinarian treating a severely anaemic (haematocrit 13.8 percent) dog. Whole blood in EDTA was submitted to MPI's AHL where *Ehrlichia canis*, generic haemotropic *Mycoplasma*, and *Mycoplasma/Acholeplasma* PCR testing was negative. However, generic piroplasm PCR testing was positive. Genomic sequencing of the PCR positive amplicon was performed and was identified as 99.9 percent identical to *Babesia gibsonii*. Exotic disease was confirmed and a biosecurity response was initiated.

Babesia investigations arising as part of enhanced Babesia surveillance

As a result of the detection of *Babesia gibsonii* as described above, proactive communications were delivered to veterinarians via the New Zealand Chief Veterinary Officer asking veterinarians to increase their vigilance about any cases of disease in dogs that might resemble babesiosis. Thanks to proactive veterinarians, Incursion Investigators received increased notifications about cases of

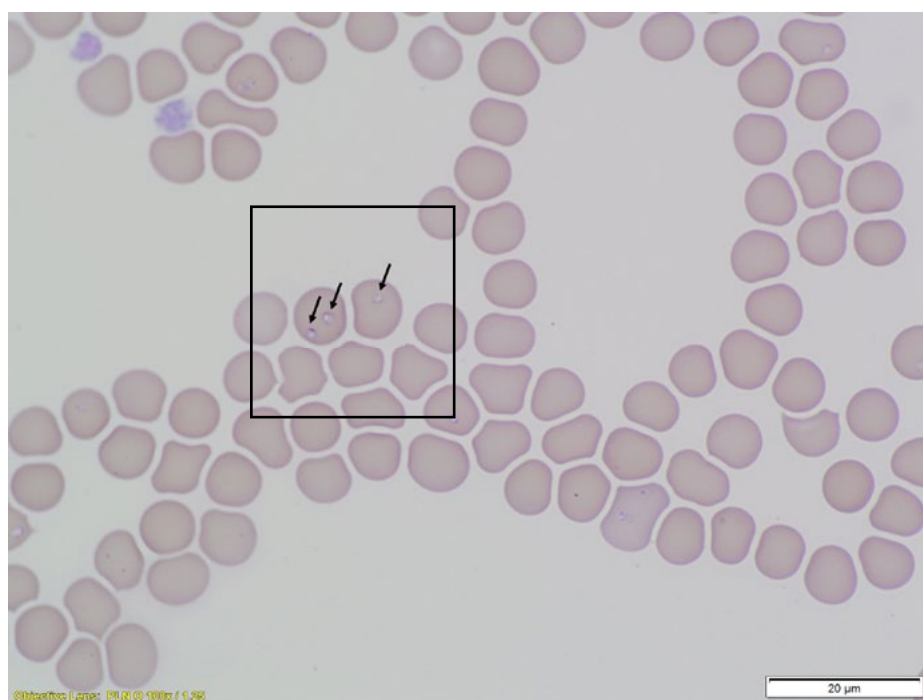


Figure 9: *Babesia gibsonii* organisms forming teardrop-shaped clearings (arrows) within erythrocytes (red blood cells) in the blood smear from the infected dog. Anisocytosis and polychromasia are also present, indicating a regenerative anaemia. Photo: Karen Bailey, Awanui Veterinary

Table 2: Investigations of possible babesiosis in dogs

Case	Region	Signalment	Clinical signs	Final diagnosis
1	Canterbury	Retriever	Haemolytic anaemia and thrombocytopaenia	Piroplasm (including <i>Babesia</i> spp.) negative by PCR Likely immune-mediated haemolytic anaemia.
2	Canterbury	9-year-old Staffordshire Bull Terrier	Severe pancytopenia and anaemia	Piroplasm and <i>Ehrlichia</i> spp. negative by PCR and serology.
3	Manawātū-Whanganui	10-year-old Miniature Schnauzer	Anaemia and thrombocytopaenia	<i>Babesia</i> spp. PCR negative.
4	Canterbury	Dog	Severe anaemia	Piroplasm (including <i>Babesia</i> spp.) negative by PCR and blood smear.
5	Nelson–Tasman	11-year-old dog	Moderate regenerative thrombocytopaenia and anaemia	Piroplasm (including <i>Babesia</i> spp.) negative by PCR and blood smear.

anaemia and thrombocytopaenia in dogs, resulting in five investigations, all of which were negative. These are summarised in **Table 2**, next page.

Brucellosis excluded in four dogs

Case 1. A veterinary pathologist from a commercial veterinary laboratory rang the exotic pest and disease hotline to report histological findings that could be consistent with *Brucella canis* infection. The three-year-old dog had presented for surgical castration, and during veterinary examination a firm nodule around 1 cm in diameter was palpated at the head of the epididymis of the right testis. Castration proceeded as planned and both testicles were submitted to a regional veterinary laboratory for histopathology. A histological diagnosis of bilateral, suppurative orchitis, epididymitis and periorchitis was made. The dog had never been used for breeding, had spent its entire life in New Zealand and had no overseas links. Nevertheless, out of abundance of caution whole blood and serum were submitted to MPI’s AHL and subcontracted to the Commonwealth Scientific and Industrial Research Organisation Laboratory (CSIRO) in Australia. Serum and molecular results were negative, exotic disease was excluded, and the investigation was closed.

Case 2: A veterinarian phoned the exotic pest and disease hotline to report a severe testicular infection in a dog of unknown age. The dog had

been euthanased due to the severity of the infection and the body had already been buried; however, the vet had collected a blood sample before euthanasia. Multiple pathogens may cause testicular infections, including the exotic agent *Brucella canis*. The affected dog was not imported and was not thought to have been bred, allowing exclusion on epidemiological grounds. As a precaution, whole blood was submitted to AHL for molecular testing for *B. canis*, and returned a negative result. Exotic disease was excluded and the investigation closed.

Case 3: A veterinarian phoned the exotic pest and disease hotline to report a severe testicular infection in a 3-year-old Labrador. The dog had been castrated due to the severity of the infection. Multiple pathogens may cause testicular infections, including the exotic agent *Brucella canis*. The affected dog was not imported and was not thought to have been bred. As a precaution, whole blood, serum and fresh testicular tissue was submitted to AHL for further testing, and fixed testicular tissue was sent to a commercial laboratory for histology. Histology revealed a chronic pyogranulomatous epididymitis and orchitis; however, no causative agents could be seen after staining. Molecular testing for *B. canis* on the whole blood and testicular tissue was negative for *Brucella* spp., and the serum returned a negative result on the *B. canis* serum agglutination test at CSIRO in Australia. Exotic disease was excluded and the investigation was closed.

Case 4: A pathologist from a commercial veterinary laboratory phoned the exotic pest and disease hotline to report that a general bacterial culture from an ear swab from a 5-year-old Miniature Poodle had grown what was identified as *Ochrobactrum anthropi* by MALDI-TOF assay, which uses mass spectrometry to identify microbes. The system result indicated that there was also a possibility the isolate was a *Brucella* species, many of which are exotic to New Zealand, likely due to the similarities between these two genera. To definitively exclude an exotic *Brucella* sp., the isolate was referred to AHL. The identification as an *Ochrobactrum* sp. was confirmed by API 20NE profiling, sequencing the 16S rRNA gene, phylogenetic analysis of the isolate, and MALDI-TOF with a genus-level confidence score of 1.90. Although the species of *Ochrobactrum* could not be definitively determined, the possibility of an exotic *Brucella* species was excluded and the investigation was closed.

Ehrlichiosis confirmed in an imported dog

A veterinarian from Canterbury contacted the MPI exotic pest and disease hotline to request *Ehrlichia* spp. testing for a dog exhibiting polyarthritis. The dog had been imported from Zambia in 2022, where ehrlichiosis is endemic. New Zealand’s import health standards do not require *Ehrlichia* testing due to the absence of any competent vector in New Zealand for onward transmission. A serum sample from the dog returned a high positive result (1:5,120; cut-off 1:80), indicating the presence of antibodies from prior exposure. However, the EDTA blood sample tested negative by PCR. While PCR has good sensitivity during the acute phase of the disease, it may not detect circulating organisms in more chronic stages. The results were provided to the clinician to help inform the treatment plan, but no further action was required regarding the evidence of prior exposure to *Ehrlichia*.

Wild-type canine distemper excluded in four investigations

A Northland veterinarian phoned the MPI exotic pest and disease hotline to report that two crossbred puppies from a litter of four from a local council pound had been euthanased after showing clinical signs consistent with canine distemper virus (CDV) including hypersalivation, conjunctivitis, rhinitis and neurological signs including blindness and circling. Necropsy was performed on one of the puppies, with a full range of formalin-fixed and fresh samples (including brain) submitted to a regional commercial veterinary laboratory and MPI's AHL. A PCR for CDV was positive on a full range of eight different tissue samples at AHL. Sequencing of the nucleic acid product of the PCR from brain tissue resulted in a very close match to sequencing from a vial of vaccine from the same batch that had been used in the vaccination 10 days before, allowing investigators to exclude the possibility of wild-type CDV and conclude that vaccine-associated CDV was an explanation. Furthermore, six wax blocks containing a range of tissues (brain, spleen, lymph node, kidney, heart, haired skin) were sent to the University of Guelph animal health laboratory for immunohistochemistry, which showed up CDV antigen in all sites. This provided further evidence that CDV was a causative factor in development of lesions.

In late May, a veterinary pathologist from a regional commercial laboratory rang the MPI exotic pest and disease hotline to report a case of rapidly fatal respiratory disease in a three-month-old male neutered Yorkshire Terrier in Tasman. The dog had received a vaccine containing live attenuated CDV two days before. This vaccine has recently been flagged by the MPI Agricultural Compounds and Veterinary Medicines group (ACVM) for potentially causing post-vaccinal distemper, with an alert for veterinarians to report any post-vaccination diseases. Although the dog did not exhibit neurological clinical signs, which reduced concerns for distemper, a sample of cerebrospinal

fluid was sent to MPI's AHL for PCR testing. The results returned negative for distemper. A complete necropsy could not be performed, so a definitive diagnosis was not achieved in this case. However, distemper was excluded based on the negative PCR findings.

A pathologist from a commercial veterinary laboratory phoned the exotic pest and disease hotline to report that two 3-month-old Huntaway-Bearded Collie cross puppies from the same litter had become unwell after vaccination, one of which had been euthanased after becoming ataxic and developing seizures. Previous cases of vaccine-associated CDV have been reported following administration of this vaccine and prompted alerts by the Animal Compounds and Veterinary Medicines (ACVM) group at Food Safety New Zealand (<https://www.mpi.govt.nz/agriculture/agricultural-compounds-vet-medicines/acvm-news-and-resources/acvm-alerts-and-notifications/>, accessed 14 August 2024). Unfortunately, the deceased dog had already been buried, preventing further diagnostics. The surviving dog was lethargic, weak and ataxic with mild anaemia. A blood sample from this dog was submitted to AHL for further diagnostics and returned a positive molecular test for CDV; however, this is to be expected given the recent vaccination and cannot be interpreted as the cause of disease. In order to confirm CDV as the cause of death or disease, histology and subsequent immunohistochemistry is required, ideally on brain tissue, and this cannot be done on a live dog. As the dog was anaemic, molecular testing for piroplasms was also carried out given the recent *Babesia gibsonii* incursion. This testing also returned a negative result. The dog proceeded to make a full clinical recovery, which would be unusual in a wild-type CDV infection, and the case was closed.

A veterinarian phoned the exotic pest and disease hotline to report that a Miniature Schnauzer puppy had developed respiratory distress and died three days after vaccination. Previous cases of vaccine-associated CDV have been reported following administration of this vaccine, and

the veterinarian was concerned this may be another case. The deceased dog was submitted to a commercial veterinary laboratory for post-mortem examination. Gross necropsy revealed diffuse pulmonary disease and histology confirmed an acute severe bronchopneumonia, with respiratory failure secondary to this pneumonia deemed the likely cause of death. Molecular testing for CDV on fresh lung tissue was negative, and in conjunction with the timeline, clinical picture and histological lesions not being suggestive of CDV, exotic disease was excluded and the investigation was closed.

Babesia confirmed in an imported cat

A veterinarian from an Auckland clinic phoned the MPI exotic pest and disease hotline to report an imported 2.5-year-old cat with liver disease, jaundice and free abdominal fluid, suspected to be feline infectious peritonitis (FIP) caused by feline coronavirus. Given the cat had been imported from South Africa six months before, the vet was also concerned that exotic disease could be possible. Samples of abdominal fluid were submitted to a regional commercial laboratory where cytology revealed a modified transudate consistent with FIP infection; however, feline coronavirus PCR was negative. Exotic differentials to consider were babesiosis and leishmaniasis, which are not tested for in imported cats as there are no known competent vectors for transmission present in New Zealand. Unlike other *Babesia* spp. there are no competent vectors of *B. felis* in New Zealand. Serum, EDTA blood and abdominal fluid were sent to MPI's AHL and were negative for *Leishmania* IFAT and PCR. Piroplasm PCR was positive and subsequent sequencing on the EDTA blood sample detected *B. felis*. Over the next two weeks the cat's condition deteriorated and it died. The body was submitted to AHL for a full necropsy and histological examination. There was marked abdominal fluid accumulation and diffuse peritonitis, hepatic dissociation and cholestasis, pancreatitis, pulmonary oedema and a right ventricular dilated cardiomyopathy. FIP was confirmed

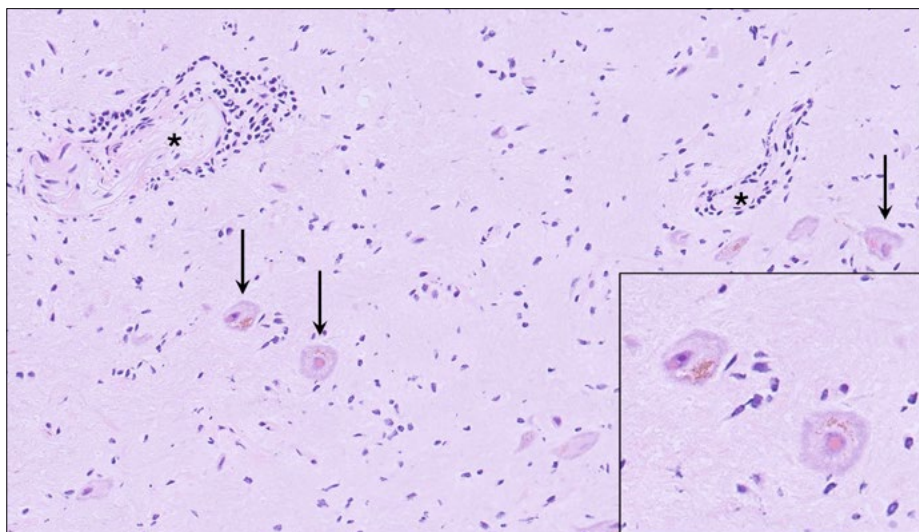


Figure 10: Cerebrum with focal encephalitis. Low numbers of mononuclear leukocytes cuff vessels in the grey matter (asterisk) and nearby neuronal bodies contain smudgy eosinophilic intranuclear material (possible inclusions; arrow). The neurons also contain stippled brown pigment consistent with lipofuscin. H&E-stained section, frozen-thawed tissue. Photo: Emma Gulliver, Awanui Veterinary

based on autopsy findings, although feline coronavirus was not detected on molecular testing. *Babesia felis* may have contributed to the cat's demise, but it is considered to have died from an endemic disease, FIP.

Unusual virus excluded in a cat

A pathologist from a commercial veterinary laboratory phoned the MPI exotic pest and disease hotline to report the presence of syncytial cells within renal tubules from an eight-year-old Devon Rex cat with inflammatory renal disease of unknown origin. The presence of feline morbillivirus could not be ruled out as a cause of the inflammatory condition, and this agent has not been identified previously in New Zealand. Formalin-fixed, paraffin-embedded tissue was submitted to a reference laboratory at Berne University in Switzerland for further testing. The in situ results were negative for feline morbillivirus. Molecular sequencing for virus discovery was conducted. None of the analyses of the sequences returned a viral identification. No exotic viral agent was identified, and this investigation was closed.

Cetacean morbillivirus excluded in a dolphin

A pathologist from a commercial veterinary laboratory rang the exotic pest and disease hotline to report finding inclusion bodies in the brain

tissue of a stranded rough-toothed dolphin (*Steno bredanensis*). The dolphin had reportedly stranded in Northland along with a pod of 10 others and researchers had conducted a post-mortem examination on this one individual. The pathologist reported that histology showed mild encephalitis, and that intranuclear and intracytoplasmic inclusion bodies were observed (**Figure 10**). The inclusion bodies suggest a viral infection was the cause of the encephalitis, and given their location the exotic disease agent cetacean morbillivirus could not be excluded. Fresh brain tissue from the dolphin was submitted to MPI's AHL where it tested negative to cetacean morbillivirus, as well as adenovirus, herpesvirus and coronavirus. A cause for the encephalitis was not determined; however, exotic disease was excluded and the investigation was closed.



Figure 11: Oothecae of a cockroach, found in an empty beehive. Photo: Vicki Allen

SARS-CoV-2 excluded in a zoo otter

A zoo veterinarian phoned the MPI exotic disease and pest hotline to obtain assistance in testing otters for COVID. Four male Asian small-clawed otters (*Aonyx cinereus*), with flu-like clinical signs were noted in April 2024. Faecal samples and a nasal swab were submitted to MPI's AHL for molecular testing and found to be negative on the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RT-PCR against the N and E genes for COVID. The important reverse zoonosis COVID was excluded from the differential diagnoses for the otters and the case was closed.

Small hive beetle and other exotic parasites of bees excluded in two cases

An apiary inspector (Authorised Persons Level 2 or AP2) (Phiri et al., 2021) contacted the exotic pest and disease hotline for assistance in confirming the identity of an unusual insect at an apiary inspection. Two brown egglike objects were found on clean stored frames in an empty hive (**Figure 11**). There were no health issues identified in the four hive colonies that made up the apiary. An MPI Plant Health and Environment Laboratory (PHEL) (Tamaki) entomologist used photographs to confirm that these were two egg cases, or oothecae, of a cockroach, most likely the Gisborne cockroach (*Drymaplaneta semivittata*), a common species in New Zealand. It is not uncommon to find cockroaches themselves in beehives, particularly under the top cover (Qing Hai Fan,

PHEL, pers. comm.). The investigation was closed.

A member of the public rang the MPI exotic disease hotline to report a finding of unusual mites on a varroa sticky board, which were discovered during a routine hive inspection. The sample of the affected board was submitted to MPI's PHEL Tamaki for morphological identification by an entomologist. Two species in the Acaridae family were identified. The first was a fungivorous mould mite, *Tyrophagus vanheurni*, a mite that has previously been seen in honey bee hives in New Zealand. The second was a pollen mite (*Neocyphophyllus novaezelandiae*). These pollen mites are regularly found on honey bees in New Zealand. An exotic pathogenic

mite of bees was excluded and the case closed.

Validated new-to-New Zealand microorganisms or emerging diseases: April to June 2024
Microorganisms not previously reported within New Zealand are reported to the Incursion Investigation team as notifications. These notifications are evaluated for their likelihood to be novel introductions, and for their likelihood to cause damage to New Zealand's primary industries, environment and human health. Evaluations are done by the team with support from the Animal Health Laboratory and the Animal

Health Surveillance team. Findings are presented in **Table 3**.

Whether a microorganism is likely to represent a true incursion is evaluated based on New Zealand's historical surveillance data, how widespread globally a microbe is, whether there is any reported disease impact of significance which would be likely to indicate its presence in a general surveillance system, and whether the microbe is related to any known border movements (e.g., imported animals or animal products).

Initially (see Buckle, 2023) each detection was verified using classical bacteriological techniques. Following review of outcomes, it was decided to streamline the process and to reserve classical bacteriology for microbes thought to be likely risks or likely true incursions.

For this quarter, all organisms were determined to be baseline surveillance detections of organisms considered to have been present historically within New Zealand, not representing a new introduction or emerging disease. These novel baseline organisms are reported in **Table 3**.

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Table 3: New-to-New Zealand organisms or emerging diseases associated with animal health cases: April to June 2024

Organism	Classification/ method of ID	Host	Isolated from	Location	Comments
<i>Citrobacter farmeri</i>	New MALDI-TOF*	Dog	Urine sample	Auckland	Urine culture from a dog with urolithiasis.
<i>Sporosarcina newyorkensis</i>	New MALDI-TOF	Cow	Milk sample	Manawatū	Milk culture from a cow with mastitis. The clinical relevance of this isolate is unclear.
<i>Klebsiella variicola</i>	New MALDI-TOF	Dog	Urine sample (free catch)	Auckland	The clinical relevance of this isolate is unclear. Considered likely to be an environmental contaminant or opportunistic infection.
<i>Trueperella bernardiae</i>	New MALDI-TOF	Dog	Ear swab	Manawatū	The clinical relevance of this isolate is unclear. Considered likely to be an environmental contaminant or opportunistic infection.
<i>Jeotgalicoccus nanhaiensis</i>	New MALDI-TOF	Cat	Urine sample (free catch)	Southland	Considered likely an environmental contaminant.
<i>Buchananella hordeovulneris</i>	New MALDI-TOF	Dog	Wound/abscess	Auckland	Isolated from a wound/abscess on ventral neck of dog. Considered likely to be clinically significant in this case as it has been reported as a cause of actinomycosis in dogs previously. Not considered to be of wider significance.
<i>Streptococcus hyovaginalis</i>	New MALDI-TOF	Cat	Urine sample (cystocentesis)	Auckland	Isolated as part of mixed growth.
<i>Arcanobacterium pluranimalium</i>	New MALDI-TOF	Cow	Milk sample	Manawatū	The clinical relevance of this isolate is unclear. Considered likely to be an environmental contaminant or opportunistic infection.

* MALDI-TOF mass spectrometry may be insufficient to definitively identify bacterial species. The bacterial species identities listed above should be considered probable where further validation methods have not been applied.

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Quarterly report of diagnostic cases: April to June 2024

Awanui, formerly Gribbles

Bovine

On a South Canterbury farm, four rising 1-year-old beef calves in a group of 150 died and two were sick. The calves had had access to oak trees two weeks before. The two sick calves were severely azotaemic with serum creatinine concentrations of 2,002 and 2,558 $\mu\text{mol/L}$ (reference range 39–181) and serum urea concentrations of 70.7 and 79.4 $\mu\text{mol/L}$ (reference range 2.7–11.9). Histologically, there was acute tubular necrosis in the kidney. These laboratory findings, combined with the history, were typical for **acorn toxicity**. Cases of acorn toxicity are seen every year in autumn and often involve calves that are put in areas where there are oak trees, either to clean up rank pasture, or because of a lack of feed in other areas of the farm.

Seven of a group of 170 Friesian Jersey cross heifers on a central Canterbury farm aborted in early June. Samples from one aborted fetus were sent to the laboratory for testing. This calf had been aborted about 12 hours before samples were collected and processed, and despite the cold temperatures it was decomposed. The affected heifer remained well with no fever or diarrhoea. On histopathological examination the fetal tissues were in a poor state of preservation and large numbers of bacteria were present in many of the tissues or within their blood vessels. The placenta had massive numbers of bacteria in the villi of the cotyledon and filling many capillaries within those villi. These features, particularly those in the placenta, were suspicious for **abortion** due to *Salmonella* sp. infection. Bacterial culture of fetal thoracic fluid yielded a heavy growth of *Salmonella* **Brandenburg**, confirming this diagnosis.

A cow of unspecified age from a Bay of Plenty property had a mass on the ventral jaw. Histopathological

examination of a biopsy from the lesion revealed severe pyogranulomatous inflammation with intralesional Splendore–Hoeppli material. Splendore–Hoeppli material is a distinctive histologic feature that is thought to reflect immune complex deposition in an inflammatory lesion and may be seen with an array of bacterial infections including *Actinobacillus* spp., *Actinomyces bovis*, *Staphylococcus* spp., and *Nocardia* spp., as well as some fungal and parasitic infections and, rarely, in response to foreign material. A Gram stain revealed abundant intralesional bacteria, predominantly clusters of gram-positive coccoid bacteria (likely *Staphylococcus* spp.), with fewer gram-positive coccobacilli and gram-negative bacilli. These findings were consistent with **botryomycosis**. A penetrative wound or foreign body, probably extending from the skin surface, or possibly from the oral cavity, was considered the most likely primary aetiology in this case.

In May, 12 out of a group of 15 neonatal Jersey calves on a Taranaki farm became ill, some with diarrhoea. Five died. Faecal samples from two of the affected calves tested negative for *Salmonella* spp., *Escherichia coli*, rotavirus and cryptosporidium using bacterial culture and antigen tests. Histopathological examination of fixed tissues collected from one calf revealed evidence of disseminated bacterial infection, including suppurative interstitial pneumonia, and suppurative hepatitis with associated bacterial colonies. Bacterial culture of abomasal contents from a dead calf yielded a mixed growth including *Listeria monocytogenes*. It was suspected that **neonatal listeriosis** may have arisen from maternal bacteraemia and placentitis in this calf. Whether listeriosis was the cause of the illness and deaths in the wider group could not be definitively determined as samples were only received from one animal.

Outbreaks of *Neospora* sp. **abortion** occurred on several farms during

April and May. On a farm near Eltham, two first-calving heifers from a group of 70 aborted over two days. On a farm near Galatea, five heifers from a group of 125 aborted over several days. Multiple abortions also occurred among mixed-age cows on farm near New Plymouth. Samples of fixed tissue from aborted fetuses were submitted for histopathological examination from each of the aforementioned farms, revealing characteristic multifocal mononuclear inflammatory infiltrates in the brain and heart in each case. Additionally, *Neospora caninum* was detected by PCR in the stomach contents from aborted calves from two of the affected farms. Risk factors for *Neospora* sp. abortions in cattle include *N. caninum* seropositivity of the dam and increasing dam age as well as the presence of dogs, poultry or wildlife on the farm (Bartels et al., 1999).

On a North Canterbury farm, five of a group of 600 mixed-age dairy cows aborted over a period of about one week. The cows had been grazing a rape crop and had not been vaccinated against leptospirosis, salmonellosis or bovine viral diarrhoea (BVD) infection. One fetus from a dam that became unwell after aborting was sampled for histopathology, bacterial culture and BVD PCR. Histopathological examination of the fixed tissues revealed severe necrotising placentitis with vasculitis and intralesional fungal hyphae, in addition to inflammatory lesions in the fetal brain and liver. The BVD PCR was negative. Bacterial culture of fetal stomach contents yielded a growth of *Mortierella wolfii*, which was considered causative, given the histological findings. *Mortierella wolfii* **abortion** occurs sporadically in mixed-age cows. Feeding of spoiled silage or baleage increases the risk of infection. Affected cows may develop a fatal pneumonia, or, rarely, meningitis, following abortion.

Two 8-month-old dairy heifers on a South Canterbury farm died and enteric disease was suspected from the clinical signs. Faecal cultures were

negative for *Salmonella* sp. and bovine adenovirus type 10 was not detected by PCR. Multiple fixed tissue samples were collected for histopathological evaluation. Significant lesions were found in the kidney, characterised by tubular necrosis and interstitial fibrosis and inflammation. The lesions were consistent with a toxic insult. Based on subsequently obtained additional history, the findings were attributed to **acorn toxicity**. Fallen acorns are a common cause of nephrotoxicity in cattle during autumn, whereas oak buds from fallen branches may cause oak toxicity in spring.

Several neoplasms were diagnosed in cattle this autumn. In South Canterbury a **fibropapilloma** was excised from the penis of a young bull. Cutaneous fibropapillomas usually occur in young cattle and are caused by bovine papillomaviruses (BPV) 1, 2 or 5. BPV-1 has been associated with fibropapillomas on the glans penis of young bulls. These masses can be single or multiple and usually spontaneously regress within a year of their appearance. As they are caused by a virus, transmission to in-contact cattle is possible, including by the venereal route.

A 10-year-old Friesian-cross cow on a Taranaki farm had a lesion on the third eyelid. A biopsy was collected and fixed in formalin for histopathological examination. This revealed a neoplasm composed of atypical keratinising squamous cells, extending to the biopsy margins, confirming a diagnosis of **squamous cell carcinoma**. This is the most common tumour of the ocular tissues in cattle, occurring with increased frequency in non-pigmented areas and in older cattle. Risk factors include ultraviolet radiation, chronic inflammation, absence of pigment and genetic tendency.

On a dairy farm in North Canterbury during routine body scoring, a 6-year-old crossbred cow was noted to be displaying marked abdominal respiratory effort and a veterinarian was called to examine her. The heart could not be auscultated on the right side of the chest and lung sounds were markedly reduced. After failing to respond to treatment for a

presumptive pneumonia, the cow was euthanased and a necropsy performed. About 10 L of serosanguinous fluid were drained from the thoracic cavity and multiple firm nodules were present throughout the lung and pleura. Samples of the masses were submitted for histopathological examination that revealed a malignant neoplasm comprised of spindle cells in a myxomatous-to-chondroid matrix with areas of well-differentiated cartilage. This was consistent with a **chondrosarcoma**. The presence of multiple nodules within the lungs is suggestive of metastatic neoplasia, although a primary neoplasm was not identified. In cattle, primary chondrosarcomas have been reported in the ribs or scapulae, with metastasis to thoracic lymph nodes, pleura and lungs being described (Acland, 1983).

A 12-year-old Friesian cow on a dairy farm in Taranaki had a slow-growing, ulcerated mass in the cranial udder. The cow was otherwise well, with no loss of condition or reduction in milk production. After the mass was surgically excised, representative samples of it were fixed and submitted for histopathological examination. Histological findings were consistent with a **squamous cell carcinoma**. The udder is an uncommon location for this tumour in cattle, although it has previously been reported. The propensity for development on non-pigmented skin is suggestive of solar radiation as a potential contributing cause.

A 10-year-old Friesian-cross dairy cow, one of a group of 180 on a Taranaki farm, developed pyrexia and had a drop in milk production. A 6-cm diameter, discrete and mobile mass was present below the right ear. Another smaller mass was identified below the mandible on the same side. Initially, fine needle aspirate samples were collected for cytological examination but the smears were non-diagnostic. Subsequent biopsies of the masses had histopathological findings consistent with a poorly differentiated carcinoma. Upon becoming dyspnoeic, the cow was euthanased. Necropsy performed by the referring veterinarian revealed that

the largest mass was located within the parotid salivary gland, which was most suggestive of a **salivary carcinoma**. This mass had extended ventrally and caudally to compress the larynx and trachea, causing the dyspnoea.

Several outbreaks of acute illness and sudden death in young cattle occurred during this period that were attributed to infection with **bovine adenovirus 10**. The diagnosis in each case was confirmed by PCR on intestinal contents and/or histology. In one case, three yearlings died overnight on a coastal Taranaki farm. In another case, on another Taranaki property, one animal died and another was unwell in a group of 68 nine-month-old Friesians, with two other calves in a different group having died on the same property the week before. Another case occurred in Marlborough where six animals from a group of 100 rising 1-year-old heifers became very unwell, with two dying soon after discovery and another dying just before the veterinarian arrived to perform necropsies. Bovine adenovirus (BAdV) typically causes small outbreaks of enteric and/or sudden death in young cattle, particularly those 6–12 months of age in autumn, winter and spring. While several strains of adenovirus have been identified in cattle, BAdV-10 is implicated in nearly all clinical cases where PCR confirmation is undertaken. It is unclear why some animals develop severe illness and others do not, although stressors such as transport, parasitism, change in diet, weather and concurrent disease may be implicated.

On a property in mid-Canterbury in April, several Wagyu beef calves, 1–4 weeks old, from a group of unspecified size, were diarrhoeic and unwell. Histopathological examination of fixed tissues from one dead calf revealed moderate-to-severe acute multifocal inflammation involving the abomasum, small intestine and colon with aggregates of bacteria on mucosal surfaces and clusters of neutrophils in colonic crypts. These findings were consistent with a bacterial aetiology and **salmonellosis** was suspected. Bacterial culture of rectal swabs, faeces or intestinal contents from

four different animals all yielded *Salmonella* sp. and subsequent typing identified *Salmonella Bovismorbificans*. Sensitivity testing revealed the isolated organism to be resistant to penicillin, tetracycline and combined trimethoprim/sulfamethoxazole but sensitive to cephalothin and enrofloxacin.

In May, on a Central Otago beef farm, **acorn toxicity** was suspected when ten 9-month-old Wagyu calves were found dead and another 20 were unwell out of a group of 160 animals that had previously had access to oak trees. Histopathological examination of fixed kidney from a euthanased calf revealed severe changes consistent with acorn toxicity.

On a small farm in Otago, three of a group of twenty 9-month-old Hereford beef cattle were found dead 24–36 hours after being given an injectable copper supplement and a long-acting selenium supplement. The copper concentration in the kidney in one of the dead animals was 153 µmol/kg. This was very close to the concentration considered to be diagnostic for toxicity (greater than 157 µmol/kg) and, along with the history, was highly suggestive of **acute copper toxicity**.

On a Southland dairy farm, 27 of a group of 190 cows developed smelly diarrhoea with reduced milk production and slow rumination. Four affected cows aborted. Samples of faeces from two of the affected cows were submitted to the laboratory and bacterial culture from both samples yielded *Salmonella* sp., subsequently typed as *Salmonella Typhimurium*, confirming a diagnosis of **salmonellosis**.

A large **abortion** outbreak occurred in early June on a large dairy farm in Canterbury with 50 cows aborting over a two-week period after the ingestion of **macrocarpa** (*Hesperocyparis macrocarpa*) pine needles. The aborted calves appeared well preserved with no gross lesions. The affected cows were on a reduced plane of nutrition as they were being dried off. The hungry cows broke through a fence into a paddock that

was bordered by a recently trimmed macrocarpa hedge. The trimmings had been left in two large piles in the paddock and partially burned. Examination of this area showed that the cows had ingested a large quantity of this material, which provided support for this being the aetiology.

Ovine

In April, a group of 2,500 mixed-breed 6-month-old lambs from a Waikato property were assessed for poor growth rates and increased mortality. Many of the lambs had been scouring and more than 30 had died. They had been treated with anthelmintic 29 days before the submitting veterinarian performed necropsy examinations on three lambs. Two were noted to have pneumonia and one had worms visible in the abomasum. Histopathological examination revealed severe small bowel enteritis with villus atrophy and fusion and occasional intramucosal larval nematodes, consistent with **chronic enteric parasitism**. One lamb also had a severe abomasitis. Faecal egg counts were 200, 900 and 1,550 strongylid eggs per gram of faeces, and all three lambs had severely low hepatic vitamin B12 concentrations (< 74 nmol/kg, adequate range 340–1,037), suggestive of cobalt deficiency, but they had normal hepatic copper and selenium concentrations. Two lambs had severe **fibrinosuppurative pneumonia** with intralesional gram-negative bacilli. Bacterial bronchopneumonia is often multifactorial, with physiological stress, environmental factors such as exposure to cold or inhaled irritants, or viral infection predisposing affected lambs to opportunistic bacterial infection. The cause of illthrift in these lambs was determined to be multifactorial.

Camelid

Faecal samples from seven of a group of 15-month-old female alpaca on a Southland property near Te Anau were received for faecal worm egg counts and larval cultures. The animals had a history of clinically apparent anaemia. Individual faecal samples had 0 to 6,750 eggs per gram of faeces, consistent with parasitism.

Individual larval cultures showed that 90–100 percent of the larvae were *Haemonchus* sp., 0–9 percent were *Teladorsagia* sp., 1–2 percent were *Trichostrongylus* sp. and 0–1 percent were *Oesophagostomum/Chabertia* sp. High burdens of *Haemonchus* sp. worms were considered to be the probable cause of anaemia in this group, leading to a diagnosis of clinical **haemonchosis**. Historically, haemonchosis would not have been expected in animals living so far south, but in recent years, this disease, generally expected in the warmer northern parts of New Zealand as warmer temperatures optimise larval development, has been increasingly occurring in the traditionally colder south.

Equine

In March, a 26-year-old Clydesdale cross gelding from greater Auckland had a well-circumscribed skin mass lesion in the stifle region surgically excised. Histopathological examination revealed a multilobular, densely cellular proliferation of fusiform cells supported by myxomatous stroma. Neoplastic cells often palisaded around a central hyalinised vessel and sometimes formed bundles lining a channel or cleft filled with serous fluid or blood. The mass was locally infiltrative but appeared to have been completely excised. The cell of origin was difficult to determine with routine histological staining but was suspected to be of neuroectodermal origin, with histological features that were highly suggestive of an **equine cutaneous schwannoma**. This is a type of peripheral nerve sheath tumour which is usually seen in older horses and generally has a benign clinical course, being amenable to surgical excision. Immunohistochemistry is required for definitive diagnosis of the cell of origin. This is not routinely available in New Zealand commercial veterinary laboratories and requires referral elsewhere.

A 20-year-old Warmblood horse in Canterbury developed progressive and extensive skin disease characterised by hives, oedema, crusts, oozing and pruritis. A decision was made to euthanase owing to a poor response

to treatment with corticosteroids. Multiple skin biopsies were collected immediately postmortem. Microscopic examination showed severe dermatitis with thick crusts containing many dissociated, rounded-up keratinocytes (acantholytic cells), confirming the clinical suspicion of **pemphigus foliaceus (PF)**. PF is the most common autoimmune skin disease of horses. It results from circulating autoantibodies against cellular adhesion proteins of desmosomes, leading to dissociation of cells in the superficial epidermis and characteristic pustules, crusts and acantholytic cells. PF may affect horses of any age and is characterised by localised to generalised crusting, scaling and alopecia with or without systemic signs such as weight loss and fever.

Porcine

In Canterbury, outbreaks of **pleuropneumonia** occurred in groups of pigs on two different properties. In the first outbreak in late April, swabs from the respiratory tract of three different pigs all yielded heavy growths of *Actinobacillus pleuropneumoniae* in bacterial culture. In the second outbreak, about two weeks later and on a different property, several sudden deaths in grower pigs prompted investigation and swabs from the lungs of three dead pigs again all yielded *A. pleuropneumoniae* on bacteria culture. Pleuropneumonia is a worldwide severe contagious respiratory disease that mostly affects pigs under six months of age. It usually has a short clinical course and high morbidity and mortality, with nose-to-nose contact being the usual route of transmission.

Fixed tissues were received from a 4-month-old piglet from Nelson that had been coughing for two weeks and then died. Histopathological examination revealed an eosinophilic bronchiolitis with many nematodes in the airways that were consistent with **Metastrongylus apri**. **Lungworm infestation** is rare to absent in housed commercial pigs but is still seen in outdoor, backyard or small holding pigs from time to time. The

life cycle of this species includes larval development within earthworms as an intermediate host, so infection is only seen in pigs with access to earthworms.

In April, two juvenile gilts from a research facility in greater Auckland suddenly developed malaise, with one having a fever of 41°C. One gilt stopped eating and was euthanased. Necropsy revealed pleuropneumonia, which was confirmed histologically as subacute fibrinosuppurative pleuropneumonia with intralesional gram-negative bacilli. Aerobic bacterial culture yielded a growth of *Actinobacillus pleuropneumoniae*, the causative agent of **porcine contagious pleuropneumonia**. This is a primary pathogen of pigs and may cause disease without coinfection. Disease may be seen in pigs of any age group. Piglets from six weeks to six months of age are most often affected, with peak mortality generally occurring between 3–4 months of age. The lesions are characterised by severe fibrinosuppurative pleuropneumonia and over time can lead to development of sequestra. Systemic spread with lesions in other parenchymatous organs can occur. Pigs that survive the initial infection may become long-term carriers of the organism and have chronic illthrift.

Canine

Blood samples were received from a 5-year-old, desexed female Pug cross dog in Auckland that had been unwell for 48 hours after being observed to have possibly ingested mushrooms and then vomited. Biochemistry testing of the submitted blood demonstrated extreme elevation of serum ALT at 22,286 IU/L (reference range 0–88) and AST at 17,557 IU/L (reference range 0–51), indicating severe hepatocellular injury. Moderate hyperbilirubinaemia of 52.1 µmol/L (reference range 1–3) and mildly increased ALP at 140 IU/L (reference range 0–87) were also detected, likely reflecting cholestasis secondary to the hepatocellular necrosis. These findings, together with the history, supported a presumptive diagnosis of **mushroom toxicity**. Occasional

cases of mushroom toxicity have been anecdotally reported in dogs in New Zealand. Overseas, *Amanita spp.* are most commonly implicated as causing poisoning in dogs, the deadliest being *Amanita phalloides* (death cap). This mushroom contains a number of toxic peptides including amatoxins and phallotoxins, which target the liver and kidneys, causing death in humans and animals after ingestion of very small quantities. Onset of clinical signs and hepatic injury characteristically occur 6–15 hours after ingestion. *Amanita phalloides* has been observed growing in grass under oak trees at Auckland, Cambridge and Dunedin and likely occurs under other deciduous trees and in other localities around the country.

A 7-year-old neutered male Bichon Frise and Shih Tzu crossbreed dog from Canterbury had chronic generalised alopecia and scaling. The dog had been on long-term prednisone and chlorambucil for lymphoma. A fungal culture was performed on a skin scraping and was negative for dermatophytes. Skin biopsies from two sites were submitted for histopathological examination, which revealed follicular hyperkeratosis with multiple intraluminal *Demodex spp.* mites. One of the sites also had multifocal bacterial folliculitis. It was concluded that the skin disease was caused by the **demodicosis**, with likely secondary bacterial infection. *Demodex spp.* mites are part of the normal flora of canine skin and inhabit hair follicles and sebaceous glands. They are usually present in small numbers, causing no clinical disease. The pathogenesis of demodicosis is complex and might involve hereditary predisposition. Immunosuppression can also facilitate clinical disease. Localised demodicosis occurs most often in young puppies six months old or younger. The lesions usually appear on the front legs and face, and the clinical effects tend to be mild. Generalised demodicosis is far more severe than the localised form, especially when it starts when the dog is an adult. Secondary bacterial infections commonly occur and can

be severe. In this case it is likely that the chemotherapy for lymphoma resulted in immunosuppression and subsequent proliferation of the mites.

Feline

A 7-month-old desexed male domestic short-haired cat in Auckland had a chronic cough that had failed to respond to antibiotics and anti-inflammatories. Thick mucoid discharge was produced on coughing and on radiographs, multiple 3–5 mm opacities were seen throughout the lung fields. A bronchoalveolar lavage was performed and the fluid submitted to the laboratory for cytological examination. Eosinophilic to mixed inflammation and numerous parasitic larvae were observed on cytological examination of the smears, confirming a diagnosis of **lungworm infection** due to *Aelurostrongylus abstrusus*. Lungworm infection is an important differential for chronic coughing in young cats of hunting age in New Zealand. Cats become infected through hunting and eating various auxiliary hosts such as birds, rodents and lizards that have ingested the infected intermediate hosts which are slugs and snails.

A 10-year-old female domestic medium-hair cat from Christchurch presented with a 12-day history of left foreleg medial digit swelling, ulceration and necrosis. Samples of tissue were collected for bacterial culture and histopathological examination. The latter revealed a severe pyogranulomatous inflammatory lesion with a population of pigmented dimorphic fungal organisms, consistent with **phaeohyphomycosis**. This type of infection generally results from traumatic implantation of environmental fungal opportunist pathogens. Infections are locally aggressive and destructive and may require a combination of surgery and long-term antifungal therapy to control.

On a routine visit for a vaccination, an abdominal mass was palpated in an 8-year-old Burmese cat in South Wairarapa. The cat otherwise appeared in good health, with no history of vomiting, diarrhoea or weight loss.

After treatment for a presumptive lymphoma, with no change in the clinical picture, an exploratory laparotomy was performed. Biopsy of an enlarged ileocaecal lymph node showed large central areas of caseous necrosis which were visible grossly and on histopathological examination were bordered by pyogranulomatous inflammation and moderate numbers of gram-positive coccobacilli. PCR performed on formalin-fixed paraffin embedded tissues confirmed the presence of *Listeria monocytogenes*. **Listerial mesenteric lymphadenitis** has been described uncommonly in young to middle-aged cats in New Zealand, particularly in Oriental breeds such as Siamese and Burmese (Fluen et al., 2019). Feeding a raw meat diet may be a contributing factor in some cases. It was subsequently confirmed that this cat had been on a raw meat diet.

A 5-year-old cat from Selwyn was presented for examination in late March with thickened skin over the right lateral thorax/flank region. The lesion included multiple (about 10) open sinuses about 2 x 2 mm in diameter. Treatment with 10 days of combined amoxicillin and clavulanic acid antibiotic resolved the lesion. However, one month later it recurred with an additional similar lesion in the left lateral groin with purulent material and several (about five) 2 x 2 mm 'holes' in the skin. Routine blood tests were unremarkable and tests for feline immunodeficiency virus (FIV) and feline leukaemia virus (FeLV) were negative. Routine bacterial culture on swabs from the right flank and left groin both yielded a *Staphylococcus aureus* isolate which was sensitive to common antibiotics, including penicillin. The pathologist commented that the history was suggestive for possible deep tissue fungal or mycobacterial infection, which may not have been detected on culture from a superficial skin swab. Six weeks later, tissue biopsies were received for histopathology and culture. The histopathological diagnosis was multifocal to coalescing pyogranulomatous dermatitis and panniculitis with sinus formation, most consistent with infection such

as mycobacteriosis, nocardiosis, actinomycosis or less likely fungal infection or a foreign body reaction. Culture from a deep tissue sample yielded a scant growth of *Mycobacterium smegmatis*. This species was the most common isolate in a recent paper on feline **mycobacteriosis** in 19 cats in California (Munro et al., 2021).

A 12-year-old spayed female domestic short-haired cat in Tasman had hypokalaemia and hypertension. Ultrasound revealed a left adrenal gland mass, and a fine needle aspirate was performed with smears submitted to the laboratory for evaluation. Cytological findings were suggestive of **adrenocortical neoplasia**, which was later confirmed by histological examination. Given the clinical signs, these findings supported a diagnosis of **primary hyperaldosteronism**. This disease is likely to be the most common adrenocortical disorder in cats and may be an important cause of arterial hypertension in this species. Affected cats generally present with signs related to systemic hypertension, hypokalaemia, or both. Signs associated with hypertension include vision loss or acute neurological compromise. Hypokalaemia may result in weakness, collapse and cervical ventroflexion. Affected cats have poor muscle tone and are often unable to stand unaided. Polyuria and polydipsia are also commonly reported. Most cats with primary hyperaldosteronism are over 10 years of age. No breed or gender predispositions have been established.

Avian

An Antipodes Island parakeet (*Cyanoramphus unicolor*) from the Auckland area became unwell and was euthanased. At necropsy a large granulomatous lesion affecting the lung on the right side was observed. Histopathological examination of fixed tissues from the bird revealed granulomas and amyloidosis within the right lung and the adjacent air sacs. Periodic acid–Schiff (PAS) staining demonstrated even-walled, branching, septate fungal hyphae within the granulomas. These findings were consistent with **aspergillosis**.

Fluid aspirated from an infected nasal sinus in a pheasant (*Phasianus colchicus*) from Whangārei yielded a moderate growth of *Avibacterium* sp. in bacterial culture. Along with the clinical presentation, this supported a diagnosis of **infectious coryza** caused by *Avibacterium paragallinarum* (previously known as *Haemophilus paragallinarum*). This disease is most commonly seen in domestic chickens but has been reported in other birds such as pheasants and guinea fowl.

In May, a group of 3-week-old chicks from a layer flock in greater Auckland were assessed following reports of increased mortalities and weak birds since delivery to the property as day-old chicks. Multiple previously submitted chicks had a mononuclear encephalitis suggestive of avian encephalomyelitis (picornavirus). One weak chick was euthanased and multiple fixed tissues were examined histologically, revealing granulocytic interstitial pneumonia and severe granulocytic panophthalmitis with abundant gram-negative bacilli in the posterior and anterior chambers. There was a focal wedge-shaped area of fibrosis adjacent to the physis of the tibia, suggestive of a previous infarction. The presence of multisystemic inflammation alongside bacteria in the ocular cavities was considered consistent with **gram-negative bacterial septicæmia**, which in young birds often develops secondary to omphalitis, yolk sacculitis or haematogenous spread secondary to primary inflammation in another organ system. No fresh tissues were available for bacterial culture and the underlying cause of the septicæmia was unable to be determined in this chick.

In Canterbury, over a one-month period, five adult quail of unspecified species, held in an aviary, died. A necropsy on one of the birds revealed white plaques over the mucosal surface of the small intestine. Fixed tissue samples were submitted to the diagnostic laboratory for histopathological examination. This revealed multifocal partial or full thickness ulceration of the small intestinal mucosa, which was replaced

by necrotic cellular and karyorrhectic debris admixed with colonies of large gram-positive bacilli and degenerate heterophils. These findings were characteristic of **ulcerative enteritis**, a disease caused by *Clostridium colinum* in quail. Typically, this disease causes sudden death in young birds (4–12 weeks old) but deaths can occur in adults as well. Chronically affected birds can become carriers and display diarrhoea and emaciation.

Fifty 1-year-old pigeons from a loft in Canterbury experienced a 6-week outbreak of gastroenteritis with slow transmission through the flock and multiple deaths (mortality rate was not specified). Faecal samples from two birds were submitted to the laboratory for an avian diarrhoea panel. Results of *Giardia* antigen ELISA, *Cryptosporidium* ELISA and faecal egg count testing were negative. Bacterial culture yielded a growth of *Salmonella* sp. from enrichment broth that was confirmed by the Enteric Reference Laboratory at the Institute of Environmental Science and Research as *Salmonella enterica* subsp. *enterica* serovar **Typhimurium**. Necropsy or histopathological examination of affected tissues was not performed; however, given the history in this case the culture results were considered significant and consistent with **salmonellosis** in this flock, a diagnosis of zoonotic significance.

Primate

A 9-year-old pygmy marmoset (*Cebuella* sp.) from a zoological park was euthanased after a 2-week history of lethargy, marked weight loss and anorexia. A necropsy was performed by the referring veterinarian and fixed tissue samples were sent to the diagnostic laboratory for histopathological examination. Within the mucosa of the small intestine and within the mesenteric lymph node were large amounts of congophilic extracellular protein consistent with amyloid. These findings are consistent with **amyloidosis**. The most common form of amyloidosis, reactive secondary amyloidosis, is a common finding in older marmosets.

The disease is characterised by extracellular deposition of amyloid-A and is typically associated with a chronic inflammatory process that induces elevated levels of a precursor molecule for amyloid.

Rodent

A 4-month-old capybara had mucoid and bloody diarrhoea for at least three weeks. During this time, faecal examinations had failed to find any coccidia or parasite eggs. Bacterial culture of faeces for *Yersinia*, *Salmonella* or *Campylobacter* were also negative, as were tests for *Cryptosporidium* and *Giardia* spp. The animal died and necropsy revealed extensive caseous mesenteric lymphadenitis. A mesenteric lymph node was submitted for bacterial culture and yielded a growth of *Yersinia pseudotuberculosis*, a gram-negative bacterium reported to infect a wide variety of animal hosts, including cattle, sheep, goats, deer, dogs and cats. Cases have also been reported in captive zoo animals, with artiodactyls, birds, non-human primates and rodents being particularly susceptible to infection. Recently, an outbreak of acute mortality due to **yersiniosis** was reported in a capybara population kept in a zoological park in Spain. Five of the seven capybara were affected and the fatality rate was 100 percent (Cano-Terriza et al., 2022).

In Canterbury, the owner of a 5-year-old male guinea pig noticed that he had developed a discharging mass in the mammary region. The mass was 1.5 cm in diameter and the discharge was serosanguinous. A fine needle aspirate was collected and four smears made for cytological evaluation which revealed aggregates of variably sized, polygonal epithelial cells with moderate anisocytosis and anisokaryosis and occasional multinucleated cells within a background of moderate haemorrhage and mild suppurative to macrophagic inflammation, consistent with **mammary neoplasia**. Mammary tumours in guinea pigs are common in animals over three years of age, with males and females equally affected. Both benign and malignant types are seen, and surgical excision

is the mainstay of treatment, but the outcome in this case is unknown.

Amphibian

An Archey's frog (*Leiopelma archeyi*) died shortly after being presented for veterinary care with a skin wound. Histopathological examination of fixed tissues revealed a peracute dermatitis with plant material, mixed bacteria and Zygomycetes environmental fungal hyphae. These changes were most likely the result of trauma. Within the ovarian tissue was a necrotising and granulomatous oophoritis with multiple oval 2–3 µm acid-fast (Ziehl–Neelsen)-positive, variably gram-positive, PAS-negative organisms consistent with microsporidia atypical fungal spores. **Microsporidia atypical fungi** were once thought to be a type of protozoa but are currently considered to be atypical fungi without mitochondria. They have been described in amphibians and seen previously in New Zealand. In this case they may have been causing subclinical disease.

IDEXX Laboratories

Bovine

During April a 6-year-old crossbreed cow in a herd of unknown size near New Plymouth had decreased body condition, decreased milk production and diarrhoea. The cow tested positive on the serological Johne's screening test, indicating *Mycobacterium avium* subsp. *paratuberculosis* infection. In addition, on chemistry tests the enzyme gamma-glutamyl transferase (GGT) was markedly elevated at 438 IU/L (reference range 0–36) suggesting concurrent mild-to-moderate biliary damage. This was consistent with concurrent sporidesmin toxicity (facial eczema). Facial eczema is typically seen in late summer months when sporidesmin spore counts are high.

A 9-month-old calf from a herd of unknown size in Waikato showed decreased body condition two weeks after being drenched. A faecal sample and serum were submitted to the laboratory for testing. The animal tested negative for bovine viral diarrhoea (BVD) virus antigen on serology. On faecal culture, *Yersinia*

pseudotuberculosis was isolated. The strongyle egg count was 150 eggs per gram (epg). In cattle, an epg less than 300 is considered low (Forbes, 2017). The clinical signs in this case were primarily attributed to yersiniosis, with strongyles likely contributing to the loss of body condition. Yersiniosis is caused by an overgrowth of this otherwise normal gut bacterium. Outbreaks result in diarrhoea in affected calves and often occur in early winter or early spring. It may be exacerbated during heavy rain due to the ability of the bacterium to survive and grow in the environment at low temperatures.

A mixed-breed dairy herd on a property near New Plymouth had calves from two different mobs develop skin lesions that were suspected to be facial eczema. The animals also developed diarrhoea, coughing and fever. The calves had been drenched 10–20 days previously and before that the previous drenching had been four months earlier. Samples from five animals were submitted for testing. On faecal culture, samples from three of the five animals yielded growth of *Yersinia pseudotuberculosis*. The faecal egg count and GGT enzyme results were unremarkable. Yersiniosis was attributed to being the primary cause for diarrhoea in this herd. Facial eczema was not supported with the normal GGT levels; however, there was some haemolysis of the samples, which may have falsely decreased the GGT level. Samples of lungs were not examined and a cause for the coughing was not determined, but there may have been a concurrent or secondary respiratory infection.

A dairy cow on a farm near Palmerston North developed scours. On faecal culture, *Salmonella Bovismorbicans* was isolated. The red blood cell variables were relatively elevated and attributed to dehydration. In addition, there was a neutropaenia and a left shift, indicating neutrophil toxicity, which was consistent with the acute inflammation caused by salmonellosis. *Salmonella* is a zoonotic organism and a potential health risk to people who work closely with infected animals. In cattle, it has typically been associated

with diarrhoea, toxemia and abortion.

Beef cows in a herd of unknown size in Nelson were showing a loss of body condition following calf weaning and a summer drought. Chemistry results showed decreased iodine levels at 52 µg/L (normal range is 65–400) (Puls, 1988). In addition, the serum selenium levels were low at a mean value of 80 nmol/L (reference range is 150–3,500). **Iodine and selenium deficiency** will negatively affect dairy cows by decreasing energy metabolism, milk production, disease resistance, reproductive ability and calf viability.

A 2-year-old dairy cow on a property in Waikato had a humerus fracture. Serum copper levels were low at 5.2 µmol/L (reference range 8.0–20.0). Adequate copper intake is necessary for optimal growth, production, immunity, reproduction and calf viability. **Copper deficiency** will negatively affect these factors.

A 1-year-old heifer on a property near New Plymouth died acutely. A post-mortem examination was conducted shortly after death and the carcass was fresh; however, the gastrointestinal tract contents were notably foul smelling. Samples were submitted for culture and histopathology. On histopathology, intranuclear inclusions were noted in some endothelial cells in the mucosa. A presumptive diagnosis of **bovine adenoviral enteritis** was made based on the histology findings. Ideally, kidney sections should be checked for adenoviral inclusions. This virus localises in the endothelial cells of blood vessels in various organs, resulting in thrombosis and focal ischaemic necrosis. Bovine adenoviral enteritis is a sporadic disease that may affect animals that are immunocompromised by stress or with concurrent BVD infection.

A dairy herd of unknown size in Waikato had a history of positive Johne's disease milk test results. Johne's disease is caused by *Mycobacterium avium* subsp. *paratuberculosis*. Blood samples from 11 cows were submitted for screening serology tests. A total of 9 out of the 11 animals tested were positive on the ELISA test, confirming

that this herd was infected. Johne's disease is endemic in cattle and sheep in New Zealand and has spread to farmed deer.

Beef bulls were grazing paddocks overgrown with gravel groundsel (*Senecio skirrhodon*) in Northland. One bull collapsed and was euthanased. Samples were collected for histology and blood chemistry. Chemistry results revealed a cholestatic hepatopathy and on histology of the liver sample there was evidence of liver cell damage. Gravel groundsel contains **pyrrolizidine alkaloids** and can cause liver damage. Plants vary in their toxicity depending on the season and from year to year. In follow-up to this, serum samples from seven bulls were submitted to the laboratory for liver function tests. The GGT enzyme levels were high with an average of 61 IU/L (normal range is 0–36), with the highest level being 116 IU/L. These results supported the suspicion that the bulls had a cholestatic hepatopathy and the cause was suspected to be ingestion of excessive amounts of gravel groundsel.

In late June, a 9-year-old dairy cow on a property in South Taranaki became ill with an increased heart rate, increased respiratory rate, fever, anaemia, jaundice and decreased feed intake. Based on these clinical signs, *Theileria* was suspected but deemed unusual for the time of year. Blood samples were sent to the laboratory and *Theileria* organisms were identified on blood smears. The total blood count confirmed a severe regenerative anaemia with a haematocrit of 0.11L/L (litre of cells per litre of blood; normal range is 0.24–0.40).

Ovine

Five lambs in a mob of 11 sheep on an Auckland property developed dags and one lamb subsequently died. The veterinarian was unsure about when the last drenching had been given and suspected it had been the previous summer. A faecal sample was submitted for analysis. The **strongyle** count was 700 epg (a count of 600–2,000 is considered moderate) (McKenna, 1981). Low numbers of coccidia oocysts and *Moniezia* eggs

were also found. Internal parasites were attributed to being the main cause for the clinical signs in this mob. Drenching was advised.

At a property in Manawatū there were 10 lamb deaths out of a mob of 260 over several days. On post-mortem examination, microabscessation, necrotising lymphadenitis and signs of septicaemia were noted. Mesenteric lymph nodes were sampled for microbial culture and yielded moderate growth of *Mannheimia haemolytica* (previously *Pasteurella haemolytica*). Mannheimiosis in sheep is typically an infection in the lower respiratory tract that can spread to affect joints and cause septic arthritis, especially in young lambs.

In a group of six 1-year-old Suffolk sheep on a lifestyle property outside Auckland city, one animal was found in lateral recumbency. This lamb was severely anaemic, with an elevated heart rate and no gastrointestinal sounds. It was decided to euthanase the animal and faecal samples were submitted for testing. The strongyle egg count was 53,750 epg. In sheep, particularly those under two years old, a count greater than 200 epg has potential economic impact, while a count greater than 500 epg is considered high enough to warrant treatment and pasture management. Severe **strongylosis** is attributed to being the cause of death in this lamb. Given the severe anaemia, it is likely that *Haemonchus contortus* (barber's pole worm) was a significant constituent of the strongyles as this worm attaches to the lining of the gastrointestinal tract and feeds on blood, causing anaemia and weakness. In high enough numbers, worm burdens can lead to death.

Camelid

A 1-year-old male llama on a rural property outside Auckland developed diarrhoea, and became lethargic, dehydrated and emaciated. Faecal samples were collected two days apart and submitted for testing. The **strongyle** egg counts were 5,050 epg and 10,550 epg, respectively, over the two days. **Coccidia** oocyst levels were low to moderate, scoring 1+ and 2+ (out of a range 0 to 4+), respectively,

over the two days. Gastrointestinal nematodes are known to undermine the overall health and productivity of camels and in this case the high strongyle epg was interpreted as significant in causing the clinical signs seen in this animal (Chhabra and Gupta, 2006). Coccidiosis was a likely secondary cause and exacerbated the effects of severe strongylosis in this llama.

Equine

A horse of unknown age and gender on a property in Hauraki had a history of chronic diarrhoea with weight loss, watery diarrhoea and ventral oedema. Faecal and blood samples were tested. The faecal culture yielded growth of *Campylobacter jejuni* and was negative for *Salmonella*. On blood chemistry testing, a marked hypoalbuminaemic hypoproteinaemia was noted with a total protein level of 38 g/L (reference range 53–73) and albumin of 15 g/L (reference range 29–41). The low protein level was attributed to loss via the gastrointestinal tract. The blood cell count revealed a monocytosis and neutropaenia that indicated an increased demand or sequestration of neutrophils at a site of inflammation, likely due to bacterial enteritis in this case. Monocytosis was indicative of the chronicity of the infection. *Campylobacter* species are potential zoonotic organisms that cause gastrointestinal disease such as diarrhoea and vomiting in multiple animal species and humans.

A 1-year-old Thoroughbred gelding in Manawatū presented with a history of having been very ill due to colitis associated with *Clostridium difficile* infection and requiring multiple urinary catheterisations. The horse developed urinary retention and a urine sample was submitted for testing. On urinalysis a high number of bacterial rods with blood were observed, and on culture yielded a heavy growth of a **multi-drug resistant *Escherichia coli*** isolate. Based on the culture results, it was advised that strict infection control measures be implemented, such as contact precautions, hand hygiene, isolation and restriction of patient

movement, intensive cleaning of the environment that the patient frequents and minimising visitor contact. Infection with *E. coli* is usually treated with antibiotics such as tetracyclines, sulfonamides, cephalosporins, macrolides and aminoglycosides. However, these bacteria have developed resistance and are ubiquitous in the gastrointestinal tract, which has strengthened the development of antimicrobial resistance in this group (Kabir et al., 2024).

Canine

A 10-week-old Pomeranian puppy in Waikato developed diarrhoea, decreased appetite and had two episodes of vomiting. A parvovirus rapid test was done and had a negative result. A faecal sample was submitted for a complete gastrointestinal disease panel. Faecal examination revealed extremely high numbers of **Coccidia** oocysts (scored 4+ out of a range of 0 to 4+). In addition, PCR testing revealed positive results for **Cryptosporidium** and **Giardia**. On microbial culture, **Campylobacter jejuni** was isolated. The culture result was negative for *Salmonella* and *Yersinia* species. This puppy had multiple coinfections of pathogenic organisms, all contributing to the clinical signs observed. Of these infectious agents, *Giardia*, *Cryptosporidium* and *Campylobacter* spp. have zoonotic potential. It was not clear whether this animal was part of a litter or group of other puppies showing similar signs. Environmental management, such as disinfection, together with individual treatment was advised as vital to controlling this puppy's infections as well as other pups in the household or on the property.

Avian

Faecal samples were submitted from a kiwi of unknown age and gender that was being housed at a conservation facility. Clinical signs were not indicated. The sample was positive for ventricular worm and 480 **coccidia** oocysts were counted. **Ventricular nematodiasis** is described in kiwi with typically nonspecific clinical signs that include inappetence, anaemia,

emaciation, perching low and a fluffed-up appearance. Overwhelming infections can cause peracute death without overt signs. Coccidiosis is likely to exacerbate gastrointestinal pathology in such cases.

Rodent

A 5-year-old guinea pig from Auckland develop a large mass on the ventral neck that was described as being baseball-sized, fluctuant and not communicating with the jaw bone. A few firmer masses, suspected to be lymph nodes, were present within the large fluctuant swelling. The axillary lymph nodes were also enlarged. Fine needle aspirate smears were submitted to the laboratory for cytology. In addition, the animal had developed a purulent nasal discharge from one nostril. The smears revealed a population of round cells that were consistent with **lymphoma**. Lymphoid neoplasia is reported less commonly in guinea pigs compared with other species. However, some reports have included leukaemia and lymphoma that is widespread or affecting multiple lymph nodes, as well as lymphoma in the eyes and skin.

SVS

Bovine

In late April, a mob of 4-week-old calves from Waikato presented with bloody diarrhoea. Two animals were recumbent and one of these died while being examined. Faecal culture for *Salmonella* and *Yersinia* was negative. Parasitology revealed large numbers of coccidial oocysts (> 250,000 oocysts per gram). On histology there was a severe necrotising enteritis with large numbers of coccidia, confirming **coccidiosis** as the cause of diarrhoea and death.

In Waikato a mob of 9-month-old Jersey heifers presented with illthrift. Some animals also had diarrhoea, while others had pyrexia. Serum samples were taken from three animals and all animals had serum selenium levels < 50 nmol/L (reference range 150–1,500) suggesting **selenium deficiency**.

In early May, four beef cows from Northland died after presenting neurological signs for 24 hours. Two

more animals died one week later. The animals had been grazing a paddock where treated timber had previously been burned. Kidneys from two animals had arsenic levels of 7.2 and 7.8 mg/kg. Levels above 2 mg/kg are considered abnormal and levels > 4 mg/kg confirm **arsenic toxicity**.

In May, a 4-year-old Friesian cow from Northland presented with diarrhoea, fever, weight loss and lethargy. A faecal culture detected the presence of **Salmonella Emek**. This is an uncommon *Salmonella* serovar that was first reported in New Zealand cattle in 2008 (Bingham, 2008) and has since been reported sporadically.

Four yearling crossbred beef calves initially presented with illthrift and two subsequently died. Faecal samples in the two remaining calves were taken and in-house parasitology revealed no parasitism or coccidia. A faecal culture was negative for *Salmonella*, *Yersinia* and *Campylobacter*. PCR for bovine viral diarrhoea (BVD) was negative and gamma-glutamyl transferase (GGT) was normal. Serum zinc was markedly elevated at 240 and 300 µmol/L (facial eczema protective range 20–35) consistent with **zinc toxicity**.

In mid-May, a 10-month-old dairy heifer presented with illthrift and scouring. PCR for BVD was negative and no parasite eggs were seen on faecal flotation. A faecal culture revealed the presence of **Salmonella Enteritidis**.

A 1-year-old mixed-breed heifer presented with bilateral corneal oedema as well as nasal, oral and vulvar lesions. PCR for **ovine herpesvirus-2** was positive, confirming **malignant catarrhal fever**.

In late May, an 8-month-old bull died five days after being transported from Waikato to Northland. No lesions were noted on postmortem and faecal cultures for *Yersinia* and *Salmonella* were negative. On histology of the small intestine there were several amphophilic intranuclear inclusions within endothelial cells of the superficial mucosa, suggesting **bovine adenovirus** infection as the cause of death in this animal.

In late May, two Friesian cows from Waikato presented acutely with anorexia, depression and recumbency. Both animals had marked increases in GLDH (2,553 and 2,651 U/L; reference range 8–41) and more modest increases in GGT (274 and 263 U/L; reference range 1–36). One of the cows died and histology of the liver showed severe centrilobular to midzonal hepatocellular necrosis. Liver copper was 6,200 µmol/kg (reference range 95–2,000) confirming **copper toxicity**. Liver biopsies from eight other animals in the herd showed copper levels of 1,700 to 4,700 µmol/kg with a mean level of 3,138 µmol/kg.

Ovine

A mob of ewes from Coromandel presented with crusty erosions on the muzzle and biopsies of the lesions were taken. Histology showed chronic proliferative and erosive dermatitis with intracytoplasmic viral inclusions consistent with ovine parapoxvirus, confirming the clinician's suspicion of **scabby mouth** (also called orf). The virus mostly affects sheep and goats, but can also cause lesions in humans, most often on the hands and forearms.

In Waikato, two animals died in a mob of 15 mixed breed ewes. The remaining animals were ill-thrifty and some had haemorrhagic diarrhoea and pale mucous membranes. Faecal culture for *Salmonella* was negative. A faecal egg count from three animals revealed high strongyle loads (1,850 to 3,250 eggs per gram) consistent with **parasitism**.

On an Auckland lifestyle block, fifteen 9-month-old Wiltshire lambs out of 21 presented with severe facial and submandibular oedema (bottle jaw) as well as ascites, anaemia, weight loss and weakness. The lambs had last been drenched four months before presentation. A pooled faecal egg count revealed 10,860 strongyle eggs per gram of faeces and a larval culture showed 75 percent *Haemonchus* sp., 20 percent *Cooperia* sp., 3 percent *Trichostrongylus* sp., and 2 percent *Oesophagostomum* or *Chabertia* sp. This is consistent with severe **haemonchosis**.

In late June, several female hoggets from Hawke's Bay died suddenly. The animals were in good body condition. Post-mortem examination of two animals showed abomasitis and enteritis. On histology, there was severe, acute and superficial necrotising and erosive abomasitis and enteritis with numerous gram-positive coccobacilli. Aerobic culture of intestinal contents yielded a heavy growth of *Listeria ivanovii*. *Salmonella* culture was negative. *Listeria* spp. are ubiquitous in the environment and culture alone does not confirm enteric listeriosis; however, given the histological lesions, this remains the most likely diagnosis in this case.

Cervine

In late April, a mob of 4-month-old weaner deer presented with illthrift, with 70 animals affected out of 200. Some had diarrhoea and six animals had died. A faecal egg count was negative, and no lungworm larvae were present on a Baermann's test. Faecal culture was positive for *Yersinia pseudotuberculosis*.

Canine

A 5-year-old male dog from Bay of Plenty presented with muscle tremors and lethargy a day after eating wild pork. Blood samples revealed an increase in serum creatine kinase (6,700 U/L; reference range 0–609) and AST (568 U/L; reference range 0–79), which confirmed muscle damage. This was consistent with **idiopathic myopathy of hunting dogs**, also called **Go Slow myopathy**, which has been associated with ingestion of wild pig (Hunt et al., 2018).

Feline

A 15-year-old Ragdoll male cat from Coromandel presented for recurrent intermittent haematuria in early May. A urine sediment confirmed the presence of 50–100 red blood cells per high power field (normal 0–5) and 5–10 white blood cells per high power field (normal 0–5), as well as occasional rod-shaped bacteria, confirming a **urinary tract infection**. A urine culture revealed the presence of *Salmonella Bovismorbificans*.

Salmonella is an uncommon urinary pathogen but *Salmonella* I:ROUGH-O:g,m,s:- was detected in the urine of a cat being fed *Salmonella*-contaminated uncooked diet (Fauth et al., 2015) and *Salmonella* Typhimurium pyelonephritis has been described in a cat being fed a regular diet (Wilson and Barrs, 2024). The organism could localise to the urinary tract via hematogenous dissemination or faecal contamination with ascending infection.

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MPI PACIFIC PARTNERS PROGRAMME

Annual reports from Ministry for Primary Industries

Pacific partnership programme in animal health and biosecurity

Introduction

There is a shortage of veterinarians and limited resources associated with animal health and biosecurity in Pacific Island countries and territories (PICT). Thus, there is limited ability for PICT to thoroughly investigate significant animal disease events. Many PICT also lack in-country diagnostic capability (for animal disease) to determine the aetiological cause of an event, making it difficult to exclude transboundary animal disease, zoonotic diseases and significant production-limiting diseases. The lack of these resources highlights potential risks for managing transboundary animal disease incursions and new and emerging disease threats. Therefore, strengthening animal health and biosecurity systems is crucial for PICT, with this resilience having flow-on benefits to the wider region. The programme runs within the New Zealand Ministry for Primary Industries (MPI), Biosecurity New Zealand Branch and is funded by the Ministry of Foreign Affairs and Trade (MFAT), with the aim of supporting capability development to combat current and future animal disease threats. Activities carried out between July 2023 and June 2024 are summarised.

Programme objective and scope

The objective of the programme is to support animal health and reduce the risk of transboundary animal disease incursions, including African swine fever (ASF) and foot and mouth disease (FMD), by supporting the integrity of biosecurity systems.

The scope of the New Zealand programme is sufficiently broad to cover most components of the biosecurity system. It is targeted towards a Polynesian subset of PICT with close links to New Zealand (Tonga, Samoa, Cook Islands and Niue), as well as two of the larger Melanesian countries in the region (Fiji and Vanuatu). Given the current ASF



Figure 1: PHOVAPS meeting: network of Pacific heads of veterinary and livestock sectors, with donor partners, uniting to set regional animal health and production priorities. November 2023, Fiji

pandemic and recent FMD incursion into Indonesia, the programme provides support to manage these threats as a primary goal. This support focuses on building strong foundations for, as well as enhancements to, each country's biosecurity system.

Approach

The team employs a novel approach to understand country-level needs and then prioritise the use of scarce resources for managing biosecurity and animal health needs relevant to each programme country. The approach is called a 'facilitated self-assessment' and empowers local staff and stakeholders to understand their own biosecurity system and to determine recommendations for improvement (McFadden et al., 2024). The process of facilitated self-assessment involves contributors (including government ministries, educators and livestock sector stakeholders) from the PICT mapping the biosecurity system to explore attributes of component activities. Understanding the system components from a 'bird's-eye' view (including pre-border, border and post-border activities) allows stakeholders (not the programme staff) to recommend improvements to address future needs. These recommendations are prioritised by contributors and a workplan developed. The main outcome for the PICT, where we have run the process, has been development of para-veterinary skills, a training programme on surveillance to support both general and active surveillance as well as laboratory training and

support. These initiatives are tailored to the country's skillset and needs. Active surveillance initiatives provide a framework for developing field and laboratory skills, alongside the aim of providing baseline data on animal diseases relevant to human health, trade and animal production in the PICT. In many of the PICT there have been no significant active surveillance programmes for 20–30 years. The team works with PICT border agencies to explore how the border system is functioning, identifying areas for development and supporting the undertaking of improvements.

The team has a strategic focus through our support and involvement in the governance of the Pacific Heads of Veterinary and Animal Production Services (PHOVAPS) network. PHOVAPS is the Pacific's key decision-making structure on issues relating to animal health, production, welfare and biosecurity. The PHOVAPS network has identified that developing animal health services by investing in paraveterinarians (paravets) and supporting capacity and capability building of this important group is a priority for the region. This investment will allow the delivery of more comprehensive animal disease surveillance, strengthen technical capacity in the animal production sector and implement a One Health approach. The team is dedicated to supporting the work of PHOVAPS to build up a Pacific animal health and production voice in international forums (**Figure 1**, previous page).



Figure 2: June 2024 – Niue livestock officers completing the 2024 SPC Paravet training course, with course tutors and Poi Okesene, Director Department of Agriculture, Forestry and Fisheries (DAFF) Niue



Figure 3: Certificate ceremony, March 2024 – Cook Island livestock officers receiving their SPC (Pacific Community) certificates after completing the 2023 SPC Paravet training course, with course tutors and Mrs Temarama Anguna-Kamana, Secretary of Agriculture and Head of Ministry (MOA) Cook Islands

Technical work

Surveillance has been used as the foundation for training on para-veterinary skills. Training is operational and has included animal handling, clinical examination, postmortem technique and sample collection, handling and processing. Thus, ministry staff have had opportunities to be involved in disease surveillance from the point of collection of specimens from animals on the farm, right up to packaging of samples for transport to an overseas

laboratory for testing (Figures 2 through 5).

Specialist training has also been provided on outbreak investigation and biosecurity response, in some cases using disease events occurring in the country as case examples for this training (McFadden et al., 2024). The aim is to ensure that all technical training delivery includes on-the-ground, hands-on field and laboratory training. In essence there is a specific purpose that embeds theory into practice, for example, generation

of surveillance data to inform on human and animal health risks, or investigating the cause of a disease event (Figure 6, page 109).

Animal health diagnostic support underpinning disease surveillance has been at two levels. The first has been to provide diagnostic support to our programme countries. Testing has been conducted as part of general baseline surveillance, but also as part of disease outbreak investigations. Diagnostic samples from four PICT have been received and processed from multiple species at New Zealand's Animal Health Laboratory, Wallaceville. Support for diagnostics has also included laboratory training and provision of equipment to enable in-country testing, and processing and packaging of samples for international transfer. Major equipment provided has included -20°C laboratory-grade freezers, sample weighing scales and centrifuges. The programme has also provided consumables for testing, as well as pen-side/rapid test kits (Figure 6, page 109).

The major in-country activities (following country-level workplans) conducted in the region over the past 12 months (July 2023–July 2024) are summarised in Table 1, next page.

Communications and awareness activities

Cook Islands Television News (CITV): Coverage of paravet summer school training in Rarotonga (8 September 2023).

Pacific Community SPC joint press release: Aspiring para-veterinarians in the Cook Islands undertake their final practical and written assessments (September 2023): See [https://www.spc.int/updates/news/joint-release/2023/09/newly-opened-summer-school-for-cook-islands-para-veterinarians#:~:text=The%20Pacific%20Community%20\(SPC\)%2C,training%20programme%20launched%20in%-20April](https://www.spc.int/updates/news/joint-release/2023/09/newly-opened-summer-school-for-cook-islands-para-veterinarians#:~:text=The%20Pacific%20Community%20(SPC)%2C,training%20programme%20launched%20in%-20April)

Pacific Heads of Veterinary and Animal Production Services (PHOVAPS) Meeting (November 2023): [Pacific heads chart way forward for](#)



Figure 4: Training with the Biosecurity Authority of Fiji (BAF) included members of the Plant and Animal Health teams at Koronivia. Front row: Divya Kumar (BAF), Swartika Prasad (BAF). Back row: Dr Chaminda Dissanayake (CVO BAF), Panapasa Rakuita (BAF), Oliver Quinn (NZ MPI), Virisila Rasousou (BAF)



Figure 5: The Tongan livestock team were joined by other students taking part in the SPC Paravet Course orientation week (May 2024), which included a workshop focused on One Health. This initiative aimed to communicate surveillance findings and help develop a strategy for zoonotic disease risk management in Tonga. Agencies represented included Ministry of Health, Food Safety Agency,

veterinary and animal production services | The Pacific Community (spc.int)

CITV: Coverage of Paravet refresher training with Ma'uke Livestock Division (4 April 2024).

TV News Tonga Broadcasting Commission: Coverage of One Health workshop in Tongatapu (May 2024).

Pacific Community SPC media release: Paravet training boosts animal health capability in Niue (June 2024): <https://www.spc.int/updates/news/>

[media-release/2024/06/paravet-course-boosts-niue-animal-health-care-capabilities](https://www.spc.int/updates/news/)

TV News Broadcasting Corporation of Niue: Coverage of Paravet 'summer school' in Niue (June 2024): <https://www.facebook.com/share/v/dDVgvgYZabKvq9GV/?mibextid=oFDknk>

Team overview

Technical experts from MPI who run or have contributed to the MPI Pacific Partnership Programme over the last 12 months to support animal health supporting animal health and biosecurity in the Pacific islands are:

- Olivia Patty PhD, MSc, BSc: 22 years of science experience starting off in ecology-based field work to microbiology and molecular genetics-based laboratory work with a focus on streptococcal infections in New Zealand horses. Most recently, experience as a Biosecurity Intelligence Analyst and now a current focus on providing strategic and operational support on the Pacific animal health activities across Biosecurity New Zealand and for our Pacific partner countries.
- Andy McFadden BVSc, MVS (Epidemiology): 14 years in clinical practice; 19 years as a veterinary epidemiologist, with a focus on animal disease investigation and surveillance, including 10 years associated with supporting animal health programmes in developing countries (South East and East Asia, the Pacific).
- Oliver Quinn PhD, PGDE, BSc: 20 years' experience in the science and diagnostics field with a focus on diagnostics of exotic animal disease. A current focus is on supporting and developing diagnostics and baseline disease assessments in our Pacific partner countries.
- Tom Rawdon BVSc, DBR, MSc (Epidemiology): 14 years in clinical practice; 21 years as a veterinary epidemiologist. Core work areas include disease and pest investigation, surveillance and response activities in New Zealand, and involvement in

continued page 110



Figure 6: (Left) Ministry staff from DAFF Niue participating in the SPC 'Summer School' para-veterinary skills training, supported by NZ MPI, SPC and Bryan Gartrell (RockVets). Here participants learn skills to clinically examine poultry and take temperatures. This hands-on week is the culmination of a 16-week course which also included the students' final written and practical examinations. (Centre) Animal health field and lab skills training was extended to the Pa Enua of the Cook Islands. This was a valuable opportunity for trained paravets from Ma'uke and Rarotonga to extend skills development to other livestock officers from the outer islands. (Right) Diagnostic training was designed to be fit for purpose for the specific PICT. In Fiji, focus of support has included honey bees, incorporating surveillance design, processing bee samples and molecular diagnostics, to assess prevalence and spread of American foulbrood

Table 1: Significant in-country training and field activities conducted over the last 12 months in Pacific island countries and territories

Month	Country	Activity
August 2023	Vanuatu	Technical assistance provided to Vanuatu Ministry of Agriculture, Livestock, Forestry, Fisheries and Biosecurity (MALFFB) for livestock recovery efforts following cyclones Judy and Kevin (Figure 7).
September 2023	Cook Islands	SPC 'Summer School' paraveterinary skills training week, including final written and practical examinations. Training delivered by MPI with support from veterinarian Michael Baer (Te Are Manu Veterinary Clinic, Cook Islands), and Peter Thorner (Australian Department of Agriculture, Fisheries and Forestry – DAFF).
September 2023	Tonga	Syndromic surveillance workshop covering theoretical and practical application of surveillance and disease investigation, including hands-on field, postmortem and laboratory practical training.
October 2023	Niue	Survey review and design workshop, with initiation of baseline surveillance. Workshop covered previous survey findings from Niue, the theory behind surveillance and practical training of sample collection and laboratory processing as part of an active surveillance initiative.
October 2023	Samoa	Syndromic surveillance workshop focused on surveillance design for key agents of relevance to Samoa. Paravet skills training included field and laboratory skills.
November 2023	Fiji	Rejuvenation of the Pacific Heads of Veterinary and Animal Production Services (PHOVAPS) network with its first in-person meeting since inception to unite in regional priorities resulting in a 2-year interim workplan.
November 2023	Vanuatu	Biosecurity, disease investigation and surveillance design workshop for key species (cattle, sheep and chickens) in Vanuatu. Practical training on field skills including sample collection (blood, swabs), postmortem technique and farm biosecurity protocols. Laboratory training included general skills (sample processing, use of RAT tests for FMD) and advanced skills (focused on lab staff) around DNA extraction and processing of samples for PCR.
January 2024	Samoa	Workshops to scope border processes and system support activities with the Ministry of Agriculture and Fisheries Biosecurity teams.
February 2024	Samoa	Disease investigation skills including sampling, postmortem and lab skills. Surveillance design theory and components with initiation focused on key agents relevant to Samoa.
March 2024	Cook Islands	Animal health field and lab skills training extended to the Pa Enua of the Cook Islands. SPC-trained paravets from Ma'uke and Rarotonga extend skills development to other livestock officers from the outer islands.
May 2024	Tonga	One Health workshop, with practical lab and field skills. The workshop formed part of the orientation and initiation for the SPC Paravet training course.
May 2024	Fiji	Surveillance implementation for American foulbrood focused on molecular diagnostic training covering practical DNA extraction and PCR testing skills.
June 2024	Niue	Paravet training 'Summer School'. A para-veterinary skills training week, including final written and practical examinations. Delivered in conjunction with Elenoa Salele from SPC and Bryan Gartrell, lead veterinarian for Rock Vets, Niue.



Figure 7: Technical assistance was provided to Vanuatu Ministry of Agriculture for livestock recovery efforts following cyclones Judy and Kevin. Here Chris Morley meets Animal Health Officers at the TAFEA head office and breeding centre

overseas disease responses and/or research programmes, chiefly in South East Asia, Australia and the United States. Current role involves field operations training and surveillance delivery for the Pacific programme.

- Siosifa Fifita BVSc, BSc, Associate of Sci Dipl.: Former Head of Livestock Division, Tonga MAFF; Animal Health and Production Officer; SPC, duties include design and delivery of the SPC Para-veterinary Training Programme in the PICT (SPC Animal Health Division). Expert Pasifika veterinary adviser to the programme.
- Chris Morley BVSc, MVPHMgt, MANZCVS (Epidemiology): 25 years' professional experience in animal health, biosecurity, readiness and response, risk management, strategy, policy development, epidemiology and teaching. Chris has considerable leadership experience across many different sectors and cultures, having lived and worked in

Europe, North America, the Middle East, South East Asia, Africa and New Zealand.

- Bryan Gartrell BVSc. In practice for 50 years covering everything from mice to elephants. Involvement includes, early chemical capture of feral deer, New Zealand Communicable Diseases Centre, zoo medicine, city animal control, avian medicine and wildlife ecosystems. Involved in volunteer work in the Pacific for over 30 years dealing with animal welfare and population control, within a One World-One Health framework. Currently lead vet for RockVets with a focus on animal health support to Niue.
- Michaela Hannah BSc: 20+ years' experience in animal diagnostic testing. Currently a scientist working in Animal Health Laboratory in the Immunology team.
- Elisha Sheeba BSc, MSc: Five years' experience in science research and diagnostic testing. Currently

a senior technician working in Animal Health Laboratory in the Immunology team.

- Howard Hamilton: 39 years' experience working within all parts of the border and other biosecurity teams within Biosecurity NZ, including response. Started as a Quarantine Officer and has had a range of leadership and project management roles.
- Diagnostic subject matter experts within the Animal Health Laboratory, Wallaceville, New Zealand: The programme has foundational support from a number of technical experts from the National Biocontainment Laboratory, who provide specialist advice and conduct diagnostics where needed as part of the surveillance component of the programme.

Staff publications

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SURVEILLANCE ENGAGEMENT AND SYSTEMS

Annual reports from Ministry for Primary Industries

Surveillance engagement and systems annual report

Whakataukī

Unuhia te rito o te harakeke, kei hea te kōmako e kō? Ui mai ki ahau, “He aha te mea nui o te Ao?” Māku e kī atu, “He atua, he taiao, he tangata.”

If you remove the central shoot of the flax bush, where will the bellbird find rest? If you were to ask me, “What is the most important thing in the world?” I would reply, “It is the celestial, the environment and the people.”

E ora tonu tēnei whakataukī I roto I ngā mahi katoa kei mua I a mātou. Ki a mātou o te tīma Surveillance Engagement and Systems, e kore tētahi ahuatanga e tū atu I tēnei whakaaro. Mā te tūhononga ki te Taiao, ka ora tonu ai te koiora. Mā te whakawhanaungatanga o tētahi ki tētahi, ka whakahaumaru ai te whenua taurikura mo ngā reanga e haere ake nei.

For the Surveillance Engagement and Systems team, this whakataukī captures how important relationships are to strong biosecurity outcomes. Relationships with the environment and relationships between people are key to protecting and preserving our biodiversity and unique way of life for future generations.

Team overview

The Surveillance Engagement and Systems (SES) team was formed in January 2023. The team has several key functions and works across the animal, aquatic, environment and plant health teams. Their major work programmes are the general surveillance engagement programme, the Biosecurity Surveillance Panel and the health and safety requirements for the Surveillance and Incursion Investigation group.

The SES group consists of five team members who are spread across the North Island representing different portfolios and work streams (**Table 1**).

As of July 2024, the SES team has merged with the Environment Health

Table 1: The Surveillance Engagement and Systems team

Name	Role	Years of Service	Location	Portfolio
Kelly McKenzie	Team Manager	12	Wallaceville	
Laura Nichols	Senior Adviser, Surveillance Programmes	13	Wallaceville	Surveillance Panel and Programmes
Jaco Greyling	Senior Adviser, Surveillance Systems	11	Wallaceville	Health & Safety and Systems
Yanika Te Paea Reiter	Senior Adviser, Biosecurity Engagement	2	Tauranga	Aquatic and Animal
Eileen-Rita Folwell	Senior Adviser, Biosecurity Engagement	7	Auckland	Plants, Environment and Reporting Channels

team within the Surveillance and Incursion Investigation group.

Team – Professional development and conference attendance

- Aotearoa Aquatic Diseases Symposium;
- New Zealand Marine Sciences Society Conference;
- NETS (National Education and Training Seminar) – New Zealand Biosecurity Institute;
- Tauranga Moana Biosecurity Capital (TMBC) Partners Forum;
- TMBC Biosecurity Excellence Symposium;
- Toi Ohomai Level 3 Te Reo course;
- Safeguard Health and Safety conference; and
- NZ Institute of Safety Management professional accreditation.

Work programmes

The Biosecurity Surveillance Panel (Panel)

The Biosecurity Surveillance and Incursion Investigation (BSII) group convenes a panel of providers for the provision of goods and services for all surveillance programmes related to post-border activity. The Panel is key to the success of our procurement of surveillance programmes. It fosters a strong relationship between the programme providers and BSII staff, enabling trust, respect and ease of service. The Senior Adviser Surveillance Programmes manages the overall relationship between both

parties and consolidates contract management and administration for the surveillance programmes across the BSII Group.

The Panel comprises the following providers:

- AsureQuality;
- Cawthron Institute;
- Gribbles Veterinary Pathology Ltd (now Awanui Ltd);
- IDEXX;
- Manaaki Whenua Landcare Research;
- Mosquito Consulting Service;
- NIWA;
- NZ Biosecurity Services;
- Rentokil;
- Scion;
- SPS Biosecurity Limited; and
- SVS Laboratories.

The Panel meets twice a year in a culture where members are free to raise issues and opportunities within a productive and constructive environment. The Panel met in November 2023.

Health and safety

The Senior Adviser Systems is a dedicated role responsible for the health and safety functions of the group, including our responsibility to our contractors. The Senior Adviser Systems has established a work programme to ensure compliance and identify opportunities for improvement for surveillance programmes and incursion investigations.

A key component of this programme is addressing the overlapping duties of PCBU's (Persons Conducting a Business or Undertaking), ensuring that all parties understand their responsibilities to prevent any gaps in the management of health and safety. This will ensure MPI is meeting its duties for health and safety with contractors/subcontractors and provide opportunities for standardisation and improvement.

A recent initiative is a protocol for working in and around water bodies, which includes appropriate training provided to relevant staff. This protocol is designed to protect staff members and equip them with the necessary tools to be safe and assist others working in these environments.

General surveillance engagement programme

General surveillance relies on external observers reporting in a timely manner through our reporting channels: the MPI exotic pest and disease hotline and the online form. Engagement is critical to ensuring this part of the biosecurity system functions effectively. The work led by the Engagement advisers with our stakeholders (including members of the public) and our Treaty partners, to foster, strengthen and maintain relationships with various sectors is fundamental to enhancing better biosecurity outcomes.

As agents of behavioural change, the engagement advisers educate groups (across all sectors: aquatic, environment, plant and animal) on new-to-New Zealand pests and diseases, through workshops, presentations, projects and events to:

- improve notifications in targeted primary industry communities and the general public;
- improve access to reporting infrastructure; and
- improve the capability of these groups to report.

Recent initiatives include efforts include:

- Northland community-led surveillance project (with the Aquatic Health team);

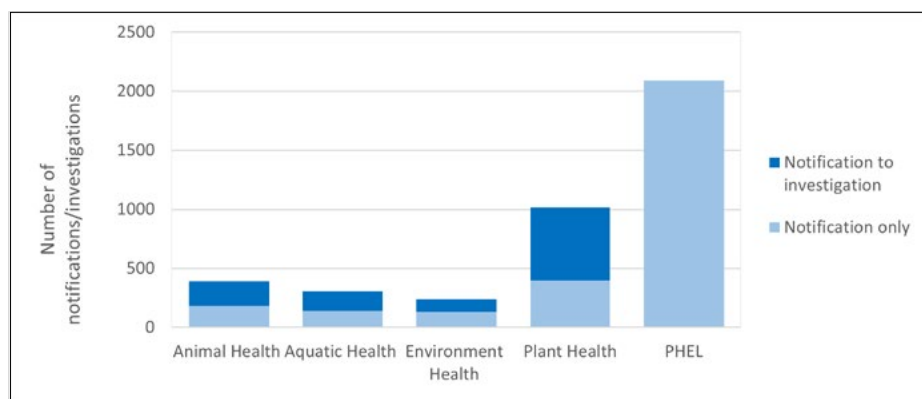


Figure 1: Pest and disease hotline notifications and investigations, 2023

- Biosecurity New Zealand stand at the Tauranga Careers expo;
- Hutchwilco Boat show with 'Clean Below Good to Go' council stand;
- Development of a dive log with the Bay of Plenty Regional Council (with information on marine pests);
- Coastguard tutor forum presentation;
- ApicultureNZ Gisborne beekeeper field day presentation;
- Development of the 'Exotic Animal Disease' leaflet;
- Toi Ohomai Institute of Technology Horticulture class presentation;
- Development of the 'High Pathogen Avian Influenza Reporting' factsheet;
- Plant & Food research student internship; and
- The Small Hive Beetle Project.

Reporting channels

The MPI exotic pest and disease hotline and online form received 7,064 notifications in 2023 and 4,308 were directed to the BSII teams or the Plant Health and Environment Laboratories. Of those referrals, 1,099 were investigated. **Figure 1** shows the breakdown of investigations across the aquatic, animal, plant and environment disciplines.

The online notification form received 953 notifications (24 percent of all notifications received by our teams) in 2023. This online tool complements the existing MPI exotic pest and disease hotline. It allows for the reported data to be refined before submission and supports

photo attachments, which is helpful for our Incursion Investigators and diagnostic colleagues.

Eye on nature

The General Surveillance and Plant Health and Environment Lab (PHEL) teams joined forces to present at the 'Eye on Nature' school days event, held in March at the Auckland Botanical Gardens. Their pest awareness workshop was presented to nearly 500 students, teachers and parents who visited their Biosecurity tent across the four days.

Eye on Nature works to educate communities about their environment and how to care for it. The theme this year was 'Act Local: Grow with Te Taiao', with the goal of empowering our children to be the heroes of tomorrow for our environment.

Eileen-Rita Folwell (General Surveillance) and Joanna Mackisack (PHEL) created a workshop teaching



Figure 2: Eileen-Rita Folwell, Senior Adviser, Biosecurity Engagement with the game 'Pest or Pal?'



Figure 3: Left to right: Ants Harmer (BNZ RRS exotic caulerpa response), Leigh Takirau (Blake NZ and Pou kōkiri – Ngāti Paoa Ki Waiheke), Eileen-Rita Folwell (Surveillance Engagement), Sidney Wales (BNZ exotic caulerpa response), Miranda Andrews (Te Korowai o Waiheke), Yanika Reed (Surveillance Engagement), Jeanine Clarkin (Ngāti Paoa), Alice McSherry (Waiheke Marine Project Coordinator), Grant Crawford (WMP communications) and Blair Anderson (Ngāti Paoa)

the students the life cycles of two high-profile exotic pests, the brown marmorated stink bug and the spongy moth, and explained at which life stage they pose the biggest threat to New Zealand (**Figure 2**, previous page). The game 'Pest or Pal' then helped the group understand that not all the insects we find in our backyard pose a threat and what steps they should take if they see something new in their environment.

The event was an excellent opportunity to build pest awareness amongst the young audience and to motivate them to be curious about their own gardens and surroundings so they can react to change. This awareness leads to early detection in our communities and increases engagement in our biosecurity system.

Collaboration with Ngāti Paoa to enhance our general surveillance system

In collaboration with the Exotic Caulerpa Response team, the team delivered a marine pest and disease workshop hosted by Ngāti Paoa on Waiheke Island. The workshop, as part of year-long project with Waiheke Marine Project (WMP), featured presentations from Ngāti Paoa, WMP and Biosecurity New Zealand with emphasis on the vital role of early detection of new-to-New Zealand pests and diseases (**Figure 3**).

Participants engaged in interactive sessions, dividing into groups for demonstrations to distinguish native marine species from non-indigenous ones, simulating the process of reporting suspected pests to MPI and submitting samples to MPI's Animal Health Laboratory, Wallaceville, upon the request of an aquatic Incursion Investigator.

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Marine surveillance annual report

The targeted surveillance programme for non-indigenous marine species focuses surveillance activities on 12 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 Aotearoa 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://pierpestregister.mpi.govt.nz/>) under the Biosecurity Act 1993. These include primary target species that are not currently known to be present in New Zealand (e.g., the 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 locally present in various places around New Zealand (the Asian bag mussel *Arcuatula senhousia*, Australian droplet tunicate *Eudistoma elongatum*, Mediterranean fanworm *Sabella spallanzanii* and clubbed tunicate *Styela clava*).

All unidentified suspect samples collected during targeted and general surveillance activities are sent for identification to Marine Invasives Taxonomic Service (MITS). These include public submissions via MPI's exotic pest and disease hotline and online notification system. All identifications are subsequently entered into the marine non-native species database for future reference. The data are accessible at www.marinebiosecurity.org.nz.

This report includes summary information for the Marine High Risk Site Surveillance (MHRSS) national programme run by the Ministry for Primary Industries (MPI), for the winter and summer periods from May 2023 to April 2024 inclusive, and the Marine Invasives Taxonomic Service (MITS) provided by the National Institute for Water & Atmospheric Research (NIWA) and funded by MPI, from July 2023 to June 2024.

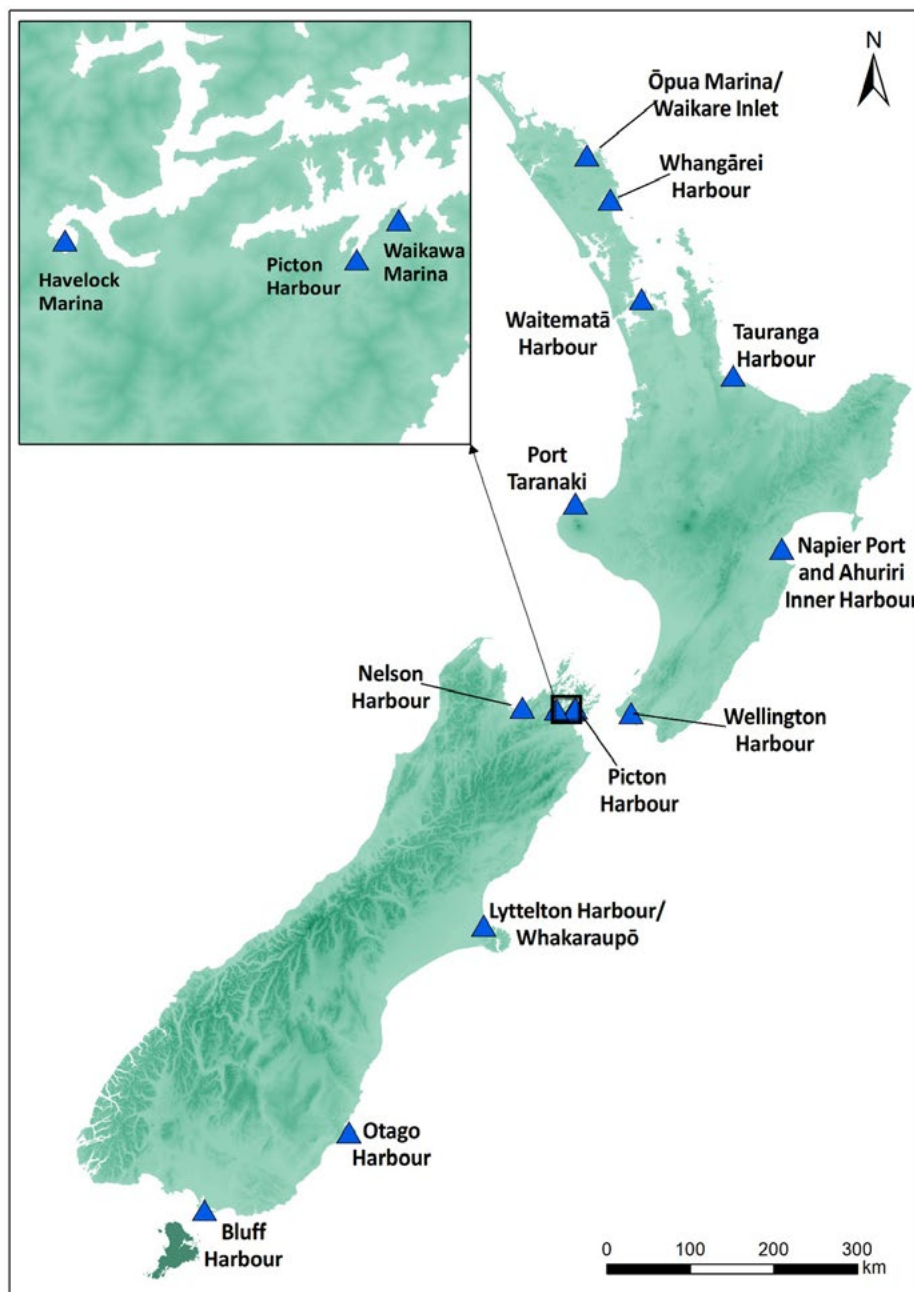


Figure 1: Locations of the 12 high-risk locations covered by the National Marine High Risk Site Surveillance programme

Sample collection

In total, 3,198 sites were surveyed during the 2023 winter sampling period (May to September) and 3,185 sites were surveyed during the

summer sampling period (November 2023 to April 2024). These figures represent 101.7 percent and 101.6 percent of the target number of sites, respectively. Habitats sampled

Table 1: Sampling methods used for high-risk sites surveyed in 2023/24

Representative list of non-indigenous species that are likely to be detected by each sampling 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	<i>Arcuatula senhousia</i> <i>Asterias amurensis</i> <i>Caulerpa taxifolia</i> <i>Carcinus maenas</i> <i>Eudistoma elongatum</i> <i>Potamocorbula amurensis</i> <i>Sabella spallanzanii</i> <i>Styela clava</i>	<i>Acentrogobius pflaumii</i> <i>Chaetopterus</i> sp. <i>Charybdis japonica</i> <i>Didemnum vexillum</i> <i>Grateloupia turuturu</i> <i>Hypnea</i> sp. <i>Metapenaeus bennettiae</i> <i>Pyromaia tuberculata</i> <i>Theora lubrica</i> <i>Tritia burchardi</i> <i>Undaria pinnatifida</i>	Subtidal soft sediments. Particular focus on known shellfish beds (for <i>Asterias</i>) and areas next to public access (e.g., wharves, boat ramps, marinas for <i>Caulerpa</i> , <i>Sabella</i>).	Narrow width but 100-m tow length and high replication enables a reasonably large area to be sampled (≈ 3,500 m 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	<i>Asterias amurensis</i> <i>Carcinus maenas</i> <i>Eriocheir sinensis</i>	<i>Acentrogobius pflaumii</i> <i>Charybdis japonica</i> <i>Metapenaeus bennettiae</i> <i>Oratosquilla oratoria</i> <i>Pyromaia tuberculata</i> <i>Styela clava</i>¹	Adjacent to wharf pilings and other artificial habitats. Shores and shallow subtidal habitats, breakwalls and saltmarshes, 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 and 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., <i>Styela clava</i> attached to masking crabs).
Crab condos	<i>Carcinus maenas</i> <i>Eriocheir sinensis</i>	<i>Acentrogobius pflaumii</i> <i>Charybdis japonica</i> <i>Metapenaeus bennettiae</i> <i>Pyromaia tuberculata</i> <i>Tritia burchardi</i>	Intertidal and shallow subtidal banks of rivers. Particular focus on brackish-water habitats with complex physical structure (e.g., saltmarshes or fringing vegetation).	High replication possible. Availability of suitable estuarine habitat may limit deployment.	Effectively samples other species of crabs. Higher rates of detection of crabs than baited traps in some conditions.
Diver searches	<i>Arcuatula senhousia</i> <i>Asterias amurensis</i> <i>Carcinus maenas</i> <i>Caulerpa taxifolia</i> <i>Eriocheir sinensis</i> <i>Eudistoma elongatum</i> <i>Sabella spallanzanii</i> <i>Styela clava</i>	<i>Amathia verticillata</i> <i>Botrylloides giganteum</i> <i>Caprella mutica</i> <i>Chaetopterus</i> sp. <i>Charybdis japonica</i> <i>Clavelina lepadiformis</i> <i>Didemnum vexillum</i> <i>Grateloupia turuturu</i> <i>Hypnea</i> sp. <i>Pyromaia tuberculata</i> <i>Undaria pinnatifida</i>	Wharf and marina piles, 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	<i>Arcuatula senhousia</i> <i>Asterias amurensis</i> <i>Carcinus maenas</i> <i>Caulerpa taxifolia</i> <i>Eriocheir sinensis</i> <i>Eudistoma elongatum</i> <i>Sabella spallanzanii</i> <i>Styela clava</i>	<i>Amathia verticillata</i> <i>Chaetopterus</i> sp. <i>Charybdis japonica</i> <i>Clavelina lepadiformis</i> <i>Didemnum vexillum</i> <i>Grateloupia turuturu</i> <i>Hypnea</i> sp. <i>Undaria pinnatifida</i>	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 <i>Styela clava</i> . Access to intertidal areas may be limiting.

¹Incidentally, as specimens attached to masking crabs (*Notomithrax* spp.) caught in traps

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 (habitat traps) and diver and shore searches (**Table 1**).

No primary target species were detected during the survey period at any of the NMHRSS locations, but

at least one of the four secondary target species was found in eight of the locations surveyed (**Table 2**, next page). Additionally, one new-to-New Zealand species and seven range extensions of non-target non-

Table 2: Marine high-risk sites surveyed in 2023/24, and non-indigenous species found

Location	Sampling round	Target number of sites	Actual number of sites	Target species ¹	Non-target species
Ōpua	Winter 2023	248	253	<i>Eudistoma elongatum</i> , <i>Sabella spallanzanii</i> , <i>Styela clava</i>	<i>Acentrogobius pflaumii</i> , <i>Celleporaria nodulosa</i> , <i>Ectopleura</i> spp., <i>Omobranchus anolius</i> , <i>Pyromaia tuberculata</i> , <i>Theora lubrica</i> , <i>Tritia burchardi</i>
	Summer 2023/24	248	252	<i>Eudistoma elongatum</i> , <i>Sabella spallanzanii</i> , <i>Styela clava</i>	<i>Acentrogobius pflaumii</i> , <i>Agnezia</i> sp., <i>Botrylloides diegensis</i> , <i>Caprella scauroides</i> , <i>Celleporaria nodulosa</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Limaria orientalis</i> , <i>Omobranchus anolius</i> , <i>Oratosquilla oratoria</i> , <i>Polycera hedgpethi</i> , <i>Pyromaia tuberculata</i> , <i>Thecacera pennigera</i> , <i>Theora lubrica</i> , <i>Tritia burchardi</i>
Whangārei	Winter 2023	243	245	<i>Arcuatula senhousia</i> , <i>Eudistoma elongatum</i> , <i>Sabella spallanzanii</i> , <i>Styela clava</i>	<i>Acentrogobius pflaumii</i> , <i>Amathia verticillata</i> , <i>Arenigobius bifrenatus</i> , <i>Botrylloides diegensis</i> , <i>Botrylloides giganteus</i> , <i>Celleporaria nodulosa</i> , <i>Charybdis japonica</i> , <i>Ciona intestinalis</i> , <i>Ciona savignyi</i> , <i>Ciona</i> spp., <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Ficopomatus enigmaticus</i> , <i>Metapenaeus bennettiae</i> , <i>Omobranchus anolius</i> , <i>Polyandrocarpa zorritensis</i> , <i>Polycera hedgpethi</i> , <i>Pyromaia tuberculata</i> , <i>Symplegma brakenhielmi</i> , <i>Thalamoporella californica</i> , <i>Thecacera pennigera</i> , <i>Theora lubrica</i> , <i>Tritia burchardi</i>
	Summer 2023/24	243	245	<i>Arcuatula senhousia</i> , <i>Eudistoma elongatum</i> , <i>Sabella spallanzanii</i> , <i>Styela clava</i>	<i>Acentrogobius pflaumii</i> , <i>Amathia verticillata</i> , <i>Arenigobius bifrenatus</i> , <i>Botrylloides diegensis</i> , <i>Celleporaria nodulosa</i> , <i>Charybdis japonica</i> , <i>Ciona intestinalis</i> , <i>Ciona savignyi</i> , <i>Ciona</i> spp., <i>Clavelina lepadiformis</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Ficopomatus enigmaticus</i> , <i>Metapenaeus bennettiae</i> , <i>Omobranchus anolius</i> , <i>Oratosquilla oratoria</i> , <i>Polyandrocarpa zorritensis</i> , <i>Pyromaia tuberculata</i> , <i>Symplegma brakenhielmi</i> , <i>Symplegma rubra</i> , <i>Thalamoporella californica</i> , <i>Theora lubrica</i> , <i>Tritia burchardi</i>
Auckland/ Waitematā	Winter 2023	486	503	<i>Arcuatula senhousia</i> , <i>Sabella spallanzanii</i> , <i>Styela clava</i>	<i>Acentrogobius pflaumii</i> , <i>Ascidia latesiphonica</i> , <i>Asciidiella aspersa</i> , <i>Botrylloides diegensis</i> , <i>Celleporaria nodulosa</i> , <i>Celleporaria umbonatoidea</i> , <i>Charybdis japonica</i> , <i>Ciona intestinalis</i> , <i>Ciona savignyi</i> , <i>Ciona</i> spp., <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Metapenaeus bennettiae</i> , <i>Oratosquilla oratoria</i> , <i>Polycera hedgpethi</i> , <i>Pyromaia tuberculata</i> , <i>Symplegma brakenhielmi</i> , <i>Thalamoporella californica</i> , <i>Theora lubrica</i> , <i>Tritia burchardi</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	486	506	<i>Sabella spallanzanii</i> , <i>Styela clava</i>	<i>Acentrogobius pflaumii</i> , <i>Amathia verticillata</i> , <i>Ascidia latesiphonica</i> , <i>Botrylloides diegensis</i> , <i>Celleporaria nodulosa</i> , <i>Charybdis japonica</i> , <i>Ciona intestinalis</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Metapenaeus bennettiae</i> , <i>Omobranchus anolius</i> , <i>Oratosquilla oratoria</i> , <i>Polyandrocarpa zorritensis</i> , <i>Polycera fujitai</i> , <i>Pyromaia tuberculata</i> , <i>Symplegma brakenhielmi</i> , <i>Thalamoporella californica</i> , <i>Theora lubrica</i> , <i>Tritia burchardi</i>
Tauranga	Winter 2023	243	247	<i>Styela clava</i>	<i>Amathia verticillata</i> , <i>Botrylloides diegensis</i> , <i>Celleporaria nodulosa</i> , <i>Charybdis japonica</i> , <i>Ciona intestinalis</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Parablennius tasmanianus</i> , <i>Pyromaia tuberculata</i> , <i>Tritia burchardi</i>
	Summer 2023/24	243	244	<i>Sabella spallanzanii</i>	<i>Botrylloides diegensis</i> , <i>Botrylloides giganteus</i> , <i>Celleporaria nodulosa</i> , <i>Charybdis japonica</i> , <i>Ciona intestinalis</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Ectopleura</i> spp., <i>Polycera hedgpethi</i> , <i>Pyromaia tuberculata</i> , <i>Thecacera pennigera</i> , <i>Undaria pinnatifida</i>
New Plymouth/ Port Taranaki	Winter 2023	243	246	None	<i>Botrylloides diegensis</i> , <i>Celleporaria nodulosa</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Lissoclinum perforatum</i> , <i>Polycera hedgpethi</i> , <i>Pyromaia tuberculata</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	232 ²	235	None	<i>Celleporaria nodulosa</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Grateloupia turuturu</i> , <i>Pachymeniopsis lanceolata</i> , <i>Pyromaia tuberculata</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
Napier	Winter 2023	243	245	None	<i>Botrylloides diegensis</i> , <i>Celleporaria umbonatoidea</i> , <i>Ciona intestinalis</i> , <i>Ciona savignyi</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Ficopomatus enigmaticus</i> , <i>Grateloupia turuturu</i> , <i>Lissoclinum perforatum</i> , <i>Pyromaia tuberculata</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	243	246	None	<i>Botrylloides diegensis</i> , <i>Ciona intestinalis</i> , <i>Ciona savignyi</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Ficopomatus enigmaticus</i> , <i>Lissoclinum perforatum</i> , <i>Polycera hedgpethi</i> , <i>Pyromaia tuberculata</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>

Continued p118

Table 2: Marine high-risk sites surveyed in 2023/24, and non-indigenous species found (continued)

Location	Sampling round	Target number of sites	Actual number of sites	Target species ¹	Non-target species
Wellington	Winter 2023	243	247	None	<i>Botrylloides diegensis</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Dactylosiphon bullosus</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Grateloupia turuturu</i> , <i>Polycera hedgpethi</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	243	248	None	<i>Botrylloides diegensis</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Grateloupia turuturu</i> , <i>Polycera hedgpethi</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
Picton and Havelock	Winter 2023	243	246	None	<i>Botrylloides diegensis</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Dactylosiphon bullosus</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Grateloupia turuturu</i> , <i>Polycera hedgpethi</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	243	246	<i>Styela clava</i>	<i>Botrylloides diegensis</i> , <i>Caprella mutica</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Ciona</i> spp., <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Grateloupia turuturu</i> , <i>Polycera hedgpethi</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
Nelson	Winter 2023	243	246	<i>Styela clava</i>	<i>Acentrogobius pflaumii</i> , <i>Amathia verticillata</i> , <i>Botrylloides diegensis</i> , <i>Celleporaria nodulosa</i> , <i>Celleporaria umbonatoidea</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Ciona</i> spp., <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Ectopleura</i> spp., <i>Grateloupia turuturu</i> , <i>Polyandrocarpa zorritensis</i> , <i>Polycera hedgpethi</i> , <i>Pyromaia tuberculata</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	243	243	<i>Styela clava</i>	<i>Acentrogobius pflaumii</i> , <i>Botrylloides diegensis</i> , <i>Celleporaria nodulosa</i> , <i>Celleporaria umbonatoidea</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Ciona</i> spp., <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Polyandrocarpa zorritensis</i> , <i>Polycera hedgpethi</i> , <i>Pyromaia tuberculata</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
Lyttelton	Winter 2023	243	247	<i>Sabella spallanzanii</i> , <i>Styela clava</i>	<i>Alcyonidium verrilli</i> (Figure 2, page 120), <i>Asciidiella aspersa</i> , <i>Botrylloides diegensis</i> , <i>Caprella mutica</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Ectopleura</i> spp., <i>Fushitsunagia catenata</i> , <i>Magallana gigas</i> , <i>Pachymeniopsis lanceolata</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	243	246	<i>Sabella spallanzanii</i> , <i>Styela clava</i>	<i>Asciidiella aspersa</i> , <i>Botrylloides diegensis</i> , <i>Caprella mutica</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Fushitsunagia catenata</i> , <i>Pachymeniopsis lanceolata</i> , <i>Theora lubrica</i> , <i>Undaria pinnatifida</i>
Otago	Winter 2023	243	245	None	<i>Asciidiella aspersa</i> , <i>Botrylloides diegensis</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Schizymenia apoda</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	243	246	<i>Styela clava</i>	<i>Asciidiella aspersa</i> , <i>Botrylloides diegensis</i> , <i>Ciona intestinalis</i> , <i>Ciona robusta</i> , <i>Ciona savignyi</i> , <i>Clavelina lepadiformis</i> , <i>Didemnum vexillum</i> , <i>Diplosoma listerianum</i> , <i>Undaria pinnatifida</i>
Bluff	Winter 2023	225	228	None	<i>Botrylloides diegensis</i> , <i>Caprella mutica</i> , <i>Didemnum patulum</i> , <i>Undaria pinnatifida</i>
	Summer 2023/24	225	238	None	<i>Asciidiella aspersa</i> , <i>Botrylloides diegensis</i> , <i>Caprella mutica</i> , <i>Didemnum patulum</i> , <i>Diplosoma listerianum</i> , <i>Undaria pinnatifida</i>

¹ Only secondary target species are listed, as no primary species were detected during these surveys

² By agreement with Biosecurity New Zealand, from summer 2023/24 onwards the total target number of sampling locations in Port Taranaki has been reduced compared with earlier surveys (from 243 down to 232), due to the relatively small size of the port in relation to benthic sled sampling effort. The number of benthic sled locations has been reduced (from 100 to 80) and the number of crab trap and diver search locations increased (from 80 to 84, and from 30 to 35, respectively), with several of those diver search locations taking place in a recreational vessel swing mooring area, which is difficult to sample with the benthic sled due to rocky benthos and associated entanglement hazards.

Table 3: Specimens collected and identified by Marine Invasives Taxonomic Service from each Marine High-Risk Site Surveillance sampling locality, 2023/24

Non-indigenous species are in **BOLD**. Range extensions are in **BLUE**. New to New Zealand are in **RED**. Sites are ordered geographically from north to south

Location	Taxonomic identification		Location of previous detections ¹
	Taxonomic group	Species	
Ōpua	Amphipod	<i>Caprella scauroides</i>	N/A
	Bryozoan	<i>Celleporaria nodulosa</i>	Port Tarakohe, Port Taranaki, Gisborne, Tauranga, Timaru, Waitematā and Whangārei harbours
	Gastropod	<i>Thecacera pennigera</i>	Waitematā and Whangārei harbours
Whangārei	Ascidian	<i>Cnemidocarpa</i> sp., <i>Thecacera pennigera</i> , <i>Ciona savignyi</i> , <i>Molgula mortenseni</i> , <i>Symplegma rubra</i>	Waitematā Harbour
	Decapod	<i>Oratosquilla oratoria</i>	Bay of Islands, Hokianga, Kaipara, Mangōnui, Raglan, Waitematā, Whangaroa and Whitianga harbours
Auckland/Waitematā	Ascidian	<i>Ascidella aspersa</i>	N/A
	Decapod	<i>Oratosquilla oratoria</i>	N/A
Tauranga	Ascidian	<i>Clavelina lepadiformis</i> , <i>Molgula mortenseni</i>	N/A
	Bivalve	<i>Venerupis largillierii</i>	N/A
	Fish	<i>Parablennius tasmanianus</i>	Napier Port and Ahuriri Inner Harbour
	Gastropod	<i>Aphelodoris luctuosa</i> , <i>Jorunna pantherina</i> , <i>Onchidella nigricans</i> , <i>Polycera hedgpethi</i> , <i>Thecacera pennigera</i>	Waitematā and Whangārei harbours
New Plymouth/Port Taranaki	Algae	<i>Cladostephus</i> sp., <i>Lindauera panpenfussii</i> , <i>Griffithsia crassiuscula</i> , <i>Plocamium</i> sp., <i>Sporochnus moorei</i>	N/A
	Anthozoan	<i>Epizoanthus</i> sp.	N/A
	Bryozoan	<i>Celleporaria nodulosa</i>	N/A
	Crab	<i>Metadromia wilsoni</i> , <i>Nectocarcinus antarcticus</i>	N/A
Napier	Ascidian	<i>Lissoclinum perforatum</i>	Port Taranaki
	Crab	<i>Ebalia laevis</i>	N/A
	Sponge	<i>Halichondria</i> sp.	N/A
Wellington	Ascidian	<i>Corella</i> sp.	N/A
Picton/Havelock	Ascidian	<i>Styela clava</i>	N/A
	Hydroid	<i>Hybocodon prolifer</i>	N/A
Nelson	Annelid	<i>Chaetopterus chaetopterus</i> -A, Sabellidae ²	N/A
	Anthozoan	<i>Anthopleura</i> sp.	
	Ascidian	<i>Agnezia glaciata</i>	N/A
Lyttelton	Ascidian	<i>Didemnum</i> sp., <i>Diplosoma listerianum</i>	N/A
	Algae	<i>Cladophora albida</i> , <i>Cladophora laetevirens</i>	N/A
	Bryozoan	<i>Alcyonidium verrilli</i>	N/A
Otago	Ascidian	<i>Polyclinum sluiteri</i>	N/A

¹ For species in the previous column that are detected range extensions in **BLUE**. This is only documented for non-indigenous species.

² Unidentified annelid belonging to the family Sabellidae

indigenous species were detected (Table 3). Among the samples submitted from other sources, 20 range extensions were detected (Table 4, next page).

Number of specimens collected by the NMHRSS and sent to MITS

In total, 50 specimens were sent to

MITS for identification: 20 from the winter survey and 30 from summer. Suspect specimens found at high-risk sites represented 13 major taxonomic groups and included 20 non-

Table 4: Range extensions of non-indigenous species identified by Marine Invasives Taxonomy Service via non-Marine High-Risk Site Surveillance activity, July 2023–June 2024

Location	Date ¹	Taxonomic identification	
		Taxonomic group	Species
Kawau Island	July	Alga	<i>Caulerpa parvifolia</i>
Nelson Haven, Nelson	July	Bivalve	<i>Arcuatula senhousia</i>
Mōhakatino estuary, Taranaki	July	Bivalve	<i>Arcuatula senhousia</i>
Tongaporutu estuary, Taranaki	July	Bivalve	<i>Arcuatula senhousia</i>
Halfmoon Bay, Stewart Island	November	Amphipod	<i>Caprella mutica</i>
Halfmoon Bay, Stewart Island	November	Amphipod	<i>Jassa marmorata</i>
Medlands Beach, Great Barrier Island	November	Alga	Exotic caulerpa ²
Easy Harbour, Stewart Island	November	Ascidian	<i>Didemnum patulum</i>
Cape Barrier, Great Barrier Island	December	Alga	Exotic caulerpa
Tūranganui Estuary, Gisborne	March	Bivalve	<i>Arcuatula senhousia</i>
Port Fitzroy, Great Barrier Island	March	Alga	Exotic caulerpa
East Bay, Queen Charlotte Sound	March	Ascidian	<i>Pyura doppelganger</i>
Little Barrier Island	March	Isopod	<i>Paracerceis sculpta</i>
Luncheon Cove, Anchor Island, Fiordland	April	Ascidian	<i>Didemnum patulum</i>
Mokohinau Islands	April	Alga	<i>Caulerpa parvifolia</i>
Rākino Island	May	Alga	<i>Caulerpa parvifolia</i>
Fantail Bay, Coromandel Peninsula	May	Alga	Exotic caulerpa
Pipikaretu Beach, Otago Peninsula	June	Alga	<i>Undaria pinnatifida</i>
Slipper Island, Coromandel	June	Alga	<i>Undaria pinnatifida</i>
Omaha Cove, Leigh	June	Alga	<i>Caulerpa parvifolia</i>
Raglan	June	Crab	<i>Charybdis japonica</i>

¹ Date when the sample was submitted to MITS.
² Identified from images. Species differentiation of *Caulerpa brachypus* and *Caulerpa parvifolia* is only possible via molecular analysis.



Figure 2: Uncalcified branching bryozoan *Alcyonidium verrilli* identified for the first time in New Zealand during the Lyttelton 2023 winter survey as part of the National Marine High-Risk Site Surveillance programme. Photo: Chris Woods, NIWA

indigenous species (Table 3, previous page). One new-to-New Zealand species and seven range extensions of previously known non-indigenous species were detected during the NMHRSS surveys.

Number of specimens collected from other sources and sent to MITS

MITS also received 97 samples that were collected and submitted as part of MPI investigations into exotic

marine organisms from July 2023 to June 2024, generally after notification via the exotic pest and disease hotline with 21 range extensions being detected (Table 4). From all submissions to MITS, 170 specimens were identified. Identifications of samples submitted as part of MPI investigations into exotic marine organisms were completed rapidly, with identifications taking 1.3 days on average.

Additional resources for the MHRSS and MITS programmes

Anyone with an interest in marine biosecurity can access and download recent information on what has been recorded in New Zealand waters, where, and in many cases when, it was reported. Annual reports and the updated *New Zealand Marine Pest Identification Guide* (MPI, 2024) are available to read and download from <https://marinebiosecurity.org.nz/surveillance/> and <https://marinebiosecurity.org.nz/speciesid/>, respectively. For results from a specific surveillance location, email surveillance@mpi.govt.nz to be added to the distribution list. 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

The background of the page is a photograph of a shipwreck underwater. The ship's hull is visible, covered in coral and other marine life. The water is dark and murky, with some light filtering through from above. The ship's structure is partially obscured by the growth of marine organisms.

and other verified observations. 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 past reports commissioned by MPI or completed by NIWA.

References

MPI (2024). New Zealand marine pest identification guide. Wellington: Biosecurity New Zealand.

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Aquatic health surveillance and incursion investigation annual report

Tangaroa ki uta, Tangaroa ki tai.
E whakapono ana mātou ki te tino whakahirahiratanga o tēnei ao te ao ā Tangaroa. Ka noho manu tūtei e mātou i raro iho o te kaitiakitanga me te manaakitanga o te ao a Tangaroa hei ārai i ngā momo taru me ngā momo riha rāwaho, mō te painga o tātou ngā iwi o Aotearoa.

Tangaroa to the land, Tangaroa to the sea

This statement expresses the importance of our aquatic worlds. It embodies our belief that our aquatic environments are crucial to our wellbeing. We strive always to protect our waters from invasive pests and diseases, connecting to our unique way of life and special relationship with the aquatic worlds for the benefit of all New Zealanders

Overview

The Surveillance and Incursion Investigation (Aquatic Health) team has established capability in surveillance and incursion investigation, aquatic health diagnostics, data management systems integration, facilities and equipment. Key team outcomes include:

- strengthening surveillance for aquatic pests and diseases;
- supporting the future growth of the aquaculture industry through improved management of biosecurity risks (growth target of \$NZ3 billion in annual sales by 2035);
- protection of the aquatic environment; and
- building strong partnerships with Māori, other government agencies, industry and international agencies.

Team function

The core function of the Aquatic Health team is to rapidly detect and mitigate biosecurity risks from exotic aquatic pests and diseases. The aim is to protect primary production (e.g.,

aquaculture, fisheries and kaimoana), the environment and cultural values from harmful organisms. This is achieved by implementing national targeted and general surveillance programmes for high-risk exotic pests, and investigating suspected incursions of exotic pests and diseases.

The Aquatic Health team works in partnership with iwi/hapū, the aquaculture industry, other government agencies, research institutes and other MPI business units (e.g., Fisheries NZ, NZ Food Safety) and teams, often providing advice on aquatic pests and diseases across the biosecurity system. Incursion investigation is a critical foundation for early detection and is of particular importance for generating information on Aotearoa New Zealand’s aquatic disease status. This system provides assurance to New Zealand’s trading partners that a new or emerging disease would be rapidly discovered, and appropriate risk management measures implemented.

The role of MPI’s Aquatic Health biosecurity Incursion Investigators is to determine the potential presence and nature of the biosecurity risk from exotic aquatic pests and diseases. The investigation may then lead to a biosecurity response, depending on the type and magnitude of the risks identified.

The Aquatic Health team leads the national targeted surveillance programme for marine pests (for which an annual report is also presented in this issue of *Surveillance*). This surveillance programme provides an opportunity for early intervention by early detection of new-to-New Zealand marine pests. Significant research is also occurring aimed to develop tools for improving the likelihood of early detection of marine organisms. This is supported by development and testing of molecular detection tools and sampling regimes, video photogrammetry to map marine habitats and use of remotely operated vehicles.

A national Freshwater Surveillance programme is in development, aimed at improving detection of new-to-New Zealand freshwater organisms. Programme development is focused on delivering updated risk profiling data for exotic freshwater organisms across freshwater taxa (fish, invertebrates and plants), modelling of high-risk sites using habitat viability and pathways information, and building partnerships through extensive engagement. Further projects are proposed over the next year to establish the scientific and operational basis for implementation of the programme, with targeted surveillance scheduled to start in 2025/26 (funding permitting).

Table 1: Members of the Aquatic Health team

Team member	Function	Role	Qualifications	Years within MPI*
Michael Taylor		Team Manager	PhD, BSc	9
Rissa Williams	Surveillance	Senior Adviser	PhD, BSc (Hons)	18
Giulia Raponi	Surveillance and Incursion Investigation	Senior Adviser/ Incursion Investigator	MSc, BSc	4
Abraham Growcott	Surveillance	Principal Adviser	MSc, PGDipArts, BSc	12
Joanne Howells	Surveillance	Senior Adviser	PhD, BSc (Hons)	6
Joshua Wardle	Incursion Investigation	Incursion Investigator	BSc	3
Rachel Hooks	Incursion Investigation	Incursion Investigator	BSc	3
Avantika Masand	Incursion Investigation	Incursion Investigator	MSc, BSc	2

*or previous within MPI or MAF.

Ultimately, improving aquatic animal health surveillance in New Zealand is critical to protecting aquatic species, including taonga species, in the environment and in commercial aquaculture industries.

Team composition

Aquatic Health team members (Table 1, previous page) are regarded as trusted specialists and our technical expertise is often sought across all aspects of the aquatic biosecurity system. The team is based at the MPI Animal Health Laboratory (AHL), Wallaceville.

Programmes and selected projects

The National Marine High Risk Site Surveillance programme is managed from within the Aquatic Health team. This targeted surveillance programme detected one new-to-New Zealand species in 2023/24 and seven established non-indigenous marine species were detected in new locations. A full report on this programme is on page 115.

Aquatic animal health

Collaboration has continued with external stakeholders to improve aquatic animal disease surveillance, including with Awanui Veterinary (formerly Gribbles) and Cawthron Institute. This collaboration has led to increased communication and information sharing with the goal of improving our early detection capability of aquatic diseases.

Cawthron Institute's Emerging Aquatic Disease programme was funded in 2022 by the Ministry of Business, Innovation and Employment Endeavour Fund. This project is aiming to improve approaches to investigation and diagnosis of emerging aquatic diseases, including the development of novel diagnostic tools, and MPI is likely to directly benefit from this research. Recent progress in the programme relevant to MPI includes:

- establishment of in vitro culture of the WOA-listed mollusc parasite *Perkinsus olseni* and application in challenge trials of green-lipped mussels;
- collaboration with MPI's SII Animal Health, Awanui Veterinary,



Figure 1: MPI representatives visit Te Au Nui (Mataura Falls), a significant location for kanakana migration and traditional harvest. From left to right: Tim Hewison, Andrea Barcelo (Aquatic Animal Diseases team), Rissa Williams (Aquatic Health team) and Kelly McKenzie (Surveillance Engagement and Systems team). Photo: R. Williams

Auckland City Council and SVS Laboratories to investigate a disease event involving tarāpuka (black-billed gulls) leading to the identification of *Schistosoma* trematodes as a likely cause and possible emerging disease threat to this at-risk and declining endemic sea bird;

- opportunistic observation of tail fan necrosis in rock lobsters during tank trials;
- success in growing two variants of NZ-RLO on solid culture media from a frozen stock, which previously was achieved using only cell-lines, following collaboration between Cawthron and MPI's AHL.

The programme also seeks to heighten engagement with communities and iwi. Members of the Aquatic Health, Environment Health, Surveillance Engagement and Systems, and AHL's Aquatic Animal Diseases teams were fortunate to be able to participate in a two-day wānanga hosted by Hokonui Runānga in Gore in November 2023 (Figure 1). This wānanga aimed to build an understanding of kanakana (lamprey) reddening syndrome and to design an improved surveillance, reporting and response system. As

a follow-up, a workshop was hosted by Cawthron in June 2024 to develop better approaches to working with taonga species, which was led by Jane Kitson (Kitson Consulting Ltd) and Jamie Ataria (Cawthron Institute) and attended by Rissa Williams (Aquatic Health team) and Tim Hewison (Aquatic Animal Diseases team). This was a very informative hui, where invited researchers presented their experience and insights from working with mana whenua and taonga species, and all participants discussed principles for working with taonga species in the future.

World Organisation for Animal Health aquatic Focal Point

New Zealand is a member country of the World Organisation for Animal Health (WOAH, formerly the Office International des Epizooties, the OIE), and is represented by a Delegate and national Focal Points for eight key topics, including aquatic animals, which sits within the Aquatic Health team.

This year, the aquatic Focal Point activities have been shared between Giulia Raponi and Rissa Williams and have included advising and reporting on New Zealand's aquatic animal

health status (both internally within MPI and as part of regular regional and global reporting to WOA), providing advice to the New Zealand WOA Delegate on aquatic health matters, and reviewing Aquatic Code changes relevant to New Zealand.

Northland community-led surveillance project

The Aquatic Health and Surveillance Engagement and Systems teams partnered with Matapōuri hapū – Te Whānau a Rangi Whakaahu – and the Auckland War Memorial Museum to offer a ten-week summer studentship to a tertiary student for a community-led surveillance project. Helen Hargraves (student) worked with Charlie Mackie (**Figure 2**) and other hapū members over summer 2023/24 to test three trapping methods for estuarine pest fish in two estuarine environments.

The project targeted the non-indigenous Australian flatback mangrove goby (*Mugilogobius platynotus*) and found Gee's minnow traps were the most effective. The fish showed a strong preference for the shallow, warm and sandy environment of the estuary, and the numbers of exotic fish caught were significantly lower than similar native fish – a positive observation from a surveillance perspective. Additionally, through kōrero with iwi on the Tutukaka coast, Helen and MPI staff learned of two Mātauranga Māori trapping techniques and the effects of lunar cycles on fish trapping. While these techniques were not able to be tested during the timeframe of the project, they do offer a promising option for future community surveillance projects.

Following the end of the project, a community workshop was hosted by Te Whānau a Rangi Whakaahu at Matapōuri marae, with forty participants from the wider community attending. The workshop saw presentations on the project results and a live-trapping demonstration (**Figure 3**). These improved the Matapōuri community's understanding of the biosecurity system, heightened awareness of general surveillance and increased the



Figure 2: Charlie Mackie holding a freshly caught giant bully, *Gobiomorphus gobiodes* collected from the Matapōuri estuary. Photo: Helen Hargreaves, MPI

capability of community members to report new-to-New Zealand aquatic species. We aim to use the knowledge learned from this shared experience to lay the foundation for future community-led surveillance projects.

Other technical projects

The Aquatic Health team contributes to a range of technical projects and tool development. For example, the team has participated in Cawthron Institute's 5-year marine biosecurity toolbox research programme (see <https://www.biosecurity-toolbox.org.nz/research/>), which has a goal of developing tools that can prevent, detect and respond to marine pests.

Engagement with the Australian Marine Pest Sectorial Committee allows coordination and input into policies and tools that will improve biosecurity outcomes in both countries (see <https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/marine-pests/mp-sect-committee>).

We also provide regular input and technical advice regarding open ocean aquaculture and domestic pathway management. Other marine operational research projects are ongoing and include risks and management options for domestic ballast water, efficacy of marine growth protection systems and treatments for marine non-indigenous species.

Scientific and stakeholder engagement activities and publications

The Aquatic Health team has maintained its scientific and stakeholder engagement activities, with highlights including attendance at the 2023 Aquaculture New Zealand conference in Nelson in October, working with Aquaculture New Zealand and, in conjunction



Figure 3: Helen Hargraves (kneeling, centre) performing a live-trapping demonstration at the Matapōuri Community Day. Photo: Josh Wardle, MPI

Table 2: External scientific communications (1 July 2023 – 30 June 2024)

Month	Title	Type	Publication/Event
July 2023	Wardle, J. Enhancing biosecurity for Aotearoa through Collaboration with Mana Whenua on Incursion Investigations, Engagement, and Surveillance	Conference presentation	2023 NZ Biosecurity Institute's National Education and Training Seminar, Waitangi NZ
July 2023	Frances, J. New Zealand's general surveillance system - current initiatives in aquatic animal health	Conference presentation	6th FRDC Scientific conference on Aquatic Animal Health and Biosecurity, Cairns, Australia
July 2023	Frances, J. New Zealand's general surveillance system: aquatic health and shellfish reporting posters	AGM presentation	Oyster Industry AGM, Kerikeri, Northland
August 2023	Reed, Y. Marine general surveillance in Aotearoa New Zealand. Protecting our moana from pests and disease	Forum presentation	Coastguard annual tutor forum. Whangārei, Northland
April 2024	Raponi, G and Williams, R. Aquatic animal health surveillance in Aotearoa New Zealand	MPI Market Access – International government presentation	MPI Charles Fergusson Building, Wellington
May 2024	Raponi, G. Aquatic Animal Health – Surveillance and Incursion Investigation	MPI–Massey Day (Figure 7, page 128)	Ākau Tangi Sports Centre, Wellington

with the Surveillance Engagement and Systems team, producing a suite of communication material. These include Onboard Biosecurity posters for oysters and mussels for the aquaculture industry to enhance quality reporting and sample submissions to AHL. The team has also produced a generic two-sided reporting poster for the public, with one side detailing how to identify and report suspected disease and the other for reporting pests. See **Tables 2 and 3** for more detail on communications and engagement activities.

Enhancing aquatic disease awareness in shellfish industries

In September, the team worked with the Surveillance Engagement and Systems team to develop a suite of aquaculture industry-targeted disease

Table 3: Stakeholder communications and engagement (1 July 2023 – 30 June 2024)

Month	Title	Type	Publication/Event
July 2023	Attended the 2023 Oyster Industry AGM in Opito Bay/Kerikeri: distributed the shellfish disease reporting posters, networked with industry	Targeted	Oyster industry, aquaculture professionals, NZ Food Safety, iwi/hapū
August 2023	Tauranga Moana Careers Expo: held a stand with Fisheries New Zealand to share aquatic pest and disease knowledge to students	General	Students, government agencies, private businesses, tertiary institutes, general public
September 2023	Shellfish mortality events on Marsden peninsula	Targeted	Patuharakeke iwi, Takahiwai Marae hui
October/ November 2023	Aquatic surveillance and incursion investigation team presentation to the Top of the North and Top of the South Marine Biosecurity partnerships	Targeted	Top of the North and Top of the South regional councils, DOC, and biosecurity provider partners
October/ December 2023	Whanganui Awa Tuna deaths response planning	Targeted	Iwi, DOC, Horizons Regional Council
November 2023	Marine pest identification workshop, Christchurch	Targeted	Environment Canterbury Regional Council
November 2023	Participation in two-day wānanga hosted by Hokonui Runānga in Gore in November 2023, which aimed to build an understanding of lamprey reddening syndrome and to design an improved surveillance, reporting and response system	Targeted	Knowledge holders from 10 groups across iwi, local and national government, and science sectors
December 2023	Marine pest identification workshop, Auckland	General	Auckland Council, public, scientists, consultants, MPI staff
January–April 2024	Lake Ōmāpere Readiness work for mass mortality events	Targeted	Lake Ōmāpere Trust, iwi representatives, BNZ Animal Health Team, DOC, Northland Regional Council, Massey University, Cawthron
February 2024	Marine general surveillance in Aotearoa New Zealand and the Northland goby project	Targeted	Te Whānau a Rangi Whakaahu (Matapouri, Whangārei)
February 2024	Northland community-led surveillance engagement day	Targeted	Tutukaka coast iwi and wider community. Northland staff from DOC and Northland Regional Council
February 2024 - ongoing	Freshwater Biosecurity Partnership Programme (FWBPP): co-chair of meetings	Targeted	Regional and local councils, iwi representatives, Fish & Game Council
April 2024	Ongoing engagement with Aquaculture New Zealand: developing aquaculture farmer-targeted reporting material, to provide more information around the reporting process and reduce barriers to reporting	Targeted	AQNZ staff, wider aquaculture industry
15 May 2024	Ngāti Pāoa and Waiheke Marine Project: pest and disease workshop with BNZ	General	Ngāti Pāoa (iwi), Waiheke Marine Project, Auckland Council, community of Waiheke
16 May 2024	Hutchwilco Boat show: regional councils and BNZ marine pest stand	Targeted	Boat owners, industry, recreational fishers, government agencies, public, industry bodies

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Table 3: Stakeholder communications and engagement (1 July 2023 – 30 June 2024), continued

Month	Title	Type	Publication/Event
27 May 2024	Pāua Industry Council biosecurity protocols meeting; development of aquatic disease material to support improving samples submission	Targeted	Pāua Industry Council
May 2024	Marine pest identification workshop, Nelson	General	Scientists, public, government organisations, marine industry, MPI staff, Nelson, Tasman and Marlborough councils
May 2024	Marine pest identification workshop, Gisborne	General	Gisborne District Council, iwi taiao groups, MPI staff, public
18–19 June 2024	Attended MBIE Endeavour-funded programme ‘Emerging Aquatic Diseases’ - science update - taonga species handling workshop - programme advisory and implementation group meeting	Targeted	Cawthron Institute, DOC, seafood and aquaculture industry, Plant & Food, University of Otago and other programme partners
Ongoing	Bay of Plenty Regional Council: regular meetings	Targeted	BOPRC biosecurity staff regular meetings, strengthen relationships, align and identify areas of collaboration
Ongoing	Ongoing engagement with DOC: improving samples submission	Targeted	Department of Conservation

awareness pieces. Prompted by Aquaculture New Zealand, the team identified the need for the Onboard Biosecurity posters for farmers to better understand signs of disease, how to report to MPI and how to submit timely and quality samples to AHL for disease testing (**Figure 4**).

The posters highlight common aquatic disease signs as seen in shellfish and provide details on sample handling for investigations. The reporting process posters have been printed and distributed to industry, as well as being made available on the BNZ website.

Profiling aquatic disease with a new guide

To address the identified gap in educational resources on aquatic disease, the team has worked with the Surveillance Engagement and Systems team to develop ‘The New Zealand Aquatic Disease Guide’, which is intended to complement the existing ‘New Zealand Marine Pest ID Guide’ (**Figure 5**, next page).

The purpose of the guide is not to teach laypersons how to diagnose aquatic disease, but provide visual guidance on how to recognise signs of disease in fish, crustaceans and shellfish (e.g., lesions, cysts, etc.). It also walks the reader through reporting to the Aquatic Health team, and how to collect and submit samples aquatic disease testing to MPI’s AHL.

The guide will be a great addition to the team’s pool of resources when engaging with technical groups and industry bodies.



Figure 4: The onboard biosecurity reporting posters

Improving reporting and sample submissions in aquatic animal mass mortalities with guides

The Aquatic Health team worked with regional councils and the Department of Conservation (DOC) to develop guides for improving reporting and submission of samples during aquatic mass mortality events (**Figure 6**, next page).

During aquatic animal mortality investigations, and in collaboration with other stakeholders, the team identified the need for targeted guidance material that would help stakeholders to better understand our incursion investigations process. Improving the quality of samples that are collected and arrive to MPI’s AHL for testing ultimately improves the

chances of understanding the possible causes of these mortalities.

The guide provides details to help regional councils to report unexpected fish, shellfish and crustacean mortalities within freshwater and marine environments, when exotic diseases are suspected, and step-by-step information for sample collection and submission to AHL.

Courses, training programmes and appointments

Aquatic Health team members undertook courses on the following topics in the past 12 months:

Health and safety:

- Sustainable health and safety behaviours;

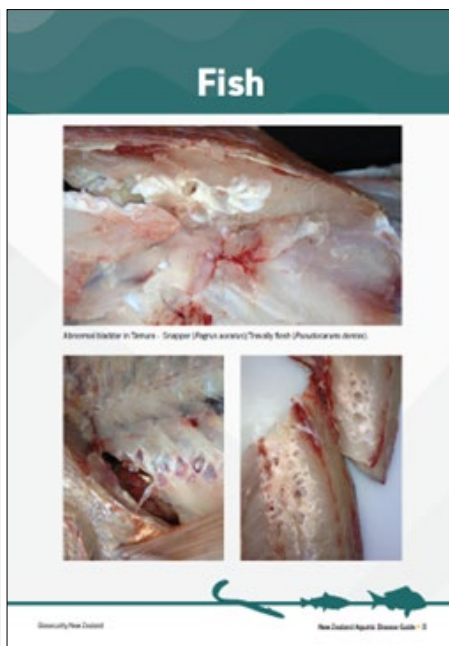


Figure 5: The New Zealand Aquatic Disease Guide

- Health and safety stage 1 Unit standards 30264, 29315;
- First aid certificate level 2 and refresher courses;
- First responder first aid Unit standard 6401;
- Drive to survive training; and
- Wader and water safety training.

Professional development:

- Response simulation Northern Pacific seastar (*Asterias amurensis*);
- Response Essentials (Response Stage 2.2);
- Advanced reading;



- Technical writing lab;
- Finance overview for managers;
- Security and privacy;
- Contract manager responsibilities;
- Challenging conversations and resilience;
- Information management;
- The Biosecurity Act and the VADE (Voluntary, Assisted, Directed, Enforced) compliance model;
- Group Facilitation Skills;
- Te Ara ki Matangireia; and
- BNZ introduction to project management.

Te Tiriti o Waitangi:

- Effective engagement with Māori (Institute of Public Administration New Zealand);
- Te ao Māori for professionals;
- Te reo Māori;
- New Zealand colonial history and the treaty of Waitangi;
- The Wall Walk®, history of Aotearoa; and
- Building Māori cultural capability.

Technical:

- Tuatua (*Paphies subtriangulata*) anatomy and dissection refresher (provided by MPI's AHL).

Developing young Māori leaders in the Public Service

One member of the Animal Health Team is currently participating in Te Ara ki Matangireia, a young Māori emerging leadership programme. A cohort/tira of 30 rangatahi (young people) were selected from across the public service to participate (Figure 8). The rangatahi develop their leadership skills by participating in four marae-based wānanga, receiving mentorship from influential Māori leaders in the public service and delivering projects that serve their communities. Kaikōrero (speakers) at the wānanga include the likes of Heather Baggot (acting Public Service Commissioner), Hoani Lambert (DCE at Department of Internal Affairs),



Figure 6: Aquatic animal mortality event reporting guides



Figure 7: Representatives of the Aquatic team attending the MPI-Massey Day

Sheridan Smith (DCE at Te Arawhiti) and many more.

Although currently only halfway through this year, the kaupapa has already been transformative. Through personal reflection and strengthening of identity, this kaupapa has helped the tira build strong foundations for leadership. Each of the four wānanga has a theme from the Māori creation story, which helps rangatahi to dig deeper to focus on what drives them to make a difference in the public service. For the majority, this means building the future for descendants while relying on the wisdom of tūpuna (ancestors). It also emphasises understanding individual strengths and recognising that when working with others with different strengths, we become stronger together. Rangatahi have been fortunate to build strong relationships across ministries with past and present tira and mentors, something that strengthens the Public Service as a whole, and each person individually too. Ehara taku toa i te toa takitahi, engari he toa takitini. Success is not the work of an individual, but the work of many.

Summary of aquatic health notifications and investigations for 2023

Incursion Investigators in the Aquatic Health team receive notifications of potential exotic or emerging aquatic

pests or diseases via the MPI exotic pest and disease hotline. On evaluating the notification, the Incursion Investigator may not take any action if biosecurity risk can be excluded (e.g., it is a range extension of a pest organism already present in New Zealand or the species can be identified as native). If biosecurity risk cannot be quickly excluded, then an investigation will be opened to determine the nature of the biosecurity risk and start to explore what options may be available to mitigate the risk.

Investigations can be complex, involving other parts of MPI (e.g., AHL, Compliance Directorate and Animal Imports), external stakeholders,

other government agencies (e.g., DOC and regional councils) and the wider science community. They often involve coordinating sample submission and other operational activities in varying and sometimes remote parts of New Zealand, making the most of any opportunity to identify a potential new pest or aquatic disease.

Three types of investigation are undertaken by the Aquatic Health team:

- Disease diagnosis investigations look into exotic or emerging diseases, and involve testing plausible organisms, such as bacteria, viruses and parasites.
- Species identification investigations are carried out to rule out potential pest species.
- Risk goods investigations have an association with the border, such as recently imported products that may not meet the import requirements. These are usually associated with the ornamental fish and aquarium trade but have also involved hitchhiking aquatic organisms in aquatic products such as fish bait.

The number of investigations increased for almost every month in 2023 when compared with 2022 (**Figure 9**). The largest increase occurred in the second half of the year and peaked in the last quarter.

In 2023, 306 notifications were transferred to the Aquatic Health



Figure 8: Te ara ki Matangireia 2024 tira alongside hau kāinga, mentors, kaikōrero and rangatira (leaders) at Tāheke Marae, Rotorua

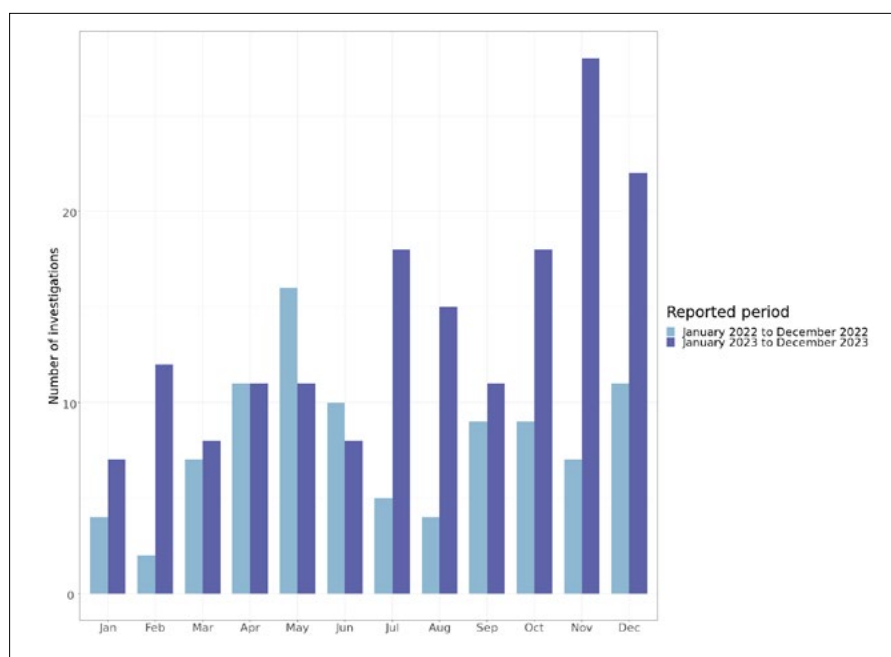


Figure 9: Number of new aquatic investigations per month for 2022 and 2023

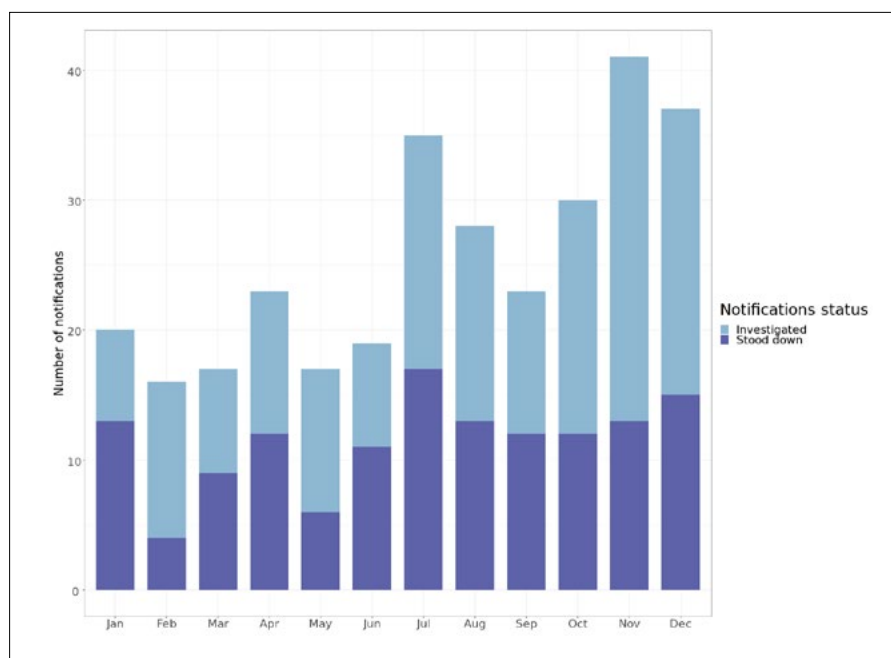


Figure 10: Number of new aquatic notifications by month, with the proportion of those progressed to investigations

team and 167 of these notifications progressed to an investigation. A monthly breakdown is shown in **Figure 10** and further demonstrates the growing numbers of both notifications and investigations. It is interesting to note that notifications doubled in 2023 compared with 2022, and total investigations for 2023 outnumber the 106 notifications from 2022 by nearly 60 percent.

Notifications that proceed to an investigation fall into three categories: disease diagnosis, risk goods and species identification. All

investigation types increased in 2023 when compared with 2022 (**Figure 11**, next page). Species identification investigations were still the predominant type of investigation conducted by the Aquatic Health team.

Four taxa were represented in disease diagnosis investigations: fish (including sharks and rays), molluscs, algae and crustaceans. Disease investigations were predominantly fish and molluscs. However, this year we received two bull kelp mortality investigations classed under disease diagnostics. One disease investigation

was classed as 'other' as it was run in conjunction with an animal health investigation to rule out biotoxins. Risk goods investigations predominantly involved ornamental fish. As expected, species identification investigations involved a much higher diversity of taxa and included eight different taxa. Algae and molluscs were represented highly in 2023 due to the ongoing exotic caulerpa and corbicula responses. A full breakdown of taxa by investigation type can be found in **Figure 12**, next page.

Most aquatic notifications were received from the members of the public (**Figure 13**, next page). However, the proportion of notifications that proceeded to investigations was much higher from other notifier types. This may indicate that these types are more familiar with what they are reporting, may run into biosecurity issues more frequently due to the type of work they are undertaking, or may be more familiar with the investigation process and have adequate information and samples ready for investigators.

The marine environment was by far the most common for disease diagnosis and species identification investigations, with freshwater second, followed by an even split across estuarine and captivity. The Freshwater Surveillance programme that is currently in development and associated awareness campaigns should see an increase in the number of freshwater notifications. Almost all risk goods investigations involved captive organisms from the ornamental fish trade. However, a few risk goods investigations did not fit into an environment category, relating to organisms found in products. A full breakdown of taxa by investigation type can be found in **Figure 14**.

Responses supported by Aquatic Health

When an incursion investigation determines that there is an exotic disease or exotic pest of significance, MPI may activate a response to mitigate or eliminate the biosecurity risk. This involves transitioning from the investigation phase to the response

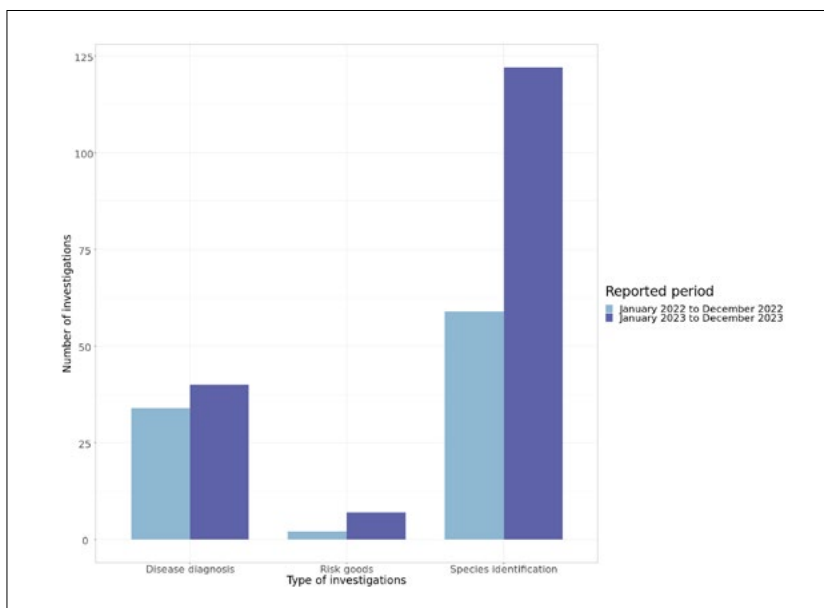


Figure 11: Comparison of aquatic investigations by type between 2022 and 2023.

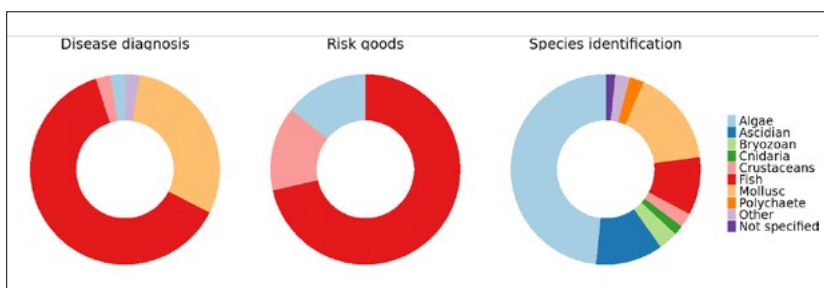


Figure 12: Taxonomic groups of organisms investigated by the Aquatic Health team (1 January – 31 December 2023)

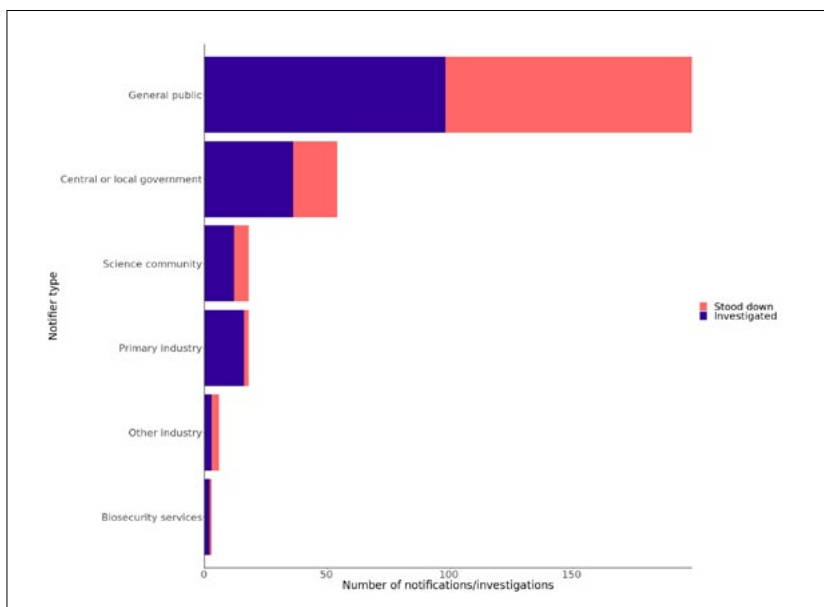


Figure 13: Proportion of aquatic notifications and investigations by notifier type for 2023

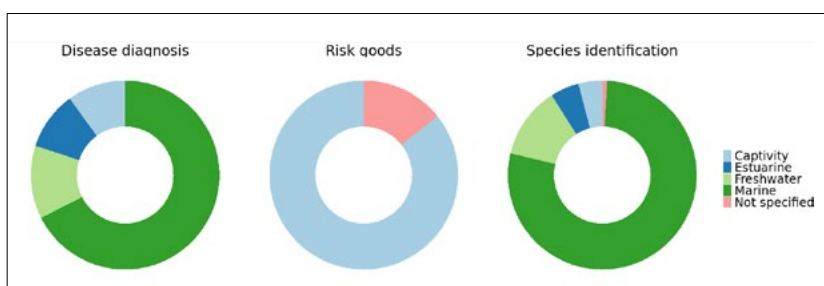


Figure 14: Environment types for aquatic investigations (1 January – 31 December 2023)

phase. The Aquatic Health team's role in the response phase is to provide technical expertise including advice on organism ecology and management, and input into control methodologies. During 2023 team members were involved in the following MPI responses:

- Exotic freshwater clams (*Corbicula*) response (initiated 2023);
- Exotic caulerpa response (initiated 2021); and
- New Zealand *Rickettsia*-like organisms and *Tenacibaculum maritimum* in farmed salmon response (initiated 2015).

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Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases: April – June 2024

Reports of exotic caulerpa investigated

The exotic caulerpa species *Caulerpa brachypus* and *C. parvifolia* were first detected in 2021 in the waters near Aotea (Great Barrier Island), and a response was initiated by Biosecurity New Zealand (MPI). Exotic caulerpa species are pest green algae that form vast, dense mats, smothering native seagrass and bottom-dwelling invertebrates, thereby altering the marine ecosystem. Initially these algal species were only thought to exist in depths shallower than 10 m but were later found deeper than 40 m. Fragmentation of exotic caulerpa frequently occurs through storms, currents or disturbance by people engaging in water activities such as boating, diving and fishing. These fragments facilitate these pest species' invasion and rapid spread, as viable plants can regenerate from very small pieces.

So far, exotic caulerpa has been found around Great Barrier Island, Ahuahu (Great Mercury Island), Te Rāwhiti Inlet in Ipipiri (the Bay of Islands), and near Kawau Island and Waiheke Island. Most recently, these species have been detected from three locations in Tāmaki Makaurau (Auckland) – Omaha Cove, the Mokohinau Islands and Rākino Island – and from Fantail Bay to Port Jackson on the Coromandel Peninsula. MPI is working closely with mana whenua, regional councils and local communities to understand this algal species' ecology and manage their spread from areas of known presence. Controlled Area Notices (CANs) are in place at Great Barrier Island, Great Mercury Island and Te Rāwhiti Inlet to manage activities that are likely to result in the movement of exotic caulerpa and help prevent spreading.

In the period April–June 2024, MPI received 13 suspected exotic caulerpa reports from a range of notifiers, including members of the public, iwi representatives, staff from regional councils and the Department of

Conservation (DOC). Notifications were received from the regions of Te Tai Tokerau (Northland), Auckland, and Waikato. Marine Invasives Taxonomic Service (MITS) used images to rule out exotic caulerpa in six of these cases. Seven of those reports were confirmed as exotic caulerpa, and four new locations have been identified. **Table 1** summarises these investigations.

Scientific divers conducting fish surveys around the Mokohinau Islands found multiple patches of exotic caulerpa growth. The scientists subsequently collected a sample and molecular analysis identified it as *C. parvifolia*. This confirmed detection has resulted in DOC leading delimitation and manual removal efforts with hand-held suction equipment to minimise fragments escaping.

Auckland Council identified exotic caulerpa during surveillance activities on Rākino Island. It is considered present around the whole island but is reported as very sparse, with an

estimation of less than one percent cover. It is suspected that the high sediment load seen around Rākino Island may inhibit the growth of macroalgae species, suppressing caulerpa growth. Surveillance remains ongoing in the area to monitor the situation.

A scientist from Auckland University found what was suspected to be exotic caulerpa in Fantail Bay while conducting unrelated research surveys in the Coromandel. MPI is leading further surveillance surveys in the area as DOC is prioritising efforts in the Mokohinau Islands. MPI has confirmed the presence of exotic caulerpa up to Port Jackson and all detected patches have been covered with benthic matting in an attempt to suppress the population.

Auckland Council detected a patch of what was suspected to be exotic caulerpa at Omaha Cove, Leigh in Auckland during surveillance activities for the Mediterranean fanworm, *Sabella spallanzanii*. A sample was confirmed by MITS as *C. parvifolia* via molecular

Table 1: Summary of the outcomes of suspected exotic caulerpa cases investigated by region during April–June 2024

Locality	Taxa identified
Northland	
Poroporo Island, Bay of Islands	Exotic <i>Caulerpa</i> sp. (either <i>C. brachypus</i> or <i>C. parvifolia</i>)
Taupō Bay	Native caulerpa (<i>Caulerpa flexilis</i>)
Auckland	
Long Bay Beach	Seagrass <i>Zostera muelleri</i>
Oneroa beach, Waiheke Island	Seagrass <i>Zostera muelleri</i>
Thorne Bay, Takapuna, Auckland	Seagrass <i>Zostera muelleri</i>
Mokohinau Islands	Exotic caulerpa (<i>Caulerpa parvifolia</i>)
Warkworth	Inconclusive – exotic <i>Caulerpa</i> sp. ruled out
Rākino Island	Exotic <i>Caulerpa</i> sp. (either <i>C. brachypus</i> or <i>C. parvifolia</i>)
Rākino Island	Exotic <i>Caulerpa</i> sp. (either <i>C. brachypus</i> or <i>C. parvifolia</i>)
Omaha Cove	Exotic caulerpa (<i>Caulerpa parvifolia</i>)
Aotea Great Barrier Island	Exotic <i>Caulerpa</i> sp. (either <i>C. brachypus</i> or <i>C. parvifolia</i>)
Waikato	
Crayfish Bay, Coromandel	Green alga <i>Ulva</i> sp.
Fantail Bay, Coromandel	Exotic <i>Caulerpa</i> sp. (either <i>C. brachypus</i> or <i>C. parvifolia</i>)

testing. Since this detection, Auckland Council has been directing efforts to suppress the population through a combination of chlorine treatment under a tarpaulin mat to kill the patch, followed by hand removal with the assistance of a hand-held suction device to minimise fragmentation.

Large quantities of red filamentous algae investigated

MPI received multiple reports from members of the public that a significant quantity of red filamentous seaweed was washing up on Red Beach and Ōrewa Beach in Auckland. One notifier reported it was covering most of the sand at Red Beach and more was washing up with each tide (see **Figure 1**). Two of the notifiers collected samples – one from Red Beach and one from Ōrewa Beach – and these were submitted to MITS for examination.



Figure 1: *Kapraunia* sp. on Red Beach. Photo: Judy Klaus

Identification of the red alga could not be achieved from morphology, so molecular analysis was carried out. Both samples were identical and belong to an undescribed cryptogenic species of the *Kapraunia* genus. Previous specimens have been collected from Whangārei Harbour in 2010, and were originally identified as *Polysiphonia* sp., before the genus *Kapraunia* was segregated from *Polysiphonia* in 2018 (Roberta D'Archino, NIWA, pers. comm.). *Kapraunia* has also been recorded from Wellington Harbour twice as part of National Marine High Risk Site Surveillance (NMHRSS). None of these New Zealand samples of *Kapraunia* match any overseas sequences and

there are no reasons to consider it a non-native.

The taxonomy of *Polysiphonia* species group remains unresolved, therefore it is not a surprise to find an undescribed species in Aotearoa New Zealand. It is likely that the algal mats reported on Auckland beaches were the result of a significant summer growth from warm water temperatures and abundant nutrients, followed by a seasonal reduction in temperature and nutrient availability causing the population to crash. The mass of seaweed was then unable to sustain its growth and died off in large quantities, washing ashore with each tide.

Details of the situation and findings were passed on to Auckland Council to monitor the accumulation of seaweed on the beach. However, as there was no biosecurity issue present, the investigation was closed.

Upon receiving the results, one of the notifiers further reported there were now “fuzzy seaweed balls” washing up on Ōrewa Beach (**Figure 2**). After examining photographs submitted by the notifier, MITS suggested that they may be aegagropiles, which are tightly packed balls of fibrous marine material, more commonly reported from the Mediterranean. These bundles of material are made by wave action on drifting seagrass and organic debris. It is likely that these are associated with the red seaweed that was washing up. Although not often observed in New Zealand, there was no biosecurity concern associated and the investigation remained closed.



Figure 2: Aegagropiles on Ōrewa Beach. Photo: Judy Klaus

Range extensions of the non-indigenous Asian seaweed Wakame (*Undaria pinnatifida*)

MPI received two reports of the non-indigenous Asian seaweed Wakame (*Undaria pinnatifida*) through April–June 2024. One report came from a member of the public who reported the algae at Pipikaretu Beach and Ryans Beach, on the eastern side of Harrington Point, Ōtepoti (Dunedin). The other came from DOC, sighting the seaweed north of Rabbit Island, close to Whakahau/Slipper Island in Waikato. In both instances, notifiers provided clear images that MITS was able to use to confirm the sightings of the suspected pest seaweed.

Undaria pinnatifida (**Figure 3**) is a pest seaweed that is native to Japan and is typically spread by the movement of fouled vessels. Previous records indicated that these detections represent range extensions for the species. Within Otago, this is the first report of *U. pinnatifida* outside Otago Harbour, and the detection near Slipper Island was the first detection from Waikato.



Figure 3: Asian seaweed (*Undaria pinnatifida*) Harrington Point. Photo: Ashley McMillan, The Otago Peninsula Eco Restoration Alliance (the OPERA)

Undaria pinnatifida is widespread across New Zealand at most of the international seaports and nearby harbours, including offshore islands.

However, it is not known to be present in Te Tai Poutini (West Coast) of Te Waipounamu (the South Island) or the west coast of Te Ika a Maui (the North Island), except for in Ngāmotu (New Plymouth). The results were communicated to the notifiers, MPI’s pest management team, Otago Regional Council and to the Waikato Regional Council, and the investigation was closed.

Reports of exotic freshwater gold clam (*Corbicula fluminea*) investigated

The exotic freshwater gold clam (*Corbicula fluminea*) was first detected in New Zealand in the Bob’s Landing area of the Waikato River near Lake Karapiro in early May 2023. This highly invasive species reproduces rapidly and forms large populations that can obstruct freshwater infrastructure, such as electricity generation plants, irrigation systems and water treatment plants. They are filter feeders that also likely compete with native species for food.

MPI established a biosecurity response in partnership with river iwi and other stakeholders, including Waikato Regional Council, the Waikato River Authority, DOC, Land Information New Zealand (LINZ) and others. The freshwater gold clam was declared an Unwanted Organism under the Biosecurity Act 1993 and two CANs were established to limit its spread – one for the Waikato River and another for the Rotorua Te Arawa lakes, with additional protections for Lake Ōkātina.

Twelve reports of suspected exotic freshwater clams were referred to the Aquatic Health team from the *Corbicula* response for this reporting period (April–June 2024). The locations and findings from these investigations are summarised in **Table 2**.

Four of these notifications were identified as the New Zealand freshwater mussel (*Echyridella menziesii*) and one as the native fingernail clam (*Sphaeriidae* sp.). Six sightings were confirmed as *C. fluminea*, all within the known

Table 2: Summary of the outcomes of suspected *Corbicula fluminea* cases investigated by region, for the period April–June 2024

Waikato	
Pukete, Hamilton (Waikato River)	<i>Corbicula fluminea</i>
Lake Taupō Aqua Park	<i>Corbicula australis</i>
Lake Karapiro (Waikato River)	<i>Corbicula fluminea</i>
Lake Karapiro (Waikato River)	<i>Corbicula fluminea</i>
Hamilton City (Waikato River)	<i>Corbicula fluminea</i>
Horotiu (Waikato River)	<i>Corbicula fluminea</i>
Lake Taupō	<i>Echyridella menziesii</i>
Lake Taupō	<i>Echyridella menziesii</i>
Hammond Park, Hamilton (Waikato River)	<i>Corbicula fluminea</i>
Waikato River	<i>Sphaeriidae</i> sp.
Ātiāmuri (Waikato River)	<i>Echyridella menziesii</i>
Bay of Plenty	
Lake Ōkātina	<i>Echyridella menziesii</i>

range for the organism. One notification resulted in the identification of a second new-to-New Zealand species, the Australian corbicula (*Corbicula australis*). Further details of this detection are included separately in this report.

Surveillance for *Corbicula* remains ongoing. The exotic bivalve has now been seen along a 227 km stretch of the Waikato River, from Lake Maraetai to Tuakau. Any positive environmental DNA (eDNA) results are followed up with visual surveys and further water sampling to confirm the presence of clams. To date, surveillance has not detected clams outside the river.

New-to-New Zealand Australian corbicula (*Corbicula australis*) detected

An MPI staff member submitted images (**Figure 4**) of freshwater clams suspected to be from the non-indigenous *Corbicula* genus, found in a small, contained water park adjacent to the Waikato River near Lake Taupō. MITS was able to confirm that the molluscs were a species of *Corbicula*, and samples were collected to further resolve their identification. Morphological and genomic testing confirmed that the clam found in the lagoon was the Australian corbicula (*Corbicula australis*), a new-to-New Zealand species closely related to *C. fluminea* that had already been detected in the Waikato River in May 2023.

Corbicula australis is native to Australia and has not been previously reported from outside of its native range. However, *C. australis* has potential to exhibit similar invasive characteristics to *C. fluminea*, due to two species sharing many biological similarities (Walton and Marshall, 2024). The detection was transitioned to the ongoing biosecurity response for *C. fluminea*, so that management and response effort is coordinated across the two species.



Figure 4: *Corbicula australis* Taupō. Photo: Abraham Growcott

Range extensions of the non-indigenous Asian date mussel (*Arcuatula senhousia*)

Taranaki Regional Council and Nelson City Council both contacted MPI after detecting the non-indigenous Asian

date mussel (*Arcuatula senhousia*) in their State of Environment monitoring, at Mōhakatino and Tongaporutū estuaries and Nelson Haven Marina, respectively. Additionally, a research institute contacted MPI after finding two live Asian date mussels during estuary surveys in the Tūranganui estuary, Te Tairāwhiti (Gisborne). The samples were all examined by malacologists at Te Papa Tongarewa, Museum of New Zealand and MacLean Marine Identifiers Ltd, who confirmed all cases to be *A. senhousia*.

The Asian date mussel can form large mats that can change sediment composition through waste production and the trapping of fine sediments forming mud banks (depth of 50–150 mm). They reduce planktonic food availability via competition, and create anoxic environments due to decomposition of the waste they produce or accumulation of dead mussels during a die-off. The effects of these mats can impact other invertebrates that share the habitat. A study on the species in Tāmaki, Auckland by Creese et al. (1997), found significantly higher abundances and higher species richness of macroinvertebrates outside mussel mats, with native bivalves eight times more abundant outside mats. However, the Asian date mussels live only for up to two years and then mats die off and disintegrate. Post die-off, it has been observed that the muddy banks left behind are quickly colonised by a rich flora of native invertebrates. Following this spike in diversity, it has been found that the local species diversity returns to stable numbers, similar to the original sandy sediments, as the muddy banks are slowly washed away by tides (Hayward et al., 1999).

There are currently no suitable techniques available for controlling this species. They have a free-swimming larval stage lasting up to 55 days that can disperse over large distances on ocean currents. Larvae are far too small to contain and once they settle on soft sediments, effective techniques to remove the adults, such as dredging, would likely have more significant impacts on the natural environment and other species in the area than on the mussels themselves.

This detection represents range extensions for the species, which was previously known only from Opuā, Whangārei, Kaipara Harbour, Waitematā Harbour, Manukau Harbour, Whangaparāoa, Waiheke Island, the Firth of Thames and Tauranga. Due to the lack of evidence for significant impacts, a lack of suitable control options for the species, and the existence of a domestic pathway for reintroduction after eradication no further action was taken and the investigations were closed. The importance of promoting good biosecurity practices when moving potentially fouled marine equipment domestically was highlighted by these investigations.

Mass mortality in wild tuatua (*Paphies subtriangulata*) investigated

A member of the public notified MPI of a tuatua (*Paphies subtriangulata*) mortality at Ruakaka Beach, Northland. The notifier also reported a possible algal bloom occurring recently in a nearby area. Twenty tuatua were submitted to MPI's Animal Health Laboratory, Wallaceville (AHL) for bacteriology and histopathology to investigate if exotic or emerging diseases may have contributed to the mortality.

Macroscopic examination from AHL showed that the tuatua appeared pale, thin, and khaki-coloured with pale streaking and occasional small pale spots in the mantle.

Histological examination showed that the mantle was thin, and that animals were in a post-spawning, depleted state. Spawning can contribute to poor body condition and increase molluscs' susceptibility to disease or environmental stressors. Several hydroids were present in small-to-large numbers within the gill and mantle space, suggesting that the environmental and water conditions were favourable for the growth and proliferation of hydroids in the area. Hydroids may cause physical damage to the gill surface and in large numbers, may obstruct or affect the flow of water and nutrients through

the gills. It is unlikely they would have caused the mortality, but they may have contributed to the observed poor body condition in the tuatua. There was an increase in inflammation of the gills and digestive gland, with the presence of brown cell aggregates (ceroid, lipofuscin-containing haemocytes). This is a non-specific immune response in molluscs, and potential causes include environmental stressors, toxins and pathogens. The presence of inflammation and aggregates of brown cells – especially in the gills – suggests oxidative damage to cells and cell breakdown. This has often been linked to the presence of environmental stressors and toxins in shellfish, although brown cells may occur with various factors resulting in peroxidative damage, including chemicals, toxins (algal, bacterial), pathogens, pollutants, heavy metals, reduced nutrient availability and lowered water quality.

Bacteriology testing detected *Pseudoalteromonas* spp. bacteria in one of the tuatua samples, most likely *P. tetradonis*. This is a marine bacterium and can secrete the neurotoxin tetrodotoxin. This does not represent a concern from a biosecurity point of view, but this finding was referred to New Zealand Food Safety, who conducted additional testing to investigate this toxin further. While the toxin was detected during food safety testing, it was not detected in harmful concentrations.

Overall, no evidence of exotic disease or any infectious agents were observed and a clear cause for the mortality event was not apparent in the sampled tuatua. The notifier and the Northland Regional Council were informed of the results and the case was closed.

Mass mortality in Pacific oysters (*Crassostrea gigas*) investigated

A Pacific oyster (*Crassostrea gigas*) farm notified MPI of fifty-percent mortality in their stock. No obvious abnormal weather or environmental conditions were reported as a likely explanation, and the farm submitted 30 whole live oysters of varying size classes to MPI's AHL to investigate if exotic disease was a

factor in the mortality. AHL completed histopathology, general aquatic bacteriology and molecular testing for ostreid herpesvirus (OsHV-1).

Histology revealed that submitted oysters lacked gonad development, appeared watery and were in very poor condition with retracted mantles. A moderate inflammatory response was also seen. These observations are non-specific, but could indicate poor water quality, feeding, nutrient availability or nutrient quality. The oysters tested negative for OSHV-1, bacterial cultures all contained normal flora for the organisms and no infectious aetiology for the mortality was identified in any of the submitted oysters.

Results were communicated back to the farm manager, who was advised to consider factors such as nutrient availability and quality, stock densities, water quality changes or possible irritants which may have impacted the health of the oysters. As no biosecurity concerns were identified and the mortality had resolved, the investigation was closed.

Mass mortality in green-lipped mussel (*Perna canaliculus*) spat investigated

A mussel farm notified MPI of ongoing mortalities in farmed juvenile, green-lipped mussels (*Perna canaliculus*). The farm reported about 20 percent mortality in their spat. No obvious abnormal weather or environmental conditions were reported as a likely explanation and the farm submitted whole live juvenile mussels to AHL to investigate if exotic disease was a factor.

AHL completed histopathology and molecular testing for *Perkinsus* sp. on the submitted samples. Mussels showed digestive gland disruption and inflammation and moderate tissue inflammation. These findings are not cause-specific and may be seen in connection with environmental changes, physical stressors and chemical or toxic events. The changes in the digestive glands were quite marked but gills were unable to be

examined due to the sloughing of epithelium cells. This may have been due to some form of chemical or toxin, although sampling artefact affecting the gills due to their very small size and fragile nature was possible. If not a sampling artefact, this could indicate a response to chemicals (effluent, pesticides, agrichemicals, etc.) or toxins (algal/cyanobacterial or bacterial). As the digestive glands are the main area of absorption and accumulation of toxins, this may account for the cell changes observed.

The mussels tested negative for *Perkinsus* sp. and no infectious aetiology for the mortality was identified. The results were communicated back to the farm manager, so that they could consider factors that may have contributed to the mortality event. With the mortality no longer ongoing and no indication of a biosecurity issue, the investigation was closed.

Mass mortality in cockles (*Austrovenus stutchburyi*) and pipi (*Paphies australis*) investigated

A member of the public and a kaitiaki rohe moana from Pātāua South both contacted MPI to report a shellfish mass mortality, suspected to be caused by an algal bloom. Fisheries Officers in the area were contacted and samples were collected for diagnostic testing to investigate if exotic or emerging disease may have contributed to the mortality. Forty-two affected cockles (*Austrovenus stutchburyi*) and 27 affected pipi (*Paphies australis*) were submitted to MPI's AHL for clinical examination, histopathology and bacterial examination.

Testing did not identify a clear cause for the mortality, but no evidence of infectious agents was seen. Both cockles and pipi were in a post-spawning reproductive stage, which can contribute to a period of poor energy balance. Gonad development and spawning has a high energy demand on molluscs and can predispose shellfish to increased disease susceptibility and decreased

tolerance to environmental change. The cockles appeared to be the most affected population. The digestive glands appeared disrupted in all cockles observed. Damage to the digestive glands may have been caused by biotoxins (bacterial, algal) or environmental pollutants and toxicants. In the pipi, swelling of the digestive gland epithelium with a mild increase in inflammation was observed. This may be associated with factors like those affecting the cockles (bacterial, algal or environmental pollutants and toxicants), although to a lesser degree.

All bacteria grown on cultures during bacteriology were found to be of normal flora for shellfish and not significant. In addition to this, the weekly algal bloom and toxin testing carried out at Marsden Point – the closest test site to Pātāua South – did not detect anything unusual. As no biosecurity concerns were detected and no further reports of shellfish mortality were received, the investigation was closed.

Mass mortality of blackfoot pāua (*Haliotis iris*) investigated

A kaitiaki contacted MPI to report a mass mortality of pāua on Riversdale Beach, Te Upoko o Te Ika a Maui (Greater Wellington). The notifier submitted eight blackfoot pāua (*Haliotis iris*) to AHL to investigate if exotic or emerging disease contributed to the mortality. Pathologists performed histopathology, bacteriology and molecular testing for abalone herpesvirus (AHV-1), *Perkinsus* and *Xenohaliotis californiensis* on all samples.

There was no histological evidence to suggest abalone ganglioneuritis infection or infection with *Perkinsus* species and all results for molecular testing came back negative.

All pāua showed evidence of tissue breakdown, as marked by the accumulation of melanomacrophages (highly pigmented phagocytes) with small aggregates of brown cells formed due to oxidative stress, damage to cells and accumulation of products of

cell breakdown. Formation of brown cells can be associated with age, pathological conditions, contaminant degradation, detoxification, and metals (including cadmium, copper, iron, mercury and zinc). Chronic food shortage or limited sources of food – leading to poor nutrient availability – may also result in degenerative changes in the pāua population and result in formation of brown cells.

A non-specific overall increase in inflammatory cells within the tissues was seen, which can be associated with physical stressors, environmental stressors, exposure to toxins and chemicals or infectious agents. Evidence of increased inflammation in the gills associated with possibility of abnormal water quality was seen. Ciliates were observed in gill spaces, which may cause mechanical damage to the gills and could predispose the pāua to increased inflammation. Other factors include pollutants, algal blooms, algal toxins, bacteria and bacterial toxins. Further to this, haplosporidian-like parasites were seen in the kidney tubules but have been previously seen in pāua. Although it is unclear whether this pathogen represents a cause or an effect, it could be associated with poor growth and condition (Copedo et al., 2024).

A minimal growth of *Pseudoalteromonas espejiana* was seen in only one of the pāua. The genus is frequently found associated with both healthy and diseased shellfish. As no biosecurity concerns were detected and no further mortality was reported, the investigation was closed.

Colonial ascidian *Symplegma brakenhielmi* locations reviewed

Aquatic Incursion Investigators recently completed a review of iNaturalist posts for suspected *Symplegma brakenhielmi*. *Symplegma brakenhielmi* is a small non-indigenous colonial ascidian that was first detected in Auckland in 2015. There have been no reports of significant impacts in New Zealand since the initial incursion. However, investigators often review new

locations for recent arrivals to ensure official records remain up to date. Investigators have now confirmed 17 new locations based on the iNaturalist data. Auckland Council was notified of these newly confirmed locations and the investigation was closed.

Range extension of the non-indigenous ascidian *Symplegma rubra*

MITS notified MPI of the range extension for the non-indigenous colonial ascidian *Symplegma rubra*. MITS collected a sample during NMHRSS at Marsden Cove Marina, Whangārei. *Symplegma rubra* is a bright red ascidian that lives in colonies forming two dimensional mats commonly found in ships' biofouling. Distributed widely in the tropical West Atlantic and Indo-Pacific, its colour varies from cream-yellow to pink depending on its geographic location. This exotic colonial ascidian was first detected in Auckland's Waitematā Harbour in 2022 during a NMHRSS survey. Due to its small size, impacts to native species and aquaculture were predicted to be low, and since the initial detection there have been no reported significant impacts for the species in New Zealand. Additionally, investigators reviewed iNaturalist posts for the organism and were able to confirm five posts from Auckland as positive detections. Information from these detections was passed on to Northland Regional Council and Auckland Council and the investigation was closed.

Range extension of *Pyura doppelgangera*

A researcher contacted MPI to report a sighting of suspected *Pyura doppelgangera* from East Bay in Queen Charlotte Sound, Te Taihū-o-te-waka (Marlborough). The researcher found the organism while conducting a study into the community dynamics of *Chaetopterus* sp. beds in the area. The notifier collected a sample and sent it into MITS where molecular testing confirmed it as *P. doppelgangera*. *Pyura doppelgangera* is a non-indigenous ascidian native to Tasmania. The species was first discovered in

New Zealand in the Far North in 2007 and has remained isolated to this district until this detection.

One field study from 2018 conducted into the effects of *P. doppelgangera* on native species observed significant differences in community composition between places with *P. doppelgangera* growth and native green-lipped mussel (*Perna canaliculus*) beds (Davis et al., 2018). However, a recent experimental study by Atalah et al. (2021) investigated the impacts of *P. doppelgangera* on native mussels and rocky shore communities in the Far North and did not find any evidence to suggest that the ascidian would outcompete native mussels. This study reported that *P. doppelgangera* exhibited no overgrowth or spatial competition with the mussels and exhibited minimal natural recruitment and spread over the 1.5-year experiment. Atalah et al. (2021) also suggested that the species may have been present in the Far North of New Zealand longer than originally thought.

The new location and details of these studies were passed on to Marlborough District Council for consideration and the investigation was closed.

Range extension of the non-indigenous clubbed tunicate (*Styela clava*)

MITS notified MPI of a new locality for the non-indigenous solitary ascidian *Styela clava*. MITS collected a specimen during NMHRSS from Havelock Marina, Marlborough. *Styela clava* is a widespread biofouling pest in New Zealand's marine environments. Fouling from this organism can have detrimental economic impacts on aquaculture due to aggressive growth over cultured species or on farm equipment. While the pest is too widespread for national eradication, local populations can be managed or removed. Pathway management is necessary to reduce the spread of the organism to new locations. Initiatives such as the 'Clean Below, Good to Go' campaign that promote good biosecurity practices for marine users and boat owners are key to managing

the spread of pest organisms such as these. The details of this detection were passed on to Marlborough District Council and the investigation was closed.

Colonial ascidian *Didemnum* spp. investigated

Environment Southland contacted MPI after identifying potential *Didemnum* species during surveillance in Tamatea (Dusky Sound), Te Rua-o-te-moko (Fiordland). The council submitted preserved specimens to MITS where taxonomists identified two species of the *Didemnum* genus. The first specimen had very small spicules and was determined most likely to be an undescribed native species. The other specimen was an immature colony too small for morphological identification. However, molecular sequencing revealed that this specimen was the non-indigenous *Didemnum patulum*. This detection represents a minor range extension for the species as it had previously only been recorded from Rakiura (Stewart Island) and Motupōhue (Bluff). The impact of *D. patulum* to native species assemblages or aquaculture structures is likely to be very low. The small size of colonies suggests they are unlikely to outcompete other encrusting species. However, Environment Southland was informed of the new location for the organism and the investigation was closed.

Worms growing over oysters investigated

The Northland Regional Council's Marine Biosecurity Team notified MPI about an unusual mass of worm-like organisms growing over oysters at an oyster farm. Samples of each type of unidentified worm were collected and sent to MITS for identification. Taxonomists indicated that the larger worms included in the sample were *Parasabella aberrans* (Figure 5), a native sabellid worm growing attached to the oysters' shells. The dense smaller tubes fouling on the two oysters in the sample were *Boccardia acus* (Figure 6), a small native shell-boring spionid more usually noticed on cockles. No non-indigenous shell-borers or boring sabellids were

found in the samples provided. As no biosecurity concerns were observed, the information was passed on to the council and the investigation was closed.



Figure 5: *Parasabella aberrans*. Photo: Northland Regional Council Marine Biosecurity Team



Figure 6: *Boccardia acus* on an oyster. Photo: Northland Regional Council Marine Biosecurity Team

Polychaete (*Perinereis amblyodonta*) investigated

A member of the public contacted MPI to report a worm-like sea creature near the water on the Clyde Quay boat sheds in Te Whanganui-a-Tara (Wellington City). Images provided by the notifier (Figure 7) were sent to MITS, who identified the polychaete worm as a native female *Perinereis amblyodonta* belonging to the family Nereididae. This specimen was easily recognisable due to its characteristic blue colour and its 19 non-natatory anterior segments. The female polychaete undergoes metamorphosis to be able to swim to find a male polychaete to reproduce with and this individual may have been partly metamorphosed. As the polychaete

is a native species, the investigation was closed.



Figure 7: *Perinereis amblyodonta* Wellington City. Photo: Bob McVeagh

Polychaete (*Nicon aestuariensis*) investigated

A member of the public notified MPI of an unidentified worm swimming through the water in Tauranga Harbour, Te Moana-a-Toi (Bay of Plenty). The notifier provided a clear video of the worm which MITS taxonomists used to identify the organism as *Nicon aestuariensis*, a native species found burrowing in the soft sediments of estuarine environments all around New Zealand. They are bottom-dwelling deposit feeders and live for about two years, completing their life cycle by laying eggs at the surface and dying shortly after. As this is a native species, the investigation was closed.

Erythrocyte inclusions in kingfish (*Seriola lalandi*) investigated

A veterinary pathologist contacted MPI after finding erythrocyte inclusions in blood samples taken from a captive kingfish (*Seriola lalandi*) population. Inclusions in red blood cells can arise for several reasons but can be a sign of diseases and disorders. There are currently no diseases present in the

New Zealand kingfish population that are known to cause red blood cell inclusions, so an investigation was opened to rule out exotic or emerging pathogens.

The veterinary pathologist submitted six stained blood slides prepared from EDTA-preserved blood samples for examination at MPI's AHL. These were the same slides in which the pathologist identified the inclusions. Additionally, the fish owners collected twelve kidney samples preserved in RNAlater™ from the same population that the inclusions were seen in. AHL pathologists performed PCR for pan-piscine reovirus (PRV) and erythrocytic necrosis virus (ENV) on all samples, which all returned negative results. A conventional PCR for *Piscirickettsia salmonis* was also performed on all samples to test for the presence of rickettsia/rickettsia-like organisms as per Marshall et al. (1998) and Corbeil and Crane (2009) in the absence of a fully comprehensive *Rickettsia* PCR. This testing also returned negative results.

The next step was to perform transmission electron microscopy (TEM) and genomics testing on fresh blood and kidney samples. The fish owners submitted three additional EDTA-preserved blood and RNAlater-preserved kidney samples to AHL. However, upon arrival, microscopy showed that no inclusions were present in these samples. In the absence of clear inclusions, further testing was not completed.

The sample submitters were asked to stay in touch and keep an eye out for signs of disease in the population, check any blood samples they collect from the kingfish population and contact MPI if samples from fish presenting with symptoms, or showing the inclusions become available. At this stage, the investigation has been closed and a new investigation will be opened if the notifiers or fish owners get back in touch.

Mortalities in New Zealand eels (*Anguilla* sp.) investigated

A member of the public contacted

MPI to report mortality involving New Zealand freshwater eels or tuna (*Anguilla* sp.) in a stream on their property in Torbay, Auckland. The notifier found eight small dead eels and a few large ones that were lethargic and exhibiting a very pale colour. The notifier noted that downstream the water was flowing slowly and was quite stagnant due to an obstruction from a fallen branch but did not note any signs of pollution or algal blooms. They had also been for a walk down to the river mouth at the beach and did not note any dead organisms there. Only eels were affected. Investigators dispatched a collection kit and asked the notifier to collect a freshly dead sample if mortalities continued. The notifier noted one dead adult eel the following day. However, no more mortalities occurred once the sampling kit arrived. Investigators asked the notifier to hold on to the kit and get back in touch if a sample became available. As no more mortalities have occurred, the investigation has been closed.

A member of the public notified MPI of 15 dead freshwater eels (*Anguilla* sp.) in the river below the Kōtukuwhakaoka (Arnold River) dam on The West Coast. The notifier reported that the tuna seemed to have been “chopped”, noticing scrapes and lacerations on their bodies. No viable samples were available at the time as the dead eels appeared to be extremely decomposed in the pictures. The notifier was again in contact a few weeks later, reporting another 20 dead eels in the area. A local DOC ranger – who was in contact with the notifier – forwarded investigators pictures of the dead eels. Unfortunately, the eels were again too decomposed for testing at AHL. Investigators have asked the ranger to collect a sample and get back in touch if they find freshly dead or moribund eels in the area that would be suitable for analysis. As no samples have become available, and MPI has not received any further reports, this investigation was closed. A new investigation will be opened if the issue appears to be ongoing.

Sockeye salmon (*Oncorhynchus nerka*) with missing tail fins investigated

A member of the public contacted MPI to report about twenty ‘trout’ with missing tails in Lake Benmore, Twizel. The angler was able to catch one and provided high quality images of the fish to MPI. With the help of Fish and Game, investigators confirmed the fish to be sockeye salmon (*Oncorhynchus nerka*) rather than trout. Damage to tail fins in this manner is expected for sockeye salmon because females use their tails to dig nests (redds) in the gravel of streams, where they lay their eggs. Males then fertilise the eggs and the females again use their tails to cover the eggs with gravel. The salmon then die a few weeks after spawning (NOAA, 2023). Sockeye salmon in New Zealand can be traced back to a single importation of eggs in 1902 (NIWA, n.d.). They are only found in the Waitaki River catchment in the South Island and are landlocked, meaning they never have an ocean-going phase, unlike sockeye salmon overseas. They co-exist in the Waitaki catchment with Chinook salmon (*Oncorhynchus tshawytscha*) and brown and rainbow trout (*Salmo trutta* and *Oncorhynchus mykiss*, respectively). As there was no biosecurity concern regarding the fish or their damaged tails, the investigation was closed.

Unusual holes in snapper muscle tissue investigated

A member of the public emailed MPI to report seeing unusual holes through the musculature of snapper caught from the Coromandel Peninsula, Waikato. The notifier provided a detailed description of the observations and clear photos (see **Figure 8**), showing one hole through the rib cage extending into the swim bladder and another in the loin. Pathologists at AHL reviewed the images and were able to identify these holes as being caused by cysts, likely associated with swim bladder ectasia (outpouchings or dilation of the swim bladder into the fish musculature). This phenomenon has

been mainly reported in snapper in Australian waters (Diggles, 2003) but has been seen in past investigations in New Zealand. The cause is unknown. However, it is suspected to be a genetic abnormality. AHL were interested to study this condition further. However, to understand the impact and cause of this abnormality holistically, the whole fish needs to be examined. Unfortunately, the notifier only had one fillet available. Since no appropriate samples were available, the investigation was closed.



Figure 8: Holes in snapper musculature. Photo: Geoffrey Robinson

Suspected milky flesh syndrome in kingfish (*Seriola lalandi*) investigated

A member of the public contacted MPI after catching a kingfish (*Seriola lalandi*) on the east coast of Great Barrier Island that appeared to exhibit the classic symptoms – white mushy flesh – of ‘milky flesh syndrome’ commonly seen in snapper. Unfortunately, the fish had been filleted and no longer had an intact gut, which is required for meaningful analysis of the syndrome at MPI’s AHL. As no samples were available, the case was closed. The notifier was asked to keep a lookout for the syndrome and

keep the whole fish, with guts in situ chilled and get back in touch.

Isopod found in a sponge investigated

A member of the public contacted MPI to report a suspected pest species, *Paracerceis sculpta*, seen in Ōrākei, Auckland. Photos were provided to MITS taxonomists who were able to confirm that the specimen was most likely a species of *Paracerceis*. However, the taxonomists were unable to determine the species without a sample. Unfortunately, the member of the public did not collect the specimen at the time but was advised to do so in the future if the isopod was spotted again. The investigation was closed as no samples were available.

Range extension recorded for the non-indigenous isopod *Paracerceis sculpta*

NIWA notified MPI of a detection of the non-indigenous sphaeromatid isopod, *Paracerceis sculpta* found in a subtidal area of Great Barrier Island, Auckland. Eleven specimens were collected as part of a wider NIWA Hamilton ecological survey and subsequently identified by MITS taxonomists. This species was first detected in New Zealand in 2005 and has been previously detected on vessel hulls from Opua, Auckland and Kawatiri (Westport). This species is widely recorded from ports and harbours around the world and is considered to have been introduced to Brazil, Hawaii, Atlantic Europe, the Mediterranean and Hong Kong and is widely present in Australian ports on all coasts. Although this species is a widespread invader, no ecological or economic impacts have been reported (Smithsonian Environmental Research Center, n.d.). This information was passed onto Auckland Council and DOC and the investigation was closed.

Greasyback prawn (*Metapenaeus bennettiae*) detected

A Fisheries New Zealand staff member contacted investigators on behalf of a commercial fisher who requested species identification of a prawn they

seemed to be catching more frequently in the Firth of Thames, Auckland. Photographs were sent to MITS where taxonomists confirmed the species as the non-indigenous greasyback prawn (*Metapenaeus bennettiae*). It reaches about 110 mm in length and typically lives in coastal rivers or shallow estuaries on muddy and sandy-mud substrates to a depth of about 15 m (Grey et al., 1983). Juveniles usually live in nearshore habitats such as mangrove mudflats and seagrass beds, whereas adults are more common in the open embayments of the estuary (Ahyong, 2009). This species is native to eastern Australia and its first record for New Zealand comes from the Waitematā Harbour in 2009. Potential impacts are unrecorded and none have been demonstrated since 2009. It was first detected in the Firth of Thames in 2017 and has also been reported from Northland. As this species is already known from the area, the notifier was informed of the identification and the investigation was closed.

Shrimp-like organism investigated

A member of the public contacted MPI to report mounds of shrimp-like creatures washed up on Pegasus Beach, Waitaha (Canterbury). The notifier provided images of the shrimp-like, small and transparent creatures that MITS taxonomists identified as hyperiid amphipods – small aquatic crustaceans – belonging to the genus *Vibilia*. Taxonomists required samples to confirm the identity to species level. However, these organisms are indigenous and have a cosmopolitan distribution – extending across most of the world – so sampling was not needed. As no biosecurity concerns were identified, the outcome was passed onto the notifier and the investigation was closed.

Kōura (*Paranephrops planifrons*) mass mortality investigated

A biodiversity ranger at DOC contacted MPI to report a large-scale mass mortality of over 7,000 kōura (*Paranephrops planifrons*) in the Waitangi Stream, Manawātū–

Whanganui. The ranger informed Horizons Regional Council of the mortality and a pollution response officer collected ten fresh samples to submit to MPI's AHL. Pathologists conducted histopathology, bacteriology, postmortem and molecular analysis for *Aphanomyces invadans*, *Aphanomyces astaci*, yellow head virus (YHV-1), and white spot syndrome virus to investigate if an exotic or emerging disease contributed to the mortality.

A clear cause for the mortality could not be ascertained. However, macroscopic examination showed that the stomachs of all kōura were full, suggesting a relatively sudden onset of the mortality. There were no clear histological signs of the cause of the deaths, but chemicals or toxins cannot be excluded. In all kōura examined, small numbers of encysted parasites were observed. The parasites were likely trematode and nematode life-stages, where crayfish act as an intermediate host stage and fish or birds as the final host, making this an incidental find. Evidence of inflammation affecting internal tissues was observed in a small number of specimens. Another specimen had mild inflammation in the hepatopancreas suggesting a possible low-grade infection. A deep and necrotising lesion associated with fungal invasion was observed in one sample. Water moulds (*Saprolegnia* and *Aphanomyces* species) can attach to and invade the cuticle of crustaceans resulting in ulcerative and necrotising deep infections as in this case. Similar lesions were not identified in any other kōura.

There was no consistent clinical sign or bacteria isolated between the different individual kōura, suggesting that the bacteria seen in cultures were incidental finds, or opportunistic secondary pathogens. The PCR results for all four exotic diseases were negative.

As no biosecurity concerns were identified and no further mortality was reported, this investigation was closed.

Crab larvae found in an aquaculture facility

An aquaculture research facility contacted MPI after observing unusual larvae in a tank containing green-lipped mussels. While staff at the facility were reasonably confident that the larvae were that of pea crabs (*Pinnotheres* sp.), they wanted to ensure that any potential biosecurity concerns were addressed. Images of the larvae were sent to MITS for species identification (Figure 9). It can be difficult to identify crustacean larvae of an early stage; however, MITS narrowed the candidates down to two species that look like the larvae in the images: *Ebalia laevis* (an endemic coastal crab) and the pea crabs, *Pinnotheres* sp. Pea crabs are small, parasitic crabs that commonly live inside oysters and mussels. Adult pea crabs are entirely reliant on their host for shelter and food. Trottier et al. (2012) looked at the impact of pea crab on green-lipped mussels in an aquaculture setting and found that infected mussels were 30 percent smaller in total wet weight and had a 29 percent lower meat yield. MITS was able to confirm the larvae as most likely belonging to pea crabs, primarily based on the association with green-lipped mussels. As no biosecurity concerns were identified, this investigation was closed.

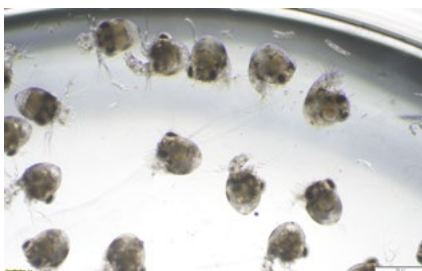


Figure 9: Pea crab larvae (*Pinnotheres* sp.).
Photo: Cawthron Institute

Range extension of the non-indigenous Asian paddle crab (*Charybdis japonica*)

A member of the public called MPI to report suspected Asian paddle crabs (*Charybdis japonica*) seen on the beach near Te Puru School, Waikato. Taxonomists used images provided by the notifier to confirm the sighting

of the suspected pest. Asian paddle crabs were first detected in Whangārei and Waitematā harbours in 2000. Since then, these crabs have spread widely across Auckland and Northland. They inhabit intertidal to subtidal estuarine habitats and can be found on several different substrate types from fine mud to reefs. They can produce hundreds to thousands of larvae that can survive for 3–4 weeks, facilitating spread to new areas. They are also capable of swimming large distances. They are known to be aggressive and compete with native crabs and other benthic species for habitat and food. Some educational links and material were provided to the notifier. The information on this detection was passed on to Waikato Regional Council and this investigation was closed.

Following this investigation, MITS notified MPI of another *C. japonica* sighting posted to iNaturalist. This sighting also originated in Waikato, in Whāingaroa (Raglan Harbour). Investigators then worked with taxonomists to review and confirm another five iNaturalist posts as *C. japonica*, all within regions where the species is known to be present. These detections were from Kereta in Waikato, Bowentown in Bay of Plenty and Tiritiri Matangi, Arkles Bay and Browns Bay in Auckland.

Relevant regional councils and DOC were informed of the new records in their regions and the investigation was closed.

Mass mortality of crabs investigated

A member of the public contacted MPI to report a mass mortality of crabs on Pines Beach, Canterbury. The notifier estimated dead crab numbers to be over 800 and reported that they were mostly empty carapaces with only a few whole crabs seen. No adverse weather or signs of pollution or algal blooms were reported. Investigators dispatched a collection kit to the notifier to collect a sample for disease diagnostics testing at AHL. However, no suitable samples could be found on arrival and the mortality had ceased. Investigators asked the notifier, Environment Canterbury, and the

local DOC office to keep an eye out for further crab mortalities in the area. As no samples were available for testing and the mortality had resolved, the investigation was closed.

Sea star investigated

An MPI employee reported an iNaturalist observation of an unidentified sea star in Wellington Harbour. The associated photograph was sent to MITS for species identification. However, with only a picture of the top of the sea star available, taxonomists were unable to identify the species. Possible species included *Allostichaster insignis* or *Allostichaster polyplax*. *Allostichaster insignis* occurs intertidally and subtidally around New Zealand, but is more common from Cook Strait southwards. *Allostichaster polyplax* is also known to be distributed around New Zealand. The notifier was asked to collect a sample, but they could not locate the sea star again. As no samples or additional images were available, the case was closed.

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ENVIRONMENT HEALTH

Annual reports from Ministry for Primary Industries

Environment health surveillance and incursion investigation annual report

Team overview

The Environment Health team seeks to protect native biodiversity and the environment by rapidly detecting and mitigating biosecurity risk from suspected new exotic organisms. This is achieved by implementing national targeted surveillance programmes for high-risk exotic organisms and investigating suspected incursions of exotic organisms and interceptions of risk goods that may pose a threat to animal health. Within the team, there is also expertise in Asian foods and traditional Chinese medicines.

The team manages four targeted surveillance programmes:

- national invasive ant surveillance programme (NIAS) (page 147);
- national mosquito surveillance programme (page 149);
- arbovirus surveillance programme (page 59); and
- Ports of Auckland prophylactic exotic ant treatment programme.

The team also collaborates with Animal Health Surveillance and the Animal Health Laboratory on the following honey bee health-related programmes:

- The Colony Loss Survey;
- Project Varroa; and



Figure 1: Incursion Investigators learning capture techniques with professional snake handlers in Adelaide, Australia. Photo: Adelaide Snake Catchers

- Small Hive Beetle Surveillance Project (page 20).

Environment Health team members are specialists and technical experts in their fields. The team consists of six team members who are spread across the motu representing different portfolios and work streams (**Table 1**).

As of July 2024, the Environment Health team has merged with the Surveillance Engagement and Systems team within the Surveillance and Incursion Investigation group.

Professional development and conference attendance

During 2023, team members attended the following courses and events:

- Leading beyond Sustainability (postgraduate paper): Non-linear and systems thinking, leadership for change (Lisa Maria);
- Snake handling course for Incursion Investigators (Lisa Maria and Incursion Investigators from Animal/Plant Health) (**Figure 1**);
- Fourth International Congress on Biological Invasions (Lora Peacock and Lisa Maria);
- 15th Mosquito Control Association of Australia, Brisbane (Lora Peacock); and
- Health and Safety Representative stage 2: Risk assessment and incident investigation (Lora Peacock).

Publications and conference presentations

Peer-reviewed papers and work presented at conferences:

Peacock L, Rae A, Moss K (2023). *Reprioritisation of surveillance to*

Table 1: Environment Health team roles, qualifications, and experience at MPI

Name	Role	Portfolio	Location	Qualifications	Years of service
Lisa Maria	Acting Manager/ Senior Incursion Investigator	Environment Investigations	Nelson	BSc, MSc	10
Zoran Sinovic	Principal Adviser	Asian Foods and Traditional Chinese Medicines	Auckland	BSc	26
Lora Peacock	Senior Adviser Surveillance	Environment Surveillance	Christchurch	PhD, MSc (credit), BSc, Dip (Tcg)	19
Rachel McIntyre	Incursion Investigator	Risk Goods Investigations	Christchurch	BA, BSc	15
Hayley Pragert	Senior Adviser Surveillance	Bee Health	Auckland	BSc, PGDipSc, MSc	8
Hayden Kinraid	Adviser	Freshwater surveillance	Christchurch	BSc	1

Note: AF = Asian foods; TCM = traditional Chinese medicine

respond to changes in risk of arrival and establishment of exotic mosquitoes into New Zealand. 15th Mosquito Control Association of Australia Conference, 'The new normal: responding to emerging and resurging mosquito risks'. 20–24 August 2023. Brisbane, Australia.

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Engagement and communication

Engagement and communication activities raise public awareness of biosecurity risks and encourage reporting through MPI's exotic pest and disease hotline (0800 80 90 60).

At the New Zealand National Apiculture Conference, Hayley Pragert was a panellist on *Varroa*, what we currently know and where do we need to go, discussing the current challenges faced by beekeepers managing varroa, what current tools are available to manage varroa better and what the industry needs to do to manage varroa successfully in the future. View here: https://www.youtube.com/watch?v=oQtqKe9_niw.

Providing trusted technical expertise

During 2023, our expertise was called on as subject matter experts both internally (e.g., Readiness and Response Science Products programme) and externally (e.g., Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Te Mana o te Taiao Biodiversity Strategy Interagency Reference Group and Better Border Biosecurity (B3)).

International work programmes

Intergovernmental science-policy: Platform for Biodiversity and Ecosystem Services (IPBES)

Lora Peacock is one of the New Zealand science experts carrying out assessments for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

Invasive alien species are one of the five most important direct drivers of biodiversity loss – alongside changes in land and sea use, direct exploitation of species, climate change and pollution. IPBES was charged to provide the best available evidence and policy options to deal with the challenges of biological invasions. The resulting report was produced by 86 experts from 49 countries, working for more than four and a half years. It draws on more than 13,000 references, making it the most comprehensive assessment ever carried out of invasive alien species.

Lora was a lead author for Chapter Five of the *Thematic Assessment Report on Invasive Alien Species and their Control (Management; challenges; opportunities and lessons learned)*. The assessment of invasive alien species is now completed, and the report has been disseminated globally:

IPBES 2023. Thematic assessment report on invasive alien species and their control for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Roy, HE, Pauchard, A, Stoett, P and Renard Truong, T (eds.). IPBES secretariat, Bonn, Germany. <http://doi.org/10.5281/zenodo.7430682>

CSIRO and Agriculture Victoria varroa preparedness

In 2022, varroa mites (*Varroa destructor*) were found for the first time in honey bees in New South Wales, Australia. The arrival and establishment of the mites has created considerable concern for Australian beekeepers. The Environment Health team (alongside the Animal Health Laboratory – Dr Richard Hall) has since supported hosting a delegation of Australian bee scientists from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Agriculture Victoria (Victoria State Government). Their mission was to collect samples from varroa-infested hives to trial new varroa environmental DNA (eDNA) surveillance methods (**Figure 2**, next page). eDNA technology has the potential to improve the accuracy



Figure 2: Australian bee scientists swabbing a brood frame for eDNA testing for varroa infestation. Photo: Richard Hall

and efficiency of surveillance and pest eradication for honey bees; more information can be found at: <https://www.mpi.govt.nz/dmsdocument/56311-Biosecurity-New-Zealand-partners-with-Australian-scientists-on-varroa>.

Australian Honey Bee Industry Council varroa preparedness

The Environment Health team (alongside the Animal Health Laboratory – Dr Richard Hall) also helped host Australian bee biosecurity officers from Western Australia, New South Wales and Victoria, as well as Australian Honey Bee Industry Council representatives. Their purpose was to build knowledge and experience with varroa, and provide an opportunity to strengthen capacity in the Australian honey bee industry. More information can be found at <https://honeybee.org.au/ahbic-new-zealand-immersion-tour-sponsored-by-agrifutures/>.

Technical projects

National Freshwater Surveillance programme

A national Freshwater Surveillance programme is in development, aimed at improving detection of new-to-New Zealand freshwater organisms. Programme development is focused on delivering updated risk profiling data for exotic freshwater organisms across freshwater taxa (fish, invertebrates and plants), modelling to determine high-risk sites using habitat viability and pathways information, and building partnerships through extensive engagement. Further projects are proposed over the next year to establish the scientific and operational basis for implementation of the programme. This programme

of work is being led by Environment Health team in collaboration with subject matter experts from the Aquatic Health team.

Operational research project: Project Varroa

Varroa destructor is now the number one cause for bee loss in Aotearoa New Zealand. While the mite has been in the country for 24 years, varroa continues to present a challenge for beekeepers in New Zealand. Each year, the mite is estimated to cost beekeepers more than \$20 million in winter alone. *Project Varroa* (MPI Operational Research) looked at better ways to monitor and improve varroa treatment in New Zealand to reduce mite burden. The project developed field guidance for beekeepers to monitor the success of their varroa treatments (a field trial), and gathered insights via focus groups into why beekeepers have difficulty with varroa. These insights included understanding more about the timing of treatment, reinvasion, and any difficulties they are experiencing with varroa treatments.

Operational research project: Japanese encephalitis virus risk areas and feeding preferences of New Zealand mosquitoes

Japanese encephalitis virus (JEV) is a zoonotic vector-borne virus spread by mosquitoes and occurs widely across Asia. JEV infects both humans and animals and is a leading cause of human encephalitis and death. JEV can also cause reproductive and nervous disease in animals. The socio-cultural, health and economic impacts of a JEV incursion in New Zealand would be significant. With climate change and the increased frequency of severe weather events, and the recent outbreak in Australia, there is a need to increase preparedness for JEV and related arboviruses. The aim of this project is to fill knowledge gaps related to a JEV incursion and establishment by identifying New Zealand locations that have suitable ecological conditions to allow establishment and amplification of competent mosquito vectors for JEV. This project will also determine the predominant vertebrate animal types

fed upon by New Zealand mosquito species (endemic and already introduced) across these suitable areas and will determine which vertebrate animal species are best to sample for serological surveillance. The research is being led by the Animal Health Surveillance & Incursion Investigation and Environmental Health teams. Lora Peacock is the Environmental Health representative.

The New Zealand Colony Loss Survey

The Colony Loss Survey is completed annually by New Zealand beekeepers to help us understand the state of honey bee colonies. It is part of an international effort involving more than 40 countries to track bee health and beekeeping practices. New Zealand has one of the highest response rates in the survey worldwide and compared with other New Zealand primary industry surveys. In total, 3,457 New Zealand beekeepers (42.6 percent) actively engaged in the 2023 survey. The survey is carried out in partnership with Manaaki Whenua – Landcare Research, with 2023 marking the ninth year of data collection. Full results can be found here: <https://www.mpi.govt.nz/biosecurity/how-to-find-report-and-prevent-pests-and-diseases/bee-biosecurity/bee-colony-loss-survey/>

Summary reports on notifications and investigations for 2023

The Environment Health Incursion Investigators' activities cover:

- exotic vertebrate interceptions;
- risk goods (imported commodities) that might harbour animal pathogens;
- exotic mosquitoes; and
- biosecurity risks associated with Asian food and traditional Chinese medicine products.

Environment and risk good incursion investigations can be complex, involving a number of MPI teams (e.g., Compliance Directorate and Animal Imports), external stakeholders, mana whenua, government agencies (e.g., Te Whatu Ora) and providers of surveillance programme operational

services. We also work closely with the Department of Conservation and regional councils, whose field staff assist with investigations where we are trying to establish risk, e.g., if a breeding population of an exotic species is present.

In the risk goods domain, the investigator may work closely with the importer or their agent, Biosecurity New Zealand border clearance quarantine officers and target evaluators, retailers and members of the public who have purchased a commodity with a biosecurity risk.

On average, the Environment Health Incursion Investigators receive about 280 notifications via the 0800 exotic pest and disease hotline per annum. Typically, about half of these notifications progress to an incursion investigation.

Most notifications in 2023 were generated by members of the public (71 percent), followed by central or local government (16 percent); the remainder was split between biosecurity providers, primary industry and the science community.

Figure 3 shows that overall, there was a decline in the number of investigations in 2023; this correlates with drop in risk good notifications over the past few years as demonstrated in **Figure 4**.

The decline in risk good investigations aligns with external trends of a general economic slowdown, along with a shift back towards in-store purchasing, after the e-commerce peak experienced during the COVID-19 pandemic. An MPI e-commerce work programme set up in June 2022 has made significant progress in this space. Engagement with large international online platforms has resulted in some goods on those platforms not being available for purchase to New Zealand buyers.

Figures 5 and 6 (next page) show the proportion of investigations by taxon and the proportion of risk good investigations by type, showing a predominance of exotic reptile investigations and illegal bee products, respectively. Exotic stowaway reptiles continue to comprise of over half of environment investigations

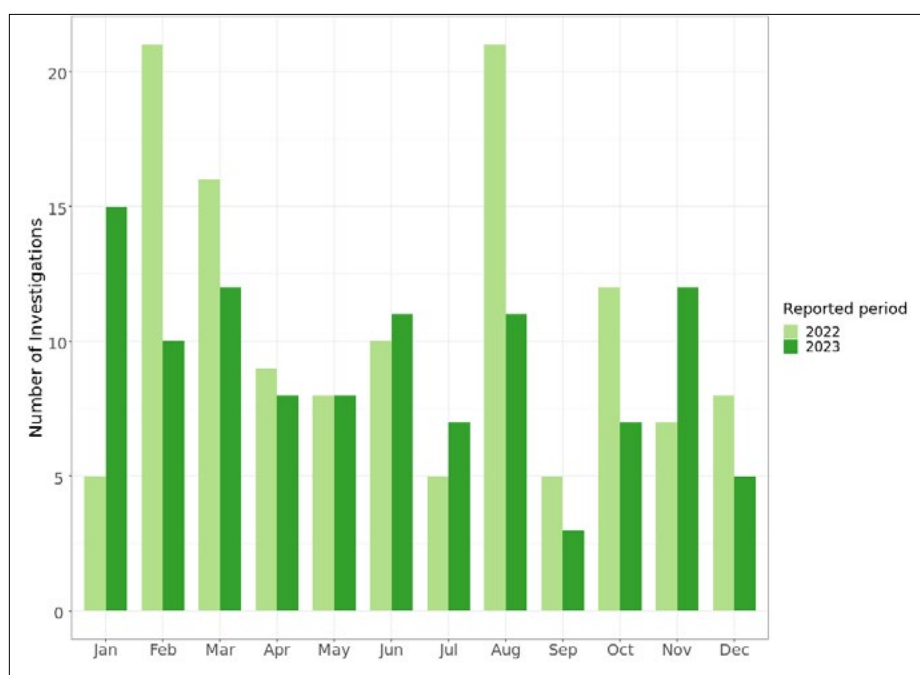


Figure 3: Number of investigations per month in 2023 compared with 2022

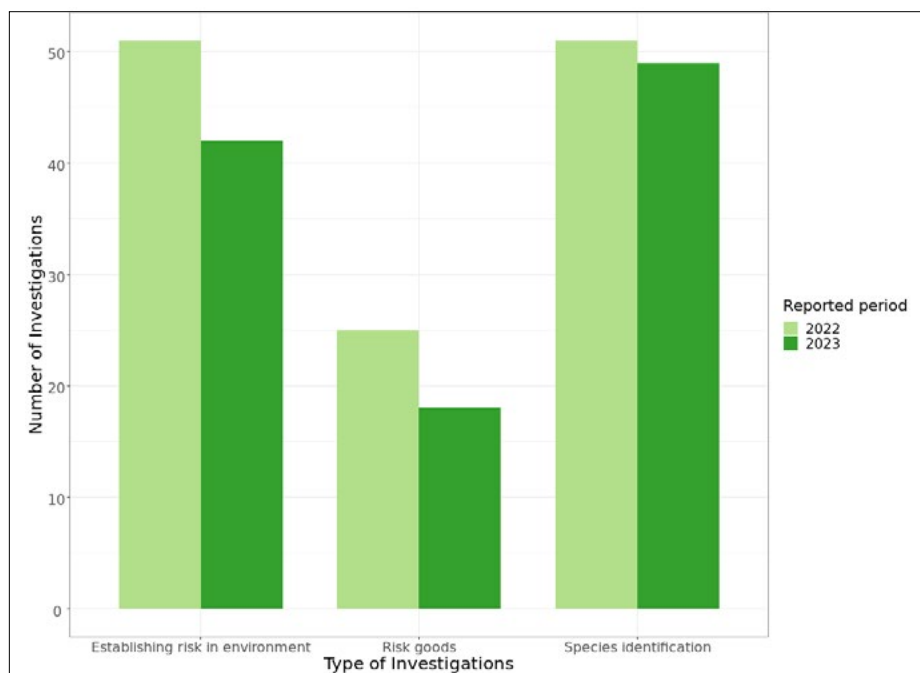


Figure 4: Number of investigations by type in 2023 compared with 2022

with specimens arriving from countries with whom we have trade connections and vacation hot spots (e.g., Pacific islands, China, southeast Asia and Australia).

Notable investigations

Notifications in the digital world – first appearances can deceive

Environment Health investigators receive a diverse range of notifications, and 2023 was no exception. Increasingly we are receiving notifications of suspected exotic

animals and risk goods that are found in the digital domain (e.g. social media).

Recently a member of the public reported a person selling fennec foxes (*Vulpes zerda*) on a New Zealand pet rescue social media site. Fennec foxes are the world's smallest fox species, native to the deserts of North Africa and the Sinai and Arabian peninsulas. There is no legal pathway for this species to enter New Zealand as a pet.

The investigation revealed that this listing was not legitimate. The phone number was not valid and

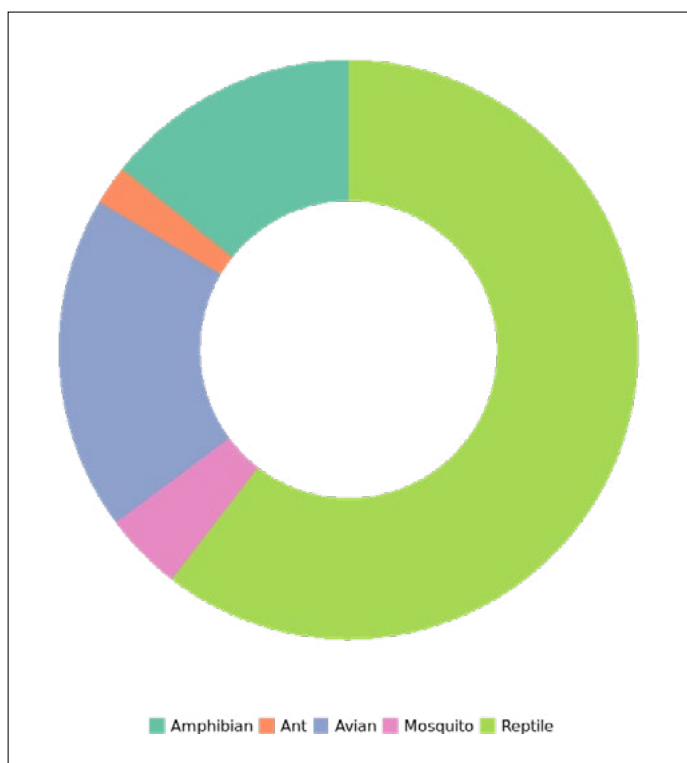


Figure 5: Proportion of environment investigations by taxon

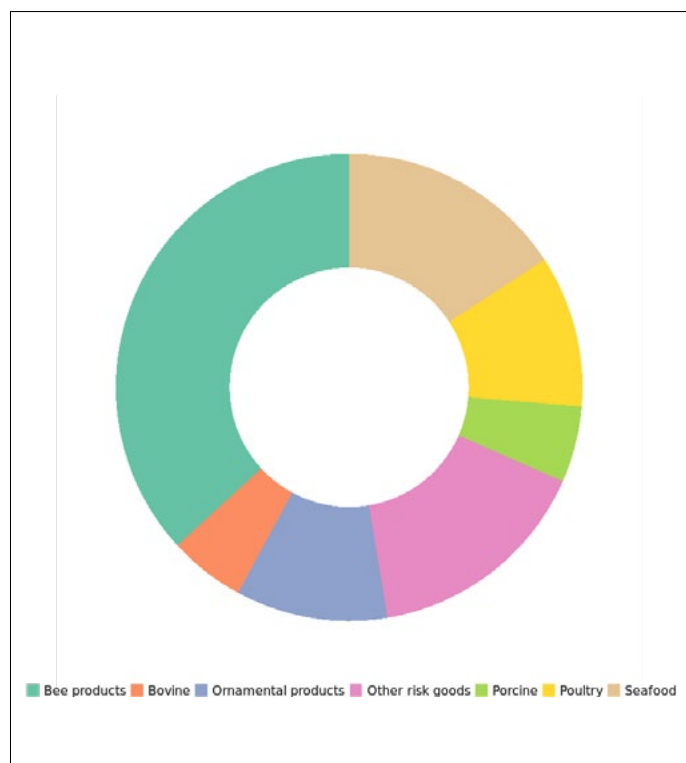


Figure 6: Proportion of risk goods investigations by type

not consistent with the city that the foxes were said to be available from. Assurances made about USDA licensing are not relevant to New Zealand and a reverse image search found the same pictures on overseas social media advertising the foxes for sale.

Similarly, capuchin monkeys (subfamily Cebinae) are frequently advertised for sale on social media. Capuchin monkeys live primarily in Central and South American tropical forests. These listings typically offer baby capuchin monkeys complete with health documentation, vet checks and vaccinations. These primates are not able to be legally imported into New Zealand by private individuals, regardless of documentation.

Both fennec foxes and capuchin monkeys are common animals that have been used to scam people out of money around the world. The assurances provided about regulatory documentation and vaccinations are used to make the sale look legitimate. Once the initial payment is made, scammers will ask for further payments to cover transit problems. When it becomes clear that there is no pet and money stops flowing, the scammer disappears.

Scams are not the only reason that exotic animals online may appear to be present in New Zealand. A recent post to a social media group made a claim that Australian parrot eggs had crossed the New Zealand border. In general, bird eggs are not permitted to be imported into New Zealand as they present a potential exotic disease risk. New Zealand has eight endemic species of parrot. All of the mainland species are threatened with extinction in varying degrees and biosecurity regulation supports conservation efforts by keeping novel pathogens offshore. In this case, BNZ Intelligence analysts were able to establish that the post, or person who made the post, was not authentic. The investigation revealed that the person had intentionally engaged with the group in a deceptive manner on several occasions, with no obvious motivation able to be determined.

Social media content may also be unintentionally misleading. A video posted on social media of a snake raised concern when the street names seemed to indicate the video was taken in Auckland. Clues to the real location of the snake included the types of vegetation in the video and information on the poster's profile indicating that the video was shot in

Queensland. A quick search showed that the area and street names mentioned were in Brisbane as well as Auckland.

Sometimes even the individual behind the post is not even aware of the post. A report was made of photos of a salamander on a community's social media group. Weather information for the week before the post showed lows down to -4°C, not survivable for a sub-tropical salamander. When further information was requested by the group administrator in the comments, the original poster apologised, saying he had accidentally made the post and that the photo was taken while he was on holiday in Florida.

We will always respond to reports of unusual sightings, no matter how unlikely it may seem that these present a biosecurity risk.

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National invasive ant surveillance programme annual report

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 and sea containers. Some are major urban pests, invading homes and businesses where food is readily available. They also threaten natural biodiversity by displacing and preying on 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 (**Figure 1**), 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.

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

GPS locations and associated data are recorded and stored in a secure ArcGIS server. All samples are tracked electronically from the field to identification in the laboratory. Pottles are sent to the Ministry for Primary Industries' Plant Health and Environment laboratories (Auckland and Christchurch) for screening and identification. Once an exotic ant has been identified, an investigation is



Figure 1: Typical environment of Ports of Auckland surveyed during NIAS. Photo: L Peacock



Figure 2: NIAS baited pottle with a carbohydrate source (cotton wool soaked in sugar solution) at Ports of Auckland. Photo: P Craddock

initiated to track and eradicate nests near the location of the original find.

Results

In the 2024 season, 26,988 pottles were deployed nationally, with three pottles attracting exotic ants (**Table 1**, next page). All three detections resulted in investigations under urgent measures, which was a decrease from 2023 (Peacock et al., 2023). One

Ports of Auckland pottle (**Figure 3**, next page) contained 43 exotic ants (*Paratrechina longicornis*), which showed that a nest was present. That nest was located and destroyed.

The other two detections (**Table 1**) also led to successful eradications because the single nest detected in each case was small enough to be successfully treated. This was probably due to the ants likely being

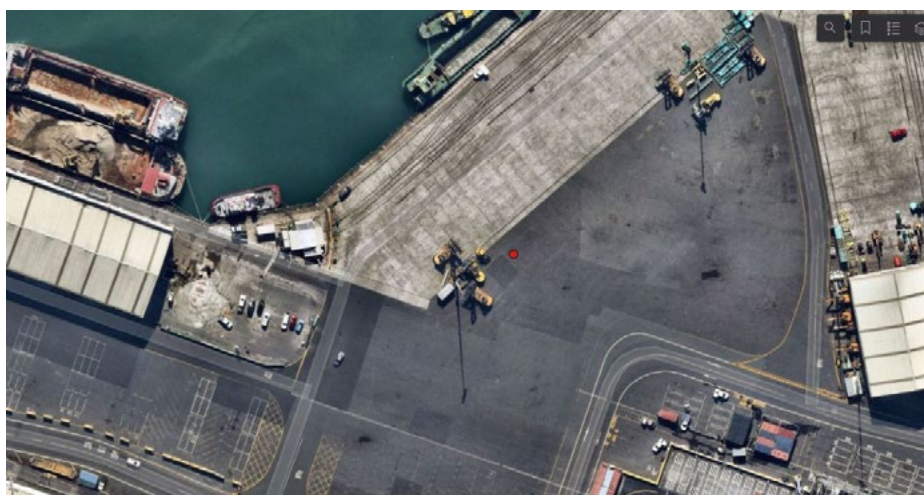


Figure 3: MPI's ArcGIS dashboard showing detection of the exotic species *Paratrechina longicornis* at Ports of Auckland (red dot = original detection in surveillance pottle). The nest was eradicated

Table 1: Locations of exotic ant detections during NIAS, 2024

Species	Location	Date of detection	Number of pottles with ants	Number of exotic ants in pottle
<i>Paratrechina longicornis</i>	Ports of Auckland	24 Jan	1	43
<i>Paratrechina longicornis</i>	Mt Maunganui	8 Feb	1	1
<i>Monomorium sahlbergi</i>	Port of Tauranga	18 Feb	1	1

recent arrivals to the country. The NIAS system continues to work well in detecting and eradicating early established ant species through continuous systems improvement. Yet again, the 2024 season demonstrates the value of early intervention in preventing the establishment and spread of exotic ants in New Zealand that arrive via international trade.

A delimiting survey was undertaken at a container storage Transitional Facility in Christchurch in December 2023 to confirm eradication of the exotic *Tapinoma* ant species from the *nigerrimum* complex detected in the last season (Peacock et al., 2023). However, seven exotic ants from the *Tapinoma nigerrimum* complex were detected, resulting in further treatment of the site. The site was surveyed again in February under the NIAS programme and no more exotic ants were detected. This facility is surveyed every year by the NIAS programme as it receives high volumes of containers.

Reference

Peacock L, Craddock P, Archer M, Gunawardana D, McCarthy B, Thomas A (2023). National invasive ant surveillance programme annual report. *Surveillance* 50(3), 128–129.

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National mosquito surveillance programme annual report

Introduction

In 2023/24, there were no detections of any life stages of exotic mosquito species in the post-border saltmarsh/brackish and freshwater breeding habitats surveyed by the National Exotic Mosquito Surveillance Programme (NSP).

The programme

The NSP underwent significant extension during 2023/24 due to three major and overlapping risk factors. The first is the high number of potential pathways of exotic mosquito species entering New Zealand via the large number of Transitional Facilities in existence outside traditional coastal port environments. The second reason is the rapid expansion of Japanese encephalitis virus (JEV) risk from Australia that could become associated with freshwater exotic mosquito breeding adjacent to New Zealand piggeries (pigs are amplifying hosts of JEV). The third is that many mosquito-borne diseases are vectored by freshwater-breeding exotic mosquito species (including JEV) and have, historically, received only limited post-border surveillance beyond saltmarsh mosquito breeding habitat. The changes are described below in detail to highlight the effort MPI goes to protect New Zealand against these serious threats.

In March 2023, the NSP agreement was amended to provide a process to include high-risk exotic mosquito breeding habitats associated with a new assemblage of 'Target Locations', collectively, Transitional Facilities, First Places of Arrival and commercial piggeries within New Zealand. The Target Locations are premises more generally concentrated in industrial centres, agricultural hubs and so-called inland ports. The rapid and widespread emergence of JEV with human cases including five fatalities in Australia in 2021/22, along with widespread flooding in New Zealand and high rainfall in 2023, were strong considerations in proceeding with the



Figure 1: Sampling mosquito larvae from an urban constructed wetland assisted by MPI observer

inclusion of exotic JEV vector mosquito freshwater breeding habitats. MPI's risk assessment of Target Locations concluded that potential exotic mosquito breeding habitat within 6 km of these locations would be included in the expanded NSP. An important outcome of the 2023 variation was to develop the methodology for identifying and prioritising mosquito habitat within the 6 km radius and to use that to produce a transitional plan to implement this significant expansion of the NSP.

Methodology

The methodology to identify exotic mosquito habitat, select and characterise field sampling locations and list these for inclusion in NSP operations was field-tested in the Hamilton/Waikato region in September 2023. Remote desktop mapping of habitat within a 6-km radius of each Target Location used macro-level national wetland and drainage GIS layers to provide a

gross overview of potential habitats. Deployment of experienced NSP field surveillance officers to systematically traverse each Target Locality showed that GIS layers were highly incomplete and of only limited assistance in identifying potential survey sites. Field surveillance teams equipped with ArcGIS-compatible devices identified future survey sites by ground-truthing a high percentage of accessible habitats, marking and characterising each site for inclusion in programmed NSP surveillance when approval to implement the expanded NSP was given. As such, there is considerable overlap in the 6-km radius from each individual Target Location. Therefore, regions with such overlaps were grouped using logical geographical boundaries including major roadways, rail lines, rivers, topography, etc., into the newly coined NSP 'Surveillance Blocks'. Each Surveillance Block was designed to be similar in size. The Surveillance Block approach of overlapping Target Locations allows

for individual surveillance sites to be associated with several Target Locations, increasing the efficiency of operational planning and deployment to undertake site surveillance per Target Location covered.

The Transitional Plan for an expanded NSP was approved in December 2023 and in March 2024 a further variation to the NSP agreement was approved to implement the wider NSP. Progressive field ground-truthing surveys of major portions of NSP Surveillance Block concentrations have been undertaken since the beginning of April 2024. Auckland has largely been covered by virtue of much of the newly mapped NSP Surveillance Blocks overlapping with existing NSP Saltmarsh Habitat surveillance. A redesignation and filling in some relatively minor gaps in habitat coverage have been identified for inclusion in the new Auckland NSP Surveillance Blocks. Other centres of NSP Surveillance Block concentrations that have been mapped for NSP (to the end of June 2024) include the Hamilton, Christchurch (south to around Ashburton and north to Amberley), Nelson, Picton and Blenheim south to Kaikoura regions. These regions were surveyed by large teams on specific deployments. Other locations of high NSP Surveillance Block concentration including Tauranga are scheduled for team deployment to complete mapping soon. Areas that have sparsely distributed NSP Surveillance Blocks without much overlap are being mapped by individual NSP surveillance officers from their bases of existing NSP operations. All NSP mapping will be completed by the end of March 2025. Implementation of actual field surveillance of newly identified sites has begun and will be progressively included. An important element of the implementation of the expanded NSP field surveillance will be the recruitment and training of additional NSP surveillance officers to cover the increased field surveillance demand.

The existing methodology for calculating individual NSP saltmarsh site annual surveillance effort (hours of actual site surveillance per site) will be adapted for the new NSP Surveillance Blocks. Reporting on

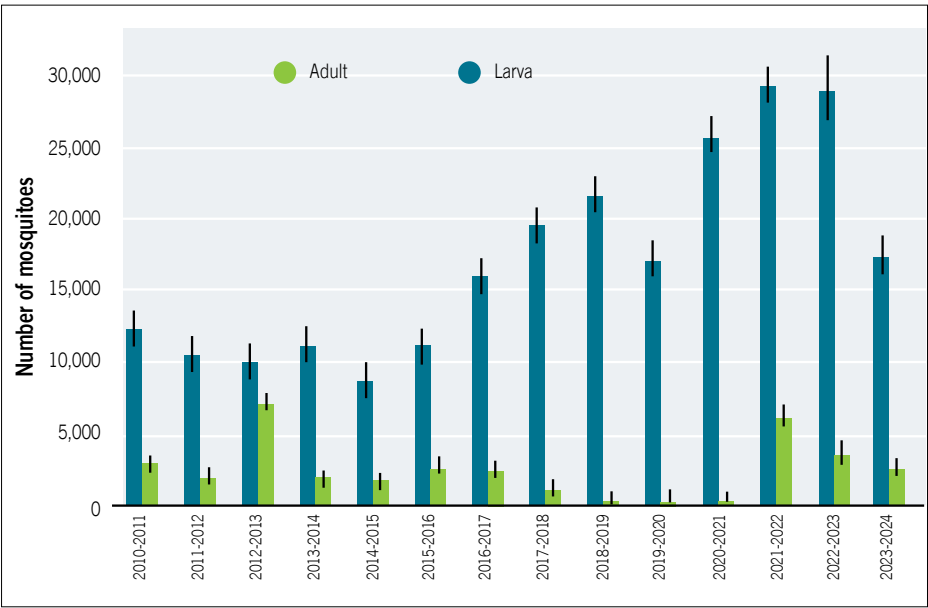


Figure 2: Annual mosquito collections (larvae and adults 2010–2024)

overall NSP surveillance effort will be generally at the Surveillance Block level; however, new GIS tools are being developed to provide for detailed interrogation and reporting on specific surveillance queries.

The expansion of the NSP to include all potential exotic mosquito habitat within 6 km of Target Locations will increase the number of individual NSP sites from 831 (in 2023) to 2,307 when fully implemented by April 2025. Notwithstanding implementing the expanded exotic mosquito surveillance transition plan, routine surveillance of existing NSP sites has been maintained throughout 2023/24 without any major disruption.

The physical conditions of NSP mosquito breeding sites change over time due to land use changes; that is, erosion and accretion of water courses/drainage altering water flow relative to mosquito breeding habitat. Some sites change slowly and some very rapidly. One particularly important and relatively recent factor in changing mosquito breeding opportunities is the proliferation of urban stormwater management devices including constructed wetlands, sediment control ponds and other engineered water management installations. **Figure 1**, (previous page) shows mosquito breeding surveillance within an urban constructed wetland designed to provide residential housing stormwater collection

and filtering before discharge. In response to the dynamic nature of mosquito habitat productivity, all NSP surveillance sites undergo an annual reassessment to recalculate the next year’s target surveillance effort measured in hours of recorded GPS tracks per site.

Each NSP site is routinely visited up to four times per year to collect mosquito larvae when optimal mosquito breeding conditions are present. As field surveillance officers traverse the NSP site (individual sites may vary from a few m² to several ha), GPS tracks are recorded, sample locations marked and characterised, sampled larvae recorded for dispatch and that site’s data synced with the NSP database. Samples are killed, preserved and traceably couriered to

Table 1: Larval and adult stage mosquitos collected 2022/23. No exotic mosquitos found

Species	Larva	Adult
<i>Aedes antipodeus</i>	1,939	188
<i>Culex pervigilans</i>	16,734	264
<i>Coquillettidia iracunda</i>	0	60
<i>Aedes notoscriptus</i>	13	144
<i>Culex quinquefasciatus</i>	69	6
<i>Aedes subalbipennis</i>	231	0
<i>Culiseta tonnoiri</i>	0	4
<i>Coquillettidia tenuipalpis</i>	0	2
Total	18,986	668

the Mosquito Consulting Services (NZ) laboratory for mosquito identification to species. ID results are matched with field sampling data and reported to MPI via the NSP database. Any mosquito life stage identified as exotic is confirmed by a second entomologist and reported to MPI within one hour of identification.

Results

In 2023/24 there were 18,986 larvae and 668 adult mosquitoes identified to species from programme field collections (**Table 1**, previous page). **Figure 2** (previous page) shows annual results of all mosquito life stages collected by the NSP since 2010.

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PLANTS AND ENVIRONMENT

Annual reports from Ministry for Primary Industries

Plant Health and Environment Laboratory annual report

About us

PHEL has two well-equipped laboratory facilities located in Auckland and Christchurch, and New Zealand’s only level 3B post-entry quarantine (PEQ) greenhouses at two locations in Auckland. PHEL is accredited to the ISO 17025 standard (General requirements for the competence of testing and calibration laboratories) by International Accreditation New Zealand (IANZ) and has fixed and flexible scope accreditation for PCR testing and morphological identification of fungi, invertebrates and plants. Our staff are highly skilled and include 27 technical personnel who are accredited to sign off laboratory test results.

We have physical containment level 2 (PC2) and level 3 (PC3 – invertebrate rearing) laboratories, a level 3B PEQ greenhouse and level 3 tissue culture facilities. The laboratories have highly specialised and advanced equipment including a transmission electron microscope (TEM) and high-throughput sequencing (HTS) platforms. PHEL also actively curates numerous reference and data collections, including important exotic invertebrates, plant virus and herbarium collections.

Our services

Diagnostics

PHEL provides a range of diagnostic services to identify bacteria, fungi,

The Plant Health and Environment Laboratory (PHEL) of Biosecurity New Zealand, Ministry for Primary Industries (MPI) is New Zealand’s national plant health reference laboratory, responsible for identifying organisms of biosecurity concern and confirming all suspected new plant pests, diseases and invasive plants found in New Zealand. We help to protect New Zealand’s primary industries and the environment from exotic organisms and reassure our trading partners that New Zealand is free of unwanted pests and diseases. This report gives an overview of PHEL activities from 1 July 2023 to 30 June 2024.

Table 1: Summary of diagnostic testing carried out at Plant Health and Environment Laboratory from 1 July 2023 to 30 June 2024

Purpose of testing	Description	Number of tests
Border diagnostics	Testing samples of suspect exotic pests and diseases found during the inspection of imported goods and produce at the border and pre-border (including post-entry quarantine)	25,152
Domestic testing	A tailored plant disease testing service to support industry needs for clean planting material	3,347
Export pre-clearance	Testing to ensure that products leaving New Zealand meet the import requirements of our trading partners	319
Post-border diagnostics	Testing samples from recently imported material to determine if the pest or disease could have been introduced from overseas	819
Response diagnostics	Providing diagnostic services during a biosecurity incursion. In 2023/24 these included potato spindle tuber viroid, and subterranean termite (<i>Coptotermes acinaciformis</i>)	2,476
Surveillance and investigation testing	Testing samples from various surveillance programmes including general surveillance, high-risk sites, forest biosecurity, fruit fly, arbovirus, bee mite and national invasive ant; scale on black currents, brown marmorated stink bug trapping and public awareness of stink bugs	63,593
Other	Providing diagnostic services for overseas cost-recovered testing, overseas insect collections and proficiency testing programmes	555

insects, mites, nematodes, oomycetes, phytoplasmas, liberibacters, viroids, viruses and unwanted plants.

In 2023/24 PHEL processed 4,946 submissions (each usually

consisting of multiple samples) and completed 96,261 tests (Table 1). We provided a range of diagnostic techniques including microscopy (stereo, compound and TEM), molecular testing (end-point and



Figure 1: Plant Health and Environment Laboratory staff processing samples for bee mite surveillance diagnostics (left); inspecting plants at the post-entry quarantine greenhouse (middle); and testing suspected infected plant material using molecular diagnostics (right)

real-time PCR, loop-mediated isothermal amplification, Sanger and HTS sequence analysis), as well as serological (e.g., ELISA) and biochemical tests to screen and identify suspected unwanted organisms (**Figure 1**, previous page).

Pest and disease notifications

Each year PHEL receives notifications of suspect new-to-New Zealand pests and diseases. Notifications are reported through the exotic pest and disease hotline (0800 80 99 66) or online (<https://report.mpi.govt.nz/pest/>).

In 2023/24 PHEL processed about 2,200 notifications, with the months of January to March being the busiest (**Figure 2**). Suspect brown marmorated stink bug notifications made up a large proportion of these notifications (32 percent). The remainder of the notifications were mostly of native or established organisms, with some leading to incursion investigations.

Plant post-entry quarantine

PHEL is currently the sole provider of level 3B PEQ services in New Zealand. This stringent level of quarantine is required for high-risk, high-value imported plant germplasm such as berry crops, kiwifruit and grapevines. PEQ ensures that the material is free from unwanted pests and pathogens before being released. Plants undergo a series of tests and regular inspections to screen for regulated pests and diseases.

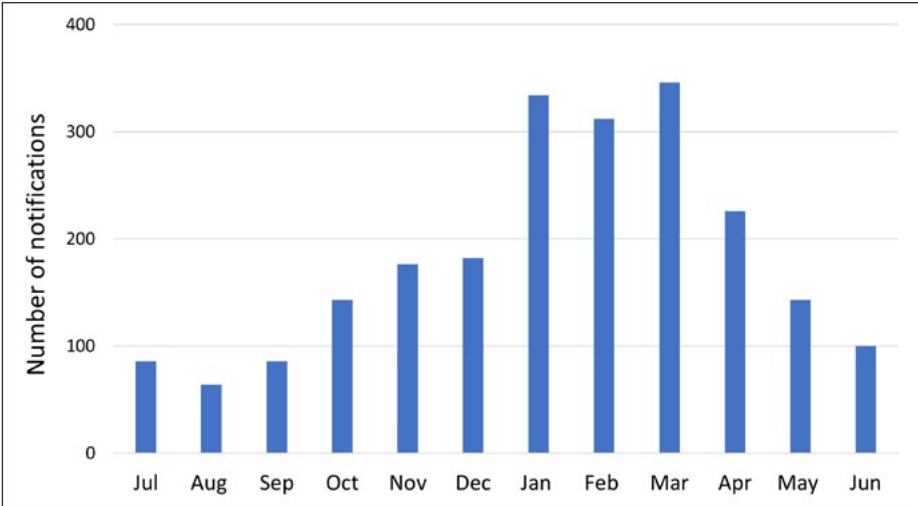


Figure 2: Number of suspect exotic pest and disease notifications processed by Plant Health and Environment Laboratory 2023/24



Figure 3: An aerial view of the new level 3B post-entry quarantine greenhouse facility in Mount Albert, Auckland (left); and plants in one of the 12 units that were used for biological commissioning (right)

In 2023/24 we handled 80 imported cultivars in our PEQ level 3B greenhouse. These included apple, apricot, avocado, blackberry, blueberry, cherry, grapevine, kiwifruit, kumara, lemon, peach, raspberry, strawberry and sweet orange. Thirty cultivars were released, and the remainder are due for release in 2024/25. Imports arrived from Australia, France, Israel, Italy, Japan, Korea, the Netherlands, South Africa and the United States.

Technical advice

Our scientists often work with stakeholders to provide technical and scientific advice. We advise on border interceptions, organism biology, phenology and taxonomy, and reply to media queries. We also review diagnostic protocols, manuscripts, external project reports, risk assessments, pest lists and import health standards, as well as the robustness of science in MPI-funded projects. Since July 2023, PHEL has received and processed 474 requests,

mostly from other MPI teams, local government bodies, Government Industry Agreement partners, growers and importers.

Our facilities

New greenhouse facility in Auckland

PHEL’s new level 3B greenhouse facility build at the Mount Albert Research Centre in Auckland was completed in February 2024 (**Figure 3**). Following completion, the facility underwent biological commissioning to ensure that the 12 new greenhouse units are suitable for plant growth and the associated systems meet the requirements outlined in the standards. The greenhouses are expected to receive the first imported plants in September 2024.

The addition of the 12 new level 3B greenhouses will nearly double MPI’s capacity to process imported plant material and provide more opportunities for industry to introduce new plant varieties from overseas. PHEL has also introduced a new PEQ space booking and prioritisation policy that provides greater transparency about how greenhouse space is allocated and gives importers new options to secure the PEQ space they need.

Plant Health and Environment Capability (PHEC) Programme

The PHEC programme is progressing the design of a new Plant Health and Environment Laboratory and greenhouses to replace our existing facility in Auckland. Our staff have been heavily involved in the design as it has progressed through concept, preliminary and developed design



Figure 4: Artist's impression of the new Auckland Plant Health and Environment Laboratory in Mount Albert, Auckland (subject to change), showing the entry, office and laboratory areas (left to right)

phases. The final detailed design phase will begin in the third quarter of 2024.

The new PHEL (**Figure 4**) will be located at the same site as our newly completed greenhouses at Mount Albert Research Centre in Auckland, and early site preparation has begun.

Quality assurance

Our quality system and culture underpin PHEL's effectiveness and credibility to deliver high-quality and timely diagnostics and meet stakeholders' requirements and expectations. Our systems, work processes and test performance are assessed annually through internal and external audits that help to introduce business improvements and ensure that we comply with the testing standard ISO 17025:2018. Following the latest external audits in 2023, PHEL continues to maintain its ISO 17025:2018 accreditation and MPI facility certification for the Auckland and Christchurch laboratories.

In 2023/24, 11 new PCR assays were added to the list of PHEL's IANZ-accredited assays under the flexible scope (1.70). This has increased the number of our IANZ-accredited PCR assays to 44. We also conducted a two-day internal auditor training workshop at PHEL to develop staff auditing skills and increase the pool of internal auditors.

We also received an authorisation from the Ministry of Health to test cannabis material for the presence of plant pathogens. This approval helps to

test for and investigate suspect plant diseases in imported or domestically grown cannabis plant samples.

Over the last year, PHEL introduced a virtual dashboard for tracking our performance. The dashboard helps visualise and track key metrics which assist with developing improvement strategies where needed.

National and international networks

PHEL maintains an extensive national and international network of contacts that ensures access to reference material, technical advice and scientific collaborations. PHEL scientists are well connected with Crown research institutes and universities in New Zealand through contributing to collaborative projects, delivering invited presentations and interacting with professional associations.

PHEL represents MPI in the Better Border Biosecurity (B3) programme and contributed to several projects in the past year. We were actively involved in 12 projects related to diagnostics, risk assessment and pathway risk management and contributed as stakeholders to these projects.

PHEL staff collaborate with many overseas quarantine laboratories involved in national plant protection work including the United States Department of Agriculture (USDA), the French Agency for Food, Environmental and Occupational

Health and Safety (ANSES), the United Kingdom's Department for Environment, Food & Rural Affairs (DEFRA), the Australian Department of Agriculture, Fisheries and Forestry (DAFF), the Canadian Food Inspection Agency (CFIA) and Fera Science, United Kingdom, as well as a number of universities and research institutes. We also represent New Zealand on international plant protection bodies providing leadership in biosecurity diagnostics.

Table 2 (next page) highlights some of the active collaborations in 2023/24 and their significance.

Innovation and preparedness

At PHEL, we strive to constantly improve our preparedness for emerging biosecurity threats by researching novel diagnostic tools, adopting the best equipment, technology and methods in biosecurity diagnostics and surveillance, and continuously improving laboratory and data management efficiencies. This is achieved through in-house initiatives, external collaborative projects and the operational research projects funded by MPI.

High-throughput sequencing

High-throughput sequencing (HTS), also known as Next Generation Sequencing (NGS), is one of the most significant advances in recent molecular diagnostics, becoming a powerful technology for the identification of pests and diseases globally. PHEL diagnosticians use HTS to find multiple pathogens in a single sample, to differentiate between closely related plant pathogens and to detect unknown pathogens.

We are routinely using Illumina MiSeq and Oxford Nanopore Technology (ONT) MinION platforms and have recently focused on developing bioinformatic capability through staff training programmes. We are also working on improving the quality control around these technologies to facilitate the increasing demand for the use of HTS in our diagnostics. This year, PHEL applied for the accreditation of two established HTS assays: one for detecting and

Table 2: Plant Health and Environment Laboratory's international collaborations and the major outcomes in 2023/24

Collaboration partner	Activities	Outcomes in 2023/24
International Plant Protection Convention (IPPC)	Development and review of diagnostic protocols and reviews of International Standards for Phytosanitary Measures	Co-authored the draft diagnostic protocol for the identification of <i>Amaranthus palmeri</i> . Two protocols that PHEL scientists contributed to (DP 32 <i>Ceratitis</i> , fruit fly; DP33 <i>Mononychellus tanajoa</i> , cassava mite) have been adopted. Contributed to the development of <i>Xylella fastidiosa</i> , <i>Ips</i> spp., and <i>Anastrepha</i> diagnostic protocols.
Subcommittee on Plant Health Diagnostics	Observer status in committee. Writing, validating and peer-reviewing diagnostic protocols	Participated in the High-Throughput Sequencing (HTS) and Novel Technologies Working Group.
Quadrilateral (Quads) Scientific Collaboration in Plant Biosecurity (New Zealand, Australia, United States, Canada)*	Contributed to four working groups: • Molecular diagnostics • Managing regulatory issues arising from new diagnostic technology • Antimicrobial resistance (AMR) and plant health: review of current evidence and gaps • Quads seed health	Discussed and compared HTS protocols, analysing the data from the HTS ring testing. Evaluated the evidence on AMR in plant health and identified research gaps on the role of plant protection practices in AMR emergence and spread. Partners shared seed extraction and testing protocols, quality controls, interception data, emerging risks and regulatory changes.
European Network for Phytosanitary Research Co-ordination (Euphresco)	Participation in 15 projects	Four projects have been closed and 11 are in progress. New diagnostic methods, tools and experience explored with other diagnostic laboratories.
Northwestern University, USA; Maseno University, Kenya; National Crops Resources Research Institute, Uganda	PLANT-dx 2.0 – Rapid, simple and scalable plant pathogen detection (Bill and Melinda Gates Foundation-funded project)	Developing and validating a rapid HTS based methodology to determine the viral plant disease diversity and distribution.

* The United Kingdom is joining the different working groups in 2024. A new name for this scientific collaboration is being finalised.

identifying viral/viroid pathogens in symptomatic plant tissue, and one for identifying bacterial isolates.

MPI's Plant Imports team has accepted the use of HTS protocols as part of imported nursery stock screening for *Fragaria* species (strawberry). We are expanding this work to validate the method for other high-value import commodities.

Operational research

PHEL carries out applied diagnostic preparedness research projects, mostly supported by internal MPI Operational Research funding. Their aim is to explore and implement new methodologies to strengthen our diagnostic capacity. Over the past year, three projects have been completed:

- **eRNA greenhouse testing for viruses:** This one-year project developed an effective enrichment method of water samples and optimised a RT-qPCR assay for

maximal detection sensitivity of pepino mosaic virus from greenhouse wastewater samples. The project provided a proof of concept to implement commercial greenhouse wastewater testing for high-risk plant pathogens. This project was partially funded by industry.

- **Life after death: Tracking RNA to pinpoint death:** This project identified candidate biomarkers that can be potentially deployed to determine the viability and time of death in *Drosophila melanogaster* (as a model organism for other flies, including fruit flies), and to assess viability in *Nezara viridula* (as a model organism for other stink bugs, including brown marmorated stink bug). The project also developed a robust and scalable computational pipeline for miRNA discovery that can be used for future diagnostic approaches at PHEL to identify candidate

biomarkers from multiple pest and pathogen species.

- **Optimisation of seed testing for sensitive detection of viruses and viroids:** This project improved pathogen detection efficiencies in seed testing by improving nucleic acid extraction methods to increase test sensitivity and allow greater seed bulking. Several multiplex-PCR assays for the detection of viruses and viroids in solanaceous and cucurbit seed species were also validated and optimised. These improvements reduced testing costs to seed importers. The project also completed a proof of concept for using HTS on an ONT MinION platform, with a tiling amplification enrichment to increase the detection sensitivity of cucumber green mottle mosaic virus in cucumber seeds. The results were comparable to RT-qPCR, showing that this modified HTS technique can be used to validate RT-qPCR detections of low viral titres.

The projects currently in progress are:

- **Improving diagnostic capability and readiness for plant pathogens:** This project develops real-time PCR tests for rapid and sensitive detection of six significant fungal and bacterial plant pathogens. Two assays were developed and/or validated in the past year. Work is in progress to complete the final assay development for the wheat pathogen *Puccinia graminis* f. sp. *tritici* Ug99.
- **Improving microbial biosecurity diagnostics with novel genome sequencing technologies:** This project uses HTS to identify fungi and bacteria cultured from diagnostic samples. In the last year, multiplex PCRs to amplify sets of genes for fungi and bacteria were developed and the best bioinformatic tools for HTS data analysis were screened. A diagnostic bioinformatics pipeline has been developed for bacterial amplicons, and testing is in progress on a multiplex-PCR analysis pipeline developed for

fungal diagnostics.

- **eDNA for biting midge surveillance diagnostics:** This project develops improved eDNA isolating and metabarcoding approaches for detecting bluetongue vectoring biting midges (*Culicoides* spp.) in surveillance samples, without the need of laborious microscopic screening. To date, suitable extraction protocols, metabarcoding assays and a bioinformatic pipeline for data analyses have been developed. The newly developed metabarcoding method can detect one individual in a mixture of 20,000 bycatch insects.
- **Enhancing high-risk fruit fly diagnostics:** This project focuses on acquiring enriched DNA barcode information for six unwanted fruit fly species, to develop and implement new qPCR assays for increased accuracy and efficiency. To date, 82 complete mitochondrial genomes have been sequenced and analysed for 18 fruit fly species from the Pacific islands. qPCR assays have been developed for six *Bactrocera* species and the development of multiplex assays is in progress.
- **Application of HTS in PEQ germplasm testing:** This project develops and validates HTS protocols for identifying non-culturable organisms (e.g. viruses, viroids, phytoplasmas) during imported nursery stock screening and PEQ testing. In the past year, protocols have been developed for using HTS for screening *Fragaria* (strawberry) nursery stock. Methodology application is currently being expanded to validate the method for other high-value import commodities (e.g., *Vitis*, *Prunus*).
- **Passive sampling to survey virus activity in production systems:** This new project builds on the results of the eRNA greenhouse testing for viruses project and aims to further develop and verify methods for water-based environmental surveillance of plant viruses. The project also develops



Figure 5: PHEL trainers and Vanuatu officers in Port Vila joining a remote microscopy diagnostics session(left); Biosecurity Vanuatu and PHEL staff at the symptom recognition training in Port Vila (right)



Figure 6: Biosecurity Vanuatu officer during entomology diagnostic training in New Zealand (left); Tonga biosecurity officers at their Ministry for Primary Industries' quarantine officer induction training graduation (right)

methods that allow users to assess the risk associated with a detection (e.g., by developing a molecular-based viability test).

Laboratory Information Management System

The Laboratory Information Management System (LIMS) is used to process and store data associated with sample submissions. It provides an environment to support information workflow, eliminate errors, provide trustworthy results and promote the efficient input of data and output of information. In the past year, PHEL has upgraded to the latest version of the software (Labware V8) to improve its performance, enhanced automation of the specimen reception and laboratory processes for the MPI surveillance programmes, and implemented the application of new diagnostic test prices for border testing as part of a wider cost-recovery implementation plan.

Training

Enhanced Pacific Biosecurity Partnership Programme

The Ministry of Foreign Affairs and Trade (MFAT)-funded 'Enhanced Pacific Biosecurity Partnership

Programme' has supported capability development in Fiji, Cook Islands, Samoa, Tonga and Vanuatu biosecurity systems since 2021. We engage with our counterparts across the Pacific and Australia, collaborate with Manaaki Whenua Landcare Research, and work with other MPI teams such as Biosecurity Surveillance & Incursion Investigation, Border Clearance Services and Plant Risk Assessment to reach the project goals. In addition, PHEL conducted a scoping visit to Tonga.

Over the past year, PHEL completed the following activities in the partner countries (Figure 5):

- delivered crop survey training for the Cook Islands Ministry of Agriculture (MOA) biosecurity, research and advisory staff;
- delivered first entomology and plant pathology training for Biosecurity Vanuatu plant health officers;
- set up a remote microscopy system in Biosecurity Vanuatu;
- delivered symptom recognition training for Biosecurity Vanuatu border clearance staff, assisting with pest or disease damage recognition on fresh produce



Figure 7: Sarah Han (Senior Technician, Post Entry Quarantine) delivering mental health first aid training to PHEL staff, a session arranged by the PHEL Professional Development Opportunities team

Outreach

PHEL and the Biosecurity Surveillance Incursion and Investigation Plant Health team continue to run joint outreach activities. Over the past year, the team has staffed booths at five career expos, hosted several groups of school students and teachers and the Te-Pu-A-Nga-Maara (rangatahi-led collective of taiao innovators and rangers) – providing presentations, onsite demonstrations, and tours of the laboratories. PHEL staff also gave talks and lectures at universities and polytechnics and represented MPI at fairs and other events, including the Northland Field Days. Through highlighting our role in protecting New Zealand’s industries and biodiversity, and sharing our enthusiasm about biosecurity science, we aim to enhance collaboration and partnerships with diverse communities and inspire future biosecurity champions (**Figure 8**).

The team also contributes to and benefits from our Te Kākano Ako (the seed of learning) group activities which provide a safe, encouraging and inclusive space for staff to navigate cultural capability, thereby honouring Te Tiriti o Waitangi and becoming better Treaty partners. We continue to discuss, practise and incorporate te ao Māori, te Reo, pepeha, waiata and karakia into our work.



Figure 8: PHEL staff interacting with a young family at the Northland Field Days (left), and talking to university students at the Auckland University of Technology Career expo (right)

to strengthen their border processes; and

- attended the Regional Early Warning System and Emergency Response Planning exercise in Fiji conducted by Biosecurity Authority Fiji and the Pacific Community. PHEL experts contributed as subject matter experts in surveillance for fruit flies, fall armyworm and little fire ant.

Our Pacific colleagues were also able to attend activities in New Zealand (**Figure 6**, previous page):

- officers from the Cook Islands and Vanuatu who received specific entomology training, focusing on improving their diagnostic skills;
- officers from the Cook Islands, Fiji, Tonga and Vanuatu attended introductory nematology training conducted by a nematology expert from Australia; and
- biosecurity officers from Tonga attended MPI quarantine inspector induction training in Auckland.

In-house professional development

PHEL’s professional development opportunities programme aims to increase our staff capabilities, strengthen connections between disciplines and support diverse skill sets within PHEL. The sessions delivered last year included an introduction of the specimen reception processes at PHEL, an overview of MPI standards and a discussion around mental health first aid (**Figure 7**). PHEL also organised a training programme to enhance our people’s HTS sample preparation and data analysis skills.

Responses

Potato spindle tuber viroid

Following the detection of potato spindle tuber viroid (PSTVd) in Nelson, a biosecurity response was initiated in November 2022. After introducing the control measures (e.g., movement control, depopulation, disposal and disinfection/decontamination of glasshouses), there have been no subsequent detections of PSTVd at the location, and the response was officially closed in February 2024.

Our people

Director, Diagnostics, Readiness and Surveillance*	Fleur Francois, Veronica Herrera**
Plant Health and Environment Laboratory, Manager	Lalith Kumarasinghe
Bacteriology and Botany	
Team Manager	Robert Taylor
Senior Scientists	Jeyaseelan Baskarathevan, Luciano Rigano, Michael Gemmell
Scientists	Carol Elliott, Ruth Griffin
Senior Technicians	Alison Penn, Kate Pitches**
Entomology	
Team Managers	Dave Voice, Sherly George
Principal Scientists	Disna Gunawardana, Dongmei Li, Qing Hai Fan
Senior Scientists	Asha Thomas, Ben Boyd, James Haw, Rebijith Balan
Scientists	Bede McCarthy, Hamaseh Aliakbarpour, Yan Chen, Anthony Gonzaga
Senior Technicians	Ben Wynne-Jones, Eloise Lancaster, Jiawei Shen, Joanna Mackisack, Elizabeth De Jong, Sally Ladbrook
Mycology and Nematology	
Team Manager	Wellcome Ho
Principal Scientist	Merje Toome
Senior Scientist	Katharina Hofer
Scientists	Karthikeyan Dharmaraj, Raja Thangavel, Jack Vasey**, Esha Arshad**
Senior Technician	Natalie Pettitt
Virology and Phytoplasmology	
Team Manager	Jeremy Thompson
Principal Scientists	Lia Liefiting, Catia Delmiglio
Senior Scientists	David Waite, Joe Tang, Stella Veerakone, Subha Das, Subuhi Khan, Zoila Perez
Scientist	Sonia Lilly
Senior Technicians	Deepika Kanchiraopally, Michelle Kelly
Post-Entry Quarantine	
Team Manager	Sathish Puthigae (acting)
Principal Scientist	Abu Iqram
Senior Scientist	Kirsty McDermid
Scientist	Eloise Hollins**, Emma Milleza
Senior Technicians	Frances Graham**, Henri Lee Huddleston, Sarah Han
Assurance, Biosafety and Containment	
Team Manager	Sumathi Murugan
Senior Laboratory Technical Officer	Jane Martin
Senior Adviser Quality Assurance	Alina Antony
Senior Adviser Health and Safety, Containment	Benedict Uy
Senior Scientist	Maximilian Nepel
Scientist	Adam Colsell**
Senior Technician Laboratory Support	Brittany Scouller**, Deepa Dupaguntla
Diagnostic Readiness and Innovation	
Team Manager	Sathish Puthigae
Senior Scientist	Sreejith Padinjare Chakkatu**
Scientists	Georgia Breckell, Georgia Wakerley, Hester Roberts, Hui Wen Lee, Juncong Yan, Luciano Nunes Leite, Nathaly Lara Castellanos, Toan Hong**
Other staff	
Principal Scientist	Brett Alexander

* Before July 2024, the Directorate was named Diagnostic and Surveillance Services.

** These staff have left or moved to other roles within MPI since last year's report.

PSTVd has also not been detected from any other location. Therefore, PSTVd is considered to be eliminated from all known locations in New Zealand.

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Biannual newsletter

PHEL produces a biannual newsletter, *PHELosophies*. Access the latest issues (January 2024 and June 2024) at:

Plant Health and Environment Laboratory publications and newsletters | NZ Government (mpi.govt.nz).

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Plant health incursion investigation annual report 2024

Incursion Investigation Plant Health team: annual report 2024

For the 12 months ended 30 June 2024, the IIPH team managed 1,019 notifications (**Figure 1**), only one more than the previous year. Of those notifications, 22 percent (221) were assessed by IIs and immediately stood down because they posed no biosecurity risk and 14 percent (139) were redirected to other teams or agencies. As in 2023, 65 percent (659) of notifications required further investigation to determine the degree of the risk.

The origins of the notifications that have been investigated are shown in **Figure 1** with 65 percent of notifications reported by members of the public; of these, 60 percent were investigated and the other 40 percent were stood down. The fact that most of the notifications are reported by the public, either to the exotic disease and pest emergency hotline – 0800 80 99 66 – or using the online notification reporting tool <https://report.mpi.govt.nz/pest/>, is a positive result and indicates that our multi-layered biosecurity system is working.

Figure 2 (next page) shows the outcome of the 659 investigations completed in 2024, of which 395 (60 percent) were negative, thereby ruling out suspect unwanted or notifiable organisms. Corresponding figures in 2023 were 624 and 386, respectively, with similar percentages across all outcomes comparable to the 2023 year.

Notably, only one percent of investigations transferred to the Response team (part of Readiness and Response Services), illustrating the importance of urgent measures undertaken by IIs to rapidly mitigate risk.

For the twelve-month period to 30 June 2024, IIs investigated 63 reports of new-to-New Zealand organisms across PHEL's teams (**Figure 3**, next page), compared

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

The 2024 annual report sees the 50th anniversary of Surveillance and being a milestone publication, it provides an opportunity to get an insight into other parts the IIPH team play in supporting New Zealand's biosecurity.

with 31 investigations in 2023. Ten investigations are reported in the quarterly report below under 'Investigations of new-to-New Zealand organisms', while the balance have been reported in previous *Surveillance* publications.

Incursion Investigators

The plant health Incursion Investigators (II) are rostered on duty from 8.30 am to 9.00 pm seven days a week including public holidays to mitigate and manage risk. There are currently nine plant health investigators: four in Auckland, one

in Rotorua and four, plus the team manager, in Christchurch.

The II role is not just limited to investigating and managing threats posed by exotic pests and diseases. This multidisciplinary team is passionate about biosecurity systems and its critical role in growing and protecting New Zealand. The Investigators spend time educating students, industry and members of the public about incursion investigations, how they are managed quickly, and the urgent measures taken to respond and quickly mitigate biosecurity risks. Most investigations are managed by

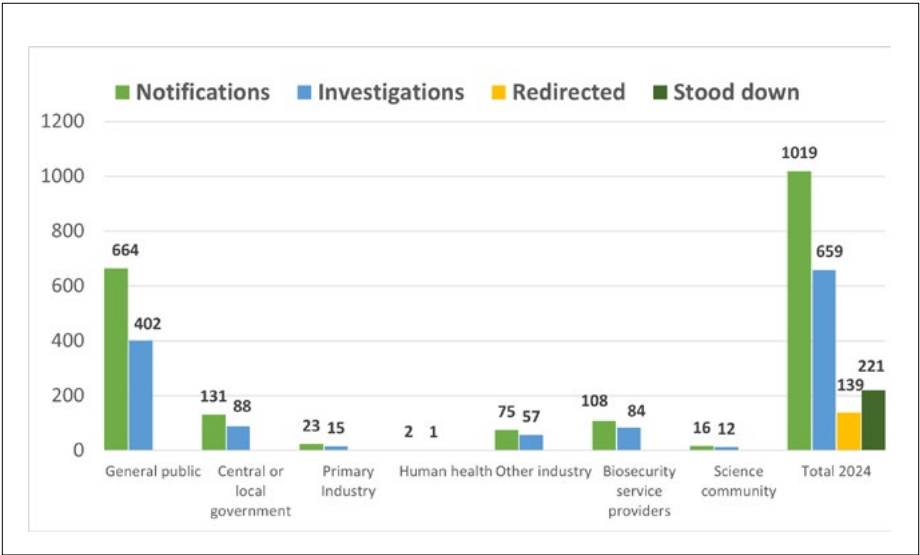


Figure 1: Incursion Investigation Plant Health team notifications from all sectors and resulting investigations for the year ended 30 June 2024

the IIPH team but occasionally (one percent of investigations) transition to a biosecurity response managed using the coordinated incident management system (CIMS). During biosecurity responses the scientifically savvy IIPH team takes technical and leadership roles in the surveillance, movement control, tracing and organism management workstreams as well as providing a critical link between Biosecurity New Zealand and affected industry partners, helping to coordinate operational response activities. Thus, they are an active hands on team.

New Zealand’s biosecurity system and our unique role are important and of great interest to stakeholders. That is reflected in invitations extended to the IIPH team to speak at industry conferences and universities and

to community groups. While not an exhaustive list, they have included: Horticulture NZ, New Zealand Grain and Seed Trade Association, Forest Biosecurity Conference, New Zealand Plant Protection Society, New Zealand Tree Crops Association, Better Border Biosecurity (B3), Auckland, Lincoln and Canterbury universities, West Melton Garden Group, Canterbury Rose Society, Tamaki Estuary Environmental Forum, Agricultural field days at Feilding, Hamilton and Canterbury, Te Pu-a-ngā Maara, Auckland Zoo and students interested in science, technology, engineering and maths (STEM). At these meetings, we present an overview of Biosecurity New Zealand, our part in the biosecurity system, and examples of incursion investigations that are targeted to the audience. A small sample of that work is described here.

Pacific island biosecurity training

In October 2023, Dr Carolyn Bleach and Alessandro Marin conducted a five-day incursion investigation and response training for the Cook Islands’ Ministry of Agriculture (MoA) Biosecurity team, as part of the Ministry of Foreign Affairs and Trade-funded New Zealand Aid Programme. The training was well received by the MoA staff, who were highly engaged throughout the week.

The training focused on plant pests, and included processes and frameworks that can be adapted to aquatic or animal health investigations. The importance of surveillance and early detection of exotic pests and diseases was a key part of the training, which delivered a robust workshop on incursion investigation procedures and risk analysis and mitigation.

The workshop also included response simulations relevant to the Cook Islands, with scenarios being run for both coconut rhinoceros beetle and brown marmorated stink bug (BMSB). The lessons from the simulations and workshop were then used to adapt New Zealand’s Incursion Investigation and Response management frameworks to the existing frameworks used by the MoA. A response structure was created and populated with MoA staff and staff from other Cook Islands government agencies who could support a biosecurity response.

The training concluded with MoA and MPI collaborating on an actions list that is intended to improve their biosecurity preparedness. Ongoing support to improve the MoA’s preparedness will continue to be delivered by MPI at their request.

Tertiary biosecurity education
Tanya Greenwood lectures bi-annually at the University of Auckland for Professor Margaret Stanley’s biosecurity post-graduate students. In February, the lecture focused on MPI’s role in biosecurity, including the relevance of pre-border, border and post-border functions. Tanya discussed the relevant risk mitigation measures taken at each stage of the

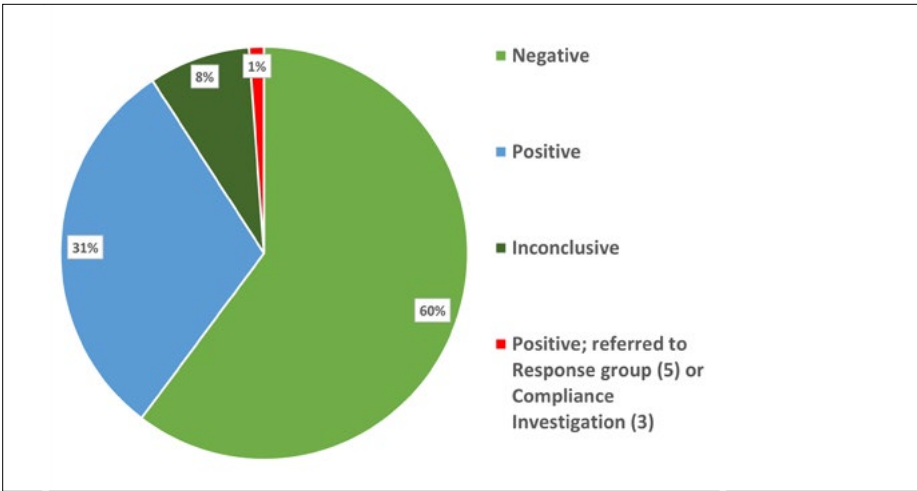


Figure 2: Outcome of the 659 investigations completed in 2024

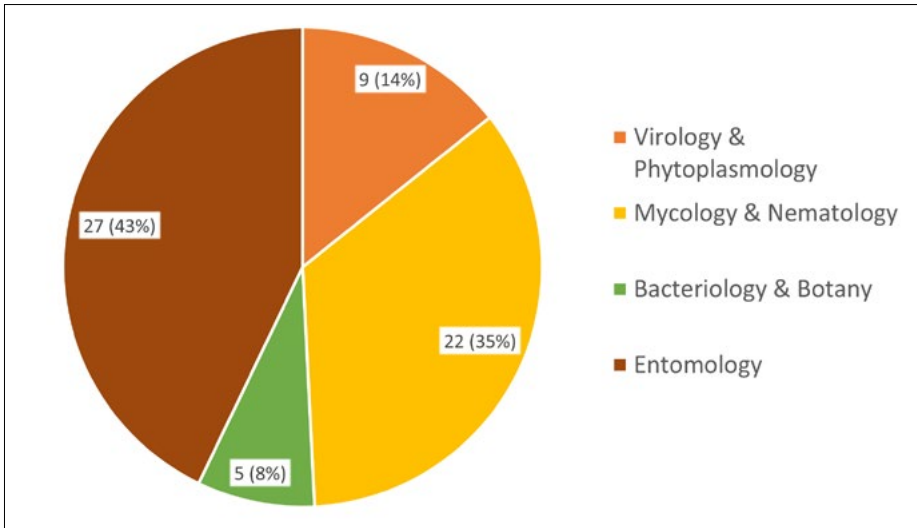


Figure 3: Percentage and number per Plant Health and Environment discipline for investigations of new-to-New Zealand organisms 1 July 2023–30 June 2024

continuum. For pre-border protection, Tanya highlighted the relevance of Import Health Standards and offshore interventions, including treatments and audits. For border functions, she explained the role of quarantine officers, their tools, and the difference between Transitional and Containment facilities. Finally, for the post-border environment, students learned about the role of Incursion Investigators, the importance of surveillance programmes, and how critical early reporting is (via the 0800 80 99 66 hotline).

In July, Tanya spoke to the students about the role of Incursion Investigators in plant health biosecurity, delving into the complexities of working across all of Aotearoa New Zealand and how they deal with ambiguity and the logistically challenging landscape. Tanya explained to the students that *to be a good incursion investigator means you need to be a Jack-of-all trades. We are often working in less than ideal situations, with incomplete information and time pressures. However, if you have a pragmatic, attention to detail approach to life, and can easily communicate with a diversity of audiences, then this is the job for you!*

Tanya guided students through a series of case studies before students then work on real-life scenarios. The students considered the biosecurity issue, biological risk and the threat(s) to New Zealand's values (human health, economic, environmental and socio-cultural). They then thought through the likelihood and consequences for their assigned organism or disease spreading/establishing, considering potential vectors, hosts, and how they might contain or eradicate the pest by implementing movement controls, tracing, and surveillance measures.

High school biosecurity education

In 2023, Erin Gillespie participated in the Secondary School Employer Partnerships programme, running three classroom sessions with a local Christchurch high school. In these sessions, students were

given the opportunity to become Incursion Investigators. They were given an incursion situation with limited situational and organism risk information. Working in groups, students used critical thinking and investigative skills to determine how to progress the investigation. They were required to consider how to identify an organism, assess risk, contain and manage risk, as well as any proactive measures that could be put in place to prevent this happening again. Students considered industry and social implications of the incursion, including any long-term effects if eradication is unsuccessful.

Reflecting the general population, the students had varying levels of biosecurity knowledge and awareness. These sessions highlighted the importance of biosecurity and started a vital conversation with the next generation.

Mazda Wildlife Science Careers Expo at Auckland Zoo

In 2023 and 2024, Graham Surrey, Alessandro Marin and Tanya Greenwood were part of the Biosecurity New Zealand team invited to participate in two Wildlife Science Careers expos held at Auckland Zoo.

The two events held in July and August 2024 involved over 600 students from 22 schools across Auckland and the Coromandel who were interested in learning more about potential science careers. Biosecurity New Zealand had a stand at both events showing a variety of risk goods that had been intercepted at the border. Students were provided with information about the work that MPI undertakes to protect New Zealand's biosecurity.

A workshop presented by PHEL Tamaki staff highlighted how risk items intercepted at the border are analysed by laboratory staff and how that work provides evidence-based diagnostics to manage risk. The students' interactions with MPI staff, and positive feedback by the expo organisers, shows the value of this hands-on learning approach with young New Zealanders.

Evaluation of the potato mop-top virus incursion published

In 2018, the first observation and timely reporting of symptoms of *Pomovirus solani* (common name: potato mop-top virus, PMTV) to the IIPH team by a potato processing company produced excellent outcomes. The PMTV incursion investigation swiftly transitioned into a biosecurity response, although the virus may have been present one or two years before this first record. Dr Carolyn Bleach led the technical field work stream and Dr Catia Delmiglio led the diagnostic workstream. This was in collaboration with the PMTV Technical Advisory Group, which included experts (from Switzerland, the United Kingdom, Australia and New Zealand), and Potatoes New Zealand (Inc.). The prompt response to the PMTV 'incursion', including development of capability for ongoing monitoring and management of the virus led predominantly by the potato industry, has reduced potential impacts of PMTV in this country, as demonstrated by low incidence of the virus in seed potato crops in 2019/20 and 2020/21. The recently published knowledge review and evaluation of the biosecurity response to the PMTV 'incursion' (Falloon et al., 2024) is an important contribution, as the paper outlines the first government/industry response to a plant virus incursion into New Zealand. The response showed how the biosecurity system works in practice, relying on inputs from the then surveillance incursion investigation team, PHEL, and the potato industry. A paper on the PMTV response has been recently published (Falloon et al., 2024).

Fruit fly readiness and organism management capability

Technical experts working in the New Zealand's 2015 Queensland fruit fly response recognised an opportunity to optimise bait formulation and application for enhanced efficacy against Queensland fruit flies. The organism management workstream led by Dr Amin Pathan from the then Surveillance and Incursion Investigation team who,

alongside PHEL entomologist Dave Voice and Australian fruit fly experts drove the innovation and scientific collaboration on a 'Bait Improvement Project' to better address biosecurity threats. Continuous refinements since then have led to the improvement providing better insecticide control for the organism management toolbox and therefore, strengthening the capacity to respond to future incursions here and overseas.

The team identified an opportunity to formulate the bait mix using a xanthan gum-based additive and a protein bait to deliver insecticides efficiently while minimising off-target drift to ensure the highest standards of environmental, human, and pet safety were being met in urban areas during baiting operations during fruit fly responses.

Amin, Dave and Australian fruit fly expert Professor Dick Drew conducted bio-efficacy experiments in Australia to develop and test improved bait mix formulations with optimised efficacy, safety and economy. The results (Pathan et al., 2022) clearly demonstrated significantly enhanced bio-efficacy of insecticides over existing formulations and bait mixes. The innovative bait mix was successfully deployed in New Zealand's 2019 fruit fly response, proving its effectiveness in situ helping to support a much required social and regulatory licence to undertake eradication response operations.

In 2021, during the Riverlands, South Australia fruit fly response the improved bait mix was used and acclaimed by Professor Drew as being highly successful in managing the fruit fly incursion, proving its broader use and value beyond New Zealand.

Our commitment to innovation and scientific excellence continues to protect New Zealand's horticultural industry from biosecurity threats and demonstrates MPI's mission to grow and protect New Zealand's primary industries through innovation.

We pride ourselves in *Leading Biosecurity Surveillance and Investigation to protect Aotearoa* and the IIPH team are always willing to

undertake 'excursions from incursions' to go out and inform and educate others. Early detection of harmful new pests and diseases is a vital part of our biosecurity system. Every New Zealander has a responsibility to be vigilant for and report suspected new organisms. Therefore, the more people who know and understand what we do and what they need to do helps everyone to protect New Zealand's unique flora, fauna and environment. The IIPH annual data are reported below; the new-to-New Zealand organisms (63) reported this year doubles the number the team investigated the previous year. The investigation outcome reports for this quarter (April, May and June 2024) are discussed afterwards.

Plant health incursion investigation report: April to June 2024

A selection of investigation outcomes is reported below for this quarter, including the ten suspected new-to-New Zealand organisms.

Investigation Positive – Urgent Measures prevent establishment

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

Stink bug cases

For the April to June quarter, 36 notifications of exotic stink bugs were investigated by the IIPH team. There were five positive cases of exotic stink bugs. Two investigations involved single dead adult BMSB (*Halyomorpha halys*) associated with vehicles imported from Japan. The third included a dead BMSB found adjacent to a recently imported open-topped container, while the fourth investigation involved a single dead BMSB in a parcel imported from an unknown country.

The final investigation involved 28 dead BMSB associated with sparkling

water imported from Italy. In most stink bug cases, the biological risk was mitigated by tracing the origin of the goods, inspecting the goods and the sites, distributing educational material and, where possible, notifying the overseas supplier of the detections as well as the Emerging Risk, Animal and Plant Health Directorate, and National Operations Centre teams for audit purposes. Although only five BMSB cases are discussed here, the serious threat of this pest requires that IIs assess the risk in all instances.

Ant cases

There were four suspect exotic ant investigations this quarter. Two were identified as species already present in New Zealand (the endemic species *Chelaner antarcticus* and the established species *Amblyopone australis*).

One case investigated a single carpenter ant (*Camponotus* sp.) found on a sticky trap at a Transitional Facility (TF) in Hamilton. The trap was part of a pest surveillance programme. Due to the lack of any further finds, it was determined that the carpenter ant was a single hitchhiker. The detection was reported to the National Invasive Ants Surveillance (NIAS) supervisor, and the TF advised to be on the alert for potential exotic ants on their premises.

In another case, a business staff member noticed dead ants while unloading a crate containing a spectrometer from the United States following clearance from a TF. The business notified the TF. PHEL Entomology identified the ants as black carpenter ants (*Camponotus pennsylvanicus*), an unwanted organism not present in New Zealand. The crate had not been opened; however, as 100+ dead ants were reported to have been seen under the shrink wrap, there was concern live ants may be present inside the crate. The II asked a quarantine officer to have the crate returned to the TF and supervise its inspection. No live ants were found, the dead ants were disposed of, and the crate and contents returned to the business.

Other cases of note

Bark infested with insects from the United States

The New Zealand Customs Service flagged two consignments from the United States as suspicious (**Figure 4**). The consignments were declared as sweatshirts but contained 100 kg of wet bark infested with insects. Two Quarantine Officers inspected the goods before transitioning the risk goods to the IIPH team as the consignment was located at a place that was not a TF. The II arranged for the consignments to be destroyed via steam sterilisation and deep burial.



Figure 4: Containers of wet bark and insects contained and awaiting destruction

Weevil in coffee beans from Indonesia

An Auckland coffee roaster reported live weevils in a sack of green coffee beans from Indonesia. Samples submitted to PHEL confirmed the coffee bean weevil, *Araecerus fasciculatus*, a common pest of stored products including coffee and cacao, but not known to be present in New Zealand. The beans (19,000 kg) imported in November 2023, had been stored at a Wellington logistics company's warehouse. From there, 180 kg had been distributed to an Auckland warehouse and some to a Wellington roastery for processing. The weevils crawling around the sacks of coffee beans were noticed by Auckland roastery staff. As a precautionary measure, the II asked the notifier to wrap the sacks and isolate the infested goods from other products. The same measures were applied to beans stored in Wellington. Further inspection revealed consignments at all locations had been heavily contaminated.

The phytosanitary certificate provided to the II confirmed that the goods had been correctly fumigated with methyl

bromide (MeBr) in 48 g/m³ at 10–15°C for 24 hours, conforming with the Import Health Standard: Stored Plant Products for Human Consumption. A nine-day delay between the treatment date and shipping may have resulted in a re-infestation. Liaising with MPI's Treatments and Plant Imports teams, the II determined MeBr fumigation would be effective and the beans safe for human consumption. All the beans were transported to Auckland for treatment but since the sacks were plastic-lined hessian bags, treatment for each bag meant they had to be slashed to ensure penetration of the fumigant. Fumigation was successfully completed and the beans returned to the notifier for roasting.

Investigation Positive – Urgent Measures limit harm

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

Unsolicited seeds received from the United States

A member of the public notified MPI that they had received a card with a packet of seeds from the United States. The notifier is part of a card-swap group which is sponsored by a rare-seed company and the seeds had been sent as a one-time gift to members. The borage seeds had not been inspected at the border; therefore, they were not compliant with MPI entry requirements. The notifier sent the seeds to the II who destroyed them as quarantine waste. The II contacted the offshore organisation founder and issued an educational email advising of our biosecurity requirements for exporting seed to New Zealand, with a recommendation not to send seeds and plant material here unless they comply with import requirements. The founder was not aware of our requirements but was extremely cooperative and will avoid sending these products in future. The company also provided the contact details for two other

New Zealand recipients of the seeds. The II contacted both parties, sending educational and destruction information. One destroyed their seeds in their barbeque and the II is still pursuing the other recipient for destruction of the seeds.

Investigation Positive – no action taken

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

eDNA detection of *Phytophthora*, Waitākere Ranges

Plant & Food Research (PFR) reported a new-to-science *Phytophthora* species detected from metabarcoding of eDNA samples from kauri soils collected during surveillance in the Waitākere Ranges in 2021. The aim was to investigate *Phytophthora* communities associated with healthy and symptomatic kauri in the Waitākere Ranges. The new-to-science *Phytophthora* was identified by amplification and sequencing of the Internal Transcribed Spacer (ITS) and cytochrome c oxidase subunit 1 (COX1) gene regions. It was isolated from 20 soil eDNA samples, comprising 2.6 percent of the total detections from the study. GPS locations of the 20 eDNA samples covered an area of nearly 100 km² and did not reveal a spatial pattern that would indicate that this was a recent incursion.

PFR's phylogeny analysis showed that the new-to-science *Phytophthora* species clusters with other *Phytophthora* species on Clade 7 and is most closely related to *P. europea*, which is present in New Zealand. *Phytophthora* Clade 7 includes several

important plant pathogens causing damage to the root system of plants, but some species have also been isolated from the rhizosphere soils, or nearby streams, of healthy plants. No isolate is available for the unknown species; therefore, it could not be identified as a new species, thus its impact or host range is not known.

PFR cross-analysed the new-to-science *Phytophthora* species with their culture collection and found further two undescribed historic isolates that had come from kauri soils. PHEL Mycology and Nematology analysed the ITS and COX1 sequences of those two isolates and confirmed they were undescribed species. PFR suggests that these species do not play a key role in kauri health through a pathogenicity trial that found these isolates to be not very pathogenic on kauri.

Based on our findings, the conclusion was that the new-to-science *Phytophthora* species have been in the environment for many years at a low prevalence and could potentially be endemic, thus pose a low-to-negligible biosecurity risk. The results of the surveillance programme were communicated to Te Kawerau ā Maki and Auckland Council by PFR.

Fruit-piercing moth in Hawke's Bay

A scientist at PFR contacted MPI regarding a suspect fruit-piercing moth found in Hawke's Bay. The exotic moth had been found in a malaise trap set near Roy's Hill, Hastings 15–22 December 2022 although the specimen was not available. PHEL Entomology Christchurch confirmed it was *Eudocima materna*, the fruit-piercing moth. This is an Unwanted Organism and a regulated pest. Since 2017, IIPH has recorded five detections of this species in Auckland, mid-Canterbury and Nelson. The only life stages found have been adults. *Eudocima materna* larvae are host specific to plants in the Menispermaceae family, a plant family not present in New Zealand, thus potentially inhibiting the establishment of this species here. The scientist was informed, and no further action was taken due to the low risk of establishment and the lack of suitable hosts.

Investigations of new-to-New Zealand organisms

Four entomology, three mycology, one bacteriology and two virology notifications of new-to-New Zealand organisms are described below.

New moth in Bay of Islands

A member of the public based in the Bay of Islands uploaded a photo to iNaturalist of a moth attracted to their light trap on 14 November 2023 (Figure 5). A New Zealand lepidopteran taxonomist saw the posting and identified it as *Rhesalides curvata*, a suspected new-to-New Zealand organism and advised the iNaturalist member to notify MPI. The II contacted the notifier, who advised they had not captured the moth as they were unsure if it was a local species. They were running the light trap to learn about the fauna composition around their residential place and did not want to kill any invertebrates already established in the country. The II requested if another moth came to the light to collect the specimen and notify MPI. A second moth was subsequently collected on 17 November 2023 and submitted for formal identification.

PHEL entomology, with assistance from a Manaaki Whenua Landcare Lepidoptera taxonomist, confirmed the moth as *R. curvata*. Members of this taxon are known from the tropical South Pacific, reaching east to Samoa and Tonga. They are very common in Australia with Yeppoon (23° latitude) as the southernmost distribution point recorded by CSIRO. Images uploaded



Figure 5: New moth *Rhesalides curvata*, a suspect new-to-New Zealand organism. Photo: Lindsay Alexander

on the iNaturalist social platform report *R. curvata* individuals further south, at Lamington National Park, Queensland (28° latitude).

There is little information available regarding the biology of *R. curvata*. Adults are common in dry grasslands, as well as in city parks and gardens, where they have been collected in large numbers in light traps. Larvae feed on *Albizia* spp., and there is no record of them defoliating the trees. Based on that information, the II concluded that it was unlikely *R. curvata* would establish in New Zealand. The two individuals observed (one of them killed), may have been incidentally imported into the country; however, their origin remains unknown.

After the second detection, no more moths were found until 11 January–14 March 2024 when ten more observations were made. Two of the moths were killed and submitted to PHEL for identification. The II was in communication with the notifier until mid-May 2024 when the investigation was closed as no further observations had been made since March 2024. Communication will resume in the next flying season, which is expected to be at the beginning of November 2024. Given the predominantly tropical distribution of *R. curvata*, it is uncertain if this species will survive in the New Zealand environment over winter. Monitoring of the site in the 2024/25 spring–summer is important to validate the possible establishment of this species in New Zealand.

New parasitoid wasps found by Plant & Food Research

In February 2024, IIPH was notified by PHEL Entomology Auckland of a suspect new-to-science parasitoid wasp. The wasp, *Trissolcus* sp., is a parasitoid of stinkbug eggs. The suspect new-to-science species was detected during a PFR project. The project involved deploying pentatomid sentinel egg masses and surveying wild egg masses from November 2023 to March 2024. This *Trissolcus* sp. was found in wild egg masses from Auckland, Bay of Plenty and Waikato and in one sentinel egg mass in the Bay of Plenty. The stinkbug hosts were *Glaucias amyoti*, *Cermatulus nasalis* and

Monteithiella humeralis. This suggests it is widespread in New Zealand's upper North Island and may have been here for a long time, only now being discovered during the targeted survey. PHEL compared the specimens with undescribed New Zealand species and known *Trissolcus* species, but none matched. PFR sent their specimens to an international expert, who agreed that this was an undescribed, new-to-science species. The biosecurity risk posed by this parasitoid wasp is minimal and it is indeed likely to be beneficial, parasitising stinkbug eggs.

In April, PFR shared an additional finding from their stinkbug egg survey. PHEL Entomology confirmed they had found a suspect new-to-science *Telenomus* sp. It was found in wild pentatomid egg masses from Auckland, Bay of Plenty and Waikato. The stink bug host was *Glaucias amyoti*.

Both the suspect new-to-science parasitoid wasp species (*Trissolcus* and *Telenomus* spp.) are established, at least in the upper North Island. The II sent a courtesy email to the Department of Conservation to inform it of the investigation findings. The parasitoid wasp expert will work to describe the two new-to-science species.

New mite on kiwifruit and herbage, Auckland

An MPI Principal Adviser had recently become aware of an interception by Australian biosecurity authorities of an erythraeid mite from the genus *Abrolophus* (Acari: Erythraeidae) on kiwifruit from New Zealand. From personal communications with an Australian colleague, it appeared detections were frequent. That prompted the Principal Adviser to carry out a mite collection around the PHEL at Tamaki in April 2024. Specimens were readily detected and four adult females of the mite, *Abrolophus ripicola* from *Muehlenbeckia* sp. plants, were identified (Figure 6). *Abrolophus ripicola* was originally found among herbage on banks of the Hindmarsh River in Victor Harbour, South Australia (Womersley, 1934) and was recorded only from Australia. There has been no published information



Figure 6: New-to-New Zealand mite *Abrolophus ripicola* found on kiwifruit. Photo: PHEL Entomology

on the biology, ecology or significance of this species. Similarly, there is no evidence that the organism has moved beyond the detection point but surveillance further afield has not been undertaken. Based on the information available and lack of evidence of a biosecurity risk, no further action has been taken and the investigation closed.

Exotic cockroach in Auckland

On 30 April 2024, a member of the public posted a photo on iNaturalist of an unusual-looking cockroach at a business address in Remuera, Auckland. The cockroach was identified by the iNaturalist community as an exotic cockroach, *Methana marginalis* and reported to MPI (Figure 7). The notifier did not capture a specimen, but PHEL Entomology confirmed the identification via photos.

The genus *Methana* is present in Australia and Papua New Guinea and member species are often found in heavily forested areas. They usually live under the bark of fallen or upright dead trees and among the foliage of living trees, such as *Acacia* spp. (Mackerras, 1968). *Methana* species can enter houses but are unlikely to survive for long in the dry environment of most premises (Rentz, 2014).

The notifier reported that the

cockroaches had been found within the building for at least six months, although most of the specimens were dead. Toxic cockroach baits had been laid by the notifier but had been ineffective in eliminating the infestation. The II conducted a site visit and five live adult cockroaches were collected from different rooms inside the building. PHEL Entomology confirmed both male and female *M. marginalis*. No harbourage was detected during the site visit; however, there is ample suitable habitat and organic matter underneath the building for food and refuge. No pathway either via imported goods or travellers from Australia was identified.

A PHEL entomologist confirmed that this species is not recorded as a pest overseas and there are no records to suggest it is a vector of an organism that could cause disease in humans or animals. As cockroaches are highly adaptable and thrive in warm and humid environments, establishment of this species in New Zealand is feasible, especially in warmer areas.

Due to its nocturnal nature, this species may have gone undetected until now or it may have been mistaken as a local species, namely the Gisborne cockroach (*Drymaplaneta semivitta*) to which it bears a superficial resemblance.

Given the length of time that cockroaches have been detected at the property, and the extent of the infestation, *M. marginalis* is considered locally established. The investigation determined that the detection of *M. marginalis* posed a negligible biosecurity risk and no further action was required by MPI.



Figure 7: Dorsal view of new-to-New Zealand cockroach, *Methana marginalis*. Photo: PHEL Entomology

New fungus from *Pittosporum* tree

On 1 February 2024, PHEL Mycology and Nematology reported to IIPH the detection of *Diaporthe celeris*, a new-to-New Zealand fungus. The fungus was found on samples of kōhūhū (*Pittosporum tenuifolium*) collected from a Lower Hutt residential property during High-Risk Site Surveillance (HRSS). The plant showed stem tip dieback and internal vascular discolouration, with fungus fruiting bodies evident on the leaves (Figure 8). Two undescribed *Diaporthe* species were isolated from this sample in addition to *D. celeris* (Figure 9). *Diaporthe celeris* is closely associated with the *Diaporthe eres* species complex, which is established here. A recently published revision of the genus *Diaporthe* considers the fungi previously identified as *D. celeris* to belong to *D. eres* (Dissanayake et al., 2024). It is a minor pathogen of a variety of woody plant hosts, causing leaf spots, stem cankers and dieback.

Further investigation by PHEL Mycology & Nematology found that although there is evidence that *D. celeris* can cause grapevine disease symptoms, the disease severity and

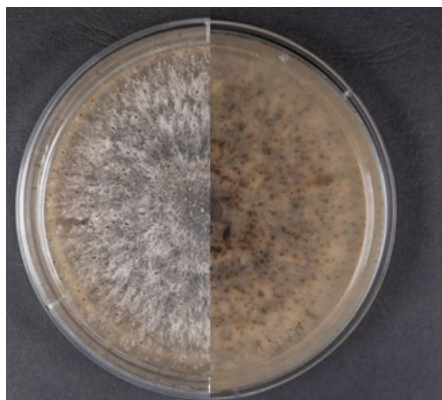


Figure 9: *Diaporthe celeris* growing on a culture media in the laboratory (left: view from top of media plate, right: view from bottom of plate). Photo: PHEL Mycology and Nematology

infectiousness of this fungus is not well understood.

Diaporthe species are generally considered to be weak grapevine trunk disease pathogens in New Zealand and there is currently no evidence to suggest that *D. celeris* is any different. The overall biosecurity risk of *D. celeris* to both grapevines and native *Pittosporum* species was assessed as low and unlikely to present either a biosecurity or biological risk based on the information available.

New Zealand Winegrowers' Association, the Department of Conservation and Te Tira Whakamātaki were informed of the discovery of *D. celeris* and the associated biosecurity risk assessment, and the investigation closed.

New fungus on *Sorbus* plants

In April 2024, a new-to-New Zealand fungal pathogen, *Cytospora erumpens*, was identified from *Sorbus* plants showing symptoms of sunken branch lesions and dieback. The *Sorbus* samples were collected from a cemetery on the Kāpiti coast during HRSS.

This is the first detection of *C. erumpens* in New Zealand, and the first isolation from *Sorbus* sp. *Cytospora erumpens* is not listed as a pest of concern on the Official New Zealand Pest Register (ONZPR). It is unknown if it is a recent introduction to New Zealand, or if it has been present for a while and has only now been detected due to improved diagnostic tools.

Cytospora are often opportunistic or secondary pathogens, exploiting external damage to plants. Literature reports that *C. erumpens* has been recovered from symptomatic (dead/dying) branches of *Prunus padus* and *Salix x fragilis* in China and Russia. The significance of *C. erumpens* as a plant pathogen is uncertain as no host pathogenicity studies have been published. There are only three published detections since its discovery in 2017 (Fan et al., 2020; Norphanphoun et al., 2017; Pan et al., 2020). With no evidence to suggest that this organism poses a unique or higher risk than detections of *Cytospora parasitica* in August 2020 and an undescribed *Cytospora* species in January 2021, the investigation has been closed.

New fungus of kiwifruit, Bay of Plenty

In January 2024, a kiwifruit grower from Te Puke notified Kiwifruit Vine Health (KVH) of 20 affected plants lacking cane and canopy development (Figure 10, next page). The grower first noticed the gradual decline in his vines in the previous three years. The gold kiwifruit (*Actinidia chinensis*) orchard had been planted in 2018 and consisted of the Gold3 scion on Bruno rootstock. The trunk bases of the vines had splitting and cankering, and the roots showed signs of decline. KVH arranged for an industry representative to visit the orchard who noted that the affected plants spanned across 2–3 rows and were planted in what had previously been a dam site. They collected root, soil, and trunk samples and submitted them to Plant Diagnostics Laboratory (PDL) in Christchurch.

On 22 February 2024, PDL identified a suspect new-to-New Zealand oomycete, *Phytophthium helicoides*, and another established oomycete pathogen, *Phytophthium littorale*. *Phytophthium helicoides* is an unwanted organism in New Zealand. On 29 February 2024, KVH contacted the PHEL Mycology and Nematology (M&N) team to validate the results, which confirmed *P. helicoides* and reported the suspected new-to-New Zealand organism to the IIPH



Figure 8: *Pittosporum* showing signs of tip dieback and vascular discolouration due to *Diaporthe celeris*. Photo: SPS Biota

team. Following submission of sequences and cultures from PDL by the II, on 11 March 2024 the M&N team confirmed the identification as *Pp. helicoides*. They also identified another established oomycete pathogen, *Phytophthora citrophthora*, that can cause fruit and root rot on various hosts and previously recorded from kiwifruit here.

On 13 March 2024, IIPH and M&N teams met with KVH to discuss the diagnostic results and consider management options for the affected orchard. Given the pathway of entry for *Pp. helicoides* was not known and there was no association with imported plant material, it seemed likely the *Phytophthora* had been present for some time but not detected until now; therefore, a biosecurity response was not warranted. KVH worked with the grower to implement additional hygiene measures and roped off the infected vines to mitigate risk of movement of *Pp. helicoides* with soil and equipment during the impending fruit harvest. Additional sampling was arranged by KVH, to collect roots and soil to better understand the spread of infection on the orchard. From that sampling, the M&N team detected *Pp. helicoides* from two samples taken from vines sited lower down than the historic dam site, indicating a potential spread by water runoff.

The M&N team looked at historical records of *Phytophthora* and *Pythium* species isolated from kiwifruit roots and soil during a survey conducted across New Zealand kiwifruit orchards in 2020–2022. While the survey was focused on *Phytophthora* species, there were several isolates of *Phytophthora* and *Pythium* sp. isolated, including a suspect *Pp. helicoides* from a nursery in Bay of Plenty (~175 km away from the Te Puke orchard). On 15 May 2024, the M&N team verified the identification of the suspect isolates and confirmed that three isolates from the nursery were *Pp. helicoides*. One was isolated from Bruno rootstock roots in a waste bin, presumed to be from a diseased vine. Other isolates were isolated from discoloured roots and potting mix of Japanese cedar (*Cryptomeria japonica*) used as a shelterbelt.

As *Pp. helicoides* is non-host specific, IIPH discussed options with Plant Imports and Plant Exports regarding implications of this incursion. Host specificity and management options have been reviewed by MPI risk assessors (2018), who recommended that the management of comparable diseases already present in New Zealand will likely be effective to also manage *Pp. helicoides*. Plant Exports did not foresee any adverse trade export implications for kiwifruit markets, as none of the countries list *Pp. helicoides* as a quarantine pest. Given *P. helicoides* has been found at two locations in Bay of Plenty, with no association with imported plant material, it is surmised that *P. helicoides* could be found in other locations in New Zealand. The IIPH team, in consultation with industry, sought and was granted revocation of the UO status of *Pp. helicoides*. Government Industry Partners have been informed of the investigation outcome.



Figure 10: Former dam site showing kiwifruit with stunted growth (cane and canopy development). Photo: Kiwifruit Vine Health

New bacterium from kamahi in Upper Hutt

On 15 March 2024, the MPI M&N team notified a new-to-New Zealand bacterium (*Pseudomonas mensesis*) isolated from a *Weinmannia racemosa* (kamahi) leaf sample that was collected during HRSS in February 2024 from Upper Hutt. The sample displayed both bacterial and fungal leaf spots and the bacterium was recovered specifically from the leaf spots. There are no records of this organism from New Zealand, and this is the first record from a *Weinmannia* species.

There is no evidence to suggest that this species is a plant pathogen and may instead be beneficial to plant growth as a biofertiliser and bio-stimulant. In essence, *P. mensesis* is a rhizospheric bacterium with no pathogenic effects on plants noted in the literature.

New-to-science virus from lacebark, Upper Hutt

During HRSS at Kaitoke Regional Park, Upper Hutt, a lacebark (*Hoheria populnea*) tree displaying mosaic symptoms was sampled (**Figure 11**). Material submitted to PHEL Virology for testing revealed a virus that had been provisionally associated with the group of emaraviruses. Being a suspect new-to-science species, the IIPH team was notified. PHEL validated the new-to-science status; however, virologists suggested that additional work was probably necessary to better characterise the virus and assess its potential impact on the host. The HRSS surveyor was contacted by the II, who advised that the plant had not shown any signs of decline. Based on the information available, the II assessed no further action was warranted.



Figure 11: Mosaic virus symptoms on lacebark leaves. Photo: SPS Biota

New poinsettia virus, Auckland

Samples from a poinsettia (*Euphorbia pulcherrima*) with yellowing of the veins at an Auckland nursery were taken and submitted to PHEL for testing (Figure 12). Poinsettia latent virus (PnLV) was detected and validated from the sample. This is the first time PnLV has been detected in New Zealand. In response to the detection, a preserved sample of *E. pulcherrima* collected in 2002 from an Auckland home garden and archived at PHEL was retested and tested positive for PnLV. Technical constraints in 2002 are likely why the virus was not detected then.

PnLV has been reported as a latent virus and research so far has not recorded any observable symptoms or pathogenicity (Aus dem Siepen et al., 2005; Bernuetz, 2001; Koenig and Lesemann, 1980). Previously referred to as poinsettia cryptic virus (PnCV), PnLV is found to be transmissible via grafting and through seed, it is possible that the virus may be transmitted through soil and water. PnLV has a known host range limited to poinsettias *E. pulcherrima* and *E. cornastra*.

Although not conclusive, the symptoms observed may have been caused by a combination of PnLV and the environmental conditions these plants were growing in. A site investigation was undertaken by IIPH and PHEL to inspect the plant in situ. A further eight symptomatic and non-symptomatic poinsettia samples were collected from

the nursery: three from specimens for sale, three from specimens planted within the nursery and two from specimens planted near the driveway. All samples were positive for PnLV.

The positive result for PnLV from the archived sample indicates that the virus may have been present in New Zealand since 2002 but its origin and distribution are unknown.

The nursery owner was advised that until the virus is determined as present in New Zealand by the Environmental Protection Authority, PnLV is considered a new-to-New Zealand virus. MPI does not encourage the propagation, trade or marketing of plants that are known or likely to be infected. Based on the available information, the biosecurity risk is considered low to negligible, and no further action is planned.

Investigation of suspect high-impact pests – Negative

These cases involved reports of suspect high-impact pests or diseases that were investigated by the IIPH team, but no biosecurity risk was identified. Most notifications were of suspected BMSB (31 investigations, as reported above) and fruit flies (three investigations). Exotic fruit flies were ruled out by identification of individuals from photos or dead specimens submitted to PHEL.

Negative – Other

These investigations were negative for the presence of any biosecurity risk. The IIPH team received 63 notifications this quarter (April to June 2024) that included 51 entomology cases, eight for botany, two for mycology, one for bacteriology and one for virology.

'New' *Juncus hybridus* plants detection in Richmond

A plant not known to be present here was detected in Richmond, Nelson and reported on iNaturalist in November 2023 (<https://inaturalist.nz/observations/191892899>). The detection site showed a group of 20–30 plants on the edge of an estuary at Sandeman Reserve, Richmond.

Based on the morphological features, the sample was identified as *Juncus hybridus* by the botany curator (Leon Perrie) at the Museum of New Zealand Te Papa Tongarewa. There are no sequences of *J. hybridus* available on GenBank for comparison. Initially, a PHEL Botanist appeared to agree with the curator's diagnosis, which prompted a notification to the IIPH team in January 2024.

The plants are native to Mediterranean countries and widely distributed there and as an introduced species from North to South America, Australia, South Africa and the United Kingdom (<https://bit.ly/Juncushybridus>). There was no available information in the literature that suggested it being a weed species of concern.

Department of Conservation (DOC) and Tasman District Council (TDS) were informed of the detection. A plant taxonomy expert from the Allan Herbarium was approached for clarification on available past specimen of *Juncus species* in their collection and their taxonomy. They advised that their herbarium specimen CHR 3675, identified originally by E. Edgar in 1975 as *Juncus ambiguus*, is now regarded as a synonym of *Juncus hybridus*, establishing that *J. hybridus* was present in New Zealand for a long time and historical specimens may have been identified differently since the taxonomy has been recently updated for the group. Considering the taxonomy proposed in Kirschner (2002) and the revision of Lastrucci et al. (2022), the Allan Herbarium plant taxonomist had already updated the New Zealand list with the synonymy of the two scientific names, *Juncus ambiguus* being the junior synonym of *J. hybridus*. That makes the CHR 3675 specimen a suspect *J. hybridus*. Given the updates in taxonomy and nomenclature, it is likely this detection considered as a member of *Juncus hybridus* has been present in New Zealand from 1975 onwards as *J. ambiguus*, and not considered as a new-to-New Zealand detection. The investigation concluded as no biosecurity risk was associated with this detection.



Figure 12: New virus in poinsettia at nursery

Inconclusive

These investigations were stood down because results or absence of results meant the presence or absence of a biological risk could not be determined, but it was decided that further investigation was not warranted. Most of the 10 notifications received by IIPH this quarter were closed because IIs could not obtain specimens for identification, or the condition of specimens submitted to PHEL was too poor for analysis. Biological risk in all cases was mitigated by a range of measures appropriate to the case, such as freezing a sample for 48 hours before disposal. Some cases are discussed below.

New parasitoid wasp in park, Auckland

In late January 2024, a PHEL scientist collected six individuals of a suspect new-to-New Zealand parasitoid wasp (Encyrtidae) around the base of a eucalypt (*Eucalyptus globulus*) tree near a reserve in Parnell, Auckland (Figure 13). After completing further diagnostics and consulting with an expert (John Noyes – Natural History Museum, London), PHEL Entomology determined that the wasps represented an undescribed genus in the family Encyrtidae (Hymenoptera). The specimens were not able to be identified further and are likely to represent a new-to-science species.

Encyrtidae wasps have a global distribution and are found everywhere except Antarctica. In 1988, Noyes recorded 35 genera and 67 species from this family in New Zealand.



Figure 13: New parasitoid wasp found in Auckland. Photo: PHEL Entomology

Encyrtidae wasps are parasitoids of insects, spiders, ticks, and mites. They are commonly associated with scale insects (Hemiptera: Coccoidea). In addition to Coccoidea, Encyrtidae are also associated with the Coleoptera, Lepidoptera and Diptera. They are considered to be beneficial insects and are often used as biocontrol agents for pest insects. The host of the undescribed parasitoid wasp is unknown; further study would be necessary to describe this wasp and to identify its insect host. Biosecurity New Zealand does not intend to complete this work.

The same parasitoid wasp may have been reported on iNaturalist from Auckland (Mount Roskill, CBD, and Mount Albert) from 2023 to the present. These records have not been verified but they suggest this wasp may be well established. As this wasp is undescribed, there is no published information available on its biology or hosts. Given the evidence thus far, the investigation concludes the biological risk of this new wasp is likely negligible and no further action is planned.

New moth from Russell

The notifier reported a suspect new-to-New Zealand moth tentatively identified as the alfalfa leaf tier, *Dichomeris acuminatus*. The single individual (from a light trap) was photographed, and photos uploaded to iNaturalist. From the photos, a Manaaki Whenua lepidopterist tentatively identified *D. acuminatus* and reported it to PHEL Entomology, which then passed the notification on to the IIPH team. Identification to species level was not possible without the specimen. The Incursion Investigator contacted the photographer and asked him to collect a specimen the next time the moth came to the light trap. However, about three months later no further individuals were observed, and the investigation closed. The photographer will be contacted in spring (November 2024) and the investigation will be re-opened if additional individuals are found.

New ladybird on Cheviot road sign

A member of the public added an observation to iNaturalist of a ladybird found on a road sign in Cheviot. The iNaturalist science community identified this as the exotic *Hippodamia variegata* (variegated lady beetle) and asked the observer to notify MPI. PHEL Entomology Christchurch received this notification and agreed the species was likely *H. variegata* but were unable to confirm that without a specimen. They passed the notification to IIPH as a suspect new-to-New Zealand species. *Hippodamia variegata* does not pose a high biosecurity risk and would likely be beneficial as it mainly preys upon aphids. However, in other countries where it has been introduced it has sometimes negatively affected native ladybird populations. *Hippodamia variegata* had previously been detected at the border on grape consignments and on the vehicle pathway but this appears to be the first post-border detection. As the notifier had just been travelling through Cheviot, no specimen had been collected. The iNaturalist community will keep an eye out for any similar observations and hopefully specimens can be collected to confirm the species and its presence here. Due to the absence of a specimen and the low biosecurity risk, no further action was taken.

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Plant health surveillance annual report

Team overview

The Plant Health Surveillance (PHS) team is responsible for managing targeted surveillance programmes for exotic pests and diseases affecting plants, including forestry, horticulture and ornamental or amenity species (Table 1). The team works nationally, with team members based in the Plant Health and Environment Laboratory (PHEL) in Auckland and MPI’s Charles Fergusson Building in Wellington.

The PHS team manages the brown marmorated stink bug surveillance programme, the high-risk site surveillance programme (HRSS), the national fruit fly surveillance programme and the spongy moth surveillance programme. Each programme has its own summary in this issue provided by the associated Technical Managers.

The PHS team also provides technical input into the Forest Biosecurity Surveillance programme (FBS), which is funded by the Ministry for Primary Industries (MPI) and the New Zealand Forest Owners Association (NZFOA). FBS is a joint programme as part of an operational agreement under the Government Industry Agreement (GIA) for forestry. Additionally, members of the PHS team provide technical advice to GIA species groups including the BMSB Council, Lepidopteran Working Group and Fruit Fly Council.

The PHS team received funding from a budget bid in 2022 to increase the capacity of the team and recruited two new surveillance advisers in April 2023: James Kim and Ranjitha Hande-Harikrishna. Their arrival was offset

by the departures of Principal Adviser Rory Maclellan and Adviser Brendan Murphy in early 2024.

Professional development

Team manager Nick Ward chaired the organising committee for the New Zealand Biosecurity Institute’s National Education and Training Seminar in Northland in July 2023. The training seminar brings together a wide range of biosecurity professionals from government, local authorities, community groups and private sector providers to share knowledge. In addition, Nick Ward is Chair of the Northland Auckland branch of the New Zealand Biosecurity Institute.

Nick Ward was also invited to provide a keynote address at the New Zealand Tree Crops Association’s national conference in Otaki in March 2023. The conference promotes interest in useful tree crops such as fruit, nuts, timber, fuel, livestock fodder, bee forage and other productive crops.

In May 2023, Nick Ward presented virtually at the Plant Surveillance Network Asia Pacific (PSNAP) Annual Surveillance and Diagnostic Workshop. The presentation provided an overview of how improvements in digital image technology are improving the efficiency of the plant health surveillance programmes.

During the year, the PHS team contributed to several outreach activities in conjunction with other parts of MPI, particularly Plant Health and Environment Laboratory staff. The focus of these outreach activities

was to increase awareness of our surveillance activities and MPI’s role in biosecurity. The PHS team also delivered several presentations to tertiary students to encourage them to consider careers with MPI.

Publications

The PHS team provided technical support and subject matter expertise to the Biosecurity New Zealand Technical Standard for Fruit Fly Responses. The standard specifies the technical and operational requirements during a fruit fly response.

The PHS team also contributed to the development of a BMSB readiness plan and a long-term management strategy.

Communications activities

Each plant health surveillance programme has a communications strategy that directs how surveillance contractors will communicate and interact with stakeholders. For example, the fruit fly surveillance programme communications plan sets out the objectives for the programme and identifies target audiences for communication, including homeowners hosting fruit fly traps for the season. The communications plan also includes copies of key documents like information brochures.

PHS team members may also be called on to contribute to media releases and external communications related to the team’s surveillance programmes.

Technical projects

The PHS Team contributed to the New Zealand aid programme supporting biosecurity activities in Pacific island nations. For example, Surveillance Adviser James Kim travelled to the Cook Islands with PHEL Entomologist Ben Boyd to co-ordinate training of local Ministry of Agriculture biosecurity officers in surveillance principles. The training included designing and carrying out crop surveys for pests of various

Table 1: Plant health surveillance team

Name	Role	Qualifications	Years of service
Nick Ward	Team Manager	PGDipSci	13
George Gill	Principal Adviser	MSc	20+
Rory Maclellan	Principal Adviser	BSc (Agriculture)	12
Paul Stevens	Senior Adviser	BForSci/GDipBusStuds	15+
Brendan Murphy	Adviser	PhD	6
James Kim	Adviser	MSc	1
Ranjitha Hande-Harikrishna	Adviser	MSc	1

local crops, as well as processes for collecting samples for diagnostics. PHS team members also provided technical advice to Biosecurity Vanuatu on fall armyworm surveillance and response processes.

The PHS team continued an expanded project to test RapidAIM automated traps for detecting Queensland fruit flies. This year, 100 RapidAIM traps were deployed across New Zealand compared with 60 traps in Auckland last year. The project was funded by the Fruit Fly Council and ran alongside the national fruit fly surveillance programme. A further summary of the RapidAIM project is provided with the national fruit fly surveillance programme annual report on page 178.

The PHS team also supported a project funded by the Fruit Fly Council to investigate whether fruit fly lures could be combined in the traps without reducing the efficacy of the traps. If lures could be combined, it may lead to greater efficiencies in the programme such as reducing the number of traps required to cover the same high-risk areas.

The PHS team also began a trial of a new aerodynamic windvane trap for BMSB. Ten windvane traps were deployed at high-risk sites around Auckland to test their effectiveness in New Zealand conditions. The trial was based on the results of international research and funded by the BMSB Council. Further information about the trial is summarised with the BMSB Surveillance Programme report on page 174.

The technical managers for the BMSB surveillance programme worked with MPI's Geospatial team to refine and automate the model for identifying high-risk sites for BMSB trap placement. The model combines data from several sources and includes import volumes, records of previous interceptions and Transitional Facilities receiving goods from high-risk countries to identify areas of greatest risk for BMSB arrival, allowing the trapping grid to be optimised.

The PHS team also continues to contribute to several international and national committees such as Better Border Biosecurity (B3), Quadrilaterals Collaboration Working Group (QCWG), Subcommittee on National Plant Health Surveillance (SNPHS) and the International Plant Protection Committee (IPPC).

Response participation

The PHS team provides subject matter expertise during responses, particularly those relating to surveillance programme targets, e.g., fruit fly. PHS team members often form part of the surveillance workstream within responses, particularly technical advice and developing operational specifications.

In the past year, the PHS team contributed to readiness plans and activities for fruit fly and BMSB responses. Members of the PHS team have also provided advice for several incursion investigations.

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National brown marmorated stink bug surveillance programme annual report

The brown marmorated stink bug or BMSB (*Halyomorpha halys*; Hemiptera: Pentatomidae) is a high-impact horticultural and environmental pest and can 'hitch-hike' through many entry pathways. BMSB feeds on a wide variety of fruits, vegetables and ornamental plants, causing significant economic losses in many horticultural crops. It is also a significant nuisance pest owing to its habit of gathering in very large numbers during winter in homes and other structures.

Methods

Risk sites

The number of high-risk inspection sites remained at 80 for the 2023/24 season (**Figure 1**). MPI recognises that import pathways for BMSB are not limited to any one commodity. Rather, several high-risk pathways exist for accidental importation (hitch-hiking), associated with international cargo such as new and used vehicles, machinery and containers carrying goods from BMSB host countries. Of the targeted risk sites this season, 74 were Transitional Facilities with past histories of BMSB interceptions or importing significant volumes of risk cargo from BMSB host countries. The remaining six sites were car yards that store imported cars from BMSB host countries, a recognised risk pathway for BMSB. Kiwifruit Vine Health Inc. (KVH) funded six additional sites, specifically in the Bay of Plenty region. Data from KVH-funded sites have been presented separately from the national sites (80) in this report. All surveillance sites were modelled using the same risk methodology.

Field surveillance

All targeted sites were surveyed for the presence of host trees before the traps were established. As BMSB can exploit more than a hundred hosts belonging to 45 plant families (Leskey et al., 2012), native species including titoki (*Alectryon excelsus*) and karaka (*Corynocarpus laevigatus*) were included as potential hosts. The survey method entails putting two

MPI established the national brown marmorated stink bug (BMSB) surveillance programme in 2019, targeting high-risk areas such as Transitional Facilities, airports, and car yards. A significant number of programme innovations were implemented this season, particularly regarding field data capture and analysis. This was the first year of a project trialling a set of new aerodynamic tunnel traps for BMSB detection. The 2023/24 surveillance season had a record number of pentatomid specimens captured (1,082). No BMSB were detected.

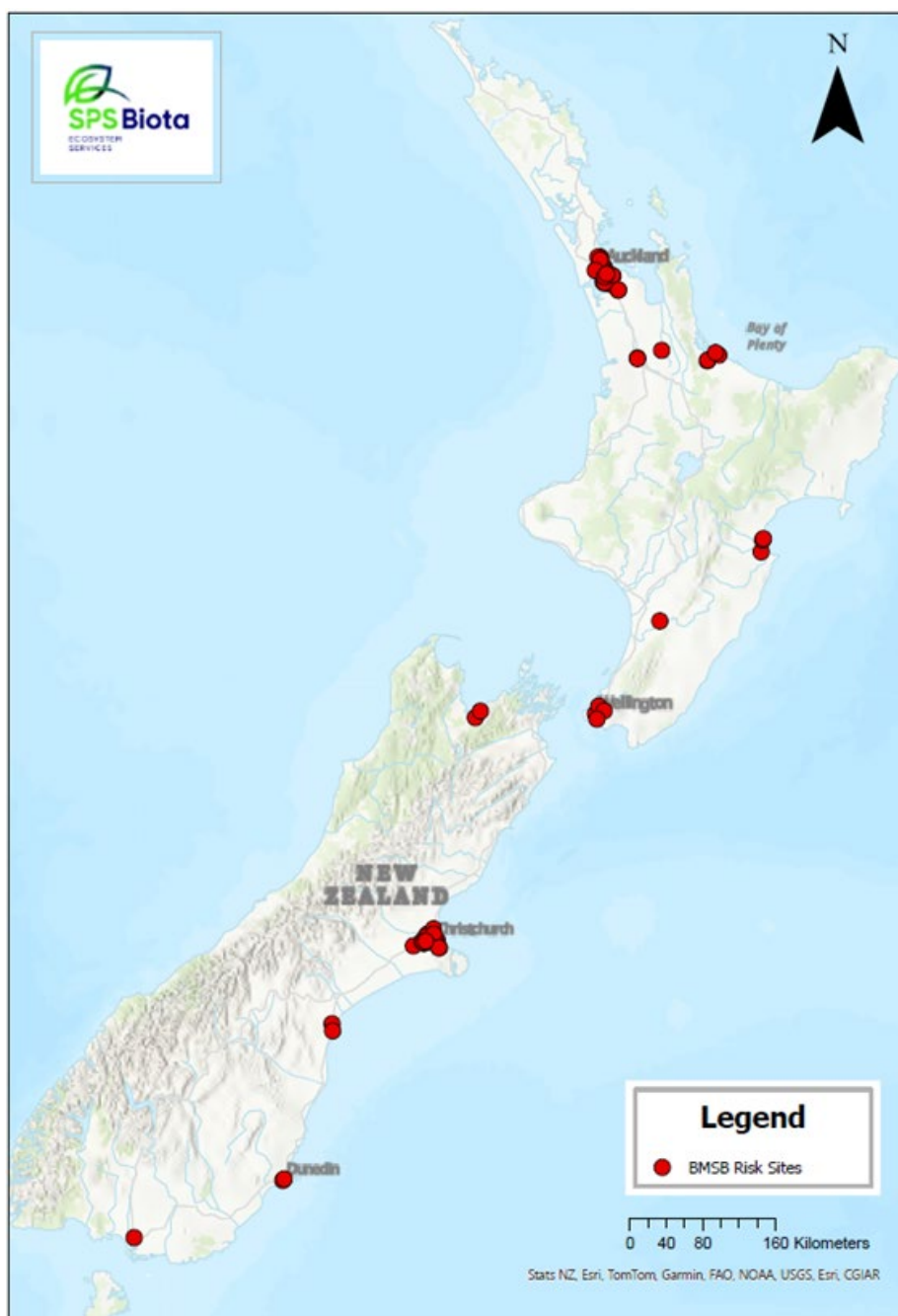


Figure 1: Risk site locations targeted for brown marmorated stink bug surveillance, 2023/24

lured sticky-card traps on host plants about 125 m apart, or on wooden stakes where vegetation is lacking.

The programme used the Trécé® Pherocon BMSB dual lure, which has two components: a high dose 4x lure

of 20 mg of BMSB pheromone and 200 mg of the aggregation component to attract BMSB towards the traps. This lure is designed to attract both adult and nymphal BMSB. A sticky-card trap is also used with each lure and changed every 12 weeks throughout the trapping season. Field officers collect insects by a combination of trap inspections and vegetation searches, beating the bushes over sheets to collect pentatomid bugs within 5–10 m of the trap (**Figure 2**). It has been shown that using both methods is more effective than just one (Morrison et al., 2015).

The survey season spanned 24 weeks from November to April, and traps were inspected every 14 (±3) days. Any pentatomid egg masses or nymphs and adults between one to two centimetres in body length were regarded as suspect BMSB. A decision table is used to decide which life stages of each species are sent to the laboratory for diagnostics or if a digital photo was submitted to confirm an identification. All adult green pentatomid species can be identified from photo submissions. All physical samples were retained during the season in case subsequent laboratory identification was required.

Results

Risk sites

From the 80 national risk sites, 1,073 samples (some samples contained more than one species) were collected and 1,082 pentatomid specimens were recorded (**Table 1**). The six KVH-funded risk sites captured 62 samples and generated 64 pentatomid specimen identifications (**Table 2**). Throughout this season, 20 marked specimens were placed on traps to audit field officers, and all were successfully collected showing a high level of compliance.

Field surveillance

Figure 3 (next page) shows the number of each pentatomid species collected. No adult or juvenile BMSB. However, two further specimens of interest other than pentatomids were collected (a Syrphidae egg mass and *Cassida compuncta*). These were all determined not to be of



Figure 2: Survey methods include (left) inspection of the sticky trap for pentatomid bugs attracted by the lure, and (right) samples collected by using beating sheets. Photos: SPS Biota

Table 1: Summary of national risk sites per region for BMSB 2023/24 surveillance

Region	Number of sites surveyed	Number of samples taken	Average number of samples per site
Auckland	35	537	15.3
Waikato	3	204	68.0
Bay of Plenty*	4	35	8.8
Hawke's Bay	3	18	6.0
Manawatū	1	6	6.0
Wellington	4	23	5.8
Nelson	2	57	28.5
Mid-Canterbury	23	174	7.6
Timaru	2	16	8.0
Dunedin	2	3	1.5
Southland	1	0	0.0
Totals	80	1,073	

*Excluding KVH-funded sites (Table 2)

Table 2: Summary of KVH-funded risk sites for BMSB 2023/24 surveillance

Region	Number of sites surveyed	Number of samples	Average number of samples per site
Bay of Plenty	6	62	10.3

biosecurity risk and were either native to New Zealand or naturalised introduced species.

Of the 1,082 pentatomids collected, most (78 percent) were collected within a 10-m radius of the trap (**Table 3**, next page). This suggests that the currently used lures are effective at attracting a range of pentatomid species to a given locality.

Weather and climate can have a substantial effect on finding BMSB. Warm weather provides the best time for surveys as insects will be more active than in cold conditions. Over 51 percent of all trap clearances were conducted in sunny conditions, and

surveys under cloudy conditions made up about 30 percent of clearances. This resulted in an overall trap clearance rate of 81 percent in conditions optimal for detecting pentatomids. Surveys during rainy and windy conditions were less frequent, partly because trappers tended to avoid conditions where vegetation searches and sheet-beating are impractical.

Figure 4 (next page) shows the pattern of pentatomid detections over the past five years of trapping to date. This appears to effectively track pentatomid populations, from emergence in November to a decline from March onwards. There

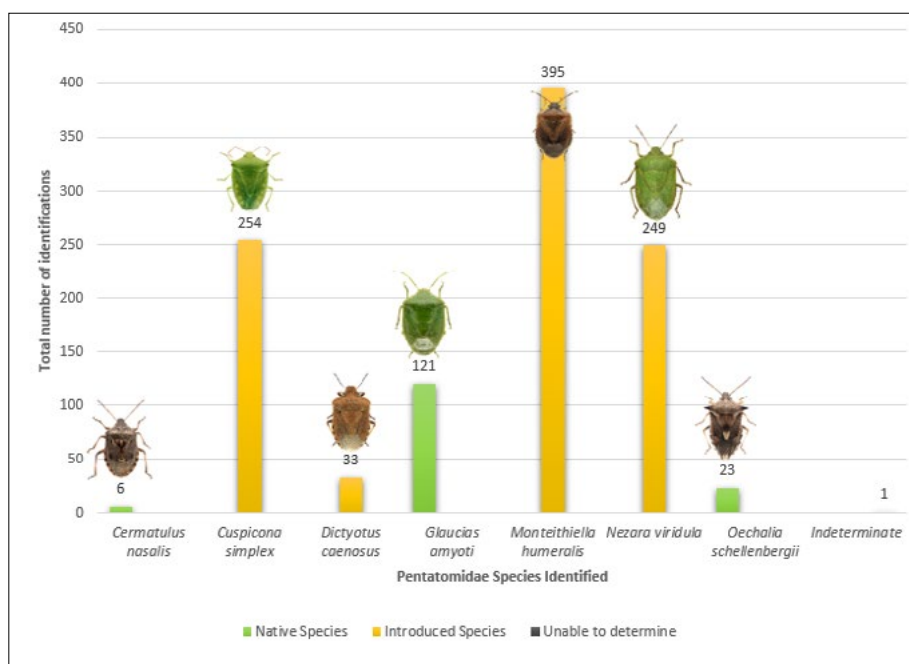


Figure 3: Numbers of each Pentatomidae species collected, 2023/24

Table 3: Pentatomidae species identified from BMSB surveillance programme trap sites and type of sample collection, 2023/24

Species	Sample Source			Total
	Trap	Vegetation (10m radius)	Vegetation (outside 10m radius)	
<i>Cermatulus nasalis</i>	0	4	2	6
<i>Cuspicona simplex</i>	8	170	76	254
<i>Dictyotus caenosus</i>	4	22	7	33
<i>Glaucias amyoti</i>	20	89	12	121
<i>Monteithiella humeralis</i>	25	273	97	395
<i>Nezara viridula</i>	17	190	42	249
<i>Oechalia schellenbergii</i>	1	20	2	23
Indeterminate	0	0	1	1
Total identifications	75	768	239	1,082



Figure 4: Pentatomidae detections from 2019 to 2024.

is little evidence to suggest that the surveys should be extended beyond these dates.

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Aerodynamic BMSB trap trial

Beginning in 2019, several international trials were conducted using a novel BMSB tunnel trap that used an aerodynamic windvane (**Figure 5**) (Suckling et al., 2019). This design allowed for the trap to self-orientate to the direction of the wind, producing a more concentrated plume of pheromones that travels further than the currently used sticky panel traps. Promising results from this study initiated a project from the BMSB Council (a Government Industry Agreement group) to trial these aerodynamic traps in New Zealand conditions. Ten aerodynamic traps were established across Auckland in proximity to regular sticky panel BMSB traps. Results indicated that the aerodynamic traps captured up to 16 percent more samples per trap compared with sticky panel traps. However, due to the small sample size, statistical significance could not be determined. Furthermore, there were eight instances of suspected vandalism throughout the trial, suggesting that public visibility may need to be taken into further consideration when setting up these traps. The BMSB Council has funded an additional year trialling these aerodynamic traps to support results and apply lessons learnt from this season.



Figure 5: Aerodynamic BMSB trap

National fruit fly surveillance programme annual report

The NFFSP was initiated in the mid-1970s to provide early detection capability of fruit fly incursions, and to provide direct evidence that New Zealand is free of these pests. Since 1989, the NFFSP has recorded 12 detections of economically important fruit flies: nine in Auckland and three in Whangārei (**Table 1**).

Rapid investigation of these events quickly determined whether a population of flies was present. When a breeding population was found to exist (Mediterranean fruit fly in 1996 and Queensland fruit fly in 2015) or to have possibly existed (Auckland 2019), prompt action was taken to eradicate and prevent establishment. Intensified surveillance in response to the other detections yielded no further flies and provided evidence that populations had not established. While it is not possible to conclusively determine the pathway of entry, it is likely that these cases were the result of discarded infested fruit brought in by travellers from overseas. Six species of fruit fly were involved in the 12 detections (**Table 1**).

The absence of economically important fruit flies in New Zealand enables produce to be grown and exported without incurring costs of treatments. The horticultural

New Zealand’s National Fruit Fly Surveillance Programme (NFFSP) undertakes seasonal monitoring (September–June) for the presence of economically significant fruit flies. The NFFSP strategically targets areas designated as high risk for a fruit fly incursion, including seaports, airports, suitable host plants and areas of high population density and tourism. Field work during the 2023/24 season involved 148,622 inspections across 7,878 traps distributed throughout New Zealand. No exotic fruit fly species were detected.

industry represents over 4,500 fruit and vegetable growers. The industry is valued at NZD 7.48 billion and generates NZD 4.67 billion annually in exports (Horticulture New Zealand, 2024). To maintain this advantage, the NFFSP is deployed annually.

Methods

Start and end dates

The Ministry for Primary Industries (MPI) specifies the start and end dates of the trapping programme. The season covers the months that fruit fly population development and flight activity are expected to occur (Stringer et al., 2013). Traps are placed strategically in areas designated as high risk for an incursion of fruit fly, including seaports, airports, and areas of high population density. Also considered as high risk are places where visitors tend to spend

their first night in New Zealand, places where suitable host plants are present, and areas where summer and winter temperatures are suitable. Areas targeted for surveillance in the 2023/24 season are shown in **Figure 1**, next page.

Trap runs

Operationally, the programme is divided into three regions: upper North Island, central North Island, and the South Island. Traps are inspected every 14 days (± 1 day) by a field officer during the trapping period. Trapping is carried out in a grid system, where traps are situated as close as possible to the centre of each cell in the grid. The use of three fruit fly lures (cuelure, trimmedlure and methyl eugenol) provides broad coverage of *Bactrocera*, *Dacus*, *Zeugodacus* and *Ceratitis* species, and in particular Queensland fruit fly

Table 1: Detections of economically important fruit flies since 1990 and outcomes

Species	Location	Date	Outcome
Queensland fruit fly (<i>Bactrocera tryoni</i>)	Auckland (North Shore)	02/2019	Increased surveillance, precautionary baiting, no further finds
Facialis fruit fly (<i>Bactrocera facialis</i>)	Auckland (Otara)	02/2019	Increased surveillance. Three flies detected. No population establishment
Tau fruit fly (<i>Bactrocera tau</i>)	Auckland (Manurewa)	01/2016	Increased surveillance. No further finds
Queensland fruit fly (<i>Bactrocera tryoni</i>)	Auckland (Grey Lynn)	02/2015	Eradication successful
Queensland fruit fly (<i>Bactrocera tryoni</i>)	Whangārei (Riverside)	04/2014	Increased surveillance. No further finds
Queensland fruit fly (<i>Bactrocera tryoni</i>)	Whangārei (Riverside)	01/2014	Increased surveillance. No further finds
Queensland fruit fly (<i>Bactrocera tryoni</i>)	Auckland (Avondale)	05/2012	Increased surveillance. No further finds
Mediterranean fruit fly (<i>Ceratitis capitata</i>)	Auckland (Mt Roskill)	05/1996	Local larval population delimited and successfully eradicated
Queensland fruit fly (<i>Bactrocera tryoni</i>)	Auckland (Mt Eden)	04/1996	Increased surveillance. No further finds
<i>Bactrocera papayae</i>	Auckland (Mt Eden)	04/1996	Increased surveillance. No further finds
Queensland fruit fly (<i>Bactrocera tryoni</i>)	Whangārei	06/1995	Increased surveillance. No further finds
Fijian fruit fly (<i>Bactrocera passiflorae</i>)	Auckland	03/1990	Increased surveillance. No further finds

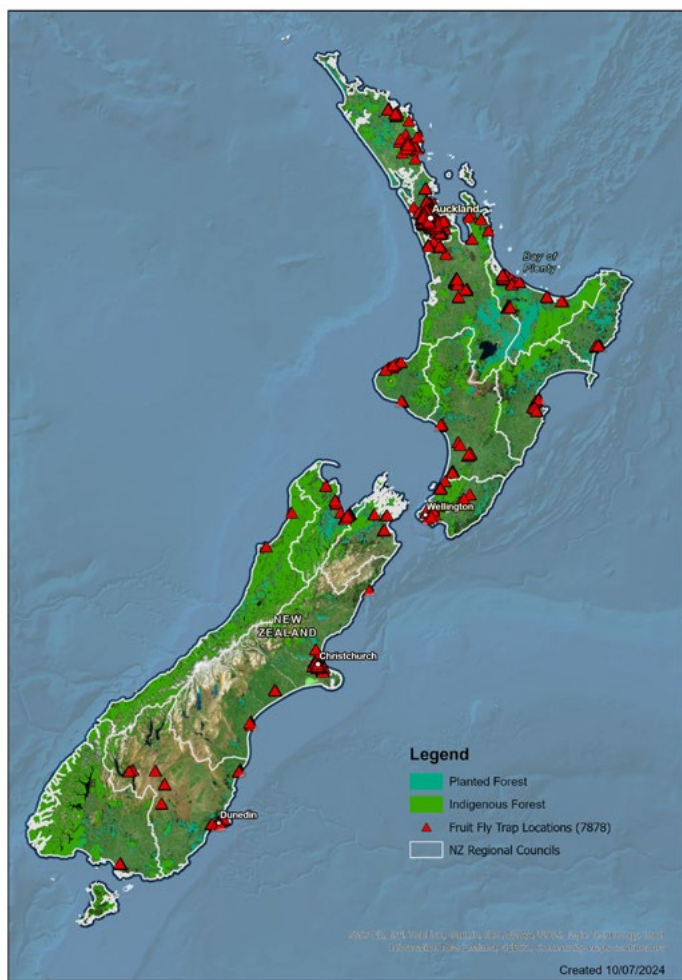


Figure 1: Fruit fly trap locations in New Zealand, 2023/24 season

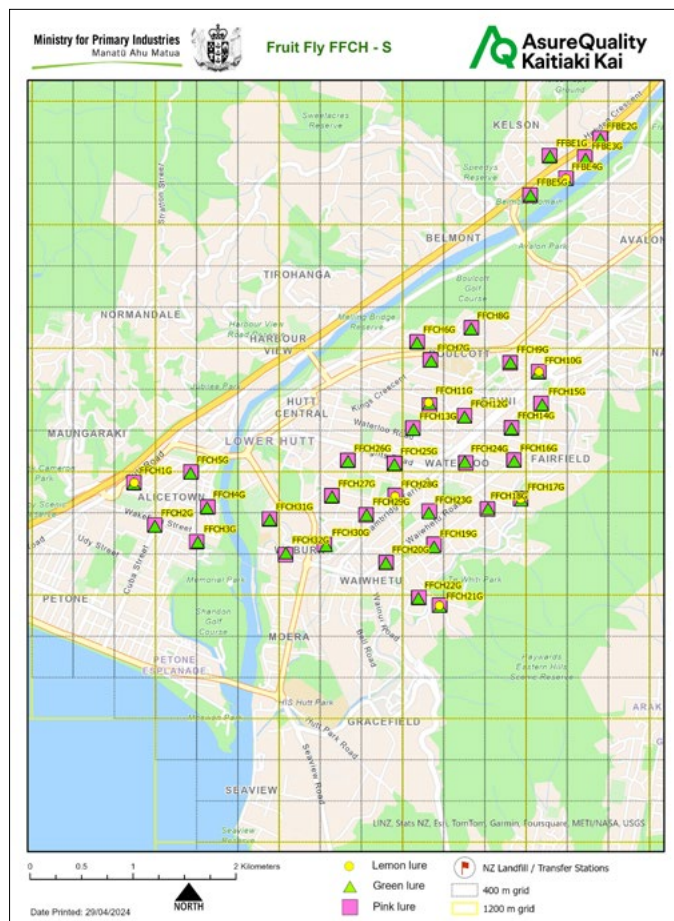


Figure 2: The use of grid cells and the placement of trimedlure (pink), cuelure (green) and methyl eugenol (lemon) lures in Hutt Valley, Wellington

(*B. tryoni*), Mediterranean fruit fly (*C. capitata*) and Oriental fruit fly (*B. dorsalis* complex). **Figure 2** shows an example of deployment of three different fruit fly lures in Hutt Valley, Wellington for the 2023/24 surveillance season.

Traps with cuelure and trimedlure are placed in 400 m x 400 m cells, while trap sites with methyl eugenol (which has a greater effective range) are placed in 1,200 m x 1,200 m cells. Traps are placed according to a ranking system based on host status, with fruiting host trees given priority.

At the start of the surveillance season, new Lynfield traps (**Figure 3**) are placed at historical trapping sites chosen based on the criteria mentioned earlier. These sites are reviewed periodically and relocated or moved to other areas as agreed between MPI andASUREQuality. GPS co-ordinates are recorded for each trap. Traps are replaced immediately if they go missing or the field officer considers them to be significantly damaged. Trap data are captured electronically using the ArcGIS Field Maps app and displayed immediately as live data in dashboards designed for ASUREQuality and MPI.



Figure 3: A Lynfield trap used to catch male fruit flies. Photo: ASUREQuality

Traps are placed where they are protected from direct sunlight, wind and dust, are at least 1.3 m from the ground, and are in an area of dappled light within the canopy of the selected tree. These factors increase the probability of attracting target species. To avoid cross-contamination between lures, traps are placed at least 3 m apart from any other insect trap.

Cuelure and methyl eugenol lures are replaced every 12 weeks while trimedlure lures are replaced every eight weeks with the trap being rotated to another fruiting host tree. This increases the chances of detecting Mediterranean fruit fly as this species is known to form colonies within an individual fruit tree and tends not to disperse to other fruit trees if sufficient host material is present. Calibration of the lures is undertaken whenever new stock is purchased by analysing three random samples of each lure.

Each Lynfield trap contains a wafer lure impregnated with one of the pheromone lures and a dichlorvos (DDVP) insecticide-impregnated strip. Male flies attracted to the trap are killed by the fumigant action of the DDVP strip. Traps carry a 'Fruit Fly Trap' label, display both MPI

Table 2: Total number of traps and trap runs by region, 2023/24

Region	Number of trap runs	Number of traps
Auckland/Northland	71	5,006
Waikato/Bay of Plenty	15	812
Lower North Island	22	929
Upper South Island	20	757
Lower South Island	12	374
Total	140	7,878

and AsureQuality logos, provide a freephone contact telephone number, and carry the warning ‘Danger – Contains a DDVP insecticide strip with 186-193g/kg dichlorvos. Keep out of reach of children’. The insecticide strips are replaced at intervals of 8 weeks or less.

samples are collected, a nil return is filed with PHEL. Any finds of exotic economically significant fruit flies must be confirmed within 10 working hours of the initial identification and reported within 15 minutes of confirmation to the MPI Incursion Investigation team via the MPI exotic

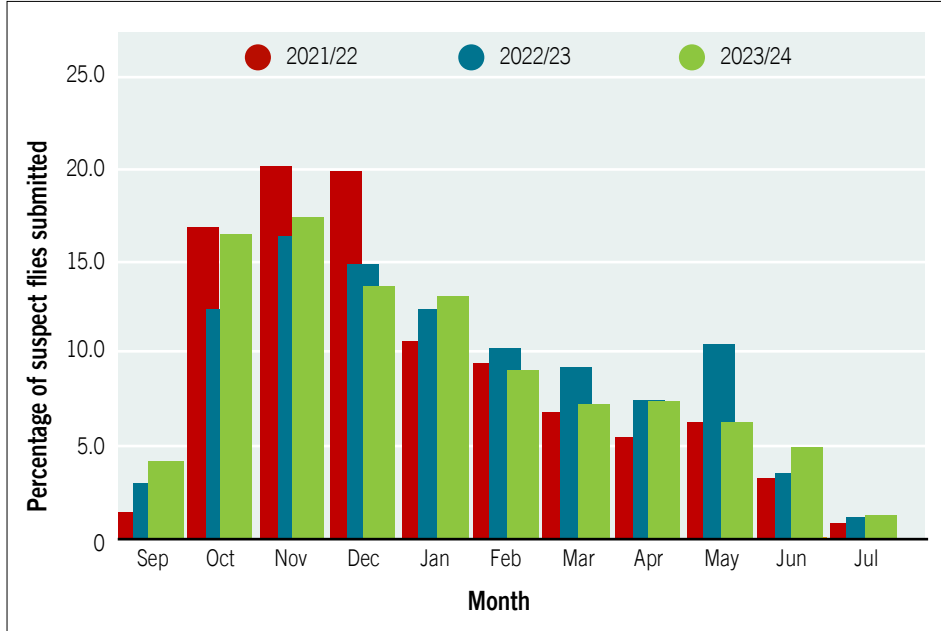


Figure 4: Percentage of fruit fly samples submitted by month for the 2023/24 season In total, 52 samples collected in fruit fly traps were categorised as ‘specimens of interest’. These are organisms that do not resemble fruit flies but were found in or on the trap and were considered potential biosecurity threats. A further seven specimens were submitted by trappers as passive surveillance samples. These are specimens that were not caught in or on fruit fly traps or that were provided by members of the public. None of the specimens of interest or passive surveillance samples generated a new-to-New Zealand species record or was of biosecurity significance.

Suspect samples

Any insect resembling a fly that is between 3 and 15 mm long is regarded as a suspect sample. All samples from a trap are placed in one vial and sent to the Plant Health and Environment Laboratory (PHEL) in either Auckland (upper North Island traps) or Christchurch (rest of New Zealand) within two working days of trap servicing. Submissions are screened by MPI entomologists within eight working hours and replies are sent to AsureQuality area managers within five working days. Where no suspect

pest and disease hotline (0800 80 99 66).

Results

Start and end dates

The first traps were inspected on 25 September 2023 and the last inspections were on 5 July 2024.

Trap runs

No new traps were established this season. A total of 140 individual trap runs were used to service the 7,878 Lynfield traps in use. The number of

traps in a run ranged from seven to 99, with a mean of 56.7. Table 2 shows the distribution of traps and trap runs for the 2023/24 season.

Suspect samples

From the 2,675 trap-run submissions (including nil returns), a total of 9,040 vials were submitted. No exotic fruit flies were detected. The number of vial submissions in 2023/24 was 7.6 percent lower than the previous season (9,040 compared with 9,786 in 2022/23). Vials from the Auckland and Northland regions accounted for 60 percent of samples submitted, and peak submissions occurred from October to December (Figure 4).

In total, 52 samples collected in fruit fly traps were categorised as ‘specimens of interest’. These are organisms that do not resemble fruit flies but were found in or on the trap and were considered potential biosecurity threats. A further seven specimens were submitted by trappers as passive surveillance samples. These are specimens that were not caught in or on fruit fly traps or that were provided by members of the public. None of the specimens of interest or passive surveillance samples generated a new-to-New Zealand species record or was of biosecurity significance.

Conclusion

AsureQuality recorded another successful NFFSP season. The programme met its objectives by collecting a large number of flies that were negative for exotic fruit fly species while maintaining a robust network of traps. This robust and science-based approach generates evidence of the absence of economically important fruit fly species in New Zealand and supports New Zealand’s claims of area freedom for another season.

While there were no detections of harmful exotic fruit flies in New Zealand this year, there have been notable incursions overseas. For example, over the past year, several species of exotic fruit flies were detected in California, United States. Due to their well-established active surveillance programme, they were

Automated Fruit Fly Traps – RapidAIM Trial Summary

In 2022, the Fruit Fly Council funded a two-year trial of automated fruit fly traps from RapidAIM® (Figure 5). These ‘smart’ traps use cuelure to attract Queensland fruit fly and contain smart sensors that can identify the presence of a suspect fruit fly based on a behavioural algorithm and send an alert toASUREQuality in real time. The benefit of this technology is that a potential incursion may be detected more rapidly than our standard Lynfield traps. Sixty RapidAIM traps were deployed in Auckland during the first and second years. An additional 40 traps were distributed nationally for the 2023/24 season.

Over the two-year trial, a total of 35 alerts were received. No alerts were confirmed as positive detections of Queensland fruit fly. After investigation of each alert, the conclusion was that these were all false positives from other ‘fly-like’ insects that triggered the sensors. The trap units were found to be compatible with the New Zealand mobile network and durable for field conditions. Each RapidAIM trap was placed on a property with a conventional cuelure Lynfield trap as a backup.

MPI and the Fruit Fly Council were satisfied with the results and conclusion of this trial. While RapidAIM® traps will not be incorporated into the NFFSP, we gained valuable insight into the benefits and limitations of automated trap technology within the future of fruit fly surveillance.



Figure 5: A RapidAIM© automated fruit fly trap unit

able to mount rapid and effective biosecurity responses. While some of the responses in California are continuing, eradication has been declared for tau fly (*Bactrocera tau*) and Queensland fruit fly (*B. tryoni*), and quarantine status has been removed in Sacramento for Oriental fruit fly (*B. dorsalis*).

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National spongy moth surveillance programme annual report

Background

The larval (caterpillar) stage of spongy moth (*Lymantria dispar*) is a severe defoliator of trees with a wide host range including oak, poplars, birch, willow and alder (Castedo-Dorado et al., 2016). Spongy moth is regarded as both an economic and environmental high-impact pest and is a Notifiable Organism under the Biosecurity Act 1993. A major outbreak in New Zealand could severely affect forestry, horticulture, natural ecosystems and our biodiversity. There could also be impacts on tourism and amenity plantings in parks and gardens. The urticating hairs of the caterpillars can cause skin irritation and respiratory problems in people. Females are capable of depositing egg masses on inanimate structures such as ships and vehicles in addition to vegetation. Hatching larvae can use silk threads to disperse long distances in the wind by 'ballooning' (Hajek and Tobin, 2009). These factors increase the risk of this pest establishing and spreading in New Zealand. Offshore (pre-border) risk management is an essential effective mitigation strategy; however, the most effective means of detecting any established population is by an active surveillance programme with appropriate detection tools.

As a result of increased global trade, a national surveillance programme was established in 1992 to provide early warning of incursions to enable effective eradication and provide verifiable evidence that New Zealand is free of this pest. The spongy moth surveillance programme conducts seasonal monitoring with pheromone traps placed on favoured hosts.

A single adult spongy moth was detected in Hamilton in 2003, leading to an eradication programme. The programme was declared successful in 2005 when no more spongy moths were detected. After the eradication, a substantial overhaul of the programme occurred in the 2005/06 season, with increased awareness of the risk at Transitional Facilities and other high-

The National Spongy Moth Surveillance Programme was established in New Zealand in 1992. Spongy moth surveillance provides early detection of the pest, enabling quick and efficient elimination, thus preventing their establishment, and spread. The surveillance programme generated 21,422 trap inspection records for the period from October 2023 to April 2024. No spongy moth life stages were identified during this season. The field operations were undertaken by SPS Biota and diagnostic services for the spongy moth surveillance programme were provided by Scion.



Figure 1: Distribution of risk sites, 2023/24

risk pathways, while also targeting traditional risk areas such as seaports, airports and sites handling imported machinery, vehicles and breakbulk (typically larger goods that are not transported in a container) from spongy moth host countries.

This season's review describes the results for the 2023/24 national surveillance programme. This season's field operations were carried out by SPS Biota and diagnostics were provided by Scion.

Methods

High-risk site mapping and trapping runs

High-risk sites are mapped nationally to identify spatial patterns of risk. These areas are then targeted for spongy moth surveillance. **Figure 1** (previous page) shows the distribution of risk sites throughout New Zealand for the 2023/24 season. The location of high-risk sites is regularly reviewed using annual imports data. Surveillance areas are divided into trapping runs, with each trapping run covering the high-risk sites in a specific city, town or geographic area based on the number of traps that have been allocated. A field officer may cover one or more trap runs.

Matrix placement

After the high-risk areas are defined, GIS is used to cover these areas with grid cells measuring 750 x 750 m with two central circles with 100 m and 250 m radii (**Figure 2**). Host plant species are assigned into one of three suitability classes for spongy moth larvae:

- Type 1 hosts, considered high-quality hosts for larval development;
- Type 2 hosts, less suitable hosts; and
- Type 3 hosts, poor-quality hosts for larval development, including inanimate objects (e.g., lamp posts).

This results in a 3 x 3 matrix. Within each grid cell, a host plant species as close to the centre as possible is selected for trap placement using the hierarchical ranking of the suitable host plants. This may also include a

preference for groups of suitable host trees rather than individual trees.

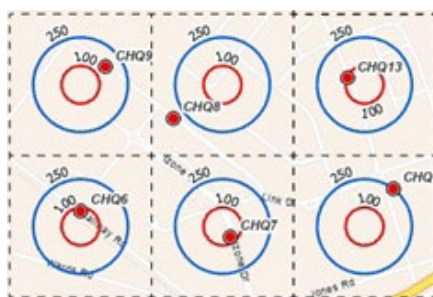


Figure 2: Array of six grid cells used for spongy moth surveillance. Each 750 m x 750 m grid cell is divided into three areas using 100 m and 250 m radii. The matrix method is then used to help field officers determine the optimal position and best combination of host trees on which to place a pheromone trap (red circles)

Lures and traps

Each active grid cell contains a green delta trap baited with disparlure, a sex pheromone to attract male moths, and attached to the trunk or branch of the selected host tree at a height from 1.3 to 1.8 m (**Figure 3**). The trap contains two sticky internal surfaces designed to trap any insects that enter it. To ensure the integrity of the attractant, nine lures (three per batch or supplier) are sent for calibration tests before the season starts. All tests confirmed that the level of active ingredient met the specification. All traps were re-lured once during the season as required.

Suspect sample

A suspect spongy moth sample is defined as any moth with a body length of more than 10 mm found in or on a spongy moth trap. All the suspect samples are photographed and removed from the trap. The photos are uploaded into a surveillance data system that Scion has access to and can review for the possible presence of spongy moths. The surveillance system has a dashboard where all users can see the completed actions from inspections to results of sample diagnostics. Specimens are sent to Scion for identification if requested.

Results

Field surveillance

For the 2023/24 season, spongy moth traps were deployed from 23 October 2023 until 21 April 2024, for a total of 26 weeks. They were inspected every 14 days $\pm$ 1 day. In all, 1,530 traps

were deployed along 37 trapping runs and 21,422 trap inspection records were submitted. Two new grids were established in Dunedin based on the grid and trap review. Overall, 77 percent of the trap placements were on Type 1 and Type 2 host species and at locations within 250 m of the grid centre demonstrating that the selected host trees and the locations maximise the effectiveness of the spongy moth surveillance programme.



Figure 3: A field officer inspecting a delta trap for a suspect spongy moth sample

Diagnostics

In total, 92 suspect samples were collected and submitted to Scion for identification. All the suspect samples were identified from image submission. No physical samples were submitted. Of these, three samples were too small (< 10 mm) to meet the definition of a suspect sample. No spongy moth was detected this season. **Figure 4** (next page) shows that noctuid moths were the most commonly caught group (81 percent) although there is no evidence that noctuids are specifically attracted to disparlure.

Conclusion

Finding a male moth that has been attracted by disparlure is the best way to potentially detect an established population of spongy moth in New Zealand. Other life stages such as egg masses, larvae or pupae can be difficult to find visually unless present in large numbers. A total of 1,530 traps generated 21,422 trap inspection records. Although no spongy moths were detected, this season again generated robust data to support the assertion that spongy moth is not present in New Zealand.

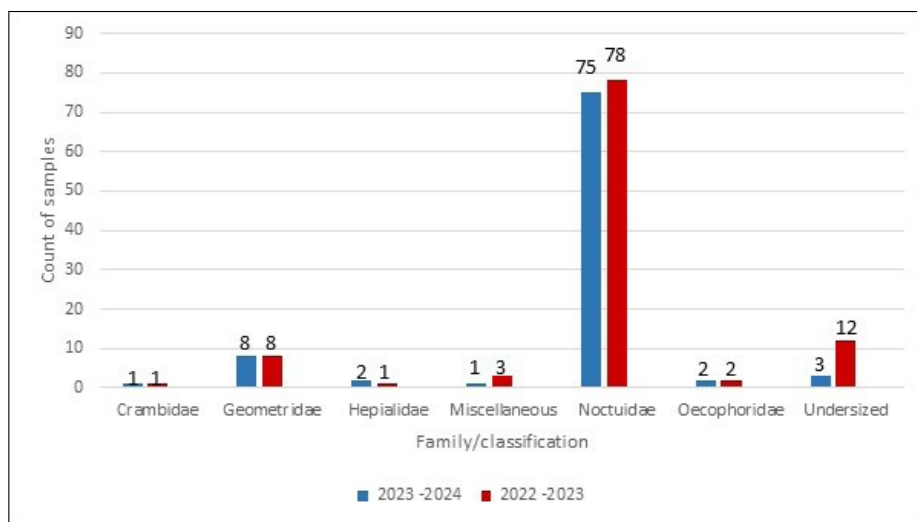


Figure 4: Number of moths caught in or on delta traps during spongy moth surveillance, by family in comparison with the previous season

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High-risk site surveillance programme annual report

Context

HRSS is one of the post-border biosecurity surveillance programmes that Biosecurity New Zealand (BNZ) delivers for New Zealand. Post-border biosecurity surveillance is important because while we have important values (economy, environment and socio/cultural) that we want to protect from overseas pests, the border must be porous enough to allow trade and tourism. Post-border surveillance is part of the continuum of activities (<https://www.mpi.govt.nz/biosecurity/about-biosecurity-in-new-zealand/our-work-to-keep-pests-and-diseases-out-of-nz/>) protecting all the things New Zealanders value. More information about our biosecurity surveillance programmes can be found in the New Zealand Atlas of Biosecurity Surveillance: [Atlas of Biosecurity Surveillance \(arcgis.com\)](https://www.mpi.govt.nz/biosecurity/about-biosecurity-in-new-zealand/our-work-to-keep-pests-and-diseases-out-of-nz/).

The main focus for HRSS is finding pests that might negatively impact native forests, urban trees, plantation forests and other productive plants (e.g., fruit trees) early enough that

High risk site surveillance (HRSS) reduces biosecurity risk by targeting pests and diseases that might have an adverse impact on native vegetation, forestry and horticulture. HRSS targets plants found in risk sites along risk pathways into New Zealand. Field work during the 2023/24 season involved 7,007 inspections in higher risk areas, which included over 335,000 individual plants from 1,382 different host species. In all, 1,009 submissions of biosecurity interest were sent from the field to the laboratory for diagnosis. MPI's Plant Health and Environment Laboratory (PHEL) did over 7,000 tests on 1,509 samples and produced 1,013 organism identifications. Significant identifications included 10 new-to-New Zealand species, 258 new host records and 39 new distribution records.

we can effectively manage them before the pests significantly affect plants we value. While we are out looking, we also monitor the spread of known organisms (e.g., to new hosts and new locations). We manage a database of host species and locations in case it is needed for other surveillance and responses. More information can be found on the HRSS page in the New Zealand Atlas of Biosecurity Surveillance: [High-Risk](https://www.mpi.govt.nz/biosecurity/about-biosecurity-in-new-zealand/our-work-to-keep-pests-and-diseases-out-of-nz/)

[Site Surveillance Programme \(HRSS\) \(arcgis.com\)](https://www.mpi.govt.nz/biosecurity/about-biosecurity-in-new-zealand/our-work-to-keep-pests-and-diseases-out-of-nz/).

An important planning factor is the constantly increasing risk with more trade, tourism, primary production and wind-spread/climate change increasing the potential impact of new pests and diseases on New Zealand. In response, BNZ constantly monitors new pest and disease reports (with Emerging Risks summary reports supplied to stakeholders) and new

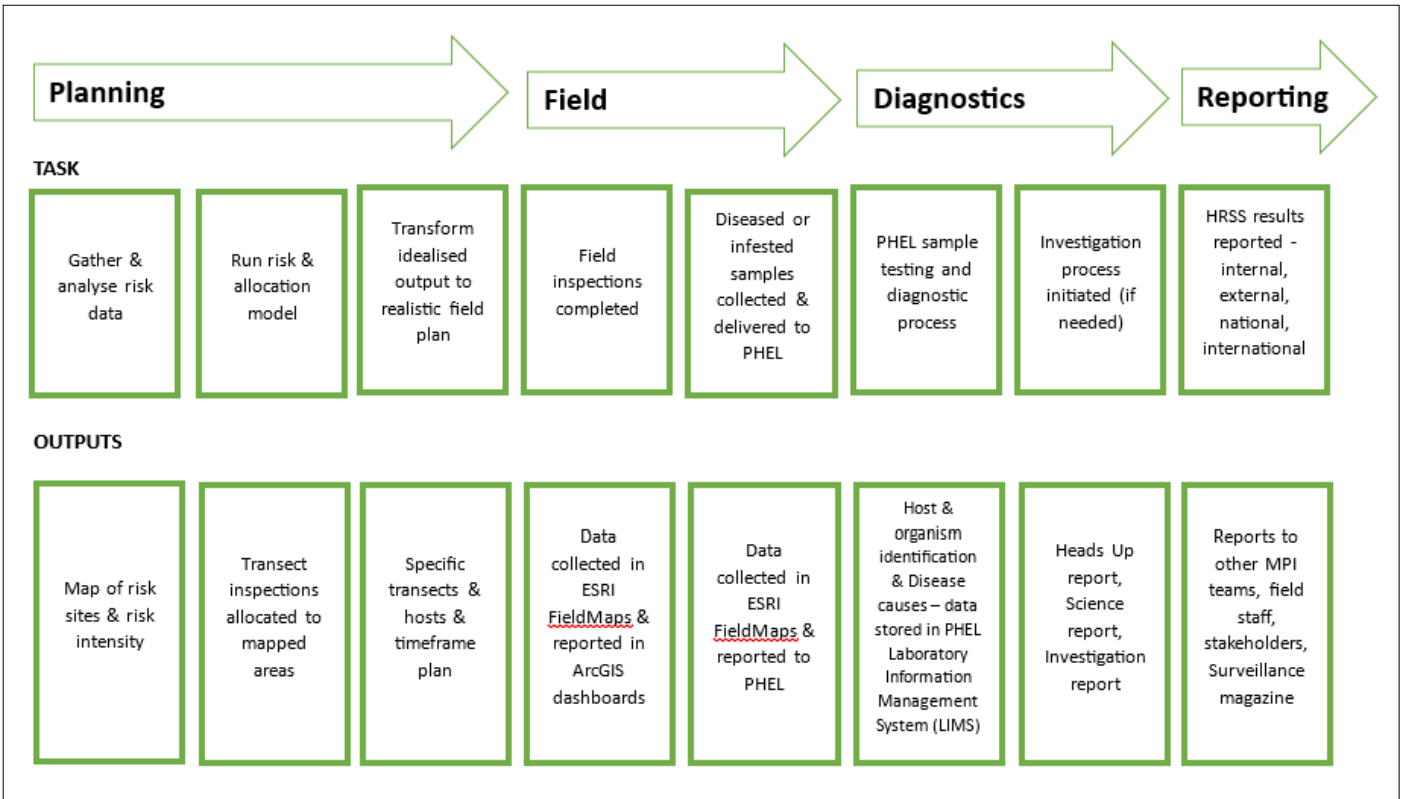


Figure 1: Flow diagram of the work undertaken to implement HRSS. Work is sorted by task, outputs, and who does each task

surveillance technologies through co-operative research ventures such as Better Border Security (B3) ([Surveillance and Eradication - B3 | Science Solutions for Better Border Biosecurity](#) (b3nz.org.nz)).

Methods

Figure 1 (previous page) shows a simplified flow diagram of the work undertaken to implement HRSS. Further details are provided in previous reports (Stevens, 2019).

The HRSS fieldwork is supplied by SPS Biosecurity. Diagnostic input to the programme is provided by MPI's Plant Health and Environment Laboratories (PHEL) who are scientific experts in multiple disciplines including entomology, mycology, virology, bacteriology, nematology and botany (see p 152). PHEL also validates new-to-New Zealand records. PHEL is accredited to ISO/IEC 17025 'General Requirements for the Competence of Calibration and Testing Laboratories'.

The use of fully electronic data collection for HRSS information management continues to provide significant efficiency advantages. Organising the data in a geospatial database has also improved the effectiveness of pre-season planning by providing the ability to target specific host species groups. Significant improvements to HRSS software were provided by SPS

Biosecurity this season: for example, enhancements to the GIS WebApp used for planning to allow better targeting of multiple hosts, enhancements to field collection software to allow better tracking of specific submissions (e.g., samples from *Xylella fastidiosa* hosts). During the annual planning phase, HRSS updates risk data and re-analyses risk spread because import volumes and distribution change every year. Additionally, there have been significant systemic shifts in New Zealand's pathway risk distribution over the past five years. While many of these were due to COVID-19 pandemic supply chain and logistics issues, in many cases the pandemic has only accelerated an already ongoing trend. For example, the shift from Auckland for most container entry to a wider spread across the country (e.g., regional hubbing) is also driven by increased cost efficiencies, barriers to expansion in Auckland and changes to international shipping. Most of the reduction in volumes that occurred during the pandemic (e.g., fewer visitors) have reversed and are now generally back to pre-pandemic levels.

In addition to early detection surveillance, HRSS field officers were tasked with conducting additional surveillance and sample collection for a New Zealand *Xylella fastidiosa* country freedom declaration necessary for trading with the

European Union. While HRSS inspects more than 100,000 potential *Xylella fastidiosa* hosts every season, it was decided to also include asymptomatic samples for testing to provide additional assurance.

Results

Field surveillance

During the 2023/24 survey season (August 2023 to June 2024), 7,007 transect inspections were completed across 6,126 individual transects (Blakie & Rogan, 2024). The changes in pathway risk volume meant that 881 transects (14 percent) received a second visit during the season. During the season, over 543 kilometres of transect inspections were done across New Zealand. **Figure 2** shows the location of transects inspected during this survey season.

In total, 1,382 different plant species were examined (Blakie & Rogan, 2024), a decrease of 8 percent on last season. Of the plants inspected in transects, 54 percent were exotic and 46 percent native. Primary industry was supported with inspections of plantation forestry trees (over 10,000) and fruit trees (over 16,000). More than 335,000 individual plants were inspected by surveyors in transects.

This season surveyors sent 1,009 submissions to the laboratory from the plants inspected. Because the surveyors are also tasked with



Figure 2: Location of High-Risk Site Surveillance transects inspected during 2023/24 season

Table 2: Diagnostic outcomes, 2020–2024

Sample type	Number and percentage by year			
	2020/21	2021/22	2022/23	2023/24
Insect	449 (30)	367 (19)	396 (19)	431 (26)
Fungus	661 (43)	785 (41)	738 (36)	429 (26)
Bacterium	4 (0)	16 (1)	21 (1)	9 (1)
Nematode	6 (0)	6 (0)	17 (1)	19 (1)
Virus	23 (2)	50 (3)	44 (2)	34 (2)
Plant	195 (13)	294 (16)	122 (6)	91 (5)
No organism identified	185 (12)	374 (20)	711 (35)	650 (39)
Total	1,523	1,892	2,049	1,663

Table 3: Summary of new records, 2020–2024

Type	2020/21	2021/22	2022/23	2023/24
Number of submissions (excluding area freedom samples)	782	759	804	745
Number of diagnostic outcomes	1,523	1,892	1,536	1,399
New-to-New Zealand species	36	24	14	10
Significant to Plant Pest Information Network (new host association or new distribution)	578	829	539	314
Significant detections* (percentage of total submissions)	78	112	67	43

Source: Gemmell et al., 2024

* For the purposes of reporting, the results of HRSS significant detections are either suspect new-to-New Zealand organisms, or organisms that are already known to occur in New Zealand that are living or feeding on vegetation for which they have never been previously recorded in PPIN, and/or present in a region for which they have never previously been recorded in PPIN.

monitoring the health of plants as they move between transects, nearly one third of the submissions were collected outside transects. The inspection component from outside the measured transects, while still being in areas considered of higher biosecurity risk, adds to the probability of early detection without adding significant cost. In the current season, 72 percent of all submissions came from exotic hosts and 28 percent from native hosts.

Diagnostics

Each plant part in a submission from the field is treated as a separate sample in the lab. For example, a tree might have dieback symptoms. In this case one submission might include leaves, branches, and soil samples (three samples) in one submission to the lab. From August 2023 to June 2024 PHEL received 1,009 submissions that yielded 1,509 samples and led to 1,663 diagnostic outcomes (Gemmell et al., 2024). (Diagnostic outcomes include organism identifications and where

abiotic factors caused the symptoms.) This was, respectively, a 5, 16 and 19 percent decrease on last season's numbers. Samples submitted consisted of both symptomatic plant material and suspect organisms such as insects or fungal fruiting bodies. In total, 1,013 organism identifications were provided. This is 24 percent less than last season. Most of the identifications were insects (43 percent) or fungi (42 percent).

The submissions included over 260 samples from *Xylella fastidiosa* hosts contributing towards country freedom declaration. Samples collected from general surveillance reports were also tested and contributed to the data supporting the country freedom declaration.

Table 2 compares diagnostic outcomes over the past four seasons. This year's results show an increased proportion of samples with no identification and some reasons for this are discussed below. Due to a change in laboratory procedures, fewer host-plant species were identified.

In 39 percent of cases, no organism was identified. This is mainly because of the substantial number of asymptomatic submissions to support area freedom surveillance. All these submissions tested negative for *Xylella fastidiosa*. This category also included cases where symptoms were non-specific and needed to be tested by more than one PHEL discipline to rule out a possible cause or the symptoms had abiotic causes. In many of these cases an organism was found by another discipline, demonstrating the value of having multiple diagnostic disciplines working together.

More than 7,000 diagnostic tests were done by PHEL across the six disciplines to generate the HRSS results during 2023/24. These included morphological and molecular identifications (e.g. real-time and taxon-specific PCR tests, DNA sequence analyses). Newer technologies such as high-throughput sequencing (HTS), were used in complex cases.

Sixty-five percent of the organisms identified were identified to species level (compared with 74 percent last season) and an additional 28 percent were identified to genus (21 percent last season). Most organisms that could not be identified to species level were DNA-sequenced so they can be identified in future once taxonomists have described them. In all, 359 organisms were not identified to species level this season. Of these, 57 percent were fungi. Some of the reasons the organisms were not identified to species level are:

- organism is part of a species complex or closely related to another species where there are not enough data available to identify in more detail;
- organism is identical to another species already found in New Zealand but currently unnamed; or
- organism is new to science and currently unnamed.

The HRSS programme yielded 10 new-to-New Zealand records (14 last season) and 323 new host or distribution records (539 last season).

Ten new-to-New-Zealand organisms were identified: four fungi, four viruses, one bacterium and one weedy plant. These will be reported in the *Surveillance* Pest Watch tables once validation is complete.

Table 3 summarises the numbers of submissions made each year since 2020 and lists new-to-New Zealand records, new host associations, or new distribution records.

Discussion

Diagnostics identified a substantial number of unnamed organisms this season. This will become an increasingly vexing problem as techniques such as HTS become more discerning, as only about 10–20 percent of the estimated species in the world are actually named (Blaxter, 2016). The purpose of the HRSS programme is to detect new plant pests and diseases that may pose a biosecurity risk. Spending money on identifying organisms to species level that are not likely to be a biosecurity risk is not a high priority, so HRSS underwent a review before the start of this season to determine ways of reducing resource use in diagnostics without compromising biosecurity.

This season there were significant drops in numbers of submissions (down 5 percent), laboratory samples (down 16 percent) and diagnostic outcomes (down 19 percent) due to a concerted effort in the field and laboratory to improve triage processes to reduce the work volume. SPS surveyors used an internal app to share information about possible submissions and draw on the experience of others in the team as well as having regular catch-up sessions to discuss trends and significant finds to ensure everyone was aligned. In the PHEL, procedures were updated to allow more filtering before using costly tests, laboratory organisation was improved, new reporting guidelines were introduced, batch processing was used where appropriate, an upskilling programme was implemented and new techniques were applied. As a result, the Mycology

team was able to reduce the number of tests performed by 21 percent. While many of these changes required specialist laboratory tools or specialised knowledge, guidelines that would be helpful to field staff have been scheduled for the pre-season training for the 2024/25 season.

While the focus of HRSS is on arborescent species (trees, tree-like shrubs) the programme does inspect some non-arborescent species where inspection adds biosecurity value and has minimal impact on time taken to inspect a transect. For example, when Solanaceae plants are found in a transect they are inspected because they can be sources of pests and diseases of tomato and potato plants.

Nil records are also an important part of any surveillance programme. In many cases, knowing what is *not* there is important – and, when it comes to providing pest freedom assurances to facilitate trade, it may be even more important. From the more than 335,000 plants inspected, a thorough triaging process selected samples from 1,009 symptomatic plants to be submitted to PHEL to check further for suspect pests and diseases. This gave MPI a high degree of confidence that the areas inspected were free of potentially high-impact pests.

With data on more than 100,000 individual plants and over 1,500 species gathered over the past 15 years, HRSS is at a stage where it can be used to effectively plan and provide efficient host-specific pest species surveys. With a chosen pest or pathogen and known host species, HRSS can target transects containing the host species at any time during the planning phase or, if required, at short notice in response to an incursion. This season, HRSS continued to target some of the highest-risk *X. fastidiosa* hosts during extensive *X. fastidiosa* surveillance.

Conclusion

The technical competence of the HRSS programme is demonstrated by the numbers of plants inspected (in the right place) and underpinned

by our knowledge of biosecurity risk pathways and the validation of this field inspection by world-class diagnostic testing.

Another measure of the effectiveness of this surveillance programme is detection of new-to-New Zealand organisms and records of new hosts or regions. The continued numbers of significant organism records this season is the result of the increasing knowledge of Field Officers and an ongoing focus on quality diagnostics. PHEL has identified a high number of new records owing to its excellent skills in diagnostics, the ability of staff to perform molecular diagnostics to a high standard and its co-operative way of working where multiple disciplines are housed together.

The 2023/24 HRSS season was very successful and demonstrates the flexibility and robustness of this MPI-funded surveillance programme.

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Blakie A, Rogan B (2024). *High risk site surveillance: Field operations annual report 2023-2024*. MPI Internal Report.

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PEST WATCH: 1 May – 30 July 2024

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

This information was compiled from notifications to MPI of suspected new-to-New Zealand organisms. The list includes organism records validated and entered in to the MPI Plant Pest Information Network (PPIN) database from 1 May to 30 July 2024. Wherever possible, common names have been included.

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

Validated new to New Zealand reports

Type	Organism	Host	Location	Submitted by	Comments
Bacterium	<i>Rouxiella badensis</i> no common name	<i>Allium cepa</i> onion	Mid Canterbury	PHEL General Surveillance	This bacterium was described in 2017. It has been recorded causing bulb rot disease in onions in the United States.
Chromista	<i>Phytophythium helicoides</i> no common name	<i>Actinidia</i> sp. kiwifruit	Bay of Plenty	PHEL General Surveillance	One of several oomycetes that may contribute to a kiwifruit decline syndrome. Globally distributed.
Fungus	<i>Cytospora erumpens</i> no common name	<i>Sorbus</i> sp. rowan	Wellington	PHEL High Risk Site Survey	This fungus has been recorded only three times since its discovery in 2017.
Insect	<i>Methana marginalis</i> bush cockroach	Inanimate host: building	Auckland	PHEL General Surveillance	This cockroach is native to Australia and is also found in New Guinea.
Virus	<i>Badnavirus occultipomeae</i> sweet potato pakakuy virus, SPPV	<i>Ipomoea batatas</i> kūmara, sweet potato	Northland	PHEL General Surveillance	This virus does not present discernible symptoms and is globally distributed.
Virus	<i>Hoheria emaravirus</i> 1 (tentative), HoEV1	<i>Hoheria populnea</i> houhere, lacebark	Wellington	PHEL High Risk Site Survey	An undescribed species. Emaraviruses are often transmitted by host-specific eriophyid mites.
Virus	<i>Polemovirus PNLV</i> Poinsettia latent virus, PnLV	<i>Euphorbia pulcherrima</i> poinsettia	Auckland	PHEL General Surveillance	This virus occurs regularly in commercial poinsettia plants worldwide.

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

VETERINARY DIAGNOSTIC LABORATORIES

AWANUI VETERINARY VETERINARY PATHOLOGY

- **AUCKLAND**
Courier: 37–41 Carbine Road, Mount Wellington, Auckland 1060
Postal: PO Box 12049, Penrose, Auckland 1642
Tel: 09 574 4701 Fax: 09 574 5304
- **HAMILTON**
Courier: 20a Maui Street, Pukete, Hamilton 3200
Postal: PO Box 944, Hamilton 3200
Tel: 0800 83 85 22 or 07 839 1470 Fax: 07 839 1471
- **PALMERSTON NORTH**
Courier: 840 Tremain 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

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

0800 80 99 66

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

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

Plant Health and Environment
Laboratory – Christchurch
14 Sir William Pickering Drive
Christchurch
Tel: 03 943 3209

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- **HAMILTON**
Courier: Cnr Anglesea and Knox Streets, Hamilton
Postal: PO Box 944, Hamilton
Tel: 07 839 1470 Fax: 07 839 1471
- **PALMERSTON NORTH**
Courier: IVABS Building, 1st Floor, Massey University, Tennant Drive, Palmerston North
Postal: PO Box 325, Palmerston North
Tel: 06 353 3983 Fax: 06 353 3986

SVS LABORATORY

- **HAMILTON**
PO Box 10304
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