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Message from the Australian Chief Veterinary Officer

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

One of the challenges we face is the changing nature of animal health risks. New risks emerge and recognised ones evolve. Their causes can be complex and multifactorial.

In this edition, we emphasise the importance of integrated and responsive animal health and disease surveillance systems, with articles on the risk of white-nose syndrome to Australian bats, and the detection of *Chlamydia psittaci* in a different host species. These also demonstrate that while the production animal sector is often the perceived focus of animal health surveillance, other sectors are critical. This was a key message of my presentation on wildlife health surveillance, emerging issues and One Health in Australia at the Science on the Swan 2017: One Health conference in May 2017 in Fremantle.

At the 31st meeting of the Animal Health Committee in April 2017, together with state and territory chief veterinary officers and representatives from CSIRO Australian Animal Health Laboratory, Animal Health Australia and Wildlife Health Australia, I participated in a 'futures thinking seminar' where tools to capture biosecurity intelligence were discussed. The gathering of timely information and intelligence to inform early decision-making and preventive measures can be critical.

Communications within the international community are vital too. As the chair for the Quadrilateral Animal Health Group at the time, we hosted a meeting in Sydney with senior animal health officials from Canada, New Zealand and the United States in April 2017. This provided an opportunity to share information on emerging and strategic issues affecting animal health, and discuss ways to manage risks at an international level.

In May, I led a delegation to the 85th General Session of the World Organisation for Animal Health (OIE) in Paris. The General Session provides opportunities for discussions with countries in and outside our region, to understand the challenges being faced globally and approaches to address them. One technical item focused on global action to alleviate the threat of antimicrobial resistance (AMR), and the progress and opportunities for future activities under the 'One Health' initiative.

I spoke about AMR strategies and plans at a plenary session of the annual Australian Veterinary Association conference, and at the Australasian Society for Infectious Diseases Summit, in Melbourne in June 2017. I appreciated these opportunities to discuss the important implications of AMR and strategies for the future, and I am encouraged as I witness others proactively seek and share information, and participate in discussions that shape how we plan for the future.

I hope that this edition of *Animal Health Surveillance Quarterly* may similarly provide pause for reflection, as we share information and aim to work together as part of integrated and responsive animal health systems within Australia and within the global community.

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).

White-nose syndrome and the risk to Australian bats

Keren Cox-Witton, Wildlife Health Australia
Rachel Iglesias, Australian Government Department of Agriculture and Water Resources

White-nose syndrome (WNS) is a fungal disease caused by *Pseudogymnoascus destructans* that has caused significant mortalities of insectivorous bats in North America.

Since WNS was first recognised in New York State in 2006, it has spread through eastern USA and Canada, causing the collapse of numerous bat populations, with mortality estimates of over 6 million bats.[1,2,3] In March 2016, the fungus was detected in Washington State, more than 2,000 km from prior detections in the eastern states.[4]

The *P. destructans* fungus has been found across Europe and in north-east China, but without the mass mortalities observed in North America.[5,6]

***P. destructans* requires low temperatures to grow and can persist in the environment for long periods, even in the absence of bats.**

P. destructans has not been identified in Australia. Exclusion of WNS in suspect cases has previously been reported in AHSQ (Vol. 15 Issue 1; Vol. 17 Issue 3; Vol. 18 Issue 3; Vol. 19 Issue 1).

WNS is a disease of hibernating insectivorous bats, causing wing damage that leads to physiological disturbance and depletion of fat reserves over winter.[7] Clinical signs include:

- white or grey powdery fungus on the fur, skin or wings
- wing membrane damage, such as membrane thinning, depigmented areas, flaky appearance or non-traumatic holes
- mass mortality
- aberrant behaviour, such as flying during the day or increased frequency of arousal or activity during a period of torpor or hibernation (lowering of body temperature to conserve energy).

P. destructans requires low temperatures to grow and can persist in the environment for long periods, even in the absence of bats.[8] Humans have been implicated in the spread of the disease by transferring fungal

1 Frick WF, Pollock JF, Hicks AC, Langwig KE, Reynolds DS, Turner GG, Butchkoski, CM, Kunz TH (2010). An emerging disease causes regional population collapse of a common North American bat species. *Science* 329(5992): 679–682

2 US Fish & Wildlife Service, 2016. White-Nose Syndrome Fact Sheet, May 2016 *www.whitenosesyndrome.org/sites/default/files/resource/white-nose_fact_sheet_5-2016_2.pdf*

3 Turner GG, Reeder DM, Coleman JTH (2011). A five-year assessment of mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. *Bat Research News* 52(2): 1327

4 US Geological Survey (2016). Bat with white-nose syndrome confirmed in Washington state. News Release, 31 March 2016 *www.usgs.gov/news/bat-white-nose-syndrome-confirmed-washington-state*

5 Puechmaille SJ, Wibbelt G, Korn V, Fuller H, Forget F, Mühldorfer K, Kurth A, Bogdanowicz W, Borel C, Bosch T, Cherezy T (2011). Pan-European distribution of white-nose syndrome fungus (Geomyces destructans) not associated with mass mortality. PLoS One 6(4):e19167

6 Hoyt JR, Sun K, Parise KL, Lu G, Langwig KE, Jiang T, Yang S, Frick WF, Kilpatrick AM, Foster JT, Feng J (2016). Widespread bat white-nose syndrome fungus, northeastern China. *Emerging Infectious Diseases* 22(1): 140–142.

7 Verant ML, Meteyer CU, Speakman JR, Cryan PM, Lorch JM, Blehert DS (2014). White-nose syndrome initiates a cascade of physiologic disturbances in the hibernating bat host. *BMC Physiology* 14(1): 10.

8 Lorch JM, Muller LK, Russell RE, O'Connor M, Lindner DL, Blehert DS (2013). Distribution and environmental persistence of the causative agent of white-nose syndrome, Geomyces destructans, in bat hibernacula of the eastern United States. Applied and Environmental Microbiology, 79(4): 1293–1301.

Little brown bat; fungus on wing membrane, Oct. 2008, New York (Photo: Ryan von Linden/New York Department of Environmental Conservation)

spores on boots and equipment.[9] Guidance on decontamination of clothing, footwear and equipment has been developed in North America.[10] There are no known human health risks from WNS.

Risk assessment

Australia is home to many species of insectivorous bats, or microbats, and a number of these live in caves ranging from small splits or crevices through to extensive caverns. In 2015-16, Wildlife Health Australia (WHA), with funding from the Australian Government Department of Agriculture and Water Resources, coordinated a project to assess the risk of WNS for Australian bats. This initiated ongoing work to improve Australia's preparedness for a potential incursion of this disease.

A qualitative risk assessment for introduction of WNS into Australia was conducted by a team of Australian experts.[11] The assessment found there was a non-negligible risk of introduction of WNS into Australia and the most likely method of entry of *P. destructans* is via fomites (contaminated objects), such as clothing, footwear or equipment used in affected caves overseas; for example, by a caver, researcher or tourist.

While the susceptibility of Australian bat species to WNS is not known, cave-dwelling insectivorous bats in the colder southern parts of Australia are considered likely to be at risk of WNS if introduced, in particular the southern bent-winged bat (*Miniopterus orianae bassanii*), a critically endangered species, and the eastern bent-winged bat (*M. orianae oceanensis*).

The large-scale mortalities seen in North America are considered less likely to occur in Australia due to the difference in climate, but lower mortality rates due to WNS could still be significant for the survival of species such as the southern bent-wing bat.

Preparedness

A number of activities are underway to prevent the introduction of WNS, and to better prepare Australia for any incursion of this exotic disease.

Response guidelines have been developed to assist response agencies in the event of an incursion of WNS. The guidelines were developed in consultation with stakeholders, including Australian, state and territory government agencies for agriculture and environment, Animal Health Australia, biosecurity emergency management experts, the Australasian Bat Society and universities involved in relevant research. The guidelines describe management activities that can be considered in the event of an outbreak.

An information document on how to recognise and report a suspect case of WNS has been developed for people who come into contact with microbats, such as bat and wildlife carers, ecologists, cavers,

9 Reynolds HT, Ingersoll T, Barton HA (2015). Modeling the environmental growth of Pseudogymnoascus destructans and its impact on the white-nose syndrome epidemic. Journal of Wildlife Diseases, 51(2): 318–331.

10 US Fish & Wildlife Service (2016). National White-Nose Syndrome Decontamination Protocol. *www.whitenosesyndrome.org/topics/decontamination*

11 Holz P, Hufschmid J, Boardman W, Cassey P, Firestone S, Lumsden L, Prowse T, Reardon T, Stevenson M (2016). Qualitative risk assessment: White-nose syndrome in bats in Australia. *www.wildlifehealthaustralia.com.au/ProgramsProjects/BatHealthFocusGroup.aspx* - WNS

cave managers, park rangers and members of the public, and made available via the WHA website.[12]

Guidelines are also available for veterinarians on how to collect and submit appropriate samples from suspect cases for exclusion of WNS.[13] Advice has been provided to Australian and visiting cavers by the Department of Agriculture and Water Resources on how to avoid introducing WNS into Australia.[14] The department also considered the effectiveness of border disinfection protocols against this fungus, and developed an alternative protocol to ensure risk items would be adequately decontaminated.

When the 17th International Congress of Speleology was held in Sydney in July 2017, its program included a number of field trips to Australian caves that were attended by international speleologists, who study caves or explore caves for sport. The Department of Agriculture and Water Resources, WHA and congress organisers worked together to reduce the risk of visitors bringing contaminated clothing and equipment into Australian caves, and to minimise the chances of an incursion of this disease. This included a suite of communication activities, culminating in a letter from the Australian Chief Veterinary Officer to congress participants shortly before the congress, and collaborative planning of biosecurity measures for pre- and post-congress field trips to Australian caves.

The event also served as an opportunity to raise awareness of the disease and the prevention and preparedness work undertaken by WHA and the Department of Agriculture and Water Resources.

12 Wildlife Health Australia. How to report a suspect case of white-nose syndrome. *www.wildlifehealthaustralia.com.au/ProgramsProjects/BatHealthFocusGroup.aspx* - WNS

13 Wildlife Health Australia. National guidelines for sample submission for WNS exclusion testing. *www.wildlifehealthaustralia.com.au/ProgramsProjects/BatHealthFocusGroup.aspx* - WNS

14 Australian Government Department of Agriculture and Water Resources. White nose syndrome in cave-hibernating bats. *www.agriculture.gov.au/pests-diseases-weeds/animal/white-nose-syndrome*

Bat showing symptoms of white-nose syndrome (Photo: Marvin Moriarty/USFWS)

Conclusion

If introduced to Australia, WNS could pose a significant threat to insectivorous bats, including one species that is critically endangered. Australia has taken steps to mitigate the risk of introduction of WNS, and to better prepare for a possible incursion of this disease. This work also provided a useful model for Australia's approach to managing the risk of exotic wildlife diseases of primary biodiversity concern.

Further information on WNS:

- Wildlife Health Australia fact sheet[15]
- Australian Government Department of Agriculture and Water Resources website[16]
- USGS National Wildlife Health Center website[17]
- White-noseSyndrome.org website[18]

15 *www.wildlifehealthaustralia.com.au/FactSheets.aspx*

16 *www.agriculture.gov.au/pests-diseases-weeds/animal/white-nose-syndrome*

17 *www.nwhc.usgs.gov/disease_information/white-nose_syndrome/index.jsp*

18 *www.whitenosesyndrome.org*

An example of integrated disease surveillance in action

Rory Arthur
NSW Department of Primary Industries

The New South Wales Department of Primary Industries (DPI) Surveillance Program has three core components.

First, it relies on government field veterinarians, who are located according to relative-risk of notifiable disease occurrence. They have the authority and responsibility to investigate incidents of suspected notifiable disease and to report the notifiable disease status of their districts to the state and national veterinary authorities.

Second, it uses a quality-assured government laboratory support service that can diagnose notifiable diseases and provides professional support to the field veterinarians and to the veterinary authorities on technically complex disease issues.

Third (and this point is sometimes overlooked), the program has immediate access to animal biosecurity research scientists who can address difficult-to-diagnose disease issues; develop and validate more advanced laboratory tests; and — by working with field and diagnostics colleagues — thoroughly investigate the epidemiology of new and emerging diseases.

A challenge for surveillance managers is to integrate these three components into one animal disease surveillance system.

This article highlights an example in which the integration of these core disease surveillance components has worked well. It also identifies the challenges that need to be overcome to make this kind of integration successful across a range of circumstances.

Chlamydia psittaci abortion in mares

A cluster of five (5) human psittacosis cases occurred in southern NSW in late 2014 in veterinary students and a horse stud manager who had either direct or indirect contact with a horse placenta. The placenta was considered abnormal in appearance by the stud manager. He bagged it and sent it to a veterinary hospital for testing. It was opened and examined on a concrete pad by seven people who all wore gloves and overalls but none used masks or googles. Some of the people handled the placenta directly and some had roles cleaning the concrete after the placenta was examined.

Although *Chlamydia psittaci* is endemic in Australia, chlamydia had not been reported previously in Australia as a possible cause of abortion in mares. This situation therefore had not been recognised as a potential serious work health and safety hazard.

Veterinary officials in New South Wales needed to ensure that a new strain of *Chlamydia* spp. had not emerged and that *C. abortus*, which is exotic to Australia, had not been introduced to the Australian horse population. Field staff and staff working in diagnostic pathology, research and policy were integrated into a single project team to define the problems and provide answers. Policy staff allocated sufficient resources, including funds to conduct testing, to define the extent of the problem.

Field staff collaborated with Charles Sturt University and private horse veterinarians. They submitted samples from cases of equine abortion to the State Veterinary Diagnostic Laboratory in Menangle and kept relevant parties informed about potential zoonotic risks and progress in the investigation.

Laboratory pathologists checked their diagnostic tools, collated data on submissions, and submitted samples to the CSIRO Australian Animal Health Laboratory and to animal biosecurity research staff for further testing.

Animal biosecurity researchers conducted genome sequencing, experimented with diagnostic PCR and in situ hybridisation tests, and collaborated with Australia's experts in chlamydial infection of birds and other animals to define the key epidemiological features.

Efforts to culture *Chlamydia* spp. from aborted material were unsuccessful, but polymerase chain reaction (PCR) testing and gene sequencing revealed that the samples of aborted material contained *Chlamydia* spp. The research staff, in collaboration with outside experts, further determined that the detected strain of *C. psittaci* was the same as the strain commonly carried by members of the parrot family (Psittaciformes); it was not a new or exotic strain.

Nevertheless, it was difficult to make epidemiological associations because the organism could not be detected in affected mares or their cohorts, or in samples of bird faeces taken from horse studs where the abortions were occurring. When researchers developed an in situ hybridisation test, they showed that the *Chlamydia* organisms could be visualised in large numbers in aborted material, and that they were not simply contaminants.

At that point, the evidence was firm and consistent with international reports that Australian strains of *C. psittaci* can also cause abortion in mares and that it is probably not an emerging disease but simply one that had not been diagnosed before.

It transpired that *C. psittaci* was associated with about 10% of equine abortion cases submitted to the State Veterinary Diagnostic Laboratory last foaling season. More work needs to be done on the epidemiology of these infections and on understanding why the zoonotic risks of this disease had not previously surfaced.

Challenges for veterinary authorities

Veterinary authorities face two major challenges in detecting the potential emergence of a new disease or the incursion of an exotic agent.

The first is to decide whether or not the issue is about the detection and management of notifiable diseases, which is core government business. In this case, *C. psittaci* is a listed disease in New South Wales, but only in relation to pet birds and for taking regulatory action in pet shops if necessary. It is not currently notifiable for the purpose of controlling abortions in horses. In these grey areas of government responsibility, it was important to make the call early that the NSW DPI would take the lead in committing resources to identifying the scope of the problem, despite the fact that there is always competition for these resources.

Even if there are doubts about the notifiable-disease status of an incident, all potentially new or emerging diseases must be considered potentially notifiable until proven otherwise.

A second challenge is to define the scope of collaboration required by all staff involved in the investigation.

It's the nature of scientists to protect proprietary ownership of their intellectual efforts in advancing the understanding of new diseases. In fact, they often have to rely on scientific publications to advance their own careers. However, it's important to balance this with the need for collaboration with other scientists, including external experts, so that answers are provided in a timely way.

To continue to meet these challenges, NSW DPI intends to further define standard operating procedures to make sure that field staff, diagnostic laboratory staff and research staff work together to investigate new and emerging diseases. These procedures will also define when a response should be managed nationally, rather than by an individual government veterinary service.

Update on white spot syndrome virus surveillance in Queensland waters

Janine Barrett
Queensland Department of Agriculture and Fisheries

Surveillance for white spot syndrome virus (WSSV) during the April to June 2017 period was focused on the Queensland coast between Cairns and Mooloolaba (Figure 1). All samples were negative for WSSV. These results are consistent with white spot disease having been confined to the area associated with the original cluster of affected prawn farms.

Approximately 2500 crustaceans, including wild prawns, were collected during the quarter from the area north of the Moreton Bay and Logan River area. Samples collected by Biosecurity Queensland or with the support of commercial fishers were submitted to the Biosecurity Sciences Laboratory for testing by polymerase chain reaction (PCR) assay.

The next stage of the White Spot Disease Program will be to establish proof of freedom in the previously affected Moreton Bay and Logan River area.

White spot disease due to WSSV was first confirmed on a prawn farm on the Logan River in December 2016 and subsequently spread to six adjacent prawn farms. The initial destruction and decontamination phase was completed on 22 May 2017.

Further spread of WSSV has been prevented through effective implementation of movement restrictions for high-risk animals, such as prawns, yabbies and marine worms. An exemption now exists for low-risk species, such as crabs, lobster and bugs.

Movement restrictions have been supported by an intensive effort to engage with residents, recreational and commercial fishers and other waterway users in an area that extends from Caloundra to the New South Wales border, and as far west as Ipswich.

Engagement activities include on-the-ground community interactions, distribution of brochures, boat ramp signage, newspaper and radio advertising and an active social media campaign. Further information about WSSV, including a White Spot Information Guide, is available from the Queensland Government.[19]

Further spread of WSSV has been prevented through effective implementation of movement restrictions for high-risk animals, such as prawns, yabbies and marine worms. An exemption now exists for low-risk species, such as crabs, lobster and bugs.

19 *www.daf.qld.gov.au/animal-industries/animal-health-and-diseases/a-z-list/white-spot-disease*

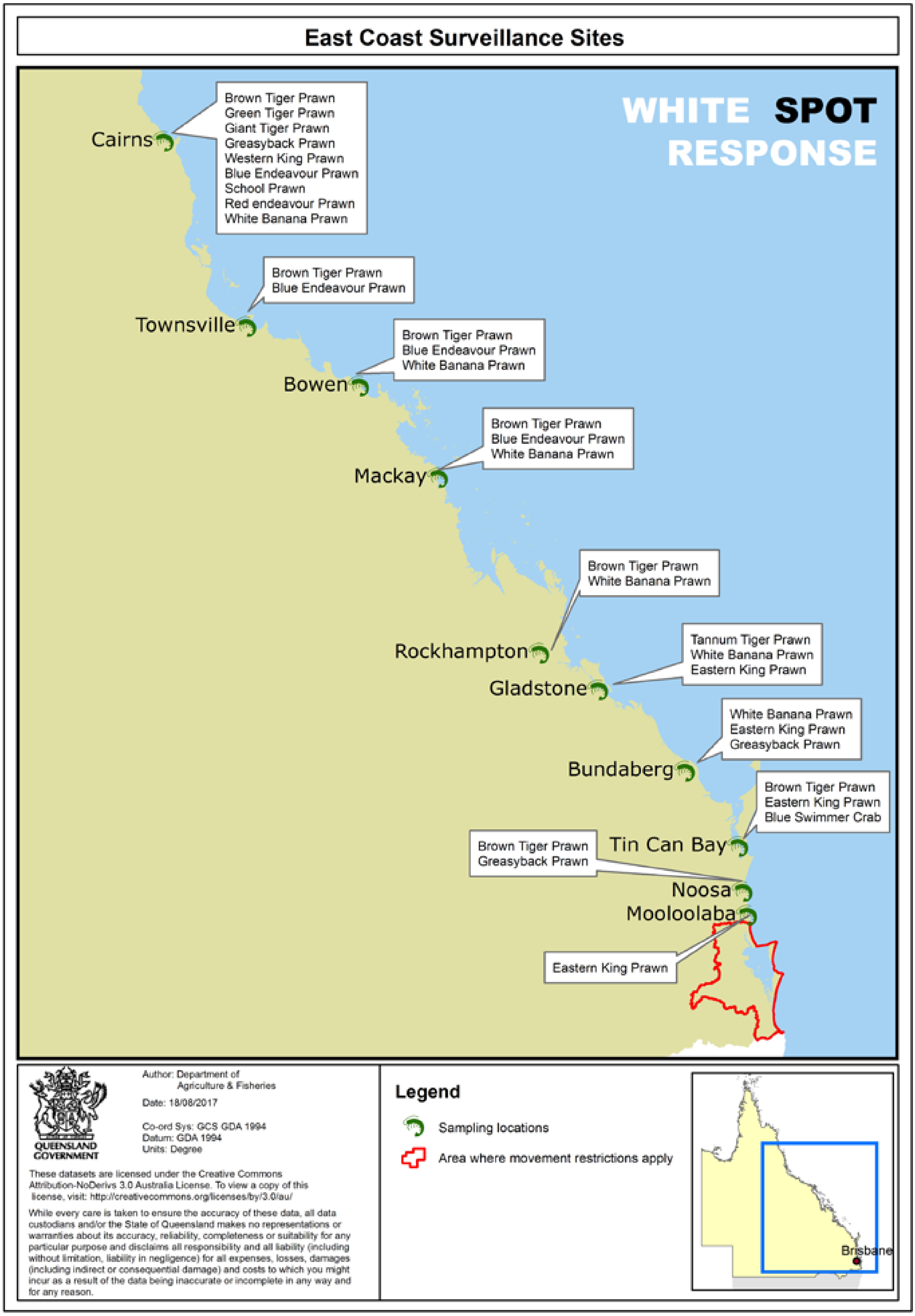

Figure 1 Surveillance for white spot syndrome virus along the Queensland coast, north of the Morton Bay and Logan River area (where movement restrictions apply), April to June 2017

Wildlife Health Australia

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)[20] 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)[21] — including submissions by WHA subscribers, state and territory WHA coordinators, researchers, and university, zoo and sentinel clinic veterinarians. During the quarter, 159 wildlife disease investigation events were reported into eWHIS (Table 1) and samples were collected from 1370 wild birds for avian influenza surveillance. 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 42 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 2. 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 11 of the events as part of Australia's general (sick and dead bird) AI surveillance

Wattlebird (Photo: Max Maddock)

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

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

Table 1 Number of disease investigations reported into eWHIS, April to June 2017[a]

Bats[b]	Birds[c,d]	Feral animals	Frogs	Marsupials
65	42	6	1	45

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.
c Additional sampling for targeted avian influenza surveillance is presented separately.
d Includes native and feral bird species.

Table 2 Wild bird disease investigations reported into eWHIS, April to June 2017

Bird order	Common name for bird order[a]	Events reported[b]
Anseriformes	Magpie geese, ducks, geese and swans	1
Columbiformes	Doves and pigeons	4
Falconiformes	Falcons	1
Gruiformes	Rails, gallinules, coots and cranes	1
Passeriformes	Passerines or perching birds	8
Pelecaniformes	Ibis, herons and pelicans	2
Psittaciformes	Parrots and cockatoos	26

a Common names adapted from: del Hoyo & 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 one wild bird event involved multiple bird orders, which were Falconiformes and Passeriformes.

program. AI exclusion testing was not warranted in the remaining 31 events, based on clinical signs, history, prevailing environmental conditions or other diagnoses. In addition, avian paramyxovirus was excluded in 10 events by PCR testing specific for Newcastle disease (ND) virus and/or pigeon paramyxovirus 1 (PPMV-1).

Detection of pigeon paramyxovirus 1 in a feral pigeon

In May, a feral pigeon (*Columba livia*) found on the ground in Melbourne by a member of the public was submitted to Lort Smith Animal Hospital, presenting with a head tilt, circling, thin body condition and green faeces. The bird was euthanased and submitted to AgriBio Veterinary Diagnostic Services, Bundoora, for investigation. No gross or microscopic evidence of current active infection with PPMV were reported but tissues were positive for PPMV-1 on PCR testing. Pigeon rotavirus and AI were both excluded via PCR testing.

Avian influenza and avian paramyxovirus 1 surveillance

Australia's National Avian Influenza Wild Bird (and Avian Paramyxovirus 1) Surveillance Program comprises two components (with a focus on exclusion testing for AI virus subtypes H5 and H7):

1. Pathogen-specific, risk-based surveillance by sampling of apparently healthy, live and hunter-killed wild birds
2. General surveillance by investigating significant unexplained morbidity and mortality events in wild birds, including captive and wild birds within zoo grounds.

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 New South Wales, North Territory, Queensland, Tasmania and Western Australia. Cloacal and faecal environmental swabs were collected from 1471 waterbirds, with 1471 tested for AI and 1271 for APVM-1. Results are pending.

Non-enterotoxigenic *Vibrio cholerae* strain in ringtail possums

Six subadult ringtail possums (*Pseudocheirus peregrinus*) died in care in Victoria over a period of a week in February 2017. A necropsy of one animal found hepatocellular necrosis with intralesional bacteria. There was heavy growth of *Vibrio cholerae* on culture of a liver swab.

Another possum from the same group in care presented a week later with diarrhoea, dehydration and depression and was euthanased. In addition to hepatocellular necrosis, this animal had severe necrotising typhlocolitis. *V. cholerae* was cultured from the liver and large intestine, and was further identified by PCR testing as a non-enterotoxigenic strain (not the notifiable[22] O1 or O139 strains that cause human cholera).

A variety of non-O1/O139 strains of *V. cholerae* are present in the aquatic environment in Australia and overseas. These strains do not produce cholera toxin but can still be pathogenic to humans, particularly if immunocompromised.[23,24]

Salmonella enterica subsp. *diarizonae* infection in western ringtail possum

A wild western ringtail possum (*Pseudocheirus peregrinus occidentalis*) presented in May 2017 to a veterinary clinic in south-west Western Australia with neurological signs, including a head tilt and ataxia. There were no abnormal findings on X-ray, and Toxoplasma serology was negative. After failing to respond to antibiotic, anti-inflammatory and supportive treatment, the possum was euthanased. Histopathology revealed a severe chronic granulomatous, lymphocytic and suppurative encephalitis. *Salmonella enterica* subsp. *diarizonae* was cultured from fresh frozen brain.

This *Salmonella* subspecies is known to infect wild and captive reptiles in Australia[25] and is considered a zoonotic risk for people in contact with pet reptiles.[26] It is usually associated with cold-blooded species[27] although it has been occasionally identified in Australian native mammals, such as the quokka (*Setonix brachyurus*) in Western Australia and an eastern grey kangaroo (*Macropus giganteus giganteus*) in Queensland.[28,29]

Australian bat lyssavirus

Reports to WHA for the quarter included 65 bats tested for Australian bat lyssavirus (ABLV) from the Australian Capital Territory, New South Wales, Northern Territory, Queensland, South Australia and Victoria.

Bat submissions were made for a variety of reasons:

- 24 cases involved contact with the potential for ABLV transmission to humans; of these
  - 8 were also associated with trauma (e.g. barbed wire fence or netting entanglement)
  - 4 involved contact with a pet dog or cat
  - 2 displayed neurological signs
  - 1 displayed other (non- neurological) signs
  - 1 was found dead
  - the remainder had no further history reported
- 22 cases involved contact with a pet dog (18) or cat (4)
- 7 bats displayed neurological signs (e.g. aggression, seizures, twitching, head tilt)
- 6 cases were associated with trauma (e.g. netting entanglement, fractures)
- 2 bats displayed other (non- neurological) signs
- 1 bat was associated with a mass mortality event in juveniles
- 1 bat was found dead
- 2 bats had no further history reported at this time.

During the quarter, three flying-foxes from Queensland were confirmed positive for ABLV by PCR testing for pteropid ABLV ribonucleic acid (RNA). An adult male little red flying-fox (*Pteropus scapulatus*) was submitted for testing due to contact with a pet dog. Histopathology found moderate nonsuppurative meningoencephalitis. An adult male spectacled flying-fox (*P. conspicillatus*) presented with neurological signs, including unusual hanging posture, difficulty managing food in the mouth and tongue protrusion. Histopathology was not conducted in this case. An adult male grey-headed flying-fox (*P. poliocephalus*) initially had a swollen left foot. The animal later developed severe aggression, deterioration of mentation and stupor, and inability to eat and drink, and was euthanased. On necropsy, the animal had reduced muscle mass. Histopathology revealed mild nonsuppurative encephalitis with Negri-like bodies in neurons of the medulla and basal ganglia, and aspiration pneumonia. In two of these cases (spectacled and grey-headed flying-foxes) there had been potentially infectious human contact and 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*.[30] 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.

22 *www.health.gov.au/casedefinitions*

23 Islam A, Labbate M, Djordjevic SP, Alam M, Darling A, Melvold J, Holmes AJ, Johura FT, Cravioto A, Charles IG & Stokes HW 2013. Indigenous *Vibrio cholerae* strains from a non-endemic region are pathogenic. Open Biology 3: 120181.

24 Trubiano JA, Lee JY, Valcanis M, Gregory J, Sutton BA & Holmes NE 201. Non-O1, non-O139 Vibrio cholerae bacteraemia in an Australian population. *Internal Medicine Journal* 44(5): 508–511.

25 Scheelings TF, Lightfoot D & Holz P 2011. Prevalence of Salmonella in Australian reptiles. *Journal of Wildlife Diseases* 47(1): 1–11.

26 Schröter M, Roggentin P, Hofmann J, Speicher A, Laufs R & Mack D 2004. Pet snakes as a reservoir for Salmonella enterica subsp. diarizonae (Serogroup IIIb): a prospective study. *Applied and Environmental Microbiology* 70(1): 613–615.

27 Brenner FW, Villar RG, Angulo FJ, Tauxe R & Swaminathan B 2000. Salmonella nomenclature. *Journal of clinical microbiology 38*(7): 2465–2467.

28 Martínez-Pérez P 2016. Health and disease status in a threatened marsupial, the quokka (*Setonix brachyurus*). PhD thesis, Murdoch University.

29 Thomas AD, Forbes-Faulkner JC, Speare R & Murray C 2001. Salmonellosis in wildlife from Queensland. *Journal of Wildlife Diseases 37*(2): 229–238.

30 *www.wildlifehealthaustralia.com.au/ProgramsProjects/BatHealthFocusGroup.aspx*

Aquatic animal health

Alicia McArdle
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Increasing northern Australia's aquatic biosecurity capability

In 2015, the Australian Government released the Agricultural Competitiveness White Paper, a plan of practical actions to grow the agricultural sector and strengthen Australia's economy. Within this white paper was a commitment to a stronger biosecurity system, including in northern Australia. A range of biosecurity projects were developed for the region and are being delivered by the Department of Agriculture and Water Resources, one of which was the Aquatic Biosecurity Capability initiative.

The project is now mid-way through its 4-year term with an objective to 'increase and improve pest and disease surveillance activities in northern Australia through increased collaboration with northern jurisdictions and industry, and development of agreed approaches to priority surveillance activities including the development of a new aquatic pest and disease capability'.

The work builds on the success of the Northern Australia Quarantine Strategy (NAQS), which has delivered terrestrial plant and animal health surveillance in the north for more than 20 years. This is the first time that NAQS has worked collaboratively with state and territory governments and industry to strengthen and enhance existing marine biosecurity programs and help to build new networks and capability to improve disease recognition and reporting.

Tim Kerlin (Department of Agriculture and Water Resources) explaining how to take a good photo of a suspected marine pest at the Kimberley Land Council indigenous ranger forum

Table 3 Priority aquatic diseases for northern Australia and their risk estimation

Disease	Affected animals	Level of assessed risk
Acute hepatopancreatic necrosis disease (AHPND) (caused by toxic strains of *Vibrio parahaemolyticus*)	Crustaceans	High
Acute viral necrosis of scallops (caused by acute viral necrosis virus, AVNV)	Molluscs	High
Megalocytivirus — infectious spleen and kidney necrosis virus (ISKNV), red sea bream iridovirus (RSIV) and like viruses	Finfish	High
White spot disease (caused by white spot syndrome virus, WSSV)	Crustaceans	High
Yellowhead disease (caused by yellowhead virus)	Crustaceans	High
Edwardsiella ictaluri	Finfish	Moderate
Enterocytozoon hepatopenaeii (EHP)	Crustaceans	Moderate
Taura syndrome virus (TSV)	Crustaceans	Moderate
Necrotising hepatopancreatitis (caused by infection with Hepatobacter penaei)	Crustaceans	Low
Infectious myonecrosis virus (IMNV)	Crustaceans	Very low

The first task in the project was to gather feedback from as many stakeholders as possible across northern Australia on issues they deemed high priorities, those which had the best value for money and activities that could be achieved within the project's time frame and would leave a sustainable legacy. The project received support from all northern jurisdictions, and project plans and strategies were developed through discussions with jurisdictions, industry and research organisations.

A hazard identification and prioritisation workshop held in September 2016 with pest and disease experts across northern Australia identified a list of priority aquatic diseases relevant to the region. Criteria for listing included: whether the disease is listed by the World Organisation for Animal Health (OIE); if the disease has been identified in relevant previous import risk assessments; and if the disease has active pathways for introduction and establishment potential in tropical northern Australia. The initial list of aquatic diseases were prioritised by:

- value or significance of industry in northern Australia
- environmental impact
- public health impact
- social impact.

A list of 10 priority aquatic diseases (Table 3) was reviewed and accepted by the Sub-Committee on Aquatic Animal Health.

A qualitative risk assessment undertaken by an independent expert for each priority disease helped to determine the overall relative likelihood of introduction, establishment and spread across the 17 relevant Integrated Marine and Coastal Regionalisation of Australia (IMCRA) provisional bioregions. This estimate of risk will be used to develop and implement a surveillance framework for priority aquatic diseases in northern Australia.

To assist the delivery of this project, the Department of Agriculture and Water Resources has recently funded a position for an aquatic industry liaison officer.

To assist the delivery of this project, the Department of Agriculture and Water Resources has recently funded a position for an aquatic industry liaison officer. The position will be hosted by Animal Health Australia and the incumbent will work with northern Australian aquaculture, emerging industries and wild catch fisheries to strengthen industry engagement and stewardship of biosecurity issues and aquatic disease surveillance.

Over the next 2 years, the project will improve surveillance for the early detection of priority aquatic diseases through increased training in disease recognition and sampling techniques for those at the frontline of aquatic biosecurity. Training participants will include Indigenous ranger groups, aquaculture and wild catch fishery operators and recreational fishers. This training will be supported by increased capacity of diagnostic laboratories in northern Australia and more consistent data capture and reporting. Innovative options for trialling targeted surveillance of aquatic diseases is being considered as part of the project.

Rikkii Clarke and Alicia McArdle (both Department of Agriculture and Water Resources) undertaking an aquatic biosecurity survey in Darwin

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 18 of 'Quarterly statistics'.

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

New South Wales

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NSW Department of Primary Industries

During the quarter in New South Wales, 729 livestock and other disease investigations[31] were conducted to investigate suspect notifiable diseases or rule out emergency diseases.[32] The number of investigations by species is shown in Figure 2. Field investigations were conducted by government veterinary or biosecurity officers (453) and private veterinary practitioners (276). 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 457 livestock sample submissions[33] 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. They also 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.

Anthrax update

No anthrax incidents were reported during the quarter.

Anthrax was excluded as the cause of death in 35 mortality investigations during the quarter. These involved 7 investigations in sheep where alternative diagnoses included clostridial infection and enteritis; 26 investigations in cattle where alternative diagnoses included clostridial infection, pneumonia, meningitis, traumatic reticulopericarditis and *Cheilanthes sieberi* (bracken fern) toxicity; and 2 investigations where anthrax was excluded but an alternate diagnosis was not made. Immunochromatographic testing (ICT) was used in 21 of these mortality investigations, with negative results. In the other 14 investigations, anthrax was excluded by laboratory testing or on clinical grounds based on alternative diagnoses.

Notifiable disease exclusions across the Riverina Local Land Services region

In New South Wales, responsibility

31 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.

32 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*

33 Some investigations did not involve suspected notifiable diseases

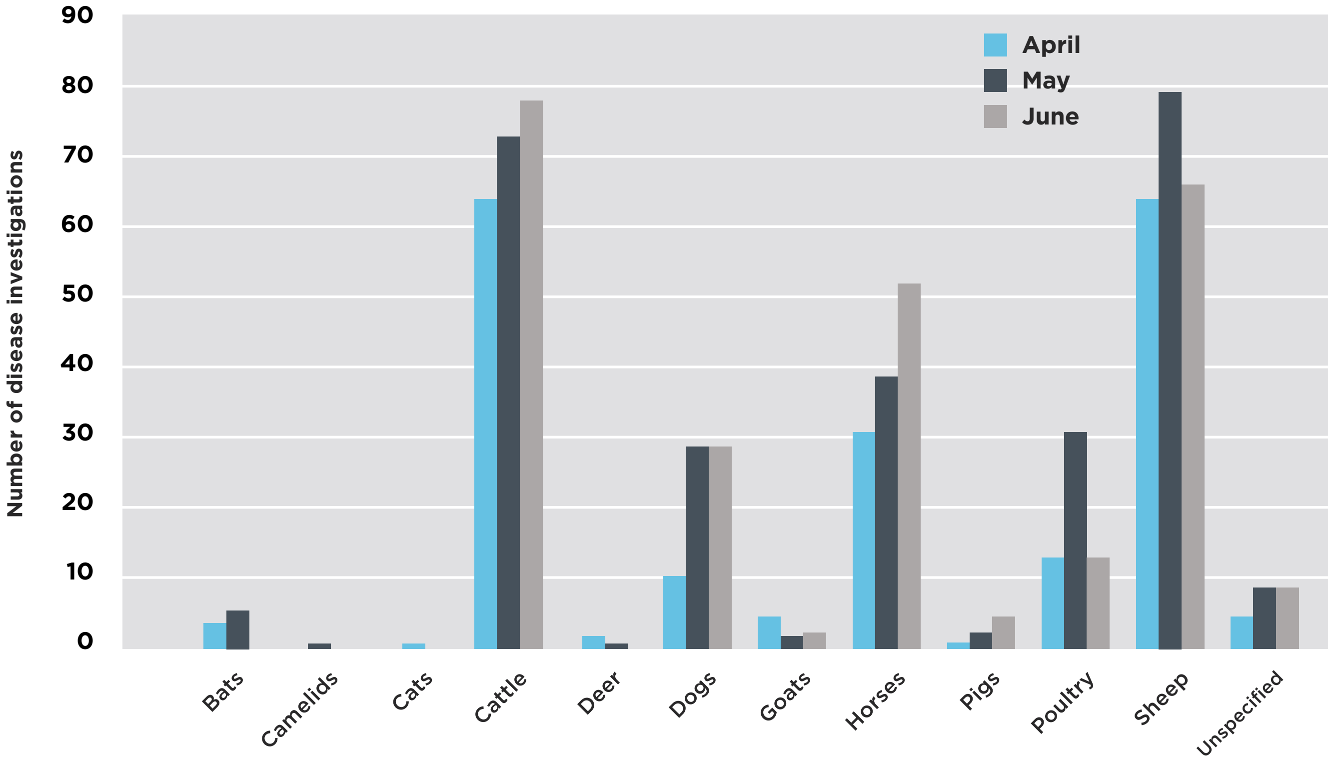


Figure 2 Number of field disease investigations to investigate suspect notifiable diseases or rule out emergency diseases, in New South Wales, April to June 2017

for notifiable disease surveillance is delegated to the district level. All potential notifiable disease outbreaks should come to the attention of the district government veterinarian who conducts a field investigation and sends samples to the State Veterinary Diagnostic Laboratory for laboratory diagnosis. In cases where there is private veterinary involvement, district veterinarians and private veterinarians often work collaboratively in excluding notifiable diseases. Information from Riverina Local Lands Services demonstrates how this works in practice.

During quarter, there were 41 recorded disease exclusions in the Riverina Local Lands Services region. The approximate locations of these disease events are shown in Figure 3. The positive diagnoses (red triangles) were for ovine footrot. A diagnosis of virulent footrot required owners to undertake an eradication program in line with the *Biosecurity Act 2015*. In some cases, a notifiable disease was suspected and excluded but the cause of the disease was not confirmed by the laboratory at the time of reporting.

In other cases, the notifiable disease was excluded and an alternate diagnosis was made. Examples of alternative diagnoses included Marek's disease, polioencephalomalacia, hepatic encephalopathy, pneumonia, ovine Johne's disease, mucosal disease and benign footrot.

The notifiable diseases exclusions were virulent footrot in sheep (26 exclusions), bovine brucellosis (1), equine herpesvirus 1 (1), anthrax (2), transmissible spongiform encephalopathy (3), foot-and-mouth disease (1), vesicular stomatitis (1), infectious laryngotracheitis (1), highly pathogenic avian influenza (1), Newcastle disease (1), fowl plague (1), bluetongue virus (1) and ovine Johne's disease (1).

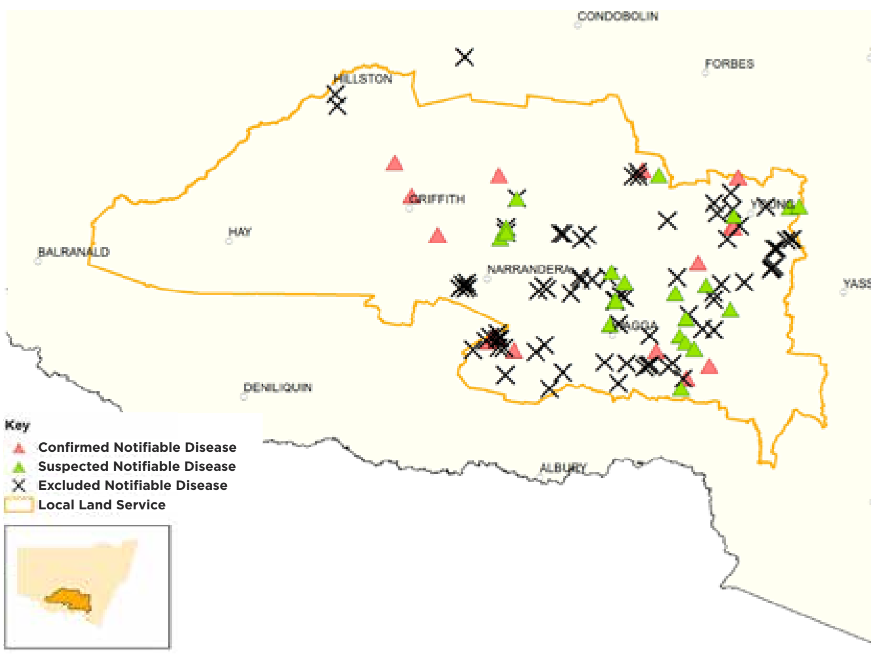


Figure 3 Surveillance for notifiable diseases in the Riverina Local Lands Services region, April to June 2017

The data are generated by district veterinarians entering the details of each investigation in the Livestock Health Management System (LHMS) and then using reporting tools to generate intelligence on the disease status of the district, as well as determining whether targets for investigation activity are being met. The data can also be mapped using the Department of Primary Industries BioMAP application. This allows managers to identify any gaps in the geographic coverage of clinical surveillance for potential notifiable diseases.

Leptospira pomona likely cause of reduced fertility in heifers

In April 2017, leptospirosis was provisionally diagnosed as the cause of reduced fertility in a group of Angus heifers on the Central Tablelands. At routine pregnancy testing, 47 out of 191 heifers were found to be not pregnant.

Working together, a private veterinarian and the district veterinarian collected blood samples from 8 of the nonpregnant heifers, and 4 showed *Leptospira pomona* titres of 1:3200 or greater. These are indicative of recent infection. Two non-pregnant heifers had evidence of previous exposure to bovine viral diarrhoea virus (BVDV)[34] but not recently; the remainder were naïve. None of the 8 heifers tested had serological evidence of exposure to *Neospora*.

Another 10 non-pregnant heifers and cows from across the herd were tested for antibody to leptospires. Four were negative to both *L. hardjo* and *L. pomona*. Six were positive to *L. hardjo* at relatively low titres of less than 1:200, and four had *L. pomona* titres at relatively high levels of 1:800 to 1:3200. Four of the 10 cows had evidence of previous exposure to BVDV 1, but again not recently. One of the 10 was positive for *Campylobacter* on a vaginal mucus agglutination test.

None of these cattle had been vaccinated against leptospirosis. Feral pigs, which are natural reservoirs for *L. pomona* are an increasing problem on this property in the Oberon district.

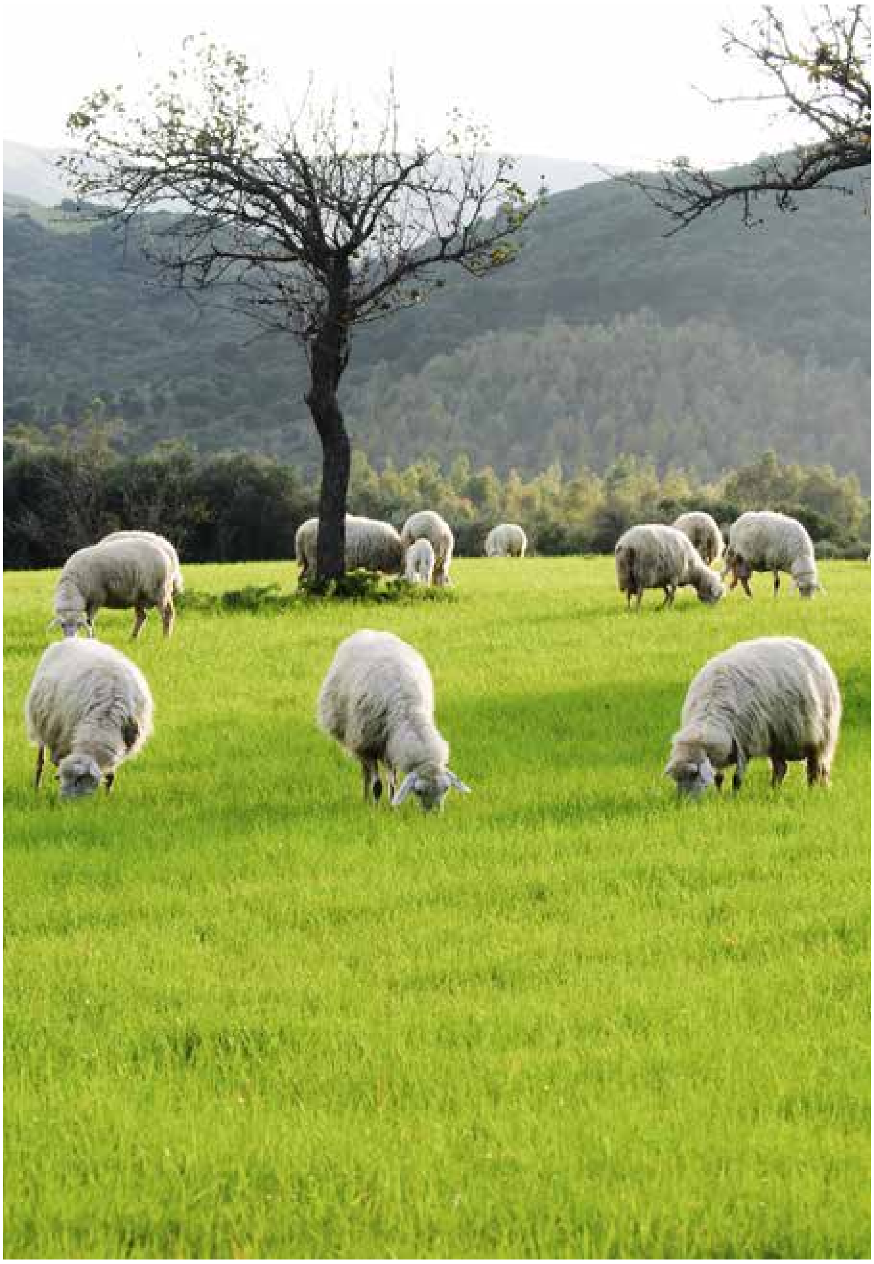
Although isolation of the causative organism is normally regarded as necessary to diagnose leptospirosis, such high antibody levels in unvaccinated cattle are consistent with a recent *L. pomona* infection with subsequent abortions. These cattle were about 5 months pregnant when pregnancy tested. *L. pomona* can cause abortion any time after the fourth month of gestation — most commonly in the sixth and seventh months

These test results were not sufficient to prove that *L. pomona* was a major factor in this case of reduced fertility. However, they do show that *L. pomona* is a risk to cows and heifers on the property, as well as to people handling the

34 The severe BVDV-2 form in Europe and North America has not been found in Australia.

cattle and that a full vaccination program against leptospirosis was warranted. The finding of a low level of *Campylobacter* was of uncertain significance, but given the low cost and high efficiency of vaccinating bulls against *Campylobacter*, bull vaccination was recommended. It was also recommended that a vaccination program using a killed vaccine made from a local strain of BVDV-1 be commenced, given that 6 of 8 heifers and 6 of 10 cows were naïve.

Outbreaks of leptospirosis *L. pomona* have occurred across New South Wales in the past, but not in the Central Tablelands recently. Despite routine surveillance as part of infertility and abortion investigations, *L. pomona* has been diagnosed as a cause of abortions only once in the Central Tablelands in the past 13 years. Continued surveillance is important because the reason for the current low prevalence of *L. pomona* on the Central Tablelands is not well understood; moreover, feral pig numbers are increasing in some areas, vaccination against leptospirosis is not routine, and leptospirosis is an important zoonosis.



Prenatal deaths in ewes

Abnormally high death rates of pregnant ewes before lambing were reported on more than 12 properties on the Southern Tablelands between April and June 2017. Owners noticed ewes dying suddenly, with the first deaths occurring about 2 weeks before the expected date for lambing to start. Deaths occurred in all breeds — especially first crosses — and predominantly in multiparous ewes. The presenting syndrome was quite unusual and the district veterinarian examined each case, excluded anthrax on clinical grounds and conducted necropsy examinations.

Most of the deaths involved spontaneous vaginal rupture (‘exploding ewe syndrome’). A tear, usually in the dorsal wall of the vagina, allowed herniation of the intestines. Most ewes were found dead, with internal haemorrhage from the root of the mesentery or external haemorrhage from trailing intestines found at necropsy.

Few producers recognised the condition from previous experience, and most queried the cause. Most of the losses were in twin-bearing ewes in fat condition (body condition score 4 out of 5) following good autumn pasture growth. Not all groups on a property were affected, and the pasture type varied. Some producers had provided mineral supplements. One common factor was the availability of clover in the pasture, suggesting that increased intra-abdominal pressure from gas build-up in the intestines played a part. Exactly why this occurred in some ewes and not others could not be determined.

Losses in some groups were up to 5%, with more than 1% commonly reported. One producer noted that 21 of 2100 ewes had died from the condition. He had been inspecting his ewes twice a day and had found all cases in the morning. Two-thirds of his affected ewes were carrying twins, with the remainder each carrying a large single foetus. This owner noted a similar number of vaginal prolapses in his lambing ewes.

Northern Territory

Susanne Fitzpatrick
Northern Territory Department of Primary Industry and Resources

During the quarter in the Northern Territory, 76 livestock disease investigations[35] were conducted to rule out emergency diseases or investigate suspect notifiable diseases.[36] The number of investigations by category of livestock is shown in Figure 4. Field investigations were conducted by government veterinary or biosecurity officers (61) and private veterinary practitioners (15). 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 177 livestock sample submissions[37] 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.

Hendra virus excluded in horse with *Crotalaria* sp. toxicity

Acute neurological disease was investigated in an 18-year-old stockhorse mare in June 2017. The mare had been losing weight for the previous 3 weeks despite a normal appetite, and was observed to suddenly become unbalanced with a 'hunched up' stance. The horse was in a group of 3 horses that had been brought to the Darwin property from the Katherine region 12 months previously.

On clinical examination, the mare was mildly depressed and dragging the toe of the hind feet, which was more apparent when turned in a tight circle (Figure 5). She was easily pulled to the side on the tail sway test. There was no pain or abnormalities found on musculoskeletal palpation.

Hendra virus infection was ruled out with PCR testing of nasal swabs and blood. Haematology was unremarkable but clinical chemistry revealed a significant elevation in gamma glutamyl transferase (GGT), suggestive of liver injury. There were mild elevations in creatinine phosphokinase (CPK) and aspartate aminotransferase (AST), likely due to mild muscle damage associated with ataxia. Viral isolation from a single blood sample was attempted using multiple cell lines to investigate the possibility of acute infection with an arbovirus, but no virus was isolated.

On questioning the owners, it became apparent that the horse had access to pastures containing *Crotalaria* spp. (rattlepods) over several years when residing in the Katherine region. *Crotalaria* spp. contain pyrrolizidine alkaloids that can cause cumulative liver damage and hepatic encephalopathy in horses several months after ingestion, known as 'Kimberley horse disease' or 'walkabout disease'. A diagnosis of pyrrolizidine toxicity was made based on the history, clinical signs and clinical chemistry. There is no effective treatment for this disease, and the mare was euthanased after further deterioration.

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35 Field investigation 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*

37 Some investigations involved multiple submissions.

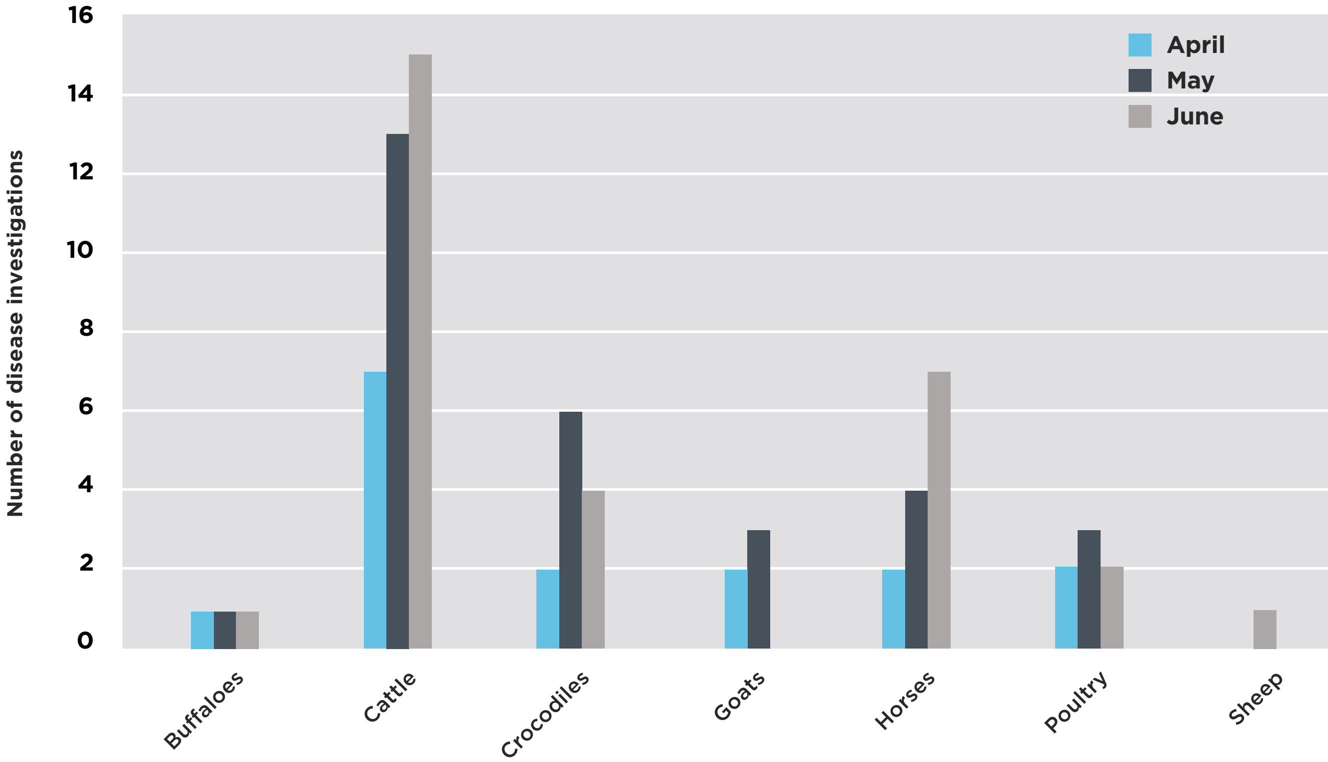

Figure 4 Number of field disease investigations to rule out emergency diseases or investigate suspect notifiable diseases, in the Northern Territory, April to June 2017

Figure 5 Toe dragging in a horse with pyrrolizidine alkaloidosis

Psittacosis excluded in a cockatiel

A notification was received from a member of the public, who had visited a roadhouse in Central Australia in late March 2017, advising that three cockatiels in an aviary cage of 25 were exhibiting clinical signs consistent with psittacosis. A photograph of the most severely affected bird was provided, showing the bird 'fluffed up' and depressed, with stained plumage and one eye swollen and partially closed, indicating conjunctivitis and possible sinusitis (Figure 6).

At a follow-up visit by the regional veterinary officer, the most severely affected bird was euthanased for necropsy. Gross necropsy revealed caseous conjunctivitis involving both eyes. Histopathology showed a marked squamous metaplasia of the lacrimal duct and nasal mucosae, with massive intraluminal accumulation of keratin. There were no notable gross or histological findings in other tissues. Polymerase chain reaction (PCR) testing of pooled cloacal, tracheal and ocular swabs from the euthanased bird and two other affected birds excluded influenza type A, Newcastle disease virus and Chlamydiaceae bacteria.

A diagnosis of hypovitaminosis A was made, and the owner was given advice to change the birds' diet. No losses have been reported.

Figure 6 Hypovitaminosis A affected bird with ruffled feathers

Queensland

Greg Williamson
Queensland Department of Agriculture and Fisheries

During the quarter in Queensland, 734 livestock disease investigations[38] were conducted to investigate suspect notifiable diseases or rule out emergency diseases.[39] The number of investigations by species of livestock is shown in Figure 7.

Terrestrial livestock disease investigations were conducted by government veterinary or biosecurity officers (98) and private veterinary practitioners (636). Diagnostic testing was conducted at the Queensland Biosecurity Sciences Laboratory and CSIRO Australian Animal Health Laboratory. Disease investigations were also carried out on non-livestock terrestrial species (106) and aquatic animals (25).

The Biosecurity Sciences Laboratory also processed sample submissions to substantiate proof of disease freedom certifications (199), for accreditation programs (21), regulatory activities (68) and targeted surveillance (296). The Biosecurity Sciences Laboratory received 1449 animal health related submissions 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.

Encephalopathy in a horse — exclusion of notifiable encephalitides

Equine herpesvirus 1 (EHV-1) and Hendra virus (HeV) were among a number of notifiable diseases excluded following abortion and neurological signs in a broodmare on a thoroughbred stud in the Western Downs in late May 2017.

The broodmare was one of 18 pregnant mares on the property and was noticed to be unwell when it aborted its foal during the first trimester. The foetus was not made available for sampling. During the next 5 days, the mare was observed to become progressively anorexic, adipsic (but played with water), depressed, incontinent and ataxic,

38 Field investigations with laboratory diagnostic testing.

39 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*

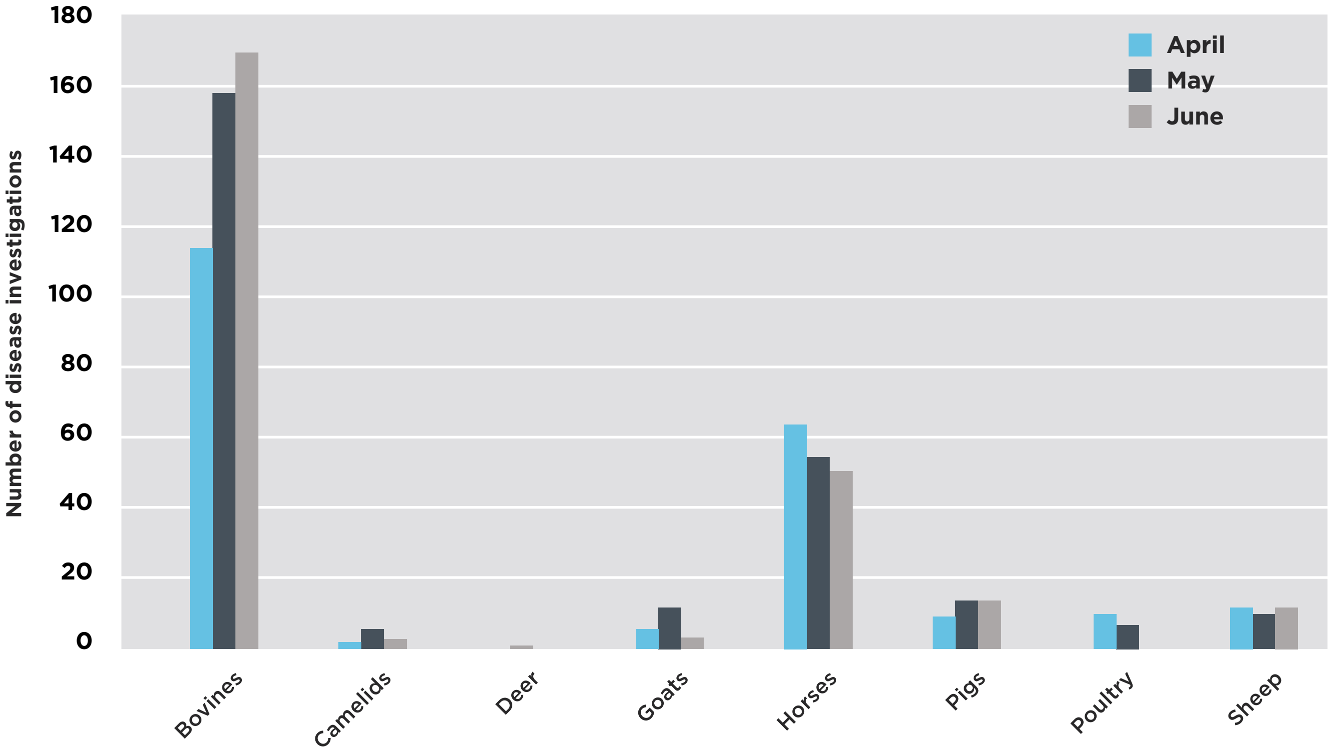

Figure 7 Number of terrestrial livestock disease investigations to investigate suspect notifiable diseases or rule out emergency diseases, in Queensland, April to June 2017

leading to a suspicion of EHV-1 and recognition of the need to exclude HeV.

Blood samples and swabs were collected for laboratory testing. The mare died the following day. After donning appropriate personal protective equipment (PPE), the veterinarian conducted a partial necropsy to collect the whole brain, which was submitted half fresh and half fixed in formalin to the Biosecurity Sciences Laboratory.

Real-time polymerase chain reaction (PCR) tests on blood samples and swabs were negative for HeV, EHV-1 and EHV-4, and real-time PCR tests on unpreserved brain tissue were negative for Australian bat lyssavirus (ABLV), Kunjin virus and Murray Valley virus. Swabs collected aseptically from the fresh brain yielded no aerobic growth. Histopathological examination of fixed brain revealed status spongiosus (alteration of central nervous tissue) of white matter and numerous Alzheimer type II astrocytes within grey matter; pathology consistent with metabolic encephalopathy. Marked elevations in urea and creatinine supported a putative diagnosis of uraemic encephalopathy.

Uraemic encephalopathy is an uncommon cause of neurological presentation in horses and can be associated with seizures, ataxia and abnormal mentation. Zoonotic diseases, including HeV and ABLV, should be considered as differential diagnoses when investigating acute neurological disease in horses. The brain of a horse with acute neurological disease should not be removed unless precautions are taken to prevent or minimise the risks of HeV and ABLV transmission. These may include exclusion of HeV prior to brain removal, only rabies-vaccinated veterinarians sampling the brain and/or wearing appropriate personal protective equipment.

Hendra virus infection in a horse

HeV infection was confirmed in one horse on a property in the Scenic Rim Council region, South East Queensland, in May 2017.

A 16-year-old riding pony, one of two horses not vaccinated against HeV on the property, developed rapidly progressing lethargy, inappetance and ataxia, with a respiratory rate of 30 breaths per minute, heart rate of 140 beats per minute and grey membranes with a slow capillary refill time. The owner opted to euthanase the horse. Nasal and rectal swabs and blood samples were taken prior to deep burial on the property. PCR tests on blood samples and both swabs swabs were positive for HeV. The veterinarians who attended the horse wore appropriate PPE and completed appropriate entry and exit decontamination procedures.

A risk assessment identified the remaining horse on the property, a 20-year-old thoroughbred as at risk of having been exposed. Blood samples and swabs were collected on Day 1 and Day 21 after the death of the index case. The thoroughbred remained clinically normal and PCR tests on all samples were negative for HeV. The surviving horse was subsequently vaccinated against HeV.

During the quarter, 159 equine submissions for HeV disease investigation were made to the Biosecurity Science Laboratory. A further 15 submissions were made for health testing to exclude HeV in clinically well horses before interstate or international movement, movement to stud or veterinary procedures that posed a high risk of disease transmission. Apart from the case of the 16-year-old pony in the Scenic Rim Council region, all HeV investigations were negative.

This was Queensland's first incident of HeV spillover since July 2015. The property had no roosting colonies of flying foxes and feeding points for the horses were not located under trees; however, the property was adjacent to forested land and flying foxes did fly overhead.

HeV infection in horses continues to pose work health and safety, public health and biosecurity risks. Equine veterinarians should regularly review their HeV risk management systems to ensure that human and animal health risks are minimised as much as practicable. Vaccination is the single most effective way of preventing HeV disease in horses. Horse owners are advised to talk to their veterinarians about vaccinating their horses. Further advice for preventing HeV disease in horses is available from the Queensland Government.[40]

Brucella suis in dogs - an emerging zoonosis

During the second quarter of 2017, serological evidence of infection with *Brucella suis* was detected in blood samples from 5 of 19 dogs. There has been steady increase in both the number of submissions for *B. suis* exclusion and detections during the past 4 years (Figure 8).

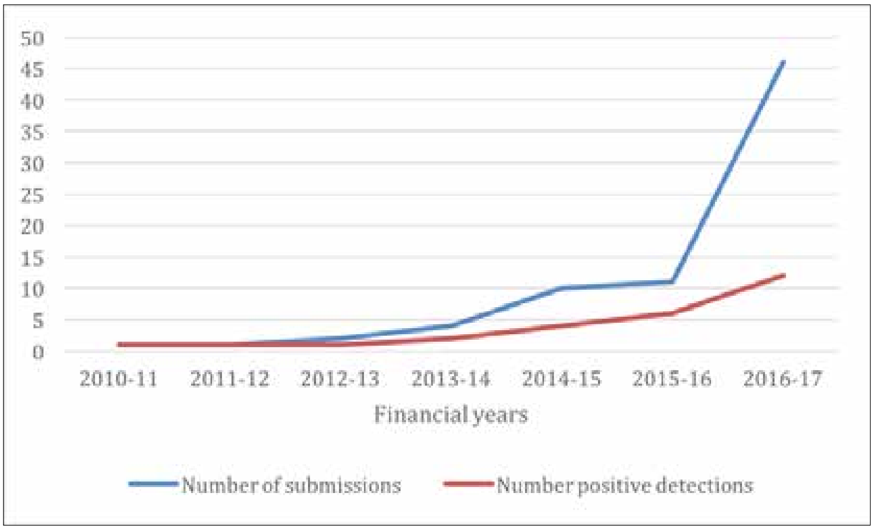

Figure 8 Serological investigation of *Brucella suis* in dogs in Queensland, 1 July 2010 to 30 June 2017

In a typical incident, a 4-year-old male Great Dane-cross dog used for feral pig hunting in the Maranoa region developed a swollen red area around the penis in June 2017. The prostate was enlarged, prepuce swollen and cellulitis extended to the testicles and the ventral abdomen. Rose Bengal and complement fixation tests on blood samples from the affected dog detected antibodies indicative of *B. suis* infection.

Tracing identified three other asymptomatic dogs, with three separate owners, that had been hunting feral pigs with the affected dog. Serological tests on samples from the three dogs indicated that one additional dog was infected. The owners were advised of the zoonotic risk and appropriate hygiene when dealing with their dogs.

Both seropositive dogs were treated with rifampin and doxycycline, and clinical signs in the affected dog responded well.

While the complement fixation test is specific for *B. suis*, false-negative results can occur in infected dogs prior to the mounting of a detectable antibody response. Dogs with clinical signs and history consistent with *B. suis* for which laboratory tests are inconclusive, should be re-tested after 6 weeks.

Spillover of *B. suis* into dogs and humans is almost exclusively associated with hunting feral pigs. The most common modes of infection in dogs is by direct contact with live feral pigs, the consumption of raw feral pig meat and offal, and exposure to bodily fluids of feral pigs. Transmission between dogs and humans can occur via direct contact or exposure to body fluids. Vertical transmission from dam to pups can also occur.

B. suis is a zoonosis with potentially serious consequences in humans and is endemic in the feral pig population of Queensland. *B. suis* has not been detected in the intensive pig industry. A *B. suis* accredited herd scheme was implemented in Queensland in 2001. Producers are encouraged to buy breeding stock only from herds registered in this scheme. It remains unclear whether the emergence of *B. suis* in dogs that hunt feral pigs is due to increased awareness and testing, an increase in the frequency of pig hunting activities or an increased prevalence of *B. suis* in feral pigs.

40 *www.daf.qld.gov.au/animal-industries/animal-health-and-diseases/a-z-list/hendra-virus*

South Australia

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

During the quarter in South Australia, 140 livestock disease investigations[41] were conducted to rule out emergency diseases and investigate suspect notifiable diseases.[42] The number of investigations by category of livestock is shown in Figure 9.

Subsidised field investigations were conducted by government veterinary or biosecurity officers (49) and private veterinary practitioners, who in 91 cases[43] 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 processes sample submissions requiring testing for export, accreditation programs and targeted surveillance.

Biosecurity SA, a division of Primary Industries and Regions South Australia (PIRSA), 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 in 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.

Suspected *Histophilus somni* infection in weaner cattle

During late autumn on a mixed-grazing property near Naracoorte in the south-east, two animals from of a group of 200 weaner beef cattle displayed weakness, depression, anorexia and a stiff-legged gait. The 6-month-old cattle had been grazing on fresh phalaris mixed pasture.

One of the recumbent animals was euthanased for necropsy. Gross lesions were thickened pleura and multifocal purulent abscesses in the lungs. Bacterial differentials included *Mannheimia haemolytica*, *Pasteurella multocida*, *Histophilus somni*, *Arcanobacterium pyogenes*, *Salmonella* spp. and *Mycoplasma* spp. Culture of lung abscesses were inconclusive, yielding a heavy growth of mixed organisms. Histopathology showed a fibrinous pleuritis and epicarditis, indicating polyserositis. These changes were suggestive of a systemic infection with *H. somni*, despite the lack of successful culture of *H. somni*. The brain exhibited random multifocal areas of meningoencephalitis with occasional thrombi, which were consistent with a presumptive diagnosis of systemic *H. somni*. Fatty liver changes were present and were likely to be a reflection of the mobilisation of body fat stores due to the anorexia.

H. somni is a commensal bacteria of cattle mucous membranes. The disease typically affects cattle aged 6 to 12 months old, especially feedlot cattle. Stress factors can precipitate clinical disease. No further weaner cattle were affected.

Panic grass poisoning in Merino sheep

Over a 2-week period in late April 2017, a sheep producer near Koonunga, north of the Barossa Valley, reported losing 8 Merino hoggets from a group of 200, with 8 others affected by photosensitisation. Sheep were noted to exhibit ocular and nasal discharges, which progressed to blindness, with crusted lesions at the mucocutaneous junction. Some of the sheep were coughing and had lost condition.

41 Subsidised field investigation with laboratory diagnostic testing.

42 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*

43 Some investigations involved multiple submissions.

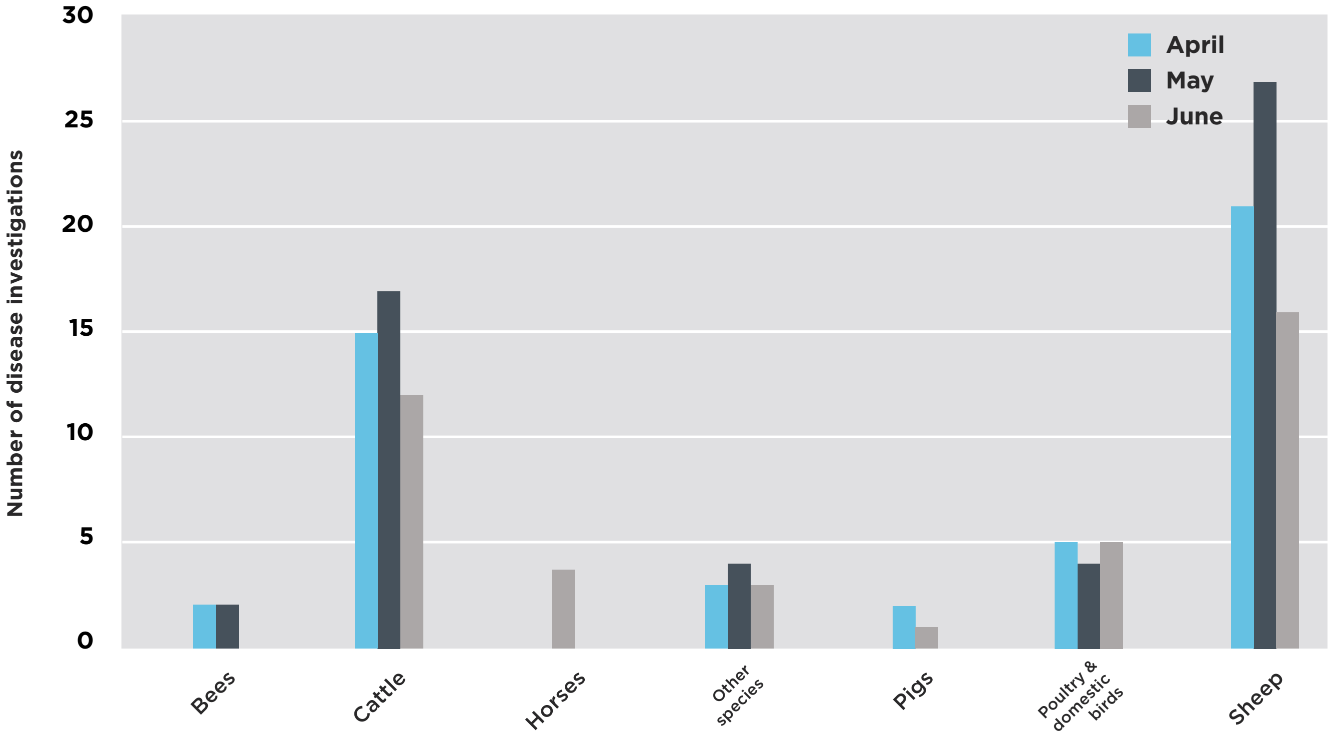

Figure 9 Number of disease investigations in South Australia, April to June 2017

On-farm investigation by Biosecurity SA officers revealed that affected animals were severely jaundiced and lethargic, with subcutaneous oedema in the face, jawline and ears, and excessive discharge from the eyes. Those observed were separate from the main group and would seek shade and lie down if left undisturbed. Most affected animals died within 2 or 3 days, even when moved from the paddock and placed under shelter.

An affected sheep was euthanased for necropsy. Gross findings included significant jaundice and yellowing of the mucous membranes and subcutaneous fat (Figure 10), with an enlarged liver that was pale orange in colour, and a grey consolidated right cranial lung lobe.

A provisional differential diagnosis list of facial eczema, polioencephalomalacia and plant toxicity was compiled and samples were sent to Gribbles VETLAB for analysis. Due to the ocular and nasal discharges and mucocutaneous junction lesions, additional exclusion testing for

Figure 10 Significant jaundice and yellowing of the mucous membranes and subcutaneous fat in a sheep affected by panic grass toxicity

bluetongue virus (BTV), foot-and-mouth disease (FMD) and vesicular stomatitis was performed, all tests were negative.

Histological findings in the liver and kidney were consistent with crystalline cholangitis/ cholangiohepatopathy and nephrosis, typical of panic grass (*Panicum capillare*) poisoning. This is likely due to the ingestion of steroidal saponins present in plants and manifests clinically as generalised icterus and facial oedema.

The summer of 2016–17 was characterised by well-above-average summer rainfall, allowing the proliferation of summer weeds. The group of hoggets had been agisted on a previously ungrazed grass-dominant pasture and had been on the paddock for 2 weeks prior to the mortality event. Examination of the pasture revealed that the dominant species was panic grass (Figure 11), which has become more prevalent in the general area in the past 10 years. Most of the panic grass was no longer actively growing but there were still plenty of lush green leaves, which might have appealed to the young sheep.

Figure 11 Panic grass specimen showing lush green leaves

The farmer was advised to move the group onto pastures where panic grass was less prevalent and allow access to shade, water and dry cereal hay. Despite doing this, sporadic deaths continued for another 2 weeks. The producer is now acutely aware of the importance of controlling toxic plants and plans to institute a control program.

Bluetongue exclusion in sheep deaths

Over a 3 to 4-week period during April 2017, deaths occurred in a group of 130 lambing ewes in the Adelaide Hills. Some ewes were found dead and others were recumbent after lambing and died after a few days. Many of the dead ewes were observed to have enlarged hardened udders, some with 'black udders', possibly indicating staphylococcal mastitis. A total of 29 ewes and 35 lambs died prior to an on-farm visit, with approximately 70% of ewes and some lambs seen with resolving muzzle lesions. Some ewes responded to treatment for hypocalcaemia or pregnancy toxaemia but others did not. The producer was concerned about *Heliotrope europaeum* (potato weed) toxicity as there had been prolific growth of this plant in the cropping areas of South Australia this season.

A 4-year-old ewe with scabby lesions around the muzzle and lips (Figure 12) was euthanased for necropsy. Other external lesions included dry crusty superficial lesions on the posterior aspect of the udder, with one necrotic-looking teat and clinical mastitis (Figure 13); mild suppurative erosions on the coronet of one foot and interdigital region of another foot; all hooves had a blueish discolouration beneath the coronet (Figure 14). There were no abnormal gross lesions in the mouth or gingiva, the liver and other major internal organs.

Histopathology revealed mild hepatic lipidosis, mild chronic inflammatory changes in the small intestine, abomasum and heart myocardium, with low numbers of myocardial sarcocysts. There was evidence of gastrointestinal parasitism but this was not considered severe enough to cause death (faecal egg count was negative). Bacterial cultures from the udder were positive for *Staphylococcus aureus*, with negative faecal cultures for *Yersinia*, *Salmonella* and *Camypylobacter* spp. Testing was negative for vesicular stomatitis virus (serum PCR and SNT), foot and mouth disease (serum cELISA and PCR) and bluetongue virus (serum cELISA, AGID and SNT), and transmissible spongiform encephalopathy (TSE) was excluded by histopathology. There was evidence of a severe gangrenous mastitis associated with staphylococcal infection. The exudative and crusted muzzle and udder lesions were not compatible with photosensitisation and the liver had minimal pathology with no gross evidence of pyrrolizidine alkaloid toxicity due to prior *Heliotrope* spp. grazing. Serum biochemistry revealed high normal fibrinogen and elevated globulin levels suggestive of inflammation, low cholesterol reflecting anorexia and marginal GGT elevation, indicating only mild hepatobiliary disease. The muzzle and udder lesions were suggestive of ovine parapoxvirus infection (scabby mouth), however electron microscopy was not performed. A presumptive diagnosis of primary scabby mouth was made on clinical grounds, resulting in a secondary Staphylococcal mastitis.

Figure 12 Scabby lesions around the muzzle and lips of affected ewe

Figure 13 Dry crusty superficial lesions on the udder showing one necrotic-looking teat

Figure 14 Blueish discolouration beneath the coronet of ewe's hoof

Scabby mouth is known to be a mild disease from which sheep recover quickly. In this case the clinician suspected that udder lesions and inflammation caused by the transient scabby mouth infection led to the ewes becoming susceptible to secondary mastitis. Mastitis tends to occur in late lactation associated with bruising of the udder by larger lambs and inoculation of bacteria from their oropharyngeal mucosa. Lamb deaths were likely to be due to starvation from inability to feed due to muzzle or udder lesions; or reduced maternal care due to maternal illness. No lambs were available for necropsy. Scabby mouth is a common infection of sheep caused by a parapoxvirus, and it occurs sporadically in flocks or in outbreak conditions where there is a naïve population.

Phalaris staggers in crossbred lambs

A south-east sheep producer lost 20 crossbred lambs from a group of 200 in a 2-week period in late May 2017. The 13-month-old lambs had been grazing a phalaris and clover paddock for a few weeks and were then moved onto a new paddock containing a mix of barley and clover when they started to show neurological signs, including ataxia, falling onto knees and collapsing after forced exercise.

Peripheral blood samples showed liver enzymes, calcium and magnesium were within normal limits but there were mild increases in creatinine kinase (CK) and aspartate transaminase (AST),

which were likely due to recumbency. Culture of a pharyngeal lymph node did not isolate any anaerobes, and no species of *Salmonella*, *Listeria* or *Brucella* were isolated. No gross pathological changes were observed in necropsy. Histopathology of the brain revealed intracytoplasmic green–brown granules, particularly in the basal ganglia, which is consistent with chronic phalaris intoxication but is not pathognomonic. However, a history of prior exposure to phalaris pasture indicates a diagnosis of phalaris staggers is most probable. Following the initial outbreak after the animals were moved onto new pasture, no further cases were observed.

Unfortunately, there is no treatment for phalaris staggers and any animal showing signs should be euthanased. The rest of the flock should be removed from the phalaris pasture. Control of this disease is based on good grazing management plus the use of cobalt as a protective agent.

Sinusitis in layer poultry

During June 2017, on a farm in the Riverland, approximately 50 adult free-range Hy-Line layer chickens, in two poultry sheds of 7000 birds, exhibited severe swelling above the eyes (Figure 15), ocular discharge and a drop in production. Birds in a third shed appeared unaffected. Differential diagnoses included infectious coryza, fowl cholera and fowl pox. The enterprise had a previous history of *Mycoplasma gallisepticum* infection but the flock had since been vaccinated against it.

Tissue samples and sinus swabs were collected from four birds for histopathology and culture. The histopathological findings confirmed the gross diagnosis of severe rhinitis, sinusitis, blepharitis and conjunctivitis accompanied by a mild laryngotracheitis with mild cellulitis of the head. Histopathology indicated that this process had likely been going on for 10 to 14 days. There no evidence of involvement of the lungs or air sacs, suggesting fowl cholera (*Pasteurella multocida*) was unlikely.

Avian influenza and Newcastle disease were excluded by polymerase chain reaction (PCR) testing of oropharyngeal swabs, and no species of *Salmonella*, *Listeria* or *Yersinia* were isolated from culture of sinus swabs. A heavy growth of *Avibacterium* sp. was isolated; possibly *Avibacterium volantium* (a nonpathogenic commensal bacteria) but it was not sequenced to confirm identification. Involvement of other agents such as *Mycoplasma* spp. and avian respiratory viruses in complicating the disease presentation could not be ruled out.

Given the localisation and severity of the changes, infectious coryza (caused by *Avibacterium paragallinarum*) was considered the most likely initiating cause but the agent was not isolated on culture or detected on PCR testing of sinus/nasal swabs. This unexpectedly negative result was presumably related to the chronicity of infection and invasion/overgrowth of other secondary opportunistic organisms, consistent with the culture results.

Infectious coryza is a contagious disease that is uncommon in commercial poultry flocks in South Australia. It may be transmitted by asymptomatic carrier birds.

Figure 15 Exposed diseased sinuses of affected layer chicken (Photo: Gribbles VETLAB)

Tasmania

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

During the quarter in Tasmania, 272 livestock disease investigations[44] were conducted to rule out emergency diseases or investigate suspect notifiable diseases.[45] The number of investigations by category of livestock is shown in Figure 16. Field investigations were conducted by government veterinary or biosecurity officers (19) and private veterinary practitioners (253). 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 593 livestock sample submissions[46] 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.

Two of the investigations this quarter were 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.

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.

Neospora abortion storm

In May 2017, neosporosis was diagnosed as the cause of an abortion storm in a dairy herd in north-west Tasmania.

The herd consisted of 400 mixed-aged Friesian cows, 163 of which aborted over a 2 to 3-week period at approximately 4 to 5 months' gestation. While all the cows that aborted were raised on the property and were in their first lactation, 27 newly lactating cows were introduced into the herd from other farms in the area 6 to 8 weeks prior to the first abortion.

Samples from aborted foetuses were submitted for microbiology; no species of *Listeria*, *Campylobacter*, *Salmonella*, *Histophilus* or fungi were isolated from any of the samples. Histopathology showed mild epicarditis and myocarditis in all aborted calves sampled. Inflammatory foci were present in the brain but no protozoal cysts were found associated with this inflammation. Aborted foetuses were negative for *Mycoplasma bovis*, *Chlamydia abortus*, *Tritrichomonas fetus* and *Leptospira* sp. by PCR testing.

Blood and milk samples were collected from aborting cows. While there was an inflammatory response evident in all cows sampled, clinical pathology results did not indicate a specific metabolic crisis or severe hepatic toxicoses, which could have predisposed the cows to abort. Milk samples were negative for *M. bovis* by PCR testing. Because of the significant number of abortions, *Brucella abortus* serology was conducted by DPIPWE to exclude this exotic disease; all results were negative. Serology was used to exclude Q fever, *L. pomona* and *L. hardjo*.

All blood samples from aborting cows returned a positive titre for Neosporum IFA (immunofluorescence). Blood samples were collected from a cohort of unaffected cows and only 30% of these in-calf cows seroconverted to *Neospora*. The uniform seroconversion to *Neospora* across the aborted cows compared to the lower rate of seroconversion for in-calf cattle in conjunction with the histopathology strongly suggested

44 Field investigation with laboratory diagnostic testing.

45 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*

46 Some investigations involved multiple submissions.

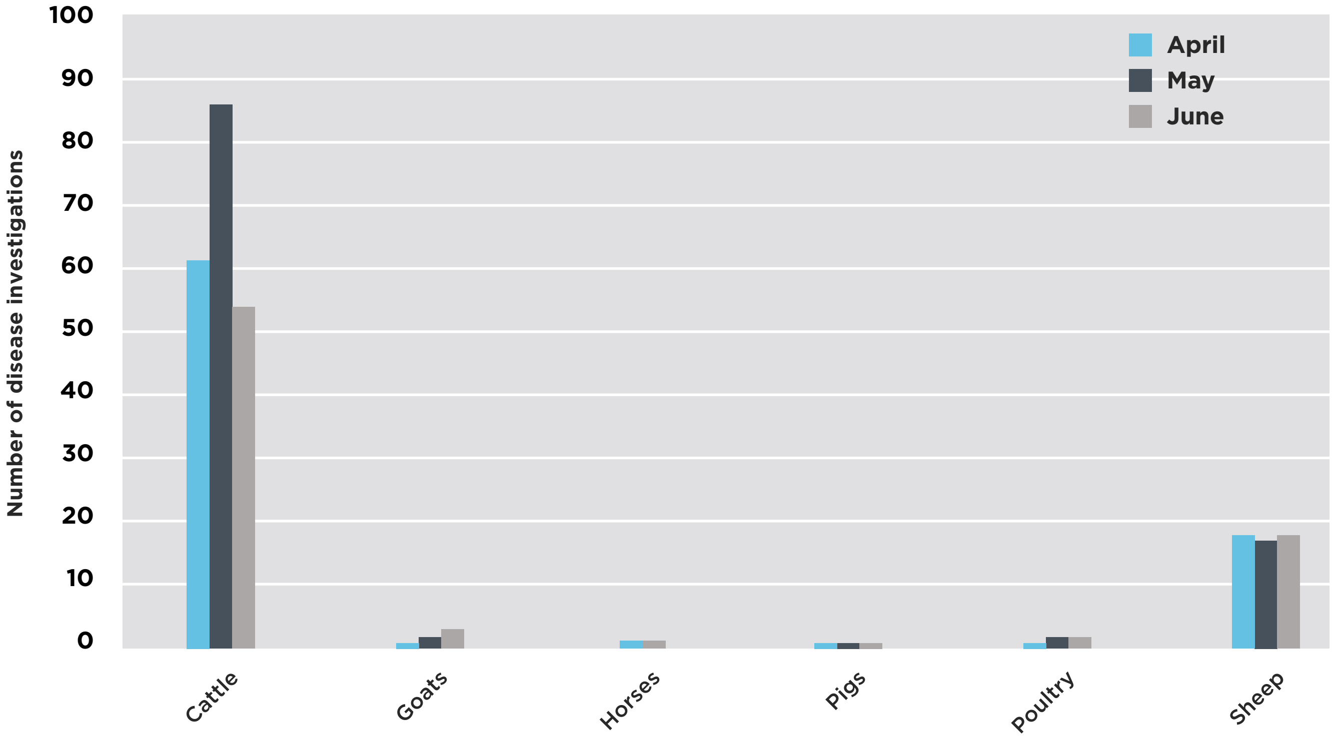

Figure 16 Number of field disease investigations to rule out emergency diseases or investigate suspect notifiable diseases, in Tasmania, April to June 2017

neosporosis as the cause of abortion.

More blood samples from affected cows were collected approximately 1 month later; these all showed falling titres to *Neospora* sp., suggesting that infection with *Neospora* sp. had been a recent occurrence. A group of pregnant cows that had been moved off the property about 5 months prior to the abortion storm all tested as seronegative for *Neospora* sp., suggesting there was likely a point source exposure to *Neospora* sp. for the affected milking herd after this time.

As *Neospora* sp. protozoa was not confirmed in the brain lesions, to complete the differential diagnosis list, samples from the affected group were also tested for Akabane and bluetongue virus. Bluetongue and Akabane ELISA tests were used to exclude these viruses. These viruses were included on the differential diagnosis list as both bluetongue and Akabane virus can cause abortion later in term (along with foetal deformities, which these calves did not have). Bluetongue can also produce mild inflammation or necrosis in the brain, similar to the necrosis in the brain of these calves. All samples were negative for bluetongue and Akabane viruses.

Cows are an intermediate host of protozoan parasite, *Neospora caninum*, and most likely become infected by eating oocysts of the parasite that have been passed in the faeces of a dog (or possibly some other carnivore) that has ingested infected foetal tissue or afterbirth. Infection can then pass from the cow to the foetus through the placenta.

The property owners were advised to collect, bury or burn all aborted material promptly, to avoid contact with potentially infective material and to ensure that their dogs had no access to this material, thus reducing the likelihood of contamination of pasture by dogs and other carnivores.

Victoria

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

During the quarter in Victoria, 578 livestock disease investigations[47] were conducted to investigate suspect notifiable diseases or rule out emergency diseases.[48] The number of investigations by species of livestock is shown in Figure 17. Field investigations were conducted by government veterinary or biosecurity officers (201) and private veterinary practitioners (377). 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 776 livestock sample submissions[49] to investigate suspect notifiable diseases or rule out emergency diseases. Sample submissions (260) were also 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 reproductive tract. The diseases most commonly diagnosed by species were gastrointestinal and reproductive disease in cattle, central nervous system in horses, and central nervous system and musculoskeletal disease in sheep. The majority of horse submissions were undertaken as part of a project investigating arbovirus-associated disease. 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 18).

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.

Winter keratoconjunctivitis in calves

In May 2017, an outbreak of keratoconjunctivitis occurred in more than half of the 300 weaned Friesian calves (aged 4 months) on a calf-rearing property in upper north-east Victoria. The outbreak appeared to have spread from the introduction of clinically affected calves that exhibited blepharospasm, epiphora, corneal ulceration, scleral injection and corneal oedema (Figure 18).

Figure 18 Calf affected by keratoconjunctivitis

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-response-agreement*

49 Some investigations involved multiple submissions.

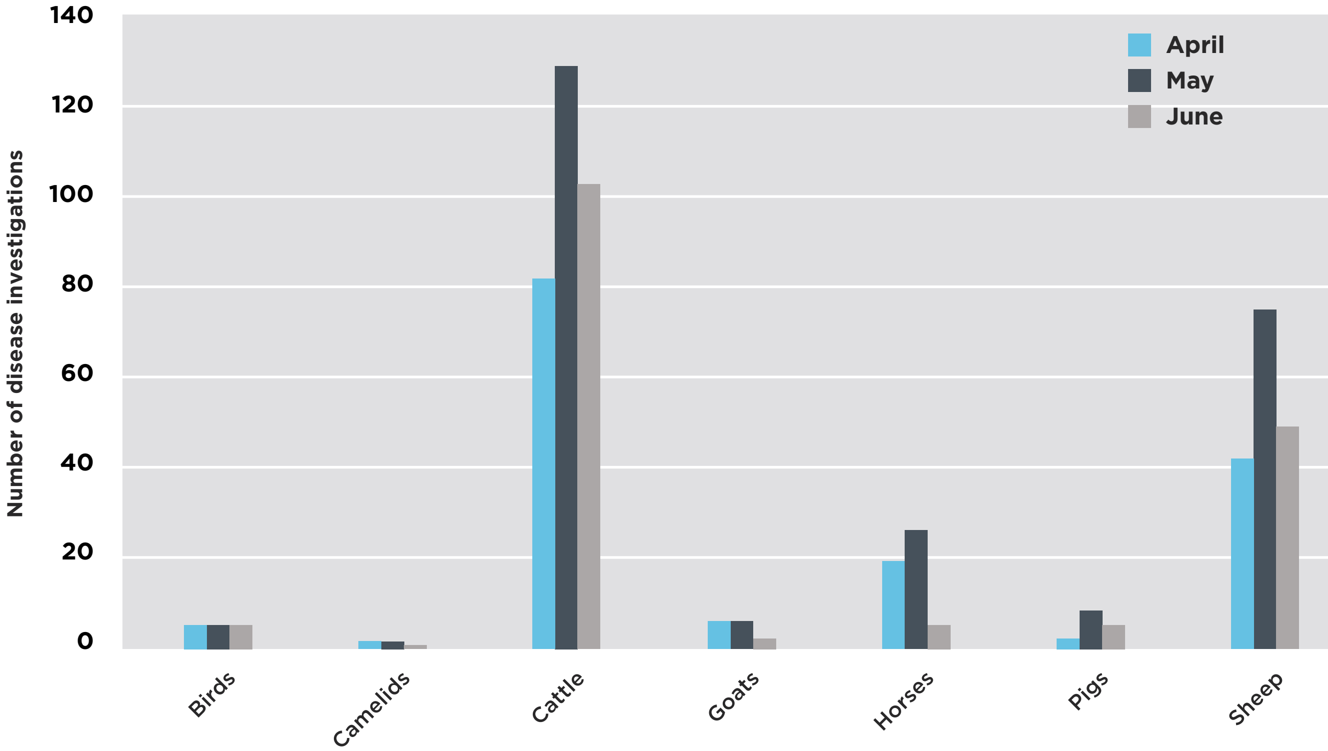

Figure 17 Number of field disease investigations to investigate suspect notifiable diseases or rule out emergency diseases, in Victoria, April to June 2017

Conjunctival swabs collected from seven affected calves and three unaffected calves were submitted for bacterial culture. *Moraxella bovoculi* was cultured from all swabs of affected calves but no significant growth was recorded from swabs of unaffected calves. Affected calves responded favourably to daily topical administration of cloxacillin benzathine.

The unusual feature of this outbreak was that keratoconjunctivitis was observed in winter, with the gregarious nature of calves possibly helping to spread the condition. Following anecdotal reports of similar outbreaks both this and last winter, Agriculture Victoria has initiated a small research project to better understand the condition.

The owner was advised to treat clinically affected calves and to separate affected calves from unaffected calves.

Spontaneous vaginal rupture in Dorset ewes

Spontaneous vaginal rupture led to the deaths of 13 late-pregnant twin-bearing Dorset ewes from a group of 300 on a property in upper north-east Victoria in May 2017. Affected ewes were usually found dead, with a section of intestine protruding through a tear in the dorsal vaginal wall.

Necropsy showed abdominal haemorrhages, particularly around the mesentery, as well absence of some of the small or large intestine and/or caecum. Nothing significant was found on histopathology or clinical pathology. Affected ewes were all heavily pregnant, in fat condition, on energy-rich lush pasture, and on hilly country, which may have contributed to the occurrence of the condition. Hilly country is a recognised risk factor for vaginal prolapse.

The outbreak ceased 2 weeks after its onset. No interventions were instituted – the farmer chose not to alter the ewes' feed intake due to concern for triggering cases of pregnancy toxaemia.

Western Australia

Emily Glass
Department of Primary Industries and Regional Development, Western Australia

During the quarter in Western Australia, 257 livestock disease investigations[50] were conducted to rule out emergency diseases or investigate suspect notifiable diseases.[51] The number of investigations by category of livestock is shown in Figure 19. Field investigations were conducted by government veterinary officers (50) and private veterinary practitioners (207). All diagnostic testing was conducted by the Department of Primary Industries and Regional Development (DPIRD) or CSIRO Australian Animal Health Laboratory.

During the quarter, DPIRD processed 501 livestock sample submissions,[52] 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.

DPIRD, 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. This supports 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.

Sudden death in backyard chickens

In May 2017, DPIRD investigated a case of weakness, depression and death in a flock of backyard chickens in the Broome region.

The owner had a flock of 3 to 7-year-old Hy-Line-cross laying hens that presented with sudden onset of weakness and depression, and subsequent death. Of the flock of 10 birds, 6 died over a 3-day period. Three new chicks had been introduced to the flock a week prior to the onset of disease.

A DPIRD field veterinary officer conducted an investigation and necropsy on the property wearing appropriate personal protective equipment (PPE). Affected birds showed neck weakness and dyspnoea. Necropsy of two deceased birds showed mild bloody fluid in the sinuses and thorax. No other gross signs were noted and an epidemiological assessment resulted in a reduced level of suspicion of reportable disease involvement. A range of swabs and fresh and fixed tissues were submitted to the DPIRD laboratory for exclusion of reportable diseases, and to determine the cause of the deaths in the flock. Differential diagnoses at that stage included bacterial and viral diseases or acute toxicity.

Avian influenza and Newcastle disease polymerase chain reaction

In May 2017, DPIRD investigated a case of weakness, depression and death in a flock of backyard chickens in the Broome region.

50 Field investigation with laboratory diagnostic testing.

51 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*

52 Some investigations involved multiple submissions.

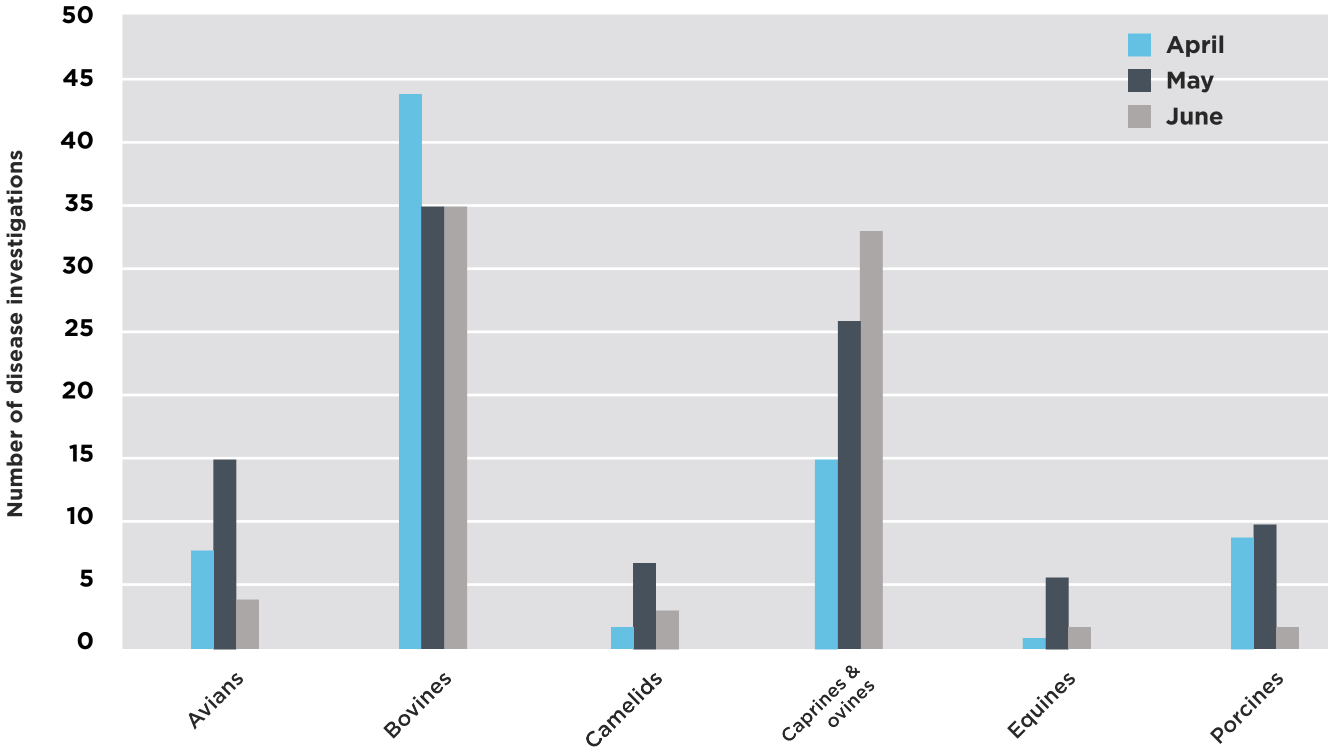

Figure 19 Number of field disease investigations to rule out emergency diseases or investigate suspect notifiable diseases, in Western Australia, in April to June 2017

(PCR) tests of oropharyngeal and cloacal swabs were negative. Histopathology revealed multiple small foci of acute epithelial erosion in the trachea in one bird, and a moderate chronic lymphoplasmacytic tracheitis affecting all birds submitted. The birds were also affected by a mild enteric helminthiasis.

Further bacteriology and molecular biology testing was conducted, including avian mycoplasma and infectious laryngotracheitis (ILT) virus PCR tests. This identified *Mycoplasma synoviae* as the likely cause of the chronic tracheitis affecting the birds. ILT testing was negative and therefore excluded as the cause for the acute erosive tracheitis in the single bird.

Given the clinical presentation of neck weakness and dyspnoea, *Clostridium botulinum* types C and D toxin ELISA was performed, and was positive on crop content for one of the birds, which is highly suggestive of recent ingestion of the toxin. The diagnosis of botulism is consistent with the presentation of the case, and was determined the most likely cause of the deaths in this flock. DPIRD provided this information to the owner of the flock, and provided them biosecurity advice to prevent further disease.

Respiratory disease and weight loss in weaner pigs

In June 2017, a private veterinarian notified the local DPIRD field veterinary officer of a case of respiratory disease, wasting and deaths in 6-week-old weaner pigs in the Albany region.

Respiratory signs, including dyspnoea and tachypnoea, were noticed by the producer, with affected pigs losing condition and showing signs of diarrhoea. From a group of 11 weaners in a shed of 200 pigs, 5 were affected, and 3 of those subsequently died.

Necropsy was conducted on four weaners at DPIRD. Necropsy findings were consistent across all weaners, including darkened caudal lung lobes, pleural and abdominal effusion, diffuse patches of pallor in the livers, and pale kidneys. The provisional diagnoses at this stage were Glässer's disease and pleuropneumonia.

On histopathology, there was evidence of severe hepatic necrosis, pulmonary haemorrhage, pyogranulomatous bronchointerstitial pneumonia and severe necrotising lymphadenitis. The severe necrotising lesions were associated with macrophages containing intracytoplasmic amphophilic botyroid inclusion bodies, with immunohistochemical staining for porcine circovirus 2 (PCV-2) strongly positive. Samples from all weaners were cultured with no significant isolates found.

Samples were provided to the CSIRO Australian Animal Health Laboratory to exclude the reportable diseases swine influenza and porcine reproductive and respiratory syndrome (PRRS). All samples were negative for these reportable diseases after testing that included influenza A TaqMan assay, influenza HINI NA TaqMan assay, porcine respiratory and reproductive syndrome European and North American TaqMan assay and swine influenza A TaqMan assay.

DPIRD provided the diagnosis of PCV-2 associated disease to the private veterinarian, who worked with the producer to control disease in the weaners.

Strengthening our foot-and-mouth disease surveillance networks

Western Australia's access to livestock and livestock product export markets relies on Australia being free of foot-and-mouth disease (FMD). Private veterinarians are an integral part of the surveillance network for FMD and other reportable diseases.

In this quarter, DPIRD ran a series of four regional workshops for private veterinarians across the states, with the aim of strengthening animal surveillance capacity and ensuring that reportable diseases such as FMD are detected and reported early, should an incursion occur. Any reports of clinical signs consistent with FMD are investigated and laboratory exclusion testing performed. An example of a case in which FMD exclusion testing was conducted is presented as follows.

Foot-and-mouth disease exclusion in a dairy cow

In March 2017, a private veterinarian investigated a report from a producer in the South West Agricultural Region of a recumbent 4-year-old dairy cow. Ill-thrift had been observed in the cow since it calved 3 weeks prior, and it had been recumbent for the past 4 days. From a herd of 30 cows, only this cow was affected.

On clinical examination by the private veterinarian, the cow was in poor body condition, with reduced gut sounds, dry faeces, a purulent vaginal discharge and oral mucosal erosions. There was no history of recent animal introduction or movements of people or equipment that might suggest an infectious disease event.

The preliminary diagnosis based on history and clinical presentation was post-calving metritis. Although the history and clinical presentation meant the index of suspicion for FMD was very low, DPIRD determined that exclusion testing was warranted given the presence of oral erosions. The veterinarian collected samples from the affected cow and the remainder of the herd to exclude FMD and vesicular stomatitis, including blood, saliva, oral swabs, smears and faeces. Testing for FMD and vesicular stomatitis at the CSIRO Australian Animal Health Laboratory was negative for all animals. Tests conducted included FMD and vesicular stomatitis PCR, ELISA, serum neutralisation and virus isolation.

Due to severity of the illness, the affected cow was euthanased. Necropsy revealed evidence of metritis. Swabs taken from the uterus isolated a heavy growth of *Truperella pyogenes*. The definitive diagnosis was confirmed as post-calving bacterial metritis.

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 18. 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 4 shows the number of PICs inspected and found with one or more infected animals.

Table 4 Summary of National Sheep Health Monitoring Project (NSHMP) inspected and infected line results, 1 April to 30 June 2017

State	Number of animals inspected	Number of PICs inspected	Number of PICs infected	Percentage of PICs infected
NSW	4,005	13	1	7.7
NT	0	0	0	0
Qld	1,071	2	0	0
SA	94,356	659	6	0.9
Tas.	12,539	72	0	0
Vic.	12,446	83	11	13.3
WA	561	3	0	0
Aus.	**124,978**	**832**	**18**	**2.2**

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 5. For status definition, see the current species MAP manual.[53] Lists of alpaca, goat herds and sheep flocks assessed in the MAPs are available on the Endemic Disease Information System website.[54] 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.

Table 5 Herds or flocks[a] with a Market Assurance Program status of at least Monitored Negative 1, 1 January to 30 June 2017

Quarter	Alpacas	Goats	Sheep	Total
Jan–Mar 2017	15	23	370	408
Apr–Jun 2017				
NSW	7	7	149	163
Qld	0	6	2	8
SA	7	8	161	176
Tas.	0	1	13	14
Vic.	1	2	51	54
WA	0	0	4	4
Aus.	**15**	**24**	**380**	**419**

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

53 *www.animalhealthaustralia.com.au/maps*

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

Ovine Brucellosis

Infection with *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 brucellosis freedom operate in all states. Table 6 shows the number of accredited flocks at the end of the quarter.

Table 6 Ovine Brucellosis accredited-free flocks, 1 April 2016 to 30 June 2017

State	Apr–Jun 2016	Jul–Sep 2016	Oct–Dec 2016	Jan–Mar 2017	Apr–Jun 2017
NSW	861	861	861	851	851
Qld	73	72	72	74	78
SA	530	539	539	533	533
Tas.	71	56	59	62	62
Vic.	457	436	436	423	454
WA	184	184	180	168	185
Aus.	**2,176**	**2,148**	**2,147**	**2,111**	**2,163**

Laboratory testing

Serological testing

Table 7 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 7 Results of serological testing for two equine viruses, 1 April 2016 to 30 June 2017

Quarter	No. of tests (equine infectious anaemia)	Positive (equine infectious anaemia)	No. of tests (equine viral arteritis)	Positive (equine viral arteritis)
Apr–Jun 2016	825	0	943	4
Jul–Sep 2016	473	0	446	2
Oct–Dec 2016	1,303	16	547	0
Jan–Mar 2017	758	0	652	1
Apr–Jun 2017				
NSW	737	0	784	4
NT	0	0	0	0
Qld	8	0	7	0
SA	0	0	0	0
Tas.	0	0	0	0
Vic.	222	0	188	1
WA	2	0	1	0
Aus.	**969**	**0**	**980**	**5**

Table 8 summarises the results of laboratory testing for equine herpesvirus 1 on samples submitted to state and territory animal health laboratories during the quarter.

Table 8 Results of testing for equine herpesvirus 1 (EHV-1), at 30 June 2017

Syndrome	EHV-1 suspected but not confirmed	Negative	Positive	Total
Abortion	0	61	0	61
Neurological	0	4	0	4
Other	0	20	7	27
Total	**0**	**85**	**7**	**92**

Table 9 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).[55] Positive serological test results are not an indication of the presence of clinical disease.

Table 9 Results of serological testing for three arboviruses, 1 April 2016 to 30 June 2017

Quarter	No. of tests (Akabane)	Positive (Akabane)	No. of tests (BEF)	Positive (BEF)	No. of tests (BTV)	Positive (BTV)
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
Apr–Jun 2017	580	84	1,222	44	1,577	123

BEF = bovine ephemeral fever virus; BTV = bluetongue virus

55 *namp.animalhealthaustralia.com.au*

Surveillance activities

Bovine brucellosis

Australia declared freedom from bovine brucellosis (caused by Brucella abortus) in 1989.[56] Surveillance is maintained through abortion investigations and additional testing of cattle for export or other reasons. Table 10 shows 279 bovine abortion investigations and 902 investigations for other reasons were performed during the quarter; all were negative for bovine brucellosis.

Table 10 Bovine brucellosis testing, 1 April 2016 to 30 June 2017

Quarter	No. of tests (abortion)	Positive (abortion)	No. of tests (other reasons)[a]	Positive (other reasons)
Apr–Jun 2016	132	0	376	0
Jul–Sep 2016	121	0	316	0
Oct–Dec 2016	33	0	147	0
Jan–Mar 2017	137	0	1,367	0
Apr–Jun 2017				
NSW	9	0	869	0
NT	0	0	0	0
Qld	56	0	14	0
SA	24	0	7	0
Tas.	3	0	0	0
Vic.	11	0	9	0
WA	176	0	3	0
Aus.	**279**	**0**	**902**	**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.

56 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*[57], 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 (likelihood of detecting BSE). Australia's target is to achieve a minimum of 150,000 points over a rolling 7-year period. Table 11 shows the number of animals sampled for BSE and scrapie and the points tally for cattle in the NTSESP[58] during the past 12 months. All samples tested were negative.

Table 11 Samples tested for transmissible spongiform encephalopathies (TSEs), 1 July 2016 to 30 June 2017

State	No. examined (cattle)	Points (cattle)	Positive (cattle)	No. examined (sheep)	Positive (sheep)
NSW	230	40,095.9	0	177	0
NT	16	6,270.7	0	0	0
Qld	166	54,418.5	0	49	0
SA	25	11,538.6	0	32	0
Tas.	20	5,284.9	0	12	0
Vic.	134	37,868.3	0	104	0
WA	34	16,550	0	135	0
Aus.	**625**	**172,776.9**	**0**	**509**	**0**

Avian influenza

Australia is currently free from highly pathogenic avian influenza (AI). A number of low pathogenic subtypes of AI have previously 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, 820 birds from 114 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 12). Tests included competitive ELISA (enzyme-linked immunosorbent assay), haemagglutination inhibition, agar gel immunodiffusion (AGID), reverse-transcriptase polymerase chain reaction (PCR) and virus isolation.

Table 12 Results of testing for avian influenza virus in poultry, 1 April to 30 June 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.

57 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*

58 *www.animalhealthaustralia.com.au/what-we-do/disease-surveillance/tse-freedom-assurance-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[59] in all Australian jurisdictions. Vaccination exceptions for broilers apply in Tasmania, Western Australia, Queensland and South Australia. During the quarter, 836 birds from 116 laboratory submissions were tested for Newcastle disease (Table 13). Please consult the Wildlife Health Australia report in this publication for information on avian paramyxovirus in wild birds.

Table 13 Results of testing for Newcastle disease (ND) testing in poultry, 1 April to 30 June 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	3	0

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 14 summarises *Salmonella* spp. isolations from animals reported to NEPSS.

Table 14 Salmonella notifications reported to the National Enteric Pathogen Surveillance Scheme (NEPSS), 1 April to 30 June 2017

Salmonella serovar	Birds[a]	Cats	Cattle	Dogs	Horses	Pigs	Sheep	Other	Total
Bovismorbificans	0	0	1	0	0	3	0	0	4
Dublin	0	0	8	0	0	0	0	0	8
Infantis	0	0	3	0	0	0	0	0	3
Typhimurium	1	4	9	8	1	2	1	1	27
Other	1	0	20	1	0	12	0	8	42
Total	**2**	**4**	**41**	**9**	**1**	**17**	**1**	**9**	**84**

a Includes both poultry and wild birds.

59 '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 15 summarises NAQS animal testing for specific target diseases in Australia during the past five quarters.

Table 15 Disease testing and pest surveillance under the Northern Australia Quarantine Strategy (NAQS), 1 April 2016 to 30 June 2017

Target disease	Apr–Jun 2016		Jul–Sep 2016		Oct–Dec 2016		Jan–Mar 2017		Apr–Jun 2017	
	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive
Aujeszky's disease[a]	146	0	196	0	189	0	0	0	46	0
Australian bat lyssavirus	0	0	0	0	0	0	1	0	0	0
Avian influenza[a]	103	0	0	0	0	0	123	3	29	0
Classical swine fever	206	0	196	0	189	0	0	0	46	0
Japanese encephalitis	59	1[b]	0	0	45	0	53	3	60	0
Surra (*Trypanosoma evansi*)	199	0	244	0	207	0	3	0	84	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.[60] 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 18). 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 16 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**.[61]

Table 16 Summary of fly-trapping events conducted, 1 July 2016 to 30 June 2017[a]

Risk entry pathway	Conducted by	Jul–Sep 2016	Oct–Dec 2016	Jan–Mar 2017	Apr–Jun 2017
Torres Strait	NAQS	15	15	15	15
Livestock export ports	NT, Qld and WA governments	52	61	56	54

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**[62] and quarterly in the journal Communicable Diseases Intelligence and are replicated in *Animal Health Surveillance Quarterly* (Table 17) for five important zoonoses.

Table 17 National notifications of five zoonotic infections in humans, 1 April 2016 to 30 June 2017

Quarter	Brucellosis[a]	Chlamydia[b]	Leptospirosis	Listeriosis	Q fever
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	2	2	55	22	124
Apr–Jun 2017					
ACT	0	0	0	0	0
NSW	2	0	4	7	39
NT	0	0	2	0	0
Qld	3	0	17	8	54
SA	0	0	1	1	4
Tas.	0	0	0	0	1
Vic.	1	0	0	2	2
WA	0	0	1	2	2
Aus.	**6**	**0**	**25**	**20**	**102**

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'.

60 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).

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

62 *www9.health.gov.au/cda/source/cda-index.cfm*

National notifiable animal disease investigations

During the quarter, 776 national notifiable animal disease investigations[63] were conducted into suspect disease events. National notifiable animal diseases include a subset of emergency diseases.[64] Table 18 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 (see contact 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*.[65]

Table 18 Investigations for national notifiable animal diseases, 1 April to 30 June 2017

Disease	Species	State	Month	Response code[a]	Finding
African swine fever	Pig	Vic.	May	3	Negative
Anaplasmosis in tick-free areas	Cattle	WA	Apr	2	Negative (3 unrelated investigations)
Australian bat lyssavirus[b]	Cat	NSW	Apr	3	Negative
	Deer	NSW	Apr	3	Negative
	Dog	NSW	Jun	3	Negative
	Dog	Qld	Apr	2	Negative
	Horse	Qld	Apr	2	Negative (2 unrelated investigations)
	Horse	Qld	May	2	Negative
	Horse	Qld	Jun	2	Negative
Babesiosis in tick-free areas	Cattle	WA	Apr	2	Negative (3 unrelated investigations)
Bluetongue — clinical disease	Camel	WA	May	2	Negative
	Cattle	NSW	Jun	2	Negative (2 unrelated investigations)
	Cattle	Qld	Jun	2	Negative
	Cattle	SA	Apr	3	Negative
	Cattle	SA	Jun	2	Negative
	Cattle	Tas.	Jun	3	Negative
	Cattle	Vic.	Apr	2	Negative
	Cattle	WA	Apr	2	Negative
	Cattle	WA	May	2	Negative (2 unrelated investigations)
	Cattle	WA	Jun	3	Negative
	Goat	Qld	May	2	Negative
	Sheep	NSW	May	2	Negative (2 unrelated investigations)
	Sheep	NSW	Jun	2	Negative (2 unrelated investigations)
	Sheep	Qld	Apr	2	Negative
	Sheep	SA	Apr	2	Negative

Cont

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

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

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

Disease	Species	State	Month	Response code[a]	Finding
	Sheep	SA	Apr	3	Negative
	Sheep	SA	May	2	Negative
	Sheep	SA	May	3	Negative
	Sheep	Vic.	May	2	Negative
	Sheep	WA	Apr	2	Negative
	Sheep	WA	May	2	Negative
	Sheep	WA	June	2	Negative (3 unrelated investigations)
Bovine viral diarrhoea virus 2	Cattle	WA	Apr	2	Negative (4 unrelated investigations)
	Sheep	WA	Jun	2	Negative
Brucella abortus (excl. cattle)	Sheep	WA	May	2	Negative
	Sheep	WA	Jun	2	Negative (2 unrelated investigations)
Brucella suis	Dog	NSW	Apr	2	Positive (3 unrelated investigations)
	Dog	NSW	Apr	2	Negative (7 unrelated investigations)
	Dog	NSW	Apr	3	Negative
	Dog	NSW	May	2	Positive (2 unrelated investigations)
	Dog	NSW	May	2	Negative (18 unrelated investigations)
	Dog	NSW	May	3	Negative
	Dog	NSW	Jun	2	Positive
	Dog	NSW	Jun	2	Negative (25 unrelated investigations)
	Dog	NT	May	2	Negative
	Dog	Qld	Apr	2	Negative (3 unrelated investigations)
	Dog	Qld	May	2	Negative (3 unrelated investigations)
	Dog	Qld	Jun	2	Positive (3 related investigations)
	Dog	Qld	Jun	2	Negative (5 unrelated investigations)
	Dog	Qld	Jun	2	Negative (3 related investigations)
	Dog	Qld	Jun	2	Positive (2 unrelated investigations)
	Dog	Vic.	May	3	Negative
	Pig	NSW	Jun	2	Negative
Contagious agalactia	Sheep	WA	May	2	Negative
Enzootic bovine leucosis	Cattle	SA	Apr	3	Negative
Equine encephalomyelitis (Eastern, Western and Venezuelan)	Horse	WA	May	3	Negative (2 unrelated investigations)
	Horse	WA	Jun	3	Negative
Equine influenza	Horse	NSW	May	2	Negative
Foot-and-mouth disease	Cattle	NSW	May	3	Negative (3 unrelated investigations)
	Cattle	NSW	Jun	3	Negative (2 unrelated investigations)
	Cattle	NT	Jun	2	Negative
	Cattle	Vic.	Apr	3	Negative (2 unrelated investigations)
	Cattle	Vic.	May	3	Negative (2 unrelated investigations)
	Cattle	Vic.	Jun	3	Negative (4 unrelated investigations)

Cont

Disease	Species	State	Month	Response code[a]	Finding
	Cattle	WA	Apr	3	Negative (2 unrelated investigations)
	Cattle	WA	May	2	Negative
	Cattle	WA	Jun	3	Negative (2 unrelated investigations)
	Pig	Qld	May	3	Negative
	Sheep	NSW	Apr	3	Negative
	Sheep	SA	Apr	3	Negative
	Sheep	SA	May	3	Negative
	Sheep	Vic.	Apr	3	Negative
	Sheep	Vic.	Jun	3	Negative (2 unrelated investigations)
	Sheep	WA	May	2	Negative
Infection of bees with *Melissococcus plutonius* (European foulbrood)	Bees	Qld	Apr	2	Positive
	Bees	Qld	Apr	2	Negative (14 unrelated investigations)
	Bees	Qld	May	2	Negative (15 unrelated investigations)
	Bees	Qld	May	2	Positive
	Bees	Qld	Jun	2	Negative (6 unrelated investigations)
	Bees	SA	Apr	2	Negative (2 related investigations)
Infection of bees with Paenibacillus larvae (American foulbrood)	Bees	Qld	Apr	2	Positive (10 unrelated investigations)
	Bees	Qld	Apr	2	Negative (5 unrelated investigations)
	Bees	Qld	May	2	Positive (8 unrelated investigations)
	Bees	Qld	May	2	Negative (8 unrelated investigations)
	Bees	Qld	Jun	2	Negative (2 unrelated investigations)
	Bees	Qld	Jun	2	Positive (4 unrelated investigations)
	Bees	SA	Apr	2	Positive (2 related investigations)
	Bees	SA	Apr	2	Positive (2 unrelated investigations)
	Bees	SA	Apr	2	Negative (48 unrelated investigations)
	Bees	SA	May	2	Negative (2 related investigations)
	Bees	SA	May	2	Negative (68 unrelated investigations)
	Bees	SA	May	2	Positive (8 unrelated investigations)
	Bees	SA	Jun	2	Positive (2 unrelated investigations)
	Bees	SA	Jun	2	Negative (11 unrelated investigations)
Infection with African horse sickness virus	Horse	WA	Jun	3	Negative
Infection with *Chlamydophila abortus* (enzootic abortion of ewes, ovine chlamydiosis)	Sheep	WA	Apr	2	Negative
	Sheep	WA	May	2	Negative
	Sheep	WA	Jun	2	Negative
Infection with classical swine fever virus	Pig	Vic.	May	3	Negative
	Pig	WA	Apr	2	Negative (4 unrelated investigations)
	Pig	WA	May	2	Negative (2 unrelated investigations)

Cont

Disease	Species	State	Month	Response code[a]	Finding
Infection with Hendra virus	Dog	NSW	Jun	3	Negative
	Horse	NSW	Apr	2	Negative (14 unrelated investigations)
	Horse	NSW	May	2	Negative (12 unrelated investigations)
	Horse	NSW	Jun	3	Negative (2 unrelated investigations)
	Horse	NSW	Jun	2	Negative (27 unrelated investigations)
	Horse	NT	Apr	2	Negative
	Horse	NT	Jun	2	Negative
	Horse	Qld	Apr	2	Negative (57 unrelated investigations)
	Horse	Qld	May	2	Negative
	Horse	Qld	May	2	Negative (52 unrelated investigations)
	Horse	Qld	May	3	Positive
	Horse	Qld	Jun	2	Negative (47 unrelated investigations)
	Horse	Qld	Jun	2	Negative
	Horse	SA	Jun	3	Negative
	Horse	Vic.	Apr	3	Negative (17 unrelated investigations)
	Horse	Vic.	May	3	Negative (22 unrelated investigations)
	Horse	Vic	Jun	2	Negative
	Horse	Vic.	Jun	3	Negative (6 unrelated investigations)
	Horse	WA	Apr	2	Negative
	Horse	WA	May	2	Negative
	Horse	WA	May	3	Negative (3 unrelated investigations)
Infection with influenza A viruses in swine	Pig	Qld	May	2	Negative
	Pig	Vic.	May	2	Negative
	Pig	WA	Apr	2	Negative
	Pig	WA	May	2	Negative (2 unrelated investigations)
	Pig	WA	May	3	Negative (3 unrelated investigations)
	Pig	WA	Jun	3	Negative
Infection with *Mycobacterium avium* (avian tuberculosis)	Bird[c]	Tas.	Jun	2	Positive
Infection with *Mycoplasma mycoides* subsp. *mycoides* SC (contagious bovine pleuropneumonia)	Cattle	WA	May	2	Negative
Infection with *Neorickettsia risticii* (Potomac fever)	Horse	WA	Jun	3	Negative
Infection with porcine epidemic diarrhoea virus	Pig	WA	Apr	3	Negative
Infection with rabies virus	Horse	WA	May	3	Negative
Infection with Rift Valley fever virus	Cattle	WA	May	3	Negative (2 unrelated investigations)

Cont

Disease	Species	State	Month	Response code[a]	Finding
Infection with *Salmonella enteritidis* in poultry	Bird[c]	WA	May	2	Negative (2 unrelated investigations)
Infection with *Taenia saginata* (cysticercus bovis)	Cattle	Vic.	Jun	2	Negative
Infection with swine vesicular disease virus	Pig	Qld	May	3	Negative
Infection with vesicular stomatitis virus	Cattle	NSW	May	3	Negative (3 unrelated investigations)
	Cattle	NSW	Jun	3	Negative (2 unrelated investigations)
	Cattle	Vic.	Apr	3	Negative (2 unrelated investigations)
	Cattle	Vic.	May	3	Negative (2 unrelated investigations)
	Cattle	Vic.	Jun	3	Negative (4 unrelated investigations)
	Cattle	WA	Apr	3	Negative (2 unrelated investigations)
	Cattle	WA	Jun	3	Negative (2 unrelated investigations)
	Pig	Qld	May	3	Negative
	Sheep	NSW	Apr	3	Negative
	Sheep	SA	Apr	3	Negative
	Sheep	SA	May	3	Negative
	Sheep	Vic.	Apr	3	Negative
	Sheep	Vic.	Jun	3	Negative (2 unrelated investigations)
Infestation of bees with *Acarapis woodi* (acariasis tracheal mite)	Bees	Qld	Apr	2	Negative (6 unrelated investigations)
Infestation of bees with *Tropilaelaps clareae* or *T. mercedesae* (Tropilaelaps mite)	Bees	Qld	Apr	2	Negative (6 unrelated investigations)
Infestation of bees with *Varroa destructor* or *V. jacobsoni* (Varroosis)	Bees	Qld	Apr	2	Negative (6 unrelated investigations)
	Bees	Vic.	May	2	Negative
Lumpy skin disease	Cattle	Vic.	Apr	3	Negative
Malignant catarrhal fever — wildebeest-associated	Cattle	NSW	May	2	Negative
	Cattle	WA	Apr	2	Negative
Paratuberculosis — Johne's disease	Bison	Qld	May	2	Negative
	Cattle	NSW	Apr	2	Negative
	Cattle	NSW	May	2	Negative
	Cattle	NSW	Jun	2	Negative (3 unrelated investigations)
	Cattle	WA	Apr	2	Negative (3 unrelated investigations)
	Cattle	WA	May	2	Negative
	Cattle	WA	Jun	2	Negative
	Sheep	NSW	May	2	Negative
	Sheep	NSW	Jun	2	Positive
	Sheep	WA	Apr	2	Negative
	Sheep	WA	May	2	Negative (2 unrelated investigations)

Cont

Disease	Species	State	Month	Response code[a]	Finding
Porcine reproductive and respiratory syndrome	Pig	WA	Apr	3	Negative (2 unrelated investigations)
	Pig	WA	May	3	Negative
	Pig	WA	Jun	3	Negative
Pulmonary adenomatosis — Jaagsiekte	Sheep	NSW	Jun	3	Negative
Salmonellosis (*Salmonella abortus-ovis*)	Sheep	WA	May	2	Negative (2 unrelated investigations)
Screw-worm fly — New World (*Cochliomyia hominivorax*)	Cat	NT	Jun	2	Negative
	Sheep	WA	Jun	2	Negative (2 unrelated investigations)
Screw-worm fly — Old World (*Chrysomya bezziana*)	Cat	NT	Jun	2	Negative (2 unrelated investigations)
	Sheep	WA	Jun	2	Negative (2 unrelated investigations)
Transmissible gastroenteritis	Pig	Qld	Apr	3	Negative
	Pig	WA	Apr	3	Negative
Tuberculosis (*Mycobacterium bovis*)	Cattle	NSW	Apr	2	Negative (2 granulomas examined)
	Cattle	NT	Apr	2	Negative (1 granulomas examined)
Tularaemia	Rabbit	NSW	May	3	Negative
West Nile virus infection — clinical	Horse	NSW	Apr	2	Negative
	Horse	NSW	May	2	Negative
	Horse	NSW	Jun	2	Negative (4 unrelated investigations)
	Horse	SA	Jun	3	Negative
	Horse	WA	May	2	Negative
	Horse	WA	May	3	Negative (3 unrelated investigations)

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 1891 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.

1891 CALLS THIS QUARTER

Name	Role	Phone	Email
Ian Langstaff	NAHIS program manager	02 6203 3909	ILangstaff@animalhealthaustralia.com.au
Robert Gurney	Aquatic Animal Health	02 6272 2172	Robert.Gurney@agriculture.gov.au
Corissa Miller	Australian Government NAHIS coordinator	02 6272 3645	Corissa.Miller@agriculture.gov.au
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
Emily Sears	Surveillance information coordinator	02 6203 3906	ESears@animalhealthaustralia.com.au
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			
Rory Arthur	New South Wales	02 6391 3608	Rory.Arthur@dpi.nsw.gov.au
Sue Fitzpatrick	Northern Territory	08 8999 2123	Susanne.Fitzpatrick@nt.gov.au
Greg Williamson	Queensland	07 3330 4545	Greg.Williamson@daf.qld.gov.au
Allison Crawley	South Australia	08 8429 0866	Allison.Crawley@sa.gov.au
Mary Lou Conway	Tasmania	03 6233 6330	MaryLou.Conway@dpipwe.tas.gov.au
Karen Moore	Victoria	03 5430 4525	Karen.Moore@ecodev.vic.gov.au
Emily Glass	Western Australia	08 9368 3360	Emily.Glass@agric.wa.gov.au