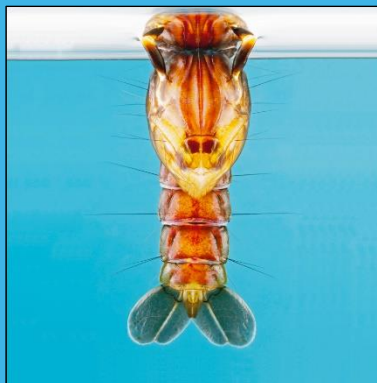


NSW Arbovirus Surveillance & Mosquito Monitoring Program, 2018-2019

Weekly Update: 8 February 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

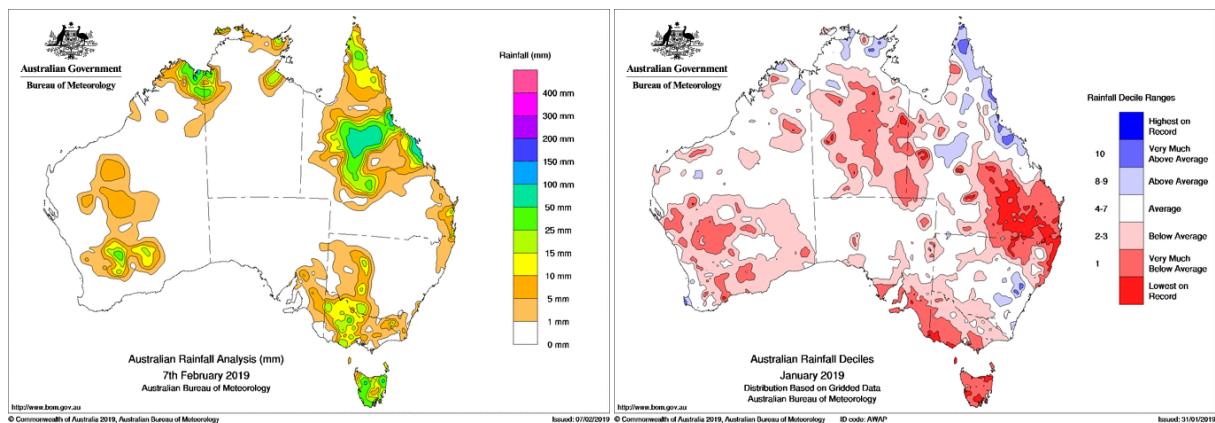
- **Climate:** over the last week, there was little precipitation across the state. For January, rainfall was below average for the state north east and mostly average elsewhere, although the Murray Valley experienced below average rainfall. Maximum and minimum temperatures for January were up to six degrees above average.
- **Three Month Forecast:** for February 2019 to April 2019, rainfall is predicted to be average for NSW. Maximum and minimum temperatures are predicted to exceed the average. According to the Bureau of Meteorology (BOM) as of 5 February 2019, the El Niño Southern Oscillation remains neutral, however there is increased chance that an El Niño will form later this year.
- **Tides:** the next series of high tides are due over 17-23 February 2019, when heights of just over 2.0m are predicted.
- **Murray Valley Encephalitis virus (MVEV) Models:** the data relevant to both the Forbes' and Nicholl's hypotheses have been updated to January 2019. Neither model is suggestive of an MVEV epidemic.
- **Mosquito Numbers Inland:** the trend of below average numbers continue for this season with only Griffith producing 'high' numbers (100-1,000 mosquitoes/trap).
- **Mosquito Numbers Coast:** collections were up this week following the recent spring tides, with noticeably higher numbers of *Aedes vigilax*. Ballina, Gosford, Kempsey, and Tweed all produced 'high' yields.
- **Mosquito Numbers Sydney:** following the recent spring tides, numbers of *Aedes vigilax* have increased, producing the highest collection for the season. Duck River yielded an 'extreme' number of almost 14,000 mosquitoes. The Georges River sites also had very high numbers with over 7,000 from Picnic Point and over 4,000 from Alfords Point.
- **Arboviral Isolates:** there was one new Stratford virus detection from the Ourimbah site of the Central Coast, from a collection made on 4 February 2019, and one new Edge Hill virus detection from Alfords Point along the Georges River from a collection made on 6 February 2019.
- **Chicken Sentinel Flocks:** all chickens were negative to MVEV and Kunjin virus (KUNV).
Human Notifications: for the current fiscal year, there have been 243 - Ross River virus (RRV) and 33 Barmah Forest virus (BFV) notifications.

Comment: following the recent spring tides, collections of *Aedes vigilax* have increased all along the coast, but especially for the Sydney sites. The catch of almost 14,000 mosquitoes from Duck River is one of the largest yields. Ballina, Gosford, Kempsey and Tweed has also produced high yields.

Environmental Conditions

Rainfall

Rainfall across Australia for the week ending 7 February 2019 is depicted on the left and monthly rainfall deciles for January 2019 are on the right. Over the last week, there was little precipitation across the state. For January, rainfall was below average for the state north east and mostly average elsewhere, although the Murray Valley experienced below average rainfall. Maximum and minimum temperatures for January were up to six degrees above average.



Three Month Rainfall & Temperature Forecast

For February 2019 to April 2019, rainfall is predicted to be mostly average for NSW. 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 (Rainfall outlook).

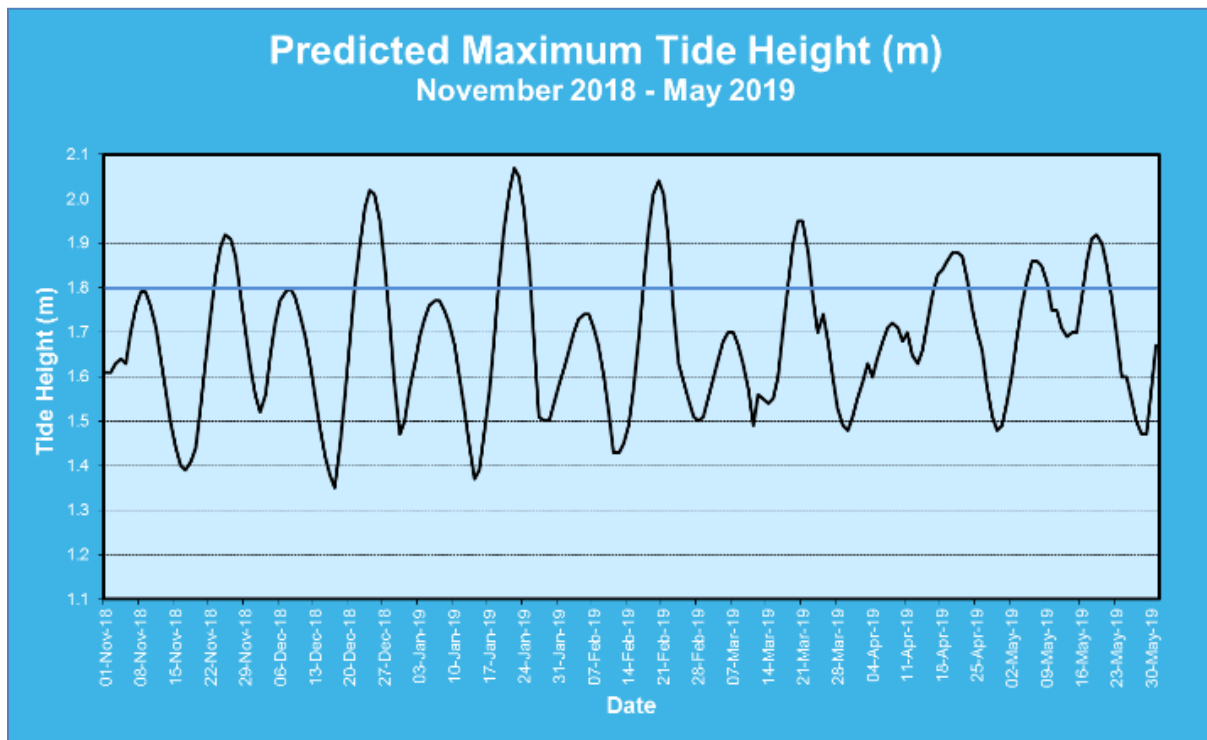
www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 5 February 2019, the El Niño–Southern Oscillation (ENSO) remains neutral. However, there remains an increased likelihood that El Niño will develop later in 2019. The Indian Ocean Dipole (IOD) is now neutral, although the IOD has little influence on the nation’s climate over December to April.

For more information: www.bom.gov.au/climate/enso/ and 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, high tides of over 1.8m, as measured at Sydney, can induce hatching of *Aedes vigilax* larvae and the graph below left 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 recent series of spring high tides that occurred over 21-25 January 2019, were the highest forecasted for this summer and the actual heights were close to predicted (see top right graph from Manly Hydraulics Works, <https://mhl.nsw.gov.au/data/realtime/oceantide/Station-213470>). These tides did trigger *Aedes vigilax* hatching in saline habitats.

The next series of high tides that may trigger *Aedes vigilax* hatching are due over 17-23 February 2019, with heights of over 2m predicted.

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), Nicholl's (based on the Southern Oscillation), and the 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 south-eastern 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, the last quarter of 2018, or the first quarter of 2019* (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	0.71	0.26
Lachlan/Murrumbidgee/Murray Rivers	1.15	0.70	0.87	2.21
Northern Rivers	0.81	1.07	0.70	0.69
North Lake Eyre system	0.75	0.69	0.56	0.28

*Data for January only

ii. Nicholl's Hypothesis

Table 2. The seasonal atmospheric pressures (in mm) according to Nicholl's 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 Nicholl's hypothesis is not in line with past MVEV active years.

Arboviral Isolates

LOCATION – Site	Date Trapped	Detection Method	Virus
GEORGES RIVER – Alford's Point	6/Feb/2019	Whole trap grind	Edge Hill
CENTRAL COAST – Ourimbah	4/Feb/2019	Whole trap grind	Stratford
GRIFFITH – Lake Wyangan	29/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Alford's Point	24/Jan/2019	Whole trap grind	Edge Hill
PARRAMATTA – Duck River	23/Jan/2019	Whole trap grind	Stratford
HILLS – Glenorie	23/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Picnic Point	23/Jan/2019	Whole trap grind	Edge Hill
BLACKTOWN – Ropes Crossing	22/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Picnic Point	16/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Alford's 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

There was another detection of *Aedes aegypti*, this time at a freight handling facility at Sydney International Airport. The mosquito was collected on 5 February 2019 by the Commonwealth Department of Agriculture and Water Resources as part of routine monitoring and the species identity 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.

As the detections of exotic mosquitoes has been a common occurrence over the last five years, both in NSW and other ports across Australia, NSW Health in conjunction with the Department of Medical Entomology, will be developing a Standard Operating Procedure to deal with future exotic detections. This will expedite the response process.

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).

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

Week Ending	RRV	BFV	DENV [†]	Malaria [†]	CHIKV [†]	ZIKV [†]	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. [†]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 [†]	Malaria [†]	CHIKV [†]	ZIKV [†]	Total
5-Jan-19	10	0	4	1	0	0	15
12-Jan-19	6	0	4	2	0	0	12
19-Jan-19	10	1	11	3	0	0	25
26-Jan-19	4	2	7	0	0	0	13
2-Feb-19	8	3	5	0	0	0	16
Total	239	32	151	50	8	0	480

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

[†]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.

The numbers in this table may be different to those below for several reasons. For example, the tables are produced at different times, with slightly different numbers resulting. However the main reason is that retrospective analysis of patient reports may result in the modification (and removal) of some data. The numbers in Tables 5 & 6 below have undergone review and thus should be considered more accurate in terms of total notifications. Table 4, provides a better indication of weekly notification trends.

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							117	304	431	265	102	50	1,269
2015-2016	54	60	53	61	69	54	43	61	78	81	66	25	705
2016-2017	14	15	21	19	46	229	430	274	200	142	174	89	1,653
2017-2018	29	37	52	56	37	31	30	38	51	75	96	70	602
2018-2019	32	40	32	46	32	25	32	4					243
Ave [†]	32	38	40	46	46	85	130	136	190	141	110	59	894

*updated 8 February 2019 (this table is updated at different times to Table 4 above, hence there maybe differences in the numbers).

[†]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							12	17	43	43	16	11	142
2015-2016	6	9	7	9	6	3	4	5	2	3	10	2	66
2016-2017	4	3	0	0	1	9	9	5	8	6	24	25	94
2017-2018	8	10	6	8	8	6	5	12	8	10	6	7	94
2018-2019	4	6	5	2	6	4	6	0					33
Ave [†]	6	7	5	5	5	6	7	8	15	16	14	11	86

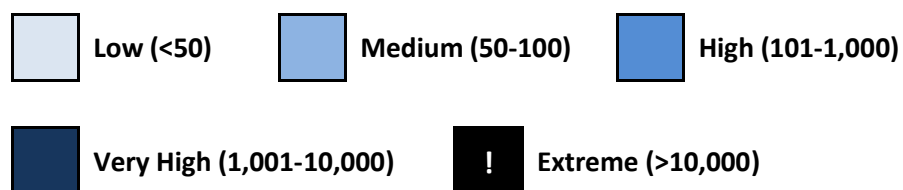
*updated 8 February 2019 (this table is updated at different times to Table 4 above, hence there maybe differences in the numbers).

[†]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.

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			15N	15N															
Dubbo								15N		15N	15N	15N															
Forbes			12N	12N	12N	14N	15N	15N			14N	15N	15N														
Griffith		15N	15N	15N	15N	15N	15N	15N			15N	14N	14N														
Hay		15N	15N	15N	15N	15N	15N	15N	15N	15N	15N	15N															
Leeton	15N	15N	15N	15N	15N	15N	15N		15N	15N	15N	15N	15N														
Macquarie Marshes		15N		15N	15N	15N	15N	15N	15N	15N		15N	15N														
Menindee		15N		15N	15N	15N	15N				15N	15N	15N														
Moree				15N	15N	15N	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