



★ **FIGHT** *the* **BITE** ★

SOUTH AUSTRALIAN ARBOVIRUS AND MOSQUITO MONITORING AND CONTROL ANNUAL REPORT: 2022-2023

Contents

List of figures.....	3	10. Mosquito surveillance and control.....	21
List of tables.....	4	Overview.....	21
Acronyms and abbreviations	4	Laboratory analysis.....	21
Executive summary	5	Larval control.....	21
1. Introduction.....	7	Northern Adelaide mosquito surveillance program.....	22
2. South Australian Arbovirus Coordinated Control and Operations Plan	7	Globe Derby Park Mosquito Management Program.....	24
3. 2022-23 season arbovirus response level indicators	8	HPP targeted mosquito surveillance.....	25
September 2022 – Level 3 indicators.....	8	Health Protection Programs Anangu Pitjantjatjara Yankunytjatjara (APY) mosquito surveillance	26
4. Arbovirus Response Cross Agency Group.....	9	Metropolitan trapping program	27
5. One Health	10	SA River Murray council mosquito surveillance and control	28
6. Local council mosquito management subsidy.....	11	Overview.....	28
2022-23 subsidy program	12	Alexandrina Council	31
7. Arbovirus prevention campaign (Fight the Bite)	13	Berri Barmera Council	32
2022-23 season communications		Coorong District Council	33
tools/tactics.....	14	District Council of Loxton Waikerie.....	34
8. Meteorological data	15	Mid Murray Council.....	35
2022-23 summary of weather (environmental) conditions	15	Rural City of Murray Bridge	36
South Australia in spring 2022: very wet with cool days	15	Renmark Paringa Council	37
South Australia in summer 2022-23: drier in many areas; warm in the north and west.....	16	Metropolitan council mosquito surveillance and control	38
South Australia in autumn 2023.....	16	Overview.....	38
Flooding event summary.....	16	Adelaide Plains.....	38
Acknowledgement	16	Mount Barker District Council.....	39
9. SA JEV mitigation through surveillance and control program	17	City of Port Adelaide Enfield.....	41
Federal funding.....	17	City of Salisbury	41
9.1 Expansion of Mosquito Trapping, Viral Screening and Management	18	City of Tea Tree Gully.....	42
9.2 Feral Pig Surveillance Program	18	Regional council mosquito surveillance and control	43
9.3 Sentinel chicken program	19	Barossa Council.....	43
9.4 Wastewater Surveillance	19	Barunga West Council	43
9.5 Stakeholder Engagement, Project Management and Training	19	Clare and Gilbert Valleys Council	43
9.6 Policy and Legislative Framework.....	20	District Council of Elliston	45
9.7 Interjurisdictional Research Collaboration.....	20	Regional Council of Goyder	46
		Kangaroo Island Council.....	47
		Southern Mallee District Council.....	48
		Whyalla City Council	49
		Arbovirus isolations from trapped mosquitos (whole trap grinds)	50

11. South Australian sentinel surveillance program	51	Figure 8 SA River Murray councils mean <i>Culex annulirostris</i> abundance – three season comparison	29
12. Notification of arbovirus infections	52	Figure 9 River Murray councils <i>Culex annulirostris</i> monthly mean abundance	30
Ross River virus (RRV).....	53	Figure 10 Alexandrina Council mosquito abundance by month and trap location.....	31
Barmah Forest virus (BFV).....	53	Figure 11 Berri Barmera Council mosquito abundance by month and trap location	32
Japanese encephalitis virus (JEV).....	53	Figure 12 Coorong District Council mosquito abundance by month and trap location	33
Murray Valley encephalitis virus (MVEV)	53	Figure 13 District Council of Loxton Waikerie mosquito abundance by month and trap location.	34
West Nile virus Kunjin strain (WNV/KUN).....	54	Figure 14 Mid Murray Council mosquito abundance by month and trap location	35
Exposure locations	54	Figure 15 Rural City of Murray Bridge mosquito abundance by month and trap location	36
Exotic mosquito-borne diseases.....	54	Figure 16 Renmark Paringa Council mosquito abundance by month and trap location	37
13. Exotic mosquito detections.....	55	Figure 17 Adelaide Plains Council mosquito abundance by month and trap location	38
Airport incursion and response	55	Figure 18 Mount Barker District Council mosquito abundance by month and trap location	39
14. Events.....	56	Figure 19 City of Playford Council mosquito abundance by month and trap location	40
15. Future directions for mosquito surveillance and control in South Australia	56	Figure 20 City of Salisbury Council mosquito abundance by month and trap location	41
16. Reporting	56	Figure 21 Clare and Gilbert Valley Council mosquito abundance by month and trap location	44
17. Training videos and resources	57	Figure 22 District council of Elliston mosquito abundance by month and trap location	45
18. Further information	57	Figure 23 District council of Elliston mosquito abundance by month and trap location	46
Appendix 1: Mosquito monitoring and arbovirus prevention stakeholders	58	Figure 24 Kangaroo Island Council mosquito abundance by month and trap location	47
Appendix 2: Arbovirus response cross agency group membership	59	Figure 25 Southern Mallee District Council mosquito abundance by month and trap location	48
Appendix 3: Northern Adelaide mosquito surveillance program trapping locations	59	Figure 26 Whyalla City Council mosquito abundance by month and trap location.....	49
Appendix 4: South Australian River Murray council trap locations	60	Figure 27 Arbovirus notifications in South Australia by notification date Jan 2019-Jun 23.....	52
Appendix 5: Metropolitan council mosquito surveillance and control trap locations	62	Figure 28 Exotic disease notifications in South Australia by Financial year - three-year comparison 2020-23.....	54
Appendix 6: Regional council mosquito surveillance and control trap locations	63		
List of figures			
Figure 1 Mosquito subsidy costs by financial year 2009-2023.....	12		
Figure 2 Northern Adelaide mosquito trapping total abundance - three season comparison	22		
Figure 3 Northern Adelaide mean mosquito abundance by month 2022-23	23		
Figure 4 Northern Adelaide surveillance program season averages	24		
Figure 5 Metropolitan surveillance program trap locations 2022-23.....	27		
Figure 6 River Murray council mosquito trap mean abundance by council area - three season comparison 2020-23	28		
Figure 7 River Murray council mosquito trap mean abundance by council area	29		

List of tables

Table 1 Health Protection Programs regional officers trapped mosquito data 2022-23 season.....	25
Table 2 Arbovirus isolations from whole trap grinds for the 2022-23 mosquito season in South Australia.....	50
Table 3 MVEV, KUNV and JEV results in sentinel chicken flocks	51
Table 4 Arbovirus response cross agency group ..	59
Table 5 Northern Adelaide mosquito surveillance trap locations.....	59
Table 6 River Murray councils mosquito surveillance trap locations	60
Table 7 Metropolitan council mosquito surveillance and control trap locations	62
Table 8 Regional council mosquito surveillance and control trap locations	63

Acronyms and abbreviations

APY	Anangu Pitjantjatjara Yankunytjatjara
AVR	Agriculture Victoria Research
ARCAG	Arbovirus Response Cross Agency Group
BOM	Bureau of Meteorology
BFV	Barmah Forest virus
CDCB	Communicable Disease Control Branch, Department for Health and Wellbeing
CDINS	Communicable Disease Incident of National Significance
CDNA	Communicable Disease Network of Australia
DAFF	Department of Agriculture, Fisheries and Forestry (Commonwealth)
DEW	Department for Environment and Water
DHW	Department for Health and Wellbeing
DMB	Disaster management Branch, Department for Health and Wellbeing
DoH	Department of Health and Aged Care (Commonwealth)
ENSO	El Niño–Southern Oscillation
EVS	Encephalitis vector survey
HoR	Hierarchy of Response
HPO	Health Protection Operations, Department for Health and Wellbeing
HPP	Health Protection Programs, Department for Health and Wellbeing
ICPMR	Institute of Clinical Pathology and Medical Research, Westmead Hospital
JE	Japanese encephalitis
JEV	Japanese encephalitis virus
WNV/KUN	West Nile virus – Kunjin strain
LHA	Local Health Authority
MVEV	Murray Valley encephalitis virus
OHSAWG	One Health South Australia Working Group
PIRSA	Department of Primary Industries and Regions
RRV	Ross River virus
SAIMMRP	South Australian Integrated Mosquito Management Resource Pack

Executive summary

The South Australian Arbovirus and Mosquito Monitoring and Control Annual Report (the annual report) summarises mosquito-borne disease notifications and mosquito surveillance and control activities undertaken by the Department for Health and Wellbeing (DHW) and local health authorities (LHAs) across the state. The annual report also details climatic influences on the 2022-23 mosquito season in South Australia. Arboviral surveillance is conducted to identify high risk periods and locations, providing opportunities to intervene and prevent or reduce cases of human infection.

The 2022-23 mosquito season was influenced by a third consecutive La Niña weather event resulting in above average rainfall across much of south-eastern Australia. High rainfall resulted in major flooding events along the River Murray.

The climatic influences combined with the emergence of Japanese encephalitis virus (JEV) in south-eastern Australia during the 2021-22 mosquito season indicated that the risk of local transmission of flaviviruses was its highest since 2010-11, when two human cases (one fatal) of Murray Valley encephalitis virus (MVEV) were notified in South Australia.

Following the declaration of JEV as a communicable disease incident of national significance (CDINS) the Commonwealth provided \$2.7m in funding to DHW to support the JEV response through mosquito surveillance and control in South Australia. The Commonwealth funding allowed for considerable expansion of the South Australian mosquito surveillance and control program, the sentinel chicken program, extensive stakeholder engagement, increased public health promotion, and interjurisdictional research collaboration.

Screening of trapped mosquitoes resulted in detections of MVEV, West Nile Virus – Kunjin strain (WNV/KUN), Ross River virus (RRV) and Barmah Forest virus (BFV). The expanded South Australian sentinel chicken program resulted detections of MVEV and WNV/KUN in multiple samples from several locations. There were no detections of JEV from environmental surveillance.

- ➔ Control measures implemented by LHAs included larvicide treatments at known breeding sites, identification and mapping of new breeding sites, local health promotion activities and public health messaging. In addition, DHW provided increased funding to extend coverage of the annual Fight the Bite campaign and continued monthly reporting to ensure clear and timely communication to relevant stakeholders. DHW's Health Protection Programs (HPP) team attended multiple large community events in high risk areas. DHW liaised with the Department of Primary Industries and Regions (PIRSA) to develop a data sharing agreement which enabled timely, risk-based responses to suspected or probable detections of arbovirus in animals.

HPP continued to support LHAs through the South Australian mosquito management subsidy program which included training, technical support, equipment, and funding to undertake the following activities:

- ➔ Mosquito surveillance activities, including adult mosquito trapping and identification.
- ➔ Viral analysis of trapped mosquitoes.
- ➔ Mosquito larval surveillance and control.
- ➔ Local health promotion activities and enhanced public messaging.
- ➔ Local mosquito management training.
- ➔ In addition to the support provided to LHAs, HPP continued to undertake mosquito trapping in the northern Adelaide region and coordinated the sixth season of the Globe Derby Park mosquito management aerial treatment program.

One human case of JEV and one human case of MVEV were reported during the season in South Australia. There were no reported cases of WNV/KUN. Notified cases of RRV and BFV were lower than the previous seasons and what was predicted from climate forecasts. The number of arbovirus infections reported in the 2022-23 season was 50% lower than the 2021-22 season but similar to the number reported for the 2020-21 season. The peak number of cases for the 2022-23 season occurred in January and most cases likely acquired their infection in the Riverland, Murray Lands and Lower Lakes regions which is consistent with previous years.

An incursion of the exotic mosquito species, *Aedes aegypti*, was detected at the Adelaide Airport by the Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF) during their routine surveillance. *Aedes aegypti* pose a risk as they can transmit dengue, chikungunya and Zika viruses, which are not present in South Australia. This triggered an emergency response and enhanced surveillance which resulted in no further detections of exotic mosquitoes in the area.

1. Introduction

The annual report provides an overview of the wide range of programs, surveillance and other activities undertaken in South Australia during the 2022-23 mosquito season which collectively aimed to:

- ➔ Monitor human mosquito-borne disease risk status.
- ➔ Provide an early warning of the presence of the viruses known to cause mosquito-borne disease.
- ➔ Inform activities to reduce mosquito breeding opportunities in high-risk locations.
- ➔ Advise the public and visitors to South Australia of the risks and how to protect themselves from mosquito-borne disease.
- ➔ Promote interagency cooperation on matters relating to the monitoring, prevention, and control of human mosquito-borne disease.

Mosquito monitoring and arbovirus prevention in South Australia is a multi-agency collaborative effort involving the work of a broad range of stakeholders (see appendix 1).

2. South Australian Arbovirus Coordinated Control and Operations Plan

The [South Australian Arbovirus Coordinated Control and Operations Plan](#) (the Plan) was prepared for the Chief Executive and approved by the Minister for Health and Wellbeing in 2015. The Plan details the strategies to be administered by DHW for mosquito control and the prevention of human cases of arboviral infections such as MVEV and WNV/KUN.

The Plan guides collaboration between relevant state and local government agencies in South Australia in the areas of mosquito surveillance, management and control and provides the framework for the implementation of coordinated mosquito control programs. The Plan establishes procedures for DHW officers to implement coordinated mosquito control programs and outlines the responsibilities, authorities, and mechanisms to minimise, manage and recover from an outbreak of mosquito-borne arboviral disease in South Australia.

The Hierarchy of Response (HoR), as detailed in the Plan, is dependent upon on-going data and trends identified by surveillance activities, weather forecasting and disease notifications. The HoR was developed to guide decision making on an appropriate level of response that is proportionate to the risk or incidence of serious human arboviral diseases. The HoR specifies trigger conditions for each level of response and measures that should be considered for implementation at that level.

DHW declares the response level as low, medium, or high depending on the intelligence received. Level 1 or a low response represents normal surveillance and control activities during mosquito season. Levels 2 (medium) and 3 (high) are heightened response levels which may require additional resources and coordination.

At Level 2, DHWs primary role is to support local council run mosquito surveillance and control programs. At Level 3, DHW coordinates and supports local council mosquito control programs in targeted high-risk locations.

In February 2022 JEV was detected in domestic pigs in the eastern states. JEV was also detected in pigs in various locations in south-eastern Australia including South Australia, this coincided with a cluster of acute human encephalitis cases in South Australia. Japanese encephalitis (JE) was declared a CDINS by the Department of Health and Aged Care (DoH) in March 2022 triggering a national response to the emerging situation. Whilst not previously contemplated in the Plan, the JEV situation triggered a Level 3 (high) response during the 2021-22 mosquito season.

3. 2022-23 season arbovirus response level indicators

In accordance with the HoR, as detailed in the Plan, DHW considered the following indicators in relation to the risk of transmission of flaviviruses for the 2022-23 mosquito season:

September 2022 – Level 3 indicators

- ➔ A La Niña event during the 2021-22 season, above average rainfall during spring/summer of 2021-22.
- ➔ Third La Niña event declared for the 2022-23 summer.
- ➔ The emergence of JEV: cluster of human cases in early 2022 (two fatal).
- ➔ The declaration of a CDNIS in March 2022.
- ➔ Arbovirus detections in trapped mosquitoes in the 2021-22 season.
- ➔ Positive JEV, MVEV and WNV/KUN antibodies found in sentinel chickens in the 2021-22 season.
- ➔ JEV detections interstate from human cases, in surveillance mosquitoes and in sentinel chickens.
- ➔ Flooding event from early 2022 in the communities of the Far North, Flinders Ranges, Upper Spencer Gulf and Eyre Peninsula.
- ➔ The predicted flood event occurring along the River Murray due to heavy rainfall in August interstate, expected to reach SA in early 2023.
- ➔ Above average RRV/BFV human case notifications in 2021-22.
- ➔ Level 3 response during 2021-22 mosquito season.

In response to the indicators identified the 2022-23 mosquito season commenced at risk level 3. The DHWs HPP team worked closely with LHAs to ensure preparedness for the season and increased funding to support a heightened response to the increased threat level.

4. Arbovirus Response Cross Agency Group

The Arbovirus Response Cross Agency Group (ARCAG) was established in accordance with the Plan. The purpose of the ARCAG is to provide a mechanism for effective communication amongst key stakeholder agencies and organisations on all aspects of the planning and implementation of coordinated mosquito control programs. The ARCAG assists DHW to plan and, if necessary, implement a state coordinated response through:

- ➔ Providing advice (technical, operational, and strategic).
- ➔ Facilitating access to intelligence, information, and resources.
- ➔ Facilitating communication and decision making within the representative agencies, where required, to ensure an effective and timely response.

The ARCAG also considers the preparedness of representative agencies, other organisations, and the state to support a state coordinated response should it be necessary and makes appropriate recommendations to government.

- ➔ Meeting frequencies are determined by the HoR level for each mosquito season. ARCAG membership (see appendix 2) reflects the main purpose of the Plan to guide collaboration between relevant state and local government agencies in South Australia in mosquito surveillance, management, and control.

5. One Health

A 'One Health' approach is taken to maintaining and improving health protection services by working closely with relevant agencies and non-government organisations to identify and address the interactions between human, animal, and environmental health. The One Health SA Working Group (OHSAWG), formerly the Zoonoses Working Group, is a government cross-agency information sharing and advisory group established in 2009, with the following membership:

- ➔ The Department of Primary Industries and Regions SA (PIRSA) – Biosecurity:
 - Animal Biosecurity.
 - Food Safety Program.
- ➔ SA Health – Public Health:
 - Health Protection and Regulation:
 - Health Protection Programs (HPP).
 - Health Protection Operations (HPO).
 - Food Safety and Regulation Branch.
- ➔ Communicable Disease Control Branch (CDCB):
 - Disease Prevention and Control.
 - Disease Surveillance and Investigation Services.
- ➔ Department of Environment and Water (DEW).
- ➔ Wildlife Management.

The objectives of OHSAWG are to:

- ➔ Provide a forum for interagency collaboration and application of a One Health approach to achieve better overall outcomes in managing zoonoses and other public health concerns where human, animal and environmental health intersect.
- ➔ Enhance surveillance for zoonotic diseases in SA through interagency cooperation.
- ➔ Provide expert technical advice on policy and operational matters in relation to zoonotic diseases, including emergency responses.
- ➔ Review and discuss relevant legislative changes.
- ➔ Enhance communication on zoonotic diseases among stakeholders.
- ➔ Assist in timely and accurate communication with the South Australian community.
- ➔ Inform policy development and improve health outcomes in relation to zoonotic diseases.
- ➔ Encourage collaboration with other stakeholders such as universities and private sector.

6. Local council mosquito management subsidy

As LHAs for their areas, local councils are responsible for ensuring appropriate mosquito management on public land, including Crown Land, within their jurisdictions. To achieve the best possible public health outcomes, councils are encouraged to implement integrated programs incorporating a considered balance of surveillance, mosquito control, and health promotion activities. Where mosquito control activities are deemed necessary, these are targeted in locations which most directly impact on residents and visitors.

Local council subsidy funding for mosquito management (the subsidy) began in the summer of 2000-01. The aim of the subsidy is to support mosquito surveillance and control activities undertaken by, or on behalf of, local councils in specific high-risk mosquito breeding areas of South Australia where the cost of effective mosquito management exceeds available local council resources.

The subsidy covers up to half of the cost of mosquito control and surveillance undertaken by council on public land, including Crown Land. Funding for local council activities is assessed and allocated on an annual basis and is prioritised based on:

- ➔ Public health risk.
- ➔ Amenity benefit.

Councils report on their mosquito management activities to HPP monthly during the mosquito season. Adult mosquito trap abundance, species data and viral analysis is provided to DHW by Agriculture Victoria Research (AVR), Victorian Department of Energy, Environment and Climate Action. DHW pay all AVR service charges with no cost to councils.

2022-23 subsidy program

Commonwealth funding provided to DHW in response to the CDINS allowed for the expansion of the subsidy program to include additional at-risk councils. To reduce the economic burden on councils in delivering a level 3 response, subsidy funding to councils to support local mosquito management activities was increased and councils were able to claim 100% of expenditure compared to 50% in previous seasons.

25 local councils were pre-approved for the subsidy for the 2022-23 season, compared to fourteen for the 2021-22 mosquito season. 21 councils subsequently submitted end of season claims. These included the seven River Murray councils and seven additional councils identified as high JEV risk locations in both regional and metropolitan council areas. In addition, seven regional and metropolitan councils identified as being low JEV risk areas received subsidy funding at a lower rate.

As shown in figure 1, the end of season subsidy expenditure totalled \$512,816.20. This included abundance and speciation data, and viral analysis of trapped mosquitoes provided by AVR. The expenditure was increased significantly compared to previous seasons in response to the season threat level.

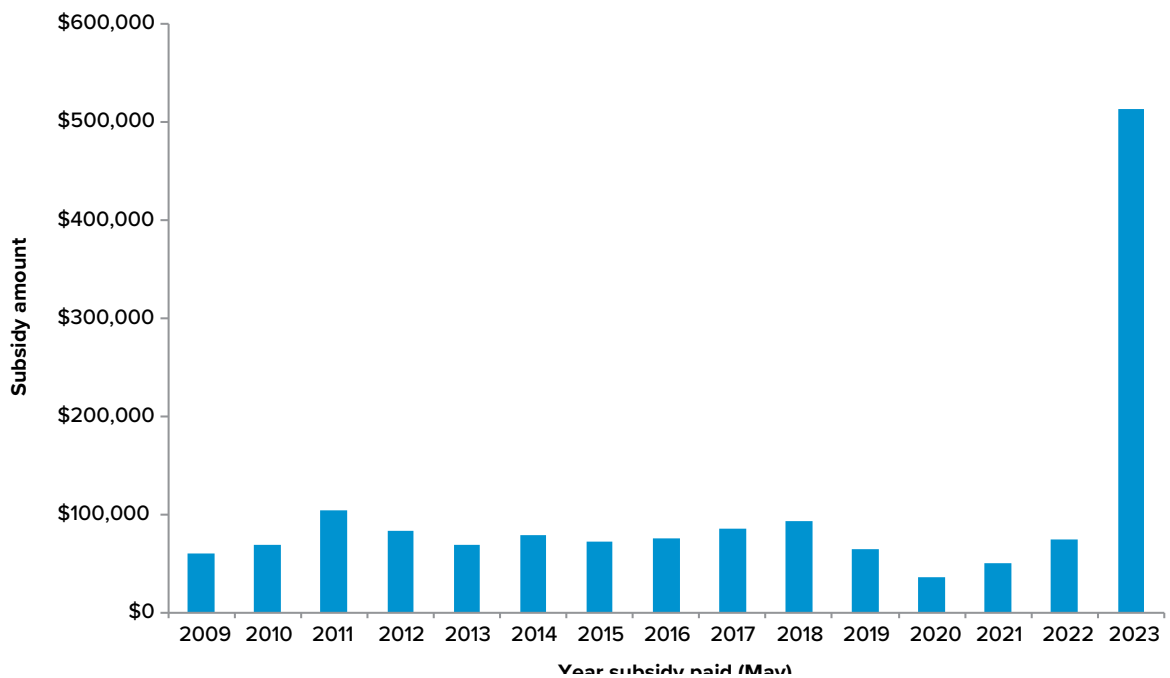


Figure 1 Mosquito subsidy costs by financial year 2009-2023

7. Arbovirus prevention campaign (Fight the Bite)

Pursuant to the *South Australian Public Health Act 2011* (the Act), the Minister for Health and Wellbeing and DHW have statutory obligations to promote proper standards of public and environmental health in South Australia. As part of its responsibility, SA Health uses the Fight the Bite campaign to advise and inform all South Australians about the health risks associated with mosquito bites and how individuals can reduce their risk of acquiring an arbovirus. Fight the Bite was first launched in 2004 and runs annually.

The campaign highlights the adverse effects of mosquito bites on human health and encourages individuals to adopt protective measures to reduce the likelihood of being bitten by mosquitoes and acquiring a mosquito-borne disease. In addition to raising awareness about health issues associated with mosquito bites, the campaign also aims to raise awareness about the importance of eliminating environments where mosquitoes live and breed.

Campaign resources are distributed to relevant councils and radio advertising is broadcast on local radio stations in affected areas.

To increase awareness about mosquito-borne disease and the importance of protecting against mosquito bites, the following tools and tactics are used as part of the Level 1 response:

- ➔ Advertising - An integrated advertising campaign to increase awareness of mosquito-borne diseases and protection measures, serving to motivate and remind target audiences to take appropriate action to prevent mosquito bites and the spread of mosquito-borne disease.
- ➔ Website – DHW’s mosquito-borne disease information is available at www.sahealth.sa.gov.au/fightthebite. The short URL is used in print publications and in DHW’s social media content.
- ➔ Social media – SA Health proactively promotes Fight the Bite messages through social media channels, including Facebook, Twitter and Instagram, for the duration of the campaign period.
- ➔ Digital assets - Internal communications including an email signature banner, screensavers and TV screens are distributed and displayed.
- ➔ Campaign pack - DHW provides a campaign pack to partner agencies with a cover letter outlining activities and encouraging them to share the information in their local communities.

2022-23 season communications tools/tactics

The campaign is guided by the annual Fight the Bite communications plan. The standby communications action plan is in place to supplement the HoR if DHW declares that a Level 2 or Level 3 response is required. For the 2022-23 season, in accordance with the Plan, the standby communications action plan was activated in response to the increased risk of arboviral infection.

To coincide with a level 3 response, the Fight the Bite campaign budget was planned to be \$89,956.72 for the 2022-23 season. An additional \$20,000 was spent on digital media and radio advertising to extend the campaign into school holidays, to create awareness for families travelling into high-risk areas during the flood emergency period.

The 2022-23 level 3 Fight the Bite campaign included:

- ➔ Updated mosquito surveillance results and mosquito-borne disease information on the website to alert the public to the current risk.
- ➔ Increased paid posts on SA Health's social media channels including Facebook and Instagram, including specific geo targeting on high risk areas in South Australia.
- ➔ Public health alerts on SA Health's Facebook and Twitter.
- ➔ Metropolitan and regional radio messaging with a 30 second recorded Fight the Bite advert.
- ➔ Outdoor signage was displayed at high-risk holiday locations, including venues such as community centres.
- ➔ Digital TV advertisements on screens at GP clinics.
- ➔ School and child targeted resources were created to help raise awareness of mosquito-borne diseases for children.

8. Meteorological data

Mosquito numbers in inland parts of South Australia are influenced by rainfall and temperature during the peak period for mosquito breeding, which usually spans the months of September through to April. In coastal saltmarsh areas, tidal inundation patterns significantly impact mosquito abundance, particularly during the months of January through to April.

Meteorological data is used in the assessment of mosquito-borne disease risk by signalling conditions associated with previous outbreaks of arbovirus infection in humans. This is particularly significant after a period of high and prolonged river flow when floodwaters recede and during times of high spring and summer rainfall. The broad areas of flood plain associated with the River Murray provide breeding opportunities for the main disease vector mosquito of concern, *Culex annulirostris*.

Culex annulirostris is considered the major species of concern for transmission of RRV, BFV, WNV/ KUN, and MVEV. It is also believed to be a major vector for JEV. *Aedes camptorhynchus* and *Aedes vigilax* are the major vectors of RRV and BFV in coastal saltwater habitats.

2022-23 summary of weather (environmental) conditions

During September 2022 the Bureau of Meteorology (BOM) declared that a third consecutive La Niña was underway in the tropical Pacific and the El Niño-Southern Oscillation (ENSO) outlook was raised to La Niña. La Niña conditions increase the chance of above average spring and summer rainfall in northern and eastern Australia. When a La Niña and a negative phase of the Indian Ocean Dipole coincide, the likelihood of above average rainfall over Australia, particularly over the eastern half of the continent, is further increased.

Most models predicted an easing of the La Niña in early 2023, suggesting a relatively short-lived event. Overall, models did not anticipate this event would be as strong as the La Niña of 2010-12, which was one of the four strongest La Niña events on record. The 2010-11 La Niña saw significantly higher than average notifications of cases of human arbovirus infection when 1,298 arbovirus infections were reported in South Australia. The 2022-2023 La Niña weakened during January 2023 and the ENSO outlook returned to neutral in March 2023.

South Australia in spring 2022: very wet with cool days

Rainfall for spring was very much above average across most of South Australia, with each of September, October, and November wetter than average for the state. Overall, it was the state's fifth-wettest spring on record since 1900 and the wettest since 2010. Mean maximum temperatures were very much below average across most of South Australia and overall, it was state's coolest spring days since 2010. Mean minimum temperatures were generally close to average, though nights were cooler than average across some central and eastern areas of the state and warmer than average in the far north and south.

South Australia in summer 2022-23: drier in many areas; warm in the north and west

Total rainfall in summer 2022–23 was below average across large areas of South Australia making it the state's driest summer since 2019–20. Daytime temperatures for summer were close to average or warmer than average across most of South Australia. Night-time temperatures for summer were close to average in many areas but were warmer than average in the state's north and cooler than average in the east. Overall, it was the state's warmest summer since 2019–20.

South Australia in autumn 2023

Rainfall in autumn tended to be above average in the state's north-western and south-eastern districts but was below average in parts of the Northeast Pastoral district. For South Australia as a whole, rainfall in autumn was 15% below average (based on 1961–1990). Several sites had their highest total autumn rainfall on record or their highest total autumn rainfall for at least 20 years.

Mean maximum temperatures for autumn were close to average in most areas of South Australia but were below average in the Southeast districts and above average in the far north-east. For South Australia as a whole, the mean maximum temperature was 0.57 °C above average (based on 1961–1990). Mean minimum temperatures for autumn were generally warmer than average in the state's west and cooler than average in the east, although they were above average in some areas of the Southeast districts. For South Australia as a whole, the mean minimum temperature was 0.10 °C below average (based on 1961–1990).

Flooding event summary

High rainfall in the Murray-darling basin during spring led to increased flow upstream of the South Australian border during spring 2022. The peak flow of 190 GL/day reached the South Australian border on 23 December 2022 and the flood ended on 7 February 2023. Flows remained elevated through the length of the River Murray in South Australia and the Lower Lakes.

Widespread flooding in the region led to River Murray flow levels reached many areas of the landscape for the first time in 70 years. The flood was a slow-moving event which had the potential to result in pooling water leading to widespread mosquito breeding opportunities.

The River Murray flood event resulted in water spilling from the River channel out onto the surrounding floodplains and waterfront land. Flooding, pooling and excess surface water provided optimal habitats for mosquito breeding, and consequentially the risk of mosquito-borne disease increased.

The flooding event resulted in the declaration of a Major Emergency in these regions. HPP's regional officers attended flood recovery meetings to provide advice and information in relation to the risk of mosquito-borne disease. They distributed personal repellents to communities and provided advice to local businesses in relation to preventative mosquito management.

Regional officers from HPP were able to support local councils by conducting routine mosquito surveillance in flood affected areas enabling local council environmental health officers (EHOs) to focus on the flood response in their area. In addition to the physical response to the emergency, Fight the Bite campaign messaging was increased using targeted radio messaging and social media posts.

Acknowledgement

Content (adapted) thanks to [Bureau of Meteorology, Australian Government](#) and [the Department for Environment and Water](#).

9. SA JEV mitigation through surveillance and control program

Federal funding

The declaration of JEV as a CDINS, resulted in South Australia receiving funding under the Federation Funding Agreement (the Agreement). The total financial contribution of \$2.7 million over the period of 18 April 2022 to 30 June 2023 was made available to support the surveillance and control (where area has confirmed JEV present) of JEV mosquito vectors outside of infected premises.

The Commonwealth funding provided through the Agreement allowed for the development of the 'South Australian JEV Mitigation through Surveillance and Control Program' (the JEV Program). The JEV Program detailed additional mosquito and JEV monitoring, and surveillance strategies and actions planned to be undertaken over the Agreement period. The JEV Program was submitted to the Commonwealth and DHW were required to report progress against key performance indicators at a frequency outlined in the Agreement.

As JEV was previously considered not likely in Australia and even less likely further south in South Australia, it was not historically contemplated in the Plan or included as part of the routine arbovirus surveillance program. DHW utilised, modified and adapted existing surveillance and control work to support the DHW led JEV response and the delivery of the JEV Program. The additional strategies and activities conducted over the Agreement period are detailed below.

9.1 Expansion of Mosquito Trapping, Viral Screening and Management

Strategies:

- Expand routine mosquito surveillance by SA Health.
- Expand mosquito surveillance and management by councils.
- Contractor engagement.
- Identification, enumeration and viral screening.
- Data management.

Actions:

- JEV team established to support the delivery of the JEV Program.
- Regionally based officers employed to support local councils and undertake targeted surveillance and control activities.
- DHW routine mosquito surveillance and control activities enhanced.
- Mosquito surveillance and control expanded to regional and remote areas through the DHW's regionally based officers.
- Responsive surveillance undertaken following notifications of possible arbovirus detections in human and animals.
- Adult mosquito surveillance program initiated in metropolitan Adelaide.
- South Australian subsidy program extended to include additional to high-risk councils for the 2022-23 mosquito season.
- Local council trapping frequency increased.
- Sentinel chicken program expanded.
- Contractors engaged in preparation for on ground support in the event of an outbreak.
- Trapped mosquitoes sent to AVR for speciation, enumeration, and molecular viral screening for RRV, BFV, MVEV, JEV and WNV/KUN.
- Development of data dashboard and a web-based application for use when undertaking field-based surveillance and control operations.
- DHW guided risk-based application of adulticide treatment within LHNs and privately-owned high-risk locations (caravan parks and camp sites).

9.2 Feral Pig Surveillance Program

Strategy:

- Facilitate collaboration of feral pig surveillance between relevant stakeholders and enable sharing of knowledge, resources and skills to get an understanding of JEV in the South Australian regional and remote environment.

Actions:

- Key stakeholders and partners were identified to explore the feasibility of and explore opportunities for feral pig surveillance.
- A package was developed for the program to be undertaken, with a view to scaling up as required.

9.3 Sentinel chicken program

Strategy:

- ➔ Expand current chicken sentinel surveillance program for monitoring of JEV.

Actions:

- ➔ Additional four flocks established in high-risk locations.
- ➔ Bleed frequency increased.
- ➔ Blood screened for MVEV, WNV/KUN and JEV.

9.4 Wastewater Surveillance

Strategies:

- ➔ Determine the feasibility of wastewater JEV surveillance testing in areas such as Anangu Pitjantjatjara Yankunytjatjara (APY lands) and other remote locations where regular mosquito trapping is impractical and SARS-CoV-2 testing had been successfully implemented.
- ➔ Conduct wastewater surveillance and use these results alongside testing, vaccine and case information and for JEV monitoring and surveillance.

Actions:

- ➔ Key stakeholders and partners were identified and relationships established with laboratory, the pork industry, local council, and interstate departments working on aligning strategies.
- ➔ Engaged the laboratory to develop methodology and determine the suitability of human and industry piggery wastewater for surveillance.

9.5 Stakeholder Engagement, Project Management and Training

Strategies:

- ➔ Ensure effective JEV surveillance and monitoring occurs with appropriately skilled workforce and informed stakeholders to be able to respond effectively to public health risks posed by JEV in South Australia.
- ➔ Ensure effective inter-departmental and inter-jurisdictional liaison.

Actions:

- ➔ Extensive stakeholder engagement undertaken during the 2022-23 mosquito season.
- ➔ Local councils supported by DHW to prepare, review and update local mosquito management plans.
- ➔ Additional resources and training provided to local councils to support the delivery of local responses.
- ➔ ARCAG membership expanded to include additional high risk councils and representatives from the SA Local Government Association and DHW's Disaster management Branch (DMB).
- ➔ Engagement with the LEGATUS group to support regional councils participation in the South Australian subsidy program.
- ➔ Positive viral detections from surveillance activities routinely communicated to ARCAG and shared through local networks.
- ➔ Public health alert and information signage erected in high-risk locations.

- ➔ Public health information and Fight the Bite campaign materials distributed at major events, caravan parks, national parks and sporting clubs.
- ➔ Advice and guidance on the development of planned preventative maintenance programs provided to owners and operators of caravan parks and local businesses.
- ➔ Posters and leaflets distributed to local pharmacies, hospital, GPs and tourist information centres.
- ➔ Data sharing agreement developed by OHSAWG providing a framework to support timely responses to notifications of probable and confirmed incidence of disease in humans and animals.
- ➔ DHW engaged with PIRSA and the pork industry to develop a factsheet for pig producers to support surveillance and control should JEV be identified on a farm.

9.6 Policy and Legislative Framework

Strategies:

- ➔ Ensure legislative and policy requirements are met.
- ➔ Policy framework review and development of guidelines for program sustainability.

Actions:

- ➔ Review of SA Coordinated control and operations plan commenced.

9.7 Interjurisdictional Research Collaboration

Strategy:

- ➔ Collaborate with other Australian jurisdictions and contribute to collaborative national research.

Actions:

- ➔ Supported national response by assisting national working groups of communicable disease, vaccine and arbovirus experts that were established to support the coordinated national response.
- ➔ Contributed to and provided advice to the Australian Health Principal Protection Committee (AHPPC), Communicable Disease Network of Australia (CDNA) through the National Arbovirus and Malaria Advisory Committee (NAMAC) which is a subcommittee of the CDNA.
- ➔ Provided data to JEV mapping and modelling work being conducted by the University of Melbourne team on behalf of the Commonwealth.

10. Mosquito surveillance and control

Overview

Adult mosquito trapping in South Australia is undertaken using 3D printed encephalitis vector survey (EVS) mosquito surveillance traps baited with CO² and a light source which are produced by HPP. Trapped mosquitoes from local council surveillance programs are then sent for enumeration, species identification and viral screening. This information is used to inform South Australian public health interventions, compare mosquito populations and species composition across various localities, and track how these relationships change over time.

The South Australian mosquito surveillance program has historically consisted of two main elements, the northern Adelaide mosquito surveillance program, and the subsidy program. Both programs are coordinated by HPP. In unincorporated areas of South Australia (areas outside of local government jurisdiction), any reference in the Plan to the roles and responsibilities of local councils are taken to be the roles and responsibilities of DHWs Health Protection Operations (HPO) team. When required, the HPO team carries out trapping in unincorporated areas of South Australia.

The Commonwealth funding received under the terms of the Agreement enabled the South Australian mosquito surveillance program to be expanded significantly to include additional councils in high-risk locations. The Greater Adelaide metropolitan area, the APY lands and targeted responsive trapping were also included.

Laboratory analysis

AVR was contracted for the 2022-23 mosquito season to identify and enumerate key vector species and screen mosquitoes for arboviruses. The five viral arbovirus targets are: RRV, BFV, WNV/KUNV, MVEV and JEV.

A total of 1,004 adult mosquito trap catches were received by AVR from local councils, the SA Health JEV team and HPP. As a result, an estimated total of 670,228 mosquitoes were received in the 2022-23 mosquito season from September 2022 and April 2023, over 50% of which were trapped in December 2022.

27% of trapped mosquitoes sent to AVR were morphologically identified and enumerated but not speciated during the 2022-23 mosquito season. An estimate of species diversity was provided based on subsampling and weight extrapolation for the non-identified proportion. All mosquito samples received that had >10 mosquitoes were tested for virus. The main reasons why enumeration and viral screening were prioritised during the Christmas period was due to the higher-than-average number of mosquitoes received during the season and the need to provide a rapid turnaround time for virus screening.

Larval control

In addition to adult mosquito surveillance, several councils also conducted larval surveillance and control activities within their council area. One metropolitan and two regional councils undertook larval surveillance and control only in their council areas. HPP continued the Globe Derby aerial mosquito management program and HPP conducted larval surveillance and control at multiple locations across the state.

Northern Adelaide mosquito surveillance program

The northern Adelaide mosquito surveillance program for the 2022-23 mosquito season commenced on 6 September 2022 and concluded on 27 April 2023. Mosquito surveillance was conducted at six locations (see appendix 3) over 34 weeks with a total of 204 dry ice baited EVS mosquito traps set. Nine of the 204 mosquito traps failed.

A total of 191,288 mosquitoes were trapped across the six trap locations over the eight months of the 2022-23 season, which is an increase compared to 2021-22 (n=134,146) and the 2020-21 season (n=142,307).

The average number of trapped mosquitoes across all trap locations in the northern Adelaide mosquito surveillance program for the 2022-23 season was 31,881 compared to 22,357 and 27,718 during the 2021-22 and 2020-21 seasons respectively. As detailed in figure 2, five of the six northern Adelaide trap locations had increased abundance compared to the previous two seasons.

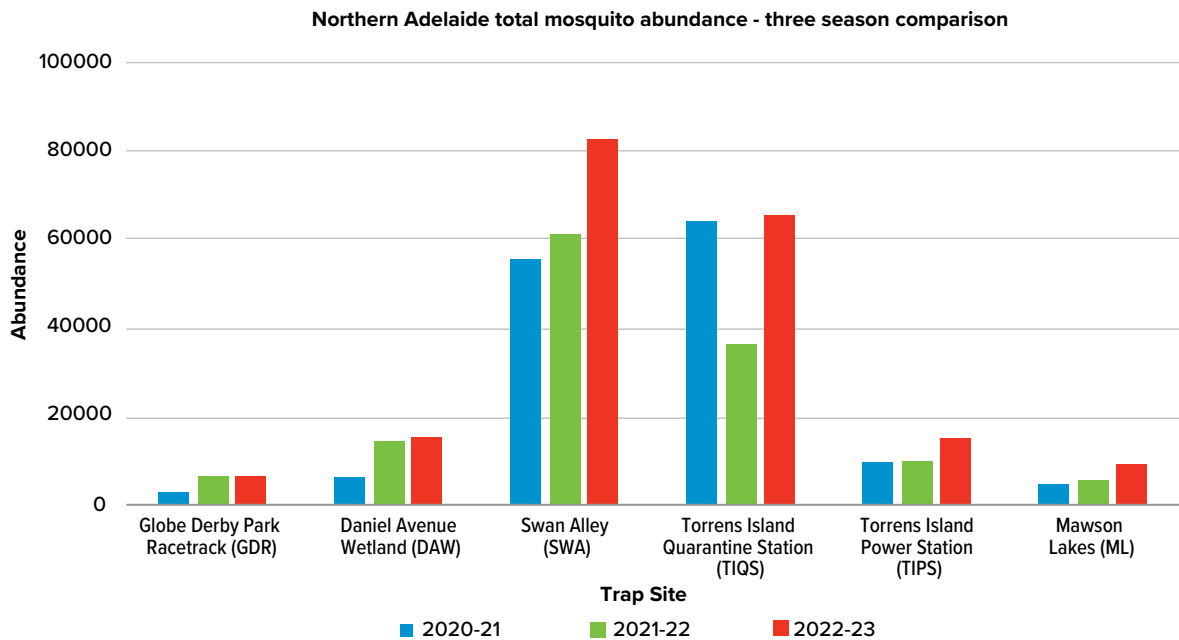


Figure 2 Northern Adelaide mosquito trapping total abundance - three season comparison

As shown in figure 3, mean mosquito abundance was greatest during October 2022 at five trap locations. The largest single catch of the season of 22,207 was at the Torrens Island Quarantine Station (TIQS) trap location in October 2022. The Swan Alley (SWA) trap had the greatest mean abundance during December 2022.

The SWA trap accounted for 42% of the 2022-23 season total catch (n=80,930) The TIQS trap accounted for 34% (n=65,595) of the total season catch, with Daniel Avenue Wetlands (DAW) accounting for 8% (n=15,176), Torrens Island Power Station (TIPS) accounting for 8% (n=14,588), Mawson Lakes (ML) for 5% (n=8,988) and Globe Derby Racecourse (GDR) 3% (n=6,244).

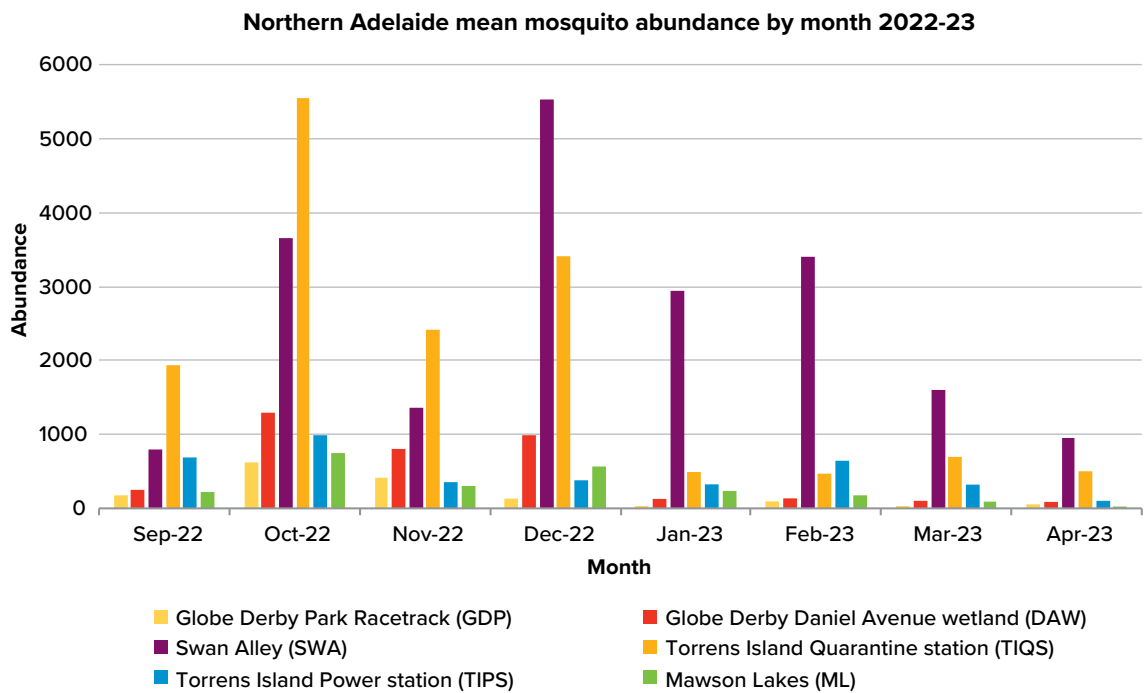


Figure 3 Northern Adelaide mean mosquito abundance by month 2022-23

Mosquitoes trapped as part of the northern Adelaide program are not routinely sent for speciation or viral screening. However, in response to the increased arbovirus risk during the 2022-23 season, trapped mosquitoes were sent to AVR for analysis nine times during the season. Seven of the nine sets of traps sent to AVR were from mosquitoes trapped during the period January 2023 to April 2023. Of the species identified, *Aedes vigilax* accounted for 62.6% (n=15,319), *Aedes camptorhynchus* accounted for 26% (n=6345) and *Culex annulirostris* accounted for 3.5% (n=859).

Globe Derby Park Mosquito Management Program

Globe Derby Park is an outer metropolitan suburb located approximately 15km to the north of the Adelaide CBD. It is located adjacent to highly mosquito-prone saltmarsh and samphire habitats.

Historically a comprehensive ground-based mosquito larvicide program was coordinated by SA Health in the saltmarsh adjacent to Globe Derby Park. In 2017, an ongoing program of aerial application of Bti mosquito larvicide was established to replace the ground-based program. For 2022-23 the total cost of the aerial program for the mosquito season was \$37,652.

As shown in figure 4, the three-season average abundance was greater at all trap locations compared to the five-season average but was lower than the ten-season average. The three-season average was influenced by three consecutive years with a La Niña weather event.

The SWA and TIQS trap sites have had consistently greater average abundance than all other trap locations. The TIQS trap location is used as a reference point as environmental conditions are similar to those at the SWA trap site. No larval control was undertaken at this remote location.

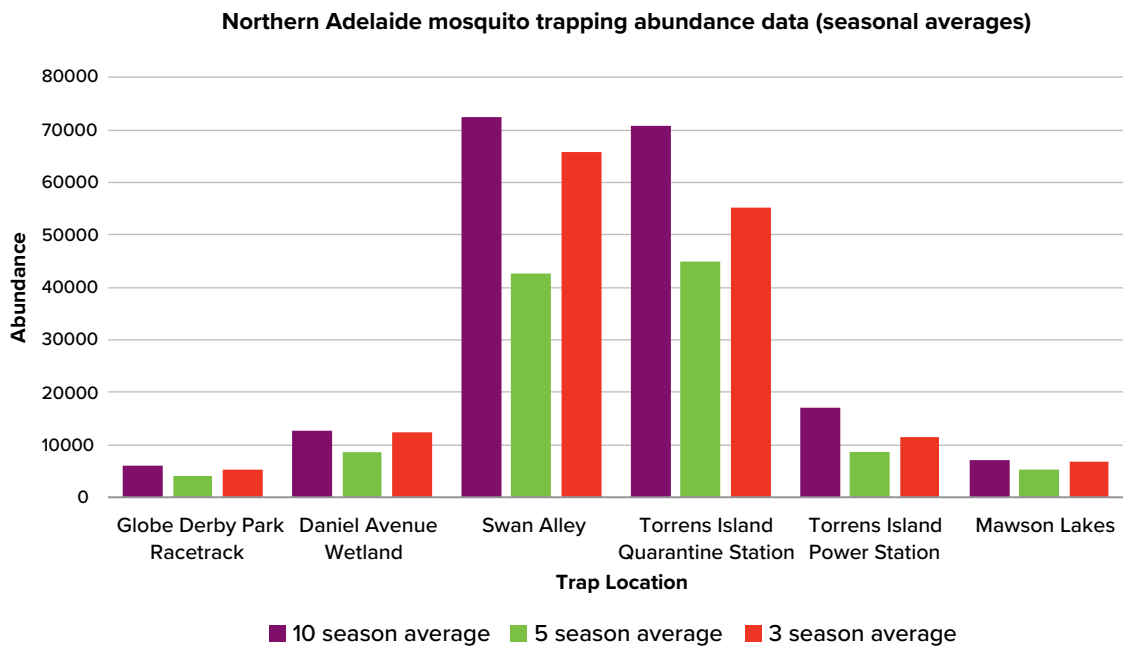


Figure 4 Northern Adelaide surveillance program season averages

HPP targeted mosquito surveillance

HPP regional officers conducted routine and responsive targeted surveillance and control in high-risk areas. HPP surveillance was targeted to areas where human, animal or environmental surveillance indicated increased arbovirus risk. 297 mosquito traps were set across 21 council areas this season, some in areas which have previously had no surveillance.

Table 1 summarises the key results from all targeted surveillance trapping conducted throughout the season by HPP regional officers. Of the 168,000 mosquitoes trapped during targeted surveillance by the regional officers, the data shows that *Culex annulirostris* was the most abundant species, accounting for 71% (n=119,724). The second most abundant species was *Aedes camptorhynchus* which accounted for 10% (n=16,106) of the total season catch.

The Mid Murray Council area had the greatest mean abundance of trapped mosquitoes during the season (n=1365) of which 78% (n=61,835) were *Culex annulirostris*. Loxton Waikerie Council area had the second greatest mean abundance (n=982) of which 74% (n=49,385) were *Culex annulirostris*. Adelaide Plains Council had the third greatest mean abundance (n=963) of which 1% (n=10) were *Culex annulirostris*. Trapping was undertaken in the Gerard Community Council area once during the season, total abundance was low (n=64) however 92% of the total catch were *Culex annulirostris*.

Table 1 Health Protection Programs regional officers trapped mosquito data 2022-23 season

Council areas	No. of traps set	Mean abundance	% <i>Culex annulirostris</i> – total catch
Adelaide Plains Council	1	963	1%
Alexandrina Council	16	128	42%
APY lands	2	18	0
Barossa Council	13	23	25%
Berri Barmera Council	15	37	57%
Clare and Gilbert Valleys Council	16	227	67%
Coorong District Council	13	71	9%
Town of Gawler	8	19	22%
Gerard Community Lands	1	64	92%
Regional Council of Goyder	3	25	32%
Light Regional Council	6	68	4%
Loxton Waikerie Council	64	982	74%
Mid Murray Council	58	1,365	78%
Rural City of Murray Bridge	32	169	35%
Northern Areas Council	18	49	32%
City of Onkaparinga	9	37	6.5%
Port Pirie Regional Council	2	16	3%
Renmark Paringa Council	12	293	36%
Southern Mallee District Council	2	47	13%
Unincorporated Areas	1	13	31%
Wakefield Regional Council	5	96	10%

Health Protection Programs Anangu Pitjantjatjara Yankunytjatjara (APY) mosquito surveillance

In response to the increased risk of flavivirus in South Australia, HPP facilitated one mosquito surveillance and control trip in the APY lands with support from the Department for Education SA. A HPP regional officer and an EHO from the HPO team travelled to the APY lands in March 2023.

Visits to the Anangu schools were organised with school principals. The HPP regional officer spoke to staff, students, and local community about the importance of protecting yourself from mosquito bites and reducing mosquito breeding sites. DHW and Commonwealth Government educational and promotional resources were also provided to the schools.

Schools in Umuwa, Indulkana, Fregon, Mimili, Ernabella/Pukatja, Amata and Pipalyatjara were visited and EVS traps were set at all locations except Amata due to depleted dry ice provisions. High winds resulted in no mosquitoes being trapped at several locations with only very low numbers of mosquitoes trapped at Umuwa (n=22) and Mimili (n=13). The two species found were *Culex quinquefasciatus* and *Aedes tremulus*, which are both domestic pest species known for breeding in drains, containers and septic tanks. No *Culex annulirostris* were caught.

The HPP regional officer reported standing water and breeding sites due to human activity and associated infrastructure, a lack of maintenance being a key factor. School staff advised of high mosquito numbers in the area. Despite the low number of trapped mosquitoes, the trip provided valuable logistical information, built relationships with key stakeholders including local communities and provided an opportunity to share public health messaging.

Metropolitan trapping program

In response to the increased arbovirus risk during the 2022-23 mosquito season, HPP coordinated an inaugural targeted surveillance program in the metropolitan Adelaide area. Mosquito trapping was undertaken on a voluntary basis by 27 DHW staff based on the geographical location of their home address. Figure 5 shows the distribution of EVS traps set. Trapping was undertaken on three occasions during summer 2023 and trapped mosquitoes were sent to AVR for analysis.

998 mosquitoes were trapped, and nine species of mosquitoes were detected. The most abundant species trapped was *Aedes notoscriptus* which accounted for 66% (n=659) of the total metropolitan program catch. The second most abundant species was *Culex quinquefasciatus* which accounted for 15.87% (n=158) of the total metropolitan program catch. The third most abundant species was *Culex molestus* which accounted for 9.52% (n=95) of the total metropolitan program catch. *Culex annulirostris* was trapped in four locations and accounted for 1.93% (n=19) of the total metropolitan program catch.

● Metropolitan Trapping Program

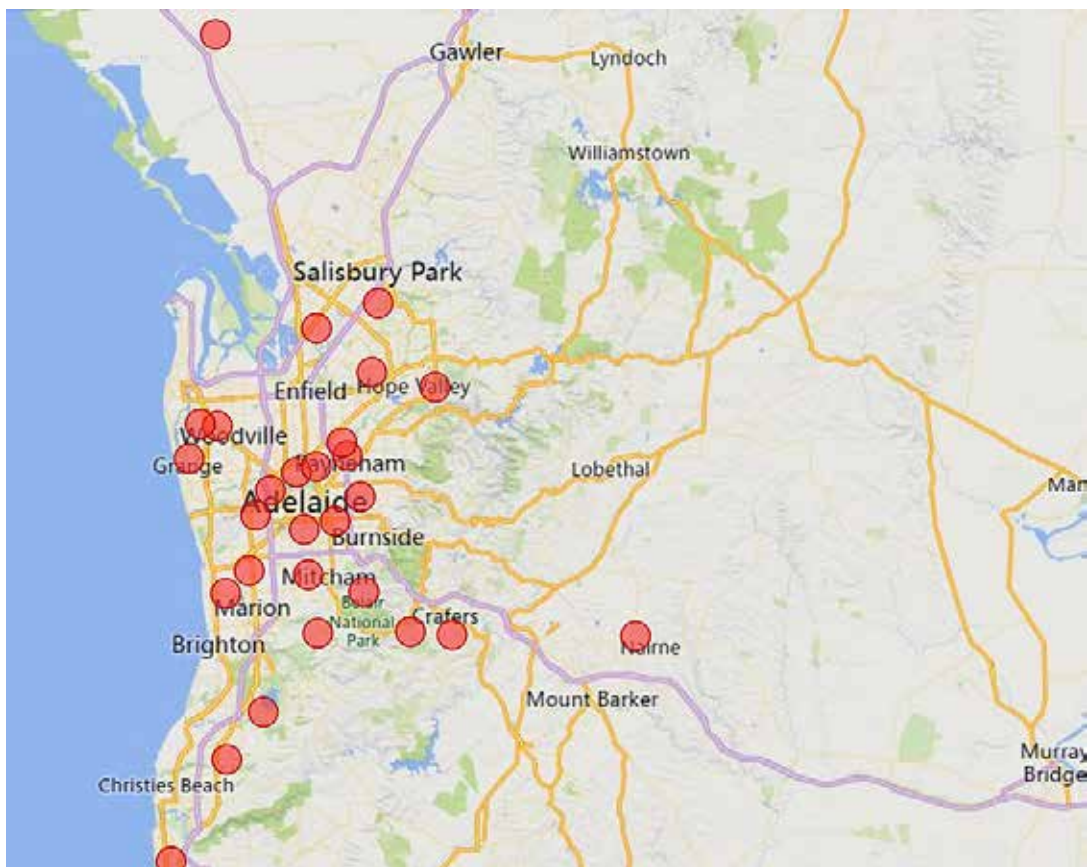


Figure 5 Metropolitan surveillance program trap locations 2022-23

SA River Murray council mosquito surveillance and control

Overview

During the 2022-23 mosquito season all seven River Murray councils conducted trapping in their own council areas with support from HPP, which included training and the provision of trapping equipment. In response to the increased threat level and in accordance with the Plan, the subsidy program required each River Murray council to arrange for four to six EVS mosquito surveillance traps to be set fortnightly in strategically selected locations from September 2022 to April 2023.

Spring of the 2022-23 season was dominated by the effects of a third consecutive La Niña, with above average rainfall across the state. Flooding in the River Murray region resulted in multiple trap locations becoming inundated, and some council traps had to be relocated several times during the season. For reporting purposes, where possible, trap locations have been grouped by proximately to routine fixed trap locations. See appendix 4 for a full list of River Murray mosquito trap locations.

Figure 6 shows increased mean abundance in all River Murray Council areas compared to the previous two seasons.

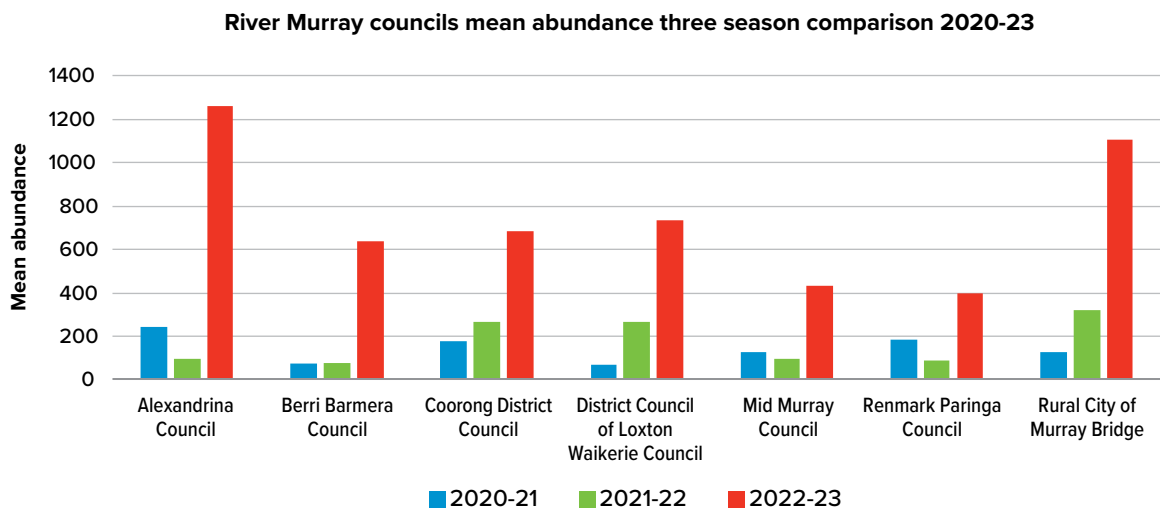


Figure 6 River Murray council mosquito trap mean abundance by council area - three season comparison 2020-23

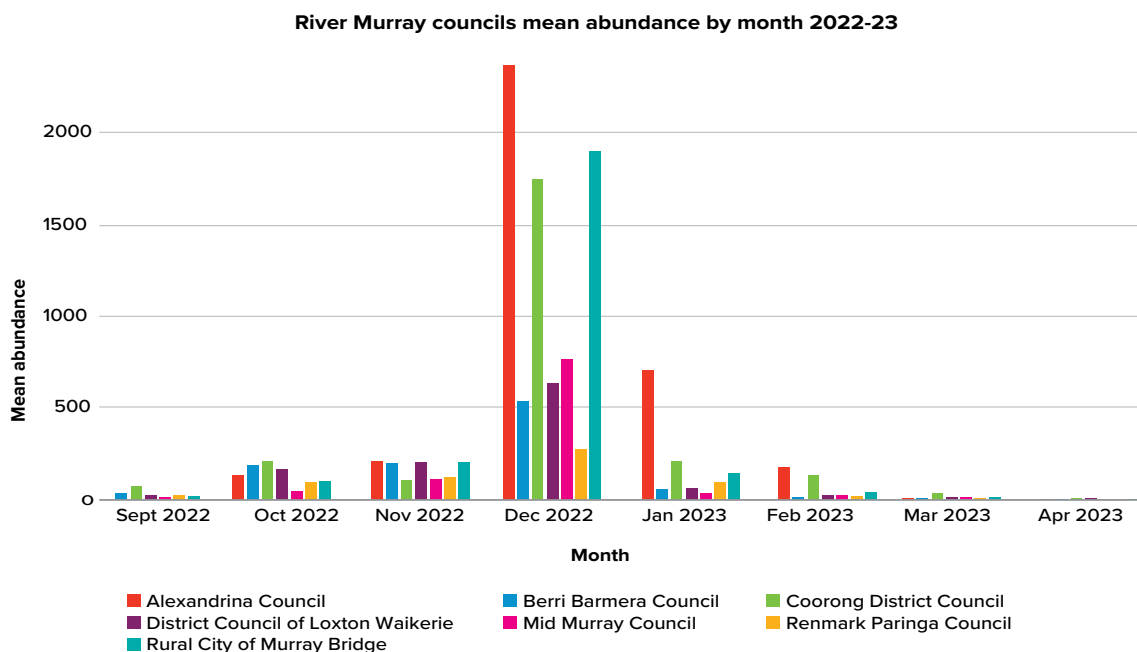


Figure 7 River Murray council mosquito trap mean abundance by council area

As detailed in figure 7, mean monthly abundance was greatest for all River Murray councils during December 2022. There was a significant decline in mean mosquito abundance in all council areas in January 2023.

Figure 8 show that all River Murray councils had increased mean abundance of *Culex annulirostris* compared to the previous two seasons.

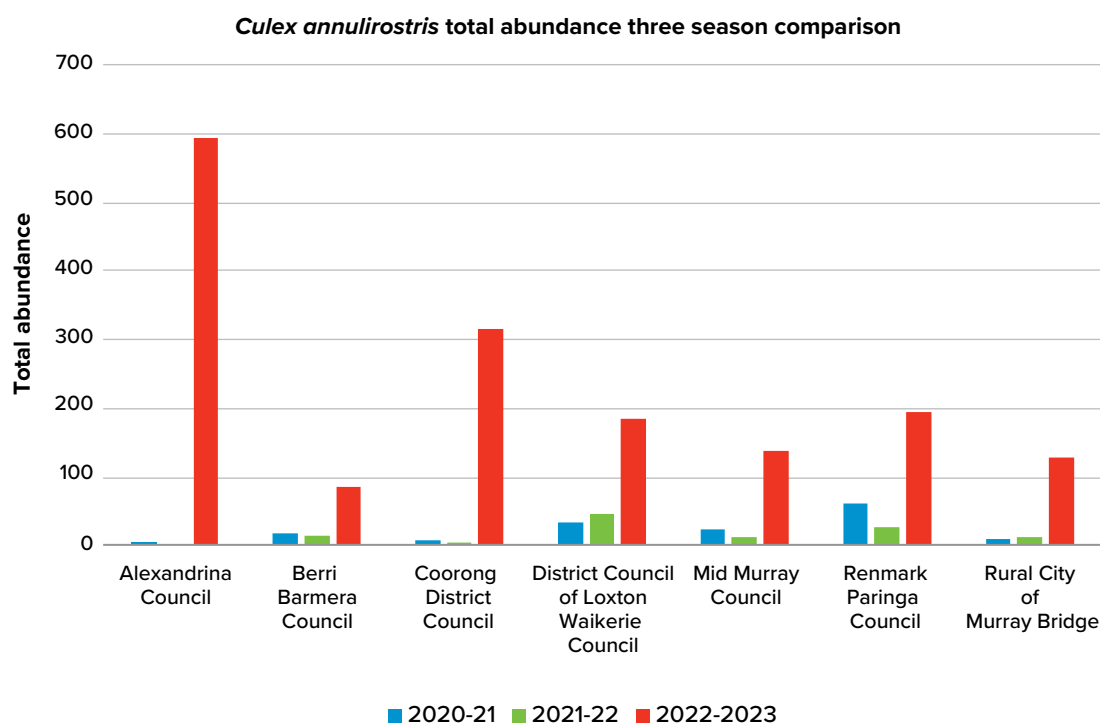


Figure 8 SA River Murray councils mean *Culex annulirostris* abundance – three season comparison

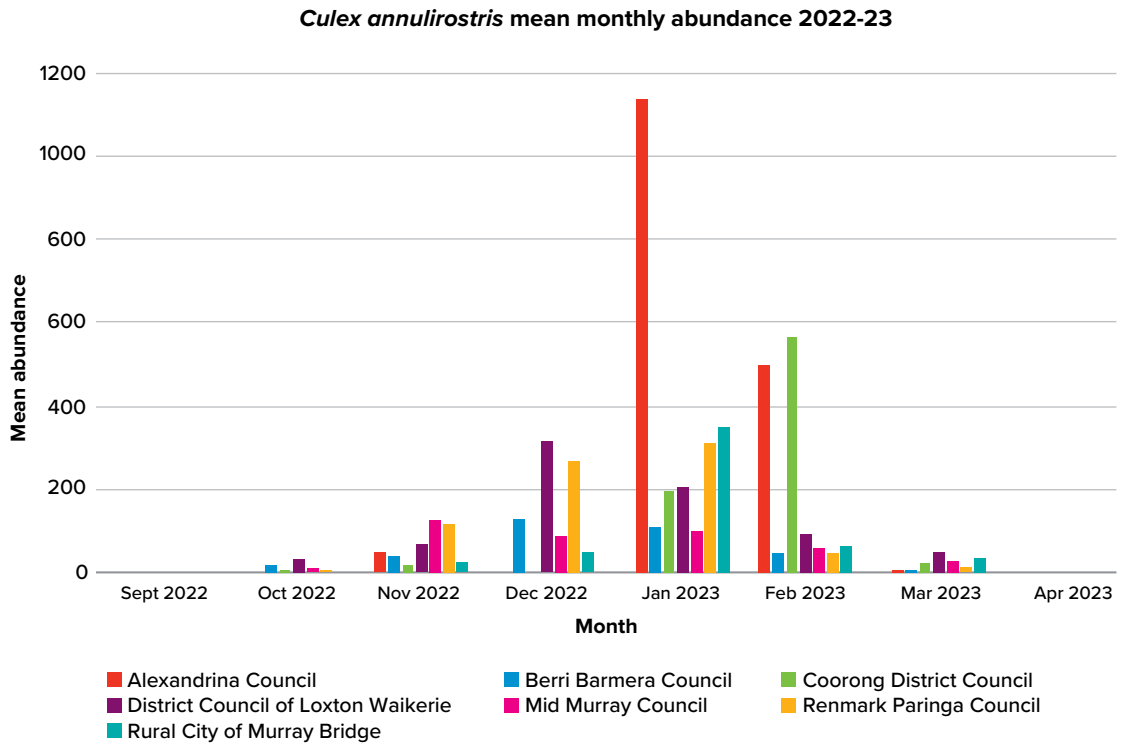


Figure 9 River Murray councils *Culex annulirostris* monthly mean abundance

Figure 9 shows that the greatest mean abundance of *Culex annulirostris* during the 2022-23 mosquito season was seen in the Alexandrina Council area in January 2023.

In addition to increased surveillance, and in accordance with the HoR, River Murray councils implemented actions contained within their local mosquito management plans. These actions included increased surveillance of adult mosquitoes, mapping of high-risk locations and breeding sites within their council areas and additional larval control. Some councils also undertook targeted adulticide treatment in high-risk public areas, such as public toilets and council owned BBQ areas.

Alexandrina Council

Alexandrina Council officers have undertaken their own mosquito trapping program since the start of the 2019-20 mosquito season. Council officers conducted mosquito surveillance from October 2022 to April 2023 across 5 fixed trap locations. Trapping occurred twice per month between October 2022 and December 2022 and once per month between January 2023 and April 2023 due to resource constraints.

A total of 61,732 mosquitoes were trapped across the 2022-23 season. The average number of mosquitoes trapped monthly during the 2022-23 season was 1,260. This was an increase compared to the 2021-22 season (n=93) and the 2020-21 season (n=241).

Of species identified, the most abundant species trapped was *Aedes camptorhynchus* accounting for 44.3% (n=27,539) of the total season catch. The second most abundant was *Culex annulirostris* accounting for 9.6% (n=5,951) of the total season catch. The next most abundant was *Anopheles annulipes* accounting for 12% (n= 4,925) of the total season catch.

As shown in figure 10, the greatest total monthly abundance was in December 2022 at the Clayton Bay (A1) trap location (n=16,557) of which 10,323 were *Aedes camptorhynchus*. This trap location had the greatest abundance of *Culex annulirostris* (n=3353) during the season in January 2023 and had consistently higher total abundance compared to all other fixed trap locations within the Alexandrina Council area.

Alexandrina Council officers undertook larval control activities during the season, which included the monitoring and restocking of s-methoprene briquets in pre-existing larval treatment stations.

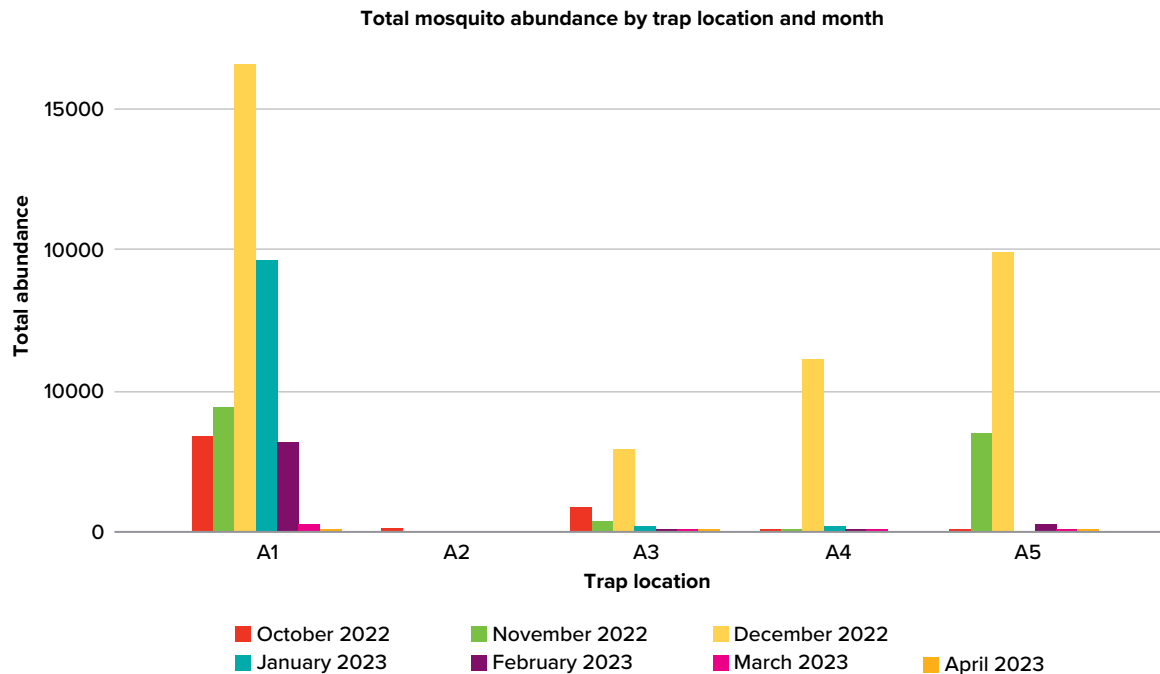


Figure 10 Alexandrina Council mosquito abundance by month and trap location

Berri Barmera Council

Berri Barmera Council officers have undertaken their own mosquito trapping since the start of the 2019-20 mosquito season. Berri Barmera Council’s mosquito surveillance activities included trapping twice per month between September 2022 and April 2023. Routine trapping occurred across 8 locations during the season as some sites had to move in response to flooding, traps are grouped by geographical proximity to routine trap locations for reporting purposes.

A total of 48,539 mosquitoes were trapped across the 2022-23 season. The average number of mosquitoes trapped monthly during the 2022-23 season was 639. This was an increase compared to the 2021-22 season (n=73) and the 2020-21 season (n=77).

Of species identified, the most abundant species trapped was *Culex australicus* accounting for 37.1% (n=18,012) of total season catch. The second most abundant was *Anopheles annulipes* accounting for 14.6% (n=7,062) of the total season catch. The third most abundant was *Aedes camptorhynchus* accounting for 12.2% (n=5,925) of the total season catch. *Culex annulirostris* accounted for 6% (n=2,640) of the total season catch.

As shown in figure 11, the trap site with the greatest monthly abundance was Monash Playground trap site (B1) in December 2022 (n=8,406) of which 4366 were *Culex australicus*. This trap location also had the greatest abundance of *Culex annulirostris* (n=411) during the season in January 2023.

Berri Barmera Council engaged a contractor to undertake adult mosquito surveillance and conduct assessments, inspection, and treatment of known larval breeding sites. Several new sites were identified and added to the database for ongoing monitoring. Targeted public health messaging and alerts were placed in strategic locations in response to viral detections.

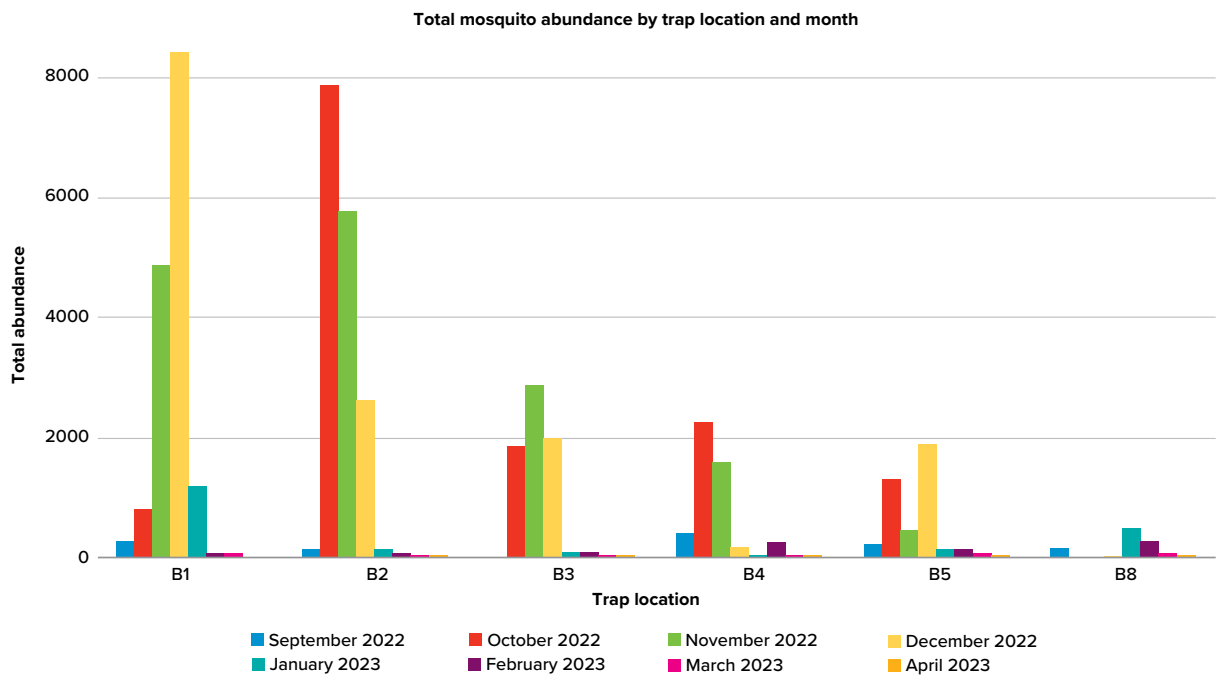


Figure 11 Berri Barmera Council mosquito abundance by month and trap location

Coorong District Council

Coorong District Council have undertaken their own mosquito trapping since the start of the 2019-20 mosquito season. Coorong District Council has engaged the Rural City of Murray Bridge to deliver their mosquito surveillance program since 2021-22. Council's mosquito surveillance activities included trapping twice per month at six fixed locations between September 2022 and April 2023.

A total of 40,426 mosquitoes were trapped across the 2022-23 season. The average number of mosquitoes trapped monthly across all trap locations during the 2022-23 season was 685. This was an increase compared to 266 during the 2021-22 season and 176 during the 2020-21 season.

Of species identified, the most abundant species trapped was *Aedes camptorhynchus*, which accounted for 33% (n=13,488) of the total season catch. The second most abundant was *Culex annulirostris* which accounted for 11.65% (n=4,711) of total season catch. The third most abundant was *Culex australicus* which accounted for 6% (n=1,392) of total season catch.

As shown in figure 12, the trap site with the greatest monthly abundance was Meningie Golf Course (C12) trap site (n=6,421) in December 2022. The Alexandrina Drive trap site (C11) at Narrung had the second greatest monthly abundance (n=6447) of which 6221 were *Aedes camptorhynchus*. This trap location had the greatest abundance of *Culex annulirostris* (n=837) during the season in January 2023 and had higher overall total abundance compared to all other fixed trap locations within the Coorong District Council area.

Coorong District Council undertook treatment and public awareness activities during the season in accordance with their mosquito management plan. Enhanced health promotion activities were undertaken including placement of posters at popular reserves and public restrooms, provision of resources at council owned facilities, distribution of stubby holders and pamphlets to caravan parks, regular social media posts, contact with schools with heightened risk and emails to sporting clubs. Council treated known larval breeding sites throughout the season and engaged with a pest control company to apply adulticide treatments in public toilets.

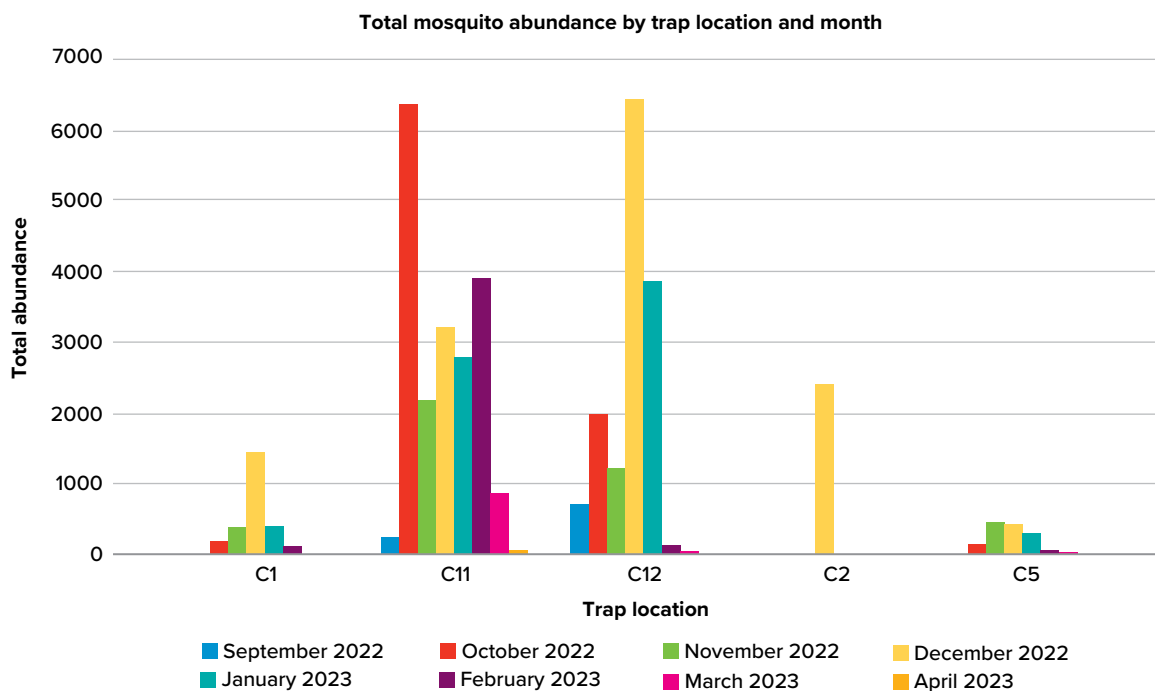


Figure 12 Coorong District Council mosquito abundance by month and trap location

District Council of Loxton Waikerie

The District Council of Loxton Waikerie have undertaken their own mosquito trapping since the start of the 2020-21 mosquito season. Council engaged a contractor to deliver mosquito surveillance and control activities. Mosquito surveillance was conducted twice per month between September 2022 and April 2023. Routine trapping occurred across 7 locations during the season as some sites had to move in response to flooding, traps are grouped by geographical proximity to routine trap locations for reporting purposes.

A total of 65,450 mosquitoes were trapped across the seven trap locations over the 2022-23 season. The average number of mosquitoes trapped across all trap locations during the 2022-23 season was 735. This was an increase compared to the 2021-22 season (n=264) and the 2020-21 season (n=67).

Of species identified, the most abundant species trapped in the District Council of Loxton Waikerie was *Culex australicus* which accounted for 21.9% (n=14,331) of the total season catch. The second most abundant species was *Anopheles annulipes* which accounted for 17% (n=11,105) of the total season catch, followed by *Aedes camptorhynchus* which accounted for 13.9% (n=9,069) of the total season catch. *Culex annulirostris* accounted for 14% (n=6,728) of the total season catch.

As shown in figure 13 the trap site with the greatest monthly abundance was the Thieles Floodplain (L1) trap site (n=5801) in December 2022. The Waikerie Caravan Park (L5) trap site had the second greatest monthly abundance (n=5687) in December 2022. The greatest number of *Culex annulirostris* caught in a single trap was at the Paisley (L6) trap site in January 2023 (n=998).

Larval surveillance was conducted by contractors once per month across known and new larval breeding sites. It was identified that larval numbers didn't increase exponentially with the increase in breeding sites – likely due to predation from fish present in isolated pools and dragonflies. Larvicide was applied as necessary.

Health promotion increased in response to viral detections, council promoted public messaging via social media, distribution of Fight the Bite leaflets to events, caravan parks, libraries, council offices and council depots. Encephalitis alert corflutes were erected to high-risk areas including some trap locations, the riverfront, sporting grounds and dog parks.

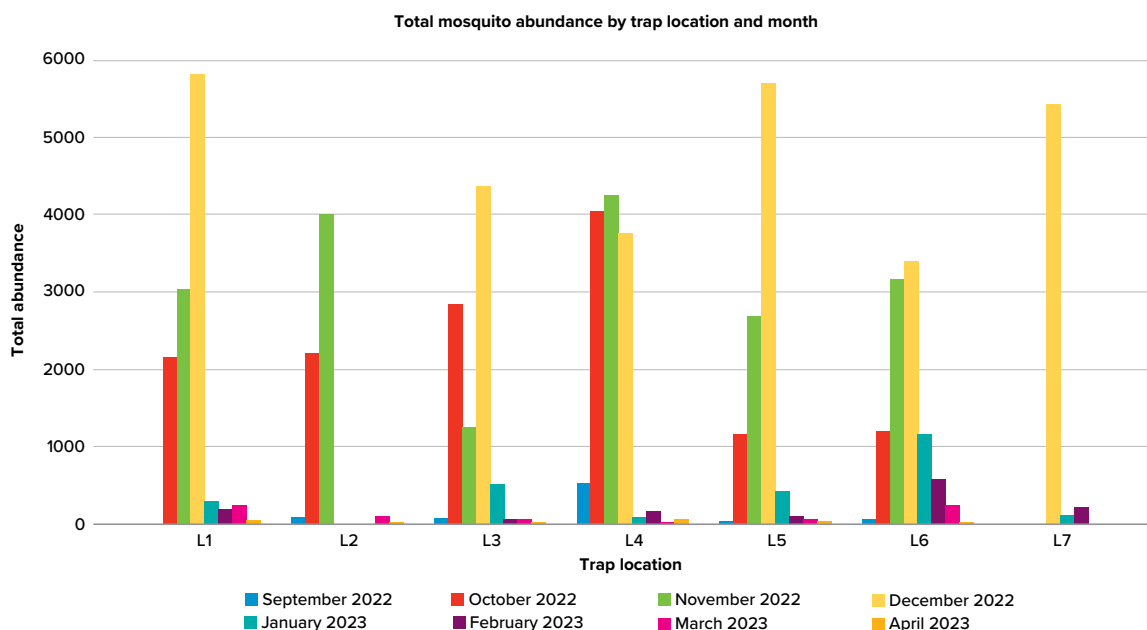


Figure 13 District Council of Loxton Waikerie mosquito abundance by month and trap location.

Mid Murray Council

Mid Murray Council have undertaken their own mosquito trapping since the start of the 2020-21 mosquito season. Mosquito surveillance activities included trapping twice per month between September 2022 and April 2023. Routine trapping occurred across 11 locations during the season as some sites had to move in response to flooding, traps are grouped by geographical proximity to routine trap locations for reporting purposes.

A total of 30,484 mosquitoes were trapped throughout the 2022-23 mosquito season. The average number of mosquitoes trapped across all locations for the 2022-23 season was 435. This was an increase compared to the 2021-22 season (n=92) and the 2020-21 season (n=126).

Of species identified, the most abundant species trapped for the 2022-23 season was *Aedes camptorhynchus* which accounted for 17.9% (n=7199) of the total season catch. The second most abundant was *Culex annulirostris* accounting for 11.7% (n=4716) of the total season catch, the next most abundant was *Culex australicus* which accounted for 5.6% (n=2251) of the total season catch.

As shown in figure 14, the trap site with the greatest monthly abundance was the Morgan Causeway (MM11) trap site (n=7,056) in December 2022. The greatest number of *Culex annulirostris* caught in a single trap was at the Morgan Ferry (MM1) trap site in November 2023 (n=670).

Council officers undertook the inspection and treatment of larval breeding sites a dozen times between September 2022 and February 2023. The council implemented their mosquito management plan which supported the execution of monitoring, control, information management and public awareness activities. Health promotion increased with frequent social media posts, public health alert signage placed in key locations throughout the district, sporting groups were contacted and encouraged to promote Fight the Bite and public toilet were sprayed with residual insect spray prior to the River Murray flooding.

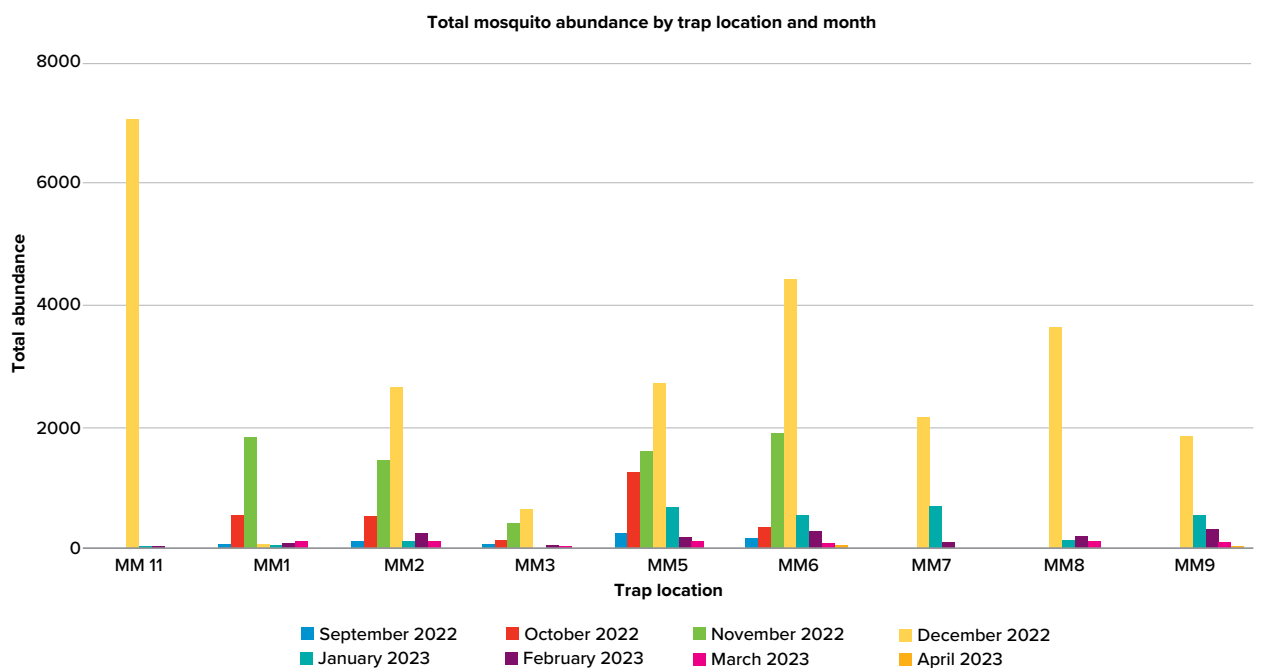


Figure 14 Mid Murray Council mosquito abundance by month and trap location

Rural City of Murray Bridge

The Rural City of Murray Bridge have undertaken their own mosquito trapping since the start of the 2020-21 mosquito season. Mosquito surveillance activities included trapping twice per month at six locations.

A total of 78,579 mosquitoes were trapped over the 8 months of the 2022-23 season. The average number of mosquitoes trapped across all trap locations for the 2022-23 season was 1106. This was an increase compared to the 2021-22 season (n=321) and the 2020-21 season (n=127).

Of species identified, the most abundant species was *Aedes camptorhynchus*, which accounted for 46.7% (n=36,656) of the total season catch. The second most abundant species was *Culex australicus* which accounted for 7.5% (n=5920) of the total season catch followed by *Culex annulirostris* which accounted for 3.6% (n=2790) of the total season catch.

As shown in figure 15, the trap site with the greatest monthly abundance was the Wellington Caravan Park (MB4) trap site in December 2022 (n=30,500). The greatest number of *Culex annulirostris* caught in a single trap during the season was at the Murray Bridge Golf Course (MB3) trap site in January 2023 (n=497).

Council officers undertook regular surveillance of known larval breeding sites throughout the season. Investigation and monitoring of council stormwater basin occurred, and several new breeding sites were identified. Council conducted regular larval treatment throughout the season and engaged a provide pest control company to undertaken spraying of public toilet facilities in December 2022.

Council officers undertook regular surveillance of known larval breeding sites throughout the season. Investigation and monitoring of council stormwater basin occurred, and several new breeding sites were identified. In response to the high-risk season, the Rural City of Murray Bridge increased their health promotion activities in the 2022-23 season. This included placement of Fight the Bite resources at council facilities and reserves, communication with sports clubs and community groups, a Fight the Bite promotion stall was established at the council office, resources were provided to schools and childcare centres and regular social media posts.

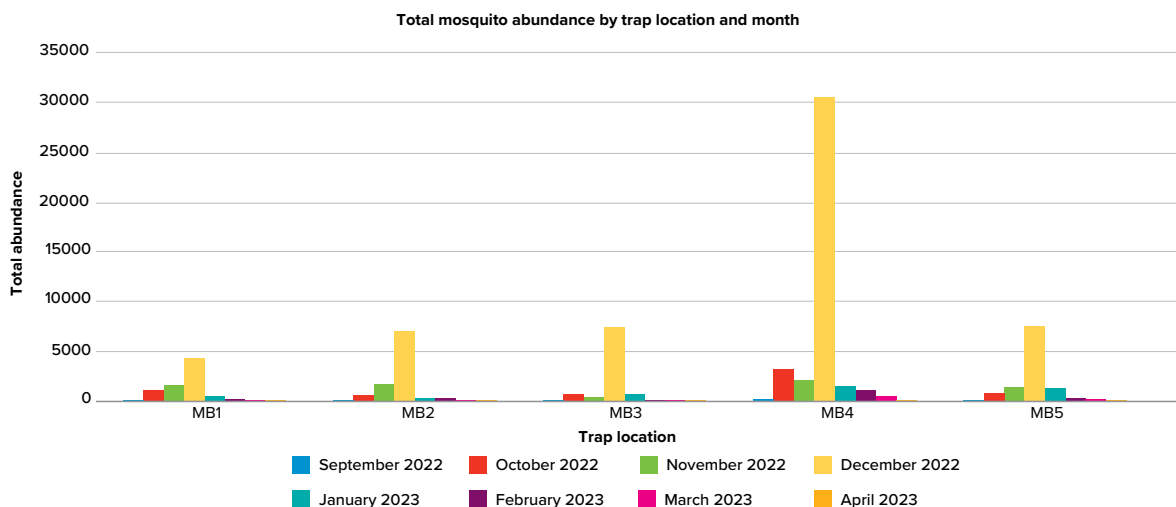


Figure 15 Rural City of Murray Bridge mosquito abundance by month and trap location

Renmark Paringa Council

Renmark Paringa Council have undertaken mosquito trapping since the start of the 2019-20 mosquito season. Mosquito surveillance activities included trapping twice per month at six between September 22 and May 2023. Routine trapping occurred at several locations; trap sites relocated several times during the season to account for flood waters inundating regular flood sites. Traps are grouped by geographical proximity to routine trap locations for reporting purposes.

A total of 37,021 mosquitoes were trapped throughout the 2022-23 mosquito season. The average number of mosquitoes trapped across all locations for the 2022-23 season was 398. This was an increase compared to the 2021-22 season (n=89) and the 2020-21 season (n=186).

Of species identified, the most abundant species was *Culex australicus* which accounted for 21.9% (n=7797) of the total season catch. The second most abundant species was *Culex annulirostris* which accounted for 18.3% (n=6685) of the total season catch, followed by *Anopheles annulipes* which accounted for 16.8% (n=6136) of the total season catch.

As shown in figure 16, the trap site with the greatest monthly abundance was the Plush Bends Road (R6) trap site (n=3789). The greatest number of *Culex annulirostris* caught in a single trap was at the Ellen Park (R5) trap site in December 2022 (n=803).

Adult mosquito trapping was undertaken by council officers, with assistance from contractor, Mapping Services SA and the SA Health regional officer. Larval surveillance of known breeding sites by a contractor and council was undertaken on fortnightly basis, increasing to weekly as flood waters receded and created potential breeding grounds. Many new breeding sites, including stormwater drains, were identified at the base of levee banks and on vast flood plains, they were treated with briquets, pellets and sand. An additional application of 'spider spray' was applied to public toilets and BBQ shelters prior to the Easter long weekend to ensure protection past the long weekend. No adulticide treatment was used.

Health promotion activities included displaying Fight the Bite signage on the back of town entry signs at Renmark, Paringa, and Lyrup and health alert signs being displayed at local events. FTB pamphlets and electronic displays were present at the Civic centre and visitor information centre. Regular sharing of FTB messaging was shared via E-newsletter articles, Council website and on social media. FTB posters and Health Alert posters were displayed at public toilets, playgrounds, BBQ shelters, dog park, walking paths, on boat ramps, tracks and trails signs and campgrounds. Two community complaints were received and followed up appropriately.

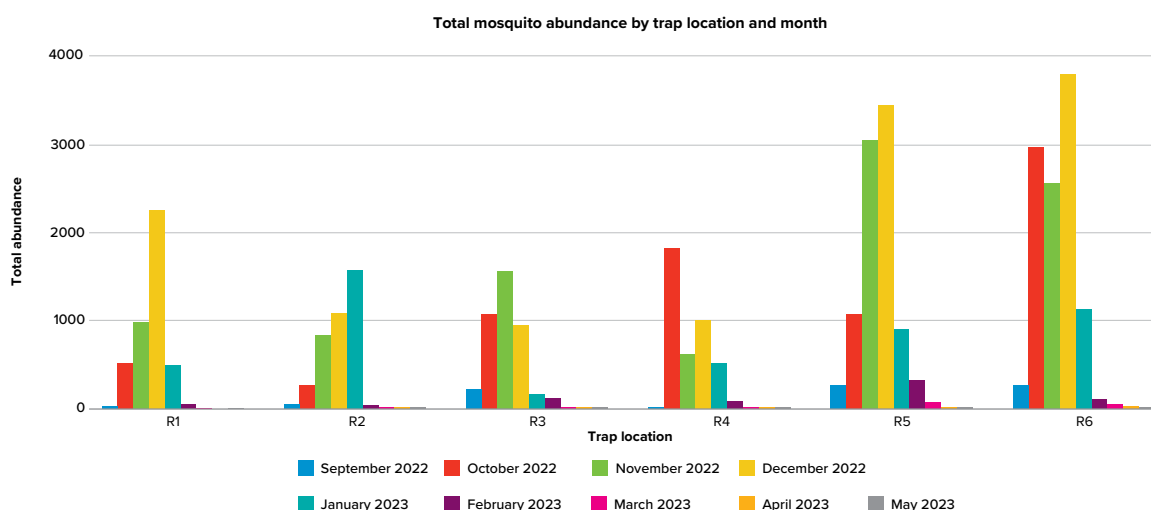


Figure 16 Renmark Paringa Council mosquito abundance by month and trap location

Metropolitan council mosquito surveillance and control

Overview

During the 2022-23 mosquito season six metropolitan councils participated in the subsidy program. Three of these councils were new to the subsidy program and three councils had participated in the subsidy program during previous seasons. See appendix 5 for a full list of metropolitan council mosquito trap locations.

Adult mosquito surveillance was undertaken by four metropolitan councils on a regular basis, one council conducted adult mosquito surveillance on an ad hoc basis and one council undertook treatment only. All councils undertook larval surveillance and applied larvicide treatment as required.

Adelaide Plains

Adelaide Plains Council took part in the mosquito subsidy program for the first time during the 2022-23 season. SA Health staff met with officers from the Adelaide Plains Council and provided equipment and training. Trapping was conducted 12 times between September 2022 and April 2023 across five trap sites. Trapping occurred once per month in September 2022 and April 2023, twice per month between October 2022 and March 2023 and did not occur in January due to staffing issues.

A total of 71,123 mosquitoes were trapped across the season. Of species identified, the most abundant species was *Aedes Camptorhynchus* accounting for 89.5% (n=63,645) of the total season catch. The second most abundant species was *Anopheles annulipes* which accounted for 1.8% (n=1263) of the total season catch. The third most abundant species was *Culex quinquefasciatus* which accounted for 1% (n=738) of the total season catch.

As shown in figure 17, the trap site with the greatest monthly abundance was the Thompsons Beach (APC-2) trap site (n=22,510) during October 2022. The greatest number of *Culex annulirostris* caught in a single trap was at the Lower Light (APC1) trap site in December 2022 (n=247).

Vector control was determined not to be necessary during the season. A4 and A3 corflute signs supplied by SA Health were installed at several public locations throughout the Council area to promote the Fight the Bite campaign. Council's website was also updated, and leaflets were available in each Council office with further information on the campaign.

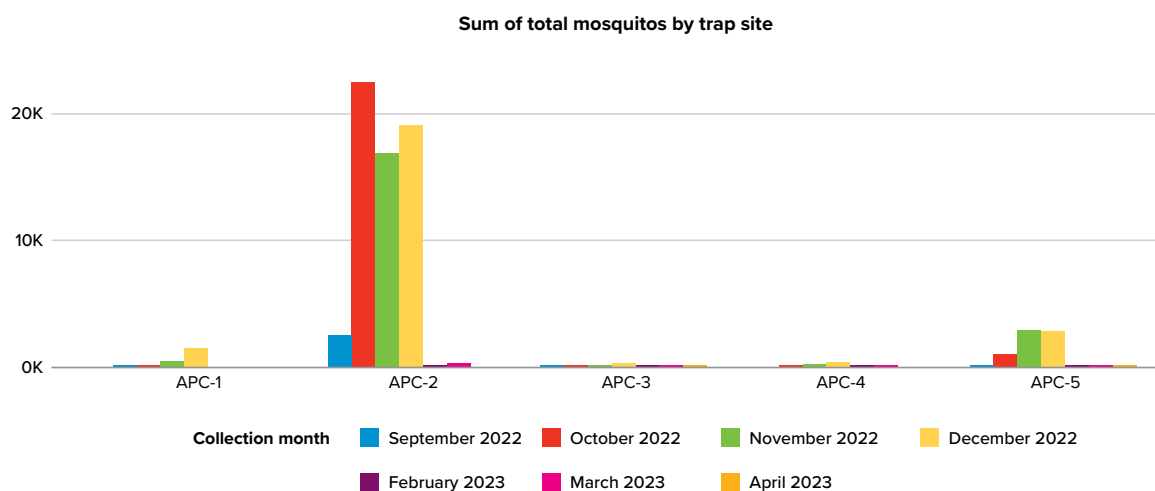


Figure 17 Adelaide Plains Council mosquito abundance by month and trap location

Mount Barker District Council

Mount Barker District Council have undertaken their own mosquito trapping since the 2021-22 mosquito season. Mosquito surveillance activities included trapping once per month at nine locations between September 2022 and April 2023.

A total of 1,085 mosquitoes were trapped across the 2022-23 season. The average number of mosquitoes trapped across all trap locations was 12.7. Of species identified, the most abundant species trapped was *Culex molestus*, which accounted for 18.6% (n=170) of the total season catch. The next most abundant species was *Aedes Camptorhynchus* which accounted for 17.4% (n=159) of the total season catch, followed by *Anopheles annulipes* which accounted for 14% (128). *Culex annulirostris* accounted for 13.5% (n=123) of the total season catch.

As shown in figure 18, the trap site with the greatest monthly abundance was the Parkview Drive (M5) trap site (n=129) during December 2022. The greatest number of *Culex annulirostris* caught in a single trap was at the Crystal Lake (M8) trap site (n=21) in January 2023.

Larval surveillance was undertaken multiple times per month between August 2022 to April 2023 – treatment was applied when larvae was present.

Council carried out proactive health promotion by placing JEV health alerts around the district and distributing SA Health’s Fight the Bite campaign information. Council’s communication team also posted regular updates and health alerts on Councils Facebook page and website. Council officers presented an educational seminar to senior groups of the district as well as attending the Mount Barker district show to educate the public on JEV and how to Fight the Bite.

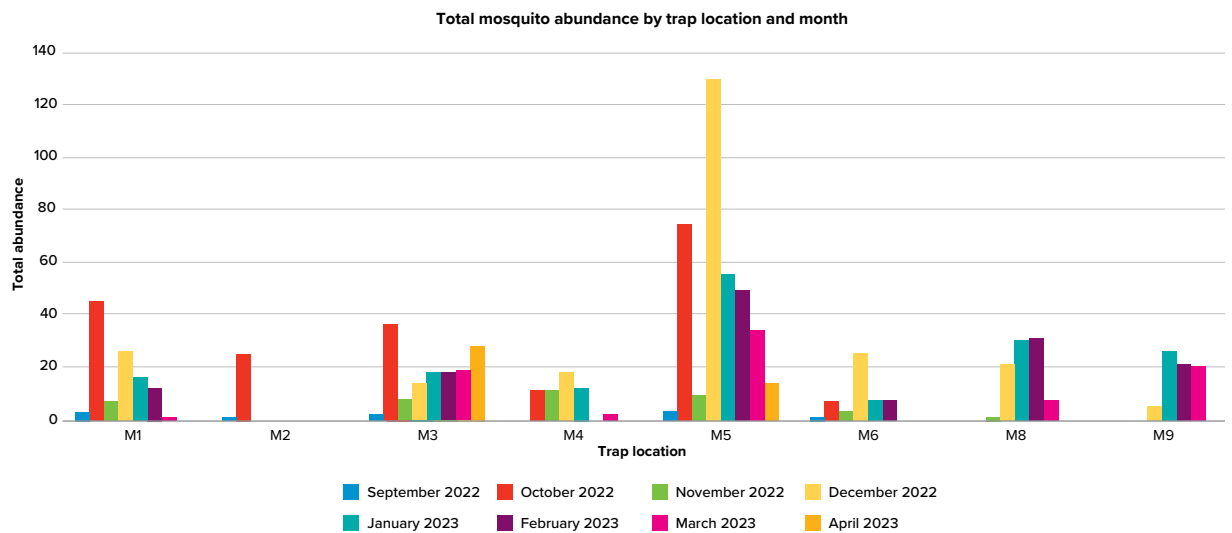


Figure 18 Mount Barker District Council mosquito abundance by month and trap location

City of Playford

The City of Playford took part in the mosquito subsidy program for the first time during the 2022-23 season. SA Health staff met with officers from the City of Playford and provided training and equipment. The City of Playford engaged with contractors to undertake all larval surveillance, trapping and treatment for the season. Trapping was undertaken 11 times at varying frequencies between November 2022 and April 2023 across seven trap locations.

A total of 8,365 mosquitoes were trapped throughout the 2022-23 season. The average number of mosquitoes trapped across all trap locations was 155. Of species identified, the most abundant species caught was *Aedes camptorhynchus* which accounted for 52% (n=4377) of the total season catch. The second most abundant was *Aedes vigilax* which accounted for 12% (n=1023) of the total season followed by *Culex globocoxitus* which accounted for 12% (n=969) of the total season catch.

Culex annulirostris accounted for 10.08% of the total season catch (n=843). The greatest number of *Culex annulirostris* caught was at the Windamere Park (WIN-001) trap site (n=337) in December 2022.

Larval surveillance was undertaken multiple times per month between August 2022 to April 2023 – treatment was applied when larvae was present.

Council carried out proactive health promotion by placing JEV health alerts around the district and distributing SA Health’s Fight the Bite campaign information. Council’s communication team also posted regular updates and health alerts on Councils Facebook page and website. Council officers presented an educational seminar to senior groups of the district as well as attending the Mount Barker district show to educate the public on JEV and how to Fight the Bite.

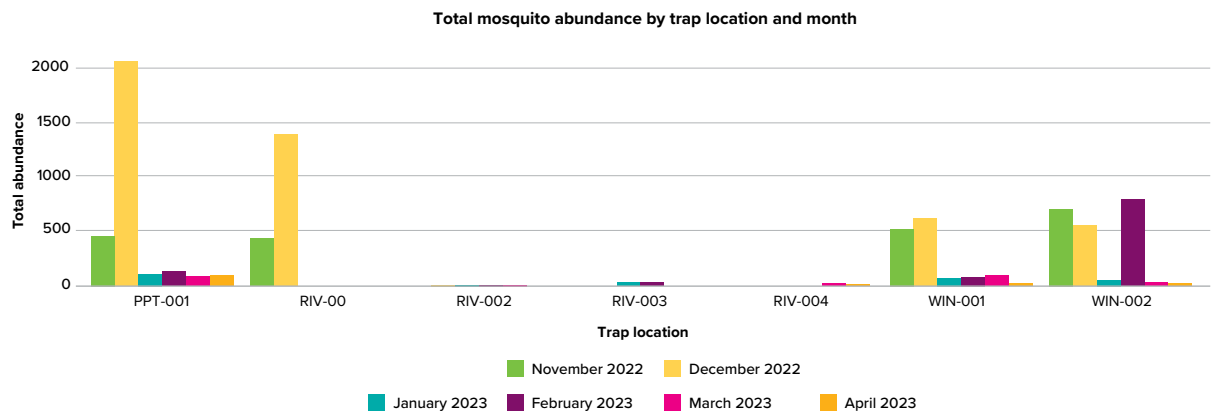


Figure 19 City of Playford Council mosquito abundance by month and trap location

City of Port Adelaide Enfield

The City of Port Adelaide Enfield continued their usual program of larval control within the council area for the 2022-23 season. Council engaged a contractor to undertake larval control treatment at known high risk mosquito breeding sites between September 2022 and April 2023. In addition, ad-hoc investigation and treatment was undertaken in response to resident reports.

Council continued to provide public health messaging and education to the community when required.

City of Salisbury

The City of Salisbury have undertaken their own mosquito trapping since the start of the 2021-22 mosquito season. Council engaged a contractor to undertake larval control treatment at known high risk mosquito breeding sites between September 2022 and April 2023. Mosquito surveillance was conducted by council officers once per month between November 2022 and April 2023.

A total of 5,898 mosquitoes were trapped over the season. Of species identified, the most abundant species trapped was *Aedes camptorhynchus* which accounted for 41% (n=2429) of the total season catch. The second most abundant species was *Culex australicus*, which accounted for 16% (n=940) of the total season catch. The third most abundant species was *Anopheles annulipes* which accounted for 14% (n=801) of the total season catch.

Culex annulirostris accounted for 7% (n=431) of the total season catch. The greatest number of *Culex annulirostris* caught in a single trap was at the South Terrace (PTP) trap site (n=234) during February 2023. As shown in figure 20, the trap site with the greatest monthly abundance was at the Yarle Street (DAR) trap site (n=2234) during December 2022.

Through a contracted service and internal staff, the City of Salisbury undertook extensive surveillance and treatment at breeding sites between September 2022 and April 2023 inclusive. In addition, Council responded to various complaints related to increased mosquito activities throughout the season and provided community updates on mosquito control and bite prevention via social media, website and direct mail out to specific high-risk areas.

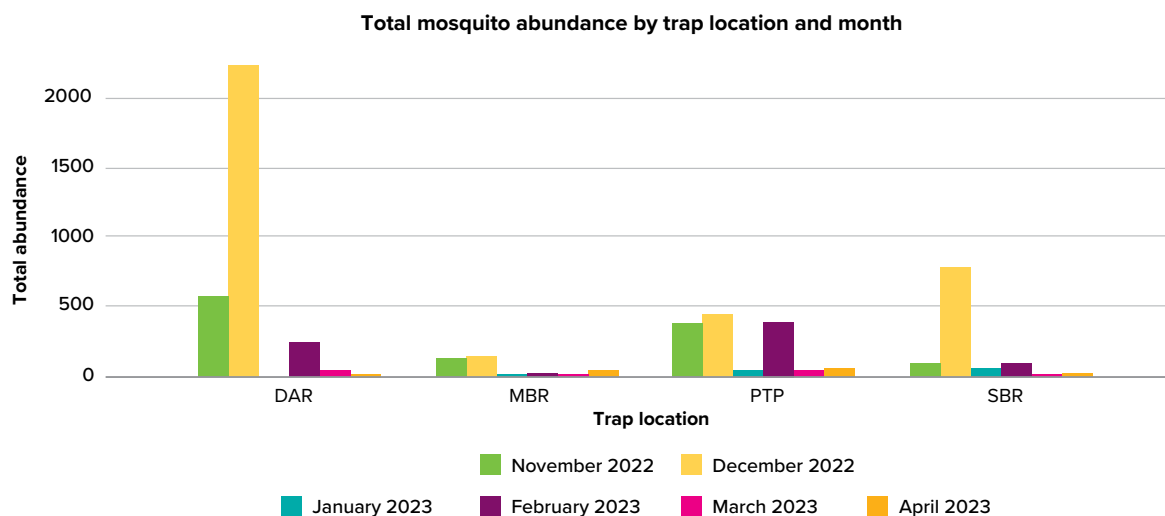


Figure 20 City of Salisbury Council mosquito abundance by month and trap location

City of Tea Tree Gully

The City of Tea Tree Gully took part in the mosquito subsidy program for the first time during the 2022-23 season. Council surveyed potential breeding sites and identified two sites of interest for surveillance. Mosquitoes were trapped monthly from November 2022 to April 2023. During the early part of the season mosquitoes were enumerated by council staff.

Mosquitoes trapped in March 2023 and April 2023 were sent to AVR for speciation, counting and viral screening. Of the species identified, *Aedes notoscriptus* was the most abundant accounting for 51% (n=31) of the season catch. The second most abundant species were *Aedes alboannulatus* and *Culex quinquefasciatus* each accounting for 16% (n=10). *Culex annulirostris* accounted for 3% (n=2) of the total season catch.

Mosquito control measures included larval surveillance intermittently throughout the season in areas previously identified as potential breeding sites. Council also assessed other potential breeding sites for future monitoring. Where larvae were detected in the water bodies these were then treated by the council's pest control team.

Regional council mosquito surveillance and control

During the 2022-23 mosquito season eight regional councils participated in the subsidy program. Three of these councils had existing mosquito management programs in place, five were new to the subsidy program. Adult mosquito surveillance was undertaken by six regional council on a regular basis, one council undertook treatment only and one council undertook larval surveillance only. See appendix 6 for a full list of regional council mosquito trap locations.

Barossa Council

The Barossa Council finalised their mosquito management plan later into the 2022-23 mosquito season. This was advocated by EHOs after PIRSA alerted SA Health of a potential detection in the Barossa region. Alert signs were erected in response to the flavivirus detection. Council staff undertook larval dipping between February and March 2023 and potential new trapping sites were established for the 2023-24 season.

Barunga West Council

Officers of Barunga West Council undertook regular routine treatment at known mosquito breeding sites from September to April within the 2022-23 season. Treatment was undertaken using s-methoprene granules and briquettes at strategic locations.

No formal complaints were received during the season. Council staff provided public health advice and information to the community using social media, local newspapers, and Fight the Bite campaign materials including brochures and leaflets.

Clare and Gilbert Valleys Council

Clare and Gilbert Valleys Council took part in the mosquito subsidy program for the first time during the 2022-23 season. SA Health staff met with officers from the council and provided education on surveillance trapping and larval dipping procedures. Trapping was conducted fortnightly during January 2023 and April 2023 across six trap sites.

A total of 1161 mosquitoes were trapped across the season. Of species identified, the most abundant species was *Culex annulirostris* accounting for 55% (n=634) of the total season catch. The second most abundant species was *Anopheles annulipes* which accounted for 16% (n=215) of the total season catch. The third most abundant species was *Culex molestus* which accounted for 16% (n=190) of the total season catch.

As shown in figure 21, the trap site with the greatest monthly abundance was at the Auburn Centenary Park (CG2) trap site (n=246) during January 2023. This trap site also had the greatest abundance of *Culex annulirostris* during the season (n=153).

Council engaged with a pest control company to spray chemicals in public toilets. A4 and A3 corflute signs supplied by SA Health were installed at several public locations throughout the Council area to promote the Fight the Bite campaign. Council's website was also updated, and leaflets were available in each council office with further information on the campaign.

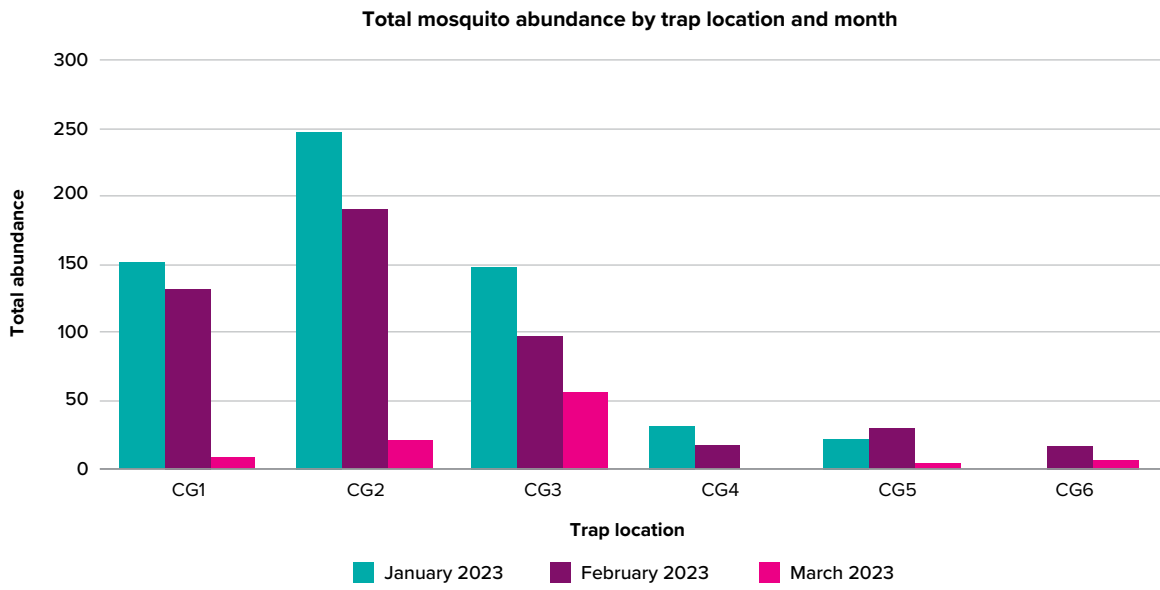


Figure 21 Clare and Gilbert Valleys Council mosquito abundance by month and trap location

District Council of Elliston

The 2022-23 season was the second year that the District Council of Elliston participated in a mosquito management program. Trapping was conducted once per month between September 2022 and March 2023 across five trap sites.

A total of 11,123 mosquitoes were trapped during the season. Of species identified, the most abundant species trapped was *Aedes camptorhynchus* which accounted for 89% (n=9384) of the total season catch. The next most abundant species was *Aedes australis* which accounted for 4% (n=403) of the total season catch followed by *Aedes Molestus* which accounted for 3% (n=278) of the total season catch.

As shown in figure 22, the greatest single catch of the season was in September 2022 at the Wetlands trap site (WL1) (n=2525). *Culex annulirostris* was trapped once during the season at Pedro's Reserve trap site (PR1) trap site in October 2022 accounting for 0.06% (n=1) of the season total catch.

In response to increased mosquito numbers and viral detections in trapped mosquitoes during November 2022, treatment was undertaken. This included spraying of public amenities close to the detection site and ongoing larval control.

Council staff provided Fight the Bite campaign material utilising social media pages, newsletters, signage, posters, local newspapers and radio. In addition, educational resource material was provided to local schools. Monthly surveillance and trapping was carried out for viral screening and remuneration. Community and local health services engagement was heightened during the season. Door knocking was carried out in high-risk areas advising residents, businesses and workers of how to Fight the Bite.

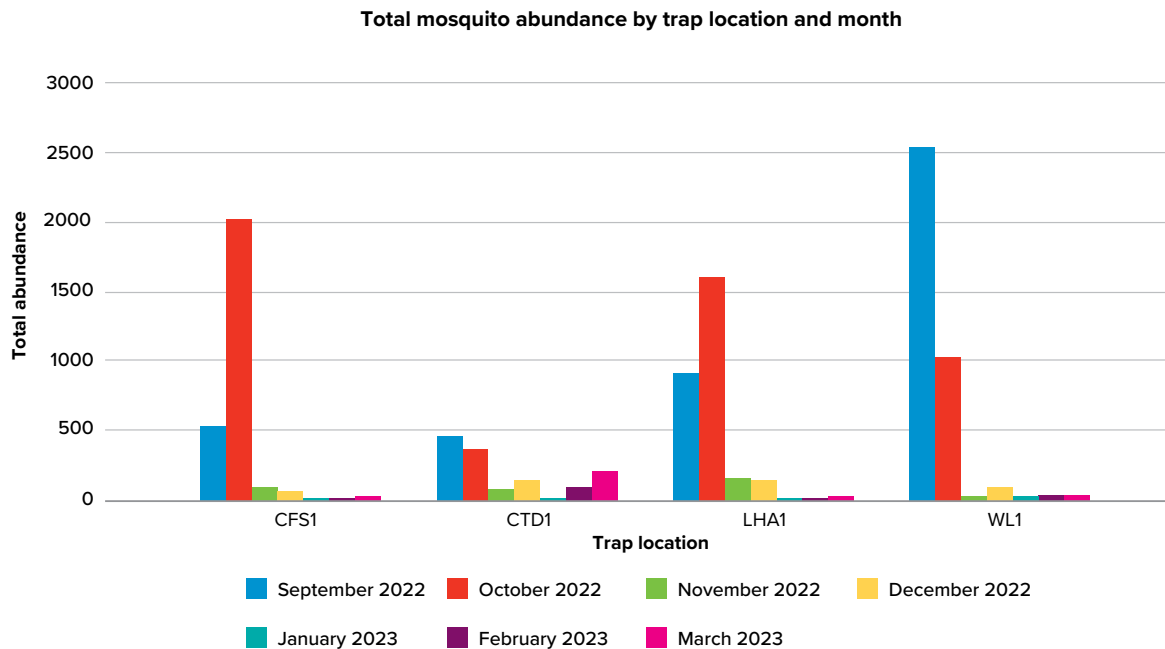


Figure 22 District council of Elliston mosquito abundance by month and trap location

Regional Council of Goyder

The Regional Council of Goyder took part in the mosquito subsidy program for the first time during the 2022-23 season. Officers from Clare and Gilbert Valleys Council managed the local mosquito management program. SA Health staff met with officers from council and training and equipment. Trapping was conducted fortnightly during January 2023 and April 2023 across five trap sites.

A total of 718 mosquitoes were trapped during the season. Of species identified, the most abundant species was *Culex annulirostris* accounting for 61% (n=438) of the total season catch. The second most abundant species was *Culex molestus* which accounted for 20% (n=146) of the total season catch. The third most abundant species was *Anopheles annulipes* which accounted for 8% (n=55) of the total season catch.

As shown in figure 23, the trap site with the greatest monthly abundance was at the Burra Creek catchment (GC2) trap site (n=185) during February 2023. This trap site also had the great abundance of *Culex annulirostris* during the season (n=129).

Larvicide was applied in areas where larvae were identified. Council engaged with a pest control company to spray chemicals in public toilets. A4 and A3 corflute signs supplied by SA Health were installed at several public locations throughout the council area to promote the Fight the Bite campaign. Council's website was also updated, and leaflets were available in each council office with further information on the campaign.

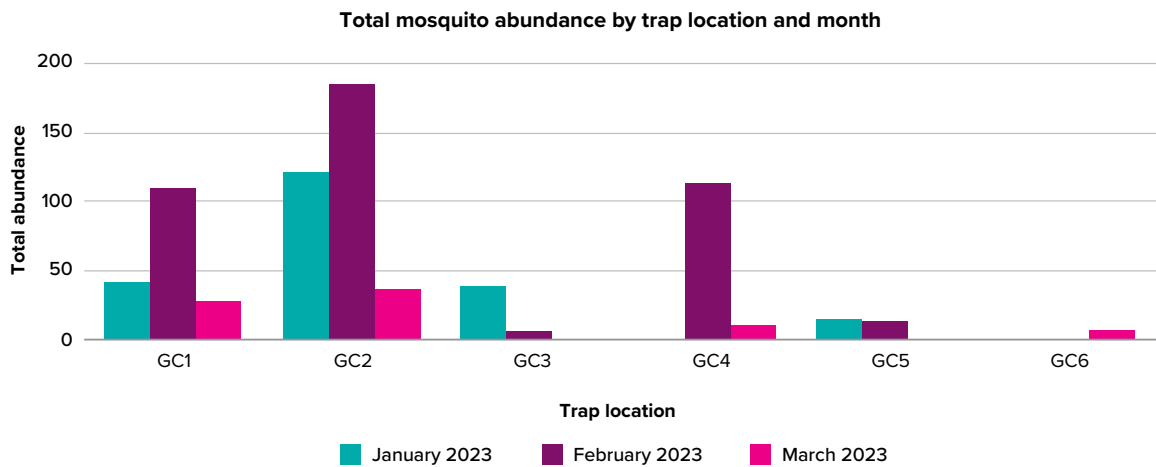


Figure 23 District council of Elliston mosquito abundance by month and trap location

Kangaroo Island Council

Kangaroo Island Council participated in the in the subsidy program during the 2022-23 season. SA Health staff met with officers from the council and training and equipment. Council engaged a contractor to undertake larval control. Adult mosquito surveillance was conducted at four sites between October 2022 and December 2022.

A total of 3986 mosquitoes were trapped across four locations. Of species identified, the most abundant species was *Aedes camptorhynchus* which accounted for 44% (n=1760) of the season total. The second and third most abundant species were *Culex australicus* and *Anopheles annulipes* each accounting for 1% (n=23) of the total season catch. No *Culex annulirostris* were trapped during the season. As shown in figure 24, the greatest single catch of the season was in November 2022 at the Flinders street (K12) trap location (n=2128).

Treatment was applied to confirmed mosquito breeding sites, council amenities, places of concern throughout the island and in response to council complaints.

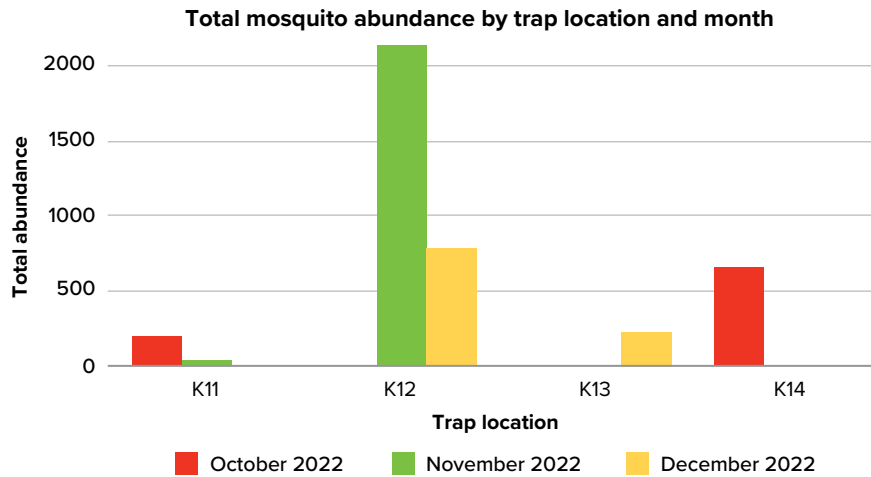


Figure 24 Kangaroo Island Council mosquito abundance by month and trap location

Southern Mallee District Council

Southern Mallee District Council took part in the mosquito subsidy program for the first time during the 2022-23 season. Council engaged officers from the Rural City of Murray Bridge to support the local mosquito management program. Officers from the Rural City of Murray Bridge provided training to council officers. Trapping was conducted fortnightly over five months at four locations during the season.

A total of 3825 mosquitoes were trapped across the season. Of species identified, the most abundant species was *Culex australicus* accounting for 15% (n=562) of the total season catch. The second most abundant species was *Anopheles annulipes* which accounted for 7% (n=276) of the total season catch. The third most abundant species was *Culex molestus* which accounted for 8% (n=273) of the total season catch. *Culex annulirostris* accounted for 6% (n=237) of the total season catch.

As shown in figure 25, the trap site with the greatest monthly abundance was at the Lameroo (SM3) trap site (n=1245) during December 2022. The greatest number of *Culex annulirostris* caught in a single trap was at the Parrakie (SM2) trap site during March 2023 (n=45).

Larvicide was applied in areas where larvae were identified. Council engaged with a pest control company to spray chemicals in public toilets. A4 and A3 corflute signs supplied by SA Health were installed at several public locations throughout the council area to promote the Fight the Bite campaign. Council's website was also updated, and leaflets were available in each council office with further information on the campaign.

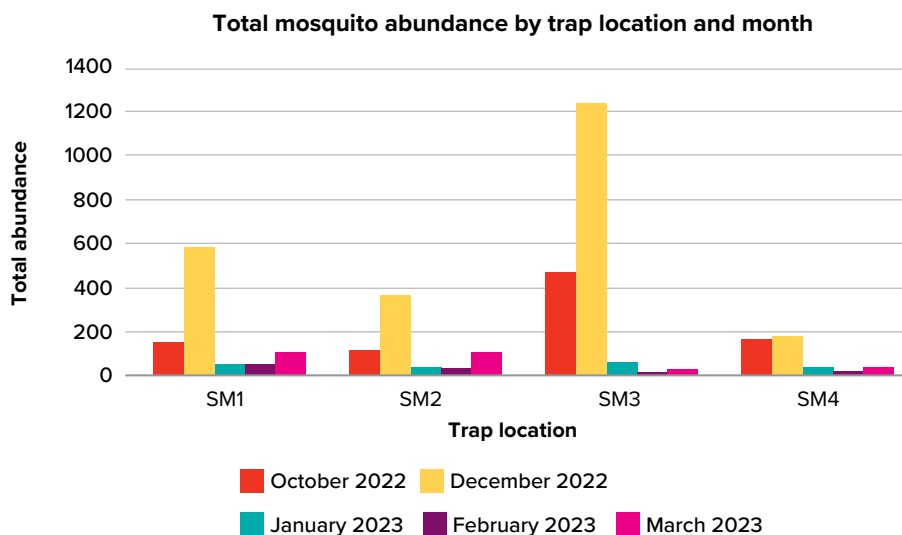


Figure 25 Southern Mallee District Council mosquito abundance by month and trap location

Whyalla City Council

Surveillance was undertaken by a council environmental health officer monthly with trapping first occurring late November 2022 with the last being conducted in March 2023.

Whyalla City Council enhanced their surveillance and control program during the 2022-23 mosquito season. Trapping was conducted three times during the season over four fixed locations.

A total of 1535 mosquitoes were trapped across the season. Of species identified, the most abundant species was *Aedes Vigilax* accounting for 65% (n=989) of the total season catch. The second most trapped mosquito was *Aedes camptorhyncus* accounting for 13% (n=201) of the total season catch. The third most trapped mosquito was *Culex quinquefasciatus* accounting for 10% (n=151) of the season total. *Culex annulirostris* accounted for 1% (n=18) of the total season catch.

As shown in figure 26, the month with the greatest number of mosquitoes caught was February with the Salt Marsh Mangrove trap (WHY-01) having the greatest single catch of the season (n=350). *Culex annulirostris* were detected in low numbers (<10) at three trap locations during February 2023.

Council staff conducted treatments monthly from November 2022, with the last treatment being conducted on the 5 April 2023, two additional treatments were also conducted during the year due to high rainfall events that were observed.

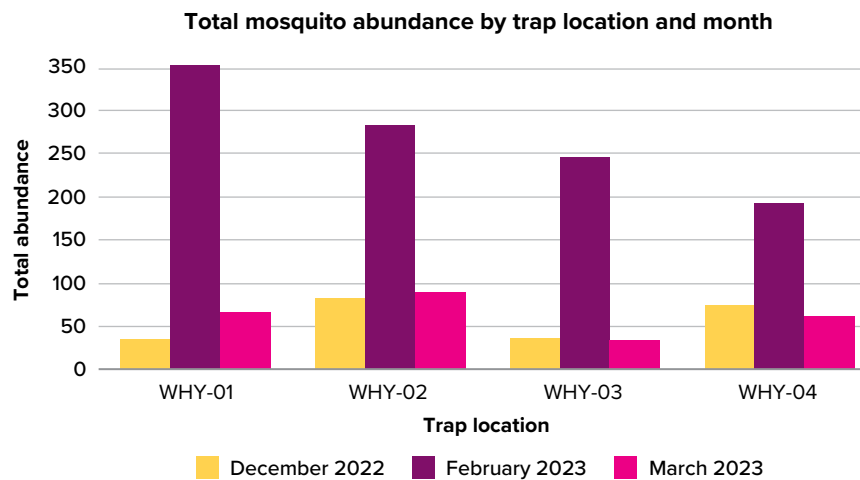


Figure 26 Whyalla City Council mosquito abundance by month and trap location

Arbovirus isolations from trapped mosquitos (whole trap grinds)

Mosquitoes trapped during HPP targeted surveillance, the metropolitan project and nine rounds of trapping from the Northern Adelaide surveillance program were all screened for arboviruses. Each batch of ten or more trapped mosquitoes were sent to AVR and processed according to trap location, counted, identified to species level, and then ground and screened for viruses.

In response to the JEV situation, the viral screening program was expanded to include JEV in March 2022. Table 2 details the arbovirus isolations from trapped mosquitoes in South Australia during the 2022-23 mosquito season.

Testing for arboviruses resulted in eleven detections of MVEV and two detections of WNV/KUN from whole trap grinds from trapped mosquitoes during the 2022-23 mosquito season. The first flavivirus detection was in January 2023 and the last came through at the end of the season in April 2023. There were no detections of JEV from trapped mosquitoes during the 2022-23 mosquito season.

There were 19 detections of RRV and 13 detections of BFV from whole trap grinds of trapped mosquitoes during the 2022-23 mosquito season. The first detection was a RRV from mosquitoes trapped in the Coorong District Council in November 2022. The majority of the 32 RRV and BFV detections came in November and January (n=28).

Table 2 Arbovirus isolations from whole trap grinds for the 2022-23 mosquito season in South Australia

Arbovirus	RRV	BFV	MVEV	WNV/KUN	JEV
Alexandrina Council	2	3			
Barossa Council	1				
Berri Barmera Council	1		1	1	
Coorong District Council	4				
District Council of Elliston		2			
District Council of Loxton Waikerie	1	3	2	1	
Mid Murray Council	2	1	1		
Rural City of Murray Bridge	5	4	1		
Renmark Paringa Council	1		6		
Southern Mallee District Council	1				
Total	19	13	11	2	0

11. South Australian sentinel surveillance program

The aim of the South Australian sentinel surveillance program is to monitor for flaviviruses in the environment before the presentation of human cases. Chickens are a good indicator of mosquito-borne disease risk to the community, as they readily produce antibodies to arboviruses once infected without developing symptoms.

Prior to the 2022-23 season, six sentinel chicken flocks had been established in strategic locations along the River Murray since 2011. In response to the emergence of JEV, the sentinel chicken surveillance program expanded from six to ten flocks in the 2022-23 season. Each flock contains five chickens that have blood samples collected by local vets according to a schedule based on risk determined by HPP. For the 2022-23 mosquito season weekly bleeds commenced in October 2022 and concluded in April 2023.

During the season, seroconversion to MVEV occurred in nine sentinel chickens from six locations. Flavivirus seroconversion in sentinel chickens was reported between January to April 2023. This was the fourth consecutive season that sentinel chickens in South Australia have seroconverted to MVEV, and the fourth time since the program's inception in 2011. Two chickens from different flocks seroconverted to WNV/KUN in the 2022-23 mosquito season. This is the first time that WNV/KUN seroconversion has been detected in sentinel chickens in South Australia.

Positive detections were predominantly from flocks located in River Murray council areas. However, seroconversions of both MVEV and WNV/KUN occurred in the newly established flock based in the Clare and Gilbert Valleys Council area, demonstrating that these viruses are not limited to the River Murray region. Results were confirmed by repeat testing. Table 3 details positive results by council area and collection date.

Table 3 MVEV, KUNV and JEV results in sentinel chicken flocks

Collection Date	Flock	Tags	MVEV	WNV/KUN	JEV
23/01/2023	Paringa	Yellow	Positive	Negative	Negative
25/01/2023	Mannum	Blue	Positive	Negative	Negative
31/01/2023	Clare	Red	Positive	Negative	Negative
31/01/2023	Swan Reach	Orange	Positive	Negative	Negative
06/02/2023	Clare	Red	Positive	Positive	Negative
06/02/2023	Qualco	Red	Positive	Negative	Negative
07/02/2023	Paringa	Red	Positive	Negative	Negative
07/02/2023	Swan Reach	Red	Positive	Negative	Negative
13/02/2023	Meningie	Black	Positive	Negative	Negative
04/04/2023	Paringa	Blue	Positive	Positive	Negative

12. Notification of arbovirus infections

All arbovirus infections detected in humans in South Australia are notifiable under the *SA Public Health Act 2011*. The SA Health Communicable Disease Control Branch (CDCB) receive laboratory notifications for all positive arbovirus tests and medical notifications from doctors with place of exposure when known.

The two most common locally acquired arbovirus infections notified in South Australia are RRV and BFV. As shown in figure 27, the number of RRV and BFV cases reported in South Australia in 2022-23 was less than in 2021-22 but similar to the 2020-21 season. Cases peaked between January and February 2023. There were 117 RRV and BFV infections in 2022-23 compared to 223 cases in 2021-22 and 113 cases in 2020-2021. Although numbers have been consistently high for the last three seasons, there were significantly fewer cases reported than the 2010-11 financial year where 1298 arbovirus infections were notified to CDCB. Human cases of JEV were notified to CDCB in 2022 and 2023. There was also a case of MVEV notified which is the first human case since the 2010-11 season.

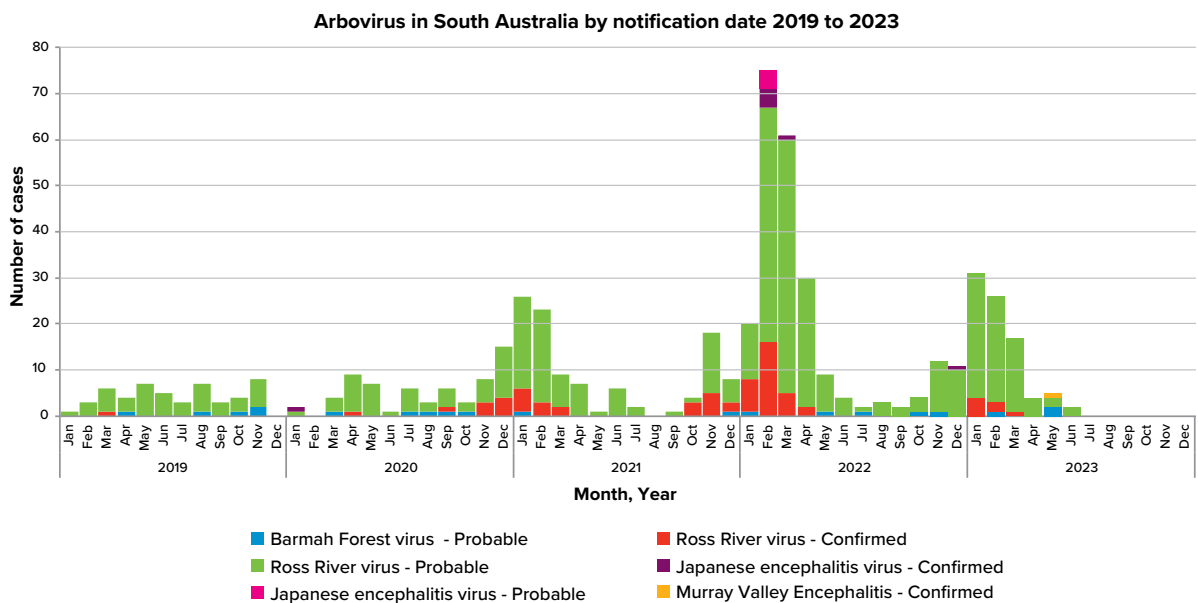


Figure 27 Arbovirus notifications in South Australia by notification date Jan 2019-Jun 23

Ross River virus (RRV)

RRV infection is the most notified mosquito-borne disease in South Australia. Patients with RRV infection experience a polyarthritic condition with or without other symptoms such as fever, headaches, lethargy, rash, and sore muscles. Serological testing is the only reliable way to diagnose an active RRV infection.

In the 2022-23 season there were 111 cases of RRV infection notified in South Australia, this was a 50 percent decrease compared to 220 cases notified in 2021-22 but similar to the 108 cases notified in 2019-20.

Barmah Forest virus (BFV)

Historically, BFV infection has been the second most notified mosquito-borne disease in South Australia. The virus is closely related to RRV, and the symptoms of infection are similar. Serological testing is used to correctly diagnose the causative virus and differentiate an active infection from RRV infection.

In the 2022-23 season there were six cases of BFV notified in South Australia. There were three notified cases in 2021-22 and five in the 2019-20 season.

Japanese encephalitis virus (JEV)

Most people with JEV virus infection do not experience any illness. Patients with JEV infection may experience mild symptoms such as fever and headache. A small proportion will have encephalitis (inflammation of the brain). This may begin with symptoms such as tiredness, fever and headache, nausea, vomiting, or diarrhoea. Confusion, unusual behaviour, sleepiness, seizures, weakness, and abnormal movements may develop. Encephalitis can cause permanent damage to the nervous system or death. JE is confirmed through a combination laboratory testing and clinical assessment.

In the 2022-23 season there was one case of JEV notified in South Australia. This was a significant decrease compared with the 2021-22 season with nine cases reported. All notified cases of JEV were hospitalised, and two cases died in the 2021-22 season.

Murray Valley encephalitis virus (MVEV)

Murray Valley encephalitis is a rare disease in humans caused by MVEV. This infection has the capacity to cause acute and severe illness in humans and can be fatal. MVEV is endemic (always present) in northern Australia (northern Western Australia and the top end of the Northern Territory) and probably in Papua New Guinea, but illness in humans is rare. Most reported human cases occur in northern Australia and Papua New Guinea, although there have been rare cases from South Australia.

In the 2022-23 season there was one case of MVEV notified in South Australia. This was the first case notified since the 2010-11 season. The case was hospitalised but recovered.

West Nile virus Kunjin strain (WNV/KUN)

WNV/KUN is endemic (always present) in tropical parts of Australia, in birds. Illness in humans is rare and most reported cases occur in northern Australia.

In the 2022-23 season there no cases of WNV/KUN notified in South Australia.

Exposure locations

For the 2022-23 season, 62% of cases with infections between July 2022 and June 2023 were medically notified with information regarding their likely exposure location. When cases are not medically notified, residential address is used as likely exposure location.

Of the cases reported for the 2022-23 season, 90% were exposed in regional areas, 6% in metropolitan Adelaide and 4% interstate. The council areas with the most recorded cases by exposure location were Alexandrina (12), Loxton Waikerie (10), Renmark Paringa (10), Berri and Barmera (9) and Murray Bridge (7). The notified cases of JEV and MVEV both had exposures in the South Australian River Murray region.

Exotic mosquito-borne diseases

Mosquito-borne diseases not locally acquired within South Australia are considered exotic mosquito-borne diseases. These diseases are diagnosed in residents or visitors returning from international travel. The most common exotic mosquito-borne diseases diagnosed in South Australia are Dengue virus infection, Chikungunya virus infection, and Malaria (caused by infection with one of five different species of protozoan parasites).

All notified cases of exotic mosquito-borne diseases are followed up to determine whether the disease was acquired overseas. In the 2022-23 season, there were two Chikungunya cases, 46 Dengue fever cases and 16 Malaria cases acquired overseas. There were no cases of overseas acquired JEV notified in the 2022-23 season. As shown in figure 28, exotic mosquito-borne disease notifications increased compared to the 2021-22 and 2020-21 seasons. The most likely cause of this increase was the return to travel after the impact of COVID-19 on global travel.

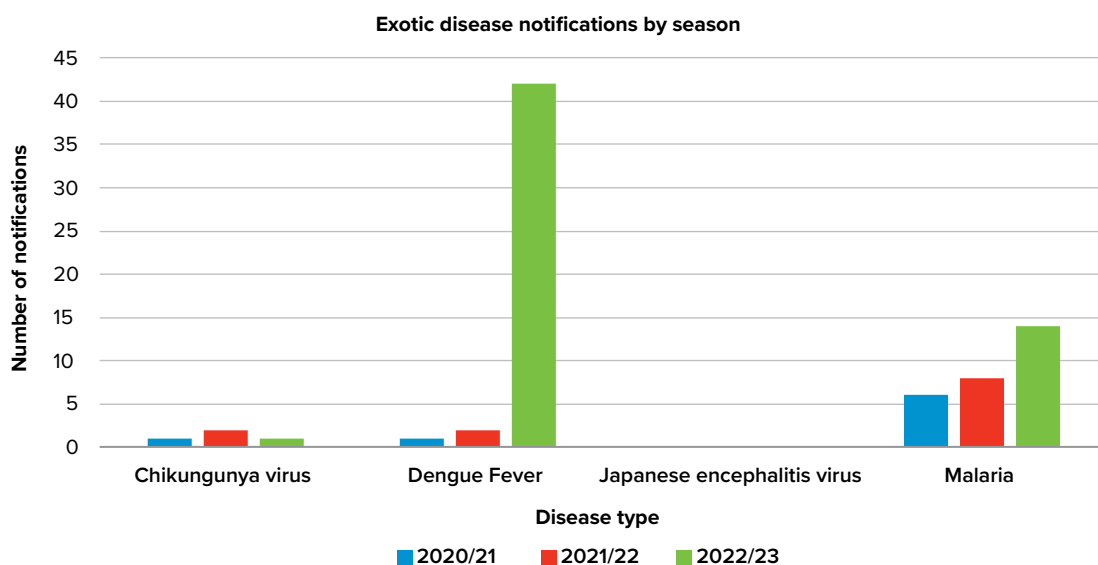


Figure 28 Exotic disease notifications in South Australia by Financial year - three-year comparison 2020-23

13. Exotic mosquito detections

Some species of mosquito, not currently established in South Australia, are capable of transmitting diseases that can have severe impacts on the health of people and animals. For this reason, it is vital that processes are in place to ensure these mosquitoes are prevented from entering and becoming established in Australia. *Aedes aegypti* and *Aedes albopictus* are the two exotic mosquito species most frequently detected through inspection and surveillance procedures.

DAFF conducts exotic mosquito detection surveillance and mitigation activities at international ports. DAFF performs mosquito vector monitoring within a 400m perimeter at international air and seaports and identifies mosquito breeding sites within the port area for remediation. DAFF encourages and promotes source reduction with stakeholders in the port area. Following ground surveys, sites requiring remediation are reported to the port authority and/or land/lease holder for action.

If exotic mosquitoes are detected at an international port, DAFF will notify SA Health. SA Health is responsible for coordinating surveillance and control activities in the port area extending beyond the 400m interception perimeter, or beyond the port area, and liaising with local government responsible for areas where an incursion has been detected.

Airport incursion and response

In March 2023, SA Health was notified by DAFF that during their routine surveillance for exotic mosquitoes, an adult female *Aedes aegypti* mosquito was detected at Adelaide Airport. This detection was confirmed by DAFF and NSW Health Pathology, Department of Medical, Entomology entomologists. *Aedes aegypti* is an exotic species, not present in South Australia. It is the primary virus vector for yellow fever, dengue fever, chikungunya, and Zika fever. Establishment of this species presents a public health risk to residents of and visitors to South Australia.

In response to the detection, SA Health, in conjunction with DAFF, NSW Health Pathology and Adelaide Airport Duty Manager, coordinated comprehensive surveillance and control operations. This involved extensive adulticide and larvicide treatments by a licenced pest control operator, consistent with the Commonwealth Government's "Response guide for exotic mosquito detections at Australian first points of entry".

SA Health attended the airport and conducted receptacle and drain surveys within a 600-metre radius and at known waterbodies within a 1km radius of the of the trap where the *Aedes aegypti* mosquito was detected. Where required treatment was applied. DAFF conducted enhanced surveillance within the airport area for four weeks following the detection. Surveillance did not identify local breeding of this invasive species indicating that the response was successful.

The number of exotic mosquito species incursions has increased over the past 10 years (excluding the period of the COVID-19 pandemic which saw international travel reduce significantly).

14. Events

As a result of the Commonwealth funding the expanded HPP team were able to significantly increase community engagement compared to previous seasons. HPP attended 12 major public events during the 2023-23 mosquito season. The events attended were predominately in high risk River Murray locations and were selected based on event type and predicted rate of attendance.

Key messaging at the events related to Fight the Bite messaging and raising awareness of the increased risk of flavivirus. This message was reinforced by giving away free repellent, brochures, and drink holders to attendees. Advice was given in relation to the correct method of application of repellent. HPP also provided advice and information in relation to the SA Health JEV vaccination program.

The feedback provided by event attendees was overwhelmingly positive. Attendees were particularly receptive of the free repellent. An additional benefit of attending the events was that HPP obtained local intelligence in relation to mosquito breeding sites enabling additional surveillance and treatment in targeted areas.

15. Future directions for mosquito surveillance and control in South Australia

HPP are evaluating the delivery of JEV program to support the development of sustainable policies, processes, and procedures for future mosquito seasons. Planning and preparation for the 2023-24 mosquito season has commenced, including a review of the Plan and the South Australian integrated mosquito management resource pack (SAIMMRP).

HPP will continue to provide support to local councils in the development and review of local mosquito management plans.

16. Reporting

The **South Australian Arbovirus and Mosquito Monitoring and Control Annual Report** will be published online at the completion of each subsequent mosquito season. SA Health will build on the data each year to form a comprehensive overview of mosquito activity across South Australia and the associated public health risks.

HPP will continue to produce the **South Australian arbovirus and mosquito monthly reports** which summarise the most recent available data to inform the current level of risk of mosquito-borne disease in South Australia.

17. Training videos and resources

HPP has developed a suite of videos to support LHAs in undertaking adult and larval mosquito surveillance, which are available on the [SA Health website](#). HPP intend to extend the range of videos to include larval control with the intention of building council capacity for mosquito surveillance and control across South Australia.

The review of the SAIMMRP will result in the development of a suite of resources to support local councils in delivering mosquito surveillance and control activities.

HPP will continue to 3D print and supply mosquito surveillance traps at no charge for all South Australian councils wishing to use them.

18. Further information

For further information regarding mosquito-borne disease, visit www.sahealth.sa.gov.au/fightthebite

Appendix 1: Mosquito monitoring and arbovirus prevention stakeholders

- ➔ Health Protection Programs, Department for Health and Wellbeing
- ➔ Communicable Disease Control Branch, Department for Health and Wellbeing
- ➔ Aerotech Australasia
- ➔ Arbovirus Response Cross Agency Group
- ➔ Department of Agriculture, Fisheries and Forestry (Commonwealth)
- ➔ Department of Health and Aged Care (Commonwealth)
- ➔ Department of Primary Industries and Regions (SA)
- ➔ Corporate Communications Branch, Department for Health and Wellbeing
- ➔ Healthy Environs
- ➔ Local councils:
 - Adelaide Plains Council
 - Alexandrina Council
 - Barossa Council
 - Barunga West Council
 - Berri Barmera Council
 - City of Playford
 - City of Port Adelaide Enfield
 - City of Salisbury
 - City of Tea Tree Gull
 - City of Whyalla
 - Clare and Gilbert Valleys Council
 - Coorong District Council
 - District Council of Loxton Waikerie
 - District Council of Elliston
 - Kangaroo Island Council
 - Mid Murray Council
 - Mount Barker District Council
 - Regional Council of Goyder
 - Rural City of Murray Bridge
 - Renmark Paringa Council
 - Southern Mallee District Council
- ➔ Agriculture Victoria Research
- ➔ NSW Health Pathology, Medical Entomology, ICPMR, Westmead Hospital
- ➔ One Health SA Working Group (formerly Zoonoses Working Group)
- ➔ Private pest control service providers
- ➔ Riverland veterinarians
- ➔ Sentinel chicken host families.

Appendix 2: Arbovirus response cross agency group membership

Table 4 Arbovirus response cross agency group

Coordinator - SA Health, Health Protection Programs	Murray and Mallee Zone Emergency Management Committee
Local councils participating in SA subsidy program	PIRSA – Biosecurity SA
SA Health, CDCB	Local Government Association
SA Health, HPO	Environmental Protection Authority
SA Health, DMB	Department for Environment and Water
SA Water	

Appendix 3: Northern Adelaide mosquito surveillance program trapping locations

Table 5 Northern Adelaide mosquito surveillance trap locations

Trap Code	Trap Name	Location	Latitude / Longitude
DAW	Daniel Avenue Wetland	Globe Derby Park	-34.787358 / 138.586398
GDR	Globe Derby Racetrack	Globe Derby Park	-34.794579 / 138.589952
ML	Mawson Lakes	Mawson Lakes	-34.799232 / 138.597332
SWA	Swan Alley	Globe Derby Park	-34.790797 / 138.580558
TIPS	Torrens Island Power Station	Torrens Island	-34.805968 / 138.525777
TIQS	Torrens Island Quarantine Station	Torrens Island	-34.776148 / 138.523854

Appendix 4: South Australian River Murray council trap locations

Table 6 River Murray councils mosquito surveillance trap locations

Council	Trap Code	Trap Name	Location	Latitude / Longitude
Alexandrina Council	A1	Island View	Clayton Bay	-35.49088889 / 138.922139
	A2	Cinema Court	Port Elliot	-35.53111122 / 138.921667
	A3	Bike Track	Port Elliot	-35.515833 / 138.75889
	A4	Football Club	Goolwa	-35.502778 / 138.780556
	A5	Tolarno Drive	Hindmarsh Island	-35.5075 / 138.806389
Berri Barmera Council	B1	Monash Playground	Monash	-34.23313889 / 140.558139
	B2	Glossop	Glossop	-34.26872222 / 140.526889
	B3	Barmera	Barmera	-34.253794 / 140.467928
	B4	Berri Caravan Park	Berri	-34.28591667 / 140.612639
	B5	Cobdogla	Cobdogla	-34.24205556 / 140.396944
	B6	Martins Bend	Berri	-34.28909 / 140.631269
	B7	Cobdogla Oval	Cobdogla	-34.24205556 / 140.396944
	B8	Berri Scout Hall	Berri	-34.28909 / 140.631269
Coorong District Council	C1	Tailem Bend Golf Course	Tailem Bend	-35.257861 / 139.446722
	C2	Tailem Bend Reserve	Tailem Bend	-34.25833 / 139.454722
	C11	Alexandrina Drive	Narrung	-35.51372 / 139.18375
	C12	Meningie Golf Course	Meningie	-35.721667 / 139.269944
	C12a	Meningie Golf Course	Meningie	-34.4134 / 139.2002
	C5	Meningie School	Meningie	-35.683056 / 139.388889
District Council of Loxton Waikerie	L1	Thieles Floodplain	Loxton	-34.433861 / 140.591556
	L1A	Thieles Floodplain	Loxton	-34.43881 / 140.58472
	L2	Boardwalk	Loxton	-34.45095 / 140.55877
	L3	Moorook Campground	Moorook South	-34.28501 / 140.36686
	L4	Kingston Caravan Park	Kingston on Murray	-34.22132 / 140.35037
	L4A	Kingston on Murray A	Kingston on Murray	-34.175333 / 140.350417
	L4B	Kingston on Murray B	Kingston on Murray	-34.2222 / 140.348076
	L5	Waikerie Caravan Park	Waikerie	-34.175333 / 139.98035
	L6	Paisley	Paisley	-34.34325 / 139.62156
	L6A	Paisley A	Paisley	-34.342004 / 139.623321
	L7	Schubert Drive	Loxton	-34.451627 / 140.561596
	L7A	Schubert Drive A	Loxton	-34.450898 / 140.564246

Mid Murray Council	MM1	Morgan Ferry	Morgan	-34.039 / 139.67663
	MM1 A	Morgan A	Morgan	-34.043056 / 139.676112
	MM1 B	Morgan B	Morgan	-34.03889 / 139.675833
	MM2	Blanchetown Golf Course	Blanchetown	-34.563222 / 139.597306
	MM2 A	Blanchetown A	Blanchetown	-34.35583333 / 139.616389
	MM2 B	Blanchetown B	Blanchetown	-34.35472222 / 139.614167
	MM3	Swan Reach Ferry	Swan Reach	-34.56277778 / 139.59778
	MM5	Port Mannum	Port Mannum	-34.930278 / 139.303056
	MM6	Haythorpe	Haythorpe	-34.909583 / 139.322694
	MM7	Port Mannum Esplanade	Mannum	-34.92828 / 139.303941
	MM8	Blanchetown Hall	Blanchetown	-34.901109 / 139.322607
	MM9	Long Gully Road	Mannum	-34.352439 / 139.61519
	MM10	Swan Reach cemetery	Swan Reach	-34.570051 / 139.5969
MM11	Morgan Causeway	Morgan	-34.037497 / 139.670442	
Renmark Paringa Council	R1	Bert Dix Park	Paringa	-34.18241667 / 140.777361
	R1A	Bert Dix Park A	Paringa	-34.17874 / 140.76464
	R2	Ski Site	Renmark	-34.17763889 / 140.76275
	R2A	Ski Site A	Renmark	-34.17879 / 140.763119
	R2B	Ski Site B	Renmark	-34.178831 / 140.760509
	R2C	Ski Site C	Renmark	-34.17866 / 140.76371
	R3	Jane Eliza Avenue	Renmark	-34.16327778 / 140.788889
	R3A	Jane Eliza Avenue A	Renmark	-34.163021 / 140.754537
	R4	Bookmark Creek	Renmark	-34.17394444 / 140.728917
	R4A	Bookmark Creek A	Renmark	-34.174294 / 140.730337
	R4B	Bookmark Creek B	Renmark	-34.17501 / 140.73036
	R5	Ellen Park	Lyrup	-34.253611 / 140.64775
	R5A	Ellen Park A	Lyrup	-34.254732 / -140.647513
	R6	Plush Bends Road	Crescent	-34.20908 / 140.75454
	R6A	Plush Bends Road A	Crescent	-34.208704 / 140.75387
	R6B	Plush Bends Road B	Crescent	-34.19537 / 140.745532
Rural City of Murray Bridge	MB1	Mypolonga School	Mypolonga	-35.041917 / 139.357933
	MB1A	Mypolonga School A	Mypolonga	-35.03939 / 139.35481
	MB2	Sturt Reserve	Murray Bridge	-35.123783 / 139.28785
	MB2A	Sturt Reserve	Murray Bridge	-35.123005 / 139.280555
	MB3	Murray Bridge Golf Course	Murray Bridge	-35.130617 / 139.269983
	MB4	Wellington Caravan Park	Wellington	-35.330133 / 139.382117
	MB5	Murray Bridge East	Murray Bridge East	-35.09 / 308056
	MB5A	Murray Bridge East A	Murray Bridge East	-35.088333 / 139.30916
	MB5B	Murray Bridge East B	Murray Bridge East	-35.0917 / 139.3088

Appendix 5: Metropolitan council mosquito surveillance and control trap locations

Table 7 Metropolitan council mosquito surveillance and control trap locations

Council	Trap Code	Trap Name	Location	Latitude / Longitude
Adelaide Plains Council	APC1	Lower Light	Lower Light	-34.552682 / 138.452104
	APC2	Thompson Beach	Dublin	-34.475753 / 138.266484
	APC3	Mallala	Mallala	-34.436399 / 138.509462
	APC4	Lewiston	Lewiston	-34.602633 / 138.595569
	APC5	Two Wells	Two Wells	-34.585138 / 138.500985
Mount Barker District Council	M1	ESC	Mount Barker	-35.068 / 138.87
	M2	Lilac Parade	Mount Barker	-35.09 / 138.843
	M3	Kennebec	Mount Barker	-35.086 / 138.865
	M4	Rainbird Drive	Mount Barker	-35.081 / 138.846
	M5	Parkview Drive	Mount Barker	-35.07 / 138.881
	M6	Rayson Way	Mount Barker	-35.085 / 138.882
	M7	Rule Court	Mount Barker	-35.041 / 138.864
	M8	Crystal Lake	Macclesfield	-35.181 / 138.837
	M9	River Road	Mount Barker	-35.04 / 138.775
City of Playford	WIN-001	Windamere Park 1	Port Gawler	-34.656924 / 138.490056
	WIN002	Windamere Park 2	Buckland Park	-34.664223 / 138.494417
	PPT001	P'Petual Holdings	Buckland Park	-34.666423 / 138.519756
	RIV001	Riverlea Estate-1	Buckland Park	-34.6545 / 138.530545
	RIV002	Riverlea Estate-2	Buckland Park	-34.652444 / 138.532528
	RIV003	Riverlea Estate-3	Buckland Park	-34.652677 / 138.236153
	RIV004	Riverlea Estate-4	Buckland Park	-34.648909 / 138.530924
City of Salisbury	PTP	South Terrace		-34.835843 / 138.618439
	DAR	Yarle Street	Mawson Lakes	-34.808952 / 138.601312
	SBR	Springbank Blvd	Burton	-34.742613 / 138.594044
	MBR	Myall Blvd	Salisbury	-34.762719 / 138.626241
City of Tea Tree Gully	TTG 01	Zircon Reserve	Hope Valley	-34.841926 / 138.716736
	TTG 02	Holmes Avenue	Redwood Park	-34.814813 / 138.710162

Appendix 6: Regional council mosquito surveillance and control trap locations

Table 8 Regional council mosquito surveillance and control trap locations

Council	Trap Code	Trap Name	Location	Latitude / Longitude
Clare and Gilbert Valleys Council	CG1	Riverton Duck Pond	Clare	-34.158516 / 138.751816
	CG2	Auburn Centenary Park	Clare	-34.02533 / 138.68689
	CG3	Gleeson Wetland	Clare	-33.826752 / 138.608353
	CG4	Hutt River Creek	Clare	-33.832253 / 138.609406
	CG5	Armagh Creek	Clare	-33.831406 / 138.581192
	CG6	Bennys Hill Road	Clare	-33.839035 / 138.604121
	CG7	Gleeson Street	Clare	-33.834644 / 138.611633
Elliston District Council	E1	Lake Hamp Area	Elliston	-33.638194 / 134.896944
	E2	CFS Shed	Elliston	-33.647639 / 134.896111
	E3	Clifftop Drive	Elliston	-33.633194 / 134.871389
	E4	Pedros Drive	Elliston	-33.65125 / 134.888611
	E5	Wetlands	Elliston	-33.647083 / 134.890555
Goyder Regional Council	GC1	Burra Caravan Park	Burra	-33.679253 / 138.937561
	GC2	Burra Creek Catchment	Burra	-33.684932 / 138.942764
	GC3	Burra Mine Lake	Burra	-33.679157 / 138.927811
	GC4	World End Reserve	Worlds End	-33.831715 / 139.044525
	GC5	Porter Lagoon	Porter Lagoon	-33.819752 / 138.873474
	GC6	World End Reserve 2	Worlds end	-33.833076 / 139.040246
Kangaroo Island Council	KI1	Golf Course	Kingscote	-35.67296 / 137.60043
	KI2	Flinders Street	Kingscote	-35.65731 / 137.62902
	KI3	Brownlow Public Toilets	Kingscote	-35.64646 / 137.62746
Southern Mallee District Council	SM1	Geranium	Geranium	-35.38124 / 140.15989
	SM2	Parrakie	Parrakie	-35.38041 / 140.24987 140.
	SM3	Lameroo Golf Course	Lameroo	-35.32454 / 140.51922
	SM4	Pinaroo Golf Course	Pinaroo	-35.95985 / 140.90304
Whyalla Council	WHY1	Salt Marsh Mangrove	Whyalla	-33.043101 / 137.574858
	WHY2	Salt Marsh Boat Ramp	Whyalla	-33.043101 / 137.574857
	WHY3	Salt Marsh Tidal Creek	Whyalla	-33/035471 / 137.558573
	WHY4	Salt Marsh Flood Plain	Whyalla	-33.049285 / 137.563668

For more information

Health Protection Programs
Health Protection and Regulation
Department for Health and Wellbeing

Email: HealthProtectionPrograms@sa.gov.au

Telephone: 08 8226 7100

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