

NSW ARBOVIRUS SURVEILLANCE & MOSQUITO MONITORING PROGRAM 2016-2017

Weekly Update

Date: 6/Jan/2017

SUMMARY

- **Climate:** over the last week, there was light to moderate rainfall across the entire state. For December, rainfall was average for most of the state with parts of the coast and northern inland being drier than normal, and parts of the west being wetter than average. Maximum and minimum temperatures for December were 2-3 degrees above average.
- **Three Month Forecast:** for January to March 2017, rainfall predictions for NSW are for below average precipitation, with a higher probability of eastern areas being drier than average. Maximum and minimum temperatures are predicted to be above normal and warmer in eastern areas. According to the BOM as of 3/Jan/17, the El Niño-Southern Oscillation remains neutral.
- **Tidal:** the next series of high tides that may result in larval hatching are due to occur over 10-14/Jan/2017.
- **MVEV models:** the data relevant to both the Forbes' and Nichols' hypotheses have been updated to the end of December 2016 and both theories remain inconsistent with past MVEV outbreaks.
- **Mosquito Numbers Inland:** mosquito collections were much lower this week due to high winds affecting trap collections at some sites. In spite of this, numbers at Griffith continue to be 'very high', although were 'low' at other sites.
- **Mosquito Numbers Coast:** few collections were made this week, with 'high' mosquito numbers from Ballina and Gosford.
- **Mosquito Numbers Sydney:** the Christmas week yielded 'very high' mosquito numbers at Georges River with the collections dominated by *Aedes vigilax*. This week however, numbers were well down with the cooler conditions, as they were at most other sites.
- **Arboviral Isolates:** new arboviral isolates include; Albury (1RRV), Georges River (1RRV), and Griffith (1SINV).
- **Chicken Sentinel Seroconversions:** there have been no seroconversions.
- **Human Notifications:** for the current fiscal year, the Ross River virus notifications are now only slightly below average, with December reports being more than double the average. There have been few notifications of Barmah Forest virus disease.

Comment: over the last two weeks only a few mosquito trap collections were made. Numbers this week were down due to the weather conditions being less than favourable for mosquito trapping (cool, wet and windy). Human notifications of Ross River virus for the season are now close to average largely due to the spike in December, which was double the norm for the month.

The only other notable event over the last fortnight were some large collections at Georges River during the Christmas week, with 'very high' mosquito numbers being yielded, dominated by *Aedes vigilax*. There was also one Ross River viral isolate from the site of Alford's Point, the second for the season from this location.

For information on Ross River notifications, see:

<http://www0.health.nsw.gov.au/data/diseases/rossriver.asp>

Media resources on mosquitoes:

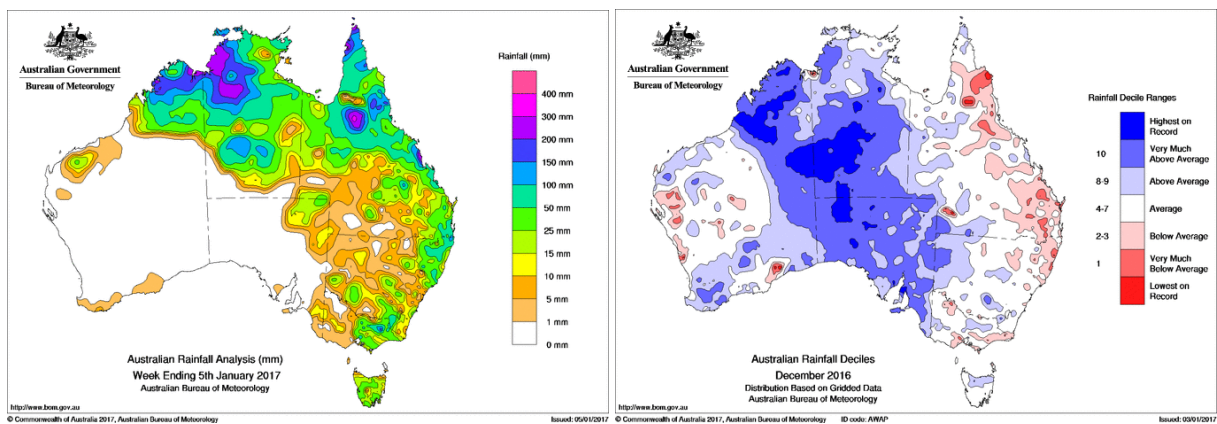
<http://www.health.nsw.gov.au/environment/pests/vector/Pages/resources.aspx>

<http://www.health.nsw.gov.au/Infectious/factsheets/Pages/mosquito.aspx>

ENVIRONMENTAL CONDITIONS

Rainfall

Rainfall across Australia for the week ending 5/Jan/2017 is depicted on the left and monthly rainfall deciles for December 2016 are on the right. Over the last week, there was light to moderate rainfall across the state. Rainfall during December (right graph below) was average for most of the state with parts of the coast and northern inland being drier than normal, and parts of the west being wetter than average. Maximum and minimum temperatures for December were 2-3 degrees above average.



Three Month Rainfall & Temperature Forecast

For January to March 2017, rainfall predictions for NSW are for below average precipitation, with a higher probability of eastern areas being drier than average. Maximum and minimum temperatures are expected to be above normal across the state and warmer in eastern areas. The following pages contain graphics of the seasonal outlook:

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

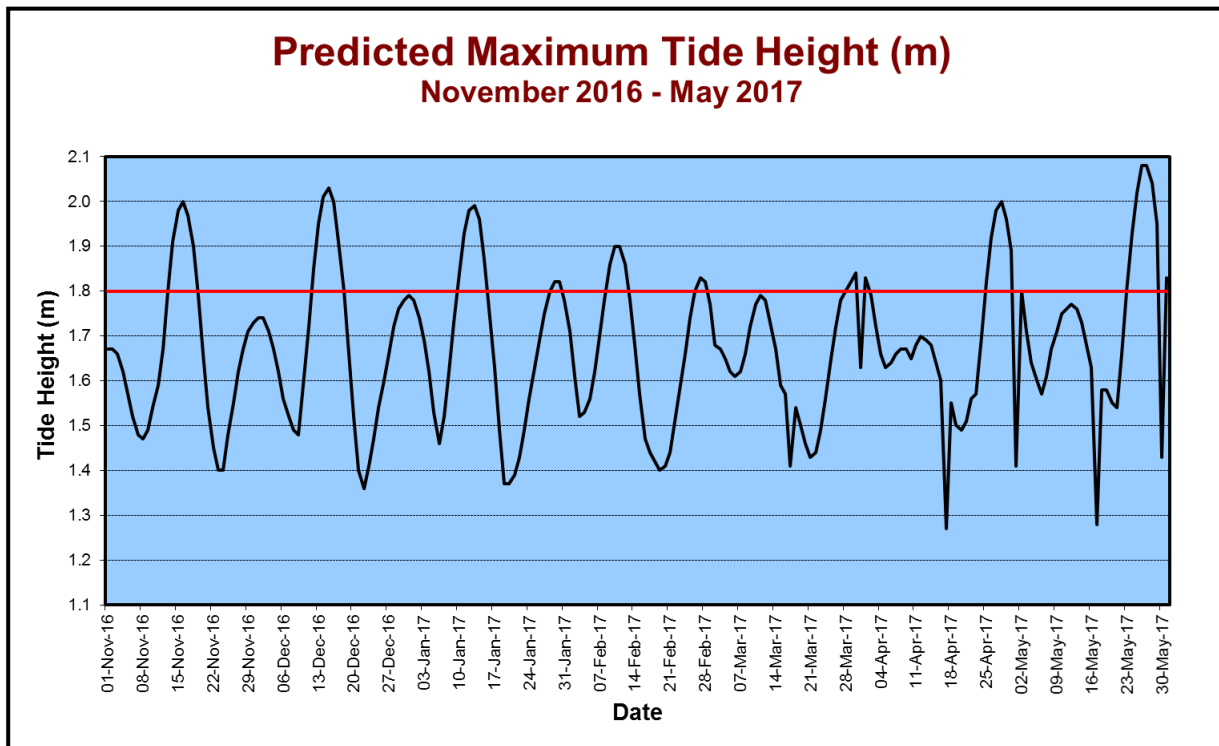
www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 3/Jan/17 the El Niño-Southern Oscillation remains neutral (a La Niña event is typically associated with wetter than average conditions and an El Niño with drier conditions).

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 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.



The recent series of high tides did not reach a high level and unlikely to result in much egg hatching. The next series of high tides that may lead to *Aedes vigilax* larval hatching are due over 10-14/Jan/2017.

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 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 2015 or the majority of the catchments for the first quarter of 2016 (Table 1). For the Oct-Dec 2016 period, rainfall was not above Decile 7 in all of the catchment basins.

Table 1. Rainfall indices for the main catchment basins of eastern Australia as per Forbes' hypothesis, relevant to the 2016-2017 season. Note that a value of 1 equals Decile 7 rainfall.

Catchment Basin	Oct-Dec 2015	Jan-Mar 2016	Oct-Dec 2016	Jan-Mar 2017
Darling River	0.72	0.67	0.58	
Lachlan/Murrumbidgee/Murray Rivers	0.70	1.14	0.92	
Northern Rivers	1.35	0.57	0.98	
North Lake Eyre system	1.35	0.63	1.09	

ii. Nichol's Hypothesis

Table 2. The seasonal atmospheric pressures (in mm) according to Nichol's hypothesis, relevant to the 2016-2017 season.

	Autumn 2016	Winter 2016	Spring 2016
2015 Value	1010.30	1012.57	1010.07
Pre past MVEV seasons	<1009.74	<1012.99	<1009.99

Only the Winter period pertaining to the Nichol's hypothesis is in line with past MVEV active years.

ARBOVIRAL ISOLATES

LOCATION - Site	Date Trapped	Mosquito Species	Virus
GEORGES RIVER – Alford's Point	29/Dec/16	*	Ross River
ALBURY – Kremur St	19/Dec/16	*	Ross River
ALBURY – Kremur St	19/Dec/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
LEETON – Farm 347	13/Dec/16	<i>Culex annulirostris</i>	Ross River
LEETON – Farm 347	13/Dec/16	<i>Culex annulirostris</i>	Ross River
LEETON – Farm 347	13/Dec/16	<i>Culex annulirostris</i>	Sindbis
LEETON – Farm 347	13/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	12/Dec/16	*	Ross River
GRIFFITH – Barren Box	12/Dec/16	<i>Anopheles annulipes</i>	Sindbis
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GEORGES RIVER – Illawong	8/Dec/16	*	Ross River
LEETON – Farm 347	7/Dec/16	*	Ross River
LEETON – Farm 347	7/Dec/16	<i>Culex annulirostris</i>	Sindbis
MURRAY – Moama	6/Dec/16	*	Ross River
ALBURY – Kremur St	5/Dec/16	*	Ross River
ALBURY – Kremur St	5/Dec/16	<i>Culex annulirostris</i>	Ross River
ALBURY – Kremur St	5/Dec/16	<i>Aedes bancroftianus</i>	Ross River
FORBES – STP	5/Dec/16	*	Ross River
FORBES – STP	5/Dec/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	5/Dec/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	5/Dec/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	5/Dec/16	<i>Culex australicus</i>	Ross River
GRIFFITH – Barren Box	5/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	5/Dec/16	<i>Culex australicus</i>	Ross River
GRIFFITH – Lake Wyangan	5/Dec/16	<i>Culex australicus</i>	Ross River
GRIFFITH – Hanwood	31/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Hanwood	31/Nov/16	<i>Culex annulirostris</i>	Sindbis

GRIFFITH – Hanwood	31/Nov/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Hanwood	31/Nov/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	31/Nov/16	<i>Anopheles annulipes</i>	Ross River
GRIFFITH – Lake Wyangan	31/Nov/16	<i>Anopheles annulipes</i>	Ross River
GRIFFITH – Lake Wyangan	31/Nov/16	*	Ross River
FORBES – STP	29/Nov/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	29/Nov/16	<i>Culex australicus</i>	Ross River
FORBES – Toms Lagoon	29/Nov/16	<i>Culex annulirostris</i>	Ross River
LEETON – Farm 347	29/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	<i>Anopheles annulipes</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Hanwood	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Hanwood	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Hanwood	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	*	Ross River
LEETON – Farm 347	16/Nov/16	<i>Culex annulirostris</i>	Ross River
LEETON – Farm 347	16/Nov/16	<i>Anopheles annulipes</i>	Ross River
LEETON – Farm 347	16/Nov/16	*	Ross River
FORBES – Toms Lagoon	15/Nov/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	15/Nov/16	<i>Culex annulirostris</i>	Barmah Forest
FORBES – STP	15/Nov/16	*	Barmah Forest
GRIFFITH – Lake Wyangan	14/Nov/16	<i>Aedes sagax</i>	Barmah Forest
GRIFFITH – Lake Wyangan	14/Nov/16	*	Barmah Forest
MURRAY – Moama	8/Nov/16	*	Ross River
MURRAY – Moama	8/Nov/16	<i>Aedes sagax</i>	Ross River
FORBES – Toms Lagoon	7/Nov/16	<i>Aedes sagax</i>	Sindbis
GRIFFITH – Lake Wyangan	1/Nov/16	<i>Aedes theobaldi</i>	Ross River
GRIFFITH – Lake Wyangan	1/Nov/16	<i>Anopheles annulipes</i>	Ross River

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

<http://medent.usyd.edu.au/arbovirus/results/virusisolates.htm>

The Victorian Arbovirus Surveillance Program has also had a series of Ross River virus detections at sites along the Murray, including nine from Moira and two at Mildura. These were detection in late November to early December (information courtesy Stacey Rowe, DHHS, Victoria).

Arboviral Isolates 2016-2017, Summary Table

LOCATION	Date Trapped	Virus			Total
		BFV	RRV	SINV	
ALBURY	19/Dec/16		2		2
ALBURY	5/Dec/16		3		3
FORBES	5/Dec/16		5		5
FORBES	29/Nov/16		3		3
FORBES	15/Nov/16	2	1		3
FORBES	7/Nov/16			1	1
GEORGES RIVER	29/Dec/16		1		1
GEORGES RIVER	8/Dec/16		1		1
GRIFFITH	19/Dec/16			9	9
GRIFFITH	12/Dec/16		3	7	10
GRIFFITH	5/Dec/16		2	1	3
GRIFFITH	31/Nov/16		4	3	7
GRIFFITH	21/Nov/16		7	1	8
GRIFFITH	14/Nov/16	2			2
GRIFFITH	1/Nov/16		2		2
LEETON	13/Dec/16		2	2	4
LEETON	7/Dec/16		1	1	2
LEETON	29/Nov/16		1		1
LEETON	16/Nov/16		3		3
MURRAY	6/Dec/16		1		1
MURRAY	8/Nov/16		2		2
TOTAL		4	44	25	73

HUMAN NOTIFICATIONS

Weekly notifications of human mosquito-borne diseases infections are available from the NSW Ministry of Health, Communicable Disease Weekly Report and summarised in the Table below*: www.health.nsw.gov.au/Infectious/reports/Pages/CDWR.aspx

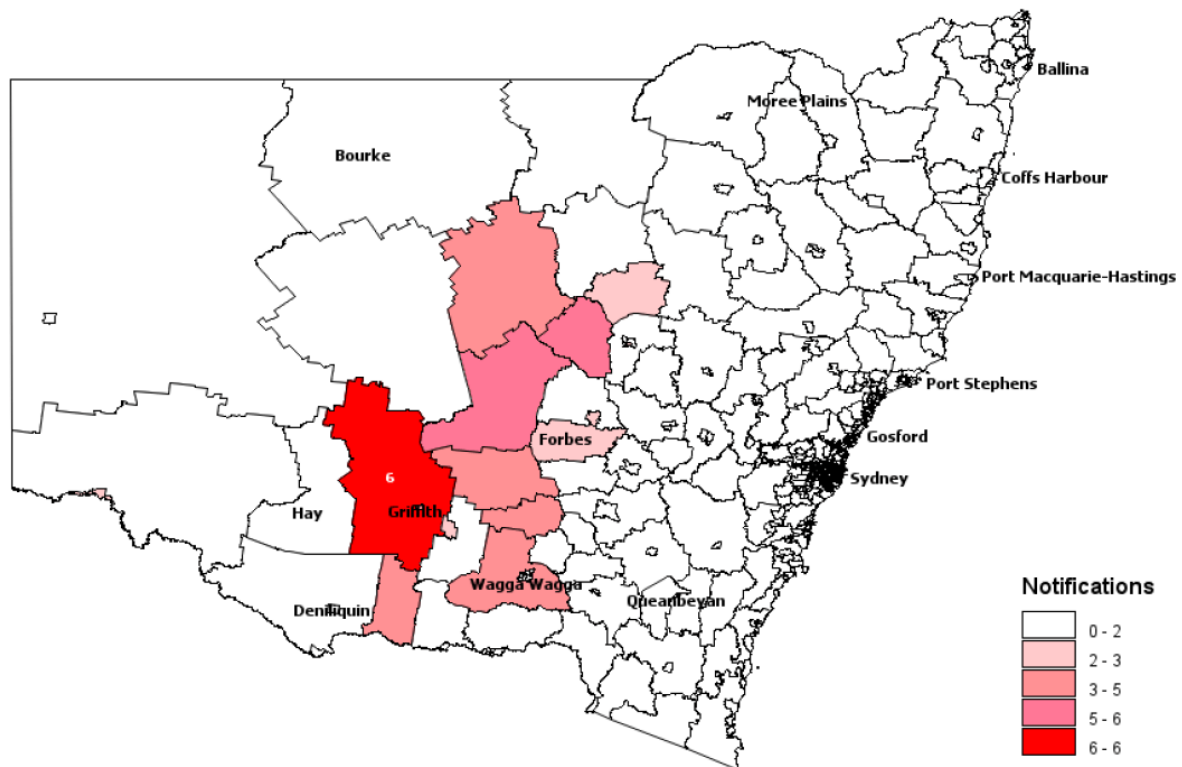
Notifications of Mosquito-Borne Disease in NSW, 2016-2017*

Week Ending	RRV	BFV	DENV [†]	Malaria [†]	CHIKV [†]	ZIKV [†]	Total
3-Jul-16	3	0	1	1	0	0	5
10-Jul-16	2	0	5	2	0	0	9
17-Jul-16	4	1	6	0	0	0	11
24-Jul-16	3	3	9	2	0	0	17
31-Jul-16	2	0	6	4	0	0	12
7-Aug-16	2	0	6	3	0	0	11
14-Aug-16	1	0	5	1	0	0	7
21-Aug-16	4	0	1	1	1	0	7
28-Aug-16	2	0	4	0	1	0	7
4-Sep-16	3	0	4	0	0	0	7
11-Sep-16	1	0	3	2	0	0	6
18-Sep-16	3	0	3	1	0	1	8
25-Sep-16	9	0	4	1	0	1	15
2-Oct-16	2	0	0	0	0	1	3
9-Oct-16	3	0	5	2	0	0	10
16-Oct-16	2	0	8	4	1	0	15
23-Oct-16	3	0	9	0	1	0	13
30-Oct-16	6	0	5	0	1	0	12
6-Nov-16	4	0	4	2	2	0	12
13-Nov-16	2	0	9	0	1	0	12
20-Nov-16	6	0	10	0	1	0	17
27-Nov-16	8	0	4	2	1	0	15
4-Dec-16	13	0	6	2	1	0	22
11-Dec-16	18	0	8	3	0	0	29
18-Dec-16	21	0	2	0	2	0	25
25-Dec-16	31	0	0	2	0	0	33
1-Jan-17	8	0	0	1	0	0	9
Total	166	4	127	36	13	3	346

[†]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: the notifications of Ross River virus for 2016-2017 are continuing to rise and now only slightly below the long term average. During December there were 91 Ross River virus notifications being more than double the average. Most of the

notifications are from central NSW (see Figure below). In contrast, Barmah Forest virus notifications have been few, being less than one tenth of the longer term average. However, the decline is probably artificial and due to the withdrawal of the commercial test that was over diagnosing patients.



Ross River virus notifications in NSW residents for December 2016, by onset date and Australian Bureau of Statistics statistical area 2. From the Communicable Diseases Weekly Report, Weeks 51-52.

For more data on Ross River virus notifications in NSW see:
<http://www0.health.nsw.gov.au/data/diseases/rossriver.asp>

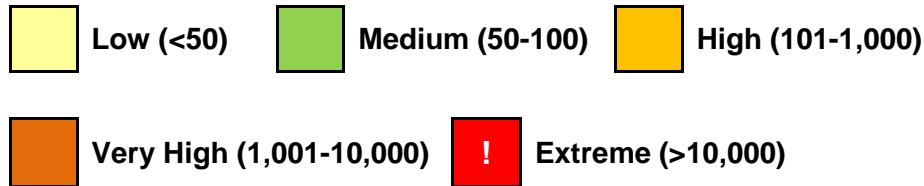
For more data on Barmah Forest virus notifications in NSW see:
<http://www0.health.nsw.gov.au/data/diseases/barmahforest.asp>

It should also be noted that notifications are for NSW residents and that infection may have been acquired elsewhere.

MOSQUITO RESULTS

All the full mosquito results can be obtained from:
<http://medent.usyd.edu.au/arbovirus/results/results.htm#site>

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-16					Nov					Dec					Jan-17					Feb				Mar			
		2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	5	12	19	26		
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.																												
Mathoura	<i>Cx. annul</i>																												
	Total Mosq.																												
Menindee	<i>Cx. annul</i>																												
	Total Mosq.																												
Wagga	<i>Cx. annul</i>																												
	Total Mosq.																												

Coastal

Location	Mosquito	Nov				Dec				Jan-17					Feb				Mar				Apr				
		6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	5	12	19	26	2	9	16	23	30
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-17				Feb				Mar				Apr					
		6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	5	12	19	26	2	9	16	23	30
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 Seroconversions

http://medent.usyd.edu.au/arbovirus/results/chicken_results_all_sites.htm

Location	Oct-16					Nov				Dec				Jan-17					Feb				Mar				
	2	9	16	23	30	8	13	20	27	4	11	18	22	1	8	15	22	29	5	12	19	26	5	12	19	26	
Bourke																											
Deniliquin						15N	15N	13N		13N	13N	13N															
Forbes				15N	15N	15N	15N	15N	15N	15N	15N																
Griffith			15N	15N	15N	15N	15N	15N	15N	15N	13N	14N															
Hay			15N	15N	15N	15N	15N	15N	15N		15N																
Leeton			15N	15N	15N	15N	15N	15N	15N		15N	14N															
Macquarie Marshes								15N	15N		15N																
Menindee					15N	15N	15N	14N	14N	15N	13N	13N															
Moama								15N	15N			15N															
Moree										15N	15N	15N															
Wee Waa							15N	13N	15N	15N	15N		15N														

N= Negative for MVEV & KUNV

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

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 organizations without permission.