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Manatū Ahu Matua

Surveillance

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Inside this issue:

Fifty years of *Surveillance*
Special report: history of animal health surveillance
Serological test for Japanese encephalitis virus

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

Surveillance: informing biosecurity for 50 years

Welcome to the December edition of *Surveillance*. In this issue we celebrate the 50th anniversary of publishing *Surveillance* (1974–2024) and explore the history of *Surveillance* over this 50-year period. *Surveillance* is New Zealand's authoritative source of information on… (*apologies for the brief interlude as I pause writing this editorial in early October to assist a 3-year-old Romney-cross ewe struggling on a cold, rainy spring morning to give birth for the first time to a rather large lamb*) … surveillance programmes for exotic and emerging pests and diseases to help preserve the health of animals, plants and the environment of New Zealand. Surveillance is a critical part of the biosecurity system that:

- detects incursions of risk organisms early enough to appropriately manage them;
- maintains and enhances international trade by providing evidence of our pest and disease status to underpin export certificates and inform import health standards;
- better detects and monitors new and emerging pests and diseases in New Zealand; and
- informs strategies for the long-term management of pests and diseases.

Surveillance provides awareness of pests and diseases in New Zealand. This knowledge is acquired by the collection, collation, analysis, interpretation and timely dissemination of information on the presence, distribution or prevalence of pests and diseases and the plants and animals they affect.

Over the past 50 years *Surveillance* has recorded the evolution of New Zealand's government veterinary services. In 1974 the first edition of *Surveillance* listed six regional veterinary offices and seven veterinary laboratories across New Zealand along with the Central Animal Health Reference Laboratory established a year earlier at Wallaceville, Upper Hutt. The Chief Veterinary Officer and Director of the Animal Health Division of the then Ministry of Agriculture and Fisheries (MAF) was Dr George Henry Adlam, who was also appointed Office International des Epizooties (OIE) Chairman of the regional commission for Asia and Oceania. Veterinary leadership roles at this time in New Zealand were predominantly held by men. Laboratory diagnostic techniques recorded in use in 1974 included serology, bacteriology, parasitology, biochemistry, haematology and histopathology. Computer-based management information systems such as the Brucella Management Information System (BMIS) were just starting to be developed and introduced for recording and processing animal health data. Interestingly, some of the challenges described back then remain today when implementing innovations that change ways of working. The 1974 editions included animal health reports such as 'Poisoning by tutu (*Coriaria arborea*) has been recognised for a long time. Fittchett[1] gave a detailed account of tutu poisoning and suggested that tutu may have been the poison that thwarted Captain Cook's attempts to stock New Zealand with sheep.' That year, the number of sheep in New Zealand was 55.88 million.

Fast forward 50 years to 2024 and the Ministry for Primary Industries (MPI, formerly MAF) has consolidated government animal health surveillance and diagnostic services at Wallaceville, Upper Hutt. The animal health surveillance and incursion investigation teams of veterinarians are co-located with the national Animal Health Laboratory. The rebuilt laboratory was opened in 2021, providing New Zealand with the highest-level biocontainment facility of enhanced PC3 designed to enable high throughput diagnostic testing of foot and mouth disease should it ever arrive in New Zealand. While the traditional laboratory diagnostic tests are still largely available, there has been a significant shift in technology to molecular techniques such as real-time PCR and whole genome sequencing. Bacteriology, once looking down a microscope and identifying bacteria by eye and using biochemical and physiological tests, now largely uses matrix-assisted laser desorption/ionisation (MALDI-TOF). Computer-based animal health data, reporting dashboards, disease modelling, geospatial analysis and electronic animal tracking are now everyday features of our working life. The gender composition of the veterinary workforce has also shifted over the past 50 years; for example, the Chief Veterinary Officer of MPI and New Zealand's member on the World Organisation of Animal Health (WOAH, formerly OIE) is Dr Mary van Andel, the 10th CVO of New Zealand and the first woman in this role.

The number of sheep in New Zealand in 2024 has declined to 23.31 million ... plus two … (*postscript on lambing event – second lamb born without intervention – both lambs and mother now under cover out of the southerly weather and all three are doing well*) (see photo, next page).

In addition to continued reporting on animal health surveillance, *Surveillance* has expanded to include reports

on marine and freshwater, plants and environment sectors and MPI's national Plant Health and Environment Laboratories based in Auckland and Christchurch.

In 1974 the objectives of *Surveillance* were explicitly[2] to complement the *New Zealand Veterinary Journal* and to serve as an internal divisional communication, and were summarised as:

1. To aid in the continuing education of all veterinarians by sharing information that we ourselves generate.
2. To keep veterinarians up to date with the latest disease occurrences and trends as seen by the Animal Health Division.
3. To stress that the Animal Health Division relates to practitioners as a complementary, and not as a competitive, veterinary force.
4. To explain current disease-control policy and to inform all veterinarians of future lines of development which the Division proposes to follow.

In 2024, *Surveillance* continues to be MPI's authoritative source of information on surveillance programmes and the biosecurity 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. *Surveillance* is published on-line at sciquest.org.nz with links to all issues back to 1974 for people interested in further exploring the history of *the* publication. Today there are over 4,000 subscribers to *Surveillance* with more than 5,000 articles downloaded annually by 53 international countries.

I would like to take this opportunity to thank the many authors, technical editors and the editorial services provided by Words & Pictures. I hope you enjoy reading this 50th anniversary special edition of *Surveillance*.

Matihere,

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Wendy's 'plus two' lambs

[2] *Surveillance* (1974). Vol. 1 No. 5.

ANIMALS

Special Report

The history of animal health surveillance in New Zealand

Foreword

This year marks the 50th jubilee of *Surveillance*. First published in 1974, it continues to be an 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. Of particular significance to this work, *Surveillance* is a vital repository of New Zealand's disease investigation and surveillance work and is trusted by both local and international audiences.

In recognition of this milestone for *Surveillance*, and to highlight the enormous effort that has been put into animal disease surveillance over the years by numerous people, the Biosecurity Surveillance (Animal Health) team have sought to summarise the evolution of the animal health surveillance and incursion investigation function over the past 50 years in a series of articles published in this issue.

Seven separate papers summarise the following themes and describe specific components of the surveillance system:

- New Zealand's animal disease surveillance system;
- Communicating surveillance;
- New Zealand's animal health diagnostic laboratory network;
- Incursion investigation;
- Surveillance programmes and disease control;
- Tools and information management;
- Organisations and collaboration.

Within each paper, the information is organised in chronological order to help the reader understand the major changes that had been implemented over the years. These papers are high-level summaries and are not intended to be comprehensive. In the interests of space, we have only been able to focus on the main themes.

Behind the scenes, the Biosecurity Surveillance (Animal Health) team has put a lot of effort and time into gathering, writing, and summarising information that was scattered through numerous editions of *Surveillance* as well as many other historical publications and archived documents. What initially started as a side discussion at a team meeting on how to mark the 50th anniversary of *Surveillance* became a full-scale research project and historical overview, of not only animal health surveillance programmes and systems, but also touching on other various supporting departments and teams, such as the MPI Animal Health Laboratory, the Biosecurity Incursion Investigation (Animal Health) teams, the Surveillance Information Management team and others.

While *Surveillance* has been an excellent repository of information for us to develop these reports, and in fact most of the information included in these reports has come from *Surveillance*, there have been gaps that we have needed to fill in.

As a result, we have contacted several former Ministry employees to ask them for their recollections of events during their time with the Ministry. Everyone we contacted was very generous with their time and we would like to express our sincere gratitude for their assistance. These people have included Stuart C MacDiarmid, Barry O'Neil, Maurice Alley, Derek Belton, Matthew Stone, Kerri Varney, Joanna McKenzie, John Hellström and Veronica Herrera. Richard Campbell from SVS Laboratories and Mark Neill from OSPRI also provided valuable input.

In terms of developing these papers we have had fantastic advice and support from Phil Stewart and Gretchen Rasch from Words & Pictures, as well as Robyn Hampton from the MPI Library helping us source images and Selena Henry from MPI Communications helping us with the significant task of updating the many maps and diagrams in the papers.

Finally, although a number of MPI staff helped write these papers, special mention must go to Jon Watts and Toni Tana who did the lion's share of crafting this story. We also acknowledge the contributions from MPI's Paul Bingham and Joseph O'Keefe.

Without the help of all these people we would not have been able to pull this significant piece of work together. The process of developing this series of papers mirrors the surveillance system itself: it can only be successful when everyone willingly participates and plays their part; surveillance, as with this piece of work, is a team effort.

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New Zealand's animal disease surveillance system

Introduction

Surveillance is a critical part of New Zealand's biosecurity and animal health systems. It provides evidence to:

- establish disease freedom, supporting both export trade and border measures to prevent the entry of undesired pests and diseases that may impact our country's human or animal health;
- provide for the detection of exotic or emerging diseases early enough to allow for optimal management, including eradication where appropriate; and
- to inform disease management and government policy on animal disease control with information on the presence and distribution of diseases, including zoonotic disease.

The Ministry for Primary Industries (MPI) is the lead organisation in New Zealand's biosecurity system, including animal health at the national level.

Biosecurity encompasses the policies and measures taken to protect people, natural resources, plants and animals against potentially harmful species and diseases from other countries. It is a relatively new term that gained currency in New Zealand from the 1990s – especially after the passing of the Biosecurity Act 1993 (Keyes and Walrond, 2008).

Biosecurity is not a single line of defence at the border; rather, it is a multi-layer system that begins offshore, is strengthened by measures at the border and continues post-border into New Zealand. Biosecurity risks that may remain following the strict border regulations on imports are managed through MPI's surveillance system.

New Zealand's terrestrial animal post-border exotic pest and disease surveillance system includes the MPI Animal General (passive) Surveillance programme (Tana, 2014) and is augmented by a number of targeted surveillance programmes (see *Surveillance programmes and disease control,* p. 37). This system is managed by two teams within MPI:

- The Biosecurity Surveillance (Animal Health) team;
- The Biosecurity Incursion Investigation (Animal Health) team.

The general (passive) surveillance programme provides national coverage of all species affecting animal health. The programme is multifaceted and has the following core components:

- an ongoing public, farmer, and veterinarian awareness/ communication programme;
- a legal obligation to report suspected exotic pests and diseases to MPI;
- a 24-hour toll-free pest and disease emergency phone number;
- epidemiological investigation;
- laboratory diagnostics, including both a network of MPI-approved diagnostic laboratories and the capability of MPI's National Animal Health Laboratory;
- data capture and analysis; and
- communication of findings.

The surveillance function is intimately connected to the structure of MPI and the priorities of the government of the day. Consequently, surveillance will be impacted by any changes that occur within the Ministry. This paper is about the evolution and structure of New Zealand's animal disease surveillance system, highlighting its importance in biosecurity and domestic animal health systems over the past 50 years. The accompanying papers describe the evolution of the important component parts of surveillance listed above (also see Tana, 2014). These papers are:

- *Communicating surveillance*: this will describe the evolution of aspects of surveillance communication over the past 50 years, including the *Surveillance* publication;
- *New Zealand's animal health diagnostic laboratory network*: the evolution from a government-owned veterinary laboratory service to the current state with commercial veterinary laboratories and a government-owned national reference laboratory;
- *Incursion investigation*: the development of the of the present-day Incursion Investigation team is described;
- *Surveillance programmes and disease control*: a selection of surveillance activities from the past 50 years;
- *Information management and tools*: describing how data have been managed and shared over time; and
- *Organisations and collaboration*: surveillance work by New Zealand internationally as well as domestic legislation and collaboration.

The evolution of New Zealand's animal disease surveillance system

Animal Health Division

In the 1970s the Animal Health Division of the Ministry of Agriculture and Fisheries (MAF) employed about 94 veterinarians. In the mid-seventies the Director of the Division was Dr George Adlam, who was also designated the Chief Veterinary Officer of New Zealand (Anon., 1979). The objectives of the Animal Health Division were to define, protect, and improve animal health in New Zealand. More specifically these objectives were defined as:

- to prevent the introduction of exotic animal diseases from overseas;
- to control and eradicate economically important endemic disease of livestock; and
- to provide a diagnostic service to veterinary surgeons to facilitate

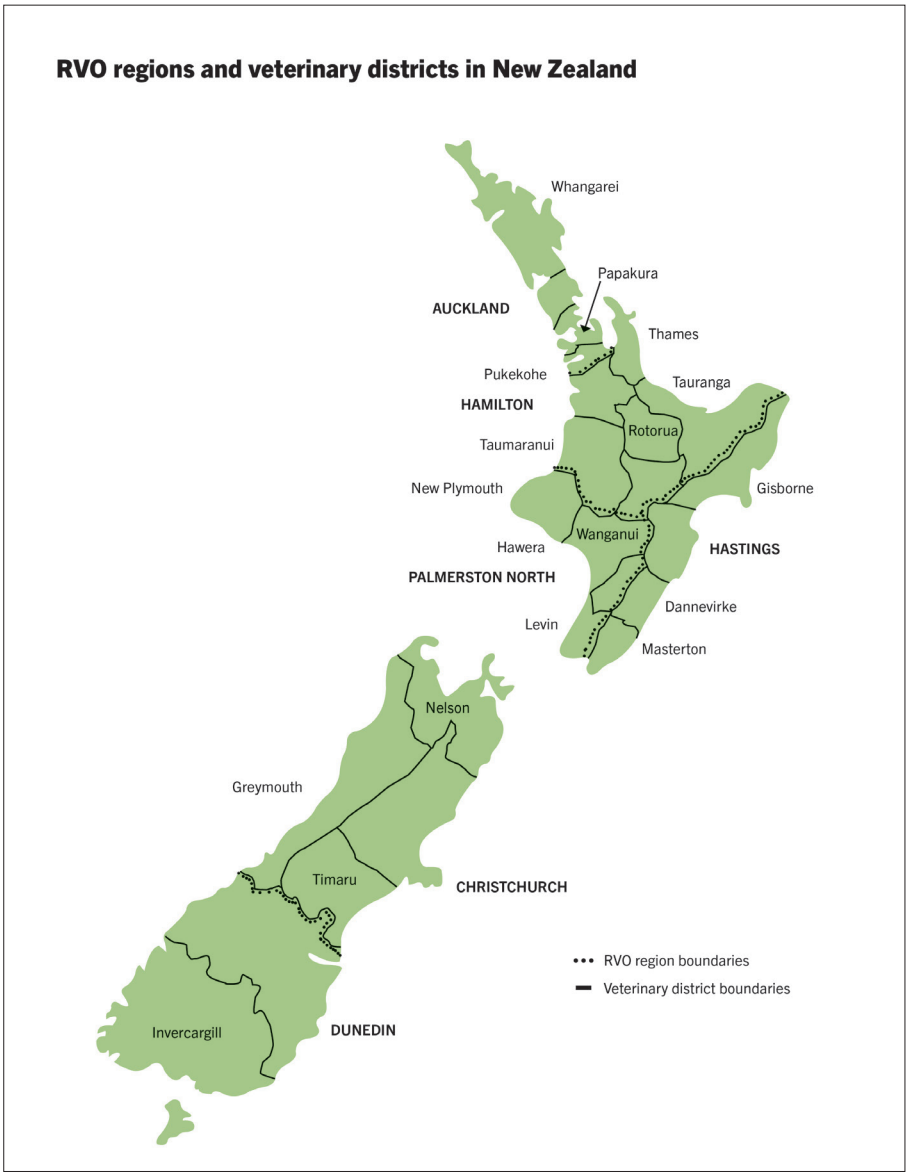

Figure 1: Regional veterinary offices and veterinary districts, mid-1970s. (Adapted from Anon., 1979)

> the treatment of diseased or unfit farm and domestic animals (Anon., 1980).

By the early 1980s the division employed more than 100 veterinary officers, 300 livestock officers, and 120 scientists and technicians around the country to carry out these objectives (Guild and Houldgreaves, 1980).

The Animal Health Division was divided into two sections: Field Services and Laboratory Services, each headed by an Assistant Director. The directorate and several senior staff officers were stationed in the Wellington headquarters of MAF. Both the Field Services and Laboratory Services were organised regionally. The Field Services had six regional veterinary officers stationed at Auckland, Hamilton, Hastings, Palmerston North, Christchurch and Dunedin. Each region was further divided into several veterinary districts staffed by one or more district veterinary officers (VOs), livestock officers and clerks. During the early 1970s there were also several Veterinary Advisory Officers (VAOs) who carried out field investigations into specific diseases such as kikuyu toxicity, bovine leptospirosis and ovine intestinal carcinoma. (These positions were subsequently absorbed into the animal health laboratories and renamed Veterinary Investigation Officers or VIOs.) VAOs included Basil Smith in Whangarei, David Lake in Hamilton, Bruce Simpson in Palmerston North and Ru Davis in Hastings (John Hellström, pers. comm.).

There were 24 veterinary districts in all (**Figure 1**). In each region except Hastings there was an Animal Health laboratory controlled by a superintendent and staffed by VIOs, scientists, technicians and clerks. New Zealand's Animal Health Reference Laboratory (AHL) was (and continues to be) located at Wallaceville near Upper Hutt (Anon., 1979). In 1984 the Animal Health Reference Laboratory changed its name to the Central Animal Health Laboratory (Anon., 1984). The Animal Health Division also administered and enforced strict quarantine regulations to protect New Zealand stock, with a quarantine station on Somes Island in Wellington Harbour and another quarantine station at Silverstream in the Hutt Valley north of Wellington (Guild and Houldgreaves, 1980).

Technical Services Group

In the early 1980s John Hellström led the Technical Services Group (formed March 1980) within the Animal Health Division of MAF. The Technical Services Group was responsible for national disease control programmes (such as the brucellosis eradication programme and those for *Mycobacterium bovis*, Aujeszky's disease, Johne's disease and hydatids), disease surveillance, disease preparedness, epidemiology and research, which was largely based around the understanding of endemic diseases.

MAF livestock officers and veterinary officers

During this period MAF livestock officers were responsible for having knowledge of the livestock populations in their area and providing technical services as required. These individuals were in regional offices and were on call 24 hours a day, 7 days a week. At this time, exotic disease investigations were managed at the local laboratory level. MPI veterinary officers would attend calls of suspected exotic or emerging diseases and coordinate any subsequent further investigation. Collected samples were sent to the local MAF Animal Health Laboratory.

In a *Surveillance* report from 1989 it was reported that Veterinary Officers and Livestock Officers visited over 17,000 farms in the course of export

certification and disease control duties. These farm visits were seen as an opportunity to monitor animal health and reinforce the message that unusual disease problems should always be brought to the attention of a veterinarian. Additionally, these staff were involved in the registration and regular inspection of piggeries that fed food waste to their animals. Inspections involved monitoring both the health status of the pigs and the facilities used to treat the garbage (Hellström, 1990).

Surveillance at that time had a focus on supporting trade but also was significantly involved in the understanding of endemic diseases. Before the 1980s, there was a practitioner-based system that had been trialled through several veterinary clubs. Each month the practice would submit a checklist of syndromes seen, although apparently these data were never collated and analysed (S MacDiarmid, pers. comm.). An important part of the Division's role was linking with the regional veterinary laboratory networks and veterinarians in order to understand baseline disease occurrence and to monitor for emerging disease. At the time, disease surveillance information was collected and collated from all the regional Animal Health laboratories. This information was gathered from laboratory results from submissions received from general practitioners and field officers. Trained observation by field officers also played an important part in the surveillance programme.

Surveys were also carried out both to better understand endemic disease occurrence and to confirm freedom. An example of a significant surveillance activity undertaken by the Technical Services Group was a national survey for anaplasmosis in response to a challenge to our freedom status by a trading partner. This was a complicated programme of work that involved the veterinarians within MAF's Technical Services Group, the Central Animal Health Laboratory and Livestock Officers (MacDiarmid et al., 1984). Reporting of New Zealand's animal health status was also an important function. This was comprised of reporting to the OIE (Office International des Epizooties, now World Organisation for Animal Health or WOAH), which at that time maintained lists (A and B) of reportable diseases, and the UN's Food and Agricultural Organization's (FAO) C list diseases.

User pays approach and restructure

Following the general election in 1984, significant impacts occurred as a result of a change in government policy. Farming subsidies ceased and a 'user pays' approach was adopted. Consequently the Animal Health Division was tasked with achieving a compact organisation with short, direct lines of communication, the simplest management structure possible, and decision-making delegated to the lowest possible level. A key objective was to create field and laboratory operational groups that had a clear perspective of purpose and direction and were free to make most of the decisions on how their resources were deployed. Another major challenge at the time facing the laboratory network was the requirement to commercialise services (see *New Zealand's animal health diagnostic laboratory network* p. 25) (O'Hara, 1985).

Important national programmes came under scrutiny, including the bovine tuberculosis programme and the ultimately successful bovine brucellosis programme (MacDiarmid, 1994). Thankfully, these programmes were successfully defended by the veterinary leadership within MAF at the time, leading to New Zealand publishing a declaration of freedom from *Brucella abortus* in the OIE Bulletin in 1996 (see *Surveillance programmes and disease control*, p. 37).

MAFQual established

Through 1987 and 1988, a major reorganisation was undertaken within MAF. The outcome was the establishment of four businesses of MAF New Zealand. The term 'business' was used at the time in an attempt to reinforce the need for MAF to operate in a commercial fashion with client-oriented systems and even entrepreneurial flair. It was, however, somewhat misleading, as MAF remained a distinctly public service organisation, with its primary accountabilities to the Minister of Agriculture (Hellström, 1988). The four businesses of MAF were:

- MAFQual (regulatory activities);
- MAFTech (research and extension activities);
- MAFFish (fisheries management and fisheries research); and
- MAFCorp (provision of corporate administrative systems).

The former Animal Health Division became MAFQual. The organisation of MAFQual contained the functions of the state veterinary service. The state veterinary service no longer existed as a named or even a separately identifiable entity. It had become integrated throughout the structure and operations of MAFQual. The plain language mission statement of MAFQual was to 'help New Zealand penetrate any market and outperform any competitor'. It sought to achieve this mission through an emphasis on quality management systems designed to meet the needs of its clients (Hellström, 1988).

MAFQual's main activities included:

- traditional state veterinary service activity, including meat and fish inspection and veterinary public health;
- administration of milk and milk product quality management systems;
- administration of regulatory plant health and phytosanitary activities;
- administration of quarantine border control;
- provision of a supporting laboratory infrastructure; and
- administration of the control of noxious plants and pests, agricultural chemicals and veterinary drugs (Hellström, 1988).

The overall management of MAFQual was under the control of a board of directors who set policy, monitored performance and sought to maintain the effective operation of the total organisation. The board was led by a Group Director who was himself a

member of the Corporate Board of MAF. The other directors were the:

- Chief Veterinary Officer;
- Chief Plants Officer;
- Chief Dairy Officer;
- Director of Operations;
- Director of Laboratories; and
- four Regional Managers.

Policy was set by the board plus regional managers, and all operational control would be in the hands of regional management. The only notional line of control that existed was from Group Director to Regional Manager. The directors were essentially staff positions, with no direct operational involvement. Of the nine directors, three were veterinarians from the former state veterinary service and the Group Director was also a veterinarian (Hellström, 1988).

Government veterinary service

The full range of state veterinary service functions were shared between the three veterinary directors in recognition of the skills and background of each. The Chief Veterinary Officer (CVO) was responsible for:

- international zoo-sanitary reporting and certification;
- specifications of disease control programmes;
- operation of veterinary diagnostic laboratories;
- import permitting and quarantine of animals and products;
- animal welfare specifications;
- provision of legislation;
- exotic disease control specifications; and
- design of 'nation' contracts (government as a client).

The Director of Laboratories (later redesignated Chief Meat Veterinary Officer) was responsible for:

- technical access of meat products;
- registration of veterinary drugs;
- veterinary public health;
- accreditation of industry food fish certification; and
- organisation of MAFQual food testing labs.

The Director of Operations was responsible for:

- organisation of systems to deliver:
  - disease control,
  - emergency response procedures (includes exotic disease control),
  - border control quarantine,
  - meat inspection,
  - export certification;
- operation of personnel systems, including training; and
- auditing of operating systems.

In summary, the CVO and Director (Labs) were largely concerned with specifying what state veterinary service systems should deliver, and the Director (Operations) was mainly concerned with specifying to the regions how the systems should operate. The last was also responsible for auditing the performance of those systems on behalf of the other directors.

With respect to regional operations, within each region there was at least one senior veterinarian with the responsibility to manage the state veterinary service programmes in that region. Their task was to interpret the policy and specifications provided from the board for these programmes, and they were accountable for any problems identified during auditing of the systems. The four regional managers were given broad guidelines for establishing their own operating infrastructures. Essentially there were two:

- reduction of levels of management; and
- emphasis on managerial and operational teams rather than hierarchies.

As a result, three quite distinct regional configurations arose that reflected the style of each regional manager and what they saw as the particular attributes or problems presented by their region. While this approach was considered untidy at the time (Hellström, 1988), it was a useful method of encouraging change in existing beliefs, systems or cultures of the old divisions now amalgamated into MAFQual. However, it did create problems for the delegation of legal authorities to people at appropriate levels and with appropriate skills within MAFQual, and there was almost a total absence of standardised designations. The directive on designations was that they should not imply hierarchy. Thus, terms such as 'senior', 'deputy', and 'assistant' all vanished (Hellström, 1988).

A significant issue that arose due to the new structure was the potential conflict between provision of services and new financial considerations. Under the new rules MAFQual was required to earn revenue to survive and that revenue was a direct credit to the business. If more revenue was earned, MAFQual could reinvest and grow through the provision of additional or enhanced services. However, if they earned less revenue, they must scale down operations and reduce staff (Hellström, 1988).

Change within MAFQual continued into 1988 with the reorganisation of the core functions of the state veterinary service into a combined plant and animal service, the National Agriculture Security Service (NASS).

This new structure brought together:

- offshore quarantine; border protection;
- post-entry quarantine;
- disease and pest surveillance; and
- exotic disease and pest response.

This was 100 percent taxpayer-funded. A very important aspect of the creation of the NASS was the negotiation with government and those industry groups affected by the activities of NASS to develop a policy, the Agriculture Security Policy, which stood as a proxy for clients' specifications. This policy represented the point of measurement against which the performance of NASS could be assessed. NASS was jointly administered by the Chief Plants Officer and the CVO, and was very much focused on information-related activities to ensure both effective communication both within NASS and externally of its performance, its nature and its outputs (Hellström, 1989).

Significant change occurred in the state veterinary service in 1990.

Restructuring of the Ministry of Agriculture and Fisheries separated out those veterinary positions that formulated policy and set standards from those that delivered services. The CVO and the veterinary epidemiology group staff were placed in MAF Policy while the operational veterinary staff remained in MAF Quality Management. The new MAF Policy retained responsibility for: negotiating government-to-government protocols on import and export requirements; setting zoo-sanitary and quarantine standards; and setting the standards for the use of official New Zealand certification and auditing compliance with these standards. The delivery of specific services became the responsibility of MAF Quality Management and private sector groups. The documentation of operating procedures as an amalgamation of standards and operating instructions was appropriate while policy decisions and delivery of services were both functions of MAF. However, now that policy and delivery were separate it became necessary to distinguish between standards and operating instructions. An increase in the number of services, such as disease control testing, delivered by non-MAF personnel gave added impetus to this move and so specifications governing the quality of services were extracted from operating instructions and were placed in MAF Policy standards. MAF Policy also had to develop a standard for compliance investigations that would be acceptable to the supplier and, at the same time, be durable in the face of a third-party audit. The separation of policy and delivery functions was facilitated by developing fully documented and auditable delivery systems for the state veterinary service. (MacDiarmid, 1991a)

The 1990s also signalled the start of privatisation of the government laboratories, a shift in MAF surveillance activities from a previous focus of understanding endemic disease occurrence and endemic disease control aimed at eradication, to primarily exotic disease prevention, detection and response. MAF saw its role as for the public good and no longer being responsible for enhancing production health, or contributing to researching or controlling production diseases – these became the responsibility of private industry. National disease control activities became developed under pest management plans or became industry-managed.

Animal health monitoring

From the late 1980s through to 1991, MAF refined its animal disease surveillance system into one based on clearly specified information needs with specific subsystems to provide the relevant information. A national animal health information system was developed and known as the Surveillance and Animal Health Monitoring System (McKenzie and Thompson, 1991).

The information required by this system was:

- early detection and reporting of clinical cases of OIE List A diseases;
- assurance of freedom from infection for the disease agents in OIE Lists A and B, FAO List C, Second Schedule (Animals Act 1967) that are not present in New Zealand, and other exotic disease agents which are important to international trade;
- assurance of freedom from clinical disease for the diseases in OIE List B, FAO List C and Second Schedule (Animals Act 1967) where the aetiological agent is present in New Zealand;
- detection and identification of diseases exotic to New Zealand and of new animal diseases;
- epidemiologically sound information to describe the pattern of specific endemic diseases that are important to the international trade of animals and to public health;
- a general profile of the endemic animal diseases that are on the OIE List B and FAO List C;
- an up-to-date reference database on the status of animal diseases in New Zealand; and
- reports on significant disease events in the animal populations (McKenzie and Thompson, 1991).

Note: OIE list A and B diseases were combined into a single list on 1 January 2005 https://www.woah.org/en/who-we-are/structure/framework/basic-texts/animal-health-information/

The Agricultural Security Team was responsible for surveillance activities during this period, which were provided by MAFQual through the MAF Animal Health Laboratory network (now reduced to six sites), field staff and staff in meat slaughtering plants (O'Hara, 1993).

The technical co-ordinator of the surveillance and animal health monitoring system produced a monthly technical report that was distributed to the CVO and MAF veterinarians in operational positions. This report disseminated information on the key animal disease events and fed the collated information back to those who provided the raw data. It contained information under the following headings:

- investigation of suspect exotic disease cases;
- investigation of new diseases or unusual cases;
- summary of interesting disease events;
- emerging disease patterns;
- technical capability relating to disease surveillance;
- disease summaries;
- project summaries or updates; and
- quarterly diagnostic report on diseases of significance to international trade.

MAF Regulatory Authority

In 1992 the MAF Regulatory Authority was established and included the Animal Health and Welfare Group that reported to the CVO (Boland, 1992). Also established was a Chief Meat Veterinary Officer, operating in parallel to the CVO role, especially in international standard-setting bodies of the OIE/WOAH and Codex Alimentarius (B O'Neil, pers. comm.). The Regulatory Authority was MAF's standard-setter for a range of regulatory activities related to the maintenance of agricultural security, the assurance of quality and

certification of New Zealand exports of primary products, the management of endemic pests and diseases and animal welfare. MAFQual provided services to the Regulatory Authority (O'Hara, 1992).

Biosecurity Act 1993

In 1993 the Biosecurity Act became law. After a three-year transition period it completely replaced the Animals Act 1967, the Agricultural Pest Destruction Act 1967, the Poultry Act 1968 and the Noxious Plants Act 1978; also, the agricultural security provisions of the Plants Act 1970, and the Apiaries Act 1969; and the hydatids control portion of the Dog Control and Hydatids Act 1982. The Act consolidated and reviewed the law necessary to enable border protection and pest management. Among other things it introduced a new concept, the pest management strategy, whereby any Minister or regional council could propose a plan to manage any pest provided that the criteria laid down in the Act are met and there is general support for the measure (O'Hara, 1994).

As well as defining 'unwanted organisms' and providing various powers for their control or eradication, from a surveillance perspective it also included Part 4 'Surveillance and Prevention' to support New Zealand's biosecurity surveillance activities, and included important provisions including: section 44, the general duty to inform, section 45, notifiable organisms, and section 48, the power to require information (Anon., 1993).

The reason we have a Biosecurity Act and not an Agricultural Protection Act is that the group in MAF who were drafting the law were struggling for a name to cover the range of values to be protected by the Bill. John Hellström had just been to a conference in Colorado, United States, where all the talk was about biosecurity as a system for preventing escapes from high-security labs right at the beginning of the genetically modified organism revolution. John proposed to the MAF team that the term could be used with its meaning reversed: a system to keep pests and diseases out – not to keep them in. The team accepted the proposal and the name was adopted (J Hellström, pers. comm.; see box below).



Figure 2: Animal Health Laboratories 1995 (Adapted from Orr and Black, 1996)



Widely known as one of the leaders of biosecurity in New Zealand, **Dr John Hellström's** involvement in the industry spans almost half a century.

Dr Hellström is a pioneer of biosecurity in New Zealand and is probably best known for his work as Chairman of the Biosecurity Council and as Chief Veterinary Officer for MAF. He was instrumental in developing the 2003 Biosecurity Strategy; he has established new systems for protecting native plants and agriculture from pests and disease, and for animal welfare in New Zealand.

https://www.gia.org.nz/News-Events/ID/2993/QA-Dr-John-Hellstrom

Animal Health Surveillance programme

The beginnings of the current national disease monitoring programme – the Animal Health Surveillance programme – that complements the disease investigation system, occurred around the same time as the Biosecurity Act became operational. Up until 1996, the Animal Health Surveillance programme had obtained surveillance information via the network of five regional and one central government-owned veterinary diagnostic laboratories (**Figure 2**).

However, by 1995 a private veterinary diagnostic laboratory in Hamilton, Alpha Scientific Ltd, was handling a significant proportion of the total farmed animal caseload. To ensure that critical information was not lost, MAF's Regulatory Authority developed a cost-effective and equitable means of purchasing surveillance information from the private veterinary diagnostic laboratories.

The stated objectives of this Animal Health Surveillance programme were:

- prompt reporting of exotic disease;
- to meet international reporting obligations;
- to support the development of technically justifiable import requirements for animals and their products;
- the development of animal disease control strategies and public health policies; and,
- facilitation of the export trade in animals and animal products.

A standard for the approval of private laboratories as suppliers of surveillance information to the government was developed. The standard specified the technical proficiency and reporting requirements a laboratory must fulfil to ensure that the surveillance information they generate is of suitable quality and timeliness. As Alpha Scientific Ltd met the requirements, a contract with them became effective on 1 July 1996. Consequently, starting in the December 1996 issue of *Surveillance*, Alpha Scientific Laboratory contributed information to the animal health surveillance reports (Poland, 1996).

While there have been variations to how this programme has operated since 1996, the core objectives and requirements detailed during this period have remained. The programme has now expanded to include all three commercial veterinary diagnostic laboratories: SVS Laboratories, IDEXX Laboratories and Awanui (formerly Gribbles) Laboratories, and has been in operation for nearly 30 years (*New Zealand's animal health diagnostic laboratory network*, p 25).

SPS agreement

In 1995 the SPS Agreement, the World Trade Organization's (WTO) agreement on the Application of Sanitary and Phytosanitary Measures, was introduced. As a member of the WTO, New Zealand is committed to fully implementing the provisions of the SPS agreement. The SPS agreement established principles that bind countries when they set health protection measures for the importation of plants, animals and their products, and aims to prevent trade barriers being set up under the guise of sanitary measures. As a signatory to the SPS agreement, New Zealand's right to protect its animal health is not diminished, provided the sanitary measures we take are not inconsistent with the agreement. Measures must be applied only to the extent necessary and must be justified by science. They must be consistent between different member countries, and between our domestic and international procedures. Sanitary measures should be harmonised with international standards where possible. New Zealand must recognise 'equivalence'; countries exporting to this country can employ a variety of different sanitary methods if they can objectively demonstrate that these achieve the level of health protection New Zealand requires (O'Neil, 1996).

The WOAH was recognised as the standard-setting organisation by the WTO SPS Agreement. WOAH defines the standards that must be met where countries wish to declare freedom from various animal health diseases, as well as standards for risk analysis, import health standards and international trade in animals and animal-based commodities. Surveillance provides the data that underpin these declarations and standards (see *Organisations and collaboration* p. 51). Furthermore, WOAH also provides standards on the structure of a national surveillance system, both for general surveillance and for specific diseases.

MAF Biosecurity Authority

In 1999 the MAF Regulatory Authority split into the MAF Biosecurity Authority and MAF Food Assurance Authority. MAF Biosecurity Authority, primarily staffed by veterinarians, retained responsibility for animal and plant biosecurity, animal welfare and export assurance of plants and live animals. Its responsibility was for all food exports and primary production, assurances for animal product and plant product exports, the regulation of pesticides and veterinary medicines. The mission of MAF's Biosecurity Authority was to protect New Zealand's unique biodiversity and facilitate exports by managing risks to plant and animal health and welfare.

At this time MAFQual became two state-owned enterprises (SOE): ASURE New Zealand Ltd (handling meat inspection) and AgriQuality (specialising in livestock, horticulture and forestry) (AsureQuality, 2024).

In the early 2000s MAF Biosecurity Authority, Animal Biosecurity group in Wellington maintained and managed New Zealand's national animal disease surveillance programme (**Figure 3**, next page). The programme was multifaceted to meet its objectives, with surveillance services purchased and agreed with providers from both outside of MAF and from other directorates within MAF. The quality and timeliness of surveillance was maintained through MAF standards produced by MAF Animal Biosecurity that stated the technical and operational requirements that had to be met. The service providers included:

- both components of the National Centre for Disease Investigation (NCDI) in MAF Operations (the New Zealand Animal Health Reference Laboratory and the Exotic Disease Response Centre, see *New Zealand's animal health diagnostic laboratory network*, p. 25, for the establishment of the National Centre for Disease Investigation);
- commercial veterinary laboratories, pathology and parasitology expertise; and
- laboratories conducting testing for export certification, and other providers of targeted surveillance activities.

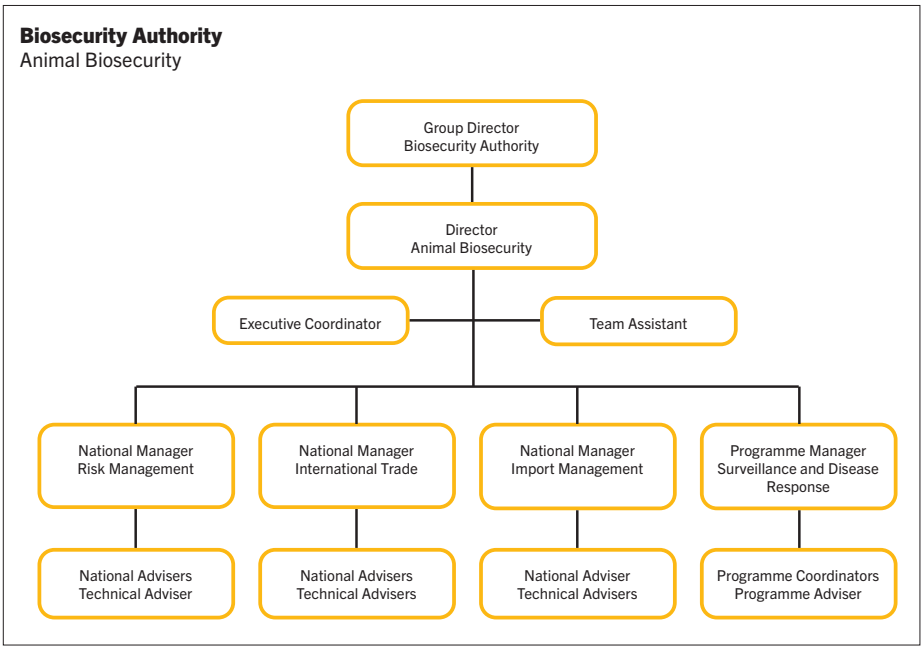

Figure 3: Structure of the Animal Biosecurity Authority (consisting of about 25 Wellington-based staff)

Suppliers of services were regularly audited against MAF standards.

The objectives for MAF's animal disease surveillance programme in the early 2000s were:

- establishing freedom from notifiable diseases;
- detecting incursions of exotic disease quickly enough to allow for optimal management, including eradication wherever appropriate;
- detecting significant emerging diseases; and
- understanding the distribution and incidence of endemic diseases to:
  - support the development of import and export health standards,
  - provide input into human health policies on zoonotic diseases, and
  - assist in characterising disease events as endemic or exotic.

To meet these objectives, the programme included a number of key components:

- an ongoing awareness programme of significant exotic diseases;
- a schedule of Notifiable Organisms under the Biosecurity Act 1993;
- a 24-hour/7 day-a-week free phone line to report exotic pests or diseases to MAF;
- a team of veterinary epidemiologists to conduct field investigations of suspected exotic disease;
- laboratory support for investigation and targeted surveillance activities provided by the New Zealand Animal Health Reference Laboratory (NZAHRL), now known as the National Animal Health Laboratory;
- a network of privately owned, MAF-approved, veterinary diagnostic laboratories;
- MAF-approved laboratories undertaking export testing;
- employment of a MAF expert parasitologist and a MAF expert pathologist who, free of charge, received referral cases from MAF investigations, NZAHRL, or approved MAF laboratories (**Figure 4**);
- contracted field services for surveillance. In particular, AgriQuality (AQ), a state-owned enterprise, was the provider of some field services for surveillance, including the arbovirus and apiculture surveillance programmes (In 2007 AsureQuality was established from AgriQuality and ASURE (AsureQuality, 2024)).

This model formed the basis of the surveillance system we still have in place today.

With the new century, surveillance to support our stated animal health status continued to increase in importance and was scrutinised by trading partners. This was particularly evident in the surveillance programme for transmissible spongiform encephalopathies, which in 2002/03 had a substantial lift in funding. The expectation at that time was that international markets would require additional active surveillance programmes to support our stated animal health status and consequently, the new position of active surveillance programme co-ordinator was established in 2002 (Belton, 2003).

Biosecurity surveillance reviews

In 2002, Prime Consulting International Ltd was contracted

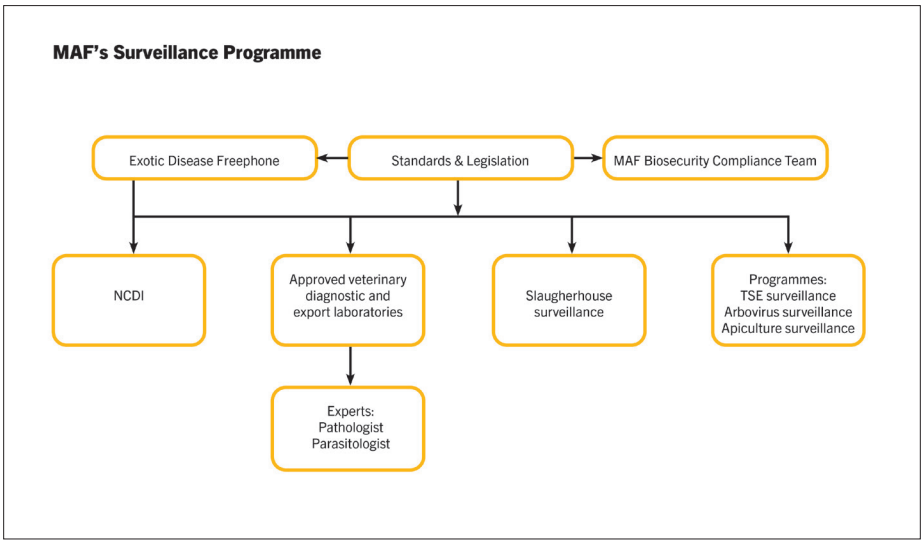

Figure 4: Components of MAF's Surveillance programme in about 2000

by the MAF Biosecurity Authority to undertake a comprehensive review of New Zealand's biosecurity surveillance programmes.

The purpose was to evaluate the status of New Zealand's surveillance systems and make recommendations for their further improvement. Key parameters considered were the ability of surveillance systems to:

- facilitate the early detection of new organisms, pests or diseases, and enable eradication options to be pursued if required;
- enable demonstration of freedom from certain organisms to support market access requirements of importing countries for export products;
- provide essential background information on pest and disease status for use in developing Import Health Standards; and
- track the spread of harmful organisms within the country as the basis for determining an appropriate response.

The broad-based biosecurity review covered the marine, freshwater and terrestrial environments, the country's extensive commercial agriculture, fishing and forestry industries, and indigenous biodiversity. It required extensive consultation and information-gathering across a wide range of government agencies as well as with industry sectors and research scientists. The 12-month project also considered funding options for surveillance and an economic decision-making framework was developed for determining funding priorities.

The review recognised New Zealand's biosecurity system as based on four interlocking subsystems:

- managing risks offshore as far as possible;
- protection at the border and through quarantine and post-entry conditions;
- surveillance systems to detect pests and diseases which may have entered New Zealand; and
- control and eradication programmes to manage or eliminate unwanted pests.

The review report noted that the reviewing team were impressed by the dedication and commitment of both the government and industry staff involved in surveillance.

Recommendations were made covering all aspects of New Zealand's biosecurity surveillance system. These 98 recommendations formed the basis of work subsequently carried out over the following 13 years to improve and strengthen the system, as part of New Zealand's overall Biosecurity Strategy. A copy of the Prime report is available at www.biosecurity.govt.nz/pests-diseases/surveillance-review/index.htm (Prime consulting website accessed 28 August 2024).

As well as the Prime review, other reviews of the biosecurity system were undertaken. Some of the key findings of those reviews were:

- a lack of coordination and unclear leadership had resulted in confusion about future direction;
- risk management processes were struggling to cope with the complexity of the wider scope of biosecurity, and decision making was not handling multi-value realities;
- scientific findings had become more complex and there was greater awareness of knowledge gaps, especially in environmental (terrestrial and marine) areas; and
- trade and international agreements were demanding greater transparency (O'Neil, 2005).

Biosecurity New Zealand

These reviews occurred in parallel with the development of the Biosecurity Strategy by the Biosecurity Council, which was started in 2000 and completed in August 2003, making 57 recommendations.

The Biosecurity Council, under the chairmanship of John Hellström, was established by Simon Upton, the Minister for Biosecurity in 1997, who recognised that biosecurity activities and impacts were far broader than those contained within agriculture. Its purpose was to coordinate biosecurity policy and delivery across a broad range of government agencies. This ultimately led to the Council leading the development of a Biosecurity Strategy (J Hellström, pers. comm.).

Consequently, the government adopted the strategy as the basis for improvements to the New Zealand biosecurity system and implemented most of those recommendations over the following years, including the establishment of Biosecurity New Zealand in 2004 (**Figure 5** and **Figure 6**, next page). This brought together the previous biosecurity responsibilities of MAF, the Ministry of Fisheries, the Department of Conservation and the Ministry of Health, which was deliberately organised not on a sector-based structure, but with policy and technical groups based on function. This resulted in the establishment of a new structure including Pre-clearance and Post-clearance Directorates, a new Policy and Business Development Directorate, and the inclusion of the investigation and diagnostic centres (**Figure 7,** page 16) (O'Neil, 2005). Consequently, the primary chief technical officer (CTO) designation for animal health decision-making under the Biosecurity Act, once associated with the Director of Animal Biosecurity, was replaced with new CTO designations for each of the pre-clearance and post-clearance directorates. For biosecurity surveillance, the change to a function-based structure was delayed for a number of years before being implemented at the time of the establishment of MAF Biosecurity New Zealand (see below) (Clift, 2007).

A new Investigation and Diagnostics Centre directorate (IDC) was established and altered the relationship of its components (NZAHRL and EDRC) with the animal health staff managing the coordination of the national animal surveillance system. IDC changed from being a service provider of the surveillance system, under the direction of the animal surveillance programme managers, to being operationally alongside those positions. The IDC continued to be accountable for the investigation and diagnosis of suspected incursions of exotic or

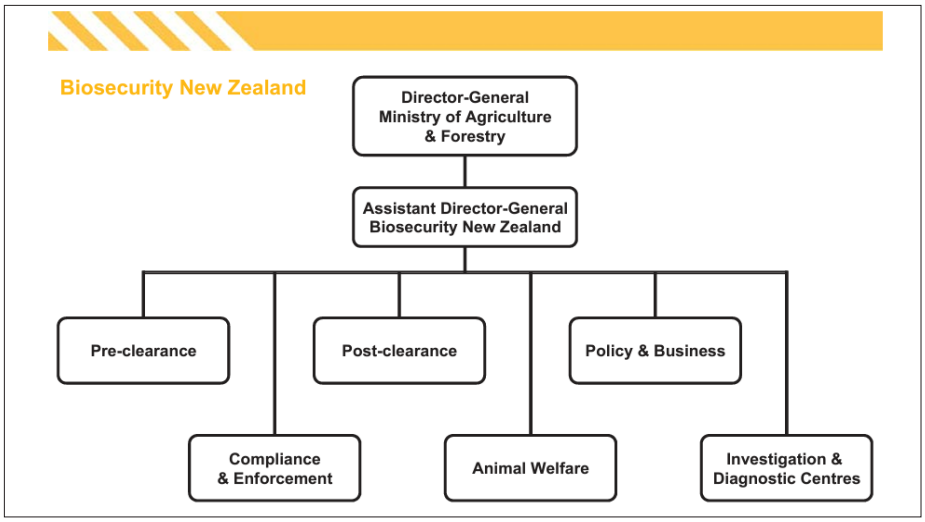

Figure 5: Structure of Biosecurity New Zealand (Adapted from O'Neil, 2005)

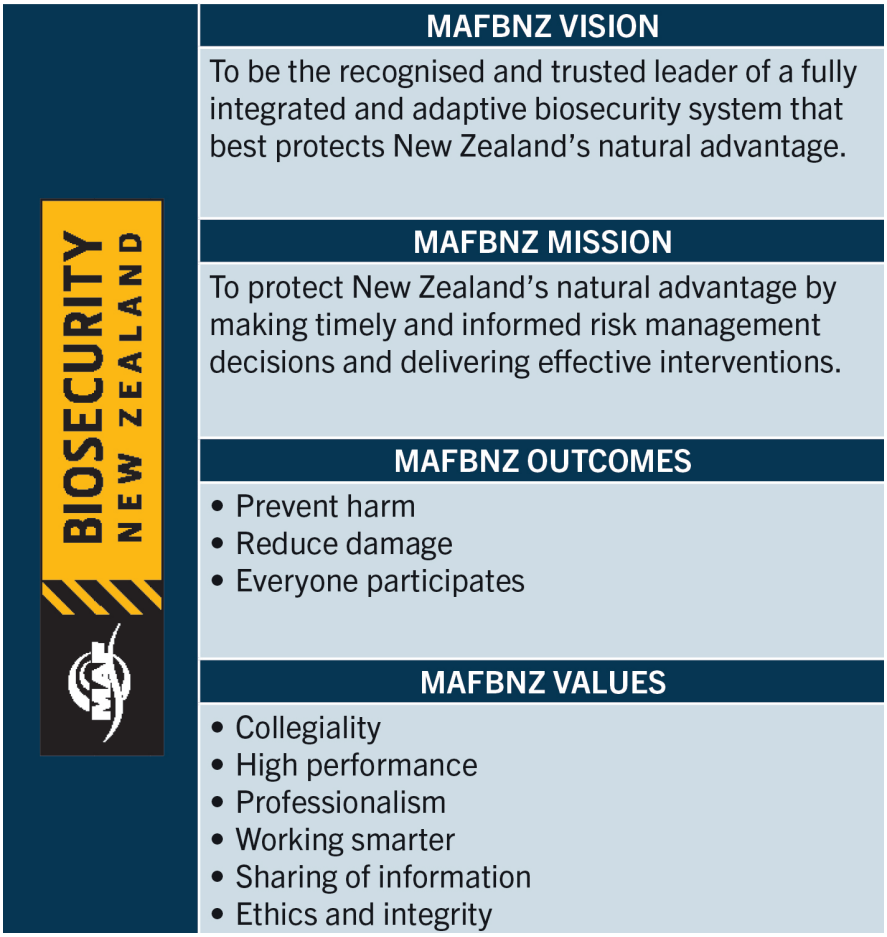

Figure 6: MAF BNZ vision, mission, outcomes and values (extracted from an internal MAFBNZ presentation)

emerging diseases and pests affecting agriculture, horticulture and the aquatic and terrestrial environments.

MAF Biosecurity New Zealand (MAFBNZ)

In July 2007, MAF Biosecurity New Zealand (MAFBNZ) was established, integrating MAF's two biosecurity parts: Biosecurity New Zealand (BNZ) and the MAF Quarantine Service, bringing a closer link between biosecurity policy development, risk assessment, standard setting and operational functions (**Figure 6**). MAFBNZ was led by Assistant Director-General Barry O'Neil (Anon., 2007, see box, right).



Barry O'Neil began his veterinary career in Tauranga clinical practice after graduating from Massey in 1979. He joined MAF in 1984, initially as a meat veterinarian, then becoming the Veterinary Officer for Bay of Plenty. His next move was to Wellington and Brussels as Veterinary Counsellor to the European Union, before returning to New Zealand in 1994 to become MAF's Chief Veterinary Officer. During his time at MAF he led the establishment of MAF Biosecurity NZ and become MAF's Deputy Director General responsible for the group. He was President of the OIE from 2006–2009. In 2011, Barry was awarded the OIE's gold medal for his outstanding service to world animal health.

The reorganisation saw significant changes to New Zealand's central veterinary service structure. The earlier planned reorganisation of surveillance, from a sector-based structure to a function-based structure as part of the implementation of BNZ in 2004, was achieved at this time. MAF Biosecurity, which had all the core components of the terrestrial and aquatic animal biosecurity policy and management functions under the same Animal Director (CTO) and Chief Veterinary Officer, now had the personnel of the four sectors of BNZ (plants, forestry, marine and animals) intermingled and grouped together in function-based groups – imports, exports, surveillance, response, risk analysis – across two separate directorates: Pre- and Post-Border. **Figure 7** (next page) shows the relationship between directorates, and how MAF Biosecurity New Zealand had expanded to accommodate the increasing need for its services across many sectors in New Zealand.

In the early 2000s New Zealand's national animal disease surveillance programme for both terrestrial and aquatic animals was primarily managed by Roger Poland.

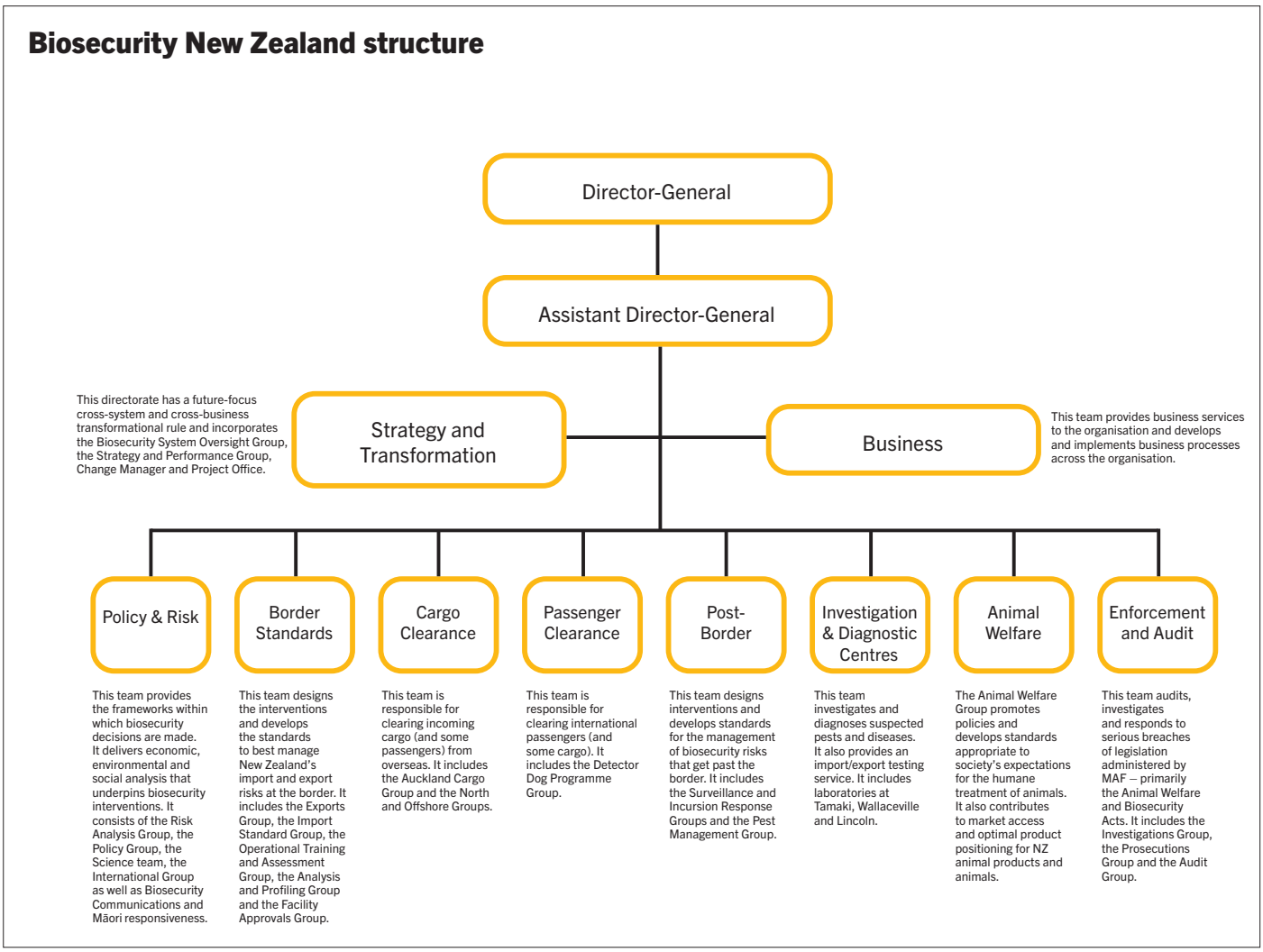

Figure 7: MAFBNZ structure (Adapted from Anon., 2007)

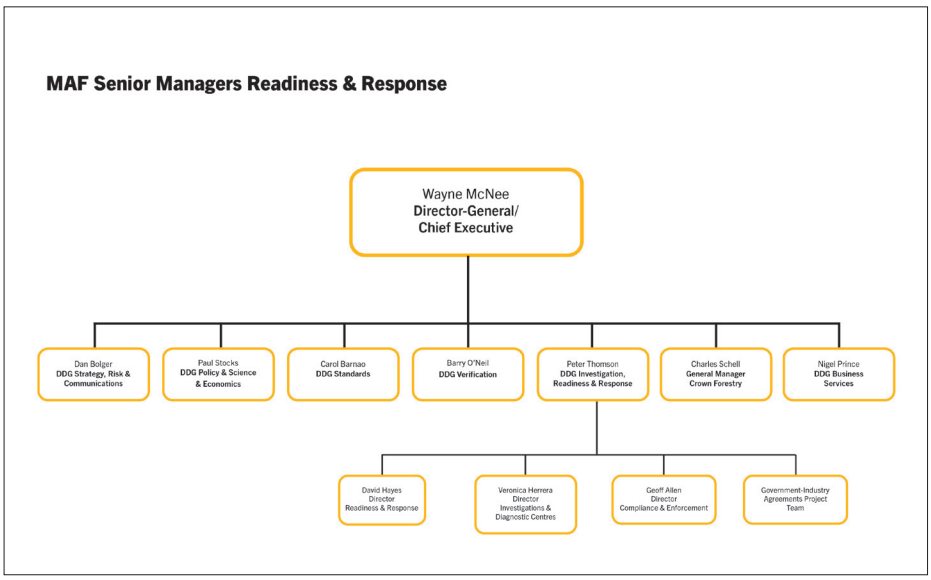

Figure 8: Structure of integrated MAF and NZFSA, July 2011

In 2005, a second role was created, of which half was to have a focus on environmental pests. With the establishment of MAFBNZ and the new cross-sector Biosecurity Surveillance team in the Post-Border Directorate under Katherine Clift (Clift, 2007), the number of animal surveillance positions increased initially to three, and then later to four under a dedicated manager in 2010.

Biosecurity Surveillance Strategy

In 2007, the Biosecurity Surveillance Strategy was under development as an outcome from the 2002 Prime review. The strategy was developed as a framework which would then be consulted across all those that had a stake in biosecurity (Clift, 2008). The Biosecurity Surveillance Strategy was formally launched by then Biosecurity Minister David Carter in February 2010. Over the subsequent months of 2010, workshops were held to gather information on surveillance needs and to identify the gaps (Clift, 2010). Work on the Biosecurity Surveillance strategy continued for several years until it was eventually superseded by developments in surveillance that influenced the activities undertaken. One significant outcome of the strategy was the recognition of a need to improve information management, which led to the development of the MPI Surveillance Information

management System (SIMS) see *Information management and tools,* p. 47).

Ministry of Agriculture and Forestry (MAF) and New Zealand Food Safety Authority (NZFSA) amalgamated

In July 2010 MAF and New Zealand Food Safety Authority (NZFSA) were amalgamated into a single agency. Following the merger, work to create a new organisational structure that fully integrated the functions previously managed separately by MAF and NZFSA teams was undertaken. The new structure came into effect on 1 February 2011 (**Figure 8**, previous page).

Ministry for Primary Industries

In 2012, The Ministry for Primary Industries (MPI) was formed for the oversight of agriculture, food safety, forestry and fisheries. This included the new Compliance and Response branch within which the Investigation and Diagnostic Centres & Response (IDC&R) Directorate was established under Veronica Herrera, (see box, right). The animal health roles within the previous MAFBNZ Surveillance group and the Animal Health and Marine Incursion Investigation team within the previous IDC were merged into a new group: the Surveillance and Incursion Investigation (S&II) Animal Health and Marine team under Paul Bingham (Herrera, 2013). Until 2012, the Surveillance team was located in central Wellington at Pastoral House; however, when the new S&II team was formed, the surveillance team members relocated to the MPI Wallaceville site to be co-located with their Incursion Investigation colleagues.

The structure of MPI as it related to the Surveillance and Incursion Investigation Animal Health and Marine team is shown in **Figure 9**.



Dr Veronica Herrera first started at MPI in 1997 as a scientist in the Plant Health and Environment Laboratory in Auckland, and during her 25 year career at MPI held many roles within Biosecurity New Zealand, including management positions in the development of import standards, quarantine facilities and laboratories. From 2010 to 2023 as a Director of the Investigation and Diagnostic Centre she focused on strengthening and improving our post border biosecurity.

Diagnostic and Surveillance Directorate

In late 2016, MPI restructured the IDC&R Directorate and established the Diagnostic & Surveillance Services

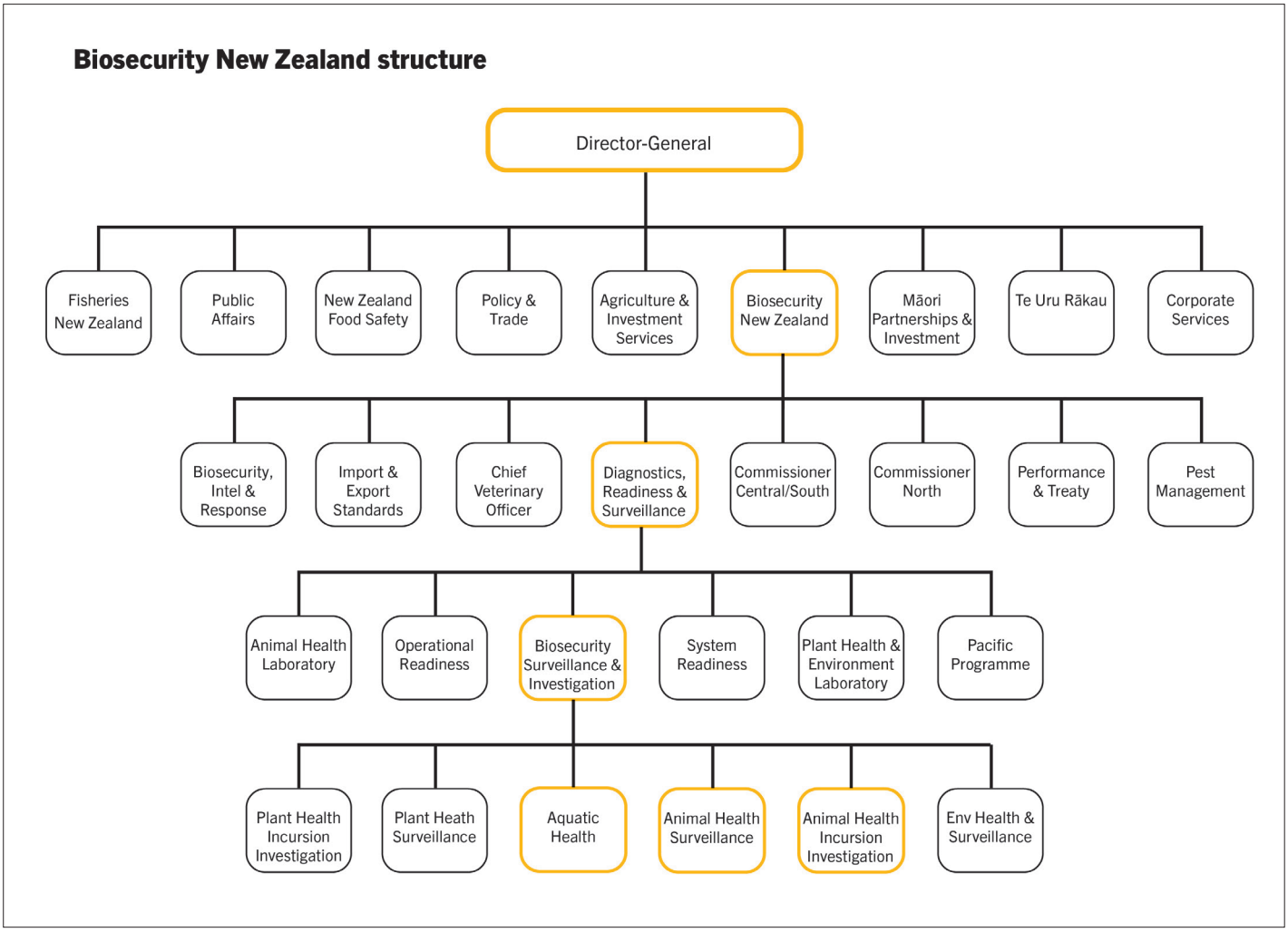

Figure 9: Ministry for Primary Industries structure. The Animal Surveillance and Incursion Investigation teams are shown as yellow boxes

(DSS) and Readiness & Response Services as two separate Directorates. The DSS Directorate comprised the MPI Plant Health & Environment Laboratory (PHEL), MPI National Animal Health Laboratory (AHL), and Plant and Animal Surveillance and Incursion Investigation teams whose mandate spanned the terrestrial, marine and freshwater environments. A key consideration in forming a separate Readiness and Response Services Directorate was to manage increasing demands, achieve economies of scale and eliminate duplication by bringing biosecurity, food safety, climatic and international responses under the same umbrella (Herrera, 2018). In 2017, the responsibility for marine and freshwater surveillance and incursion investigation was transferred to a new team within the S&II group, the Aquatic and Environment Health team, under Michael Taylor.

Re-establishment of Biosecurity New Zealand

In May 2018, the business unit within MPI responsible for leading New Zealand's biosecurity was once again named Biosecurity New Zealand (MPI, 2018). In 2022, it was considered that the S&II team had become too large to be managed by a single manager. Consequently, in late 2022, the S&II team was split into the Surveillance (Animal Health) and the Incursion Investigation (Animal Health) teams, with separate managers. Both teams remained co-located in the MPI Wallaceville site as part of the Surveillance and Incursion Investigation group, in the Surveillance and Diagnostics Directorate, part of Biosecurity New Zealand. The Aquatic and Environment Health team was also split at this time. This resulted in a formation of a dedicated Aquatic Health team comprising both surveillance and investigation functions.

In July 2024, as part of a restructure within MPI, the directorate was renamed the Diagnostics, Readiness and Surveillance directorate.

The Surveillance (Animal Health) team

The Biosecurity Surveillance team (Animal Health) of 2024 is made up of seven veterinarians. All either already have, or are studying towards, a post-graduate epidemiology qualification. The team ensures a coordinated terrestrial animal health surveillance system, and as part of this manages active and passive surveillance programmes including:

- the Transmissible Spongiform Encephalopathy surveillance programme (see *Surveillance programmes and disease control*, p. 37);
- the Bee surveillance programme (see *Surveillance programmes and disease control*);
- the Animal Health surveillance programme (see *New Zealand's animal health diagnostic laboratory network*, p. 25);
- the Wildlife surveillance programme (see *Surveillance programmes and disease control*);
- the Avian Influenza surveillance programme (see *Surveillance programmes and disease control*); and
- the general surveillance system (Tana, 2014).

Other responsibilities of the team include:

- international reporting;
- collating, analysing and publishing disease occurrence data;
- publishing *Surveillance* (see *Communicating surveillance*);
- stakeholder engagement;
- contributing and advising on WOAH Terrestrial Code Chapter requirements and changes;
- defining and preparing documents on the animal health status of New Zealand;
- responding to ad hoc requests, e.g., from the MPI Market Access team, trading partners, domestic stakeholders, etc.;
- acting as subject matter experts, e.g., in responses, project work, on expert panels, etc.; and
- providing subject matter advice for other surveillance programmes managed within the Diagnostics, Readiness and Surveillance Directorate, e.g., the Arbovirus surveillance programme.

Conclusion

Along with other teams within MPI's Surveillance and Incursion Investigation Group, the Biosecurity Surveillance (Animal Health) team has a critical role in maintaining the MPI general surveillance programme and targeted surveillance programmes. These teams and the programmes they maintain have evolved over many years through the hard work of many New Zealanders to ensure we have a world-class surveillance system. Collectively, these programmes are vital to ensure ongoing market access for New Zealand primary products and the early detection of exotic and emerging diseases, protecting our economy, animal and human health, environment and cultural taonga.

References

Anonymous (1979). Animal health data–Animal Health Division organisation. *Surveillance* 6(2), 16–19.

Anonymous (1993). The Biosecurity Act 1993. https://www.legislation.govt.nz/act/public/1993/0095/latest/whole.html#DLM315339, accessed 9 April 2024

Anonymous (2007). MAF Biosecurity New Zealand heralds 'whole of biosecurity' system. *Surveillance* 34(3), 20.

AsureQuality (2024). The history of food quality management and assurance stems from the very beginnings of settlement in Aotearoa, New Zealand. https://www.asurequality.com/about/who-we-are/our-history/ accessed 4 September 2024.

Belton D (2003). Introduction. *Surveillance* 30(2), 3.

Boland C (1992). The establishment of a MAF regulatory authority. *Surveillance* 19(2), 8–9.

Clift K (2007). Surveillance for biosecurity. *Surveillance* 34(2), 3.

Clift K (2008). Surveillance has benefits across the biosphere. *Surveillance* 35(1), 3.

Clift K (2010). Editorial - New approaches in biosecurity. *Surveillance* 37(2), 3–4.

Guild C, Houldgreaves I (1980). Editorial. *Surveillance* 7(1), 2.

Hellström J (1988). Organisation of veterinary services in New Zealand. *Surveillance* 15(2), 3–4.

Hellström J (1990). Chief veterinary officer's annual report 1989 – Animal health laboratories. *Surveillance* 17(3), 11–13.

Herrera V (2013). MPI one year down the track. *Surveillance* 40(2), 3–4.

Keyes H, Walrond C (2008). 'Biosecurity – definitions and history', Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/biosecurity/page-1. (accessed 30 October 2024).

MacDiarmid S, Jones D, Durham P (1984). Survey confirms freedom from anaplasmosis. *Surveillance* 11(3), 2–4.

MacDiarmid S (1991a), Chief veterinary officer's annual report 1990 – Introduction. *Surveillance* 18(4), 3.

McKenzie J, Thompson J (1991). New Zealand's animal health information system. *Surveillance* 18(5), 12–15.

MPI (2018). MPI's new business units launched, https://www.mpi.govt.nz/news/media-releases/mpis-new-business-units-launched/ accessed 26 September 2024.

O'Hara P (1985). Chief veterinary officer's annual report 1985. *Surveillance* 12(4), 4–5.

O'Hara P (1992). Chief veterinary officer's annual report 1992 – Agricultural security. *Surveillance* 20(3), 4–9.

O'Hara P (1994). Chief veterinary officer's annual report 1993 – Legislation. *Surveillance* 21(3), 16.

O'Neil B (1996). Chief veterinary officer's annual report 1995 – Sanitary and phytosanitary (SPS) agreement. *Surveillance* 23(3), 14.

O'Neil B (2005). Biosecurity New Zealand. *Surveillance* 32(2), 3.

Orr M, Black A (1996). Animal Health Laboratory network: Review of diagnostic cases – October to December 1995, *Surveillance* 23(1), 3–5.

Poland R (1996). Surveillance contract with Alpha Scientific Laboratory. *Surveillance* 23(2), 10.

Tana T (2014). The MPI animal general surveillance programme. *Surveillance* 41(2), 5–8.

The Animals Act 1967. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nzlii.org/nz/legis/hist_act/aa19671967n50110.pdf Accessed 10 September 2024.

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Communicating surveillance

Introduction

Effective communication is a key component for successful biosecurity surveillance. It informs and engages with important participants in surveillance programmes, it promotes awareness of surveillance activities to domestic and international stakeholders, provides information on disease occurrence, and it ensures that international reporting obligations are met. All these things are important for the successful ongoing implementation of surveillance for activities, for animal and human health biosecurity, for continued market access for New Zealand products and the protection of New Zealand's environment This paper describes some of the surveillance communication publications and staff activities that have been undertaken over the past 50 years.

Surveillance

The *Surveillance* publication was established by Royce Elliot and Peter Grace in 1974 (**Figures 1** and **2**) and published by the MAF Animal Health Division (AHD) with these objectives:

1. To aid in the continuing education of all veterinarians by sharing information that the AHD generated.
2. To keep veterinarians up to date with the latest disease occurrences and trends as seen by the AHD.
3. To stress that the AHD relates to practitioners as a complementary, and not as a competitive, veterinary force.
4. To explain current disease-control policy and to inform all veterinarians of future lines of development which the Division proposes to follow (Anonymous, 1974).

Over time, *Surveillance* has evolved to include other aspects of work undertaken by the Ministry such as aquatic, plant and environmental surveillance. Its objectives have increased accordingly to incorporate

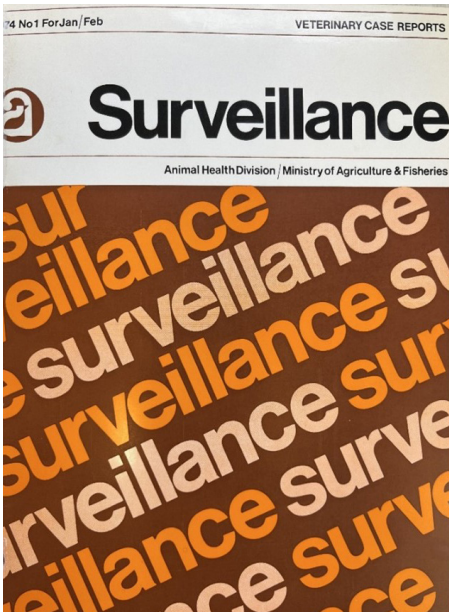


Figure 1: Cover of first edition of *Surveillance* 1974

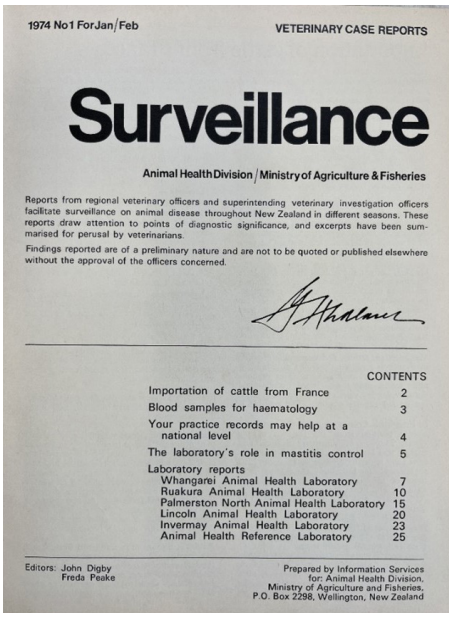


Figure 2: Inside cover of first edition of *Surveillance* 1974

communication of these surveillance activities to both domestic and international audiences.

The original *Surveillance* in 1974 was a hard-copy publication in A5 size format. A decade later, under the government's 1984 cost-cutting measures, *Surveillance's* future was in doubt. Fortunately for the magazine and the New Zealand Veterinary Service, MAF had just been informed by a trading partner that reports published in *Surveillance* had convinced them that New Zealand was free from a particular disease that they had been reviewing. Consequently, they had decided against the imposition of additional testing requirements for certain products imported from New Zealand, which would have incurred significant additional cost to our exporters. The avoidance of this testing was a significant cost saving for New Zealand importers and demonstrated the value of the publication (S MacDiarmid, pers. comm.).

In November 1987, the future of *Surveillance* was assured when the MAFQual board, under the chairmanship of the magazine's founder Royce Elliot, agreed unanimously that the publication should continue. The Chief Veterinary Officer at the time, John Hellström, outlined the major aims of *Surveillance*:

- to promote within the New Zealand veterinary profession a better understanding of the role and expertise of veterinarians employed by the Ministry of Agriculture and Fisheries, and to foster a good relationship between MAFQual and practising veterinarians;
- to promote to the veterinary profession the consultancy and laboratory services of MAFQual; and
- to promote New Zealand's veterinary infrastructure and animal health status to the state veterinary services of our overseas trading partners.

At the time, hard-copy editions of the magazine were sent to chief veterinary officers and veterinary policy makers of all countries with whom New Zealand had agricultural trade (MacDiarmid, 1988).

Cost savings were also achieved in 1988 when the edition changed from the smaller A5 format to an A4 format, which was cheaper to produce.

Surveillance became completely electronic in 2010 with only pdf

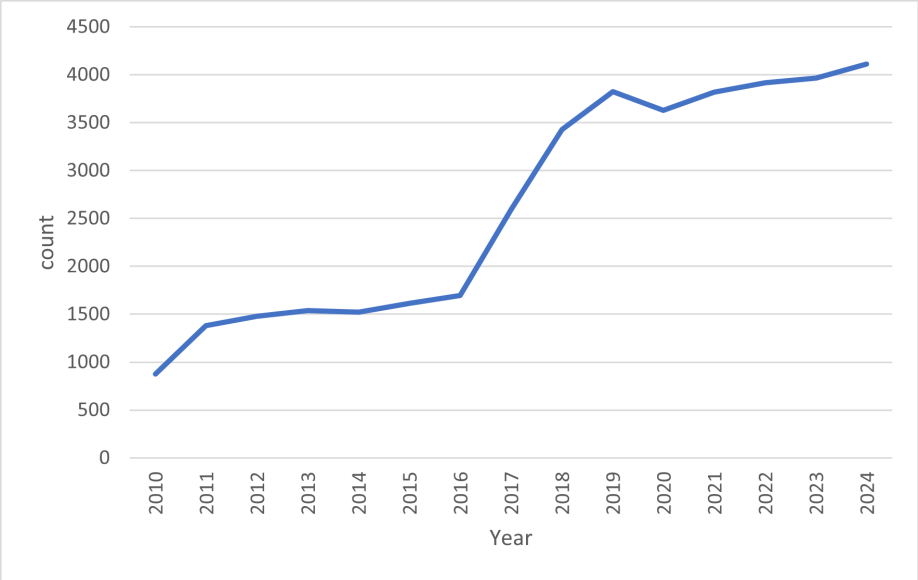


Figure 3: *Surveillance* subscribers 2010 to August 2024

versions of the publication being sent out to subscribers. At this stage the readership was about 1,200 people. A hard copy of the annual report was still produced until 2023, and was distributed to subscribers both domestically and internationally. In December 2010, a separate Aquatics team section was added to the edition, and in 2011 the Plants and Environment teams also had sections added. The 2011 Annual report was the first annual report to include reports from all biosecurity sectors – terrestrial and aquatic animals, plants and forestry, marine and environment. In 2024 *Surveillance* magazine has a readership of over 4,000 subscribers (**Figure 3**) in 53 countries.

As well as its core objectives, *Surveillance* continues to play a significant role in maintaining and furthering New Zealand livestock trade through providing a published, transparent record of the activities of New Zealand's veterinary authority and of disease occurrence within New Zealand. Most recently its articles on the eradication of infectious bursal disease serotype 1 (Tana et al., 2023) and *Theileria equi* (Tana et al., 2021) contributed epidemiology-based evidence for trade negotiations and for New Zealand's disease status claims. It is MPI's , as the WOAH New Zealand Veterinary Authority, official publication. It now has over 50 years' worth of information that is freely and easily accessible via the SciQuest platform (see *Information management and tools*, p. 47) and it has been instrumental in the development of the reports in this edition (**Figure 4**).

It is worth noting that when *Surveillance* was launched in the mid-1970s, the period was something of a golden era for MAF information published in various formats. As well as *Surveillance* there were magazines on fisheries (*Catch*), economics (*Agricultural Economics*), meat (*4quarter*), horticulture (*Growth*), genetics (*Flock and Herd*) and from the 1980s, a magazine on research (*Agrisearch*). In addition, there was the massive *AgLink* series of fact sheets and a very active MAF media effort through general and rural media outlets. Of significance here is that of all of these titles, *Surveillance* is the only publication still being produced, indicating the strategic importance of this specialised information channel for MAF/MPI's biosecurity functions and of the ongoing need to publish surveillance information in the credible format needed by stakeholders and overseas counterparts (P Stewart, pers. comm.).

Bovine Disease Surveillance Quarterly Report

In 2022 a companion report to *Surveillance*, the *Bovine Disease Surveillance Quarterly Report*, was developed. The Animal Health





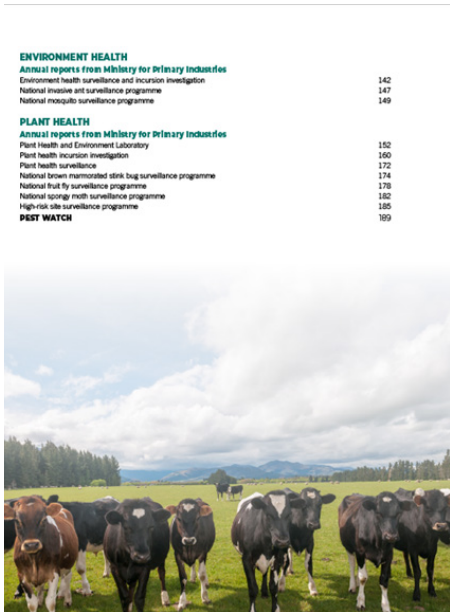


Figure 4: Cover and contents pages of *Surveillance* magazine, September 2024. Note the expansion in subject matter

Surveillance Programme collects anonymised data on all sick bovine cases seen by the veterinary diagnostic laboratories: Awanui (formerly Gribbles), SVS and IDEXX (see *New Zealand's animal health diagnostic laboratory network*, p. 25). These data provide valuable information for veterinarians, both on the clinical presentations (presenting signs) (**Figure 5**), 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 information may assist in identifying emerging diseases in a timely way.

As of mid-2024 the email subscriber list for this publication was nearly 1,000. This publication is another method where MPI can provide useful information from its surveillance programmes back to those who participate and contribute.

Sentinel

Established in 1989, brief articles on significant disease events were published in MAF's six-weekly publication *Sentinel*. In 1990 over 1,500 copies of each edition were distributed to national organisations, importers, exporters, veterinary practitioners, public libraries and educational institutes both in New Zealand and abroad, and to New Zealand government agencies and overseas authorities. The goal of the publication was to make agricultural security information readily accessible to beneficiaries and consumers, to make them aware of what was happening and to give them the opportunity to express their point of view before decisions were finalised or changes came into effect (MacDiarmid, 1991). Further detailed articles on significant disease events and epidemiological projects were either published in *Surveillance* or in refereed journals (McKenzie and Thompson, 1991). The last edition of *Sentinel* was published in 1997 (**Figure 6**).

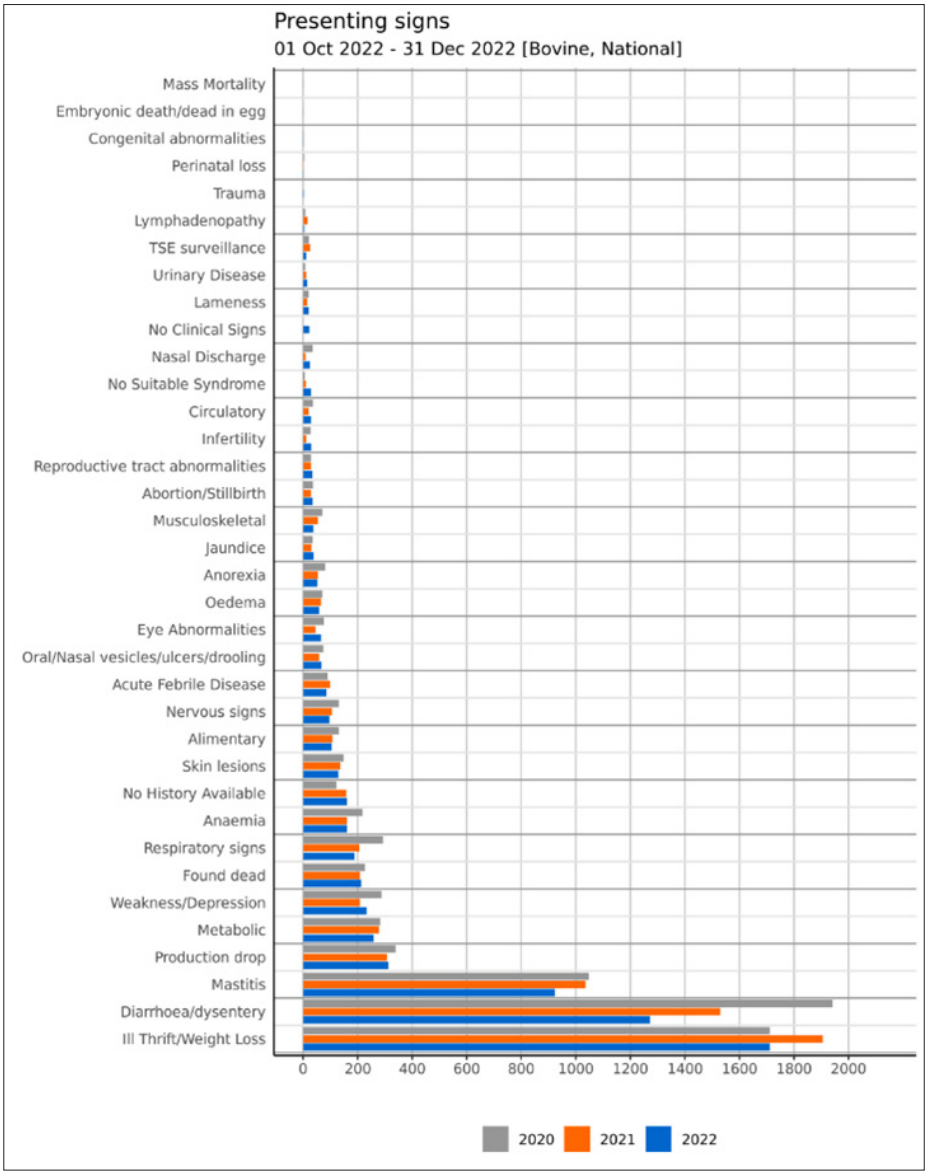


Figure 5: The presenting signs (syndromes) for the October–December period (fourth quarter),at a national level, for 2020, 2021 and 2022. These may indicate results for the same period in 2023



Figure 6: The first edition of *Sentinel* in November 1989 (top) and the last issue in December 1997 (bottom)

SciQuest

SciQuest was launched in 2003. MAF Biosecurity provided financial support to cover the costs of including *Surveillance* on the SciQuest platform, and to provide all users free access to *Surveillance* via SciQuest. Without that access, SciQuest was open only to New Zealand Veterinary Association members, *New Zealand Veterinary Journal* subscribers, and subscribers of any other journals hosted on the site (D Belton, pers. comm.).

SciQuest is a search engine and database of New Zealand veterinary literature and at the time, represented a significant step in simplifying access to this resource. With the addition of *Surveillance* to the SciQuest site, most of New Zealand's veterinary literature was now accessible through a single portal. The arrival of SciQuest was important for animal disease surveillance, as it provided ready access to reports from a variety of sources that could be used to summarise current disease status and to focus new investigatory and research projects (Belton, 2004).

Atlas of Biosecurity Surveillance

The *Atlas of Biosecurity Surveillance* was first published in 2011 with a new edition published online (www.mpi. govt.nz/dmsdocument/39674-atlas-of-biosecurity-2019) and in hard copy in 2020 (**Figure 7**). The Atlas of Biosecurity Surveillance is an illustrated 87-page publication to educate stakeholders, including international trade delegations, about Biosecurity New Zealand's animal, plant, marine and environment surveillance programmes. For each programme, the Atlas provides summary information in a less technical format than *Surveillance*, including the purpose of surveillance, how sampling is conducted, the history of incursions, and facts about some of the pests and diseases the programme aims to detect (Rawdon, 2020).

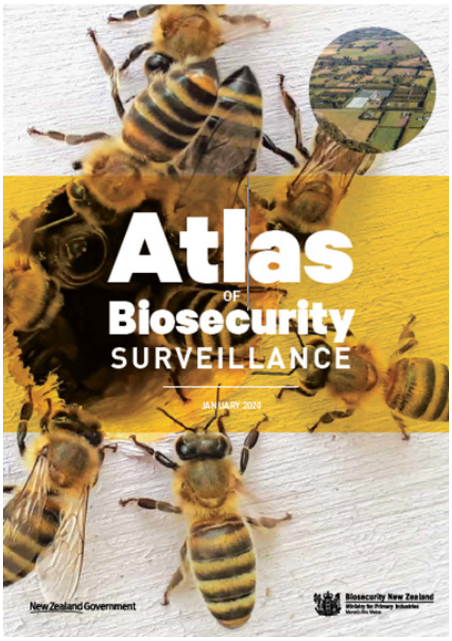


Figure 7: The cover of the 2020 edition of the Atlas of Biosecurity Surveillance

Animal Surveillance Engagement team

The animal disease surveillance function in MPI and its predecessors has always had a component focused on ensuring an ongoing programme of public, industry, farmer and veterinary awareness of the Exotic Pest and Disease hotline and the signs of significant exotic diseases. A method for stakeholders and the public to report suspect new and exotic pests and diseases to the veterinary authority is recognised internationally as a critical component of a biosecurity surveillance system. For this system to be successful, stakeholders need to be highly engaged and aware of what organisms or disease syndromes they should report and how to report them.

In early 2017, to strengthen MPI's engagement work, a permanent role was created within the Biosecurity Surveillance & Incursion Investigation (S&II) group to enhance the notification system's engagement programme. In 2019, a project was initiated to evaluate the existing engagement activities and to formalise an animal health surveillance engagement programme that continues to the present day. This project led to the development of the General Surveillance Engagement team within the S&II group in 2023. This team was created to support the formal engagement programme, and the S&II teams in awareness activities. However, all members of the S&II teams contribute to engagement activities. Key target audiences continue to be veterinarians, veterinary students, allied veterinary professionals, meat inspectors and farmers. Engagement activities include regular presentations, workshops, factsheets, newsletter and magazine articles, and advertisements (**Figure 8**).

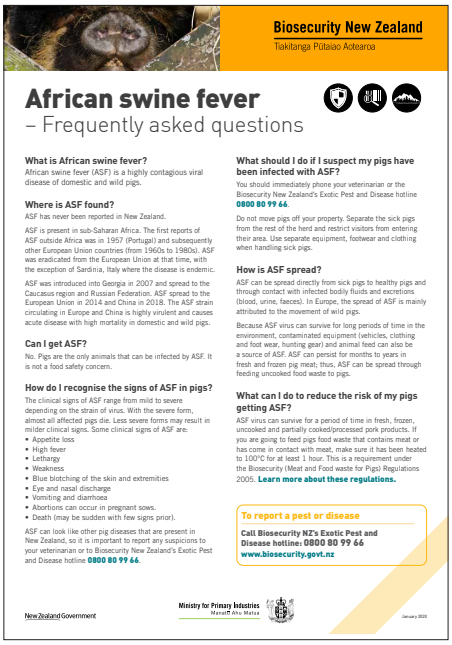


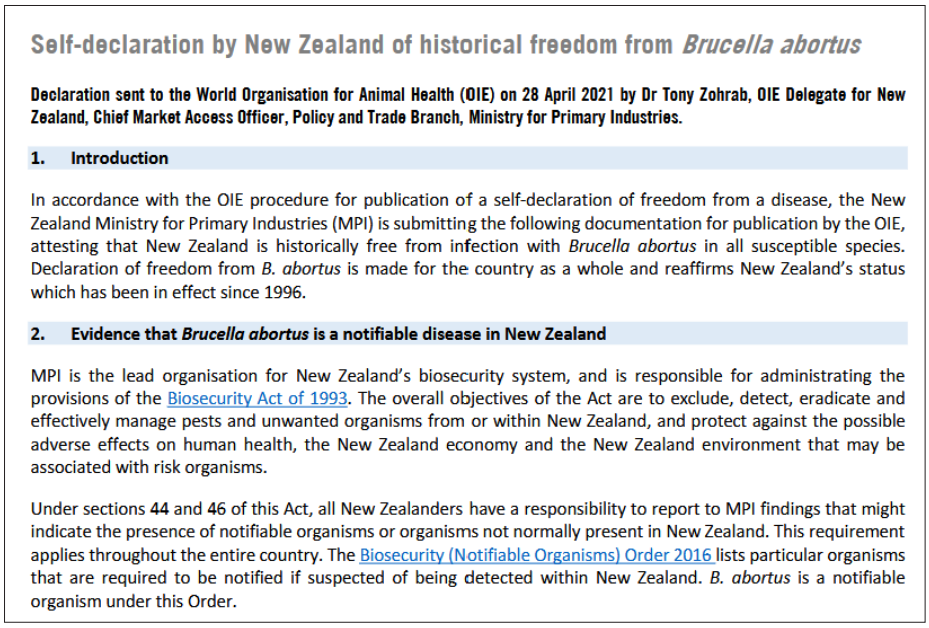
Figure 8: MPI African swine fever fact sheet

New Zealand animal disease status

Surveillance is integral to a country's statements of disease status supporting market access for New Zealand animal products and the legitimacy of import sanitary measures for animals and animal products. Consequently, the terrestrial animal and aquatic animal surveillance teams (and the surveillance predecessors), are responsible to for undertaking assessments of New Zealand's animal health status for pests and diseases, and provision of international reports on the health status of New Zealand's animal populations. Determinations of New Zealand's status is undertaken in alignment with the World Organisation for Animal Health (WOAH) terrestrial and aquatic animal health standards (**Figure 9,** next page).

Conclusion

Effective communication has always been an important part of an effective surveillance system. The fact that MPI (and its predecessor organisations) has been publishing *Surveillance* for over 50 years is testament to this. *Surveillance* has evolved to adapt



Self-declaration by New Zealand of historical freedom from *Brucella abortus*

Declaration sent to the World Organisation for Animal Health (OIE) on 28 April 2021 by Dr Tony Zohrab, OIE Delegate for New Zealand, Chief Market Access Officer, Policy and Trade Branch, Ministry for Primary Industries.

1. Introduction

In accordance with the OIE procedure for publication of a self-declaration of freedom from a disease, the New Zealand Ministry for Primary Industries (MPI) is submitting the following documentation for publication by the OIE, attesting that New Zealand is historically free from infection with *Brucella abortus* in all susceptible species. Declaration of freedom from *B. abortus* is made for the country as a whole and reaffirms New Zealand's status which has been in effect since 1996.

2. Evidence that *Brucella abortus* is a notifiable disease in New Zealand

MPI is the lead organisation for New Zealand's biosecurity system, and is responsible for administrating the provisions of the Biosecurity Act of 1993. The overall objectives of the Act are to exclude, detect, eradicate and effectively manage pests and unwanted organisms from or within New Zealand, and protect against the possible adverse effects on human health, the New Zealand economy and the New Zealand environment that may be associated with risk organisms.

Under sections 44 and 46 of this Act, all New Zealanders have a responsibility to report to MPI findings that might indicate the presence of notifiable organisms or organisms not normally present in New Zealand. This requirement applies throughout the entire country. The Biosecurity (Notifiable Organisms) Order 2016 lists particular organisms that are required to be notified if suspected of being detected within New Zealand. *B. abortus* is a notifiable organism under this Order.

Figure 9: Extract from New Zealand's 2021 published self-declaration of freedom from *Brucella abortus* (https://www.woah.org/app/uploads/2021/06/2021-04-new-zealand-brucella-abortus-self-declaration.pdf)

to the changed structures within the organisation and to modern technology, and continues to be a crucial repository of animal health information for New Zealand and a communication tool that supports trade. As well as *Surveillance*, there are multiple ways stakeholders can engage with the surveillance system. SciQuest has made New Zealand's published biosecurity information much more accessible.

References

Anonymous (1974). *Surveillance* versus the *New Zealand Veterinary Journal*. *Surveillance* 1(5), 5.

Belton D (2004). Introduction. *Surveillance* 31(2), 3.

MacDiarmid S (1988). Editorial – Future of *Surveillance*. *Surveillance* 15(1), 7.

MacDiarmid S (1991). Chief veterinary officer's annual report 1990 – Agricultural security. *Surveillance* 18(4), 4-6

McKenzie J, Thompson J (1991). New Zealand's animal health information system. Surveillance 18(5), 12–15.

Rawdon T (2020). Animal Health Surveillance & Incursion Investigation annual report. Surveillance 47(3), 18–24.

Tana T, McFadden A, Watts J, Eames M, Pearce P (2021). Re-establishing New Zealand's freedom from *Theileria equi* after the introduction of a single infected horse. *Surveillance* 48(3), 59–61.

Tana T, Mulqueen K, Russell J (2023). Eradication of infectious bursal disease virus type 1 from New Zealand commercial poultry. Surveillance 50(1), 5–11.

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New Zealand's animal health diagnostic laboratory network

An effective and world-class veterinary laboratory network is critical to trading partners having confidence in New Zealand's veterinary infrastructure and the animal health declarations that support our ongoing market access. We describe the evolution of that laboratory network from one that was fully government-owned to the present day, where there is a single National Reference Animal Health Laboratory and eight commercially owned veterinary laboratories.

National animal disease investigation laboratory

New Zealand's National Animal Health Laboratory (AHL), Wallaceville, Upper Hutt has provided a veterinary diagnostic service since its inception. Scottish-born John Gilruth, the first government veterinary surgeon, pioneered the establishment of a national animal disease investigation laboratory in New Zealand, which was also the first veterinary laboratory in the southern hemisphere. Gilruth initially used a small room in Government House equipped with an incubator and a microscope — with this equipment, he performed the bulk of New Zealand's veterinary diagnostic work (**Figure 1**). His postmortems on pigs and sheep were reportedly performed on the roof of the old Government Buildings on Wellington's Lambton Quay, the disposal of carcasses afterwards being an absolute nightmare. He was then given a converted generator shed, previously used for supplying power to Parliament Buildings, as a laboratory. Subsequently, the Wallaceville laboratory was established at his instigation and built in 1901–1905. Gilruth was appointed Officer in Charge – the first veterinary laboratory in the southern hemisphere (Tenquist, 1990). He was well before his time in believing that a 'one health' approach to disease diagnosis was needed, having diagnosed anthrax and tuberculosis in this country before 1900 (M Alley, pers. comm.). Gilruth is also credited, among other things, with founding the New Zealand Governmental Veterinary Service and setting up the NZ Meat Inspection Service (Tenquist, 1990).

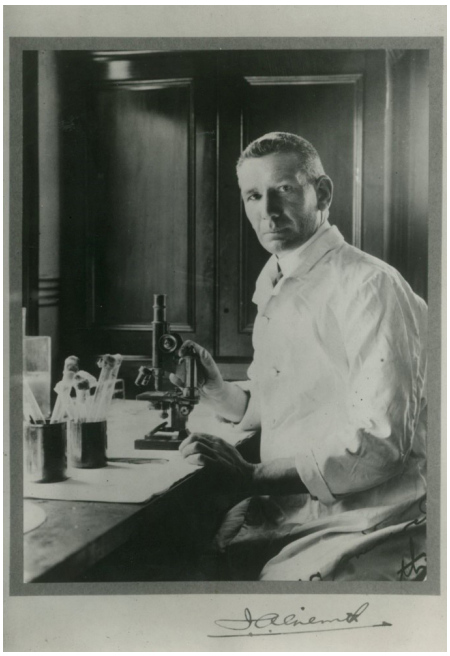


Figure 1: JA Gilruth; no date (Upper Hutt City Library Heritage Collections)

In its initial years, the Wallaceville site was not only a veterinary laboratory supporting disease investigations, but the entire Division of Veterinary Science (established by 1899, Department of Agriculture) was organised and directed by Gilruth from Wallaceville. Around 1906 this included 22 veterinarians: 18 were working on meat inspection and another four were involved in field work. In addition, 40 meat inspectors were stationed around the country (Tenquist, 1990).

During World War I the Wallaceville laboratory, along with its diagnostic work on livestock, became an equine hospital; research into controlling strangles was undertaken.

While diagnosis and control of disease was the overriding concern, the laboratory was reportedly well known for the varied projects it undertook (Tenquist, 1990), including vaccine production, vaccine and fertiliser treatment trials, toxicity studies and disease research. In the late 1930s an increasing priority for the laboratory was the development of veterinary research and it became the Wallaceville Animal Research Centre with strong microbiological, parasitological and nutritional sections. Former soldier Cyril Hopkirk became Director in 1924 (Tenquist, 1990). A diagnostic section was developed further in the early 1950s and histopathology was established as an important discipline (M Alley, pers. comm.).



Figure 2: Wallaceville Animal Research Centre staff in the 1950s. Standing; Graham Shirley, unknown, John Kicks, unknown, Bill Hartley, unknown, George Colello, unknown, unknown, Norm Hansen, Ray Salisbury. Seated: Second from left, Noel Williams, right hand end, Ray Russell

Bill Hartley joined the staff at Wallaceville in the early 1950s as a pathologist and diagnostician (**Figure 2**, previous page; see box below). He published more than 200 papers in scientific journals covering a huge range of diseases, thus becoming the 'grandfather' of veterinary pathology in New Zealand. His work confirmed the value of histopathology as a fast and efficient diagnostic discipline (M Alley, pers. comm.).



William ('Bill') Hartley was born in England in 1922 and graduated from the Royal Veterinary College in 1945. He worked in New Zealand until hypersensitivity to *Brucella abortus* forced his retirement from general practice. He moved to the Wallaceville Animal Research Station where he worked for 12 years before joining Sydney University in 1962. Keen to return to New Zealand, Bill accepted a diagnostic post at Wallaceville Animal Research Station NZ in 1981 and proceeded to establish the Pathology Register of Diseases of Farm Animals. He then returned to Sydney where he had a varied and international career. Throughout his 53 years in the veterinary profession, Bill Hartley enjoyed a distinguished and diverse career, with roles as a clinician, laboratory diagnostic officer, field disease investigator, researcher, and university lecturer.

https://journals.sagepub.com/doi/full/10.1177/0300985814565134

https://theveterinarian.com.au/?p=1849

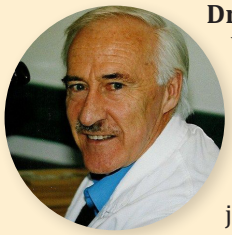
By 1954 the Wallaceville laboratory was examining over 38,000 specimens a year from 9,000 case histories. Consequently, a second diagnostic laboratory was established at Ruakura in 1956 (Tenquist, 1990) and David Dodd (later to become the first New Zealand diplomate of the American College of Veterinary Pathology), who had also worked at Wallaceville, was appointed Officer-in-Charge (M Alley, pers. comm.). During its first year in operation, the Ruakura site handled almost 21,000 specimens from over 4,000 cases (Tenquist, 1990). The animal health laboratories subsequently expanded into five regional labs in the 1960s with new facilities built at Invermay, Lincoln, Palmerston North and Whangārei, all mainly servicing production animals.

The veterinary diagnostic officers (later known as veterinary investigation officers or VIOs) associated with the regional laboratories undertook veterinary diagnostic pathology and were often provided on-site, rent-free accommodation. The accommodation at the Wallaceville Diagnostic Station (later known as the Wallaceville Animal Research Centre) included a 1930s villa found just two metres from the 'new' post-mortem room which received animals and specimens daily. This included many bovine tuberculous lymph nodes and lungs from the meat works, all handled without masks or fume hoods (M Alley, pers. comm.).

Before the 1960s, case records were accessed by a card index system with cases entered into about 10 pathological and aetiological categories. Detailed case reports were stored chronologically in voluminous filing cabinets. In 1967, MAF's first electronic database initiative was instigated by Maurice Alley (see box, right) and colleagues (Alley et al., 1968) with the support of Royce Elliot. The idea was to store and access electronically the vast quantity of data handled by diagnostic laboratories. The project was undertaken in collaboration with the Biometrics Division of the Department of Agriculture, who used the government IBM 360 computer in Lower Hutt, which required punch cards to input data.

Animal Health Division

In the 1970s the Animal Health Division of the Ministry of Agriculture and Fisheries was responsible for the veterinary diagnostic laboratories. The laboratory services section of



Dr Maurice Alley began as a MAF veterinary investigation officer in the 1960s. He joined Massey University as a Lecturer in Veterinary Pathology in 1968 and is now Professor with Wildbase Pathology. He has worked with some of New Zealand's most iconic and vulnerable birds. He was made a Member of the New Zealand Order of Merit in 2016 in recognition for his services to conservation and education.

https://tamiro.massey.ac.nz/nodes/view/4516

the Animal Health Division was headed by an Assistant Director and was regionally organised. There were 24 veterinary districts in all (**Figure 3**, next page). In each region except Hastings there was an animal health laboratory controlled by a superintendent and staffed by VIOs, scientists, technicians and clerks. During the 1970s and early 1980s, all diagnostic testing that was undertaken by veterinarians was conducted free of charge by one of the MAF veterinary diagnostic laboratories (VDL). This included all companion animal testing. MAF had a network of VDLs throughout New Zealand which, by the end of the 1980s, had increased to include Auckland (**Figure 4**, next page).

The Animal Health Reference Laboratory (and at the time the Central Brucellosis Laboratory) was and continues to be located at Wallaceville near Upper Hutt (Anon., 1979). In 1984 the Animal Health Reference Laboratory changed its name to the Central Animal Health Laboratory (Anon. 1984).

User-pays approach and restructure

By the early 1980s, indications were that the system was under financial pressure, with the ministry reporting that it was reviewing the value of abortion investigations in some areas,

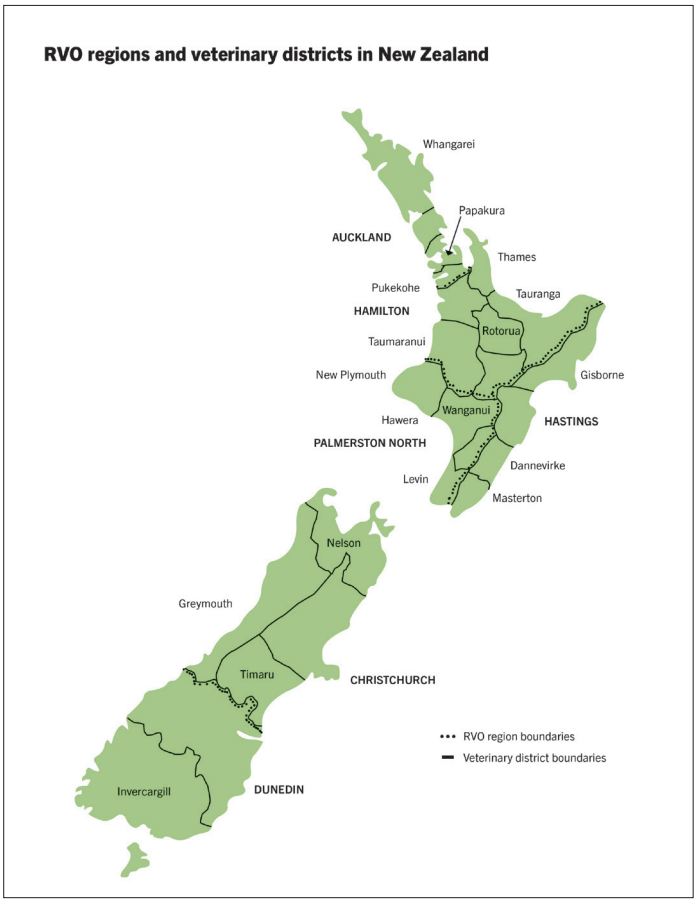


Figure 3: Regional veterinary offices and veterinary districts mid-1970s (adapted from Anon., 1979)



Figure 4: distribution of MAF veterinary diagnostic laboratories. Reproduced from *Surveillance* (Adapted from Anon., 1990)

the charges applied for export testing and the cost of the companion animal component of the workload. At the time, it was reported that the average cost of each diagnostic test was about $6.14 (Anon., 1980). By 1983 charging for companion animal work had begun (Black, 1987).

Following the 1984 election, significant impacts resulted from a change in government policy (see *New Zealand's animal disease surveillance system*, p. 25). The laboratory network was faced with the requirement to commercialise services. There were concerns about the challenge of providing services, that veterinary clients wanted, at fees they were prepared to pay. A significant issue was how surveillance would be conducted given the new commercial user-pays environment. Up to this point the laboratory network's primary purpose was the collection and collation of disease surveillance data; however, this might be at odds with client needs and their financial priorities (O'Hara, 1985).

Despite these concerns, market research conducted in 1992 demonstrated that the MAF Animal Health Laboratories (AHL) processed 80 percent of the total veterinary diagnostic caseload. This was estimated to comprise about 65 percent of the small animal and horse caseload, and over 90 percent of the farm animal caseload (McKenzie and Thompson, 1991).



Kerri Varney joined the Lincoln MAF Animal Health Laboratory in 1988 as a clinical pathology technician. She became the Laboratory Manager in 1997. In 1998, she played a key role in helping a team of experienced technical and veterinary staff establish a new private laboratory business called Labworks. Kerri remained active in the veterinary laboratory field until she joined MPI's Live Animal Import/Exports and Verification Team in Christchurch in 2024.

In 1998, staff at the MAF-operated AHLs were informed that the future of the laboratories was under review with closure, a reduced number of sites, reduction in services or maintenance of the status quo all being considered. Consequently, staff at the MAF Lincoln site resigned and opened Labworks under private ownership (see box, left). Similarly, staff from Invermay AHL set up Labnet under private ownership in 1998/99 and the Invermay MAF AHL no longer existed (K Varney, pers. comm.). The remaining MAF sites (including the MAF Lincoln site) continued to operate (some with reduced services) but were rebranded as AgriQuality.

Animal Health Surveillance programme

The current Animal Health Surveillance programme began in the late 1990s. Up until 1996, the Animal Health Surveillance programme had obtained surveillance information via the network of five regional and one central government-owned veterinary diagnostic laboratories (**Figure 5**, next page).



Figure 5: Animal Health laboratories 1995 (adapted from Orr and Black, 1996)

However, by 1995 a private veterinary diagnostic laboratory located in Hamilton, Alpha Scientific Ltd, was handling a significant proportion of the total farmed animal caseload. To ensure that critical information was not lost, MAF's Regulatory Authority developed a cost-effective and equitable means of purchasing surveillance information from the private veterinary diagnostic laboratories (see the 'Animal Health Surveillance programme' in *New Zealand's animal disease surveillance system,* p. 6).

National Centre for Disease Investigation (NCDI)

In 1996 the government undertook an independent review of the functions of MAF Quality Management, the delivery arm of MAF. This review concluded that the central reference laboratory for exotic diseases of animals and the critical resources to plan and manage a response to an incursion of exotic disease should remain in Crown ownership. Other laboratory services and the specific expertise and resources required during an exotic disease response could be delivered through contractual relationships with third party suppliers (Davis 1999). This led to the establishment, on 1 November 1998, of the National Centre for Disease Investigation (NCDI) on the AgResearch Wallaceville campus.

Before 1998, delivery of exotic disease management, disease surveillance and specialised diagnostic capabilities had been contracted by MAF as secondary services provided by a number of external delivery agencies. This had worked well, but it was not a sharply focused approach, and MAF did not always have the necessary degree of control in system development. Hence, MAF established its own capability through the NCDI to conduct some of these activities, delivered to standards developed by the MAF Regulatory Authority. Some field services and routine diagnosis remained contracted to other members of the veterinary profession such as practitioners, laboratory diagnosticians and industry veterinarians.

The NCDI sat in the Operations directorate of MAF and provided surveillance services to the MAF Biosecurity Authority. The NCDI had two functionally distinct but interrelated parts:

1. Exotic disease management and disease surveillance were delivered by a group of veterinarians within an Exotic Disease Response Centre (see *Incursion investigation* p. 32).
2. Diagnostic services provided by veterinarians, scientists and technicians working in the New Zealand Animal Health Reference Laboratory (AHRL).

The total staff complement was 38, of whom 10 were registered veterinarians. Another four specialist microbiologists had veterinary training but were not registered in New Zealand (Davis, 1999).

The primary function of AHRL was to meet the requirements of the Chief Veterinary Officer within the MAF Biosecurity Authority for the diagnosis of exotic disease of animals and the design and implementation of surveys to confirm New Zealand's freedom from exotic unwanted organisms. Additionally, AHRL also provided endemic disease testing for livestock diseases of importance to MAF Biosecurity where those tests were not provided by commercial laboratories. AHL also did diagnostic testing of samples supporting export, contributed to technical articles for *Surveillance*, and ran technical audit and intra-laboratory comparison programmes for the accreditation

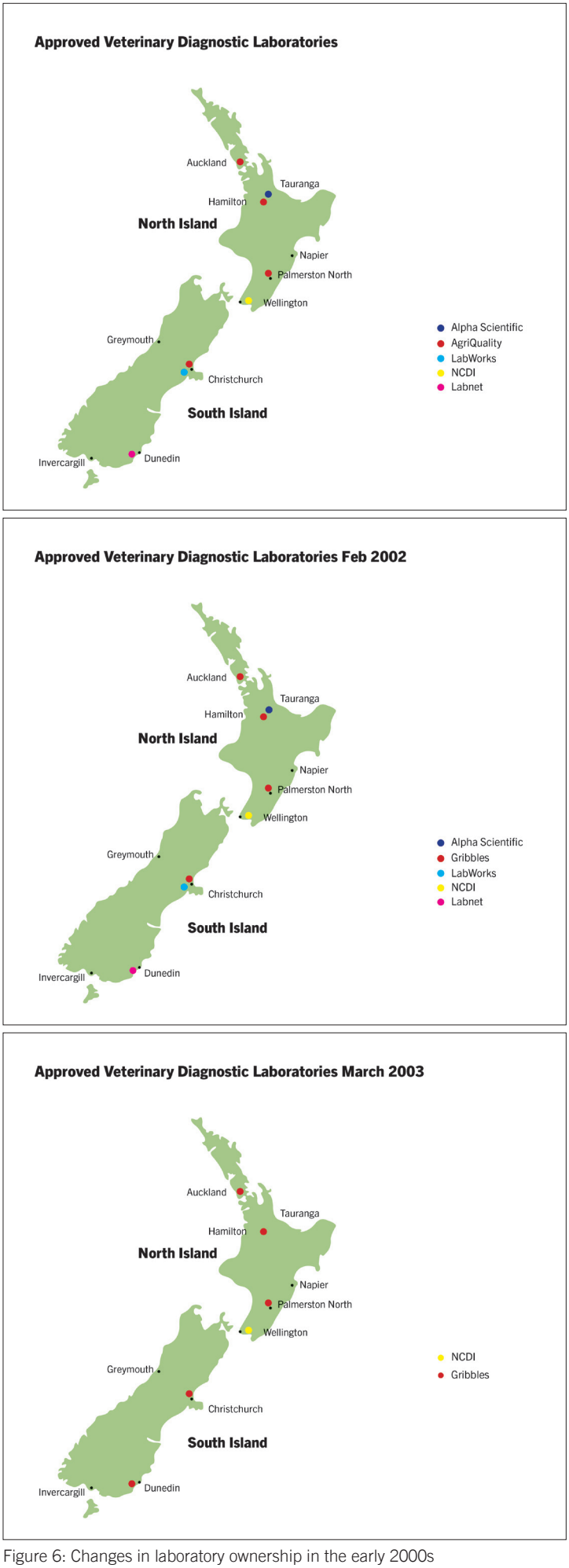


Figure 6: Changes in laboratory ownership in the early 2000s

of private laboratories that wished to supply passive surveillance information to the Crown (Davis, 1999).

The NCDI was succeeded by the Investigation and Diagnostic Centre (IDC) (V Herrera, pers. comm.).

Commercial veterinary laboratories

At the start of 2000, the laboratory network was made up of Labnet in Dunedin, Labworks in Christchurch, AgriQuality in Palmerston North, Hamilton and Auckland, Alpha Scientific in Hamilton and the Central Animal Health Laboratory in Wallaceville.

By mid-2002, Gribbles succeeded in purchasing Labnet, Labworks and Alpha Scientific. By 2003 they had also purchased the AgriQuality labs, so by late 2003, Gribbles owned of all New Zealand's private veterinary laboratories. The Animal Health Reference Laboratory in Wallaceville, Upper Hutt, remained in public ownership (**Figure 6**).

This changed in 2005 when New Zealand Veterinary Pathology Ltd (NZVP) entered the market and subsequently became part of the Animal Health Surveillance programme. A former pathologist from Alpha Scientific, together with a laboratory owner from the human sector, identified an opportunity for a new independent, New Zealand-owned veterinary laboratory. Massey University was approached and agreed to become a shareholder on the basis they could make space available in the Institute of Veterinary Animal and Biomedical Sciences (IVABS), thus gaining an on-site laboratory. Massey engaged a veterinary group to provide management and marketing capabilities and also became a foundation shareholder (R Campbell, pers. comm.).

In 2015, NZVP was bought by the United States-based, multinational IDEXX Laboratories. At this time the two participants in the Animal Health Surveillance programme were Gribbles and IDEXX. In 2016, New Zealand-owned SVS Laboratories in Hamilton entered the New Zealand market. This laboratory was audited to ensure it could comply with the contractual requirements of the Animal Health Surveillance programme and commenced being a participant in the programme in December 2016. In 2024 Gribbles changed its name to Awanui. As of 2024, three laboratories are participants in the Animal Health Surveillance programme: Awanui, IDEXX and SVS. Data collected from this programme have steadily increased over the past two decades (**Figure 7**, next page).

Meanwhile, leveraging off the established relationships with the veterinary laboratories, detailed design work for a live animal antimicrobial resistance (AMR) surveillance programme began in 2021, with a finalised design successfully presented for funding in May 2022. The programme was initiated in June 2022 with the three veterinary diagnostic laboratories uploading anonymised live animal AMR data directly into the Surveillance & Incursion Investigation (S&II) Surveillance Information Management

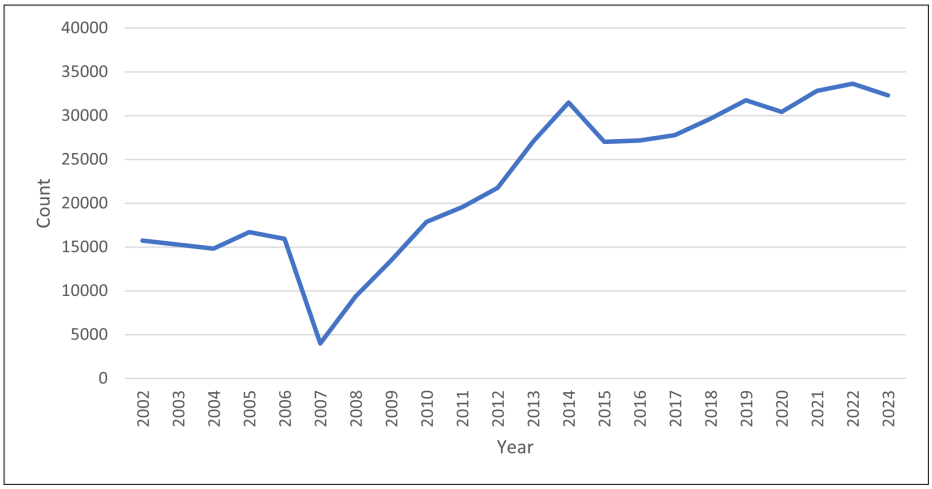


Figure 7: Laboratory submissions to the Animal Health Surveillance programme 2002–2023. Before 2002, all reports to the veterinary diagnostic laboratories were reported in *Surveillance*; consequently the number reported was significantly higher than for the years immediately following, due to the earlier inclusion of companion animal cases (Poland, 2003). The drop in case numbers in 2007 was due to contractual changes with the veterinary diagnostic laboratories that were subsequently reversed

System (SIMS) (see *Information management and tools,* p. 47). The initiation of this programme meets the objectives within the AMR Action Plan (chrome-extension://aidnbmnnnibpcajpcglclefindmkaj/https://www.mpi.govt.nz/dmsdocument/19391-NZ-Antimicrobial-Resistance-Action-Plan). In 2023 this programme was fully handed over to the new AMR team within the MPI Agricultural Compounds and Veterinary Medicines group.

National Centre for Biosecurity and Infectious Disease (NCBID – Wallaceville)

In 2007, MAF's Investigation and Diagnostic Centre at Wallaceville in Upper Hutt became part of the National Centre for Biosecurity and Infectious Disease (NCBID – Wallaceville). The NCBID – Wallaceville involved staff from four government research organisations: AgResearch, AgriQuality, Environmental Science and Research and MAF. It aimed to bring together experts in research and diagnostics to achieve outcomes for the veterinary and medical communities (a 'one health' approach). It was intended that the Centre would provide synergies in diagnostics (improved capability, new method implementation, access to a wider range of technical skills) and the development of research programmes in areas that could not be implemented elsewhere (for example, high-risk zoonotic pathogens) (O'Keefe, 2007).

National Biocontainment Laboratory

In 2012 MPI had both high- and medium-level containment laboratories on the Wallaceville site to support veterinary biosecurity operations for surveillance and incursion investigation. The high-level (PC3) laboratory had an excellent safety record, but it was small and nearing the end of its 15 to 20-year design life. When it was built in 1998, the design did not anticipate the advent of fast and accurate molecular diagnostic techniques. Consequently, in 2013, planning for the new national biocontainment facility at Wallaceville commenced. Over the next three years, detailed investigations influenced the design of the new lab. A thorough identification of business and user requirements determined the key components of the design. Careful assessment of biological risks, with benchmarking against international best practice, worldwide containment standards and comparison with similar facilities in Australia, North America and Europe, were all used to understand and develop a design response to operational risks. Included in the design was advanced seismic protection so the new laboratory met Important Level 4 building standards (the same as for buildings with critical national functions such as tertiary hospitals). It is base isolated, with a tolerance of 900 mm sideways movement, and able to withstand a one-in-2,500-year earthquake (O'Keefe, 2015).

Construction on this NZ$87m project began in 2015 and ended in 2020. Extensive and detailed testing of the new National Biocontainment Laboratory (NBL) and its systems was undertaken, including how the building reacts to system failures and emergencies. The laboratory met or exceeded international standards and at the end of 2020 the first part



Figure 8: Ministry for Primary Industries National Biocontainment Laboratory

of it was certified for biosecurity operations (O'Keefe, 2021). All AHL operations moved into the NBL in February and March 2021 (**Figure 8**, previous page) (O'Keefe, 2022).

Conclusion

New Zealand has a world-class veterinary laboratory network supporting the New Zealand veterinary services in the investigation and diagnosis of disease. This network plays a critical role in the New Zealand biosecurity surveillance system.

For more than 118 years, from the pioneering public laboratory initiative of the early 1900s to the private laboratory network and public national reference laboratory present today, New Zealand has maintained quality veterinary diagnostic laboratory capability, supporting the investigation and diagnosis of disease, targeted surveillance and veterinary services research, and the country's biosecurity defences.

References

Alley MR, Beck BE, Lyons D, Smith BL (1968). Letters to the editor: Electronic data-processing in diagnostic laboratories. *New Zealand Veterinary Journal* 16(7), 129.

Anonymous (1979). Animal Health Data – Animal Health Division organisation. *Surveillance* 6(2), 16–19.

Anonymous (1980). Editorial. *Surveillance* 7(5), 2.

Anonymous (1984). Organisation and staffing of Animal Health Division. *Surveillance* 11(4), 9–11.

Anonymous (1990). Chief veterinary officer's annual report 1989 – Appendix 1: MAF Quality Management regional distribution. *Surveillance* 17(3), 19.

Black H (1987). Laboratory services for companion animals, *Surveillance* 14(2) 3–4.

Davis H (1999), Structure and functions of MAF's National Centre for Disease Investigation. *Proceedings of the Deer Branch NZVA* 16, 163–166.

McKenzie J, Thompson J (1991). New Zealand's animal health information system. *Surveillance* 18(5), 12–15.

O'Hara P (1985). Chief veterinary officer's annual report 1985. *Surveillance* 12(4), 4–5.

O'Keefe J (2007). Reports from Biosecurity New Zealand - Investigation and Diagnostic Centre – Wallaceville. *Surveillance* 34(2) 17–18.

O'Keefe J (2015). Building our biosecurity capability. *Surveillance* 42(3), 3–4.

O'Keefe J (2021). Animal Health Laboratory annual report, *Surveillance* 48(3), 12–18.

O'Keefe J (2022). Animal Health Laboratory annual report, *Surveillance* 48(3), 11–18.

Poland R (2003). Reports from MAF Biosecurity Authority - Animal disease surveillance. *Surveillance* 30(2), 9–11.

Tenquist J (1990). *Wallaceville Veterinary Laboratory: an anecdotal history*. MAF Technology Publication 77. 196 p.

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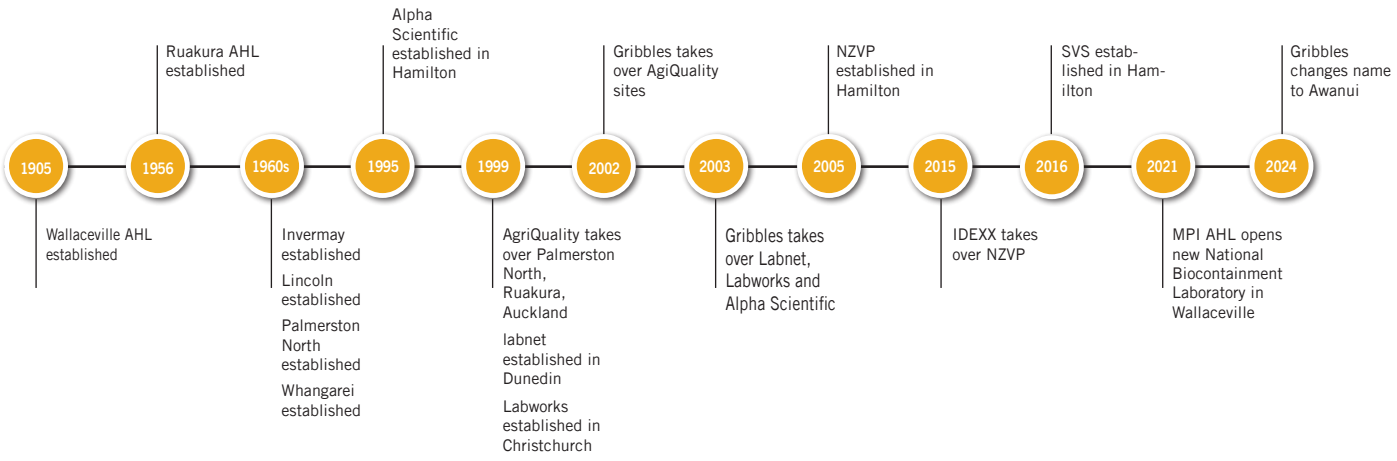
Timeline of the animal health laboratory network



Incursion investigation

Introduction

The prompt detection of an exotic pest or disease is critical to ensure a successful response to the incursion and to keep negative impacts to a minimum. New Zealand relies heavily on its primary sector so an outbreak of a significant animal disease could have major implications for both animal health and the economy. One just needs to look at the devastating impacts of the 2001 foot and mouth disease outbreak in the United Kingdom to illustrate this point (BBC, 2016). Here we describe the evolution of the incursion investigation function that has protected New Zealand livestock for the past 50 years.

Animal Health Division

In the 1970s the Animal Health Division of the Ministry of Agriculture and Fisheries (MAF) was responsible for animal health in New Zealand. This included preventing the introduction of exotic animal diseases and investigation of livestock diseases (Anon., 1980).

The field service of the Animal Health Division was organised regionally. The Field Services had six regional veterinary officers stationed at Auckland, Hamilton, Hastings, Palmerston North, Christchurch and Dunedin. Each region was divided into several veterinary districts staffed by one or more veterinary officers, livestock officers and clerks. There were 24 veterinary districts in all, each with their own staff and laboratory (**Figure 1**) (see *New Zealand's animal disease surveillance system*, p. 6). MAF livestock officers were responsible for understanding the livestock populations in their area and providing technical services as required. These individuals were in regional offices and were on call 24 hours a day, seven days a week. Where a private veterinarian suspected an exotic or emerging disease, they would call the local veterinary officer who would then attend the call (Hellström, 1990).

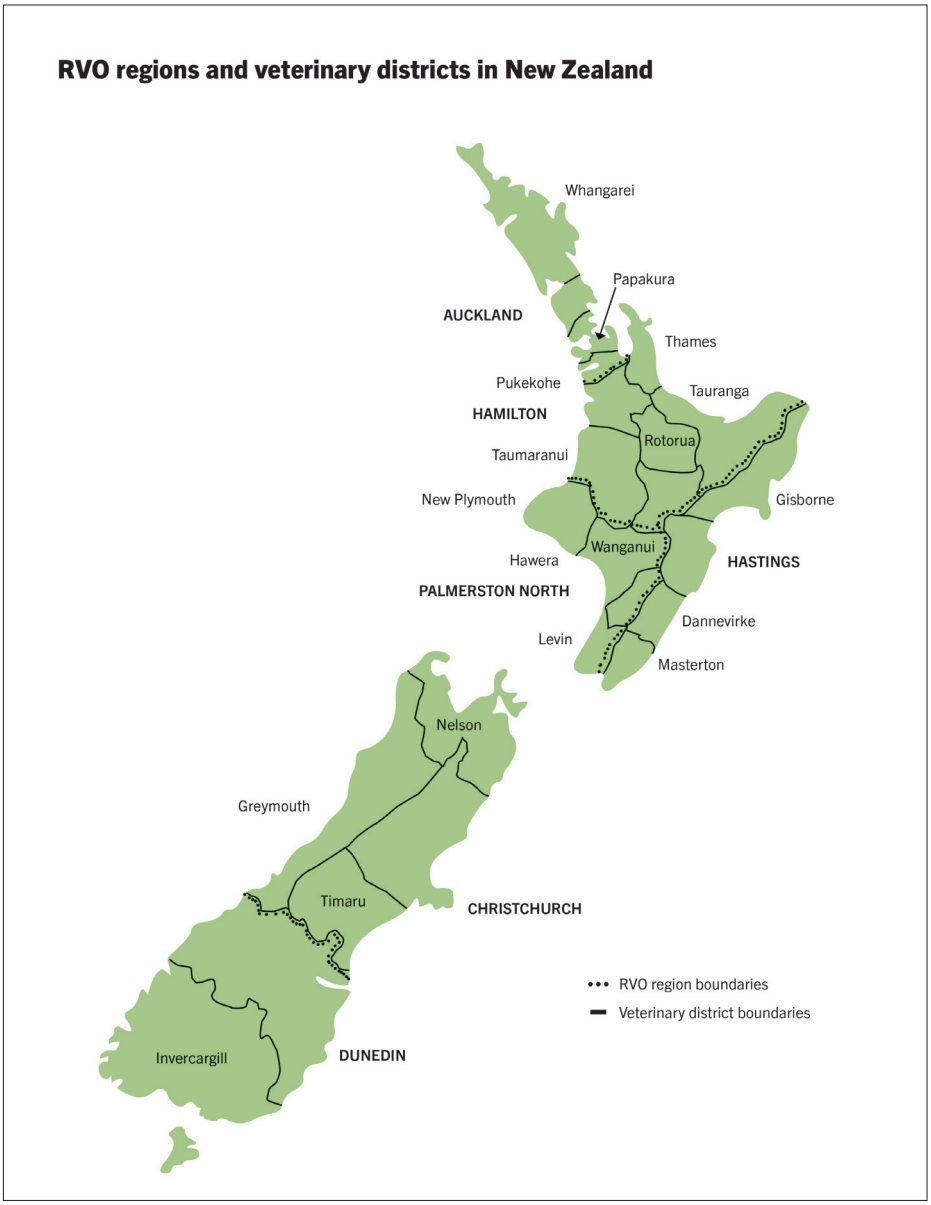


Figure 1: Regional veterinary offices and veterinary districts in the mid-1970s (adapted from Anon., 1979)

Exotic disease calls were based on foot and mouth disease (FMD) protocols. A veterinary officer would normally lead with a livestock officer. If they could not rule out FMD, a veterinary officer 2 (VO2) was sent out. The VO2s generally had experience with FMD or were more senior veterinarians. All VO2s had experience of seeing live FMD cases. If the VO2 could not rule out FMD, an FMD response was initiated (contact tracing, surveillance patrols, restricted place notices, movement controls, etc.) and samples were collected and sent to the Animal Health Laboratory (AHL) Wallaceville. These samples were then packaged and sent to the Pirbright Institute laboratory in the United Kingdom. The samples were carried by a MAF person from the farm under investigation to Pirbright (for fear of samples being misplaced en route). The initial FMD response mechanism was highly specified with significant detail including flow charts, time limits for getting to the farm, reporting back, etc. An FMD response could only be initiated by the Chief Veterinary Officer (CVO) and was supported by all the head office apparatus (legal services, etc.). It was very rare to get to initiate an FMD response.

The Temuka incident



Slaughtered pigs being buried during the Temuka response in 1981. Photo: Barry Philips/ South Canterbury Museum

'John Dennis remembers feeling his heart fall through his gumboots on February 10, 1981, when he found blisters around his pigs' mouths and near their feet. "They had lesions on the feet and mouth, and temperatures, and I thought the worst. That's why I rang the vet." Over the next few days the whole country held its breath, the share market shook and Mr Dennis, aged 25, was trapped on his quarantined farm near Temuka in the eye of a hurricane of activity. Though only 28 pigs showed symptoms, all 800 on the property were slaughtered by officers of the then Ministry of Agriculture and Fisheries (MAF). The news broke on February 13, and much of South Canterbury was quarantined because of the suspected foot-and-mouth disease outbreak at the farm. Movement of animals in and out of the South Island was suspended. A movement control zone was enforced for 50km around the farm, and in a 3-km radius a 'stand still' area was decreed. These zones were gradually reduced until the final clearance was given on February 27. The local police force was increased by 35, and more than 60 MAF officials arrived on the scene. But no other animals showed symptoms and it was soon apparent it was only a scare, though samples were flown to Britain for testing.'

New Zealand Herald, 25 February 2001 (abridged)

The so-called Temuka incident of 1981 (Anon., 1981; see left box) is the best documented example of such an FMD response (D Belton, pers. comm.; see right box). The VO2s at the time included Jim Hutton (VO2 for the Temuka incident), and Hugh Black. Both had attended the UK 1967 outbreak, and at the time of the Temuka incident were also VIOs (Jim Hutton at Lincoln, and Hugh Black at Whangārei). Various others had been to observe controlled FMD in containment facilities at Gross Isle (Canada), and Plum Island (United States), and a few practitioners had been sent to Thailand to see FMD in the field (D Belton, pers. comm.).

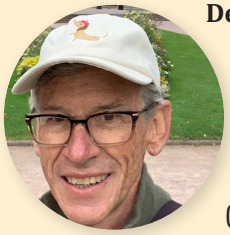
For other exotic diseases, the veterinary officer and livestock officer conducted investigations with subsequent samples sent to the reference AHL at Wallaceville for testing.

Notifiable lists

Veterinarians were required to report diseases included in the notifiable lists. These lists were less extensive than the current Notifiable Organisms list (under the Biosecurity Act 1993) and were focused largely on diseases that were a differential diagnosis for FMD. During this period, FMD was considered the most significant exotic disease (Animals Act 1967).

Exotic disease preparedness

In preparation for an exotic disease incursion, a contingency plan existed and was being continuously updated. To ensure that Animal Health Division staff and practitioners had up-to-date knowledge of exotic diseases, the division ran annual exotic disease control courses for its staff and for practitioners at Flock House, about 14 km outside Bulls. There was an expectation that all veterinarians would avail themselves of these courses so that, in the event of an exotic disease outbreak, they would be prepared and able to assist in any response (Guild and Houldgreaves, 1980). Training regional infrastructure for the detection and response to foot and mouth disease was a principal focus.



Derek Belton – BVSc, BPhil (vet pathology), Dip Bact (microbiology), and MANZCVSc (epidemiology).

Derek joined MAF at the Whangārei Animal Health Lab 1978–1987, and then the Auckland Animal Health Lab 1987–1996 (and ESR 1996–1999). He joined MAF Biosecurity in 1999 as Programme Manager Surveillance & Response, then became Director Animal Biosecurity 2000–2004, and Manager International Organisations 2005–2012.

Exotic disease investigation and response

Through 1987 and 1988, a major reorganisation within MAF resulted in the establishment of MAF Quality Management (see *New Zealand's animal disease surveillance system*, p. 6). Further significant change occurred in 1990 as those veterinary roles that formulated policy and set standards were separated from those that delivered services. The Chief Veterinary Officer (CVO) and the veterinary epidemiology group staff were placed in MAF Policy while the operational veterinary staff remained in MAF Quality Management.

Consequently in 1990, the Exotic Disease and Pest Response (EDPR) Policy Advisory Group was responsible for designing specifications for containment and eradication of exotic diseases should they enter the country. The CVO used these specifications to negotiate with MAF Quality Management (the delivery organisation) for the provision of EDPR services. The group was also responsible for assessing the adequacy and effectiveness of MAF Quality Management systems in meeting the specifications set for the investigation and eradication of exotic diseases. In 1990 suspect cases of exotic disease were reported to MAF Quality Management at a

frequency of about one call every two weeks. Investigations were carried out on cases suggestive of foot and mouth disease, bovine spongiform encephalopathy, Akabane disease, bluetongue, equine viral arteritis, equine vesicular stomatitis, scrapie and rabies. All investigations followed specified procedures and exotic disease was eliminated on the basis of clinical and laboratory diagnosis. In each case an endemic condition was diagnosed (MacDiarmid, 1991).

Exotic Disease Response Centre

The establishment of MAF's National Centre for Disease Investigation (NCDI) has already been described in *New Zealand's animal health diagnostic laboratory network.*

NCDI's functions included exotic disease management and disease surveillance, delivered by a group of veterinarians within an Exotic Disease Response Centre (EDRC). These veterinarians were called Exotic Disease Diagnosticians but also referred to as Exotic Disease Investigators.

The EDRC had three core functions:

- to investigate and manage exotic, new or emerging diseases within policy guidelines provided by the MAF Biosecurity Authority;
- to design (where necessary), implement, analyse and report surveys as agreed with the MAF Biosecurity Authority to verify New Zealand's disease status or to gain information on endemic disease; and
- to compile international disease status reports for submission by the MAF Biosecurity Authority.

Veterinarians within the EDRC were responsible for the design and delivery of disease response systems according to specifications written by MAF Regulatory Authority. All suspected exotic or emerging diseases of animals, bees or fish were logged at the EDRC via a 24-hr 0800 exotic pest and disease hotline, (which still operates today). An Exotic Disease Response Manager took the call and discussed the case with the caller then acted as appropriate. The Exotic Disease Response Manager could decide to send a veterinarian from the EDRC to a property. Otherwise, a specially trained veterinarian from an external agency would attend (see 'Initial Investigating Veterinarians', next page).

The Exotic Disease Investigator's main duties were containment, disease diagnosis, sample collection and gathering of epidemiological data. Epidemiological data were transferred electronically to the EDRC for analysis by epidemiologists. At this time, Geographic Information Systems (GIS) technology was becoming important for disease outbreak analysis and modelling (Thornton, 1999). The investigators had Biosecurity Act regulatory powers and instruments needed to implement local control procedures should a disease response be declared.

In 1998 the EDRC received about 5,000 calls a year to the exotic pest and disease hotline, of which one or two each day related to suspected exotic disease. These calls led to further investigation by NCDI staff about once a week (Davis, 1999). In 2002 there were a total of five Exotic Disease Investigators: Paul Bingham, Mark Bosson, Caleb King, Clifton King and Graham Mackereth, managed by Ron Thornton (P Bingham, pers. comm.).

To ensure a standardised approach to investigation of high-impact diseases (e.g., foot and mouth disease), standard operating procedures were developed. These SOPs have continued to be used and are regularly reviewed and updated (P Bingham, pers. comm.).

Should an investigation transition to a response, the planned EDRC response structure followed the Coordinated Incident Management System (CIMS) (as MPI does now), which is the same model used by other emergency response organisations such as the NZ Police, FENZ, and Civil Defence. A National Control Centre (at the time essentially MAF Biosecurity Authority) provided policy direction (strategy) while the EDRC managed the response within policy guidelines (tactics). A Field Outbreak Response Team implemented field activities. In the CIMS model, an Incident Controller is responsible for effectively progressing the response. There are managers for Logistics, Operations and Intelligence. 'Logistics' facilitates the response. 'Operations' deals with tracing, movement control, prioritisation of inspections, mapping and industry liaison. 'Intelligence' provides technical information – anything from information about the agent to modelling the disease outbreak and possibilities for control, e.g., pre-emptive slaughter or vaccination (Thornton, 2001).

The NCDI was succeeded by the Investigation and Diagnostic Centre (IDC) (V Herrera, pers. comm.).

Biosecurity New Zealand

When the MAF Biosecurity Authority was restructured in 2004 and MAF Biosecurity New Zealand (MAFBNZ) was established, there was a move from a sector-based system to a function-based system (see *New Zealand's animal disease surveillance system* p. 6). At this time, the plants and animals investigation teams were brought together under a senior manager. Concurrently, a dedicated aquatic pest and disease investigator was included in the animals investigation team. The job title for the animals members of this larger group changed from Exotic Disease Investigators to Incursion Investigators given the broader scope (P Bingham, pers. comm.).

AsureQuality

In 2010, another initiative aimed at improving New Zealand's response to any incursion was launched, with MAFBNZ establishing a long-term relationship with AsureQuality, a state-owned enterprise and provider of food-quality assurance and biosecurity services. AsureQuality would provide all response operations on behalf of MAFBNZ including building and maintaining a capability network and supporting systems to contain the widest possible inventory of organisations and individuals who have capability and willingness to deliver skills, equipment, materials or services for biosecurity responses (Clift, 2010). This initiative was replaced in mid-2020 by the Biosecurity New Zealand Response

Services (BioNZRS) panel (B Dearsley, pers. comm.).

Biosecurity Incursion Investigation (Animal Health) team today

The present-day Biosecurity Incursion Investigation (Animal Health) team, which undertakes investigation of reported disease events for terrestrial animals, is made up of seven veterinarians with extensive New Zealand veterinary experience and overseas training in diagnosis of exotic animal diseases such as FMD. All Incursion Investigators (II) are inspectors under the Biosecurity Act 1993, with certain powers and responsibilities. The team is located at the MPI Wallaceville site. All have a veterinary degree registered with the New Zealand Veterinary Council and either already have a post-graduate qualification in epidemiology or are studying towards it. Any suspected exotic or emerging pests or diseases are called into the MPI freephone 0800 80 99 66, where the call is triaged by a call centre, and if appropriate, an II is paged. Incursion Investigators are on call 24 hours a day, seven days a week, 365 days of the year and a system is in place to ensure that any page is responded to within 15 minutes.

Veterinary pathologists in the veterinary diagnostic laboratories represent a very important source of notifications and as such are a key component of the general surveillance system. To improve the efficiency of the notification process for pathologists, a streamlined system was organised to ensure that notifications are as easy as possible for these key stakeholders. Data management and reporting is undertaken within the Surveillance Information Management System (see *Information management and tools*, p. 47).

Initial Investigating Veterinarians (IIV)

Where a notification requires urgent on-farm investigation (e.g., for a suspect case of FMD), the Initial Investigating Veterinarian system (IIV) can be initiated by an II.

Initial Investigating Veterinarians (IIV) are a network of veterinarians managed on behalf of MPI by AsureQuality.

The IIV network was initiated in 1998 as part of the NCDI and was/is managed by EDRC.

As of 2024, 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, with IIVs required to respond, investigate and make an initial report on a case of suspected vesicular disease (e.g., FMD) within five hours (O'Connell, 2020).

Almost everyone in the IIV network has received specialist training through MPI-sponsored European Union FMD (EuFMD) courses in Nepal or Kenya. All IIVs also participate biennially in a refresher course in New Zealand, which covers core competencies including knowledge of legal powers, biosecurity protocols, differential diagnosis of exotic vesicular disease, and the investigation and epidemiological approach for excluding FMD (McFadden, 2011). The biosecurity protocol for visiting a farm under investigation for FMD follows very detailed and prescribed steps to ensure a high level of confidence that infectious agents are not conveyed to other, non-affected properties that may be visited subsequently (McFadden et al., 2021).

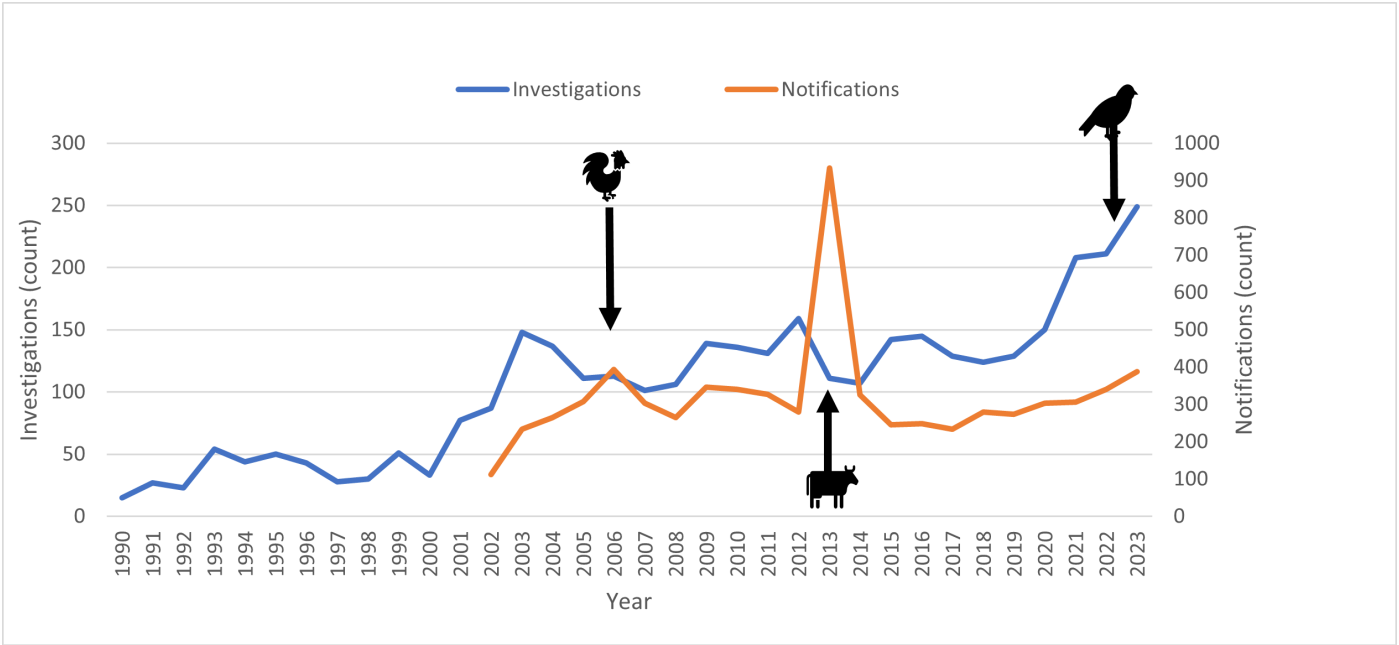


Figure 2: Trend of notifications (2003–2023) and investigations (1990–2023)

This spike in notifications was the result of increased awareness of avian influenza which was occurring in several parts of the world between 2002 and 2005.

This spike in notifications in 2013 was associated with the *Theileria orientalis* Ikeda response (see text).

This spike in notifications and investigations was due to increased vigilance due to the HPAI wild bird pandemic.

The network has a skill set that more generally can be used in other urgent disease investigations (e.g., African swine fever) that may be undertaken by MPI. The IIV training includes biosecurity procedures based on the field training received and material produced as part of the EuFMD programme (Brangenberg and van Andel, 2011a, b).

Notifications and investigations

For the periods for which MPI holds data (investigations 1990–present, notifications 2011–present) there has been an increased trend in both notifications and resulting investigations (**Figure 2**, previous page) with spikes occurring during particular periods of heightened awareness, e.g., the avian influenza pandemic in south-east Asia 2002–2005, the detection of *Theileria orientalis* Ikeda in New Zealand in 2013 and the subsequent response, and the current concern with a potential incursion of the highly pathogenic avian influenza (HPAI) clade 2.3.4.4.b. currently causing widespread wild bird and poultry deaths overseas.

Conclusion

The highly qualified and experienced members of the Biosecurity Incursion Investigation (Animal Health) team are a critical component of New Zealand's general (passive) surveillance system for animal pests and diseases. An effective early warning system, utilising epidemiological investigation and appropriately trained veterinary or aquatic experts, is essential for the timely detection of an incursion of an unwanted organism or emergence of a significant disease impacting animal health and for the appropriate and timely initial management of such detections. The Incursion Investigator's skills are also vitally important for responses where their expertise can be called on to provide epidemiological advice to decision makers.

References

Anonymous (1979). Animal Health Data – Animal Health Division organisation. *Surveillance* 6(2), 16–19.

Anonymous (1980). Editorial. *Surveillance* 7(4), 6.

Anonymous (1980). Editorial, *Surveillance* 7(5), 2.

Anonymous (1981). The Temuka incident. *Surveillance* 8(1), 5–6.

Anonymous (1984). Organisation and staffing of Animal Health Division. *Surveillance* 11(4), 9–11.

BBC (2016). When foot-and-mouth disease stopped the UK in its tracks. BBC News. 17 February 2016. https://www.bbc.com/news/magazine-35581830. Accessed 20 November 2024.

Brangenberg N, van Andel M (2011a). Clinical and epidemiological investigation to exclude foot-and-mouth disease in cattle. *Surveillance* 38(2), 4–6.

Brangenberg N, van Andel M (2011b). Clinical and epidemiological investigation to exclude foot-and-mouth disease in cattle. *Surveillance* 38(4), 4–9.

Clift K (2010). Editorial - New approaches in biosecurity. *Surveillance* 37(2), 3–4.

Davis H (1999). Structure and functions of MAF's National Centre for Disease Investigation. *Proceedings of the Deer Branch NZVA*. 16, 163–166.

Guild C, Houldgreaves I (1980). Editorial. *Surveillance* 7(1), 2.

Hellström J (1990). Chief veterinary officer's annual report 1989 – Animal health laboratories. *Surveillance* 17(3), 11–13.

MacDiarmid S (1991a). Chief veterinary officer's annual report 1990 – Introduction. *Surveillance* 18(4), 3.

MacDiarmid S (1991b). Chief veterinary officer's annual report 1990 – Agricultural security. *Surveillance* 18(4), 4–6.

McFadden A (2011). Clinical and epidemiological investigation to exclude foot and mouth disease in cattle. *Surveillance* 38(1), 8–20.

McFadden A, Buckle K, Rawdon T, Greissworth E (2021). Developing fit-for-purpose tools for New Zealand's initial investigating veterinarians – farm biosecurity. *Surveillance* 48(1), 11–14.

New Zealand Herald (2001). Our close call with a disastrous disease. New Zealand Herald, 25 February 2001. https://www.nzherald.co.nz/business/our-close-call-with-a-disastrous-disease/LCJKW3N5LSJD3UJVSISHZWKB5U/. Accessed 24 November 2024.

O'Connell J (2020). Passive surveillance and exotic disease investigation. *Surveillance* 47(2), 4–6.

The Animals Act 1967. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nzlii.org/nz/legis/hist_act/aa19671967n50110.pdf Accessed 10 September 2024.

Thornton R (1999). The national centre for disease investigation (NCDI), *Surveillance* 26(1), 9-10.

Thornton R (2001). National centre for disease investigation and deer diseases. *Proceedings of the Deer Branch NZVA*, 18, 59–63.

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Surveillance programmes and disease control

Introduction

In addition to New Zealand's general or passive surveillance programme (see *New Zealand's animal disease surveillance system*, p. 6), the Ministry of Primary Industries' (MPI's) targeted surveillance programmes play an important role in detecting particular exotic diseases, understanding endemic disease occurrence and supporting New Zealand's declared animal health status. These programmes are managed by members of the Biosecurity Surveillance (Animal Health) team and are described in this section.

Where a disease incursion does occur, a response can be initiated in an effort to control and eradicate it. Disease control programmes are implemented against endemic diseases where the decision has been made that the control or eradication of the disease is feasible and would generate significant trade or animal and human health benefits.

Members of the Biosecurity Surveillance (Animal Health) team and the Biosecurity Incursion Investigation (Animal Health) team (and their predecessor teams) have frequently had important roles in responses and in the design and implementation of disease control programmes. We describe a selection of those activities.

Targeted surveillance programmes

Targeted surveillance programmes provide additional surveillance activities to the general (passive) surveillance system where the WOAH Terrestrial Code stipulates its requirement to support our stated health status, or it is assessed that further surveillance activities are required to support our understanding of a particular disease and enhance early detection.

Here we present an abridged history of our five targeted surveillance programmes.

Avian influenza (AI) surveillance

In 1989 the Central Animal Health Laboratory, Wallaceville, carried out a survey to determine the prevalence of avian influenza viruses (AIV) carried by the New Zealand wild duck population. Three hundred and forty-four samples were collected and processed. Two low pathogenic avian influenza viruses (LPAI) and one paramyxovirus were isolated (Stanislawek, 1990). Further work was carried out in the following decade leading to the initiation of the Avian Influenza Surveillance programme in 2004.

A year later, the survey carried out in 1989 was repeated. Two hundred and eight samples were examined for the presence of haemagglutinating viruses with negative results. From the total of 552, mainly mallards, samples examined in the 1989 and 1990 surveys, only three isolates were obtained (all in 1989). Two were LPAI (typed as H6N4 and H4N6) and one was a paramyxovirus (typed as PM-4) (Stanislawek, 1992).

This survey work was repeated in 1997 where wild ducks from five sites in New Zealand were captured for the collection of tracheal swabs, cloacal swabs and blood samples. Thirty-three viruses isolated from 321 tracheal and cloacal swabs were characterised as six LPAI (two H5N2 and four H4N6). Of 335 sera samples tested for AIV antibodies, 109 (32.5 percent) sera were positive by nucleoprotein-blocking ELISA (NP-B-ELISA) (Stanislawek et al., 2002).

Beginning in 2004, Biosecurity New Zealand had, in conjunction with the Pūkorokoro Miranda Naturalists' Trust, New Zealand Fish & Game, the Department of Conservation and other stakeholders, carried out surveillance for AI on targeted migratory birds. In particular, this surveillance focused on the bar-tailed godwit and red knot, on their arrival from late September through to November, at Miranda on the Firth of Thames, their main North Island arrival site. In 2006, sampling was extended to other areas of New Zealand including South Island sites. In addition, waterfowl, predominantly mallards (*Anas platyrhynchos)*, were sampled in the summer months throughout New Zealand, with a particular focus on coastal areas (Tana et al., 2007; Stanislawek et al., 2024).

In 2005, in response to the OIE (now WOAH) introduction of reporting requirements for the presence of what were classified as low pathogenic notifiable avian influenza (LPNAI) viruses of subtype H5 and H7 in poultry, (in addition to the reporting requirements for high pathogenicity notifiable avian influenza (HPNAI), and, as part of New Zealand's commitment to a global early warning and response network for highly pathogenic avian influenza, work commenced on reviewing and expanding New Zealand's AI surveillance programme. In 2006, Biosecurity New Zealand's Avian Influenza Steering Committee ratified a three-year surveillance programme. The objectives of the surveillance programme were:

- to demonstrate country freedom from HPNAI; and
- to demonstrate freedom from notifiable avian influenza (as defined by the OIE at the time) in commercial Galliformes.

The surveillance programme was multifaceted, incorporating active surveillance of poultry, active surveillance of resident and migratory wild birds and enhanced passive surveillance (Tana et al., 2007).

In May 2006, MAF Biosecurity New Zealand, with the support of the Poultry Industry Association of New Zealand and the Egg Producers Federation, implemented a comprehensive active surveillance programme for avian influenza virus H5 and H7 subtypes in commercial chickens, which was developed

to meet OIE guidelines. Active surveillance in commercial turkey broilers was subsequently completed in 2007 (Frazer et al., 2008). For ducks, quail, pheasants, partridges and guinea fowl produced for meat, eggs, or release in game preserves, it began in September 2008 and was completed in March 2009 (Frazer, 2009; Frazer et al., 2010). In all cases, no AI virus was isolated.

For the wild bird surveillance, the results between 2004 and 2010 indicated that migratory birds pose a very low risk for the introduction of AI to New Zealand (Stanislawek et al., 2024). Subsequently, in 2010 to the time of writing, surveillance has focused on resident birds, mainly waterfowl (Stanislawek et al., 2012; Sokolova et al., 2023).

Wildlife surveillance

As well as the survey work detailed above for avian influenza, wildlife surveillance in the late 1980s and into the 1990s consisted primarily of ad hoc surveys for specific diseases to support eradication efforts or to understand endemic disease occurrence. For example, as noted earlier, surveys in feral pigs as part of the Aujeszky's disease eradication programme were undertaken in the South Island in 1993/94 and in the North Island during 1993–1997. Surveys were also undertaken for paramyxoviruses in waterfowl (in conjunction with the AI surveys) and for *Mycobacterium bovis* in various species.

During the 2000s, several wildlife-related projects were undertaken, including a cross-department (MAF, Ministry of Health and Department of Conservation) research project managed by MAF. Wildlife aspects were also part of an MPI project on New Zealand disease vectors and vector-borne disease.

In 2009, work started to strengthen MAF's general surveillance system for wildlife, focusing on encouraging information sharing between organisations with wildlife data, increasingly promoting the 0800 number and incursion investigation system for both wildlife and domestic animals, and strengthening MAF's wildlife information management. A standalone wildlife surveillance programme was established in the MAF Surveillance team for the first time in 2012. The programme's definition of wildlife aligned with the WOAH Terrestrial Animal Health Code and included all free-living and captive wildlife.

In 2020, the COVID-19 pandemic increased global awareness of risks posed to humans and animals from emerging disease and spillover events, and WOAH released its Wildlife Health Framework and expanded its work in wildlife health. Coincidentally, the strengthening of MPI's national wildlife general surveillance programme also continued at this time with the establishment of wildlife disease surveillance contracts with four key wildlife hospitals to provide information on infectious and toxic disease occurrence in free-living species. Later, in 2022, a bird rehabilitation centre and a fifth hospital joined the wildlife surveillance network.

Honey bee surveillance

Surveillance for pests and diseases affecting honey bees in New Zealand has a long history. It effectively commenced about 40 years after honey bees were introduced in New Zealand, when American foulbrood (AFB) was first reported. Honey bees were imported from Europe in 1839 (Ministry for Culture and Heritage, 2018) while AFB was reported in 1877 (Goodwin, 2006; Vink, 2016). AFB has remained an important endemic disease of honey bees in New Zealand. The requirements for its control led to the enactment of the Apiaries Act 1906, which was replaced by the Apiaries Act 1969. Essentially, the responsibility for disease control under the legislation was on the beekeeper while MAF was required to maintain the Apiary Register. The register contained names and addresses for apiaries or locations where hives are kept (Reid, 1988). Each spring, every registered beekeeper was required to inspect all hives for AFB, complete a hive inspection statement and return it to the issuing office by December. In addition to beekeepers inspecting their hives and reporting their findings, five Apicultural Advisory Officers in a MAFQual-led a team of over 120 warranted inspectors to examine 10 percent of apiaries for AFB each year. The inspectors were beekeepers who did the work on a voluntary basis although MAF Field Officers and Livestock Officers were also used.

For exotic disease surveillance, MAF Apicultural Advisory Officers received overseas training in exotic bee diseases. They took part in an active surveillance programme in which samples were collected for laboratory examination. This involved 74 beekeepers throughout New Zealand, who sampled bees, brood and detritus from a predetermined hive four times a year. Additionally, hives supplying bees for export were tested and declared to be free from a range of diseases (Reid, 1988).

In 1991, MAF ceased funding the endemic honey bee disease surveillance, which led to a reduced number of beehive inspections. The beekeeping industry raised beekeeper levies to fund AFB control from its own resources (Van Eaton, 1992). Despite the cessation of funding for the surveillance of endemic diseases, MAF continued to fund the surveillance of exotic bee diseases and the Emergency Disease and Pest Response (EDPR) programme (van Eaton, 1992).

The active surveillance programme carried out by MAF involved inspecting and sampling 500 apiaries in at-risk locations. These were regarded as the most likely places where an exotic bee disease could establish in New Zealand. They included major population centres, international ports, seaports and centres with a significant overseas tourist industry (van Eaton, 1992). The Apiaries Act 1969 was eventually incorporated into the Biosecurity Act 1993, through which a strategy to manage AFB was established under the Biosecurity (National American Foulbrood Pest Management Plan) Order 1998. The plan was originally funded by a commodity levy paid under the

Commodity Levies (Bee Products) Order 1996, and subsequently by the Biosecurity (American Foulbrood – Apiary and Beekeeper Levy) Order 2003 (Vink, 2016).

Varroa mites were another significant incursion affecting honey bees after American foulbrood. The mites were detected in April 2000 in two different ways. First, a hobbyist beekeeper had a collapsed hive investigated by a bee disease expert and notified MAF through the pest and disease hotline. Second, MAF also detected varroa on the same day as part of its testing of samples of bees from export consignments (Office of the Auditor-General, 2002).

Essentially, the objectives and implementation of surveillance have remained similar over the decades. At present, surveillance is conducted by the objectives of the National Apiculture Surveillance Programme (NASP); its objectives are:

- to detect target organisms early, before they can successfully establish in New Zealand;
- to help confirm that New Zealand is free from specified organisms for the purposes of international trade and fulfilling international reporting obligations; and
- to raise biosecurity awareness among beekeepers.

Similarly, the operational format is similar to that of the 1990s. Active surveillance for exotic pests and diseases is still conducted within high-risk areas and bees from export consignments are tested. Additionally, all inspections carried out by warranted inspectors under the AFB Pest Management Plan include examination for the presence of exotic pests or diseases (Phiri et al., 2023).

Arbovirus surveillance programme

The Arbovirus surveillance programme was established in 1991 to meet the OIE's (now WOAH) requirements for national freedom from bluetongue, epizootic haemorrhagic disease, Akabane and Palyam viruses (Motha et al., 1997), which are vectored by *Culicoides* spp. The big stimulus for this programme was the recent recognition of bluetongue in Australia, and the theoretical windborne spread of *Culicoides* to New Zealand from Australia (D Belton, pers. comm.).

A 1990 pilot study set up a sentinel herd system with a cattle herd from each of ten districts considered at highest risk of *Culicoides* survival. A clotted blood sample was collected from all cattle (n = 2,027) in these herds and insect trapping using light traps was carried out on the same properties. The light traps were effective in trapping native midges (Ceratopogonidae) suggesting that the traps would catch *Culicoides* species if they were present. Out of 15,019 insects collected, no *Culicoides* spp. were found and no antibodies were detected for the arboviruses.

An active surveillance programme was then initiated for ongoing monitoring (Motha, 1997). The programme was set up with three main components:

- general (passive) surveillance (exotic pest and disease hotline);
- vector surveillance (*Culicoides* spp., midges); and
- serosurveillance (serological testing of cattle).

For the two active surveillance components, ten cattle from 17 randomly selected herds in northern North Island districts were tested serologically, and traps for *Culicoides* spp. were installed on the same properties.

A significant change to the programme was made in 2015 (Peacock et al., 2015) in the wake of a paper describing the identification of risk areas in New Zealand for *Culicoides* introduction (Burgin, 2013). Twenty blood samples from 32 cattle farms in four regions (Northland, Auckland, Waikato and Bay of Plenty) were collected at slaughter premises in February through April for serological testing for bluetongue, Akabane and epizootic haemorrhagic disease viruses. Twelve light traps were deployed on cattle farms in coastal areas and near ports around the North Island and northwestern South Island in February and March with weekly collections.

Further changes were made in 2017, adding bovine ephemeral fever virus to the serology testing and trialling two new traps containing the attractants carbon dioxide and octenol for comparison to the light traps (Peacock et al., 2018). In 2020, all new traps using a combination of green LEDs, carbon dioxide and octenol as attractants to mimic the scent of animals were deployed.

In 2023, opportunistic sampling was undertaken for Japanese encephalitis virus (JEV) because of the range extension that occurred in Australia in 2022 (https://www. agriculture.gov. au/biosecurity-trade/ pests-diseases-weeds/animal/japanese-encephalitis); and there is potential for infected mosquitoes, in particular *Culex annulirostris* to reach New Zealand. No antibodies were detected to the four arboviruses or JEV (see p. 55).

Transmissible spongiform encephalopathy (TSE) surveillance programme

The bovine spongiform encephalopathy (BSE) component of the transmissible spongiform encephalopathy (TSE) surveillance programme began in 1989 in response to the BSE epidemic in the United Kingdom. TSE surveillance in New Zealand has a long history and can be traced back to the early 1950s when scrapie was detected and eradicated (see 'Responses' below). Following the emergence of BSE in Great Britain in 1986, a targeted surveillance programme for BSE in 1989, and in late 1990 a programme was implemented whereby veterinary practitioners received a financial incentive for referring suspect spongiform encephalopathy cases to MAF (BSE, chronic wasting disease (CWD), or scrapie) (MacDiarmid, 1991a), which continues today. The importation of bovine, cervine and ovine and their respective semen and embryos was temporarily banned around the same period but was resumed once appropriate safeguards had been developed by WOAH.



Dr Stuart MacDiarmid worked in veterinary practice, the veterinary pharmaceutical industry and as a university lecturer before joining MAF in 1982. During his career in MAF he designed, worked in, and managed animal disease control programmes (brucellosis, caprine arthritis encephalitis, Aujeszky's disease), surveillance programmes and risk analysis. Stuart has participated in the work of several OIE ad hoc groups (BSE, scrapie, risk analysis) and was a member of the Terrestrial Animal Health Standards Commission from 2002 to 2016. He has been the author or co-author of over 90 scientific papers.

He is an expert in transmissible spongiform encephalopathies (TSE) and a key person in establishing the MAF TSE surveillance programme, and was the first New Zealander to receive the prestigious WOAH Médaille du Mérite (medal of merit) in 2002. The award paid tribute to Dr MacDiarmid's years of work in developing risk analysis as a basis for ensuring safe trade in animals and animal products and for developing standards to reduce the threat of BSE.

In that same year, MAF increased the financial incentives offered for its TSE surveillance programme and changed to a system of direct payment to farmers and veterinarians. The incentives and clinical criteria for cattle were revised again in 2005 in response to changes to the WOAH Terrestrial Code. As part of the move to a system of point accumulation (as described at the time by the WOAH Terrestrial Code), incentive payments to veterinary practitioners and farmers for cattle samples were reduced again in May 2007 (McIntyre, 2008). In 2008, payments to veterinary practitioners were increased for sheep and goat samples in an effort to increase submissions from these species. At the same time, a limit of two was placed on the number of samples per year from each eligible species that could be submitted from a given farm. The opportunity for investigation of further cases by the hotline notification system was left open (McIntyre, 2009).

In 2010, due to insufficient levels of sample submission to the targeted scheme for sheep and deer, the targeted passive surveillance scheme was supplemented by an active surveillance scheme (Vink, 2017). This scheme involves the testing of samples from randomly selected healthy deer and sheep from slaughter plants across the country.

In May 2023, a new version of the BSE chapter was adopted in the WOAH Terrestrial Code to acknowledge the end of the epidemic of classical BSE. In May 2023, the point system came to an end and the Terrestrial Code's emphasis changed to the maintenance of a stakeholder awareness programme of BSE clinical signs and reporting suspected cases to New Zealand's WOAH Veterinary Authority, and on the prevention of another epidemic of BSE in the future by avoiding any risk of recycling prion via the ruminant feed chain. The key to surveillance for BSE and other TSEs remains to target livestock with clinical signs evocative of TSE for ruling out the disease, to support the claim of disease absence for all three TSEs (BSE, scrapie and CWD) in New Zealand (**Figure 1**).



Figure 1: TSE programme information sheet 2022

Disease control programmes

Bovine tuberculosis *Mycobacterium bovis*

New Zealand has been working to control and eradicate bovine tuberculosis (bovine TB) since the 1950s. The Ministry of Agriculture ran a compulsory livestock 'test and slaughter' programme for dairy farms and included beef farms in the late 1960s (followed by farmed deer in the late 1980s). Initially, the 'test and slaughter' approach was very successful, removing infection from herds in some regions such as Northland, Taranaki and mid-Canterbury. However, this was not the case in other regions, such as the central North Island, Wairarapa and the West Coast. In these areas, the test and slaughter approach failed as herds continued to become reinfected despite the conscientious removal of positive reactors. This suggested something else was infecting livestock. In the late 1960s, Australian brushtail possums (*Trichosurus vulpecula*) were identified as carrying bovine TB and were the main wildlife reservoir for the disease. Control of possums was undertaken by a network of locally funded pest destruction boards, with some support from the national Agricultural Pest Destruction Council and this saw a decline in the number of infected herds. During the early 1980s the budget for possum control was severely cut. This resulted in a gradual and then exponential increase in bovine TB in livestock. In 1989, both the Agricultural Pest Destruction Council and local pest boards were dissolved in a major reform of local authorities and incorporated into the new regional councils. The increase in infected herd numbers created a potential risk to our New Zealand beef, dairy and venison export industries, and the government delegated national bovine TB control policy and decision-making, for both domestic animals and wildlife, to an industry-led advisory committee.

The Animal Health Board was established in the early 1990s and operated under the newly implemented Biosecurity Act of 1993 (see *Organisations and collaboration*,

p. 51). A National Pest Management Strategy came into effect in 1998 with the Animal Health Board as the Management Agency. The strategy was jointly funded by Government and industry. The number of infected herds peaked in the mid-1990s and over the subsequent two decades, the prevalence of bovine TB has been trending downwards. TBFree New Zealand was a programme of the Animal Health Board since 2008 and became a registered company in 2013 under OSPRI (formed from a merger of NAIT and The Animal Health Board) (M Neill, pers. comm.) For a complete update on recent activities please see the latest annual report at https://www.ospri.co.nz/our-programmes/the-tbfree-programme/.

Hydatids

Hydatid disease was first recognised in humans in 1862, and initial control efforts began in 1938, but planning for a national eradication campaign did not get underway until the mid-1950s. Four phases in the control and eradication of hydatids have been described: 'planning', 'attack', 'consolidation', and 'maintenance of eradication'. The years before 1990 covered the planning and attack phases. The passage of the Hydatids Act in 1959 provided the funding base for the eradication programme through a tax on dogs, and the attack phase began soon after. At that time, up to 80 percent of adult sheep carried the cystic stage of *Echinococcus granulosus*, and it had been estimated that about 10 percent of dogs carried the tapeworm. Prevalence in rural dogs was as high as 37 percent. Various measures were applied over the course of the eradication programme, including dog control, diagnosis of dog infections, regular anthelmintic treatment of dogs, regulation of on-farm slaughter of animals, and a prohibition of the feeding of uncooked offal to dogs (**Figure 2**) (Pharo, 2002).

In the early 1990s, the programme moved into the consolidation phase where the surveillance of livestock through post-mortem inspection at slaughterhouses, linked with trace-back to infected farms, became increasingly important.

The phasing out of compulsory dog treatments marked the transition to the maintenance of eradication phase in the mid-1990s; surveillance and trace-back, together with controls placed on infected properties, became the core components of the programme (Pharo, 2002). Detections of hydatids continued to occur and be investigated through the late 1990s and into 2000. In 2002, after almost half a century of control efforts, New Zealand declared 'provisional freedom' from hydatids (Pharo, 2002). Restrictions on the feeding of offal from livestock to dogs remain in place, unless the offal has been either (a) treated or (b) slaughtered by a processor operating a risk management programme registered under the Animal Products Act 1999.

In 2024 New Zealand officially updated its self-declaration of country freedom from hydatids to the World Organisation for Animal Health (WOAH).

Brucella abortus

In 1966, a slaughterhouse survey revealed that about 15 percent of cattle were infected with *Brucella abortus*. As the prevalence was considered too high for a test and slaughter programme, vaccination of all female calves between 3 and 6 months of age was made compulsory in 1966 and continued to be compulsory until 1977 (MacDiarmid, 1994). A compulsory test, slaughter and quarantine programme began in 1971. By August 1986, there were only 35 herds under quarantine for bovine brucellosis. At this stage it was concluded that vaccination was hindering the progress of eradication due to interference with the serological testing, so it was banned in June 1987. In the final stages of the campaign, low-dose, strain 19 vaccination of adult cattle was used in problem herds. The field strain of *B. abortus* was last isolated in 1988 and the last two cattle herds under quarantine (because of a history of serological reactions) were accredited free of the disease in December 1989. Active on-farm testing of all breeding cattle continued until June 1995 with any animal that had a positive or suspicious reaction to a test quarantined and investigated. New Zealand declared itself free from brucellosis to WOAH (then the OIE) in 1996 (Sabirovic, 1997).



Figure 2: Hydatids prevention poster from the 1950s. Creative Commons, Archives New Zealand Te Rua Mahara o te Kāwanatanga. https://digitalnz.org/records/36378442

Aujeszky's disease

Aujeszky's disease had been diagnosed in New Zealand for the first time in 1976 although it had almost certainly been introduced several years earlier in live pigs imported from Europe. From the time the disease was first recognised, the pork industry had lobbied the government for support in eradicating it. While the government did fund some surveys, which determined that the disease had spread through the North Island but that the South Island was disease-free, it declined to fund eradication. Consequently, industry decided to design and fund its own eradication programme.

The Pork Industry Board established a levy appropriate to fund such eradication and the New Zealand Aujeszky's disease eradication programme was launched in December 1989. The programme was designed by MAF and the New Zealand Pork Industry Board in consultation with interested groups and individuals. Two industry-funded initiatives preceded the eradication programme itself. The first was a herd accreditation scheme, which was launched in

1986. This scheme was intended to provide a source of replacement stock guaranteed to be free from Aujeszky's disease. The second initiative was to carry out a slaughterhouse survey to provide a reasonably accurate estimate of the number of pig herds infected with the Aujeszky's disease virus. With the launching of the eradication programme in 1989, surveillance for Aujeszky's disease was maintained by three means: continuation of slaughterhouse testing of all culled breeding pigs, on-farm testing of herds located within a 1-km radius of known infected herds, and investigation of cases of porcine disease suggestive of Aujeszky's disease. The approach to eradicating Aujeszky's disease from most infected herds was a conventional test-and-cull procedure (MacDiarmid, 2000).

The last pigs seropositive for Aujeszky's disease were detected in 1995. However, to confirm freedom from the infection, slaughterhouse testing of culled breeding pigs continued until April 1999. To confirm that the South Island had remained free from the infection, a slaughterhouse survey was carried out in 1993. Serological surveys of wild pigs were also carried out in both islands to demonstrate that Aujeszky's disease was not present in feral populations. The New Zealand approach to eradicating Aujeszky's disease was unusual in several ways. First, it was entirely industry funded and it was voluntary. Second, it combined traditional test-and-removal strategies with (at the time) a new-generation vaccine and complementary ELISA (DIVA testing). Surveillance for the disease relied on a relatively low-cost approach, using a sample collection technique uniquely adapted for ease of application in the slaughterhouse. The success of this approach is evidenced by the fact that eradication was embarked upon in 1989, attained by 1995 and confirmed by 1999 (MacDiarmid, 2000).

Equine viral arteritis

Equine arteritis virus (EAV) was first found in horses in New Zealand in 1988. The release of the virus was considered to have been from horses imported from North America. A serological survey carried out in 1989 showed that the virus had been circulating widely in the Standardbred sector, with 54 percent of Standardbreds testing serologically positive. A low level of seropositivity (three percent) was also detected in Thoroughbreds using the virus neutralisation test (VNT) to antibody for EAV. In 1989, soon after the first detection of EAV, the disease was made notifiable in New Zealand and an equine viral arteritis (EVA) control scheme implemented. The ultimate aim was to eradicate the disease from the horse population in New Zealand. The main component of the scheme was serological testing of breeding stallions, with additional virus culture of semen in cases where the stallion was serologically positive. The scheme involved controls on the use of carrier stallions and included quarantine of inseminated mares (Pearce et al., 2014).

In 1990, an estimate of the seroprevalence in New Zealand was updated from the results of testing additional stallions under the EVA control scheme. At this time, three percent of Thoroughbred and 37 percent of Standardbred stallions were seropositive to EAV using the VNT. Low VNT titres were obtained from the Thoroughbred stallions tested and very high titres from the Standardbreds. All seropositive Thoroughbred stallions were semen-tested using virus culture and none were found to be carriers of EAV. There were no seropositive stallions detected from 121 horses of other breeds tested. The scheme broke down during 1997/98, when a Standardbred stallion previously confirmed as free of EAV, and which had stood at the same stud as a carrier stallion, was determined to be semen test-positive. It was determined that semen from this stallion had been inadvertently used to service mares outside the required quarantine regime. A trace-back of contacts identified only this one additional carrier stallion. Consequentially the scheme was modified by incorporating controls for the use of semen from shedder stallions and vaccination for EVA of stallions standing alongside carrier stallions (Pearce et al., 2014).

A 2002 summary of testing carried out as part of the EVA control scheme showed that from 1989 to 2002 (despite the breakdown in 1997/98), the programme had been effective, with a declining seroprevalence in the horse population as well as a reduction in the number of known EAV carriers. The number of carrier stallions declined from a maximum of 20 in 1991/92 to three in 2002. In June 2012, the last EAV carrier stallion was euthanased at the age of 20. No stallion known to be a carrier of EAV remained in New Zealand. Clinical signs of disease have not been observed in horses in New Zealand since EVA was first diagnosed in 1988. Consequently, in June 2014, New Zealand self-declared freedom from EVA to WOAH (then the Office International des Epizooties or OIE) (Pearce et al., 2014).

Responses

Scrapie at Mana Island and Crater Block

The importation of sheep from all countries except Australia was banned in 1952 after a case of scrapie was found in a Suffolk ewe imported from the United Kingdom two to three years previously. At the time, the Department of Agriculture controlled the disease by the slaughter of all in-contact animals in the flock and of all sheep that had been removed from the farm during the previous three years.

Except for a single outbreak of scrapie in 1954, which was traced directly to the earlier outbreak, no further cases have occurred in sheep outside quarantine in New Zealand.

In 1972, the New Zealand Government specially imported 110 sheep from the United Kingdom for crossbreeding research experiments under strict quarantine conditions on Mana Island. In June 1976, the New Zealand Romney flock of I,000 in-lamb ewes that had been mated to exotic rams, as well as 350 crossbred ewes born in 1974 from New Zealand Romney ewes, were transferred from Mana Island to the Crater Block quarantine farm near Rotorua for more extensive crossbreeding trials.

However, in September 1976 a clinical case of scrapie was identified in a ewe in quarantine on Mana Island. The consequence of this detection was that all the stock on both Mana Island and Crater Block were slaughtered to prevent any biosecurity risk to New Zealand. Both sites no longer have sheep on them (Anonymous, 1976).

Mycoplasma mycoides subspecies *mycoides* (Large Colony) infection in goats

In the spring of 2001, investigations by the National Centre for Disease Investigation (NCDI) (see *Incursion investigation*, p. 32) identified *Mycoplasma mycoides* subspecies *mycoides* (Large Colony) (MmmLC) as the infective agent responsible for concurrent outbreaks of disease on a dairy goat farm and on a calf rearing farm in Waikato. Incursion Investigators established that the link between the two farms was the feeding of unpasteurised bulk goat milk and colostrum from the affected goat herd to kids on the goat farm and the calves on the calf rearing operation.

The Unwanted Organism classification of MmmLC and the unusual features of the outbreaks triggered a response by MAF for containment of affected and exposed animals and investigation of options for dealing with the outbreaks. This was heightened amid concerns that the disease might spread more widely in goats, possibly establish in cattle and affect international trade. A Technical Advisory Group of MAF, industry and veterinary experts met twice to review up-to-date information about the outbreaks and laboratory diagnostic test procedures and to report options for response to the MAF Director, Animal Biosecurity. However, as information was collected during the investigation it became clear that MmmLC was already endemic in New Zealand (King and Jackson, 2002).

Post-weaning multisystemic wasting syndrome

Post-weaning multisystemic wasting syndrome (PMWS) emerged as a clinical entity during the 1990s in several European and North American countries. In September 2003, PMWS was diagnosed on a pig farm in the North Island following investigations by Exotic Disease Investigators from MAF's NCDI. During the subsequent response, PMWS was identified on several other farms in the North Island but not the South Island.

Post-weaning multisystemic wasting syndrome was declared an unwanted organism under the Biosecurity Act 1993 on 1 October 2003, giving authorities powers to inspect properties, sample animals and apply disease control measures on suspicion of infection. A Technical Advisory Group, established to advise on objectives and policy, included veterinary experts and key stakeholders. Operational aspects of the response were managed by MAF's NCDI (Stone, 2004). Control of the disease was handed over to industry, and stamping out was attempted. However, in 2006 a further outbreak was detected in the South Island and after consideration of the epidemiological factors, a decision was made to not attempt to control the disease in the South Island outbreak (Morris et al., 2006).

Operation Waiheke

On 10 May 2005, MAF responded to a letter claiming deliberate release of foot and mouth disease (FMD) virus on Waiheke Island. The Government's position was that while the letter was probably a hoax, all necessary steps to safeguard New Zealand's interests and public welfare should be taken. This included quarantine of the island and 14 days of surveillance of susceptible animals. MAF adopted a coordinated incident management system (CIMS) to manage the operation, dubbed 'Operation Waiheke'. In accordance with CIMS, Operation Waiheke was directly managed by an operations group with the support of logistics and intelligence groups (Mackereth and Stone, 2006).

Agencies involved in the MPI-led Operation Waiheke included the EpiCentre (Massey University), National Institute of Water and Atmospheric Research (NIWA), Landcare Research Manaaki Whenua, and AgriQuality. These agencies were involved in several projects that were initiated to inform critical aspects of the response. The projects were completed in a five-day timeframe. The operation was scaled back and eventually stood down after a second letter was received one week later confirming that it was a hoax (Stone, 2005; Mackereth and Stone, 2006). This was the first large-scale utilisation of CIMS in a disease response in New Zealand (Mackereth and Stone, 2006).

Theileria orientalis Ikeda

In late 2012 and extending into 2013, the general surveillance system successfully detected an incursion of *Theileria orientalis* Ikeda, following a notification to the exotic pest and disease hotline by a veterinary pathologist. This incursion had significant implications for animal health. Members of the Biosecurity Surveillance & Incursion Investigation (Animal Health) (S&II) team, led by Incursion Investigator Andrew McFadden, were heavily involved in multiple aspects of the response along with leading technical and industry working groups, producing numerous articles in places like in *Surveillance*, *VetScript* and a special edition of the *New Zealand Veterinary Journal*. Members of the team were also involved in a workshop in Australia to discuss experiences of the disease in both countries and better understand management strategies (Bingham, 2013).

Equine herpes myeloencephalopathy (EHM)

In 2014, a veterinary pathologist notified MPI of an outbreak of a rapidly progressive neurological disease in a group of Thoroughbred mares on a Waikato stud farm. Cases typically presented with varying degrees of ataxia, hindlimb weakness, urinary incontinence, cranial nerve deficits and in some cases recumbency with no previous clinical signs. These signs were consistent with previous reports of equine herpes myeloencephalopathy (EHM) overseas and this was confirmed through diagnostic testing of affected and in-contact animals. Laboratory testing used to confirm the diagnosis included a positive PCR for the neuropathogenic

strain of EHM (a single substitution from aspargine (N) to aspartic acid (D) at amino-acid position 752). The PCR was carried out on tissues collected at postmortem from euthanased mares and from nasal swabs collected from clinically affected animals. In addition, serology confirmed the diagnosis in a number of other mares. There was a fourfold rise in the VNT titre to equine herpesvirus subtype 1 from paired sera collected from several of the clinically affected horses. A total of 15 clinical cases occurred in a group of about 290 at-risk animals within a 33-day period and seven affected horses were euthanased during this outbreak (Bingham, 2014).

This was a very complex investigation, with high-value animals affected and at risk. Liaison with the local farm owner and the attending vet was managed by the S&II Incursion Investigators.

Mycoplasma bovis

On 19 July 2017, following a notification to the exotic pest and disease hotline, an investigation was conducted on a dairy farm in the South Island that was experiencing clinical disease consistent with *Mycoplasma bovis* infection. Subsequently *M. bovis* was confirmed. Following this detection, a national response commenced to define the extent of *M. bovis* infection in New Zealand and contain its spread. Members of the S&II team were in critical roles across the response, including:

- field investigations (development of exotic disease investigation reports (EDIR));
- liaison with industry;
- collaborating with MPI Animal Health Laboratory (AHL) to develop field testing protocols;
- investigation of published literature;
- management of the intelligence function within the CIMS structure. Responsibilities within this function was broader than described within the CIMS structure as it included:
  - intelligence,
  - epidemiology,
  - surveillance,
  - casing, and
  - tracing.
- the design, development and management of the bulk tank milk surveillance programme and the mastitic milk surveillance programme. For both programmes, data management and reporting occurred within SIMS (see *Information management and tools*, p. 47);
- analysis and advice on collection of samples, in particular pathology and slaughterhouse-derived samples, and helping co-ordinate the programme with contractors at Massey University;
- production of a follow-up report on transmission pathways, which reviewed and updated the 2017 Pathways Report (MPI, 2017);
- surveillance data management including the integration between the AHL information management (LIMS) and SIMS systems; and
- research into the performance parameters of serological and molecular assays to support disease surveillance.

Members of the S&II team continued to be involved in the response until it was gradually transitioned to the *Mycoplasma bovis* Directorate in 2018 and 2019.

Theileria equi response

In April 2020, during routine export testing, a pregnant 4-year-old mare tested positive for antibodies to *Theileria equi* by cELISA and IFAT. Further testing on 22 May 2020 with a generic semi-nested conventional piroplasma PCR test, followed by gene sequencing, confirmed that the animal was infected with *T. equi*. Before this diagnosis, New Zealand had never had a case of *T. equi*. The mare was clinically healthy and had no history of disease since being imported. Blood biochemistry and haematology confirmed that blood parameters were within normal limits.

The mare had previously lived in France before being imported in February 2019 via the United Kingdom. It met the requirements of New Zealand's import health standard, which included a negative cELISA test for *T. equi* during the 21 days before importation. However, although the pre-import test was negative, an investigation undertaken by MPI in collaboration with the New Zealand Equine Health Association, determined that the mare had previously raced in both Germany and France, where *T. equi* is endemic, and had tested positive to *T. equi* by IFAT carried out on blood collected on 12 December 2018 before her pre-import testing. This positive test was not previously known to MPI. The investigation concluded that the mare was a chronic carrier of *T. equi* and was already infected at the time of importation. After extensive tracing and testing, no further infected animals were detected. The mare was re-exported without treatment for *T. equi* on 26 June 2020, thus removing the only infected horse present in New Zealand. A dossier was supplied to OIE (now WOAH) and accepted in January 2021, re-establishing New Zealand's freedom from *T. equi* (Tana et al., 2021).

Members of the S&II team made highly significant contributions to the successful outcome of this response including:

- providing epidemiological expertise;
- advising on OIE (WOAH) Terrestrial Code requirements;
- conducting literature reviews;
- liaising with the farm owner;
- liaising with industry;
- development of the surveillance plan, including active and enhanced passive surveillance through the veterinary diagnostic laboratories and costing of surveillance options; and
- development of the OIE (WOAH) freedom dossier and response to trading partner queries.

Infectious bursal disease serotype-1 response

In June 2019, routine serological surveillance identified a layer chicken farm in the South Island that was positive for antibodies to infectious bursal disease virus (IBDV). New Zealand's MPI initiated an investigation that subsequently confirmed the presence

of IBDV serotype 1 (IBDV-1) and found infection on a second epidemiologically linked farm. No clinical disease or changes in production were evident on either of the two farms. The affected farms were placed under movement control and a national delimiting survey of commercial chicken farms was undertaken. The survey confirmed infection was limited to the two properties. Depopulation of infected flocks was completed in May 2021. All sheds on the affected properties were cleaned and disinfected after depopulation. A final round of serology in November 2021 confirmed that IBDV had been eradicated from the affected properties and that New Zealand commercial poultry was again free from IBDV-1 (Tana et al., 2023).

Once again, members of the S&II team had highly significant contributions to the successful outcome of this response, including:

- providing investigation, response and epidemiological expertise;
- advising on WOAH Terrestrial Code requirements;
- liaising with the farm owners;
- liaising with industry;
- development of the active surveillance plan to demonstrate eradication; and
- development of responses to trading partner queries.

Conclusion

As evidenced in this section, New Zealand has a proud history of disease surveillance and control. In particular, the eradication of hydatids and brucellosis from New Zealand was a huge public health achievement made possible by the organisational skills of the state veterinary service at the time in collaboration with the New Zealand farming community.

The veterinarians of the S&II group and their predecessors, have consistently demonstrated the value of their expertise in improving animal health in New Zealand. They manage the general and targeted surveillance programmes that support ongoing market access and enable the early detection of a disease incursion; and when required, they provide an invaluable source of expertise for the design and implementation of disease control programmes or responses.

References

Anonymous (1976). Exotic sheep crossbreeding programme terminated. *Surveillance* 5(4), 3–4.

Bingham P (2013). Quarterly report of exotic diseases. *Surveillance* 40(2), 14–19.

Bingham P (2014). Quarterly report of exotic diseases. *Surveillance* 41(3), 52–58.

Frazer J, Rawdon T, Stanislawek W (2008). Avian influenza surveillance programme. *Surveillance* 35(2), 14–16

Frazer J (2009). Avian influenza surveillance programme. *Surveillance* 36(2), 17–18.

Frazer J, Rawdon T, Stanislawek W, McFadden A (2010). Avian influenza surveillance programme. *Surveillance* 37(2) 20–22.

Goodwin M (2006). *Elimination of American foulbrood disease without the use of drugs – a practical manual for beekeepers.* Revised. Wellington, New Zealand: National Beekeepers' Association of New Zealand Inc.

King C, Jackson R (2002). *Mycoplasma mycoides* subspecies *mycoides* (Large Colony) infection in goats. *Surveillance* 29(3), 8–12.

MacDiarmid S (1991a). Chief veterinary officer's annual report 1990 – Introduction. *Surveillance* 18(4), 3.

MacDiarmid S (1994). Bovine brucellosis eradication in New Zealand. *Surveillance* 21(2), 18–21.

MacDiarmid S (2000). Aujeszky's disease eradication in New Zealand. *Australian Veterinary Journal* 78(7), 470–471.

Mackereth G, Stone M (2006). T3-1.3.5 - Veterinary intelligence in response to a foot and mouth disease hoax on Waiheke Island, New Zealand. *International Symposia on Veterinary Epidemiology and Economics proceedings*, Volume ISVEE 11: Proceedings of the 11th Symposium, Cairns, Australia, Issue Theme 3 - Animal health delivery & response: Emergency response session.

McIntyre L (2008). Reports from MAF Biosecurity New Zealand – TSE programme. *Surveillance* 35(2), 19–20.

McIntyre L (2009). Reports from MAF Biosecurity New Zealand – TSE surveillance programme, *Surveillance* 36(2), 21–22.

Ministry for Culture and Heritage (2018). Honey bees brought to New Zealand. https://nzhistory.govt.nz/mary-bumby-brings-the-first-honey-bees-in-new-zealand.p. 8.

Motha M, Hansen M, Irwin G (1997) Continued freedom from arbovirus infections and arbovirus vectors in New Zealand, *Surveillance* 24(4), 18–19.

Morris R, Clement F, McIntyre L, Davidson A (2006). PMWS Control in New Zealand – an industry perspective. *International Symposia on Veterinary Epidemiology and Economics proceedings*, Volume ISVEE 11: Proceedings of the 11th Symposium, Cairns, Australia, Issue Theme 3 - Animal health delivery & response: Poster session session, p. 748.

MPI (2017). Analysis of risk pathways for the introduction of *Mycoplasma bovis* into New Zealand. Paper no. 2017/1. https://www.mpi.govt.nz/dmsdocument/28050-pathways-report-redacted-pdf. Accessed 6 September 2020.

Office of the Auditor-General (2002). Response to the incursion of the varroa bee mite. https://oag.parliament.nz/2002/biosecurity-case-studies.

Peacock L, Kittelberger R, Bueno R, Green O, Muir C, George S (2015). Arbovirus surveillance programme. *Surveillance* 42(3), 28–29.

Peacock L, Boyd B, George S, Garcia T, Hannah M, Begg D (2018). Arbovirus surveillance programme. *Surveillance* 45(3), 28–29.

Pearce T, McFadden A, van Andel M (2014). New Zealand declares freedom from equine viral arteritis (EVA) to the OIE. *Surveillance* 41(3), 6–8.

Pharo H (2002). New Zealand declares 'provisional freedom' from hydatids. *Surveillance* 29(3), 3–7.

Phiri BJ, King K, Gonzalez M, George S (2023). Honey bee exotic pest and disease surveillance annual report. *Surveillance* 50(3), 35–37.

Reid M (1988). Diseases of honey bees in New Zealand. *Surveillance* 15(5), 15–17.

Sabirovic M (1997). *Brucella abortus* has been eradicated from New Zealand. *Surveillance* 24(1), 13.

Sokolova M, Stanislawek W, Tana T, King C, Pleydell E, Watts J, Mulqueen K (2023). Avian influenza surveillance programme annual report. *Surveillance* 50(3), 28–34.

Stanislawek W (1990), Avian influenza survey of New Zealand wild ducks. *Surveillance* 17(2), 13–14.

Stanislawek W (1992). Survey of wild ducks for evidence of avian influenza viruses, 1989 and 1990. *Surveillance* 19(1), 21–22.

Stanislawek W, Wilks C, Meers J, Horner G, Alexander D, Manvell R, Kattenbelt J, Gould A (2002). Avian paramyxoviruses and influenza viruses isolated from mallard ducks (*Anas platyrhynchos*) in New Zealand, *Archives of Virology* 147, 1287–1302. DOI 10.1007/s00705-002-0818-2.

Stanislawek W, Rawdon T, Tana T, McFadden A (2012). Avian influenza surveillance programme. *Surveillance* 39(3), 20–23.

Stanislawek WL, Tana T, Rawdon TG, Cork SC, Chen K, Fatoyinbo H [...] O'Keefe JS (2024). Avian influenza viruses in New Zealand wild birds, with an emphasis on subtypes H5 and H7: Their distinctive epidemiology and genomic properties. *PLoS ONE* 19(6), e0303756. https://doi.org/10.1371/journal.pone.0303756.

Stone M (2004). Response to first diagnosis of post-weaning multisystemic wasting syndrome. *Surveillance* 31(4), 8–14.

Stone M (2005). Quarterly report of investigations of suspected exotic diseases. *Surveillance* 32(3), 16–19.

Tana T, Rawdon T, Stanislawek W (2007). Avian influenza surveillance programme. *Surveillance* 34(2), 11–13.

Tana T, McFadden A, Watts J, Eames M, Pearce P (2021). Re-establishing New Zealand's freedom from *Theileria equi* after the introduction of a single infected horse. *Surveillance* 48(3), 59–61.

Tana T, Mulqueen K, Russell J (2023). Eradication of infectious bursal disease virus type 1 from New Zealand commercial poultry. *Surveillance* 50(1), 5–11.

van Eaton C (1992). New developments in the control of honey bee diseases in New Zealand. *Surveillance* 19(1), 8–9.

Vink D (2016). *National Apiculture Surveillance Programme (NASP) – An evaluation of New Zealand's exotic pest and disease surveillance programme*. Technical report, Ministry for Primary Industries, Wellington, New Zealand.

Vink D (2017). Transmissible spongiform encephalopathies (TSE) surveillance programme. *Surveillance* 44(3), 26–27.

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Information management and tools

Introduction

Surveillance is information for action. Information management (IM), and the development of tools to enable the analysis and visualisation of data, are critical to the evolution of data to information, allowing informed decisions to be made. This paper provides some examples of IM and tools used within the surveillance system.

Epidemic Management System (EpiMAN)

During the 1990s, the computer-based Epidemic Management System (EpiMAN) for foot and mouth disease emergencies was developed. EPiMAN incorporated a database management system, a geographic information system (GIS), a foot and mouth disease simulation model, and a series of expert systems. EpiMAN allowed the rapid integration of important information such as digital farm-based maps, farm profiles, location of saleyards, meat and dairy processing plants, and feral animal distribution maps. EpiMAN could map an epidemic as it developed and provide epidemiological reports, thereby enhancing operational effectiveness during the emergency as well as acting as a decision support tool. In addition, an expert system could provide access to technical information relevant to the epidemiology of foot and mouth disease. (MacDiarmid, 1991; Sanson, 1994).

AgriBase

AgriBase™ is a multi-sectoral national spatial database that records information on rural land use at the farm management unit level (Sanson & Pearson, 1997; Sanson, 2000). When EpiMAN was developed, a clear requirement for a national spatial farms database was identified. No such database existed at the time, and AgriBase was developed to fill this need. Data capture started in 1993, and archived records since January 1999 are available. However, two significant government policies of the early 1990s – namely, user-pays and policy/delivery separation within government departments – meant that the government was not prepared to underwrite the cost of the development and maintenance of the system purely for biosecurity preparedness. This resulted in AgriBase being developed with a much broader range of intended uses within MAF Quality Management, the field operational arm of MAF, which became AgriQuality Ltd in 1998. The overriding philosophy behind AgriBase was that it would be a central register of every farm (including orchards and forests) involved in some form of primary production in New Zealand. It would enable the linking of disparate farm-based datasets referenced to the unique FarmID, hold contact details for key personnel involved in the ownership or management of the farm, furnish denominator data to facilitate epidemiological investigations and research, and provide the spatial coordinates to enable data to be manipulated within GIS. Agribase continues to be managed by AsureQuality and is used as the source of property and animal population denominator data by the Surveillance and Incursion Investigation teams.

Farms Online

In 2011 the FarmsOnline database went live, also providing information on the ownership, location and management of rural properties. FarmsOnline was intended to support the joint industry/government National Animal Identification and Tracing (NAIT) initiative that provides lifetime identification and traceability for cattle. FarmsOnline was eventually superseded by AgriBase.

National Animal Identification and Tracing (NAIT)

The National Animal Identification and Tracing (NAIT) programme is an online tool that went live in 2012, establishing a national system for cattle. In 2013 the programme was extended to deer. The NAIT programme records the location and movement of individual animals (for example to another farm or to slaughter) and the contact details for the person in charge of an animal.

The four drivers of NAIT are:

- **Biosecurity**
  To be an effective livestock traceability system that enables New Zealand to respond to biosecurity outbreaks by tracing livestock and locating, prioritising and treating suspect or infected premises or animals.
- **Food safety**
  Provide assurance to local and overseas markets about food safety standards and product integrity through traceability of livestock and origin of those products.
- **Market assurance and access**
  Provide assurance to both local and overseas markets and customers of the attributes associated with livestock product integrity and wholesomeness, for which traceability is a clear enabling requirement.
- **Animal health surveillance**
  Provide the ability to integrate animal health information and enable the monitoring, surveillance and management of both endemic and exotic diseases. This means any response activities, whether for treatment, vaccination or slaughter, can be prioritised based on location and animal status, enabling more effective emergency responses (OSPRI, 2024).

After the *Mycoplasma bovis* response (see *Surveillance programmes and disease control*, p. 37) several areas for improvement were identified and implemented.

Members of the MPI Surveillance team (Katherine Clift and Chris Houston) were heavily involved in the initial design and implementation of NAIT. The NAIT programme is administered

by OSPRI New Zealand (Operational Solutions for Primary Industries), a not-for-profit partnership company between primary industries and government.

Surveillance evaluation framework (SurF)

Surveillance evaluation should be an integral part of the surveillance life cycle, as it provides a means to identify and correct problems and to sustain and enhance the existing strengths of a surveillance system (**Figure 1**). The Surveillance Evaluation Framework (SurF) was developed in 2016 to meet that objective. It provides a generic framework within which the MPI biosecurity surveillance portfolio, and all of its components, can be consistently assessed. SurF is an innovative, cross-sectoral effort that provides a common umbrella for surveillance evaluation in the animal, plant, environment and aquatic sectors. It includes the following four distinct components of an evaluation project:

- motivation for the evaluation;
- scope of the evaluation;
- evaluation, design and implementation; and
- reporting and communication of evaluation outputs.

During SurF's development, three case studies were prepared by MPI subject matter experts and included in the framework to guide users in their assessment. These case studies were used to assure practical application and to confirm usability of SurF across all included sectors. It was anticipated that the structured approach and information provided by SurF will not only benefit MPI but also other New Zealand stakeholders. Although SurF was developed for internal use by MPI, it could be applied to any surveillance system in New Zealand or elsewhere (Muellner, 2018). At the time of writing, (2024) SurF has been used by the Biosecurity Surveillance (Animal Health) team to assess all its surveillance programmes on an ongoing basis.

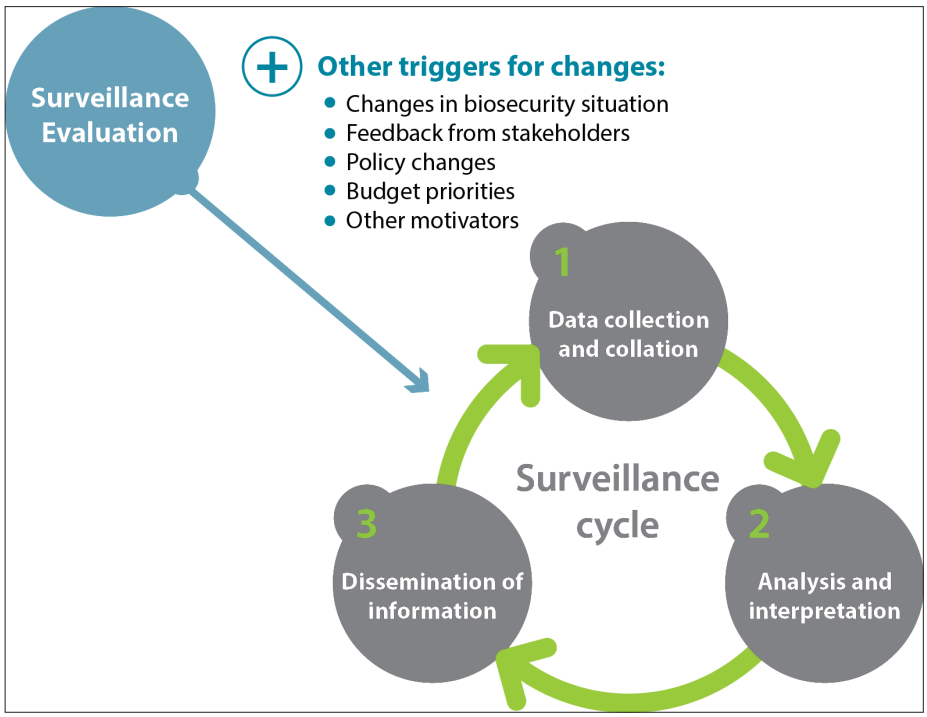

Figure 1: Evaluation as part of the surveillance life cycle (Muellner, 2018). SurF is represented by the blue circle

Surveillance Information Management System (SIMS)

The 2002 Prime Consulting International Ltd review identified some issues with information management (IM) for surveillance data that needed to be addressed.

For the surveillance function, several issues were identified: each programme had its own method of data management that ranged from Excel spreadsheets to standalone databases, there were no standardised reference tables, it was difficult to assess data quality and reporting was manual and cumbersome. Consequently, the Animal Health Surveillance Information Management (AHSIM) project was initiated in 2012. The objectives of the AHSIM project were to:

- develop a fully integrated, web-based database management system and user interface that collects and stores data from across the multiple components of the Animal Surveillance work programme collectively (e.g., the Animal Health Surveillance programme, the Transmissible Spongiform Encephalopathy programme and the Wildlife programme);
- provide for data sharing with other parts of MPI and web-based access to selected external stakeholders;
- allow data to be entered into the database via a web interface;
- allow alerts and reports to be generated (both regular and ad hoc reports); and
- include a national wildlife database in future.

Throughout 2013 and through to mid-2014, Jon Watts and Toni Tana led the complex detailed design work for the system, with a preferred vendor selected to build the system in late 2014 (Bryan O'Leary, EpiSoft Ltd). The build commenced in early 2015, with the system (now called the Surveillance Information Management System or SIMS) going live in mid-2016. Continued improvements have been made since 2016, including the use of XML schemas for data upload, auditing reports, the implementation of an early-aberration reporting system and the inclusion of climate data.

For the Incursion Investigation function before 2011, notification and investigation data were recorded in two Microsoft Excel worksheets. The value of this information to other parts of the organisation, and particularly to the surveillance teams reporting,

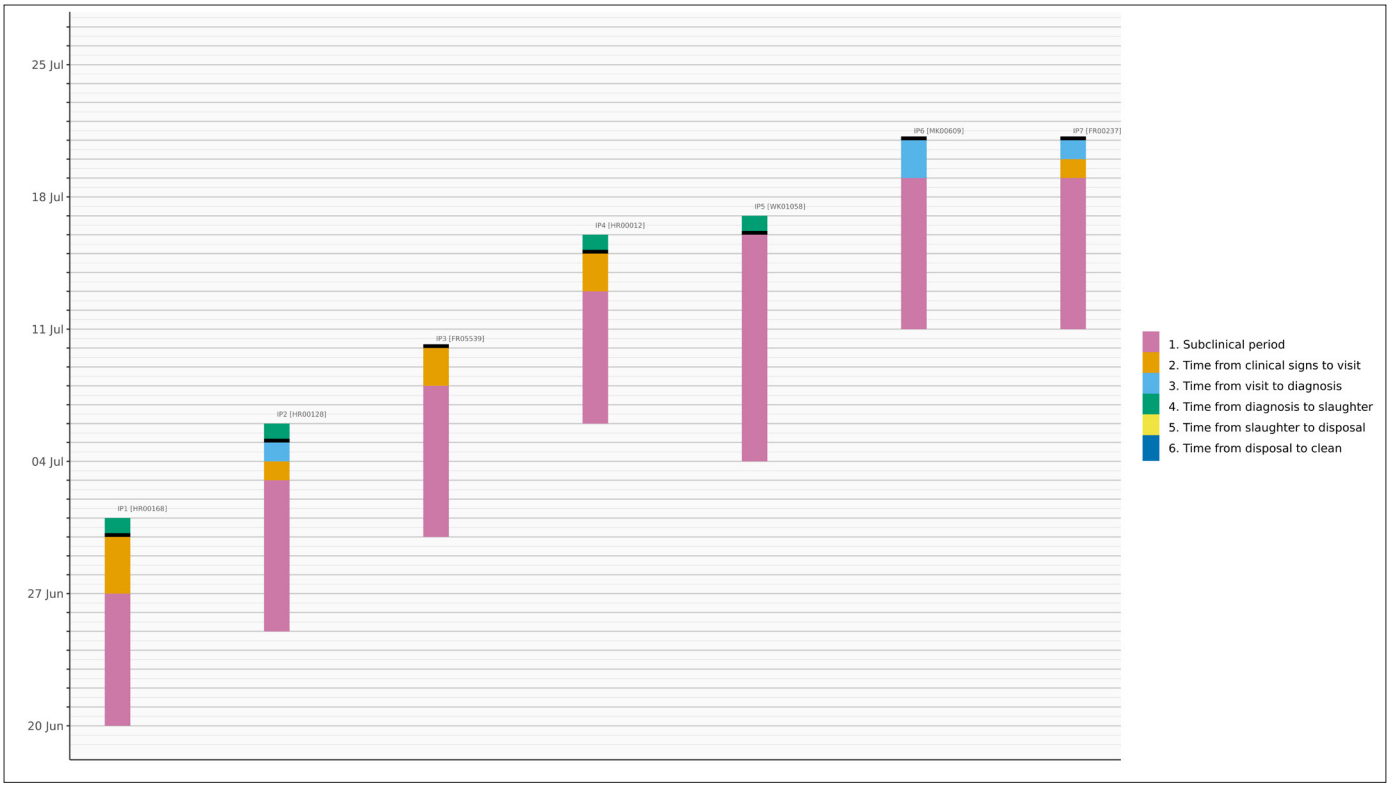

Figure 2: Example of a SADI report; response timeline by property ('Wada plot')

could not be realised. The main issues were that:

- the data could not be organised in a relational way when a single investigation ruled out multiple diseases or organisms;
- only the highest impact differential diagnosis was reported against an investigation;
- there were inherent data safety issues; and
- reporting required multiple individual copies of narratives consolidated and formatted by the manager, which was very time-consuming.

In 2011 the Notification Investigation Manager Application was developed in C++, a cross-platform language that can be used to create high-performance applications. This was a standalone application which sat on the MPI server. It overcame most of these issues and was a step forward for all investigation teams. The relational aspect of reporting was still limited, however. This difficulty was overcome when, in 2019, NIMA transitioned into SIMS and, for the first time, all MPI's surveillance data were in one database in a standardised format.

In 2023, a dedicated team was established to provide technical support to the SIMS application including reviewing reference table structures, maintenance of reference tables, ensuring SIMS was resilient and troubleshooting problems as they arose. SIMS was a critically important piece of work that has generated numerous benefits for the S&II team, MPI and New Zealand .

SIMS is now used for all animal pest and disease surveillance programmes including:

- the Animal Health Surveillance Programme (see *New Zealand's animal disease surveillance*, p. 6);
- the Transmissible Spongiform Encephalopathy (TSE) surveillance programme;
- the Wildlife Surveillance programme;
- the Notification and Investigation Manager Application;
- Aquatic Animal Health Surveillance;
- Animal Health Surveillance Engagement; and
- the Antimicrobial Resistance (AMR) Surveillance Programme (managed by the Agricultural Compounds and Veterinary Medicines group).

There are numerous examples of where SIMS has also enabled the development of tools to improve the analysis of data. Just two examples are given below.

Standardised Analysis for Disease Investigation (SADI)

During large biosecurity events or disease control programmes, field data are collected and then managed in a response database. The epidemiology group needs to extract reports from the database which can then be analysed. The ability to write (or code) such reports is a skill in short supply and takes time. Automating a standardised set of analyses for a given epidemic is an effective use of a limited resource and allows the epidemiology team to be a real-time functioning response group. Having an automated standardised analyses also allows these tools to be used by a wider epidemiological audience and is a step toward driving information to inform action (**Figure 2**).

Early-aberration reporting system

To give the best opportunity for a successful response, an exotic or emerging disease needs to be detected as soon as possible. As well as other

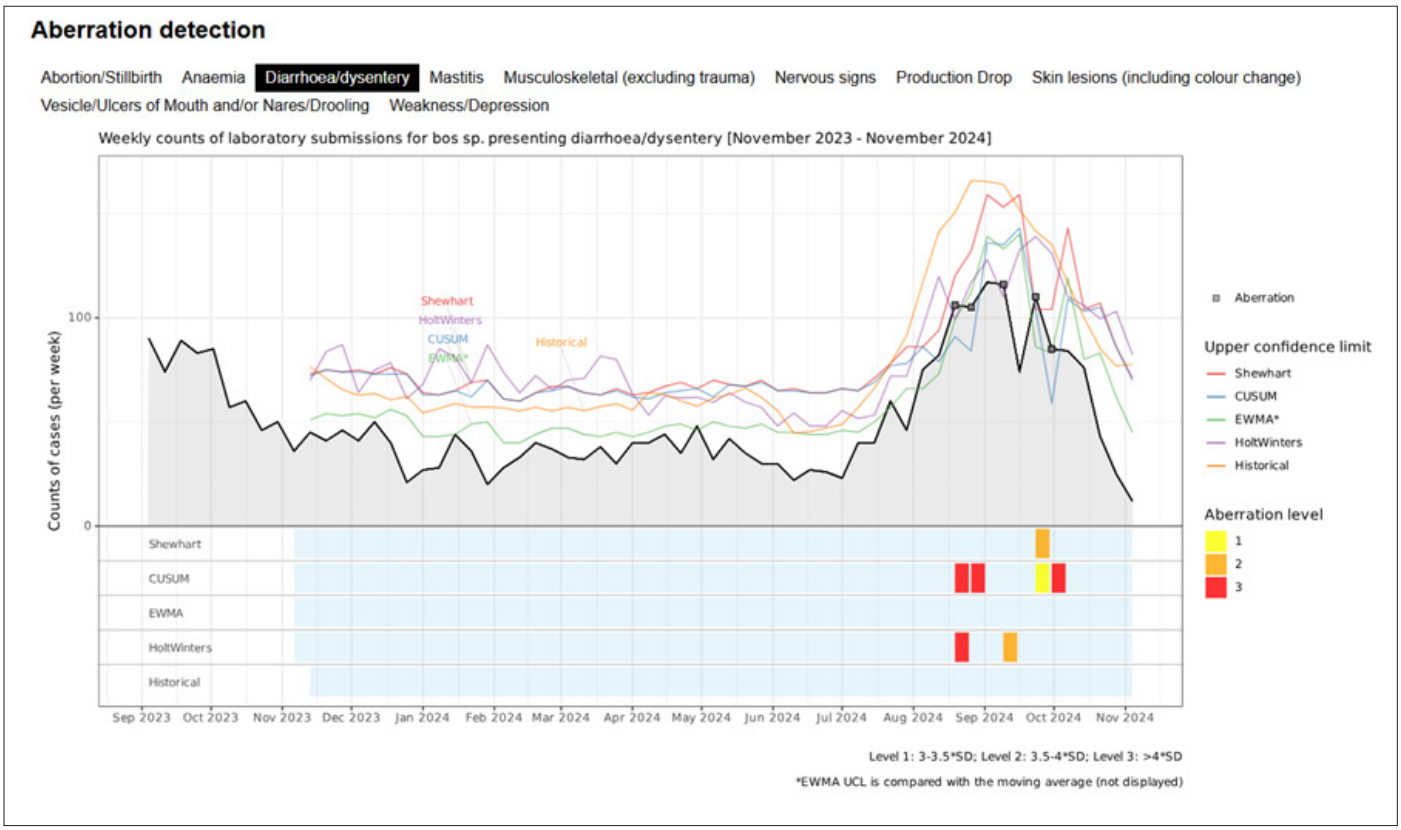

Figure 3: Example report from EARS for the syndrome 'diarrhoea and dysentery'

surveillance activities that are already in place, an early-aberration reporting system may assist in achieving that objective. MPI has been collecting animal health case data for over two decades, all of which is stored within SIMS. These data can allow for an 'expected' case count to be calculated using various algorithms and compared with observed counts. Should the observed count exceed the expected, a flag can be generated and prompt an investigation (**Figure 3**).

As well as providing IM for the S&II team, it has also been used in responses such as the *Mycoplasma bovis* response in 2017 where it was the IM system used for the mastitic milk surveillance programme and the bulk tank milk surveillance programme.

Conclusion

Information management is important to an effective surveillance system. NAIT has allowed traceability of cattle and deer, AgriBase provides a denominator dataset, and SurF ensures that MPI's animal disease surveillance programmes continue to be fit for purpose. The advent of SIMS has significantly improved the management of data and reporting of information from surveillance programmes. It has reduced the amount of resource that is required to maintain surveillance datasets, allowing resources to instead be allocated to analysis and interpretation of data, therefore increasing the value of the programme and the dataset. Improvement of information management is a continuous process.

References

MacDiarmid S (1991a). Chief veterinary officer's annual report 1990 – Introduction. *Surveillance* 18(4), 3.

MacDiarmid S (1991b). Chief veterinary officer's annual report 1990 – Agricultural security. *Surveillance* 18(4), 4–6.

Muellner P, Watts J, Bingham P, Bullians M, Gould B, Pande A, Stärk KD (2018). SurF: an innovative framework in biosecurity and animal health surveillance evaluation. *Transboundary and Emerging Diseases* 65(6), 1545–1552.

OSPRI (2024). https://www.ospri.co.nz/our-programmes/nait-programme/. accessed 30 October 2024.

Sanson R (1994). EpiMAN - a decision support system for managing a foot and mouth disease epidemic. *Surveillance* 21(1), 22–24.

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Organisations and collaboration

Introduction

As a trading nation, it is essential that we are active participants in the international bodies that regulate trade and that our international reporting obligations are met. This ensures we are supporting the ongoing efforts to improve animal health at a global level, but also that we have access to markets overseas for our primary products. Working with international partners on information sharing and animal disease control projects builds trust and goodwill as well as confidence in our capabilities and expertise.

Our domestic legislation provides us with the legal powers that support our surveillance system, allowing us to carry out activities or collect information to maintain our national biosecurity.

International

World Organisation for Animal Health (WOAH)

The World Organisation for Animal Health (WOAH, formerly the Office International des Epizooties (OIE)) was founded in 1924 as a response to the cattle disease rinderpest, which swept across the globe, ravaging livestock and devastating livelihoods. The crisis clearly demonstrated how animal diseases can pose a threat to food security and economic growth, and that the global community needed to address them in a coordinated way.

Headquartered in Paris, the Organisation maintains permanent relations with over 70 international and regional organisations and has regional and sub-regional offices worldwide. It has 183 members. Together, WOAH and its Members coordinate the global response to animal health emergencies, the prevention of zoonotic diseases, the promotion of animal health and welfare, and better access to animal health care.

Having already held the role of vice-chairman of the OIE regional commission for Asia the Far East and Oceania since 1972, in June 1979 Dr George Adlam was the first New Zealander to be elected to the World Organisation for Animal Health administration commission (now known as the World Organisation for Animal Health Council). The value of this appointment and relevance of New Zealand's WOAH membership was noted, and still holds true today:

- New Zealand relies on a healthy animal population for its export trade, so is vitally concerned with the occurrence and distribution of livestock diseases anywhere in the world, and;
- taking an active part in the development of international Zoo Sanitary rules for international trade in animals and animal products is important in safeguarding New Zealand's interests in animal exports (Anon., 1979).

Since that time, Barry O'Neil (who was the New Zealand's WOAH delegate from 1994 until 2012) also served on the Council from 2000 to 2012, including as president of the Council 2006–2009. Matthew Stone was Zealand's Delegate between 2011–2016 and also served as Deputy Director General International Standards and Science to the OIE for five years (see box below). Mary van Andel (New Zealand's current WOAH Delegate) was elected to the council in 2024.



Mat Stone joined MAF in 1995 and by the time he left MPI in 2016, he had worked across import/export, emergency management, incursion investigation, animal welfare and food safety programmes, including as Director of Animals and Animal Products and New Zealand's Delegate to OIE (2011–2016). After five years at OIE as Deputy Director General International Standards and Science, in 2021 he established his consultancy as SPADE Solutions Ltd. In 2022 he was appointed chair of the National Animal Welfare Advisory Committee.

Members of the Surveillance team have undertaken roles in WOAH ad hoc groups, or as WOAH Focal Points for New Zealand, in particular the Animal Disease Notification Focal Point, Wildlife Focal Point, Aquatic Focal Point and Communications Focal Point.

Animal Health Quadrilateral Alliance ('QUADs')

QUADs is a formal agreement across Australia, Canada, New Zealand, the United States and the United Kingdom (a later addition) with the vision of achieving economic prosperity, public health and food security through collaborative thinking and concerted actions in the field of global animal health, welfare and trade.

The group provides a forum for senior animal health officials of the QUADs Alliance countries to address strategic issues related to the health and welfare of terrestrial and aquatic animals and wildlife, especially as they affect international trade.

The objectives of the QUADs are:

- Preserve and strengthen the integrity and effectiveness of the rules-based global order for international trade in animals and their products, with a particular focus on strategic participation and influence at WOAH.
- Combine, amplify and leverage the influence, investment and effort of like-minded countries to achieve desired global animal health, biosecurity and trade outcomes of priority concern to QUADs Alliance members.

The Surveillance & Incursion Investigation group members actively participate in a number of the QUADs groups, including on the following topics: surveillance, epi-modelling, emergency management, vaccination

and Terrestrial Code standards and reporting.

International co-operation

The Ministry for Primary Industries has been active in its engagement with trading partners in bilateral, plurilateral and multilateral forums to help improve the trading environment. One way this is achieved is through agricultural co-operation. Agricultural co-operation may contribute to:

- fulfilling obligations to which New Zealand is committed under trade agreements;
- building greater understanding and recognition of New Zealand biosecurity, food safety and farming systems;
- promoting our goods and services export sectors; and
- building our capacity and capability through collaboration.

As part of these co-operation agreements, members of the Surveillance and Incursion Investigation Group successfully established collaborative relationships with several international partners; for example, in April 2016 the inaugural Korea–New Zealand Animal Health and Veterinary Epidemiology Workshop was held in Seoul, South Korea (**Figure 1**). This workshop was established under the New Zealand–Korea Free Trade Agreement (NZK–FTA) with the objective of sharing of animal health and veterinary epidemiological expertise between the two countries for mutual benefit (Watts, 2016). This workshop was followed up with a meeting in New Zealand in 2017 and a further meeting in Korea in 2018.



Figure 1: Attendees at the inaugural Korea–New Zealand Animal Health and Veterinary Epidemiology Workshop in Seoul, South Korea, 2016

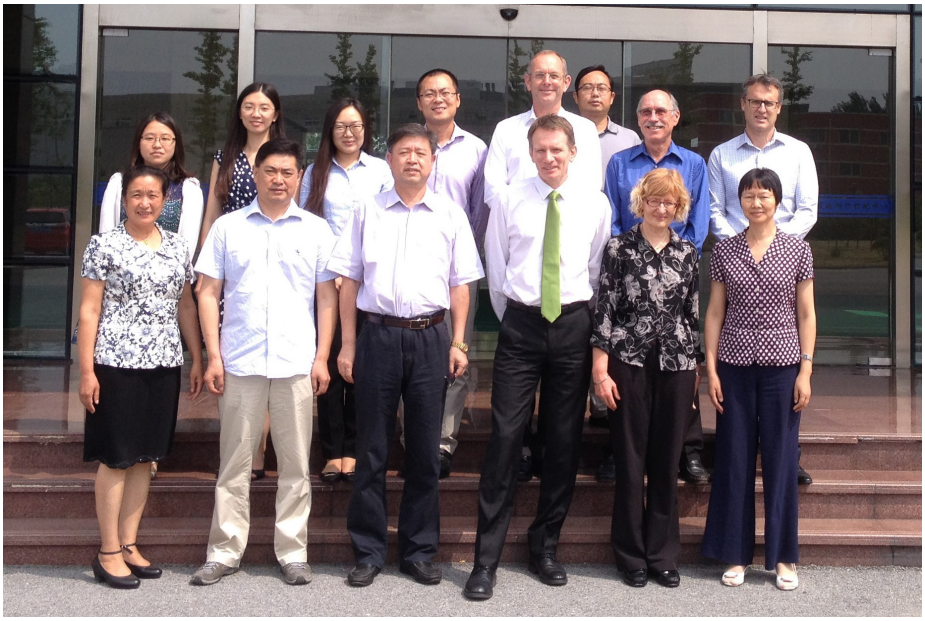

Figure 2: Members of the MPI delegation together with members from the Chinese Centre for Animal Disease Control 2016. The New Zealand delegation included Wang Can (NZ Embassy), Andre van Halderen (MPI), Professor Tim Carpenter (Massey University), David Allen (NZ Embassy), Paul Bingham (MPI), Wendy McDonald (MPI)

A similar initiative was undertaken with China. MPI and China's Ministry of Agriculture signed a work plan of co-operation in animal disease prevention and control in November 2016. The scope of the work involved four collaborating organisations: MPI, Massey University's EpiCentre, China's Animal Health and Epidemiology Centre and China's Animal Disease Control Centre. Collaboration among these agencies was centred on training, exchanges and research (**Figure 2**) (Watts, 2016).

MPI has also assisted the OIE/FAO global effort against foot and mouth disease (FMD) through support of the Southeast Asia and China Foot-and-Mouth Disease Control Programme (SEACFMD). A Memorandum of Understanding was developed with the OIE/WOAH to provide technical expertise to this programme with a particular focus in Laos (PDR Laos) and Myanmar (**Figure 3**, next page) (Watts, 2016; McFadden et al., 2019).

Domestic

Chief Veterinary Officer (CVO)

Until 1993, the position of New Zealand Chief Veterinary Officer (CVO) was described in the Animals Act 1967. However, with the implementation of the Biosecurity Act 1993, which replaced the Animals Act 1967, the role of CVO was no longer included in legislation and rather was replaced with Chief Technical Officers (CTO). From 1993 to 2004, the role of CVO was attributed to the Director of Animal Biosecurity. With the restructure that occurred in 2004, the role of Director of Animal Biosecurity was disestablished and from that point until 2022, New Zealand did not have a CVO. In 2022, the position of CVO was re-established within MPI, with Mary van Andel taking the role.

Table 1 (next page) shows the CVO during the 50-year period of animal health surveillance chronicled in this edition of Surveillance. As well as those names listed below as CVO, MAF formally appointed several veterinarians as acting CVO while the actual CVO was on leave or out



Figure 3: Drs Ian Dacre (left) and Tom Rawdon (right) piloting the biosecurity protocols developed for foot and mouth disease vaccination teams in Laos and Myanmar (McFadden, 2019)

of the country so that the emergency response system could still function according to the requirements of the Animals Act. In those situations the period was usually two to three weeks. These veterinarians included Stuart MacDiarmid, Terry Ryan, Alan Harrison, Bruce Simpson, Gary Clark and Chris Boland (J Hellström, pers. comm.).

Massey University EpiCentre

Established in 1986, the EpiCentre at Massey University has developed into an international focus group for veterinary epidemiology and public health, and is considered one of the leading groups in the world. In 2014 it became the WOAH Collaborating Centre for Veterinary Epidemiology and Public Health. EpiCentre is the lead agency for this collaborating centre, partnering with mEpiLab and China Animal Health and Epidemiology (Massey University, 2024).

The Surveillance & Incursion Investigation (S&II) group maintains both formal and informal relationships with EpiCentre. There is an ongoing contract with EpiCentre for the provision of epidemiology services including project work, continuing education and providing response capability; this arrangement has been in place since the early 2000s. Members of EpiCentre have also been contracted for specific pieces of work such as development of the Early Aberration Reporting System (EARS) for the Animal Health Surveillance programme and specific analytical and reporting tools within SIMS (such as the Standardised Analyses for Disease Investigation (SADI)). Members of the S&II team participate in the masters epidemiology course administered by the EpiCentre.

Table 1: New Zealand Chief Veterinary Officers from 1963

Year(s)	New Zealand
1963–1971	Dr Sam Jamison
1971–1985	Dr George Adlam
1985–1986	Dr Peter O'Hara
1986	Dr John Hellström
1987	Dr Alan Royal
1987–1991	Dr John Hellström
1991	Dr Stuart MacDiarmid (acting)
1991–1993	Dr Peter O'Hara
1993–1994	Dr Stuart MacDiarmid (acting)
1994–2000	Dr Barry O'Neil
2000–2004	Dr Derek Belton*
2022–Present	Dr Mary van Andel

* New Zealand identified the Director of Animal Biosecurity as the CVO to WOAH. When that role became disestablished in 2004 with the establishment of Biosecurity New Zealand, Dr Derek Belton continued to be identified as the CVO until 2011.

Conclusion

Domestically, New Zealand has enacted legislation to ensure that the biosecurity surveillance system functions optimally; effectively, everyone in New Zealand becomes the eyes and ears of the surveillance system. Where something is detected, the tools are available to manage the incursion. Collaboration with epidemiologists in the private sector has also increased capacity and the availability of additional skills.

Internationally, New Zealand has a long history of ensuring that it is an active participant in the organisations tasked with protecting animal health and trade. This is vital for a trading nation such as New Zealand and will continue.

References

Anonymous (1979). Animal Health Director appointed to world body. *Surveillance* 6(4), 12.

Massey University (2024). WOAH collaborating centre. https://www.massey.ac.nz/about/colleges-schools-and-institutes/college-of-sciences/our-research/research-projects-and-groups/epicentre/#WOAHCollaboratingCentres. Accessed 14 November 2024.

McFadden A, Buckle K, van Andel M, Phiri B, Rawdon T, Spence R, Swainsbury R, Binney B (2019). The New Zealand OIE foot-and-mouth disease control programme in Southeast Asia *Surveillance* 46(1), 12–14.

The Animals Act 1967. http://www.nzlii.org/nz/legis/hist_act/aa19671967n50110/. Accessed 10 September 2024.

Watts J (2016). 2016: A year of international co-operation for animal health and agriculture. *Surveillance* 43(4), 3.

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Reports from Ministry for Primary Industries

Diagnostic specificity of the Japanese encephalitis serological test for bovine and canine sera in New Zealand

Introduction

Japanese encephalitis virus (JEV) is a single-stranded RNA flavivirus related to dengue, yellow fever and West Nile viruses. It is transmitted mainly by *Culex* spp. mosquitoes and is a significant zoonosis. Infection can result in Japanese encephalitis (JE) a severe neurological disease and the leading cause of viral encephalitis in southeast Asia and the Western Pacific Rim, particularly in children (Mulvey et al., 2021; Endy and Nisalak, 2002; Pearce et al., 2018).

Only a small proportion (less than 1 percent) of infected people exhibit clinical symptoms, ranging from non-specific febrile illness to severe encephalitis with convulsions. The fatality rate among clinical cases is about 30 percent, with half of survivors experiencing cognitive or neurophysiological sequelae (Mulvey et al., 2021).

In countries with endemic JEV a maintenance cycle of transmission exists between wading birds and mosquitoes. Wild and domestic pigs exhibit a high and prolonged viraemia, resulting in the amplification of the virus which, in turn, allows mosquitoes to pick up infection easily. Most mammals, including humans, are spillover/dead-end hosts and do not amplify the virus to the degree needed to infect mosquitoes and facilitate onward transmission (Pearce et al., 2018; Oliveira et al., 2018).

Until 2022, the known southerly limit of JE was the far north of Australia, Cape York Peninsula (Hanna et al., 1996; Hanna et al., 1999). Then on 25 February 2022, the presence of JEV was confirmed in samples from a commercial pig farm in southern Queensland, Australia, following an unusually high rate of abortion and stillbirths in farrowing sows. Notifications from other piggeries in New South Wales and Victoria quickly followed (Yakob et al., 2023). Evidence of JEV circulation has now been found in all mainland states and the Northern Territory (McGuinness et al., 2023; Mackenzie et al., 2022; Zhang et al., 2023). Because vector abundance drives disease incidence, some areas of Australia will be subject to sporadic epidemics while other areas could have a level of persistent endemicity.

Status in New Zealand

Japanese encephalitis is a listed disease with the World Organisation for Animal Health (WOAH).
New Zealand claims historical freedom from the virus as:

- there has never been an occurrence of disease in New Zealand;
- an early detection system and measures to prevent introduction are in place;
- no vaccination is practised here; and
- there is no JEV established in wildlife.

JEV is notifiable under the Biosecurity (Notifiable Organisms) Order 2016 (Ministry for Primary Industries, 2018) and is an unwanted organism under the Biosecurity Act 1993 (Ministry for Primary Industries, 2009).

The establishment of JEV across Australia has altered the risk profile for introduction into New Zealand. While the risk in any given year is low, it will fluctuate as climate and vector abundance vary in Australia. New Zealand has a competent vector in *Culex quinquefasciatus* and potentially, *Ochlerotatus notoscriptus*; the ability of these mosquitoes to effectively vector JEV is likely to increase with increasing temperatures expected through climate change (Kramer et al., 2011).

Methods of introduction of JEV into New Zealand would be through infected mosquitoes or larvae as hitchhikers on ships or aircraft, windborne transfer of mosquitoes, or arrival of infected reservoir bird species. The epidemiology, risk and possible surveillance methods for New Zealand have recently been reviewed (Morris and Bingham, 2023).

Vector and virus surveillance

Early detection surveillance for exotic mosquitoes and protective control actions at the New Zealand border (airports and international seaports) are led by Health New Zealand (Te Whatu Ora). Reports of suspected exotic mosquitoes from within New Zealand (post-border) are followed up by local public health services informed by the Ministry of Primary Industries' mosquito hotline number 0800 MOZZIE (0800 66 99 43) (Ndoungué et al., 2024). Targeted post-border surveillance for exotic mosquitoes, as well as surveillance for exotic vector-borne diseases of animals, is led by the Ministry for Primary Industries (MPI) (Roper, 2023; McGinn, 2023).

The objective of post-border surveillance for JE is the early detection of clinical disease in pigs or horses. Early detection would be achieved by following up reports from veterinarians of suspected disease to the MPI general surveillance system (exotic pest and disease hotline – 0800 80 99 66). The report would then be rapidly investigated followed by confirmation of infection. Early detection in animals acts as an early warning system for all stakeholders, particularly those in the human health sector.

Additional active surveillance to augment the general surveillance system would be beneficial because JE is largely a subclinical disease in animals. Only a small percentage of infected animals show clinical signs and JEV could be circulating for some time before disease is suspected and reported. Dogs would be an effective sentinel species because they live in close proximity to people and readily seroconvert (Morris and Bingham, 2023). Cattle are also known

to seroconvert without showing clinical disease. Cattle samples are available as hundreds of sera are collected annually for MPI's existing arbovirus surveillance programme (Peacock et al., 2023). The risk areas of introduction for *Culicoides*-vectored diseases, which are the target of the arbovirus surveillance programme, and for JEV establishment are likely to overlap. Therefore, flavivirus serological testing was added to the arbovirus surveillance panel in 2022.

With respect to vectors, the objective of the MPI National Mosquito Surveillance Programme (NMSP) is early detection of exotic mosquito species within the programme's identified post-border habitats. In March 2023, the operational scope of the NMSP was extended to include freshwater mosquito breeding habitats associated with high-risk Transitional Facilities (TFs), first ports of arrival and commercial piggeries. This was a result of a risk assessment performed looking at the risk of introduction and establishment of freshwater mosquitoes through TFs, the unprecedented range extension of JEV in Australia in 2022 and the acknowledgement of more volatile weather patterns (McGinn, 2023).

Serological testing for active surveillance

Interpretation of serological tests for JEV antibodies is complicated by the antigenic relatedness of flaviviruses, particularly those belonging to the same serogroup (Chan et al., 2022). New Zealand is free of all other members of the serogroup (such as Murray Valley encephalitis and West Nile virus). However, of the species that could readily be sampled for surveillance, dogs are imported from Australia and could have been exposed to flaviviruses before importation. Serological test results need to be interpreted in this context.

Serological tests to detect IgM and IgG antibodies to flaviviruses include competitive (C-)ELISAs, IgM capture (MAC-)ELISAs, and virus neutralisation (VN) tests. To resolve any cross-reactive antibodies, the more specific VN tests are used. Of the different VN test formats that may be employed, the plaque reduction neutralisation test (PRNT) is considered the most specific (Maeda and Maeda, 2013).

A diagnosis of recent infection can be based on the demonstration of seroconversion between paired serum samples collected in the acute or convalescent phases, or a significant rise in antibody levels (fourfold or greater) using the neutralisation test.

No JEV-specific animal ELISA tests are available in New Zealand. Therefore, a multi-species flavivirus C-ELISA is used for screening samples. It detects antibodies to a conserved surface protein across several flaviviruses. In the case of repeatable reactors, PRNT would be undertaken for confirmation. Confirmatory tests are not available in New Zealand, and would be subcontracted to the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia.

Testing suspect clinical cases

In New Zealand the investigation of suspected clinical disease in pigs or horses would be performed using molecular tests together with serology or paired serology.

Diagnostic specificity of the C-ELISA in dogs and cattle in New Zealand

Very little flavivirus serology has been undertaken on animals in New Zealand and the operating characteristics of the available tests are unknown. Determining the diagnostic specificity (DSp) of the C-ELISA is important, as working through positive results without first understanding the test performance with dog or cattle sera could be expensive and time-consuming. Making false assumptions from a non-validated assay and without confirmation of results could also initiate confusion leading to unnecessary response actions and media attention. For these reasons, New Zealand dogs and cattle were sampled to attempt to determine the DSp of the test in a trial programme.

Our starting assumption was that New Zealand is free of circulating flaviviruses and therefore all sera collected should be negative for JEV. This is not unreasonable as New Zealand claims a historical freedom status with WOAH based on the criteria previously listed.

However, as Australia's status for JEV has changed and the status of New Zealand had not been determined by active surveillance over the previous twelve-month period, any serum from this work that returned a repeatable reaction on the C-ELISA would be investigated further by PRNT, which is the gold standard serological test. In this way we performed partial verification (only positives and not negatives were followed up) (Greiner and Gardner, 2000). Should the PRNT also prove positive, the surveillance and investigation teams, together with the MPI Animal Health Laboratory (AHL), would meet to determine whether additional surveillance or adjustment to existing surveillance was required. For seropositive dogs, their import history would be checked as they could have been exposed to a flavivirus before travel.

The case definition for JEV would not be met until a sequenced PCR product was found or virus cultured. As noted earlier, serological positivity did not mean active or even prior

Table 1: Sources and numbers of sera and C-ELISA specificity results

Source of sera	Species	Numbers sampled	Number C-ELISA positive	Timing of collection	Likely 95% Lower confidence interval**
Opportunistic collection	Dogs	100	0	As the samples became available in 2022/23	DSp 96.4%
Arbovirus surveillance programme	Cattle	640 from 133 farms	0	1 April – 15 May 2023	DSp 99.4%

** Exact binomial confidence limits for specificity given zero positives

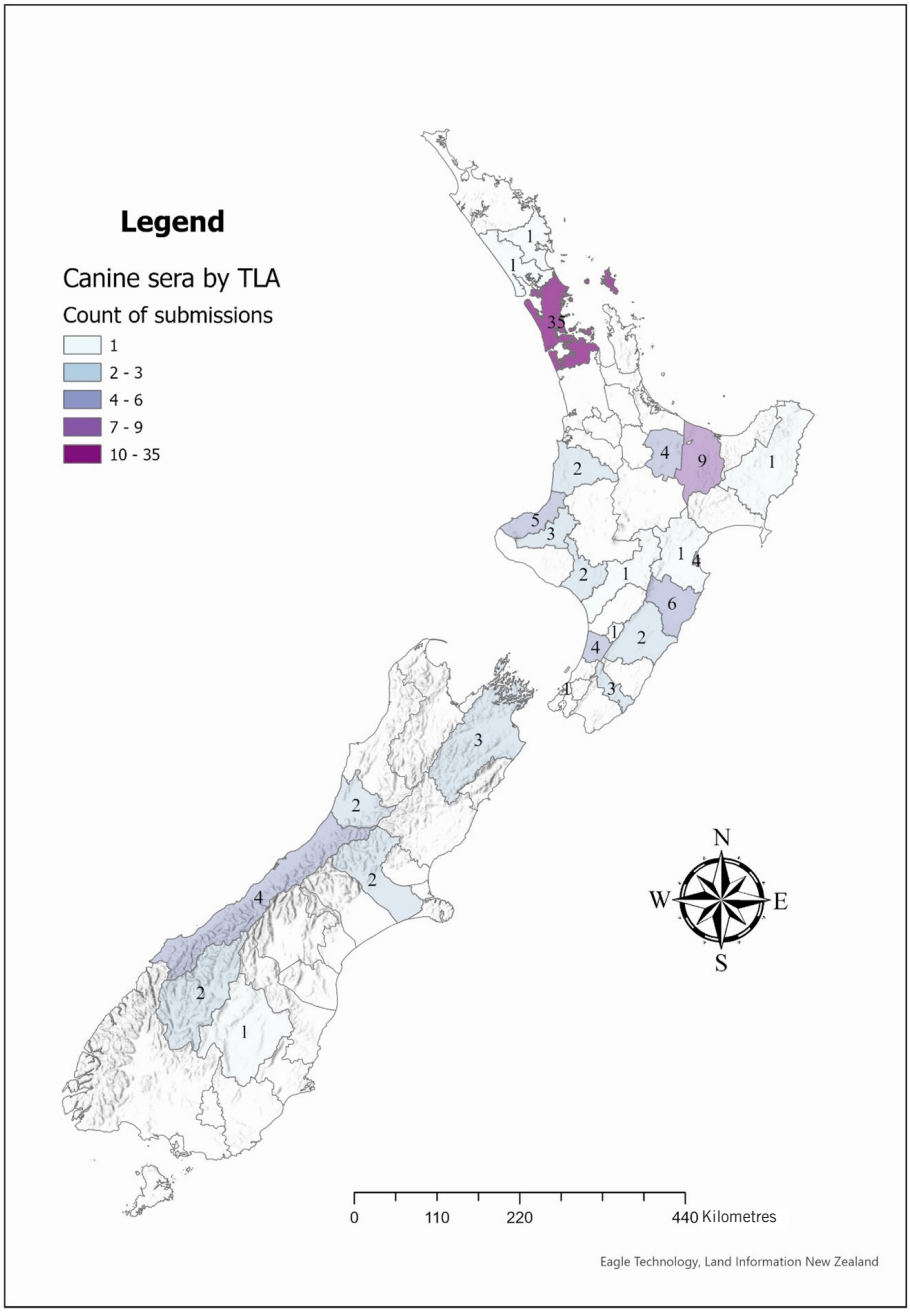

Figure 1: Count of serum samples submitted from dogs (2022/23) mapped to the dog's resident Territorial Local Authority

infection with JEV as cross-reacting agents are possible. It should be noted that the C-ELISA and VNT may not be completely independent tests due to antigenic overlap of targets in both assays.

The populations of interest were New Zealand dogs in general and cattle farms within the geographical areas identified as at risk from *Culicoides* introduction, and by proxy, also at risk of introduction (by migratory birds and wind assisted introduction) of competent mosquitoes and establishment of JEV. The units of sampling were individual dogs and slaughter cattle from the populations of interest.

The sampling method for dogs was non-probabilistic opportunistic sampling based on dog sera presented to regional veterinary laboratories over the study period. Each of the three veterinary laboratory companies was asked to supply 35 canine serum samples. The sera were submitted to MPI's AHL along with a unique sample identification and the Territorial Local Authority that the dog originated from (**Table 1**, previous page, **Figure 1** and **Figure 2**, next page).

The sampling method for cattle was proportional stratified random sampling to select the number of farms taken from each sampling frame: Northland, Auckland, Bay of Plenty and Waikato, based on regional council boundaries. Spatial random sampling was used to choose the farms in each region, ensuring a spatial representation. Practically, for some areas/farms/animals, sampling was based on the schedule stipulated on the plant's kill sheets and opportunistic sampling was undertaken on what was available at the time.

Conclusion

Testing undertaken shows the specificity of the C-ELISA is high with no positives found in the sampled animals. Given the sample sizes, the lower confidence interval for the C-ELISA in dogs could be as low as 0.964 and for cattle, 0.994 (**Table 1**). JEV is an important zoonosis. This work provides further evidence of absence of the virus in New Zealand. The work also gives insight into test performance of the generic flavivirus C-ELISA in the negative dog and cattle populations of New Zealand.

References

Chan KR, Ismail AA, Thergarajan G, Raju CS, Yam HC, Rishya M, Sekaran SD (2022). Serological cross-reactivity among common flaviviruses. *Frontiers in Cellular and Infection Microbiology* 12, 975398.

Endy TP, Nisalak A (2002). Japanese encephalitis virus: Ecology and epidemiology In: Mackenzie JS, Barrett ADT, Deubel V (eds) *Japanese Encephalitis and West Nile Viruses. Current Topics in Microbiology and Immunology*, vol 267. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-59403-8_2.

Greiner M, Gardner IA (2000). Epidemiologic issues in the validation of veterinary diagnostic tests. *Preventive Veterinary Medicine* 45(1–2), 3–22.

Hanna JN, Ritchie SA, Hills SL, van den Hurk AF, Phillips DA, Pyke AT, . . . Mackenzie JS (1999). Japanese encephalitis in north Queensland, Australia, 1998. *Medical Journal of Australia* 170(11), 533–536.

Hanna JN, Ritchie SA, Phillips DA, Shield J, Bailey MC, Mackenzie JS, . . . Mills PJ (1996). An outbreak of Japanese encephalitis in the Torres Strait, Australia, 1995. *Medical Journal of Australia* 165(5), 256–260.

Kramer LD, Chin P, Cane RP, Kauffman EB, Mackereth G (2011). Vector competence of New Zealand mosquitoes for selected arboviruses. *The American Journal of Tropical Medicine and Hygiene* 85(1), 182.

Mackenzie JS, Williams DT, van den Hurk AF, Smith DW, Currie BJ (2022). Japanese encephalitis virus: The emergence of genotype IV in Australia and its potential endemicity. *Viruses* 14(11), 2480.

Maeda A, Maeda J (2013). Review of diagnostic plaque reduction neutralization tests for flavivirus infection. *The Veterinary Journal* 195(1), 33–40.

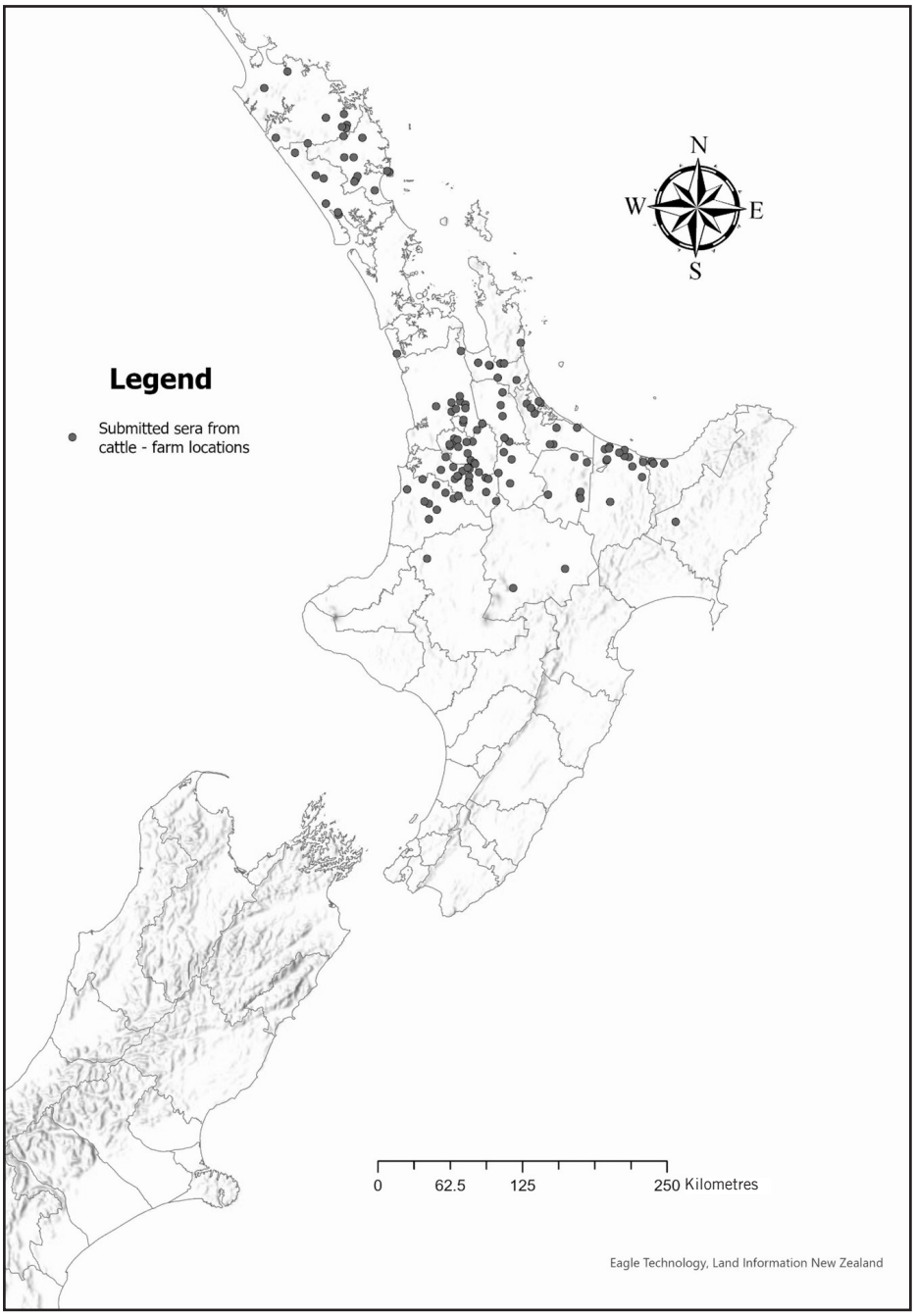

Figure 2: Locations of cattle farms from which cattle sera were obtained (2023)

McGinn D (2023). National mosquito surveillance programme annual report. *Surveillance* 50(3), 130–131.

McGuinness SL, Muhi S, Britton PN, Leder K (2023). Japanese encephalitis: Emergence in Australia. *Current Infectious Disease Reports* 25(6), 111–122.

Ministry for Primary Industries (2009). Unwanted organisms register. Retrieved from https://pierpestregister.mpi.govt.nz/PestsRegister/ImportCommodity/.

Ministry for Primary Industries (2018). Biosecurity (Notifiable Organisms) Order 2016. Retrieved from https://www.mpi.govt.nz/dmsdocument/6403/direct.

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.

Mulvey P, Duong V, Boyer S, Burgess G, Williams DT, Dussart P, Horwood PF (2021). The ecology and evolution of Japanese encephalitis virus. *Pathogens* 10(12), 1534.

Ndoungué VF, Ngapagna AN, Kouadio SA, Djinguebey R, Gnigninanjouena O, Eyangoh S, Njajou O (2024). Requirements for international points of entry. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/36443744.

Oliveira AR, Cohnstaedt LW, Cernicchiaro N (2018). Japanese encephalitis virus: Placing disease vectors in the epidemiologic triad. *Annals of the Entomological Society of America* 111(6), 295–303.

Peacock L, Trim C, Boyd B, Begg D, Bueno R, Bestbier M, Rolston A, Wildman C, Pigott C (2023). Arbovirus surveillance programme annual report. *Surveillance* 50(3), 48–49.

Pearce JC, Learoyd TP, Langendorf BJ, Logan JG (2018). Japanese encephalitis: The vectors, ecology and potential for expansion. *Journal of Travel Medicine* 25(Suppl_1), S16–S26.

Roper T (2023). Surveillance programmes for pests and diseases. Retrieved from https://natlib-primo.hosted.exlibrisgroup.com/primo-explore/search?query=any,contains,9985735636028 37&tab=innz&search_ope=INNZ&vid=NLNZ&offset=0.

Yakob L, Hu W, Frentiu FD, Gyawali N, Hugo LE, Johnson B, ... Devine G (2023). Japanese encephalitis emergence in Australia: The potential population at risk. *Clinical Infectious Diseases* 76(2), 335–337.

Zhang W, Yin Q, Wang H, Liang G (2023). The reemerging and outbreak of genotypes 4 and 5 of Japanese encephalitis virus. *Frontiers in Cellular and Infection Microbiology* 13.

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Quarterly report of investigations of suspected exotic diseases: July to September 2024

Exotic pest and disease investigations are managed and reported by MPI's Diagnostic & Surveillance Directorate. The following is a summary of investigations of suspect exotic and emerging pests and diseases during the period from July to September 2024.

Exotic vesicular diseases ruled out in a cow

A veterinarian in greater Auckland phoned the exotic pest and disease hotline to report a three-year-old kiwi-cross dairy cow with ulcerative lesions on the hard palate (**Figure 1**) and nose. The affected cow was first noticed sick that morning and was afebrile, lethargic, displaying hypersalivation and had experienced an acute drop in milk production. Ulcerative lesions in these locations can arise from many causes, but of most concern are the exotic vesicular diseases such as foot and mouth disease (FMD). The rest of the herd (n = 360) had not been inspected, and given the torn edges and acute appearance of the lesions it was decided that activating the Initial Investigating Veterinarian (IIV) system was appropriate. The IIV carried out a clinical examination on the affected animal and subsequently visually inspected the rest of the herd, and all other mobs on the farm, and no illness or cause for concern was identified. Exotic disease was excluded on epidemiological and clinical grounds. Endemic diseases such as bovine viral diarrhoea (BVD) and malignant catarrhal fever (MCF) can cause ulcerative lesions in cattle, but molecular assays for these agents were negative. A palate lesion biopsy showed moderate pyogranulomatous inflammation with multifocal nodules of abundant neutrophils and macrophages centred on colonies of gram-negative bacteria with Splendore–Hoeppli material, consistent with infection by *Actinobacillus lignieresii*. It is likely that the lesions observed in this case were due to actinobacillosis, and the torn-looking lesion edges were in fact sharply-demarcated edges of coalescing actinobacillosis lesions. Exotic disease was excluded, and the investigation was closed.

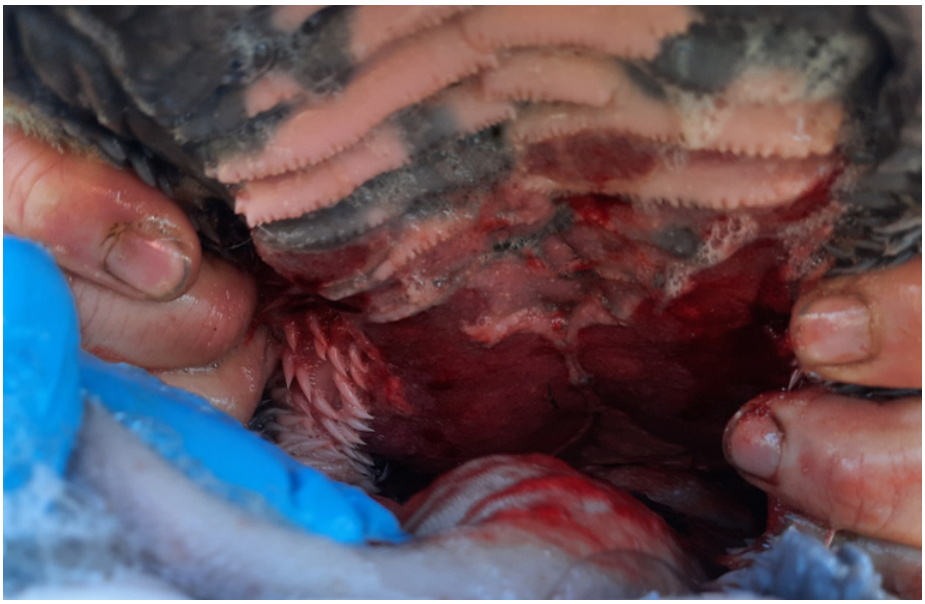

Figure 1: Hard palate of a cow with oral and nasal planum lesions, showing a large reddened ulcerated region with a torn, ragged-appearance to the lesion edge. Photo: Neil Murray, Franklin Vets

Exotic vesicular diseases ruled out in a sheep

A veterinarian in Canterbury phoned the exotic pest and disease hotline to report one of seven sheep with lesions on the feet and mouth (**Figure 2** and **Figure 3** (next page)). The affected animal was an 8-year-old wether. Two cattle were also present on the property. The owner had been overseas recently, and the veterinarian could not exclude exotic vesicular disease as a cause of the lesions. The wether had been diagnosed with lymphoma about 10 days before and been given steroid treatment, meaning that immunosuppression may have been a factor. The veterinarian was asked to examine the other six sheep and two cattle on the property, and no signs of vesicular lesions, lameness or salivation were found. It was also subsequently determined that the owner's travel was to Japan and the United States, both foot and mouth disease-free countries. All of this together enabled standing down the case as vesicular. The sheep was euthanased at the owner's request on humane grounds and samples of the foot lesions were submitted to the MPI Animal Health Laboratory (AHL). Histology showed extensive, suppurative and hyperplastic dermatitis, with marked serocellular



Figure 2: Lesions on the coronary bands and pasterns of the feet of an eight-year-old wether

crusting and abundant gram-positive cocci, ballooning degeneration and suspected multiple intra-cytoplasmic small inclusions. The most likely cause for such a presentation in sheep is parapoxvirus (orf), although molecular testing of the formalin-fixed tissues was negative so this could not be confirmed. The immunosuppressed status of this sheep may have contributed to the severity of lesions.



Figure 3: Lesions on the lips of an eight-year-old wether that also had lesions on the feet

Brucellosis excluded in a bull

An MPI AHL scientist contacted the duty Incursion Investigator to report a positive result for *Brucella abortus* in one of seven stud bulls at a semen collection centre. Due to export testing requirements, bulls are screened using a Complement Fixation Test (CFT). The bull had failed this test, and confirmatory testing by immunosorbent assay (ELISA), also returned a positive result. The bull had been residing at the semen collection centre for three months and had previously tested negative for *Brucella abortus* on a CFT taken three weeks before this latest sample. New Zealand has maintained official freedom from bovine brucellosis since 1989, following a rigorous eradication programme that involved test-and-slaughter methods, vaccination and movement control (Hopkirk, 1966). This has made any positive test result for *Brucella abortus* highly significant. The bull was clinically healthy, but as a precaution it was immediately isolated from the other bulls for further testing. A comprehensive veterinary examination found no abnormalities, including a normal rectal temperature and healthy testicular soundness. It is well documented that the CFT for bovine brucellosis can yield false-positive results due to cross-reactivity with antibodies from other infections, such as *Yersinia enterocolitica*, or recent vaccinations, such as those for leptospirosis. Specifically, *Yersinia enterocolitica* serotype O:9 shares antigenic similarities with *Brucella*, which can lead to cross-reactivity in serological tests like the CFT. Similarly, leptospirosis vaccines can induce antibodies that interfere with the CFT, producing false positives. Therefore, more specific methods such as ELISA are often used to rule out such cross-reactivity and confirm true *Brucella* infections (Legesse et al., 2023; Trotta et al., 2020). *Yersinia enterocolitica* was excluded as a cause of the false-positive result due to a negative faecal sample culture. True brucellosis is a chronic condition and infected animals remain seropositive over long periods. A follow-up serum sample four weeks later was negative for *Brucella abortus* using both the ELISA and CFT. The six cohort bulls all re-tested negative at the same time. With these conclusive negative results, the semen collection centre was able to clear all seven bulls for entry, operations resumed as usual, and the investigation was closed.

Anthrax excluded in two cattle investigations

A veterinarian in Otago rang the exotic pest and disease hotline after receiving alarming photographs and a description from a farmer regarding a dead cow. The cow exhibited frank blood oozing from the eyes, mouth, nostrils and rear end, raising concerns of a potential anthrax case (**Figure 4**). The cow had calved only hours earlier, and a closer examination revealed that the blood at the rear end was originating from the vulva. Anthrax has not been reported in New Zealand since the 1950s, when it was found in Waikato. The South Island has been free of the disease since 1905, with the last case occurring in Southland, far from the location of this notification. Given this history, and following further discussions with the veterinarian and farmer, the likelihood of anthrax was assessed as extremely low. However, to ensure safety, a post-mortem examination was conducted under strict personal protective equipment (PPE) protocols to prevent any potential exposure. A whole blood sample in EDTA was submitted to MPI's AHL, where PCR testing for *Bacillus anthracis* returned a negative result. Non-exotic diseases causing sudden death in cows include metabolic disorders, toxicity, clostridial disease and others. The cow's recent calving suggested a



Figure 4: Frank blood from the eyes, mouth and nostrils (right) and vulva (centre) from a recently calved cow found dead. Photo: Chase Jordan, Clutha Vets

possible metabolic disorder. Analysis of the aqueous humour revealed hypocalcaemia (calcium 0.91 mmol/L, reference range 1.00–2.00 mmol/L), and hypermagnesaemia (1.32 mmol/L, reference range 0.50–1.15 mmol/L). Metabolic disease was confirmed and the investigation was closed.

A veterinarian called the exotic pest and disease hotline to discuss a potential case of anthrax in a herd of cows on a farm in Waikato. Eight animals from a herd of 280 mixed-age cows had died suddenly over a 4-week period. The veterinarian had initially visited the farm four weeks before the notification when the farmer noticed two sick cows and one dead cow. One of the sick cows subsequently died and the other recovered. Both sick cows were negative for *Salmonella* and magnesium levels were normal. Next, a group of five cows were found dead one morning after having been observed normal the previous afternoon. The carcasses were noted to be more gaseous and bloated than the post-mortem interval would have suggested. When the farmer contacted the veterinarian to report an eighth dead cow within four weeks, this one reportedly with blood coming from the nose, eyes and vulva, the veterinarian became concerned. Bloody discharge from orifices is associated with anthrax, and the veterinarian called the hotline. Upon inspection of the carcass the veterinarian did not see any frank haemorrhage, although they noted the conjunctiva and mucosa of the vulva were very injected and red, which may have been mistaken for blood by the farmer. The veterinarian obtained a history, determining there was no recent history of excavation, other soil movements or other risk factors for anthrax on the property. Under the direction of the Incursion Investigator a peripheral ear vein blood smear was taken and delivered by the veterinarian to a regional commercial veterinary laboratory for assessment. There were no bacteria present on Gram-stained slides, allowing exclusion of septicaemia by *Bacillus anthracis* and other clostridial bacilli. Once anthrax had been excluded by smear examination, a postmortem was conducted, which was diagnostic for cause of death. The abomasum contained massive amounts of stones and gravel which appeared to be blocking ruminal outflow – the rumen was full of large quantities of fluid, gas and grass material and the small intestine and large intestine were empty. No other abnormalities were noted in the remainder of the carcass, but it was considered that this cow might not be representative of whatever process had killed the other seven. All eight of the dead cows affected were part of a mixed mob of both younger and older animals but only cows four years or older had died. The veterinarian subsequently took blood samples from other cows in the herd to investigate possible nutritional deficiencies that could lead to pica. Of the 10 cows sampled one cow was low in copper and one was low in selenium. The herd were supplemented with a B12 and selenium injection and there were no further deaths.

Babesiosis excluded as the cause of anaemia in cattle

A veterinarian in Greymouth phoned the exotic pest and disease hotline to report a large mortality event in a dairy herd. Twenty-eight cows were affected out of a herd of 980, of which 15 had died and 13 were showing clinical signs of anaemia, lethargy, weakness and reduced milk production. Exotic piroplasms, such as *Babesia bovis*, may cause severe anaemia in cattle and lead to clinical signs such as those observed. In order to exclude exotic disease, blood samples from four affected cows were submitted to MPI's AHL for piroplasm testing. Molecular testing was negative for exotic piroplasms and returned a positive result for three-quarters of the cows for *Theileria* spp. Subsequent sequencing confirmed the endemic piroplasm *Theileria orientalis,* with molecular testing at a commercial veterinary laboratory confirming *Theileria orientalis* Ikeda type as the cause of this outbreak. Although reports of this organism are rare this far south (Lawrence et al., 2021; McFadden et al., 2016), these cattle had been over-wintered in Westport where *Theileria* spp. infection occurs sporadically, and it is likely they were infected during this time. The start of calving some two weeks before the onset of the outbreak likely caused stress and subsequent immunosuppression, leading to the clinical disease observed. Exotic disease was excluded, and the investigation was closed.

Ischaemic teat necrosis confirmed in cattle

This period saw the publication of a peer-reviewed article (O'Connell et al., 2024) describing the investigation of an outbreak of teat lesions in a Taranaki dairy herd in the spring of 2021 that culminated in a diagnosis of ischaemic teat necrosis. Twelve first-calving heifers of 170 in a 720-head herd developed dry, red to black, crusting lesions on the medial aspect of one or more teats, at the teat udder junction, and extending down the teat (**Figure 5**). Affected heifers were observed to aggressively lick their teats. In three heifers, lesions progressed to sloughing of a teat. Serology and virology ruled out the involvement of bovine alphaherpesvirus (BoHV-2) bovine gammaherpesvirus (BoHV-4), orthopoxviruses (cowpox) and parapoxviruses (pseudocowpox). Histopathology of an affected and surgically amputated teat showed



Figure 5: Ischaemic teat necrosis lesions showing severe necrosis and partial sloughing of the left front teat and diffuse red to black discolouration of the medial aspect of the right front and right hind teats. Photo: Kyle Crowley, Coastal Vets Opunake

multifocal erosion and ulceration of the epidermis, covered by a thick serocellular crust. In areas of ulceration, there were numerous neutrophils and the dermis was expanded by granulation tissue with variable numbers of neutrophils, eosinophils, and lymphocytes around small blood vessels. The history, clinical presentation and histopathological changes were like those described for the condition termed ischaemic teat necrosis in the United Kingdom (Crosby-Durrani, 2023). This is the first confirmation of this disease condition in New Zealand.

Ovine pulmonary adenomatosis investigated

A veterinary pathologist contacted the duty Incursion Investigator to report a diagnosis of pulmonary adenocarcinoma on samples submitted from a five-year-old Romney-cross ewe. The ewe was part of an 1,800-head breeding ewe flock on a sheep-and-beef farm on the East Cape of the North Island. The farmer's veterinarian had been called to necropsy the affected ewe after she was observed to have lost body condition over the course of two months and showed signs of respiratory distress before death. A small percentage (1–2 percent) of the flock were reported to be in light body condition, but respiratory disease did not appear to be widespread at flock level. Pulmonary adenocarcinoma in sheep may occur sporadically; however, it can also be caused by the exotic agent jaagsiekte sheep retrovirus (JSRV). Jaagsiekte sheep retrovirus is a betaretrovirus and is the causative agent of ovine pulmonary adenocarcinoma (OPA), a contagious lung tumour of sheep and, more rarely, goats. Fixed lesional lung was submitted to the Moredun Research Institute, Scotland, where OPA virus was excluded via immunohistochemistry, the definitive test for OPA. Exotic disease was excluded and the investigation was closed.

Unusual lesions in abattoirs

An MPI Verification Services veterinarian from Gisborne shared photographs with the Incursion Investigation team, showing unusual subcutaneous and muscle lesions (**Figures 6 and 7**) in one goat carcass from a line of 550. Histology of the subcutaneous lesions showed they were expanded follicular cysts containing large numbers of *Demodex* mites (**Figure 8**). In goats, *Demodex caprae* commonly causes these large cystic lesions, which, when ruptured, release mites that contaminate the hair coat and environment, facilitating transmission to other animals in close contact. *Demodex caprae* has been previously isolated from goats in New Zealand (Heath et al., 2021; Nutting et al., 1975). The muscle lesions were associated with fat degeneration and mineralisation, with no evidence of active inflammation and there was no evident connection with the hide lesions. The exact cause remains uncertain, but trauma, along with potential underlying nutritional or metabolic factors, may contribute to fat saponification and degeneration.

A veterinarian from MPI's Verification Services contacted an Incursion Investigator to report unusual lesions observed in the kidneys of a mature beef cow during processing. At postmortem, both kidneys showed pale multifocal raised lesions (**Figure 9**, next page). There was no indication of systemic spread, and lymph nodes appeared unaffected. Histopathology confirmed the presence of severe, necrotising and predominantly granulomatous tubulo-interstitial nephritis with intralesional bacteria, primarily found within necrotic tubules. This suggested an ascending urinary tract infection. Additionally, there was evidence of interstitial and glomerular fibrosis, which may indicate previous episodes of kidney infection. While an ascending infection was most likely, the possibility of a systemic infectious cause that localised in the kidneys could not be entirely ruled out, given the presence of arteriolar and glomerular necrosis in certain areas.

A veterinarian with the MPI Verification Services contacted the Incursion Investigation team to report finding several 'stone-like'



Figure 6: Carcass of a goat at processing, showing dozens of oval, occasionally coalescing, well-demarcated pale raised nodules within the muscle – these were determined to be regions of fat saponification unrelated to the lesions in **Figure 7**. Photo: Alan Gaynor, MPI Verification Services



Figure 7: Subcutis of a goatskin corresponding to the carcass in **Figure 6**, showing dozens of oval, occasionally coalescing, well-demarcated nodules. Photo: Alan Gaynor, MPI Verification Services

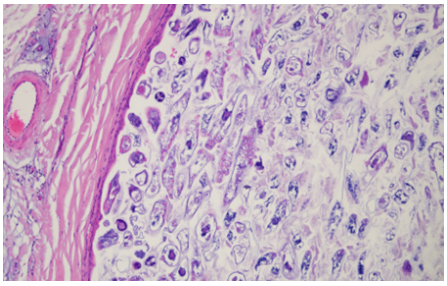

Figure 8: Parasite sections within a walled cyst (wall at left) corresponding to lesions seen grossly in **Figure 7**. Sections of *Demodex* mites are densely packed, with cross-sections showing elongated forms, transverse sections through the body, and occasional chitinous appendage joints. Photo: Mark Bestbier, MPI Animal Health Laboratory

structures found during boning out of a chopper sow (older sow no longer required for production) presented for slaughter at an abattoir. Five dense stone-like structures, less than 2 cm

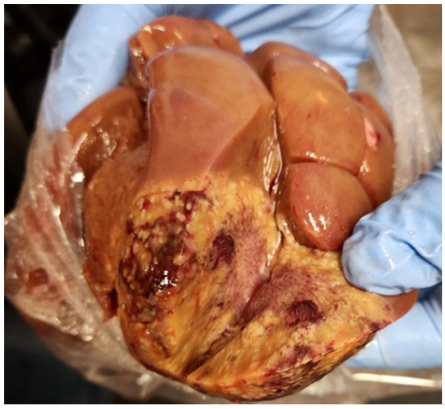
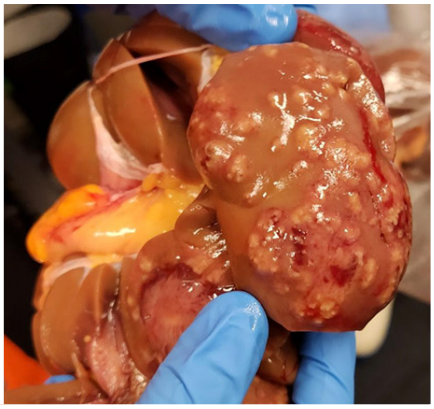

Figure 9: Pale to haemorrhagic, expansile, multifocal lesions in the cortex of the kidneys of a beef cow at slaughter. Histology suggested ascending pyelonephritis as the cause of these lesions. Photos: MPI Verification Services

in diameter were found between the muscles of the shoulder (**Figure 10**) and were not clearly associated with any ligaments, tendons, injection sites or joints. Histological examination found the 'stones' consisted of well-circumscribed, rounded structures with an outer fibrous sheath that progressed into dense hyaline cartilage nests, lobules and short trabeculae of chondrocytes interspersed with hyaline and mineralised cartilage. In cross-section, layers of chondrocytes gave the lesion a concentric, layered appearance. In the deeper areas the cartilaginous matrix had degenerated and there were small cystic cavities. It was concluded that the masses were soft-tissue, benign, cartilaginous proliferations and were most suggestive of soft-tissue chondroma. Chondromas have been reported mainly in humans and often arise in the vicinity of joints or tendons, commonly of the hands and feet of adults. As exotic disease was ruled out, this investigation was closed and noted as an interesting baseline finding.

Swine fever viruses excluded in mortality event

A veterinarian called the exotic pest and disease hotline to report a mortality event in a farrow-to-finish, 40-sow, free range, mid-Canterbury pig farm. Over seven days, 15 of 27 pigs, 8 to 12 weeks old, from two adjacent paddocks had become lethargic and died. Two typical cases were euthanased and necropsied. In the first case there was no gross pathology, but polyserositis (**Figure 11**) featured in the second necropsy. Tissue samples from both necropsies were submitted to MPI's AHL and were negative on molecular testing for the exotic viral agents of African swine fever and classical swine fever. Fixed and fresh tissues were also submitted to a commercial veterinary laboratory where histopathology in both cases suggested a septicaemic condition. Bacterial culture from the first necropsy yielded a light growth of *Glasserella parasuis* (formerly *Haemophilus parasuis*) and a light growth of *Streptococcus equi* subsp.




Figure 10: Left: Smooth, white hard stones found in the shoulder muscles of a sow at slaughter. Right: Muscle site of origin of stones (blue circle). Photo: Ayanda Mpehle, MPI Verification Services



Figure 11: Polyserositis was the significant gross finding on necropsy of a pig from a mortality event on a mid-Canterbury free range pig farm. Photo: Donald Arthur, Selwyn-Rakaia Vets

zooepidemicus (*S. zooepidemicus*). Culture of spleen and kidney, and a swab from the abdominal cavity of the second necropsy yielded light, moderate, and heavy growths, respectively, of *S. zooepidemicus*. Subsequent multilocus sequence typing (MLST) of the isolate at MPI's AHL identified it as Sequence Type (ST) 194. This is the second New Zealand confirmation of *S. zooepidemicus* ST 194 associated with a mortality event of pigs. A significant 2018 mortality event was attributed to *S. zooepidemicus* (Rawdon, 2019). The 2018 isolate was subsequently identified as ST 194 (T Rawdon, pers. comm., 15 September 2024). *Streptococcus zooepidemicus* has historically been considered a commensal of pigs, although strains virulent to pigs have also been reported in China in the 1970s, and in Canada and the United States since 2019 (Anonymous, 2021; Costa et al., 2020). This particular sequence type has been associated with all these outbreaks. *Streptococcus equi* ssp. *zooepidemicus* should be considered when conducting diagnostic investigations of mortality events in pigs (Costa et al., 2022).

Infectious bursal disease excluded in commercial poultry

The New Zealand poultry industry operates an infectious bursal disease (IBD) surveillance programme for the exotic IBD type 1 with the IDEXX

FlockChek ELISA used as a screening test at the commercial poultry laboratories (Mulqueen et al., 2021). If the prevalence of reactors in an epidemiological unit is 50 percent or over on the screening test, the positive sera are submitted to MPI's AHL for the virus neutralisation test (VNT). If the prevalence is under 50 percent, a rebleed and retest is carried out at the poultry laboratory. Any sera that are ELISA-positive on the rebleed are submitted to AHL for VNT. The duty Incursion Investigator is then notified of any positives on VNT (PIANZ et al., 2015).

In a first of two IBD investigations, a scientist from MPI's AHL contacted the duty Incursion Investigator to report positive results on serological testing for IBD virus during routine surveillance as part of the national IBD surveillance programme. In this case a commercial broiler farm in greater Auckland had 1/10 and 7/10 positive ELISA results in two sheds. These samples were forwarded to AHL for virus neutralisation testing in which 5/10 were positive. The sheds had been depopulated by this point, so serum and cloacal swabs were taken at the first cut of the next cohort of birds to go through the sheds. All 20 of the sera from this round of testing were negative on the ELISA allowing the exotic disease investigation to be closed.

In a second case, one of eight free range commercial layer flocks on a South Island farm were blood sampled at 28 weeks as part of the programme. Seven of ten samples were positive on the ELISA test with S/P values ranging from 0.234 to 0.562. Values greater than or equal to 0.2 are positive. On submission of the positive sera to the AHL, four were positive on the VNT with titres of 1:12, 1:32, 1:64 and 1:128. (A titre of greater than 1:8 is positive.) On rebleeding the flock at 31 weeks, one of 10 samples was ELISA-positive with an S/P value of 0.209. This serum sample returned a VNT titre of 1:16 at AHL. Ten of ten birds from this flock had tested ELISA negative at 15 weeks at the rearing sheds before being moved to the laying sheds at 16 weeks. This serology picture is not consistent with what would be seen in an IBD type 1 incursion, where persistent, high prevalence and higher titres would be expected (Tana et al., 2023). A review of results from routine scheduled serosurveillance across sheds from both the laying and rearing farms further supported the absence of IBD type 1. In addition, 24 cloacal swabs were collected into avian transport medium from a 12-week-old flock currently in the rearing shed from which the flock under investigation had originated. On submission to AHL these were negative for IBD on molecular testing. With exotic disease excluded, the investigation could be closed. Explanations for the seropositivity could include non-specific reactions or the presence of endemic IBD type 2 (Rawdon et al., 2019).

Avian influenza excluded as the cause of domestic bird mortality events

The owner of a private aviary contacted the exotic pest and disease hotline to report the apparent sudden death of 12 of 13 zebra finches (*Taeniopygia guttata*). The finches had been found dead that morning, having been last seen alive late the previous afternoon. The remaining zebra finch was described as having ruffled feathers but could still fly. The other birds in the aviary that shared the same water and food were unaffected and included two yellowhammers/hurukōwhai (*Emberiza citrinella*), 11 California quail/tikaokao (*Callipepla californica*), two chaffinches/pahirini (*Fringilla coelebs*), two common redpolls (*Acanthis flammea*), one European goldfinch/kōurarini (*Carduelis carduelis*) and one house sparrow/tiu (*Passer domesticus*). Having seen an item on avian influenza on the evening news two nights earlier, the owner contacted the hotline, with concerns around avian influenza. Although disease was confined to only one species and therefore not entirely consistent with highly pathogenic avian influenza (HPAI), due to the high level of mortality, oral and cloacal swabs were taken from ten birds. Avian influenza was ruled out on PCR testing. In an attempt to determine the cause of this unusual mortality event, six birds were necropsied. Three finches had soiling of the vent with tarry, black or brown faecal material. The entire intestinal tract of the finches examined was dark. While marked autolysis of the intestinal tract was observed on histology, some areas of intraluminal haemorrhage could be seen. Cloacal swabs from five birds were taken, cultured and monitored for growth. Resulting bacterial isolates were characterised by MALDI-TOF mass spectrometry. Cloacal swabs resulted in light growth from two birds and moderate-heavy growth from three birds of a mix of species including *Enterobacter* spp. (*Enterobacter cloacae* complex), *Lelliottia* spp., *Pseudescherichia* spp. and *Citrobacter* spp. A peracute enteritis/enteropathy was suspected but a specific cause could not be determined, although *Enterobacter* spp. and *Citrobacter* spp. have been reported as disease-causing in birds. The investigation was closed.

A concerned member of the public contacted the MPI exotic pest and disease hotline to report finding 10–15 dead house sparrows (*Passer domesticus*) found near to two dead backyard chickens in the Wairau Valley. Shortly after, another individual from the same neighbourhood also reported observing dead sparrows. The two chickens had died over a span of several days and were subsequently buried, making them unavailable for necropsy. However, five freshly deceased sparrows were collected from the area and sent to MPI's AHL for necropsy and diagnostic testing. Cloacal and oral swabs from each of the five sparrows returned negative results for both Newcastle disease (ND) and influenza A through real-time PCR testing, allowing the exotic disease investigation to be closed. Necropsy findings indicated that the sparrows' crops and gizzards were uniformly filled with a specific type of grain, raising the possibility of feed source toxicity as the cause of death.

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 summarised in **Table 1** (p. 67) with five example narratives provided in which HPAI virus and other exotic avian diseases such as ND virus were excluded.

Case 1. A member of the public notified the MPI exotic pest and disease hotline to advise that there was a morbidity and mortality event occurring near her residence in yellowhammer finches/hurukowhai (*Emberiza citrinella*). A population of several hundred passerine birds including sparrows/tiu (*Passer domesticus*), greenfinches (*Chloris chloris)* and goldfinches (*Carduelis carduelis)* were being fed at a retirement home by the residents. Seven dead goldfinches were presented for postmortem; however, three of these were too desiccated to be of any sampling value. Four of the birds were submitted to the MPI's AHL, one was postmortemed, and all four sampled by cloacal swab for HPAI. All four birds were negative for HPAI on molecular testing. One of the seven birds was submitted for flavivirus testing of brain tissue, and was also negative for flavivirus on West Nile virus ProC RT-qPCR TaqMan testing. All four birds were positive on testing for *Salmonella* Typhimurium sequence type ST568. Salmonellosis is a known cause of mortality in wild avian populations. The finding of a *Salmonella* Typhimurium outbreak in a wild bird population that was being fed bread, is potentially a risk to the people involved and the notifier was informed of this risk. Historically, many outbreaks of *S*. Typhimurium have been linked to using bird feeders, and there is a correlation between the temporal and spatial trends in *S*. Typhimurium infection in populations of garden birds and humans, which has been described previously in New Zealand. The important exotic viral causes of disease were excluded, and the case was stood down.

Case 2. A member of the public called the exotic pest and disease hotline to report sighting about eight dead or moribund black-backed gulls (karoro or *Larus domanicanus*) along the shoreline in a bay in the Pauatahanui 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 all three gulls were in reasonable body condition but the gastrointestinal tracts were empty, likely due to a short period of starvation before death. No clear cause of death was noted, but there was also 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 low pathogenicity avian influenza 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. All other samples returned negative results. As exotic avian disease was ruled out, this case was closed.

Case 3. A member of the public called the exotic pest and disease hotline to report finding 28 dead birds of various species including silvereyes/tauhou (*Zosterops lateralis*), house sparrows/tiu (*Passer domesticus*), common mynas (*Acridotheres tristis*) and blackbirds (*Turdus merula*) over the course of two days in their back garden in Waikato. Four of six birds submitted to a regional commercial veterinary laboratory for necropsy were diagnosed with ingluvitis, oesophagitis and pharyngitis, with white pasty material present within the oral cavity, oesophagus and crop. On histological examination subacute-to-chronic, diffuse ventriculitis with associated fungal hyphae and yeast was identified. No other significant lesions were identified grossly or on histology. *Candida albicans* was isolated on culture of oesophageal contents of affected birds and could be responsible for the described lesions. No *Salmonella* was isolated on bacterial culture. Choanal and cloacal swabs from three birds were submitted to the AHL, where they tested negative for avian influenza virus and avian paramyxovirus type 1 via molecular assay. Given the involvement of the native species, silvereye, the Department of Conservation was informed. Exotic disease was excluded, and the investigation was closed.

Case 4. A member of the public phoned the exotic disease and pest hotline to report a cluster of six dead black-backed gulls/karoro (*Larus domanicanus*) on the foreshore in the Porirua area where she walked her dog. The location of the sighting was communicated accurately and an MPI Incursion Investigator visited the site and collected two birds for necropsy and avian influenza testing. On necropsy both birds were in good body condition, weighed close to 1 kg, and the presence of a well-formed thymus in one bird indicated it was a young adult. A significant finding on gross necropsy for both birds was an enlarged, swollen and very friable liver. On histology the livers had mild multifocal, periportal lymphocytic infiltration. Testing of the liver of one bird was positive on the *Clostridium botulinum* neurotoxin D, with the mosaic real-time PCR, indicating presence of the preformed clostridial toxin, and a probable explanation for the hepatopathy and mortality observed. Both birds were negative on influenza A real-time PCR on testing samples of brain, swabs from the cloaca and swabs from the oral cavity. Avian influenza was ruled out and the case was stood down.

Case 5. A member of the public in greater Auckland phoned the exotic

pest and disease hotline to report finding about 20–30 sick or dead sparrows/tiu (*Passer domesticus*) on the road. Some of the live birds were reported to have white powder on their beaks, and were displaying flaccid paralysis and an inability to fly. Some exotic diseases, such as HPAI, can cause large and sudden bird mortality events with neurological signs such as this. Swabs from three dead sparrows were submitted to MPI's AHL and returned negative results for influenza A molecular testing. A pathologist at a commercial veterinary laboratory completed post-mortem examinations. Grossly no significant abnormalities were recognised; however, all three sparrows' crops and gizzards appeared to contain the same seed mix (**Figure 12**), raising suspicion of a poisoning event. The notifier later reported that two affected birds that were placed in a warmed box overnight made a full recovery, further suggesting the cause of these deaths was alphachloralose toxicity. Alphachloralose is a bird and rat control chemical, acting as an anaesthetic agent that exerts barbiturate-like actions on the synaptic transmissions in the brain and induces a state of dissociation, then sleep, in birds (Garret et al., 1998; Nelson et al., 1994). Although essential bodily functions are unaffected, if the bird does not recover in time eventually it dies of hypothermia. In this case exotic disease was excluded and the investigation closed.



Figure 12: Sparrows examined in Case 5 reported in text. Uniform seed mixtures were recovered from the crops and gizzards of all three birds (inset). Alpha-chloralose toxicity was suspected, which was supported by the recovery of sick birds when warmed. Photos: Cathy Harvey, Awanui Labs

Exotic ticks found on returned human travellers

A medical practitioner from Gore rang the exotic pest and disease hotline to report finding a tick on a man returning from the United States. The patient had travelled for three weeks in the Connecticut Berkshire Mountains area. Six days after returning to New Zealand he discovered the tick attached to his skin and visited his doctor. The tick was successfully removed and sent to the MPI Plant Health and Environment Laboratory (PHEL) in Auckland where it was identified as *Dermacentor variabilis*, commonly known as the American dog tick. This tick is predominantly found in the United States, mainly east of the Rocky Mountains, but can also occur in certain areas of Canada, Mexico and the Pacific Northwest of the United States (Boorgula et al., 2020; Halliday and Sutherst, 1990). The American dog tick is a 3-host tick and requires a blood meal before progression from each stage; the full lifecycle takes at least 54 days to complete. *Dermacentor variabilis* targets small mammals as a larva and nymph and larger animals as an adult. It is normally found on dogs but will readily attach to larger animals such as cattle, horses and humans. The tick is known to be a vector of the bacterium *Rickettsia rickettsii*, which causes Rocky Mountain spotted fever, and *Francisella tularensis*, which causes tularaemia in humans, so the traveller was monitored carefully for symptoms by the general practitioner (Chan and Kaufman, 2021). In dogs, *D. variabilis* can cause canine tick paralysis and is considered exotic to New Zealand. Although *D. variabilis* could potentially establish in New Zealand climatic conditions, it is thought to be unlikely (Heath, pers. comm. 2024; Heath and Hardwick, 2011). The tick removed from this patient (**Figure 13**) was a female that had not yet fed. Since *D. variabilis* is not parthenogenetic, unless a male was also present or a second female that had been fertilised and which managed to feed on the host (both deemed unlikely), the risk of establishment in this case was very low (AC Heath, pers. comm., 2024). The patient monitored himself and his two pet dogs over the following month and also treated both dogs with an appropriate veterinary medicine for the prevention/treatment of ticks.


Figure 13: Adult female *Dermacentor variabilis* (American dog tick) found on a returned traveller. Photo: Ben Boyd, Plant Health and Environment Laboratory, Auckland

There were two notifications of *Ixodes holocylus* detection post-travel this quarter. In the first, a member of the public from Canterbury rang the exotic pest and disease hotline on finding an about 3-mm diameter tick (**Figure 14**, p. 68) on her body a day after returning from Sydney. The tick (preserved in 70 percent alcohol) was submitted to MPI's PHEL in Christchurch, where it was identified as a nymph stage of *Ixodes holocyclus*,

Table 1: Summary of wild bird mortality investigations for July to September

Case	Region	Species	Number affected	Location	Clinical signs	Exotic disease assays	Endemic diagnosis
1	Wellington	Yellowhammer/hurukōwhai (*Emberiza citrinella*)	Dozens affected out of several hundred finches	Near rest home	Found dead	HPAI, WNV	Autopsy of four fresh birds, culture of all birds positive for *Salmonella* ser. Typhimurium sequence type ST568 salmonellosis confirmed.
2	Wellington	Black-backed gulls/karoro (*Larus domanicanus*)	About a dozen	Shore of inlet	Found dead	HPAI, ND	No diagnosis made, one gull positive for low-pathogenic avian influenza (LPAI) H11N1, an endemic circulating virus known to be present.
3	Waikato	Silvereye/tauhou (*Zosterops lateralis*), house sparrow/tiu (*Passer domesticus*), common myna (*Acridotheres tristis*), blackbird (*Turdus merula*)	28 over 2 days	Back garden	Found dead	HPAI, ND	Fungal ingluvitis, oesophagitis and pharyngitis present in 4/6 birds, Candida *albicans* isolated.
4	Wellington	Black-backed gulls/karoro (*Larus domanicanus*)	Six	Short span of beach	Found dead	HPAI	Autopsy and histology performed. *Clostridium botulinum* neurotoxin D present within liver suggesting possible botulism.
5	Auckland	House sparrows/tiu (*Passer domesticus*)	20–30	On a road	Sick and dead	HPAI	Autopsy of three sparrows showed crops full of seed mix, no other gross abnormalities. Rescued sick sparrows kept warm recovered overnight, consistent with alphachloralose toxicity.
6	Bay of Plenty	Black-backed gulls/karoro (*Larus domanicanus*)	Small cluster, number unknown	Beach	Most dead, one neurological gull euthanased and tested	HPAI, ND, WNV	Starvation and muscle wastage on post-mortem examination.
7	Northland	Red-billed gulls/tarāpunga (*Larus novaehollandiae*)	14	Beach	Dead. No other adjacent species affected	HPAI, ND	Five autopsied, widespread haemorrhage observed. Pindone rabbit poison laid nearby was suspected as the cause of mortality.
8	Wellington	Red-billed gull/tarāpunga (*Larus novaehollandiae*), two feral pigeons (*Columba livia*), a thrush (*Turdus philomelos*), one house sparrow	10–15	CBD alleyway	Dead and dying	HPAI, ND	Six swabbed birds. No cause of death ascertained.
9	Bay of Plenty	Grey-faced petrels/ōi (*Pterodroma gouldi*)	5–7	Island-based breeding colony	Weepy eyes, shaking, lethargy, breathlessness, diarrhoea, death	HPAI, ND	Five birds autopsied. Poxviral lesions present in oesophagus of two birds – PCR of formalin-fixed tissue not confirmatory.
10	Northland	Southern giant petrel/ pāngurunguru, (*Macronectes giganteus*)	1	Beach	Found dead with leg band indicating South African origin	HPAI, ND	Emaciated with crop containing feathers on autopsy.
11	Nelson	House sparrows/tiu (*Passer domesticus*)	58 over 3 weeks	House garden	Found dead and seen falling from the sky sick, died soon after	HPAI, ND	Good condition, crops indicating all birds (n = 5) had been recently feeding on similar seed. Poisoning possible.
12	Marlborough	House sparrows/tiu (*Passer domesticus*)	22	Residential neighbourhood	Found dead	HPAI, ND	Good condition, crops indicating all birds (n = 4) had been recently feeding on similar oat mixture.
13	Christchurch	Red-billed gulls/tarāpunga (*Larus novaehollandiae*)	6	Derelict city lot with small breeding gull colony	Found dead, other species unaffected	HPAI, ND	No autopsies performed; cause of deaths not determined.
14	Bay of Plenty	Black-billed gulls/tarāpuka (*Larus bulleri*)	3	Near a mine	Found dead	HPAI, ND	Autopsies showed thin condition, no gross lesions. Advanced autolysis prevented further diagnosis.

Table continued over page

Table 1, continued from previous page

Case	Region	Species	Number affected	Location	Clinical signs	Exotic disease assays	Endemic diagnosis
15	Auckland	Black swans/kakīānau (*Cygnus atratus*)	11	Coastline	Sick and dead	HPAI	Postmortem of one swan indicated hepatitis with hepatocellular necrosis of no known cause.
16	Auckland	House sparrows/tiu (*Passer domesticus*)	7	In a park	Dead	HPAI	Epidemiology and species suggestive of alpha-chloralose toxicity, no autopsies performed.



Figure 14: The tick found on a Canterbury resident on their return from a holiday in Australia). Photo: Elizabeth De Jongh, Plant Health and Environment Laboratory, Christchurch

the Australian paralysis tick (**Figure 15**). As the tick is known to transmit Queensland tick typhus to humans, the notifier was advised to consult with their doctor.

In a second case, a Christchurch medical laboratory phoned the exotic pest and disease hotline for assistance in identifying a tick that had been submitted. The tick had been found on a person who had returned to New Zealand from Queensland, Australia. On subsequent submission to MPI's PHEL in Christchurch, it was identified as an engorged adult female *I. holocyclus*. The identification was reported to the medical laboratory. No other information was provided and the investigation was closed.

Ixodes holocyclus is the tick most commonly encountered on humans returning from Australia, where its normal range spans almost the entire east coast. Rarely is more than one tick reported to be found on a returning traveller. Fortunately for biosecurity, the tick's strict bioclimatic requirements mean that even if there were more than one of them, or fertilised tick eggs were present on the traveller's personal items, survival or establishment would be highly unlikely except in the most northerly parts of New Zealand (Heath and Hardwick, 2011). The notifications above were considered post-border interceptions.

Brown dog tick excluded

A Hamilton veterinarian contacted the exotic pest and disease hotline for assistance in identifying a tick that had been discovered on a dog whose owner operated a boarding kennel. Recently boarded dogs had included some that had come directly from post-entry quarantine where they would have been subject to required examination for hitchhikers such as the brown dog tick. Although considered unlikely, an exotic tick such as the brown dog tick (*Rhipicephalus sanguineus*) had to be excluded. The duty Incursion Investigator had the tick submitted to a subject matter expert who determined the tick to be a nymph stage of the endemic New Zealand cattle tick (*Haemaphysalis longicornis*). Hamilton is within the known distribution area of the NZ cattle tick. The investigation was closed.

Brucellosis excluded in dogs

A veterinary pathologist contacted the exotic pest and disease hotline to report possible brucellosis in a submission from a 2-year-old huntaway dog. Canine brucellosis can be caused by the exotic agents *Brucella canis* and *Brucella suis*. The dog had presented for veterinary examination due to the development of severe acute unilateral testicular swelling which had apparently developed overnight. Antimicrobial and anti-inflammatory therapy was commenced, and the affected testicle was surgically removed. Fixed tissue was submitted to a regional veterinary laboratory for histopathological examination. The Incursion Investigator followed up with the submitting veterinarian, and it was determined that the dog was New Zealand-born and had never travelled overseas. The dog had not knowingly been mated and to the best of the owners' knowledge had not been in contact with imported dogs. Nevertheless, fresh lesional tissue was submitted to MPI's AHL for *Brucella* genus PCR testing. The *Brucella* genus PCR was negative, excluding exotic disease. On histology severe, chronic, fibrinosuppurative epididymitis and funisitis (inflammation of the spermatic cord) with presumptive bacteria present was diagnosed morphologically. Gram staining identified gram-positive cocci within inflamed areas, suggestive of staphylococcal infection most likely due to penetrating injury or migrating



Figure 15: Dorsal (left) and ventral (right) views of the tick from **Figure 14**, which was identified as an *Ixodes holocyclus* nymph. Photos: Elizabeth De Jongh, Plant Health and Environment Laboratory Christchurch

foreign body. As exotic disease was excluded the investigation was closed.

Babesiosis excluded in dogs

Following detection of *Babesia gibsoni* in a dog, and initiation of a Biosecurity Response (Buckle, 2024), vets in practice had been asked to notify Incursion Investigators about cases in which *B. gibsoni* could be a differential, including cases of canine anaemia. This has resulted in increased numbers of notifications about this disease. This quarter, two such notifications became investigations.

In the first case, a veterinarian in Canterbury called the exotic pest and disease hotline to report severe anaemia affecting a 4-year-old neutered female dog. The dog presented for veterinary examination due to lethargy, inappetence, episodes of apparent imbalance and episodes of increased respiratory effort over a period of two weeks. On initial work up, severe non-regenerative anaemia was identified. Haematological alterations due to *B. gibsoni* are typically manifested by regenerative haemolytic anaemia together with poikilocytosis, polychromasia, anisocytosis and thrombocytopenia rather than non-regenerative anaemia (Karasová et al., 2022). Nevertheless, out of abundance of caution, whole blood in EDTA and serum was submitted to MPI's AHL for exclusion of the exotic agents *B. gibsoni, Ehrlichia canis*, *Leishmania* spp. and exotic species of *Mycoplasma* and *Acholeplasma*. *Ehrlichia canis* PCR, haemotropic *Mycoplasma* PCR, *Mycoplasma/Acholeplasma* PCR, and piroplasm PCR all returned negative results. *Leishmania* PCR was performed at the Commonwealth Scientific and Industrial Research Organisation Australian Centre for Disease Preparedness Laboratory, Geelong and was negative. Serological tests for *E. canis* and *Leishmania* spp. were also negative. A blood smear and bone marrow biopsy were submitted to a regional commercial veterinary laboratory for cytological examination and histology, respectively. Cytological examination of bone marrow showed abrupt erythrocyte maturation arrest with few metarubricytes, and occasional metarubricyte-containing macrophages were observed, consistent with precursor targeted immune-mediated anaemia (PIMA). Treatment for PIMA with prednisolone and azathioprine was commenced, and the dog responded well. Exotic disease was excluded, and the case was closed.

In a second case, a veterinarian from Nelson contacted the exotic pest and disease hotline to report a moderate regenerative thrombocytopaenia and anaemia affecting an 11-year-old dog. Whole blood and a blood smear were submitted to MPI's AHL for generic piroplasm PCR testing and blood smear examination. The smear was of good cellular density and cell distribution and no evidence of intra-erythrocytic haemoparasites was identified. The piroplasm PCR was negative, therefore exotic disease, including *B. gibsoni*, was excluded and the investigation was closed. The owners elected euthanasia for this dog and no follow-up was received.

Wild-type canine distemper excluded in two dogs

A veterinarian from an SPCA in Auckland rang the exotic pest and disease hotline to report a stray puppy with clinical signs consistent with canine distemper. The male entire cross-bred puppy was thought to be about five months old, was not microchipped and the vaccination history was unknown. The puppy had been found on the side of the road and upon presentation at the SPCA was pyrexic, had ocular and nasal discharge, was anorexic and vomiting, but no diarrhoea was noted. The puppy had mild ataxia, and the eyelids were noted to twitch and flutter and the papillae of the nose were possibly thickened and prominent. An in-house biochemistry panel was unremarkable except for mildly increased phosphate and protein. A parvovirus snap-test was conducted and this returned a negative result. The puppy deteriorated despite supportive therapy and was euthanased by the attending veterinarian due to a poor prognosis. Cerebrospinal fluid and fresh brain samples were submitted to MPI's AHL for testing to rule out canine distemper virus. Results of molecular testing were negative for canine distemper virus, therefore the investigation was closed. Since the history of the puppy was unknown, many underlying factors could have contributed to the disease in this case, but a definitive diagnosis for the clinical signs was not able to be determined.

A veterinarian contacted the Incursion Investigation team via email to request assistance in the case of a dog brought into the clinic with clinical signs consistent with canine distemper. The 2-year-old, mixed breed, male entire dog presented at the clinic with a 2-week history of swelling of the face, head and neck. Upon clinical examination the dog had extensive swelling of the entire head, the eyes were swollen shut, there was red inflamed tissue around the eyes, a mild pyrexia, mild nasal and ocular discharge, normal lymph nodes and increased thirst. The dog was noted to be slightly unsteady on its feet, which was attributed to poor vision due to the periocular swelling. No neurological signs were noted. The pads of the feet were rough but otherwise normal and the nasal planum was slightly thickened. There was no history of vaccination and the dog was kept predominantly outdoors. Blood was taken and tested for canine distemper virus, RT-qPCR, at MPI's AHL, and returned negative results. As wild-type exotic canine distemper virus was ruled out, this investigation was closed.

Ehrlichiosis excluded in a dog bound for export

A positive pre-export test result for *Ehrlichia canis* was reported to the Incursion Investigation team by scientists at MPI's AHL. The dog, a four-month-old Japanese Akita, was positive by IFAT serology. The test result was unexpected as the dog was born in New Zealand, and had not travelled before this result. The dog was on a tight schedule, expecting to be exported in the coming week; therefore, repeat testing was done immediately and as an additional precaution EDTA blood was also

collected and submitted for molecular screening for *Ehrlichia* spp. On repeat IFAT testing the dog was found to be seronegative for *Ehrlichia* spp. and on PCR testing the whole blood sample was negative confirming the initial serology test as a false positive. As part of pre-export testing the dog was also seronegative for *Leishmania*, *Babesia gibsoni*, *Leptospira canicola* and *Leptospira icterohaemorrhagica.* Exotic disease was excluded and the investigation was stood down.

Validated new-to-New Zealand microorganisms or emerging diseases: July to September 2024

The cases below represent reports of confirmed new-to-New Zealand organisms or species detected in notably new hosts or associated with unusual clinical signs or outbreaks. The majority of these are considered to have arisen as artefacts of changes to bacterial nomenclature and/or in conjunction with increased sensitivity of molecular and mass-spectrometry-based (e.g., MALDI-TOF) assays. We present these here as a record of these new detections, and to demonstrate the process for assessment of these potential pathogens. The narrative below presents an interesting case demonstrating this, and appears in **Table 2** (next page) along with other similar cases.

A pathologist from a commercial veterinary laboratory phoned the exotic pest and disease hotline to report that a general culture from the lung of a 3-year-old male horse, collected via broncho-alveolar lavage, had grown *Actinobacillus arthritidis*. The isolate was identified as *A. arthritidis* via MALDI-TOF, and as this organism has not been previously identified in New Zealand, the isolate was referred to MPI's AHL for identification confirmation. The identity of the isolate was determined by phylogenetic analysis and sequencing the 16S rRNA gene (99.81 percent BLAST homology to *A. arthritidis*). MALDI-TOF mass spectrometry identified the isolate to the *Actinobacillus* species level only, and could not differentiate between *A. arthritidis* (score = 2.31) and *A. suis* (score = 2.32). *Actinobacillus arthritidis* was first described as a new species in 2002 by Christensen et al. (2002), previously being classified as Bisgaard taxon 9, and has been isolated from horses with arthritis and septicaemia. The horse in this case was sampled due to poor recovery from exercise, and no arthritis or clinical signs consistent with septicaemia were reported by the attending veterinarian. As a result, the clinical and pathogenic significance of *A. arthritidis* remains unclear in this case. However, the concurrent presence of *Streptococcus equi* subsp. *zooepidemicus* suggest that in this case *A. arthritidis* is most likely to be a non-pathogenic, opportunistic secondary infection of little importance.

References

Anonymous (2021). *Streptococcus equi* subsp. *zooepidemicus*. https://www.swinehealth.org/wp-content/uploads/2021/03/S.-Zoo-Fact-Sheet.pdf viewed 20 August 2024.

PIANZ (Poultry Industry Association of New Zealand), Egg Producers Federation of New Zealand, MAF BNZ (2015). *Surveillance for Infectious Bursal Disease Virus Quality Manual* Version 3.

Boorgula GDY, Peterson AT, Foly DH, Ganta RR, Raghavan RK (2020). Assessing the current and future potential geographic distribution of the American dog tick, *Dermacentor variabilis* (Say) (Acari: Ixodidae) in North America. *PLoS ONE* 15(8), e0237191. https://doi.org/10.1371/ journal.pone.0237191 e collection 2020.

Buckle K (2024). Quarterly report of investigations of suspected exotic diseases: April to June 2024. *Surveillance* 51(3), 80–94.

Chan WH, Kaufman PE (2021). American dog tick - *Dermacentor variabilis* (Say) (ufl.edu). University of Florida Entomology and Nematology fact sheet.

Christensen H, Bisgaard M, Angen O, Olsen JE (2002). Final classification of Bisgaard taxon 9 as *Actinobacillus arthritidis* sp. nov. and recognition of a novel genomospecies for equine strains of *Actinobacillus lignieresii*. *International Journal of Systematic and Evolutionary Microbiology* 52(4), 1239–1246.

Connolly JH, Alley MR, Dutton GJ, Rogers LE (2006). Infectivity and persistence of an outbreak strain of *Salmonella enterica* serotype Typhimurium DT160 for house sparrows (*Passer domesticus*) in New Zealand. *New Zealand Veterinary Journal* 54(6), 329–332.

Costa MO, Lage B (2020). *Streptococcus equi* subspecies *zooepidemicus* and sudden deaths in swine, Canada. *Emerging Infectious Diseases* 26(10), 2522–2524. https://doi.org/10.3201/eid2610.191485.

Costa MO, Harding JCS, Huang Y, Nosach R (2022). *Streptococcus equi* subsp. *zooepidemicus* infection of pigs leads to shedding in faeces and a carrier state. *Transboundary and Emerging Diseases* 69(5), e1503e1509. https://doi.org/10.1111/tbed.14481.

Crosby-Durrani H (2023). Disease investigation into bovine ischaemic teat necrosis: a severe, emerging disease of economic importance. PhD thesis, University of Liverpool, Liverpool, UK.

Garrett KM, Gan J (1998). Enhancement of γ-aminobutyric acid A receptor activity by α-chloralose. *Journal of Pharmacology and Experimental Therapeutics* 285(2), 680–686.

Halliday RB, Sutherst RW (1990). An Australian record of the American dog tick *Dermacentor variabilis*, and the risk of its establishment outside North America. *Experimental & Applied Acarology* 65–70.

Heath AC, Hardwick S (2011). The role of humans in the importation of ticks to New Zealand: a threat to public health and biosecurity. *New Zealand Medical Journal* 124(1339).

Heath AC, Rolfe JR, Michel P (2021). *Conservation status of parasitic mites and ticks (Acari) in New Zealand, 2021*. New Zealand Threat Classification Series 37. Department of Conservation, Te Papa Atawhai, Wellington.

Hopkirk CSM (1966). Eradication of brucellosis from the New Zealand cattle population. *Proceedings of the New Zealand Society of Animal Production*. New Zealand Society of Animal Production. 26(Jan), 125–133.

Karasová M, Tthov, C, Grelov S, Fialkovicov M (2022). The etiology, incidence, pathogenesis, diagnostics, and treatment of canine babesiosis caused by *Babesia gibsoni* infection. *Animals* 12(6), 739. https://doi.org/10.3390/ani12060739.

Lawrence K, Gedye K, McFadden A, Pulford D, Heath A, Pomroy W (2021). Review of the New Zealand *Theileria orientalis* Ikeda type epidemic and epidemiological research since 2012. *Pathogens* 10(10), 1346.

Legesse A, Mekuriaw A, Gelaye E, Abayneh T, Getachew B, Wledermedhin W, Tesgera T, Deresse G, Birhanu K (2023). Comparative evaluation of RBPT, I-ELISA, and CFT for the diagnosis of brucellosis and PCR detection of *Brucella* species from Ethiopian sheep, goats, and cattle sera. *BMC Microbiology* 23, 216. https://doi.org/10.1186/s12866-023-02962-2.

McFadden AMJ, Gias E, Heuer C, McFadden FJS, Pulford DJ (2016). Prevalence and spatial distribution of cattle herds infected with *Theileria orientalis* in New Zealand between 2012 and 2013. *New Zealand Veterinary Journal* 64(1), 55–59.

Mulqueen K, Russell J (2021). Infectious bursal disease surveillance programme. *Surveillance* 48(3), 73–74.

Nelson PC (1994). Bird control in New Zealand using alpha-chloralose and DRC1339. In *Proceedings of the Sixteenth Vertebrate Pest Conference* 16(16), 40. https://digitalcommons.unl.edu/40.

Nutting WB, Kettle PR, Tenquist JD, Whitten LK (1975). Hair follicle mites (*Demodex* spp.) in New Zealand. *New Zealand Journal of Zoology* 2(2), 219222. https://doi.org/10.1080/03014223.1975.9517871.

O'Connell J, Lawrence K, Taylor H, Orbell G, Bestbier M, Crowley K, Hunt H (2024). An outbreak of ischaemic teat necrosis in a dairy herd in Taranaki, New Zealand. *New Zealand Veterinary Journal* 72(6), 347–354. https://doi.org/10.1080/00480169.2024.2

Table 2: New-to-New Zealand organisms or emerging diseases associated with animal-related health cases: July to September 2024

Organism	Classification/Method of ID	Host	Isolated from	Location	Comments
*Actinobacillus arthritidis**	First report, 16S rRNA gene (99.81% BLAST homology) and MALDI-TOF (score 2.31, and 2.32 for *A. suis*).	3-year-old male horse	Bronchoalveolar lavage	Manawatū	Concurrent presence of *Streptococcus equi* subsp. *zooepidemicus*, presence of *A. arthritidis* likely to be opportunistic.
Burkholderia spp. most closely resembling *B. multivorans*	Not new to NZ. MALDI-TOF**, score 2.39	Cat	Urine sample via cystocentesis	Christchurch	Not previously reported in veterinary species in New Zealand
Limosilactobacillus spp.	First report MALDI-TOF**, score 1.9	Cockatiel with watery droppings	Free catch urate sample from watery droppings	Christchurch	Previously classified *Lactobacillus* species before changes in 2020, likely to account for apparent first report.
Salmonella enterica subsp. *enterica* serovar Pontypridd	First report, ESR serotyping	11-year-old child	Stool sample	Manawatū	Likely to have been acquired during overseas travel to Brazil.

*Presented in narrative form above **Table 2**.

**These cases were not further examined by other techniques. The use of 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.

392687.

Rawdon T (2019). Quarterly report of investigations of suspected exotic diseases: January to March 2019. *Surveillance* 46(2), 15–20.

Rawdon T, Stanislawek W, Soubies S, Eterradossi N, Buckle K, Jones B (2019). Detection of infectious bursal disease virus serotype 2 (IBDV-2) in New Zealand poultry and waterfowl. *Surveillance* 46(1), 4–7.

Stanislawek WL, Tana T, Rawdon TG, Cork SC, Chen K, Fatoyinbo H, Cogger N, Webby RG, Webster, Joyce M, Tuboltsev MA, Orr D, Ohneiser S, Watts J, Riegen AC, McDougall M, Klee D, O'Keefe JS (2024). Avian influenza viruses in New Zealand wild birds, with an emphasis on subtypes H5 and H7: Their distinctive epidemiology and genomic properties. *PLoS ONE* 19(6), e0303756. https://doi.org/10.1371/journal.pone.0303756.

Tana T, Mulqueen K, Russell J (2023). Eradication of infectious bursal disease virus type 1 from New Zealand commercial poultry. *Surveillance* 50(1), 5–11.

Trotta A, Marinaro M, Cirilli M, Sposato A, Adone R, Beverelli M, Buonavoglia D, Corrente M (2020). *Brucella melitensis* B115-based ELISA to unravel false positive serologic reactions in bovine brucellosis: a field study. *BMC Veterinary Research* 16, 50. https://doi.org/10.1186/s12917-020-02278-7CSM.

Update

At the time of publication a response was underway after the discovery of the highly pathogenic H7N6 strain of avian influenza on a poultry farm in Otago. While H7N6 is not the H5N1 strain circulating in wildlife around the world, every effort is being made to contain and eliminate the virus. We will present detailed reports in future issues of *Surveillance*.

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Quarterly report of diagnostic cases: July to September 2024

SVS

Bovine

An adult beef cow presented with dysuria. On physical exam, the urethra was swollen, and a urine sample collected by catheterisation had a flocculent appearance. A stained smear from a urine sediment revealed haematuria and large numbers of bacilli as well as degenerate nucleated cells. Culture yielded a moderate growth of ***Corynebacterium renale*** and a scant growth of Lancefield group D *Streptococcus* sp. (*S. bovis, S. equinus, S. suis*). *Corynebacterium renale* is a normal inhabitant of the genitourinary tract in cattle and is one of the most commonly reported causes of ascending pyelonephritis in this species. Infection can be precipitated by trauma, for example, calving and breeding. *Streptococcus bovis* is a common inhabitant of the intestinal tract of cattle and has also been associated with cases of bovine cystitis and pyelonephritis.

In late July, a 1-year-old heifer from King Country presented with a yellow nasal discharge, blindness and ataxia. The animal was pyrexic. No other animals were affected. A PCR for **ovine herpesvirus-2** on a blood sample was positive, confirming **malignant catarrhal fever**.

In August, three 2-year-old crossbred dairy cows from south Waikato presented with **fractured humerus bones**. Liver copper levels were < 50, 73 and 190 µmol/kg (< 45µmol/L: deficient; 45–95: marginal; > 95: adequate). On a different farm, three crossbred dairy cows born in 2017 had **fractured humeri**. Liver copper levels in two of these animals were 65.3 and 386.2 µmol/kg. Outbreaks of cows with fractured humeri have been described in New Zealand dairy herds, but these typically occur in first and second lactation animals. Although the factors contributing to outbreaks have not been fully elucidated, cows with humeral fractures have been shown to have osteoporosis, and this is likely associated with poor feed quality, with copper deficiency being a possible contributor (Wehrle-Martinez et al., 2023).

A 1-year-old dairy cow from Hawke's Bay was found dead with no prior clinical signs. The only gross lesion was the presence of bloody faeces in the colon. The PCR for bovine viral diarrhoea (BVD) on heart blood was negative and cultures for *Yersinia* and *Salmonella* from intestinal contents were also negative. **Bovine adenovirus** was detected by PCR on intestinal contents.

In Northland, a mob of 4 to 6-week-old Jersey calves presented with bloody diarrhoea and three calves had died. A faecal egg count revealed small numbers of coccidia in one of the three samples tested. Culture from the intestinal contents of a dead calf yielded ***Salmonella*** **Typhimurium**.

In late August, a 2-year-old dairy cow from Hawke's Bay that had calved in May presented with weight loss. Haematology showed a moderate anaemia with a haematocrit of 0.15 L/L (reference range 0.24–0.40). There was evidence of moderate regeneration with reticulocytes of 21.1 x 10^9/L (reference range 0.0–1.0 x 10^9/L) and very large numbers of nucleated red blood cells were present (918/100 WBC, normal is none seen). Large numbers of stippled red blood cells were also present. Serum magnesium level was 0.10 mmol/L (reference range 0.60–1.23), which confirmed severe **hypomagnesaemia**. Hypomagnesaemia has been associated with **siderocytic anaemia**, also called Taranaki anaemia, which is characterised by the presence of large numbers of nucleated red blood cells (inappropriate metarubricytosis) and stippled red blood cells.

In late August, an adult Jersey cow from Bay of Plenty presented for watery diarrhoea. Another cow had died with similar clinical signs and another cow was also affected. Faecal culture for *Salmonella* was negative. The cow deteriorated over the following week and became ataxic and anorexic. The cow was euthanased and no gross lesions were observed on a field postmortem. Histology revealed multifocal renal tubular necrosis. Liver arsenic levels was 10.9 mg/kg with levels greater than 4 mg/kg consistent with **arsenic toxicity**. Most cases of arsenic toxicity are due to ingestion of ashes from burned treated timber, but arsenic levels can also be high in soil and water in geothermal and volcanic areas, which can also lead to toxicity.

Two cows from a King Country dairy herd died shortly after milking, after a short period of respiratory distress. The animals were receiving a daily oral drench in the milking shed. On necropsy, both animals had bilateral cranioventral consolidation of the lungs with the remaining lung markedly emphysematous. Histology revealed **a severe necrotising bronchitis and bronchiolitis** with bronchiolitis obliterans, alveolar oedema and haemorrhage as well as areas of fibrosis in the consolidated lungs while other areas were normal or emphysematous. There was also intralesional basophilic material within alveoli and airways, but no bacteria were seen. This was suggestive of **aspiration pneumonia** and the fibrosis suggested chronicity and probable repeated bronchial and bronchiolar injury, most likely due to repeated aspiration from poor drenching technique.

Ovine

In early July, a ewe from Hawke's Bay presented moribund with severe diarrhoea. The animal was in moderate body condition. A faecal egg count had 1,900 strongyle eggs per gram. Culture of intestinal contents was negative for *Campylobacter* sp. but yielded a growth of ***Salmonella*** **Hindmarsh**.

Twelve hoggets from an unknown size flock in Hawke's Bay were found to have dead fetuses at scanning. The animals had been vaccinated

for *Campylobacter* and *Toxoplasma*. An aborted fetus was submitted for necropsy. No gross lesions were seen. Culture from the stomach contents yielded a heavy growth of ***Listeria ivanovii***.

A veterinarian was called to investigate late-term abortions and stillbirths in East Friesian ewes from a Waipa lifestyle block. Four out of the six previous lambs were born dead or died in the first 24 hours after birth. The sheep had been vaccinated with a 5-in-1 clostridial vaccine, but no other vaccines had been given. One late-term aborted fetus and placenta was submitted for necropsy. The cotyledons of the placenta were dark red with multiple tan-to-white foci suggestive of placentitis. Culture of the fetal stomach contents was negative for *Listeria*, *Campylobacter* and *Salmonella*. The PCR for *Toxoplasma* on the placenta was positive, confirming **toxoplasmosis**.

Canine

A 6-year-old spayed female Greyhound from Waikato presented with a 2-month history of chronic coughing with intermittent haemoptysis. A soft tissue mass was identified in the right cranial lung lobe by radiography and computed tomography. There were multiple adhesions between the mass and the pleura and mediastinum. The lung lobe was removed surgically, and portions were submitted fixed for histology and fresh for culture. On trimming the fixed tissue, a grass awn was seen. Histology showed a focally extensive, chronic pyogranulomatous pneumonia with intralesional material and bacteria. Culture yielded a moderate growth of *Pasteurella multocida* and a scant growth of alpha-haemolytic *Streptococcus* sp., which are common respiratory tract commensals. This was consistent with **pneumonia secondary to a migrating grass awn** with secondary bacterial infection. Awns from multiple grass species can be inhaled accidentally. The shape of the awns and barbs prevent these from being coughed up. They can occasionally be removed by endoscopy, but if they migrate deeper into tissues, surgical removal becomes necessary. Grass awns can also occasionally penetrate skin, ear canals, nostrils and conjunctiva and cause inflammation and abscesses.

A 10-year-old male Labrador-cross dog from a Waikato farm presented with acute renal failure (in-house laboratory results not provided). Serology by microscopic agglutination (MAT) was performed, with titres of less than 1/25 (negative) for serovars Copenhageni and Hardjo and low titre for *Leptospira interrogans* serovar Pomona (1/50). Repeat MAT for serovar Pomona two weeks later showed a very high titre (1/3,200), confirming **leptospirosis**.

Feline

A cheetah from a zoo presented with pyrexia and tongue ulcers. A swab from the tongue lesion was taken and PCR for feline herpesvirus-1 was negative, while PCR for **feline calicivirus** was positive. Feline calicivirus is present worldwide and affects both domestic and exotic felids. It causes upper respiratory tract and oral disease. Most cases and mild and self-limiting, but some strains can cause severe generalised disease. Cats can become subclinical carriers after recovery from clinical disease.

A six-month-old kitten from Coromandel presented with pyrexia, inappetence, lethargy and diarrhoea. A littermate recently had similar clinical signs without a fever and a member of the owner's family had also had gastroenteritis for a period of two weeks with signs resolving one week before the kitten became sick. Culture of the faeces yielded growth of ***Salmonella* Typhimurium.**

Avian

A Barred Rock pullet of unknown age was euthanased due to emaciation and lethargy. A post-mortem examination revealed markedly distended caeca and multiple necrotic foci on the liver. On histology, there was a severe segmental necrotising and granulomatous typhlitis and a multifocal necrotising and granulomatous hepatitis, both with intralesional protozoan parasites consistent with **histomoniasis (blackhead disease)**. There was also proliferative and granulomatous ingluvitis and oesophagitis with intralesional nematode larvae and oocysts, consistent with **capillariasis**. In general, turkeys have a much higher susceptibility to blackhead disease than other gallinaceous birds. Chickens, while they can be subclinical carriers, can become clinically ill with this disease. Gross lesions seen in the caeca (caecal cores) and the liver (typically targetoid lesions) are considered pathognomonic in poultry. Histomonads are commonly transmitted via *Heterakis gallinarum*. Intestinal parasites are shed intermittently and a lack of oocytes on a faecal egg count would not rule out infection (if this has been done previously). Initial signs include listlessness, moderate anorexia and drooping wings, and chickens may have some blood in their faeces. Ulceration of the caecum can result in coliform septicaemia.

An 8-month-old Barred Plymouth Rock pullet from a small backyard flock presented with lethargy for six days. On physical exam, the pullet had a hunched posture, mild dyspnoea and a fluid-filled crop. There was no response to antibiotic and non-steroidal anti-inflammatory treatment. The bird was euthanased and submitted for a post-mortem evaluation which revealed multiple tan foci in the liver and enlarged kidneys and spleen. Histologically, there was marked infiltration of the liver, kidney and spleen with neoplastic lymphocytes, consistent with **lymphoma**. In poultry, this is most often secondary to viral infection by avian leukosis virus (ALV), gallid herpesvirus-2 (Marek's disease) and reticuloendotheliosis virus (REV). PCR for gallid herpesvirus-2 was negative but was not performed for the other viruses.

Awanui

Bovine

Faecal samples from five mixed-age Friesian-cross dairy cows from a herd of 570 in Southland were submitted to the laboratory for bacterial culture. About 30–40 cows in the herd had become skinny with reduced milk production and diarrhoea in the

week following the feeding of old palm kernel with magnesium. The farmer had also noticed that the cows were not eating all the feed in the shed or the grass in paddocks. On clinical examination, one cow had a high temperature with diarrhoea, while another was observed to be wobbly, diarrhoeic, with sunken eyes and a low body temperature. All five faecal samples grew a heavy growth of *Salmonella* sp., one of which was serotyped as *Salmonella* Give. This is the first outbreak of bovine **enteritis** due to ***Salmonella* Give** reported in the South Island. *Salmonella* Give was first recorded as a cause of salmonellosis in New Zealand cattle in 2019. At that time, cases were tightly restricted to South Waikato but in the past few years, cases have also occurred in the wider North Island including as far south as Horowhenua. In addition to the present case, an increase in salmonellosis in general has been noted this spring in adult dairy cows and calves in Southland, a region that has historically had a low prevalence of salmonellosis in dairy cattle. Extremely wet weather conditions with surface flooding of paddocks have been notable in the region this season, with farmers feeding out more supplement as a consequence. Both weather and supplement feeding could be factors in the increased prevalence of salmonellosis this year.

A group of 80 Angus calves, 8 to 9 months old, were moved onto hill country pasture in central Hawke's Bay. Over the following 2–3 months, the calves received two oral double combination drenches (benzimidazole/levamisole) and two doses of an 8-in-1 clostridial vaccination. A large proportion of the mob developed cough, dyspnoea and variable bloating. Five animals died over a 7-day period in June. Necropsy revealed patchy interstitial changes in the lung and a bloated rumen but no bloat line in the oesophagus was observed. Histopathological examination of sections of lung from one animal revealed severe, eosinophilic and granulomatous airway and interstitial inflammation with intralesional nematode larvae. The final diagnosis was **lungworm pneumonia** due to infection with ***Dictyocaulus viviparus.***

A rising 2-year-old dairy heifer on a Whanganui district grazing block was found recumbent and hypothermic. The heifer was in good condition and had no prior history of illness. It failed to respond to treatment and was euthanased. The gastrointestinal mucosa was diffusely reddened at necropsy. Histopathological examination of fixed tissues revealed acute haemorrhagic and necrotising changes in the abomasum, small intestine and colon. In addition, there were intranuclear inclusion bodies in the endothelial cells of the kidney and gastrointestinal tract. Bovine adenovirus type 10 was detected by PCR on a sample of faeces, confirming the diagnosis of **bovine adenoviral enteritis**. A similar case later occurred on the same property. This disease typically presents as small outbreaks of enteric disease and death in rising 1-year-old cattle. It is very unusual to see cases in rising 2-year-olds as in this instance.

Ten Friesian-cross dairy cows, in the last trimester of pregnancy, aborted over a period of 10 days on a West Coast farm in the Grey district. The cows ranged from four to nine years old and were clinically well, aside from subsequent retained fetal membranes. The herd was fed a diet of kale, silage and maize. Leptospirosis and salmonellosis vaccinations were up-to-date and a bovine viral diarrhoea (BVD) PCR test on a bulk milk sample was negative. No gross lesions were observed in the aborted calves. Histopathological assessment of fixed tissues from one calf revealed a neutrophilic bronchointerstitial pneumonia, consistent with an infectious process. *Aspergillus fumigatus* and *Ureaplasma diversum* were detected by PCR from the stomach contents of the same calf. Based on all these results, an outbreak of **mycotic abortion** was considered most likely, with a possible additional role for *Ureaplasma diversum*.

Four out of twenty-seven 1-year-old heifers on a Manawatū farm were found dead during the daily inspection of the group. Examination of other heifers revealed some with increased body temperatures (39.5–40.5°C), loose faeces and coughing. Histopathological assessment was limited by autolysis of the submitted tissues but revealed large bacterial colonies in the small intestine. Nitrate was not detected from ocular fluid taken from two of the calves. Samples of intestinal content were negative for *Salmonella* species on bacterial culture but yielded heavy growths of ***Yersinia pseudotuberculosis*** from both calves, supporting a diagnosis of **yersiniosis**. While *Y. pseudotuberculosis* can be cultured from normal as well as diarrhoeic cattle, the heavy growth in both samples, in conjunction with signs of enteric disease and absence of other detectable causes, supported a pathogenic role in this case.

Ten mixed-age beef cows on a farm in the Mackenzie Basin developed lethargy and red urine while grazing mature kale. One cow died and had watery blood at necropsy. Histopathological examination of a sample of fixed kidney revealed deeply eosinophilic material, interpreted as haemoglobin, in the tubules and golden-brown pigment in tubular epithelial cells, interpreted as haemosiderin. These findings supported the clinical impression of a haemolytic crisis. Haemolysis in cattle has many causes, including toxicity from S-methyl-cysteine sulfoxide (SMCO), copper, sporidesmin, onion and zinc, infections with *Theileria* and *Leptospira* species and severe deficiencies of phosphorus and selenium. In this case, **SMCO toxicity (kale anaemia)** was diagnosed, given the history of exposure to mature brassicas and absence of other possible causes.

Three Friesian-cross dairy heifers on a farm in Hauraki had watery diarrhoea and were losing weight after calving. Initial blood testing identified hypoproteinaemia in one animal. The total serum protein concentration was 45 g/L (reference range 60–81) and the serum albumin concentration was 21 g/L (reference range 27–42). Serological testing for Johne's disease was negative on

two animals and faecal culture was negative for *Salmonella* and *Yersinia* species. After the animals failed to respond to several courses of antibiotics, one heifer was euthanased due to her poor condition. At necropsy, the liver was reduced in size with rounded edges and numerous nodules were noted in the abomasum. The small and large intestines did not appear inflamed but the intestinal contents were watery throughout. Multiple tissues were submitted to the laboratory for histopathological examination. A severe chronic proliferative eosinophilic abomasitis with numerous adult nematodes was identified on histopathology confirming **ostertagiasis** as the primary cause for the wasting and diarrhoea. Chronic portal fibrosis with ductular reaction was present in the liver indicating likely previous liver injury from **facial eczema (sporidesmin toxicity)**. Protozoal cysts consistent with *Sarcocystis* sp**.** were also noted as an incidental finding in the heart muscle.

A 6-month-old Friesian-cross calf on a farm in Northland was found recumbent by the farmer. On clinical exam the left forelimb and ventral and left lateral chest and neck were severely oedematous. A blood sample was collected for serum biochemistry, but the calf died shortly afterwards. Examination of the muscles of the left shoulder revealed dark erythematous areas throughout the muscle, which had a 'bubbly' texture. Samples of affected muscle were collected for culture and histopathology. Serum biochemistry revealed markedly elevated muscle enzymes with AST (aspartate transferase) 1,019 IU/L (reference range 56–130) and CK (creatine kinase) 53,860 IU/L (reference range 127–537), consistent with severe muscle damage. Histopathological examination of samples of fixed muscle revealed a fibrinosuppurative myositis with intralesional gram-positive bacilli**.** ***Clostridium septicum*** was isolated on bacterial culture of the muscle, supporting a diagnosis of **clostridial myositis**. *Clostridium septicum* is most commonly associated with gas gangrene (malignant oedema), although a wound was not identified in this case.

On a farm in South Canterbury, a herd of mixed-aged pregnant beef cows were introduced slowly to kale over three days (initially only stalks, then leaf and flower). Over the following three days, three cows were found dead and a further five displayed rapid, shallow breathing. On physical examination, these cows were also pyrexic and four of the five displayed severe subcutaneous emphysema. Necropsy of one of the dead cows revealed widespread subcutaneous emphysema as well as interlobular pulmonary emphysema. Histopathological examination of the lung revealed acute interstitial pneumonia with extensive emphysema, oedema, hyaline membrane formation and type II pneumocyte hyperplasia. These findings are consistent with **acute bovine pulmonary oedema and emphysema** (fog fever). Common causes of this condition include movement from dry pasture onto lush pasture or paddocks of kale or turnips, which contain high levels of L-tryptophan. This compound is converted to 3-methylindole by bacteria in the rumen, which subsequently causes toxic damage to type I pneumocytes in the lungs.

On a Hawke's Bay farm, an outbreak of about 20 late-term **abortions and stillborn calves** occurred in a herd of mixed-aged beef cows. These cows had recently been transported to the property from a South Island farm. One of the cows was reportedly sick, and others in the herd appeared lethargic. No abortions occurred in the resident cows on the farm; only the recent arrivals were affected. Bacterial culture of the stomach contents of an aborted fetus was negative. Placental and fetal tissues were unremarkable on histopathological examination. Blood samples collected from three of the affected dams showed marked anaemia with haematocrits of 0.12–13 L/L (reference range 0.24–0.46). Numerous organisms consistent with *Theileria* spp. were present on the blood smears. A presumptive diagnosis of **theileriosis** was made, based on the epidemiological findings, blood results and absence of other causes of abortion. Outbreaks of abortion due to *Theileria orientalis* (Ikeda) have been reported overseas. The pathogenesis of the abortion is suspected to be due to hypoxia secondary to maternal anaemia, rather than the result of transplacental infection (Swilks et al., 2017).

Over a period of two months, 10 cows aborted on a dairy farm in Oamaru (information on cow age or estimates of fetal age was not provided). Affected cows had retained fetal membranes but otherwise remained well. Histopathological examination of multiple fixed tissues from an aborted fetus revealed moderate suppurative bronchopneumonia, mild lymphoplasmacytic and suppurative hepatitis and severe suppurative amnionitis with vasculitis. Large numbers of gram-positive bacterial cocci were identified in the amnionic membrane. Aerobic culture of stomach contents from the fetus yielded moderate growth of ***Helcococcus ovis.*** Identification of the bacterium was assisted by use of matrix-assisted laser desorption/ionisation time of flight mass spectrometry (MALDI-TOF MS). Given the histopathological findings this was considered significant and likely to be the cause of the abortion in this case. *Helcococcus ovis* is a gram-positive, catalase-negative bacterium reported as pathogenic in several species, including sheep, cattle, horses and goats, and associated with a variety of conditions including abortions (Anonymous, 2014), mastitis, metritis, endocarditis and pulmonary disease (Schwaiger et al., 2012).

A 13-year-old Friesian dairy cow on a property in Clutha had a chronic lameness characterised by thickening, ulceration and proliferative lesions of the interdigital cleft and heel bulbs of the hind feet. Biopsies received for histopathological examination revealed severe diffuse epidermal hyperplasia with a thick layer of orthokeratotic hyperkeratosis containing aggregates of neutrophils. A Warthin–Starry stain revealed numerous spirochaete bacteria. The findings were consistent with **bovine digital dermatitis** predominantly

associated with infection by ***Treponema*** species.

Two calves in poor body condition on a Buller district property died after a short illness. Necropsy revealed gassy intestines. There was no milk clot in the abomasum of one calf and rancid milk in the abomasum of the other. Histopathologic evaluation of a range of tissues from both calves revealed a suppurative bronchopneumonia with alveolitis and intra-alveolar amorphous pink material, suggestive of aspiration of milk resulting in **aspiration pneumonia.** Both calves also had enteritis with crypt microabscesses. The calves were reared on twice-a-day milk until four days of age and then fed a milk replacement only once a day, which would account for the poor body condition and is also likely to cause rapid ingestion of milk with subsequent risk of aspiration of milk.

On a North Canterbury property, a calf that had been disbudded the day before was found dead. No gross lesions were noted at necropsy. Fixed tissues submitted for histopathological examination revealed subacute rumenitis and interstitial pneumonia. This suggested that the calf was a so-called **rumen-drinker**. In this condition the oesophageal groove fails to close and milk enters the rumen where it is inappropriately fermented, leading to rumenitis and a potential portal of entry for bacteria.

A veterinarian investigated reproductive loss in a herd of 80 dairy cows in Wairarapa where there had been six abortions (7.5 percent) in February/March with another six cows empty at pregnancy testing (7.5 percent) for a total 15 percent reproductive failure rate. Although it had been up to six months since the losses had occurred, serology for *Neospora caninum* and BVD exposure was performed on four of the empty cows. The *Neospora* ELISA was performed rather than the immunofluorescent antibody test (IFAT) as detectable antibody reduces quickly to negligible levels within 1–2 months using the IFAT. All four of the cows tested positive for *Neospora* on the ELISA, indicating that ***Neospora caninum*** was the likely cause of reproductive loss in this herd. One older cow was antibody-seropositive for BVD.

Ovine

Listeriosis in its various manifestations was a common diagnosis in sheep during this winter period. In one case, eight Merino wether hoggets (castrated male sheep under a year old) on a North Canterbury farm developed neurological signs and three died over a few days. The affected sheep had been eating kale and baleage. Samples were collected from the three dead sheep. Histopathological evaluation of tissues from one animal revealed inflammatory lesions in the midbrain and brainstem consistent with **encephalitic listeriosis**. Outbreaks of listeriosis (encephalitic, gastrointestinal or abortion) are often associated with feeding poorly preserved silage or baleage, although cases can also occur in animals on pasture alone. The organism can survive and grow in cold temperatures. The incubation period for the encephalitic form is generally longer than for enteric listeriosis, and it may take up to four weeks before clinical signs develop.

In another case, a farmer on a Mackenzie Basin farm was finding Merino hoggets down and unable to walk when lifted. Around 13 of 1,600 animals had been affected over a period of a week. The animals were grazing ryecorn and being supplemented with baleage and silage. The veterinarian suspected listeriosis and typical lesions of listeriosis were found in the brainstem of two animals on histopathological examination. A surge in cases of **encephalitic listeriosis** can be seen when sheep are fed improperly ensiled silage or baleage in which ***Listeria monocytogenes*** can proliferate.

In Hawke's Bay, deaths were occurring in lambs displaying neurological signs including ataxia, head tilt and falling to one side. Histopathological examination of the brain from one of the dead lambs revealed a necrosuppurative meningoencephalitis, predominantly affecting the brainstem, with malacia and microabscesses, containing rare gram-positive coccobacilli, characteristic of **listeriosis.**

In the Clutha district, 12 hoggets from a group of 750 became recumbent and some showed neurologic signs, including circling. The sheep had been on a brassica crop with access to baleage. Fixed brain tissue was submitted for histopathological evaluation, which revealed a suppurative encephalitis within the brain stem and a mononuclear meningitis in the brain stem and midbrain, consistent with **encephalitic listeriosis**. Potential sources in this case included poorly fermented baleage (for example, ripped plastic affects the fermentation process, causing an increased pH that allows *Listeria* sp. bacteria to proliferate) or increased ingestion of soil if conditions become muddy.

Abortion due to listeriosis was also noted during this period. In one case, about 100 hoggets from a group of unspecified size on a North Canterbury farm aborted. A variety of tissue samples were received from two aborted lambs. Both had a neutrophilic placentitis with large numbers of small bacteria present, and one had large numbers of similar bacteria in the lung. Bacterial culture yielded a heavy growth of ***Listeria ivanovii*** from the stomach contents of both lambs, confirming a diagnosis of **listerial abortion**. *Listeria ivanovii* is a common cause of abortion in sheep in New Zealand.

In another case, three ewes aborted on a sheep farm near New Plymouth. Samples from an aborted fetus were collected and sent to the laboratory for histopathology and bacterial culture. Microscopic examination of fixed fetal tissues showed severe necrosuppurative inflammation with intralesional bacteria. There was also evidence of bacterial overgrowth in the lung. Bacterial culture of the fetal lung tissue yielded heavy growth of both ***Listeria monocytogenes*** and ***Listeria ivanovii***, which can both be associated with outbreaks of **listerial abortion** in sheep.

The enteric form of listeriosis was also seen during this period. In one case, multiple lambs under a year old died suddenly on a kale crop in the Mackenzie Basin. They were removed from the crop, which reduced the losses. They were fully vaccinated for clostridial diseases. At necropsy there was no evidence of jaundice or haemoglobinuria to suggest kale anaemia; hence, fixed tissues were submitted for histopathological examination. In the small intestine there were multiple foci of enteritis that extended to involve the underlying muscularis mucosae. Gram staining identified short gram-positive bacilli within the lesions, consistent with **enteric listeriosis** due to ***Listeria monocytogenes*.**

On a Canterbury farm near Ashburton, 60–70 of a group of 350 two-tooth (2-year-old) ewes (nearly 20 percent) aborted. Samples from three of the aborted lambs were sent to the laboratory. *Toxoplasma* titres in the samples of heart blood were all positive at 1:128, 1:256 and 1:1,028. All three lambs had *Toxoplasma* detected in fetal stomach contents by PCR. The stomach contents were PCR-negative for hairy shaker disease virus and *Campylobacter* species were not detected on bacterial culture of stomach contents. The findings were consistent with a diagnosis of ***Toxoplasma gondii* abortion**.

Three 1-year-old hoggets from a flock of 1,200 in Clutha had neurological signs that the attending veterinarian considered highly suggestive for **polioencephalomalacia** (PEM). They were grazing swedes and baleage. The brain from one affected animal was submitted for histopathological examination, which revealed multiple areas with focally extensive laminar loss of the cortical grey matter, significantly diminishing the cortical thickness. These findings were highly suggestive of PEM and, given the history, this was the most likely diagnosis. The pathogenesis of this disease involves deficiency of thiamine, which is an essential component of several enzymes involved in carbohydrate metabolism (West et al., 2018). There are multiple possible causes, including lead toxicity, salt toxicity, sulphur toxicity, cobalt deficiency, and thiaminase-producing bacteria within the rumen after a feed change to one with less roughage (West et al., 2018; McKenzie et al., 2009). Brassica crops such as swedes have been associated with PEM through the effects of high sulphur within the plant (McKenzie et al., 2009). Sulphur is metabolised in the rumen to hydrogen sulphide and sulphide-containing free radicals, which block the electron transport chain. This reduces the oxidative processes within mitochondria, leading to depletion of adenosine triphosphate (ATP), with subsequent cellular anoxia and death (Niles et al., 2002).

In the Selwyn district of Canterbury, a group of 1,800 pregnant mixed-aged ewes broke into a paddock of kale, resulting in 35 deaths. Necropsy findings included red urine, dark kidneys and possible jaundice. Histopathological examination of the kidney confirmed the presence of haemoglobin within the renal tubules. The liver displayed severe centrilobular necrosis, which was considered likely to be secondary to hypoxia from a haemolytic anaemia caused by **S-methylcysteine sulfoxide (SMCO) toxicity**. S-methylcysteine sulfoxide is found in brassicas and when ingested this is converted to dimethyl disulfide, which causes haemolysis.

In Central Otago, about 8 to 10 Merino hoggets from a group of 500 were found dead over about three to four weeks. Another hogget displaying blindness and circling was euthanased and the brain submitted for histopathological examination which revealed a laminar cortical necrosis, consistent with **polioencephalomalacia (PEM)**.

Caprine

In August, a 10-year-old Saanen nanny goat from greater Auckland was noticed to have a vascular growth at the limbus of the left eye. The goat was mainly white with pink skin around the eyes but had no prior history of cutaneous neoplasia in the facial region. A biopsy of the mass was submitted for histopathological examination. This revealed a neoplastic proliferation of atypical and pleomorphic endothelial cells forming irregular blood-filled vascular channels, consistent with **limbal haemangiosarcoma**. Solar-induced neoplasms are relatively common within the non-pigmented integument of the third eyelid, sclera, limbus and skin, and include those arising from the blood vasculature (haemangioma and haemangiosarcoma) and epithelium (squamous cell carcinoma). While haemangiosarcoma arising from the ocular adnexa may be locally infiltrative, it is not commonly associated with metastasis or systemic disease, and excision is usually curative.

Cervine

On a property in the Mackenzie Basin, 10 mixed-aged red deer stags from a group of 140 died suddenly over a 48-hour period. One other stag showed signs of respiratory distress. The deer had been on a diet of kale, barley and baleage. Necropsy less than 12 hours after death revealed excess haemorrhagic pericardial fluid and congested kidneys but minimal other findings. A rapid nitrate test on the kale leaf was negative. Nitrate was not detected in ocular fluid from an affected stag. No *Yersinia* or *Salmonella* species were isolated on bacterial culture of intestinal contents. The most significant finding on histopathological examination was a marked interstitial pneumonia with oedema, hyaline membranes and type II pneumocyte hyperplasia. This is a reaction pattern which can be seen with a number of toxic and infectious insults to the lung. The most well-recognised cause and the most likely diagnosis in this case was **atypical interstitial pneumonia due to L-tryptophan toxicity**, which typically occurs when ruminants undergo a diet change to more lush pasture regrowth or a brassica crop. Other causes include mycotoxins (e.g., 4-ipomeanol in mouldy sweet potatoes), plant toxins (e.g., perilla ketone, possible toxins in rape or kale), hypersensitivity to *Dictyocaulus* sp. larvae, or viral pneumonia. Atypical interstitial pneumonia (fog fever) is well recognised in cattle but only

rarely reported in deer (Mawhinney et al., 2010).

In mid-Canterbury, four out of a group of 120 8-month-old male red deer died. Necropsy findings were unremarkable apart from watery intestinal contents. Bacterial culture of intestinal contents from three animals yielded moderate-to-heavy growths of ***Yersinia pseudotuberculosis***. **Yersiniosis** is one of the most serious and common infectious diseases of farmed deer. The bacteria are widespread in soil, water and pasture and can be associated with acute inflammation of the intestines, often after a stressor such as weaning, transport, bad weather or underfeeding. Young deer, four to eight months of age, are typically affected. Affected animals are often isolated from the group and became dehydrated and weak, with watery to dark, sometimes bloody, diarrhoea. Some acute cases may be found dead without any obvious clinical signs. Prevention measures include vaccination and minimising stress for young deer.

Equine

In Ashburton, a 16-year-old Shetland pony mare presented with an inability to prehend food, though she was interested in eating. Haematological tests revealed a mildly elevated fibrinogen and neutrophil count. Serum biochemistry testing revealed significant muscle damage with creatine kinase of 15,035 IU/L (reference range 0–312) and aspartate transferase (AST) of 6,431 IU/L (reference range 0–590). There had been no history of trauma to explain the muscle injury, therefore a sample of whole blood was tested for selenium concentration. This gave a very low result of 128 nmol/L (reference range 1,600–3,200), suggesting **selenium deficiency**. Myopathy due to selenium/vitamin E deficiency in horses is relatively rare and more often seen in foals, although it can be seen in adults, particularly adult ponies or miniature horses. Clinically, it often affects the masseter muscles, resulting in difficulty with mastication.

In July, a 9-month-old Thoroughbred filly from a stud in Waikato was euthanased following a chronic history of illthrift. Necropsy revealed marked thickening of the peritoneum and multiple thickened lymphatic vessels around the mammary tissues. Histopathological examination of the peritoneum and an abdominal lymph node revealed **severe granulomatous peritoneal and perinodal steatitis.** Differential diagnoses for the aetiology that were considered relevant included infection (e.g., *Rhodococcus equi*, fungi), gastrointestinal rupture, penetrating wound, nutritional deficiency or metabolic derangement. Infectious agents were not visible on routine haematoxylin and eosin (H&E)-stained sections or with the use of special stains for bacteria, fungi or acid-fast bacteria. Additional information about the gross lesions was not available and a concurrent condition such as an enteropathy could not be ruled out. Considering the foal's age and presenting signs, a metabolic or nutritional cause for steatitis (yellow fat disease) were also considered possible.

A 22-year-old mare from Christchurch had a mass on the lower right flank which had been present for two to three years. A veterinarian was called to examine the mass after it had been bleeding for 24 hours, which the owner thought might be the result of local trauma during grooming. The mass was surgically excised and fixed tissue sent for histopathological examination. There were nests and packets of cuboidal cells, separated by thick fibrovascular stroma (**Figure 1**). A periodic acid–Schiff (PAS) stain highlighted a thin PAS-positive basement membrane surrounding individual cells or small nests of cells (**Figure 2**). These characteristics

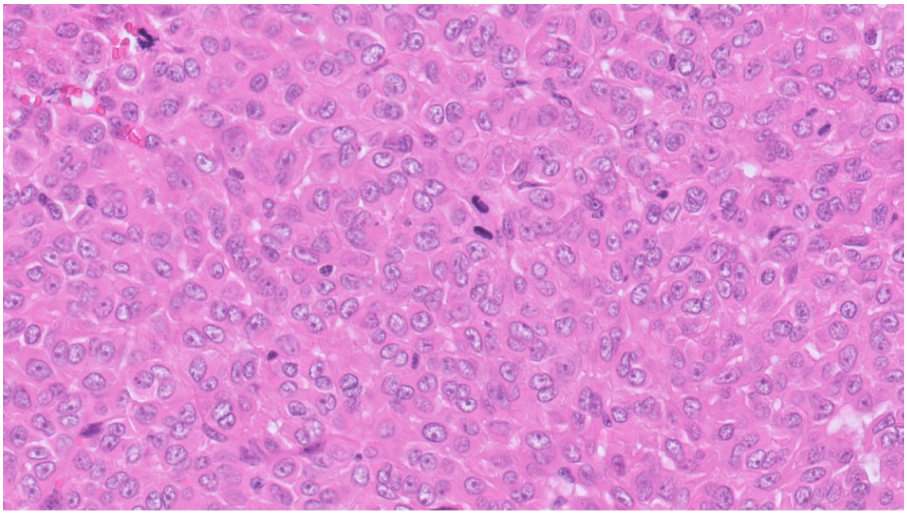

Figure 1: Nests and packets of cuboidal cells separated by thin fibrous stroma. Multiple mitoses are present

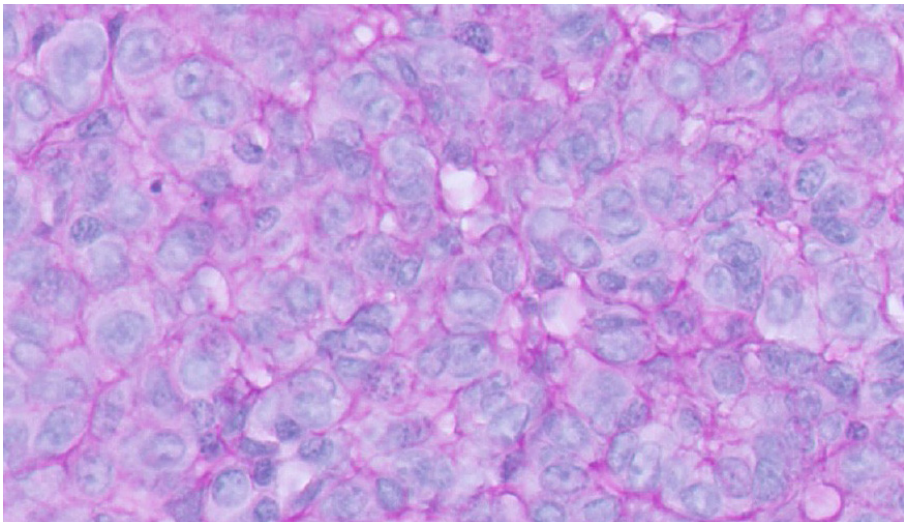

Figure 2: A periodic acid–Schiff stain highlights the purple staining basement membrane surrounding individual cells, and cells in small groups

were most consistent with a **glomus tumour**, a rare neoplasm arising from glomus cells, which are specialised, modified smooth muscle cells controlled by the sympathetic nervous system. In humans, these are frequently found in the extremities. In animals, there have been reports of glomus tumours in dogs, cats, horses, non-human primates and cows (Brounts et al., 2008; Horiuchi et al., 2015; Park et al., 2009). In horses, cases have been reported in the subcutis of the head and neck as well as in the foot (Brounts et al.; 2008; Burns et al., 2011). Most of these cases have had features of malignancy, including local invasion and a high mitotic count (Peters et al., 2016). However, there have been no reports of metastasis. This case had features suggesting malignancy, with a high mitotic count and multiple areas where the capsule had been breached. Monitoring of the surgical site for any recurrence was advised, though clean margins were achieved in this case.

Porcine

A 5-year-old female Kunekune pig on a small lifestyle farm near New Plymouth developed thickened, crusty skin on the top of the neck, on the ears and on the pads of the front feet. A representative punch biopsy was collected and examined. Histopathological examination revealed marked epidermal hyperplasia and hyperkeratosis with eosinophilic dermatitis and dermal fibrosis. Large numbers of arthropod mites were visible within the epidermal crusts, confirming a diagnosis of **sarcoptic mange.** In pigs, sarcoptic mange is caused by ***Sarcoptes scabei* var *suis*** infection. Mites are transmitted by direct contact between pigs (including to neonates from the dam) and may be carried subclinically. They tend to establish under the ear before spreading to the body and legs. They can cause intense pruritis and production loss, although mortality is unlikely. *Sarcoptes scabei* var *suis* is pig-specific, so typically only causes minor irritation to people rather than establishing a zoonotic infection.

Canine

In Canterbury, a 9-year-old dog was presented for veterinary examination after several days of inappetence and pain. The dog had a history of chronic cholelithiasis. The gallbladder wall was thickened at ultrasound examination. A sample of bile was collected for cytology and bacterial culture. Serum was also submitted for biochemistry testing. Alkaline phosphatase (ALP) was elevated at 224 IU/L (reference range 0–87) and Alanine aminotransferase (ALT) was > 10 times normal at 1,143 IU/L (reference range 0–88), indicating hepatobiliary disease. Cytological examination of the bile sample revealed a neutrophilic inflammation with presence of bacteria. ***Salmonella* Typhimurium** and ***Klebsiella pneumoniae*** were isolated from bacterial culture of the bile, confirming infection. Although **bacterial cholecystitis** is uncommonly reported, it likely occurs more frequently than previously suggested in the scientific literature and should be considered as a differential in dogs presenting with icterus and fever, abdominal pain, an inflammatory leukogram or ultrasonographic evidence of gallbladder abnormalities.

Lagomorph

A 3-year-old male rabbit in Canterbury was presented with chronic rhinitis that was unresponsive to therapy. The animal also had visible **mineralised rhinoliths**. Fixed tissue biopsies and a swab were submitted for histopathology and bacterial culture. Culture yielded a moderate growth of ***Mannheimia*** sp. and ***Pasteurella multocida*** with a light growth of ***Clostridium perfringens***. Histopathological findings were consistent with a chronic bacterial infection of the nasal cavity. There was severe, necrosuppurative inflammation, with mineralisation and Splendore–Hoeppli material. Splendore–Hoeppli material likely represents immune complex deposition and persistence of the infectious agent. *Pasteurella multocida* is known to be capable of causing this reaction. Although **pasteurellosis** is the most common cause of upper respiratory disease in rabbits, rhinolith formation is a rare phenomenon. These are calcified compactions that form because of an exogenous or endogenous nidus, such as foreign body or chronic inflammation (as in this case), accompanied by stagnation of nasal secretions and precipitation of salts.

Avian

A 2-year-old female racing pigeon (*Columba livia domestica*) from greater Auckland was submitted to the laboratory for necropsy after three stock hens in an aviary died over a one-week period. The hens were either found dead or had died after a two-day history of wasting with watery droppings. At necropsy, the liver of the pigeon was swollen with rounded margins and contained multifocal pinpoint white spots. The spleen was also enlarged, and the coelom contained scant viscous tan material suggestive of coelomitis. The serosa of the intestines was mottled red. ***Salmonella* Typhimurium** was isolated on bacterial culture of the intestinal contents, confirming **salmonellosis**. In this case, contact with wild birds or their droppings was the most likely source of infection. Outbreaks of mortality due to salmonellosis are not uncommon in wild birds in the winter months in New Zealand and Typhimurium is the most frequent serovar involved (Alley et al., 2002).

In late June, an adult male zebra finch (*Taeniopygia guttata)* weighing 19 g entered a research facility in Auckland. It was observed to initially have a good appetite, but a week later had lost 7 g in weight and was noted to be 'puffed up', lethargic and intermittently shaking. There were no gross lesions at necropsy. Histopathological examination revealed severe chronic-active proventriculitis and ventriculitis, with abundant large rod-like yeasts consistent with ***Macrorhabdus ornithogaster*** **(avian gastric yeast).** *Macrorhabdus ornithogaster* is linked with infection of the proventriculus and ventriculus in ornamental psittacines including budgerigars, finches, canaries and lovebirds. Rarely, it may infect poultry.

Most infections are subclinical, but a heavy burden combined with physiological stress can lead to illthrift, weight loss, diarrhoea and occasionally death. In live birds, the yeasts may be seen on faecal wet mount or smears and sometimes on crop wash cytology. Scrapings of the mucosa of the proventriculus/ventriculus may aid post-mortem diagnosis, alongside histopathology.

In August, an aged captive spur-winged plover (*Vanellus miles novaehollandiae*) from Auckland was found dead. There was marked haemopericardium at necropsy. Histopathological examination revealed a regionally extensive area of caseous necrosis and granulomatous inflammation dissecting the right atrial wall and pulmonary arterial trunk. Intralesional macrophages contained faintly gram-positive, acid-fast bacilli, consistent with *Mycobacterium* species. The infection was multisystemic, with granulomatous inflammation and acid-fast bacilli also present in the spleen, liver, intestinal tract, ovary and lung. The cause of death was determined to be **cardiac tamponade secondary to rupture of the right outflow tract** due to a **mycobacterial granuloma**.

A male yellowhammer (*Emberiza citronella*) from Canterbury presented with ataxia, lameness and wing damage. Necropsy findings included small pale nodules throughout the liver, lung, spleen, cerebellum and joints. Histopathological examination revealed multiorgan necrosis and abscesses with bacterial colonisation consisting of numerous gram-negative rods. This correlated with bacterial culture of samples of liver and lung, which yielded ***Yersinia pseudotuberculosis*** leading to a diagnosis of **yersiniosis.**

Reptile

In September, a captive Awakopaka skink (*Oligosoma awakopaka*) from Auckland died after three days of topical treatment for a 2–3 mm skin wound on the forelimb. Necropsy revealed the gastrointestinal tract to be devoid of contents. Histopathological examination of the tissues confirmed a mixed bacterial and fungal dermatitis on the forelimb, alongside multifocal intravascular thrombi with intralesional gram-positive bacilli within the spleen, liver, kidney and heart. The skink was determined to have died from **bacterial septicaemia** most likely secondary to dermatitis. This species was discovered in 2014 and only 20 individuals are known to exist, all in one small area of Fiordland. Its conservation status is Threatened, Nationally Critical.

Insect

In September, a captive, wild-born male wetapunga (*Deinacrida heteracantha*) in the Auckland region was found dead following a chronic history of discolouration of the left periocular region. Necropsy revealed a focally extensive area of black discolouration extending through the exoskeleton and into the tissues of the head. Histologically, there were abundant fungal hyphae forming aggregates and sheets, with an associated **fungal dermatitis of the antennae and head with fungal rhabdomyositis, steatitis and coelomitis** extending into the caudal abdomen. There was moderate fungal growth on a culture, which was identified morphologically as ***Metarhizium* sp**. *Metarhizium* spp. are known pathogenic fungi of insects and may be found in soil and in association with plant roots. Their pathogenicity to insects is such that some species have been postulated to have application as biologic control agents in place of chemical insecticides.

IDEXX

Bovine

Multiple cases of bovine salmonellosis were diagnosed during this quarter. A total of 30 cases were recorded in regions across the country including Invercargill, Ashburton, Upper Hutt, Kāpiti Coast, Taranaki, Waimakariri, Kaipara, South Taranaki, New Plymouth, Waikato, Hauraki and the Far North. Most cases were serotyped, with *Salmonella enterica* subsp. *enterica* serovar Typhimurium being the most commonly identified serovar.

Salmonella affects many species, including humans, and therefore there is a zoonotic potential. Animals can shed the bacteria in faeces as well as in aborted material that is sometimes spread by pests like rodents and birds. Recent wet conditions are likely causing increased bacterial loads, especially in the southern parts of the country. Affected animals typically present with foul-smelling diarrhoea or scours, fever, recumbency, loss in condition or milk production and abortion. Acute deaths may also occur. Management techniques include factors such as vaccination, pest control, good hygienic principles, minimal stress of animals and managing vulnerable animals' exposure to potentially high-risk areas with faecal contamination.

In a dairy herd of 300 cows in the Waikato, 10 cows had a drop in milk production and had developed a fever with severe diarrhoea. One cow died. A faecal sample of one cow was submitted for microbial culture. ***Campylobacter jejuni*** and ***Salmonella* Typhimurium** were isolated and identified. Both bacteria have zoonotic potential and cause gastrointestinal disease.

In a dairy herd of 200 cattle in Ashburton, four animals had fractured legs. Fresh liver and serum samples were collected from the affected 2-year-old heifers. The samples were submitted to the laboratory for copper and selenium testing. Liver copper levels ranged between 28 and 70 µmol/kg, at an average of 64 µmol/kg (adequate range 95–2,000 µmol/kg). Liver selenium levels were within normal range at an average of 3,433 nmol/kg (adequate range 850–10,000 nmol/kg). Mirroring the liver results, serum copper levels ranged between 1.3 and 7.6 µmol/L, at an average of 4.9 µmol/L (adequate range 8.0–20.0 µmol/L). Serum selenium levels were within normal range at an average of 228 nmol/L (adequate range 150–3,500 nmol/L). These results were an indication of **copper deficiency** in this herd.

In a similar case in Matamata-Piako, a heifer had dropped hocks in a dairy herd of unknown size. Fresh liver copper levels revealed a low result of 31 µmol/kg. Breeding cows have an increased demand for copper when they are pregnant

and during milk production. Copper is an important mineral during growth and is involved in bone strength. Rapidly growing cattle that concurrently produce milk or are pregnant, such as 2-year-old heifers, are at greatest risk of developing musculoskeletal abnormalities such as fractures and dropped hocks due to copper deficiency.

A Jersey herd of unknown size in New Plymouth had an outbreak of **conjunctivitis** in 3-day-old to 2-week-old calves. The animals did not display corneal opacity (cloudiness). Eye swab samples from two animals resulted in growth of ***Moraxella bovoculi***. The result was consistent with a diagnosis of infectious bovine keratoconjunctivitis (IBK) colloquially known as pinkeye. *Moraxella* species, including *M. bovis* and *M. bovoculi*, have been associated with this disease and colonise clinically healthy eyes as well as animals that develop conjunctivitis. Young calves are more at risk. Sensitivity testing revealed that the bacterial isolate was sensitive to multiple antimicrobials, including amoxicillin/clavulanic acid, chloramphenicol, penicillin and tetracycline. There was an intermediate sensitivity to enrofloxacin and the isolate was resistant to trimethoprim/sulfamethoxazole. Concurrent infection with infectious bovine rhinotracheitis virus (IBR) is often seen and increases the severity of the disease. In this instance IBR testing was not done.

A dairy herd near New Plymouth had multiple calf deaths at ages between 4 days and 3 weeks. Affected animals had no clear clinical signs before death. At post-mortem examination the lungs appeared firmer in consistency compared with normal lung, with some froth formation. Serum protein levels were tested in three animals and the results were between 38–40 g/L (normal range 60–86 g/L). A total protein level less than 52 g/L is regarded as evidence of **failure of passive transfer** and was indicated in these animals. In addition, one animal had hyperbilirubinaemia and a mild elevation of bicarbonate, reflecting decreased feed intake or gut stasis.

A New Plymouth dairy herd of unknown size had downer cows of mixed ages develop clinical signs within 24 hours of calving. The response to calcium treatment was reported as average by the veterinarian. Serum samples of six affected animals were submitted for calcium and phosphate testing. The calcium serum levels were 0.88–2.50 mmol/L, with an average of 1.54 mmol/L (reference range 2.00–2.60 mmol/L). The phosphate serum levels were 0.56–1.53 mmol/L, with an average of 0.89 mmol/L (reference range 1.10–2.80 mmol/L). The results are shown in **Table 1**. A diagnosis of **hypocalcaemia** (milk fever), compounded by concurrent **hypophosphataemia** was made. Hypocalcaemia and hypophosphataemia are metabolic conditions in high-producing dairy cows. Affected animals become anorexic, develop muscle weakness, muscle and bone pain and muscle damage, and can become anaemic. The average response to treatment described by the vet was likely due to the need for both calcium and phosphate supplementation in this herd.

Table 1: Calcium and phosphate serum results. 'L' following the result indicates value below reference range

Animal ID	Calcium (mmol/L)	Phosphate (mmol/L)
1	1.92 L	0.72 L
2	1.60 L	0.58 L
3	2.50	1.53
4	1.08 L	0.83 L
5	1.28 L	1.12
6	0.88 L	0.56 L
Mean	1.54	0.89
Reference range	(2.00–2.60)	(1.10–2.80)

In a herd of unknown size in Manawatū, dairy calves aged between 2 and 3 weeks developed mild to moderate scours. Faecal and serum samples from eight calves were submitted for analysis. Faecal culture and parasitology were negative for significant pathogens, such as *Salmonella* and *Cryptosporidium*. Serum tests revealed positive results for **rotavirus** in seven of the eight calves. Coronavirus tests were negative. Rotaviral infection causes diarrhoea in young beef or dairy calves. In some outbreaks, a combination of agents that include rotavirus and other pathogens, such as enterotoxigenic *Escherichia coli* and bovine coronavirus are frequently involved, causing more severe clinical signs.

A dairy herd of unknown size in Matamata-Piako had a history of young animals not doing well. Serum samples from 10 animals were submitted to the laboratory for trace element testing. The serum magnesium levels were low, ranging between 0.20–0.85 mmol/L and a mean of 0.53 mmol/L (adequate range is 0.62–1.15 mmol/L). Selenium and calcium levels were within normal ranges. A diagnosis of **magnesium deficiency** was made. This condition is more common in late winter and early spring and may be due to pastures with low magnesium content and/or high potassium content. Low magnesium may also be associated with hypocalcaemia (milk fever) in dairy cows as magnesium is required for calcium absorption.

In contrast to the case above, on a dairy farm south of Auckland, a 6-year-old Kiwi-cross cow had a drop in milk production one month post-calving, with no other significant signs of illness. Samples were submitted to the laboratory for a sick cow testing panel. The blood tests revealed elevated magnesium levels (1.39 mmol/L; reference range 0.49–1.15 mmol/L); low calcium (1.82 mmol/L; reference range 2.00–2.60 mmol/L); low potassium (3.6 mmol/L; reference range 3.9–5.8 mmol/L) and elevated bicarbonate (40 mmol/L; reference

range 26–34 mmol/L). These findings were interpreted as being consistent with **magnesium toxicity**. The elevated bicarbonate level was attributed to the cow's inappetence. The likely cause was excess magnesium in feed supplements.

On a farm in south Taranaki, three heifers developed clinical signs of dullness, depression, fever and decreased gut filling. The animals had been on silage for one month. Blood samples from two animals were sent to the laboratory for a blood profile test. Both animals had elevated beta hydroxybutyrate (B-OHB) (4.1 and 4.7 mmol/L; reference 0.2–1.0 mmol/L) and low bicarbonate (24 mmol/L in both; reference range 26–34 mmol/L). In addition, one animal had increased creatinine kinase (640 IU/L; reference 0–578 IU/L). The results were interpreted as being consistent with **ketosis**. This is a metabolic disease typically seen in well-conditioned or overweight cows or heifers that mobilise body fat to compensate for a negative energy balance in early lactation. They produce large amounts of ketones such as B-OHB, which the body cannot optimally utilise, leading to ketone build-up and ketosis. Elevated creatinine kinase is attributed to likely prolonged recumbency.

Ovine

During scanning on a 200-ewe sheep farm in the Waikato region, 10 percent of the ewes were found to have dead or dying fetuses. Affected ewes were of different ages. The 2-tooth ewes had been vaccinated against ***Toxoplasma*** **and** ***Campylobacter***. The 4-tooth ewes had been vaccinated against *Campylobacter* only. On histological examination, multifocal necrotising nonsuppurative cotyledon placentitis with central dystrophic mineralisation was observed, supporting an infectious aetiology, particularly concerning for *Toxoplasma* or *Campylobacter*. Culture results were negative for *Campylobacter* and *Salmonella*. *Campylobacter fetus fetus* serology results, however, showed sufficiently high titres in two animals to indicate possible *C. fetus fetus* infection rather than just a vaccination reaction. Similarly, serology results for *Toxoplasma* were significantly high in three animals, higher than expected with a vaccination reaction alone and suggesting recent infection. A further three animals of unknown age had less significantly increased *Toxoplasma* titre results. Depending on the age of the latter three animals, recent infection was interpreted as being likely if these were older ewes (4-tooth ewes), as that group had not been vaccinated against *Toxoplasma*. Not having the age of the animals sampled made interpretation of the results challenging.

A lifestyle block property outside Auckland had 10 Wiltshire sheep. The animals developed signs described as suspect parasitism and one died. Faecal samples of the dead sheep and a composite sample of the remaining animals was submitted for testing. The dead sheep had a **strongyle** egg count of 13,400 eggs per gram (epg) of faeces, a *Nematodirus* egg count of 50 epg of faeces, a low number of coccidia oocysts (1 in a range of 0–4) and moderate numbers of *Moniezia* eggs (2 in a range of 0–3). The composite sample had no strongyle or *Nematodirus* eggs, a low number of **coccidia** oocysts (1 in a range of 0–4) and no *Moniezia* eggs. The cause of death was attributed to severe endoparasitism. The composite sample did not reflect similar high numbers, but this could be due to the dilution effect of combining samples from nine animals. Ideally, individual testing should be performed to more accurately assess the parasite burden in this small flock.

Caprine

A goat on a farm in Waikato developed scours two days after drenching. It is not known whether other goats or animals are present on this property. A faecal sample was submitted, and a faecal egg count of 9,400 strongyle epg was found. The egg counts were interpreted as a heavy burden. Further identification of the **strongyle** species involved were not pursued. The cause for the poor response to the drenching was not determined, but possible factors to consider include drench resistance, under-dosing, missed individuals and extremely high initial worm burden requiring follow-up treatment.

Equine

An 8-month-old Thoroughbred colt on a property in Rangitīkei developed colic with a fever. No diarrhoea was observed; however, on abdominal scan the caecum was very inflamed. A faecal sample was submitted for culture, parasitology and PCR testing. A PCR panel for horse gastrointestinal pathogens was positive for *Salmonella* spp. On culture, ***Salmonella*** **Typhimurium** was isolated. No parasite eggs or larvae were found on parasitology tests. *Salmonella* is present in the environment and faeces of some healthy animals. Stress is known to play an important role in the development of salmonellosis, including factors such as surgery, transportation, severe weather, change in feed, concurrent disease (particularly other GI disorders) as well as treatment with broad-spectrum antimicrobial drugs.

Camelid

A lifestyle block owner close to Auckland had a llama that developed pasty faeces and had significant weight loss. A faecal sample and blood were submitted for testing. The faecal strongyle egg count was 664 epg, supporting the likelihood of **strongylosis** being a significant contributing factor to the animal's weight loss. The blood chemistry results were within normal limits. Other than endoparasites, a suitable and adequate diet is also an important factor to consider in llamas that lose condition.

Avian

Two 1-year-old domestic chickens in Nelson were in poor body condition with dull and broken feathers. Faecal samples were submitted for parasitology testing. The results revealed moderate to extremely high numbers of **coccidia** oocysts (3+ and 4+; out of a range 0–4+), as well as ***Heterakis*** and ***Capillaria*** eggs (the latter were not quantified). Coccidiosis is caused by a protozoan and is a common intestinal disease in chickens with the potential to be fatal when the organism is in high numbers. *Heterakis* is a worm that also infects the intestine

(typically the caecum) of chickens and other gallinaceous birds like turkeys, ducks and geese. *Capillaria* is another common intestinal worm that infects chickens and can proliferate in multiple segments of the gastrointestinal system. The combination of these three conditions is likely to have had a compounding effect on these birds, causing the clinical signs seen.

A 2-year-old female pet pigeon in Auckland became lethargic, quiet, fluffed up and inappetent. She developed crop stasis and had scant droppings. The clinical signs progressed to ataxia and stargazing the following day and the bird was taken to the vet. A suspect caudal coelomic mass was seen on radiographs. She had no history of reproductive abnormalities and was not in lay at the time. The pigeon died a day later and was submitted for post-mortem examination; a large haematoma was found filling the caudal coelomic cavity (**Figure 3**). Upon further dissection, the haematoma was found to originate from a haemorrhagic cystic structure that was attached to the ovary (**Figure 4**). On cut-section the cystic structure was filled with haemorrhage and necrotic debris. No other significant findings were noted. The large **haematoma** and associated **ruptured** cystic structure were interpreted as most likely being an **ovarian cyst** that had ruptured, leading to internal haemorrhage into the cyst lumen. The cystic structure was necrotic and did not appear neoplastic, but neoplasia with central necrosis could not be excluded without histopathology. The owner opted not to proceed with histopathology. Hypovolaemic shock was the likely cause of death in this pigeon.

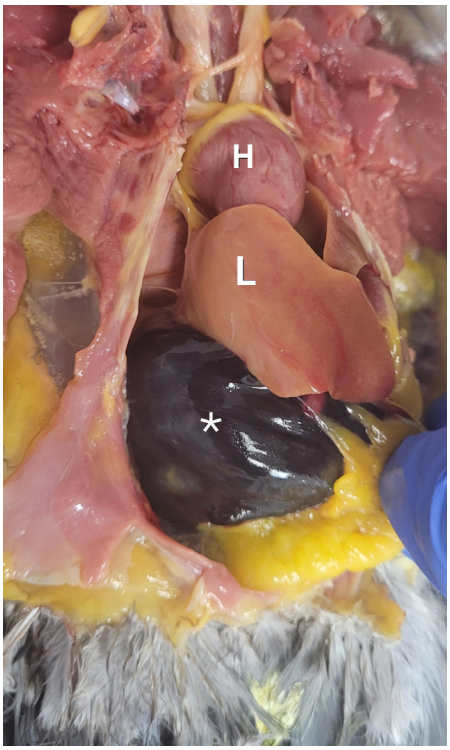

Figure 3: Coelomic cavity of a pigeon showing a haematoma in situ (*). The liver (L) and heart (H) are normal. Photo: Michelle Lewis



Figure 4: Haemorrhagic cyst (*) attached to ovaries (O) with adjacent normal intestinal tract (I) and gizzard/stomach (G). Photo: Michelle Lewis

Exotic

A 6-year-old pet bearded dragon in Auckland developed a skin mass on the side of its body over the ribs. The mass increased in size over a 3-month period of brumation but did not appear painful. There was no evidence of invasion into the underlying subcutaneous tissue. Fine needle aspirate smears were submitted for cytology. The majority of the cells contained abundant brown pigment, consistent with melanin. The cells had a mild variation is size and shape with no mitotic activity. There was a mucinous background. A cytological diagnosis of probable **melanophoroma**, mucinous subtype, was made based on these findings. These tumours are derived from melanin pigment-producing cells of the skin and are rarely reported. The mucinous type is known to occur in bearded dragons and there is the potential for local recurrence and metastatic disease.

References

Alley MR, Connolly JH, Fenwick SG, Mackereth GF, Leyland MJ, Rogers LE, Haycock M, Nicol C, Reed CEM (2002). An epidemic of salmonellosis caused by *Salmonella* Typhimurium DT160 in wild birds and humans in New Zealand. *New Zealand Veterinary Journal* 50(5), 170–176.

Anonymous (2014). AHVLA disease surveillance report. Bovine abortions caused by *Helcococcus ovis*. *Veterinary Record* 175(2), 38–41.

Brounts SH, Adams SB, Vemireddi V, Holland CH (2008). A malignant glomus tumour in the foot of a horse. *Equine Veterinary Education* 20(1), 24–27.

Burns RE, Pesavento PA, McElliott VR, Ortega J, Affolter VK (2011). Glomus tumours in the skin and subcutis of three horses. *Veterinary Dermatology* 22(2), 225–231.

Horiuchi N, Komagata M, Shitamura K, Chiba S, Matsumoto K, Inokuma H, Matsui T, Konayashi Y (2015). Glomus tumor of the liver in a cow. *Journal of Veterinary Medical Science* 77(6), 729–732.

Mawhinney I, Woodger N, Knudsen S (2010). Atypical interstitial pneumonia in grazing adult red deer (*Cervus elaphus*). *Journal of Comparative Pathology* 143(2–3), 209–212.

McKenzie RA, Carmichael AM, Schibrowski ML, Duigan SA, Gibson JA, Taylor JD (2009). Sulfur-associated polioencephalomalacia in cattle grazing plants in the family Brassicaceae. *Australian Veterinary Journal* 87(1–2), 27–32.

Niles GA, Morgan SE, Edwards WC (2002). Relationship between sulfur, thiamine and polioencephalomalacia: a review. *The Bovine Practitioner* 36(2), 93–99.

Park CH, Kozima D, Tsuzuki N, Ishi Y, Oyamada T (2009). Malignant glomus tumour in a German shepherd dog. *Veterinary Dermatology* 20(2), 127–130.

Peters M, Grafen J, Kuhnen C, Wohlsein P (2016). Malignant glomus tumour (glomangiosarcoma) with additional neuroendocrine differentiation in a horse. *Journal of Comparative Pathology* 154(4), 309–313.

Schwaiger K, Wimmer M, Huber-Schlenstedt R, Fehlings K, Holzel CS, Bauer J (2012). Hot topic: Bovine milk samples yielding negative or nonspecific results in bacterial culturing – the possible role of PCR-single strand conformation polymorphism in mastitis diagnosis. *Journal of Dairy Science* 95(1), 98–101.

Swilks E, Fell SA, Hammer JF, Sales N, Krebs GL, Jenkins C (2017). Transplacental transmission of *Theileria orientalis* occurs at a low rate in field-affected cattle: infection in utero does not appear to be a major cause of abortion. *Parasites & Vectors* 10(227), 1–9.

West DM, Bruere AN, Ridler AL (2018). Neurological disorders. In West DM, Bruere AN, Ridler AL (eds). *The Sheep: Health Disease and Production*, fourth edition, pp. 301–303. Massey University Press, Palmerston North.Wehrle-Martinez A, Lawrence K, Back PJ, Rogers CW, Gibson M, Dittmer KE (2023). Osteoporosis is the cause of spontaneous humeral fracture in dairy cows from New Zealand. *Veterinary Pathology* 60(1), 88–100.

Quarterly report of investigations of suspected exotic aquatic pests and diseases: July to September 2024

Suspected exotic caulerpa cases 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). The Aquatic Health team supports the caulerpa response by facilitating identification of reported sightings of these exotic algal species. Notifications of exotic caulerpa are submitted by a range of notifiers, including members of the public, iwi representatives, staff from regional councils and the Department of Conservation (DOC). In this period the Aquatic Health team investigated three suspected exotic caulerpa reports. Notifications were received from Te Tai Tokerau/Northland, Tāmaki Makaurau/Auckland, and Te Moana-a-Toitehuatahi/Bay of Plenty. Marine Invasives Taxonomic Service (MITS) used images to rule out exotic caulerpa in all these cases. **Table 1** summarises the outcomes of these notifications.

Table 1: Summary of the outcomes of suspected exotic caulerpa cases investigated by region during July–September 2024

Locality	Taxa identified
Northland	
Parekura Bay, Bay of Islands	Green alga *Ulva* sp.
Auckland	
Leigh	Inconclusive, likely green alga *Ulva* sp. – not *Caulerpa* sp.
Bay of Plenty	
Ōmokoroa and Sulphur Point, Tauranga	Green alga *Ulva* sp.

Range extension of the non-indigenous alga *Striaria attenuate*

MITS notified MPI of the range extension for the non-indigenous alga *Striaria attenuate*, detected in Motupōhue/Bluff during National Marine High Risk Site Surveillance (NMHRSS). *Striaria attenuate* has previously been officially recorded in Te Whanganui-a-Tara/Wellington. However, MITS also informed MPI that NIWA has had earlier collections from Rakiura/Stewart Island at Watercress Bay in 2011, Stewart Island at Bravo Island 2012, Te Rua-o-te-moko/Fiordland at Cording North Point Preservation Inlet in 2019 and Whakaraupō/Lyttelton at Te Ana marina in 2020. Additionally, a literature review indicates this species has been present in New Zealand since at least 1983 (Adams, 1983). Details of the new locations were passed on to Environment Canterbury and Environment Southland and the investigation was closed.

Non-indigenous alga *Undaria pinnatifida* detected

Otago Regional Council notified MPI that a 2023 studentship project had detected *Undaria pinnatifida* in a new location at Hooper's Inlet, Ōtākou (Otago). This location is 10 km south of a detection reported last quarter from Pipikaretu Beach, Ōtepoti (Dunedin). The species identification was confirmed by MITS through photographs. The location of the detection was added to the Marine Biosecurity Porthole www.marinebiosecurity.org.nz/ and the investigation was closed.

Seaweed investigated

A member of public contacted MPI to report what they suspected to be an unknown seagrass species from Cable Bay, Northland. Images provided by the notifier were sent to MITS for identification. Taxonomists identified it as an *Ulva* species of algae. This genus is often referred to as 'sea lettuce' and can be found commonly across New Zealand. There are no biosecurity concerns associated with the *Ulva* species that are currently present in New Zealand. Since no concerns were identified, the result was communicated to the notifier and the investigation was closed.

Reports of exotic freshwater gold clams (*Corbicula fluminea* and *Corbicula australis*)

MPI is leading an active response following the detection of two exotic freshwater gold clam species, *Corbicula fluminea* and *C. australis*. *Corbicula fluminea* was first detected in May 2023 at the Bob's Landing area of the Waikato River, and *C. australis* was detected in a water park on the shore of the Waikato River in April 2024. The exotic bivalves have now been found along a 227-km stretch of the Waikato River, from Lake Maraetai to Tuakau. Neither species has been found outside these water bodies to date.

The Aquatic Health team supports the corbicula response by helping to identify suspected sightings from outside of their known range. Notifications of suspected *Corbicula* sp. are submitted by a range of notifiers, including members of the public, iwi representatives, staff from regional councils and DOC.

For the period July–September 2024, four reports of suspected exotic freshwater gold clams were referred to the Aquatic Health team for investigation. The locations and findings from these investigations are summarised in **Table 2** (next page).

Range extension of the non-indigenous whelk *Tritia burchardi*

MITS notified MPI of the range extension for the non-indigenous whelk *Tritia burchardi*, detected in Ahuriri /Napier during NMHRSS.

Table 2: Outcomes of suspected *Corbicula fluminea* cases investigated by region during July–September 2024

Locality	Taxa identified
Waikato	
Hamilton Gardens (Waikato River)	*Corbicula* sp.
Rukuhia (Waikato River)	*Corbicula* sp.
Horahora Domain (Waikato River)	*Corbicula* sp.
Waipuke Park (Waikato River)	*Corbicula* sp.

Tritia burchardi was first detected in 2009 and has been found in Ōpua, Whangārei, Kaipara Harbour, Auckland and Tauranga. There is very little information in literature for this species. However, the length of time since first arrival, no significant increase in detections since first arrival and lack of reported impacts indicate that this species represents a low biosecurity risk. The information of this range extension was communicated to the Hawke's Bay Regional Council and the investigation was closed.

Shellfish mass mortality investigated

A member of the public contacted MPI to report a mass mortality of thousands of shellfish on Waikouaiti Beach, Otago. The notifier also reported a tuatua (*Paphies subtriangulata*) mortality event that had occurred the week before. Images provided by the notifier showed several empty shells on the beach. Otago Regional Council (ORC) was contacted to gather further information and to assist with sample collection. Local rūnaka Kāti Huirapa were also contacted to inform them of the mass mortality event. Unfortunately, no fresh samples were available at the time of the report and both the ORC and Kāti Huirapa were asked to keep an eye out for suitable samples.

Otago Regional Council informed the Incursion Investigator that Hawksbury Lagoon was opened under emergency to reduce the risk of flooding during a rain event two weeks before the mortality. MPI's Animal Health Laboratory (AHL) pathologist was of the opinion that the sudden influx of freshwater and change in salinity may have led to the shellfish mass mortalities. Further discussion with ORC indicated that the lead-up to the opening of the river mouth included large swells along with elevated river and lagoon levels. The opening of the lagoon was carried out in a controlled manner that ensured less-to-minimal freshwater flush occurring than would have ordinarily occurred naturally during the weather event once a sand bar was breached.

Two weeks after the initial notification, another mortality was reported and eight surf clams were submitted to AHL by Kāti Huirapa. Pathologists performed clinical examination, histopathology and bacteriology to assess if exotic or emerging disease contributed to the mortality. Clinical examination and histopathology revealed that the clams were in very poor body condition, with complete loss of gonad activity. An abundance of brown cells was observed, suggesting a prolonged period of connective tissue breakdown, which may be associated with a period of poor nutrient availability or environmental factors prohibiting adequate feeding. Brown cells might also indicate the presence of other stressors that damage cytoplasm and cell walls, requiring increased haematocytes (blood cells) in the area. Bacteriology showed a mixed growth of *Vibrio* sp., *Psychrobacter* sp., *Shewanella* sp., *Pseudomonas* sp. and *Serratia proteamaculans*. These bacteria are commonly isolated from aquatic organisms, and it is unlikely that they are associated with the mortality event.

The investigation did not identify any evidence in the submitted samples to suggest that disease contributed to mortality. The results did not indicate any specific causes of the mortality and there was likely a combination of environmental factors at play. As no biosecurity risk was identified and the mortalities were no longer occurring, the result was communicated to Kāti Huirapa and ORC and the investigation closed.

Spiny stalked barnacle (*Calantica spinosa*) investigated

A member of the public contacted MPI to report a significant number of unknown organisms growing in the cracks of rocks around Ōmāpere, Northland. The notifier submitted images (**Figure 1**) that MITS taxonomists used to confirm the organisms as native spiny stalked barnacles (*Calantica spinosa*). *Calantica spinosa* have a nationwide distribution and are normally found in groups within the tight spaces of rocks in the intertidal zone. As no biosecurity risk was present, the outcome of the investigation was communicated to the notifier and the investigation was closed.



Figure 1: Spiny stalked barnacle (*Calantica spinosa*) Ōmāpere. Photo: Jeremy Mitt

Suspected microbial infection in marine plankton (*Penilia avirostris*) investigated

A member of Supporters of Tiritiri Matangi Inc. notified MPI of abnormal discolouration seen on *Penilia avirostris* (**Figure 2**, next page) collected as part of plankton monitoring in Tīkapa Moana/Hauraki Gulf, near Tiritiri Matangi Island. The notifier submitted samples to MPI's AHL where mycology, bacteriology



Figure 2: Affected *Penilia avirostris* collected adjacent to Tiritiri Matangi Island. Photo: John Sibley

and molecular analysis (PCR for *Aphanomyces astaci* and *A. invadans*) were conducted to rule out emerging or exotic disease.

No fungi were isolated during mycology and two unwanted organisms (*A. astaci* and *A. invadans*) were excluded via PCR. Bacteriology showed heavy mixed growth of *Pseudoalteromonas* species, *Idiomarina loihiensis*, *Vibrio* sp., (*Splendidius* clade), *Halomonas* sp. and *Epibacterium scottomollicae*. There is no known baseline for what bacterial species would be expected to be observed in healthy populations of *Penilia avirostris*. However, there does not appear to be a biosecurity concern with any of these species isolated. *Pseudoalteromonas, Vibrio* and *Halomonas* are all relatively commonly detected in marine environments. Some species from these genera can be chitinolytic (destructive to chitin), but whether they are causing the dark discolouration observed in this instance was not determined. *Idiomarina* and *Epibacterium* are less commonly reported. However, have not been reported as being pathogenic (Hou et al., 2004; Vandecandelaere et al., 2008).

The investigation was closed as inconclusive. However, no biosecurity issues were identified. The investigator spoke to the notifier about these results and recommended that additional samples be submitted in the future for comparison.

Two crustaceans investigated

A member of the public contacted MPI about a strange shrimp they had found on the beach in Auckland. The notifier submitted photos and MITS identified the species as the snapping shrimp *Alpheus richardsoni*, which is a native species. The notifier also sent through several photographs of crabs which were all confirmed to be the native purple rock crab *Leptograpsus variegatus*. The notifier was informed of the results and the investigation was closed as there was no biosecurity concern identified.

Range extension of the non-indigenous isopod, *Paracerceis sculpta*

A scientist from University of Auckland contacted MPI to report a suspected non-indigenous isopod that was found in a dredge sample taken near Marsden Point, Whangārei. An image (**Figure 3**) was sent to MITS who concluded that a sample was needed to confirm the species. The scientist submitted an ethanol-preserved sample that MITS identified as the non-indigenous isopod, *Paracerceis sculpta*. This isopod is native to southern California and the Pacific coast of Mexico, including the Gulf of California. It has been introduced widely across the globe and can be found in warm-temperate-to-tropical harbours on every continent except Antarctica. *Paracerceis sculpta* live in dense colonies, commonly found in sheltered sandy and rocky habitats, growing within fouling communities, inside sponges, underneath rocks and among algae. Although this species has been introduced widely, no ecological or economic impacts have been reported (Smithsonian Environmental Research Centre, accessed on 9 October 2024). This detection is a range extension for this species, having previously been found in Ōpua in Northland, Waitematā Harbour in Auckland and from vessel hulls in Kawatiri (Westport) and Te Tai Poutini (West Coast). This detection has been registered on the Marine Biosecurity Porthole. Northland Regional Council and DOC were informed of this range extension and the investigation was closed.


Figure 3: Non-indigenous isopod *Paracerceis sculpta* collected from Marsden Point. Photo: Richard Taylor

Mass mortality of krill (euphausiids) investigated

A member of public contacted Cawthron Institute, Nelson to report a mass krill stranding on Pōhara and Tata beaches in Golden Bay in the Tasman District. Cawthron directed the notifier to MPI so that testing could be conducted to investigate if an exotic or emerging disease contributed to the mortality.

The notifier had collected samples and kept them frozen. While fresh samples are preferred for disease testing, the frozen samples were submitted to MPI's AHL and macroscopic examination histopathology and molecular analysis (PCR for White Spot Syndrome Virus (WSSV)) carried out.

A clear cause of mortality could not be determined. Focal areas

of melanisation of the cuticle or multiple small red-brown spots were seen on the cuticles of several krill. These lesions may be associated with possible external parasitism, secondary or primary surface biofouling and bacterial overgrowth on the cuticle. This condition has been known to occur commonly in krill (Gómez-Gutiérrez and Morales-Ávila, 2016). However in this case, no external parasites were detected. No evidence of external or internal parasites or infection by any other organisms (bacterial, viral, protozoan, etc.) was found via histology; however, tissues of the hepatopancreas and soft internal tissues could not be evaluated due to autolysis. PCR testing for WSSV was negative.

The results from the testing were communicated to the notifier. As no further mortalities were reported and no exotic or emerging disease was confirmed, this investigation was closed.

Two ascidian species *Botrylloides diegensis* and *Aplidium phortax* detected

Waikato Regional Council contacted MPI to report a suspected detection of *Didemnum vexillum*. The ascidians were found growing on a Mediterranean fanworm *Sabella spallanzanii,* another non-indigenous species, which had been collected from piles of Hannaford's Wharf, near Manaia in Coromandel. MITS was unable to confirm the identification by analysing images, so a sample was submitted for examination. Two ascidians were identified from the sample, *Aplidium phortax* and *Botrylloides diegensis*.

Aplidium phortax is a cryptogenic ascidian species known to be present along the entire east coast of New Zealand, from the top of Te Ika-a-Māui (the North Island) to the bottom of Te Waipounamu (the South Island). However, this was the first confirmed occurrence from Waikato.

Botrylloides diegensis is a non-indigenous ascidian species that is widely present around New Zealand, with several detections in Auckland and one detection from the east side of the Coromandel peninsula. *Botrylloides diegensis* was first detected in 2021 in multiple ports around New Zealand. Colonies have been observed to be much smaller than other non-indigenous ascidians that are considered invasive, such as *D. vexillum*, and have not yet been observed overgrowing aquaculture species or structures (Page and Bilewitch, 2021). It is suspected that *B. diegensis* has been present in ports and harbour assemblages for over a century and observations of *Botrylloides* spp. over the past 20 years suggest colonies are widely distributed in New Zealand and form part of our subtidal reef fauna (Page and Bilewitch, 2021). The abundance of *Botrylloides* spp. is likely regulated by predators such as sea stars (Page and Bilewitch, 2021).

These results were reported back to Waikato Regional Council and the investigation was closed.

Non-indigenous clubbed tunicates (*Styela clava*) detected in supermarket

A supermarket operator contacted MPI to report organisms growing on the shells of freshly delivered mussels. Two instances were reported from the same supermarket within a three-day period. MITS identified the first organism as the non-indigenous clubbed tunicate (*Styela clava*) via images. However, a sample was requested for the second, which was confirmed as a stalk and upper portion from a torn *S. clava* individual. These identifications were communicated back to the supermarket and investigators followed up with the mussel distributor and farm to notify them of the issue and remind them to keep an eye out for hitchhiking organisms. The regional council and Biosecurity New Zealand's Pest Management Aquatic team were also informed of the incident and the investigation was closed.

Suspected invasive tunicate investigated

DOC rangers contacted MPI to report what they suspected to be the invasive didemnid sea squirt (*Didemnum vexillum*), observed in the low-to-intertidal zone around Horomaka Island, Waitaha/ Canterbury. Images were sent to MITS, and were tentatively identified as *Aplidium phortax,* a non-indigenous tunicate species commonly seen in New Zealand.

Aplidium phortax forms large, fleshy, firm, light tan, pink or cream gelatinous colonies and is a common fouler of wharf piles and aquaculture structures in ports, bays and harbours. First detected over 20 years ago, *A. phortax* has been recorded from Tauranga, Rangitoto ki te Tonga/ D'Urville Island, Te Tauihu-o-te-Waka/ Marlborough Sounds, Wellington Harbour, Lyttelton Harbour, Otago, Rēkohu/ Chatham Islands, Stewart Island, and Fiordland (Page, 2022).

A sample is required to confirm the identification and a preservation kit was sent to DOC. As visits to Horomaka Island are infrequent in the winter months, the investigation was closed until such a time that a sample can be collected.

Range extension of the non-indigenous bryozoan *Cryptosula pallasiana*

MITS notified MPI of a range extension for *Cryptosula pallasiana*, a non-indigenous encrusting bryozoan that forms white-pink colonies with orange crusts (Gordon and Mawatari, 1992). A sample was collected during NMHRSS in Auckland Port, Auckland and identified by MITS taxonomists. In Aotearoa New Zealand, this species has previously been found from Whangārei, Tairāwhiti/Gisborne, Wellington, Ngāmotu/New Plymouth, Waitohi/Picton, Te Whanganui/ Port Underwood, Whakatū/Nelson, Lyttelton, Te Maru/Timaru, Otepoti/ Dunedin, Stewart Island and Chatham Islands. It has also been found from vessels berthed in Ōpua, Auckland, Carey's Bay, Picton, Napier and Bluff. *Cryptosula pallasiana* is a well-known biofouler of international and domestic shipping and is very widespread globally in ports, harbours and estuaries. There are no specific economic or ecological impacts reported for this bryozoan (Smithsonian Environmental Research Center). Auckland Council was

informed of the official record of the range extension and the investigation was closed.

Non-indigenous grass carp (*Ctenopharyngodon idella*) detected

A member of the public contacted MPI to report what they suspected to be a koi carp (*Cyprinus rubrofuscus*) caught in Riverlea Reserve, Auckland. Images of the fish (**Figure 4**) were reviewed by MITS who identified the fish as a grass carp (*Ctenopharyngodon idella*). Grass carp are bred in New Zealand in licensed facilities and can be released into contained areas with a permit as a biocontrol agent for exotic aquatic weed species. Riverlea Reserve is not a known location for the species, nor do its tributaries connect to any areas where recent releases have taken place. As permits for these activities are jointly managed by Fisheries New Zealand and DOC, the details of this detection were passed on to these agencies for review and the investigation was closed.

Kidney disease investigated in trout

Fish & Game contacted MPI to report a recently caught trout (either brown trout, *Salmo trutta* or rainbow trout, *Oncorhynchus mykiss*) with an enlarged kidney. The trout was submitted to MPI's AHL where cytology, histopathology and molecular testing (PCR for bacterial kidney disease (BKD)) were performed.

No evidence seen was during examination of the kidney lesion or in cytology smears taken from the kidneys to suggest an infectious cause of the mass. No organisms suggestive of protozoa, significant bacteria or *Tetracapsuloides* (agent of proliferate kidney disease) were seen, and PCR for BKD was negative.

The lump was determined to be a neoplasia (tumour). Unfortunately, the cells were quite broken down, so a specific interpretation of the mass was not possible. However, considering the location and architecture of the mass, a tumour of haematopoietic (blood cell) or lymphoid (immune system) origin is most likely.

The results of analysis were communicated back to the notifier and as no biosecurity risk was present, the investigation was closed.

New-to-New Zealand bacteria *Vagococcus salmoninarum* detected in Chinook salmon (*Oncorhynchus tshawytscha*)

Routine testing of Chinook salmon (*Oncorhynchus tshawytscha*) at AHL detected the presence of *Vagococcus salmoninarum*. Initially it was thought that this bacterium had not previously been reported as present in New Zealand. However, further investigation found that *V. salmoninarum* had been detected by other institutes at least three times in New Zealand as far back as 2021 but had not been reported to MPI at the time. Two detections were from samples from Chinook salmon, and the third was from a red rock lobster (*Jasus edwardsii*) presenting with tail fan blisters. The identification was confirmed from the range of samples using MALDI-TOF mass spectrometry, basic biochemical characterisation and 16s rRNA gene sequencing.

Vagococcus salmoninarum is a gram-positive cocci bacterium that is the causative agent of cold water streptococcocis/vagococcosis (henceforth referred to as vagococcosis) (Michel et al., 1997). Vagococcosis can cause chronic disease and mortality in several species of salmonid broodstock, including rainbow trout (*Oncorhynchus mykiss*). Mortality rates reported have ranged from 10–55 percent; variable rates appear to relate to stress factors (Michel et al., 1997; Didinen et al., 2011). In other countries, outbreaks of this disease have been reported most often from broodstock populations post-spawning, in temperatures of 7–12^{0}C (Michel et al. 1997; Didinen et al., 2011). Outbreaks of this disease have been reported in France in rainbow trout (Michel et al., 1997), United States in brook trout (*Salvelinus fontinalis*) (Standish et al., 2020), Norway in rainbow trout and brown trout, Turkey in rainbow trout (Didinen et al., 2011), Australia in rainbow trout (Schmidtke and Carson, 1994), Spain in rainbow trout and Italy in rainbow trout. As other closely related salmonid species have been affected by this disease, it is possible that Chinook salmon are also susceptible. However, we are currently not aware of any mortalities or presentation of disease in any species in New Zealand – including any salmonid species – attributed to *V. salmoninarum* infection. Additionally, we have not found any global records of *V. salmoninarum* causing disease in Chinook salmon. There is no legal status for *V. salmoninarum*. It is not an unwanted organism or WOAH-listed disease.

As this organism has been present in the New Zealand for at least three years without causing disease, the risk of this organism was determined to be low, and the investigation closed. It is likely to be widespread and – as with other gram-positive bacteria that



Figure 4: Grass carp (*Ctenopharyngodon idella*) – Riverlea Reserve, Auckland. Photo: Alex Wright

are already present in New Zealand – it can be managed through good biosecurity and husbandry practices. A fact sheet has been prepared for industry partners to raise awareness about *V. salmoninarum*, including how to recognise signs of vagococcosis. People are encouraged to report any signs of vagococcosis or any other disease or unexplained mortality to MPI.

Aeromonas bestiarum confirmed from Chinook salmon

A veterinary pathologist contacted MPI after isolating suspected *Aeromonas bestiarum* from smolt in a Chinook salmon (*O. tshawytscha*) farm. During a period of high water temperatures, the farm reported low levels of mortalities, with no notable macroscopic observations. However, behaviourally, affected fish were presenting with loss of equilibrium (erratic swimming) and lethargy. The farm was advised to cease unnecessary handling procedures and to decrease the density of fish where possible to reduce stress and promote recovery of affected fish. Veterinarians collected samples from the farm for disease analysis and *A. bestiarum* was identified as present.

The veterinarian submitted an isolate of *A. bestiarum* to AHL where the species identity was confirmed via *Aeromonas* rpoD gene sequencing. *Aeromonas bestiarum* is commonly found in freshwater environments and can be isolated from both diseased and healthy fish (Kozińska, 2007). Several strains of *A. bestiarum* have been reported as opportunistic pathogens in fish culture (Gordon et al., 2008; Zepeda-Velázquez et al., 2017; Fuentes-Valencia et al., 2022) and can cause haemorrhagic septicaemia and skin ulcers in fish (Kumru et al., 2018).

Aeromonas bestiarum was previously reported to MPI from another Chinook salmon farm in 2021 but was not associated with a mortality event.

As this bacterium was already known to be present in New Zealand and with the mortality event resolved, the investigation was closed.

Gill parasites in blue mackerel (*Scomber australasicus*) investigated

A primary industry professional contacted MPI after finding suspected parasites in the gills of three blue mackerel (*Scomber australasicus*) that had recently been caught off the coast of Tauranga. The notifier also reported catching blue mackerel with the same parasite a month earlier. The notifier submitted the three fish to AHL for species identification of the parasite.

The parasites consisted of a firmly attached structure composed of a central elongated cylindrical yellow-tan body (about 8 mm in length and 1 mm thick) with multiple bulbous sacculations (**Figure 5** and **Figure 6**, respectively).

During histopathology, AHL pathologists found spore/egg-like structures in the sinusoidal spaces of the liver, possibly of an apicomplexan or helminth egg stage (**Figure 7**, next page). However, these were not causing any clear pathology or inflammation in the liver.

Molecular results indicated that the parasite was a digenean, which is a class of trematodes in the platyhelminth phylum. Digeneans are parasitic flatworms which have a multiple-host lifecycle and require a mollusc as their first intermediate host (with one exception) (CABI, 2019). The genus was identified as *Nematobothrium*, while the species was tentatively matched to *N. scombri*.



Figure 5: Digenean parasite (*Nematobothrium* sp.) on the gill of blue mackerel (*Scomber australasicus*) collected from Tauranga. Photo: Animal Health Laboratory

This uncertainty arose from the fact that this genus has had little characterisation and few reference sequences are available for genetic comparison. It is possible that this represents an undescribed species. *Nematobothrium scombri* is a type of didymozoid digenean, flatworm parasite, which attaches to the gills of teleosts and is commonly reported from *Scomber japonicus* (chub mackerel) (Alves et al., 2003; Eiras and Rego, 1987).

Further work on additional samples would be required to fully characterise this parasite. Regardless, this genus is well known as parasitic on a range of related mackerel species

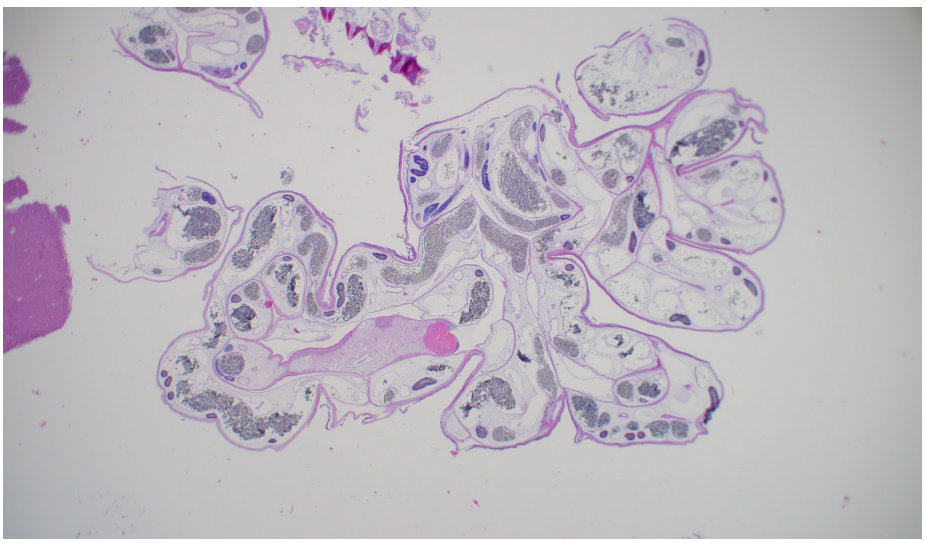

Figure 6: A section of the digenean parasite (*Nematobothrium* sp.) found on the gill of blue mackerel (*Scomber australasicus*) under 2x magnification. Photo: Animal Health Laboratory

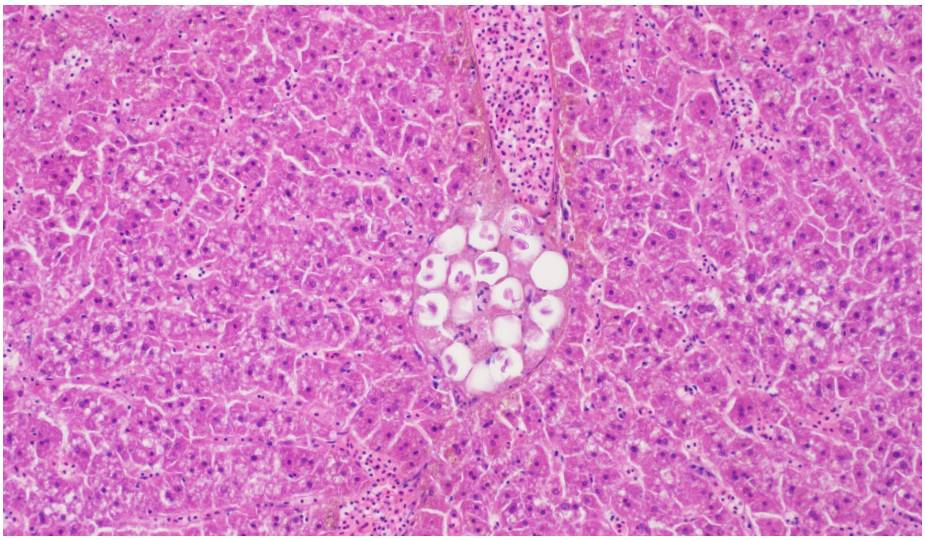

Figure 7: Liver of blue mackerel (*Scomber australasicus*) under 40x magnification, showing eggs or spore-like structures in the sinusoidal spaces. Photo: Animal Health Laboratory

(Alves et al., 2003) and very few adult stage digeneans are known to cause significant harm to the fish host (CABI, 2019). The results were communicated back to the notifier and the investigation was subsequently closed.

Unusual fish investigated

A member of the public contacted MPI to report an unusual fish caught near Te Kaha, Bay of Plenty. The notifier submitted a photograph of the fish (**Figure 8**). However, MITS was unable to identify the species using the image. The specimen was sent to the Museum of New Zealand Te Papa Tongarewa (Te Papa) where the MITS taxonomist confirmed the fish as a native rock cod (*Lotella rhacina*).



Figure 8: Rock cod *Lotella rhacina*, Bay of Plenty. Photo: Wihei Paora.

Lotella rhacina is the largest species of the *Lotella* genus, with a maximum reported length in New Zealand of 34 cm (Roberts et al., 2015). As well as New Zealand, this species is also found on the coasts of Australia where it is more commonly known as a largetooth beardie. *Lotella rhacina* is a nocturnal and demersal species, inhabiting rocky reefs at depths of 0–30 metres (Roberts et al., 2015). It typically hides in crevices and caves during the day a feeds on small benthic invertebrates at night (Roberts et al., 2015). *Lotella rhacina* is rarely caught in New Zealand, so the specimen was retained by Te Papa for their collection. As this species is native there was no biosecurity concern. The result was communicated to the notifier and the investigation was closed.

Polychaete egg mass investigated

A member of the public contacted MPI to report what appeared to be an egg mass from an unknown organism floating in the water on the shore of Kawau Island, Auckland. The notifier collected a sample of the mass and submitted it for assessment. MITS was unable to identify the mass from physical examination, so molecular analysis was completed. The results confirmed that the egg mass belonged to a polychaete worm but was not able to be matched strongly with any species in GenBank. Identification to genus or species could not be confirmed and it could not be determined if the egg masses belong to a native or non-indigenous species. Two MITS scientists commented that the egg masses have been seen from the northern North Island since at least the late 1960s, and both had personally observed them in the wild. This information suggested that even if the eggs were from a non-indigenous species, then that species would be widespread and have a decades-long history in New Zealand waters. This information was communicated back to the notifier and the investigation was closed.

Unusual sea stars investigated

A member of the public contacted MPI to report unusual sea stars (**Figure 9,** next page) washing up on Papamoa Beach, Bay of Plenty. The notifier provided a photo which MITS used to identify the species as the Australian southern sand star (*Luidia australiae*). This sea star is native to southern Australia and northern New Zealand. It can be found on reefs, or in seagrass meadows up to 110 m deep (The Australian Museum, accessed on 6 September 2024). They are beautifully patterned with a central disc and usually have seven arms that are pale-yellow, mottled with dark green or black. As the species is native, no biosecurity concerns were identified, the notifier was informed of the results and the investigation was closed.

References

Adams NM (1983). Checklist of marine algae possibly naturalised in New Zealand. *New Zealand Journal of Botany* 21, 1–2.

Alves DR, Luque JL, Abdallah VD (2003). Metazoan parasites of chub mackerel, *Scomber japonicus* Houttuyn (Osteichthyes: Scombridae), from the coastal zone of the State of Rio de Janeiro, Brazil. *Revista Brasileira de Parasitologia Veterinária* 12(4), 164–170.

Baatrup E, Nielsen MG, Danscher G (1986). Histochemical demonstration of two mercury pools in trout tissues: mercury in kidney and liver after mercuric chloride exposure. *Ecotoxicology and Environmental Safety* 12(3), 267–282. 0147-6513. 10.1016/0147-6513(86)90018-7. https://eurekamag.com/research/005/577/005577128.php

Baatrup E, Danscher G (1987). Cytochemical demonstration of mercury deposits in trout liver and kidney following methyl mercury intoxication: differentiation of two mercury pools by selenium. *Ecotoxicology and Environmental Safety* 14(2), 129–141. 0147-6513 10.1016/0147-



Figure 9: the Australian southern sand star (*Luidia australiae*) Papamoa Beach, Bay of Plenty.

6513(87)90055-8. https://eurekamag.com/research/005/083/005083909.php

CABI (2019). CABI International, Digenean infections of fish. *CABI Compendium* https://doi.org/10.1079/cabicompendium.84960

Didinen BI, Kubilay A, Diler O, Ekici S, Onuk EE, Findik A (2011). First isolation of *Vagococcus salmoninarum* from cultured rainbow trout (*Oncorhynchus mykiss*, Walbaum) broodstocks in Turkey. *Bulletin of the European Association of Fish Pathologists* 31(6), 235–243.

Eiras JC, Rego AA (1987). The histopathology of *Scomber japonicus* infection by *Nematobothriun scombri* (Trematoda: Didymozoidae) and of larval anisakid nematode infections in the liver of *Pagrus pagrus*. *Memorias do Instituto Oswaldo Cruz* 82, 155–159.

Fuentes-Valencia MA, Osornio-Esquivel JL, Martínez Palacios CA, et al. (2022). Bacterial and parasite co-infection in Mexican golden trout (*Oncorhynchus chrysogaster*) by *Aeromonas bestiarum, Aeromonas sobria, Plesiomonas shigelloides* and *Ichthyobodo necator*. *BMC Veterinary Research* 18, 137. https://doi.org/10.1186/s12917-022-03208-5

Gómez-Gutiérrez J, Morales-Ávila JR (2016). Parasites and diseases. *Biology and Ecology of Antarctic Krill* 4, 351–386. doi: 10.1007/978-3-319-29279-3_10. PMCID: PMC7153171.

Gordon DP, Mawatari F (1992). Atlas of marine-fouling Bryozoa of New Zealand ports and harbours. *Miscellaneous Publications, New Zealand Oceanographic Institute* 107, 1–52.

Gordon L, Cloeckaert A, Doublet B, Schwarz S, Bouju-Albert A, Ganiere JP, ... Giraud E (2008). Complete sequence of the floR-carrying multiresistance plasmid pAB5S9 from freshwater *Aeromonas bestiarum*. *Journal of Antimicrobial Chemotherapy* 62(1), 65–71.

Hargis WJ (1991). Disorders of the eye in finfish. *Annual Review of Fish Diseases* 1, 95–117. doi:10.1016/0959-8030(91)90025-f.

Hou S, Saw JH, Lee KS, Freitas TA, Belisle C, Kawarabayasi Y, Donachie SP, Pikina A, Galperin MY, Koonin EV, Makarova KS, Omelchenko KS, Sorokin A, Wolf YI, Li QX, Keum YS, Campbell S, Denery J, Aizawa S, Shibata S, Malahoff A, Alam M (2004). Genome sequence of the deep-sea γ-proteobacterium *Idiomarina loihiensis* reveals amino acid fermentation as a source of carbon and energy. *The Proceedings of the National Academy of Sciences* 101(52), 18036–18041. https://doi.org/10.1073/pnas.0407638102.

Johnson LL, Stehr CM, Olson OP, Myers MS, Pierce SM, McCain BB, Varanai U (1987–1989). Corporate authors(s): United States. National Marine Fisheries Service; Northwest Fisheries Science Center (U.S.); National Benthic Surveillance Project: Northeast Coast Fish Histopathology and Relationships Between Lesions and Chemical Contaminants (1987-89). *NOAA Technical Memorandum NMFS-NWFSC*; 4. https://repository.library.noaa.gov/view/noaa/29029.

Kozińska A (2007). Dominant pathogenic species of mesophilic aeromonads isolated from diseased and healthy fish cultured in Poland. *Journal of Fish Diseases* 30(5), 293–301.

Kumru S, Tekedar HC, Griffin MJ, Waldbieser GC, Liles MR, Sonstegard T, Schroeder SG, Lawrence ML, Karsi A (2018). Draft genome sequence of fish pathogen *Aeromonas bestiarum* GA97-22. *Genome Announcements* 6(24), e00524-18. doi: 10.1128/genomeA.00524-18. PMID: 29903823; PMCID: PMC6003731.

The Australian Museum. *Luidia australiae* Doderlein, 1920. Accessed on 06 September 2024. https://australian.museum/learn/animals/sea-stars/sydney-seastars/luidia-australiae-dderlein-1920/

Malik DS, Sharma AK, Sharma AK, Thakur R, Sharma M (2020). A review on impact of water pollution on freshwater fish species and their aquatic environment. *Advances in Environmental Pollution Management: Wastewater Impacts and Treatment Technologies* 1, 10.

Michel C, Nougayrede P, Eldar A, Sochon E, De Kinkelin P (1997). *Vagococcus salmoninarum*, a bacterium of pathological significance in rainbow trout *Oncorhynchus mykiss* farming. *Diseases of Aquatic Organisms* 30(3), 199–208.

Page M, Bilewitch J (2021). *Notes on the non-indigenous ascidian* Botrylloides diegensis *(Ritter & Forsyth, 1917), recently detected in multiple locations around New Zealand*. Marine Exotic Species Note: 119. National Institute of Water and Atmospheric Research. Prepared for the Ministry for Primary Industries.

Page M (2022). *Awesome Ascidians: a guide to the sea squirts of New Zealand*. Version 4. Accessed on 23 October 2024. https://webstatic.niwa.co.nz/static//web/MarineIdentificationGuidesandFactSheets/Awesome_Ascidians_Version%204_2023_NIWA.pdf

Roberts C, Stewart A, Struthers C (2015). *The Fishes of New Zealand*. Te Papa Press, Wellington, New Zealand.

Schmidtke LM, Carson J (1994). Characteristics of *Vagococcus salmoninarum* isolated from diseased salmonid fish. *Journal of Applied Bacteriology* 77(2), 229–236.

Smithsonian Environmental Research Centre, accessed on 9 October 2024. *Paracerceis sculpta*. https://invasions.si.edu/nemesis/species_summary/546038

Smithsonian Environmental Research Center. (n.d.). *Cryptosula pallasiana*. National Estuarine and Marine Exotic Species Information System (NEMESIS). Accessed 8 October 2024. https://invasions.si.edu/nemesis/species_summary/156536

Standish I, Erickson S, Leis E, Baumgartner W, Loch T, Knupp C, McCann R, Puzach C, Katona R, Lark E, Bailey J (2020). *Vagococcus salmoninarum* I-A chronic coldwater streptococcosis in broodstock brook trout (*Salvelinus fontinalis*) in Wisconsin, USA. *Journal of Fish Diseases* 43(3), 305–316.

Vandecandelaere I, Nercessian O, Segaert E, Achouak W, Faimali M, Vandamme P (2008). *Ruegeria scottomollicae* sp. nov., isolated from a marine electroactive biofilm. *International Journal of Systematic and Evolutionary Microbiology* 58(12), 2726–2733.

Williams R (2023). Quarterly report of investigations of suspected exotic aquatic pests and diseases: January to March 2023. *Surveillance* 50(2), 33–37.

Zepeda-Velázquez AP, Vega-Sánchez V, Ortega-Santana C, Rubio-Godoy M, de Oca-Mira DM, Soriano-Vargas E (2017). Pathogenicity of Mexican isolates of *Aeromonas* sp. in immersion experimentally infected rainbow trout (*Oncorhynchus mykiss*, Walbaum 1792). *Acta Tropica* 169, 122–124.

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Plant health surveillance and incursion investigation report: July to September 2024

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.

This quarter, IIs received 212 notifications (**Figure 1**), a 33 percent increase compared with the same period in 2023 (159). The presence of a biological risk was ruled out in 44 cases, and they were stood down. Eleven notifications were redirected to other internal teams or external agencies responsible for managing the pest of concern. There was an 80 percent increase in cases investigated (157) this quarter compared with the same quarter in 2023 (87). The 47 notifications of suspect exotic ladybirds in grapes from Mexico (reported below) contributed to that increase.

Urgent Measures taken to prevent establishment or limit harm

Stink bug cases

In this quarter, IIs investigated 16 notifications of exotic stink bugs. These included five positive detections of the brown marmorated stink bug, *Halyomorpha halys* (one alive, four dead) and one detection of a dead exotic yellow spotted stink bug, *Erthesina fullo*.

Ladybirds on Mexican grapes

There were 47 notifications of suspect exotic ladybirds associated with Mexican grapes this quarter. In all investigations the seven-spotted ladybird *Coccinella septempunctata* was confirmed from images or samples submitted to MPI.

Coccinella septempunctata was introduced to New Zealand in the 1970s as a potential biocontrol agent of aphids. Consequently, *C. septempunctata* is not a new-to-New Zealand organism under the Hazardous Substances and New Organisms Act 1996 and presented no biosecurity risk.

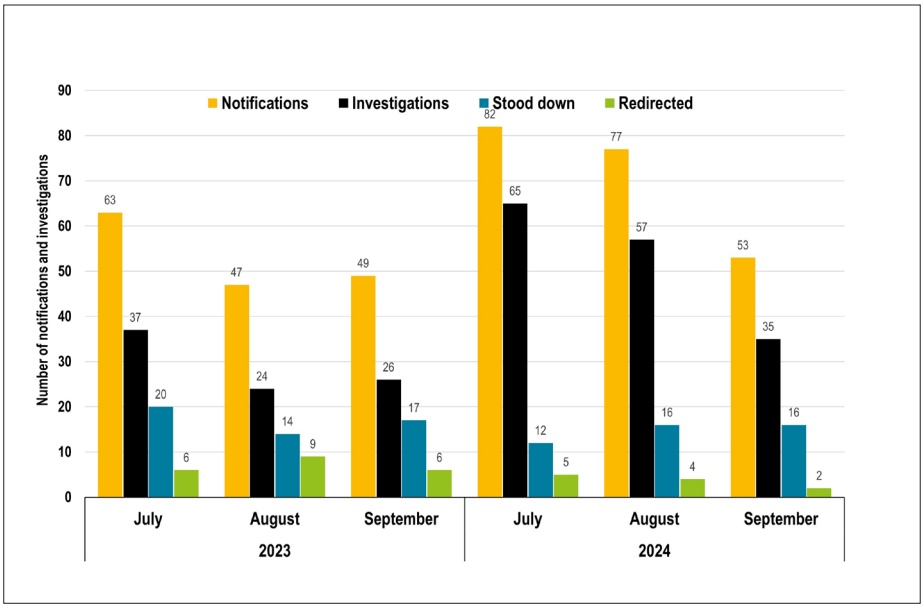

Figure 1: Plant health notifications, investigations, and other outcomes for July, August and September 2023 and 2024

Exotic plants and seeds

There were three investigations into unsolicited or unauthorised imports of plants, plant material and seeds that were deemed positive for a biological risk. The risk was mitigated by the submission of seeds and plant material to MPI for safe destruction. In one case IIs conducted a site visit to inspect and collect the risk goods and in others, the notifier destroyed the material under instruction by the II.

Pepino mosaic virus in tomato plants, Auckland

IIPH was anonymously notified that a tomato grower/retailer had been trading suspect pepino mosaic virus (PepMV) infected tomato seeds. The seeds were advertised on a social media page. Four different tomato seed varieties were independently purchased from the retailer and submitted to PHEL Virology and Phytoplasmology for testing. Using molecular methods, all four samples tested positive for PepMV, and negative for tomato brown rugose fruit virus (ToBRFV).

PepMV is an unwanted and notifiable (NO) organism under the Biosecurity Act 1993 (the Act). PepMV can easily be transmitted through mechanical means. Under section 52 and 53 of the Act, a person cannot move, sell, offer for sale, breed, exhibit, or release unwanted organisms without the permission of an MPI Chief Technical Officer.

The retailer was informed of the positive PepMV detection and immediately ceased all tomato trade (including seeds, plants, and fruits), removed their online advertisements, and contacted their customers and recalled all seeds sold through their e-commerce site. The retailer was approved by MPI (under sections 52 and 53 of the Act) to sell tomato fruit only (without truss and calyx). Tomato fruit has lesser risk of virus transmission, compared with plants and seeds.

The tomato seeds that tested positive for PepMV had been purchased by the retailer from Auckland farmers' markets. The retailer re-packaged and sold those seeds as a one-off venture; hence, they ceased that practice immediately. Working with the II, the retailer chose to burn (**Figure 2**) all tomato seeds and plants on their site on the assumption that they could be infested with PepMV. The recalled seeds from the e-commerce sales were sent to the II for secure destruction and the investigation was closed.



Figure 2: Potentially PepMV-infected tomato plants being destroyed. Photo provided by the grower as evidence of destruction

Investigations of new-to-New Zealand organisms

One botany, six mycology, one bacteriology, one virology and three entomology notifications of suspect new-to-New Zealand organisms are described below. Without a determination by the Environmental Protection Authority (EPA) under section 26 of the Hazardous Substances and New Organisms Act 1996, they remain suspect new-to-New Zealand organisms under that Act due to the absence of records of presence in New Zealand before 29 July 1998.

New grass found around a rest area in Northland

On 7 May 2024, the Northland Regional Council (NRC) reported the discovery of *Leersia hexandra* (southern cut grass) (**Figure 3**) in a rest area alongside State Highway 15 in Parakao, Northland. This species had not been recorded in New Zealand. The grass species was first noticed on 5 April 2024 during routine willow removal operations, prompting the biosecurity specialist to send samples to Auckland Museum for identification, where *L. hexandra* was confirmed. The NRC had taken all necessary precautions to manage the immediate biosecurity risk, including spraying the infested area with herbicide and containing the area to prevent the spread by vehicles, machinery and people. These measures appear to be effective in managing the organism's dispersal. Despite no regulatory status in New Zealand, *L. hexandra* is listed as a pest plant by CABI (2024), initially indicating it may pose biosecurity risks, especially in sub-tropical regions of the North Island. However, MPI's rapid risk assessment found no evidence of significant impact, noting the species' likely long-term presence, low invasive potential, and similarity to other *Leersia* species in New Zealand. IIPH liaised with NRC and the Department of Conservation (DOC) and provided the necessary biological and risk assessment information that led to a stand-down decision by MPI with a recommendation of continued monitoring and management by NRC, and possibly DOC, at their discretion.



Figure 3: *Leersia hexandra* – a new grass in Northland. Photo: Northland Regional Council

New *Phytophthora* on apples in Hawke's Bay

A Lincoln University researcher notified MPI of a suspect new-to-New Zealand oomycete, *Phytophthora rosacearum*, detected from soil samples collected from two apple orchards in Hawke's Bay. The detection resulted from a 2016 study investigating *Phytophthora* species in apple orchards, partly funded by New Zealand Apples and Pears Incorporated.

The suspect new-to-New Zealand isolate was initially identified morphologically in 2016. However, due to COVID-related delays, the study was paused, and the identification was not confirmed by molecular analysis by Lincoln University researchers until early 2024. At the time of the study, the trees at the detection sites showed general illthrift with no obvious trunk cankers or lesions observed on apples. Another plant pathogenic fungus, *Phytophthora cactorum*, already present in New Zealand, was also identified from these sites.

PHEL requested the sequence data and the isolates from Lincoln University for validation. Due to the length of time the isolates were in storage, only one isolate of *P. rosacearum* was successfully recovered by Lincoln University and was validated by PHEL. The other suspect *P. rosacearum* isolate from the second orchard was no longer viable and no further material was available for validation.

Phytophthora rosacearum has been described as an important pathogen of rosaceous fruit trees, including apple, cherry, apricot and peach in the United States (Jeffers et al., 1982; Wilcox and Mircetich, 1985; Hansen et al., 1986). The symptoms caused by *P. rosacearum* vary on different hosts and include root rot, dieback, and some cases tree mortality. Although earlier studies called *P. rosacearum* an important pathogen, most more recent studies report it either as a moderate or weak pathogen (Sanchez et al., 2019; Kurbetli et al., 2020; Bregant et al., 2023).

Given the length of time since the first detection of this suspect new-to-New Zealand oomycete and the

distance between the two orchards, *P. rosacearum* is considered as locally established here and likely spread within the two orchards. Zoospores, which can be easily transported in water, rain splash and streams, or with infected soil and farm equipment, may have assisted its spread further. Since *P. rosacearum* is a soil-borne organism, it is very difficult to control, and elimination of this species from the environment was not considered feasible.

Management of similar diseases already present in New Zealand is likely to be effective in managing *P. rosacearum*. IIPH assessed the detection posed a low biosecurity risk, with no further actions warranted. The investigation findings were communicated to New Zealand Apples and Pears Incorporated and Summerfruit New Zealand.

Rust fungus on raspberries, Auckland

On 15 April 2024, PHEL Mycology & Nematology notified IIPH of a second detection of the unwanted organism and suspect new-to-New Zealand rust fungus *Aculeastrum americanum* from a raspberry plant (*Rubus idaeus*) outside a residential property in Sandringham, Auckland (**Figure 4**). The plant had been sampled on 9 April 2024 during High Risk Site Surveillance (HRSS). Similarly, during HRSS in 2023, the rust was detected from a raspberry plant in Ellerslie, about seven kilometres from the Sandringham property. In that case, the infected plants were removed and destroyed under urgent measures. No other symptomatic plants were found at that time (Bleach, 2023).

The rust spores are wind-dispersed and the second detection suggests that this organism has probably spread in greater Auckland. In consultation with MPI technical experts, it was determined that eradication or containment of *A. americanum* was not feasible and likely to continue to establish locally and possibly further afield.

Aculeastrum americanum is commonly known as late leaf rust disease and affects product quality in cultivated red and purple raspberries. Plant hygiene practices to increase air circulation within the raspberry canes, careful disposal of pruning material and the application of preventative fungicides may help to minimise its spread.

The unwanted organism status of *A. americanum* (recorded in the Official New Zealand Pest Register under its synonym, *Pucciniastrum americanum*) was revoked in September 2024, given the organism's likely distribution in greater Auckland. The Government Industry Agreement representatives for New Zealand Plant Producers Incorporated were notified of the outcome of the investigation and the case closed.



Figure 4: Rust symptoms caused by *Aculeastrum americanum* on raspberry. Photo: Plant Health and Environment Laboratory, Mycology & Nematology

New fungus on cherry tree from Otago

MPI was notified of suspected *Calosphaeria pulchella* detected from sweet cherry trees in an Otago orchard during a Plant & Food Research study on cherry tree cankers (**Figure 5**). The species was confirmed by PHEL by molecular diagnostics completed on the fungal culture submitted by Plant & Food. This pathogen infects *Prunus* species mostly through wounds, causing cankers to develop on branches and trunks over several years. In severe cases, tree dieback can occur.

The source of infection in the orchard remains unknown and further tracing has not clarified the origin, but all the eight varieties collected from the Otago sweet cherry orchard during the follow-up site visit tested positive for *C. pulchella*. The extent of its distribution remains unclear. *Calosphaeria pulchella* may have been present in Otago for a long time and may also have spread to parts of the North Island through plant material exchange from the region.

Eradication is deemed technically and economically unfeasible due to the organism's likely historical introduction, cryptic nature, multiple pathways of spread and the lack of effective management tools. The investigation concluded that a biosecurity issue exists, but the biological risk is considered low-to-medium, with extremely low chances of successful eradication.



Figure 5: *Calosphaeria pulchella* fruiting bodies (exposed from under removed bark) on a sweet cherry tree. Photo: Plant & Food Research

New fungus on orchid, Hastings

An orchid grower reported blight symptoms on their orchids that were impacting mature plants, predominantly Venus slipper (*Paphiopedilum*) and some other genera. The orchid grower noticed the symptoms three years earlier, during summer periods when the glasshouse was more humid. From samples submitted to the PHEL Mycology & Nematology team, two bacteria and two fungi were isolated from leaf tissue. One of the fungi was a new-to-New Zealand *Colletotrichum* species that was isolated from leaf spot

lesions (**Figure 6**). *Colletotrichum* spp. are known plant pathogens causing anthracnose symptoms. The detected new-to-science *Colletotrichum* species is genetically closest to *C. orchidophilum*, an organism not recorded in New Zealand but known to impact orchids in other countries.

Additional samples were requested to verify if this *Colletotrichum* sp. was affecting other orchids in the glasshouse. Six *Paphiopedilum* and three *Cattleya* leaf samples were re-tested. The new *Colletotrichum* sp. was isolated only from the *Paphiopedilum* plants. PHEL pathologists designed a growth chamber inoculation experiment to explore the overall pathogenicity of the organism across orchid genera. Prick-injured orchid species were symptomatic after being inoculated with the *Colletotrichum* species, suggesting the organism could be an opportunistic pathogen. No further actions were taken, as it is likely that improved environmental conditions within the glasshouse, as well as fungicide treatments, will assist the grower to manage the disease. As there was no link to imported goods, the investigation was closed.



Figure 6: Orchid leaf with anthracnose symptoms associated with the new-to-science *Colletotrichum* fungus. Photo: Plant Health and Environment Laboratory Mycology & Nematology

'New' bacterium in oak, Waikato

The plant-pathogenic bacterium *Brenneria izadpanahii* was isolated from the wood of *Quercus ilex* (oak) sampled during Forest Biosecurity Surveillance in Cambridge. The oak tree had cankers and stem bleeding (**Figure 7**); no other nearby oaks were symptomatic. *Brenneria* sp. on *Quercus palustris* had been detected in Auckland four years earlier (May 2020; see Bleach, 2021). Considering the recent detection, the archived sample was re-examined and confirmed as *Brenneria izadpanahii*.

Brenneria izadpanahii is a new-to-science species named in 2021. It is one of a range of bacteria causing bleeding and dieback symptoms on oak trees overseas.

In New Zealand, no other *Brenneria* species have been detected from oak trees except *B. izadpanahii*. *Brenneria goodwinii,* one of the main bacterial pathogens causing oak dieback overseas, has not been detected in New Zealand. Another bacterial pathogen that contributes to decline in oaks, *Gibbsiella quercinecans,* has recently been detected here (August 2024). The investigation outcome of that find will be reported in the next edition of *Surveillance*. The only other *Brenneria* species present in New Zealand is *Brenneria salicis*, a plant pathogen of willow. In Iran, *Brenneria izadpanahii* has been isolated along with multiple *Brenneria* species (*B. goodwinii*, *B. roseae* ssp. *roseae*, *B. nigrifluens*) from individual symptomatic oak trees, suggesting a species complex is responsible for the symptoms observed (Bakhshi et al., 2021).

No information is available regarding dissemination of this organism. However, literature on the closely related species *Brenneria goodwinii* (acute oak decline) and *Brenneria salicis* (willow watermark disease) indicate abiotic and biotic pathways for transmission that include the movement of infected planting material, and wind and rain, respectively. *Brenneria goodwinii* has been detected in oak catkins and acorns, which indicates that transmission to offspring is a possibility.



Figure 7: Oak tree trunk showing canker and stem bleeding, likely caused by numerous bacterial pathogens. Photo: SPS Biota

The few papers on *B. izadpanahii* do not suggest it is a pathogen of economic concern. It is not an unwanted organism and based on the information available supported by a technical report, this investigation has been closed.

New fungus on Douglas fir, Hamilton

Leaves from a Douglas fir (*Pseudotsuga menziesii*) displaying needle cast (**Figure 8**, next page) were sampled during HRSS in Hamilton. The PHEL Mycology & Nematology team ruled out the presence of any *Phytophthora* in the sample but isolated *Phyllosticta capitalensis*, present in New Zealand and *Pestalotiopsis pini*, a first record for the country. *Pestalotiopsis pini* was erected as a new-to-science species based on isolates from stone pine (*Pinus pinea*) and maritime pine (*Pinus pinaster*) trees in Portugal (Silva et al., 2020).

Little is known of the significance of *Pe. pini* on its hosts. Silva et al. (2020) studied the pathogenicity on *P. pinea* and demonstrated that the fungus was causing shoot blight and stem necrosis. However, the disease symptoms were observed in only 20 percent of the inoculated seedlings, indicating a relative host resistance. The authors also contemplated the development of the disease due to more than one factor, biotic or abiotic. They supposed that the synergic effect among *Pe. pini* and other fungi may have triggered the development of shoot blight symptoms.

Monteiro et al. (2022) is the only other report where the authors mention that *Pe. pini* was observed infecting *Pinus sylvestris* and *Pinus radiata* but did not determine that the fungus was the primary causal agent of the symptoms. Ortíz et al. (2022) recovered *Pe. pini*

as an endophyte in *Pinus oocarpa*. That study was carried out on trees showing needle discolouration, resin exudation and vascular damage. *Pestalotiopsis pini* was one of the seven endophytic fungi isolated from those symptomatic trees.

The biosecurity investigation established that the isolates identified as *Pestalotiopsis* sp. and deposited in the International Collection of Microorganisms from Plants (ICMP) and the PHEL in-house collection could belong to the same species with others reported as *Pe. pini* in the studies by Monteiro et al. (2022) and Ortíz et al. (2022). The data obtained so far suggest that this fungus has been isolated from *P. radiata* in Auckland at least as far back as 2018 (pine needles used as baits in water to detect oomycetes, collected from the Waiwera River) and in 2023 (*P. radiata* needles showing sporadic yellowing and dieback in Papakura found in HRSS). These earlier detections were not identified to species level at the time but with additional sequence analysis have now been confirmed as *Pe. pini*.

MPI's Risk Assessment team concluded that the risk posed by *Pe. pini* would be low and it was not considered any greater risk than other causes of needle blight already associated with *P. radiata* in New Zealand.

Existing in-field management techniques of those pathogens are likely to minimise any impacts that *Pe. pini* may have. The other fungus in the sample (*P. capitalensis*) has been variously reported as an endophyte and weak plant pathogen with a wide host range (Wikee et al., 2013a,b) although this is the first record from Douglas fir.

The fungi were not considered to be the primary causal agent for the observed symptoms of the Douglas fir. Unknown environmental stress and opportunistic pathogens in combination with *Pe. pini* could be a likely cause as reported by Silva et al. (2020).

Although Douglas fir ranks as the second-most important plantation here after *P. radiata*, based on the above information, *Pe. pini* is considered a low biosecurity issue for New Zealand. It is most likely an endophyte or opportunistic pathogen of coniferous trees. The evidence suggests that it has been present in the country at least since 2018 and is distributed between Auckland and Hamilton. The MPI Plant Exports team concluded that no significant trade implications were expected. No further action is planned by Biosecurity New Zealand regarding the detection of this fungus. The Forest Owners Association has been notified and supported these conclusions, and the investigation has been closed.

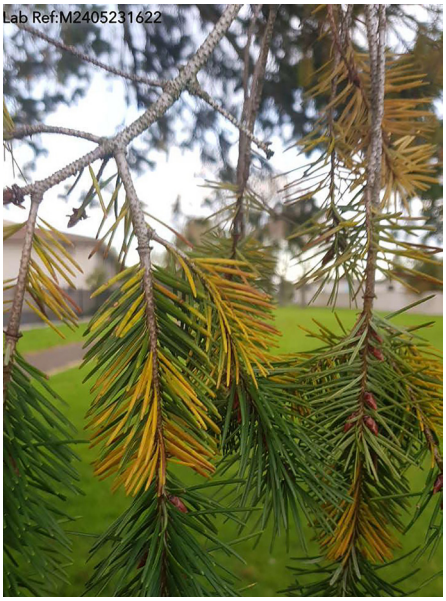

Figure 8: Symptomatic Douglas fir needles showing needle cast. Photo: SPS Biota

New fungus on NZ-grown bananas

Plant & Food Research notified MPI on 21 June 2024 that a suspect new-to-New Zealand fungus had been isolated from bananas grown at a residential property in Parua Bay, Northland. In early May 2024, they were given to a relative (the Plant & Food scientist), who noticed red spotting on the skins a couple of days after receiving them. The bananas were taken to Plant & Food's physical containment level 2 (PC2) facility and a fungus with a morphology compatible with the *Mycosphaerella* group was recovered from the spots. Internal Transcribed Spacer (ITS) sequencing by Plant & Food appeared to confirm a *Mycosphaerella*, possibly *M. musae* (banana leaf speckle); however, the ITS sequence was also very close to *Paramycosphaerella intermedia* and *P. marksii*, both present in New Zealand on *Eucalyptus*.

PHEL requested the culture and confirmed *M. musae*, an unwanted organism, not known to be present in New Zealand.

At least 20 species of *Mycosphaerella* have been recorded to occur on banana overseas (Arzanlou et al., 2008). Of those, *M. musae* is generally considered a minor pathogen causing little damage except in the sub-tropical areas of Australia (Jones, 2000) and South Africa (Mourichon, 2003; Vilijoen et al., 2003). It has a worldwide distribution, and is recorded from Africa, Central and South America, Asia, Australia and the Pacific islands. Its host range is restricted to species of *Musa* (banana).

The banana grower had not observed any issues with their banana plants or fruit. The plants had been growing at the property for about 15 years and were originally planted from three banana pups supplied from another person's banana plants who had purchased their pups from a nursery a few years earlier but could not recall the exact year or nursery they were bought from. It is likely that this fungus has been present there for some time but has only been detected now.

No association with imported plant material was found. The schedule for *Musa* in the Import Health Standard 155.02.06 Importation of Nursery Stock is currently suspended for plant material and tissue culture. The last importation of *Musa* nursery stock was in 2012.

The source and spread of *M. musae* in New Zealand are unknown; however, as spread occurs by spores blown in the wind from fruiting bodies on old leaves (Jackson and McKenzie, 2021), it may be in the wider environment. The dispersal distance of *M. musae* spores by wind has not been specifically studied but spores from other *Mycosphaerella* species that affect banana can be transported over several kilometres (Jones, 2003;

Churchill, 2010). In a 2014 study, a *Mycosphaerella* species affecting banana was shown to effectively disperse at least 1 km in a single generation (Rieux et al., 2014). Banana plants are grown in the backyards of properties within 1 km of the detection site, with small domestic plantations occurring in the wider Whangārei area. The property owner confirmed they had supplied bananas to an unknown number of people over several years.

No trade implications are anticipated regarding the detection of *M. musae* in New Zealand. The economic impact of *M. musae* in New Zealand is likely to be negligible as banana production is not currently commercially exploited, although there is a group trying to establish a local banana industry in Northland.

As no entry pathway has been identified, the plants are at least 15 years old, and the fungus is likely present in the wider environment, the biosecurity risk has been assessed as low and no further action by MPI is planned.

New *Hoya* virus in Auckland

MPI was notified in June 2024 of four *Hoya* plants showing foliar chlorosis. Samples were submitted to PHEL Virology who identified Hoya tobamovirus 2 (HoToV2) from two samples. HoToV2 is not reported as present in New Zealand. This virus was one of three viruses that were previously referred to as 'undescribed Hoya tobamoviruses' that had been detected in Post Entry Quarantine in 2020 and the consignment was subsequently destroyed. In the current Import Health Standard 155.02.06 Importation of Nursery Stock, this virus is listed as a regulated pest in the Hoya schedule as Hoya undetermined tobamoviruses. HoToV2 was identified from the *Hoya carnosa* 'crinkle 8' and *Hoya* 'noid' samples. Both plants had been purchased from Trade Me as leaf cuttings in February and November 2023, respectively and stated to be from Thailand. *Hoya* 'noid' is not an accepted species name and is therefore not eligible to be imported into New Zealand. Purchase records were requested from Trade Me that identified the sellers as two high-volume indoor plant traders based in Auckland and known to IIPH. These traders had been the focus of several investigations into illegal importation of plants, but no evidence was found to support a breach of the Biosecurity Act 1993. It is possible that the parent plant had already been infected with HoToV2 and the spread of this virus had been facilitated through the trade of asymptomatic plants.

The notifier has a collection of over 70 *Hoya* plants at their property, all purchased through Trade Me or at plant markets. They sell a small volume of propagated plants yearly, but none of the infected plants had been propagated due to their poor growth. The notifier was asked to isolate the two infected plants and any other plants associated with them. A site visit was conducted by the II and the infected *Hoya* plants were collected and disposed of via quarantine waste. Three other *Hoya* plants (*H. 'sunrise', H. monetteae* and *H. cagayanensis*) exhibiting mild yellowing and chlorosis and associated with the infected plants were sampled and tested positive for HoToV2. That result indicated the virus was established in the collection, and possibly other plants in the collection that were asymptomatic.

HoToV2 is described as causing foliar discolouration including chlorosis (Gaafar et al., 2020). However, there is evidence that HoToV2 is a latent virus (Ilyas et al., 2021). Technical advice from the Terrestrial & Aquatic Environment team was produced in 2020 and 2024 for the Live Plants team. The technical advice states that *Hoya* spp. are the only known hosts of this virus and there are no native *Hoya* species in New Zealand. This virus is known to be mechanically transmitted only but spread can be facilitated through the trade and transport of asymptomatic plants. There are no records of this virus on economically important crops (MPI 2020, 2024).

HoToV2 was previously identified post-border associated with unauthorised goods that had been destroyed but the origins of those plants are unknown nor whether the infected plants were the primary source of the virus.

HoToV2 is proposed to be de-regulated in the Import Health Standard: Nursery Stock for Hoya Plants and the measures in place to manage this virus removed. As of November 2024, an amendment to the *Hoya* schedule removing the import requirements for Hoya undetermined tobamoviruses is in process.

Given the length of time since purchase and the high volume of propagated materials sold by Trade Me sellers, HoToV2 may be well established in New Zealand. MPI's Risk Assessment team in 2020 and 2024 concluded that the virus posed a low-to-negligible overall biosecurity risk, that the economic impact would be minor and limited to the nursery sector. Given the findings of this investigation, it has been closed.

New vinegar fly detection in Auckland

A retired entomologist reported the detection of a suspect new-to-New Zealand *Scaptodrosophila lativittata* inside their Auckland home (**Figure 9**, next page). The observation was recorded by him on iNaturalist on 19 June 2024 (https://inaturalist.nz/observations/222409646). This widespread urban species is endemic to Australia and is recorded from southeastern Queensland, New South Wales and Victoria.

Scaptodrosophila lativittata is a vinegar fly in the family Drosophilidae, known for their association with fermenting fruits and decaying organic matter. It is attracted to fruit baits and normally found in association with fruit orchards. The ecological association information for most *Scaptodrosophila* species is limited or absent, but known feeding or breeding sites include tree sap, fungi, fruit, flowers and leaf litter (Throckmorton, 1975).

There are four *Scaptodrosophila* species known from New Zealand (MacFarlane et al., 2010), including the two native species *S. neozelandica* and *S. kirki*, both restricted to endemic forests of the North Island (Harrison, 1959). All four species were previously

placed under the genus *Drosophila*. There is no information that would suggest this species could pose any greater risk than native or established *Scaptodrosophila* species already found here, unlike fruit flies of economic importance that impact New Zealand's fresh fruit and vegetable industries.



Figure 9. New vinegar fly, *Scaptodrosophila lativittata.* Photo: iNaturalist

Vine hawk moth at Muriwai Beach

A member of the public captured and emailed to MPI a picture of a hawk moth found at Muriwai Beach (**Figure 10**). From the image, it was identified by MPI entomologists as *Hippotion celerio*, a rare vagrant visitor to New Zealand. The notifier went back later to look for more but was unsuccessful.

The moth has been detected as a solitary migrant to New Zealand on three occasions since 1936 and there are other observations recorded on iNaturalist (https://inaturalist.nz/observations/6225216). *Hippotion celerio* is a serious pest of kumara (*Ipomoea batatas*) and taro (*Colocasia esculenta*) overseas, particularly in the Pacific islands. To a lesser extent, it is also a pest of grapes, beetroot and maize and several weeds such as dock (*Rumex* spp.) and *Convolvulus* spp. (https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.27820).



Figure 10: Female vine hawk moth, *Hippotion celerio.* Photo provided by notifier

In the absence of evidence of an established population and given its previous history of detections as a solitary vagrant moth, it was considered another lone visitor to New Zealand and the investigation closed.

New wasp found in Paihia

A new-to-New Zealand *Arpactophilus* wasp was found in a surveillance fruit fly trap at a residential property in Paihia, Bay of Islands. The same type of wasp was first recorded on iNaturalist in 2021 in nearby Russell and had been identified by Auckland Museum the same year; however, that detection and identification was not reported to MPI. There are now a total of five observations of the wasp recorded on iNaturalist, all in the vicinity of the Russell property. Three of those observations were in 2021 and one each in 2022 and 2023. The observations recorded over consecutive years and in the same area indicate that a population of *Arpactophilus* wasps has become established in the Bay of Islands. The investigation found that the establishment of *Arpactophilus* sp. in New Zealand is unlikely to present either a biological or biosecurity risk, given that it solely preys on other small insects. Given the very low biosecurity risk associated with this organism no further action was considered necessary.

References

Arzanlou M, Groenewald JZ, Fullerton RA, Abeln ECA, Carlier J, Zapater MF, Buddenhagen IW, Viljoen A, Crous PW (2008). Multiple gene genealogies and phenotypic characters differentiate several novel species of *Mycosphaerella* and related anamorphs on banana. *Persoonia* 20,1937.

Bakhshi GM, Mackay J, Nicolaisen M, Shams-Bakhsh M (2021). Comparative genomics, pangenome, and phylogenomic analyses of *Brenneria* spp., and delineation of *Brenneria izadpanahii* sp. nov. *Phytopathology* 111(1), 78–95. doi: 10.1094/PHYTO-04-20-0129-FI. PMID: 32407252.

Bleach C (2021). Plant health surveillance and incursion investigation report: October to December 2020. *Surveillance* 48(1), 37–45.

Bleach C (2023). Plant health surveillance and incursion investigation report: July to September 2023. *Surveillance* 50(4), 33–41.

Bregant C, Batista E, Hilário S, Linaldeddu BT, Alves A (2023). *Phytophthora* species involved in *Alnus glutinosa* decline in Portugal. *Pathogens* 12, 276.

CABI (2024). *Leersia hexandra* (southern cut grass). Available from https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.30391, accessed: 16 May 2024.

Churchill ACL (2010). *Mycosphaerella fijiensis*, the black leaf streak pathogen of banana: progress towards understanding pathogen biology and detection, disease development, and the challenges of control. *Molecular Plant Pathology* 12, 307–328.

Gaafar Y, Richert-Pöggeler KR, Hartrick J, Lüddecke P, Maaß C, Schuhmann S, Wilstermann A, Ziebell H (2020). A new tobamovirus infecting *Hoya* spp. *New Disease Reports* 42, 10.

Hansen EM, Brasier CM, Shaw DS, Hamm PB (1986). The taxonomic structure of *Phytophthora megasperma*: evidence for emerging biological species groups. *Transactions of the British Mycological Society* 87(4), 557–573.

Harrison RA (1959). *Acalypterae Diptera of New Zealand.* NZ Department of Scientific and Industrial Research Bulletin, 128.

Ilyas R, Adkins S, Schmalowski D, Ziebell H, Richert-Pöggeler KR (2021). Detection of latent or symptomatic tobamoviruses in *Hoya* spp. *XV International Symposium on Virus Diseases of Ornamental Plants* 1392, 7–14.

Jackson G, McKenzie E (2021). Banana leaf speckle (308) (lucidcentral.org). Available from https://apps.lucidcentral.org/pppw_v10/pdf/web_full/banana_leaf_speckle_308.pdf, accessed 30 June 2024.

Jeffers SN, Aldwinckle HS, Burr TJ, Arneson PA (1982). *Phytophthora* and *Pythium* species associated with crown rot in New York apple orchards. *Phytopathology* 72(5), 533–538.

Jones DR (2000). *Mycosphaerella* speckle. In DR Jones (ed), *Diseases of Banana, Abac and Enset.* pp. 113–116. CABI Publishing, Wallingford, UK.

Jones DR (2003). The distribution and importance of *Mycosphaerella* leaf spot diseases of banana. In Jacome L, Lepoivre P, Martin D, Ortíz R, Escalant JV (eds). *Mycosphaerella* leaf spot diseases of bananas: present status and outlook. *Proceedings of the Workshop on* Mycosphaerella *leaf spot diseases.* San Jose (CRI), 2002/05/20-23. Montpellier (FRA): INIBAP, 317 p. ISBN: 2-910810-57-7.

Kurbetli İ, Karaca G, Aydoğdu M, Sülü G (2020). *Phytophthora* species causing root and collar rot of pomegranate in Turkey. *European Journal of Plant Pathology* 157(3), 485–496.

Macfarlane R, Maddison P, Andrew I, Berry J, Johns P, Hoare R, Larivière M-C, Greenslade P, Henderson R, Smithers C, Palma R, Ward J, Pilgrim R, Towns D, Mclellan I, Teulon D, Hitchings T, Eastop V, Martin N, Fletcher M, Stufkens M, Dale P, Burckhardt D, Buckley T, Trewick S (2010). Phylum Arthropoda. In: Gordon D. *New Zealand Inventory of Biodiversity.* Volume II, pp. 233–467.

Ministry for Primary Industries (2020). *Technical advice on: the risk to New Zealand of a Hoya undetermined tobamovirus.* Ministry for Primary Industries; Wellington, New Zealand.

Ministry for Primary Industries (2024). *Technical advice on: Viruses associated with Hoya plant germplasm.* Ministry for Primary Industries; Wellington, New Zealand.

Monteiro P, Gonçalves M, Pinto G, Silva B, Martin-García J, Diez JJ, Alves A (2022). Three novel species of fungi associated with pine species showing needle blight-like disease symptoms. *European Journal of Plant Pathology* 162, 183–202.

Mourichon X (2003). Overview of progress and results since the first international workshop on *Mycosphaerella* leaf spot diseases of bananas in 1989. Jacome L, Lepoivre P, Martin D, Ortíz R, Escalant JV (eds). *Mycosphaerella* leaf spot diseases of bananas: present status and outlook. *Proceedings of the Workshop on* Mycosphaerella *leaf spot diseases*. San Jose (CRI), 2002/05/20-23. Montpellier (FRA): INIBAP, 317 p. ISBN: 2-910810-57-7

Ortíz B, Enriquez L, Meja K, Yanez Y, Sorto Y, Guzman S, Aguilar K, Fontecha G (2022). Molecular characterization of endophytic fungi from pine (*Pinus oocarpa*) in Honduras. *Revista Bionatura* 7(3), 13.

Rieux A, Soubeyrand S, Bonnot F, Klein EK, Ngando JE, Mehl A, Ravigne V, Carlier J, de Lapeyre de Bellaire L (2014). Long-distance wind-dispersal of spores in a fungal plant pathogen: Estimation of anisotropic dispersal kernels from an extensive field experiment. *PLoS ONE* 9(8), e103225. doi: 10.1371/journal.pone.0103225

Sanchez AD, Sosa MC, Lutz MC, Carreño GA, Ousset MJ, Lucero GS (2019). Identification and pathogenicity of *Phytophthora* species in pear commercial orchards in Argentina. *European Journal of Plant Pathology* 154, 811–822.

Silva AC, Diogo E, Henriques J, Ramos AP, Sandoval-Denis M, Crous PW, Bragana H (2020). *Pestalotiopsis pini* sp. nov., an emerging pathogen on stone pine (*Pinus pinea* L.). *Forests* 11(8), 805.

Throckmorton LH (1975). Chapter 17. The phylogeny, ecology, and geography of *Drosophila*. In King RC (ed) *Handbook of Genetics*, Vol 3. Plenum, New York.

Viljoen A, Surridge AKJ, Crous PW. (2003). The impact of minor *Mycosphaerella* pathogens on bananas (*Musa*) in South Africa. Jacome L, Lepoivre P, Martin D, Ortíz R, Escalant JV (eds). *Mycosphaerella* leaf spot diseases of bananas: present status and outlook. *Proceedings of the Workshop on Mycosphaerella leaf spot diseases*. San Jose (CRI), 2002/05/20-23. Montpellier (FRA): INIBAP, 317 p. ISBN: 2-910810-57-7.

Wilcox WF and Mircetich SM (1985). Effects of flooding duration on the development of *Phytophthora* root and crown rots of cherry. *Phytopathology* 75(12), 1451-1455.

Wikee S, Lombard L, Crous P, Nakashima C, Motohashi K, Chukeatirote E, Alias S, McKenzie E, Hyde K (2013a). *Phyllosticta capitalensis*, a widespread endophyte of plants. *Fungal Diversity* 60, 91105.

Wikee S, Lombard L, Nakashima C, Motohashi K, Chukeatirote E, Cheewangkoon R, McKenzie EHC, Hyde KD, Crous PW (2013b). A phylogenetic re-evaluation of *Phyllosticta* (Botryosphaeriales). *Studies in Mycology* 76, 129.

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PEST WATCH: 31 July – 4 November 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 31 July – 4 November 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	*Brenneria izadpanahii* No common name	*Quercus ilex* evergreen oak	Waikato	Scion Forest Biosecurity Surveillance	One of the bacterial species that are associated with acute oak decline (AOD).
Bacterium	*Gibbsiella quercinecans* No common name	*Quercus robur* English oak	Auckland	PHEL High Risk Site Survey	One of the bacterial species that are associated with acute oak decline (AOD).
Bacterium	*Pseudomonas silvicola* No common name	*Knightia excelsa* rewarewa	Auckland	PHEL High Risk Site Survey	First described in 2023, this species appears to have anti-fungal properties, protecting against some plant pathogens.
Chromista	*Phytophthora rosacearum* No common name	*Malus × domestica* apple	Hawke's Bay	PHEL General Surveillance	A pathogen of rosaceous fruit trees. In other parts of the world, it has also been detected in forests, natural ecosystems and soils.
Fungus	*Aculeastrum americanum* No common name	*Rubus idaeus* raspberry	Auckland	PHEL High Risk Site Survey	This species is the causal agent of late yellow rust or late leaf rust on raspberries.
Fungus	*Calosphaeria pulchella* No common name	*Prunus avium* wild cherry	Central Otago	PHEL General Surveillance	Infection by this pathogen usually occurs at wound sites and develops slowly, causing dieback and canker.
Fungus	*Colletotrichum* sp. No common name	*Paphiopedilum* sp. Venus slipper orchid	Hawke's Bay	PHEL General Surveillance	An undescribed species. Little is known of its biology. It is genetically similar to *C. orchidophilum.*
Fungus	*Fusarium nirenbergiae* No common name	*Cucurbita maxima* pumpkin	Hawke's Bay	PHEL General Surveillance	First described in 2019, this species has been associated with a variety of hosts, from a range of countries.
Fungus	*Mycosphaerella musae* No common name	*Musa* sp. banana	Northland	PHEL General Surveillance	This species causes leaf speckling in *Musa* species.
Fungus	*Pestalotiopsis pini* No common name	*Pseudotsuga menziesii* Douglas fir	Waikato	PHEL High Risk Site Survey	First described in 2020, early studies suggest this species is an endophyte.
Insect	*Arpactophilus* sp. No common name	Inanimate host fruit fly trap	Northland	AsureQuality/PHEL Fruit Fly Surveillance	An undescribed wasp of the family Crabronidae. Most members of this family are predatory on other insects.
Insect	*Ctenolepisma lineatum* four-lined silverfish	Inanimate host house	Nelson	PHEL General Surveillance	Native to southern Europe, this species is now found worldwide, favouring dark, cool, and humid environments.

Validated new-to-New Zealand reports

Type	Organism	Host	Location	Submitted by	Comments
Insect	*Haritalodes derogata* cotton leaf roller	Alcea rosea common hollyhock	Auckland	PHEL General Surveillance	A small moth, whose leaf-rolling larvae are associated with plants in the family Malvaceae.
Insect	*Scaptodrosophila lativittata* No common name	Inanimate host building	Auckland	PHEL General Surveillance	A species of vinegar fly in the family Drosophilidae, known for their association with fermenting fruits and decaying organic matter.
Mite	*Cornigamasus lunaris* No common name	Inanimate host apiary sticky board	Auckland	PHEL Bee Mite Surveillance	A predatory mite that feeds on other mites or small insects.
Mite	*Mexecheles votandinii* No common name	Inanimate host apiary sample	Southland	PHEL Bee Mite Surveillance	A predatory mite that feeds on other mites or small insects.
Mite	*Paracheyletia pyriformis* No common name	Inanimate host apiary sample	Waikato	PHEL Bee Mite Surveillance	A predatory mite that feeds on other mites or small insects.
Virus	*Deltapartitivirus* Mulberry cryptic virus 1, MuCV1	*Morus alba* mulberry	Auckland	PHEL High Risk Site Survey	Members of *Deltapartitivirus* induce cryptic infections in plants. Cryptic viruses commonly occur in different plant species and are often asymptomatic or cause only very mild symptoms.
Virus	*Iflavirus* Tomato matilda virus, TMaV	*Solanum nigrum* black nightshade	Auckland	PHEL High Risk Site Survey	Species of *Iflavirus* are usually viruses of insects. This plant infecting *Iflavirus* species appears to be asymptomatic in its plant hosts.

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

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AWANUI VETERINARY PATHOLOGY

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

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  Tel: 06 356 7100 Fax: 06 357 1904

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  Postal: PO Box 3866, Christchurch 8140
  Tel: 03 379 9484 Fax: 03 379 9485

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  Tel: 06 353 3983 Fax: 06 353 3986

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

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

0800 80 99 66

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

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

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

Plant Health and Environment Laboratory – Christchurch
14 Sir William Pickering Drive
Christchurch
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