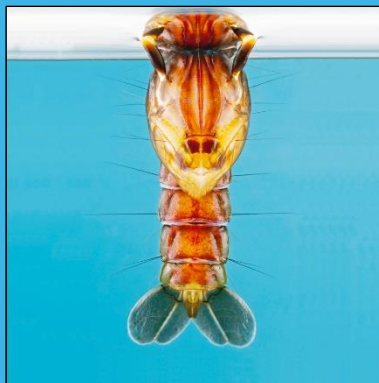


NSW Arbovirus Surveillance & Mosquito Monitoring Program, 2018-2019

Weekly Update: 25 January 2019



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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>

Please send questions or comments about this report to:

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This report was prepared by Stephen Doggett, Manager, Department of Medical Entomology, NSW Health Pathology (ICPMR). Testing and scientific services were provided by the Arbovirus Emerging Diseases Unit, NSW Health Pathology (ICPMR) for the sentinel chicken surveillance and the Department of Medical Entomology, NSW Health Pathology (ICPMR) for the mosquito 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.

Summary

- **Climate:** over the last week, light precipitation occurred along the coast and ranges of NSW. For December, rainfall was below average for the state north and mostly average elsewhere. Maximum and minimum temperatures for December were 2-3 degrees above average for the state.
- **Three Month Forecast:** for February 2019 to April 2019, rainfall is predicted to be below average for NSW, with a higher probability of being drier along the ranges. Maximum and minimum temperatures are predicted to exceed the average. According to the Bureau of Meteorology (BOM) as of 22 January 2019, the immediate risk of El Niño has passed, however there is increased chance that an El Niño will form later this year.
- **Tides:** the recent series of tides that occurred over 21-25 January 2019, were the highest forecasted for this summer, although tide heights were close to predicted. As expected, these tides have triggered *Aedes vigilax* hatching in saline habitats. The next series of tides are due over 17-23 February 2019, when heights of just over 2.0m are predicted.
- **Murray Valley Encephalitis virus (MVEV) Models:** the data relevant to both the Forbes' and Nicholl's hypotheses have been updated to December 2018. Neither model is suggestive of an MVEV epidemic.
- **Mosquito Numbers Inland:** no change this week; mosquito collections continue to be well below average and were 'low' (<50 mosquitoes/trap) at most locations. Griffith again produced 'high' numbers (100-1,000 mosquitoes/trap), when normally these collections would be in the thousands.
- **Mosquito Numbers Coast:** *Aedes vigilax* continue to be 'low' almost all sites, with overall mosquito numbers below average. Ballina again yielded 'high' mosquito numbers, dominated by freshwater breeding species, likewise for Gosford. Only Kempsey produced a 'high' collection of *Aedes vigilax*.
- **Mosquito Numbers Sydney:** as noted in last weeks '*Aedes vigilax* – Development Cycle' discussion, it was expected that numbers of this species would decline as part of the species natural tidal related cycle. Indeed this has been the case, although the saline habitats continue with the 'high' numbers (but only just for several sites). While over previous weeks we have had massive collections with more than 10,000 mossies trapped, the highest number this week was 766 from George Kendall Reserve within Parramatta.
- **Arboviral Isolates:** there was another detection of Edge Hill virus from Picnic Point, this time from mosquitoes collected on 23 January 2019.
- **Chicken Sentinel Flocks:** all chickens were negative to MVEV and Kunjin virus (KUNV).
- **Human Notifications:** for the current fiscal year, there have been 223 Ross River virus (RRV) and 28 Barmah Forest virus (BFV) notifications, which is less than half the previous four season average (470 RRV and 46 BFV, to the end of January).

Comment: This season is one of the quietest mosquito seasons that NSW has experienced. The collections from the inland are one of the smallest to date and numbers from the coast have also been below average. There has been minimal arboviral activity, with no isolates from these regions, no sentinel chicken seroconversions, and statewide human notifications are less than half the previous four season average.

The exception has been the collections from the saline habitats around Sydney. In this region, we have had the biggest *Aedes vigilax* collections since the late 90's, before a routine larval control program was implemented at Sydney Olympic Park. In spite of the big numbers over recent weeks, *Aedes vigilax* numbers have declined at these sites, as expected. Below is a continuation of last week's review of this species.

***Aedes vigilax* – Development Cycle (Continued)**

As stated last week, *Aedes vigilax* is a salt marsh mosquito and the larvae hatch out following tidal inundation of the mud flats where their eggs are laid in depressions. The population of this species fluctuates with the spring tides, being highest a week or so after the tides, and are lowest around the times of the high tides (such as now). Also noted last week was that it is this time of the cycle when the mosquito is a greater risk, being old, it may have had the opportunity to acquire an arbovirus from a viraemic vertebrate host.

However, other factors can influence this mosquito-tidal cycle. The mudflats can be inundated and initiate egg hatching from non-tidal related factors. This may include rain (and associated flooding), variations in atmospheric pressures, wind, and other climatic phenomena that can affect tidal heights. Constant wetting of the mudflats can lead to reduced *Aedes vigilax* numbers as the eggs may not be able to mature. Thus it tends to be dry conditions that result in the larger collections of this species.

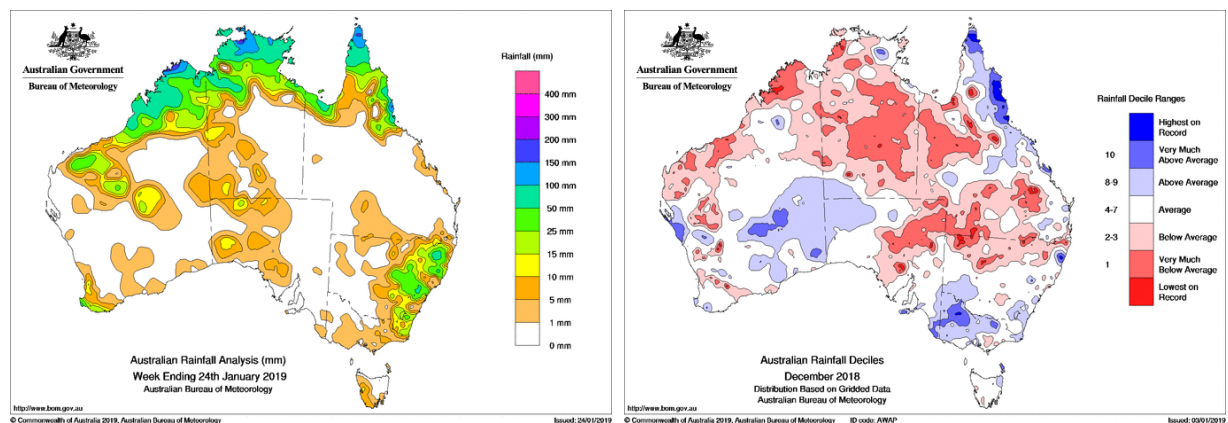
What can also influence the population through the summer months is the numbers from the earlier cycles. If the seasons starts off with massive collections, as per this year, then subsequent hatchings tend to be bigger. Thus further large collections are envisaged for this season.

As the Australian long weekend is here and people are expected to spend time outdoors, it is important to remember to keep safe and use repellent.

Environmental Conditions

Rainfall

Rainfall across Australia for the week ending 24 January 2019 is depicted on the left and monthly rainfall deciles for December 2018 are on the right. Over the last week, light precipitation occurred along the coast and ranges of NSW. For December, rainfall was below average for the state north and mostly average elsewhere. Maximum and minimum temperatures for December were 2-3 degrees above average for the state.



Three Month Rainfall & Temperature Forecast

For February 2019 to April 2019, rainfall is predicted to be below average for NSW, with a higher probability of being drier along the ranges. 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).

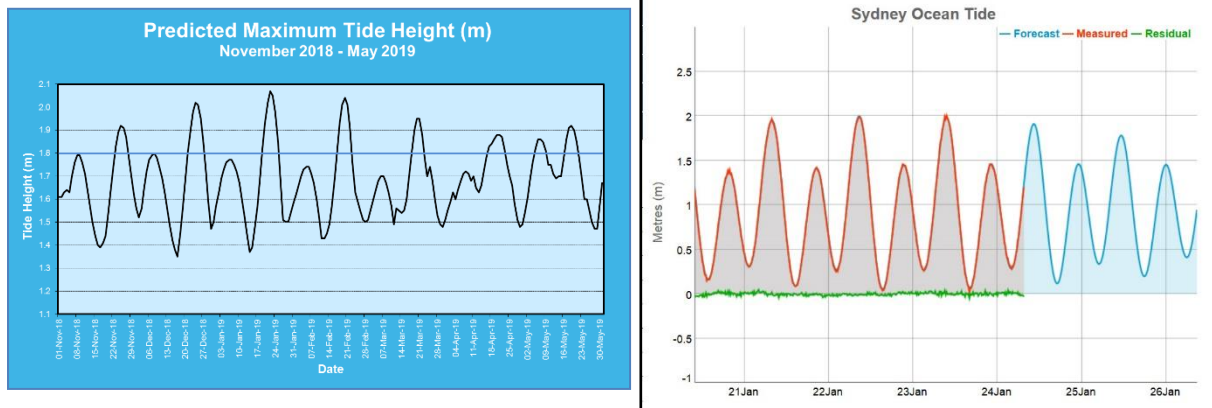
www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 22 January 2019, recent observations and climate model outlooks suggest the immediate risk of El Niño has passed. However, there remains an increased likelihood that El Niño will develop 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, 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 recent series of spring high tides that occurred over 21-25 January 2019, were the highest forecasted for this summer and the actual heights were close to predicted (see top right graph from Manly Hydraulics Works, <https://mhl.nsw.gov.au/data/realtime/oceantide/Station-213470>). These tides did trigger *Aedes vigilax* hatching in saline habitats.

The next series of high tides that may trigger *Aedes vigilax* hatching are due over 17-23 February 2019, 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), 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, 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	0.71
Lachlan/Murrumbidgee/Murray Rivers	1.15	0.70	0.77	0.87
Northern Rivers	0.81	1.07	1.00	0.70
North Lake Eyre system	0.75	0.69	0.73	0.56

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
GEORGES RIVER – Picnic Point	23/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Picnic Point	16/Jan/2019	Whole trap grind	Edge Hill
GEORGES RIVER – Alford's 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 further detections of exotic mosquitoes.

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 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	32	25	18						223
Ave [†]	33	40	43	50	51	98	155	170	190	140	106	56	1,132

*updated 25 January 2019 (this table is updated at different times to Table 4 above, hence there may be 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	4	1						28
Ave [†]	7	6	6	7	6	6	8	10	15	16	15	11	113

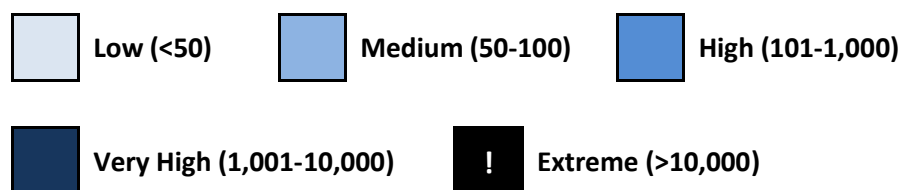
*updated 25 January 2019 (this table is updated at different times to Table 4 above, hence there may be differences in the numbers).

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