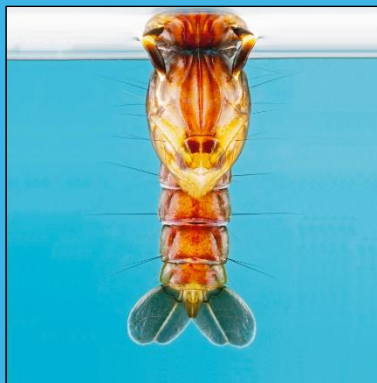


NSW Arbovirus Surveillance & Mosquito Monitoring Program, 2018-2019

Weekly Update: 22 February 2019



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Contents

Summary	2
Comment.....	3
Environmental Conditions	4
Rainfall.....	4
Three Month Rainfall & Temperature Forecast	4
Tides	5
MVEV Climatic Models	6
Forbes' Hypothesis	6
Nicholl's Hypothesis.....	6
Arboviral Isolates	7
Exotic Detections	7
Human Notifications	8
Monthly RRV notifications	10
Monthly BFV notifications.....	10
Mosquito Results	11
Inland	12
Coastal.....	13
Sydney	14
Sentinel Chicken Flocks	15

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: Environmental Epidemiology Unit, Environmental Health Branch, Health Protection NSW: nswh-envepi@health.nsw.gov.au

This report was prepared by **Stephen L. Doggett**, Manager, Department of Medical Entomology, NSW Health Pathology (ICPMR). Testing and scientific services were provided by the Department of Medical Entomology, NSW Health Pathology (ICPMR) for the mosquito surveillance, and the Arbovirus Emerging Diseases Unit, NSW Health Pathology (ICPMR) for the sentinel chicken 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. Mosquito images copyright to Stephen L. Doggett (in order, *Culex orbostiensis*, *Toxorhynchites speciosus*, *Culex sitiens*).

Summary

- **Climate:** over the last week, there was light rainfall along the coast. For January, rainfall was below average for the state north east and along the Murray, and mostly average elsewhere. Maximum and minimum temperatures were up to six degrees above average.
- **Three Month Forecast:** for March 2019 to May 2019, rainfall is predicted to be average for NSW. Maximum and minimum temperatures are forecasted to exceed the normal. According to the Bureau of Meteorology (BOM) as of 19 February 2019, the El Niño Southern Oscillation remains neutral, however there is a 50% chance that an El Niño will form later this year.
- **Tides:** the recent series of high tides that are currently occurring over 17–23 February 2019 have exceeded the forecast height by more than 1cm. The next series of high tides that may trigger hatching are due to occur over 18–23 March 2019, with heights up to 1.95m forecasted.
- **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:** mosquito numbers continue to be well below average with only Griffith yielding a 'medium' catch (50–100 mosquitoes).
- **Mosquito Numbers Coast:** collections continue to decline this week along the coast. While several locations produced 'high' mosquito numbers (100–1,000), no location had 'high' collections of *Aedes vigilax*.
- **Mosquito Numbers Sydney:** numbers of *Aedes vigilax* continue to decline with the mosquito/tide cycle and no 'very high' collection was made this week. However, the saltmarsh sites all produced 'high' mosquito numbers.
- **Arboviral Isolates:** there were six new arboviral detections this week. This included Ross River Virus (RRV) and Edge Hill Virus (EHV) from Deepwater and EHV from Picnic Point along the Georges River, Stratford Virus (STRV) from Duck River, Ross River from the Haslams Creek site of the Sydney Olympic Park Authority (SOPA), and STRV from the Newington site of SOPA. The last three are all from sites from along the Parramatta River.
- **Chicken Sentinel Flocks:** all chickens were negative to MVEV and Kunjin virus (KUNV).
- **Human Notifications:** for the current fiscal year, there have been 260 Ross River virus (RRV) and 35 Barmah Forest virus (BFV) notifications. .

Comment: with the high mosquito numbers seen at the saline habitats around Sydney, the circulation of several arboviruses including Ross River Virus is expected. RRV has been isolated in mosquitoes collected from sites along the Parramatta and Georges River area.

RRV is very rare in Parramatta area due to lack of macropods (i.e. kangaroos and wallaby's) in the immediate vicinity acting as the amplifying hosts. Historically there have been very few RRV isolates from this area and the risk to community is considered to be low.

George's River area supports habitat for macropods and thus the theoretical risk to the community is greater where amplifying host and vector are present.

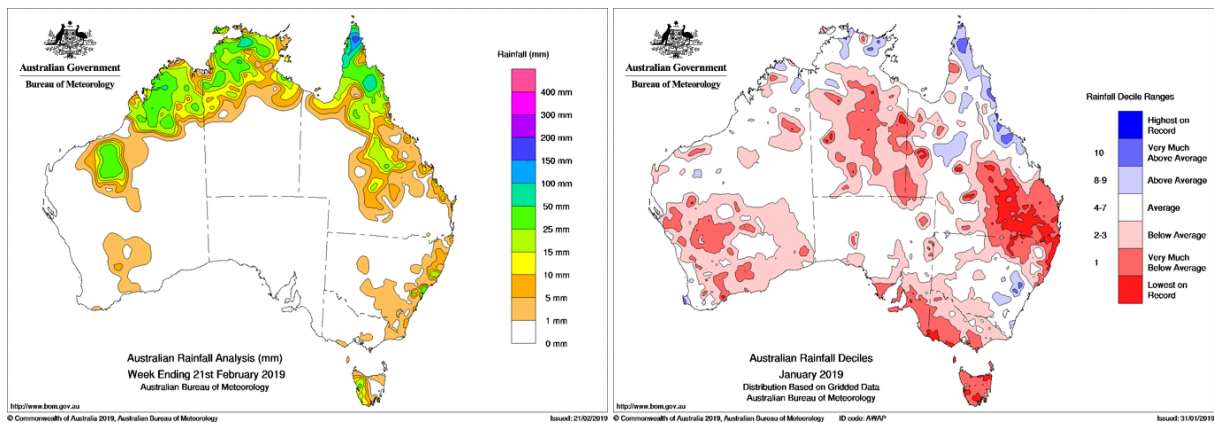
Mosquito numbers along the Georges and Parramatta Rivers were considerably lower this week, as expected considering the stage of the mosquito/tide cycle. Elsewhere in the state, the mosquito numbers have been below average and arboviral notifications one of the lowest we have seen to date.

Cyclone Oma, currently off the coast of Queensland is likely bring strong winds and rains to Southern Queensland and Northern NSW. Cyclone may also affect tidal heights and pooling water from rain can lead to enhanced mosquito breeding.

Environmental Conditions

Rainfall

Rainfall across Australia for the week ending 21 February 2019 is depicted on the left and monthly rainfall deciles for January 2019 are on the right. Over the last week, there was light rainfall along the coast. 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 March 2019 to May 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).

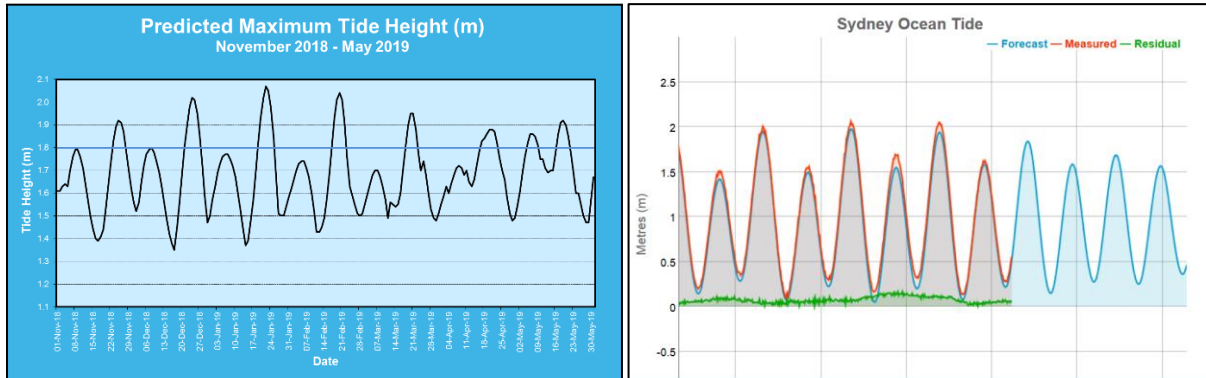
www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 19 February 2019, the El Niño–Southern Oscillation (ENSO) remains neutral. However, the BOM's ENSO outlook is 'WATCH', which means there is a 50% chance on an El Niño developing 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 most recent series of high tides that could trigger *Aedes vigilax* hatching are currently occurring over 17–23 February 2019 and heights of just over 2m were predicted. However, actual heights were just more than 1cm higher than forecast (see graph above right, source; Manly Hydraulics Laboratory, <https://mhl.nsw.gov.au/data/realtime/oceantide/Station-213470>). These tides have been supplemented by the recent rains, which have been relatively light.

The next series of high tides that may trigger hatching are due to occur over 18–23 March 2019, with heights up to 1.95m forecasted.

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
SOPA – Haslams Creek	18/Feb/2019	Whole trap grind	Ross River
PARRAMATTA – Duck River	18/Feb/2019	Whole trap grind	Stratford
GEORGES RIVER – Deepwater	12/Feb/2019	Whole trap grind	Ross River
GEORGES RIVER – Deepwater	12/Feb/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Picnic Point	12/Feb/2019	Whole trap grind	Edge Hill
SOPA – Newington	12/Feb/2019	Whole trap grind	Stratford
GEORGES RIVER – Alfords 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 – Alfords 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 – Alfords 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 were no detections of exotic mosquitoes this week.

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	6	0	0	0	17
9-Feb-19	11	2	11	2	0	0	26
16-Feb-19	8	0	8	1	1	0	18
Total	250	34	163	52	8	0	507

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	38	50	46	67	59	90	117	304	431	265	102	50	1,619
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	97	70	603
2018 - 2019	32	40	32	46	32	24	33	21					260
Ave [†]	34	41	43	51	53	101	155	169	190	141	110	59	1,145

*updated 22 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	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	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	2					35
Ave [†]	7	6	6	7	6	6	8	10	15	16	14	11	111

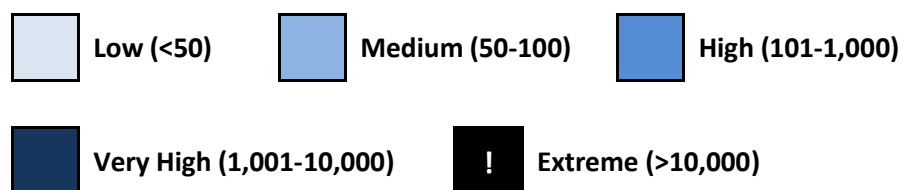
*updated 22 February 2019 (this table is updated at different times to Table 4 above, hence there maybe differences in the numbers).

[†]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	14N													
Dubbo								15N		15N	15N	15N														
Forbes			12N	12N	12N	14N	15N	15N			14N	15N	15N	15N												
Griffith		15N	15N	15N	15N	15N	15N	15N			15N	14N	14N	13N												
Hay		15N	15N	15N	15N	15N	15N	15N	15N	15N	15N	15N	15N													
Leeton	15N	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). **Positive results will be in bold.** Results are shown by week of sample collection, 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