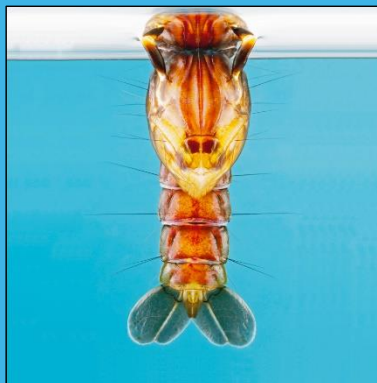


NSW Arbovirus Surveillance & Mosquito Monitoring Program, 2018-2019

Weekly Update: 07 December 2018



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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>

Summary

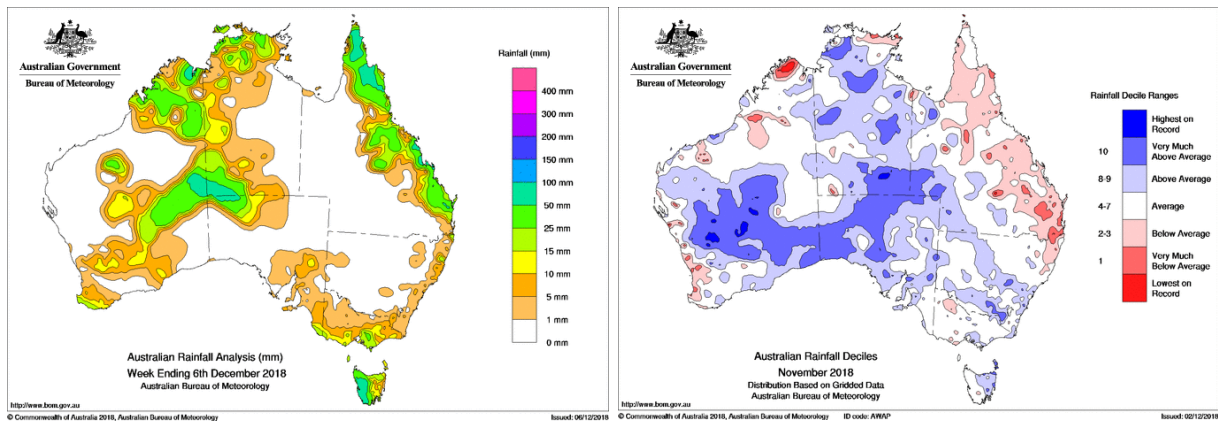
- **Climate:** over the last week, there was light rainfall along the coast and in the Murray Valley. For November, rainfall was average for most of the state, with bands of above average precipitation across the inland. The north coast had below average rainfall. Maximum temperatures and minimum temperatures for November were slightly above average for the state.
- **Three Month Forecast:** for December 2018 to February 2019, rainfall is predicted to be around average for NSW. Maximum and minimum temperatures are predicted to exceed the average. According to the Bureau of Meteorology (BOM) as of 4 December 2018, the El Niño Alert continues, although the positive Indian Ocean Dipole has weakened.
- **Tides:** high tides are now occurring over 9-12 December 2018, but are just reaching the forecasted level, which is only just at a height to trigger *Aedes vigilax* hatching. The next series of high tides are due over 21-27 December 2018, with heights of over 2m predicted.
- **Murray Valley Encephalitis virus (MVEV) Models:** the data relevant to both the Forbes' and Nichol's hypotheses have been updated to November 2018. Neither model is suggestive of an MVEV epidemic.
- **Mosquito Numbers Inland:** mosquito collections continue to be 'low' (<50 mosquitoes/trap) at most locations, with only Forbes yielding 'medium' numbers (50-100 mosquitoes/trap).
- **Mosquito Numbers Coast:** in the first week of surveillance activities, mosquitoes from the coast varied considerably, although *Aedes vigilax* numbers were 'low' at all sites. Both Ballina and Tweed produced 'high' numbers (100-1,000 mosquitoes/trap), with a mix of fresh and saline water species predominating the collections.
- **Mosquito Numbers Sydney:** the mosquito surveillance locations in the saline habitats (Georges River and Sydney Olympic Park) all produced 'high' mosquito collections, with correspondingly 'high' numbers of *Aedes vigilax*. The non-saline locations had 'low' numbers.
- **Arboviral Isolates:** there are no arboviral isolates to date.
- **Chicken Sentinel Flocks:** all chickens were negative to MVEV and Kunjin virus (KUNV).
- **Human Notifications:** for the current fiscal year, there have been 181 Ross River virus (RRV) and 24 Barmah Forest virus (BFV) notifications, which is slightly below the previous four season average.

Comment: the inland continues to trap below average mosquito numbers. As predicted over preceding weekly reports, the combination of the recent rains and above forecasted tide heights has seen 'high' mosquito collections from the Sydney region and some coastal localities. It appears that the forecast for dry conditions ahead is starting to ease, even though an El Niño Alert continues, and it is predicted that NSW will receive normal rainfall for the next three months.

Environmental Conditions

Rainfall

Rainfall across Australia for the week ending 6 December 2018 is depicted on the left and monthly rainfall deciles for November 2018 are on the right. Over the last week, there was light rainfall along the coast and in the Murray Valley. For November, rainfall was average for most of the state, with bands of above average precipitation across the inland. The north coast had below average rainfall. Maximum temperatures and minimum temperatures for November were slightly above average for the state.



Three Month Rainfall & Temperature Forecast

For December 2018 to February 2019, rainfall is predicted to be around 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).

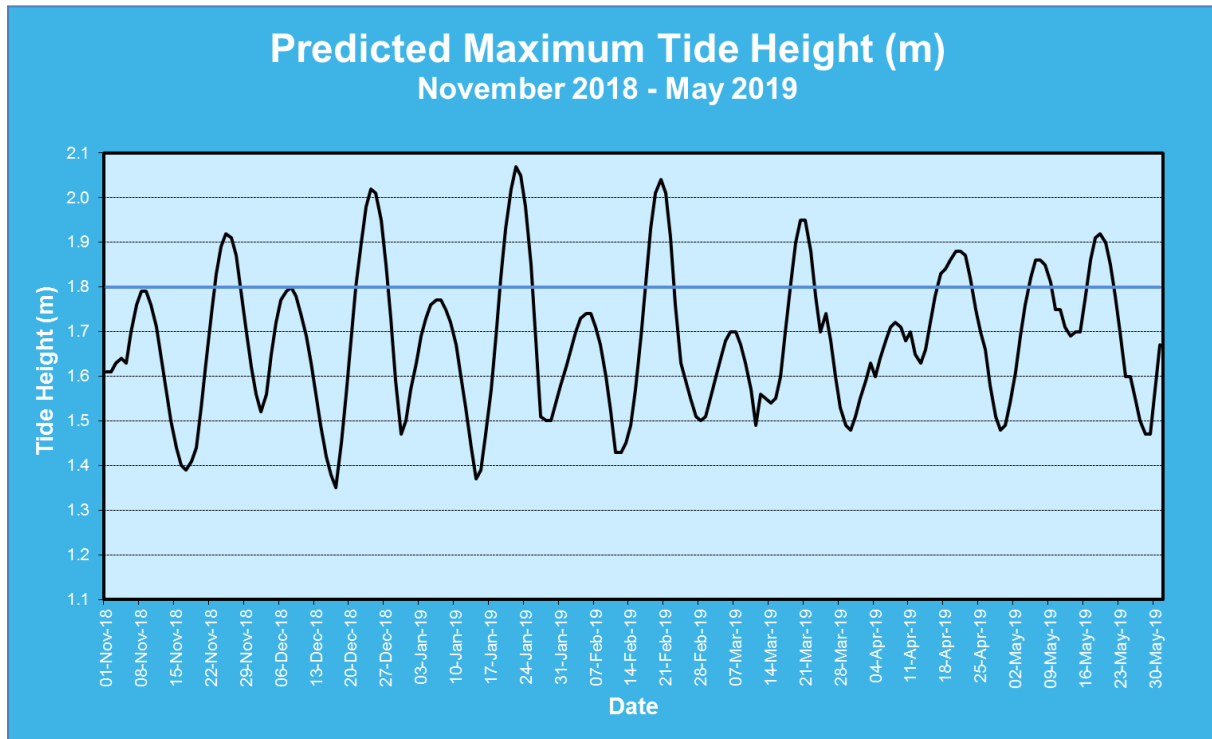
www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 4 December 2018, the El Niño Alert continues (which means that many, but not all the criteria have been met for an El Niño). 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/ and, <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.



A small series of high tides are occurring now over 9-12 December 2018, although these are forecast to be only just at the level to possibly trigger *Aedes vigilax* hatching. At present, the height of these tides are only just reaching the forecasted level in Sydney (C. Webb, *pers. comm.*).

The next series of high tides are due over 21-27 December 2018, 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), Nichols (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 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	
Lachlan/Murrumbidgee/Murray Rivers	1.15	0.70	0.77	
Northern Rivers	0.81	1.07	1.00	
North Lake Eyre system	0.75	0.69	0.73	

*Data for October and November only

ii. Nichol's Hypothesis

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

Arboviral Isolates

LOCATION – Site	Date Trapped	Mosquito Species	Virus
Nil to date			

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	11	1	1	0	25
8-Dec-18							
15-Dec-18							
22-Dec-18							
29-Dec-18							

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 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							
12-Jan-19							
19-Jan-19							
26-Jan-19							
2-Feb-19							
9-Feb-19							
16-Feb-19							
23-Feb-19							
2-Mar-19							
9-Mar-19							
16-Mar-19							
23-Mar-19							
30-Mar-19							
6-Apr-19							
13-Apr-19							
20-Apr-19							
27-Apr-19							
4-May-19							
11-May-19							
18-May-19							
25-May-19							
1-June-19							
8-June-19							
15-June-19							
22-June-19							
29-June-19							
Total	178	24	109	36	6	0	353

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.

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	1,619
2015-2016	54	61	53	61	70	54	42	60	78	79	52	16	680
2016-2017	12	11	20	17	38	216	429	274	200	142	174	89	1,622
2017-2018	29	37	52	56	37	31	30	39	51	74	96	70	602
2018 - 2019	32	41	30	45	31	2							181
Ave [†]	33	40	43	50	51	98	155	170	190	140	106	56	1,132

*updated 10 December 2018 (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	10	3	11	11	8	4	12	17	43	43	16	11	189
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	24	93
2017-2018	8	10	6	8	8	6	5	12	8	10	8	7	96
2018 - 2019	4	6	5	2	6	1							24
Ave [†]	7	6	6	7	6	6	8	10	15	16	15	11	113

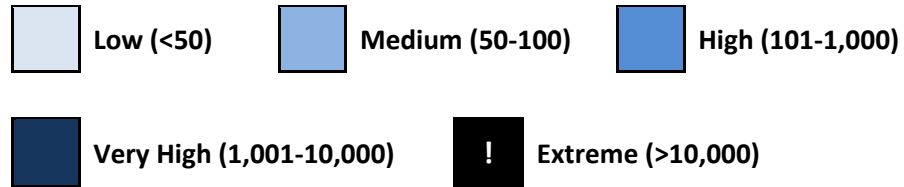
*updated 10 December 2018 (this table is updated at different times to Table 4 above, hence there maybe differences in the numbers).

[†]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.

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.																											

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.																										

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.																										

Sentinel Chicken Flocks

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

N= Negative for MVEV & Kunjin virus

*Dubbo is commencing monitoring in January 2019.

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