NSW Health

NSW Arbovirus Surveillance Program Annual report

2024-2025

https://www.health.nsw.gov.au/Infectious/mosquito-borne/Pages/surveillance.aspx

NSW Health acknowledges the traditional owners of the lands on which we work, live and play. We pay our respect to elders past, present and emerging. This report was produced on the lands of the Burramattagal and Cammeraygal People of New South Wales. NSW Health also acknowledges all the lands across NSW on which mosquito trapping, sentinel chicken surveillance and other components of the Arbovirus Surveillance and Mosquito Monitoring Program are conducted. The knowledge, resilience and strength of Aboriginal Peoples is key to supporting health for Aboriginal communities.

Produced by:

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Contents

Background

The aim of the NSW Arbovirus Surveillance and Mosquito Monitoring Program (ASMMP) is to provide an early warning of increased arboviral risk by monitoring arboviral activity in sentinel chickens and mosquitoes. The ASMMP operates annually from November to April, coinciding with the peak of mosquito and arbovirus activity.

Mosquito trapping is conducted across NSW, with captured mosquitoes tested for flaviviruses and alphaviruses of public health significance that are notifiable in NSW, including Ross River virus (RRV), Barmah Forest virus (BFV), Murray Valley encephalitis virus (MVEV), Kunjin (KUNV) and Japanese encephalitis virus (JEV). The Department of Medical Entomology also tests for additional viruses that are not notifiable in NSW, including the flaviviruses Edge Hill virus (EHV) and Stratford virus (STRV), and the alphaviruses Gan Gan virus (GGV) and Trubanaman virus (TRUV). Sentinel chicken flocks in inland locations in NSW are tested for the presence of antibodies against MVEV, KUNV and JEV.

For the purposes of the ASMMP, arbovirus activity in NSW is categorised into three broad viro-geographical zones: inland, the tablelands and the coastal strip including Sydney. Within these zones there are differences in the dynamics of environmental factors, mosquito vectors, viral reservoir hosts and mosquito-borne viruses.

Executive summary

This report summarises mosquito trapping and sentinel chicken results in NSW for the 2024-2025 arbovirus season.

Mosquito numbers during 2024-2025 were not extraordinarily high. However, JEV was detected from mosquitoes, with positives identified from Griffith and Moree during December, and there were two MVEV seroconversions in the sentinel chickens during the same month from Cowra and West Wyalong. JEV activity in mosquitoes and sentinel chickens occurred early in the season before the peak in mosquito activity.

In the 2024-2025 arbovirus season, there were 497 human notifications of RRV, primarily in inland regions such as Hunter New England (144), Murrumbidgee (138), and Western NSW (110). There were 90 human notifications of BFV, with highest numbers in Northern NSW (27) and Mid North Coast (26). Both RRV and BFV human notifications were above the 10-year average. Five human cases of JEV were acquired in NSW (3 among NSW residents, 2 interstate residents). One locally acquired human case of KUNV was notified in Hunter New England. No human cases of MVE were reported.

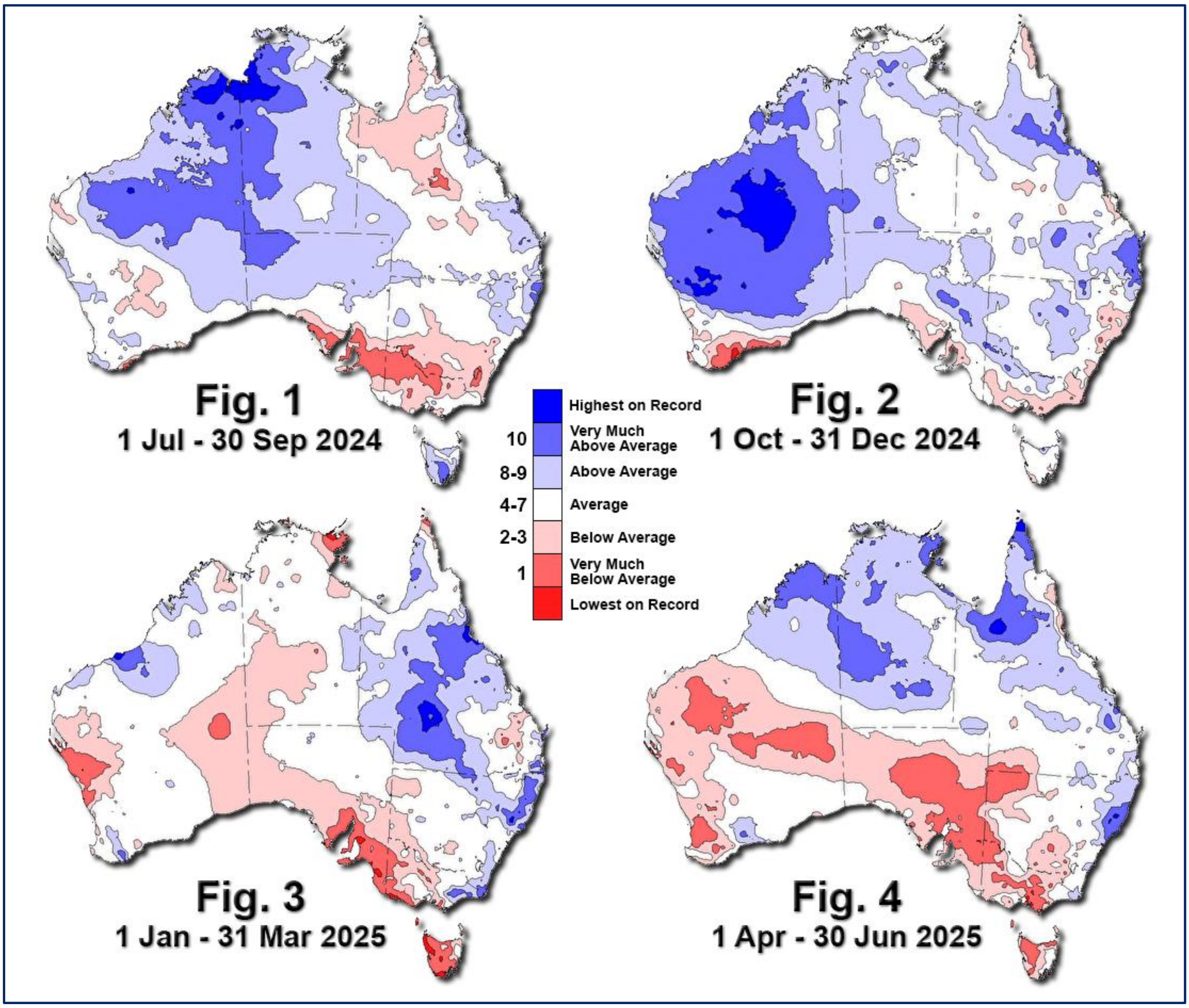
Weather data

Mosquitoes need water to breed. Mosquito abundance is therefore affected by rainfall patterns and irrigation practices in inland regions. In coastal regions, tidal inundation along with rainfall is important. Temperature and/or day-length are often critical in determining the start and duration of mosquito activity for species in temperate zones. Higher temperatures can amplify replication of the virus. Monitoring environmental parameters is therefore crucial.

Rainfall

Figures 1-4 provide an overview of Australian rainfall deciles for the 2024-2025 season.

Figures 1-4: Quarterly Rainfall Deciles, Australian Bureau of Meteorology



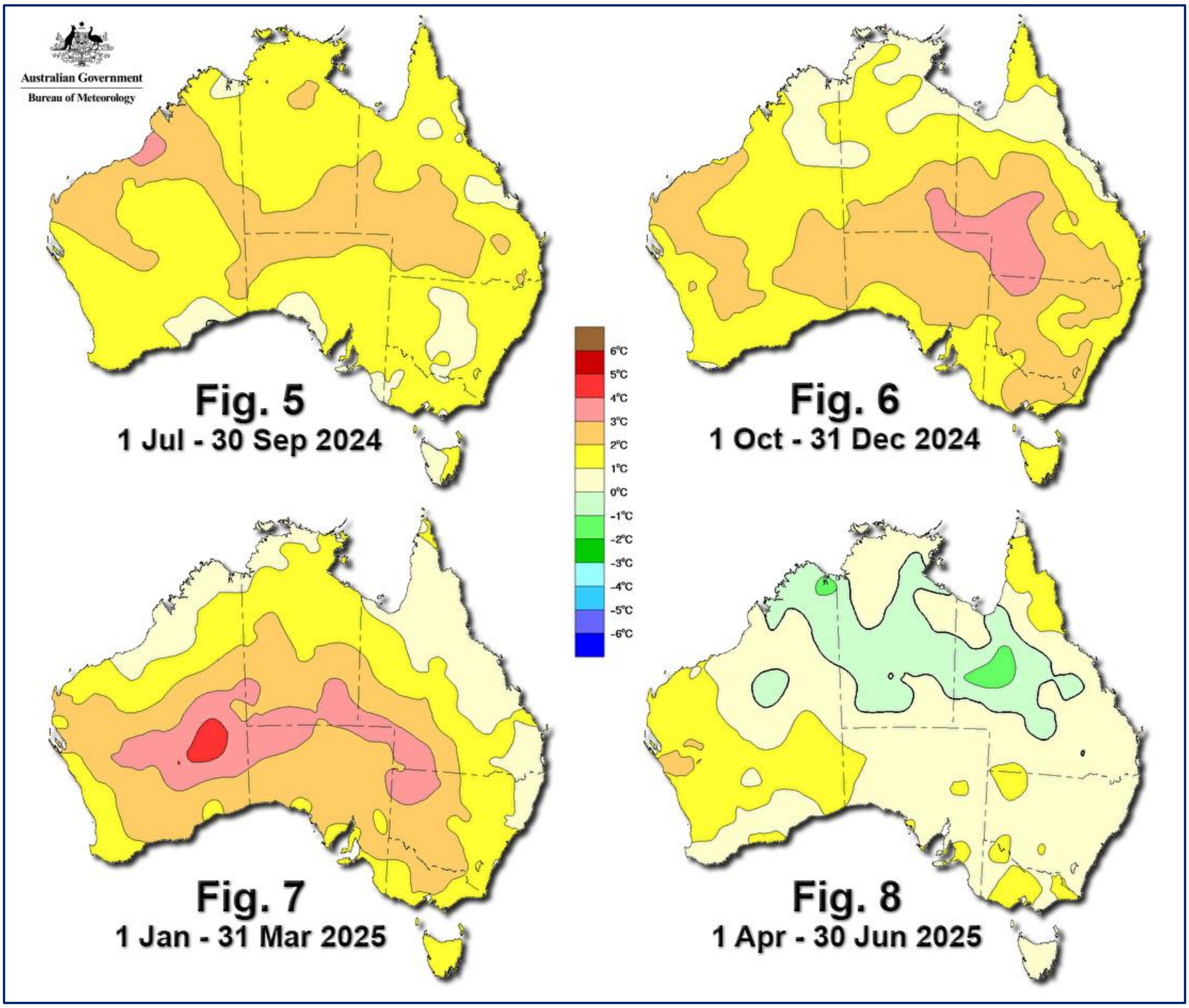
- **Figure 1: July 2024 to September 2024**. Rainfall was below average for the Murray/Murrumbidgee regions, average for most of the northern part of the state, and above average for the far north coast.
- **Figure 2: October 2024 to December 2024**. Rainfall across inland NSW was generally average to above average, while conditions along the coast were below average.

- **Figure 3: January 2025 to March 2025**. Rainfall across NSW was mostly average, with below average rainfall in the southwest and well above rainfall in the northeast.
- **Figure 4: April 2025 to June 2025.** Rainfall was below average across the far west and south inland regions, while the mid-north coast experienced very much above average rainfall.

Temperature

Figures 5-8 provide an overview of Australian temperature anomalies (differences between long-term average temperature and observed temperature) for the 2024-2025 season.

Figures 5-8: Quarterly Temperature Anomalies, Australian of Meteorology



- **Figure 5: July 2024 to September 2024**. Temperatures were around 1°C above average in NSW.
- **Figure 6: October 2024 to December 2024**. Temperatures were 1-2°C above average across NSW.
- **Figure 7: January 2025 to March 2025**. Temperatures were up to 3°C above average in the northwest, and 1-2°C above average for most of NSW.
- **Figure 8: April 2025 to June 2025.** Temperatures were near average in NSW.

Results from arbovirus predictive models

Two main models have been developed for the prediction of MVEV epidemic activity in south-eastern Australia: the Forbes' (1978)[1] and Nicholls' (1986)[2] hypotheses. According to Forbes' model, there was a lower risk of an MVEV epidemic for the 2024-2025 season. It is important to note that the Forbes' hypothesis was calculated on environmental conditions experienced during major MVEV epidemic seasons and the models do not propose to predict low to moderate level activity. Thus, negative MVEV models do not necessarily indicate an absence of MVEV activity.

The Nicholls' hypothesis uses the Southern Oscillation (SO) as a tool to indicate a possible MVEV epidemic. For 2024, the autumn, winter, and spring Nicholls' values, respectively, were 1009.97mm, 1013.73, and 1010.60. Only the autumn value was inside the range of past MVEV epidemic years.

Over the 2024-2025 season, the Southern Oscillation was mostly neutral, meaning that rainfall patterns were around average. These conditions ensured that mosquito numbers during 2024-2025 were not extraordinarily high.

Mosquito trapping methods

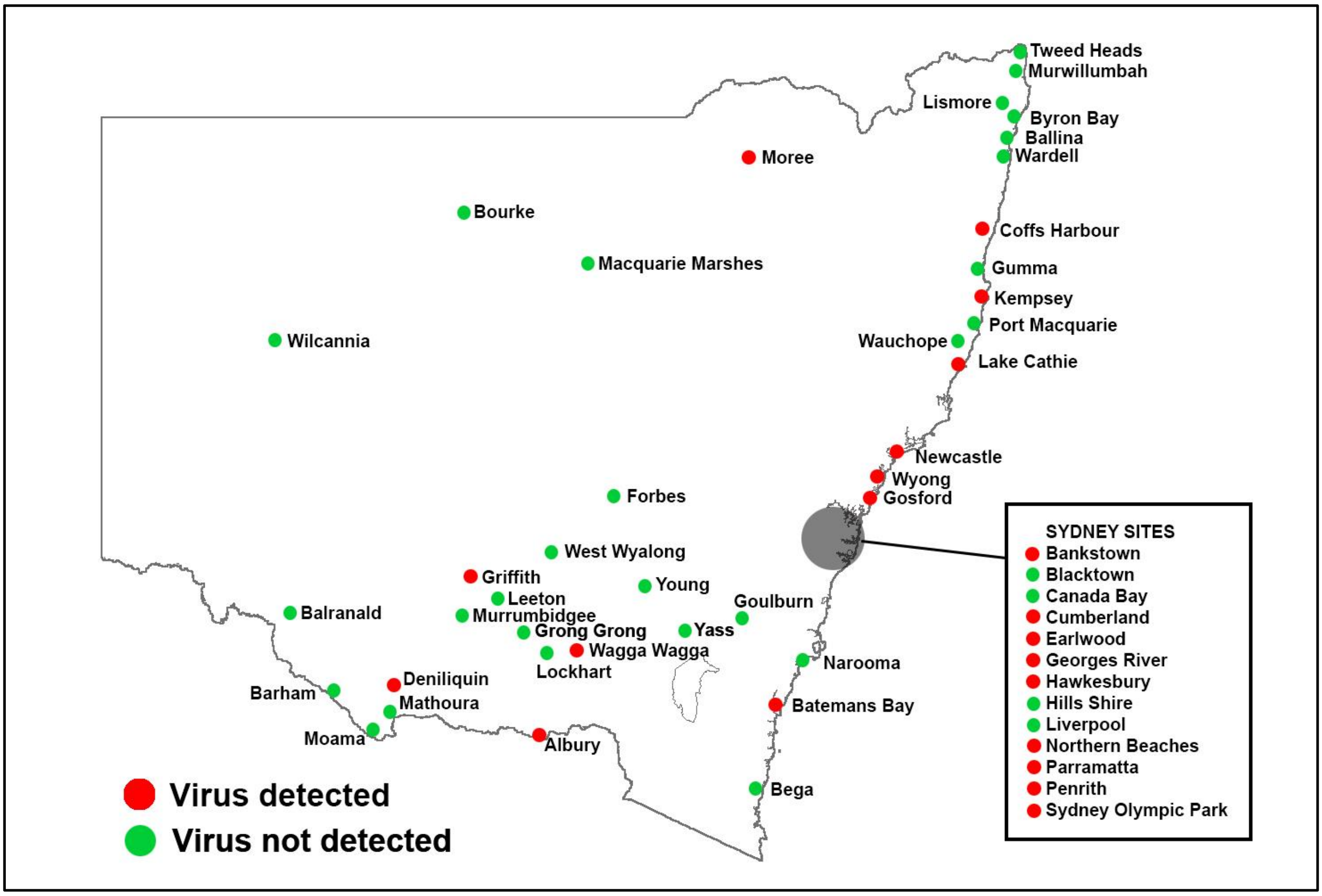
Mosquitoes are collected overnight in dry-ice baited Encephalitis Virus Surveillance (EVS) traps. EVS traps use carbon dioxide (from dry ice or gas cylinders) and light to attract host-seeking female mosquitoes. Live mosquitoes are then sent in cool, humid Eskies via overnight couriers to the Department of Medical Entomology, NSW Health Pathology-Institute of Clinical Pathology and Medical Research, for species identification and arbovirus isolation.

[1] Forbes J.A. (1978). Murray Valley encephalitis 1974 - also the epidemic variance since 1914 and predisposing rainfall patterns. Australasian Medical Publishing Co., Glebe. 20pp.
[2] Nicholls N. (1986). A method for predicting Murray Valley encephalitis in southeast Australia using the Southern Oscillation. Australian Journal of Experimental Biology and Medical Science, 64: 587-94.

Mosquito trapping results

In 2024-2025, there were 106 mosquito trapping sites across 52 locations (Figure 9).

Figure 9: Mosquito trapping locations, NSW, 2024-2025



* For a comprehensive list of detected viruses in mosquitoes, please refer to Table 2.

Mosquito counts

There were 230,808 mosquitoes collected, representing 60 species. *Culex annulirostris* was the most abundant of the inland mosquito species during the summer months. *Aedes vigilax*, *Culex annulirostris, Coquillettidia linealis*, and *Aedes notoscriptus* were the most numerous species on the coast. The below table provides a summary of results by virogeographical zones[3]. These include the inland, tablelands and coastal strip. Within these zones there are different environmental influences, mosquito vectors, viral reservoir hosts and mosquito-borne viruses. As a result, mosquito-borne disease epidemiology often can be vastly different between regions.

[3] Doggett S., Russell R. and Dwyer D. (1999). NSW Arbovirus Surveillance Web Site. NSW Public Health Bulletin, 10: 7.

Table 1: Mosquito trapping results by virogeographical zone, NSW, 2024-2025

Virogeographical zone	Total counts	Species collected
Inland	47,050 mosquitoes	34 species collected with *Culex annulirostris* (41.2%) *Aedes vittiger* (32.0%) *Aedes theobaldi* (9.1%) *Aedes notoscriptus* (5.6%) *Anopheles annulipes* (4.0%) *Culex quinquefasciatus* (3.6%)
Coastal	113,508 mosquitoes	49 species collected *Culex annulirostris* (22.0%) *Coquillettidia linealis* (17.1%) *Aedes vigilax* (15.3%) *Aedes notoscriptus* (8.6%) *Culex orbostiensis* (7.9%) *Verrallina funerea* (6.6%) *Aedes multiplex* (5.1%)
Metropolitan Sydney	70,250 mosquitoes	38 species *Aedes vigilax* (61.5%) *Aedes notoscriptus* (9.7%) *Culex annulirostris* (7.6%) *Coquillettidia linealis* (4.7%) *Verrallina funerea* (2.7%)

The below figures show mosquito trapping results by location and species type for the entire 2024-2025 arbovirus season. Mosquito abundances through the ASMMP are described and reported as:

- No collection
- 'low' (<50 per trap)
- 'moderate' (50 -100 per trap)
- 'high' (101 - 1,000 per trap)
- 'very high' (1,001 -10,000 per trap)

Figure 10: Number of mosquitoes trapped weekly from the inland region (averaged across sites for a specific location)

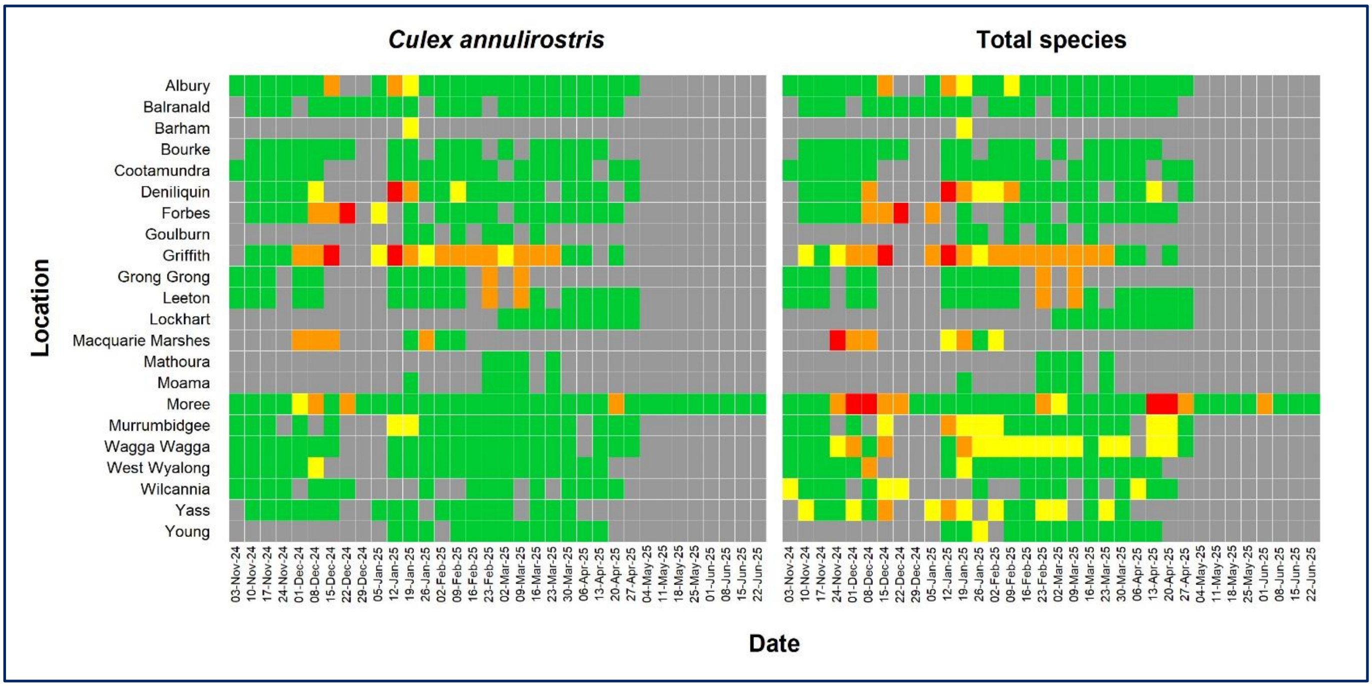


Figure 11: Number of mosquitoes trapped weekly from the coastal region (averaged across sites for a specific location)

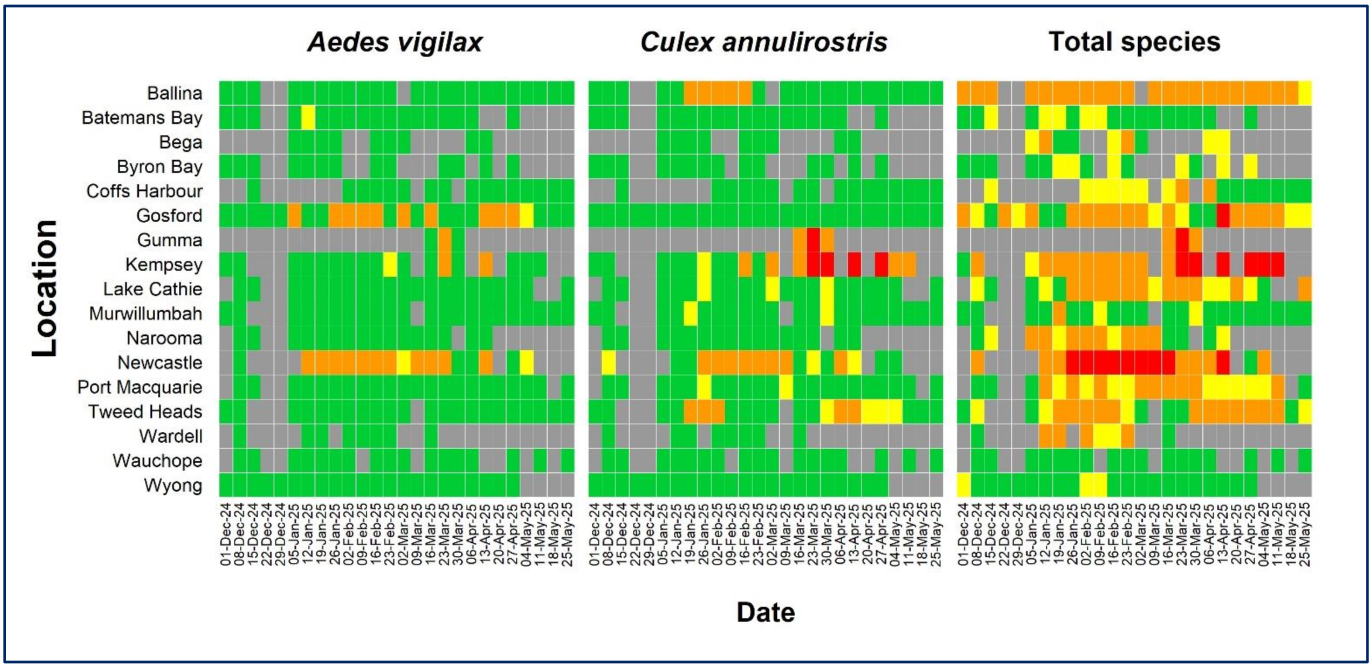
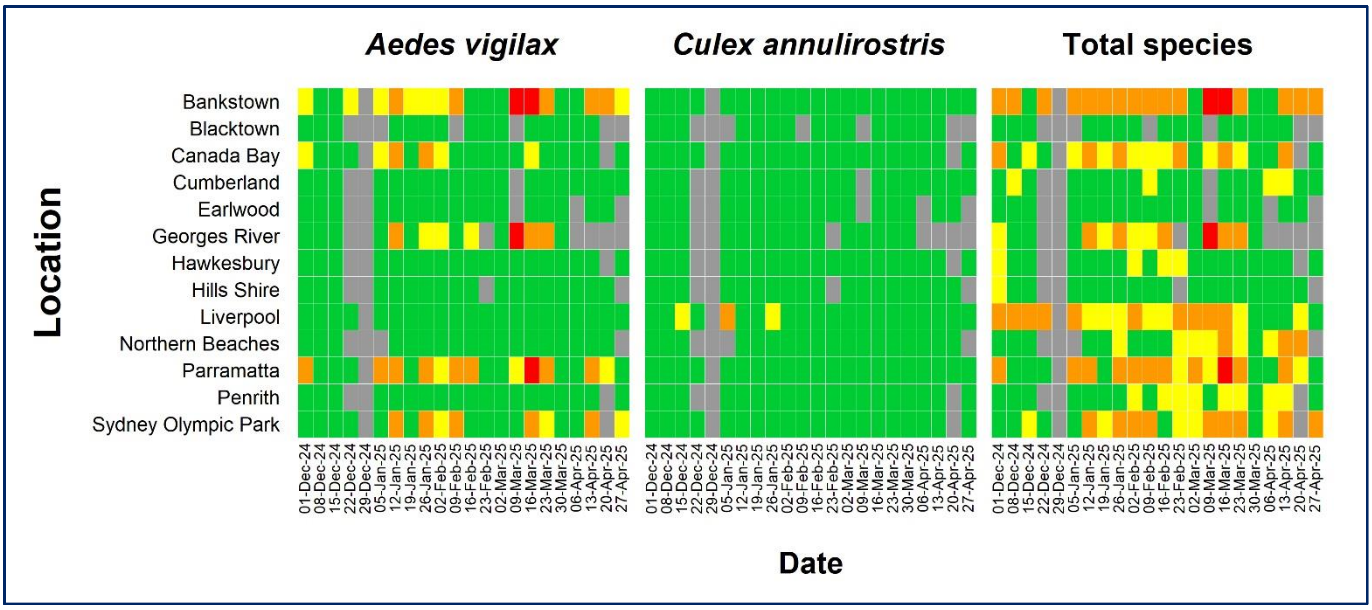


Figure 12: Number of mosquitoes trapped weekly from the Sydney region (averaged across sites for a specific location)



Arboviral detections in mosquitoes

Viral detection in mosquitoes involves modern molecular techniques for identifying viral nucleic acid. From the mosquitoes processed, there were 52 detections including 2 JEV, 12 BFV, 8 RRV, 2 EHV, 10 STRV, 15 GGV, and 3 TRUV (Table 2). Inland mosquitoes accounted for 13 viral detections (2 JEV, 5 BFV, 4 RRV, 1 EHV, and 1 TRUV), the coast for 18 viral detections (3 BFV, 4 RRV, 1 EHV, 2 STRV, and 8 GGV), and Sydney for 21 viral detections (4 BFV, 8 STRV, 7 GGV, and 2 TRUV).

Table 2: Arboviral detections in mosquitoes, NSW, 2024-2025

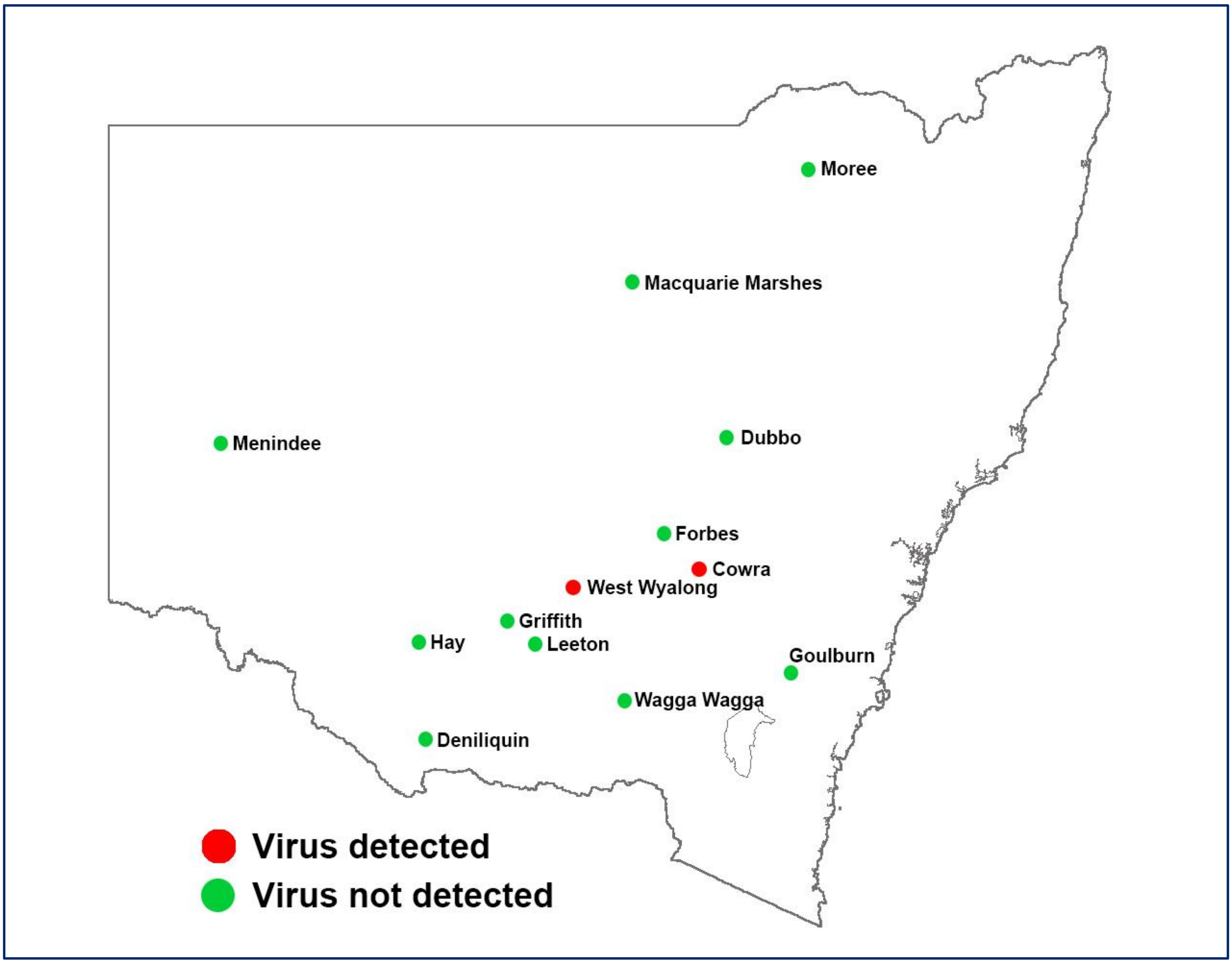
Location	Site	Date	Viruses detected
Albury	Kremur St	20 January 2025	Ross River
Bankstown	Picnic Point	18 February 2025	Gan Gan
Bankstown	Picnic Point	12 March 2025	Gan Gan
Bankstown	Picnic Point	18 March 2025	Gan Gan
Batemans Bay	Apple Berry Place	14 January 2025	Barmah Forest
Batemans Bay	Apple Berry Place	25 March 2025	Barmah Forest
Coffs Harbour	Botanical Gardens	22 April 2025	Ross River
Cumberland	Duck River Granville	3 April 2025	Stratford
Deniliquin	Fitzroy St	14 January 2025	Trubanaman
Earlwood	Turrella Reserve	23 April 2025	Stratford
Georges River	Alfords Point	29 January 2025	Stratford
Georges River	Illawong	10 February 2025	Stratford
Georges River	Alfords Point	18 March 2025	Gan Gan
Georges River	Alfords Point	25 March 2025	Barmah Forest
Gosford	Empire Bay	5 February 2025	Gan Gan
Griffith	Lake Wyangan	3 December 2024	Japanese Encephalitis
Griffith	Lake Wyangan	18 December 2024	Ross River
Griffith	Melville Crescent	21 January 2025	Ross River
Griffith	Lake Wyangan	25 March 2025	Barmah Forest
Hawkesbury	North Richmond	8 April 2025	Gan Gan
Kempsey	Treatment Plant	31 March 2025	Ross River
Kempsey	Treatment Plant	28 April 2025	Ross River
Lake Cathie	Cowarra Creek	17 March 2025	Stratford
Lake Cathie	Cowarra Creek	26 May 2025	Edge Hill
Moree	Tecam Park	22 December 2024	Japanese Encephalitis
Moree	Gully Swamp	21 April 2025	Edge Hill
Moree	Tecam Park	27 April 2025	Barmah Forest
Moree	Gully Swamp	27 April 2025	Barmah Forest
Moree	Tecam Park	1 June 2025	Barmah Forest
Moree	Gully Swamp	1 June 2025	Barmah Forest
Newcastle	Maryland	13 January 2025	Gan Gan
Newcastle	Maryland	3 February 2025	Gan Gan

Location	Site	Date	Viruses detected
Newcastle	Maryland	10 February 2025	Gan Gan
Newcastle	Tomago	17 February 2025	Barmah Forest, Gan Gan
Newcastle	Maryland	17 February 2025	Gan Gan
Newcastle	Tomago	24 February 2025	Gan Gan
Newcastle	Maryland	17 March 2025	Gan Gan
Newcastle	Tomago	7 April 2025	Ross River
Northern Beaches	Narrabeen	11 March 2025	Stratford
Northern Beaches	Narrabeen	18 March 2025	Barmah Forest
Northern Beaches	Warriewood	25 March 2025	Trubanaman
Northern Beaches	Warriewood	8 April 2025	Stratford, Trubanaman
Northern Beaches	Warriewood	15 April 2025	Stratford
Parramatta	Duck River	18 March 2025	Barmah Forest
Penrith	Werrington	25 March 2025	Barmah Forest
Penrith	Werrington	1 April 2025	Gan Gan
Penrith	Werrington	8 April 2025	Gan Gan
Sydney Olympic Park	Newington	19 March 2025	Stratford
Wagga Wagga	Botanical Gardens	28 January 2025	Ross River
Wyong	Halekulani	18 February 2025	Stratford

Sentinel chicken surveillance results

There were 13 sentinel flocks, with 15 chickens in each flock located across the inland region of NSW (Figure 13). The first bleed of the season took place on 28 October 2024 and continued until 30 April 2025. Surveillance in Leeton and Moree was extended until 11 May 2025 and 22 May 2025, respectively, due to favourable rainfall and temperature conditions and ongoing virus detections in those areas.

Figure 13: Sentinel chicken surveillance sites, NSW, 2024-2025



A total of 3,909 samples was received across all flocks in NSW during the season and tested for flaviviruses of public health concern. There were two MVEV seroconversions in the sentinel chickens; one from Cowra (sample collected date 5 December 2024) and West Wyalong (sample collected 18 December 2024).

Human notifications of locally acquired arbovirus infections

All arboviral infections detected in humans are notifiable under the *NSW Public Health Act 2010*. The two most common locally acquired arbovirus infections notified in NSW are RRV and BFV.

In the 2024-2025 arbovirus season there were a total of 498 human notifications of RRV (45 confirmed and 453 probable cases) and 90 human notifications of BFV (4 confirmed and 86 probable cases) among NSW residents (Table 3). There were also five reported cases of JEV acquired in NSW (3 among NSW residents, 2 interstate residents), and one locally acquired case of Kunjin virus. Notifications of both BFV and RRV were slightly higher than the 10-year average (Figures 14 and 15). No human cases of MVE were reported.

Figure 14: Ross River virus notifications over the last 10 years (July 2015 to June 2025) compared to 10-year average, NSW

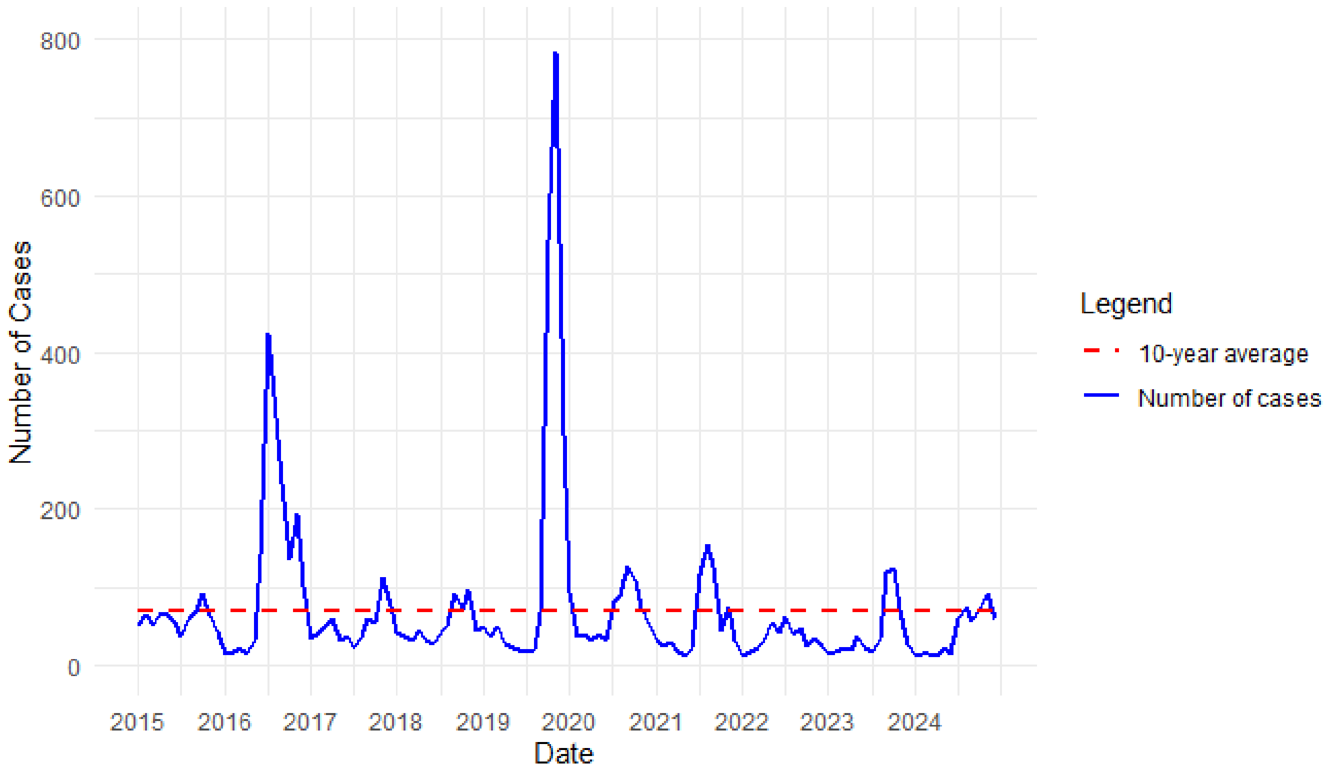


Figure 15: Barmah Forest virus notifications over the last 10 years (July 2015 to June 2025) compared to 10-year average, NSW

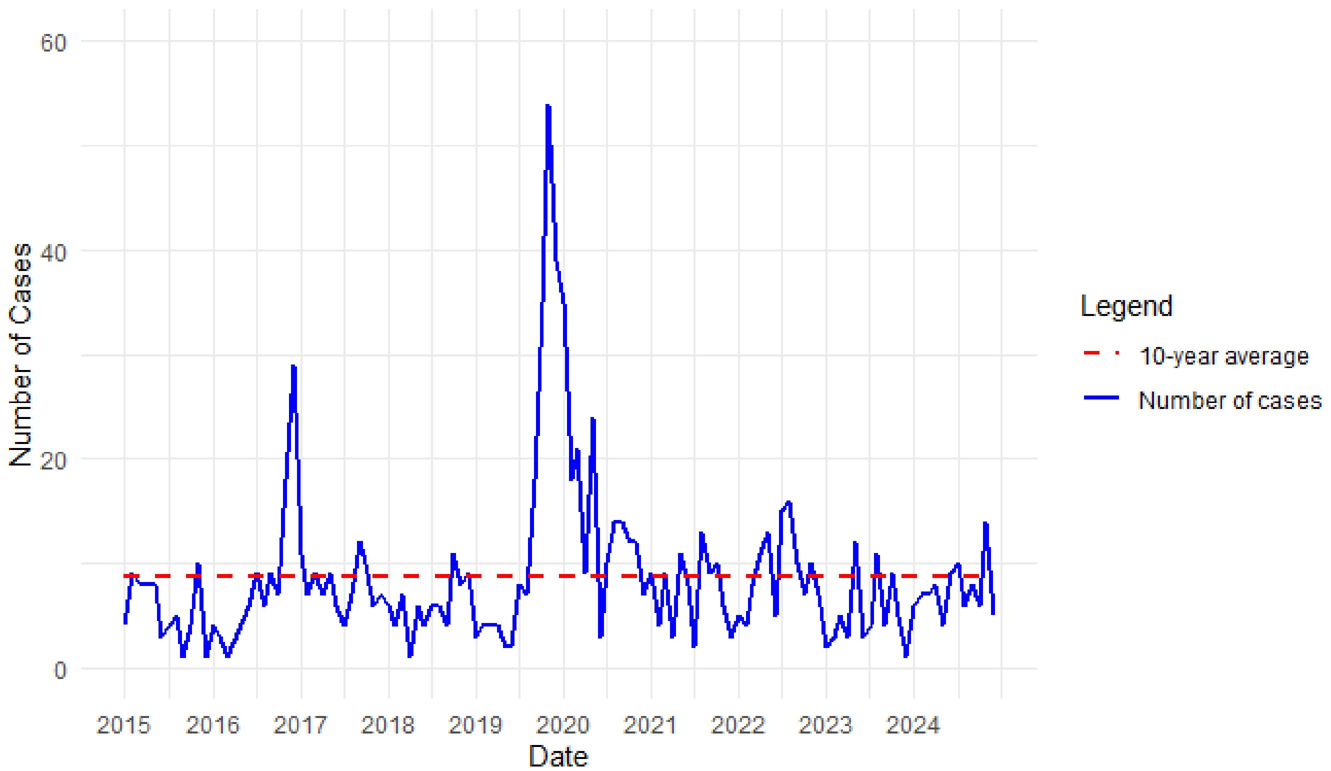
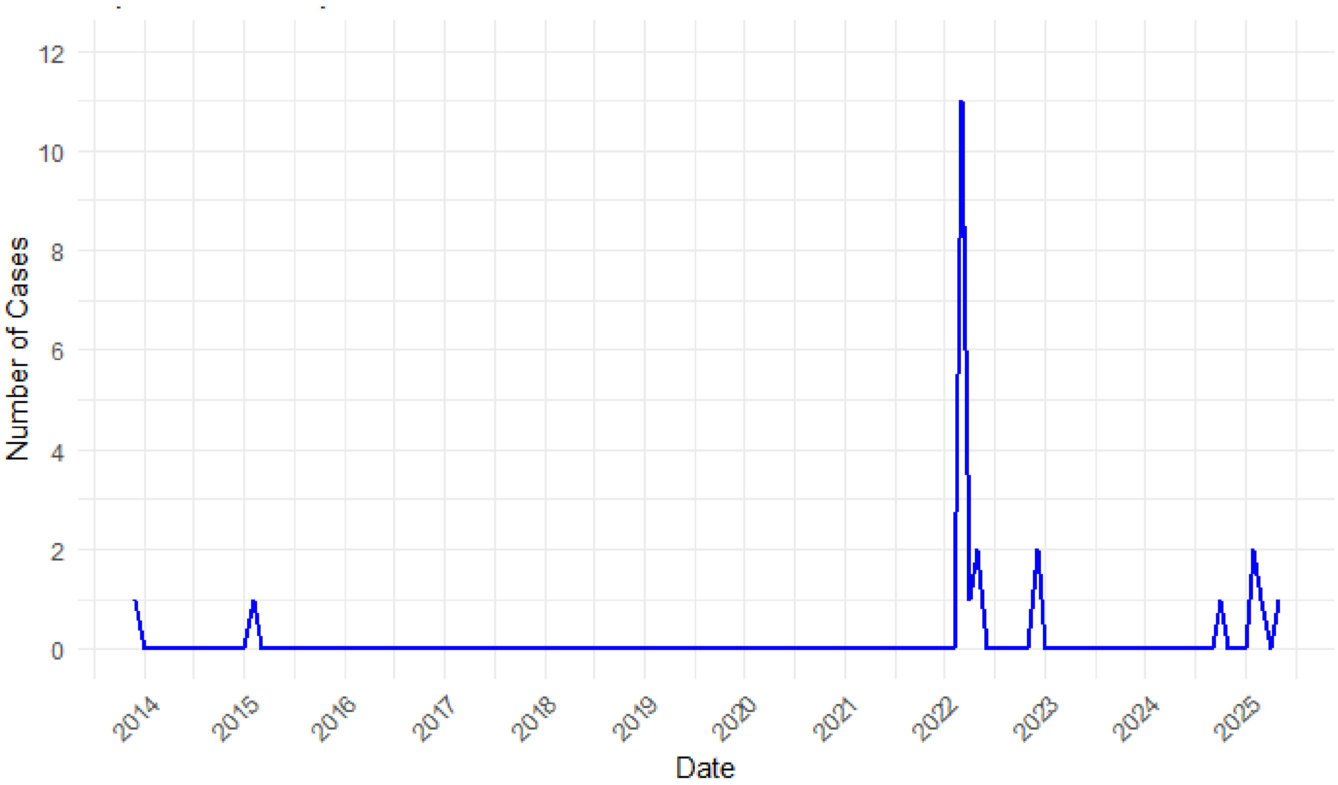


Figure 16: Japanese encephalitis notifications since 2013, NSW



RRV human notifications were highest in inland regions, particularly Hunter New England (107), Murrumbidgee (107), and Western NSW (72), with elevated activity also reported in coastal areas including Northern NSW (69) and Mid North Coast (67). BFV human notifications were substantially lower, with the highest numbers recorded in Northern NSW (27), Mid North Coast (26), and Hunter New England (18). Overall, RRV remained the predominant mosquito-borne disease reported in NSW, with the highest burden observed in inland and northern coastal regions.

Additionally, there were five confirmed cases of JEV acquired in NSW, of which three were NSW residents, one an ACT resident and one a Victorian resident. A locally acquired case of Kunjin virus was reported in Hunter New England LHD.

Table 3: Barmah Forest and Ross River virus human notifications in NSW by local health district and viro-geographic region, 2024-2025

Local health district	Viro-geographic region	Ross River virus notifications	Barmah Forest virus notifications
Hunter New England	Inland	107	18
Murrumbidgee	Inland	107	1
Western NSW	Inland	72	6
Northern NSW	Coastal	69	27
Mid North Coast	Coastal	67	26
Central Coast	Coastal	14	1
Southern NSW	Mostly coastal	15	4
Northern Sydney	Metropolitan Sydney	8	1
Nepean Blue Mountains	Metropolitan Sydney	8	0
Far West	Inland	10	0
Illawarra Shoalhaven	Coastal	5	3
South Western Sydney	Metropolitan Sydney	4	2
South Eastern Sydney	Metropolitan Sydney	4	1
Western Sydney	Metropolitan Sydney	5	0
Sydney	Metropolitan Sydney	3	0
TOTAL	**ALL REGIONS**	498	90

* Human cases are assigned to LHDs based on the individual's residential address, it is often difficult to determine where the infection was acquired, as exposure may occur in various locations visited by the individual.

For further information on surveillance for human infections with vector-borne diseases, including exotic arbovirus infections, see the following:

- NSW Health Vector-borne diseases reports
- NSW Health Notifiable diseases data (and select the relevant disease).

Exotic mosquito detections at first points of entry

The Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) is responsible for monitoring, surveillance and management of exotic mosquitoes at first points of entry include major Australian ports such as airports and approved arrangement facilities. The exotic mosquito species *Aedes aegypti* and *Aedes albopictus* both pose a serious biosecurity risk to Australia being major vectors of serious arboviral diseases including Dengue, Yellow Fever, Zika, and Chikungunya viruses.

Table 4 shows detections for the period July 2024 to June 2025.

Table 4: Detections of exotic mosquitoes in NSW, July 2024 to June 2025

Date	Mosquito species	Sex	Location	Origin*
1 July 2024	*Aedes aegypti*	F	Sydney International Airport	SE Asia
17 July 2024	*Aedes aegypti*	F	Sydney International Airport	SE Asia
10 September 2024	*Aedes aegypti*	F	Sydney International Airport	SE Asia
17 September 2024	*Aedes aegypti*	F	Sydney International Airport	Not determined
24 September 2024	*Aedes aegypti*	F	Sydney International Airport	SE Asia
30 January 2025	*Aedes albopictus*	F	Sydney International Airport	East Asia
30 January 2025	*Aedes aegypti*	M	Sydney International Airport	SE Asia
4 March 2025	*Aedes aegypti*	F	Matraville	Pending

*Origin determined through population analyses

Following the detections of exotic mosquitoes, insecticidal control and enhanced surveillance are undertaken as per the Australian Government Department of Health (2017), '*Response Guide for Exotic Mosquito Detections at Australian First Points of Entry*' (https://www.health.gov.au/resources/publications/response-guide-for-exotic-mosquito-detections-at-australian-first-points-of-entry?language=en).

Insecticidal control includes the use of thermal fogging along with residual surface sprays in the areas where the detections occurred. The enhanced surveillance includes the placement of additional mosquito traps and increased checking of the traps up to 40 days post detection of the exotic mosquitoes.

These measures have help ensure that Australia has remained free of *Aedes albopictus* and insecticide resistant strains of *Aedes aegypti*.

Discussion

The 2021–2022 and 2022–2023 seasons saw widespread cases of JEV and MVEV, respectively, across southeast Australia. These outbreak years were associated with La Niña patterns over multiple years, with 2022–2023 marking the third consecutive La Niña year, a pattern historically linked to major MVEV activity.

In 2024–2025, the Southern Oscillation shifted toward neutral conditions, resulting in more typical precipitation patterns. Neither MVEV predictive model indicated an epidemic, although these models are designed to forecast outbreak seasons and do not exclude the possibility of low-level activity. Such activity was observed in December, with two chicken seroconversions recorded at Cowra and West Wyalong. However, there were no human MVEV cases in 2024-2025. While parts of the inland experienced above-average rainfall and several early-season mosquito collections exceeded 1,000 mosquitoes per trap, this raised the possibility of vertical MVEV transmission in floodwater *Aedes* following the major 2022–2023 outbreak.

Currently, no predictive model exists for JEV activity. With its amplifying host, the pig, is widely distributed across southeast Australia in both feral and farmed populations, forecasting JEV activity remains challenging. The substantial mosquito populations recorded in December 2024 may have facilitated virus spread, as evidenced by two detections (Griffith and Moree) and five human cases acquired in New South Wales. Historical patterns suggest that above-average rainfall and increased mosquito abundance are likely indicators of future JEV activity in the region. Patterns of JEV detections in recent seasons collectively suggest that JEV is establishing endemicity in parts of Australia, posing an ongoing risk to public health.

During wet years the abundance of the saltmarsh mosquito *Aedes vigilax* tends to decline because its eggs require a drying period to mature. Throughout much of the 2024-2025 season, coastal rainfall remained above average, and *Aedes vigilax* collections along the coast never reached “very high” levels. In contrast, the freshwater mosquito *Culex annulirostris* was consistently trapped in higher numbers. For the Sydney trapping sites, many are located near major saltmarshes, hence the higher proportion of *Aedes vigilax*.

In 2024-2025, mosquitoes were tested for the presence of the bunyaviruses GGV and TRUV to assess their current distribution and activity. Both viruses are known to infect humans, GGV is a confirmed human pathogen, while TRUV is considered a suspected pathogen. Previous testing for these viruses largely dates to the early 1990s, prior to the widespread use of molecular assays, when detections relied virus isolations via cell culture and proved infrequent. In the 2024-2025 season, there were 15 detections of GGV and 3 of TRUV, almost all from coastal and Sydney sites. More information about these viruses can be found at https://onlinelibrary.wiley.com/doi/10.1111/j.1445-5994.1990.tb00371.x.

Acknowledgements

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