NATIONAL ARBOVIRUS MONITORING PROGRAM NAMP 2016–2017 REPORT

Report on the 2016-2017 arbovirus transmission season (September 2016 to August 2017)

OBJECTIVES OF THE NATIONAL ARBOVIRUS MONITORING PROGRAM

The National Arbovirus Monitoring Program (NAMP) has three specific objectives:

1. **market access**—to facilitate the export of live cattle, sheep and goats, and ruminant genetic material, to countries with concerns about bluetongue, Akabane and bovine ephemeral fever (BEF) viruses.

2. **bluetongue early warning**—to detect incursions of exotic strains of bluetongue virus (BTV) and vectors (*Culicoides* species biting midges) into Australia by surveillance of the northern BTV-endemic area.

3. **risk management**—to detect changes in the seasonal distribution in Australia of endemic bluetongue, Akabane and BEF viruses and their vectors, to support livestock exporters and producers.

The NAMP management, partners and coordinators would like to thank everyone who assisted in gathering the valuable monitoring data that underpin this report. This assistance is critical in maintaining and developing market access.

NAMP monitors the distribution of economically important arboviruses (insect-borne viruses) of ruminant livestock and associated insect vectors in Australia. Arboviruses monitored by NAMP include bluetongue, Akabane and BEF viruses. BTV infection does not adversely affect production in Australian livestock, and disease has not been reported from areas of known viral transmission.

Australia's economy benefits from the export of ruminant livestock and their genetic material (semen and embryos). This trade depends on a shared confidence between Australia and its trading partners that risks to the animal health status of the importing country can be accurately assessed and properly managed. NAMP provides credible data on the nature and distribution of important specific arbovirus infections in Australia for use by the Australian Government and livestock exporters. NAMP underpins Australian Government export certification that Australian ruminants are sourced from areas that are free from transmission of these specified arboviruses. In addition, NAMP data are available for other countries when negotiating their import health conditions for Australian livestock and their genetic material.

NAMP is jointly funded by its primary beneficiaries: the cattle, sheep and goat industries; the livestock export industry; and the state, territory and Australian governments.

OPERATION OF THE NATIONAL ARBOVIRUS MONITORING PROGRAM

NAMP data are gathered throughout Australia by serological monitoring of cattle in sentinel herds, strategic serological surveys of other cattle herds (serosurveys), and trapping of insect vectors.

Blood samples from groups of young cattle that have not previously been exposed to arbovirus infection are tested at regular intervals for evidence of new infection with the bluetongue, Akabane and BEF viruses. The frequency of blood sampling relates to the probability of arbovirus

transmission — that is, the greater the likelihood of viral transmission, the more frequent the sampling. Insect traps to detect *Culicoides* species are positioned near the monitored herds during the period of testing or near herds where conditions are favourable for *Culicoides* species survival.

The number and locations of herds (Figure 1) are selected to enable the distribution of the specified arboviruses to be determined (e.g. sentinel sites located along the border between the zone where infection is expected and not expected, and sentinel sites in areas where infection occurs sporadically), and the arbovirus-free area is monitored to verify freedom. Known endemically infected areas are sampled to detect any new strains of virus and to assess the seasonal intensity of infection with each arbovirus.

Beatrice Hill in the far north of the Northern Territory is a focus for exotic BTV surveillance; virus isolation is routinely undertaken on blood samples collected at this location. Serotyping, virus isolation and molecular testing are applied strategically in other herds in New South Wales, Northern Territory, Queensland and Western Australia after seroconversions are detected. NAMP surveillance data relating to bluetongue early warning are supplemented by targeted surveillance activities conducted by the Northern Australia Quarantine Strategy of the Australian Government Department of Agriculture and Water Resources in remote coastal regions of northern Australia, including the Torres Strait Islands.

EPIDEMIOLOGY

Bluetongue, Akabane and BEF viruses are non-contagious and are biologically transmitted by their insect vectors. Climatic factors (rainfall and temperature) determine the distribution of potential vectors. The arboviruses are transmitted only if vectors are present in sufficient density.

Culicoides brevitarsis is the main vector of both BTV and Akabane virus. A close correlation exists between the southern limits of *C. brevitarsis* and the distribution of the two viruses, although the viruses are less widely distributed than their vectors. Other vectors of BTV in Australia which are less widely distributed than *C. brevitarsis*, are *C. actoni*, *C. dumdumi*, *C. fulvus* and *C. wadai*.

The main vector of BEF virus in Australia is generally considered to be the mosquito *Culex annulirostris*. *C. annulirostris* has different ecological thresholds from *C. brevitarsis*, particularly its tolerance to lower temperatures, which accounts for its wider distribution and its occurrence in regions not affected by BTV or Akabane virus.

Research in Australia since the mid-1970s has provided a detailed understanding of the epidemiology of Australian BTV strains and their *Culicoides* midge

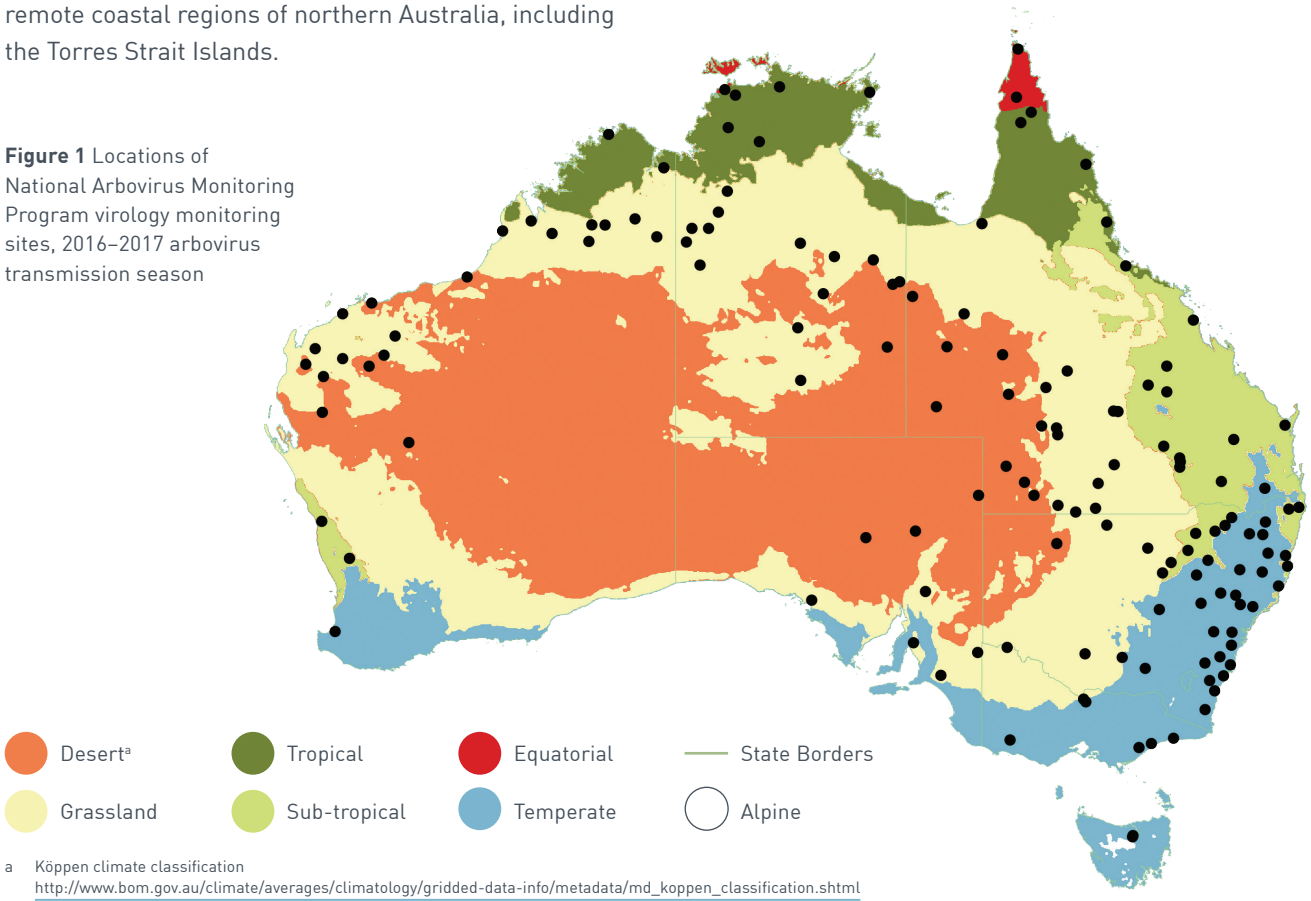


Figure 1 Locations of National Arbovirus Monitoring Program virology monitoring sites, 2016–2017 arbovirus transmission season

a Köppen climate classification
http://www.bom.gov.au/climate/averages/climatology/gridded-data-info/metadata/md_koppen_classification.shtml

vectors. The important vector species in Australia are likely to have all originally arrived on air currents from neighbouring countries.

Many regions in Australia have never recorded the presence of competent *Culicoides* vectors and are therefore free from viral transmission of arboviruses that can only be spread by these vector species (BTV and Akabane virus). BEF, which is primarily spread by certain species of mosquito, has a more variable distribution, particularly in southern Australia. Climatic conditions have a significant effect on vector distribution and partly account for changes that occur to the boundary between areas where viral transmission occurs and areas free of transmission.

MONITORING RESULTS FOR 2016–2017

This section summarises and explains the results of vector and virus monitoring and describes the limits of distribution of the bluetongue, Akabane and BEF viruses in the 2016–2017 arbovirus transmission season (September 2016 to August 2017).

The numbers of monitoring sites for sample collection in each state and territory are shown in Table 1.

Table 1 Number of NAMP virology monitoring sites, by state and territory, 2016–2017

Jurisdictions	Sentinel herds	Serosurveys	Insect traps
New South Wales	40	0	33
Northern Territory	9	9	11
Queensland	20	9	18
South Australia	5	2	3
Tasmania	1	0	1
Victoria	4	1	2
Western Australia	13	11	16
TOTAL	**92**	**32**	**84**

BLUETONGUE VIRUS DISTRIBUTION

The limits of BTV transmission in Australia are shown on the interactive Bluetongue Virus Zone Map,[1] which defines areas in which no viral transmission[2] has been detected for the past two years.

BTV transmission is endemic in northern and north-eastern Australia (New South Wales, Northern Territory, Queensland and Western Australia), and remains undetected in South Australia, Tasmania and Victoria (Figure 2). No new serotypes were detected in Australia during 2016–2017.

During the months leading up to the monsoon season, the Northern Territory recorded higher temperatures than average and severe thunderstorms in November. The first half of December was very dry across all parts of the Northern Territory except the far south. These dry conditions were broken by multiple monsoons until April. As a result, Darwin's wet season rainfall total was its third-highest on record. Virological testing in the Northern Territory showed that BTV transmission was very widespread, commencing in October in all the northern herds and continuing through until June. Serotype BTV16 was detected at four of the northernmost sentinel sites and BTV1 at all the northern sites. BTV5 and BTV21 were also found late in the season at three of the northern sites. Virus was isolated from monitoring conducted throughout the year at Beatrice Hill every month except August and September. Serosurveys identified BTV16 antibody at Wave Hill in the Victoria River District and Kurundi south of Tennant Creek. This last detection was responsible for a southern extension of the BTV zone in June 2017.

In Western Australia, above average rainfall and higher winter temperatures were recorded in the Kimberley and eastern Pilbara. These conditions and the recently established irrigation crops may increase vector survival. Sentinel site follow-up sample collections were delayed until these properties could muster stock, but were completed by August 2017. BTV seroconversions have been reported at all NAMP sites within the Kimberley BTV zone except the south-western sites of Liveringa and Broome Common. The predominant serotypes identified with a virus neutralisation test for this season have been BTV1 and BTV21 with some evidence of exposure to BTV16 at two serosurvey sites, possibly indicative of the 2015–2016 season seroconversions. A positive pre-

1 namp.animalhealthaustralia.com.au

2 Viral transmission is defined as detection of evidence of viral infection based on serological monitoring of cattle.

export test result from cattle from a property in the BTV surveillance zone led to an investigation on the property. This confirmed evidence of BTV transmission on the property and an expansion of the BTV transmission and surveillance zone was instigated. The expansion notably included the Broome port, the major export depot yards and holding properties in Broome and the current Broome cattle tick dipping yards. No evidence of BTV transmission was detected south of the Kimberley in Western Australia.

In Queensland, during spring, the western, central and southern parts experienced above-average rainfall. Below-average falls were recorded in the far north, with record mean daily maximum temperatures experienced at some locations. High mean temperatures were recorded in both summer and autumn, with a mixed rainfall pattern. Cyclone Debbie caused flooding and damaging winds in central and south-eastern areas. In winter there was little rain, with some locations experiencing the driest June on record, but overall mean maximum temperatures were above average. BTV16 was discovered in Cooktown, Normanton, Maryborough, Chinchilla, Mackay and Allora, which is close to the New South Wales border. BTV1 was also detected in northern, central and southern Queensland, with a mix of BTV21.

In New South Wales, rainfall across the endemic zone for BTV was average to below average for much of the transmission season except for 'very much above average' to 'highest on record' rainfall in late March after Cyclone Debbie. BTV seroconversions were first detected this season on the mid-north coast during January, later extending to the Far North Coast, upper Hunter Valley, Sydney Basin, South Coast and North-West Slopes regions. This widespread transmission pattern resulted in expansions of the BTV zone in four regions this season.

This year was unique in that three serotypes of BTV were detected in New South Wales (BTV1, BTV16 and BTV21). This is the first occasion that BTV16 has been detected in New South Wales (although retrospective testing has determined it was first present on the Far North Coast of New South Wales in April 2016). BTV1 and BTV21 were detected in all the sentinel herds along the coastal plain to the Sydney Basin, with mixed infections detected in many animals. In the Hunter Valley, BTV1, BTV16 and BTV21 were all detected.

BTV16 was not detected at any intervening sites on the New South Wales coast or ranges between the most southern point of detection in Queensland and the New South Wales Hunter Valley. This localised detection of BTV16 may be related to animal movements or perhaps a consequence of Cyclone Debbie. Numbers of *C. brevitarsis* were significantly higher than ever previously recorded at Paterson in the Hunter Valley in the month before the detection of BTV (including BTV16) in the region. BTV activity was consistent with the distribution of *C. brevitarsis*. *Culicoides wadai* was detected across a wider geographical distribution and in greater numbers than in any previous season, but it was restricted to the north coast and was not associated with the detection of BTV16.

In Victoria, winter and spring rainfall was above average across the whole state. Heavy spring rainfall led to flooding in some areas, resulting in very high mosquito numbers. Temperatures were slightly above average in winter and close to average in spring. Summer average daytime temperatures were above average in most parts of Victoria, but total rainfall was below average. Autumn was warmer than usual and, although rainfall was around average for the season, June was very dry for almost all of the state. No BTV activity was detected at any of the four sentinel herd sites or the one serosurvey site in Victoria during the season.

No competent vector species were detected in South Australia, Tasmania or Victoria, consistent with the serological evidence of virus absence.

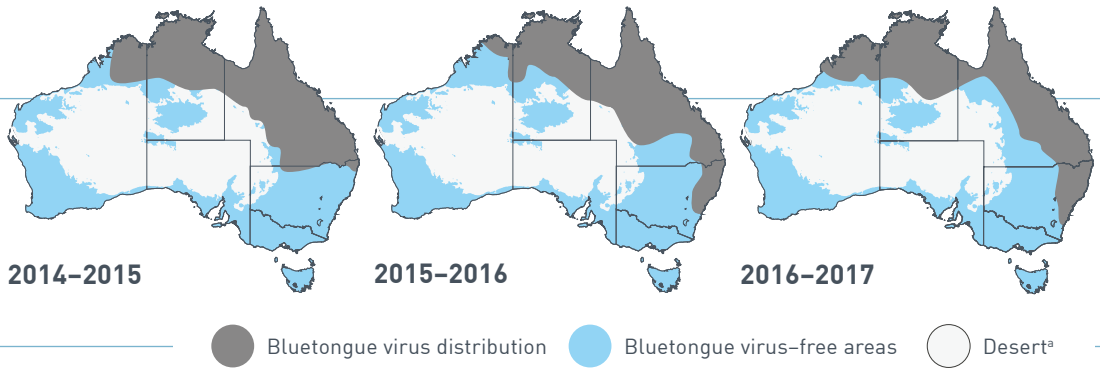


Figure 2 Distribution of bluetongue virus in Australia, 2014–2015 to 2016–2017

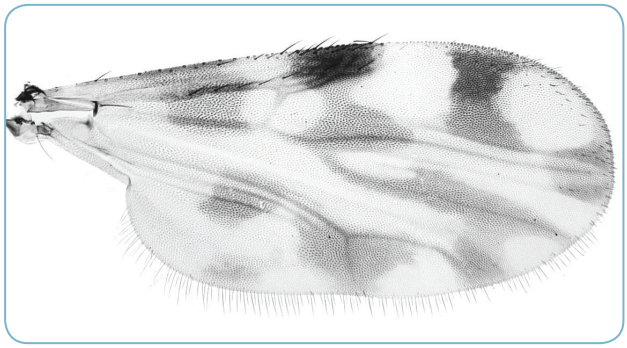
a Köppen climate classification

AKABANE VIRUS DISTRIBUTION

The distribution of Akabane virus (Figure 3) varies within the limits of its vector, *C. brevitarsis*, occurring endemically in northern Australia (northern Queensland, Northern Territory and Western Australia) and showing a distinct seasonal spread in New South Wales and southern parts of Queensland.

In Western Australia, Akabane seroconversions have been detected on all the Kimberley NAMP sites. However, there has been no evidence of Akabane transmission in the Pilbara or southwest of Western Australia. In the Northern Territory, no Akabane testing was performed in the northern endemic herds and no activity was detected at Alice Springs.

In Queensland, seroconversion at sentinel sites and seropositive animals recorded at survey sites were broadly distributed across all regions. Generally, only first and last samples were tested at sentinel sites.



Microscopy image of a *Culicoides* midge wing used for species identification

In New South Wales, Akabane virus transmission was more extensive than BTV and was also detected in the Northern Tablelands and Far South Coast regions, which are not considered endemic for this virus. Its distribution was mostly consistent with this season's distribution of the vector *C. brevitarsis*. There have been confirmed cases of Akabane-affected calves on the Northern Tablelands.

Akabane virus remains undetected in South Australia, Tasmania and Victoria.

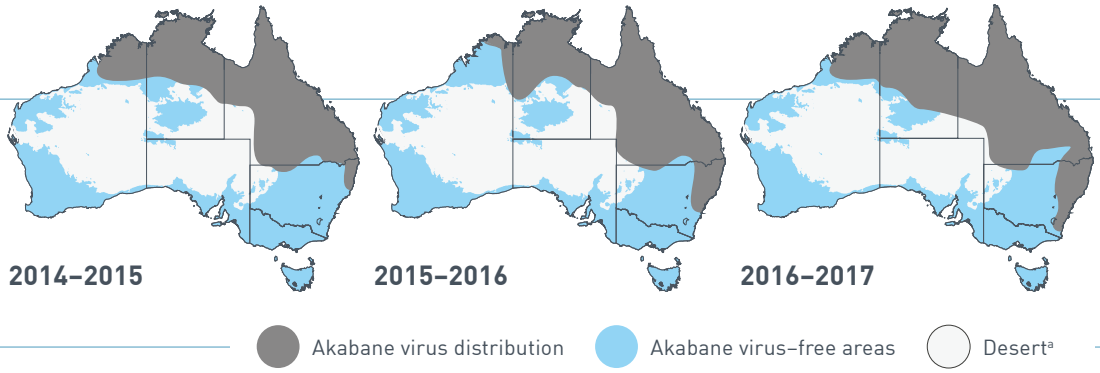


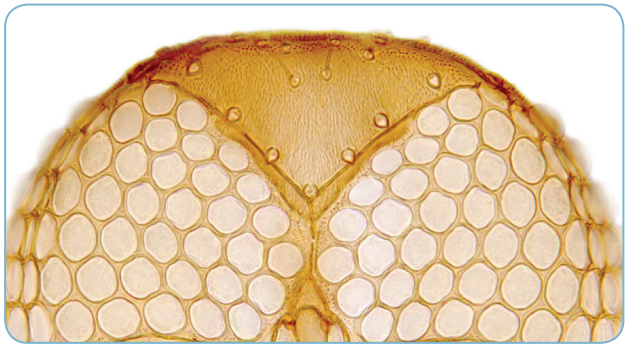
Figure 3 Distribution of Akabane virus in Australia, 2014–2015 to 2016–2017

a Köppen climate classification

BOVINE EPHEMERAL FEVER VIRUS DISTRIBUTION

BEF virus is endemic in northern Australia (Northern Territory, Queensland and Western Australia), where fever can occur in both the dry and wet seasons (spring, summer or autumn). In New South Wales and parts of southern Queensland, occurrence of the virus is limited by the effect of cold winters, restricting the distribution of its mosquito vector (Figure 4).

In Western Australia, BEF seroconversions have been found at the two sentinel sites in the Kimberley. This distribution was reduced from previous years and, as expected, no signs of clinical disease were reported. The other sites have been negative for BEF this season. Information from NAMP helped assess the risk of BEF in a disease investigation of downer cattle in an export depot. Laboratory testing confirmed that BEF was not the cause. In the Northern Territory, BEF activity was comparatively reduced compared to most years, with the only significant activities being in some northern locations.



Microscopy image of a *Culicoides* midge head used for species identification

In Queensland, BEF virus was again detected widely across the state, extending to the far south-east and far south-west.

In New South Wales, BEF virus activity was not detected in any of the monitored sentinel herds in inland New South Wales and south coast regions. This was despite early season concerns that significant rainfall and flooding during August and September in northern and central New South Wales may provide optimal conditions for an epizootic of BEF in inland New South Wales if wet conditions persisted through into summer. Cases were only confirmed from mid-summer to early autumn on the far to mid-north coast.

BEF virus was not detected in South Australia, Tasmania or Victoria.

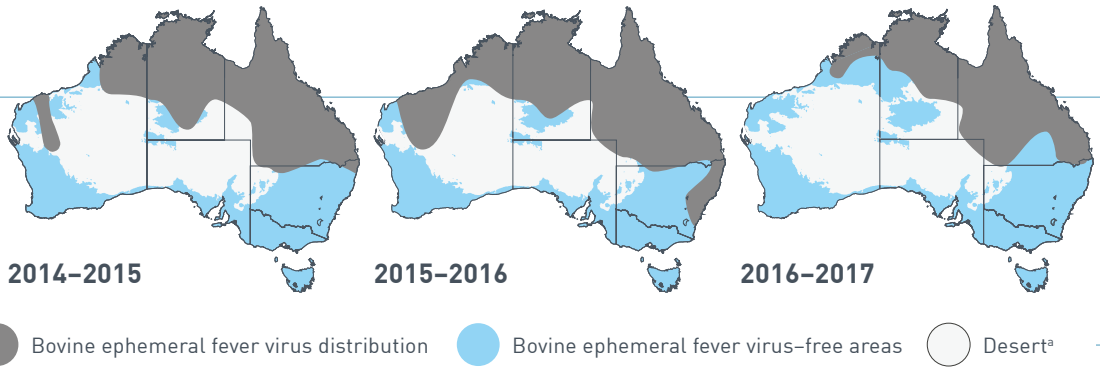


Figure 4 Distribution of bovine ephemeral fever virus in Australia, 2014–2015 to 2016–2017

a Köppen climate classification

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ISBN 978-1-921958-10-6 ISSN 1836-5418 Published January 2018