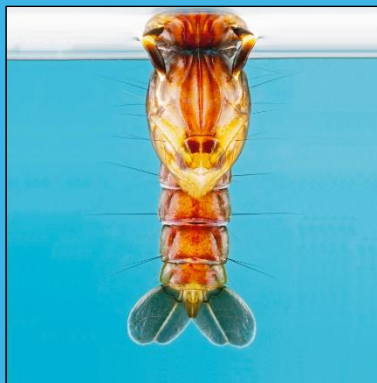


# NSW Arbovirus Surveillance & Mosquito Monitoring Program, 2018-2019

Weekly Update: 18 January 2019



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**All reports for the season are available at:**

<https://www.health.nsw.gov.au/environment/pests/vector/Pages/nswasp-weekly-report-2018-19.aspx>

**Please send questions or comments about this report to:**

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This report was prepared by Stephen Doggett, Manager, Department of Medical Entomology, NSW Health Pathology (ICPMR). Testing and scientific services were provided by the Arbovirus Emerging Diseases Unit, NSW Health Pathology (ICPMR) for the sentinel chicken surveillance and the Department of Medical Entomology, NSW Health Pathology (ICPMR) for the mosquito surveillance. Please note that these results remain the property of the NSW Ministry of Health and may not be used or disseminated to unauthorised persons or organisations without permission.

## Summary

- **Climate:** over the last week, precipitation was very low for the entire state. For December, rainfall was below average for the state north and mostly average elsewhere. Maximum and minimum temperatures for December were 2-3 degrees above average for the state.
- **Three Month Forecast:** for February 2019 to April 2019, rainfall is predicted to be below average for NSW, with a higher probability of being drier along the ranges. Maximum and minimum temperatures are predicted to exceed the average. According to the Bureau of Meteorology (BOM) as of 8 January 2019, the El Niño Alert continues.
- **Tides:** the next large series of tides that may trigger *Aedes vigilax* hatching are due over 21-25 January 2019, when heights of almost 2.1m are predicted. These are forecast to be the highest tides for the summer.
- **Murray Valley Encephalitis virus (MVEV) Models:** the data relevant to both the Forbes and Nicholls hypotheses have been updated to December 2018. Neither model is suggestive of an MVEV epidemic.
- **Mosquito Numbers Inland:** very little has changed upon the previous week; mosquito collections continue to be well below average and were 'low' (<50 mosquitoes/trap) at all but Griffith, where 'high' numbers (100-1,000 mosquitoes/trap) were yielded. However, even at this site, numbers are well below normal.
- **Mosquito Numbers Coast:** mosquito numbers are down this week with the hot weather. *Aedes vigilax* continue to be 'low' at all sites, with only Ballina yielding 'high' mosquito numbers, comprising mainly freshwater breeding species.
- **Mosquito Numbers Sydney:** the decline in the mosquito numbers from the saline habitats (Georges River and Parramatta Rivers) continue in line with tidal patterns, with only the one 'very high' collection (1,000-10,000/trap) this week, which was from Picnic Point (note that Georges River averaged 'high' numbers for the two sites). The other more productive sites continue to be Alford's Point (along the Georges River) and Duck River (near Parramatta River). The collections continue to be dominated by *Aedes vigilax*.
- **Arboviral Isolates:** there were two detections of Edge Hill virus (EHV). One was from Alford's Point on the Georges River from a mosquito collection made on 10 January 2019, and the other from Picnic Point from mosquitoes trapped on 16 January 2019.
- **Chicken Sentinel Flocks:** all chickens were negative for MVEV and Kunjin virus (KUNV).
- **Human Notifications:** for the current fiscal year, there have been 214 Ross River virus (RRV) and 27 Barmah Forest virus (BFV) notifications, which is well below the previous four season average (315RRV and 38BFV).
- **Comment:** NSW recently experienced a heatwave, continuing through to the weekend ending 20 January 2019. Mosquito numbers across the state are down due to the high temperatures and *Aedes vigilax* population decline in saline habitats.

As the statewide mosquito numbers remain low, arboviral activity has been minimal. There have been few arboviral detections in the mosquitoes (although two more EHV from Georges River this week), no seroconversions in the sentinel chickens, and human notifications are well below average. Previously reported high mosquito numbers from the saline habitats around Sydney have declined to normal; however, we are now in the highest risk period for the transmission of arboviruses in the *Aedes vigilax* cycle (discussed below).

### ***Aedes vigilax* – Development Cycle**

*Aedes vigilax* is a salt marsh mosquito. The larvae hatch out from eggs that are laid on the edges of depressions on mudflats associated with mangrove environments. The eggs are desiccant resistant and can lay dormant for some weeks to months if the conditions are not suitable for hatching.

During this time of the year we have 'spring' tides, which is when tides often reach their highest. There are series of high tides associated with the full moon and a series of lesser height with the new moon. For Sydney, when the tides go over 1.8m, this can lead to the flooding of the mud flat depressions resulting in egg hatching (which is why there is a line across the graph on Page 6 at 1.8m). Note that this figure varies at different regions, where the tidal fluctuations can be dramatically different.

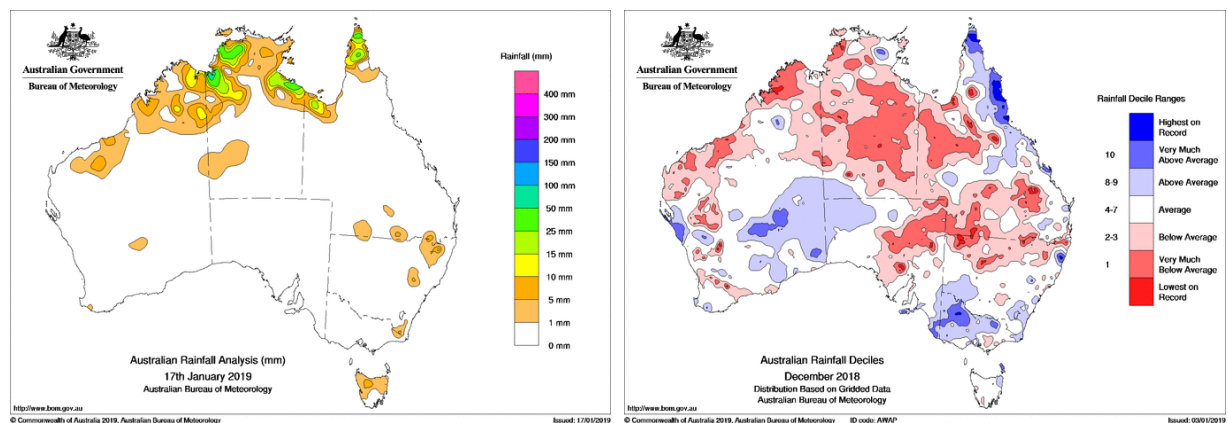
Once the eggs hatch, there is a period of larval development of around 7-10 days (which is faster in hot weather). Thus around a week or so after egg flooding, mosquito numbers are at their highest and can be massive. However, these young mosquitoes have not fed on a potential viraemic host and will not transmit arboviruses. Vertical transmission is possible, but exceedingly rare.

Thus even though there can be high mosquito numbers, the risk of acquiring an arbovirus from a mosquito bite at that time is very low. Through natural attrition, the population declines over the following weeks until the next flush of adults. However, in the meantime, the population is becoming older. This means the mosquitoes now have had the chance to have fed on a viraemic vertebrate (e.g. kangaroos for Ross River virus) and the virus then has had the time to develop inside the insect (known as the extrinsic incubation period). Thus often a small population can represent greater risk than a larger population; following this logic, an old mosquito is thus a dangerous mosquito. This is also why we are seeing isolates from the Georges River mosquitoes now, rather than earlier in the *Aedes vigilax* cycle. Additional isolates may be detected in the coming weeks.

## Environmental Conditions

### Rainfall

Rainfall across Australia for the week ending 17 January 2019 is depicted on the left and monthly rainfall deciles for December 2018 are on the right. Over the last week, precipitation was very low for the entire state. For December, rainfall was below average for the state north and mostly average elsewhere. Maximum and minimum temperatures for December were 2-3 degrees above average for the state.



### Three Month Rainfall & Temperature Forecast

For February 2019 to April 2019, rainfall is predicted to be below average for NSW, with a higher probability of being drier along the ranges. Maximum and minimum temperatures are both predicted to exceed the average. The following webpages contain graphics of the seasonal outlook:

[www.bom.gov.au/climate/outlooks/#/rainfall/median](http://www.bom.gov.au/climate/outlooks/#/rainfall/median) (Rainfall outlook)

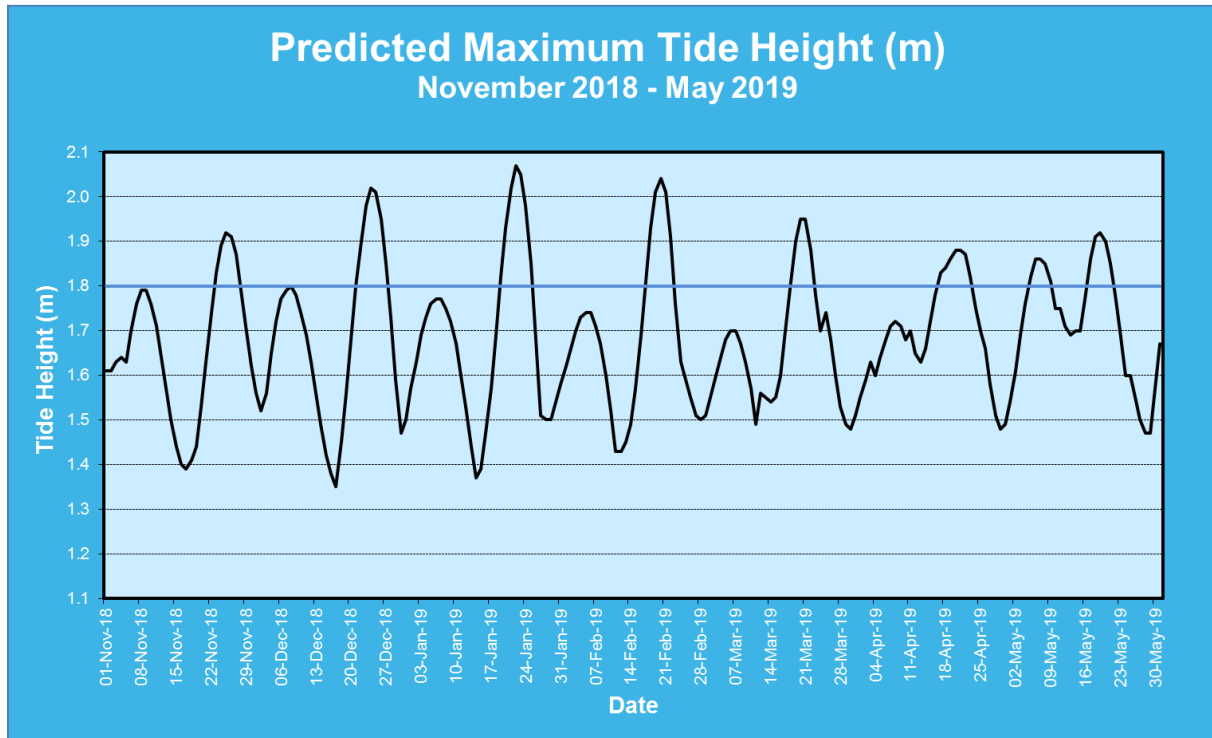
[www.bom.gov.au/climate/outlooks/#/temperature/summary](http://www.bom.gov.au/climate/outlooks/#/temperature/summary) (Max & min temperature outlook).

According to the BOM as of 8 January 2019, the El Niño Alert continues (although some contributing factors to the El Niño have become neutral). A positive Indian Ocean Dipole (IOD) is now underway, however it has now weakened (positive IODs are associated with dry conditions across Australia, although has little influence on the nation's climate over December to April).

For more information: [www.bom.gov.au/climate/enso/](http://www.bom.gov.au/climate/enso/) and [www.bom.gov.au/climate/iod/](http://www.bom.gov.au/climate/iod/)

## Tides

Tidal information is relevant for the prediction of the activity of the salt marsh mosquito, *Aedes vigilax*. Typically for NSW, tides of over 1.8m, as measured at Sydney, can induce hatching of *Aedes vigilax* larvae and the graph below of predicted tide heights can provide some indication of when this is likely to occur. Note this trigger height varies between regions, thus at Batemans Bay, a tide height over 0.8m can initiate egg hatching.



The next series of spring high tides are forecast for 21-25 January 2019, when heights of almost 2.1m are predicted. These are forecast to be the highest tides for the summer.

Actual tide heights can vary by 0.3m (or more in unusual circumstances) due to variations in atmospheric pressure, rainfall, wind and other climatic phenomena. Sea level rise with climate change may also result increased tide heights. Thus predicted tide height should be used as a gauge only for potential *Aedes vigilax* activity. The larvae of the saltmarsh mosquito relies on an inundation/drying cycle for the mudflats in which it lives; continual wet weather prevents the drying cycles thereby reducing larval production.

## MVEV Climatic Models

Three predictive environmental based models for MVEV activity have been developed; the Forbes (which relies on rainfall in the river catchment basins of Eastern Australia), Nicholls (based on the Southern Oscillation), and Bennett theory (based on the Indian Ocean Dipole). The latter theory has low reliability and is not considered below. Note that all the predictive models have been developed on a limited data set and do not always forecast activity. There can also be unusual environmental conditions that may lead to the introduction of the virus to southeastern Australia, such as the movement of low pressure cells from the north to the south of the country during 2008 and 2011. Vertical transmission of the virus (from adult to the egg in *Aedes* species) can result in restricted activity following localised heavy precipitation (as per 2003 at Menindee).

### i. Forbes Hypothesis

Rainfall was not above Decile 7 in all of the river catchment basins in eastern Australia for the last quarter of 2017, the first quarter of 2018, nor the last quarter of 2018 (Table 1). Thus Forbes hypothesis for an MVEV outbreak has not been fulfilled.

**Table 1.** Rainfall indices for the main catchment basins of eastern Australia as per Forbes hypothesis, relevant to the 2018-2019 season. Note that a value of 1 equals Decile 7 rainfall.

Catchment Basin	Oct-Dec 2017	Jan-Mar 2018	Oct-Dec 2018	Jan-Mar 2019
Darling River	0.93	0.52	0.84	0.71
Lachlan/Murrumbidgee/Murray Rivers	1.15	0.70	0.77	0.87
Northern Rivers	0.81	1.07	1.00	0.70
North Lake Eyre system	0.75	0.69	0.73	0.56

### ii. Nicholls Hypothesis

**Table 2.** The seasonal atmospheric pressures (in mm) according to Nicholls hypothesis, relevant to the 2018-2019 season.

	Autumn 2018	Winter 2018	Spring 2018
2018 Value	1009.27	1011.8	1010.90
Pre past MVEV seasons	<1009.74	<1012.99	<1009.99

The Spring period pertaining to the Nicholls hypothesis is not in line with past MVEV active years.

## Arboviral Isolates

LOCATION – Site	Date Trapped	Detection Method	Virus
GEORGES RIVER – Picnic Point	16/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Alfords Point	10/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Picnic Point	9/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Picnic Point	9/Jan/2019	FTA card	Kokobera

FTA Card = Sugar based surveillance. Whole trap grind = all the mosquitoes are ground (or a subsample of the larger collections) and tested for arboviral nucleic acid.

## Exotic Detections

An exotic mosquito, *Aedes aegypti* was detected at a freight handling facility within Sydney International Airport. The mosquitoes were collected by the Commonwealth Department of Agriculture and Water Resources as part of routine monitoring and the species identity was confirmed by the Department of Medical Entomology, NSW Health Pathology.

The response was similar to the previous detections. This included an urgent insecticide application at the site (thermal fogging and residual treatment) and enhanced surveillance was initiated. A vector survey of the site had been undertaken previously and the site was generally considered low risk for the establishment of exotic mosquitoes.



## Human Notifications

Weekly notifications of human mosquito-borne disease infections are available from the NSW Ministry of Health, Communicable Disease Weekly Report and summarized in the Table below\* ([www.health.nsw.gov.au/Infectious/reports/Pages/CDWR.aspx](http://www.health.nsw.gov.au/Infectious/reports/Pages/CDWR.aspx)).

**Table 4.** Notifications of mosquito-borne disease in NSW, 2018-2019\*

Week Ending	RRV	BFV	DENV <sup>†</sup>	Malaria <sup>†</sup>	CHIKV <sup>†</sup>	ZIKV <sup>†</sup>	Total
7-Jul-18	12	1	10	1	0	0	24
14-Jul-18	9	1	2	3	0	0	15
21-Jul-18	5	2	3	2	0	0	12
28-Jul-18	8	1	6	3	0	0	18
4-Aug-18	4	0	8	3	0	0	15
11-Aug-18	8	3	6	1	0	0	18
18-Aug-18	12	0	3	1	0	0	16
25-Aug-18	8	1	2	1	0	0	12
1-Sep-18	8	0	0	0	0	0	8
8-Sep-18	5	1	2	2	0	0	10
15-Sep-18	13	4	1	5	0	0	23
22-Sep-18	5	0	5	1	0	0	11
29-Sep-18	7	2	5	2	0	0	16
6-Oct-18	10	0	2	1	0	0	13
13-Oct-18	9	0	2	4	0	0	15
20-Oct-18	7	0	5	2	1	0	15
27-Oct-18	11	0	8	1	0	0	20
3-Nov-18	10	0	5	0	1	0	16
10-Nov-18	7	3	6	0	3	0	19
17-Nov-18	5	3	9	2	0	0	19
24-Nov-18	4	1	8	0	0	0	13
1-Dec-18	11	1	14	1	1	0	28
8-Dec-18	11	1	5	0	2	0	19
15-Dec-18	1	1	3	0	0	0	5
22-Dec-18	9	0	0	7	0	0	16
29-Dec-18	2	0	0	1	0	0	3

RRV = Ross River virus; BFV = Barmah Forest virus; DENV = Dengue virus; CHIKV = Chikungunya virus; ZIKV = Zika virus. <sup>†</sup>All of these viruses are acquired overseas, although some DENV cases may be from North Queensland. \*The data in this table is updated once available from the NSW Ministry of Health.

**Comment:** It should also be noted that notifications are for NSW residents and that the infection may have been acquired elsewhere. Winter notifications of RRV and BFV are unlikely to be recent infections or may be false positives.

**Table 4 cont.** Notifications of mosquito-borne disease in NSW, 2018-2019\*

Week Ending	RRV	BFV	DENV <sup>†</sup>	Malaria <sup>†</sup>	CHIKV <sup>†</sup>	ZIKV <sup>†</sup>	Total
<b>5-Jan-19</b>	9	0	2	1	0	0	<b>12</b>
<b>Total</b>	<b>210</b>	<b>26</b>	<b>122</b>	<b>45</b>	<b>8</b>	<b>0</b>	<b>411</b>

RRV = Ross River virus; BFV = Barmah Forest virus; DENV = Dengue virus; CHIKV = Chikungunya virus; ZIKV = Zika virus.

<sup>†</sup>All of these viruses are acquired overseas, although some DENV cases may be from North Queensland.

\*The data in this table is updated once available from the NSW Ministry of Health.

**Table 5.** Ross River virus infection notifications in NSW residents, by month of disease onset per fiscal year, July 2013 to Jun 2019\*.

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2014-2015	38	50	46	67	59	90	117	305	431	264	102	50	<b>1,619</b>
2015-2016	54	61	53	61	70	54	42	60	78	79	52	16	<b>680</b>
2016-2017	12	11	20	17	38	216	429	274	200	142	174	89	<b>1,622</b>
2017-2018	29	37	52	56	37	31	30	39	51	74	96	70	<b>602</b>
2018 - 2019	32	41	30	45	32	25	9						<b>214</b>
Ave <sup>†</sup>	<b>33</b>	<b>40</b>	<b>43</b>	<b>50</b>	<b>51</b>	<b>98</b>	<b>155</b>	<b>170</b>	<b>190</b>	<b>140</b>	<b>106</b>	<b>56</b>	<b>1,132</b>

\*updated 18 January 2019 (this table is updated at different times to Table 4 above, hence there may be differences in the numbers).

<sup>†</sup>Average for 2014-15 to 2017-18.

Table modified from: <http://www1.health.nsw.gov.au/IDD/#/ROSS>

**Table 6.** Barmah Forest virus infection notifications in NSW residents, by month of disease onset per fiscal year, July 2014 to Jun 2019\*.

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2014-2015	10	3	11	11	8	4	12	17	43	43	16	11	<b>189</b>
2015-2016	6	9	7	9	6	3	4	5	2	3	10	2	<b>66</b>
2016-2017	4	3	0	0	1	9	9	5	8	6	24	24	<b>93</b>
2017-2018	8	10	6	8	8	6	5	12	8	10	8	7	<b>96</b>
2018 - 2019	4	6	5	2	6	4	0						<b>27</b>
Ave <sup>†</sup>	<b>7</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>6</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>15</b>	<b>16</b>	<b>15</b>	<b>11</b>	<b>113</b>

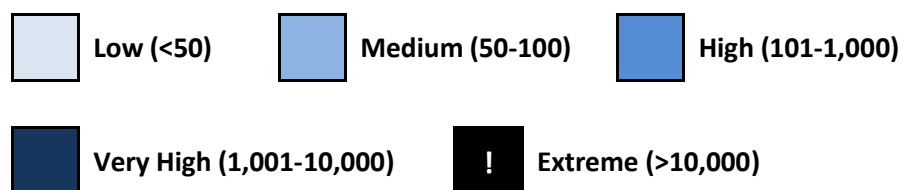
\*updated 184 January 2019 (this table is updated at different times to Table 4 above, hence there may be differences in the numbers).

<sup>†</sup>Average for 2014-15 to 2017-18.

Table modified from: <http://www1.health.nsw.gov.au/IDD/#/BF>

## Mosquito Results

Mosquito abundance is best described in relative terms, and in keeping with the terminology from previous NSW Arbovirus Surveillance and Mosquito Monitoring Program Annual Reports, mosquito numbers are depicted in the tables below as:



Each location represents the average for all trapping sites at that location.

## Inland

Location	Mosquito	Oct-18				Nov				Dec					Jan-19				Feb				Mar					
		7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	3	10	17	24	31	
Albury	<i>Cx. annul</i>																											
	Total Mosq.																											
Bourke	<i>Cx. annul</i>																											
	Total Mosq.																											
Forbes	<i>Cx. annul</i>																											
	Total Mosq.																											
Griffith	<i>Cx. annul</i>																											
	Total Mosq.																											
Leeton	<i>Cx. annul</i>																											
	Total Mosq.																											
Macquarie Marshes	<i>Cx. annul</i>																											
	Total Mosq.																											
Wagga	<i>Cx. annul</i>																											
	Total Mosq.																											

Note that the date represents the Sunday, the start of the week.

## Coastal

Location	Mosquito	Nov-18				Dec					Jan-19				Feb				Mar					Apr			
		4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	3	10	17	24	31	7	14	21	28
Ballina	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Coffs Harbour	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Gosford	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Kempsey	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Lake Macquarie	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Port Macquarie	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Tweed	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Wyong	<i>Ae. vigilax</i>																										
	Total Mosq.																										

Note that the date represents the Sunday, the start of the week.

## Sydney

Location	Mosquito	Nov-18				Dec					Jan-19				Feb				Mar					Apr			
		4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	3	10	17	24	31	7	14	21	28
Banks-town	<i>Ae. vigilax</i>					■	■	■		■	■																
	Total Mosq.					■	■	■		■	■																
Blacktown	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Georges River	<i>Ae. vigilax</i>			■		■	■	■	■	■	■																
	Total Mosq.			■		■	■	■	■	■	■																
Hawkes-bury	<i>Cx. annul</i>																										
	Total Mosq.																										
Hills Shire	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Parramatta	<i>Ae. vigilax</i>							■	■	■	■																
	Total Mosq.							■	■	■	■																
Penrith	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Sydney Olympic Park	<i>Ae. vigilax</i>					■	■	■	■	■	■																
	Total Mosq.					■	■	■	■	■	■																

Note that the date represents the Sunday, the start of the week.

### Sentinel Chicken Flocks – MVEV and Kunjin Virus Antibody Test Results

Location	Oct	Nov				Dec					Jan-19				Feb				Mar				Apr			
	28	4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	3	10	17	24	7	14	21	28
Deniliquin			15N	15N	15N	15N	15N	15N																		
Dubbo								15N		15N																
Forbes			12N	12N	12N	14N	15N	15N																		
Griffith		15N	15N	15N	15N	15N	15N	15N																		
Hay		15N	15N	15N	15N	15N	15N	15N	15N	15N																
Leeton	15N	15N	15N	15N	15N	15N	15N		15N	15N																
Macquarie Marshes		15N		15N	15N	15N	15N	15N	15N	15N																
Menindee		15N		15N	15N	15N	15N																			
Moree				15N	15N	15N	15N	15N	15N	15N																

The number represents the number of chickens by test result (N = Negative, M = Positive for MVEV, K = Positive for Kunjin virus). Results are shown by week of sample collection. **Positive results will be in bold**. Note that the date represents the Sunday, the start of the week.

Antibody test results in the sentinel chicken flocks were provided by the Arbovirus Emerging Diseases Unit, NSW Health Pathology (ICPMR).

SHPN: (EH) 180675