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Animal Health Surveillance QUARTERLY

Newsletter of Australia's National Animal Health Information System

Message from the Australian Chief Veterinary Officer

Dr Mark Schipp
Australian Chief Veterinary Officer

Welcome to the second issue of *Animal Health Surveillance Quarterly* for 2016.

During this quarter, the World Organisation for Animal Health (OIE) released its report on the Performance of Veterinary Services (PVS) in Australia, *PVS Evaluation Report: Australia*.[1] The report highlights Australia's commitment to biosecurity and its technical proficiency. The report recognises the importance of ongoing transparency and strong partnerships in Australia to key activities, such as surveillance, and protecting Australia's favourable animal health status.

There has been a continuing emphasis on international collaboration this quarter. I signed three arrangements with senior animal health officials from countries including Canada, Ireland, Mexico, New Zealand, the United Kingdom and the United States while at the 84th General Session of the World Assembly of OIE Delegates in May 2016. These risk-based arrangements complement Australia's existing preparedness for an emergency animal disease outbreak. They aim to facilitate the sharing of personnel and access to additional foot-and-mouth disease vaccines, as well as streamline recognition of each other's zoning decisions to minimise disruptions to safe trade. We work hard to protect our favourable animal health status, and international cooperation is crucial to managing the spread and impact of outbreaks.

In June 2016, I was fortunate to attend the 4th OIE Global Conference on Veterinary Education in Bangkok, which recognised the importance of close collaboration to strengthen and harmonise worldwide veterinary education. The conference highlighted the importance of veterinarians embracing non-traditional skills, such as communication, economics and leadership.

The global challenge of antimicrobial resistance (AMR) requires multidisciplinary cooperation. Together with the Chief Medical Officer, I co-chaired the Australian Strategic and Technical Advisory Group on AMR and in May I attended the Global Leaders Conference on One Health and Antimicrobial Resistance in London. The conference focused on first steps in implementing countries' action plans.

In Australia we have the opportunity and responsibility of working together across governments and between industry sectors to strengthen animal health surveillance.

1 Further information on the report can be found at www.agriculture.gov.au/animal/health/oie-evaluation-report.

Contents

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).

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Exotic disease exclusion in wild pigs in coastal Northern Territory

Joe Schmidt, Australian Government Department of Agriculture and Water Resources

Since its inception in 1989, the Northern Australia Quarantine Strategy (NAQS) of the Department of Agriculture and Water Resources has been delivering plant and animal health surveillance across our northern coastal region for the early detection of exotic pests and diseases that threaten our agricultural industries, wildlife, the environment and sometimes human health.

In AHSQ Vol. 21 Issue 1, NAQS reported findings from a targeted animal health survey conducted in October 2015 in the Northern Territory, between King River and Cobourg Peninsula Fence. During this survey, approximately 1000 feral pigs, both male and female across a range of age classes, were observed, many of which were skinny and appeared lethargic. Necropsies were performed on 106 wild pigs with almost all showing gross pathological changes, including jaundice and ecchymotic haemorrhages of several organs, including lymph nodes (predominantly gastrohepatic and renal), spleen, kidneys and tonsils.

Exotic disease exclusions were performed for Aujeszky's disease (ADV), classical swine fever (CSF), porcine reproductive and respiratory syndrome (PRRS), porcine epidemic diarrhoea (PED) virus and surra (*Trypanosoma evansi*). All test results for these diseases were negative. In addition, testing for porcine circovirus 2 (PCV-2) was conducted with negative results.

Since publication of the results from the October 2015 survey, further testing of the field samples was conducted. This included next-generation sequencing, which detected a number of porcine parvoviruses and porcine lymphotropic herpesvirus 3 (PLHV-3) in a selection of tissue samples. These viruses are not considered to be the primary aetiological agent in the cause of disease seen in these pigs, although it is possible that they were part of a multifactorial aetiology, including non-infectious contributors to disease. These non-infectious factors could include stress related to severe environmental conditions, including heat and drought, in the area at the time.

Porcine parvoviruses (PPV), thought to be distributed globally, include the recently identified PPV-2, PPV-4 and porcine hokovirus. Whilst both PPV-2 and PPV-6 have been detected in pigs with clinical disease, they have also been found in healthy pigs, and the association between the presence of these viruses and clinical disease has not been established. Porcine hokovirus does not appear to have been associated with clinical disease. None of these recently described porcine parvoviruses have been cultured, limiting the opportunity for pathogenicity studies.

During subsequent scheduled feral animal surveys conducted by NAQS, similar observations about the health of the wild pig population were made. This work continued to exclude exotic pathogens as the cause of clinical signs and to further identify possible causes of the clinical findings.

November 2015—Gulf of Carpentaria area

In November 2015, 82 pigs were sampled from the Gulf area of Northern Territory and similar gross pathology was observed to the earlier survey in October 2015. Exotic disease exclusion was performed by the CSIRO Australian Animal Health Laboratory for ADV, CSF, PRRS, PED and surra, as well as testing for PCV-2, all with negative results. Newly developed assays were used to test pooled tissue samples for the agents identified in the October survey, including for the parvoviruses and PLHV-3. Results were positive for these agents. A multifactorial aetiology was again hypothesised, including the presence of severe environmental stressors, with no evidence of exposure to an exotic pathogen.

February 2016—Croker Island and Cobourg Peninsula

In a February 2016 survey of Croker Island and Cobourg Peninsula, necropsies were performed and samples collected from 45 of 109 pigs observed. Of these, gross pathological changes were seen in all 29 pigs sampled from Cobourg Peninsula and none of the 16 pigs sampled from Croker Island. Samples (fresh and fixed tissue samples, serum, EDTA and lithium heparin blood samples) were sent to Berrimah Veterinary Laboratories, Darwin, for histopathology, haematology and bacteriology, and to CSIRO Australian Animal Health Laboratory for exotic disease exclusion testing.

Despite the absence of gross pathology in pigs on Croker Island, a single pig returned a weak positive serological result for CSF on both ELISA and neutralising peroxidase-linked assay testing. Serological testing of this sample for bovine viral diarrhoea virus (to indicate possible cross-reaction with a similar virus) was negative. A further two pigs had returned weak positive results for PRRS on both ELISA and immunoperoxidase antibody testing (reaction to EU strain only). The blood clots of all 16 blood samples collected from Croker Island were tested by PCR for both CSF and PRRS with negative results. All other results from CSIRO Australian Animal Health Laboratory for the samples from Cobourg Peninsula (where pathology had been observed) were negative for all exotic disease tests (ADV, African swine fever (ASF), CSF, foot-and-mouth disease, PRRS and PED). Histopathology results from

Berrimah Veterinary Laboratories revealed no evidence of sepsis.

Given the lack of additional laboratory and clinical evidence to support the presence of CSF or PRRS in this population of pigs, the weak positive reactions on the serological test results were considered to be false positives. However, as confirmation, further sampling of pigs in this area was conducted, in partnership with the Northern Territory Department of Primary Industry and Fisheries. The community and local ranger groups were also engaged to report regularly on the health status of the wild pigs, and confirmed that no other signs of ill-health had been observed in the population under investigation. The operational costs of the surveys to collect further samples were funded under an initiative of the Australian Government Agricultural Competitiveness White Paper, which committed $200 million over 4 years (from 2015–16) to improve surveillance and analytics, including in northern Australia.

March 2016—Cobourg Peninsula

During the first of these surveys, a veterinary pathologist from Berrimah Veterinary Laboratories performed full necropsies on three pigs from two separate sites on Cobourg Peninsula within the area of interest. Two pigs exhibited pathology similar to that seen in the same area in February 2016. A number of samples were collected from each pig, including fresh and fixed tissue samples, serum, urine, faeces, blood (EDTA, lithium heparin) and swabs of abscesses found on the two pigs. Diagnostic results from these samples correlated with results from previous surveys; the gastrohepatic lymph nodes were haemorrhagic, there was no evidence of sepsis and all tests were negative (ASF, CSF, PRRS, PED and PCV-2).

April 2016—Croker Island

A serosurvey of the wild pig population conducted on Croker Island was designed to provide 95% confidence that CSF or PRRS would be detected by serological testing if present at a

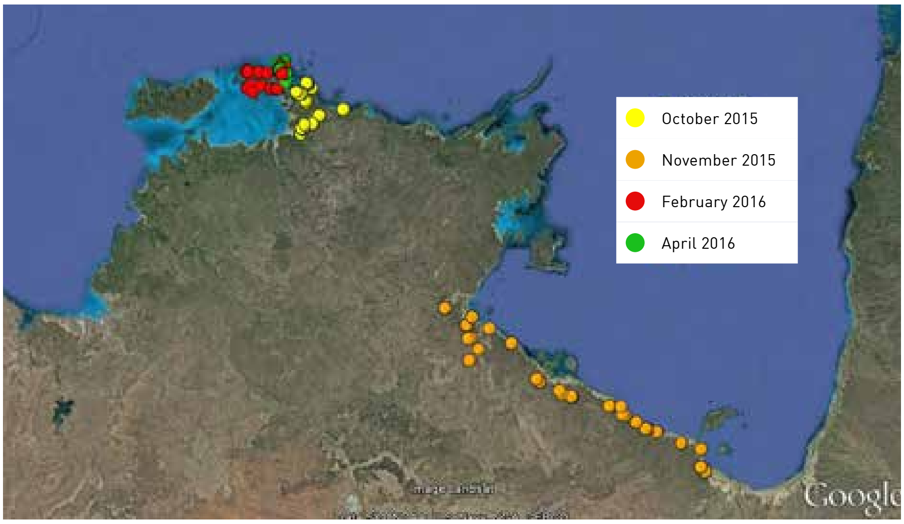


Figure 1 All pig samples collected from Oct 2015 to April 2016

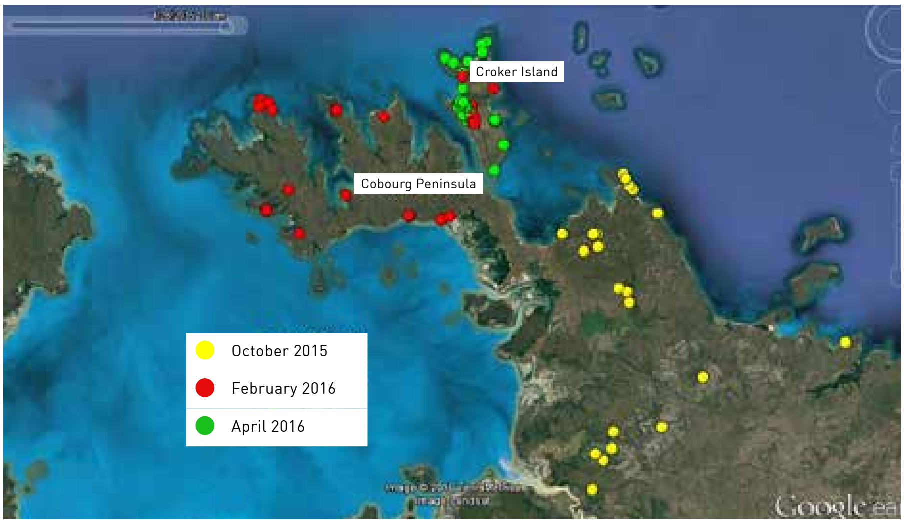


Figure 2 Northern coastal sampling sites (excludes November 2015 survey data)

prevalence of 5%. Serological testing was complemented with agent detection tests, including PCR and virus isolation in a subset of pigs examined by euthanasia and necropsy.

The pigs observed during this survey (almost 100, estimated to be approximately 10% of the total population) were markedly different from those observed and sampled during February 2016. The pigs showed signs of lethargy and open-mouth breathing, and were slow to move away from the helicopter on approach, particularly in the area where the original survey was conducted in February.

Serological samples were collected and necropsies performed on 60 pigs. The pigs were of variable ages, of both sexes and in moderate-to-good body condition (2–3 out of 5). Varying degrees of severity of gross pathology were noted on necropsy. The main findings included:

- enlarged discoloured lymph nodes, some with evidence of haemorrhage (particularly retropharyngeal, submandibular, ileocaecal and gastrohepatic nodes)
- enlarged tonsils
- fetid frothy diarrhoea
- heavy worm burdens (*Stephanurus dentatus* and *Macracanthorhynchus* sp.) with evidence of larval migration in the liver
- excess yellow peritoneal fluid
- congested friable spleens

Approximately half the pigs sampled were female, including seven pregnant (with foetuses in various stages of gestation) and three lactating. Other than small litter sizes (2–6 piglets), the only foetal abnormality observed was evidence of generalised petechial haemorrhage and localised ecchymotic haemorrhage around the head and chest in two piglets of a litter of five (estimated to be 30–35 days gestation).

Whole blood (EDTA) and samples from a range of tissues were collected from 11 of the necropsied pigs with most significant gross pathology.

All samples were tested for CSF and PRRS (serology, PCR and virus isolation) with negative results. Histopathology results showed no evidence of sepsis. Common findings, including haemorrhage, fibrosis and an abundance of eosinophils in lymph nodes, were considered to be most likely due to parasitic migration, consistent with common findings of heavy worm burdens in these and other feral pigs in Australia.

Although the primary cause of the pathology observed in the broader coastal Northern Territory feral pig population remains inconclusive, the investigations to date have provided evidence of possible contributing causes, including heavy parasite burdens, associated larval migration and environmental stressors. Exposure to known exotic pathogens was excluded. A number of porcine parvoviruses and a porcine herpesvirus were identified. Ongoing surveillance of the pig population in this area is planned to occur annually through targeted surveys, as described here, along with regular ongoing syndromic disease surveillance conducted by local Indigenous rangers.

While animal health surveillance in remote regions of northern Australia can be logistically difficult, this series of investigations demonstrated a successful collaboration between Australian and territory government departments and laboratories to investigate these unusual findings in feral pigs.

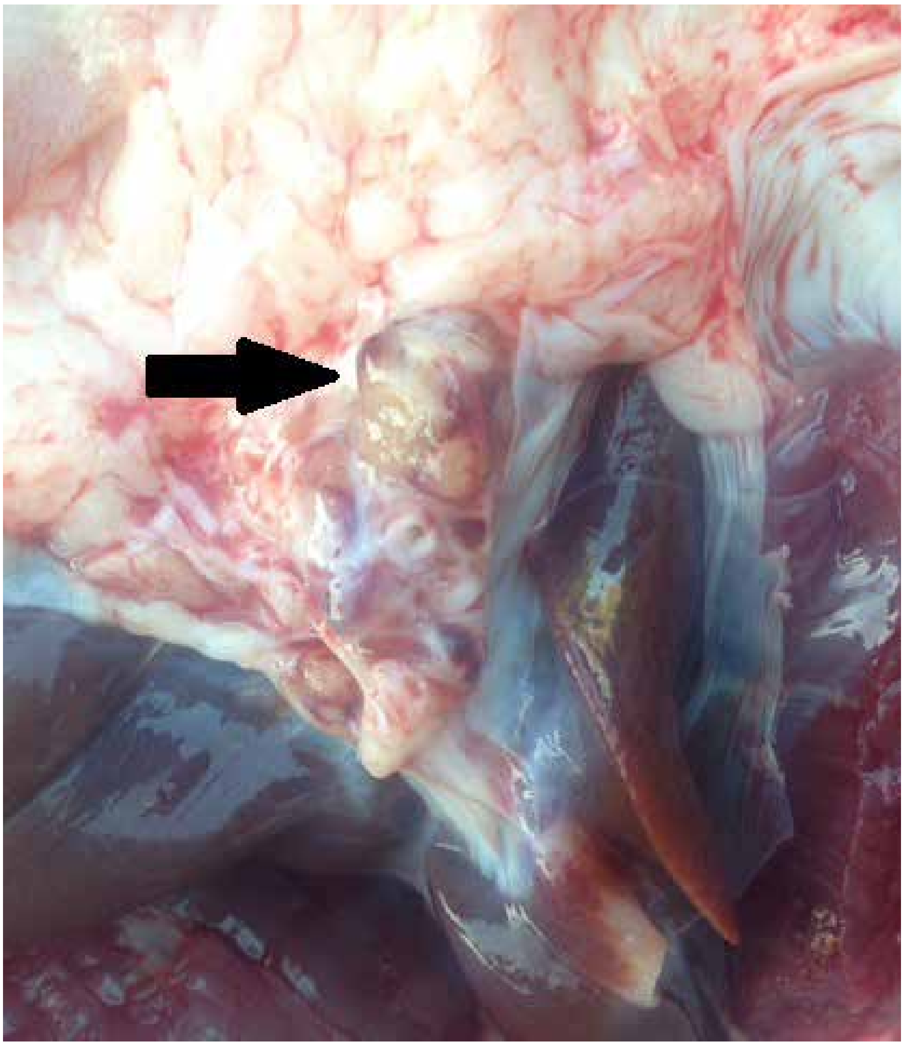


Figure 3 Gastrohepatic lymph node from a pig from Croker Island

Sharing resources in an emergency animal disease response

Dr Phoebe Readford, Australian Government Department of Agriculture and Water Resources

Veterinary response capacity during an Emergency Animal Disease (EAD) event was one of the key issues identified by Ken Matthews in a 2011 report on Australia's readiness to respond to the threat of foot-and-mouth disease.[2] Additional capacity may be available through calling upon the resources of other countries.

The International Animal Health Emergency Reserve (IAHER) Arrangement allows signatory countries to supplement their domestic emergency response capabilities by sharing personnel during an EAD event.

"In a major emergency, a lack of available resources can quickly become a constraint on the effectiveness of the response. The International Animal Health Emergency Reserve Arrangement allows countries to quickly access additional skilled resources if needed," said Australian Chief Veterinary Officer, Dr Mark Schipp.

The IAHER Arrangement provides mutual benefits to all signatory

2 Matthews K (2011). *A review of Australia's preparedness for the threat of foot and mouth disease*. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

countries; the provision of skilled assistance to the recipient country experiencing an EAD event; and valuable practical experience in EAD management and response for donor country personnel. Australia, New Zealand, the United States (US), Canada, the United Kingdom (UK) and Ireland first committed to the IAHER Arrangement in 2004.

The principles of the IAHER Arrangement and its underpinning documentation were used to obtain assistance from New Zealand during Australia's equine influenza outbreak in 2007. New Zealand Government biosecurity staff were rapidly deployed to Australia and provided assistance over a period of 3 months. Deployed staff included those with response, surveillance, incursion investigation and laboratory expertise.

Whilst the principles of the IAHER Arrangement have been used, the Arrangement itself has not been activated. At its April 2015 meeting, the Animal Health Quadrilateral Group (Quads)—comprising Australia, Canada, New Zealand and the US—agreed to review and operationalise the IAHER Arrangement so it could be invoked effectively and efficiently in the future.

The IAHER network is a Quads initiative to develop further policy and operational arrangements, under the IAHER Arrangement, to support the rapid sharing of personnel.

Throughout 2015 and 2016, Australia led the IAHER network with a program of work aimed at developing an operations manual that sets out agreed policies, procedures and templates. Use of the manual will provide signatory countries with the information and tools required to rapidly activate the IAHER Arrangement, arrange deployment and facilitate the rapid sharing of personnel across countries during an EAD event. This will support the more regular and efficient use of the IAHER Arrangement by both recipient and donor countries.

In February 2016, Australia funded an IAHER network workshop in London to fast-track the resolution of priority policy and operational issues and develop the operations manual. The main principles of the operations manual are to ensure simple and efficient administrative arrangements and an annual review and update of the manual to ensure its sustainability and validity.

Participants at the IAHER network workshop in London, February 2016.

Dr Schipp advised, "During an emergency animal disease outbreak, a range of personnel, including veterinarians, epidemiologists, laboratory specialists, emergency managers and animal health technicians, may be required."

The operations manual addresses key policies and issues in the IAHER Arrangement, such as ensuring adequate insurance and professional indemnity coverage and employment conditions for all deployed personnel, including rates of pay, overtime and leave allowances.

Following the endorsement of the operations manual and the updated IAHER Arrangement, in May 2016, Dr Schipp said, "Australia and its partners in the International Animal Health Emergency Reserve are now more prepared than ever for the rapid sharing of personnel across countries in the event of an emergency animal disease event".

In 2016–17, Australia will continue to lead the IAHER network, and the group will test the effectiveness of the operations manual by simulating a disease outbreak through a desktop exercise. All signatory countries will be involved in the exercise, which is thought to be one of the first multilateral animal health exercises to be conducted.

The exercise aims to test the procedures, timeframes and financial responsibilities outlined in the operations manual and to identify issues or gaps that need to be rectified. The IAHER network also hopes to conduct a post-exercise activity to examine estimated costs of activating the IAHER Arrangement. This will provide useful information for executive staff when activating the IAHER Arrangement.

The administrative areas, such as legal, risk assessment and finance, of each signatory country are reviewing the operations manual for accuracy. The desktop exercise will contribute to a communications plan that aims to raise awareness of the operations manual as a resource and valuable tool for use in the future.

Signatory countries are proud of their involvement in the IAHER Arrangement as it supports the concepts of transparency and sanitary safety by using the World Organisation for Animal Health's science-based international standards to strengthen EAD response and management and thus safeguard the trade of animal and animal products during these events. The IAHER Arrangement is an example of international solidarity and transparency for other countries.

IAHER signatories with OIE officials after signing of the updated IAHER Arrangement and endorsement of the operations manual in Paris, May 2016.

Wildlife Health Australia

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

Wildlife Health Australia (WHA)[3] is the peak body for wildlife health in Australia. WHA was established as the Australian Wildlife Health Network (AWHN) in 2002 as an Australian Government initiative to coordinate wildlife health surveillance information across Australia, and 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)[4]—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). 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 52 reports of wild bird mortality or morbidity investigations from around Australia in April–June 2016; 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 were 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 12 of the events as part of Australia's general (sick and dead bird) AI surveillance program. AI exclusion testing was not warranted in the remaining 40 events, based on clinical signs, history, prevailing environmental conditions or other diagnoses. In addition, avian paramyxovirus was excluded in 9 events by PCR testing specific for Newcastle disease (ND) virus and/or pigeon paramyxovirus 1 (PPMV-1).

Table 2 Wild bird disease investigations reported into eWHIS, April–June 2016

Bird order	Common name for bird order[a]	Events reported[b]
Anseriformes	Magpie geese, ducks, geese and swans	7
Charadriiformes	Shorebirds	4
Columbiformes	Doves and pigeons	3
Gruiformes	Rails, gallinules, coots and cranes	2
Passeriformes	Passerines or perching birds	7
Pelecaniformes	Ibis, herons and pelicans	3
Procellariiformes	Fulmars, petrels, prions and shearwaters	1
Psittaciformes	Parrots and cockatoos	26
Strigiformes	Typical owl and barn owls	2

a Common names adapted from: del Hoyo and Collar (2014) *HBW and BirdLife International Illustrated Checklist of the Birds of the World. Volume 1 – Non-passerines.* Lynx Editions, Barcelona. (Courtesy of the Australian Government Department of the Environment).

b Disease investigations may involve a single or multiple bird orders (e.g. mass mortality event). This quarter there were two wild bird events which involved multiple bird orders: one event involved Anseriformes, Gruiformes and Charadriiformes; the second event involved Columbiformes and Psittaciformes.

3 www.wildlifehealthaustralia.org.au/Home.aspx

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

Table 1 Number of disease investigations reported into eWHIS, April–June 2016[a]

Bats[b]	Birds	Marsupials	Feral animals	Snakes & lizards	Freshwater turtles	Monotremes	Marine mammals	Wild fish
54	52	27	23	4	2	3	3	1

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

Avian influenza surveillance

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

During the quarter, pathogen-specific, risk-based surveillance occurred at sites in New South Wales, Northern Territory, South Australia, Queensland, Tasmania and Victoria with cloacal and faecal environmental swabs collected from 1572 waterbirds. Results are pending.

Australian bat lyssavirus

Reports to WHA for the quarter included 54 bats tested for Australian bat lyssavirus (ABLV) from New South Wales, Northern Territory, Queensland, Victoria and Western Australia.

Bat submissions were made for a variety of reasons:

- 18 cases involved contact with a pet dog (15 bats) or a cat (3 bats)
- 12 cases involved contact or suspected contact with the potential for ABLV transmission to humans; of these
  - 3 also involved contact with a pet dog or cat
  - 2 were also associated with trauma (fence or netting entanglement)
  - the remainder had no further history reported
  - 9 bats displayed neurological signs (e.g. paresis, nystagmus, aggression, tremors)
  - 3 cases were associated with trauma
  - 2 bats presented with other clinical signs
  - 10 bats had no further history reported at this time.

During the quarter, two flying-foxes from Queensland were confirmed positive for ABLV by fluorescent antibody test and PCR for pteropid ABLV ribonucleic acid (RNA). One was a subadult female little red flying-fox (*Pteropus scapulatus*) that was found hanging low in a bush in a park, was very subdued and easy to handle. No injuries were detected on X-ray. The bat was euthanased on suspicion of ABLV based on unusual demeanour and behaviour in the absence of significant injuries or illness. Following necropsy examination, histopathology revealed mild to moderate, nonsuppurative meningoencephalitis. The other case was an adult female black flying-fox (*P. alecto*) found hanging low in a tree. On examination it was found to be unable to hang, appeared dazed and had increased respiratory rate and effort. There was no evidence of trauma on X-ray. The bat was euthanased on suspicion of ABLV. On necropsy examination the lungs were found to be markedly enlarged and failed to collapse, with consolidation of the right craniodorsal lobe. The urinary bladder was markedly distended with urine and had a haemorrhagic wall. Mild subcutaneous bruising was apparent over the lumbar spine. Histopathology revealed moderate to severe nonsuppurative meningoencephalomyelitis and ganglioneuritis, subacute aspiration pneumonia and mild sialoadenitis. No potentially dangerous human contact was reported for either case.

More information on ABLV testing of bats in Australia is available in *ABLV Bat Stats*.[5]

Yellow fungus disease exclusion in an eastern water dragon

An eastern water dragon (*Physignathus lesueurii lesueurii*) was found moribund in a backyard in south-east Brisbane, Queensland, and was clinically assessed at the RSPCA Queensland Wildlife Hospital. The water dragon had extensive hyperkeratotic and ulcerative skin lesions on the ventrum. It was euthanased and submitted for necropsy to Queensland's Biosecurity Sciences Laboratory. On external examination it appeared to be cachectic, however large bilateral fat pads were present in the coelom. Histology of skin revealed locally extensive, chronic necrotising dermatitis. Kidney histology revealed nephropathy with widespread glomerular sclerosis. The *Chrysosporium* anamorph of *Nannizziopsis vriesii* (CANV)[6] was excluded by fungal culture and histology. Metabolic or immune-mediated processes are possible causes for the skin lesions.

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

6 See recent taxonomic revisions to the CANV complex in: Paré JA and Sigler L (2016) An overview of reptile fungal pathogens in the genera *Nannizziopsis, Paranannizziopsis, and Ophidiomyces. Journal of Herpetological Medicine and Surgery*, 26(1–2): 46–53.

CANV causes yellow fungus disease, a slowly progressive and often fatal skin disease that affects a wide range of reptile species. It has been isolated from captive reptiles in Australia.[7,8] Skin lesions commonly affect the mouth but may occur anywhere on the body. In later stages, infection extends to muscle, bone and deeper tissues. Diagnosis is based on clinical signs, fungal culture, histopathology and PCR.[7] Further research is required to better understand the ecology of this pathogen, including which free-living reptile species may be susceptible to infection.

Investigation of skin disease in reptiles can provide further information on fungal pathogens, which are an emerging cause of diseases in wildlife with the potential to impact on biodiversity. Snake fungal disease in North America due to *Ophidiomyces ophiodiicola* is a recent example.[9]

Sparganosis in a short-beaked echidna

In June, a short-beaked echidna (*Tachyglossus aculeatus*) was found in West Gippsland, Victoria, with a moderate tick burden and a large firm mass on the ventro-lateral abdominal wall, located caudal to the left thoracic limb. The echidna was euthanased and submitted for necropsy to Wildlife Health Surveillance Victoria at the Faculty of Veterinary and Agricultural Sciences, the University of Melbourne.

On gross necropsy, one large and several small firm pale fibrous masses were found in the subcutis. The large mass measured 13 x 11 x 8 cm and weighed 602 g (approximately 16% of the total body mass of the echidna). Extensive firm pale masses were also seen in both lungs.

A short-beaked echidna with a large firm mass on the ventro-lateral abdominal wall, located caudal to the left thoracic limb. Photo: P. Whiteley.

On histopathology, the subcutaneous masses consisted of dense fibrous connective tissue with numerous cavitations containing sections of pleurocercoids (larval stages of pseudophyllidean cestodes). Similar parasitic cysts effaced the lung parenchyma. These histological findings confirm the diagnoses of subcutaneous and pulmonary sparganosis.

Sparganosis is caused by a host reaction to pleurocercoids (or sparganum) following ingestion by a vertebrate host.[10] Once ingested, pleurocercoids migrate into subcutaneous tissues where they may initiate a significant inflammatory response leading to the clinical presentation described here.

In previous reports from eastern Australia, subcutaneous masses in echidnas were considered most likely to be due to the presence of the larval stages of the cestode, *Spirometra erinacei*.[11] Carnivores are the definitive hosts of this cestode, with adult stages found within the intestine. Larval stages are found in crustaceans (procercoids) and a range of wildlife species including amphibians, reptiles and mammals (pleurocercoids).[12] Wild echidnas are most likely to become infected following accidental ingestion of water containing larval-infected crustaceans or small amphibians.[13,14] Infection of humans may also occur via accidental ingestion of contaminated water, or through the consumption of raw or insufficiently cooked meat harbouring larval infective stages (e.g. feral pigs may represent a zoonotic risk in Australia).[15]

Rabbit haemorrhagic disease virus 2 detection in wild hares

Reported in collaboration with David Peacock, Biosecurity SA; Andrew Woolnough, DEDJTR; Tanja Strive and Robyn Hall, CSIRO; Tarnya Cox, NSW DPI; and Ian Macdonald, the Invasive Animals Cooperative Research Centre.

Rabbit calicivirus, specifically rabbit haemorrhagic disease virus 1 (RHDV-1) from Czechoslovakia (Czech 351), has

7 Johnson RSP et al (2011) Deep fungal dermatitis caused by the *Chrysosporium* anamorph of *Nannizziopsis vriesii* in captive coastal bearded dragons (*Pogona barbata*). *Australian Veterinary Journal*, 89(12): 515—519.

8 Wildlife Health Australia. *Yellow fungus disease* (Chrysosporium anamorph of Nannizziopsis vriesii) *in reptiles in Australia fact sheet*. September 2009. www.wildlifehealthaustralia.com.au/Portals/0/Documents/FactSheets/Yellow%20Fungus%20Disease%20(CANV)%2018%20Aug%202009%20(1.0).pdf

9 USGS (2013) Snake Fungal Disease in the United States. *National Wildlife Health Center Wildlife Health Bulletin 2013-02*, www.nwhc.usgs.gov/publications/wildlife_health_bulletins/WHB_2013-02_Snake_Fungal_Disease.pdf

10 Taylor, MA, Coop, RL and Wall, RL. 2007. *Veterinary parasitology*. Blackwell Publishing, Ames, Iowa.

11 The national electronic Wildlife Health Information System (eWHIS). www.wildlifehealthaustralia.com.au/ProgramsProjects/eWHISWildlifeHealthInformationSystem.aspx

12 Ladds, P., 2009. Pathology of Australian native wildlife. CSIRO PUBLISHING.

13 Whittington, R, Middleton, D, Spratt, DM, Muntz, F, Carmel, B, McCracken, HE, Strakosch, MR, Stephanson-Shaw, J, Harper, PA and Hartley, WJ. 1992. Sparganosis in the monotremes Tachyglossus aculeatus and Ornithorhynchus anatinus in Australia. *Journal of wildlife diseases*, 28(4): 636–640

14 Whittington, R. 2008. Monotremes. In Proceedings: Wildlife Pathology Short Course 21–24 August 2008. Australian Registry of Wildlife Health Taronga Conservation Society Australia.

15 Henderson, WR. 2009. Pathogens in vertebrate pests in Australia. Canberra: Invasive Animals Cooperative Research Centre.

been used in Australia as a biological control agent since 1996. A new strain, rabbit haemorrhagic disease virus 2 (RHDV-2), was first detected in wild European rabbits (*Oryctolagus cuniculus*) in the Australian Capital Territory in May 2015[16] and has since been detected in pet rabbits, rabbits grown for meat and wild rabbits in every state except Queensland and Western Australia.[17]

In May 2016, as part of routine monitoring for RHDV, 3 dead wild European brown hare (*Lepus europaeus*), two from South Australia and one from Victoria, tested positive for RHDV-2 via PCR and/or virus sequencing.[15] Two additional European brown hares from South Australia have since tested positive, bringing the total detections to five. These are the first detections of RHDV-2 in European hares in Australia. It is unclear if the detections in wild hare were due to a rare spillover event from rabbits to hares or whether RHDV-2 spread directly between hares.[18]

16 OIE WAHIS Report: www.oie.int/wahis_2/public/wahid.php/Reviewreport/Review?page_refer=MapFullEventReport&reportid=18075

17 OIE WAHIS report: www.oie.int/wahis_2/temp/reports/en_imm_0000020384_20160630_165401.pdf

18 www.pestsmart.org.au/the-arrival-of-rhdv2-in-australia-and-implications-for-current-rabbit-biocontrol-initiatives/

RHDV-2 is a lagovirus, a pathogen specific to lagomorph species, that causes rabbit haemorrhagic disease (RHD). Australia only has two lagomorph species—the European rabbit and the European brown hare, both of which are invasive species. In Europe, RHDV-2 has been shown to cause disease in European rabbits, Sardinian Cape hare (*Lepus capensis mediterraneus*) and Italian hare (*Lepus corsicanus*).[19,20] RHDV-2 has not been shown to infect or kill any other native or introduced species in Australia or Europe.[21]

Current vaccination protocols provide full protection to RHDV-1 strains (Czech 351 and the soon-to-be-released K5[22]), however the current vaccine only provides partial protection against RHDV-2, under a revised vaccination protocol[23]. A vaccine is being developed in Europe specifically against RHVD-2 but is not yet available in Australia.

19 Camarda, A, Pugliese, N, Cavadini, P, Circella, E, Capucci, L, Caroli, A, Legretto, M, Mallia, E and Lavazza, A (2014). Detection of the new emerging rabbit haemorrhagic disease type 2 virus (RHDV2) in Sicily from rabbit (Oryctolagus cuniculus) and Italian hare (Lepus corsicanus). *Research in Veterinary Science* 97, 642–5.

20 Puggioni, G, Cavadini, P, Maestrale, C, Scivoli, R, Botti, G, Ligios, C, Le Gall-Recule, G, Lavazza, A and Capucci, L (2013). The new French 2010 Rabbit Hemorrhagic Disease Virus causes an RHD-like disease in the Sardinian Cape hare (Lepus capensis mediterraneus). *Veterinary Research* 44: 96.

21 www.pestsmart.org.au/rhdv2-now-confirmed-european-brown-hares/

22 www.pestsmart.org.au/rhdv-k5-frequently-asked-questions/

Virologists at the CSIRO Canberra, Elizabeth Macarthur Agricultural Institute and Biosecurity SA continue to work closely with the Invasive Animals Cooperative Research Centre to better understand the effects of RHDV-2 on rabbit control in Australia. Current research focuses on the collection of samples from affected domestic and wild European rabbits and wild European hares to monitor RHDV-2 spread and interaction with current circulating field strains.

Rabbits and hares that have died from RHDV-1 or RHDV-2 typically look physically intact, lying on the side with legs stretched out and the head tilted back. Where a rabbit or hare is suspected of having died as a result of RHDV-1 or RHDV-2, please contact CSIRO Canberra[24], Elizabeth Macarthur Agricultural Institute[25] or Biosecurity SA[26] to receive a sampling pack or instructions on how to collect a sample.

23 www.ava.com.au/rabbit-calicivirus

24 Robyn.Hall@csiro.au or Roslyn.Mourant@csiro.au

25 Andrew.J.Read@dpi.nsw.gov.au

26 John.Kovaliski@sa.gov.au

Aquatic animal health

Dr Tracey Bradley, Victorian Department of Economic Development, Jobs, Transport and Resources

Bonamiasis in farmed native oysters

Oysters are farmed in most Australian states. The main species farmed are Sydney rock oysters (in New South Wales and Queensland) and Pacific oysters (in New South Wales, South Australia and Tasmania). Both species support an industry valued at more than $90 million that supplies domestic and export markets. Native oyster (*Ostrea angasi*) culture is expanding around Australia to meet the strong domestic and international market for this high-value product. For example, in South Australia, there are currently 90 farmers who have added *O. angasi* to their aquaculture species list. Native oysters are considered to be a diversification measure to mitigate the risk associated with Pacific oyster mortality syndrome (POMS) in Pacific oyster farms.

Bonamiasis attributed to infection with a parasite called *Bonamia* spp. was responsible for the devastation of Victorian experimental stock of *O. angasi* and adjacent wild beds in the 1990s. This parasite has been previously found in native oysters in Tasmania, Western Australia, New South Wales and South Australia. The species of *Bonamia* involved in these detections were not determined. The identity of this problematic parasite in southern Australia is important for diagnostic certainty and to inform aquaculture management measures.

The shellfish industry of Victoria has recently re-established native oyster production to meet market demand. Since 2011, a commercial Victorian hatchery has been producing spat, which are grown-out in existing shellfish leases in Port Phillip Bay.

Recognising the potential for re-emergence of the disease, Fisheries Victoria undertook annual surveillance for species of *Bonamia* in pilot native oyster farms in Port Phillip Bay from 2011. The surveillance presumed a prevalence of approximately 30%, which resulted in a sample size of 21 oysters required to detect 1 positive, given the sensitivity and specificity of the PCR test used. The cost of conducting this surveillance at multiple sites was a further consideration in the sample size, due to logistics and costs of testing large numbers of samples.

In 2013, subclinical bonamiasis was detected, and in 2015 clinical bonamiasis was found, with 4 sites infected. One of these farms lost up to 80% of the stock. A low prevalence of infection was also detected by PCR in healthy wild stock in Port Phillip Bay. The investigation of the clinical disease led to identification of the parasite as *Bonamia exitiosa* in January 2016 after comprehensive testing by the Australian Animal Health Laboratory. This finding was immediately reported to the World Organisation for Animal Health (OIE) because *B. exitiosa* is listed by the OIE and had not previously been reported from Australia. Subsequent testing confirmed presence of *B. exitiosa* in South Australia.

A project to investigate bonamiasis in native oysters (funded by the Fisheries Research and Development Corporation) commenced in 2015. The aims of the project are to:

- Obtain nucleic acid sequence for comparison with other *Bonamia* spp. and to determine their taxonomic relationships.
- Elucidate best farming practices for mitigation of clinical bonamiasis and field determination of bonamiasis risk factors. This component of the project involves small field trials examining putative risk factors for clinical expression of bonamiasis. This trial is being conducted in a site in Port Phillip Bay where *B. exitiosa* is endemic and has caused clinical disease. Three infected farm sites in South Australia have also been selected. The variables being examined in the field trial include the height that oysters are held in the water column, stocking density and size (as a surrogate measure for age class). Water quality parameters, including salinity, temperature and turbidity, are being recorded. Other variables of interest (e.g. density) are based on industry practices to ensure applicability.
- Determine if stressors do induce clinical disease in subclinically infected oysters under controlled conditions at the Agriculture Victoria Queenscliff Centre on Port Phillip Bay. Stressors investigated include physical insult (tumbling—a handling practice); reduced feed provision and water temperature. Preliminary trials have been completed on oysters from areas with high prevalence and results are being collated. All effluent water from the laboratory trial was filtered to remove any risk of *Bonamia* parasites being released into the bay. Other work related to transmission and effective disinfection methods is taking place at the South Australian Research and Development Institute (SARDI) South Australian Aquatic Biosecurity Centre, Roseworthy Campus. This trial will provide material suitable for taxonomy.
- Prepare a sector-specific biosecurity plan and farm management guidelines to mitigate the risks of bonamiasis using information gathered from the trials, ongoing monitoring of *B. exitiosa* in Port Phillip Bay and in South Australia, and existing literature. The biosecurity plan will be based on the generic aquaculture farm biosecurity template, which has recently been developed by the Sub-Committee on Aquatic Animal Health.

Native oyster culture is expanding around Australia to meet the strong domestic and international market for this high-value product

The project is due to be completed at the end of August 2017.

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 17 of 'Quarterly statistics'.

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

New South Wales

Rory Arthur, New South Wales Department of Primary Industries

During the quarter in New South Wales, approximately 700 livestock disease investigations[27] were conducted to investigate suspect notifiable diseases or rule out emergency diseases[28]. The number of investigations by species of livestock is shown in Figure 4. Field investigations were conducted by government veterinary or biosecurity officers (approximately 511) and private veterinary practitioners. All diagnostic testing was conducted at the state veterinary diagnostic laboratory.

27 Field investigation with laboratory diagnostic testing.

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

During the quarter the state veterinary diagnostic laboratory, Elizabeth Macarthur Agricultural Institute, processed approximately 1100 livestock sample submissions[29] 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 following case reports are a selection of field investigations, chosen to reflect the range of livestock disease incidents during the quarter.

29 Some investigations involved multiple submissions.

Vesicular stomatitis exclusion

In late June on a thoroughbred stud in the Hunter Valley, an equine veterinarian examined a yearling filly with a bloody discharge from both nostrils and swelling of the distal limbs. The discharge contained chunks of mucosal tissue. She had a high normal heart rate (60 beats per minute; normal 45–60 beats per minute in yearlings) and a mild fever (38.8°C; normal up to 38.2°C).

The next day, the filly was bright and alert but the limb swelling, which was not painful when palpated, had worsened overnight. There were small vesicles (fluid-filled blisters) in the mouth. Upper airway endoscopy

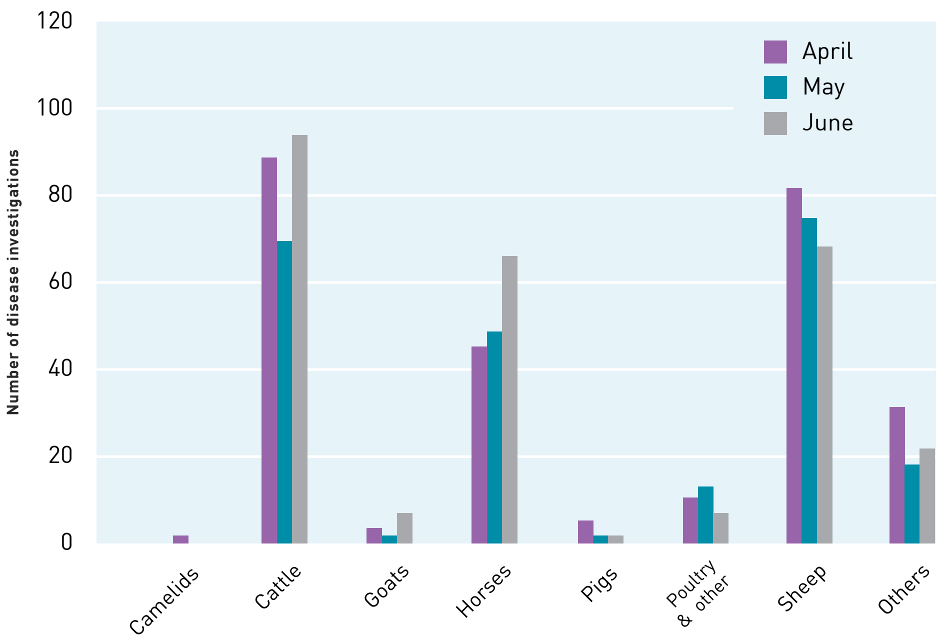


Figure 4 Field disease investigations in New South Wales to investigate suspect notifiable diseases or rule out emergency diseases, April–June 2016

revealed diffuse severe inflammation of the nasal mucosa, with ulcerations and vesicles on the roof of the nasal cavity.

After considering the vesicular lesions present, the veterinarian contacted the Local Land Services district veterinary officer and submitted samples for the exclusion of vesicular stomatitis, Hendra virus, equine infectious anaemia and equine viral arteritis. All these tests gave negative results.

Low levels of equine herpesvirus 4 were detected in PCR tests of nasal swabs and these were considered insignificant.

After an initial improvement under treatment, the filly's condition deteriorated and she was euthanased. A necropsy revealed severe multifocal, extensive acute haemorrhagic mouth inflammation, oesophagitis, gastritis and enterocolitis with fibrinoid necrosis. Haemorrhagic dermatitis and myositis were also found, with muscle tissue necrosis. Histopathology showed multisystem blood vessel damage affecting mainly the connective tissue.

Horses in contact with the filly remained healthy. Further results to conclude a diagnosis were unavailable at the time of publication The filly likely suffered an auto-immune disease, similar to but not typical of pupura haemorrhagica.

Anthrax

Three anthrax incidents were reported in New South Wales during the quarter.

Two were nearby to a property at Cumnock, which was diagnosed in March (AHSQ Vol. 21 Issue 1). These two properties were confirmed by PCR as anthrax at the state veterinary diagnostic laboratory in early April, and each involved the death of a single animal; 1 lamb out of 678 sheep and the other with 1 steer out of 279 cattle. No livestock or product movements had occurred for these properties in the preceding 20 days.

The third incident occurred in late April and involved the death of 11 out of 222 cattle on a property in the Hillston district testing positive for anthrax with the ICT and confirmed at the state veterinary diagnostic laboratory. A neighbouring property had been diagnosed with anthrax in 2006. Livestock movements were traced using the National Livestock Identification System (NLIS) and no movements from animals within 3 km of the affected part of the property were found.

These cases were managed in accordance with NSW DPI Anthrax Policy. Properties were placed in quarantine, carcases were burned and death sites disinfected. All remaining at-risk animals on the properties were vaccinated.

There were 32 investigations during the quarter where anthrax was excluded as the cause of death:

- 21 involved cattle where alternate diagnoses included bloat, urea toxicity, nitrate toxicity, clostridial infection, severe cystitis, severe mastitis and pneumonia
- 8 involved sheep where alternative diagnoses included metabolic disease (lactic acidosis and hypomagnesaemia), internal parasites, photosensitisation and *Verbesina encelioides* toxicity
- 2 involved horses with no alternate diagnoses
- 1 involved pigs, which was diagnosed as choke.

The ICT was used in 20 of the 32 negative exclusions, with negative results. The ICT was not used in the other 12 cases where exclusion was based on laboratory testing with PCR and/or polychrome methylene blue (PMB) staining or clinical examination.

Outbreak of *Salmonella* Typhimurium in beef cows on pasture

Six of a group of 90 pregnant cows grazing on improved pastures in the Lithgow district died of acute salmonellosis in late June and early July 2016.

The first cow was found dead, but subsequently affected cows were found standing alone and lethargic, with sunken eyes and sometimes diarrhoea. On clinical examination one of the cows had slightly pale mucous membranes, sunken eyes, rapid heart and respiration rates and reduced rumen motility. This cow was observed to pass watery diarrhoea with intestinal casts. *Salmonella* (provisionally typed as *Salmonella* Typhimurium) was isolated from the cow's faeces. Tests were negative for PACE (pestivirus antigen capture ELISA) and for the protozoan blood parasite *Theileria* spp.

Only one group of cattle on the property was affected. An additional two cows in

the affected group responded to treatment with trimethoprim. The group was moved to a fresh paddock and no further losses occurred. The source of the *Salmonella* has not been identified, but faecal contamination of a water source by waterbirds is a possibility.

Rock (mulga) fern toxicities in cattle

Two cases of toxicity from the small native fern, rock fern (*Cheilanthes sieberi*), also called 'poison rock fern' or 'mulga fern', were diagnosed during the quarter

The first case was in May in a herd of nine 8-month-old Angus–Charolais cross heifers in Bathurst. They had been grazing short native pasture along a rocky creek.

The owner had observed one heifer with diarrhoea 2 days previously, but all heifers had appeared normal 12 hours before the first affected heifer was discovered. During the morning inspection the owner had found the affected heifer lying on her side and unable to rise, with laboured breathing. Another heifer appeared lethargic and was staggering. When the district veterinarian arrived on the property, the recumbent heifer was dead and the second heifer was lying down, with laboured breathing; she died soon after. The paddocks were examined, and apart from large amounts of rock fern, no other toxic plants could be identified. Necropsies on both heifers showed very pale muscles, marked subserosal haemorrhages of the abdominal organs and leakage of blood in the abdominal and thoracic cavities. There was no evidence of liver fluke, and lead and nitrate toxicities were excluded.

In the second investigation south of Narromine, one steer was found dead and another seriously ill in a group of 65. The cattle had originated from western New South Wales. There had been recent rain and good pasture growth in the Narromine area.

On arriving at the property, the district veterinarian found that the sick animal had died. A necropsy revealed striking haemorrhage into the anterior chambers of both eyes. The cow also had dark tarry faeces, indicating bleeding in the upper gastrointestinal tract. There was haemorrhage under the skin of the chest area, the spleen was four times the normal size and the animal had jaundiced subcutaneous fat. There was extensive haemorrhage inside the gastrointestinal tract, with blood in the large intestine and abomasum. Stalks of rock fern were present in the rumen.

Haemorrhage into the anterior eye chamber in a cow with rock fern toxicity. Photo: J. Kelly.

Rock fern was abundant, fresh and green on the edges of the paddock, where the soil type was red and hard and pine trees were growing. Both animals had died near the edges of the paddock.

Rock fern and the equally toxic coastal species, woolly cloak fern (*C. distans*), are small upright plants with short, roughly triangular leaf blades and dark or red brown stems, growing to about 20 cm in height. Rock fern grows in hilly rocky areas and in woodlands, particularly under mulga trees. It is adapted to dry conditions, and because it may be the first green plant to reappear after drought, it may be attractive to hungry stock.

The main toxin in rock fern is ptaquiloside, which is a type of norsesquiterpene glycoside. Apart from this acute condition, the toxins in these ferns can also cause chronic, and usually fatal, poisoning over several years (bovine enzootic haematuria). The ferns also contain thiaminases that destroy vitamin B_1 and can thus lead to polioencephalomalacia, with nervous system signs.

In both these case the cattle were moved into rock fern-free paddocks and no further deaths were reported.

Polioencephalomalacia in cattle near Manildra

Polioencephalomalacia was tentatively diagnosed in June in a herd of Angus cattle near Manildra in the Central West. Five animals died from a group of 160 mixed-age Angus cattle that were grazing short improved pastures; they had been receiving supplementary wheat grain for the last 4 months. The grain had been stored outside and was not protected from the weather.

The deceased animals were yearling heifers and cows. All affected animals became ataxic and appeared blind; they lay down and were unable to rise, displaying opisthotonos (backward arching of the head and neck). One dying heifer was euthanased and a necropsy was conducted. There were no obvious abnormalities. Blood was submitted to rule out lead toxicity and the brain was submitted for histopathology. Brain histopathology was negative for transmissible spongiform encephalopathy (TSE), listeriosis and polioencephalomalacia. However, a tentative diagnosis of polioencephalomalacia was made, because four affected cattle recovered after treatment with intramuscular thiamine. The cattle were supplemented with oaten hay, and feeding of the wheat grain was stopped. There were no more new cases. The producer restarted grain feeding 10 days later and two new cases, with similar clinical signs, developed. These cattle were again treated with thiamine and recovered.

Polioencephalomalacia is a disease of the nervous system induced by vitamin B_1 deficiency. Diets high in carbohydrates and low in fibre can encourage the growth of thiaminase-producing bacteria in the rumen and thus increase the risk of the disease developing.

Transmissible spongiform encephalopathy surveillance at work

A producer in the South East Local Lands Services area reported sudden behavioural changes in one of his more valuable rams after recent rains in April. The rams had been on dry feed in the paddock plus supplementary feeding.

During the first few hours the owner noticed that the 3-year-old ram was apparently blind, bumping into objects and keeping away from the rest of the ram flock. Subsequently the ram developed generalised seizures lasting for up to 15 seconds, during which it would drool, drop to the ground and convulse; it would then slowly regain consciousness. The ram was able to sit up a few minutes after the seizure. In addition, when standing, the ram was found to circle, fall down and rise, or head-press.

The ram's right eye was cloudy, but there were no other obvious clinical signs. The likely diagnoses at this stage were trauma, neoplasia, polioencephalomalacia, hepatic encephalopathy, lead toxicity and scrapie. No potential sources of lead were found.

The ram was removed from the paddock, given access to hay and water, and treated with vitamin B_1 at therapeutic dose rates for 24 hours. The following day the animal was beginning to show signs of improvement: it was bright, alert and responsive and at one point even charged at the owner.

However, this improvement was temporary, and the ram suddenly began to deteriorate. The owner noticed that the left eye was also becoming cloudy, and the ram developed an oozing wound on his poll. The ram subsequently died.

All the neurological signs mentioned above were well within the criteria of the National Transmissible Spongiform Encephalopathy Surveillance Program (NTSESP).

A necropsy revealed nothing abnormal in the abdominal and thoracic cavities. However, brain examination revealed a green pus-filled lesion in the left cerebellum. Samples were taken and sent to the state veterinary diagnostic laboratory to exclude scrapie.

The laboratory results from this ram confirmed that it had died from a brain abscess. This is a rare diagnosis in adult sheep: it occurs more commonly in young lambs aged 3–8 months, usually from pyogenic infection initiated during the neonatal period. In this case, trauma was thought to be the cause. No further cases were noted in the ram flock.

This particular case emphasises the need to maintain active surveillance to keep diseases, such as scrapie, out of Australia. This not only ensures that Australia is free from this exotic disease but also reassures our trading partners of our scrapie-free status.

Pullorum disease exclusion

A free-range layer and chicken meat operation in the Southern Slopes of New South Wales experienced a sharp rise in mortalities in 1–4-week-old meat birds in May. The birds were sourced as day-old chicks from a northern New South Wales or Queensland hatchery. At the time of the outbreak, ambient temperatures were averaging 30°C and the increased mortalities were attributed to heat stress. However, as deaths approached 40% in each batch of 250 birds, an investigation was started.

Four birds showing typical signs were examined. Overall the birds were underweight for their age, lethargic and 'fluffed up', with eyes partially closed and marked cloacal pasting. Necropsy signs ranged from a diffuse peritonitis to multifocal 1–2 mm white lesions on the lungs and livers of 2 of the 4 birds.

Laboratory samples confirmed a predominant growth of *Salmonella* sp. Serotyping confirmed that the causative organism was *Salmonella* Typhimurium, a relatively common intestinal pathogen of poultry. At the same time, the notifiable and exotic conditions, pullorum disease (caused by *Salmonella* Pullorum) and fowl typhoid (*Salmonella* Gallinarum), were excluded.

Potentially novel staggers condition in weaner sheep

A regional disease investigation was conducted in April by the Riverina Local Lands Services in response to reports of a 'staggers' condition in weaner lambs across multiple close properties in the southern Riverina, most notably in The Rock and Milbrulong areas. Groups of sheep with the condition from five separate properties were investigated.

Case histories identified some common factors, including:

- June–August-drop Merino weaner lambs (particularly male stock) of similar genetics
- good body condition
- grazing predominantly lucerne pasture
- 5–25% morbidity
- 1–5% mortality.

The severity of symptoms observed varied; however, common findings included lumbar flexion (hunched back), shortened gait and paresis (particularly in the hindlimbs) and recumbence exacerbated with exercise. Affected animals formed a noticeable 'tail' to the group.

Several necropsies were performed following euthanasia. Gross and clinical pathology were consistently unremarkable and helped to reduce the suspicion of alternative diagnoses, including vitamin E deficiency, copper deficiency, cobalt deficiency, blood abnormalities, *Chlamydia* infection or other severe inflammatory disease processes. Histopathologic reports identified some evidence of myopathy, but vacuolisation throughout sections of the midbrain, hindbrain and spinal cord, with significant Wallerian degeneration throughout the spinal cord, was most notable. These changes were considered severe and definitely consistent with the clinical signs. However, they did not fit any of the known neurological conditions currently identified.

The possibility of plant toxicity was considered. Lesions on lucerne pasture samples were assessed at the Elizabeth Macarthur Agricultural Institute Plant Health Laboratory as indicating fungal (*Phoma medicaginis* and *Uromyces* spp.), insect and 'uncertain' damage. The fungal and insect damage was considered 'normal' for plant lesions and therefore unlikely to have been the cause of the clinical syndrome.

However, the lucerne stands at the time of the year were unusually lush and fresh, so it was considered that this out-of-season growth might have affected the development of the clinical syndrome.

After April, no new cases appeared.

This syndrome highlights the possibility of a novel disease with significant production impacts on sheep producers. District veterinarians in Riverina Local Lands Services will continue to monitor these flocks and others in the area for signs of a recurrence of this condition. Current investigation plans are to look for the presence of mycotoxins on lucerne (particularly if the upcoming season presents with exceptional out-of-season plant growth) and to investigate the potential for a familial link in Merino bloodlines to determine the possibility of an emerging genetic condition.

Northern Territory

Susanne Fitzpatrick,
Department of Primary Industry and Fisheries

During the quarter, the Department of Primary Industry and Fisheries conducted 102 livestock investigations[30] to rule out emergency diseases[31] and to provide assurance on the distribution and prevalence of notifiable diseases. Field investigations were conducted by government veterinary or biosecurity officers (82) and private veterinary practitioners (20) subsidised by the Department of Primary Industry and Fisheries. Diagnostic samples of field investigations were processed by the state veterinary diagnostic laboratory.

The number of field investigations by category of livestock is shown in Figure 5.

During the quarter, the state veterinary diagnostic laboratory processed approximately 216 submissions[32]; 61% of submissions were diagnostic requests for field investigations and the remainder were for health checks for export (5%), animal movements and accreditation programs (3%), targeted surveillance (28%) and regulatory activities (3%).

30 Field investigation with laboratory diagnostic testing.

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

32 Some investigations involved multiple submissions.

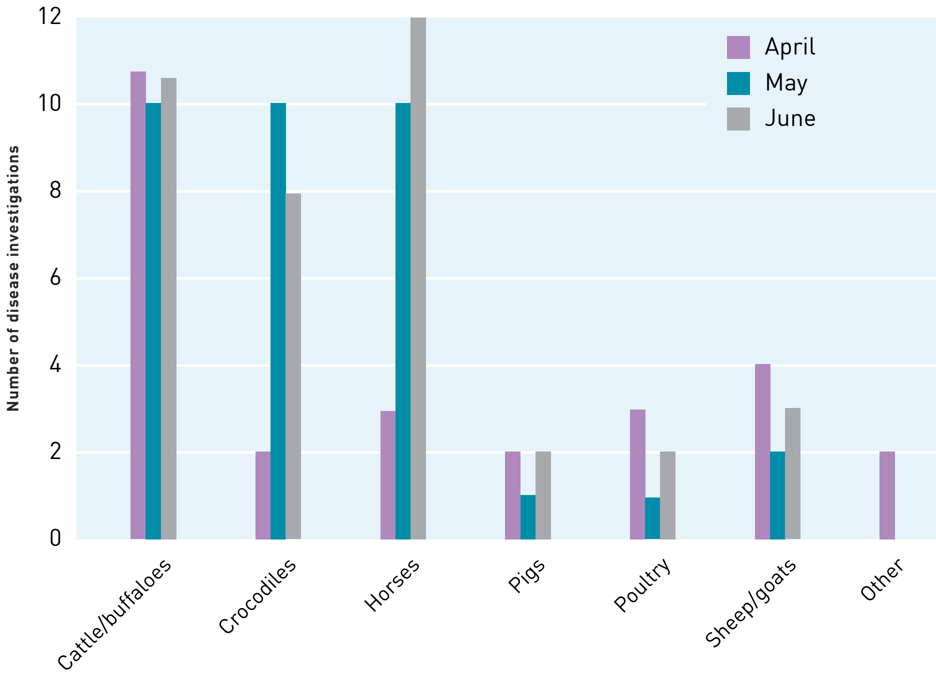


Figure 5 Number of field disease investigations in Northern Territory to rule out emergency diseases or investigate suspect notifiable diseases, April–June 2016

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

The Department of Primary Industry and Fisheries 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.

Sudden death in weaner cattle at mustering

Sudden death was investigated in 10 of 1500 weaner cattle during a muster on a property in the Darwin region in April. Contract mustering staff had noted affected cattle to briefly stagger, and then become recumbent and seizure before rapid death within minutes. The cattle had been mustered and spelled the night before, with mortalities first noted during the final 4 km of the muster the next morning.

Initial clinical examination of the carcases several hours after death showed rapid decomposition with blood present at the anus and nostrils and/or mouth of all carcases. Anthrax was excluded by the veterinary laboratory but necropsy of 10 available carcases (5 steers and 5 heifers) was delayed due to the isolated location of the property and travel required for sample submission.

Necropsy revealed all carcases to be in moderate stages of decomposition, having died up to 30 hours previously. All animals were in good body condition with no external wounds. Subcutaneous emphysema was present in all the carcases, with some having bruising and oedema of the ventrocaudal abdomen. There was an increased amount of serosanguinous abdominal fluid in several animals. Thorough examination of ruminal contents was undertaken, with all animals having adequate green roughage present. The rumen of one steer contained numerous 1–2 cm green seeds that could not be identified; however no unusual material was found in any of the other animals.

Clostridium sp. was cultured from collected tissue samples but this genus of bacteria is a common post-mortem contaminant. Clostridial species that commonly cause primary emphysematous and gangrenous disease in cattle, such as *C. chauvoei* and *C. septicum*, were not identified and were therefore unlikely to be the cause of disease. Histopathology was unrewarding due to the decomposed nature of the tissues. A blood sample from the recently dead heifer showed elevated potassium and phosphorus levels, which may have been due to delayed sampling and/or seizures or recent exercise. No venom was detected for tiger, brown, black, death adder or taipan snakes in the blood sample from the heifer, and the blood lead level was within the normal range.

Unfortunately a diagnosis could not be confirmed in this case. Given the history of the property, the location of mortalities, the good body condition of the cattle affected and the rapid progression of clinical signs, the cause of sudden death was most likely exposure to an unidentified plant toxin.

Multiple cutaneous fibropapillomas in Brahman heifers

On a property in the Katherine region in May, a small herd of 30 Brahman crossbred heifers, aged 7–18 months, were presented with numerous wart-like lesions over their entire bodies, including the eyelids, ears, head, vulva and tails. Samples of the lesions presented for histology were hard lesions ranging from small (5 mm x 3 mm x 2 mm) to large (30 mm x 20 mm x 20 mm), with the larger lesions having horn-like projections. The smaller lesions resembled thickened plaques, with fewer horny projections. Histology of several of the lesions revealed typical papillomas, characterised by marked epidermal papillary hyperplasia with fibroplasia in the underlying dermis and atrophy of remaining hair follicles.

Bovine papillomas are typically due to infection with one of 13 described bovine papillomaviruses. Bovine papillomavirus 2 in particular is often associated with typical fibropapillomas primarily on the head, neck, dewlap and shoulders of young (< 2 years of age) cattle, with lesions often spontaneously regressing within 1 year.

Papillomavirus lesion on Brahman cattle

Persistent bovine viral diarrhoea virus and osteomyelitis in a bull

During annual bull processing on a property in the Darwin region in April, the manager noted one 3-year-old composite bull with a swollen jaw. While the other bulls were in good condition, the affected bull was small for its age and in poor condition. The bull was deemed unsuitable for treatment and euthanased with a full necropsy performed.

A diffuse, hard bony swelling was palpable over the left lower mandible. The thick fibrous capsule was incised to reveal a caseous core. Retained deciduous teeth were apparent at the first three molar teeth on the left mandible, with corresponding ulceration of the buccal mucosa and tongue.

Histopathology showed a severe regional pyogranulomatous osteomyelitis of the jaw, with intralesional bacteria. *Truperella pyogenes* and *Fusobacterium necrophorum* were cultured from the core of the lesion. A positive bovine viral diarrhoea antigen (BVDV-1) ELISA test revealed the animal was also persistently infected with bovine viral diarrhoea virus (BVDV-1).[33] Notifiable exotic BVDV-2 was excluded. Faecal parasitology revealed an elevated faecal egg count of 2060 eggs/g with larval culture identifying 100% *Haemonchus* sp. Infection with BVDV can cause immunodeficiency and dental abnormalities, which likely led to the high worm burden and severe progression of the dental infection to osteomyelitis in this bull.

Haemorrhage from mouth of cattle in anthrax exclusion case

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

Ironwood toxicity in a goat

Sudden death in a pregnant nanny goat was investigated in the Darwin rural area in April. Two goats had been purchased from another property and were held in a small paddock with the existing goat herd overnight. One of the introduced goats was found dead the next morning. Necropsy revealed the pregnant goat was in good condition. There was diffuse petechial haemorrhage of the myocardium and multiple leaf fragments, identified as leaves of northern ironwood (*Erythrophleum chlorostachys)* in the rumen. Bluetongue virus was excluded and bacterial culture for acute melioidosis and other bacterial diseases were negative.

Leaves from the ironwood tree contain diterpenoid alkaloids, with ingestion of only a few leaves required to cause toxicity in goats. Young trees are particularly attractive to hungry and introduced grazing stock. Young ironwood trees were identified in the holding paddock after close examination, and removal and exclusion fencing has prevented further losses.

Leaves from the ironwood tree contain diterpenoid alkaloids, with ingestion of only a few leaves required to cause toxicity in goats.

Queensland

Greg Williamson, Biosecurity Queensland, Department of Agriculture and Fisheries

During the quarter in Queensland, 702 livestock disease investigations[34] were conducted to investigate suspect notifiable diseases or rule out emergency diseases[35]. The number of investigations by species of livestock is shown in Figure 6. Field investigations were conducted by government veterinary or biosecurity officers (48) and private veterinary practitioners (654). All diagnostic testing was conducted at the state veterinary diagnostic laboratory.

During the quarter, the state veterinary diagnostic laboratory, Biosecurity Sciences Laboratory, processed 702 livestock sample submissions[36] to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications (117) and for accreditation programs (14) and targeted surveillance (122). There were 29 submissions related to wildlife, 6 for companion animals and 41 for aquatic species. In total there were 1191 animal health related submissions to Biosecurity Sciences Laboratory during the quarter.

34 Field investigation with laboratory diagnostic testing.

35 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

36 Some investigations involved multiple submissions.

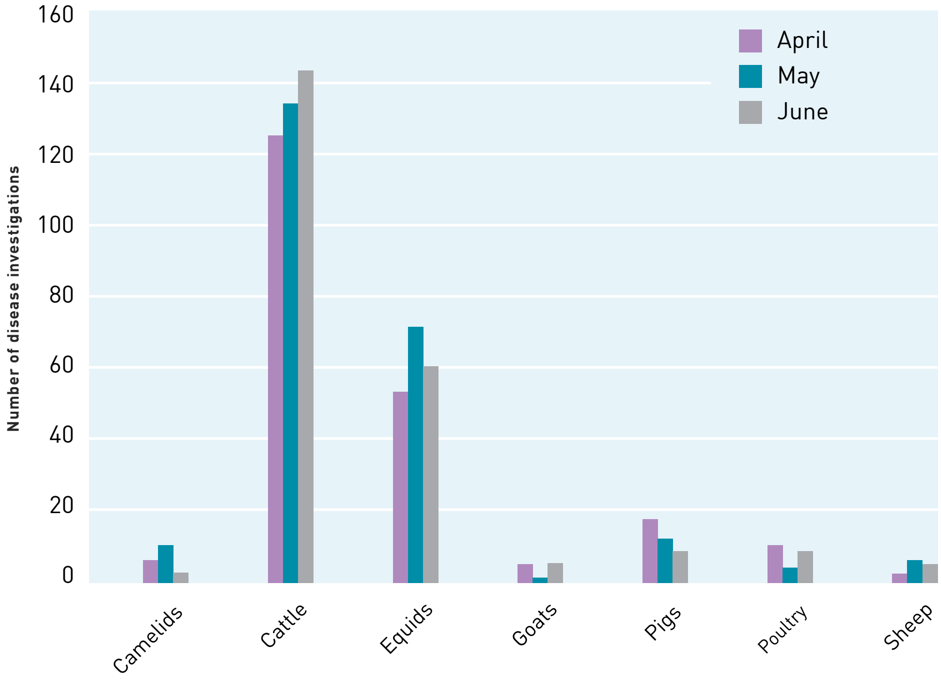


Figure 6 Number of field disease investigations in Queensland, April–June 2016

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.

Neurological disease in a cross bred calf consistent with neuronal storage disease

In April, 2 crossbred calves from the Granite Belt region of South East Queensland were investigated for abnormal neurological changes, including loss of coordination and abnormal behaviour. The 2 calves were part of a group of 32 calves born on the property. The affected calves had been sired by a neighbour's bull, while the remaining unaffected calves had been sired by the owner's bull.

The youngest of the affected calves was approximately 3 months of age and was reported to wander aimlessly around the paddock with an uncoordinated gait. On closer examination the calf appeared to be blind and there was microphthalmia of the left eye. The calf was euthanased and necropsy supported the ocular changes. No other abnormalities were detected. Laboratory results confirmed a pyogranulomatous ophthalmitis; haematology and biochemistry results were unremarkable.

The second affected calf (see video[37]) was approximately 4 months of age. Examination of this calf did not detect any gross structural abnormalities but the calf was ataxic, had a wide-based hind leg stance, knuckling of the stifles when moving, and—when it fell over—had difficulty rising. The calf was euthanased and necropsy was unremarkable. Laboratory findings were again unremarkable.

Both calves and their dams were negative for BVDV, Akabane and Aino viruses.

Histopathological examination of the brain of the second calf identified widespread neuronal swelling in the brain with foamy vacuolation of neuronal cytoplasm. This change affected basal, cortical and cerebellar Purkinje neurons. Spheroids were frequently observed. Similar changes were also noted in the neurons of the central grey matter in multiple samples of the spinal cord, and the neurons of Auerbach's and Meissner's plexuses in both the small and large intestine. Clumps of degenerate myelin were present in widely distributed vacuoles in the sciatic nerve.

The lesions, clinical features and age of the animal were consistent with a neuronal storage disease, likely to have been inherited. Lesions were not

37 https://youtu.be/9BlRmm6GTnA

consistent with Pompe disease. The exact nature of the stored material was not determined. Storage diseases in large animals include α-mannosidosis in Angus, Murray Grey, Simmental, Galloway and Holstein cattle. ß-mannosidosis is seen in Saler cattle and Nubian and Nubian-cross goats.

The owner of the cattle is continuing to monitor his new calves for signs of storage disease and reviewing his bull selection criteria. He will avoid breeding from the neighbour's bull in future.

Copper deficiency in cattle

In June, a group of approximately 35 Angus, Angus-cross and Murray Grey cattle on a Darling Downs property were investigated for possible causes of disease resulting in the death of one animal, downer cattle and ill-thrift in others with large areas of alopecia over the neck and trunk. All cattle were home bred, and ranged in age from 4-month-old calves to 13-year-old cows. The cattle had access to approximately 81 ha that had been grazed with no improvement for the past 80 years. The pasture included a patchy growth of mixed native grasses and some lantana.

At the time of the disease investigation, at least 10 animals were in poor-to-thin body condition with some noted to have large areas of thin sparse coat and alopecia on the neck, trunk and legs.

A 15-month-old Angus-cross heifer, with a body condition score 2/5, and a 5-year-old Angus cow, body condition score 1.5/5, were in sternal recumbency. Both animals had a dull demeanour and when approached, made no attempt to rise. The owner reported that the heifer had stood intermittently and was eating and drinking. Present on the heifer were significant areas of alopecia and hyperkeratosis on the neck, flank and hindquarters. Several raw patches of skin were seeping slightly with yellowish serous fluid. Both animals had a moderate burden of semi-to-fully engorged *Rhipicephalus (microplus) australis* ticks and nymphs. There was no evidence of lice. Both animals also had dark green diarrhoea. They were afebrile and tachycardic (100 bpm and 104 bpm respectively); mucous membranes and conjunctiva were white. Blood was thin and watery when sampled.

The 5-year-old cow was humanely euthanased and necropsied. Gross findings included very thin watery blood, enlarged tan liver and watery faecal material in the intestinal tract. At the request of the owner, the heifer was not euthanased but she subsequently died.

A 12-month-old Murray Grey steer with body condition score 1.5/5 was also tested. It had extensive areas of alopecia and crusting, and white mucous membranes.

All animals tested were identified as being severely deficient in copper. Copper levels ranged from 2.75 μmol/L to 5.91 μmol/L (normal 9.40–24.00 μmol/L).

All animals were severely anaemic with haemoglobin ranging from 2.61 g/dL to 5.52 g/dL (normal 9.50–14.50 g/dL) and hypoalbuminaemic 13.3 g/L to 22.3 g/L (normal 30.0–45.0 g/L). The heifer and cow were severely iron deficient with blood levels of 2.38 μmol/L and 5.68 μmol/L respectively (normal 23.3–44.8 μmol/L).

The heifer was also hypocalcaemic with a serum calcium level of 1.61 mmol/L (normal 2.10–2.80 mmol/L) and had a faecal egg count of 450 eggs/g with an 88% composition of *Haemonchus* sp. determined by larval nematode differentiation by faecal culture.

All were negative for *Babesia* sp., *Anaplasma* sp. and BVDV.

Management of these animals towards recovery includes copper replacement therapy in the form of a multimineral injection and dry lick. The owner has increased the volume of dry matter by feeding out hay. Changes have been made to the tick management regime. There have been no further deaths or downer cattle since the treatment commenced.

Copper-deficient Murray Grey crossbred steer showing alopecia and crusting

Mortalities in pre-lay pullets due to fowl cholera

Mortalities of 5 to 10 birds per day commenced in one shed of 900 pre-lay pullets on a commercial layer farm in the Mackay region in mid-April. Three days later, 70 pullets died, followed by 9 deaths the next day, then mortalities gradually decreased. No losses were reported in a neighbouring shed.

On the day of highest mortalities, a private veterinary practitioner observed birds with a fever in excess of 43°C, rapid respiration and mouth breathing. Swabs of trachea and cloaca from 3 birds were negative for influenza type A, infectious laryngotracheitis and Newcastle disease by PCR. Histopathological examination indicated interstitial pneumonia with thickened air capillary walls and moderate to severe, acute, multifocal coalescing hepatic necrosis. Fresh liver and lung samples tested positive for *Pasteurella multocida* by PCR, consistent with a presumptive diagnosis of fowl cholera.

The following week, a government veterinarian visited the farm and submitted samples from 3 birds, 2 of which appeared depressed and hunched up with ruffled feathers. Necropsy findings revealed 2 birds had translucent fibrous material adherent to the liver. The only significant histological findings were multiple small foci of hepatocellular degeneration in the same birds. No likely causative bacteria were cultured from fresh tissue; however, liver swabs taken from the 2 birds with liver pathology were positive for *P. multocida* by PCR whereas swabs taken from the cloaca and trachea were negative. The farmer intends to commence vaccinating younger pullets for *P. multocida*.

South Australia

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

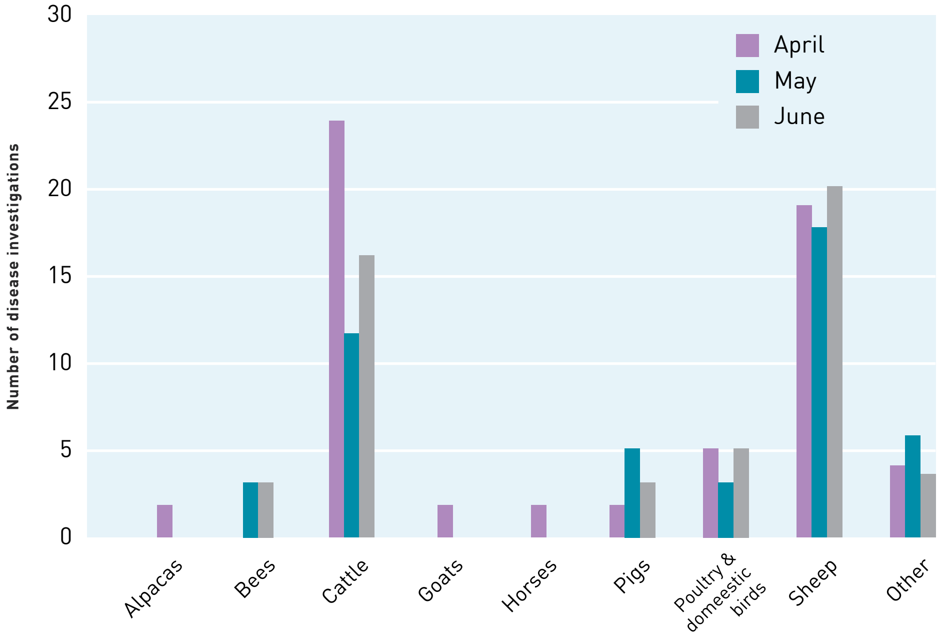


Figure 7 Number of livestock disease investigations in South Australia, April–June 2016

During the quarter in SA, 147 livestock disease investigations[38] were conducted to rule out emergency diseases[39] and investigate suspect notifiable diseases. The number of investigations by category of livestock is shown in Figure 7. Field investigations were conducted by government veterinary or biosecurity officers (29) and private veterinary practitioners, who in 118 cases submitted samples to the state diagnostic veterinary laboratory for subsidised testing to exclude or confirm notifiable diseases.

During the quarter, the state veterinary diagnostic laboratory, Gribbles Vetlab, processed 147 sample submissions[40] to rule out emergency diseases and investigate suspect notifiable diseases. Sample submissions were also received requiring testing for export, accreditation programs and targeted surveillance.

Biosecurity SA, a division of Primary Industries and Regions South Australia, maintains close communication with rural private veterinary practitioners, who make a valuable contribution to surveillance by investigating potential incidents of notifiable diseases and significant disease events. Biosecurity SA has an Enhanced Disease Surveillance Program to promote disease incident investigations in South Australian livestock. In partnership with the National Significant Disease Investigation Program, the program funds laboratory submissions for suspect infectious diseases in livestock and subsidises contracted private veterinary practitioners for costs incurred 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 the range of livestock disease incidents during the quarter.

Cattle deaths on the Fleurieu Peninsula

A beef property on the Fleurieu Peninsula reported the loss of 20 calves and 10 cows out of a herd of 220 cattle. The losses occurred over a 2-month period in autumn 2016.

Some of the calves were stillborn or premature, while others were born weak and found dead in the paddock 12–24 hours later. Nine cows and one heifer from the herd died during this period. Affected cows were older animals and were not reported by the producer as he assumed they had died of milk fever.

Veterinary investigation of a recently deceased calf revealed a visible oval-shaped hole in the midline of the forehead, with protruding brain tissue. The cranial space appeared small and the forebrain was undersized. The diagnosis was cerebral aplasia (prosencephalic hypoplasia), with cranioschisis and meningoencephalitis, ventriculitis and choroid plexitis.

Such developmental abnormalities of the brain may arise secondary to genetic or exogenous causes. In utero viral infections, toxic teratogens and hyperthermia are all possible causes. Testing at the South Australian State Veterinary Laboratory (VetLab) was negative for BVDV antigen (PCR) and antibody (ELISA) detection. Tests performed at the CSIRO Australian Animal Health Laboratory were negative for the Orthobunyavirus group (Akabane and Aino viruses) and bluetongue virus (TaqMan PCR negative). The diagnosis of central nervous system malformation is not consistent with infection with *Brucella abortus*, which was excluded based on clinical presentation. A specific toxic teratogen has not been identified in this case and no further losses have occurred.

38 Field investigation 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

40 Some investigations involved multiple submissions.

It is suspected that these abortions were caused by milk fever or exposure to an unidentified toxin, but a definitive diagnosis was not made in this instance. No further losses of calves or cattle have occurred on the property at the time of writing and the producer has been advised to report any future losses in this or subsequent seasons.

Listerial abortions in the south-east

During June 2016, a producer in the south-east reported late-term abortions in about 70 of his 722 crossbred ewe hoggets, which are domestic sheep aged between 1 and 2 years. The property had previously experienced ewe abortions due to confirmed campylobacteriosis.

Histopathology revealed advanced autolysis and evidence of widespread bacterial colonisation, most prominently within the liver. A tissue gram-stain and various organ and tissue cultures revealed a moderate growth of *Listeria monocytogenes*. Culture was negative for both *Salmonella* spp. and *Brucella* spp.

L. monocytogenes is a common gut inhabitant of many animals and can survive for extended periods in soil and vegetation. Outbreaks of the disease may be associated with wet muddy conditions. Just prior to this outbreak, bad weather and wet conditions had prompted the movement of the hoggets from a wet, muddy containment feeding area to a fresh pasture paddock with good growth. Abortions began soon afterwards and continued to occur sporadically for 3–4 weeks thereafter.

Foot-and-mouth disease excluded in sheep on the Eyre Peninsula

About 15 affected animals and a further 20 deaths occurred out of a group of 200 ewes on an Eyre Peninsula property during autumn 2016. The ewes had previously been grazing a paddock of abundant potato weed (*Heliotrope europaeum*) and were subsequently moved to a wheat stubble pasture, where the outbreak occurred. Affected sheep became weak and recumbent, with lesions described as ulcers on lips and tongues. Deaths occurred over a period of 7–10 days.

Serology revealed significant azotaemia and cholangiohepatopathy. Histopathological lesions included severe diffuse hepatic lipidosis with mild megalocytosis, and renal tubular lipidosis with tubular degeneration. Tongue lesions were a moderate, subacute, necrosuppurative and erosive glossitis with ballooning degeneration, parakeratosis and bacterial overgrowth.

Due to the presence of oral lesions, testing was conducted at the CSIRO Australian Animal Health Laboratory for the exotic diseases of foot-and-mouth disease (antigen capture ELISA, RT TaqMan PCR), vesicular stomatitis (VI, SNT, TaqMan PCR) and bluetongue virus (Taqman PCR, VNT and cELISA), all with negative results. No other viruses were detected. The chronic hepatotoxicity was considered to be caused by the ingestion of *H. europaeum,* which contains pyrrolizidine alkaloids. This also resulted in secondary hepatic photosensitisation, which may have caused or contributed to the oral lesions.

Grazing management advice was provided to the producer. No further deaths have been reported.

Pyrrolizidine alkaloid toxicity in Merino ewes after bushfire

In April 2016, 450 mixed-age Merino ewes were moved back onto burnt barley stubble after being agisted (cared for and fed) on a Yorke Peninsula property. The ewes had been agisted for 5 months after a locally devastating bushfire in the Lower North grazing/cropping region. About one week after returning, 2 sheep died and a week later another 2 showed neurological signs of head pressing, blindness, tremors and recumbency, as well as an increase in body temperature, heart rate and respiratory rate.

Ewes were being fed oaten hay and accessing water from the same source as before the bushfire. Although burnt ground is prone to weed invasion, no toxic plants were obvious and the stock did not have access to rubbish or other sources of toxins.

Two affected sheep were humanely euthanased after blood collection and samples were taken at necropsy. Histopathology revealed severe liver changes consistent with a hepatotoxin, and brain changes consistent with secondary hepatic encephalopathy, which accounts for the neurological signs. These changes were compatible with elevated liver enzymes identified on biochemistry.

The most likely cause of hepatotoxicity is pyrrolizidine alkaloid toxicity from pasture weeds, although mycotoxins could not be ruled out. The liver changes suggest a chronic ongoing process so it is likely the exposure occurred before the animals returned home, either at agistment or previous to the fire, or both.

The producers were advised to monitor for potential toxic plants or sources of mycotoxins to reduce further exposure. Feed testing should be considered to check for mycotoxins or plant toxins in the hay. No further cases have been reported.

Tasmania

Sue Martin, Biosecurity Tasmania, Department of Primary Industries, Parks, Water and Environment

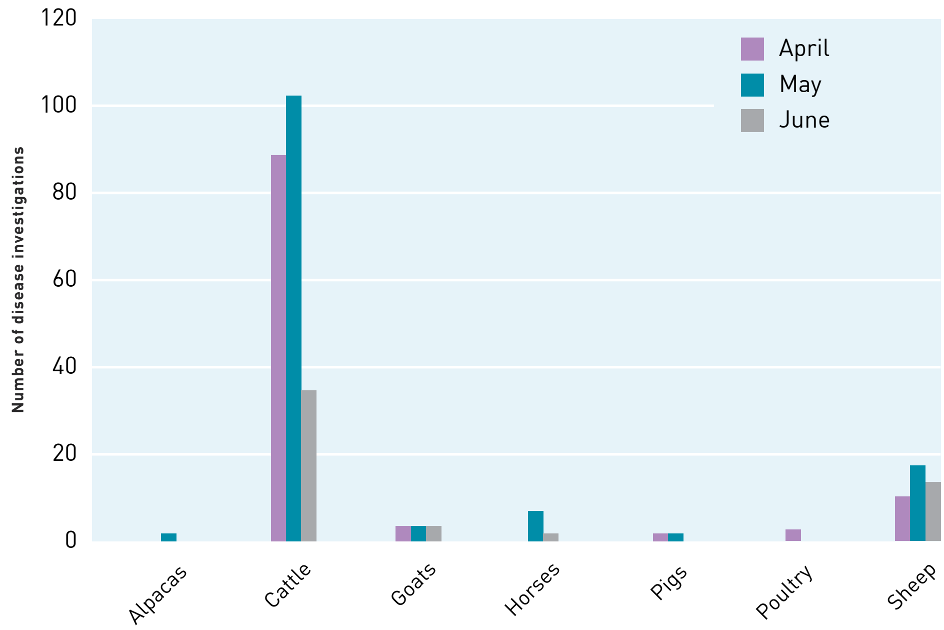


Figure 8 Number of field disease investigations in Tasmania, April–June 2016

During the quarter in Tasmania, 276 livestock disease investigations[41] were conducted to rule out emergency diseases[42] or investigate suspect notifiable diseases. The number of investigations by category of livestock is shown in Figure 8. Field investigations were conducted by government veterinary or biosecurity officers (12) and private veterinary practitioners (264). Diagnostic testing for these cases was conducted at the state veterinary diagnostic laboratory.

During the quarter the state veterinary diagnostic laboratory, Animal Health Laboratory, Launceston, processed 581 livestock sample submissions[43] 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.

Private practitioners often liaise with veterinary officers from the Department of Primary Industries, Parks, Water and Environment (DPIPWE) in the event of unusual disease events. Full support for laboratory costs and additional funding under the National Significant Disease Investigation (NSDI) Program is available for disease investigations where presenting signs may be consistent with an exotic, emergency or emerging disease, if undertaken in consultation with DPIPWE Senior Veterinary Officers and relevant samples are submitted to the state veterinary diagnostic laboratory. These investigations receive highest priority. During this quarter, one investigation was subsidised by the NSDI Program.

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 infection in a dairy herd

Abortion caused by Neospora caninum was diagnosed in a dairy herd experiencing 2–3 abortions a week over a 4-week period from mid-April to mid-May 2016. Most affected cows aborted at approximately 5 months gestation.

An aborted foetus and its placenta was submitted for necropsy. Placentitis and encephalitis were present. The brainstem was found to have multifocal nonsuppurative necrosis with a mixed inflammatory cell infiltrate, which were predominately mononuclear cells. These lesions were typical of those found commonly associated with protozoal abortions. Examination of the foetal abomasal fluid was negative for *Campylobacter*, *Listeria* and *Salmonella* species. No acid fast bacteria were detected. A placental swab was negative for *Chlamydia abortus* by PCR.

Suitable foetal tissue for Brucella abortus exclusion testing was not available. However, follow-up serology on 5 cows that had aborted and 5 unaffected cohorts in this herd found all to be negative for *Brucella abortus* antibodies. Significant titres to *Neospora caninum* were present in all aborted cows but no significant titres were found in the unaffected cohorts using the IFAT test.

N. caninum is a protozoan parasite. Cows are an intermediate host of *N. caninum* and are most likely infected by eating oocysts of the parasite that have been passed in the faeces of an infected dog (or possibly some other carnivore). Infection can then pass from the cow to the foetus through the placenta. Adult cows usually show no clinical signs of illness following infection and the majority have normal pregnancies. Calves of infected cows may be clinically normal but may become *Neospora* carriers. The female

41 Field investigation with laboratory diagnostic testing at the state veterinary diagnostic laboratory.

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.

calves may then have a high probability of infecting their own calves.

Abortion due to *Neospora* typically occurs between 4 and 7 months gestation (but can occur anytime from 3 to 9 months). Sometimes foetuses become mummified and expelled sometime after the embryo dies. Transmission from mother to daughter is thought to be the most important means of maintaining infection in a herd. If no new infection is introduced, usually only a small number within the herd will sporadically abort, although sometimes an abortion storm will occur when a previously uninfected herd is exposed to oocysts from an infected carnivore. However, it is thought that most abortions storms may be associated with other stressors that reduce the immunity in a previously infected herd and allow re-emergence of the parasite.

Dogs become infected after eating infected foetal tissue or afterbirth, then pass the oocysts in their faeces for several weeks. Cows may ingest these oocysts from contaminated pasture and feed. While most dogs show no clinical signs of infection, occasionally they can develop progressive hind limb weakness, particularly in pups under 6 months of age.

Foetal brain and heart are the most useful samples for diagnosis as they often have distinctive microscopic changes. Blood samples or foetal fluids can also be tested for antibodies. While positive results are a strong indicator of infection, negative results are not reliable as the foetus may not have had time to mount an immune response prior to death.

To control infection, contamination of pasture by infected dogs or other carnivores needs to be avoided. In this case property owners were advised to ensure their dogs were not able to scavenge aborted foetal material and advised to collect all aborted material in a timely manner, bury or burn it and take appropriate precautions to avoid contact with potentially infective material. Following the investigation the incidence of abortions within the herd tapered off over several weeks.

Nitrate poisoning in dairy heifers

Nitrate poisoning was suspected and confirmed as the cause of sudden death of 28 out of 93 dairy heifers aged 10 months that were moved to a new paddock of first-graze ryegrass in May. Animals were introduced to the paddock in the morning and appeared normal at 12:30 pm, but by 2:00 pm, 27 heifers were found dead with another dying in the next 24 hours.

Significant gross findings reported by the submitting veterinarian included serosal haemorrhaging on the intestines and brown discolouration of the blood. Elevated nitrate levels in aqueous humour submitted from 6 carcases confirmed the diagnosis.

The toxic component in growing plants is usually potassium nitrate, which — when ingested in sufficient quantities — may cause gastroenteritis. Common sources of nitrate for farm animals include cereal crops used as pasture, such as immature green oats, barley and wheat, very heavy growth of rye grass (*Lolium* spp.) in pastures and turnip tops.

Ruminal microbes convert nitrate to nitrite. In cattle and sheep this usually occurs around 5 hours after ingestion of the nitrate. Absorption of nitrites may cause methaemoglobinaemia and the development of hypoxia. Lethal levels in cattle are around 9 g of methaemoglobin per 100 ml of blood. Dyspnoea with gasping and rapid respiration is the major clinical sign. Death occurs from a few minutes to an hour after onset of clinical signs, so often the illness duration is so short that no clinical signs are observed.

Applications of excessive nitrogen-containing fertiliser or weather conditions that retard photosynthesis, such as cloudy cold weather, may result in higher-than-normal levels of nitrate accumulating in plants. Monensin (a polyether antibiotic) facilitates the conversion of nitrate to nitrite in the rumen and may result in poisoning in cattle or sheep on high nitrate fodder.

There is wide variation between species in their susceptibility to nitrite poisoning. Pigs are the most susceptible, followed by cattle, sheep and horses. The most important factor influencing susceptibility appears to be the rate of ingestion of the nitrate-bearing plants. Very hungry animals are at greater risk. Prior exposure to nitrate appears to reduce susceptibility.

Common necropsy findings with nitrate poisoning include congested and haemorrhagic gastrointestinal mucosa. In nitrite poisoning, the blood is dark red to brown in colour. There are no characteristic microscopic changes. If the animal has been dead for some time, aqueous humour is the most reliable sample for estimation of nitrate levels. Methylene blue can cause rapid reconversion of methaemoglobin to haemoglobin and can be used as an antidote if the diagnosis is made prior to death.

To reduce the risk of nitrate poisoning, ruminants that are likely to be exposed to nitrites or nitrates should receive adequate carbohydrate in their diet. Hungry animals should be fed hay or dry pasture as a filler before access to potentially toxic feed, to reduce their rate of intake. Cattle adapted to potentially toxic feed should not be supplemented with monensin.

Victoria

Karen Moore, Department of Economic Development, Jobs, Transport and Resources

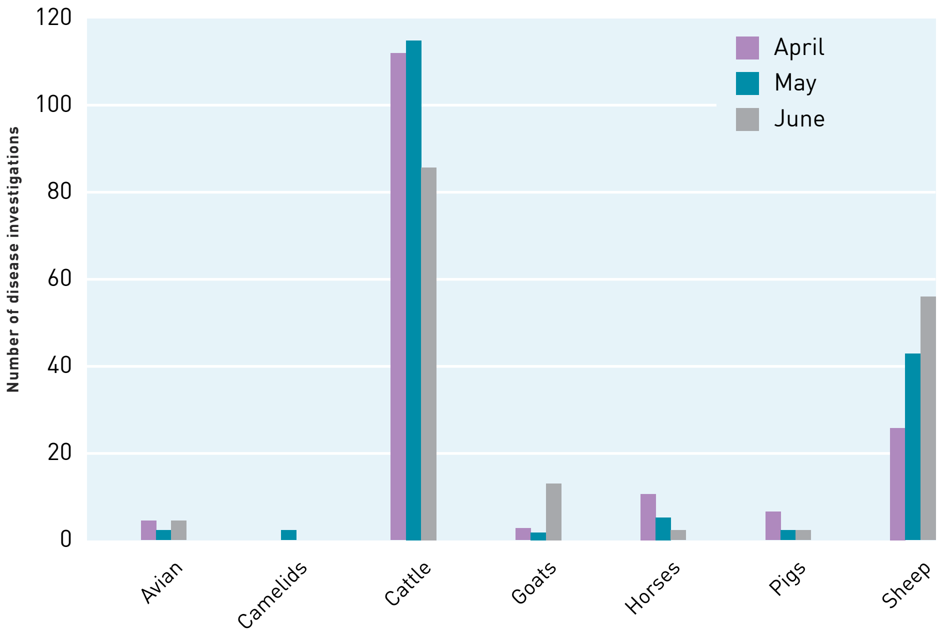


Figure 9 Number of field disease investigations in Victoria to rule out emergency diseases or investigate suspect notifiable diseases, April–June 2016

During the quarter in Victoria, 484 livestock disease investigations[44] were conducted to investigate suspect notifiable diseases or rule out emergency diseases[45]. The number of investigations by species of livestock is shown in Figure 9. Field investigations were conducted by government veterinary or biosecurity officers (149) and private veterinary practitioners (335). All diagnostic testing was conducted at registered veterinary diagnostic laboratories.

During the quarter, the state veterinary diagnostic laboratory (AgriBio, Bundoora) processed 468 livestock sample submissions[46] to investigate suspect notifiable diseases or rule out emergency diseases. Sample submissions (325) 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 system. The diseases most commonly diagnosed by species were gastrointestinal diseases in cattle, diseases of the central nervous system in sheep and pigs and respiratory disease in poultry and horses. 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 in the table of investigations for national notifiable animal diseases (Table 17).

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.

Nitrate poisoning in beef cattle

Nitrate poisoning led to the sudden deaths of four cows and an 8-month-old weaner calf in a 100-head Poll Hereford herd located near Mansfield in north east Victoria in June. The day prior to the deaths, the cattle had been fed wheaten hay and appeared to be in good health. They were found dead the following day with no signs of a struggle. The carcases bloated very quickly despite the cold weather.

The cattle had been drenched and vaccinated against clostridial diseases 3 weeks earlier and were in a bare, sacrificial confinement paddock, being fed purchased wheaten hay every second day.

Gross pathology at necropsy of two cows was unremarkable with coagulated blood being of normal colour. The aqueous humour of the calf had a nitrate level of 250 mg/L compared to the normal level of 5–10 mg/L. Nitrite levels were also increased (> 1 mg/L). Two cows had aqueous humour nitrate levels of 46 and 58 mg/L (normal < 10 mg/L).

As there was no apparent source of a toxin in the paddock, the wheaten hay was tested and found to contain a nitrate level of 7800 mg/kg DM (ME 9.6 and CP 14%); concentrations higher than 5000 mg/kg are considered toxic.

Normally plants contain relatively small amounts of nitrate as nitrate absorbed from the soil is fairly rapidly converted within the leaf to proteins and other nitrogen-containing substances. When protein synthesis is slow, nitrates will accumulate, especially in the lower part of the plant, until the rate of protein synthesis increases.

Major outbreaks of nitrate and nitrite poisoning have occurred after prolonged dry periods in Victoria. During periods of drought the concentration of nitrate in

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.

the soil can increase greatly due to a lack of leaching, reduced uptake by plants and decomposition of organic matter. After the drought breaks, nitrate uptake by plants may be high. Whilst high concentrations of nitrate are not toxic to plants, animals grazing on such plants may suffer from poisoning.

Foot-and-mouth disease exclusion in a Merino sheep

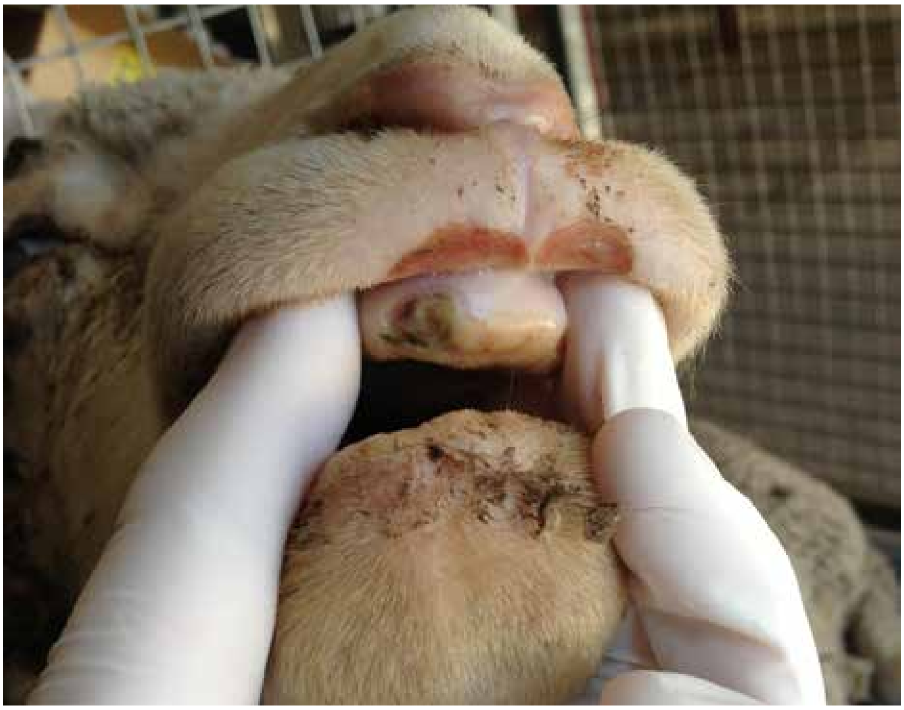
An adult Merino ewe presenting near Mansfield in north-eastern Victoria in March for a routine transmissible spongiform encephalopathy (TSE) exclusion was immediately recognised as a potential foot-and-mouth disease (FMD) case. On examination, the private practitioner discovered large oral erosions on the rostral dental pad and upper and lower lips, in addition to the presenting signs of submandibular oedema, corneal ulceration and blindness, depressed mentation, hypoaesthesia and circling to the right. The animal was immediately euthanased for necropsy.

Grossly, the necropsy revealed a large volume of clear pleural and abdominal fluid, consolidated lung lobes, multifocal firm white raised nodules on the hepatic surface and marked oedema of the abdominal viscera, mainly in the colon. Histopathology found hepatic granulomas, multifocal atelectasis of the lungs due to nematode larvae and diffuse marked villous atrophy of the small intestine due to a heavy granulomatous infiltration of paratuberculosis organisms. Bilateral spongiosis of the neuropil of the nucleus of the trigeminal nerve (cranial nerve V) in the cerebellar peduncle was observed, but tested negative for prion antigen on immunohistochemistry. A faecal egg count of 600 strongyle eggs per gram supported the lung findings.

Exotic disease testing was negative for FMD on antigen and antibody capture ELISAs, virus isolation and TaqMan assay, and negative for vesicular stomatitis on virus isolation, antibody serum neutralisation testing and TaqMan assay. Nonspecific ulceration and bacterial infection of the gingiva was found on histopathology.

This investigation, and a diagnosis of ovine Johne's disease, has allowed the producer to implement management strategies to protect their superfine wool Merino flock. The investigation provided evidence to support Australia's disease-free status for FMD, other vesicular diseases and TSEs.

The record of this investigation appears in the National Animal Health Surveillance System for the January to March period, however was omitted from Table 17 in AHSQ Vol. 21 Issue 1 as results were pending at the time of publication.



Oral erosions on the dental pad.

Suspected Monterey cypress induced abortions in beef cattle

Thirteen cows in a group of 24 Angus cattle aborted over a 48-hour period in their third trimester on a property in the Strathbogie Ranges in north-east Victoria in late June. The animals had been exposed to Monterey cypress trees (*Cupressus macrocarpa*), also known as macrocarpa trees in New Zealand. No other groups on the property were affected.

In New Zealand late-term abortion storms after a wind storm are commonly reported due to hungry cattle eating the leaves and small branches blown down from cypress trees. Reports from the United States have also implicated the consumption of the needles from some pine trees, such as the ponderosa pine (*Pinus ponderosa*), as a cause of late-term abortion in cattle. Access to prunings can cause the same outcome and, although much less common, wilting of standing intact trees may increase the palatability of the leaves. Abortions from eating cypress often result in weak or dead calves, dystocia, retained foetal membranes and secondary complications, such as peritonitis or toxaemia followed by death.

The component that is believed to cause the abortions after ingesting these trees is isocupressic acid. Studies have found concentrations in leaves ranging from 0.80% to 1.24%. With an oral dose of about 100 mg/kg of isocupressic acid fed twice daily for several days being required to induce an abortion, a pregnant cow averaging 430 kg would need to ingest 7–8 kg of *Cupressus macrocarpa* containing 1.24% isocupressic acid daily to cause an abortion.

In this case there was no wind storm before the time of the abortions, but the hungry cattle were put into a paddock that contained the Monterey cypress trees, with no supplementary feed. After the abortions had occurred, the producer noted that the lower branches of the trees had been grazed.

Laboratory testing of blood samples from the affected cows, aborted foetuses and foetal membranes ruled out BVDV, leptospirosis, neosporosis, brucellosis and other bacterial and fungal causes of abortion. Aborted foetal brain histopathology was equivocal but consistent with cypress pine toxicity.

Lameness due to tall fescue ingestion in Angus cows

Lameness, with distal hind limb swelling, associated with tall fescue (*Festuca arundinacea*) ingestion was observed in 30 out of 130 aged late-pregnant Angus cows on a property in the Upper Murray of north-east Victoria in June. The cows had been grazing a paddock containing tall fescue and annual ryegrass (*Lolium rigidum*) during the previous 6 weeks. 'Fescue foot' was suspected; a disease in which a toxin (ergovaline) produced by a microscopic fungus (*Neotyphodium coenophialum*) living within tall fescue causes local vasoconstriction within the hooves of the hind limbs.

At the time of printing, samples of the grass were being tested for the presence and concentration of ergot alkaloids along with culture and polymerase chain reaction (PCR) to identify the endophyte involved. The testing allows the differentiation of fescue foot from a similar condition called ergotism, induced by the fungus *Claviceps purpurea*. Biopsies taken from skin lesions showed ischaemic necrosis and supported the tentative diagnosis. Severely lame cows were euthanased while the remaining cows were removed from the paddock and fed roughage to prevent further cases. Interestingly, this outbreak occurred despite use of a nil-endophyte cultivar of fescue grass, highlighting challenges in pasture management.

Western Australia

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During the quarter in Western Australia, 228 livestock disease investigations[47] were conducted to rule out emergency diseases or investigate suspect notifiable diseases.[48] The number of investigations by category of livestock is shown in Figure 10. Field investigations were conducted by government veterinary officers (46) and private veterinary practitioners (182). All diagnostic testing was conducted by the Department of Agriculture and Food WA (DAFWA).

During the quarter, DAFWA processed 550 livestock sample submissions[49] which included submissions to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications, and for accreditation programs and targeted surveillance.

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

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

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

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

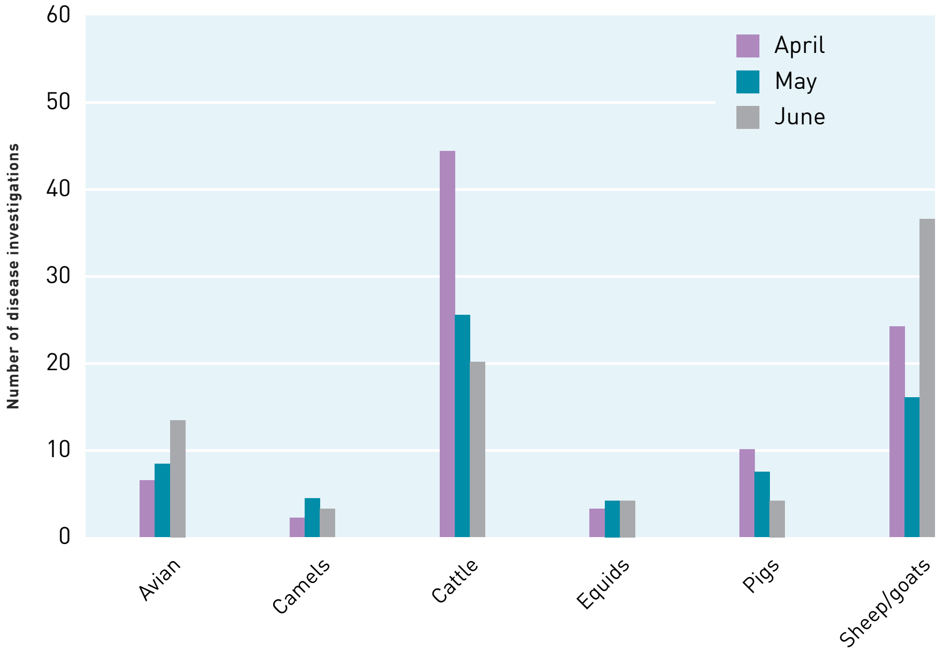

Figure 10 Number of field disease investigations in Western Australia to rule out emergency diseases or investigate suspect notifiable diseases, April–June 2016

Facial oedema in sheep: bluetongue disease and foot-and-mouth disease excluded

In April, a private veterinarian investigated a report of facial oedema in 10-month-old White Suffolk lambs in the Southern Agricultural Region, with 3 dead and 60 affected from a flock of 300.

Clinical examination revealed affected animals had extensive cutaneous exudative lesions on the face and perineum. One lamb had two well demarcated, ovoid erosions on the tongue tip. Clinical examination of cohorts revealed no evidence of oral or coronary band lesions nor was there any evidence of clinical signs associated with vesicular disease.

The private veterinarian made a provisional diagnosis of photosensitisation and submitted samples to the DAFWA laboratory for further investigation. Histopathological changes included expansion of hepatic portal areas due to a proliferation of bile ductules, extensive fibroplasia with dissection into the periportal hepatic parenchyma, as well as extensive multifocal hepatocellular loss.

Changes to the skin and pinnae included extensive superficial erosion with progression to focal ulceration. A progression from superficial intraepithelial neutrophilic pustule formation to epithelial necrosis and basal cell loss was evident. The dermis contained a neutrophilic infiltrate with high protein oedema. The bladder had deep ulceration of the mucosa and submucosa; the tunica muscularis and serosa was intact but oedematous.

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.

Facial eczema was diagnosed based on the history, clinical examination and pathological changes, with the severe hepatopathy with extensive biliary proliferation being characteristic of facial eczema. The ulcerative lesion of the bladder has been documented in cases of facial eczema and may be related to excretion of irritant compounds.

Facial eczema is a toxic hepatopathy with secondary photosensitisation inducing cutaneous oedema, necrosis and ulceration of lightly haired or pigmented skin. The hepatopathy is caused by the sporidesmin toxin of the fungus *Pithomyces chartarum*, which proliferates on pasture in moist warm conditions.

The CSIRO Australian Animal Health Laboratory undertook testing for exotic reportable diseases that could present with similar clinical signs, if present, such as bluetongue disease, foot-and-mouth disease and vesicular stomatitis. These were excluded as the cause of disease on PCR and ELISA testing.

Equine respiratory case: African horse sickness and Hendra virus infection exclusions

In April, a private veterinarian investigated a report from a horse owner in the South West Agricultural Region of a 6-year-old quarter horse with respiratory signs and difficulty swallowing. The owner reported the next day that 4 other horses on the property developed similar clinical signs.

The private veterinarian conducted a comprehensive property investigation and clinical examination of all affected horses. These horses had significant facial swelling, with no other significant findings identified. The differential diagnoses included Hendra virus infection, African horse sickness and fescue toxicoses.

The private veterinarian collected blood samples from all horses before providing symptomatic treatment to reduce tissue swelling, which improved clinical signs by approximately 30% over the subsequent 24 hours.

DAFWA laboratory ran a range of biochemistry tests with mildly elevated creatinine kinase being the most notable finding. Further investigation revealed that all 5 horses had been exposed to avocado tree cuttings. A presumptive diagnosis of avocado toxicosis was made given the history, clinical signs and the mildly elevated creatinine kinase, identified as consistent with a mild myocardiocyte injury caused by avocado poisoning. This was supported by a resolution and no reoccurrence of clinical signs once the horses' access to avocado cuttings was removed.

DAFWA laboratories and the CSIRO Australian Animal Health Laboratory excluded Hendra virus infection and African horse sickness, which could present with similar clinical signs, as the cause of disease.

The exclusion of these diseases is important in safeguarding both public and horse health. DAFWA continues to remind private veterinarians of the importance of ensuring their and their client's personal safety when examining horses with respiratory signs given the varying clinical signs in which Hendra virus infection can present.

Stillbirths and late-term abortions in cattle: *Brucella abortus* and Schmallenberg exclusion

In April, a private veterinarian investigated a report of stillbirths and late-term abortions in a herd of 580 mixed breed beef cattle in the Southern Agricultural Region.

The private veterinarian's on-farm investigation revealed that almost half the calvings had been affected. Two dead calves were examined and appeared well developed but were noted to have had enlarged heads.

DAFWA laboratories biochemical testing revealed that 10 of 12 samples submitted were low in copper, with 8 low in selenium. Molecular biological testing results included PCR positive results for *Theileria orientalis* Ikeda strain on 10 of 12 blood samples, which indicated the organism is likely present at a high prevalence within the herd and likely contributory to the clinical syndrome. Based on these results, an aetiological diagnosis of *Theileria orientalis* Ikeda infection, copper deficiency and selenium deficiency was made.

DAFWA conducted laboratory testing to exclude other potential endemic and exotic aetiological agents, including *Neospora caninum*, *Brucella abortus*, Akabane and Aino viruses. CSIRO Australian Animal Health Laboratory conducted an Orthobunyavirus PCR and specific PCR to exclude Schmallenberg as a potential cause of disease.

DAFWA laboratory's testing for leptospirosis revealed antibodies for *Leptospira* Topaz in two samples, which suggested sporadic exposure in the herd, but in the absence of widespread seroconversion, the significance of this finding was undetermined. *Leptospira* Topaz is a novel *Leptospira interrogans* serovar. While DAFWA has detected low levels of seroconversion in cattle in south-west Western Australia, a pathogenic role has not been established either epidemiologically or experimentally. DAFWA continues to liaise with producers and private veterinarians on abortion cases to further investigate any association of this agent with disease.

Neonatal deaths in goats: bluetongue disease exclusion

In April, a DAFWA field veterinary officer investigated a report of neonatal deaths in Boer and red Boer kids in the Central Agricultural Region.

The history included that kids were normal at birth (active and suckling) but those affected weakened and died within approximately 36 hours. There was no evidence of scouring reported and the does were of various ages and with no mismothering evident. At the time of investigation, 60 of 80 goats had kidded and 6 kids were affected.

Necropsy of 2 deceased kids revealed neither had milk in the abomasum, and while one had no other significant findings, the other had evidence of haemorrhage at the base of the aorta and at the vertex of the bladder extending to the urachus.

Histopathological findings from one kid were consistent with a bacterial infection that was seeding to the liver, with a significant level of neutrophils in the hepatic blood vessels and sinusoids and clusters around individual degenerate hepatocytes. Infection was determined likely originating from the gastrointestinal tract as there was significant neutrophilic inflammation with gram-negative bacilli in the submucosa of the abomasum. Bacterial cultures identified a pure growth of nonhaemolytic *Escherichia coli*. Although this isolate was nonhaemolytic, given the pure growth from the liver and presence of gram-negative bacilli, it was determined as a significant finding.

Histopathological findings from the second kid included an erosive enteropathy, with multiple foci of degenerate and sloughing enterocytes, particularly at the crypts, and with some affected areas surrounded by short bacilli that was determined highly suggestive of a viral infection.

Whilst the specific aetiological agents were not definitively diagnosed in this case, DAFWA laboratories ruled out several exotic diseases that may present with similar presenting syndromes. These included bluetongue, Akabane and Aino viruses and the Simbu virus group.

Investigation of pigeon mortalities

DAFWA has been assisting the pigeon industry to investigate mortalities in racing and fancy pigeons in the Perth metropolitan area.

In May, a pigeon owner reported to a DAFWA veterinary officer signs of diarrhoea, regurgitation and mortalities in their loft. Subsequently, multiple reports were received of similar illness in racing and fancy pigeons, with mortalities up to 20% in some lofts. An epidemiological assessment determined that an infectious disease agent was most likely involved, due to the timeline of lofts reporting illness and movement history of affected lofts revealing a potential mechanism for disease spread. A point source disease event (common source outbreak where the exposure occurs in less than one incubation period) due to contaminated feed or water was considered, but determined unlikely.

Birds were submitted to the DAFWA Diagnostic Laboratory Services where

necropsy and sampling was conducted. All birds tested negative for the reportable diseases avian influenza, pigeon paramyxovirus 1 and Newcastle disease.

Initial gross examination of affected birds was indicative of hepatic necrosis and splenitis. Histopathology confirmed the presence of extensive acute hepatocellular necrosis with a light inflammatory response in all birds examined. Variable splenic necrosis and haemorrhage was present in some birds. An aetiological agent was not evident in the sections examined, and bacterial pathogens were not detected on culture. Initial molecular testing performed at Charles Sturt University was negative for common agents of hepatitis in pigeons, including adenovirus.

These initial results suggest that the cause of mortality was acute viral hepatitis. A cause has not been demonstrated to date. DAFWA is continuing to investigate potential viral aetiological agents, including adenoviruses and reoviruses, using advanced laboratory testing (electron microscopy, viral culture and molecular testing).

In response to the outbreak of suspected viral hepatitis, the pigeon industry implemented biosecurity measures to prevent spread of the disease. The outbreak appears to have resolved, with no further cases reported to DAFWA since late June.

Excluding reportable diseases is a vital part of any avian disease investigation. This testing supports the sector through early disease detection and providing evidence of freedom from trade-relevant diseases.

Quarterly statistics

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 but has not been detected in Queensland. Johne's disease in cattle is endemic in south-eastern Australia but surveillance programs have not identified infection to be endemic in Queensland, Western Australia or the Northern Territory, and active measures have been taken to stamp out any incursions in these jurisdictions. Table 2 shows the number of herds known to be infected.

Table 2 Herds[a] known to be infected with Johne's disease, at 30 June 2016

State	Cattle	Deer	Goat	Total
NSW	96	0	0	96
NT	0	0	0	0
Qld	5	0	1	6
SA	50	0	2	52
Tas	39	0	4	52
Vic	919	2	12	933
WA	0	0	0	0
Aus	**1,109**	**2**	**19**	**1,130**

a Includes herds participating in state test and control programs.

The reporting of sheep flocks infected with Johne's disease has been replaced with the quarterly reporting of the number of sheep flocks inspected through 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 3 shows the number of PICs inspected and found with one or more infected animals.

Table 3 Summary of National Sheep Health Monitoring Project (NSHMP) inspected and infected line results, April–June 2016

State	Number of animals inspected	Number of PICs inspected	Number of PICs infected	Percentage of PICs infected
NSW	22,543	73	2	2.7
Qld	4,887	17	0	0.0
SA	76,077	608	2	0.3
Tas	12,461	51	0	0.0
Vic	23,289	132	12	9.1
WA	13,386	39	2	5.1
Aus	**153,093**	**920**	**18**	**2.0**

PIC = property identification code

New 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, cattle, goats and sheep; the numbers of herds or flocks that have reached a status of Monitored Negative 1 or higher are shown in Table 4. For status definition, see the current species MAP manual[50]. Lists of alpaca, cattle and goat herds and sheep flocks assessed in the MAPs are available on the Endemic Disease Information System website[51]. Herd or flock testing is undertaken by a MAP-approved veterinarian. Information about components of the National Johne's Disease Project can be obtained from state coordinators and Animal Health Australia's Johne's disease coordinator, Rob Barwell (tel. 02 6203 3947).

Table 4 Herds or flocks[a] with a Market Assurance Program status of at least Monitored Negative 1, 1 January – 30 June 2016

Quarter	Alpacas	Cattle	Goats	Sheep	Total
Jan–Mar 2016	18	346	26	371	761
Apr–Jun 2016					
NSW	11	143	12	157	323
Qld	0	0	4	1	5
SA	7	115	8	160	290
Tas	0	34	1	13	48
Vic	1	52	1	47	101
WA	0	0	0	4	4
Aus	**19**	**344**	**26**	**382**	**771**

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

Ovine contagious epididymitis

Contagious epididymitis, caused by *Brucella ovis*, is present in commercial sheep flocks at a low level that varies around the country. Voluntary accreditation programs (usually in stud flocks) for ovine contagious epididymitis freedom operate in all states. Table 5 shows the number of accredited flocks at the end of the quarter.

Table 5 Ovine contagious epididymitis accredited-free flocks, 1 April 2015 – 30 June 2016

State	Apr–Jun 2015	Jul–Sep 2015	Oct–Dec 2015	Jan–Mar 2016	Apr–Jun 2016
NSW	865	858	846	872	861
Qld	77	77	79	79	73
SA	530	530	530	530	530
Tas	68	59	62	63	71
Vic	496	489	471	445	457
WA	194	194	183	184	184
Aus	**2,230**	**2,207**	**2,171**	**2,173**	**2,176**

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

50 www.animalhealthaustralia.com.au/maps

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

Laboratory testing

Serological testing

Table 6 summarises the results of serological testing for two equine viruses on samples submitted to state and territory animal health laboratories during the quarter. Positive serological test results are not an indication of the presence of clinical disease.

Table 6 Results of serological testing for two equine viruses, 1 April 2015 – 30 June 2016

Quarter	No. of tests (equine infectious anaemia)	Positive (equine infectious anaemia)	No. of tests (equine viral arteritis)	Positive (equine viral arteritis)
Apr–Jun 2015	463	0	639	4
Jul–Sep 2015	582	0	519	0
Oct–Dec 2015	1,348	0	483	0
Jan–Mar 2016	629	0	603	2
Apr–Jun 2016				
NSW	536	0	711	3
NT	0	0	0	0
Qld	0	0	0	0
SA	0	0	0	0
Tas	0	0	1	1
Vic	289	0	231	0
WA	0	0	0	0
Aus	**825**	**0**	**943**	**4**

Table 7 summarises the results of laboratory testing for equine herpesvirus 1 on samples submitted to state and territory animal health laboratories during the quarter.

Table 7 Results of testing for equine herpesvirus 1, at 30 June 2016

Syndrome	EHV1 suspected but not confirmed	Negative	Positive	Total
Abortion	1	77	0	78
Neurological	0	15	0	15
Other	2	5	3	10
Total	**3**	**97**	**3**	**103**

Table 8 summarises the results of serological testing for three arboviruses on samples submitted to state and territory animal health laboratories for the National Arbovirus Monitoring Program (NAMP)[52]. **Positive serological test results are not an indication of the presence of clinical disease**.

Table 8 Results of serological testing for three arboviruses, 1 April 2015 – 30 June 2016

Quarter	No. of tests (Akabane)	Positive (Akabane)	No. of tests (BEF)	Positive (BEF)	No. of tests (BTV)	Positive (BTV)
Apr-Jun 2015	782	31	837	41	1,650	40
Jul-Sep 2015	454	22	576	33	882	37
Oct-Dec 2015	196	12	534	47	786	10
Jan-Mar 2016	217	0	789	34	1,403	71
Apr-Jun 2016	**504**	**36**	**951**	**35**	**1,513**	**91**

BEF = bovine ephemeral fever virus; BTV = bluetongue virus

52 http://namp.animalhealthaustralia.com.au

Surveillance activities

Bovine brucellosis

Australia declared freedom from bovine brucellosis (caused by *Brucella abortus*) in 1989.[53] Surveillance is maintained through abortion investigations and additional testing of cattle for export or other reasons. Table 9 shows 120 bovine abortion investigations and 376 investigations for other reasons were performed during the quarter; all were negative for bovine brucellosis.

Table 9 Bovine brucellosis testing, 1 April 2015 – 30 June 2016

Quarter	No. of tests (abortion)	Positive (abortion)	No. of tests (other reasons)[a]	Positive (other reasons)
Apr–Jun 2015	114	0	1,513	0
Jul–Sep 2015	297	0	283	0
Oct–Dec 2015	177	0	196	0
Jan–Mar 2016	202	0	704	0
Apr–Jun 2016				
NSW	1	0	286	0
NT	0	0	0	0
Qld	48	0	29	0
SA	12	0	0	0
Tas	18	0	0	0
Vic	27	0	18	0
WA	26	0	43	0
Aus	**132**	**0**	**376**	**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.

National Transmissible Spongiform Encephalopathies Surveillance Program

The National Transmissible Spongiform Encephalopathies Surveillance Program (NTSESP) is an integrated national program jointly funded by industry and government to demonstrate Australia's ongoing freedom from bovine spongiform encephalopathy (BSE) and classical scrapie, and to provide early detection of these diseases should they occur. The program, based on the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code*[54], involves testing of samples from cattle and sheep with clinical signs consistent with BSE or scrapie respectively, as well as from fallen and casualty slaughter cattle. Points are assigned to cattle samples according to the animal's age and subpopulation category (i.e. the likelihood of detecting BSE). Australia's target is to achieve a minimum of 150,000 points over a rolling 7-year period. Table 10 shows the number of animals sampled for BSE and scrapie and the points tally for cattle in the NTSESP[55] during the past 12 months. All samples tested were negative.

Table 10 Samples tested for transmissible spongiform encephalopathies (TSEs), 1 July 2015 – 30 June 2016

State	No. examined (cattle)	Points (cattle)	Positive (cattle)	No. examined (sheep)	Positive (sheep)
NSW	207	51,085.0	0	184	0
NT	31	13,525.0	0	0	0
Qld	145	5,1267.0	0	19	0
SA	33	1,5481.8	0	52	0
Tas	14	3,473.5	0	14	0
Vic	148	39,538.3	0	130	0
WA	28	14,210.7	0	116	0
Aus	**606**	**188,581.3**	**0**	**515**	**0**

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

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

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

Avian influenza

Australia is currently free from highly pathogenic avian influenza. A number of low pathogenic subtypes of avian influenza have been found in wild birds. Please consult the Wildlife Health Australia report in this publication for information on avian influenza in wild birds. During the quarter, 360 birds from 94 laboratory submissions were tested for avian influenza (excluding surveillance reported in the Wildlife Health Australia and Northern Australia Quarantine Strategy reports); no positive strains were detected (Table 11). Tests included competitive ELISA, haemagglutination inhibition, agar gel immunodiffusion, reverse-transcriptase PCR and virus isolation.

Table 11 Results of testing for avian influenza virus in poultry, 1 April – 30 June 2016[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.

Newcastle disease

Australia is currently free from virulent Newcastle disease or exotic Newcastle disease, (caused by avian paramyxovirus serotype 1) even though precursor and endemic avirulent viruses are present in Australia. Vaccination against virulent Newcastle disease using a combination of live lentogenic virus (V4) and a killed vaccine is required in commercial chicken flocks[56] in all Australian jurisdictions. Vaccination exceptions for broilers apply in Tasmania, Western Australia, Queensland and South Australia. During the quarter, 311 birds from 88 laboratory submissions were tested for Newcastle disease (Table 12). Please consult the Wildlife Health Australia report in this publication for information on avian paramyxovirus in wild birds.

Table 12 Results of testing for Newcastle Disease in poultry, 1 April – 30 June 2016[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	0	0

ND = Newcastle disease
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 13 summarises *Salmonella* spp. isolations from animals reported to NEPSS.

Table 13 Salmonella notifications reported to the National Enteric Pathogen Surveillance Scheme (NEPSS), 1 April – 30 June 2016

Salmonella serovar	Birds[a]	Cats	Cattle	Dogs	Horses	Pigs	Sheep	Other	Total
Bovismorbificans	0	0	10	0	1	1	5	0	17
Dublin	0	0	16	0	0	0	0	0	16
Infantis	0	0	0	0	0	0	0	0	0
Typhimurium	3	5	11	5	3	2	2	4	35
Other	1	2	19	4	1	21	1	18	67
Total	**4**	**7**	**56**	**9**	**5**	**24**	**8**	**22**	**135**

a Includes both poultry and wild birds.

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

Northern Australia Quarantine Strategy

In recognition of the unique biosecurity risks associated with Australia's extensive and sparsely populated northern coastline, the Australian Government Department of Agriculture and Water Resources conducts an animal disease surveillance program as an integral component of its Northern Australia Quarantine Strategy (NAQS). This surveillance program aims to provide early detection of exotic and emerging pests and diseases of significance to agriculture, public health and the environment. Information is derived from the use of sentinel animals, structured surveys, vector trapping and community reporting projects. In addition, NAQS contributes surveillance data to the National Arbovirus Monitoring Program and the electronic Wildlife Health Information System (eWHIS). Table 14 summarises NAQS animal testing for specific target diseases in Australia during the past five quarters.

Table 14 Disease testing and pest surveillance under the Northern Australia Quarantine Strategy (NAQS), 1 April 2015 – 30 June 2016

Target disease	Apr–Jun 2015		Jul–Sep 2015		Oct–Dec 2015		Jan–Mar 2016		Apr–Jun 2016	
	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive
Aujeszky's disease[a]	31	0	73	0	154	0	45	0	146	0
Avian influenza[b]	48	0	0	0	0	0	0	0	43	0
Classical swine fever	252	0	73	0	154	0	58	0	206	0
Japanese encephalitis	42	0	0	0	0	0	36	0	59	1[c]
Surra (*Trypanosoma evansi*)	278	0	73	0	183	0	16	0	199	0

a Serological screening of wild pig populations for Aujeszky's disease commenced in the April–June 2015 quarter. Prior surveillance was based on general strategies for detecting disease events in pig populations.
b Excludes testing in wild birds.
c A single pig from Moa Island, Torres Strait, tested positive to Japanese encephalitis (JE) on ELISA test for antibodies. Results from follow-up testing with Flavivirus group plaque reduction neutralisation test were consistent with an antibody response following exposure to JE virus (i.e. antibody titres for JE virus were four-fold higher than titres for Murray Valley encephalitis and Kunjin viruses). No clinical signs consistent with JE were observed in this pig (or other animals) sampled during this survey. JE virus is endemic in Papua New Guinea and is known to circulate in Torres Strait on a seasonal basis. Surveillance for JE conducted by both NAQS and Queensland Health has found no evidence of circulation of JE on the mainland this year. Queensland Health was notified of this finding and they have since conducted follow-up investigations and awareness campaigns in Torres Strait as a public health measure.

Screw-worm Fly Surveillance and Preparedness Program

The Old World screw-worm fly (OWS) and New World screw-worm fly (NWS), *Chrysomya bezziana* and *Cochliomyia hominivorax*, respectively, are exotic to Australia and suspicion of infestation in animals is notifiable under state and territory animal health legislation[57]. The OWS is a significant production disease of livestock throughout its range and is considered a greater threat to Australian livestock industries than NWS due to the proximity of its distribution to Australia (potential entry through the Torres Strait) and traffic of livestock export vessels returning from Asia to Australian ports.

Surveillance is conducted by targeted fly trapping and livestock myiasis monitoring in addition to unplanned investigations of myiasis (reported in 'National notifiable animal disease investigations' and Table 17). 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 15 summarises fly trapping events over the past year. No screw-worm fly were detected. Further information on the screw-worm fly program is available on the Animal Health Australia website[58].

Table 15 Summary of fly trapping events conducted, 1 July 2015 – 30 June 2016[a]

Risk entry pathway	Conducted by	Jul–Sep 2015	Oct–Dec 2015	Jan–Mar 2016	Apr–Jun 2016
Torres Strait	NAQS	41	15	17	30
Livestock export ports	NT, Qld and WA governments	46	28	43	56

NAQS = Northern Australia Quarantine Strategy; NPA = Northern Peninsula Area of Queensland
a Excludes traps with identification results pending.

57 Australian Government Department of Agriculture and Water Resources National List of Notifiable Animal Diseases www.agriculture.gov.au/pests-diseases-weeds/animal/notifiable [updated November 2015; cited 8 February 2016].

58 Animal Health Australia. Screw-worm Fly Surveillance and Preparedness Program www.animalhealthaustralia.com.au/what-we-do/disease-surveillance/screw-worm-fly [updated 20 November 2015; cited 8 February 2016].

Public health

The National Notifiable Diseases Surveillance System (NNDSS) coordinates the national surveillance of more than 50 communicable diseases or disease groups. Unit records of disease notifications made to the state or territory health authority, under the provisions of the public health legislation in their jurisdiction, are supplied daily to the Office of Health Protection, Australian Government Department of Health. The data are published weekly on the NNDSS website[59] and quarterly in the journal Communicable Diseases Intelligence and are replicated in *Animal Health Surveillance Quarterly* (Table 16) for five important zoonoses.

Table 16 National notifications of five zoonotic infections in humans, 1 April 2015 – 30 June 2016

Quarter	Brucellosis[a]	Chlamydia[b]	Leptospirosis	Listeriosis	Q fever
Apr–Jun 2015	5	2	17	18	127
Jul–Sep 2015	3	3	17	14	148
Oct–Dec 2015	2	6	16	22	109
Jan–Mar 2016	2	2	47	27	117
Apr–Jun 2016					
ACT	0	0	0	0	1
NSW	2	1	3	12	37
NT	0	0	0	0	0
Qld	1	0	31	5	52
SA	0	0	0	0	3
Tas	0	0	0	1	0
Vic	0	0	0	4	5
WA	0	0	2	1	4
Aus	3	1	36	23	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'.

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

National notifiable animal disease investigations

During the quarter, 480 national notifiable animal disease[60] investigations were conducted into suspect disease events. National notifiable animal diseases include a subset of emergency diseases[61]. Table 17 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.[62]

Table 17 Investigations for national notifiable animal diseases, April–June 2016

Disease	Species	State	Month	Response code[a]	Finding
African swine fever	Pig	Qld	Jun	3	Negative
	Pig	WA	Apr	3	Negative
Anaplasmosis in tick-free areas	Cattle	WA	Apr	2	Negative (2 unrelated investigations)
Australian bat lyssavirus	Camel	WA	May	3	Negative
	Cattle	Qld	Jun	2	Negative
	Dog	Qld	Jun	2	Negative
	Horse	Qld	Apr	2	Negative (4 unrelated investigations)
	Horse	Qld	May	2	Negative
Babesiosis in tick-free areas	Cattle	NSW	Apr	2	Negative (3 unrelated investigations)
	Cattle	NSW	Jun	2	Negative
	Cattle	NSW	May	2	Negative
	Cattle	WA	Apr	2	Negative (3 unrelated investigations)
Bluetongue—clinical disease	Camelid	NSW	Apr	2	Negative
	Cattle	NSW	Apr	2	Negative
	Cattle	NSW	Jun	2	Negative
	Cattle	SA	Apr	3	Negative (2 unrelated investigations)
	Cattle	WA	Jun	2	Negative
	Goat	WA	Apr	2	Negative
	Sheep	NSW	Apr	2	Negative
	Sheep	NSW	Jun	2	Negative
	Sheep	NSW	May	2	Negative (3 unrelated investigations)
	Sheep	NSW	May	3	Negative
	Sheep	SA	May	2	Negative
	Sheep	WA	Apr	2	Negative (3 unrelated investigations)
	Sheep	WA	Apr	3	Negative
	Sheep	WA	Jun	2	Negative (2 unrelated investigations)
	Sheep	WA	May	2	Negative
Brucella melitensis	Goat	WA	Apr	2	Negative
	Sheep	WA	Jun	2	Negative

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

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

62 http://www.agriculture.gov.au/animal-plant-health/emergency

Continued

Disease	Species	State	Month	Response code[a]	Finding
Brucella suis	Dog	NSW	Apr	2	Positive[b]
	Dog	NSW	Apr	2	Negative (14 unrelated investigations)
	Dog	NSW	Jun	2	Negative (13 unrelated investigations)
	Dog	NSW	Jun	2	Positive[b] (4 unrelated investigations)
	Dog	NSW	May	2	Positive[b]
	Dog	NSW	May	2	Negative (10 unrelated investigations)
	Dog	Qld	Jun	2	Negative
	Pig	NSW	Jun	2	Negative
	Pig	Qld	Apr	2	Negative
	Pig	SA	Jun	2	Negative
	Pig	SA	May	2	Negative
	Pig	WA	Apr	2	Negative
	Pig	WA	Jun	3	Negative
Enzootic bovine leucosis	Cattle	SA	Apr	2	Negative
Equine encephalomyelitis (Eastern, Western and Venezuelan)	Horse	WA	Apr	3	Negative
	Horse	WA	Jun	3	Negative
Equine influenza	Horse	NSW	May	2	Negative
	Horse	Vic	Apr	2	Negative (2 unrelated investigations)
Foot-and-mouth disease	Cattle	NSW	May	3	Negative
	Cattle	Qld	Jun	3	Negative (2 unrelated investigations)
	Cattle	SA	Apr	3	Negative
	Cattle	Vic	Apr	3	Negative (2 unrelated investigations)
	Cattle	Vic	Jun	3	Negative
	Cattle	WA	May	3	Negative
	Sheep	SA	May	3	Negative
	Sheep	Vic	May	3	Negative
	Sheep	WA	Apr	3	Negative
Infection of bees with *Melissococcus plutonius* (European foulbrood)	Bees	Qld	Apr	2	Negative (9 unrelated investigations)
	Bees	Qld	Apr	2	Positive (2 unrelated investigations)
	Bees	Qld	Jun	2	Positive (2 unrelated investigations)
	Bees	Qld	Jun	2	Negative (5 unrelated investigations)
	Bees	Qld	May	2	Negative (6 unrelated investigations)
Infection of bees with Paenibacillus larvae (American foulbrood)	Bees	Qld	Apr	2	Negative (3 unrelated investigations)
	Bees	Qld	Apr	2	Positive (8 unrelated investigations)
	Bees	Qld	Jun	2	Negative (5 unrelated investigations)
	Bees	Qld	Jun	2	Positive (2 unrelated investigations)
	Bees	Qld	May	2	Positive (5 unrelated investigations)
	Bees	Qld	May	2	Negative
	Bees	SA	Apr	2	Positive (2 unrelated investigations)
	Bees	SA	Apr	2	Negative (33 unrelated investigations)
	Bees	SA	Jun	2	Positive (3 unrelated investigations)
	Bees	SA	Jun	2	Negative (9 unrelated investigations)
	Bees	SA	May	2	Positive (7 unrelated investigations)
	Bees	SA	May	2	Negative (18 unrelated investigations)
Infection with African horse sickness virus	Horse	WA	Apr	3	Negative

Continued

Disease	Species	State	Month	Response code[a]	Finding
Infection with *Chlamydophila abortus* (ezoontic abortion of ewes, ovine chlamydiosis)	Pig	WA	May	3	Negative
	Sheep	WA	Apr	2	Negative
	Sheep	WA	Apr	3	Negative
	Sheep	WA	Jun	3	Negative
Infection with classical swine fever virus	Pig	WA	Apr	3	Negative
	Pig	WA	May	3	Negative
Infection with Hendra virus	Camel	WA	May	3	Negative
	Dog	Qld	May	2	Negative
	Donkey	Qld	Jun	2	Negative (2 unrelated investigations)
	Horse	NSW	Apr	2	Negative (21 unrelated investigations)
	Horse	NSW	Jun	2	Negative (29 unrelated investigations)
	Horse	NSW	May	2	Negative (19 unrelated investigations)
	Horse	NT	Apr	2	Negative
	Horse	NT	Jun	2	Negative (2 unrelated investigations)
	Horse	NT	May	2	Negative
	Horse	Qld	Apr	2	Negative (52 unrelated investigations)
	Horse	Qld	Jun	2	Negative (56 unrelated investigations)
	Horse	Qld	May	2	Negative (67 unrelated investigations)
	Horse	SA	Apr	3	Negative
	Horse	Vic	Jun	3	Negative (2 unrelated investigations)
	Horse	Vic	May	3	Negative
	Horse	WA	Apr	3	Negative
	Horse	WA	Jun	3	Negative
	Horse	WA	May	3	Negative
Infection with influenza A viruses in swine	Pig	WA	Apr	2	Negative (2 unrelated investigations)
	Pig	WA	May	2	Negative
Infection with *Mycoplasma mycoides* subsp. *mycoides* SC (contagious bovine pleuropneumonia)	Cattle	WA	Apr	2	Negative (3 unrelated investigations)
Infection with porcine epidemic diarrhoea virus	Pig	WA	May	3	Negative
Infection with vesicular stomatitis virus	Cattle	NSW	May	3	Negative
	Cattle	Qld	Jun	3	Negative (2 unrelated investigations)
	Cattle	SA	Apr	3	Negative
	Cattle	Vic	Apr	3	Negative (2 unrelated investigations)
	Cattle	Vic	Jun	3	Negative
	Cattle	WA	May	3	Negative
	Horse	NSW	Jun	3	Negative
	Sheep	SA	May	3	Negative
	Sheep	Vic	May	3	Negative
	Sheep	WA	Apr	3	Negative
Infestation of bees with *Varroa destructor* or *V. jacobsoni* (varroosis)	Bees	Qld	Apr	2	Negative (2 unrelated investigations)
	Bees	Qld	Jun	2	Positive[c]
Paratuberculosis—Johne's disease	Cattle	WA	Apr	2	Negative (4 unrelated investigations)
	Cattle	WA	Jun	2	Negative
	Cattle	WA	May	2	Negative
Porcine reproductive and respiratory syndrome	Pig	Vic	Apr	3	Negative
	Pig	WA	Apr	3	Negative
	Pig	WA	May	3	Negative

Continued

Disease	Species	State	Month	Response code[a]	Finding
Salmonellosis—*S. abortus-ovis*	Sheep	WA	Apr	2	Negative
Screw-worm fly—New World (*Cochliomyia hominivorax*)	Dog	NT	Jun	3	Negative
	Cattle	Qld	May	2	Negative
	Dog	Qld	Jun	2	Negative
Tuberculosis (*Mycobacterium bovis*)	Cattle	NT	Apr	2	Negative (1 granulomas examined)
	Cattle	Vic	Apr	2	Negative (2 granulomas examined)
West Nile virus infection—clinical	Camel	WA	May	3	Negative
	Horse	WA	Apr	3	Negative (2 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 Infection with *B. suis* occurs rarely in dogs that have had contact with feral pigs or their products.

c Infestation of *Apis cerana* with *Varroa jacobsoni*.

animalhealth AUSTRALIA

EMERGENCY ANIMAL DISEASE WATCH HOTLINE

1800 675 888

Animal Health Surveillance QUARTERLY

There were 1430 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.

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.

Name	Role	Phone	Email
Ian Langstaff	NAHIS program manager	02 6203 3909	ILangstaff@animalhealthaustralia.com.au
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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
Janet Strachan	National Enteric Pathogens Surveillance Scheme	03 8344 5701	JanetES@unimelb.edu.au
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To receive an email notification of new editions, contact ahsq@animalhealthaustralia.com.au.

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