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Message from the Australian Chief Veterinary Officer

Welcome to the first edition of *Animal Health Surveillance Quarterly* for 2017.

Animal health surveillance allows us to substantiate our animal health status, and identify and better understand new and emerging risks. It supports our animal industries and trade opportunities, and is an activity in which everyone has an important role. This edition features articles that recognise the significant contributions of community reporting and industry programs, and also how we can collaborate with our human health colleagues to better understand risks in what is a dynamic context.

During this quarter, the importance of working together with our colleagues overseas was highlighted when I attended the Stop Transboundary Animal Diseases and Zoonoses (STANDZ) and the 23rd World Organisation for Animal Health (OIE) Sub-Commission for Foot and Mouth Disease Control in Southeast Asia and China (SEACFMD) meetings in Siem Reap, Cambodia, on 8–10 March 2017. These programs are key platforms for building strong pre-border risk management capacity in the region.

Beyond our region, I was fortunate to attend the meeting of the OIE Regional Commission for Africa in Swakopmund, Namibia, earlier in the year as an observer, in my capacity as the Vice-President of the OIE Council. Technical items discussed included those relating to pastoralism, as well as the global strategy for the control and eradication of peste des petits ruminants. The meeting provided opportunities to engage with individual countries and the region as a whole, and further appreciate our shared interests in key animal health activities and participation in the OIE.

One of the objectives of the OIE is to ensure transparency in the global animal health situation, and along with this Member Countries are obliged to report on their animal health status. Australia has a history of strong participation and support of the OIE, and in March Australia's annual report to the OIE was submitted. This report included information on numbers of veterinarians and laboratory information, which are some of the vital components that support our surveillance systems.

Animal Health Australia is a not-for-profit public company established by the Australian Government, state and territory governments, and major national livestock industry organisations to manage national animal programs on behalf of its members. Every effort is made to ensure that the information in *Animal Health Surveillance Quarterly* is accurate at the time of publication; however, it is subject to change as a result of additional or amended data being received. Further information on the outcome of cases that were pending at the time of printing may be found at www.animalhealthaustralia.com.au/ahsq.

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Animal Health Surveillance Quarterly is a veterinary science publication that provides a topical summary of animal health matters and reports of animal health surveillance activities undertaken in Australia during the previous 3-month period. As part of the National Animal Health Information System (NAHIS), this report contributes to Australia's annual animal health report to the World Organisation for Animal Health (OIE).

Enhanced surveillance for arboviral infection in horses

Karen Moore
Victorian Department of Economic Development, Jobs, Transport & Resources

In response to flooding across Victoria in 2016, the Victorian Department of Health and Human Services (DHHS) and Agriculture Victoria investigated the incidence of mosquito-borne arboviral infection in Victorian horses. The project augments other DHHS arbovirus monitoring programs, including mosquito trapping and support for 13 sentinel chicken flocks located throughout the state.

The project is targeting three arboviral infections of public and animal health importance:

- Murray Valley encephalitis (MVEV)
- Ross River virus (RRV)
- West Nile virus Kunjin strain (WNV_{Kun}).

Human cases of RRV infection occur each year in Victoria[1] but cases of MVEV[2] and WNV_{Kun}[3] only occur sporadically. Increases in the incidence of all three viruses in the state have tended to follow heavy rains and flooding.

Interest in monitoring arboviral infection in horses occurred after an epidemic of RRV infection in horses in 2011 following heavy rains and flooding in the 2010–2011 summer season. More than 473 horses were reported to the department in Victoria during that outbreak.[4] MVEV and RRV are not notifiable diseases in animals in Victoria. Clinical West Nile virus infection is a notifiable animal disease in Australia.

In early February 2017, private veterinary practitioners in Victoria were sent information advising them of the enhanced equine arbovirus surveillance project and how they could participate. To encourage sample submission, free laboratory testing was made available for RRV, MVE and WNV_{Kun}. As Hendra virus infection is a differential diagnosis for neurological disease in horses, in addition to arbovirus testing, all samples were screened for Hendra virus. The project offered subsidies to private veterinarians for the collection of initial and convalescent bloods samples.

Between 3 February and 31 March 2017, 42 cases from 41 properties in Victoria had been submitted for testing to AgriBio Veterinary Diagnostics Services, Bundoora (Figure 1). This is considerably fewer than the number reported during the 2011 outbreak.

The most commonly reported signs were depression, oedema, ataxia, pyrexia and lameness (Table 1). Of the 23 cases finalised at the time of reporting, 7 cases were confirmed with recent RRV infection and a further 5 cases could not have RRV confirmed or excluded as the cause of illness. There was no evidence of recent infection in the remaining 11 cases. All submissions have tested negative for Hendra virus infection and no evidence of recent infection with MVEV, WNV or WNV_{Kun} has been detected.

Sample submissions will continue until the end of May 2017.

Interest in monitoring arboviral infection in horses occurred after an epidemic of RRV infection in horses in 2011 following heavy rains and flooding in the 2010–2011 summer season.

1 www2.health.vic.gov.au/public-health/infectious-diseases/disease-information-advice/ross-river-virus

2 www2.health.vic.gov.au/public-health/infectious-diseases/disease-information-advice/murray-valley-encephalitis

3 www2.health.vic.gov.au/public-health/infectious-diseases/disease-information-advice/west-nile-virus-kunjin-virus

4 Roche S, Wicks R, Garner M, East I, Paskin R, Moloney B, Carr M & Kirkland P 2013, Descriptive overview of the 2011 epidemic of arboviral disease in horses in Australia, *Australian Veterinary Journal* 91: 5–13 doi:10.1111/avj.12018

Figure 1 Location of equine arbovirus investigations, by shire, in Victoria, where darker shading indicates a greater number of properties investigated, 1 February to 31 March 2017

Table 1 Signs reported in horses investigated for arbovirus infection in Victoria, 1 February to 31 March 2017

Sign	Number of horses[a]
Depression	18
Oedema	14
Ataxia/incoordination	13
Pyrexia (fever)	12
Lameness	10
Fasciculation (twitch)	8
Emaciation/cachexia (weight loss)	7
Recumbency	7
Listlessness/lethargy	6
Behavioural change	5
Hyperaesthesia (increased sensitivity)	5
Hypermetria (high stepping gait)	5
Colic	4
Anorexia (not eating)	3
Sign not on list (specified in comments)	3
Stiff gait	2
Blepharitis (inflammation of eyelid)	1
Blindness	1
Circling	1
Corneal opacity (cloudy cornea)	1
Nasal discharge	1
Reluctant to walk	1
Seizures	1

a Multiple signs could be selected for each horse

Application of Australia's nationally agreed response policy for anthrax

Australian Government Department of Agriculture and Water Resources; with contributions from NSW Department of Primary Industries, Queensland Department of Agriculture and Fisheries and Victorian Department of Economic Development, Jobs, Transport & Resources

Anthrax is an infectious disease caused by the bacteria *Bacillus anthracis* that is known to affect humans and a wide range of domestic and wild animals. It occurs virtually worldwide, with only a few countries never having reported the disease.

Anthrax remains uncommon in Australia, and clinical cases of the disease are reported only sporadically. The areas where cases occur tend to be on floodplains along waterways with neutral to alkaline subsoil. Some cases occur away from waterways on acidic soils. Anthrax is recognised as an important disease of production, trade and public health significance.

Anthrax is a notifiable disease in all states and territories of Australia and is subject to strict compulsory government controls. Australia's nationally agreed response policy for anthrax is detailed in the *Australian Veterinary Emergency Plan (AUSVETPLAN) Disease Strategy for Anthrax*, which ensures a nationally consistent approach to rapidly contain sporadic outbreaks.

In the event of an outbreak, Australia's policy is to control anthrax using a combination of strategies based on the recommendations in the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code* (Chapter 8.1) and the OIE *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* (Chapter 2.1.1).

Standard control measures include a combination of quarantine and movement controls, tracing of all at-risk animals and their products, protection of product supply chains, appropriate destruction and disposal of diseased animals and fomites, vaccination of at-risk animals, and communication with industry, the public and trading partners.

Australia is committed to maintaining a strong and transparent animal health system. All outbreaks of anthrax are reported to the OIE according to *Terrestrial Animal Health Code* requirements.

Prompt diagnosis, reporting and management of anthrax is supported by a well-established veterinary service. Nationally agreed standard operating procedures (NASOPs) have been developed for use by states and territories during responses. These procedures underpin elements of the *AUSVETPLAN* and describe in detail specific actions to be undertaken during an outbreak response.

This quarter, responses to three sporadic outbreaks of anthrax occurred. Each response demonstrated the effectiveness of Australia's nationally agreed policy and procedures in supporting rapid disease diagnosis, reporting and control. The following case studies were contributed by authors from each of the affected jurisdictions.

New South Wales — case study 1

One anthrax incident was reported in New South Wales during the quarter. In late February 2017, 33 lambs died from a flock of 88 on a property in the Forbes district. The property is in an area with a known regional history of anthrax cases. The investigating veterinarian conducted an immunochromatographic test (ICT) for anthrax, which was positive. Samples were submitted to the State Veterinary Diagnostic Laboratory, Menangle, and confirmed as anthrax by polymerase chain reaction (PCR) testing.

The case was managed according to the New South Wales and nationally agreed anthrax procedure; all at-risk animals were vaccinated, carcases burned, and the property was subject to movement restrictions. The National Livestock Identification System (NLIS) database showed there were no movements on or off the property in the previous 20 days.

Elsewhere in the state, there were 48 other mortality investigations during the quarter where anthrax was excluded as the cause of death. Of these investigations, 18 involved sheep where alternate diagnoses included lactic acidosis, clostridial infection, toxicities due to copper, *Panicum* spp. and phomopsin; pneumonia; and intestinal parasitism. Cattle were involved in 27 investigations where alternate diagnoses included lactic acidosis, clostridial infection, bloat, cryptosporidiosis, and toxicities due to nitrate/nitrite and lead. Investigations included a horse where there was no alternate diagnosis and some goats where the alternate diagnosis was salmonellosis and intestinal parasitism. The ICT was used in 24 of these mortality investigations with negative results. The other 24 investigations had anthrax excluded by laboratory testing or clinical grounds based on alternate diagnoses.

Victoria — case study 2

On 3 March 2017, Victoria's Chief Veterinary Officer was informed of a culture-positive anthrax result from a sheep originating from the Swan Hill district in north-west Victoria. Tracing and surveillance identified a further four properties owned by the same producer in the Swan Hill area where sheep deaths due to anthrax were identified. A total of 26 confirmed cases of anthrax were recorded during this outbreak.

The response to the Swan Hill outbreak included immediate quarantine and vaccination of susceptible livestock on all affected properties and neighbouring properties within a radius of 1.25 km. During the response, 98 properties were inspected and more than 6500 head of livestock were vaccinated against anthrax, including sheep, cattle, goats, free-range pigs and horses. All vaccinated animals have been identified with NLIS ear tags and scanned so their movements off the affected properties may be traced if required. There was no movement of animals or animal products (including hides) from the affected properties during the period when quarantine was imposed. Movements of animals and animal products on and off affected properties in the 20-day incubation period before quarantine was imposed were traced and were deemed to pose no risk of spreading the disease.

Figure 2 Cow that died from anthrax infection, dead 4 days (photo: Department of Agriculture and Fisheries, Queensland)

At the time of writing, all properties had been released from quarantine.

Queensland — case study 3

Anthrax was diagnosed in early March 2017 at an extensive beef cattle property located between St George and Dirranbandi, south-west Queensland. From two paddocks on the property, a total of 119 adult cows and an unknown number of calves were affected. The pattern of deaths was consistent with the normal 4 to 7-day incubation period for anthrax.

Deceased cattle were found in the paddocks with dark blood around the nostrils, mouth and anus. The private veterinarian attending the incident suspected anthrax as the primary differential diagnosis, and took blood samples and smears that were hand-delivered to Biosecurity Sciences Laboratory. Anthrax was diagnosed using stained blood smear slides at Biosecurity Sciences Laboratory and was subsequently confirmed at CSIRO Australian Animal Health Laboratory.

Officers from Biosecurity Queensland used emergency powers under the *Biosecurity Act 2014* to place movement restrictions on all livestock and equipment on the affected property and other properties included under the same property identification code (PIC).

The Queensland Chief Veterinary Officer authorised use of the live Sterne strain (34F2) anthrax vaccine to vaccinate all at-risk livestock on the properties. Approximately 1000 cattle and 1000 sheep on the affected property were vaccinated.

Carcases were disposed of by burning in situ. Biosecurity and Balonne Council staff monitored the fires and directed heavy equipment (excavators and a bobcat) to replenish wood until carcases were burnt to ash. The ash was buried deeper than 2 m and potentially contaminated soil was decontaminated by soaking with 10% formalin. All equipment associated with the response was decontaminated by washing followed by treatment with either 10% formalin or Virkon® virucidal disinfectant.

Movement restrictions remained in place until all at-risk livestock were deemed to have acquired vaccine-induced immunity (20 days after vaccination of the last at-risk animal). Biosecurity officers worked in close cooperation with the owners throughout the response.

Thorough tracing confirmed there was no spread of anthrax from this property and no human infection associated with this outbreak. This is the first occurrence of anthrax in Queensland since 2002.

Figure 3 Carcase burnt to ash in response to anthrax outbreak (photo: Department of Agriculture and Fisheries, Queensland)

Novel rotavirus in pigeons

Australian Government Department of Agriculture and Water Resources; with contributions from NSW Department of Primary Industries, Queensland Department of Agriculture and Fisheries and Victorian Department of Economic Development, Jobs, Transport & Resources

A newly identified viral disease has recently been described in pigeons in Australia.

Since mid-2016, mortalities in kept pigeons (racing and fancy) have occurred in lofts in New South Wales, Queensland, South Australia, Tasmania, Victoria and Western Australia. A case of disease has also been reported in feral pigeons (rock pigeon; *Columba livia*) in Western Australia. A novel rotavirus, currently referred to as 'pigeon rotavirus', has been identified as the causative agent.

The virus is highly infectious and is most likely transmitted by direct contact between birds or via a common handler or fomite (contaminated object). Typical clinical signs include a sudden onset of depression, vomiting, diarrhoea, regurgitation and a hunched posture. Up to 50% of birds in a loft may be affected, and mortalities of up to 30% have been reported. Death of affected birds typically occurs within 12 to 48 hours following onset of clinical signs, with mortalities in affected lofts continuing for approximately 7 days.

Gross and histological findings include severe necrotising hepatitis (friable when handled), coalescing hepatocyte degeneration and necrosis, enlarged/pale spleens with severe depletion of lymphoid tissue and reduction in the size of the cloacal bursa.

Following initial reports of the disease, an epidemiological and comprehensive diagnostic investigation was undertaken by affected jurisdictions and at the CSIRO Australian Animal Health Laboratory. Emergency animal diseases and notifiable diseases, such as avian influenza, Newcastle disease virus and pigeon paramyxovirus virus type 1, were excluded, as were adenovirus and herpesvirus. Negative contrast electron microscopy of an impression smear of liver tissue revealed the presence of a reovirus. This finding was confirmed by next-generation sequencing, which further characterised a rotavirus of serotype G18P. The virus has since been isolated in MA104 cells.

Partnerships between CSIRO Australian Animal Health Laboratory and state laboratories have resulted in the development of new diagnostic tests for pigeon rotavirus, including a real-time polymerase chain reaction (PCR) test based on the VP7 gene.

Australia maintains its commitment to preserving a strong and transparent animal health system. Following identification and characterisation of pigeon rotavirus as a novel pathogen, notifications were made to the World Organisation for Animal Health (OIE) *World Animal Health Information System*.[5]

Rotaviruses tend to be highly species specific, and domestic poultry have not been found to be affected by pigeon rotavirus. However, clinical and post-mortem signs in poultry resembling those seen in infected pigeons is routinely investigated and exclusion of pigeon rotavirus is recommended in addition to avian influenza, Newcastle disease and pigeon paramyxovirus type 1. A transmission trial is currently underway at CSIRO Australian Animal Health Laboratory to confirm that domestic poultry are not susceptible to the virus.

There is currently no vaccine available to protect pigeons against this rotavirus. The pigeon industry is advised to implement biosecurity measures to prevent the spread of the disease, including reconsidering gatherings and movements (including racing) of pigeons. Further biosecurity recommendations for the pigeon industry and private veterinarians are available from state departments of agriculture. Disease incidents can be reported to the relevant state government or Wildlife Health Australia Coordinator,[6] or the Emergency Animal Disease Watch Hotline on 1800 675 888.

5 www.oie.int/wahis_2/public/wahid.php/Reviewreport/Review/viewsummary?fupser=&dothis=&reportid=23344

6 www.wildlifehealthaustralia.com.au/AboutUs/ContactDetails.aspx

Northern Australia Quarantine Strategy animal health surveillance summary for 2016

Dr Madusha Weeratunga and David Clarke
Australian Government Department of Agriculture and Water Resources

For agricultural producers in the north, and thousands more across rural parts of Australia, access to trade exists in part due to our animal welfare standards, pest and disease-free status and strict biosecurity laws. The Australian Department of Agriculture and Water Resources Northern Australia Quarantine Strategy (NAQS) helps to make this possible.

NAQS was established in 1989 in recognition of the country's unique northern challenges in addressing biosecurity risks. Work is conducted by Indigenous rangers, community liaison officers, veterinarians and scientists working in collaboration with jurisdictional agencies across northern Australia. This network of people undertakes surveillance activities spanning the vast, rugged and unpopulated coastlines from Broome across to Darwin, Weipa and Cairns, and up through the Torres Strait.

NAQS surveillance activities help to monitor for animal pests and diseases that could potentially threaten the livelihoods of livestock producers all over the country and harm foreign trade partnerships that maintain Australia's $32 billion agricultural export industry.

Apart from the scarcity of human resources, one of the main challenges faced by NAQS staff is effective engagement with remote northern and Indigenous communities. This can only occur in a true intercultural space that is sensitive to the diverse ways of 'doing business'. Despite the hurdles, the Community Animal Health Reporting (CAHR) program within NAQS trains Indigenous rangers to collect animal health information from a range of sources.

Indigenous rangers obtain information by visiting various groups within the community and recording answers to a set series of questions in various formats, including in an electronic questionnaire. This syndromic surveillance approach in monitoring populations is highly beneficial in analysing changes in disease levels in the domestic animal populations in and between communities in the same area. Monitoring characteristic syndromes of specific NAQS targeted pests and diseases is one of many collection points used in NAQS to provide an early warning system for emerging pests or diseases.

Furthermore, CAHR contributes to the gathering of negative data, which helps to provide evidence for the absence of NAQS targeted diseases, and assurance required for trade and market access with our foreign partners.

In late 2015, additional focus on surveillance and analytics for northern Australia was confirmed as part of the Australian Government's commitments under the *Developing Northern Australia* and *Agricultural Competitiveness* white papers. The majority of this work commenced in 2016 under the guidance of the Northern Australia Biosecurity Framework (NABF) Reference Group.

Improvements to biosecurity surveillance is being achieved through multiple projects from improving community and Indigenous ranger engagement, to improved aquatic biosecurity and improved and increased animal surveillance activities. These surveillance activities have

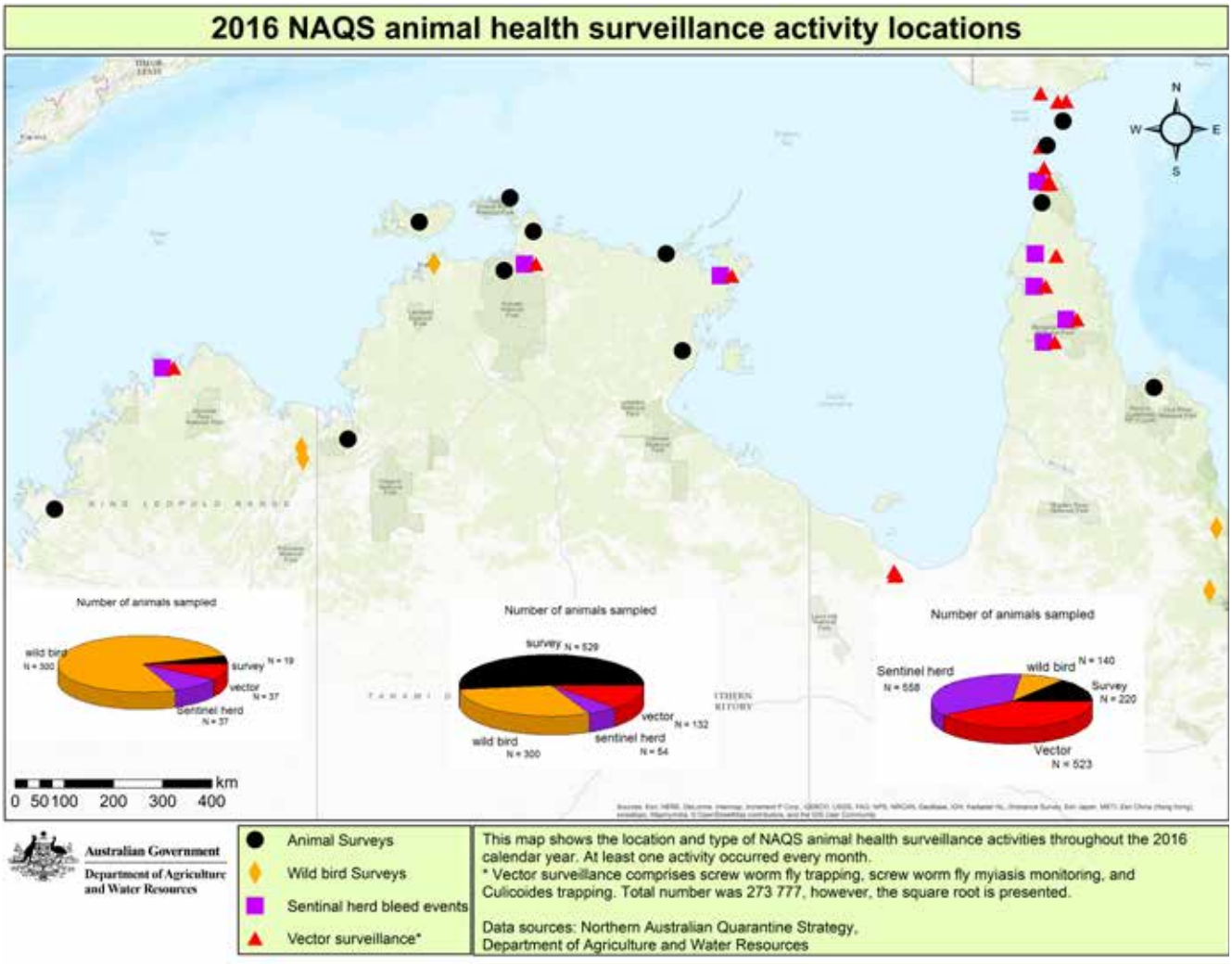


Figure 4 Locations and type of NAQS animal health surveillance activities throughout 2016. Pie charts for each jurisdiction show the number of animals sampled across the various surveillance activities, including the number of individual entomological identifications and vector surveillance activities conducted in 2016.

been developed by the working group of the NABF that is comprised of government jurisdiction agency surveillance managers, industry representatives and NAQS technical specialists.

NAQS animal health surveys

Targeted surveillance activities are focused on feral and domestic animal populations.

Information obtained include both subjective data, in the form of informal interviews with local landholders and animal owners and direct observations, and objective data from samples collected through serological or virological testing for target diseases.

Observations and samples collected through necropsies conducted on feral animals help to detect target pests and diseases. Any abnormalities detected are followed up through diagnostics to exclude targeted diseases and determine a diagnosis.

The surveys are mostly biased towards sampling animals observed to be unwell or in poor condition to increase the likelihood of detecting pests and diseases. Samples are collected after assessments occur that take into consideration the practicality, safety, convenience and disease risk profiles of areas.

During the 2016 calendar year, NAQS animal health surveillance teams carried out 11 feral and two domestic animal health surveys across northern Australia. Of the 13 surveys, seven were carried out in the Northern Territory, five in Queensland and one in Western Australia. Survey length ranged from 3 to 10 days, including travel time.

The feral and domestic surveys sampled 768 individual animals from eight animal groups, including birds, buffaloes, cattle, dogs, donkeys, goats, horses and pigs. By jurisdiction, 220 animals were tested in Queensland, 529 in the Northern Territory and 19 in Western Australia.

Pigs accounted for 88% of the individuals sampled in the feral surveys, and were the only animal group to be sampled in every survey. The bias towards feral pig (*Sus scrofa*) sampling is partly due to their greater presence,

Table 2 Pests and diseases targeted during NAQS animal health surveys, showing the number of surveys a disease was tested for in 2016

Target disease	Number of surveys	Number of surveys (%)	Number of animal groups
Aujeszky's disease	12	100	1
Avian influenza	1	8	1
Bluetongue virus	1	8	1
Classical swine fever	12	100	1
Ehrlichia canis	2	17	1
Japanese encephalitis	3	25	2
Surra (*Trypanosoma evansi*)	12	100	6
Trichinellosis	3	25	1

availability and access, and partly due to culling requirements enforced by certain states and territories due to the damaging effects of this species on both the environment and agricultural production. Additionally, being a known reservoir for exotic diseases, surveillance and management of feral pigs is greatly warranted.

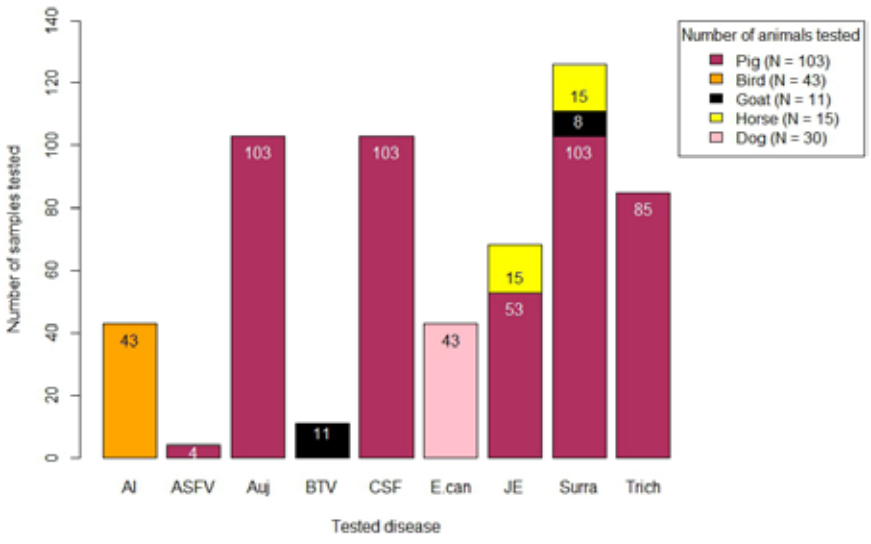
From the samples collected, we tested for eight different target diseases through the 13 surveys conducted (Table 2). All surveys tested for Ausjeszky's disease, classical swine fever and surra, whilst 25% of surveys tested for Japanese encephalitis and trichinellosis, 17% tested for *Ehrlichia canis* and 8% for bluetongue virus and avian influenza (AI). A total of 2294 samples were collected and sent away for testing. All testing returned negative results for targeted pests and diseases.

Rabies investigations

Two cases for rabies exclusion were investigated in 2016 and reported in AHSQ Vol. 21 Issue 4.

The first case was reported in November 2016 by a veterinary clinic in Darwin, Northern Territory, where a dog was presented with neurological signs, including foaming from the mouth, jaw clamping, hyperexcitable to external stimuli, as well as other general neurological symptoms. The owners elected to euthanase the dog, and a brain sample was transported to CSIRO Australian Animal Health Laboratory for lyssavirus antigen FAT (fluorescent antibody test) and lyssavirus real-time polymerase chain reaction (RT-PCR) testing, including rabies. Results came back negative for both Australian bat lyssavirus (ABLV) and rabies. Toxicology testing for lead and metaldehydes and snake venom all returned negative results, and no significant findings were made on haematology, biochemistry, cytology of cerebrospinal fluid and histology of all body organs. Final diagnosis for this case was put down as either an atypical presentation of tetanus (as this cannot be definitively tested for) or other toxicity even though no history of possible exposures was gathered.

The second case occurred in December 2016 on Horn Island, in the Torres Strait, where an owner contacted a Cairns veterinary clinic to report unusual neurological signs observed in a dog that had been exposed to a flying-fox 3 weeks prior (AHSQ Vol. 21 Issue 4). The clinic in Cairns promptly referred the owner to the Emergency Animal Disease Watch Hotline, which directed the owner to the on-call veterinary officer within Biosecurity Queensland. Biosecurity Queensland provided liaison between NAQS and Queensland Health, and coordinated the testing of samples for ABLV and rabies.

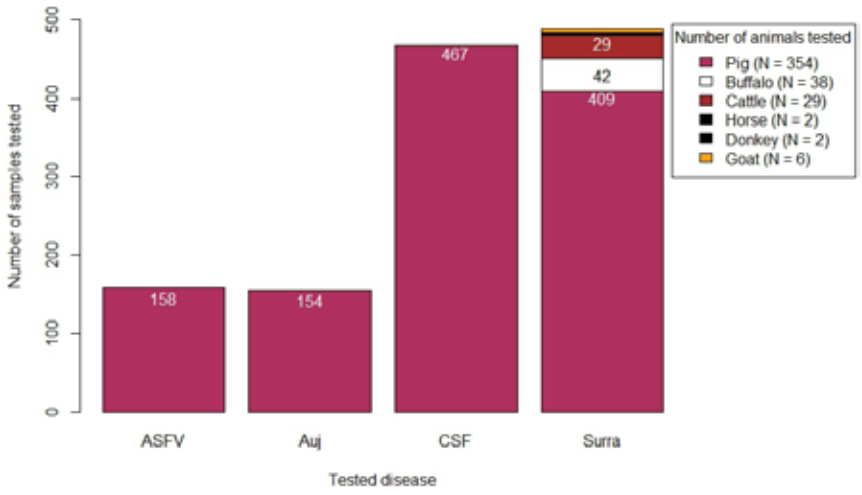


AI = avian influenza, ASFV = African swine fever virus, Auj = Aujeszky's disease, BTV = bluetongue virus, CSF = classical swine fever, E.can = Ehrlichia canis, JE = Japanese encephalitis, Trich = trichinellosis

Figure 5 Diseases tested during NAQS animal health surveys in Queensland, 2016, showing number of samples and animals tested

Testing concluded with negative results, which were reported to the owner (who had begun post-exposure prophylaxis vaccination) and to the Queensland and Australian chief veterinary officers. Histology was performed with unremarkable results. As toxicology was not performed, a toxic aetiology could not be ruled out.

Both investigations highlighted the importance of promoting awareness of reporting and notification systems, particularly the national Emergency Animal Disease Watch Hotline. These cases clearly demonstrate the coordination efforts required to manage biosecurity risks in northern Australia.



ASFV = African swine fever virus, Auj = Aujeszky's disease, CSF = classical swine fever

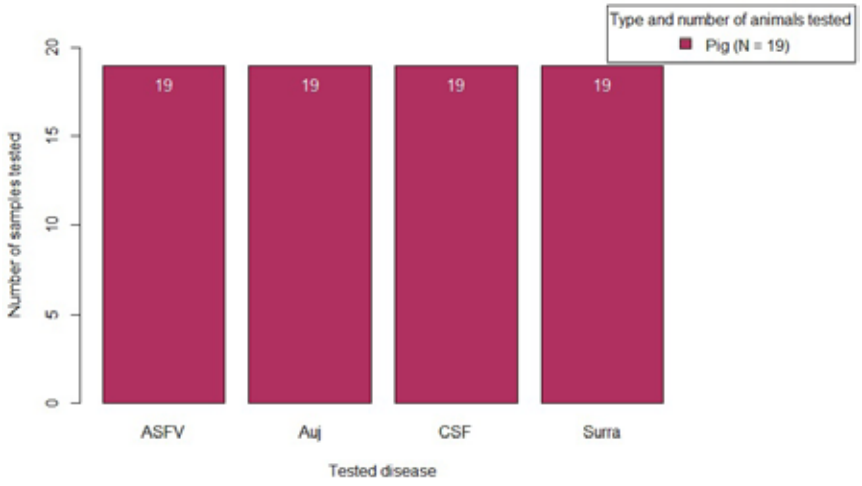
Figure 6 Diseases tested during NAQS animal health surveys in the Northern Territory, 2016, showing number of samples and animals tested. Some pigs had both serum and tissue samples taken for testing which explains the higher sample numbers obtained from pigs given the number of pigs tested.

Avian surveillance

In addition to the terrestrial animal surveillance, a total of 740 individual wild birds (*Anseriformes*) were sampled during 2016, of which only five returned positive results for low pathogenic AI (LPAI) on virus isolation. Three of these detections were in Queensland and two in Western Australia. The three detections in Queensland were all positive for AI type A on TaqMan assay. Subtyping confirmed two of these samples to contain an H9 LPAI and one sample an H5 LPAI subtype. The two positives in Western Australia were also positive for AI type A on TaqMan with both deriving H9 LPAI on further subtyping.

NAQS's surveillance of wild birds contributes to the National Avian Influenza in Wild Birds (NAIWB) Surveillance Program, coordinated by Wildlife Health Australia.

Environmental faecal samples are collected from areas where wild waterfowl congregate and are tested for AI viruses of concern. This surveillance contributes to a better understanding of the ecology of influenza viruses in Australia and provides a strong case to obtain and support ongoing funding for advanced diagnostics to facilitate biosecurity and policy development. This body of work contributes to maintaining Australia's existing freedom from AI in our commercial poultry flocks. The data collected is included in the biannual reporting that Australia makes to the OIE on the presence or absence of highly pathogenic avian influenza (HPAI), which maintains our current country freedom status.



ASFV = African swine fever virus, Auj = Aujeszky's disease, CSF = classical swine fever

Figure 7 Diseases tested during NAQS animal health surveys in Western Australia, 2016, showing number of samples and animals tested.

Sentinel herd surveillance

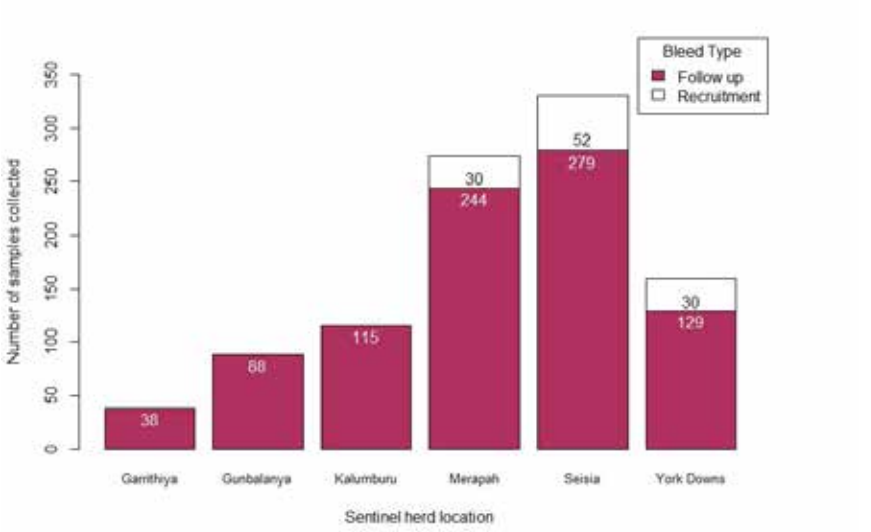
NAQS surveillance includes testing and monitoring of sentinel animals from six management sites and two recruitment sites[7]

7 A 'recruitment' site is used only as part of an initial recruitment of animals for a sentinel herd, which is different to a management site. These animals will not be managed at this site and will be relocated to the nearest management site for ongoing testing and monitoring. NAQS has two recruitment sites (Wolverton and Bertihaugh). A 'management site' is used for both recruiting and monitoring/testing animals from an existing herd that will make up the sentinel herd; all are management sites except for two recruitment-only sites, Wolverton and Bertihaugh.

as part of the National Arbovirus Monitoring Program (NAMP). These sites (Figure 9) are located at Kalumburu in Western Australia, Gunbalanya and Garrithiya in the Northern Territory, and Seisia (with recruitment site at Wolverton), York Downs (with recruitment site at Bertihaugh) and Merapah in North Queensland.

During 2016, NAQS participated in 36 individual sentinel herd-testing activities with 1002 samples tested for a number of exotic diseases, including bluetongue virus (BTV), Surra (*Trypanosoma evansi*) and Japanese encephalitis (JE). When animals were rounded up monthly for blood collection, they were also monitored for any existing wounds and maggot infestations as part of the national Screw-Worm Fly Surveillance and Preparedness Program (SWFSPP).

In addition, light trapping for culicoides midges (one of the vectors of BTV) was conducted at these sites and at three additional locations through Indigenous ranger activities.



ASFV = African swine fever virus, Auj = Aujeszky's disease, CSF = classical swine fever

Figure 8 Numbers of samples collected by NAQS from the sentinel herd management and recruitment sites in 2016

No exotic strains of BTV or other exotic diseases were detected.

Screw-worm fly and mosquito surveillance

NAQS conducts surveillance for the national Screw-Worm Fly Surveillance and Preparedness Program (SWFSPP).

Surveillance to detect Old World screw-worm fly (*Chrysomya bezziana*) is conducted on a quarterly basis in the Northern Peninsular Area (NPA) of Queensland. This area has been identified as a high-risk region for SWF incursion through unregulated pathways (migratory, windborne, illegal vessels, animal and human movement). Ongoing trapping in 2016 resulted in no detections from 75 traps set and inspected across all sites. A total of 260,998 flies were collected with morphological and PCR identification performed by NAQS entomologists through the year. Fly trapping is done in addition to myiasis surveillance in individual

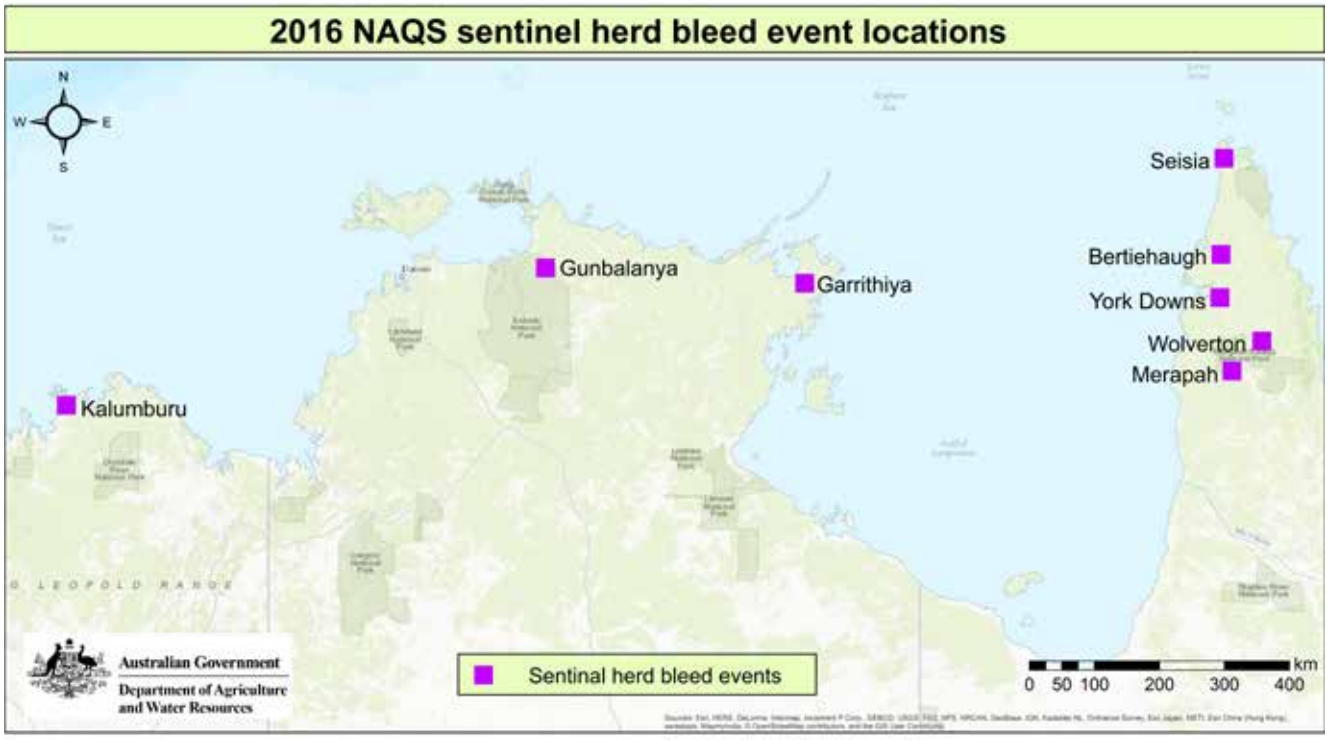


Figure 9 Locations of the sentinel herd bleed events in NAQS animal health surveys, 2016

animals from sentinel herds, and animal health surveys.

Maggot samples are received from animal and human myiasis cases submitted by hospitals, health clinics and the public. NAQS received 10 submissions from animal and human myiasis cases in 2016, all of which excluded Old World screw-worm fly.

As a commitment by NAQS to the One Health initiative,[8] data collected from mosquito trapping for the detection of Japanese encephalitis (JE) virus is shared with the Queensland Department of Health. Trapping, through the use of Flinders Technology Associates (FTA®) cards, was conducted from January to May 2016 at specific sites in the NPA, with no evidence of circulation of the JE virus detected.

General surveillance

Further reports of surveillance data collected by NAQS were made nationally available as part of ongoing contributions to programs including NAIWB, the NAMP and the National Animal Health Information System (NAHIS).

NAQS makes enormous efforts to advertise its message about animal surveillance through its Top Watch! campaign. This is a public awareness program run to advise people about reporting unusual disease signs in animals, an important strategy for the early detection of target pests and diseases.

The Top Watch! campaign recruits Indigenous ranger groups across northern Australia to distribute messages, deliver public awareness sessions and collect biosecurity surveillance information. Presentations are made to schools, community groups and other organisations, as well as to tourists.

The CAHR has become one of the key tools in NAQS for remote community surveillance. In 2016, 107 individual reports were made from 42 communities. Reports included 2748 dogs with signs that fitted the 'dog syndromes' categories, including neurological, sudden or unexplained death and pruritus. These syndromes are used to determine baseline numbers of individual syndromes across the main domestic species, with all syndromes surveyed relating to a NAQS target pest or disease. The highest number of observations recorded in dogs, for example, were for 'itchy' dogs and those that 'looked sick'. This is in line with the ongoing observations made by organisations working with community dog populations, and demonstrates the ongoing need for veterinary care in remote regions.

NAQS veterinary officers monitor these reports and follow up all unusual cases with phone calls or field visits where required to gather further information.

Summary

In 2016, survey activities conducted through NAQS helped to aid in the collection of negative data for over 15 target pests and diseases, through active and passive surveillance. This information provides data for use in the demonstration of country freedom for a number of exotic diseases important in maintaining trade and market access. With the additional projects that have been funded and implemented through the *Developing Northern Australia* and *Agricultural Competitiveness* white papers,[9] there is ongoing effort to conduct and promote the important biosecurity work needed in safeguarding the agricultural businesses of the north, while caring for country and maintaining the health of Australia's unique environment. The important objective of NAQS in influencing the early detection and reporting of exotic pests and diseases is being gradually enhanced through effective community engagement. Recruitment of Indigenous rangers has been identified as a key element in unlocking the solutions to northern Australia's surveillance challenges.

8 The One Health concept is a global strategy that has been implemented to expand interdisciplinary collaborations in areas of human and animal health and the environment. This synergistic approach has been implemented to foster and advance human and animal healthcare by accelerating biomedical research, enhancing public health and the world's scientific knowledge base at large.

9 The 4-year Northern Australia Biosecurity Surveillance initiative delivers on government priorities to improve biosecurity surveillance outlined in the Developing Northern Australia and Agricultural Competitiveness white papers.

Enzootic bovine leucosis

Robin Condron
Dairy Australia

By 2009, Australia had successfully controlled enzootic bovine leucosis (EBL) and achieved monitored negative EBL status of Australian dairy herds. Annual testing of all dairy herds from 2010 to 2012 established that at least 99.8% dairy herds tested negative for EBL. Consequently, in December 2012, in accordance with the National Dairy Enzootic Bovine Leucosis Eradication Program standard definitions and rules, Australia's dairy industry declared freedom from EBL in Australian dairy herds.

Dairy Australia, as the national post-freedom coordinating body, is responsible for monitoring the Australian dairy herd for EBL freedom, with testing of all dairy herds over 3-year cycles.

Our ongoing monitoring of EBL freedom involves annual surveys that provide 99% confidence of detecting 0.2% prevalence of infection. Over the 2012–15 period, monitoring included testing of all 6235 dairy herds in Australia. All herds were EBL negative.

Annual EBL surveys are continuing. Testing of 1685 herds in 2015–16 and 2220 herds in 2016–17 showed all were negative for EBL.

Biosecurity provisions have been incorporated in dairy on-farm quality assurance programs and in extension advice to dairy farmers to test any non-dairy cattle introductions for EBL.

Herds with serological or other evidence of EBL must be promptly notified to the relevant state or territory chief veterinary officer. The program's investigation and eradication requirements must then be met before the herd may again be considered free from EBL.

Dairy Australia, as the national post-freedom coordinating body, is responsible for monitoring the Australian dairy herd for EBL freedom, with testing of all dairy herds over 3-year cycles.

The EBL status of the Australian dairy herd remains unchanged; no infected herds have been detected.

Wildlife Health Australia

Sam Gilchrist, Keren Cox-Witton, Silvia Ban and Tiggy Grillo, Wildlife Health Australia**; and Iain East,** Australian Government Department of Agriculture and Water Resources

Wildlife Health Australia (WHA)[10] is the peak body for wildlife health in Australia. WHA was established as the Australian Wildlife Health Network in 2002 as an Australian Government initiative to coordinate wildlife health surveillance information across Australia, to support Australia's animal health industries, human health, biodiversity, trade and tourism. WHA collates information from multiple sources into a national database — the Wildlife Health Information System (eWHIS)[11] — including submissions by WHA subscribers, state and territory WHA coordinators, researchers, and university, zoo and sentinel clinic veterinarians. During the quarter, 211 wildlife disease investigation events were reported into eWHIS (Table 3). This report details some of the disease and mortality events in free-living wildlife recorded in eWHIS this quarter. WHA thanks all those who submitted information for this report.

Wild bird mortality events — Newcastle disease and avian influenza exclusion

WHA received 58 reports of wild bird mortality or morbidity investigations from around Australia during the quarter; investigations may involve a single animal or multiple animals (e.g. mass mortality event). A breakdown of the bird orders represented is presented in Table 4. Reports and samples from sick and dead birds are received from members of the public, private practitioners, universities, zoo wildlife clinics and wildlife sanctuaries. Avian influenza (AI) was excluded by polymerase chain reaction (PCR) testing for influenza A in 23 of the events as part of Australia's general (sick and dead bird) AI surveillance program. AI exclusion testing was not warranted in the remaining 35 events, based on clinical signs, history, prevailing environmental conditions or other diagnoses. In addition, avian paramyxovirus was excluded in 20 events by PCR testing specific for Newcastle disease (ND) virus and/or pigeon paramyxovirus 1 (PPMV-1).

Avian influenza surveillance

Australia's National Avian Influenza Wild Bird (NAIWB) Surveillance Program comprises two sampling components: pathogen-specific, risk-based surveillance by sampling of apparently healthy, live and hunter-killed wild birds; and general surveillance by investigating significant unexplained morbidity and mortality events in wild birds, including captive and wild birds within zoo grounds (with a focus on exclusion testing for AI virus subtypes H5 and H7). Samples from sick or dead birds were discussed earlier. Sources for targeted wild bird surveillance data include state and territory government laboratories, universities and samples collected through the Northern Australia Quarantine Strategy (NAQS).

During the quarter, pathogen-specific, risk-based surveillance occurred at sites in Queensland, South Australia, Tasmania and Victoria, with cloacal and faecal environmental swabs collected from 1266 waterbirds. Results are pending.

Mycobacterium pinnipedii in an Australian fur seal

Investigations continued this quarter into the stranding of a free-range adult male Australian fur seal (*Arctocephalus pusillus doriferus*) that commenced in late 2016. The animal was hauled out by two members of the public in Torquay, Victoria, and reported to Zoos Victoria's Marine Response Unit.

The seal was described as unusually lethargic and making a low gasping growl. Veterinarians from Melbourne Zoo examined the moribund animal, documenting fair-to-thin body condition and intermittent open-mouth breathing. Based on the severity of the clinical signs, the seal was euthanased.

The seal was submitted for full necropsy to the Faculty of Veterinary and Agricultural Sciences at the University of Melbourne. Gross pathology findings included firm, multifocal-to-coalescing cream-coloured

10 www.wildlifehealthaustralia.com.au/Home.aspx

11 www.wildlifehealthaustralia.com.au/ProgramsProjects/eWHISWildlifeHealthInformationSystem.aspx

Table 3 Number of disease investigations reported into eWHIS, January to March 2017[a]

Bats[b]	Birds	Feral animals	Marine turtles	Lizards & snakes	Marine mammals	Marsupials	Monotremes	Frogs
116	58	4	1	4	1	25	1	1

a Disease investigations may involve a single animal or multiple animals (e.g. mass mortality event).
b The majority of bat disease investigations are single bats submitted for Australian bat lyssavirus testing.

Table 4 Wild bird disease investigations reported into eWHIS, January to March 2017

Bird order	Common name for bird order[a]	Events reported[b]
Anseriformes	Magpie geese, ducks, geese and swans	7
Caprimulgiformes	Frogmouth, nightjars, owlet-nightjars, swifts	1
Charadriformes	Shorebirds	3
Columbiformes	Doves and pigeons	3
Coraciiformes	Bee-eaters and kingfishers	1
Passeriformes	Passerines or perching birds	18
Pelecaniformes	Ibis, herons and pelicans	2
Podicipediformes	Grebes	1
Psittaciformes	Parrots and cockatoos	20
Sphenisciformes	Penguins	2
Suliformes	Gannets and boobies	1

a Common names adapted from: del Hoyo and Collar, 2014, *HBW and BirdLife International Illustrated Checklist of the Birds of the World. Volume 1—Non-passerines*, Lynx Editions, Barcelona. (Courtesy of the Australian Government Department of the Environment and Energy.)
b Disease investigations may involve a single or multiple bird orders (e.g. mass mortality event). This quarter there was one wild bird event that involved multiple bird orders (Columbiformes, Passeriformes and Psittaciformes).

masses in the spleen (Figure 10) and liver. The mesentery appeared reddened with numerous slightly raised cream nodules scattered throughout. The mesenteric lymph nodes were firm and markedly enlarged, and the cut surface appeared cream-coloured, consistent with the masses present in the spleen and liver. The animal had severe ascites, and a firm cream-coloured mass located near the submandibular lymph node (Figure 11). The lungs appeared mottled and red; the left lung lobes darker red than the right lung lobes, consistent with hypostatic congestion. A focal cream-coloured firm nodule was present in the lung tissue.

Histopathological examination confirmed severe, chronic, necrotising granulomatous hepatitis, pneumonia and peritonitis with marked ascites. Necrosis and inflammation was noted in the spleen, lymph nodes and the lungs. In each of these tissues, microscopic changes were associated with acid-fast bacilli.

Samples of the liver and masses from the spleen and lymph nodes were submitted for microbial culture and mycobacterial PCR assay at the Victorian Infectious Diseases Reference Laboratory. PCR test results were positive for the *Mycobacterium tuberculosis* group, and mycobacterial culture confirmed *Mycobacterium pinnipedii*.

M. pinnipedii is a slow-growing bacillus of the *M. tuberculosis* complex, and seals are the usual host.[12,13] Clinical signs are marked by reduced body condition, listlessness and extended time spent ashore. Animals may exhibit signs of increased respiratory effort.[14] Diagnosis of *M. pinnipedii* in live pinnipeds is difficult and treatment is not indicated. Specificity and sensitivity of tuberculin skin testing is not known, and a serological ELISA test is no longer available.[15] Although other serological tests are likely to diagnose tuberculosis caused by *M. pinnipedii*, reliable, ante-mortem diagnosis[16] can only be achieved by molecular analysis or pathogen culture of lung washes.[17]

12 Cousins DV, Williams SN, Reuter R, Forshaw D, Chadwick B, Coughran D, Collins P & Gales N 1993, Tuberculosis in wild seals and characterisation of the seal bacillus, *Australian Veterinary Journal* 70(3): 92–97.

13 Cousins DV, Bastida R, Cataldi A, Quse V, Redrobe S, Dow S, Duignan P, Murray A, Dupont C, Ahmed N & Collins DM 2003, Tuberculosis in seals caused by a novel member of the Mycobacterium tuberculosis complex: Mycobacterium pinnipedii sp. nov, *International Journal of Systematic and Evolutionary Microbiology* 53(5): 1305–1314.

14 Cousins, DV et al. (1993) as above.

15 Barnes J, Higgins D & Gray R (2008). Pinnipeds, in: *Medicine of Australian Mammals* (eds L Vogelnest & R Woods), pp. 541–589, CSIRO Publishing, Collingwood.

16 Jurczynski K, Lyashchenko KP, Scharpegge J, Fluegger M, Lacave G, Moser I, Tortschanoff S & Greenwald R 2012, Use of Multiple Diagnostic Tests to Detect Mycobacterium pinnipedii Infections in a Large Group of South American Sea Lions (Otaria flavescens), *Aquatic Mammals* 38(1): 43.

17 WHA 2010, Tuberculosis in Australian seals, Fact Sheet, November 2010, Wildlife Health Australia. www.wildlifehealthaustralia.com.au/FactSheets.aspx

Figure 10 Spleen of mycobacteriosis-affected seal with multifocal to coalescing mass

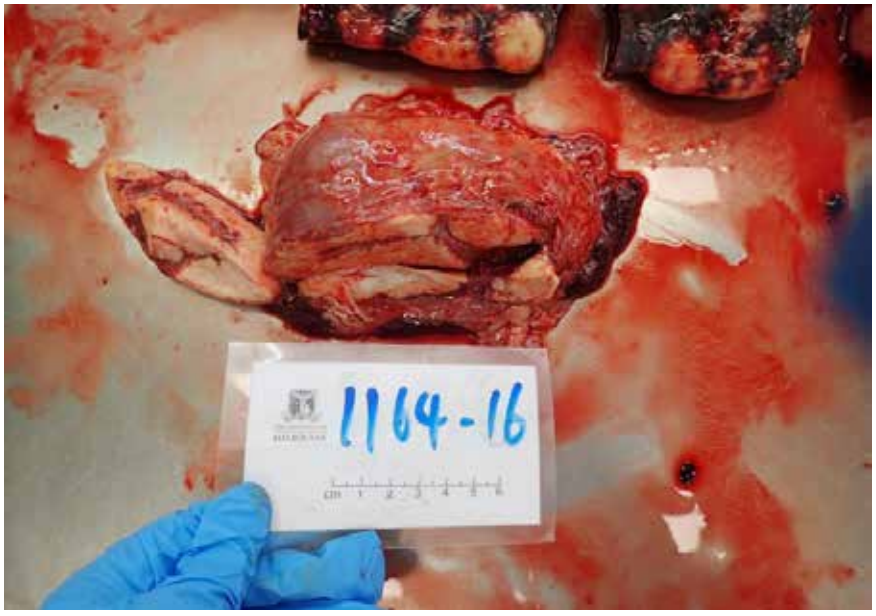


Figure 11 Mass in submandibular area in mycobacteriosis-affected seal

Microscopic lesions of *M. pinnipedii* differ from *M. bovis* in cattle and *M. tuberculosis* in humans. Usually, reduced amounts of caseous necrosis, mineralisation and multinucleate giant cells are found, and noticeable pyogranulomatous inflammation is frequently observed.[18,19,20]

The gross and histopathological findings in the Victorian seal described here were consistent with mycobacteriosis, confirmed by culture to be caused by *M. pinnipedii*. The acute necrosis with mild inflammation present in the spleen and some of the lymph nodes is not typical for mycobacteriosis and may be associated with the concurrent finding of a pure culture of *Clostridium perfringens* from the liver.

M. pinnipedii has been described in captive and wild Australian and New Zealand pinnipeds but the prevalence is not known. The organism can infect other mammals[21] and transmission from seal[22] to cattle has been described in New Zealand.[23] Tuberculosis due to *M. pinnipedii* has been reported in humans,[24] illustrating the importance of adopting personal protective equipment during examination or necropsy of sick pinnipeds to prevent the spread of infection. Screening for *M. tuberculosis* complex pathogen can be used for those at risk of infection. Further information is available in the WHA fact sheet.[25]

Francisella tularensis excluded in a western ringtail possum

Based on PCR tests performed at the CSIRO Australian Animal Health Laboratory, *Francisella tularensis* was excluded in a Western ringtail possum (*Pseudocheirus peregrinus occidentalis*) in Western Australia that presented in care with acute onset inappetence, lethargy and neurological signs in January (refer to page 46). Tularaemia is a nationally notifiable disease of terrestrial animals,[26] which has been shown to affect many species and has zoonotic potential.

18 Barnes J et al. (2008) as above.

19 Boardman WS, Shephard L, Bastian I, Globan M, Fyfe JA, Cousins DV, Machado A & Woolford L 2014, Mycobacterium pinnipedii tuberculosis in a free-ranging Australian fur seal (Arctocephalus pusillus doriferus) in South Australia, *Journal of Zoo and Wildlife Medicine* 45(4): 970–972.

20 Grillo T, Cox-Witton K & Post L 2012, *Animal Health Surveillance Quarterly* Volume 17 Issue 3, pp. 5–6, Animal Health Australia, Canberra.

21 Moser I, Prodinger WM, Hotzel H, Greenwald R, Lyashchenko KP, Bakker D, Gomis D, Seidler T, Ellenberger C, Hetzel U & Wuennemann K 2008, Mycobacterium pinnipedii: transmission from South American sea lion (Otaria byronia) to Bactrian camel (Camelus bactrianus bactrianus) and Malayan tapirs (Tapirus indicus), *Veterinary microbiology* 127(3): 399–406.

22 WHA 2010 as above.

23 Loeffler SH, de Lisle GW, Neill MA, Collins DM, Price-Carter M, Paterson B, & Crews KB 2014, The seal tuberculosis agent, Mycobacterium pinnipedii, infects domestic cattle in New Zealand: epidemiologic factors and DNA strain typing, *Journal of Wildlife Diseases* 50(2): 180–187.

24 Kiers A, Klarenbeek A, Mendelts B, Van Soolingen D, & Koëter G 2008, Transmission of Mycobacterium pinnipedii to humans in a zoo with marine mammals, *The International Journal of Tuberculosis and Lung Disease* 12(12): 1469–1473.

25 WHA 2010 as above.

26 Australian Government Department of Agriculture and Water Resources National List of Notifiable Animal Diseases www.agriculture.gov.au/pests-diseases-weeds/animal/notifiable (updated November 2015; cited 31 March 2017).

Australian bat lyssavirus

Reports to WHA for the quarter included 116 bats tested for Australian bat lyssavirus (ABLV) from New South Wales, Northern Territory, Queensland, Tasmania, Victoria and Western Australia.

Bat submissions were made for a variety of reasons:

- 45 cases involved contact with the potential for ABLV transmission to humans; of these
  - 22 were associated with trauma (e.g. barbed wire fence or netting entanglement)
  - 2 involved contact with a pet dog or cat
  - 1 displayed non-neurological signs
  - 1 was found dead
  - the remainder had no further history reported
- 35 cases involved contact with a pet dog (21) or cat (14)
- 15 cases were associated with trauma
- 7 bats displayed neurological signs (e.g. seizures)
- 5 bats displayed non-neurological signs (e.g. respiratory distress, abscess)
- 3 bats were found dead
- 6 bats had no further history reported at this time.

During the quarter, four flying-foxes were confirmed positive for ABLV by fluorescent antibody test and PCR for pteropid ABLV ribonucleic acid (RNA). Two grey-headed flying-foxes (*Pteropus poliocephalus*) were found in respiratory distress and 'bloated' at the same Victorian location; one was dead on arrival at the wildlife hospital and the other died during examination under anaesthetic. From New South Wales, a grey-headed flying-fox and an unspecified flying-fox (*Pteropus* sp.) were submitted due to neurological signs.

In cases where potentially dangerous human contact was reported, an experienced public health official provided appropriate counselling and information.

More information on ABLV testing of bats in Australia is available in *ABLV Bat Stats*.[27] ABLV is a nationally notifiable disease in Australia. Cases of suspect ABLV infection or exposure should be reported to the Emergency Animal Disease Watch Hotline on 1800 675 888.

27 www.wildlifehealthaustralia.com.au/ProgramsProjects/BatHealthFocusGroup.aspx

Aquatic animal health

Robert Gurney
Australian Government Department of Agriculture and Water Resources

Raising awareness of aquatic animal health and reporting with mobile apps

Mobile application software (mobile apps) are rapidly evolving as an adjunct to telephone hotlines for the public to report animal disease incidents to government agencies. While telephone hotlines continue to provide the primary means for reporting emergency animal diseases, mobile apps for smartphones have the potential to capture additional real-time information, including geotagged images for initial diagnosis and mapping.

The Australian Government Department of Agriculture and Water Resources has developed a mobile app to raise awareness of aquatic animal diseases. The Northern Territory Department of Primary Industries and Resources has released a mobile fishing app that includes a function to report unusual aquatic animal health events, allowing investigation of suspected diseases.

Aquatic Disease Field Guide app

The Aquatic Disease Field Guide app developed by the Department of Agriculture and Water Resources makes the online Aquatic Animal Diseases Significant to Australia: Identification Field Guide 4th Edition more accessible to the general public. The app aims to raise awareness of important aquatic animal diseases and encourage reporting of disease incidents to relevant authorities.

The field guide provides information on 49 aquatic animal diseases of significance to Australia. It is logically formatted for ease of use and includes a user guide and introductory information on aquatic animal anatomy.

Disease sections are divided into bacterial, fungal, parasitic, viral and other; covering finfish, molluscs, crustaceans and amphibians. Users can search by host, disease name, disease agent or disease status in Australia (exotic or endemic).

Disease pages include information on the clinical signs of disease, disease epidemiology, the presence of the disease in Australia and advice on how to collect samples. Most disease pages include photographs of animals with gross signs of disease that can be enlarged using simple touch screen functions.

Users can report suspect aquatic animal disease incidents through the app to the national Emergency Animal Disease Watch Hotline.

The Aquatic Disease Field Guide app is free to download through the Apple App Store, GooglePlay and the Microsoft Software & Apps Store.

NT Fishing Mate app

The Northern Territory Government released the NT Fishing Mate app to provide fishers in the Northern Territory with access to fishing rules and information. Users can report any unusual aquatic animal conditions, such as fish kills, aquatic pests and diseases or injured aquatic animals.

In the Northern Territory, fish kills are commonly reported by the public. These kills are usually the result of anoxic conditions in billabongs or dams caused by decaying algal blooms or organic matter washed into waterways by storms. Nonetheless, these events are investigated routinely to check whether disease may have been involved.

Once a fish kill report has been received via the NT Fishing Mate app, NT Fisheries Fishwatch Hotline, NT Fisheries or the NT EPA Pollution Hotline, it is loaded onto the government internal SharePoint website, which sends out notifications to all relevant Northern Territory Government agencies, including the Department of Health, Department of Environment and Natural Resources, Department of Mines and Energy, Power and Water Corporation. The size, location and initial assessment of the fish kill determines which government agency leads the investigation. If suitable samples are available, they are sent to Berrimah Veterinary Laboratories, Darwin, for examination.

Fish kill investigations resulting from public reports form an important element of passive disease surveillance, providing an opportunity to confirm the cause of disease events and add to knowledge on Australia's disease status.

NT Fisheries uses social media, such as its NT Fishing Mate Facebook page,[28] as another way to disseminate educational materials and collect information from the public.

NT Fishing Mate app is free to download from the Apple App Store and GooglePlay.

Validating tests for white spot syndrome virus

In November 2016, white spot syndrome virus (WSSV) was detected on a prawn farm in south-east Queensland. The disease subsequently occurred on all farms in the region, resulting in destruction of stock on all farms. Diagnostic testing for the virus in both wild and farmed crustaceans has been a critical aspect of the response to define the outbreak and inform response measures.

Diagnostic tests for WSSV are included in the World Organisation for Animal Health (OIE) Manual of Diagnostic Tests for Aquatic Animals.[29] The most useful methods for surveillance are real-time polymerase chain reaction (PCR) assays, due to their performance characteristics (e.g. diagnostic sensitivity and specificity), speed and cost. However, like other assays included in the OIE Aquatic Manual, the WSSV assays have not been validated through all four stages of the assay validation pathway that is described in the OIE Aquatic Manual. This means that assay validation data must be extrapolated to conditions beyond those for which the assays were initially validated or for other uses.

Given the extensive surveillance for WSSV that will continue to occur in Australia, it is important that further validation of the assays occurs so that their performance is understood for specific uses. This work will support ongoing surveillance, including that to either declare country freedom or to declare disease-free zones.

The Australian Government is supporting further validation of existing WSSV assays under Australian conditions and for specified purposes of use, through the Agricultural Competiveness White Paper initiative. In the current response, large amounts of data have been amassed on testing that can be used towards validation of the two most commonly used tests to confirm infection with WSSV. This data needs to be interpreted and analysed for use in the process of validation. In addition, numerous control and test assays will need to be run by CSIRO Australian Animal Health Laboratory to accurately determine the performance of the tests used — testing that exceeds routine positive–negative testing.

Validation of diagnostic tests for aquatic animal diseases has been recognised by the OIE as necessary to improve confidence in test results and to provide evidence required for accurate interpretation of laboratory test results. This project aims to meet those objectives.

28 www.facebook.com/FisheriesNT

29 www.oie.int/international-standard-setting/aquatic-manual/

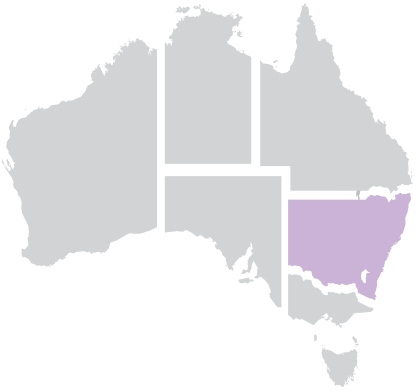
State and territory reports

Under the Australian constitution, state and territory governments are responsible for animal health services within their respective borders (jurisdictions). The governments develop and administer legislation governing the surveillance, control, investigation and reporting of disease and chemical residues and contaminants, as well as legislation relating to animal welfare. The governments deliver their services through government-appointed or government-accredited animal health personnel (district veterinarians, regional veterinary officers and local biosecurity officers). They also provide extension services to industry and the community.

The ‘State and territory reports’ summarise disease investigations undertaken within jurisdictions and describe a selection of interesting cases. Test results from national notifiable animal disease investigations are reported in Table 19 of ‘Quarterly statistics’.

Unless otherwise stated, disease events involving wildlife are reported by Wildlife Health Australia.

New South Wales



Rory Arthur
NSW Department of Primary Industries

During the quarter in New South Wales, 772 livestock and other animal disease investigations[30] were conducted to investigate suspect notifiable diseases or rule out emergency diseases.[31] The number of investigations by species is shown in Figure 12. Field investigations were conducted by government veterinary or biosecurity officers (537) and private veterinary practitioners (235). All diagnostic testing was conducted at the state veterinary diagnostic laboratory or CSIRO Australian Animal Health Laboratory.

During the quarter the State Veterinary Diagnostic Laboratory, Menangle, processed 432 livestock sample submissions[32] to investigate suspect notifiable diseases or rule out emergency diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications, and for accreditation programs and targeted surveillance.

The Department of Industry in New South Wales is obliged under the *Stock Diseases Act 1923* and the *Animal Diseases and Animal Pests (Emergency Outbreaks) Act 1991* to detect and manage notifiable disease outbreaks. The risks to government of failure to detect these diseases are managed by an active district-based disease and pest surveillance program. Part of the program requires government veterinary officers to investigate potential notifiable disease outbreaks and unusual diseases that may be new, emerging or difficult to diagnose. The officers conduct targeted surveillance projects, inspections of stock at saleyards and monitoring of compliance programs. The outcome is district-based early detection of notifiable diseases and valid reports on the animal pest and disease statuses of all districts in New South Wales. These reports are aggregated at state level, for subsequent official reporting to Animal Health Australia and, through the Commonwealth, to the World Organisation for Animal Health (OIE). The surveillance program is supported by a government veterinary diagnostic laboratory with world class diagnostic facilities and by research staff who design and improve diagnostic tests and, working with field veterinarians, investigate the epidemiology of diseases that have significant biosecurity impacts.

The following case reports are a selection of field investigations chosen to highlight surveillance and diagnostic capacity. Reports chosen are not necessarily representative of the full range of livestock disease incidents during the quarter.

Exotic turkey rhinotracheitis virus excluded

In March, a poultry veterinarian excluded a range of exotic diseases on a 4-shed turkey farm containing 8000 broiler turkeys aged 17 weeks.

Neurological signs were seen in one shed containing the oldest toms and a mild cough was present in birds from all sheds. The shed with oldest toms had a death rate of 0.3% per day for 2 consecutive days, and about 40 of the turkeys showed neurological signs, including imbalance, star gazing, opisthotonus (muscle spasm causing backward arching) and torticollis (twisting of the neck).

Swabs and blood samples submitted to the State Veterinary Diagnostic Laboratory were negative for avian influenza and

30 All field investigations by government veterinary officers plus those by private veterinarians where the government purchased the laboratory diagnostic test results because a notifiable or emergency disease was a differential diagnosis.

31 Emergency diseases are a subset of notifiable disease defined as diseases listed in the Emergency Animal Disease Response Agreement www.animalhealthaustralia.com.au/what-we-do/emergency-animal-disease/ead-response-agreement

32 Some investigations did not involve suspected notifiable diseases.

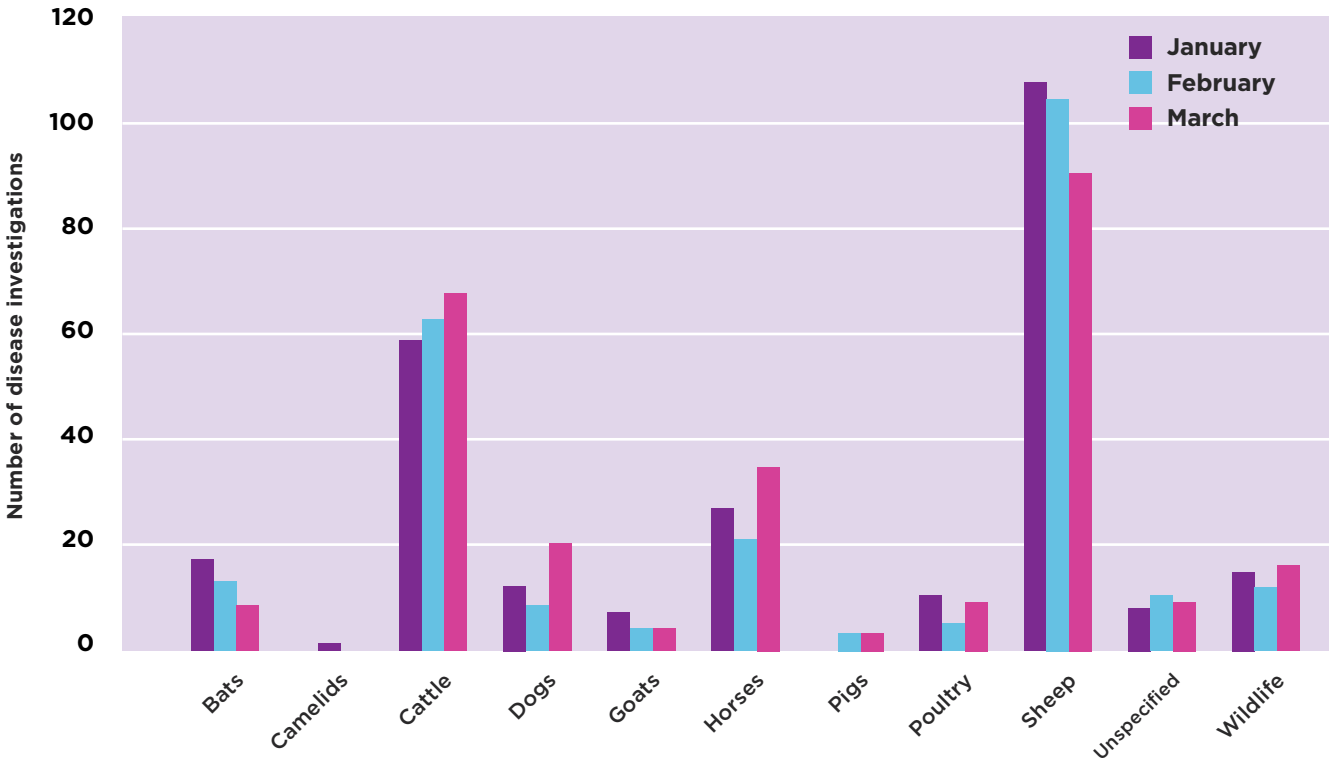


Figure 12 Number of field disease investigations to investigate suspect notifiable diseases or rule out emergency diseases, in New South Wales, January to March 2017

Newcastle disease. Swab samples submitted to CSIRO Australian Animal Health Laboratory for exclusion of turkey rhinotracheitis virus were negative. However, the serology results were inconclusive, and further investigations on the turkey farm were conducted by government veterinarians located nearby.

After the fresh samples had been sent to CSIRO Australian Animal Health Laboratory, the veterinarians prepared for a response in the unlikely event that the results were positive for turkey rhinotracheitis virus. They quarantined the farm, collected all relevant epidemiological information (including feed and chick truck movements), established the farm's relationships to other farms in the area and examined potential sources of disease entry.

Both CSIRO Australian Animal Health Laboratory and State Veterinary Diagnostic Laboratory confirmed that the samples were negative for turkey rhinotracheitis virus. However, bacterial culture confirmed a mixed bacterial infection that included

Blood sampling to exclude turkey rhinotracheitis virus. Photo: A Chowdhury

Pseudomonas aeruginosa, *Staphylococcus aureus* and *Proteus* spp. The poultry veterinarian treated the turkeys with antibiotics and the flock recovered.

Pigeon rotavirus excluded in free-range chickens

An experienced poultry veterinarian notified government veterinarians in March of high death rates on a free-range layer farm. The veterinarian advised that preliminary bacterial culture results didn't suggest any of the common bacterial infections of chickens and that emergency diseases needed to be excluded.

The free-range layer chicken farm had a flock of 10,000 hens housed in one large shed separated into four sections by mesh fences. Each section had birds of different ages ranging from 6 to 24 months. However, only the oldest birds were showing signs of tremor, high temperature, closed eyes, whitish diarrhoea, recumbency and death within 12 to 24 hours. The death rate had been 100 to 200 hens a day for 3 consecutive days.

At necropsy, the veterinarian reported that the livers of the affected birds were 'soft, friable and blotchy'. This was similar to livers he had recently seen in pigeons with rotavirus infection. Furthermore, the three adjacent younger flocks housed in the same shed and separated only by mesh remained well. This was consistent with the pattern of delayed spread to separated groups that has been seen in infected pigeon lofts. As a result, the veterinarian asked for help to exclude pigeon rotavirus infection.

A government veterinarian investigated the disease incident, collected appropriate samples and completed the surveillance forms needed for an emergency response, should it be required.

All tracheal and cloacal swab samples PCR tested negative for avian influenza, Newcastle disease and pigeon rotavirus. Histopathology was consistent with septicaemia, with random necrosis or activated vessels present predominantly in the liver and spleen. Finally, from the bacterial culture, *Enterobacter cloacae* and *Escherichia coli* were detected. The owner destocked all chickens from the infected section and implemented recommended biosecurity and farm hygiene practices. No further significant mortality has been reported.

Kikuyu poisoning in cattle

Kikuyu poisoning is suspected of causing the death of about 60 beef and dairy cattle on more than 12 properties in the Illawarra–Shoalhaven region in March.

Deaths occurred during a brief 3 to 4-week period. Losses varied from a single animal on some farms to 20 heifers on the most severely affected property; the animals' ages ranged from 15 months to mature cows.

In some incidents, animals had died suddenly without any prior opportunity to observe clinical signs. In those cases where affected animals were observed, clinical signs were variable and not specific.

Collectively, clinical signs included lethargy and isolation, staggering gait and incoordination, hindlimb weakness and difficulty rising. Some animals had mildly elevated temperatures, were drooling saliva, had weak tongues and abdominal distension and lay down after 1 or 2 days.

Some of the affected animals lying on their sternums looked as though they might have hypocalcaemia (low blood calcium) but their calcium levels were normal and the animals were not responsive to routine metabolic treatments.

Most affected cattle rapidly progressed to lying on their sides and died a day later.

Necropsies generally did not reveal any abnormalities. Occasional findings included a distended rumen with very watery content, an empty small intestine, a dry large intestine and epicardial haemorrhage (haemorrhage around the heart).

Histopathology in a number of cases showed changes consistent with kikuyu (*Pennisetum clandestinum*) toxicity. The State Veterinary Diagnostic Laboratory reported severe, acute, multifocal and coalescing necrotising, suppurative and erosive rumenitis, reticulitis and omasitis.

Kikuyu poisoning is not well understood and is often difficult to confirm. Typically, the recent outbreak was acute and sudden in onset, restricted in distribution and short in duration. Again, characteristically, these incidents occurred during a very wet autumn that was preceded by a very dry summer.

The identity of the causative toxin is unknown. Previous research has consistently isolated a fungus (*Fusarium torulosum*) from kikuyu pastures where affected cattle have grazed. This fungus is known to produce two separate toxins, both of which can produce signs and pathological changes that are similar to those seen with kikuyu poisoning.

At the time of the deaths, some of the affected pastures were heavily infested with army worms, and these infestations have previously been suspected of being implicated in the deaths. However, the presence of army worms was not a consistent

finding and their presence is more likely to be casual rather than causal.

For further information contact Steve Whittaker, District Veterinarian, South East Local Land Services, on 02 4464 6000.

Bluetongue virus exclusion in sheep

In March 2017, a district veterinarian was called to investigate a Merino ewe hogget that had developed a swollen head and was off its feed. The ewe was the only visibly affected animal from a flock of 900 sheep that had been yarded earlier that day. The group had been grazing lush green improved pasture.

The affected ewe had a swollen head with thickened ears and muzzle. The bridge of the nose was crusted and the tongue was dark pink, with a red ulcerated tip. The ewe was reluctant to walk, and the coronary bands on two of her feet showed a marked bluish–purple line. The temperature of the ewe was mildly elevated at 40.5°C. There was no evidence of jaundice.

The sheep was euthanased and a necropsy conducted. No other abnormalities were detected.

A presumptive diagnosis of primary photosensitisation was made but there was enough concern with the property location and case history to warrant the exclusion of bluetongue virus infection.

Blood and tissue samples were sent to Elizabeth Macarthur Agricultural Institute and bluetongue virus infection was excluded by PCR testing.

Facial oedema observed in affected ewe. Photo S Eastwood

Inflammation around the coronet of affected ewe. Photo S Eastwood

Northern Territory

Elizabeth Stedman
Northern Territory Department of Primary Industry and Resources

During the quarter in the Northern Territory, 58 livestock disease investigations[33] were conducted to rule out emergency diseases or investigate suspect notifiable diseases. The number of investigations by category of livestock is shown in Figure 13. Field investigations were conducted by government veterinary or biosecurity officers (42) and private veterinary practitioners (16). All diagnostic testing was conducted at the state veterinary diagnostic laboratory or CSIRO Australian Animal Health Laboratory.

During the quarter the state veterinary diagnostic laboratory Berrimah Veterinary Laboratories, Darwin, processed 142 livestock sample submissions[34] to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications, and for accreditation programs and targeted surveillance.

The Department of Primary Industry and Resources in the Northern Territory provides a free disease investigation service to livestock owners for diagnosis of notifiable emergency, exotic and endemic disease, including zoonotic diseases. Subsidies are available to private veterinarians for significant disease investigations in livestock. Berrimah Veterinary Laboratories provide free diagnostic testing for exclusion of notifiable disease for all disease investigations.

The following case reports are a selection of field investigations chosen to highlight surveillance and diagnostic capacity. Reports chosen are not necessarily representative of the full range of livestock disease incidents during the quarter.

Foot-and-mouth disease excluded in stud cattle herd

In January, a property in the Katherine region reported losses in its 12 to 18-month-old stud cattle herd, with approximately 20 out of 60 cattle missing at the muster after the prolonged wet season and presumed dead. The remaining cattle had shown signs of dehydration and scours. There were no clinical signs consistent with salivation or lameness.

One heifer in very poor body condition was euthanased and a necropsy was performed. The rumen was full and the contents dry. The gastrointestinal tract was empty and there was no evidence of diarrhoea. The lower large intestine contained fully formed faecal material. There were two small ulcerations on the buccal mucosa of the mouth, which appeared to be healing. Samples were collected from the necropsied animal and live cohorts for diagnosis, and to exclude foot-and-mouth disease (FMD).

Polymerase chain reaction (PCR) testing on tissue from the buccal ulcer and 3ABC antibody ELISA (enzyme-linked immunosorbent assay) testing of serum excluded FMD. Laboratory testing of faecal samples showed no evidence of intestinal parasitism, including coccidiosis. Blood samples from the euthanased heifer showed a moderate neutrophilia reflective of a stress leukogram, and mildly elevated urea likely due to dehydration. *Salmonella* subsp. I ser rough:e.h:1.2 was isolated by direct faecal culture and *S.* Montevideo and *S.* Reading were isolated by enrichment culture. Salmonella isolation from direct culture of faeces is often associated with clinical disease, especially in an animal with diarrhoea. Salmonella isolation from enrichment culture reflects lower numbers of organisms in the faeces and often indicates a carrier/recovered status. All cattle recovered with no further illness or death.

Bovine herpesvirus 5 causes mortality in weaner cattle

The manager of a property in the Katherine region reported sudden

33 Field investigation with laboratory diagnostic testing.

34 Some investigations involved multiple submissions.

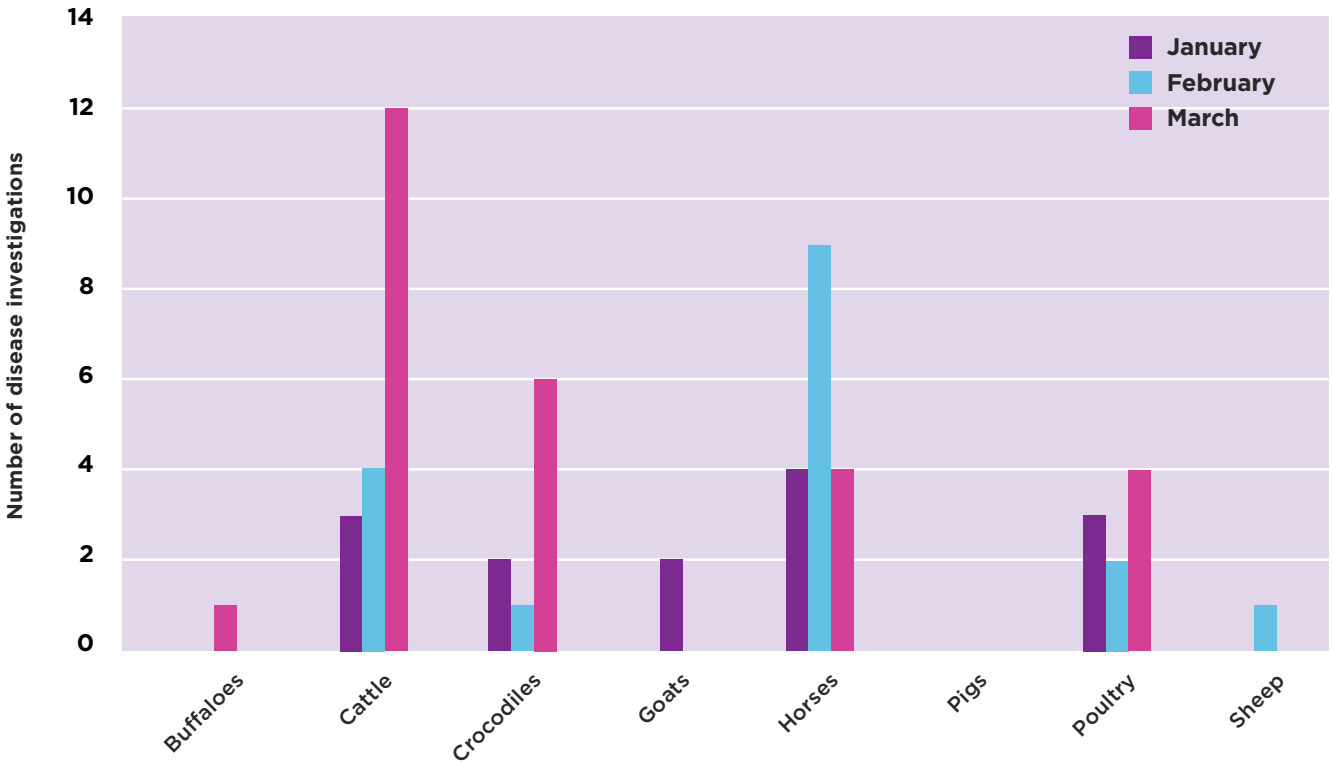


Figure 13 Number of field disease investigations in the Northern Territory to rule out emergency diseases or investigate suspect notifiable diseases, January to March 2017

death in 26 weaner cattle from a herd of 2000 over the space of a few weeks. The cattle had been weaned, processed and transported to the property in multiple lots from 6 to 2 weeks previously. They had access to weaner pellets, hay and unimproved pasture once they arrived at the property. Conditions had been particularly wet during the previous months.

The herd was in overall average condition, with some very young animals. Dead cattle were generally in poor condition and had been found under trees and in feed troughs. One heifer was observed circling and was then found laterally recumbent with a head tremor the next day. This heifer and an additional two steers, which were the weakest of the mob, were euthanased for necropsy. Gross necropsy revealed pale and ventrally consolidated lungs consistent in all three animals. The ruminal papillae in the heifer and one steer were smoother than would be expected. Other organs appeared grossly normal.

Histopathology of lung tissue samples revealed a mild subacute alveolitis in the heifer and regionally severe suppurative bronchopneumonia in the steers, with a mixed bacterial growth including *Pasteurella* sp., cultured from the steers. A nonsuppurative meningoencephalitis was identified in the one steer and heifer, with changes in the recumbent heifer being more severe. Haematology found a mild-to-moderate neutrophilia in all the animals, and clinical biochemistry showed a consistent mild degree of muscle damage. The heifer had a moderate faecal egg count (600 eggs/g). PCR testing excluded infection with

Stud cattle in poor condition

Recumbent weaner heifer infected with bovine herpesvirus 5

Kunjin virus, Murray Valley encephalitis virus, Chlamydiaecea and herpesvirus (using a generic PCR test). Bovine ephemeral fever was ruled out via PCR and viral neutralisation testing, and ELISA testing for bovine viral diarrhoea virus infection was negative. PCR testing of brain tissue specifically for bovine herpesvirus 1 and 5 was positive for bovine herpesvirus 5 in the heifer and one of the steers.

Bovine herpesvirus 5 is present in Australia and may cause nonsuppurative meningoencephalitis and neurological disease in young animals. The virus can establish latency and may be reactivated when infected cattle are stressed, when it is then excreted in nasal, ocular and genital secretions. Multiple stressors are likely to have contributed to the observed mortality of cattle in this case; early weaning, processing and transport of the large number of young cattle in a very wet season, concurrent worm burden, possible aspiration of the cattle tick treatment used prior to transport, sudden introduction of the weaners to the new post-weaning hard ration and a prolonged period of time spent in and through the cattle yards.

The cattle were turned out into a clean paddock for several weeks before being run through the yards again, and there have been no further losses reported.

Poultry mortalities on remote Northern Territory island

A report of sudden death in a backyard flock of chickens was investigated in a remote community on an island off the Northern Territory coastline. Over a 2-day period, 8 out of 12 birds showed signs of weakness and recumbency and then died. There had been no recent management changes, although a herbicide had been applied to the yard the week previously. The weather had been particularly wet and cyclonic. A recumbent hen was euthanased and its carcase frozen and transported to the Berrimah Veterinary Laboratories.

Necropsy of the hen found no evidence of infectious disease. Histological examination revealed evidence of a consolidated exudate within the air sac, likely incidental and from a previous transient, such as mild air sacculitis or serositis, with no active inflammation present. Avian influenza and Newcastle disease viruses were excluded by PCR testing of a combined cloacal and tracheal swab. A presumptive diagnosis of avian botulism was made on the basis of clinical history and lack of gross and histological evidence of other disease.

Cases of botulism in poultry, caused by consumption of maggots containing *Clostridium botulinum*, are seen annually during the wet season in the northern part of the Northern Territory. In this case, maggots were not found in the gastrointestinal tract of the bird on necropsy, however in subacute cases of poisoning maggots may already be digested. After questioning the owner, it was discovered that the chickens in this case were regularly fed leftover fish and meat. When decayed, these are common sources of *C. botulinum* toxin and maggots that concentrate the toxin. The owner was given recommendations to remove decaying food scraps from the birds and no further losses have been reported.

Queensland

Greg Williamson
Queensland Department of Agriculture and Fisheries

During the quarter in Queensland, 682 livestock disease investigations[35] were conducted to investigate suspect notifiable diseases or rule out emergency diseases.[36] The number of investigations by species of livestock is shown in Figure 14.

Field investigations were conducted by government veterinary or biosecurity officers (83) and private veterinary practitioners (599). Diagnostic testing was conducted at state veterinary diagnostic laboratories and CSIRO Australian Animal Health Laboratory.

Additional disease investigations were carried out on non-livestock terrestrial species (113) and aquatic animals (50).

The Biosecurity Sciences Laboratory also processed sample submissions to substantiate proof of disease freedom certifications (109), for accreditation programs (26), regulatory activities (30) and targeted surveillance (2076). The majority of the surveillance activities were aquatic (1961), for an ongoing response to white spot syndrome virus in prawns. In total there were 3086 animal health-related submissions to Biosecurity Sciences Laboratory during the quarter.

The following case reports are a selection of field investigations, chosen to highlight surveillance and diagnostic capacity. Reports chosen are not necessarily representative of the full range of livestock disease incidents during the quarter.

Malignant melanoma in an alpaca

In February 2017, on a small alpaca stud herd in Gympie, a 16-year-old roan male Huacaya died after an apparent 2-week illness. The owners had noted a drop in liveweight but had initially attributed this to overactivity and dominance behaviour. Veterinary assistance was sought after the alpaca did not respond to supplementary feeding. The initial investigation revealed an increase in liver

Figure 13 Heavily pigmented lung and incised heart of alpaca

35 Field investigations with laboratory diagnostic testing.

36 Emergency diseases are a subset of notifiable disease defined as diseases listed in the Emergency Animal Disease Response Agreement www.animalhealthaustralia.com.au/what-we-do/emergency-animal-disease/ead-response-agreement

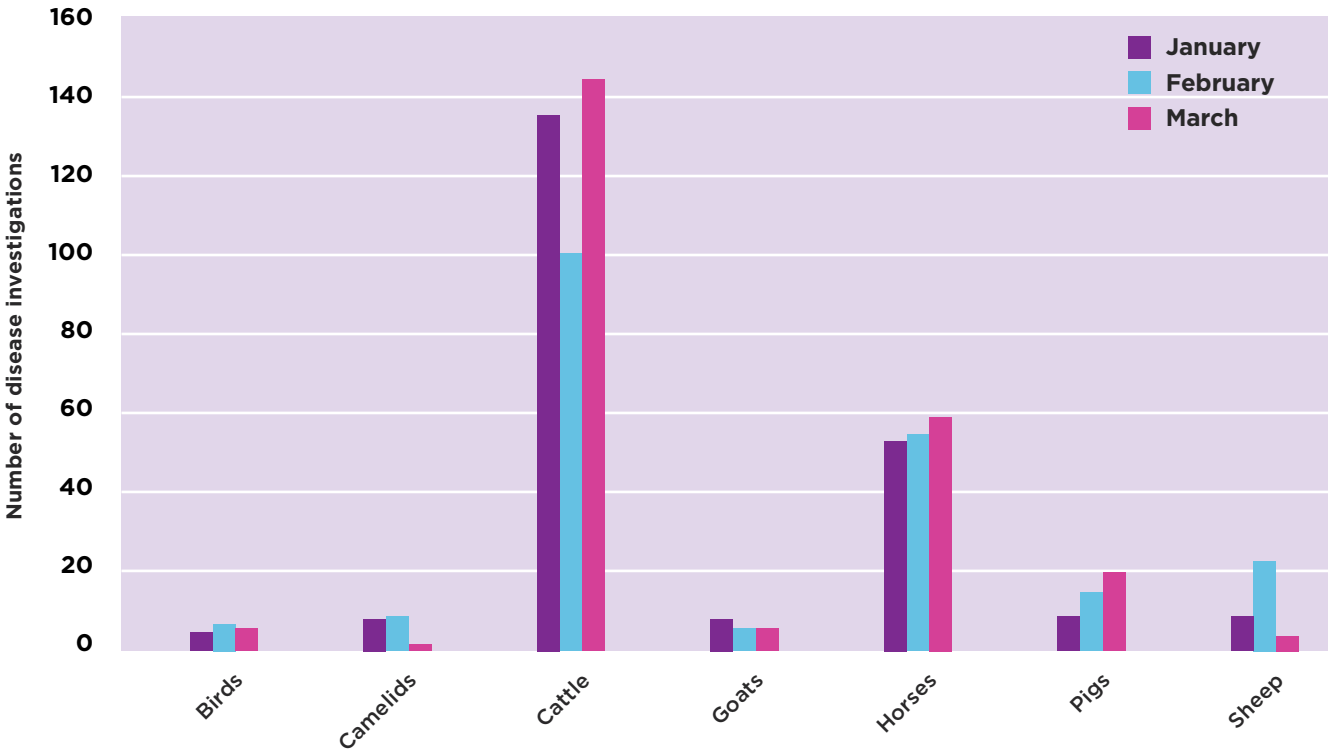


Figure 14 Number of terrestrial livestock disease investigations in Queensland, January to March 2017

enzymes and a course of antibiotics was prescribed.

The alpaca continued to lose weight and, after a further 2 weeks, clinical signs suddenly worsened. When re-examined, the animal was suffering from severe lethargy, inappetence, an inability to rise and convulsions. Increased body temperature and increased lung sounds in the absence of any crackles or wheezes led to a presumptive diagnosis of pyothorax with a grave prognosis. The alpaca died that night.

A necropsy revealed pleural and peritoneal effusions, with lungs, liver, spleen and lymph nodes throughout the body grossly and uniformly darkened (Figure 13). Small dark nodules were noted throughout the mesentery and on the serosal surfaces of the intestines (Figure 15). Nodules of malignant melanocytes within the parenchyma of lungs, liver and spleen were detected in histological sections, and nonspecific aerobic bacteria were cultured from a sample of the pleural effusion. A diagnosis of malignant melanoma was made on the basis of the pathology. Malignant melanoma has rarely been reported in alpacas.

Figure 15 Melanoma metastases on viscera of alpaca

South Australia

Celia Dickason
Biosecurity South Australia, Department of Primary Industries and Regions, South Australia

During the quarter in South Australia, 216 livestock disease investigations[37] were conducted to rule out emergency diseases[38] and investigate suspect notifiable diseases. The number of investigations by category of livestock is shown in Figure 16.

Subsidised field investigations were conducted by government veterinary or biosecurity officers (103) and private veterinary practitioners, who in 111 cases[39] submitted samples to the state diagnostic veterinary laboratory or CSIRO Australian Animal Health Laboratory for subsidised testing to exclude or confirm notifiable diseases. The state veterinary diagnostic laboratory, Gribbles VETLAB, also processed sample submissions requiring testing for export, accreditation programs and targeted surveillance.

Biosecurity SA, a division of Primary Industries and Regions South Australia, maintains close communication with rural private veterinary practitioners, who make a valuable contribution to surveillance by investigating potential incidents of notifiable diseases and significant disease events. Biosecurity SA has an Enhanced Disease Surveillance Program to promote disease incident investigations in South Australian livestock. In partnership with the National Significant Disease Investigation Program, the program funds laboratory submissions for suspect infectious diseases in livestock and subsidises contracted private veterinary practitioners for costs incurred when investigating unusual disease events. Biosecurity SA offers training and refresher courses in emergency animal disease detection and necropsy technique to practitioners, and provides ongoing technical support when required.

The following case reports are a selection of field investigations, chosen to reflect a range of livestock disease incidents during the quarter.

Lupinosis in pregnant sheep

Over a 1-week period in March 2017, approximately 45 out of 300 ewes died on a property on the Eyre Peninsula. The 3-year-old ewes were approximately 18 weeks pregnant. Affected animals had no flight response, exhibited hyperventilation with an apparent blindness, and were found dead either entangled in fences or in close proximity to troughs. The ewes had been moved onto lupin and bean stubble approximately 4 days prior to the onset of mortalities. Necropsy findings included jaundice with a yellow liver. Histology of tissues demonstrated severe, chronic active hepatic lipidosis and fibrosis, consistent with lupinosis, as well as severe diffuse renal lipidosis.

Lupinosis is caused by ingestion of lupin stubble colonised by the fungus *Diaporthe toxica*. This can result in acute or chronic liver toxicoses. Affected animals stop eating and stand apart from the group, and may lag behind the others when driven. They may have jaundiced membranes and skin, and signs of photosensitisation. Some animals die within 3 days of eating the contaminated lupins or stubble, while other animals will show loss of condition, weakness and neurological signs and death over a period of weeks.

All animals were removed from the infected paddock without any other treatment. Mortalities initially continued then waned over the next few days. Multiple rain events had occurred pre- and post-harvest, and leopard spotting was evident on stubble, consistent with *Diaporthe toxica* infection, which had most likely produced the mycotoxin. Over the previous 2 months, two other groups of sheep had suffered some mortalities while grazing the same lupin stubble. The residual nature of the toxin was explained to the producer, along with specific risk periods and management advice.

37 Subsidised field investigation with laboratory diagnostic testing.

38 Emergency diseases are a subset of notifiable disease defined as diseases listed in the Emergency Animal Disease Response Agreement www.animalhealthaustralia.com.au/what-we-do/emergency-animal-disease/ead-responseagreement

39 Some investigations involved multiple submissions.

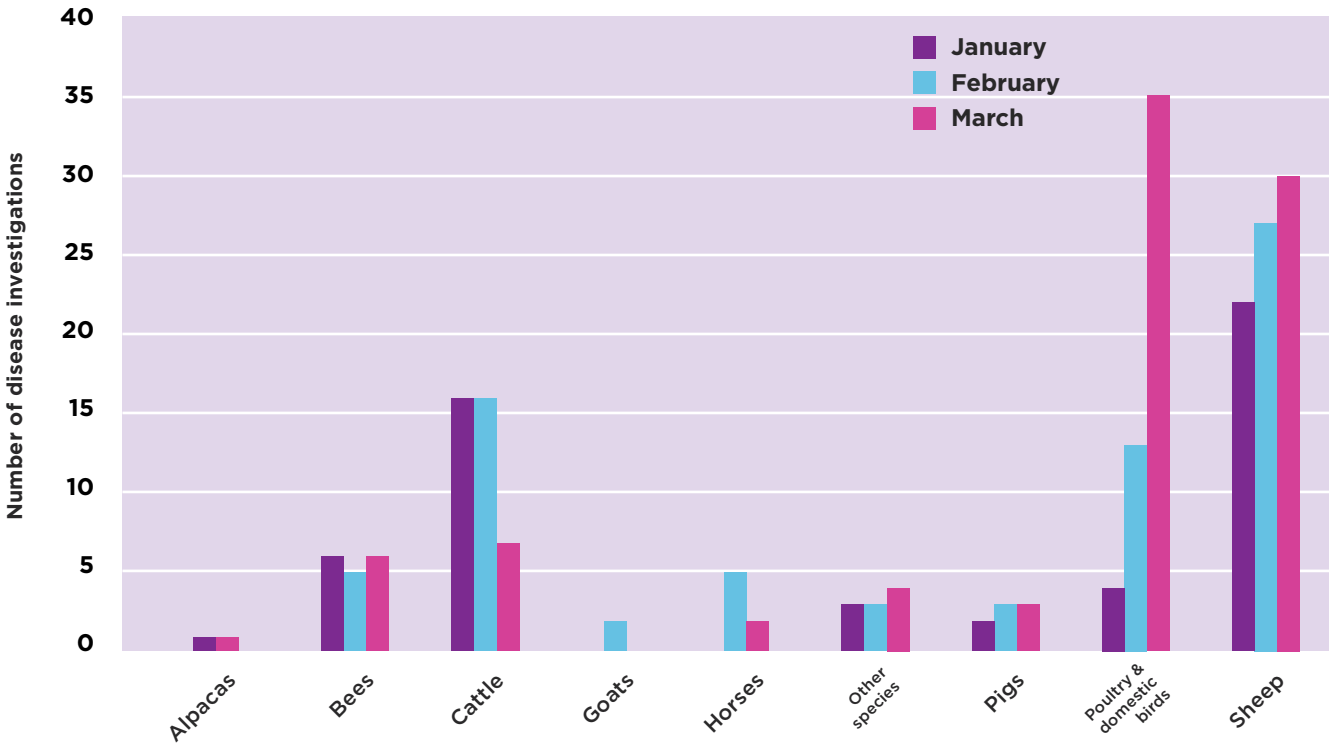


Figure 16 Number of disease investigations in South Australia, January to March 2017

Exotic neurological disease exclusion in pigs

In December, an outbreak of neurological disease was observed in 20 pigs older than 15 weeks, with seven mortalities and more than 500 pigs at risk, at a property in the Barossa Valley region. There had been no interruption in water supply, and only partial response to antibiotics and anti-inflammatories. Salt toxicity, *Streptococcus suis* infection and unknown viral or other bacterial diseases were considered as differential diagnoses.

A whole head and thoracic spinal cord were submitted for cultures and pathology, with no gross central nervous system lesions observed. Liver and lung samples submitted for culture revealed a heavy mixed growth of aerobic bacteria considered to be environmental contaminants, with no *Listeria* spp. or *Salmonella* spp. isolated. Brain cultures demonstrated a light growth of *Pasteurella multocida* sensitive to all antibiotics tested, but anaerobes, *Listeria* spp. and *Salmonella* spp. were not detected. Histopathology of brain and spinal cord showed evidence of a mild-to-moderate nonsuppurative meningoencephalitis and myelitis, with scattered perivascular cuffing and accompanying gliosis. No specific agent was identified microscopically but the pattern suggested a viral aetiology.

Fresh and paraffin-embedded brain samples were submitted to CSIRO Australian Animal Health Laboratory for exotic disease exclusion testing, including classical swine fever, Aujeszky's disease, Nipah virus, African swine fever, flavivirus (Japanese encephalitis virus serogroup) and porcine enterovirus, which were all negative. Results appear in the AHSQ Vol. 21 Issue 4 and in this issue. Testing was negative for Australian bat lyssavirus and Hendra virus. The causative agent was not identified.

Animals were isolated from other stock and administered antibiotics in water for 2 weeks. Neurological signs in surviving pigs resolved and no new deaths occurred.

Heavy intestinal parasitism in goats

South Australia experienced wetter-than-average winter and spring conditions in 2016, followed by increased reports of high faecal egg counts with heavy intestinal worm burdens in grazing animals.

In early February 2017, 10 deaths were reported in a herd of 60 mixed-age female Boer goats in the Clare Valley. The herd was routinely vaccinated with a biannual 3-in-1 clostridial vaccine, and treated in October with an unspecified anthelmintic. Affected animals were reported to exhibit weakness, depression and anorexia.

Haematology and biochemistry samples demonstrated mild anaemia and hypoproteinemia, and neutrophilia with mild electrolyte changes in only one animal.

Pooled faecal egg counts confirmed high levels of intestinal parasitism, with up to 2950 strongyle eggs per gram, moderate numbers of *Trichuris* sp. and high numbers of coccidian oocysts present. Necropsy revealed worms in the caecum and colon, as well as pulmonary consolidation and adhesions. Histopathology of multiple tissues showed a severe fibrinosuppurative bronchopneumonia, with bacterial colonies evident in lung tissue, as well as occasional lungworm larvae. In addition, large intestinal samples showed a diffuse chronic typhlocolitis, with some coccidian protozoa and intraluminal nematodes. Faecal strongyle PCR testing identified *Oesophagostomum* spp. as the predominant DNA amplicon (69%).

Pooled faecal bacterial cultures were negative for *Yersinia* sp. and *Campylobacter* sp. and positive for *Salmonella* sp., in one of two pooled samples. The *Salmonella* isolate was not typed. In the absence of vaginal discharge, abortion or stillbirth in this flock, a diagnosis of *Salmonella* Abortusovis was not considered a likely diagnosis. Coagulase-negative *Staphylococcus* was cultured from pleural fluid samples.

Environmental and husbandry stress factors, such as high strongyle intestinal parasitism, are likely to have played a role in disease incidence and severity, and predisposed affected animals to primary viral or mycoplasma respiratory pathogens, with a subsequent secondary bacterial respiratory infection that was fatal in some animals. The significance of *Salmonella* isolation was inconclusive. The producer was advised to treat all animals with an appropriate anthelmintic and to treat respiratory disease as it occurred with antibiotics.

Histophilus bronchopneumonia in calves

For the preceding 2 months, approximately one calf per week was dying on a property on the Fleurieu Peninsula, with 40 calves at risk. Most calves presented with anorexia and pneumonia, with or without scours, and death within 2 to 3 days. Salmonellosis and bovine viral diarrhoea virus type 1 (BVDV-1)[40] were considered as the main disease differentials.

In late January 2017, faecal samples were collected and a full necropsy was performed on the most recent calf death. Gross pathology and histopathology confirmed the presence of a severe cranioventral suppurative bronchopneumonia, most likely bacterial in origin. No gross intestinal lesions were observed although patchy crypt necrosis and formation of crypt abscesses was detected by histology in the small intestine associated with clusters of coccidial organisms.

Bovine herpes virus type 1 (BHV-1) was not detected on PCR testing of trachea and lung tissue but a heavy growth of *Histophilus somni* was isolated from lung tissue.

Faecal egg counts and faecal BVDV PCR tests were negative. Faecal cultures were negative for *Salmonella* sp., *Yersinia* sp., rotavirus, coronavirus and *Escherichia coli* K99 antigens. Faecal smears for *Cryptosporidium* were positive.

A diagnosis of *Histophilus somni* bronchopneumonia was confirmed. Virulence factors for *H. somni* are not fully characterised but infection and clinical disease likely require predisposing stress factors or primary viral infection of the respiratory tract. No specific predisposing causative factors were identified from this investigation (BVDV-1 and BHV-1 PCR tests negative).

Diarrhoea is a very common cause of morbidity and mortality in neonatal dairy calves and may be triggered by infectious or non-infectious aetiologies. The presence of *Cryptosporidium* on faecal smears was considered significant, with the absence of most other common enteric pathogens on faecal and intestinal samples. Coccidia were considered secondary to other disease stressors.

Animals were treated with an appropriate antibiotic, as well as the coccidiostat halofuginone to treat *Cryptosporidium*. The farmer was advised to institute calf feeder disinfection procedures and improved hygiene. No further calf mortalities occurred.

40 Only BVDV type 1 (BVDV-1) is present in Australia. The severe BVDV-2 form in Europe and North America has not been found in Australia.

Tasmania

Sue Martin
Tasmanian Department of Primary Industries, Parks, Water and Environment

During the quarter in Tasmania, 245 livestock disease investigations[41] were conducted to rule out emergency diseases or investigate suspect notifiable diseases. The number of investigations by category of livestock is shown in Figure 17. Field investigations were conducted by government veterinary or biosecurity officers (14) and private veterinary practitioners (231). All diagnostic testing was conducted at the state veterinary diagnostic laboratory or CSIRO Australian Animal Health Laboratory.

During the quarter the state veterinary diagnostic laboratory, Animal Health Laboratory, Launceston, processed 508 livestock sample submissions[42] to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications, and for accreditation programs and targeted surveillance.

During the quarter Department of Primary Industries, Parks, Water and Environment (DPIPWE) veterinary officers and private veterinary practitioners conducted 245 livestock field investigations to rule out emergency diseases and to provide assurance on the distribution and prevalence of notifiable and endemic diseases. The number of field investigations by category of livestock is shown in Figure 17.

Field investigations were conducted by government veterinary or biosecurity officers (14) and private veterinary practitioners (231). During this quarter one of these investigations was subsidised by the National Significant Disease Investigation (NSDI) Program. Private practitioners often liaise with veterinary officers from the DPIPWE in the event of unusual disease events. Full support for laboratory costs and additional funding under the NSDI Program is available for approved disease investigations where presenting signs may be consistent with events clinically consistent with national notifiable diseases or suspected to be a new or emerging disease. These investigations receive highest priority.

Diagnostic samples of field investigations were processed by the state veterinary diagnostic laboratory.

The following case reports are a selection of field investigations, chosen to highlight surveillance and diagnostic capacity. Reports chosen are not necessarily representative of the full range of livestock disease incidents during the quarter.

Porcine dermatitis and nephropathy syndrome

In January 2017 porcine dermatitis and nephropathy syndrome (PDNS) was diagnosed as the cause of skin lesions in a 3-month-old grower pig that presented with extensive patchy red cutaneous lesions and chronic weight loss. The pig was from a 700-sow herd in north-east Tasmania, which had a history of chronic ill-thrift in weaners and growers raised in ecoshelters.

The affected pig had dark red, irregular and slightly raised cutaneous patches (1 to 8 cm in diameter) and raised crusty and exudative lesions extending over the entire body, including the ears. It had superficial lymphadenopathy, particularly involving the inguinal, axillary and parotid lymph nodes.

Differential diagnosis for the skin lesions included disease associated with porcine circovirus 2 (PCV-2) (porcine dermatopathy, nephropathy syndrome), bacteraemia due to erysipelas or *Streptococcus suis* with intercurrent mite burden secondary to staphylococcal dermatitis and classical swine fever.

The affected pig was euthanased and submitted for necropsy.

41 Field investigation with laboratory diagnostic testing.

42 Some investigations involved multiple submissions.

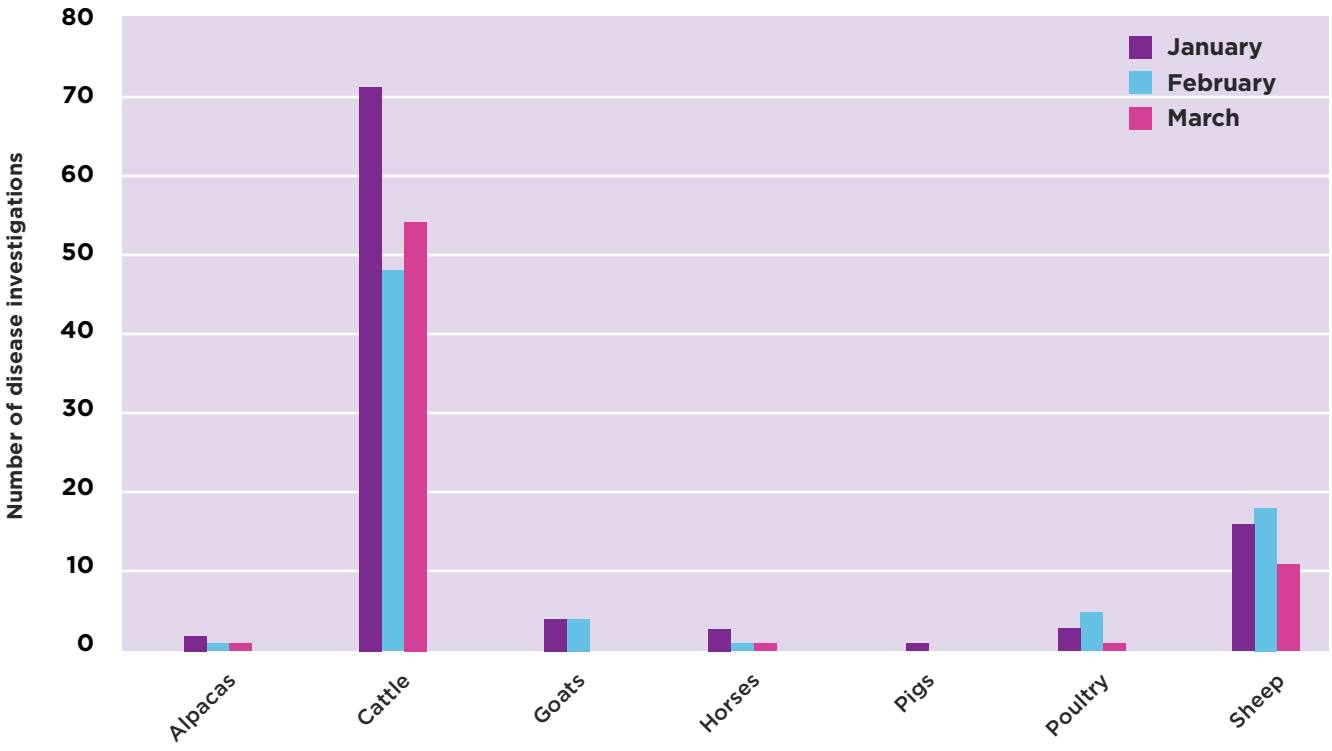


Figure 17 Number of field disease investigations in Tasmania to rule out emergency diseases or investigate suspect notifiable diseases, January to March 2017

Histologically the skin showed subacute dermatitis with vasculitis. The young pig was found to have interstitial glomerulonephritis, peribronchiolar lymphoid hyperplasia and interstitial pneumonia, characteristic of mycoplasma pneumonia. None of the necropsy findings were consistent with classical swine fever (e.g. necrosis of ileum or pharynx). Mucosal disease agar gel immunodiffusion (AGID) testing to exclude porcine pestivirus antibodies to classical swine fever was negative.

There was no significant bacterial growth on culture from samples of lymph node and liver. PCV-2 polymerase chain reaction (PCR) testing of lymph node sample was positive, consistent with the diagnosis of PDNS.

PDNS is a low morbidity but highly fatal disease of feeder pigs characterised by vascular dermatopathy, systemic necrotising vasculitis and glomerulonephritis. The disease can be highly variable in individual pigs. Usually there is no response to antibiotic therapy but antibiotics may be useful to control secondary infections that commonly occur.

Transmission of PCV-2 is not well understood but experimental studies suggest transmission is possible via aerosol or direct contact via oral and nasal routes. In this case, no other in-contact pigs developed the disease.

Environmental stressors and management factors, including recent mixing and sorting of pigs, suboptimal temperatures or ventilation and high stocking density, can affect the severity of the disease. Control measures include maintaining good biosecurity protocols and implementing management practices that help reduce environmental stress on the herd.

Victoria

Karen Moore
Victorian Department of Economic Development, Jobs, Transport & Resources

During the quarter in Victoria, 408 livestock disease investigations[43] were conducted to investigate suspect notifiable diseases or rule out emergency diseases.[44] The number of investigations by species of livestock is shown in Figure 18. Field investigations were conducted by government veterinary or biosecurity officers (108) and private veterinary practitioners (300). All diagnostic testing was conducted at state registered veterinary diagnostic laboratories or CSIRO Australian Animal Health Laboratory.

During the quarter the state veterinary diagnostic laboratory, Veterinary Diagnostics Services, Bundoora, processed 506 livestock sample submissions[45] to investigate suspect notifiable diseases or rule out emergency diseases. Another 323 sample submissions were processed to substantiate proof of disease freedom certifications, and for accreditation programs and targeted surveillance.

Across all species, nonspecific clinical patterns were most commonly reported, followed by signs associated with the gastrointestinal tract, the central nervous system and the respiratory tract. The diseases most commonly diagnosed by species were gastrointestinal diseases in cattle and sheep and respiratory disease in chickens. Anthrax was diagnosed on five sheep properties during the quarter. Cases of clinical disease where no definitive disease agent was identified were reviewed in the context of the surrounding circumstances, and exotic or emergency diseases were excluded where appropriate. Test results from exotic or emergency animal disease exclusion testing are routinely recorded as suspect emergency animal diseases (Table 19).

The following case reports are a selection of field investigations, chosen to highlight surveillance and diagnostic capacity. Reports chosen are not necessarily representative of the full range of livestock disease incidents during the quarter.

Upper alimentary ulcerative syndrome in calf — theileriosis excluded

In February 2017, a 14-week-old Friesian calf from a West Gippsland dairy herd died. The calf had been observed with scours and frothing at the mouth, was losing weight and appeared anaemic. It became progressively weaker over 1 week before dying. A second calf was unwell with similar symptoms of scouring, weight loss and anaemia. According to the producer, one or two more calves of a similar age had died with similar clinical signs over the preceding fortnight.

Necropsy examination of the dead calf revealed ulceration on the tongue, the inside mucosae of both lips, the gums and inside the oesophagus. Histological examination of submitted tissue samples confirmed widespread sublingual erosion and ulceration, with severe ulcerative oesophagitis. Tests for bovine herpesvirus 1 (BoHV-1), parapoxviruses (including orf, pseudocowpox and bovine popular stomatitis) and qPCR pan-pestivirus test for both bovine viral diarrhoea viruses BVDV-1 and BVDV-2[46] were all negative. In the absence of any detectable viral pathogens, the diagnosis of upper alimentary ulcerative syndrome (UAUS) in the dead calf was made. Tests to rule out theileriosis from fresh samples collected from the sick calf were negative. Agriculture Victoria is undertaking a project to identify risks factors associated with the development of UAUS.

Virulent footrot in sheep

A high country producer experienced severe lameness in 70 out of 400 two-year-old sheep

43 Field investigation with laboratory diagnostic testing.

44 Emergency diseases are a subset of notifiable disease defined as diseases listed in the Emergency Animal Disease Response Agreement www.animalhealthaustralia.com.au/what-we-do/emergency-animal-disease/ead-response-agreement

45 Some investigations involved multiple submissions.

46 Only bovine viral diarrhoea virus type 1 (BVDV-1) is present in Australia. The severe BVDV-2 form in Europe and North America has not been found in Australia.

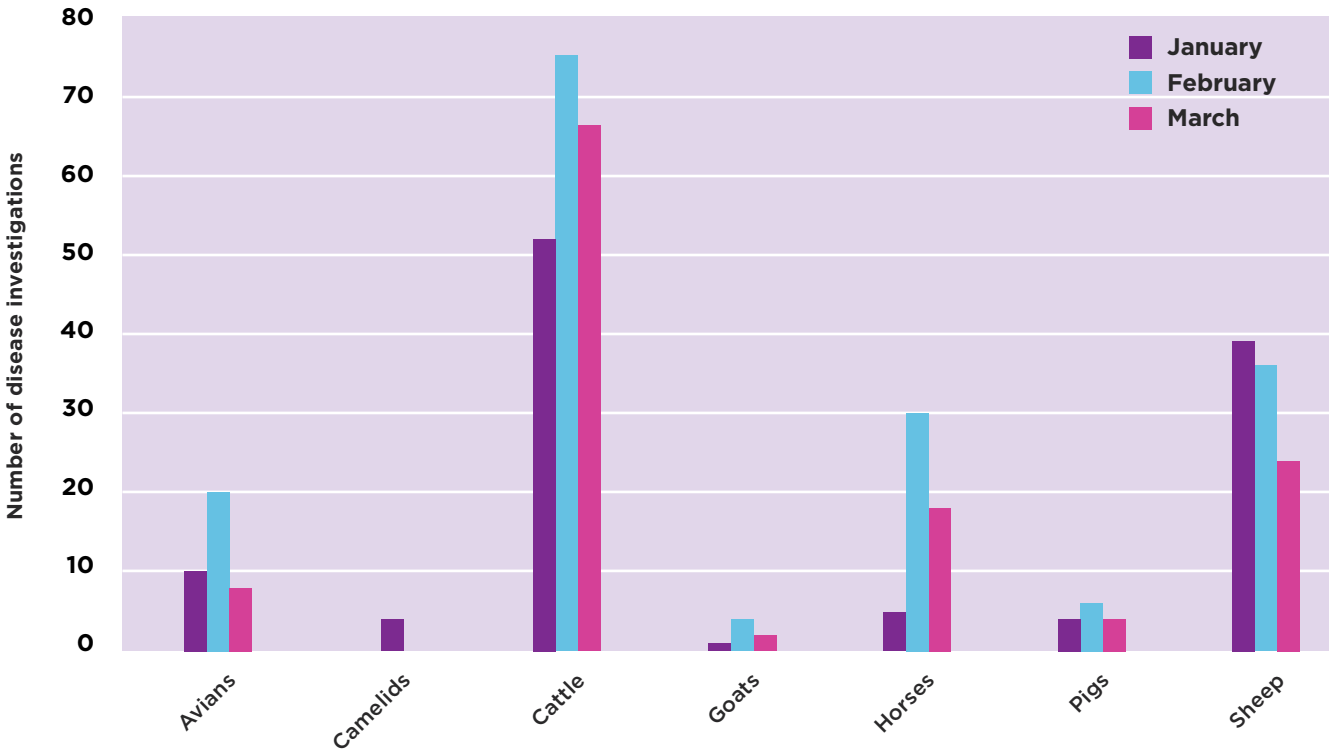


Figure 18 Number of field disease investigations to investigate suspect notifiable diseases or rule out emergency diseases, in Victoria, January to March 2017

grazing wet paddocks in East Gippsland in early January. Examination of the affected animals showed many had sloughed their hooves and others had severe under-running and interdigital dermatitis, with myiasis (flystrike) in some hooves.

Swabs were collected into Stuart's media for footrot culture and into buffer for polymerase chain reaction (PCR) testing. Bloods were taken to exclude bluetongue, given the severity of lesions. No abnormalities were detected during necropsy. An affected foot was submitted for histopathology. Culture, PCR testing and histopathology confirmed severe advanced ovine footrot with myiasis. Bluetongue was excluded by qPCR assay.

Severely affected sheep were euthanased. The producer elected to commence foot bathing the sheep to prevent further cases.

Hepatogenous copper poisoning in weaner lambs

In late January on a property north-east of Benalla, four weaner lambs died. The weaners had been progressing well and were weaned onto a lucerne paddock with a supplement ration of rich green clover hay and oats in preparation for sale. All weaners had received a second 5-in-1 vaccination booster and were drenched with a broad spectrum anthelminthic in late December.

An affected wether weaner with a body condition score of at least 3 of out 5 but with obvious jaundice to the skin, and sclera and oedema of ears and eyelids, was necropsied, revealing yellow body fat and a bronze-coloured liver. Abomasal and intestinal walls were slightly thickened but there was no visual evidence of internal helminths. Blood biochemistry showed an elevation of all hepatic enzymes, with bilirubin 105.0 µmol/L (normal range 0 to 6.8 µmol/L), aspartate aminotransferase (AST) 301 U/L (normal range 0 to 130 U/L) and a pre-renal azotaemia. Blood copper was 28.1 µmol/L (normal range 7.5 to 20.0 µmol/L). Histopathology showed moderate hepatic changes consistent with pyrrolizidine alkaloid exposure and moderate villus atrophy of submitted abomasal and intestinal sections.

Examination of the paddock revealed the presence of heliotrope (*Heliotropium europaeum*) with damage consistent with grazing by sheep.

An initial diagnosis of copper poisoning was made, and the weaners were moved to a second lucerne paddock with less heliotrope. There were no further deaths.

Hairy panic grass toxicity in sheep

In early February, hairy panic grass (*Panicum effusum*) toxicity caused the deaths of 11 Merino wethers aged 8 months, from a flock of 400 on a property near Violet Town in North East Victoria. The producer had recently purchased the lambs and placed them onto stubble paddocks with green regrowth after recent rain.

Affected lambs presented with photosensitisation, jaundice, tachycardia, pyrexia, tachypnoea, head pressing and rubbing. Necropsy of two lambs found severe jaundice and multifocal renal pallor. Haematology showed elevated liver enzymes, azotaemia and an extremely high bilirubin of 226.0 µmol/L (normal range 0 to 6.8 µmol/L). Histological examination of the liver found crystal damage consistent with saponin-induced hepatopathy.

The producer confirmed that the green regrowth was mainly hairy panic grass. The wethers were slowly removed from the paddock onto another paddock of ryegrass and appear to have made a full recovery. The possibility of permanent liver damage remains, which will lead to ongoing poor metabolic processing of food consumed in the affected sheep.

Western Australia

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During the quarter in Western Australia, 280 livestock disease investigations[47] were conducted to rule out emergency diseases or investigate suspect notifiable diseases.[48] The number of investigations by category of livestock is shown in Figure 19. Field investigations were conducted by government veterinary officers (74) and private veterinary practitioners (206). All diagnostic testing was conducted by the Department of Agriculture and Food Western Australia (DAFWA).

During the quarter DAFWA processed 583 livestock sample submissions,[49] which included submissions to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications, and for accreditation programs and targeted surveillance.

DAFWA, in partnership with private veterinarians and industry, works to protect Australia's reputation as a producer of safe wholesome livestock and livestock products.

Key aims of livestock disease surveillance are early detection of reportable diseases and demonstrating Australia's absence of, and capacity to detect, reportable diseases to support domestic and export market access for Australia's livestock and livestock products.

Given that reportable diseases may present similarly to diseases endemic in Australia, a key objective is prompt investigation of cases presenting with clinical signs consistent with a reportable disease. This has the dual purpose of assisting the affected producer to manage the disease event, by definitively diagnosing the endemic disease cause, as well as supporting the wider livestock sector by demonstrating freedom from reportable diseases, which is vital to maintaining Australia's favourable animal health status and market access.

The following case reports are a selection of field investigations, chosen to highlight surveillance and diagnostic capacity. Reports chosen are not necessarily representative of the full range of livestock disease incidents during the quarter.

Melioidosis in alpacas

In February 2017 DAFWA, in conjunction with Murdoch University and a private veterinarian, investigated a report from an Avon Valley producer of respiratory signs and death in alpacas.

The producer reported sudden death in alpacas to a private veterinarian, with progression from onset of clinical signs to mortality occurring in approximately 48 hours. The case fatality rate was 14% at the time of reporting. The producer advised that the alpacas had been vaccinated for clostridial diseases and that heavy rainfall had occurred 7 to 10 days prior.

An on-farm investigation by the private veterinarian revealed that affected alpacas, ranging from 3 to 10 years of age, presented with ataxia, abortion and respiratory difficulty, often with brown-to-bloody oronasal discharge. Given the history and clinical signs, an anthrax immunochromatographic test (ICT) was undertaken, which was negative.

Further investigation was undertaken by the private veterinarian, Murdoch University and DAFWA. Necropsy of five alpacas revealed multifocal pulmonary nodules and extensive pulmonary congestion and haemorrhage. Two of the alpacas had multifocal fibrinous deposits on the liver capsule.

Histological examination revealed the pulmonary parenchyma was diffusely consolidated, with the alveoli infiltrated by neutrophils and fibrinous exudate. Erythrocytes were present. The

47 Field investigation with laboratory diagnostic testing.

48 Emergency diseases are a subset of notifiable disease defined as diseases listed in the Emergency Animal Disease Response Agreement www.animalhealthaustralia.com.au/what-we-do/emergency-animal-disease/ead-responseagreement

49 Some investigations involved multiple submissions.

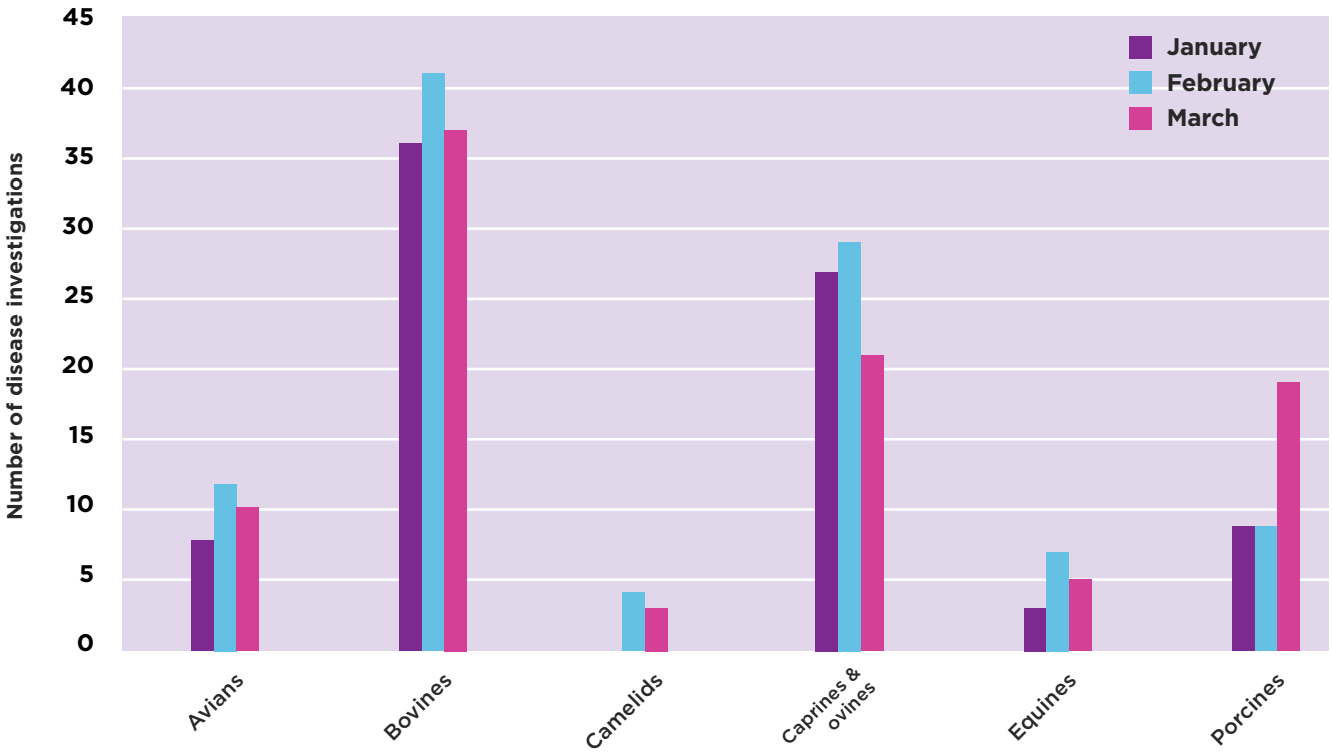

Figure 19 Number of field disease investigations in Western Australia to rule out emergency diseases or investigate suspect notifiable diseases

alveolar septa had a loss of cellular detail and evidence of necrosis, with some foci coalescing into pulmonary abscesses. Aggregates of small bacilli bacteria were present throughout the pulmonary tissue and with neutrophilic exudate diffuse within the bronchi and bronchioles.

Within the liver, multiple foci of hepatocellular necrosis and focal neutrophilic infiltration was evident throughout the parenchyma. No histopathological changes were seen in placental tissues. The cases of abortion were assumed to be a function of maternal pyrexia or septicaemia, rather than placentitis or foetal infection.

Bacterial culture of lung lesions detected *Burkholderia pseudomallei*, the aetiological agent for melioidosis. Taking into account the clinical, gross and histological findings and bacterial culture results, DAFWA diagnosed melioidosis as the cause of disease.

Melioidosis is endemic in tropical regions of Australia. Since 1966, it has been diagnosed in the Gidgegannup, Chittering and Toodyay areas of Western Australia on rare occasions. Strain typing of the *B. pseudomallei* isolated in this case confirmed it as the same strain previously detected in the area.

Recent heavy rains are thought to be the likely precipitating factor in this case. *B. pseudomallei* can survive in the soil for prolonged periods where there is optimal moisture, temperature and pH. During increased rainfall, the bacterium can move to the soil surface and be moved around in surface water, where it can infect animals and people.

DAFWA, in conjunction with the private veterinarian and Murdoch University, worked to provide disease management and biosecurity advice to the owner to minimise the impact of the disease on the alpaca herd and reduce the likelihood of a reoccurrence on this property. DAFWA provided regional private veterinarians with information on the disease occurrence, to increase the likelihood of detecting any other cases in livestock, of which none were reported.

Melioidosis is not a reportable disease in livestock. Whilst human infection does occur, there are no clearly documented cases of transmission of *B. pseudomallei* from animals to people, and the risk of zoonotic infection in this case is considered to be extremely low.

Most infections in people occur through exposure to soil and water that contains the bacterium. Given the potential environmental exposure of people to *B. pseudomallei* on the affected property, as well as exposure to infected animals, DAFWA and the Department of Health, Western Australia, liaised with the property owners and other at-risk groups to mitigate potential public health risk.

Facial oedema and respiratory signs in sheep — bluetongue excluded

In February 2017, a private veterinarian investigated a report from a producer in the Southern Agricultural region of facial swelling in mixed-sex Dohne hoggets.

Clinical examination by the private veterinarian revealed one dead and 40 affected sheep, from a flock of 700, with swollen faces and signs of respiratory difficulty. Clinical examination revealed no evidence of oral or coronary band lesions.

On necropsy, the main finding was an enlarged and jaundiced liver. The private veterinarian submitted a comprehensive sample set of blood, urine and fresh and fixed samples to DAFWA for testing.

Histological examination revealed a diffuse, moderate, acute necrotising hepatopathy, with intracellular acicular clefts within the liver and focally extensive, severe, acute necrotising and exudative dermatitis of the pinnae. Clinical biochemistry analysis revealed a markedly elevated gamma-glutamyl transferase and total and direct bilirubin, and moderately elevated glutamate dehydrogenase.

DAFWA diagnosed steroidal saponin toxicosis based on the clinical examination, biochemistry results and histopathology, confirming the presence of a hepatopathy. The detection of acicular clefts is indicative of steroidal saponin toxicosis.

Steroidal saponins are found in many plants, including *Panicum* sp., which includes French millet (*Panicum miliaceum*). The affected sheep had a history of grazing French millet, which was determined to be a potential cause of the clinical presentation. DAFWA provided the producer with advice on the use of feeds known to contain steroidal saponins. No further cases have been reported.

DAFWA undertook testing for bluetongue disease, which was negative on PCR testing.

Wildlife surveillance — tularaemia exclusions

Given the importance of the wildlife–livestock interface in disease ecology, as well as the importance of wildlife to environmental biosecurity, disease surveillance in wildlife is an important component of the surveillance system. In the last quarter, DAFWA tested for and excluded tularaemia as the cause of disease in three cases where animals showed indicative clinical signs. Included is an overview of one such case.

Neurological signs in ringtail possum

In January 2017, a private veterinarian investigated a report from a wildlife centre in the South West Agricultural region of a ringtail possum showing neurological signs. The history included recent inappetence and lethargy, and clinical signs deteriorated such that euthanasia was required.

Histological examination revealed multifocal areas of neutrophilic infiltration within the liver, varying from small foci to entire lobule infiltration. Mild and mostly peri-portal cytoplasmic vacuolation of hepatocytes was noted. Within the spleen, depletion of lymphocytes in both red and white pulp was evident.

The acute inflammatory changes in the liver and the depletion of lymphocytes in the spleen were suggestive of a bacterial infection, with septicaemia determined the most likely diagnosis. Whilst no organism was cultured, CSIRO Australian Animal Health Laboratory undertook PCR testing for *Francisella tularensis*, the causative organism for tularaemia, which was negative. No further cases were reported by the wildlife centre.

Given the potential for tularaemia to affect a number of species and its zoonotic potential, testing for tularaemia where there are suggestive clinical signs is important to safeguarding animal and public health.

Quarterly Statistics

Endemic disease monitoring
Laboratory testing
Surveillance activities

Endemic disease monitoring

Johne's disease

In Australia, Johne's disease occurs primarily in dairy cattle and sheep and to a lesser extent in beef cattle, camelids, deer and goats. Infection in sheep occurs to varying extents across the sheep-producing regions of southern Australia.

Investigations for Johne's disease in alpacas, cattle, deer, goats and sheep are reported in Table 19. There is also reporting of sheep flocks infected with Johne's disease through quarterly reporting of the National Sheep Health Monitoring Project (NSHMP) and the number of property identification codes (PICs) identified as having one or more infected animals. Sampling is from participating abattoirs and data is only for animals older than 2 years sourced directly from a property. Table 5 shows the number of PICs inspected and found with one or more infected animals.

Table 5 Summary of National Sheep Health Monitoring Project (NSHMP) inspected and infected line results, 1 January to 31 March 2017

State	Number of animals inspected	Number of PICs inspected	Number of PICs infected	Percentage of PICs infected
NSW	2,165	11	0	0.0
NT	0	0	0	0.0
Qld	0	0	0	0.0
SA	85,156	416	4	1.0
Tas.	21,080	82	1	1.2
Vic.	21,286	109	5	4.6
WA	0	0	0	0.0
Aus.	**129,687**	**618**	**10**	**1.6**

PIC = property identification code

Approaches based on risk assessment and management have been developed to control Johne's disease in all affected species. Market assurance programs (MAPs) are in operation for alpacas, goats and sheep; the numbers of herds or flocks that have reached a status of Monitored Negative 1 or higher are shown in Table 6. For status definition, see the current species MAP manual.[50] Lists of alpaca, cattle and goat herds and sheep flocks assessed in the MAPs are available on the Endemic Disease Information System website.[51] Herd or flock testing is undertaken by a MAP-approved veterinarian. The MAP for cattle ceased on 1 November 2016, with herds moving to industry-specific (beef or dairy) assurance scores. These risk profiling tools have different levels of biosecurity and testing, with higher levels requiring veterinary supervision. Information about components of the National Johne's Disease Project can be obtained from state coordinators and Animal Health Australia's Johne's disease coordinator, Rob Barwell (tel. 02 6203 3947).

Table 6 Herds or flocks[a] with a Market Assurance Program status of at least Monitored Negative 1, 1 October 2016 to 31 March 2017

Quarter	Alpacas	Goats	Sheep	Total
Oct–Dec 2016	17	23	382	747
Jan–Mar 2017				
NSW	7	6	148	161
Qld	0	5	1	6
SA	7	8	161	176
Tas.	0	1	13	14
Vic.	1	3	43	47
WA	0	0	4	4
Aus.	**15**	**23**	**370**	**408**

a There are no herds or flocks in Northern Territory in the MAPs.

50 www.animalhealthaustralia.com.au/maps

51 edis.animalhealthaustralia.com.au/public.php?page=mapsearch&aha_program=3

Ovine contagious epididymitis

Contagious epididymitis, caused by *Brucella ovis*, is present in commercial sheep flocks at a low level that varies around the country. Voluntary accreditation programs (usually in stud flocks) for ovine contagious epididymitis freedom operate in all states. Table 7 shows the number of accredited flocks at the end of the quarter.

Table 7 Ovine contagious epididymitis accredited-free flocks, 1 January 2016 to 31 March 2017

State	Jan–Mar 2016	Apr–Jun 2016	Jul–Sep 2016	Oct–Dec 2016	Jan–Mar 2017
NSW	872	861	861	861	851
Qld	79	73	72	72	74
SA	530	530	539	539	533
Tas.	63	71	56	59	62
Vic.	445	457	436	436	423
WA	184	184	184	180	168
Aus.	**2,173**	**2,176**	**2,148**	**2,147**	**2,111**

a There are no herds or flocks in Northern Territory in the MAPs. Herds or flocks in Free or Protected zones have an equivalent status of Monitored Negative 1 or better because of the zone status.

Laboratory testing

Serological testing

Table 8 summarises the results of serological testing for two equine viruses on samples submitted to state and territory animal health laboratories during the quarter, including many submissions for export certification. Positive serological test results are not an indication of the presence of clinical disease.

Table 8 Results of serological testing for two equine viruses, 1 January 2016 to 31 March 2017

Quarter	No. of tests (equine infectious anaemia)	Positive (equine infectious anaemia)	No. of tests (equine viral arteritis)	Positive (equine viral arteritis)
Jan–Mar 2016	629	0	603	2
Apr–Jun 2016	825	0	943	4
Jul–Sep 2016	473	0	446	2
Oct–Dec 2016	1,302	16	547	0
Jan–Mar 2017				
NSW	516	0	482	1
NT	0	0	0	0
Qld	35	0	2	0
SA	1	0	0	0
Tas.	0	0	0	0
Vic.	202	0	164	0
WA	4	0	4	0
Aus.	**758**	**0**	**652**	**1**

Table 9 summarises the results of laboratory testing for equine herpesvirus 1 on samples submitted to state and territory animal health laboratories during the quarter.

Table 9 Results of testing for equine herpesvirus 1 (EHV-1), at 31 March 2017

Syndrome	EHV-1 suspected but not confirmed	Negative	Positive	Total
Abortion	0	8	1	9
Neurological	0	14	0	14
Other	0	6	1	7
Total	**0**	**28**	**2**	**30**

Table 10 summarises the results of serological testing for three arboviruses on samples submitted to state and territory animal health laboratories for the National Arbovirus Monitoring Program (NAMP).[52] Positive serological test results are not an indication of the presence of clinical disease.

Table 10 Results of serological testing for three arboviruses, 1 January 2016 to 31 March 2017

Quarter	No. of tests (Akabane)	Positive (Akabane)	No. of tests (BEF)	Positive (BEF)	No. of tests (BTV)	Positive (BTV)
Jan–Mar 2016	217	0	789	34	1,403	71
Apr–Jun 2016	548	66	951	35	1,513	91
Jul–Sep 2016	454	28	757	39	1,021	32
Oct–Dec 2016	197	3	577	10	888	57
Jan–Mar 2017	341	37	938	56	1,403	111

BEF = bovine ephemeral fever virus; BTV = bluetongue virus

52 namp.animalhealthaustralia.com.au

Surveillance activities

Bovine brucellosis

Australia declared freedom from bovine brucellosis (caused by *Brucella abortus*) in 1989.[53] Surveillance is maintained through abortion investigations and additional testing of cattle for export or other reasons. Table 11 shows 129 bovine abortion investigations and 1365 investigations for other reasons were performed during the quarter; all were negative for bovine brucellosis.

Table 11 Bovine brucellosis testing, 1 January 2016 to 31 March 2017

Quarter	No. of tests (abortion)	Positive (abortion)	No. of tests (other reasons)[a]	Positive (other reasons)
Jan–Mar 2016	202	0	704	0
Apr–Jun 2016	132	0	376	0
Jul–Sep 2016	121	0	316	0
Oct–Dec 2015	33	0	147	0
Jan–Mar 2017				
NSW	0	0	1,263	0
NT	0	0	0	0
Qld	47	0	31	0
SA	2	0	2	0
Tas.	9	0	0	0
Vic.	29	0	18	0
WA	50	0	53	0
Aus.	**137**	**0**	**1,367**	**0**

a A proportion of this testing information is derived from pre-export testing of cattle destined for live export markets where the importing country requires testing. The total number of tests each quarter may therefore vary, depending on total cattle exports to particular markets.

53 www.agriculture.gov.au/SiteCollectionDocuments/animal-plant/animal-health/pet-food-safety/brucella-abortus-colour.doc

National Transmissible Spongiform Encephalopathies Surveillance Program

The National Transmissible Spongiform Encephalopathies Surveillance Program (NTSESP) is an integrated national program jointly funded by industry and government to demonstrate Australia's ongoing freedom from bovine spongiform encephalopathy (BSE) and classical scrapie, and to provide early detection of these diseases should they occur. The program, based on the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code*,[54] involves testing of samples from cattle and sheep with clinical signs consistent with BSE or scrapie respectively, as well as from fallen and casualty slaughter cattle. Points are assigned to cattle samples according to the animal's age and subpopulation category (i.e. the likelihood of detecting BSE). Australia's target is to achieve a minimum of 150,000 points over a rolling 7-year period. Table 12 shows the number of animals sampled for BSE and scrapie and the points tally for cattle in the NTSESP[55] during the past 12 months. All samples tested were negative.

Table 12 Samples tested for transmissible spongiform encephalopathies (TSEs), 1 April 2016 to 31 March 2017

State	No. examined (cattle)	Points (cattle)	Positive (cattle)	No. examined (sheep)	Positive (sheep)
NSW	294	42,321.8	0	172	0
NT	13	5,530.7	0	0	0
Qld	188	59,969.1	0	38	0
SA	29	13,028.6	0	43	0
Tas.	22	5,545.8	0	9	0
Vic.	167	39,652.0	0	94	0
WA	37	17,550.0	0	106	0
Aus.	**750**	**183,598.0**	**0**	**462**	**0**

Avian influenza

Australia is currently free from highly pathogenic avian influenza (AI). A number of low pathogenic subtypes of AI have been found in wild birds . Please consult the Wildlife Health Australia report in this publication for information on AI in wild birds. During the quarter, 624 birds from 173 laboratory submissions were tested for AI (excluding surveillance reported in the Wildlife Health Australia and Northern Australia Quarantine Strategy reports); no positive strains were detected (Table 13). Tests included competitive ELISA (enzyme-linked immunosorbent assay), haemagglutination inhibition, agar gel immunodiffusion (AGID), reverse-transcriptase polymerase chain reaction (PCR) and virus isolation.

Table 13 Results of testing for avian influenza virus in poultry, 1 January to 31 March 2017[a]

H5 positive	H7 positive	Positive for a non-H5, non-H7 strain
0	0	0

a Excludes surveillance reported in the Wildlife Health Australia and Northern Australia Quarantine Strategy reports and testing conducted for import purposes.

54 OIE (2014). Bovine spongiform encephalopathy, In: Terrestrial Animal Health Code, World Organisation for Animal Health, Paris, www.oie.int/index php?id=169&L=0&htmfile=chapitre_bse.htm

55 www.animalhealthaustralia.com.au/programs/biosecurity/tse-freedomassurance-program

Newcastle disease

Australia is currently free from virulent Newcastle disease or exotic Newcastle disease (caused by avian paramyxovirus serotype 1) even though precursor and endemic avirulent viruses are present in Australia. Vaccination against virulent Newcastle disease using a combination of live lentogenic virus (V4) and a killed vaccine is required in commercial chicken flocks[56] in all Australian jurisdictions. Vaccination exceptions for broilers apply in Tasmania, Western Australia, Queensland and South Australia. During the quarter, 852 birds from 187 laboratory submissions were tested for Newcastle disease (Table 14). Please consult the Wildlife Health Australia report in this publication for information on avian paramyxovirus in wild birds.

Table 14 Results of testing for Newcastle disease (ND) testing in poultry, 1 January to 31 March 2017[a]

Virulent strain of ND virus positive	Peats Ridge strain of ND virus positive	Lentogenic V4 or V4-like strain of ND virus positive	Other paramyxovirus positive
0	0	8	2

a Excludes testing for import purposes.

Salmonella surveillance

The National Enteric Pathogen Surveillance Scheme (NEPSS) is operated and maintained on behalf of the Australian Government and state and territory governments by the Microbiological Diagnostic Unit at the University of Melbourne. Data on isolates of *Salmonella* spp. and other pathogens are submitted to NEPSS from participating laboratories around Australia. Annual reports of both human and nonhuman isolates are available on request and detailed data searches are provided on request to NEPSS. Table 15 summarises *Salmonella* spp. isolations from animals reported to NEPSS.

Table 15 Salmonella notifications reported to the National Enteric Pathogen Surveillance Scheme (NEPSS), 1 January to 31 March 2017

Salmonella serovar	Birds[a]	Cats	Cattle	Dogs	Horses	Pigs	Sheep	Other	Total
Bovismorbificans	0	0	5	0	0	1	0	0	6
Dublin	0	0	1	0	0	0	0	0	1
Infantis	0	0	1	0	0	0	0	0	1
Typhimurium	2	9	13	9	3	18	3	0	57
Other	1	3	2	4	2	3	0	4	19
Total	**3**	**12**	**22**	**13**	**5**	**22**	**3**	**4**	**84**

a Includes both poultry and wild birds.

56 'Commercial chicken flocks' are defined in state and territory legislation.

Northern Australia Quarantine Strategy

In recognition of the unique biosecurity risks associated with Australia's extensive and sparsely populated northern coastline, the Australian Government Department of Agriculture and Water Resources conducts an animal disease surveillance program as an integral component of its Northern Australia Quarantine Strategy (NAQS). This surveillance program aims to provide early detection of exotic and emerging pests and diseases of significance to agriculture, public health and the environment. Information is derived from the use of sentinel animals, structured surveys, vector trapping and community reporting projects. In addition, NAQS contributes surveillance data to the National Arbovirus Monitoring Program (NAMP) and the electronic Wildlife Health Information System (eWHIS). Table 16 summarises NAQS animal testing for specific target diseases in Australia during the past five quarters.

Table 16 Disease testing and pest surveillance under the Northern Australia Quarantine Strategy (NAQS), 1 January 2016 to 31 March 2017

Target disease	Jan–Mar 2016		Apr–Jun 2016		Jul–Sep 2016		Oct–Dec 2016		Jan–Mar 2017	
	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive
Aujeszky's disease[a]	45	0	146	0	196	0	189	0	0	0
Australian bat lyssavirus	0	0	0	0	0	0	0	0	1	0
Avian influenza[a]	0	0	103	0	0	0	0	0	62	0
Classical swine fever	58	0	206	0	196	0	189	0	0	0
Japanese encephalitis	36	0	59	1[b]	0	0	45	0	50	0
Surra (*Trypanosoma evansi*)	16	0	199	0	244	0	207	0	0	0

a Excludes testing in wild birds.

b A single pig from Moa Island, Torres Strait, tested positive to Japanese encephalitis (JE) on ELISA test for antibodies. Results from follow-up testing with Flavivirus group plaque reduction neutralisation test were consistent with an antibody response following exposure to JE virus (i.e. antibody titres for JE virus were four-fold higher than titres for Murray Valley encephalitis and Kunjin viruses). No clinical signs consistent with JE were observed in this pig (or other animals) sampled during this survey. JE virus is endemic in Papua New Guinea and is known to circulate in Torres Strait on a seasonal basis. Surveillance for JE conducted by both NAQS and Queensland Health has found no evidence of circulation of JE on the mainland this year. Queensland Health was notified of this finding and they have since conducted follow-up investigations and awareness campaigns in Torres Strait as a public health measure.

Screw-Worm Fly Surveillance and Preparedness Program

The Old World screw-worm fly (OWS) and New World screw-worm fly (NWS), *Chrysomya bezziana* and *Cochliomyia hominivorax*, respectively, are exotic to Australia and suspicion of infestation in animals is notifiable under state and territory animal health legislation.[57] The OWS is a significant production disease of livestock throughout its range and is considered a greater threat to Australian livestock industries than NWS due to the proximity of its distribution to Australia (potential entry through the Torres Strait) and traffic of livestock export vessels returning from Asia to Australian ports. Surveillance is conducted by targeted fly trapping and livestock myiasis monitoring in addition to unplanned investigations of myiasis (reported in 'National notifiable animal disease investigations' and Table 19). Fly trapping is conducted at locations suitable for local OWS establishment following a potential incursion; in areas neighbouring livestock export ports and the Northern Peninsula Area (NPA) of Queensland. Table 17 summarises fly trapping events over the past year. No screw-worm flies were detected. Further information on the screw-worm fly program is available on the Animal Health Australia website.[58]

Table 17 Summary of fly-trapping events conducted, 1 April 2016 to 31 March 2017[a]

Risk entry pathway	Conducted by	Apr–Jun 2016	Jul–Sep 2016	Oct–Dec 2016	Jan-Mar 2017
Torres Strait	NAQS	30	15	15	0
Livestock export ports	NT, Qld and WA governments	71	52	61	56

NAQS = Northern Australia Quarantine Strategy
a Excludes traps with identification results pending.

Public health

The National Notifiable Diseases Surveillance System (NNDSS) coordinates the national surveillance of more than 50 communicable diseases or disease groups. Unit records of disease notifications made to the state or territory health authority, under the provisions of the public health legislation in their jurisdiction, are supplied daily to the Office of Health Protection, Australian Government Department of Health. The data are published weekly on the NNDSS website[59] and quarterly in the journal Communicable Diseases Intelligence and are replicated in *Animal Health Surveillance Quarterly* (Table 18) for five important zoonoses.

Table 18 National notifications of five zoonotic infections in humans, 1 January 2016 to 31 March 2017

Quarter	Brucellosis[a]	Chlamydia[b]	Leptospirosis	Listeriosis	Q fever
Jan–Mar 2016	2	2	47	27	117
Apr–Jun 2016	3	1	36	23	102
Jul–Sep 2016	6	5	19	13	121
Oct–Dec 2016	6	9	26	21	132
Jan–Mar 2017					
ACT	0	0	0	2	0
NSW	0	0	5	4	49
NT	0	0	9	0	0
Qld	2	0	40	5	66
SA	0	1	0	0	3
Tas.	0	0	0	1	0
Vic.	0	0	1	9	2
WA	0	1	0	1	4
Aus.	**2**	**2**	**55**	**22**	**124**

a Bovine brucellosis (*Brucella abortus*) was eradicated from the Australian cattle herd in 1989 and is presently considered an exotic animal disease in Australia. Caprine and ovine brucellosis (caused by *B. melitensis*) has never been reported in Australian sheep or goats. Swine brucellosis (caused by *B. suis*) is prevalent in small areas of northern Australia and northern New South Wales where it occurs in feral pigs, with human cases predominantly seen in recreational feral pig hunters.
b Also known as 'psittacosis' or 'ornithosis'.

57 Australian Government Department of Agriculture and Water Resources National List of Notifiable Animal Diseases www.agriculture.gov.au/pests-diseases-weeds/animal/notifiable (updated November 2015; cited 10 November 2016).

58 www.animalhealthaustralia.com.au/what-we-do/disease-surveillance/screw-worm-fly

59 www9.health.gov.au/cda/source/cda-index.cfm

National notifiable animal disease investigations

During the quarter, 855 national notifiable animal disease investigations[60] were conducted into suspect disease events. National notifiable animal diseases include a subset of emergency diseases.[61] Table 19 lists investigations conducted by disease finding confirmed. Note that more than one disease may be investigated for a single disease event (an outbreak of morbidity or mortality). In addition, a single investigation may involve more than one animal.

Details about selected investigations are provided in the 'State and territory reports' section of this publication and are available by contacting the relevant state or territory NAHIS program coordinator (details on last page).

Information regarding Australia's emergency preparedness and outbreak response management is available from the Australian Government Department of Agriculture and Water Resources.[62]

Table 19 Investigations for national notifiable animal diseases, 1 January to 31 March 2017

Disease	Species	State	Month	Response code[a]	Finding
African swine fever	Pig	SA	Mar	3	Negative
	Pig	SA	Jan	3	Negative
	Pig	Vic.	Feb	3	Negative
Australian bat lyssavirus[b]	Camel	WA	Mar	3	Negative
	Cat	Qld	Jan	2	Negative
	Dog	Vic.	Jan	3	Negative
	Horse	Qld	Feb	2	Negative (3 unrelated investigations)
	Horse	Qld	Jan	2	Negative (2 unrelated investigations)
	Horse	Qld	Mar	2	Negative
	Horse	SA	Feb	3	Negative
Babesiosis in tick-free areas	Cattle	WA	Feb	2	Negative (2 unrelated investigations)
	Cattle	WA	Jan	2	Negative
	Cattle	WA	Mar	2	Negative
Bluetongue — clinical disease	Cattle	Vic.	Mar	2	Negative
	Sheep	NSW	Feb	2	Negative
	Sheep	NSW	Mar	2	Negative (3 unrelated investigations)
	Sheep	SA	Jan	2	Negative
	Sheep	Tas.	Jan	2	Negative
	Sheep	Tas.	Mar	2	Negative
	Sheep	Vic.	Feb	2	Negative (5 unrelated investigations)
	Sheep	Vic.	Jan	2	Negative (3 unrelated investigations)
	Sheep	Vic.	Mar	2	Negative
	Sheep	WA	Feb	2	Negative (3 unrelated investigations)
	Sheep	WA	Jan	2	Negative
Brucella abortus (excl. cattle)	Horse	WA	Feb	2	Negative
	Pig	Vic	Mar	2	Negative
	Sheep	WA	Feb	2	Negative

Cont

60 National List of Notifiable Animal Diseases at www.agriculture.gov.au/pests-diseases-weeds/animal/notifiable

61 Emergency Animal Disease Response Agreement, Schedule 3 at www.animalhealthaustralia.com.au/what-we-do/emergency-animal-disease/ead-response-agreement

62 www.agriculture.gov.au/animal/health/livestock-movement-australia

Disease	Species	State	Month	Response code[a]	Finding
Brucella melitensis	Sheep	WA	Feb	2	Negative
Brucella suis	Dog	NSW	Feb	2	Negative (16 unrelated investigations)
	Dog	NSW	Feb	2	Positive
	Dog	NSW	Jan	2	Negative (9 unrelated investigations)
	Dog	NSW	Jan	2	Positive (3 unrelated investigations)
	Dog	NSW	Mar	2	Negative (19 unrelated investigations)
	Dog	NSW	Mar	2	Positive
	Dog	Qld	Feb	2	Negative (2 related investigations)
	Dog	Qld	Feb	2	Positive (2 related investigations)
	Dog	Qld	Feb	2	Negative (2 unrelated investigations)
	Dog	Qld	Jan	2	Negative (3 unrelated investigations)
	Dog	Qld	Mar	2	Negative (2 related investigations)
	Dog	Qld	Mar	2	Positive (2 related investigations)
	Dog	Qld	Mar	2	Negative (3 unrelated investigations)
	Dog	SA	Feb	3	Negative
	Dog	SA	Mar	3	Negative
	Pig	Qld	Mar	2	Negative
Equine encephalomyelitis (Eastern, Western and Venezuelan)	Horse	SA	Mar	3	Negative (2 unrelated investigations)
	Horse	WA	Feb	3	Negative
	Horse	WA	Mar	3	Negative (3 unrelated investigations)
Equine influenza	Horse	Qld	Mar	2	Negative
	Horse	WA	Feb	2	Negative
Equine piroplasmosis (*Babesia equi*, *Babesia caballi* and *Theileria equi*)	Horse	NSW	Mar	2	Negative
Foot-and-mouth disease	Cattle	NSW	Jan	3	Negative (3 unrelated investigations)
	Cattle	NT	Jan	3	Negative
	Cattle	Qld	Jan	3	Negative
	Cattle	Vic.	Feb	3	Negative (4 unrelated investigations)
	Cattle	Vic.	Mar	3	Negative
	Cattle	WA	Feb	3	Negative
	Cattle	WA	Jan	2	Negative (2 unrelated investigations)
	Cattle	WA	Mar	3	Negative
	Sheep	Vic.	Feb	3	Negative
	Sheep	Vic.	Jan	3	Negative
Infection of bees with *Melissococcus plutonius* (European foulbrood)	Bees	Qld	Feb	2	Negative (10 unrelated investigations)
	Bees	Qld	Feb	2	Positive
	Bees	Qld	Jan	2	Negative (9 unrelated investigations)
	Bees	Qld	Jan	2	Positive (4 unrelated investigations)
	Bees	Qld	Mar	2	Negative (11 unrelated investigations)

Cont

Disease	Species	State	Month	Response code[a]	Finding
	Bees	SA	Feb	2	Negative (4 unrelated investigations)
	Bees	SA	Jan	2	Negative (2 unrelated investigations)
	Bees	SA	Jan	2	Positive
	Bees	SA	Mar	2	Negative (4 unrelated investigations)
Infection of bees with Paenibacillus larvae (American foulbrood)	Bees	Qld	Feb	2	Negative
	Bees	Qld	Feb	2	Positive (10 unrelated investigations)
	Bees	Qld	Jan	2	Negative (5 unrelated investigations)
	Bees	Qld	Jan	2	Positive (8 unrelated investigations)
	Bees	Qld	Mar	2	Positive (11 unrelated investigations)
	Bees	SA	Feb	2	Negative (6 unrelated investigations)
	Bees	SA	Feb	2	Positive (4 unrelated investigations)
	Bees	SA	Jan	2	Negative (9 unrelated investigations)
	Bees	SA	Jan	2	Positive (3 unrelated investigations)
	Bees	SA	Mar	2	Negative (10 unrelated investigations)
	Bees	SA	Mar	2	Positive (4 unrelated investigations)
Infection with Aujeszky's disease virus	Pig	WA	Jan	3	Negative
Infection with *Chlamydophila abortus* (enzootic abortion of ewes, ovine chlamydiosis)	Sheep	WA	Feb	2	Negative
	Sheep	WA	Mar	2	Negative
Infection with classical swine fever virus	Pig	SA	Jan	3	Negative
	Pig	SA	Mar	3	Negative
	Pig	Vic	Feb	3	Negative
	Pig	WA	Feb	2	Negative
	Pig	WA	Jan	3	Negative
	Pig	WA	Mar	2	Negative
Infection with duck herpesvirus 1 (duck viral enteritis/duck plague)	Bird[c]	Qld	Jan	3	Negative
Infection with Hendra virus	Dog	NSW	Feb	2	Negative
	Horse	NSW	Feb	2	Negative (18 unrelated investigations)
	Horse	NSW	Jan	2	Negative (24 unrelated investigations)
	Horse	NSW	Mar	2	Negative (24 unrelated investigations)
	Horse	NT	Feb	2	Negative (3 unrelated investigations)
	Horse	NT	Jan	2	Negative
	Horse	Qld	Feb	2	Negative (51 unrelated investigations)
	Horse	Qld	Jan	2	Negative (53 unrelated investigations)
	Horse	Qld	Mar	2	Negative (58 unrelated investigations)
	Horse	SA	Feb	3	Negative (4 unrelated investigations)
	Horse	SA	Mar	3	Negative
	Horse	Tas.	Jan	3	Negative

Cont

Disease	Species	State	Month	Response code[a]	Finding
	Horse	Vic.	Feb	2	Negative
	Horse	Vic.	Feb	3	Negative (16 unrelated investigations)
	Horse	Vic.	Mar	3	Negative (27 unrelated investigations)
	Horse	WA	Feb	2	Negative (2 unrelated investigations)
	Horse	WA	Mar	2	Negative
Infection with influenza A viruses in swine	Pig	WA	Mar	2	Negative (4 unrelated investigations)
	Pig	WA	Mar	3	Negative
Infection with *Mycobacterium avium* (avian tuberculosis)	Bird[c]	WA	Mar	2	Negative
Infection with *Mycoplasma mycoides* subsp. *mycoides* SC (contagious bovine pleuropneumonia)	Cattle	WA	Jan	2	Negative (3 unrelated investigations)
Infection with peste des petits ruminants virus	Sheep	Vic	Feb	2	Negative
	Sheep	WA	Jan	3	Negative (2 unrelated investigations)
Infection with rabies virus	Camel	WA	Mar	3	Negative
	Horse	SA	Feb	3	Negative
Infection with *Taenia saginata* (cysticercus bovis)	Cattle	SA	Feb	2	Negative
Infection with *Theileria parva* (East Coast fever) or *T. annulata* (Mediterranean theileriosis)	Cattle	WA	Feb	2	Negative (3 unrelated investigations)
	Cattle	WA	Jan	2	Negative (3 unrelated investigations)
	Cattle	WA	Mar	2	Negative (2 unrelated investigations)
Infection with vesicular stomatitis virus	Cattle	NSW	Jan	3	Negative (3 unrelated investigations)
	Cattle	Qld	Jan	3	Negative
	Cattle	Vic.	Feb	3	Negative (4 unrelated investigations)
	Cattle	Vic.	Mar	3	Negative
	Cattle	WA	Feb	3	Negative
	Horse	SA	Feb	3	Negative
	Sheep	Vic.	Feb	3	Negative
	Sheep	Vic.	Jan	3	Negative
Infestation of bees with *Acarapis woodi* (acariasis tracheal mite)	Bees	Qld	Feb	2	Negative (24 unrelated investigations)
	Bees	Qld	Jan	2	Negative (20 unrelated investigations)
	Bees	Qld	Mar	2	Negative (26 unrelated investigations)
Infestation of bees with *Tropilaelaps clareae* or *T. mercedesae* (Tropilaelaps mite)	Bees	Qld	Feb	2	Negative (24 unrelated investigations)
	Bees	Qld	Jan	2	Negative (20 unrelated investigations)
	Bees	Qld	Mar	2	Negative (26 unrelated investigations)
Infestation of bees with *Varroa destructor* or *V. jacobsoni* (varroosis)	Bees	Qld	Feb	2	Negative (24 unrelated investigations)
	Bees	Qld	Jan	2	Negative (20 unrelated investigations)
	Bees	Qld	Mar	2	Negative (26 unrelated investigations)
Lumpy skin disease	Cattle	NSW	Feb	2	Negative

Cont

Disease	Species	State	Month	Response code[a]	Finding
Maedi-visna	Barbary Sheep	SA	Feb	2	Negative
	Sheep	Vic.	Feb	2	Negative
Paratuberculosis — Johne's disease	Cattle	NSW	Mar	2	Negative (5 unrelated investigations)
	Cattle	NSW	Mar	2	Positive (4 unrelated investigations)
	Cattle	Vic.	Feb	2	Negative (2 unrelated investigations)
	Cattle	Vic.	Feb	2	Positive (6 unrelated investigations)
	Cattle	Vic.	Mar	2	Negative (2 unrelated investigations)
	Cattle	Vic.	Mar	2	Positive (4 unrelated investigations)
	Sheep	NSW	Mar	2	Negative
	Sheep	Vic.	Feb	2	Positive (2 unrelated investigations)
	Sheep	Vic.	Jan	2	Negative
	Sheep	Vic.	Jan	2	Positive (3 unrelated investigations)
	Sheep	Vic.	Mar	2	Positive
Porcine reproductive and respiratory syndrome	Pig	SA	Jan	3	Negative
Screw-worm fly — Old World (*Chrysomya bezziana*)	Bird[c]	NT	Jan	3	Negative
Tuberculosis (*Mycobacterium bovis*)	Pig	SA	Feb	2	Negative
	Pig	SA	Mar	2	Negative
Turkey rhinotracheitis (avian metapneumovirus)	Turkey	NSW	Mar	3	Negative
West Nile virus infection — clinical	Bird[c]	SA	Feb	3	Negative (2 unrelated investigations)
	Bird[c]	SA	Jan	3	Negative
	Bird[c]	SA	Mar	3	Negative (11 unrelated investigations)
	Horse	NSW	Feb	2	Negative
	Horse	NSW	Mar	2	Negative
	Horse	Qld	Jan	2	Negative
	Horse	SA	Feb	3	Negative (3 unrelated investigations)
	Horse	SA	Jan	3	Negative
	Horse	SA	Mar	3	Negative
	Horse	Vic.	Feb	3	Negative
	Horse	Vic.	Mar	3	Negative (2 unrelated investigations)
	Horse	WA	Feb	3	Negative
	Horse	WA	Mar	3	Negative
	Pig	Vic.	Jan	2	Negative

a Key to response codes
1 = Field investigation by government officer
2 = Investigation by state or territory government veterinary laboratory
3 = Specimens sent to the CSIRO Australian Animal Health Laboratory (or CSIRO Entomology)
4 = Specimens sent to reference laboratories overseas
5 = Regulatory action taken (biosecurity or police officers)
6 = Alert or standby
7 = Eradication

b Australian bat lyssavirus (ABLV) testing is reported in the Wildlife Health Australia report.

c Includes poultry and other domestic birds.

National Animal Health Information System contacts

The National Animal Health Information System (**nahis.animalhealthaustralia.com.au**) collects summaries of animal health information from many sources; detailed data are maintained by the source organisations. Please contact the relevant person if further details are required.

EMERGENCY ANIMAL DISEASE WATCH HOTLINE

1800 675 888

There were 1761 calls to the Emergency Animal Disease Watch Hotline during the quarter.

The Emergency Animal Disease Watch Hotline is a toll-free telephone number that connects callers to the relevant state or territory officer to report concerns about any potential disease situation.

Anyone suspecting an exotic disease outbreak should use this number to get immediate advice and assistance.

1761 CALLS

THIS QUARTER

Name	Role	Phone	Email
Ian Langstaff	NAHIS program manager	02 6203 3909	ILangstaff@animalhealthaustralia.com.au
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Venessa McEniery	Australian Milk Residue Analysis Survey	03 9810 5930	VMcEniery@dairysafe.vic.gov.au
Tiggy Grillo	Wildlife Health Australia	02 9960 7444	TGrillo@wildlifehealthaustralia.com.au
Courtney Lane	National Enteric Pathogens Surveillance Scheme	03 8344 5701	Courtney.Lane@unimelb.edu.au
Mark Trungove	National Notifiable Diseases Surveillance System	02 6289 8315	Mark.Trungove@health.gov.au
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Rob Barwell	Johne's disease coordinator	02 6203 3947	RBarwell@animalhealthaustralia.com.au
Madusha Weeratunga	Northern Australia Quarantine Strategy	08 8998 4986	Madusha.Weeratunga@agriculture.gov.au
State and territory coordinators			
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Elizabeth Stedman	Northern Territory	08 8999 2035	Elizabeth.Stedman@nt.gov.au
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Karen Moore	Victoria	03 5430 4525	Karen.Moore@ecodev.vic.gov.au
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