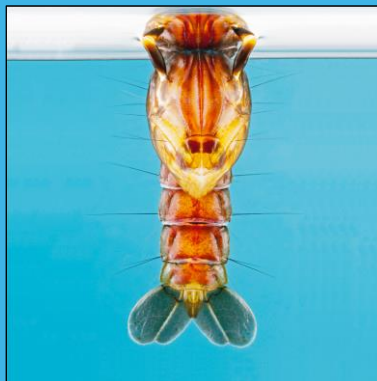


NSW Arbovirus Surveillance & Mosquito Monitoring Program, 2017-2018

Weekly Update: 12/Jan/2018



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Summary

- **Climate:** over the last week, there was light to moderate rainfall across the state, being heavier towards the coast. For December, rainfall was above average for inland southern regions and average across the north of the state.
- **Three Month Forecast:** for February to April 2018, rainfall predictions for NSW are for average precipitation for most of the state, with an increased probability for the north coast. Maximum and minimum temperatures are expected to be slightly above average, particularly around the mid-north coast. According to the BOM as of 3/Jan/2018, the weak La Niña persists, 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 series of high tides of maximum 1.76m in height is due over 17-19/Jan, however a much longer and higher series are due over 29/Jan to 4/Feb. These are predicted to peak at 2.04m.
- **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:** Griffith continues with the 'very high' numbers with over 6,000 mosquitoes trapped this week. Albury yielded a 'high' catch.
- **Mosquito Numbers Coast:** Port Macquarie yielded a 'very high' catch of around 2,000 mosquitoes at the Steven Street site, which was dominated by *Culex annulirostris*. However, other two sites at this location trapped few mosquitoes. Gosford continues with the 'high' numbers, while elsewhere, collections were 'low' to 'medium'.
- **Mosquito Numbers Sydney:** most collections were 'low', although Sydney Olympic Park produced a 'high' catch.
- **Arboviral Isolates:** there was one isolate of RRV from *Culex annulirostris* trapped at Griffith (Lake Wyangan) on 3/Jan/2018.
- **Chicken Sentinel Flocks:** there have been no seroconversions.
- **Human Notifications:** for the current fiscal year, there have been 241 RRV and 45 BFV notifications, this is around 20% below average compared with recent years.

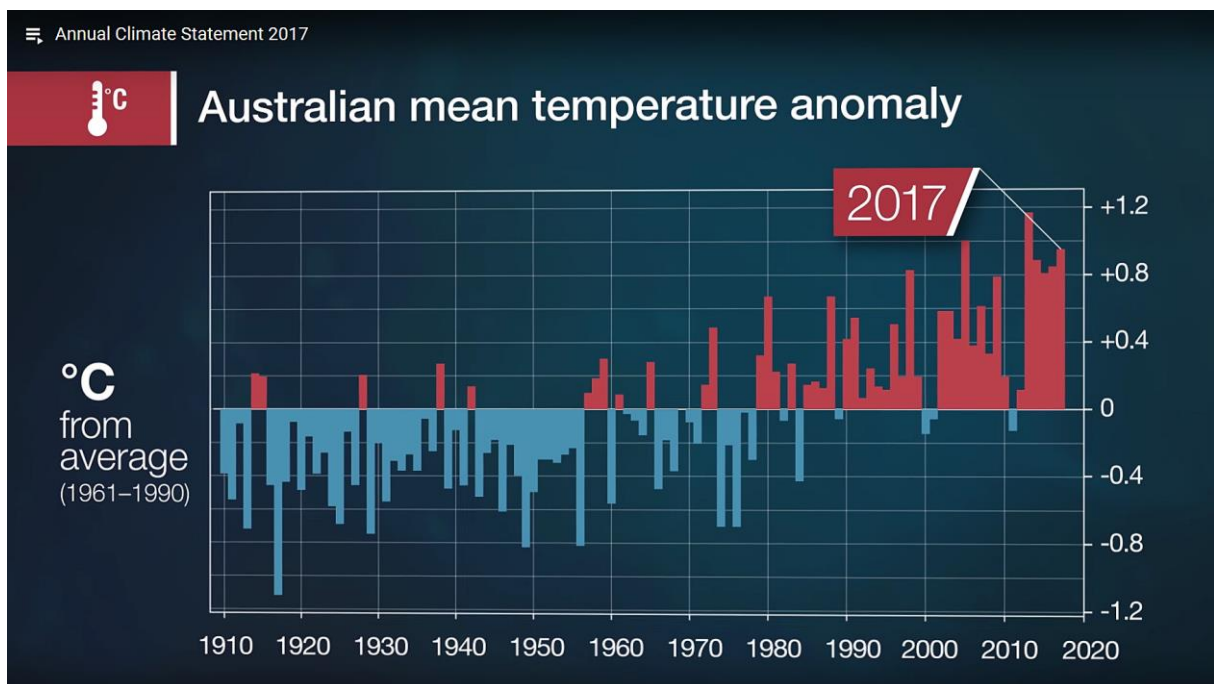
Comment: mosquito numbers continue to be 'very high' at Griffith and this week we had the first arboviral isolate of the season from this site; one RRV. An isolate of RRV from Griffith is not unusual for this time of the year and human notifications are currently below average for the state. For the coast, we are yet to see the effects of the huge recent high tides, however the 'very high' numbers of *Culex annulirostris* at Port Macquarie is a concern. Many believe that it is high numbers of freshwater mosquitoes along the coast that drives major RRV outbreaks. Fortunately the forecast for the next three months is for average rainfall, which may reduce the risk of major RRV activity.

The Annual Climate Statement for 2017 was released this week by the BOM (<http://www.bom.gov.au/climate/current/annual/aus/2017/>). Australia had its third hottest year on record (see Figure below), while for NSW, we had the highest average temperature for a calendar year measured to date.

What does this mean for mosquitoes and mosquito-borne disease to the future? Longer mosquito seasons, shorter extrinsic incubation periods (which means that mosquitoes can transmit viruses much more quickly), and the possibility of more northern species moving south (*Aedes aegypti*, the Dengue vector, is not all that far from the NSW border). However, such effects may be tempered by long term variations in rainfall patterns and other phenomena (e.g. reservoir host factors, human behaviours, etc).

Click on the link below for a video summary of the annual statement:

https://youtu.be/47XvSA08VC0?list=PLbKuJrA7Vp7naJL31deES8QAV5E0q6U_H.

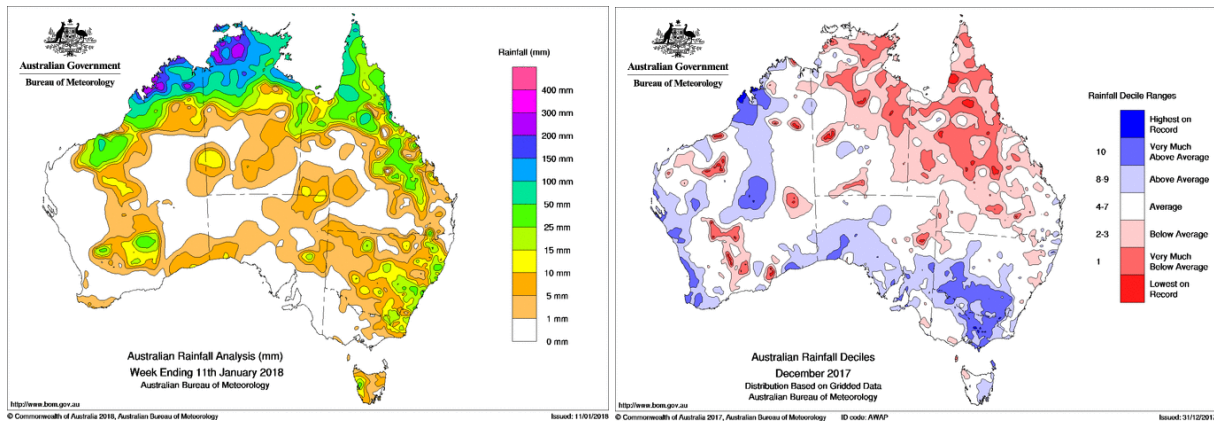


Source: BOM.

Environmental Conditions

Rainfall

Rainfall across Australia for the week ending 11/Jan/2018 is depicted on the left and monthly rainfall deciles for December 2017 are on the right. Over the last week, there was light to moderate rainfall across the state, being heavier towards the coast. For December, rainfall was above average for inland southern regions and average across the north of the state. Maximum and minimum temperatures for December were 1-2 degrees above normal.



Three Month Rainfall & Temperature Forecast

For February to April 2018, rainfall predictions for NSW are for average precipitation for most of the state, with an increased probability for the north coast. Maximum and minimum temperatures are expected to be slightly above average, particularly around the mid-north coast. The following pages contain graphics of the seasonal outlook:

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

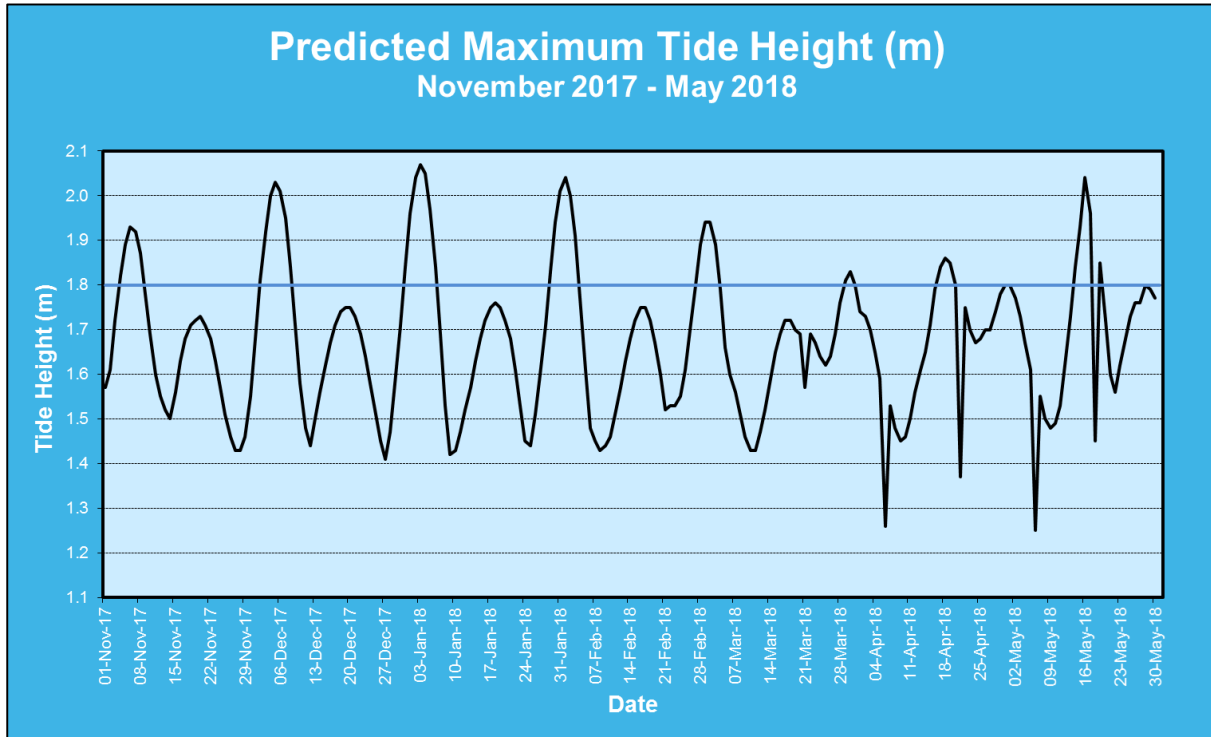
www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 3/Jan/2018, the weak La Niña persists. The climatic models suggest this is likely to be short lived ending in 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 series of high tides of maximum 1.76m in height is due over 17-19/Jan, however a much longer and higher series are due over 29/Jan to 4/Feb. These are predicted to peak at 2.04m.

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 November 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
GRIFFITH – Lake Wyangan	3/Jan/2018	<i>Culex annulirostris</i>	Ross River

*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).

Table 4. 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
16-Dec-17	9	4	2	1	2	0	18
23-Dec-17	7	0	6	0	0	0	13
30-Dec-17	4	0	1	0	0	0	5
Total	237	39	105	33	17	1	432

[†]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 5. Ross River virus infection notifications in NSW residents, by month of disease onset per fiscal year, July 2013 to January 2018*.

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	52	55	33	29	3						241
Ave [†]	36	37	37	46	51	101	156	169	188	140	107	55	1121

*updated 12/Jan/2018 (this table is updated more regularly than Table 4 above, hence there may be differences in the numbers).

[†]Average for 2013/14 to 2016/17.

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 January 2018*.

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	7	6	0						45
Ave [†]	7	5	6	7	5	5	8	9	18	17	17	12	116

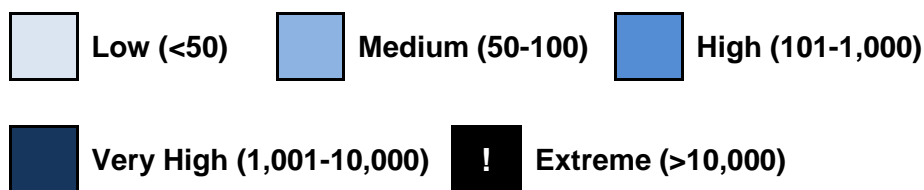
*updated 11/Jan/2018 (this table is updated more regularly than Table 4 above, hence there may be differences in the numbers).

[†]Average for 2014/15 to 2016/17.

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

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	24	31	7	14	21	28	4	11	18	25	4	11	18	25
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	24	31	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	24	31	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	15N	15N	15N														
Dubbo						15N	15N	15N	15N	15N	14N	14N	14N	14N													
Forbes						15N		15N	15N	15N	14N																
Griffith					15N	15N	15N	15N	15N	15N	15N	15N															
Hay					15N	15N	15N	15N	15N	15N	15N																
Leeton						15N	15N		15N	15N	15N	15N	15N														
Macquarie Marshes							15N	15N	15N	15N	15N			15N													
Menindee										15N	15N	15N															
Moama																											
Moree										15N	15N		15N	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

Please note that these results remain the property of the NSW Ministry of Health and may not be used or disseminated to unauthorized persons or organizations without permission.