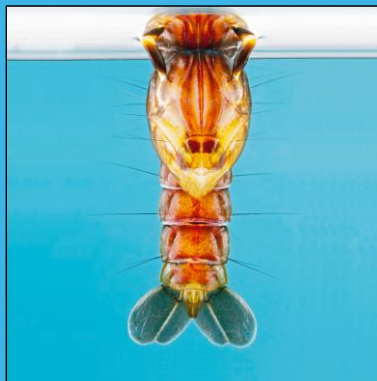


NSW Arbovirus Surveillance & Mosquito Monitoring Program, 2017-2018

Weekly Update: 15/Dec/2017



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Summary

- **Climate:** over the last week, there was light rainfall along the Murray and the coast.
- **Three Month Forecast:** for December 2017 to February 2018, rainfall predictions for NSW are for average precipitation for most of the state, with a slightly increased probability of being above average in the south east. Maximum and minimum temperatures are expected to be above average in the south of the state. According to the BOM as of 5/Dec/17, the La Niña has formed, suggesting that rainfall patterns are likely to be above average for the upcoming months until autumn and that summer will be humid.
- **Tidal:** a small set of high tides are due over 19-20/Dec that may induce some *Aedes vigilax* hatching. However, these tides are predicted to be only 1.75 and hatching may not occur. The next larger set of tides are due over 31/Dec to 6/Jan with tides up to 2.07m forecasted.
- **MVEV models:** the data relevant to both the Forbes' and Nichols' hypotheses have been updated to the end of Nov 2017. Both theories have aligned towards conditions associated with past MVEV outbreaks, but the models are not suggestive of an epidemic.
- **Mosquito Numbers Inland:** mosquito numbers were 'low' at all sites except Griffith where the numbers were 'very high'.
- **Mosquito Numbers Coast:** mosquito numbers were 'high' at the north coast sites and Gosford, although densities of *Aedes vigilax* remain 'low'.
- **Mosquito Numbers Sydney:** most locations produced a 'low' mosquito catch.
- **Arboviral Isolates:** there have been no isolates to date.
- **Chicken Sentinel Flocks:** there were no seroconversions.
- **Human Notifications:** for the current fiscal year, there have been 217 RRV and 35 BFV notifications, this is around average for recent years.

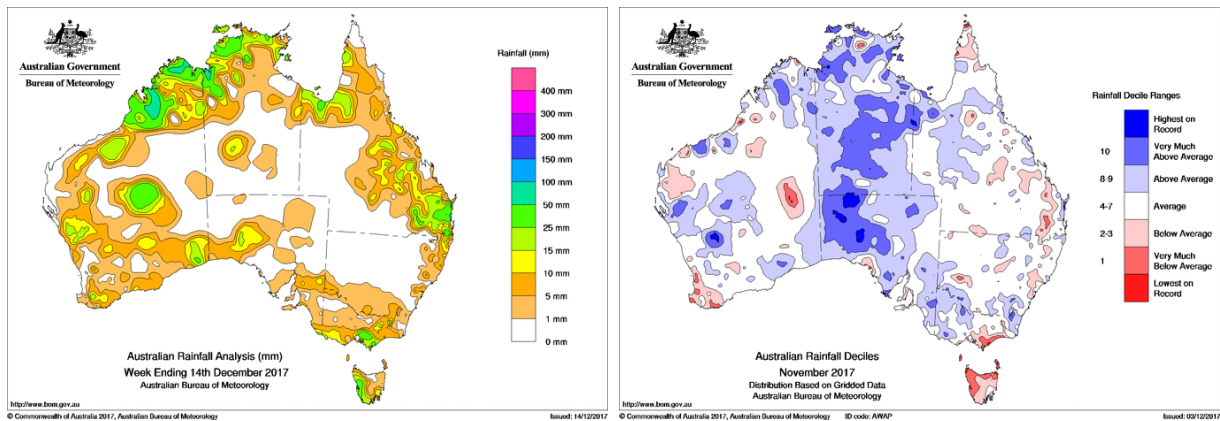
Comment: from the inland, only Griffith has yielded mosquito collections greater than 'low' in number. The new site of Lake Wyangan was especially productive, trapping almost 2,000 mosquitoes. The effects of the recent rains in the south of the state has yet to influence mosquito numbers, however much of the rain was absorbed into the ground. To date there have been no arboviral isolates nor any seroconversions in the sentinel chicken flocks.

For the coast, 'high' mosquito numbers were trapped at both Ballina and at the Tweed, with *Culex sitiens* being the predominant species. This is a mosquito that breeds in the saline environment of saltmarshes but is not as an efficient vector as *Aedes vigilax*, and historically few arboviruses have been isolated from the former species. It is also not particularly aggressive biter. Fortunately, numbers of *Aedes vigilax* continue to remain 'low', however this is expected to change shortly as a result of the recent extremely high spring tides as noted in last weeks report. There have been no arboviral isolates to date.

Environmental Conditions

Rainfall

Rainfall across Australia for the week ending 14/Dec/2017 is depicted on the left and monthly rainfall deciles for November 2017 are on the right. Over the last week, there was light rainfall along the Murray and the coast. For November, rainfall was around average for much of the state. Maximum and minimum temperatures for November were 2-3 degrees above normal and warmer to the south.



Three Month Rainfall & Temperature Forecast

For December 2017 to February 2018, rainfall predictions for NSW are for average precipitation for most of the state, with a slightly increased probability of being above average in the south east. Maximum and minimum temperatures are expected to be above average in the south of the state. The following pages contain graphics of the seasonal outlook:

www.bom.gov.au/climate/outlooks/#/rainfall/median (Rainfall outlook).

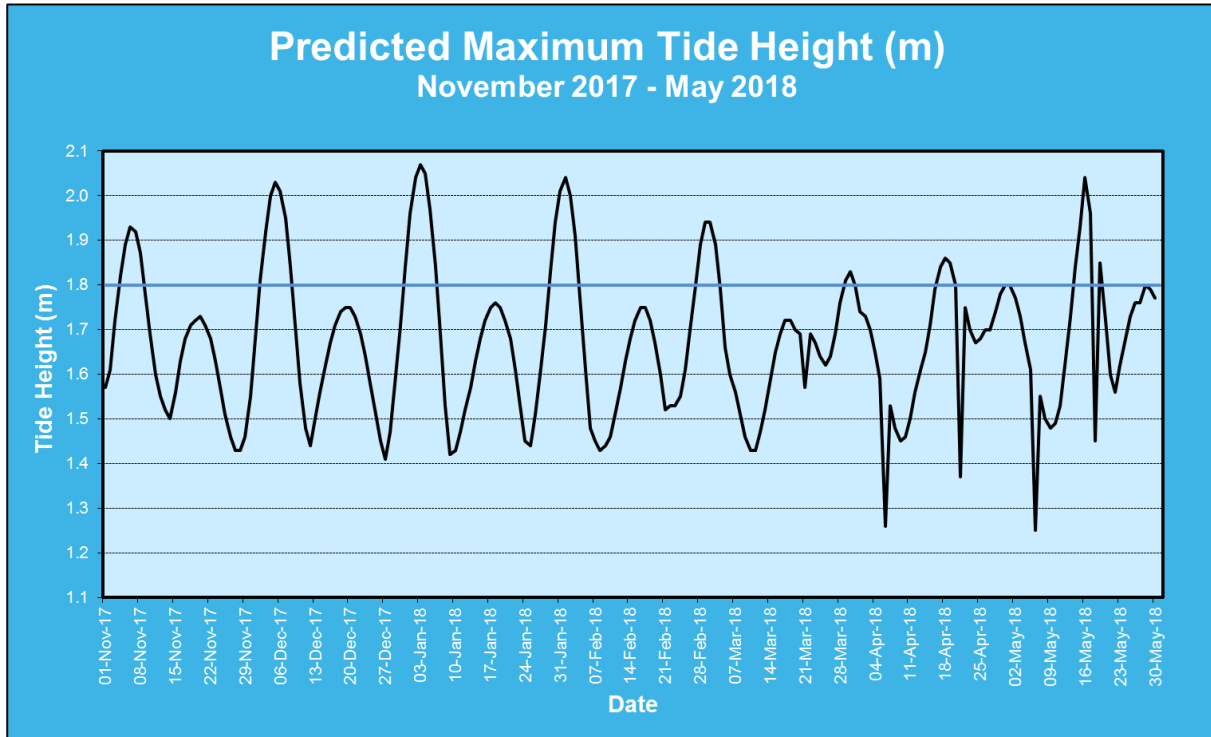
www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 5/Dec/17, the La Niña has formed. The climatic models suggest this is likely to be weak and short lived, persisting until autumn 2018. The Indian Ocean Dipole (IOD) remains neutral. This all suggests that rainfall patterns are likely to be above average for the upcoming months, with higher levels of humidity that will aid adult mosquito survival.

For more information: www.bom.gov.au/climate/enso/ and, <http://www.bom.gov.au/climate/iod/>

Tidal

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 height varies between region, thus at Batemans Bay, a tide height over 0.8m can trigger egg hatching.



A small set of high tides are due over 19-20/Dec that may induce some *Aedes vigilax* hatching. However, these tides are predicted to be only 1.75 and hatching may not occur. The next larger set of tides are due over 31/Dec to 6/Jan with tides up to 2.07m forecasted.

Note that 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. Thus predicted tide height should be used as a gauge only for potential *Aedes vigilax* activity. The larvae of the saltmarsh mosquito relies on a 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 is poorly developed (and unreliable), 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 localized 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 2016 or for the first quarter of 2017 (Table 1). For the last quarter of 2017 (October data only), rainfall was above Decile 7 in all but one catchment basin.

Table 1. Rainfall indices for the main catchment basins of eastern Australia as per Forbes' hypothesis, relevant to the 2017-2018 season. Note that a value of 1 equals Decile 7 rainfall.

Catchment Basin	Oct-Dec 2016	Jan-Mar 2017	Oct-Dec 2017*	Jan-Mar 2018
Darling River	0.58	0.81	1.05	
Lachlan/Murrumbidgee/Murray Rivers	0.92	1.01	1.01	
Northern Rivers	0.98	1.03	1.28	
North Lake Eyre system	1.09	0.73	0.82	

*Data for October and September only.

ii. Nichol's Hypothesis

Table 2. The seasonal atmospheric pressures (in mm) according to Nichol's hypothesis, relevant to the 2017-2018 season.

	Autumn 2017	Winter 2017	Spring 2017*
2017 Value	1009.60	1013.23	1009.70
Pre past MVEV seasons	<1009.74	<1012.99	<1009.99

Only the Winter 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			

*Detection via Honey-Baited Cards, the mosquito species cannot be determined.

Human Notifications

Weekly notifications of human mosquito-borne diseases 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).

Notifications of Mosquito-Borne Disease in NSW, 2017-2018*

Week Ending	RRV	BFV	DENV [†]	Malaria [†]	CHIKV [†]	ZIKV [†]	Total
1-Jul-17	14	6	3	2	0	0	25
8-Jul-17	6	4	0	4	1	0	15
15-Jul-17	8	0	2	1	0	0	11
22-Jul-17	10	3	7	2	0	0	22
29-Jul-17	6	0	2	2	0	0	10
5-Aug-17	8	0	4	0	0	0	12
12-Aug-17	11	1	3	2	5	0	22
19-Aug-17	5	2	1	2	2	0	12
26-Aug-17	6	3	3	2	0	1	15
2-Sep-17	6	0	1	0	1	0	8
9-Sep-17	14	0	1	2	1	0	18
16-Sep-17	9	1	5	0	0	0	15
23-Sep-17	9	1	3	1	0	0	14
30-Sep-17	7	0	1	1	1	0	10
7-Oct-17	7	0	3	2	0	0	12
14-Oct-17	10	1	2	1	0	0	14
21-Oct-17	11	2	8	2	1	0	24
28-Oct-17	16	1	6	1	1	0	25
4-Nov-17	14	3	7	3	1	0	28
11-Nov-17	5	2	7	0	0	0	14
18-Nov-17	3	2	10	0	0	0	15
25-Nov-17	9	2	6	1	1	0	19
2-Dec-17	14	1	8	0	0	0	23
9-Dec-17	9	0	3	1	0	0	13
Total	217	35	99	32	15	1	396

[†]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 infection may have been acquired elsewhere and that winter notifications of RRV are likely to be false positives.

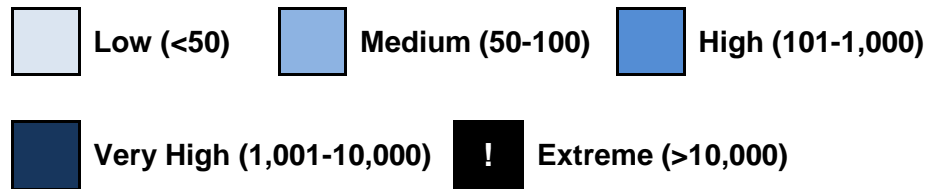
Table 6. Ross River virus infection notifications in NSW residents, by month of disease onset per fiscal year, July 2013 to November 2017*.

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2013-2014	36	23	27	36	30	30	33	35	44	72	86	57	509
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	40	53	56	35	8							221

*updated 15/Nov/2017 (this table is updated more regularly than Table 5 above, hence there maybe differences in the numbers). Table modified from: <http://www1.health.nsw.gov.au/IDD/#/ROSS>

Mosquito Results

Mosquito abundances are best described in relative terms, and in keeping with the terminology from previous NSWASP Annual Reports, mosquito numbers are depicted on the tables below as:



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

Inland

Location	Mosquito	Oct-17					Nov				Dec				Jan-18				Feb				Mar			
		1	8	15	22	29	5	12	19	26	3	10	17	21	28	7	14	21	28	4	11	18	25	4	11	18
Albury	<i>Cx. annul</i>																									
	Total Mosq.																									
Bourke	<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.																									
Mathoura	<i>Cx. annul</i>																									
	Total Mosq.																									
Wagga	<i>Cx. annul</i>																									
	Total Mosq.																									

Coastal

Location	Mosquito	Nov				Dec				Jan-18				Feb				Mar				Apr					
		5	12	19	26	3	10	17	21	28	7	14	21	28	4	11	18	25	4	11	18	25	1	8	15	22	29
Ballina	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Coffs Harbour	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Gosford	<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				Dec					Jan-18				Feb				Mar				Apr				
		5	12	19	26	3	10	17	21	28	7	14	21	28	4	11	18	25	4	11	18	25	1	8	15	22	29
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>Ae. vigilax</i>																										
	Total Mosq.																										
Hills Shire	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Penrith	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Sydney Olympic Park	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Ryde	<i>Ae. vigilax</i>																										
	Total Mosq.																										

Sentinel Chicken Flocks

Location	Oct-17					Nov				Dec					Jan-18				Feb				Mar				
	1	8	15	22	29	5	12	19	26	3	10	17	21	28	7	14	21	28	4	11	18	25	4	11	18	25	
Bourke																											
Deniliquin						15N	14N	15N	15N	15N																	
Dubbo						15N	15N	15N	15N	15N																	
Forbes						15N		15N	15N	15N																	
Griffith					15N	15N	15N	15N	15N	15N																	
Hay					15N	15N	15N	15N	15N																		
Leeton						15N	15N		15N	15N																	
Macquarie Marshes							15N	15N	15N																		
Menindee										15N																	
Moama																											
Moree										15N																	
Wee Waa																											

N= Negative for MVEV & KUNV

Prepared by: Stephen Doggett, Manager, Department of Medical Entomology, NSW Health Pathology (ICPMR), Westmead Hospital NSW 2145. Email: Stephen.Doggett@health.nsw.gov.au

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