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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 first issue of *Animal Health Surveillance Quarterly* for 2016.

Australia continues to maintain globally competitive and sustainable livestock industries within a strong biosecurity framework. To retain this status, we continue to build our national exotic disease surveillance and preparedness capabilities, with a particular focus this quarter on strengthening biosecurity in northern Australia.

In February, the Australian Government Department of Agriculture and Water Resources participated in the Northern Aquatic Pest and Health Surveillance Framework workshop to enhance our aquatic pest and disease surveillance capability in northern Australia. The department also chaired the first meeting of the Northern Australia Biosecurity Framework Reference Group to advise and support a collaborative approach to strengthen biosecurity in northern Australia.

I travelled to Thailand in March to attend the 22nd Meeting of the OIE Sub-Commission for Foot-and-Mouth Disease (FMD) Control in South-East Asia and China. This annual meeting directs and reviews progress on FMD control in our region under the South-East Asia and China Foot-and-Mouth Disease (SEACFMD) Campaign. Australia's support for the campaign fosters regional food security and biosecurity by promoting stronger veterinary services for the control and prevention of transboundary animal diseases.

Early detection of FMD is important to minimise the adverse effects of an outbreak yet few Australian veterinarians have experience in recognising the clinical signs of FMD. The department funded the European Commission for the Control of FMD (EuFMD) to develop an online FMD Emergency Preparation course to enhance the recognition of, and response to, an FMD emergency. The first course, which was piloted in March, trained veterinarians from the Australian, state and territory governments, private practice and industry in the key aspects of FMD surveillance and response.

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

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Geocoding is key to effective responses

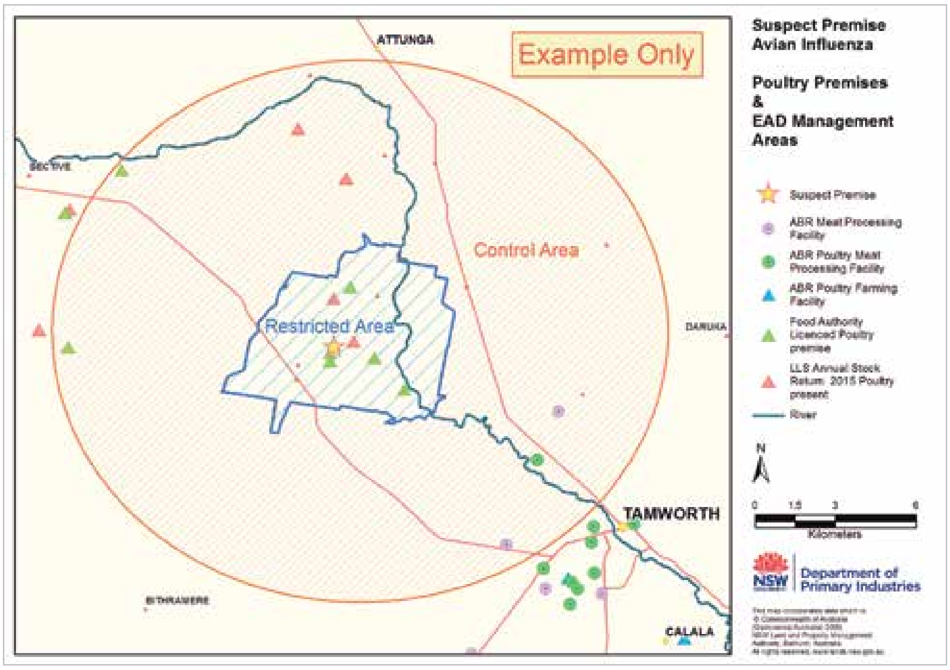
Peter Worsley, NSW Department of Primary Industries

Australia has an enviable record of high quality produce free from pests and diseases. Increasing imports, increased travel, climate change and the emergence of new diseases means there is always a risk of an emergency disease outbreak. It is vital that potentially damaging exotic incursions are identified and controlled as quickly as possible. Recent developments in information management in New South Wales have greatly reduced delays in obtaining information to detect and successfully manage emergency responses.

Table 1 Response data compiled by Biosecurity NSW — Biosecurity Information System (BIS) during a suspected avian influenza outbreak, 2016

Response zone	Total properties	Properties with susceptible species	Susceptible animals	Poultry meat processors
Restricted area	48	8	290 500	0
Control area	146	4	187 000	1
Total	**194**	**12**	**477 500**	**1**

Figure 1 Example map produced by Biosecurity NSW — Biosecurity Information System (BIS) of the response zone during a suspected avian influenza outbreak



NSW Department of Primary Industries (NSW DPI) has improved its capability to detect and eradicate a range of animal pests and diseases by extracting information from a number of different databases in real time.

The Biosecurity NSW — Biosecurity Information System (BIS) was launched in January 2015 to provide a platform that links a core database of premises across the state and any disease history for each with external databases (from other government agencies) to deliver new reporting and mapping functions and facilitate remote data entry through mobile devices.

Part of the improvement is achieved through geocoding and spatial analysis of foundation datasets. Geocoding converts address data to a spatial coordinate pair (latitude, longitude), enabling the location to be mapped and participate in spatial queries and analysis.

BIS integrates spatially enabled databases (i.e. contain mapping coordinates) that include the location of potentially susceptible animal species:

- Australian Business Register (ABR) — location of businesses by industry
- Local Land Services annual land and stock return — location of properties with number and types of animal present
- NSW Food Authority BYTE — premises licenced to carry out certain primary production and food processing activities.

Suspected disease outbreak example

For a suspected avian influenza outbreak, BIS extracted the following information.

Three properties housing 210 000 susceptible animals were potentially exposed to avian influenza through staff movements. Table 1 contains summary information for response areas. Figure 1 presents a map of the response zone.

BIS geocoding in action

Upon detection of an emergency animal disease (EAD), set actions must occur as laid out in AUSVETPLAN.

Establishing an Emergency Animal Disease Response Plan (EADRP) under AUSVETPLAN requires statistics relating to the location of premises holding potentially susceptible species to help define response zones. When creating the boundaries of an effective risk-based control area and restricted area, the risks will be influenced by many factors, including the number of susceptible animals and their proximity to affected properties and to each other.

The mapping tool in BIS rapidly provides a consolidated report that includes estimates of:

- number of susceptible species on affected properties (e.g. infected premise, suspect premise, dangerous contact premises, trace premise)
- number of susceptible animals at various proximities to those affected properties.

Combined with known epidemiological information relevant to the disease outbreak, the BIS report provides a more informed assessment of the required boundaries of the response zones.

There have been nine reports of suspected EADs over the past 12 months in New South Wales and the BIS toolset has been used to quickly extract critical information required for the draft EADRPs. Before the sampling results came back from the laboratory, BIS had compiled draft maps of the control and restricted areas, as well as data on the total number of properties, the number of premises containing susceptible species and the estimated number of at-risk susceptible animals in the response zone. Contact details for all properties of interest were immediately available for surveillance staff to commence work had the results been positive.

Enzootic bovine leucosis

Robin Condron, Dairy Australia

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

Dairy Australia, as the national post-freedom coordinating body, is responsible for monitoring the Australian dairy herd for EBL.

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

Annual EBL surveys are continuing. In 2015–16, testing of 1685 herds showed all were negative for EBL.

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

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

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

Northern Australia Quarantine Strategy animal health surveillance summary for 2015

Beth Cookson, Australian Government Department of Agriculture and Water Resources

Northern Australia faces some unique biosecurity challenges due to the close proximity of neighbouring countries, vast areas that are sparsely populated, remote communities and coastlines, monsoonal climatic events and the presence of many potential vectors and host populations. The Northern Australia Quarantine Strategy (NAQS) was established in 1989 in recognition of this unique biosecurity profile.

Since its inception, NAQS has been delivering a successful program of plant and animal health surveillance across our northern coastal region to mitigate the threats of exotic pests and diseases to agricultural industries, wildlife, the environment and human health.

Surveillance is conducted from just south of Broome in Western Australia to Cairns in Queensland, including Torres Strait (Figure 2). This vast coastline is divided into areas with differing biosecurity risk profiles based on differences in environment, host populations and pathways for pest or disease entry. These factors are used to rank the areas in terms of relative risk of introduction, establishment and spread of target pests and diseases. The relative risk for each area determines how often they are visited — from twice a year to every five years — and which surveillance activities are undertaken in each area.

The target list of pests and diseases, which is reviewed annually, is based on criteria such as potential pathways into northern Australia, likelihood of introduction, establishment and spread, and potential impact of each pest or disease if introduced.

NAQS animal health surveillance activities include targeted surveillance, comprised of animal health surveys, sentinel herds, vector monitoring and responding to unusual animal events, such as mass mortalities and sickness, in partnership with state and territory jurisdictions.

General surveillance includes syndromic surveillance conducted by Indigenous ranger groups throughout communities across northern Australia. Public awareness strategies are delivered through the Top Watch! campaign. Surveillance activities are regularly reviewed to ensure they are aligned to national and regional priorities and emerging disease threats.

NAQS works closely with northern states and territories, industry, pastoralists and communities, including many Aboriginal and Torres Strait Islander communities and their ranger groups. A government team of community liaison officers, veterinarians, botanists, plant pathologists, entomologists and scientific officers maintains this network and cooperation.

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

The key animal health surveillance achievements for NAQS in 2015 are summarised in this report.

Targeted surveillance

Animal health surveys are focused on feral and domestic animal populations. Subjective data on the apparent health of both groups and individual animals, and the size and distribution of host populations, is collected via informal interviews with local landholders and animal owners and through direct observation of animals. Samples are collected from animals for serological or virological testing for target diseases. Necropsies are conducted on feral animals to aid detection of target pests and diseases via observation of gross pathology and collection of additional samples for testing. Where abnormalities are observed, samples are taken to try to achieve a diagnosis and to exclude target pests and diseases. The surveys are biased towards sampling animals that appear unwell or are in poor condition to increase the likelihood of detecting any target diseases and pests if they were present. The remaining population is sampled to represent the entire population as much as possible but due to practical and safety constraints, samples are selected by convenience in most cases.

Figure 2 Northern Australia Quarantine Strategy (NAQS) biosecurity risk areas and the distribution of samples collected in 2015

Source: Australian Government Department of Agriculture and Water Resources

In 2015, 10 animal health surveys were delivered across northern Australia. During these surveys, 613 individual animals were sampled across a range of species, including buffaloes, cattle, chickens, dogs, horses and pigs. All samples collected were negative for a range of exotic pests and diseases.

The most significant finding was from a survey conducted in the Northern Territory, between King River and Cobourg Peninsula Fence, in October 2015. Approximately 1000 feral pigs were observed, many of which were skinny and lethargic. Necropsies were performed on 106, with all but eight having gross pathological changes, including jaundice and haemorrhages of several organs. No significant pathogens were detected, including Aujeszky's disease, classical swine fever, porcine reproductive and respiratory syndrome and surra (*Trypanosoma evansi*), despite extensive laboratory testing of serum (90 samples) and tissues (13 samples). Harsh environmental conditions, including heat and drought, are considered likely to have contributed to the clinical signs observed. Although the primary cause has not been identified, exposure to an exotic pathogen is considered highly unlikely. Animal health surveys are scheduled annually in this area and ongoing monitoring of the population is achieved by working with Indigenous ranger groups.

In addition to surveillance of terrestrial animals, NAQS conducts surveillance of wild birds as part of the National Avian Influenza in Wild Birds (NAIWB) Surveillance Program coordinated by Wildlife Health Australia. During four surveys conducted in 2015, 1094 environmental faecal samples were collected from areas where wild waterfowl had congregated and tested for avian influenza virus. Of these, 27 were positive for influenza A, with successful subtyping of low pathogencity H11N2 in two samples. This surveillance contributes to a better understanding of the ecology of influenza viruses in Australia and helps maintain national diagnostic capacity and capability to detect influenza viruses.

During 2015, NAQS conducted 29 visits to five sentinel herds it manages, with 384 samples collected and tested for a number of exotic diseases, including bluetongue virus, surra (*T. evansi*) and Japanese encephalitis. Light trapping for *Culicoides* midges (vector for bluetongue virus) was conducted at these and an additional three sites. No exotic strains of bluetongue virus, other exotic diseases or exotic *Culicoides* species were detected through this surveillance.

Surveillance by adult fly trapping for Old World screw-worm fly (*Chrysomya bezziana*) was conducted monthly in the northern-most Torres Strait islands until September 2015. At this time, the surveillance strategy for screw-worm fly was amended to reflect changes endorsed by the national Screw-Worm Fly Surveillance and Preparedness Program (SWFSPP), which NAQS contributes to, with trapping sites moved to the Northern Peninsula Area (NPA) of Queensland, an area considered to have a higher relative risk of an incursion of screw-worm fly. Trapping commenced at these new sites in September 2015 on a quarterly basis, with no detections from 113 traps set and inspected across all sites (old and new). As well as ongoing trapping for adult screw-worm fly, individual animals from sentinel herds and those observed during animal health surveys were inspected for myiasis. NAQS received six submissions from animal and human myiasis cases, all of which were identified as species other than screw-worm fly.

Trapping of mosquitoes for detection of Japanese encephalitis virus was conducted from February to May 2015 at specific sites in the NPA. No evidence of circulation of Japanese encephalitis virus was detected in 2015. This information was shared with the Queensland Department of Health as part of an ongoing commitment by NAQS to the One Health initiative.

NAQS reports surveillance results nationally to NAIWB, the National Arbovirus Monitoring Program (NAMP) and the National Animal Health Information System (NAHIS), with data reported quarterly through the *Animal Health Surveillance Quarterly* summary statistics.

General surveillance

The Top Watch! campaign successfully maintains important public awareness for NAQS animal health surveillance. Through both visual and radio broadcast material, visitors and residents to northern Australia are encouraged to report to NAQS any unusual disease signs, such as sickness and deaths in animals, which is an important strategy for the early detection of target pests and diseases. Investigations of possible disease events reported to NAQS are coordinated with the relevant state or territory authority, with field visits conducted when warranted to exclude target pests and diseases. In 2015, three such disease investigations were conducted (one each in chickens, wild birds and a dog) with no exotic pests or diseases detected.

Indigenous ranger groups across northern Australia work with NAQS to collect biosecurity surveillance information and deliver public awareness sessions and presentations to schools, community groups, tourists and other organisations. The NAQS community animal health reporting program is one of the key tools in remote community surveillance; collected data is used to determine baseline trends in disease syndromes and animal health and serves as an early indicator of unusual animal disease signs and events. NAQS veterinary officers monitor reports and follow up any unusual events with a phone call for further information and a field visit if required. In 2015, 95 community animal health reports were submitted to NAQS from 41 individual communities.

Summary

Targeted and general surveillance for NAQS target pests and diseases was conducted in 2015 with no evidence of exotic incursions. Ongoing public and community awareness and education campaigns continue to promote the importance of biosecurity in northern Australia, in particular, the importance of early detection and reporting of potential exotic pests and disease events by the public.

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)[1] 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, 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)[2] — including submissions by WHA subscribers, state and territory WHA coordinators, researchers, and university, zoo and sentinel clinic veterinarians. During the quarter, 177 wildlife disease investigation events were reported into eWHIS (Table 2). 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.

1 www.wildlifehealthaustralia.com.au

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

Table 3 Wild bird disease investigations reported into eWHIS, January–March 2016

Bird order	Common name for bird order[a]	Events reported[b]
Anseriformes	Magpie geese, ducks, geese and swans	11
Charadriiformes	Shorebirds	1
Columbiformes	Doves and pigeons	1
Coraciiformes	Bee-eaters and kingfishers	2
Falconiformes	Falcons	1
Gruiformes	Rails, gallinules, coots and cranes	14
Passeriformes	Passerines or perching birds	2
Pelecaniformes	Ibis, herons and pelicans	2
Podicipediformes	Grebes	16
Psittaciformes	Parrots and cockatoos	1
Sphenisciformes	Penguins	1

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

b Disease investigations may involve single or multiple bird orders (e.g. mass mortality event).

Wild bird mortality events — Avian paramyxovirus and avian influenza exclusion

WHA received 49 reports of wild bird mortality or morbidity investigations from around Australia in January–March 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 3. Reports and samples from sick and dead birds are received from members of the public, private practitioners, universities, zoo wildlife clinics and wildlife sanctuaries. Avian influenza (AI) was excluded by polymerase chain reaction (PCR) testing for influenza A in 18 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 31 events, based on clinical signs, history, prevailing environmental conditions or other diagnoses. In addition, avian paramyxovirus was excluded in 14 events by PCR testing specific for Newcastle disease (ND) virus and/or pigeon paramyxovirus 1 (PPMV-1).

Avian influenza surveillance

Australia's National Avian Influenza Wild Bird (NAIWB) Surveillance Program comprises two sampling components: pathogen-specific, risk-based surveillance by sampling of apparently healthy, live and hunter-killed wild birds; and general surveillance by investigating significant unexplained morbidity and mortality events in wild birds, including captive and wild birds within zoo grounds (with a focus on exclusion testing for AI virus subtypes H5 and H7). Samples from sick or dead birds 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 (NAQS).

During the quarter, pathogen-specific, risk-based surveillance occurred at sites in New South Wales, South Australia, Tasmania, and Victoria with faecal environmental swabs collected from 1190 waterbirds. Results are pending.

Wildlife disease event investigations in remote locations

Wildlife disease events present a number of challenges in terms of detection and investigation, and these difficulties are exacerbated where the event occurs in a remote location. Detection of an event relies on observation of sick or dead wildlife (e.g. by a member of the public, field researcher, ranger, hunter or wildlife carer) and then on the observer deciding to, and knowing how to, report the event.

Table 2 Number of disease investigations reported into eWHIS, January–March 2016[a]

Bats[b]	Birds	Marsupials	Feral animals	Snakes and lizards	Freshwater turtles	Monotremes	Marine mammals	Marine turtles
90	49	17	13	3	2	0	2	1

a Disease investigations may involve a single animal or multiple animals (e.g. mass mortality event).

b The majority of bat disease investigations are single bats submitted for Australian bat lyssavirus testing.

Factors such as the number, density, size, coloration and visibility of sick and dead wild animals determine the likelihood of an event being observed[3]. In addition, weather, habitat and the presence of scavengers or predators will determine persistence of carcases in the environment[4,5,6]. This not only influences the likelihood of detection but may lead to an underestimate of the number of animals affected and the extent of the event, and therefore influence the decision to report. Once reported, collection and submission of samples suitable for diagnostic investigation can be very challenging.

WHA aims to capture wildlife disease events by incorporating surveillance reports from veterinary clinics and agencies working in remote locations. For example, general wildlife disease surveillance reports are received through NAQS across remote locations in Western Australia, Northern Territory and Queensland; and wildlife hospitals and zoos participating in the Zoo Based and Sentinel Clinic Wildlife Disease Surveillance programs report on wildlife cases from Northern Territory and Far North Queensland.

3 Stallknecht DE (2007). Impediments to wildlife disease surveillance, research, and diagnostics. In *Wildlife and emerging zoonotic diseases: The biology, circumstances and consequences of cross-species transmission*, Springer Berlin Heidelberg, pp. 445–461.

4 Stallknecht DE (2007). Impediments to wildlife disease surveillance, research, and diagnostics. In *Wildlife and emerging zoonotic diseases: The biology, circumstances and consequences of cross-species transmission*, pp. 445–461. Springer Berlin Heidelberg.

5 Ward MR, Stallknecht DE, Willis J, Conroy MJ and Davidson WR (2006). Wild bird mortality and West Nile virus surveillance: biases associated with detection, reporting, and carcass persistence. *Journal of Wildlife Diseases* 42: 92–106.

6 Wobeser G and Wobeser AG (1992). Carcass disappearance and estimation of mortality in a simulated die-off of small birds. *Journal of Wildlife Diseases* 28: 548–554.

Despite all the challenges, wildlife disease events in remote locations of Australia do get reported. Two cases this quarter are outlined as examples (see Figure 3 for locations).

In early January 2016, a member of the public reported a group of rainbow lorikeets (*Trichoglossus haematodus*) found suddenly dead on Somerset Beach, in the Northern Peninsula Area, east of the tip of Cape York, Queensland. The person reported seeing the birds fly into trees and then dropping to the ground dead. Following the report to a NAQS biosecurity officer in Bamaga, one bird carcase that was fresh enough for sampling was collected. It was refrigerated and sent to Cairns for gross necropsy, where samples were taken for histology and specific disease exclusion testing at the Biosecurity Sciences Laboratory in Brisbane.

No significant findings were found on gross and histological examination. Avian influenza and avian paramyxovirus were both excluded via polymerase chain reaction (PCR) testing. The brain cholinesterase activity was measured to determine whether there had been likely exposure to organophosphate or carbamate pesticides. The value obtained was similar to levels recorded for this species with confirmed organophosphate poisoning so pesticide poisoning remains a possibility in this case. Heat exhaustion or potentially some other environmental contaminant were considered other possible factors in these mortalities but no definitive diagnosis was reached. No further deaths have been reported.

In March 2016, a black flying fox (*Pteropus alecto*) from Groote Eylandt, Northern Territory, suspected to be sick, was submitted for Australian bat lyssavirus (ABLV) exclusion following interaction with a dog. On gross necropsy, the bat was emaciated and had a number of traumatic lesions, the latter consistent with a dog interaction. ABLV was excluded via indirect fluorescent antibody test (IFAT) on brain and spinal cord tissue and pteropid TaqMan assay of brain tissue.

Figure 3 Locations of two wildlife disease event investigations in remote northern Australia, 2016

Source: Iain East, Australian Government Department of Agriculture and Water Resources

Mycobacterium ulcerans excluded in possums

Between January and February 2016, two brushtail possums (*Trichosurus vulpecula*) presented at two separate Victorian veterinary clinics, one in Parkville and the other in Barwon Heads, for investigation of skin lesions. The possum from Barwon Heads presented with a facial skin ulcer or wound that was heavily infested with maggots (myiasis).

Both possums were euthanased and swabs of the affected areas were collected by the University of Melbourne and sent to the Victorian Infectious Diseases Reference Laboratory where infection with *Mycobacterium ulcerans* was excluded by real-time PCR testing. The cause of the skin lesions was not determined in either case although mites and fungi were excluded in the Parkville case.

M. ulcerans is a slow-growing bacterium that produces a destructive toxin, mycolactone, which causes tissue damage and inhibits immune response[7]. It is the causative agent of Buruli ulcer (BU). Previous Australian synonyms for BU include Bairnsdale ulcer and Daintree ulcer, each named after localities where human cases are known to occur.

Laboratory-confirmed cases in Australian native animals have previously only been reported from Victoria and included various species of possums, koalas (*Phascolarctos cinereus*) and a long-footed potoroo (*Potorus longipes*)[8].

7 Wildlife Health Australia (2010). *Mycobacterium ulcerans* disease (Buruli ulcer) fact sheet. www.wildlifehealthaustralia.com.au/FactSheets.aspx

8 Wildlife Health Australia (2010). *Mycobacterium ulcerans* disease (Buruli ulcer) fact sheet. www.wildlifehealthaustralia.com.au/FactSheets.aspx

The transmission pathways remain unclear but recent research suggests the epidemiology of *M. ulcerans* may involve its presence in terrestrial and aquatic habitats, invertebrate vectors and vertebrate host reservoirs[9]. In a proposed transmission model for BU in south-eastern Australia, terrestrial mammals, including possums, have been suggested as environmental reservoirs for *M. ulcerans*[10].

There is currently no evidence to suggest direct transmission of *M. ulcerans* from animals to humans. Continued surveillance in wildlife presenting with suspect skin lesions may assist in identifying new locations where human infection has not previously been recorded and therefore help to direct the circulation of public health messages.

O'Brien et al (2014)[11] stated that further work was required to determine whether M. ulcerans infection posed a potential threat to possum populations and whether possums were acting as environmental reservoirs in certain geographical areas.

It is a Victorian statutory requirement that *M. ulcerans* infection in humans must be notified in writing within 5 days of diagnosis (presumptive or confirmed)[12]. Statistics on notifiable disease in humans, including *M. ulcerans*, are reported in the Victorian Department of Health Infectious Disease summaries[13].

Australia currently hosts the World Health Organization (WHO) Collaborating Centre for *Mycobacterium ulcerans*[14] at the Mycobacterium Reference Laboratory, Victoria. Agreed activities of the WHO Collaborating Centre include research, training and education and the development and application of appropriate technology.

9 Fyfe JAM, Lavender CJ, Handasyde KA, Legione AR, O'Brien CR, Stinear TP, Pidot SJ, Seemann T, Benbow ME, Wallace JR, McCowan C and Johnson PDR. (2010). A major role for mammals in the ecology of *Mycobacterium ulcerans*. *PLoS Negl Trop Dis* 4: e791. doi:10.1371/journal.pntd.0000791

10 Fyfe JAM, Lavender CJ, Handasyde KA, Legione AR, O'Brien CR, Stinear TP, Pidot SJ, Seemann T, Benbow ME, Wallace JR, McCowan C and Johnson PDR. (2010). A major role for mammals in the ecology of *Mycobacterium ulcerans*. *PLoS Negl Trop Dis* 4: e791. doi:10.1371/journal.pntd.0000791

11 O'Brien CR, Handasyde KA, Hibble J, Lavender CJ, Legione AR, et al. (2014). Clinical, microbiological and pathological findings of *Mycobacterium ulcerans* infection in three Australian possum species. *PLoS Negl Trop Dis* 8: e2666. doi:10.1371/journal.pntd.0002666

12 https://www2.health.vic.gov.au/public-health/infectious-diseases/notification-procedures

13 https://www2.health.vic.gov.au/public-health/infectious-diseases/infectious-diseases-surveillance

14 http://apps.who.int/whocc/Detail.aspx?cc_ref=AUS-95&cc_code=aus&cc_city=melbourne

Australian bat lyssavirus

Reports to WHA for the January–March quarter included 96 bats tested for ABLV from New South Wales, Northern Territory, Queensland, South Australia, Tasmania and Victoria.

Bat submissions were made for a variety of reasons:

- 33 cases involved contact or suspected contact with the potential for ABLV transmission to humans; of these
  - 6 were also associated with trauma
  - 2 displayed neurological signs and 2 displayed other clinical signs
  - 3 also involved contact with a pet dog
  - the remainder had no further history reported
- 35 cases involved contact with a pet dog (24 bats), cat (9 bats) or other animals (2)
- 8 bats displayed neurological signs (e.g. paresis, nystagmus, aggression, tremors)
- 6 bats presented with other clinical signs (e.g. emaciation, sudden death, skin disease)
- 8 cases were associated with trauma (e.g. barbed wire, netting or fishing line entanglement)
- 6 bats had no further history reported at this time.

During the quarter, seven flying foxes were confirmed positive for ABLV by PCR testing for pteropid ABLV ribonucleic acid (RNA). Of these, one little red flying fox (*Pteropus scapulatus*), one grey-headed flying fox (*P. poliocephalus*) and one unidentified flying fox (*Pteropus* sp.) were from New South Wales; one little red flying fox, one black flying fox (*P. alecto*) and one spectacled flying fox (*P. conspicillatus*) were from Queensland; and one grey-headed flying fox was from Victoria.

Three of the ABLV-positive flying foxes presented with a variety of neurological and other clinical signs, including paresis, aggression, agitation, abnormal vocalisation, twitching, nystagmus, seizures and weakness; three were submitted for testing due to human or pet contact, and one presented with suspected head injury due to trauma. In one flying fox, histology revealed very mild, patchy, nonsuppurative encephalitis. Potentially dangerous human contact was reported in two of these cases and an experienced public health official provided appropriate counselling and information.

More information on ABLV testing of bats in Australia is available in *ABLV Bat Stats*[15].

Flying fox with unusual neurological signs — Australian bat lyssavirus excluded

A juvenile male black flying fox (*Pteropus alecto*) was found orphaned at Cooktown, Queensland, in February 2016 and brought into care. He was severely underweight but behaving normally. Over a period of 8 days, he became weak with episodes of almost losing consciousness and then developed rhythmic, repetitive ear flicking. He was euthanased due to poor prognosis and submitted for necropsy. The only findings at necropsy were carcase pallor and possible mild jaundice. The liver was noticeably small but of normal colour and consistency and the lungs were mottled. Histology revealed severe subacute hepatopathy with widespread loss of periacinar and midzonal parenchyma with replacement haemorrhage and some macrophage infiltration. Patchy interstitial pneumonia and occasional cortical tubular epithelial necrosis were observed.

ABLV was excluded by PCR testing for pteropid ABLV RNA on brain tissue. The cause of the liver disease is not known but the changes were suggestive of exposure to a hepatotoxin. The neurological signs may have been a result of hepatic encephalopathy.

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

Aquatic animal health

Brett Herbert, Australian Government Department of Agriculture and Water Resources

Australia's aquatic animal health surveillance system

Australia's favourable aquatic animal health status is supported by robust disease surveillance and reporting activities.

The Australian Government Department of Agriculture and Water Resources Animal Health Policy branch manages the Quarterly Aquatic Animal Disease (QAAD) reporting system to ensure Australia meets regional and international reporting obligations.

State and territory reporting officers are required to submit a quarterly report detailing confirmed disease incidents, surveillance activities and fish kills. Submitted reports require the approval of the state chief veterinary officer (CVO) before the Department of Agriculture and Water Resources summarises the information into a concise quarterly snapshot of aquatic animal disease occurrences. Once approved by Australia's World Organisation for Animal Health (OIE) delegate, Australian CVO Dr Mark Schipp, the report is submitted to both the regional representation of the OIE in Japan and the Network of Aquaculture Centres in Asia–Pacific (NACA).

All the diseases currently reportable to the OIE and other aquatic animal diseases of national significance are included on Australia's National List of Reportable Diseases of Aquatic Animals[16]. Fortunately, Australia is free from most of these diseases, which means we can maintain market access and trade many of our valuable fisheries and aquaculture products interstate and internationally.

Every jurisdiction in Australia is responsible for surveillance activities within its borders. Passive surveillance includes regular health monitoring, investigating unusual fish mortality events and reporting and investigating listed diseases. Active surveillance is conducted for specific purposes, for example, export certification or specific diseases of importance to Australia. Active surveillance meets OIE standards, uses methods required to meet export market requirements, or complies with internal requirements for movement of animals in aquaculture or restocking (for fishery enhancement or conservation).

In Australia, aquatic animals are cultured in a wide variety of production systems, each with their own unique circumstances and risks that require tailored surveillance programs. National surveillance programs are important to determine freedom from diseases and ensure early detection and response to aquatic animal disease incidents. Epidemiologists design these programs to be robust and defensible. The national survey for oyster herpesvirus, designed on these principles, was reported in AHSQ Vol. 16 Issue 3. National surveillance programs for prawn diseases have been conducted to confidently determine national freedom from exotic prawn diseases and assure trading partners of our status for these diseases. Guidelines for aquatic animal health surveillance are available on the department's website[17]. The guidelines recommend the level of proof required to demonstrate freedom from disease and elements to be considered when designing and implementing an appropriate surveillance system. The OIE also provides guidelines for aquatic animal health surveillance, particularly aimed at declaration of freedom for trade purposes.

Australia's National List of Reportable Diseases of Aquatic Animals is amended as agreed by the Animal Health Committee, following recommendations made by the Sub-Committee for Aquatic Animal Health, and in line with changes to the OIE Aquatic Animal Health Code[18] and our national priorities.

Infection with *Enterocytozoon hepatopenaei* (EHP), a microsporidian parasite of prawns that affects prawn production in Asia and South Asia, was added to the national list for reporting in 2016. In late 2015, the disease was added to the reportable list of diseases of aquatic animals for the Asia–Pacific region, maintained by the Network of Aquaculture Centres in Asia–Pacific (NACA). While similar parasites have been reported from Australia, no confirmed reports of this species have been made to date.

From October to December 2015, jurisdictions were required to report on the monthly occurrence of the 50 diseases listed on our national list, which includes all OIE-listed aquatic animal diseases. Diseases reported included infection with *Perkinsus olseni* in wild greenlip abalone (*Haliotis laevigata*); infectious hypodermal and haematopoietic necrosis virus (IHHN) and hepatopancreatitis in farmed giant tiger prawns (*Penaeus monodon*).

Our QAAD reporting system ensures we maintain a coordinated national approach to aquatic animal disease surveillance and reporting. It provides trading partners with confidence in our disease monitoring systems, builds evidence to demonstrate our disease status and assists our aquatic animal industries to secure export markets.

16 www.agriculture.gov.au/animal/aquatic/reporting/reportable-diseases

17 www.agriculture.gov.au/animal/aquatic/guidelines-and-resources

18 www.oie.int/index.php?id=171&L=0&htmfile=chapitre_1.1.3.htm

Photo Lee Torrens

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 suspect exotic or emergency disease investigations are reported in Table 19 of 'Quarterly statistics'.

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

New South Wales

Rory Arthur, New South Wales Department of Primary Industries

During the quarter in New South Wales, 721 livestock disease investigations were conducted to investigate suspect notifiable diseases or rule out emergency diseases[19]. The number of investigations by species of livestock is shown in Figure 4.

Field investigations were conducted by government veterinary or biosecurity officers (598) and private veterinary practitioners (123). All diagnostic testing was conducted at the state veterinary diagnostic laboratory.

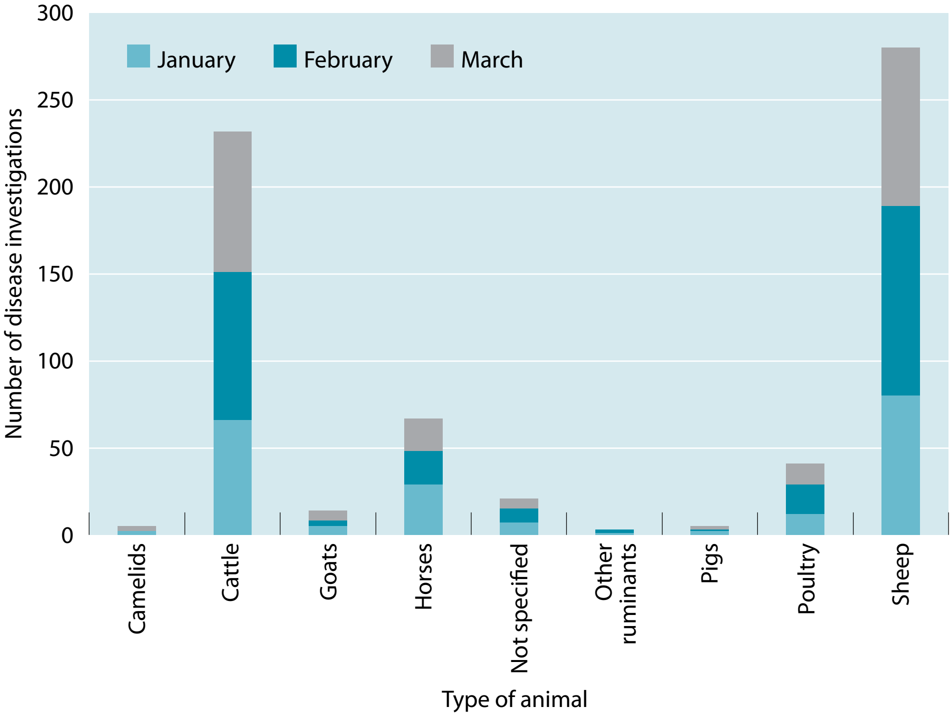
During the quarter, the state veterinary diagnostic laboratory, Elizabeth Macarthur Agricultural Institute, processed 1100 livestock sample submissions for disease diagnosis, including to investigate suspect notifiable diseases or rule out emergency diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications and for accreditation programs and targeted surveillance.

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

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

19 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/

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



became entry points for the virus. Trail (supplementary) feeding facilitated close contact between large numbers of sheep, causing the virus to spread more rapidly through the flock than would normally be seen.

Anthrax report

During the quarter, there were two anthrax incidents in New South Wales.

In late February 2016, 10 cattle died out of a herd of 230 in the Rankins Springs district of the Riverina Local Lands Services (LLS) region. Although there was no recorded history of anthrax on the property, it is in an area with historical cases of anthrax occurring since 1970 and earlier. A neighbouring property had cases in 1996 and 2005.

In mid-March, anthrax was diagnosed as the cause of death in 18 sheep out of a flock of 1197 in the Cumnock district of the Central Tablelands LLS region. This property had reports of anthrax in sheep in 1958 and 1961 but no subsequent reports until the current incident.

Immunochromatographic tests (ICTs) were used, with positive results in both incidents.

Both cases were managed in accordance with NSW Department of Primary Industries anthrax policy. The properties were quarantined, carcases were burned to ash and in-contact equipment disinfected. All remaining at-risk animals on the properties were vaccinated.

During the quarter, there were 25 investigations in which anthrax was excluded as a cause of death. ICTs were used in 17 of the 25 exclusions, with negative results. Alternative diagnoses included ptaquiloside toxicity from eating mulga fern (*Cheilanthes sieberi*), *Clostridium chauvoei* infection (blackleg) and mastitis were made for 13 cattle investigations; and *Clostridium perfringens* infection (enterotoxaemia), haemonchosis (barber's pole worm), lactic acidosis and haemobartonellosis were made for 11 sheep investigations. No diagnosis was found for one incident where 5 dogs died but the problem was suspected to be rodenticide toxicity.

Foot-and-mouth disease exclusion in the Central West

LLS were called in to investigate an outbreak of skin lesions around the mouth and feet in a Merino flock in the Central West. About 500 out of 700 lambs aged 10 months were affected. The lambs had been vaccinated with Scabigard® at marking, as well as with 6-in-1 vaccine including vitamin B_{12}. The lambs had been grazing on native pasture with spiny burr grass present in the paddock. They had also been fed oats, barley and wheat in trails on the ground.

Approximately 70% of the lambs had circular, raised, scabby lesions around their lips and nostrils. Some individuals had similar lesions on the distal limbs, mostly along the coronet. Circular erosive lesions were observed on the gums of one lamb.

Samples were collected and tested for foot-and-mouth disease, vesicular stomatitis, goat pox and bluetongue virus. All results were negative. The scabs tested positive for orf virus, commonly known as 'scabby mouth'.

The pharmaceutical company investigated vaccine failure and performed tests on the batch used. No problems were identified with the batch so it was assumed that an error in handling during transport or administration was to blame.

In this case, the presence of spiny burr grass in the paddock caused wounds that became entry points for the virus. Trail (supplementary) feeding facilitated close contact between large numbers of sheep, causing the virus to spread more rapidly through the flock than would normally be seen.

Blackleg deaths in the Illawarra region

Calf deaths due to blackleg occurred on three properties in the Gerringong–Jamberoo locality.

Common features to all three outbreaks included sudden death of calves in good condition (generally those in better condition out of the group), high mortality rates (25–50%) and poor or inadequate vaccination histories. On all three properties, there had been strong surveillance collaboration with local veterinary practitioners. Although the deaths occurred in an area where anthrax had not previously been confirmed, tests were run on one of the properties to exclude anthrax.

In the first outbreak, nine calves aged 7–9 months died from a total group of 33 over the course of one week. Calves either died suddenly or were observed to be lame in a single limb for a brief period before death. The calves had received only an initial clostridial vaccination about 5 months beforehand with no follow-up dose. Typical necropsy findings included bloody, frothy nasal discharge; rapid onset of bloating and autolysis (tissue self-destruction) with crepitus (crackling sounds indicating the presence of gas in the tissues) over the affected shoulder or hindlimb, and a dark haemorrhagic appearance of the underlying affected muscle. The presence of *Clostridium chauvoei*, the cause of blackleg, was confirmed by anaerobic culture of both the liver and affected muscle tissue.

In a similar outbreak, 6 calves died over a 3-day period from a group of 25 that were also 7–9 months old, with no prior clinical signs. The calves had been given only a single dose of clostridial vaccine about 4 months before the deaths. Other adult cattle running in the same group as the calves remained unaffected. The whole group had been grazing the same kikuyu and ryegrass paddock for some weeks before the deaths; they had no access to potentially poisonous plants or toxic chemicals. Again, post-mortem decomposition was rapid. In this instance, the affected muscle areas were confined mainly to the thoracic cavity, particularly the diaphragm and intercostal muscles.

In the third outbreak, 6 mixed-breed steers and heifers aged 12 months died over a 3-day period from a herd of 60, again with no prior clinical signs. Affected carcases featured bloody nasal and anal discharges, rapid autolysis and congested lungs. One animal had splenomegaly (enlarged spleen). As the owner had initially advised that the whole group had been revaccinated with a clostridial vaccine only 3 weeks beforehand, it was considered wise to exclude anthrax as a precaution. Further investigation subsequently revealed that staff had failed to revaccinate a small group of nine animals that were part of the larger group of 60; all six deaths occurred in the animals that were part of this small group.

Interestingly, as others have previously reported, all three incidents occurred following a period of heavy rainfall.

Follow-up clostridial vaccination appeared to have been successful in quickly halting further deaths in all three herds.

Alysiella-associated bovine pneumonia in the Hunter region

In 2015, 2 heifers on a property in the Hunter region failed to gain condition after being moved to fresh pasture, despite a good vaccination and worming history. One heifer subsequently died, with evidence on necropsy of widespread petechiae (small haemorrhagic spots), most notable on the pleural lining of the lung. Marked thoracic and pericardial effusion was noted, along with focal zones of inflammation and fibrinous effusion on the lung surface. Bacterial pneumonia and bracken fern (*Pteridium aquilinum* var. *esculentum*) poisoning were considered as possible diagnoses. The remainder of the herd was prophylactically treated with antibiotics and no further cases were reported. Investigation of lung tissue and pleural fluid from the necropsied animal revealed a profuse growth of a gram-negative, haemolytic rod-shaped bacterium. Biochemical analysis of the bacterium identified an organism belonging to the *Neisseriaceae* family. Biochemically similar bacteria were cultured from septic bicipital bursas in lame thoroughbred horses from the Hunter region in 2012. (The bicipital bursa is located over the shoulder joint, and infection in the bursa can be associated with septic arthritis of the shoulder.) Whole genome sequencing of strains from both the bovine pneumonia and equine arthritis cases revealed entirely new species of bacteria from the *Neisseriaceae* genus *Alysiella*.

Members of this genus of bacteria are normally found as commensal organisms in the oral cavity of mammals. Septicaemic infections with *Alysiella* spp. have not been reported previously, and work is ongoing to determine what makes these novel species cause disease.

Trichomoniasis diagnosed on two Central Tablelands beef properties

Trichomoniasis was diagnosed in a herd of 80 mature Angus cows, 69% of which were found to be pregnant when scanned in mid-January 2016. At scanning there was evidence of nonviable foetuses in an additional four cows. The cows were in good body condition when first joined to three, then two, Angus bulls for 9 weeks. *Neospora* spp., *Leptospira pomona*, campylobacteriosis and selenium deficiency were excluded as possible causes of infertility. Two of eight cows tested had evidence of recent bovine viral diarrhoea virus (BVDV)[20] infection, indicating that BVDV may have played a role in this case.

As the owner of this herd had leased the bulls from a nearby property, a sample of the highest-risk bulls on that property was tested for trichomoniasis and about 10% of these bulls tested positive.

A management plan was discussed for both properties. The intention is to use young bulls wherever possible and to use only older bulls if they have tested negative for trichomoniasis on sequential tests. Both owners were advised to pregnancy test cows twice and cull any cows that were not pregnant or appeared to be aborting.

Fortunately all nonpregnant cows from both properties have been sold to slaughter, reducing the risk of the disease spreading to other properties. Trichomoniasis is a notifiable disease in New South Wales but affected properties are not quarantined.

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

Klebsiella outbreaks causing septicaemia in sucker pigs

In January and February 2016, three separate outbreaks of septicaemia due to the bacterium *Klebsiella pneumoniae* were reported in pre-weaned pigs, one in each of Victoria, Queensland and New South Wales. A collaborative response across jurisdictions is reported here. Piglet mortalities were as high as 50–100% in some litters and occurred in indoor-housed herds with good hygiene.

The affected piglets were 1–4 weeks old and had been in good body condition before sudden death. Necropsy examinations were consistent with septicaemia but some cases were reported to be nonspecific, with the presence of fibrin strands in the abdominal cavity as the only common finding. *K. pneumoniae* was isolated (in heavy and almost pure growth) from a wide range of tissues, including the liver, lung, kidney, heart, intestine and brain. Similar outbreaks had occurred in the Queensland herd over summer in three of the past 5 years, which is somewhat unusual. *K. pneumoniae* more commonly causes sporadic disease in individual pigs, often in association with other diseases, such as mastitis or pneumonia. *K. pneumoniae* can be found in the intestines of healthy pigs.

Factors that may have contributed to one outbreak included the high number of gilt litters farrowed down (50%) and hot weather (42°C). Sows and gilts were cooling themselves by playing with the drinkers in the farrowing house, causing significant wetting of the pens. Staff dried the pens by throwing down sawdust, which is an ideal environment for the survival and multiplication of *K. pneumoniae*. This outbreak was treated with hygiene modifications and treatment of the sows and suckers with neomycin. The sawdust was replaced with a medicated bentonite (Staldren®). However, as the sows and piglets were being treated with the antibiotic at the same time as the Staldren was introduced, it wasn't possible to demonstrate its efficacy although it is certainly preferable to sawdust. In the early stages, the septicaemia-affected pigs had been moved into the weaning shed. The neomycin medication was withdrawn from the suckers, with no reoccurrence of disease.

Factors that may have affected another outbreak include the concurrent infection of pigs with encephalomyocarditis (EMC) virus and nonhaemolytic *Escherichia coli*. Apramycin treatment of piglets in this case reduced scouring.

K. pneumoniae can cause infection in humans. These infections are most commonly acquired in hospitals, especially in immunocompromised patients. There is no evidence to suggest that infected pigs are a source of infection in humans and the antimicrobial resistance patterns in *Klebsiella* spp. isolated from pigs have not shown the widespread resistance found in human isolates.

On-farm control of *Klebsiella*-related septicaemia with either apramycin or neomycin makes antibiotic sensitivity testing a necessity if control is to be achieved. *Klebsiella* spp. are innately resistant to ampicillin and other beta-lactam antibiotics. One *Klebsiella* isolate from the recent outbreaks in Australia has demonstrated resistance to sulfafurazole and trimethoprim and partial resistance to neomycin.

The NSW Department of Primary Industries has investigated the antimicrobial resistance of all the *Klebsiella* isolates and is examining whether antimicrobial sensitivity is stable over time. The department is typing *Klebsiella* strains from all the recent Australian outbreaks to compare the sequence types of the Australian strains with each other and with strains from similar outbreaks in the United Kingdom, which are unrelated. Strain typing is done using multilocus sequence typing (MLST) to determine the genetic relationships between bacterial isolates on the basis of differences in the DNA sequences of several 'housekeeping' genes. These genetic epidemiological studies are indicating that the outbreaks were associated with common strains of *Klebsiella* that were able to cause primary disease when the host-environment interactions were favourable.

Northern Territory

Sue Fitzpatrick, Department of Primary Industry and Fisheries

During the quarter in the Northern Territory, 80 livestock disease investigations[21] were conducted to rule out emergency diseases or investigate suspect notifiable diseases. The number of investigations by category of livestock is shown in Figure 5.

Field investigations were conducted by government veterinary or livestock biosecurity officers (52) and private veterinary practitioners (28). All diagnostic testing was conducted at the state veterinary diagnostic laboratory.

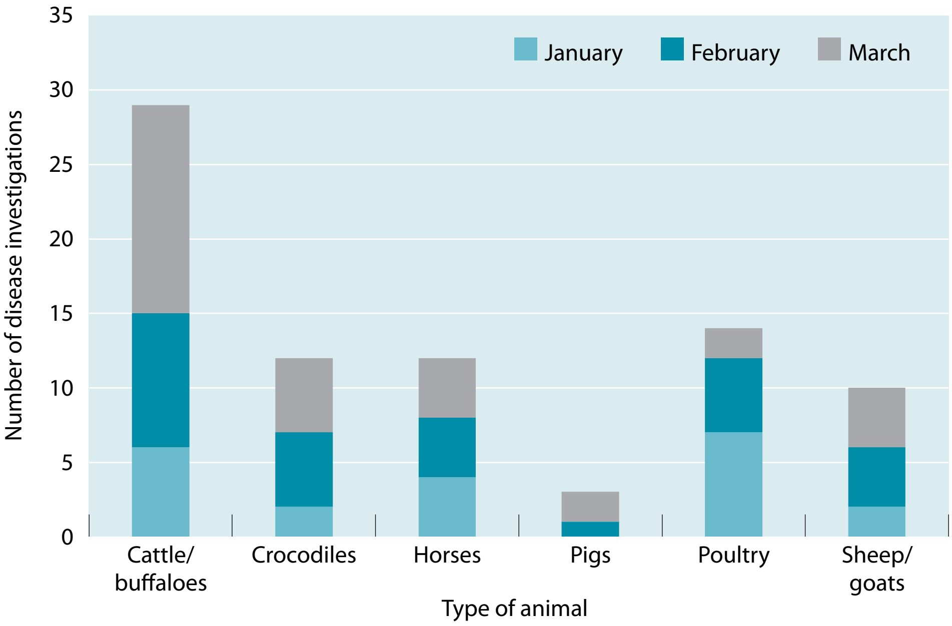
During the quarter, the state veterinary diagnostic laboratory, Berrimah Veterinary Laboratories in Darwin, processed 154 livestock sample submissions[22] to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications and for accreditation programs and targeted surveillance.

The Department of Primary Industry and Fisheries 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 diseases for all disease investigations.

21 Field investigation with laboratory diagnostic testing.

22 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, January–March 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.

Melioidosis in miniature goats

Two miniature goats, approximately 9-months-old, died within a 2-week period. Both goats had been kept on a rural property in the Darwin area for the previous 4 months. When the second goat died after a 10-day illness, it was submitted for necropsy at the Berrimah Veterinary Laboratories.

Clinical signs included fever with a tense abdomen and absence of hindlimb movement. The animal had been treated with antibiotics. Necropsy revealed multiple encapsulated foci of caseous necrosis (abscesses) in various tissues and organs throughout the body. The two largest abscesses were in the retropharyngeal and thoracic inlet region; each about 50 mm long by 30 mm in diameter. Many other smaller abscesses, ranging from 2 mm to 10 mm in diameter, were randomly scattered throughout the parenchyma of the lungs, liver, spleen, prescapular lymph node and various other lymph nodes. They were also present in the serosa of the urinary bladder and in the vertebral bodies of the lumbar vertebrae L5 and L6. An abscess in the vertebral bodies had caused loss of bone with hyperaemia (osteomyelitis) and the abscess had ruptured dorsally causing severe compression and softening of the overlying spinal cord (myelomalacia). Bacterial culture of a swab from the spleen resulted in moderate growth of *Burkholderia pseudomallei* on direct culture after 48 hours incubation.

The most common cause of bacterial septicaemia in goats in northern Australian tropical areas is melioidosis, a zoonotic disease caused by the bacterium Burkholderia pseudomallei. Goats typically acquire the infection from contaminated soil. In this case, the ruptured spinal abscess accounts for the hindlimb paresis.

Zamia toxicity in two heifers

The owner of two heifers on a small rural block outside Darwin noted progressive hindlimb lameness in both animals over a period of 2 months. There were no other clinical signs and the heifers were in good condition. Cattle had been on the block for the previous 12 months and the owner had never kept other livestock on the property. The heifers were hand fed pellets daily but no mineral supplement was provided. Clinical examination revealed severe hindlimb ataxia in both heifers; they knuckled and fell when forced to move. The paddock was found to contain abundant palm-like cycad shrubs (*Zamia* spp.).

The heifers were euthanased and there were no significant abnormalities of gross tissues on necropsy. The rumen of one heifer contained a large amount of plastic sheeting. The most significant laboratory finding was Wallerian degeneration of the ventrolateral white matter of the lumbar spinal cord in both animals, consistent with damage caused by chronic *Zamia* intoxication. *Zamia* leaves and seeds contain at least two toxins; a chemical that damages the liver and intestines and an unidentified neurotoxin that causes irreversible damage to the nerves of the spinal cord. All mammals can be poisoned but cattle are primarily affected by the neurotoxin, observed as characteristic 'zamia staggers'. Transmissible spongiform encephalopathy (TSE) was excluded in both animals.

In this case, inadequate availability of roughage may have led to consumption of unpalatable material by the heifers, with long-term consumption of *Zamia* shrub contributing to intoxication.

Joint-ill in buffalo calves

A paddock of riverine and swamp breed buffalo cows had been calving normally for the previous 3 months with no calf or cow losses. Over a period of 2 days, the manager of the property noted four of the youngest calves, aged approximately 1–2 weeks, were spending an increasing amount of time lying down away from the herd. The calves had been routinely weighed and ear tagged within 2 days of birth. The dams of the affected calves were experienced mothers and there had been no known disruption to colostrum transfer.

The four calves were alert, feeding and not dehydrated. However, they were very reluctant to stand and, when forced to move, they walked slowly with hunched back and hyperextended legs to varying degrees. Two calves had limited weight gain since birth. Clinical examination revealed a hot painful effusion in one or more joints of the limbs of all affected calves. Haematological parameters were relatively normal, with only a mild neutrophilia in two of the calves. Albumin and globulin levels were low to normal and gamma glutamyl transferase (GGT) levels were normal. GGT levels would be expected to be much higher in bovine calves younger than 30 days old due to the high level of GGT in colostrum, which suggested the calves may have been somewhat colostrum-deprived. Joint fluid collected aseptically from three of the calves was grossly cloudy, with abundant degenerate neutrophils and macrophages. *Escherichia coli* was cultured from joint fluid and/or blood samples of all calves.

Affected buffalo calf reluctant to stand. Photo: Department of Primary Industry and Fisheries.

Despite two courses of antibiotic therapy, initially with long-acting tetracycline and subsequently with daily trimethoprim-sulpha, the calves failed to improve and were euthanased. Necropsy of all calves confirmed severe chronic suppurative polyarthritis and abscessation associated with the ear tag of two calves. Only one calf exhibited a mild neutrophilia. The farm manager was advised to delay ear tagging of calves and/or use a disinfectant on the tag site, and there have been no further losses despite subsequent calvings in the same paddock.

It is possible that particularly hot weather resulted in calves spending increased time in water wallows, which may have had built up environmental contamination due to the drier-than-usual weather.

Uroperitoneum in a recently transported steer

A steer held in station yards after recent transport from another property was found sitting in sternal recumbency and alert but made no attempt to rise when approached. Its abdomen was bloated. The rectal temperature was within normal limits (38.6°C), respiration rate was 48 breaths per minute, heart rate 95 beats per minute, eyes recessed and there was poor jugular refill. The animal was euthanased and the most notable finding on necropsy was approximately 40 L of fluid free in the abdominal cavity.

Histopathological examination of various tissues did not reveal significant findings. Unfortunately, blood from the live animal was not available so serum urea and creatinine couldn't be used to definitively diagnose uroperitoneum (peritoneal fluid urea and creatinine are higher than the same parameters in serum). The markedly high values recorded for these parameters in the peritoneal fluid (creatinine 2530 μmol/L and urea 45.9 mmol/L) were highly suggestive of uroperitoneum.

The most common cause of uroperitoneum in ruminants is obstructive urolithiasis (bladder stones). In this case, the cause of the uroperitoneum was unknown because the submitting veterinarian did not identify the source of urinary tract rupture and the animal's recent arrival on the property limited the relevance of some of the possible predisposing causes.

Predisposing factors for obstructive urolithiasis include excessive mineral intake, which can occur from highly mineralised artesian water or from high concentrate diets; ingestion of certain plants containing high levels of oxalate, oestrogens or silica; diets high in magnesium; feeding high concentrate low roughage rations, pelleted rations or rations high in phosphate; and concentrated urine, which is produced when there is no drinking water available or when water is of poor quality.

Polioencephalomalacia in a Brahman calf

A 2-week-old female Brahman calf in the Darwin River area was observed to be dehydrated, listless and easily caught. The calf exhibited a flaccid drooping head and ataxia. The owner administered a vinegar and water drench and the calf was reported to improve but the next day the calf was convulsing with opisthotonos and was euthanased. The cow showed no abnormal signs. Gross necropsy revealed no significant findings. Histopathology on various brain sections showed severe polioencephalomalacia and colitis with predominance of large bacilli in the intestine.

Polioencephalomalacia is a poorly understood condition that has a myriad of possible causes, including water deprivation (salt toxicity), mercury intoxication, lead intoxication, hypoglycaemia, treatment with the coccidiostat amprolium, sulfur toxicity and thiamine deficiency. Thiamine deficiency is the most commonly recognised cause in ruminants and, in older weaned animals, is often related to a sudden change in diet with associated change in intestinal flora to thiaminase-producing bacteria.

The cause of the polioencephalomalacia in this young calf was not obvious, with the only possible indication being the colitis and associated colonic proliferation of large bacilli suggesting there may have been a problem with normal intestinal flora, allowing proliferation of potentially thiaminase-producing bacteria. The case was isolated, with other calves in the herd remaining normal.

Queensland

Greg Williamson, Biosecurity Queensland, Department of Agriculture and Fisheries

During the quarter in Queensland, 676 livestock disease investigations[23] were conducted to investigate suspect notifiable diseases or rule out emergency diseases[24]. The number of investigations by species of livestock is shown in Figure 6.

Field investigations were conducted by government veterinary or biosecurity officers (72) and private veterinary practitioners (604). All diagnostic testing was conducted at the state veterinary diagnostic laboratory.

During the quarter, the state veterinary diagnostic laboratory, Biosecurity Sciences Laboratory, processed 676 livestock sample submissions[25] to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications (115) and for accreditation programs (14) and targeted surveillance (203). There were 44 submissions related to wildlife, 12 for companion animals and 116 for aquatic species. In total there were 1170 animal health related submissions to Biosecurity Sciences Laboratory during the quarter.

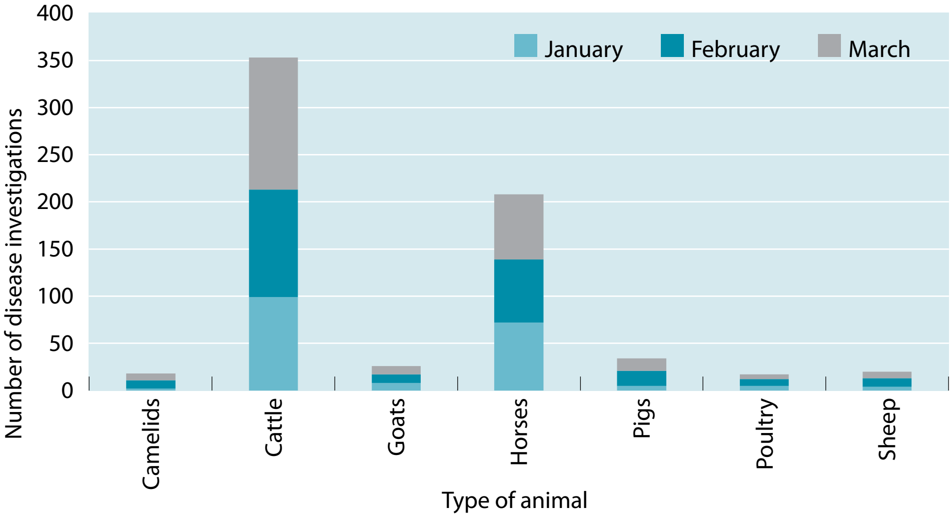
The following case reports are a selection of field investigations chosen to highlight surveillance and diagnostic capacity.

23 Field investigation with laboratory diagnostic testing.

24 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

25 Some investigations involved multiple submissions.

Figure 6 Number of field disease investigations in Queensland, January–March 2016



Reports chosen are not necessarily representative of the full range of livestock disease incidents during the quarter.

Hepatoxicity with photosensitisation of cattle secondary to lantana ingestion

In the Toowoomba region during March 2016, 6 of an at-risk group of 80 mixed-breed, sex and age cattle were found dead. The owner reported that the cattle had 'hidden' in the scrub for 3–5 days prior to dying but did not report any other clinical signs. Another 5 animals were sick with lethargy, dehydration, recumbence and peeling skin on the nose, vulva and ears. The affected cattle were part of a group of 55 animals that had been introduced to the property in December 2015 from drought-affected country near Cunnamulla, Queensland. Another 32 animals had been introduced to the property 2–3 months earlier from around the local region.

Sick animals showed marked epidermal or dermal sloughing of the muzzle, ears, periocular region, lightly haired areas on the trunk and perianal and vulval regions with some areas infested with fly maggots (myiasis). One 18-month-old steer was noted to have a marked amount of thick ocular discharge and appeared to be blind (see photograph below). One steer demonstrated significant neurological changes with marked aggression and hypersensitivity to touch and sound. The affected cattle ranged in body condition from 1.0 to 2.5 out of 5.0.

Laboratory examination of blood collected ante-mortem supported a diagnosis of cholestatic liver disease. Two animals necropsied were jaundiced and their livers were swollen and tan in colour.

A blind 18-month-old steer with epidermal sloughing from the periocular region. Photo: Department of Agriculture and Fisheries

Inspection of the paddock where the cattle had initially been kept identified the presence of lantana (*Lantana camara*) that had been grazed.

Ante-mortem examination, necropsy, laboratory findings and history support the diagnosis of a hepatoxic event, most likely secondary to lantana poisoning.

Significant lantana toxins are triterpene acids, lantadene A (rehmannic acid), lantadene B and their reduced forms. A toxic dose for a 500 kg cow varies from about 5 to 20 kg of fresh leaf (1% or more of an animal's bodyweight) depending on the toxin content of the lantana eaten.

Ingestion of lantana results in the absorption of triterpene acids from the digestive tract and in particular the small intestine. Triterpene acids are thought to be absorbed and transported to the liver via the portal system where they are then taken up by the hepatocytes. The toxins cause a decrease in rumen motility and a decline in the flow of ingesta through the small intestine. This causes retention of the toxic ingesta in the rumen and further absorption of the triterpene acids, hence, further exposure of the liver to the effects of the toxins. The liver injury is specific to hepatocytes and results in the inhibition of canalicular bile secretion, which results in intrahepatic cholestasis. Jaundice and photosensitisation occur as a consequence of the cholestasis. The photosensitisation is due to the accumulation of phylloerythrin within the dermis, which sensitises the dermis to sunlight, causing affected animals to seek shade. The jaundice occurs as a result of the accumulation of bilirubin due to the decreased biliary secretion (cholestasis).

Melioidosis in a small alpaca herd in central Queensland

In February 2016 after heavy rain, 7 out of an at-risk group of 10 female alpacas and one cria died on a small holding south of Sarina after showing signs of inappetence, dyspnoea (difficult breathing), diarrhoea and polydipsia (heightened thirst).

The private veterinarian attending the animals initially suspected heat stroke and provided supportive therapy of water and electrolytes, as well as antibiotics. The first to die was a 9 year old that had been seen standing alone two days after 280 mm of rain was recorded over the previous 2 days at a weather site about 18 km away. A week later she developed severe diarrhoea and dyspnoea and died one day after treatment. The other alpacas, aged from 6 months to 13 years, died at regular intervals over the next 12 days after displaying similar signs that lasted 1–3 days. Although the remaining 3 animals appeared depressed, none developed severe symptoms and all three slowly recovered.

Necropsy of the fifth animal to die supported a diagnosis of pneumonia. Histopathological examination of formalised lung samples showed a severe acute widespread fibrinosuppurative bronchopneumonia with pleuritis. Multifocal areas of hepatocellular necrosis were evident in the liver but there was no evidence of abscess formation. Sera submitted had a high titre (1:320) when tested for *Burkholderia pseudomallei* by indirect haemagglutination, and the bacteria were isolated in almost pure growth from fresh heart and lung samples.

The 7 animals that died were all female. Four male alpacas on the same property were managed separately and confined at night in smaller paddocks in an elevated location. During the day, the males had access to a small paddock with a steep slope. The females were kept in a paddock bisected by a small gully at the lowest elevation. Water lies in the gully after rain and the alpacas like to wallow in the mud on hot days. The females were often observed standing with their feet in the water trough, one for hours. It is likely that the females had a higher risk of exposure to *Burkholderia pseudomallei* because their feet would be softer and more easily traumatised and they had access to mud and actively sought it out.

The owners were given advice on paddock management, especially in relation to the lower paddock and particularly after rain.

South Australia

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

During the quarter in South Australia, 193 livestock disease investigations[26] were conducted to rule out emergency diseases 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 (77) and private veterinary practitioners (116), who submitted samples to the state diagnostic veterinary laboratory for subsidised testing to exclude or confirm notifiable diseases.

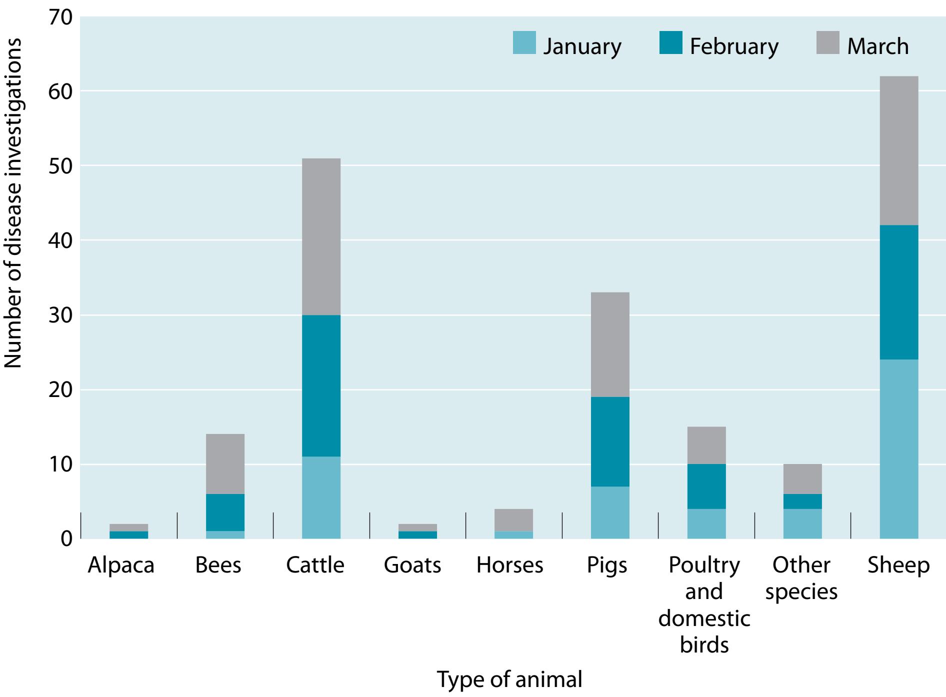
26 Subsidised field investigation with laboratory diagnostic testing.

During the quarter, the state veterinary diagnostic laboratory, Gribbles Veterinary Pathology, processed 193 sample submissions 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, our 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.

Figure 7 Number of livestock disease investigations in South Australia, January–March 2016



Cattle health investigation in the northern pastoral region

Cattle producers in the northern pastoral region of South Australia experienced a higher-than-normal incidence of cattle health issues this season, starting in October 2015. Eight properties reported a range of clinical presentations, including diarrhoea, drooling, neurological signs, abortions or deformities, and some animals were found dead. Cattle of mixed age and sex were affected and usually died within 1 week of showing signs.

A diverse and nonspecific range of pathology was observed, including liver, kidney and gastrointestinal tract changes. Faecal cultures, trace element testing, nitrate and nitrite testing in animal and plant samples were all negative or insignificant. Tests conducted by the state veterinary laboratory and CSIRO Australian Animal Health Laboratory were negative for bovine spongiform encephalopathy (BSE), foot-and-mouth disease, BVDV and other known viruses, including Hendra virus, lyssavirus, bluetongue virus, herpesviruses and adenoviruses.

Veterinarians, animal health officers and epidemiologists are working closely with cattle producers, veterinary pathologists, cattle health and arid plant specialists to get a clearer picture of the situation. The syndrome/syndromes are highly localised to specific properties, paddocks or animal groups and are not consistent with an infectious aetiology alone. A working hypothesis of a multifactorial aetiology is being pursued, with plant toxins, stock nutrition and climatic influences likely to be involved.

There have been no reports of deaths since February 2016. A similar range of syndromes was reported under similar seasonal conditions in the 1970s and the 1990s and has been recorded as far back as the early 1900s. Investigations are continuing, including epidemiological and vegetation surveys.

Acute liver failure in beef steers on the Fleurieu Peninsula

In late March 2016, a producer on the Fleurieu Peninsula reported 3 sudden deaths in a beef steer herd of mixed ages and breeds. The group of 480 animals were brought into yards one day before the deaths occurred. They had been yarded to investigate the cause of generalised ill-thrift and weight loss. The cattle originated from the northern pastoral region of South Australia and had been on the Fleurieu Peninsula property for approximately 4 months.

Blood results revealed copper deficiency (approximately 6.5 µmol/L) and high faecal egg counts (up to 3000 strongyle eggs per gram). A marked nutmeg appearance to the liver was seen on necropsy and histopathology revealed severe, diffuse submassive hepatic necrosis, which would have caused fatal acute fulminant hepatic failure. These changes were consistent with toxic hepatic necrosis. Potential causes in large animals in this area include smartweed (*Persicaria* spp.), Noogoora burr (*Xanthium strumarium*), green cestrum (*Cestrum parqui*), Ellangowan poison bush (*Eremophila deserti*), boobialla (*Myoporum montanum*), mintweed (*Salvia reflexa*) and woolly everlasting (*Argentipallium blandowskianum*) but none of these plants were found in the paddock or yards. Blue–green algae could also be implicated but there was no evidence of this in any of the accessible water sources.

A specific cause of death could not be established in this case but parasitism and copper deficiency were likely causing the generalised ill-thrift in the group. The cattle were subsequently moved to a new property and no further deaths were reported.

Listeriosis in Merino ewes

During March 2016, on a property located in the south-east, five out of 350 Merino ewes aged 3–5 years became ill and died. The ewes were all in the early stages of pregnancy. Clinical signs included depression, lethargy and separation from the flock, followed by death a day or two later.

The ewes were grazing in a paddock of potato weed (*Heliotropium europaeum*) and mature barley (*Hordeum vulgare* L.), supplemented with ad lib straw and silage.

No gross abnormalities were observed on necropsy and blood samples collected for trace element testing were all normal. Faecal samples revealed strongyle eggs but did not culture any abnormal pathogens. Histopathology revealed a severe necrosuppurative inflammatory lesion localised within the medullary region of the brain stem, consistent with encephalitis due to infection with *Listeria monocytogenes*.

L. monocytogenes is an environmental organism commonly found in spoilt (incompletely fermented) silage with a pH of 5.5 or higher. *L. monocytogenes* breaches the oral mucosal barrier through wounds in the mouth and spreads via the trigeminal nerve to the brain where it has an affinity for the medulla and brainstem.

The producer was advised to stop feeding the silage to his ewes. No further deaths were reported.

Coccidiosis in adult sheep in the Adelaide Hills

A producer in the Adelaide Hills reported death and illness in his 5-year-old Merino ewes. The flock of 1100 ewes had arrived by truck 2 weeks previously from the northern pastoral region. The producer found 25 ewes dead and 10% of the flock with bloody diarrhoea and recumbence.

Necropsy showed severe inflammation of the ileum, colon and caecum with frank clotted blood and bloody diarrhoea. Histopathology revealed scattered intralesional coccidial organisms and large numbers of coccidial oocysts on faecal flotation, compatible with intestinal coccidiosis.

Coccidiosis in sheep typically affects one or more of the distal small intestine, caecum and proximal colon. While there were not large numbers of coccidial organisms present in these sheep, the marked luminal haemorrhage noted within the specimens grossly was compatible with severe mucosal damage, suggesting release of large numbers of organisms, either previously or simultaneously from other regions of the intestine. Coccidiosis is rare in adult sheep, especially in extensively managed farming situations.

This was a case of significant morbidity and mortality occurring in sheep weakened by the stress of recent transport followed by exposure to an unfamiliar organism as a naive population. The outbreak indicates a probable high burden of *Coccidia* spp. on the property.

Recumbent adult ewe affected by coccidiosis with blood-stained scour.

Blood-stained ileum and caecum of adult ewe affected by coccidiosis. Photos: Primary Industries and Regions SA

The producer was provided with advice on various options for treatment of coccidiosis. No further losses have been reported.

Pigeon paramyxovirus in racing pigeons

In January 2016, pigeon paramyxovirus type 1 (PPMV-1) was detected in a group of approximately 400 birds housed in multiple lofts on one property in the Murraylands. Although the disease is regarded as endemic throughout Australia, this was the first formally confirmed case in South Australia.

The owner had been introducing pigeons of varying ages and breeds from various interstate locations to his pigeon loft in preparation for racing. Twenty of the 40 interstate birds were the first to become ill and die. Clinical signs included lethargy, a full watery crop (stasis) and green diarrhoea. Necropsy revealed enlarged kidneys. Quantitative PCR testing of choanal swabs and multiple organ tissues were all positive for PPMV-1.

PPMV-1 is a highly pigeon-specific viral disease that spreads rapidly and causes high rates of pigeon illness and death. Infected birds may shed the virus in their faeces and other discharges, contaminating the environment and allowing transmission to other pigeons. The virus can survive for several weeks in the environment, especially in cool weather. Spread of disease is typically due to movement of birds but it can be carried in eggs or on equipment used with pigeons, as well as on people and their clothing.

The pigeon industry was immediately advised of the outbreak with prevention advice given, including observing strict on-farm biosecurity and hygiene measures and ensuring adequate vaccination of all birds. No specific regulatory disease control measures were implemented.

The owner was advised to implement vaccination and a voluntary cessation of movement of birds from his property. Deaths continued to occur for a number of weeks thereafter. One other pigeon loft that had received birds from the Murraylands property was confirmed infected and advised about vaccination and containment. Although it is considered that PPMV-1 is now endemic in South Australia, there have been no further reports of disease since then.

Tasmania

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

During the quarter in Tasmania, 264 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 8.

Field investigations were conducted by government veterinary or biosecurity officers (11) and private veterinary practitioners (253). All diagnostic testing was conducted at the state veterinary diagnostic laboratory.

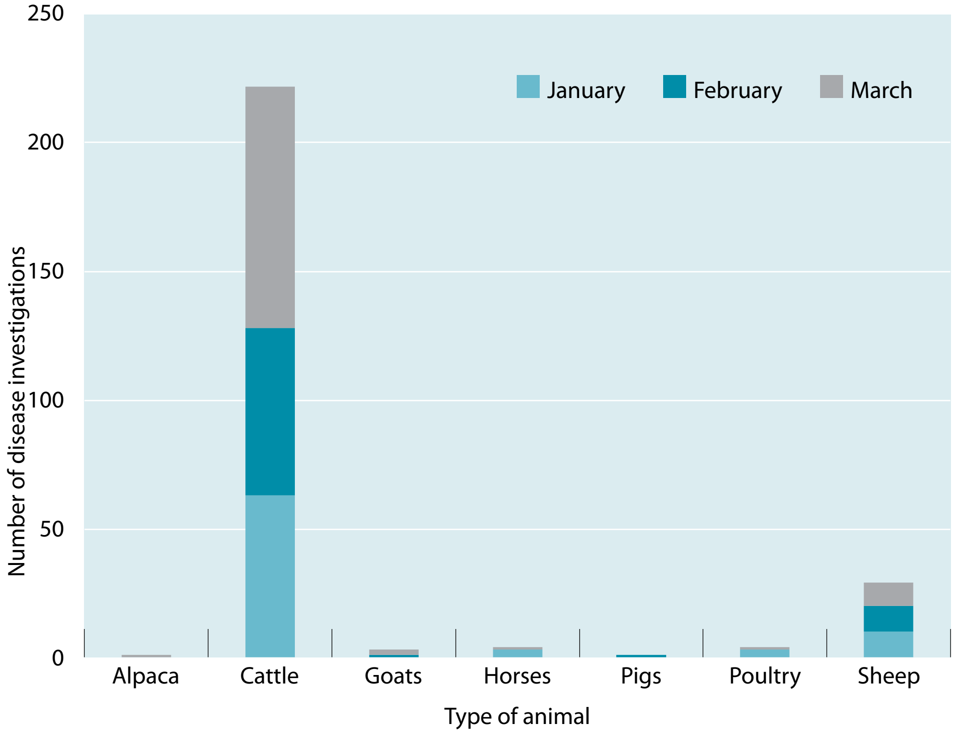
During the quarter, the state veterinary diagnostic laboratory, Animal Health Laboratory Launceston, processed 484 livestock sample submissions[29] to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions were also processed to substantiate proof of disease freedom certifications and for accreditation programs and targeted surveillance.

One of the investigations this quarter was subsidised by the National Significant Disease Investigation Program. Most animal disease investigations are undertaken by private veterinary practitioners. 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. Private veterinarians are eligible for funding under the National Significant Disease Investigation Program for disease investigations where presenting signs maybe 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 laboratory. These investigations receive highest priority.

There are approximately 2 million sheep, 0.64 million cattle and 11 000 pigs in Tasmania[30].

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 8 Number of field disease investigations in Tasmania, January–March 2016



Zinc toxicosis in north-east dairy herd

From a herd of 400 Holstein Friesian milking cows in north-east Tasmania, 20 cows developed clinical symptoms of zinc toxicosis.

Initially only heifers were affected but over a 3-week period, cows from all age groups developed symptoms. Affected cows appeared depressed with poor milk production and pale mucous membranes, and some exhibited signs of colic. Laparoscopic examination of four affected cows revealed all had swollen, inflamed intestines and livers. Initial differential diagnosis included copper deficiency, facial eczema, mycotoxicosis, theileriosis and leptospirosis.

One cow was necropsied. The lungs were found to be emphysematous with mild chronic multifocal interstitial pneumonia. Mild periacinar hepatocellular necrosis and cholestasis and marked haemolytic anaemia and haematuria were observed.

Laboratory testing suggested theileriosis, acute leptospirosis and copper toxicity or deficiency were not the cause of the haemolytic anaemia. Toxic levels of whole blood zinc (9 mg/L; normal 150 µg/L) and liver zinc were detected.

Zinc poisoning in cattle is generally a rare occurrence. Causes of zinc poisoning include access to and ingestion of galvanised surfaces, such as zinc-based painted surfaces or elevated supplementation of zinc to feed ration. In this case, the source of zinc was found to be feed stored in a silo.

27 Field investigation with laboratory diagnostic testing by the state veterinary diagnostic laboratory.

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/

29 Some investigations involved multiple submissions.

30 http://stat.abs.gov.au/

The farmer usually included a zinc supplement in the cow's pellet rations as a preventative measure to reduce the risk of facial eczema, which is endemic to the region. Late summer and early autumn are usually the times of greatest risk. During this period, the farmer added additional zinc to the feed rations as a loose supplement mixed with grain. Unfortunately, the loose zinc was not evenly distributed throughout the silo; it settled to the bottom and cattle were fed a higher-than-expected zinc load in the grain feed.

Once a diagnosis was established, the feed in the silo was removed and no further zinc was included in subsequent feed rations. All affected cows are now making a slow but steady recovery and milk yields are gradually returning to normal.

Hypophosphataemia in two north-west dairy herds

Hypophosphataemia was diagnosed in two groups of dairy cows in north-west Tasmania.

Clinical signs were a low incidence of shifting lameness in one group and pica with a number of cows reported to be licking soil in the other group. Both herds experienced poor growth rates and poor fertility rates.

Soils in this region are often found to be low in phosphorus and many farmers in the area include a phosphorus supplement in their feed rations. The farmers affected in these cases had recently changed feed rations and had not included phosphorus supplementation, which had been used in the past.

Whole clotted blood was submitted for analysis and all samples were found to have low phosphorus levels. Blood levels of phosphorus may remain normal for long periods after cattle have been exposed to serious deficiency. However, marked hypophosphatemia is a reliable indication of severe phosphorus deficiency. Serum needs to be removed from the clot within 2 hours to prevent phosphorus from leaching from red cells and falsely elevating the reading. In both of these cases, serum was submitted on the clot at least 24 hours post collection. As serum levels were still low, results were considered significant. Marginal or normal results in these cases would have been difficult to interpret.

Post diagnosis phosphorus supplementation was included in the diet and 2 months after the initial diagnosis all affected cows were retested. Serum phosphorus levels are now returning to normal.

Oxalate poisoning in northern ewe flock

Oxalate poisoning was diagnosed on a property in northern Tasmania.

Four mixed-age ewes from a group of 730 died 3 days after being moved onto new pasture. The pasture was a mixture of rye, clover, cocksfoot and sorrel. An animal was submitted for necropsy and found to have marked hydrothorax, hydropericardium and pulmonary oedema with swollen kidneys largely due to pale swollen cortices. The aqueous humour indicated azotaemia and hypocalcaemia.

Histologically, the kidneys had moderate diffuse nephrosis with oxalate crystals throughout the tubules.

High concentrations of soluble oxalate in the form of the potassium salt are present in about 70 plants, including sheep sorrel (*Acetosella vulgaris*), *Chenopodium* spp. such as fat hen (*C. album*), *Oxalis* spp. such as soursob (*O. pescaprae*), rhubarb (*Rheum rhaponticum*) and spinach (*Spinacia oleracea*).

Sheep are the most susceptible livestock to oxalate poisoning, and pregnant and lactating animals are probably more susceptible than other groups. Symptoms are most severe when plants are profuse and lush and livestock are hungry because young rapidly growing fresh plants may contain as much as 17% potassium oxalate, while old dry plants rarely contain more than 1%.

Oxalate is normally metabolised in the rumen, and continued ingestion in small quantities increases the animal's ability to decompose the oxalate to the point where relatively large quantities can be ingested without toxic effects. However, the ruminal microflora require 3–4 days to adapt to the introduction of oxalate in the diet. Thus, sheep may be very susceptible when they are grazed for the first time on pasture containing toxic plants. Clinical signs may appear within 2–4 hours of eating oxalate-containing plants if the animals are hungry.

Clinical signs vary with the amount of oxalate ingested. With large quantities, the major effect is the absorption of free oxalate and precipitation of blood calcium as calcium oxalate to produce a hypocalcaemia and nephrosis due to precipitation of calcium oxalate crystals in renal tubules, as in this case.

Treatment may include parenteral injection of calcium salts to treat the hypocalcaemia and provision of ample fluids to decrease precipitation of oxalate crystals in the urinary tract and facilitate elimination of the oxalate, but some will succumb to kidney failure despite treatment.

In this case, the sheep were removed from the pasture containing the toxic plants and were supplemented with dicalcium phosphate. No further losses occurred.

Victoria

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

During the quarter in Victoria, 416 livestock disease investigations were conducted to rule out emergency diseases or investigate suspect notifiable diseases. The number of investigations by category of livestock is shown in Figure 9.

Field investigations were conducted by government veterinary or biosecurity officers (123) and private veterinary practitioners (293). All diagnostic testing was conducted at registered veterinary diagnostic laboratories.

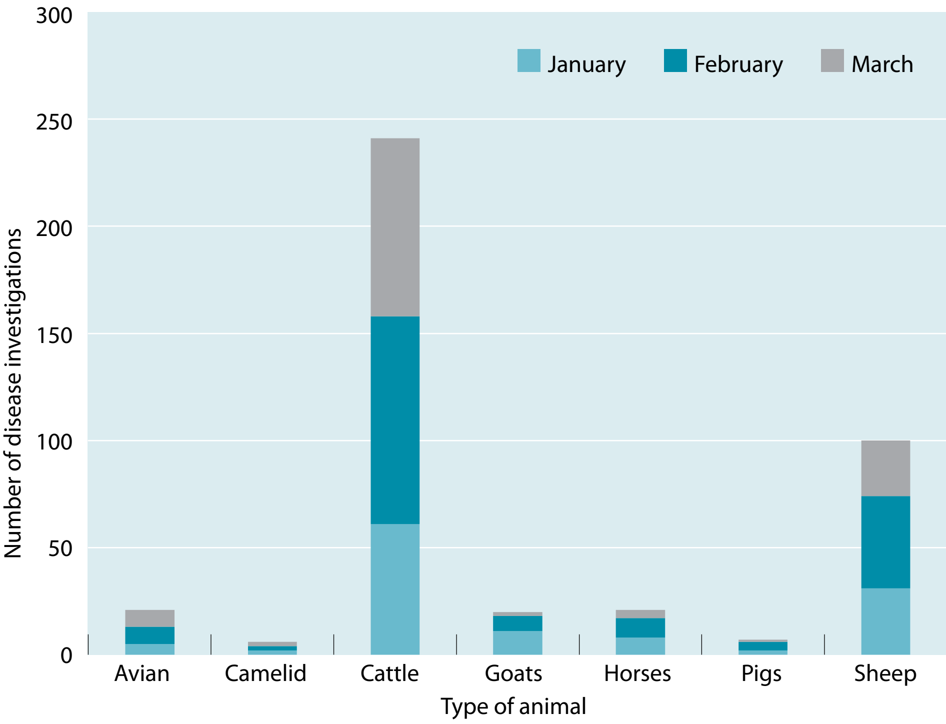
During the quarter, the state veterinary diagnostic laboratory, AgriBio, processed 422 livestock sample submissions[31] to rule out emergency diseases or investigate suspect notifiable diseases. Sample submissions (258) were also processed to substantiate proof of disease freedom certifications and for 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 respiratory tract. The diseases most commonly diagnosed by species were gastrointestinal diseases in cattle, 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 as suspect national notifiable animal diseases (Table 19).

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

31 Some investigations involved multiple submissions.

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



Ehrlichia canis in an imported dog

A case of *Ehrlichia canis* was investigated in a male dog imported from Malaysia in February 2016. The dog arrived in Australia with compliant health certification papers. Prior to export from Malaysia, he had reportedly been treated twice with a broad-spectrum insecticide and a pre-import blood sample was certified to have tested negative for *Brucella canis*, *E. canis* and *Leishmania infantum*.

On arrival in Australia, the dog was transferred to the Post Entry Quarantine facility in Melbourne where staff noted a heavy infestation of brown dog tick (*Rhipicephalus sanguineus*). He was moved to a grooming area and treated with a topical insecticide. All in-contact areas, including the transport vehicle and crate, holding pen and grooming area, were treated. All animals that were housed in the same area of the quarantine facility or transported with the dog were visually inspected and treated with a topical insecticide. A blood sample from the dog tested by CSIRO Australian Animal Health Laboratory was positive for *E. canis*. The dog was never released from quarantine and the Department of Agriculture and Water Resources gave the owner the option to export or euthanase the animal. The owner chose to have the dog euthanased.

A dog that was housed for a short period in the pen adjacent to the infected dog had been released to the Victorian Police Dog Squad training facility prior to treatment of the infected dog and environs. This dog had been placed in isolation on arrival at the police training facility and there was negligible opportunity for ticks, if present, to move from that dog to other dogs on the site. She was subsequently returned to the Post Entry Quarantine facility for treatment and found to be test-negative for *E. canis* 21 days after potential post-exposure.

Ehrlichiosis is caused by the bacterium *E. canis*. It is predominantly a disease of dogs but there have been a few cases of human infection. Clinical *E. canis* infection in dogs presents with acute and chronic phases. The acute phase lasts 2–4 weeks and is characterised by fever, serous nasal and ocular discharges, anorexia, lethargy and weight loss. The chronic phase shows marked pancytopenia, haemorrhage, peripheral oedema, emaciation and secondary bacterial infection 50–100 days post-infection.

Chronic copper poisoning in dairy cows

In early 2016, chronic copper poisoning was suspected as causing abortion in 9 Jersey cows from a high-producing 400-head dairy farm near Noorat in south-west Victoria. Poisoning was diagnosed as the cause of the subsequent death of two of the affected cows.

All the affected cows had been dried off, with the median period between drying off and abortion being 7 days (range 6–21 days). Two of the cows died 4 and 6 days after aborting (12 and 14 days after drying off).

Laboratory testing of blood from four of the aborted cows and tissues from their aborted foetuses found no evidence of an infectious cause. Blood from these and another aborted cow all had elevated serum copper and evidence of hepatopathy, which included elevated glutamate dehydrogenase (GLDH), gamma-glutamyl transpeptidase (GGT), aspartate aminotransferase (AST) and bilirubin.

The two cows that died had developed jaundice and haemoglobinuria. On necropsy, both cows had swollen nutmeg livers, dark coloured kidneys and distended gall bladders containing thick sludgy bile. Histopathological examination of tissue samples revealed a hepatopathy and nephropathy in both cows consistent with copper poisoning; elevated liver and kidney copper concentrations at the high end of normal in one cow and elevated kidney copper levels in the other.

No copper had been added to the paddocks or to the drinking water, nor had the cattle been individually supplemented with copper. The only added copper in the cows' diets was a pellet ration fed to the lactating cows. Analysis of these pellets revealed 59.20 ppm copper and 2.84 ppm available copper. Available copper is calculated from the levels of copper, molybdenum and sulfur in the feed. While these levels appear high, maximum levels for cattle are poorly defined and the cows on this property had been fed pellets containing this level of copper for a number of years. It is possible that the levels of molybdenum and/or sulfur in the total diet may have been lower in the period prior to drying off leading to excessive accumulation of copper in the liver. Elevated hepatic copper levels cause progressive individual hepatocyte necrosis releasing copper into the bloodstream. High blood copper levels eventually trigger a haemolytic crisis and the associated hypoxia as a result of the anaemia exacerbates liver necrosis and may induce abortion.

No hepatotoxic plants were identified in the paddocks at the time of these abortions and there had been no known previous exposure to hepatotoxic plants (e.g. heliotrope). The producer has since reduced the copper levels in the concentrates being fed. Some liver biopsies will also be conducted in the future to monitor copper levels.

Respiratory disease complex in dairy heifers

Respiratory disease caused sickness in 60 Friesian heifers and led to the deaths of another 30 out of a group of 300 aged 4–5 months on a dairy farm in south Gippsland during a 10-week period leading up to January 2016.

The herd was kept in a large open paddock and fed a commercial pellet ration in large hoppers.

The affected weaner heifers became febrile and dyspnoeic, progressing to recumbency and death over a few days when not treated aggressively with antibiotics. The dairy farmer observed that those treated early with either trimethoprim sulfa drugs or oxytetracycline had recovered, whereas those treated after they had become moribund seemed less responsive to treatment.

A single heifer aged 5 months was examined and found to be weak and barely able to stand with sunken eyes, moderate skin tent, pink mucous membranes with normal capillary refill time, increased lung sounds and respiratory rate, and a rectal temperature of 39.7°C.

The heifer was euthanased and gross pathological findings showed mottled congested lungs with disseminated, focal haemorrhagic consolidated lesions in the caudal lung lobes and a serosanguinous pleural effusion. The mucosal surface of the duodenum was reddened but the remainder of the necropsy was unremarkable.

A heavy growth of *Mannheimia haemolytica* was cultured from lung samples. The laboratory performed two different tests for bovine herpesvirus antibodies; a serum ELISA was positive but a separate semi-quantitative ELISA in a bovine respiratory panel assay did not detect antibodies, indicating levels were low and below the threshold of detection. This may reflect infectious bovine rhinotracheitis (IBR) in the acute stage.

BVDV serology was negative for antibodies but did not rule out a persistently infected status as a BVDV antigen test was not performed; the dams of this group of weaners had been vaccinated with pestivirus vaccine. Serology for adenovirus, bovine respiratory syncytial virus and parainfluenza virus were negative. Additional faecal cultures for *Yersinia* spp., *Salmonella* spp. and culture from fresh lung for *Mycoplasma* spp. were negative. Villous atrophy was found in the duodenum, suggestive of gastrointestinal helminthiasis.

A diagnosis of mannheimiosis was made, which raised questions from the producer as to how the disease got onto the farm and what could be done to prevent further deaths.

M. haemolytica and bovine herpesvirus are commonly found in healthy animals and, in combination, are two of the main pathogens involved in bovine respiratory disease. *M. haemolytica* is a commensal organism of the upper respiratory tract of healthy cattle and bovine herpesvirus can reside in carrier animals. It is likely that these organisms were both endemic on the farm and were introduced to naive animals via a carrier. The use of hoppers to feed this group of weaners possibly contributed to the disease affecting so many animals in the group. This disease is uncommon in south Gippsland and is more typically seen in feedlot animals.

Combination vaccines for *M. haemolytica* and bovine herpesvirus are available and the *M. haemolytica* cultured from the samples was found to be sensitive to all antibiotics tested. The producer was advised to test a statistically significant sample of animals before implementing a farm-wide vaccination program in a milking herd of 1400. The producer elected to initiate a program of closer observation and earlier isolation of affected animals with a more aggressive treatment protocol and to vaccinate all cows prior to calving with a combined vaccine.

Polioencephalomalacia in sheep — TSE exclusion

In late March 2016, on a cropping property south of Rutherglen in north-east Victoria, 6 adult Dorper ewes died out of a group of 250 in the one week. The adult ewes were grazing dry oat stubble with no fallen grain still present and were being fed wheat in a self-feeder.

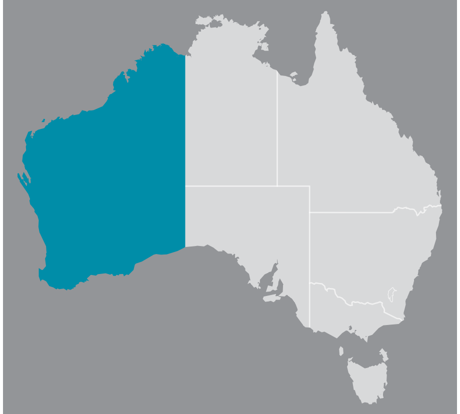
The ewes presented with ataxia, recumbency, hypoaesthesia and star-gazing or were found dead. A clinical examination of one affected ewe that was due to lamb in May found it to be pyretic, dull, recumbent and star-gazing with cyanotic gums. In December 2015 the flock had been treated with a broad-spectrum quarantine drench (an effective combination of unrelated drenches). The property received good rain into February, which produced a light green pick prior to a run of 40°C days in early March.

Necropsy of the ewe revealed no significant lesions although the abomasum contained a significant burden of barber's pole worm (*Haemonchus contortus*). A number of samples were submitted to the laboratory for testing, including the brain, which was collected as part of the National Transmissible Spongiform Encephalopathies (TSE) Surveillance Program.

The laboratory report gave a diagnosis of polioencephalomalacia, a faecal egg count of 3420 eggs per gram indicative of barber's pole worm infestation, a clinically significant low blood calcium level (1.25 mmol/L; normal 2.12–2.87 mmol/L if protein concentrations are within normal range) and lung tissue histology consistent with bronchopneumonia and a chronic lungworm infection. The brain returned a negative result for TSE.

The producer was advised to treat all the ewes with an effective anthelmintic and supply an oral calcium supplement. Losses ceased a week after treatment

Western Australia



Jamie Finkelstein, Department of Agriculture and Food Western Australia

During the quarter in Western Australia, 202 livestock disease investigations[32] were conducted to rule out emergency diseases or investigate suspect notifiable diseases. The number of investigations by category of livestock is shown in Figure 10.

Field investigations were conducted by government veterinary or biosecurity officers (51) and private veterinary practitioners (151). All diagnostic testing was conducted by Department of Agriculture and Food Western Australia (DAFWA).

During the quarter, DAFWA processed 498 livestock sample submissions, 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.

African and classical swine fever exclusion in pigs

In February 2016, a private veterinarian investigated a report of ill-thrift and deaths in 10–11-week-old piglets from a producer in the Northern Agricultural Region.

An on-farm investigation revealed 50 dead and 8 affected from a group of 800. The history included weaners going off feed, showing signs of jaundice and respiratory difficulty.

Necropsies were conducted and fresh and fixed tissues were submitted to the DAFWA laboratory. Histology revealed changes in the lung consistent with pneumonia, as well as evidence of a systemic vasculitis, with acute haemorrhage and oedema of the cerebral meninges and parenchyma likely caused by a necrotising vasculitis.

The differential diagnosis list for the acute vasculitis included porcine circovirus (PCV), as well as reportable diseases exotic to Australia, such as classical swine fever, African swine fever and porcine respiratory and reproductive syndrome.

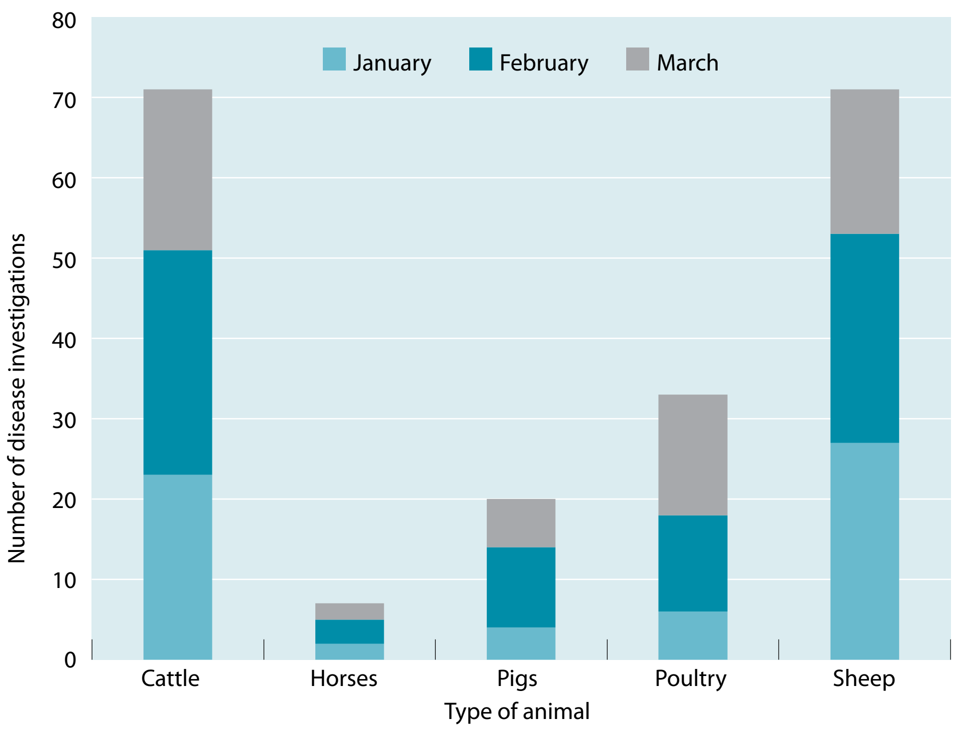
PCR testing performed at the CSIRO Australian Animal Health Laboratory confirmed a diagnosis of porcine circovirus 2 (PCV-2)-associated disease (PCVAD). PCV affects lymphatic tissues and increases the incidence and severity of other endemic diseases that may be present. The producer was provided with advice to manage the impact of PCVAD and the disease incident has resolved.

In this case, PCR testing excluded the reportable exotic diseases classical swine fever, African swine fever and porcine respiratory and reproductive syndrome.

DAFWA encourages and assists private veterinarians to undertake comprehensive sampling in cases presenting with clinical signs similar to a reportable disease, to increase the likelihood of a definitive diagnosis, as well as being able to exclude reportable diseases.

Excluding reportable diseases and reaching a definitive endemic disease diagnosis as part of a routine diagnostic process not only assists the affected producer to manage the disease but supports the livestock sector by demonstrating freedom from these reportable diseases, which is vital to maintaining Australia's market access.

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



32 Field investigation with laboratory diagnostic testing.

Sheep — bluetongue disease exclusions

DAFWA continues to advise producers and private veterinarians of the clinical signs of bluetongue disease, which may present similarly to an endemic disease and should be considered as part of routine disease investigations.

Investigation and testing for bluetongue disease is of particular importance for live animal exports by continuing to demonstrate bluetongue disease freedom in Australia.

In January 2016, a private veterinarian and DAFWA field veterinary officer investigated two unrelated reports of ill-thrift in sheep.

The first case involved 350 weaners on a property in the Northern Agricultural Region. Whilst ill-thrift was the presenting syndrome, on-farm investigation by a private veterinarian revealed two affected sheep with facial swelling and difficulty breathing.

The second case in February 2016, investigated by a DAFWA field veterinary officer, involved significant weight loss and general weakness and depression, with 8 dead and 30 affected from a group of 300 on a Central Agricultural Region property. On-farm investigation revealed affected sheep had swollen eyelids and skin inflammation of the face and ears.

Necropsy examination in both cases revealed generalised jaundice, including of the joint fluid, aqueous humour, pericardial fluid and renal pelvis. Histopathological changes included extensive cellular necrosis within the liver, with the portal triads expanded by proliferating bile ductules with some containing acicular clefts and fibrosis.

Steroidal saponin toxicity was diagnosed based on the clinical and histopathological changes and a history of grazing a clover (*Trifolium* spp.) pasture with caltrop (*Tribulus terrestris*). Bluetongue virus was excluded as a cause of the disease by serological testing.

Abortion in cattle — schistosomus reflexus

In March 2016, a private veterinarian investigated a report of increased incidence of abortion from a cattle producer in the Southern Agricultural Region.

On-farm investigation revealed 8 stillborn calves from 50 dams, which included a schistosomus reflexus calf. Schistosomus reflexus results from failure of the abdominal wall to close during embryonic development, causing dorsal flexion of the vertebral column and exposure of thoracic and abdominal organs. Schistosomus reflexus is generally considered a sporadic genetic occurrence.

The DAFWA laboratory investigated the case but no definitive cause was identified. Although no definitive diagnosis was reached and globally only approximately 40% of abortion investigations determine the causal agent, DAFWA performed considerable laboratory testing to exclude known causes of abortion. Endemic disease agents tested for included BVDV, *Campylobacter* spp. and *Listeria* spp. Diseases of significance to trade, *Brucella abortus*, Schmallenberg virus and Akabane virus, were ruled out.

Negative laboratory results are a vital component of Australia's livestock health surveillance system because they demonstrate to our trading partners that we are actively looking for disease and we can demonstrate, with these negative results, absence of trade-relevant diseases in Australia.

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 4 shows the number of herds known to be infected.

Table 4 Herds[a] known to be infected with Johne's disease, at 31 March 2016

State	Cattle	Deer	Goat	Total
NSW	117	0	0	117
NT	0	0	0	0
Qld	6	0	0	6
SA	51	0	2	53
Tas	39	0	4	43
Vic	915	2	13	930
WA	0	0	0	0
Aus	**1 128**	**2**	**19**	**1 149**

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

Table 5 Summary of National Sheep Health Monitoring Project (NSHMP) inspected and infected line results, January–March 2016

State	Number of animals inspected	Number of PICs inspected	Number of PICs infected	Percentage of PICs infected
NSW	41 120	100	1	1.0
NT	0	0	0	0.0
Qld	4 503	16	0	0.0
SA	174 818	829	2	0.2
Tas	24 295	66	3	4.5
Vic	63 438	266	27	10.2
WA	18 156	51	0	0.0
Aus	**326 330**	**1 328**	**33**	**2.5**

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 6. For status definition, see the current species MAP manual[33]. Lists of alpaca, cattle and goat herds and sheep flocks assessed in the MAPs are available on the Endemic Disease Information System website[34]. 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 6 Herds or flocks[a] with a Market Assurance Program status of at least Monitored Negative 1, 1 October – 31 March 2016

Quarter	Alpaca	Cattle	Goat	Sheep	Total
Oct–Dec 2015	19	360	24	377	780
Jan–Mar 2016					
NSW	10	141	12	150	313
Qld	0	0	3	1	4
SA	7	109	8	159	283
Tas	0	35	1	13	49
Vic	1	61	2	44	108
WA	0	0	0	4	4
Aus	**18**	**346**	**26**	**371**	**761**

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 7 shows the number of accredited flocks at the end of the quarter.

Table 7 Ovine contagious epididymitis accredited-free flocks, 1 January 2015 – 31 March 2016

State	Jan–Mar 2015	Apr–Jun 2015	Jul–Sep 2015	Oct–Dec 2015	Jan–Mar 2016
NSW	865	865	858	846	872
Qld	80	77	77	79	79
SA	522	530	530	530	530
Tas	68	68	59	62	63
Vic	504	496	489	471	445
WA	195	194	194	183	185
Aus	**2 234**	**2 230**	**2 207**	**2 171**	**2 174**

33 www.animalhealthaustralia.com.au/maps

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

Laboratory testing

Serological testing

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

Table 8 Results of serological testing for two equine viruses, 1 January 2015 – 31 March 2016

	No. of tests (equine infectious anaemia)	Positive (equine infectious anaemia)	No. of tests (equine viral arteritis)	Positive (equine viral arteritis)
Jan–Mar 2015	707	0	897	6
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				
NSW	404	0	409	2
NT	0	0	0	0
Qld	3	0	2	0
SA	0	0	0	0
Tas	0	0	0	0
Vic	213	0	183	0
WA	**9**	**0**	**9**	**0**
Aus	**629**	**0**	**603**	**2**

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

Table 9 Results of testing for equine herpesvirus 1, at 31 March 2016

Syndrome	Negative	Positive	Total
Abortion	10	0	10
Neurological	13	1	14
Other	12	0	12
Total	**35**	**1**	**36**

Table 10 summarises the results of serological testing for three arboviruses on samples submitted to state and territory animal health laboratories for the National Arbovirus Monitoring Program (NAMP)[35]. **Positive serological test results are not an indication of the presence of clinical disease.**

Table 10 Results of serological testing for three arboviruses, 1 January 2015 – 31 March 2016

Quarter	No. of tests (Akabane)	Positive (Akabane)	No. of tests (BEF)	Positive (BEF)	No. of tests (BTV)	Positive (BTV)
Jan–Mar 2015	257	11	598	46	1 336	37
Apr–Jun 2014	782	31	837	41	1 650	40
Jul–Sep 2015	454	22	576	33	882	37
Oct–Dec 2015	196	12	514	47	765	10
Jan–Mar 2016	**220**	**0**	**771**	**34**	**1 385**	**75**

BEF = bovine ephemeral fever virus; BTV = bluetongue virus

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

Surveillance activities

Bovine brucellosis

Australia declared freedom from bovine brucellosis (caused by *Brucella abortus*) in 1989[36]. Surveillance is maintained through abortion investigations and additional testing of cattle for export or other reasons. Table 11 shows 202 bovine abortion investigations and 704 investigations for other reasons were performed during the quarter; all were negative for bovine brucellosis.

Table 11 **Bovine brucellosis testing, 1 January 2015 – 31 March 2016**

Quarter	No. of tests (abortion)	Positive (abortion)	No. of tests (other reasons)[a]	Positive (other reasons)
Jan–Mar 2015	133	0	1 530	0
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				
NSW	7	0	627	0
NT	0	0	0	0
Qld	15	0	1	0
SA	38	0	38	0
Tas	5	0	0	0
Vic	71	0	8	0
WA	66	0	30	0
Aus	**202**	**0**	**704**	**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.

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

National Transmissible Spongiform Encephalopathies Surveillance Program

The National Transmissible Spongiform Encephalopathies Surveillance Program (NTSESP) is an integrated national program jointly funded by industry and government to demonstrate Australia's ongoing freedom from bovine spongiform encephalopathy (BSE) and classical scrapie, and to provide early detection of these diseases should they occur. The program, based on the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code*[37], involves testing of samples from cattle and sheep with clinical signs consistent with BSE or scrapie respectively, as well as from fallen and casualty slaughter cattle. Points are assigned to cattle samples according to the animal's age and subpopulation category (i.e. the likelihood of detecting BSE). Australia's target is to achieve a minimum of 150 000 points over a rolling 7-year period. Table 12 shows the number of animals sampled for BSE and scrapie and the points tally for cattle in the NTSESP[38] during the past 12 months. All samples tested were negative.

Table 12 Samples tested for transmissible spongiform encephalopathies (TSEs), 1 April 2015 – 31 March 2016

State	No. examined (cattle)	Points (cattle)	Positive (cattle)	No. examined (sheep)	Positive (sheep)
NSW	156	51 485.8	0	204	0
NT	38	15 305.0	0	0	0
Qld	146	50 447.1	0	22	0
SA	35	17 212.5	0	51	0
Tas	26	3 969.8	0	17	0
Vic	139	38 184.2	0	141	0
WA	23	12 735.7	0	110	0
Aus	**563**	**174 066.3**	**0**	**545**	**0**

37 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

38 https://www.animalhealthaustralia.com.au/what-we-do/disease-surveillance/tse-freedom-assurance-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, 512 birds from 77 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 13). Tests included competitive ELISA, haemagglutination inhibition, agar gel immunodiffusion, reverse-transcriptase PCR and virus isolation.

Table 13 Results of testing for avian influenza virus in poultry, 1 January – 31 March 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 in all Australian jurisdictions. Vaccination exceptions for broilers apply in Tasmania, Western Australia, Queensland and South Australia.

During the quarter, 444 birds from 70 laboratory submissions were tested for Newcastle disease (Table 14).

Table 14 Results of testing for Newcastle Disease testing in poultry, 1 January – 31 March 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 15 summarises *Salmonella* spp. isolations from animals reported to NEPSS.

Table 15 ***Salmonella* notifications reported to the National Enteric Pathogen Surveillance Scheme (NEPSS), 1 January – 31 March 2016**

Salmonella serovar	Birds[a]	Cats	Cattle	Dogs	Horses	Pigs	Sheep	Other	Total
Bovismorbificans	0	0	7	0	0	0	0	0	7
Dublin	0	0	2	0	0	0	0	0	2
Infantis	0	0	3	0	0	2	0	0	5
Typhimurium	0	9	14	4	0	1	3	3	34
Other	5	2	28	8	3	22	0	16	84
Total	**5**	**11**	**54**	**12**	**3**	**25**	**3**	**19**	**132**

a Includes both poultry and wild birds.

Northern Australian 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 16 summarises NAQS animal testing for specific target diseases in Australia during the past five quarters.

Table 16 **Disease testing and pest surveillance under the Northern Australia Quarantine Strategy (NAQS), 1 January 2015 – 31 March 2016**

	Jan–Mar 2015		Apr–Jun 2015		Jul–Sep 2015		Oct–Dec 2015		Jan–Mar 2016	
Target disease	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive	Tested	Positive
Aujeszky's disease[a]	0	0	31	0	73	0	154	0	**45**	**0**
Avian influenza[b]	0	0	48	0	0	0	0	0	**0**	**0**
Classical swine fever	0	0	252	0	73	0	154	0	**58**	**0**
Japanese encephalitis	22	0	42	0	0	0	0	0	**36**	**0**
Surra (*Trypanosoma evansi*)	0	0	278	0	73	0	183	0	**16**	**0**

a The NAQS surveillance strategy for Aujeszky's disease has recently been reviewed and serological screening of wild pig populations 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.

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[39]. 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 investigation of myiasis (reported in *Suspect exotic or emergency disease investigations* and Table 19). Fly trapping is conducted at locations suitable for local OWS establishment following a potential incursion; in areas neighbouring livestock export ports and the Northern Peninsula Area(NPA) of Queensland. Table 17 summarises fly trapping events over the past year. No screw-worm fly were detected. Further information on the screw-worm fly program is available on the Animal Health Australia website[40].

Table 17 Summary of fly trapping events conducted, 1 April 2015 – 31 March 2016[a]

Risk entry pathway	Conducted by	Apr–Jun 2015	Jul–Sep 2015	Oct–Dec 2015	Jan–Mar 2016
Torres Strait	NAQS	29	41	15	15
Livestock export ports	NT, Qld and WA governments	24	46	28	35

NAQS = Northern Australia Quarantine Strategy

a Excludes traps with identification results pending.

Public health

The National Notifiable Diseases Surveillance System (NNDSS) coordinates the national surveillance of more than 50 communicable diseases or disease groups. Unit records of disease notifications made to the state or territory health authority, under the provisions of the public health legislation in their jurisdiction, are supplied daily to the Office of Health Protection, Australian Government Department of Health. The data are published weekly on the NNDSS website[41] and quarterly in the journal *Communicable Diseases Intelligence* and are replicated in *Animal Health Surveillance Quarterly* (Table 18) for five important zoonoses.

Table 18 National notifications of five zoonotic infections in humans, 1 January 2015 – 31 March 2016

Quarter	Brucellosis[a]	*Chlamydia*[b]	Leptospirosis	Listeriosis	Q fever
Jan–Mar 2015	1	1	20	16	129
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					
ACT	0	0	0	0	0
NSW	1	1	3	12	48
NT	0	0	0	0	0
Qld	1	0	41	3	57
SA	0	0	0	1	6
Tas	0	0	0	0	0
Vic	0	1	2	10	3
WA	0	0	1	1	3
Aus	**2**	**2**	**47**	**27**	**117**

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'.

39 National List of Notifiable Animal Diseases www.agriculture.gov.au/pests-diseases-weeds/animal/notifiable [updated November 2015; cited 23 May 2016].

40 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 23 May 2016].

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

National notifiable animal disease investigations

During the quarter, 581 national notifiable animal disease[42] investigations were conducted into suspect disease events. National notifiable animal diseases include a subset of emergency diseases[43]. Table 19 lists investigations conducted by disease finding confirmed. Note that more than one disease may be investigated for a single disease event (an outbreak of morbidity or mortality). In addition, a single investigation may involve more than one animal.

Details about selected investigations are provided in the 'State and territory reports' section of this publication and are available by contacting the relevant state or territory NAHIS program coordinator (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[44].

Table 19 **Investigations for national notifiable animal diseases, January–March 2016**

Disease	Species	State	Month	Response code[a]	Finding
African swine fever	Pig	NT	Feb	3	Negative
	Pig	WA	Feb	3	Negative
Anaplasmosis in tick-free areas	Cattle	NSW	Mar	2	Negative
Australian bat lyssavirus	Bat	Vic.	Jan	3	Negative (7 unrelated investigations)
	Bat	Vic.	Feb	3	Negative (6 unrelated investigations)
	Bat	Vic.	Mar	3	Negative (7 unrelated investigations)
Babesiosis in tick-free areas	Cattle	NSW	Jan	2	Negative
	Cattle	NSW	Mar	2	Negative (4 unrelated investigations)
	Sheep	NSW	Mar	2	Negative
Bluetongue — clinical disease	Cattle	NSW	Mar	2	Negative
	Goat	Vic	Jan	2	Negative
	Sheep	NSW	Feb	2	Negative (2 unrelated investigations)
	Sheep	NSW	Mar	2	Negative (3 unrelated investigations)
	Sheep	WA	Jan	2	Negative (4 unrelated investigations)
	Sheep	WA	Feb	2	Negative (4 unrelated investigations)
	Sheep	WA	Mar	2	Negative (4 unrelated investigations)
Bovine viral diarrhoea virus type 2	Cattle	WA	Jan	2	Negative
	Pig	NT	Feb	3	Negative
Brucella suis	Dog	NSW	Jan	2	Negative (28 unrelated investigations)
	Dog	NSW	Feb	2	Negative (14 unrelated investigations)
	Dog	NSW	Mar	2	Negative (10 unrelated investigations)
	Dog	NSW	Mar	2	Positive (2 unrelated investigations)b
	Dog	Qld	Feb	2	Positive[b]
	Dog	Qld	Feb	3	Positive[b]
	Dog	Qld	Mar	2	Negative (3 unrelated investigations)
	Dog	Qld	Mar	2	Positive[b]
	Horse	NT	Mar	3	Negative
	Pig	NSW	Jan	2	Negative
	Pig	SA	Feb	2	Negative
	Pig	SA	Mar	2	Negative
Enzootic bovine leucosis	Cattle	Vic.	Feb	2	Negative
Equine encephalomyelitis (eastern, western and Venezuelan)	Horse	WA	Mar	3	Negative

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

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

44 www.agriculture.gov.au/animal-plant-health/emergency

Table 19 *Continued*

Disease	Species	State	Month	Response code[a]	Finding
Foot-and-mouth disease	Cattle	NSW	Feb	3	Negative (2 unrelated investigations)
	Cattle	NSW	Mar	3	Negative
	Cattle	SA	Jan	3	Negative
	Cattle	SA	Mar	3	Negative
	Cattle	Vic.	Jan	3	Negative
	Cattle	Vic.	Feb	3	Negative (4 unrelated investigations)
	Cattle	Vic.	Mar	3	Negative (4 unrelated investigations)
	Pig	NSW	Feb	3	Negative (2 unrelated investigations)
	Pig	NT	Feb	3	Negative
	Sheep	NSW	Feb	3	Negative (2 unrelated investigations)
	Sheep	SA	Mar	3	Negative
	Sheep	Vic.	Jan	3	Negative
	Sheep	Vic.	Mar	3	Negative
Haemorrhagic septicaemia	Cattle	WA	Mar	2	Negative (2 unrelated investigations)
Infection of bees with *Melissococcus plutonius* (European foulbrood)	Bees	NT	Mar	3	Negative
	Bees	Qld	Jan	2	Negative (11 unrelated investigations)
	Bees	Qld	Jan	2	Positive
	Bees	Qld	Feb	2	Negative (14 unrelated investigations)
	Bees	Qld	Mar	2	Negative (6 unrelated investigations)
Infection of bees with *Paenibacillus* larvae (American foulbrood)	Bees	NT	Mar	2	Negative
	Bees	Qld	Jan	2	Negative (2 unrelated investigations)
	Bees	Qld	Jan	2	Positive (11 unrelated investigations)
	Bees	Qld	Feb	2	Negative (4 unrelated investigations)
	Bees	Qld	Feb	2	Positive (10 unrelated investigations)
	Bees	Qld	Mar	2	Negative (4 unrelated investigations)
	Bees	Qld	Mar	2	Positive (2 unrelated investigations)
	Bees	SA	Jan	2	Positive
	Bees	SA	Feb	2	Negative (8 unrelated investigations)
	Bees	SA	Feb	2	Positive (4 unrelated investigations)
	Bees	SA	Mar	2	Negative (27 unrelated investigations)
	Bees	SA	Mar	2	Positive (8 unrelated investigations)
Infection with Aujezsky's disease virus	Pig	SA	Mar	3	Negative
	Pig	WA	Mar	3	Negative
Infection with Bungowannah virus (porcine myocarditis)	Pig	NSW	Feb	2	Negative
Infection with classical swine fever virus	Pig	SA	Mar	3	Negative
	Pig	WA	Feb	3	Negative
Infection with Hendra virus	Horse	NSW	Jan	2	Negative (26 unrelated investigations)
	Horse	NSW	Feb	2	Negative (18 unrelated investigations)
	Horse	NSW	Mar	2	Negative (21 unrelated investigations)
	Horse	NT	Jan	2	Negative
	Horse	Qld	Jan	2	Negative (70 unrelated investigations)
	Horse	Qld	Feb	2	Negative (63 unrelated investigations)
	Horse	Qld	Mar	2	Negative (68 unrelated investigations)
	Horse	SA	Mar	3	Negative
	Horse	Vic.	Jan	3	Negative
	Horse	Vic.	Feb	2	Negative (3 unrelated investigations)
	Horse	Vic.	Mar	2	Negative (2 unrelated investigations)
	Horse	Vic.	Mar	3	Negative

Table 19 *Continued*

Disease	Species	State	Month	Response code[a]	Finding
Infection with influenza A viruses in swine	Pig	Qld	Mar	2	Negative
	Pig	WA	Jan	2	Negative
	Pig	WA	Feb	2	Negative (3 unrelated investigations)
	Pig	WA	Mar	2	Negative (2 unrelated investigations)
Infection with Menangle virus	Horse	NSW	Feb	2	Negative
Infection with porcine epidemic diarrhoea virus	Pig	NT	Feb	3	Negative
	Pig	WA	Jan	3	Negative
Infection with swine vesicular disease virus	Pig	NSW	Feb	3	Negative
Infection with vesicular stomatitis virus	Cattle	NSW	Feb	3	Negative (4 unrelated investigations)
	Cattle	NSW	Mar	3	Negative (2 unrelated investigations)
	Cattle	SA	Jan	3	Negative
	Cattle	SA	Mar	3	Negative
	Cattle	Vic.	Jan	3	Negative
	Cattle	Vic.	Feb	3	Negative (4 unrelated investigations)
	Cattle	Vic.	Mar	3	Negative (4 unrelated investigations)
	Pig	NSW	Feb	3	Negative
	Sheep	NSW	Feb	3	Negative (2 unrelated investigations)
	Sheep	SA	Mar	3	Negative
	Sheep	Vic.	Mar	3	Negative
	Sheep	Vic.	Mar	3	Negative
	Sheep	Vic.	Jan	3	Negative
Infestation of bees with *Varroa destructor* or *V. jacobsoni* (varroosis)	Bees	Vic.	Jan	2	Negative
	Bees	Vic.	Feb	2	Negative
Malignant catarrhal fever — wildebeest-associated	Cattle	NSW	Feb	3	Negative
	Cattle	WA	Feb	2	Negative
	Cattle	NSW	Mar	3	Negative
Nipah virus infection	Pig	SA	Mar	3	Negative
Porcine reproductive and respiratory syndrome	Pig	WA	Feb	3	Negative
	Pig	WA	Mar	3	Negative
Screw-worm fly — Old World (*Chrysomya bezziana*)	Dog	Qld	Jan	2	Negative
Sheep pox and goat pox	Sheep	NSW	Feb	3	Negative
	Sheep	WA	Jan	2	Negative
Transmissible gastroenteritis	Pig	Vic	Feb	3	Negative
	Pig	WA	Jan	3	Negative
West Nile virus infection — clinical	Horse	SA	Jan	2	Negative
	Horse	WA	Feb	3	Negative
	Horse	WA	Mar	3	Negative

a **Key to response codes**

1 = Field investigation by government officer

2 = Investigation by state or territory government veterinary laboratory

3 = Specimens sent to the CSIRO Australian Animal Health Laboratory (or CSIRO Entomology)

4 = Specimens sent to reference laboratories overseas

5 = Regulatory action taken (biosecurity or police officers)

6 = Alert or standby

7 = Eradication

b Infection with *B. suis* occurs rarely in dogs that have had contact with feral pigs or their products.

animalhealth AUSTRALIA

Animal Health Surveillance QUARTERLY

EMERGENCY ANIMAL DISEASE WATCH HOTLINE

1800 675 888

There were 1037 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) collects summaries of animal health information from many sources; detailed data are maintained by the source organisations. Please contact the relevant person below if further details are required. NAHIS is on the internet (nahis.animalhealthaustralia.com.au).

Name	Role	Phone	Email
Ian Langstaff	NAHIS program manager	02 6203 3909	ILangstaff@animalhealthaustralia.com.au
Brett Herbert	Aquatic Animal Health	02 6272 5402	Brett.Herbert@agriculture.gov.au
Corissa Miller	Australian Government NAHIS coordinator	02 6272 3645	Corissa.Miller@agriculture.gov.au
Venessa McEniery	Australian Milk Residue Analysis Survey	03 9810 5930	VMcEniery@dairysafe.vic.gov.au
Tiggy Grillo	Wildlife Health Australia	02 9960 7444	TGrillo@wildlifehealthaustralia.org.au
Janet Strachan	National Enteric Pathogens Surveillance Scheme	03 8344 5701	JanetES@unimelb.edu.au
Mark Trungove	National Notifiable Diseases Surveillance System	02 6289 8315	Mark.Trungove@health.gov.au
Bonnie Skinner	Surveillance information coordinator	02 6203 3943	BSkinner@animalhealthaustralia.com.au
Rob Barwell	Johne's disease coordinator	02 6203 3947	RBarwell@animalhealthaustralia.com.au
Skye Fruean	Northern Australia Quarantine Strategy	07 4241 7866	Skye.Fruean@agriculture.gov.au
State and territory coordinators			
Rory Arthur	New South Wales	02 6391 3687	Rory.Arthur@dpi.nsw.gov.au
Susanne Fitzpatrick	Northern Territory	08 8999 2123	Susanne.Fitzpatrick@nt.gov.au
Greg Williamson	Queensland	07 3330 4545	Greg.Williamson@daf.qld.gov.au
Celia Dickason	South Australia	08 8207 7807	Celia.Dickason@sa.gov.au
Mary Lou Conway	Tasmania	03 6233 6330	MaryLou.Conway@dpipwe.tas.gov.au
Karen Moore	Victoria	03 5430 4525	Karen.Moore@ecodev.vic.gov.au
Jamie Finkelstein	Western Australia	08 9368 3805	Jamie.Finkelstein@agric.wa.gov.au

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