Wildlife Health Australia

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

Wildlife Health Australia (WHA)[17] is the peak body for wildlife health in Australia. WHA was established as the Australian Wildlife Health Network in 2002 as an Australian Government initiative to coordinate wildlife health surveillance information across Australia, to support Australia's animal health industries, human health, biodiversity, trade and tourism. WHA collates information from multiple sources into a national database — the Wildlife Health Information System (eWHIS)[18] — including submissions by WHA subscribers, state and territory WHA coordinators, researchers, and university, zoo and sentinel clinic veterinarians.

During the quarter, 190 wildlife disease investigation events were reported in eWHIS (Table 1), and samples were collected from 1226 wild birds for avian influenza and avian paramyxovirus-1 surveillance.

This report details some of the disease and mortality events in free-living wildlife recorded in eWHIS this quarter. WHA thanks all those who submitted information for this report.

Wild bird mortality event summary — Newcastle disease and avian influenza exclusion

WHA received 59 reports of wild bird mortality or morbidity investigations from around Australia during the quarter; investigations may involve a single animal or multiple animals (e.g. mass mortality event). A breakdown of the bird orders represented is presented in Table 2. Reports and samples from sick and dead birds are received from members of the public, private practitioners, universities, zoo wildlife clinics and wildlife sanctuaries. Avian influenza (AI) was excluded by polymerase chain reaction (PCR) testing for influenza A in 14 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 45 events, based on clinical signs, history, prevailing environmental conditions or other diagnoses. Also, avian paramyxovirus was excluded in 13 events by PCR testing specifically for Newcastle disease (ND) virus and/or pigeon paramyxovirus type 1 (PPMV-1).

Detection of pigeon paramyxovirus type 1 in feral pigeons

In October and November, four feral pigeons (*Columba livia*) were found in Sydney with neurological signs, including stumbling and rolling, inability to fly and inability to prehend food.

The birds were euthanased and necropsy was performed at Taronga Zoo Wildlife Hospital. Based on the history and clinical signs, cloacal and tracheal swabs were submitted to NSW DPI Elizabeth Macarthur Agricultural Institute, Menangle, for notifiable disease testing. Pooled cloacal swabs from three of the birds tested positive on PCR assay for PPMV-1.[19] AI was excluded by PCR testing.

Another two feral pigeons were found dead and emaciated at the same location in a similar period. These pigeons were presumptively diagnosed with avian trichomoniasis (*Trichomonas gallinae*)[20] based on typical yellow caseous lesions in the oral cavity observed at necropsy.

Seabird and shorebird mortalities — avian influenza and avian paramyxovirus excluded

From October to December, migratory shorebirds and seabirds arrive from their Northern Hemisphere breeding grounds to form aggregations along Australian coastlines and at inland wetlands.[21,22] Targeted wild bird AI surveillance and risk analysis has demonstrated a low likelihood of migratory birds introducing highly pathogenic AI viruses into

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

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

19 WHA 2016, *Avian Paramyxoviruses and Australian Wild Birds*, Fact sheet, November 2016, Wildlife Health Australia. www.wildlifehealthaustralia.com.au/FactSheets.aspx

20 WHA 2014, *Trichomoniasis in Australian Wild Birds*, Fact sheet, June 2014, Wildlife Health Australia. www.wildlifehealthaustralia.com.au/FactSheets.aspx

21 McCallum H, Roshier D, Tracey J, Joseph L, Heinsohn R (2004) Will the Wallace Line save Australia from avian influenza? *Ecology and Society* 13 (2).

22 Tracey JP, Woods R, Roshier D, West P, Saunders GR. (2004) The role of wild birds in the transmission of avian influenza for Australia: an ecological perspective. *Emu* 104 (2): 109-124.

Table 1 Number of disease investigations reported into eWHIS, October to December 2017[a]

Bats[b]	Birds[c,d]	Marsupials	Feral mammals	Marine turtles	Marine mammals	Monotremes	Amphibians
89	59	34	2	2	2	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.
c Additional sampling for targeted avian influenza surveillance is presented separately.
d Includes free-ranging birds (native or feral species) and a small number of events involving birds from zoological collections.

Table 2 Wild bird disease investigations reported into eWHIS, October to December 2017

Bird order	Common name for bird order[a]	Events reported[b]
Anseriformes	Magpie goose, ducks, geese and swans	3
Charadriiformes	Shorebirds	3
Columbiformes	Doves and pigeons	2
Coraciiformes	Bee-eaters and kingfishers	1
Falconiformes	Falcons	3
Galliformes	Brush turkeys, scrubowls and quails	1
Passeriformes	Passerines or perching birds	20
Pelecaniformes	Ibis, herons and pelicans	5
Psittaciformes	Parrots and cockatoos	20
Sphenisciformes	Penguins	1

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

Australia[23,24,25,26]. Excluding AI as a cause of wild bird mortality and morbidity is an important activity at this time of the year, especially in locations where long-distance migrants arrive in Australia.

Migratory seabirds and shorebirds face many threats along their flyways, including habitat loss and degradation, predation, human disturbance, over-fishing, pollution (including microplastics) and climate change. A number of activities are undertaken within Australia to conserve migratory bird populations and their habitats.[27,28] Wildlife disease surveillance, through diagnostic investigation of seabird and shorebird mortality events, may contribute to a better understanding of disease due to natural or anthropogenic origins.[29,30]

During the quarter, a number of unrelated shorebird (Charadriiformes) and seabird mortality events were investigated from multiple jurisdictions.

Tailem Bend, South Australia

In Tailem Bend region, South Australia, approximately 60 sick and dead crested terns (*Thalasseus bergii*) and one dead Caspian tern (*Hydroprogne caspia*) were reported in October. Birds were described huddled and fluffed up, occasionally rolling their heads and reportedly dying in 4 to 6 hours.

Five deceased crested terns and the Caspian tern were submitted for diagnostic investigation to Gribbles Veterinary Pathology. Necropsy found consistent evidence of degeneration and erosion of the koilin layer of the gizzard with mucosal bleeding and accumulation of digested blood in the intestinal tract (melaena). Possible causes

23 East IJ, Hamilton S, Garner G. (2008) Identifying areas of Australia at risk of H5N1 avian influenza infection from exposure to migratory birds: a spatial analysis. *Geospat Health* 2: 203–213.

24 Curran J (2012) The surveillance and risk assessment of wild birds in northern Australia for highly pathogenic avian influenza H5N1 virus [PhD thesis]. Murdoch University, Australia, 2012.

25 Hansbro PM, Hansbro PM, Warner S, Tracey JP, Arzey KE, Selleck P, O'Riley K, Beckett EL, Bunn C, Kirkland PD, Vijaykrishna D, Olsen B (2010) Surveillance and analysis of avian influenza viruses, Australia. *Emerg Infect Dis* 16: 1896.

26 Grillo V, Arzey KE, Hansbro PM, Hurt AC, Warner S, Bergfeld J, Burgess GW, Cookson B, Dickason CJ, Ferenczi M, Hollingsworth T, Hoque M Jackson RB, Klaassen M, Kirkland PD, Kung NY, Lisovski S, O'Dea MA, O'Riley K, Roshier D, Skerratt LK, Tracey JP, Wang X, Woods R, Post L (2015) Avian influenza in Australia: a summary of 5 years of wild bird surveillance. *Australian Veterinary Journal* 93 (11): 387–393.

27 www.environment.gov.au/biodiversity/migratory-species/migratory-birds

28 www.birdlife.org.au/locations/australasian-wader-studies-group/about-flyways

29 Simpson VR & Fisher DN (2017) A description of the gross pathology of drowning and other causes of mortality in seabirds. *BMC Veterinary Research* 13(1): 302.

30 Newman SH, Chmura A, Converse K, Kilpatrick AM, Patel N, Lammers E, Daszak P (2007) Aquatic bird disease and mortality as an indicator of changing ecosystem health. *Marine Ecology Progress Series* 352: 299–309

include mycotoxins, heavy metals and nutritional, viral and fungal disease, including infection with avian gastric yeast. AI and avian paramyxovirus (APMV) were both excluded via PCR assay.

No fungi (including avian gastric yeast) were detected by fungal culture and microscopic examination. All heavy metals tested for in pooled frozen liver samples, by Symbio Laboratories, were within normal ranges found for seabirds. There was evidence of superficial bacterial colonisation within the affected gastrointestinal lesions of some of the birds. However, these findings were considered most likely to reflect a secondary infection. There was evidence of tapeworm burden, which may have contributed to the general debility of these birds, but most likely an incidental finding as gastrointestinal parasites are not uncommon in wild birds.

Despite no specific cause identified, the secondary effects of gastrointestinal tract haemorrhage and subsequent melaena were considered to be responsible for the weakness and deaths of these birds.

Apollo Bay, Victoria

In September, 68 crested terns were found dead in Apollo Bay over a 2-day period.

Two birds were taken to the local veterinarian for X-ray, on suspicion they had been shot. The birds were frozen and submitted to the University of Melbourne. Necropsy revealed subcutaneous haemorrhage associated with skin puncture and haemorrhage in the thorax and liver, suggestive of possible predation secondary to another illness. There was no evidence the birds had been shot.

Histology undertaken at AgriBio, Bundoora, found no further significant findings. Based on frozen liver samples submitted to Symbio Laboratories, all pesticide residues tested were less than the level of reporting. AI viruses and APMV were excluded via PCR assay at AgriBio, Bundoora.

Agencies investigating the events in Victoria and South Australia were in contact to compare findings. In both events, no further deaths were reported. The two birds submitted in Victoria had autolytic and artefactual changes which may have masked pathological lesions. Without additional birds submitted for necropsy, limited comparisons could be made between the events in Tailem Bend and Apollo Bay.

Albany, Western Australia

In October, 77 flesh-footed shearwaters (*Ardenna carneipes*) were found dead in a state of mild decomposition in Albany, Western Australia. Eight partially frozen birds, examined at the Department of Primary Industries and Regional Development (DPIRD), were described as being in poor body condition.

Although examined tissues were autolysed and findings should be interpreted with caution, four birds presented congestion of the meninges and lungs, which is a common finding in drowned seabirds.[31] No significant toxins were detected in the stomach (n = 2) or the liver (n = 2) of the birds submitted. Brain acetylcholinesterase levels did not support organophosphate or carbamate toxicity. Birds submitted were also negative for AI and APMV via PCR assay.

Broome, Western Australia

In November, a broad-billed sandpiper (*Calidris falcinellus*) was found moribund in Broome. The bird was euthanased, and necropsy findings included an empty gastrointestinal tract, emaciation and moderate, chronic, multifocal lymphoplasmacytic enteritis with cestodes (tapeworms) in the small intestine.

It is not unusual to find parasites in wild birds, and cestodes, in particular, are typically not associated with clinical disease. However, in this case, the infestation was considered significant and the likely cause of death, on the basis of large numbers of cestodes found in each of the small sections of small intestine examined histologically. AI and APMV were excluded via PCR assay.

Roebuck Bay, Western Australia

Also in November, three sick great knots (*Calidris tenuirostris*) were found at Roebuck Bay, near Broome. Two of the birds were colour banded and had been sighted in recent weeks in the area, and therefore were not thought to be suffering from exhaustion after migration from eastern Siberia.[32]

One bird died and a second bird was euthanased and both submitted frozen to DPIRD for investigation. Trauma was diagnosed based on gross and microscopic lesions. Toxicity due to organophosphates and botulinum were excluded. AI and APMV were excluded via PCR assay.

Importance of reporting seabird and shorebird mortalities

Many of the species involved in these events are listed as migratory species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).[33] However, some species (e.g. terns) are predominantly short-distant migrants and, by and large, remain on the Australian continent in resident populations. The main

31 Simpson VR& Fisher DN (2017). A description of the gross pathology of drowning and other causes of mortality in seabirds. *BMC Veterinary Research*, 13(1), 302.

32 Department of the Environment 2018. *Calidris tenuirostris* in Species Profile and Threats Database, Department of the Environment, Canberra. www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=862

33 Department of the Environment 2018. *SPRAT EPBC Migratory Lists in Species Profile and Threats Database*, Department of the Environment, Canberra. www.environment.gov.au/cgi-bin/sprat/public/publicshowmigratory.pl

long-distance migrants noted here are the broad-billed sandpiper and the great knot. The great knot is listed as critically endangered under the EPBC Act.

Although, in many instances, the seabird and shorebird mortalities reported here do not have a conclusive diagnosis, these events highlight the importance of reporting unusual signs of disease or deaths in these species. Reporting provides not only the opportunity to exclude notifiable diseases of concern (e.g. AI and APMV) but also an opportunity to investigate other threats facing these species.

Avian influenza and avian paramyxovirus type 1 surveillance

Australia's National Avian Influenza Wild Bird (NAIWB) and Avian Paramyxovirus-1 Surveillance Program comprises two sampling components: pathogen-specific risk-based surveillance by sampling of apparently healthy, live and hunter-killed wild birds; and general surveillance by investigating significant unexplained morbidity and mortality events in wild birds, including captive and wild birds within zoo grounds (with a focus on exclusion testing for AI virus subtypes H5 and H7).

Samples from sick or dead birds were discussed earlier. Sources for targeted wild bird surveillance data include state and territory government laboratories, universities and samples collected through the Northern Australia Quarantine Strategy (NAQS). Surveillance activities were expanded in 2017 to include testing for avian paramyxoviruses (APMVs), predominantly targeting the APMV-1.

During the quarter, pathogen-specific risk-based surveillance occurred at sites in New South Wales, Queensland, South Australia and Western Australia. Faecal environmental swabs were collected from 1226 waterbirds, with 1226 tested for AI and 870 for APVM-1. Results are pending.

White-nose syndrome excluded in microbats

White-nose syndrome (WNS) was excluded in October in a mass mortality of more than 200 eastern bent-wing bats (*Miniopterus schreibersii oceanensis*) in a cave in Bungonia National Park in New South Wales. The eastern bent-wing bat is listed as vulnerable under the *Biodiversity Conservation Act 2016* (NSW).

WNS is caused by the fungus *Pseudogymnoascus destructans*, which has not been identified in Australia (AHSQ Vol. 22 Issue 2). Australian bat species hibernating in caves with a climate suitable for *P. destructans* growth are considered potentially susceptible to the disease.[34] Testing for WNS is considered when cave-dwelling bats display signs of:

- white or grey powdery fungus on the face, fur, skin or wings
- non-traumatic wing damage
- mass mortality events
- abnormal behaviour, such as flying during the day.[35]

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

35 WHA 2016, How to report a suspect case of white-nose syndrome, June 2016, Wildlife Health Australia. www.wildlifehealthaustralia.com.au/ProgramsProjects/BatHealthFocusGroup.aspx - WNS

Eastern bent-wing bats have been identified as one of the species of cave-dwelling bats from southern Australia most likely to be affected by WNS if it were to be introduced into Australia.[33]

After cavers reported more than 200 dead eastern bent-wing bats to the NSW Office of Environment and Heritage, five deceased bats covered in varying amounts of white fungus were collected by NSW National Parks and Wildlife staff. The degree of desiccation indicated that the mortality had occurred at least 4 to 6 weeks previously. Post-mortem fungal invasion was considered the most likely explanation for the white fungus observed on the bats.

To rule out WNS as a possible cause of the mass mortality event, samples were sent to the CSIRO Australian Animal Health Laboratory. They tested negative for *P. destructans* by PCR assay. The cause of the mortality is not known due to the desiccation of the carcases.

WNS was also excluded in an eastern forest bat (*Vespadelus pumilus*) from Queensland. The bat had died in 2014 and had been held frozen until October 2017, when it was examined at the Queensland Biosecurity Sciences Laboratory as part of a research project. The researcher noted white flocculent material on the nasal planum and a focus of depigmentation on the wing. Although this bat species has not been identified as a high risk for WNS were it to be introduced to Australia,[33] samples were submitted for WNS exclusion due to the appearance of the lesions. WNS was excluded by PCR testing for *P. destructans* at CSIRO Australian Animal Health Laboratory. The appearance of the skin was considered a possible artefact of freezing.

For more information on WNS and Australia's preparedness activities for this exotic disease, read the Wildlife Health Australia fact sheet,[36] the Australian Government Department of Agriculture and Water Resources website[37] and 'White-nose syndrome and the risk to Australian bats' (AHSQ Vol. 22 Issue 2).

Australian bat lyssavirus

Reports to WHA for the quarter included 122 bats tested for Australian bat lyssavirus (ABLV) from the Australian Capital Territory, New South Wales, Northern Territory, Queensland, South Australia, Victoria and Western Australia.

Bat submissions were made for a variety of reasons:

- 49 cases involved contact with the potential for ABLV transmission to humans; of these
  - 12 were also associated with trauma (e.g. netting or barbed wire fence entanglement, motor vehicle trauma)
  - 8 involved contact with a pet dog or cat
  - 7 displayed other (non-neurological) signs
  - 1 displayed neurological signs (seizure)
  - the remainder had no further history reported
- 36 cases involved contact with a pet dog (33) or cat (3)
- 14 bats were associated with a mass mortality event
- 12 bats displayed neurological signs (e.g. aggression, erratic flight, inability to swallow, weakness, paralysis, staring, tremors, seizures)
- 8 cases were associated with trauma (e.g. fracture, wing membrane injury)
- 3 bats displayed other (non-neurological) signs (e.g. dehydration).

During the quarter, 15 flying-foxes were confirmed positive for ABLV by fluorescent antibody test and/or PCR testing for pteropid ABLV ribonucleic acid (RNA). Eleven of these were from two events in Queensland where young spectacled flying-foxes (*Pteropus conspicillatus*) found together in a group were taken into care and later diagnosed with ABLV infection (see Queensland state report in this issue). In the other four cases:

- A female black flying-fox (*P. alecto*) from south-east Queensland was found hanging low in a tree in the middle of the day. It had watery eyes, and mild trauma to the wing membranes. The bat was euthanased and submitted for ABLV testing.
- A female black flying-fox in north Queensland was submitted due to contact with a pet dog.
- Two black flying-foxes from central Queensland were submitted for ABLV testing due to potentially infectious human contact. Abnormal behaviour was reported in one case. In both cases, 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.[38] ABLV is a nationally notifiable disease in Australia. Cases of suspect ABLV infection or exposure should be reported to the Emergency Animal Disease Watch Hotline on 1800 675 888.

36 WHA 2017, EXOTIC - White-nose syndrome, Fact sheet, April 2017, Wildlife Health Australia. www.wildlifehealthaustralia.com.au/FactSheets.aspx

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

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