Government of **Western Australia**
Department of **Health**

Medical Entomology Annual Report:

2020-2021

Contents

Glossary

ASR	age standardised rate
BAEHH	Biological and Applied Environmental Health Hazards
BFV	Barmah Forest virus
CHIKV	chikungunya virus
CLAG	Contiguous Local Authorities Group
CR	crude rate
DENV	dengue viruses
Department (the)	Department of Health
ENSO	El Niño–Southern Oscillation
ESD	enhanced surveillance data
FTB	Fight the Bite
JEV	Japanese encephalitis virus
KUN	Kunjin (disease)
LG	Local government
MAL	malaria protozoan parasite
ME	Medical Entomology
MVEV	Murray Valley encephalitis virus
PCR	polymerase chain reaction
Public Health Act	*Public Health Act 2016* (WA)
RRV	Ross River virus
RT-PCR	reverse transcriptase polymerase chain reactions
SOI	Southern Oscillation Index
TC	tropical cyclone
WA	Western Australia
WANIDD	Western Australian Notifiable Infectious Disease Database
WNV_{KUN}	West Nile virus Kunjin strain
ZIKV	Zika virus

Executive Summary

This Annual Report summarises the mosquito-borne disease case data from Western Australia (WA), as well as the varied and comprehensive activities undertaken by Medical Entomology (ME), with the WA Department of Health (the Department) for 2020-21 (1 July 2020 – 30 June 2021). Northern trapping data from 2019-20 has also been included, as mosquito identification and virus detections took place during the reported financial year.

Briefly, 2020-21 was characterised by a late increase in rainfall due to sporadic La Niña conditions causing a succession of low pressure weather systems and a significant tropical cyclone that impacted most of the state. These weather factors lead to ideal conditions that supported mosquito breeding and the transmission of mosquito-borne viruses to humans. After a couple of below average seasons, the 2020-21 season increased to above average for disease cases and mosquito populations.

Continued restrictions related to the COVID-19 pandemic somewhat reduced the ability for the ME team and WA local governments (LG) to undertake mosquito surveillance activities for arbovirus detection. This was predominantly due to regional travel restrictions prohibiting officers from undertaking adult mosquito trapping in areas considered high-risk for mosquito-borne disease. Some LG areas were able to continue mosquito collections on the Department's behalf to ensure virus detection processing was not interrupted.

Supporting local government

ME continued to support LG through the provision of training and technical advice and oversight of Fight the Bite, as well as the coordination of the Contiguous Local Authorities Group (CLAG) scheme and aerial treatment program. The Department approved CLAG funding requests, totalling $284,091.35, and spent a further $674,663.67 on the provision of aerial larviciding treatments across high risk regions of the State's South West.

Mosquito and arbovirus surveillance

The arbovirus surveillance program continued to play an important role in informing LG mosquito management activities and determining the need for, and timing of, media statements released by the Department in an effort to minimise the public health risk associated with mosquitoes throughout WA.

A total of 193,754 mosquitoes were collected across 21 routine surveillance sites between Mandurah and Busselton in WA's South West. Ross River virus (RRV) was detected 235 times across the South West of WA. There were 2 detections of Barmah Forest virus (BFV).

A total of 2,660 blood samples were collected from sentinel chickens across 23 flocks throughout northern WA, before they were tested for flavivirus antibodies. 43 seroconversions were detected, indicating that flavivirus activity was present in the Kimberley and Pilbara regions during 2020-21. Mosquitoes were also collected from the Kimberley region between 18 March to 11 April 2021, during ME's annual northern surveillance trip. It was estimated that 403,570 mosquitoes were collected in over 261 traps set. The collected mosquitoes will be identified to species level and processed for detection of arboviruses during 2022 and reported in the 2021-22 annual report.

As a result of the surveillance program findings, 6 media warnings were issued to remind the WA public to take precautions to avoid mosquito bites.

Exotic mosquito surveillance

The Commonwealth Department of Agriculture Science Support Program detected three importations of exotic mosquitoes in 2020-21. ME confirmed the identifications as *Aedes albopictus* collected twice at Dampier seaport; and *Culex pipiens,* collected at an approved arrangement facility located in Perth.

MEDICAL ENTOMOLOGY
2020-21 Snapshot

Surveillance efforts throughout WA are used to inform public health warnings and interventions

572 Mosquito traps set over 21 sites in the South West of WA

193,754
Adult mosquitoes collected

Adult mosquitoes trapped by region

235 Ross River virus detections

2 Barmah Forest virus detections

48 aerial larvicide applications totalling
9,253ha

23 **Sentinel chicken flocks managed throughout WA**

2660
blood samples tested

43 Mosquito-borne virus infections detected in chickens

Stakeholder engagement

19 Local government funding applications assessed

6 Media statements issued related to mosquitoes

1 Mosquito management course conducted

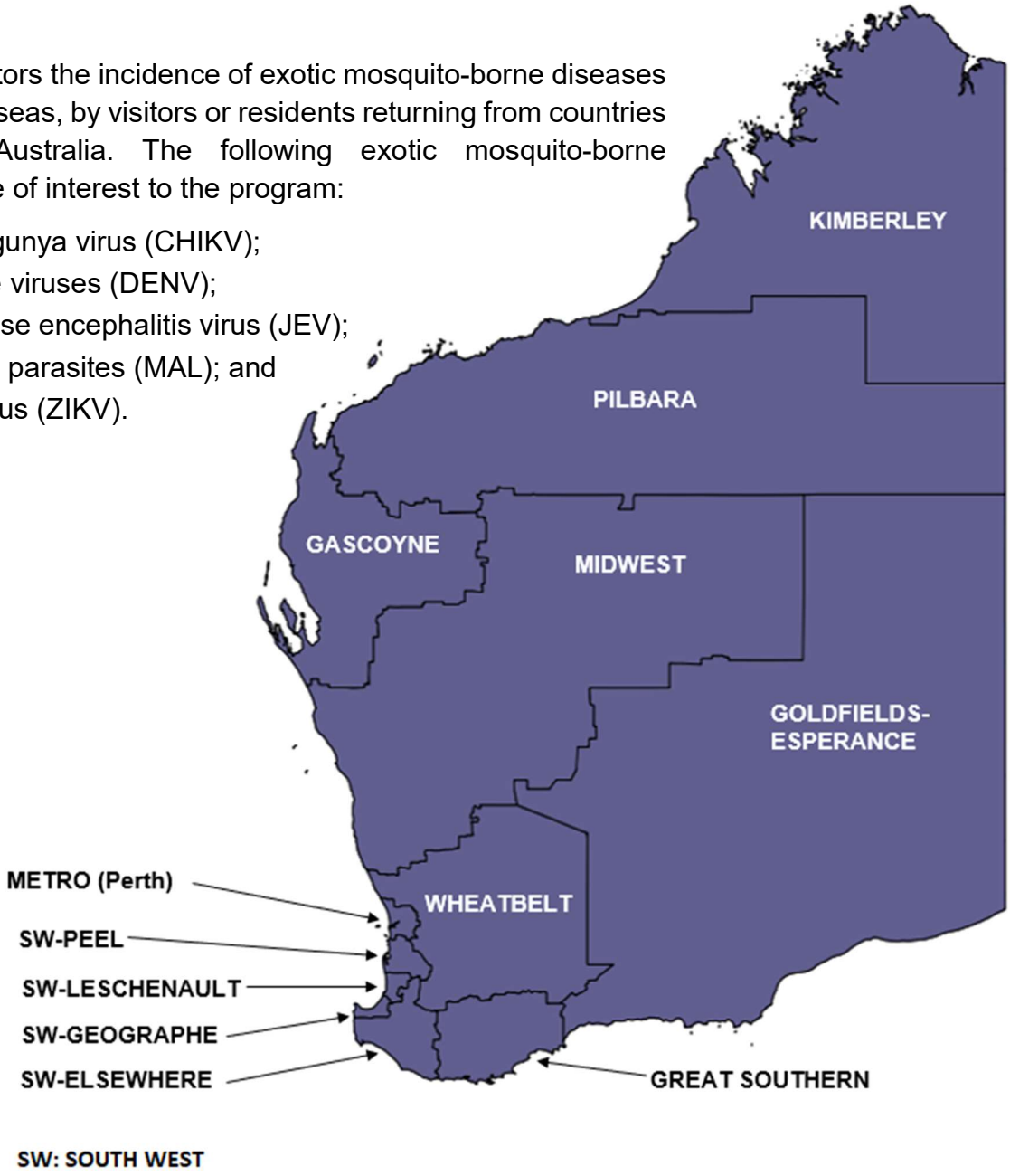
1.0 Introduction

There are 300 different species of mosquitoes in Australia, of which approximately 100 are known to occur in WA. Viruses have been isolated from over 30 species across Australia and many other species have not been tested to determine their ability to transmit these viruses. Medical Entomology (ME) monitors the following four mosquito-borne viruses, which are all known to cause locally acquired, notifiable diseases in the following regions* of WA:

1) Ross River virus (RRV) – all of WA;
2) Barmah Forest virus (BFV) – all of WA;
3) Murray Valley encephalitis virus (MVEV) – northern WA (Kimberley, Pilbara, Gascoyne and Midwest regions); and
4) West Nile virus Kunjin strain (WNV_{KUN}) – northern WA (Kimberley, Pilbara, Gascoyne and Midwest regions).

ME also monitors the incidence of exotic mosquito-borne diseases acquired overseas, by visitors or residents returning from countries outside of Australia. The following exotic mosquito-borne pathogens are of interest to the program:

1) chikungunya virus (CHIKV);
2) dengue viruses (DENV);
3) Japanese encephalitis virus (JEV);
4) malaria parasites (MAL); and
5) Zika virus (ZIKV).



*Note: ME reports data according to the regional boundaries shown here. These boundaries differ slightly compared to WA Public Health Regions.

1.1. The role of Medical Entomology

ME is responsible for:

- monitoring human cases of mosquito-borne diseases through the Western Australian Notifiable Infectious Disease Database (WANIDD) to determine patterns of disease occurrence, issue media statements and provide warnings to at-risk communities;
- provision of expert advice to the Minister for Health, senior Department executives, other State government agencies, local government authorities and members of the public on matters concerning mosquitoes and mosquito-borne disease risk;
- undertaking mosquito and arbovirus surveillance (https://ww2.health.wa.gov.au/Articles/A_E/Arbovirus-surveillance-program) to monitor RRV and BFV activity in the South West, and surveillance of MVEV and WNV_{KUN} activity through sentinel chicken flocks in the northern two-thirds of WA;
- coordination of the aerial larviciding program (https://ww2.health.wa.gov.au/Articles/A_E/Aerial-application-of-mosquito-larvicide) in high mosquito-borne disease risk regions of WA's South West;
- coordination of the Contiguous Local Authorities Group (CLAG) funding scheme (https://ww2.health.wa.gov.au/Articles/A_E/Contiguous-local-authority-group);
- resource development and coordination of the Department's public awareness campaign, Fight the Bite (https://ww2.health.wa.gov.au/Articles/F_I/Fight-the-Bite-campaign), to raise awareness of mosquitoes and improve prevention practices;
- issuing media statements when virus activity escalates, environmental conditions are suitable for vector breeding or surveillance activities identify potential public health risks;
- provision of training courses (https://ww2.health.wa.gov.au/Articles/J_M/Mosquito-management-course), forums, seminars and lectures to personnel involved in mosquito management and to disseminate information to stakeholders and the public;
- provision of specialist advice related to development applications through the identification of public health risk associated with proximity to existing mosquito breeding sites, and potential to create new breeding habitats as a result of the development itself;
- conducting and assisting other agencies in research projects focusing on mosquito ecology, arboviruses, innovative mosquito management practices, mosquito management equipment trials and calibration and newly available chemicals and/or formulations for mosquito control;
- assisting LG in field investigations and surveys of mosquito-breeding habitat related to disease outbreaks and public complaints;
- provision of technical assistance and advice on mosquito control treatments and ongoing monitoring related to exotic mosquito incursions throughout WA;
- development of policies for best practice mosquito control and use of chemicals, mosquito management plans, minimising risks for residential developments and avoidance of man-made mosquito breeding;

For further information on a range other activities, projects and research initiatives undertaken by ME, please review the Environmental Health Directorate's Yearbook (https://ww2.health.wa.gov.au/Reports-and-publications/Environmental-Health-Directorate-Publications).

Ross River virus disease case data summary

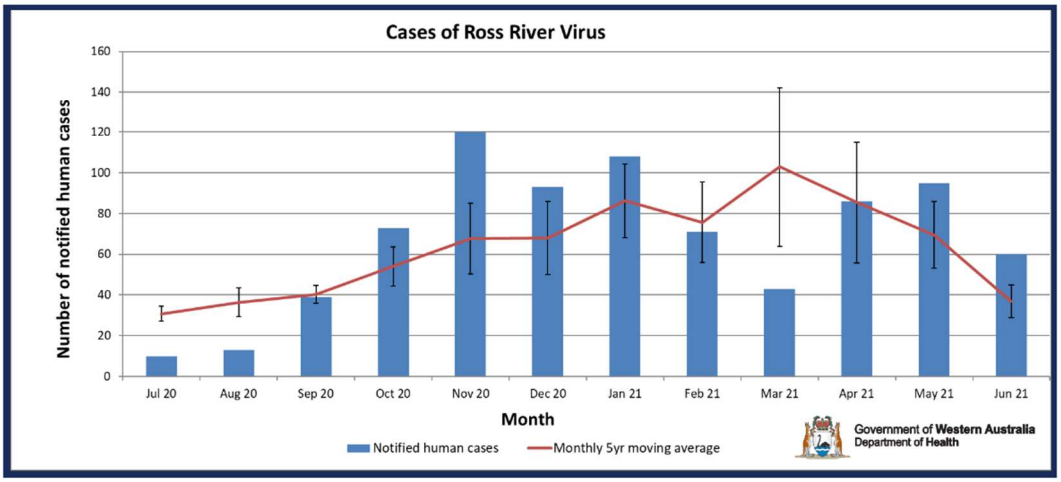
Western Australia 2020-21

Data reflected in this summary of mosquito-borne disease is taken from the Western Australia Notifiable Infectious Disease Database (WANIDD) and includes enhanced surveillance data collected by Population Health Units and local governments (only locations with notified cases of disease are shown in tables and figures).

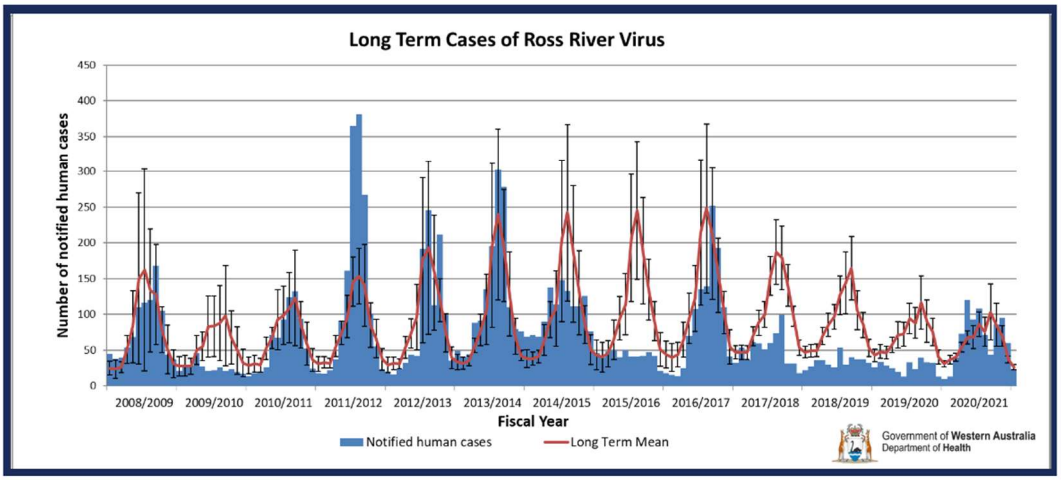
822

cases of RRV

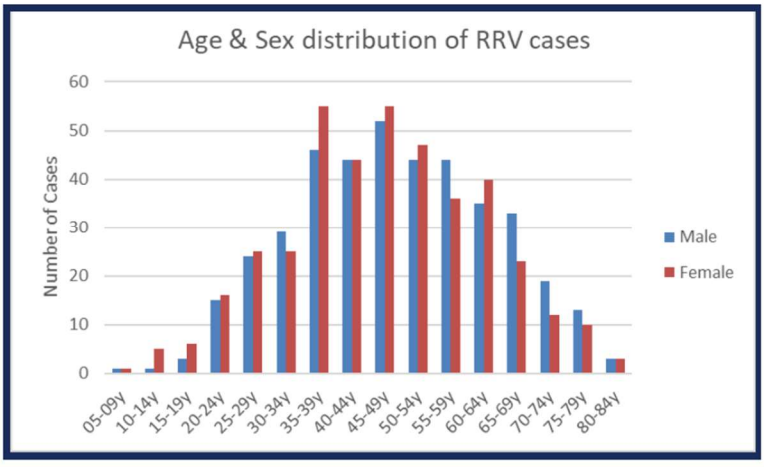
reported between 1 July 2020 and 30 June 2021 in WA



First above average season since 2017-2018, as environmental conditions have turned to a stronger La Nina pattern



The median age group was 45-49y while the average age for males was 49 and the average for females was 45. Peak year groups were between 35-39 and 45-49 years for females; and 45-49 years for males. This is similar to previous years.



2.1. Ross River virus

Ross River virus (RRV) is the most common arbovirus known to cause human disease in WA. Patients with RRV infection experience a polyarthritic condition with or without other symptoms such as fever, sore muscles, rash, lethargy and headaches. These symptoms can last from weeks to months, and in very rare cases years. Serological testing is the only reliable way to definitively diagnose an active RRV infection.

2.1.1 Regional summaries of Ross River virus cases

In 2020-21, a total of 822 cases of RRV were notified to the Department of Health (Table 1). This year marks the return to an above average season, the highest annual total of human cases since 2017. Human cases first increased in October with the peak for the season in November. Unseasonal late virus activity in the South West and southern Perth Metropolitan regions in April and May resulted in a second smaller peak in human cases.

Ross River virus disease case data summary

Western Australia: 2020-21

Data reflected in this summary of mosquito-borne disease is taken from the Western Australia Notifiable Infectious Disease Database (WANIDD) and includes enhanced surveillance data collected by Population Health Units and local governments

Table 1: Ross River virus disease cases per month between July 2020 and June 2021, with Crude and Age Standardised Rates.

REGION	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total	Crude Rate	Age Std Rate
KIMBERLEY	0	0	2	0	0	0	2	0	2	1	5	1	13	36.1	34.2
PILBARA	0	0	0	0	0	1	1	1	2	1	3	2	11	17.5	17.5
GASCOYNE	0	0	2	1	1	0	0	1	0	5	8	16	34	367.1	355.1
MIDWEST	0	6	11	13	5	2	2	1	0	10	9	2	61	101.9	102.0
WHEATBELT	0	0	2	1	3	3	1	2	1	5	17	6	41	60.0	60.2
METRO	4	1	5	6	6	15	18	34	17	29	32	17	184	10.0	9.7
SW - PEEL	3	3	8	12	20	11	12	10	4	6	10	6	105	37.1	36.7
SW - LESCHENAULT	1	0	4	6	18	8	10	4	5	9	4	1	70	93.9	93.6
SW - Geographe	1	2	5	29	55	33	10	2	5	4	2	2	150	255.4	245.3
SW - ELSEWHERE	0	0	0	2	4	6	12	3	3	9	4	1	44	90.7	91.2
SOUTH WEST(Total)	5	5	17	49	97	58	44	19	17	28	20	10	369	79.4	
GREAT SOUTHERN	1	1	0	2	5	6	26	12	8	7	2	3	73	119.0	121.2
GOLDFIELDS-ESPERANCE	0	0	0	1	4	7	14	3	3	2	0	2	36	66.8	63.4
WA UNDETERMINED	0	0	0	0	0	0	0	0	0	0	0	0	0		
INTERSTATE	0	0	0	0	1	0	1	2	0	1	1	2	8		
WA TOTAL (does not include interstate)	**10**	**13**	**39**	**73**	**121**	**92**	**108**	**73**	**50**	**88**	**96**	**59**	**822**		

The highest number of RRV cases reported was from the South West and Perth Metropolitan regions, with 369 and 184 cases respectively. Data from WA's South West is further divided into four regions (Peel, Leschenault, Geographe and SW Elsewhere) to provide a more detailed breakdown of disease distribution. The majority of cases reported in the SW were notified from the Geographe region (n=150).

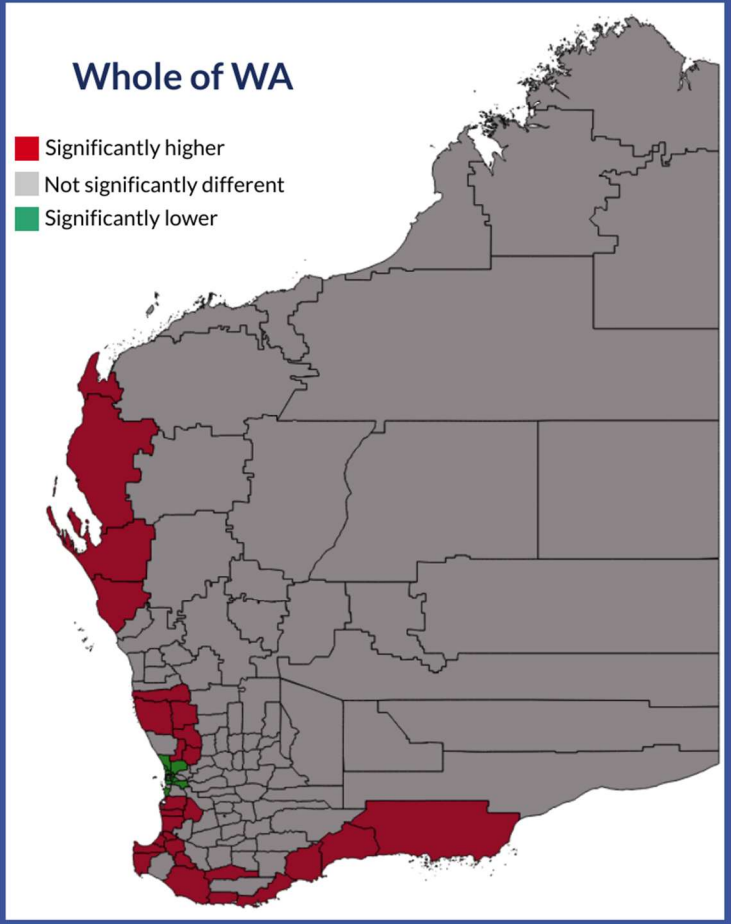
For all disease data tables in this report, the Crude Rate (CR) represents the number of disease notifications per 100,000 population in each region and the Age Standardised Rate (ASR) adjusts for differences in the age distributiuon between the regions to enable direct comparison of the rates across regions. The highest CR and ASR of 367.1 and 355.1 per 100,000 respectively, was recorded from the Gascoyne region.
Although the raw number of cases in Perth Metropolitan region appear high compared to other regions, the crude rate (CR) and age standardised rate (ASR) were actually the lowest in the State. This is a result of the large population living in Perth.

Ross River virus disease rates

Western Australia 2020-21

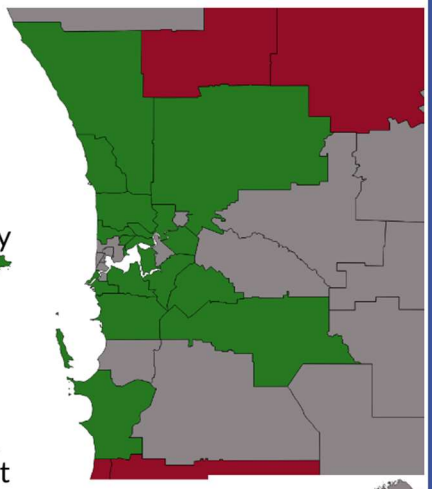
Maps of WA showing Ross River virus disease cases by local government area

Whole of WA



Cases per 100,000 people compared to the State average rate for 2020-21.

Perth Metropolitan region



During 2020-21 the majority of LGs reported similar rates of RRV disease compared to the State average.

Of 137 LGs, 29 reported significantly higher rates compared to the State average.

These were mainly coastal and inland LGs in the Gascoyne, Midwest, South West and Great Southern regions.

Heavy rainfall resulting from several Low pressure systems and TC Seroja enabled mosquitoes to breed in widespread favourable conditions.

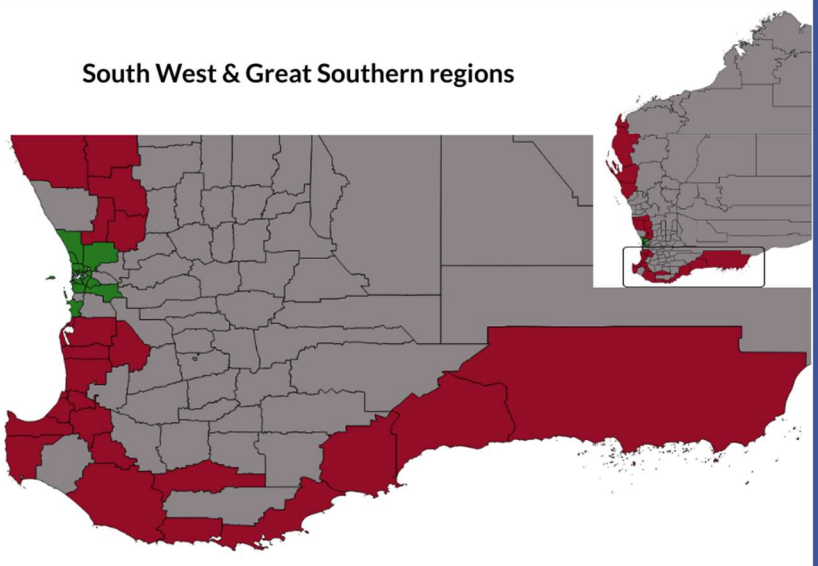
Gascoyne & Midwest regions

In the north west and central west regions of WA, Shires of Carnarvon, Chittering, Coorow, Dandaragan, Exmouth, Moora, Northampton, Shark Bay, Toodyay, and Victoria Plains were above the State average.

In the South West region of WA, Augusta Margaret River, Boddington, Bunbury, Busselton, Capel, Dardanup, Harvey, Mandurah, Murray, and Waroona LGs were above the state average.

Almost all LGs along the southern coast from Denmark to Esperance were all above the state average as well.

South West & Great Southern regions



2.1.1.1 Gascoyne Region

The Gascoyne region of WA is typically a low risk region where few numbers of RRV cases are confirmed per month. The long term average is less than 1 case per month, however increased case numbers can be expected every 5-10 years like many other remote and regional areas of WA. This region comprises the Shires of Carnarvon, Exmouth and Shark Bay.

In April 2020, RRV cases increased first in Carnarvon (n=4) but then decreased through to June. Exmouth then experienced an increase in RRV cases from May (n=5) and June (n=8), resulting from significant rainfall and tides associated with Cyclone Seroja and multiple tropical low systems impacting the region.

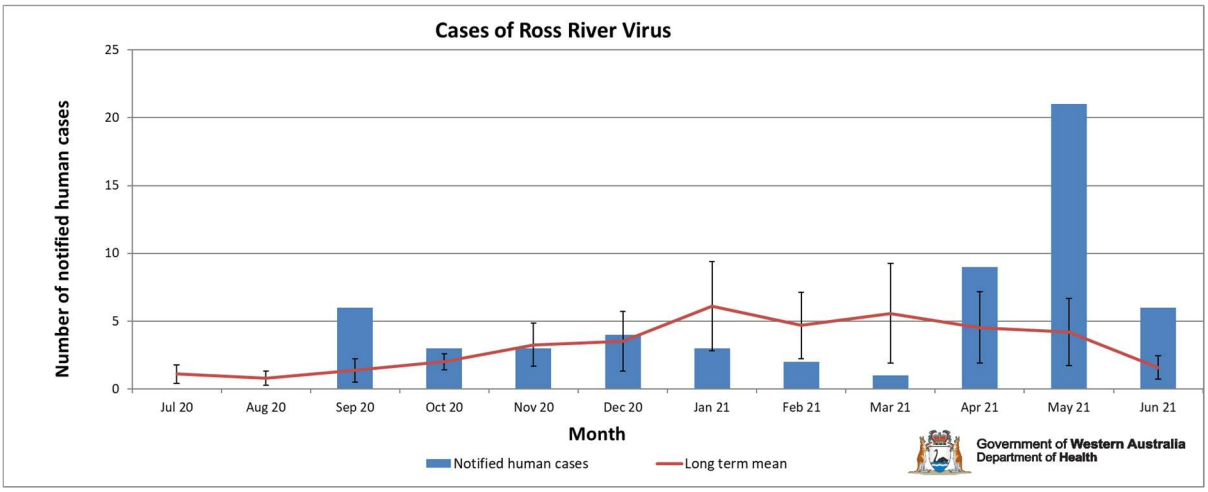


Figure 1: Total number of Ross River virus disease cases notified in WA's Gascoyne region per month between 1 July 2020 to 30 June 2021.

2.1.1.2 Midwest Region

The Midwest region is typically a low to medium risk region where RRV cases occur monthly or every few months with a peak during spring months. The long term average for the region is approximately 2 cases per month with significantly increased seasons every 5-10 years. This region comprises the City of Greater Geraldton and Shires of Chapman Valley, Coorow, Dandaragan, Irwin, Meekatharra, Moora, Northampton, and Perenjori.

The Shire of Northampton experienced an early increase of RRV cases from August to October 2020 (n=20). This was likely due to increased rainfall and tides causing an increase in mosquito populations but also an influx of travellers from Perth who were exposed to mosquito-borne viruses.

The Shire of Moora recorded a small cluster of RRV cases (n=4) in April 2021, resulting from the increased rainfall associated with Cyclone Seroja and multiple tropical lows affecting the region.

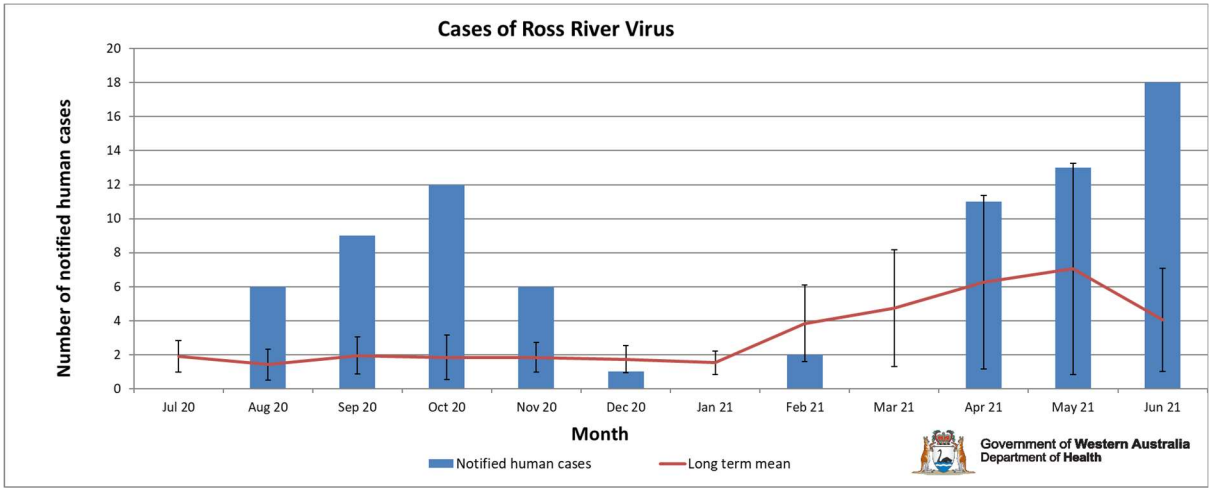


Figure 2: Total number of Ross River virus disease cases notified in WA's Midwest region per month between 1 July 2020 to 30 June 2021.

2.1.1.3 Wheatbelt Region

The Wheatbelt region of WA is typically a low-medium risk region where low numbers of RRV cases are confirmed per month, but a peak can be expected during late summer and autumn months. The long term average is approximately 3 cases per month, and increased seasonal activity can be expected every 5-6 years. This region comprises the Shires of Beverley, Boddington, Brookton, Chittering, Cuballing, Gingin, Northam, Pingelly, Toodyay, Victoria Plains, West Arthur, Williams and Yilgarn.

In May 2021, Northam and Toodyay experienced small clusters of 4 and 5 cases respectively, and at least one case was notified from most other Shires as well, resulting in a monthly total of 18 cases. This timing aligns with the increased rainfall that impacted the majority of the interior of WA, causing favourable conditions for mosquito breeding and virus activity.

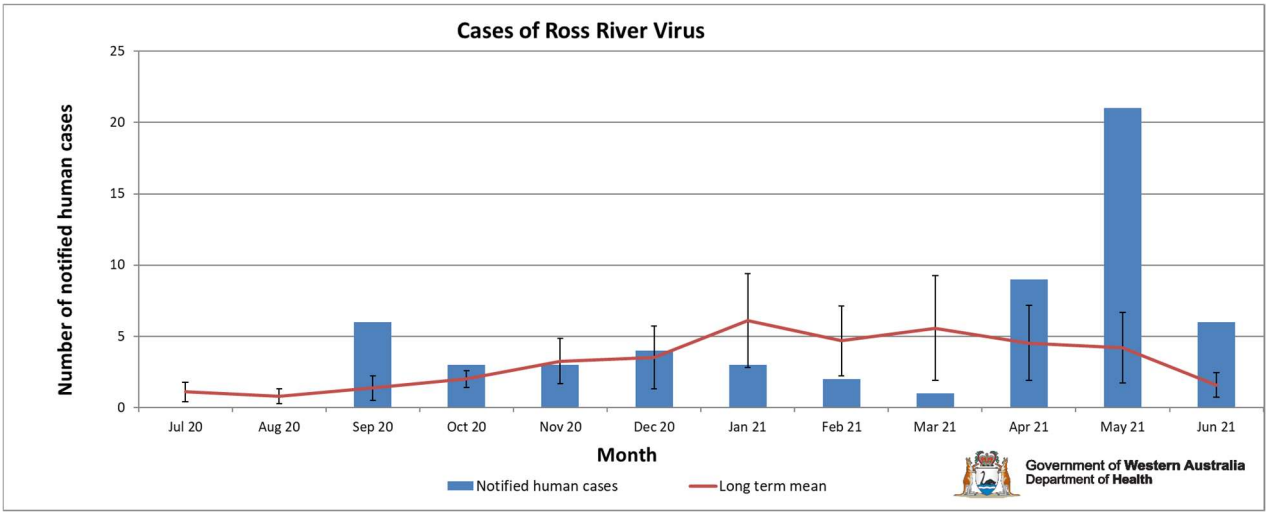


Figure 3: Total number of Ross River virus disease cases notified in WA's Wheatbelt region per month between 1 July 2020 to 30 June 2021.

2.1.2 Enhanced surveillance data response rates

There were 757 (90%) doctor notified cases of RRV/BFV that could be followed up for enhanced surveillance data (ESD). Completed ESD questionnaires were received from 472 of these, resulting in a response rate of 56%. This is an increase in rates from previous years; in 2019/2020 doctor notification rate was 57% and ESD return rates 24%.

The increase is due to a targeted campaign to improve the MBD data quality and is a combined effort by ME and the Regional Public Health Units. The ME team liaises directly with the regions experiencing high case numbers identifying missing forms and offering assistance to contact Doctors reminding them to notify. For metropolitan cases, the ME team contacts the nurses/doctors directly (phone or email) and reminds them to complete and fax the form if it is not received within 3 weeks of the laboratory report.

Although notification by Doctors is mandatory (under the *Public Health Act 2016*) historically many cases were not being completed and this directly affects the number of ESDs that can be issued as only cases notified by Doctors can be approached for follow-up (ESD). This is a policy to ensure patients are receiving their diagnosis from their GP.

The ESD provides valuable information about the likely place MBD infection was acquired. Of those questionnaires returned in 2020/2021, 45% had identified a different infection location than was automatically assigned (based on place of residence). The increased return of ESDs thus increases the quality and accuracy of the data which can then be used to identify disease clusters and areas needing mosquito management.

2.2. Barmah Forest virus

Barmah Forest virus disease case data summary

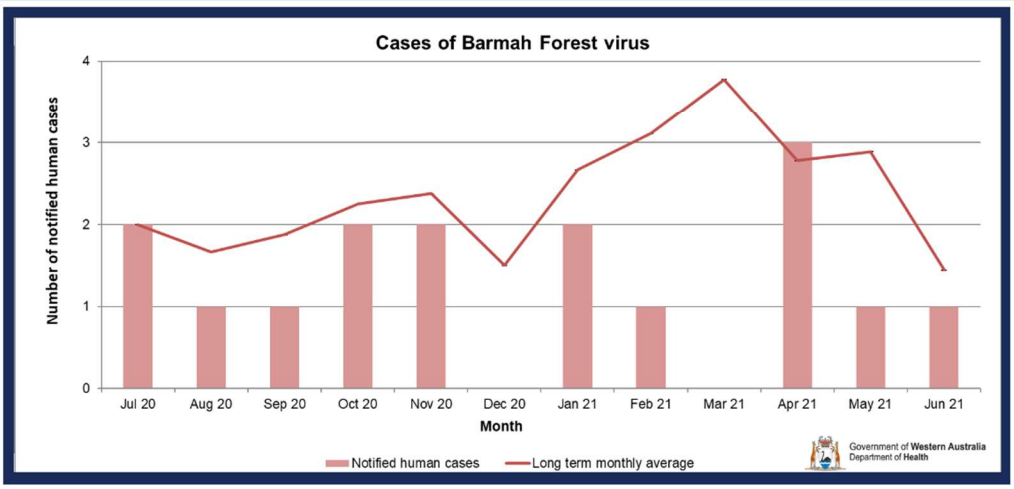
Western Australia 2020-21

Data reflected in this summary of mosquito-borne disease is taken from the Western Australia Notifiable Infectious Disease Database (WANIDD) and includes enhanced surveillance data collected by Population Health Units and local governments (only locations with notified cases of disease are shown in tables and figures).

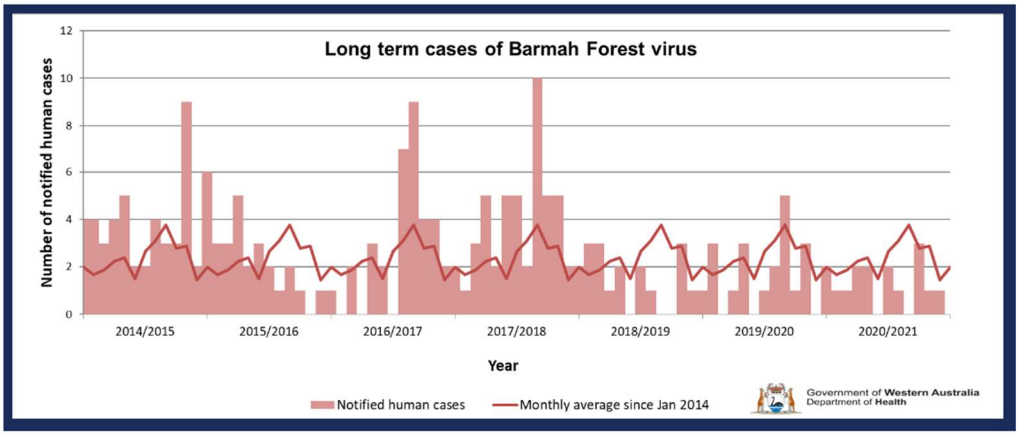
16

cases of BFV

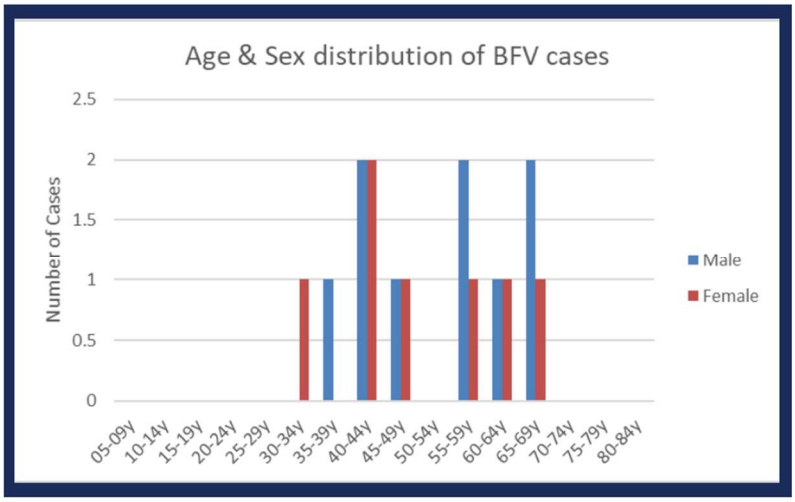
reported between 1 July 2020 and 30 June 2021 in WA



Overall, notified BFV disease cases have been below the long-term average since the end of 2017-18



The median age group was 55-59 years while the average age for males was 55 and the average for females was 45. Peak year groups were between 40-44 years for females; and 40-44, 55-59 and 65-69 years for males.



Barmah Forest virus (BFV) is the second most common arbovirus causing human disease in WA. The virus is closely related to RRV and the symptoms of infection are similar. However, BFV is generally regarded as the milder of the two and fewer BFV cases are generally reported. Serological testing is the only reliable way to correctly diagnose the causative virus and differentiate an active infection from RRV.

2.2.2 Enhanced surveillance data response rates

In 2020-21, a total of 16 cases of BFV disease were notified to the Department of Health WA (Table 2). Of these, 13 (81%) were doctor notified cases that could be followed up for ESD. Completed ESD questionnaires were received from six individuals, resulting in a response rate of 38%.

Barmah Forest virus disease case data summary

Western Australia: 2020-21

Data reflected in this summary of mosquito-borne disease is taken from the Western Australia Notifiable Infectious Disease Database (WANIDD) and includes enhanced surveillance data collected by Population Health Units and local governments

Table 2: Barmah Forest virus disease cases per month between July 2020 and June 2021, with Crude and Age Standardised Rates.

REGION	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total	Crude Rate	Age Std Rate
KIMBERLEY	2	0	1	1	0	0	2	1	0	2	0	0	9	25.0	22.7
PILBARA	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
GASCOYNE	0	0	0	0	1	0	0	0	0	0	1	0	2	21.6	24.0
MIDWEST	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
WHEATBELT	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
METRO	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
SW - PEEL	0	0	0	0	0	0	0	0	1	0	0	0	1	0.4	0.3
SW - LESCHENAULT	0	0	0	0	1	0	0	0	0	0	0	0	1	1.3	1.7
SW - Geographe	0	0	0	1	0	0	0	0	0	1	0	0	2	3.4	3.3
SW - ELSEWHERE	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
SOUTH WEST(Total)	0	0	0	1	1	0	0	0	1	1	0	0	4	0.9	
GREAT SOUTHERN	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
GOLDFIELDS-ESPERANCE	0	1	0	0	0	0	0	0	0	0	0	0	1	1.9	1.6
WA UNDETERMINED	0	0	0	0	0	0	0	0	0	0	0	0	0		
INTERSTATE	0	0	0	0	0	0	0	0	0	0	0	0	0		
WA TOTAL (does not include interstate)	**2**	**1**	**1**	**2**	**2**	**0**	**2**	**1**	**1**	**3**	**1**	**0**	**16**		

The highest number of BFV cases reported was from the Kimberley and South West regions, with 9 and 4 cases respectively. Data from WA's South West is further divided into four regions (Peel, Leschenault, Geographe and SW Elsewhere) to provide a more detailed breakdown of disease distribution. The majority of cases reported in the South West were notified from the Geographe region (n=2).

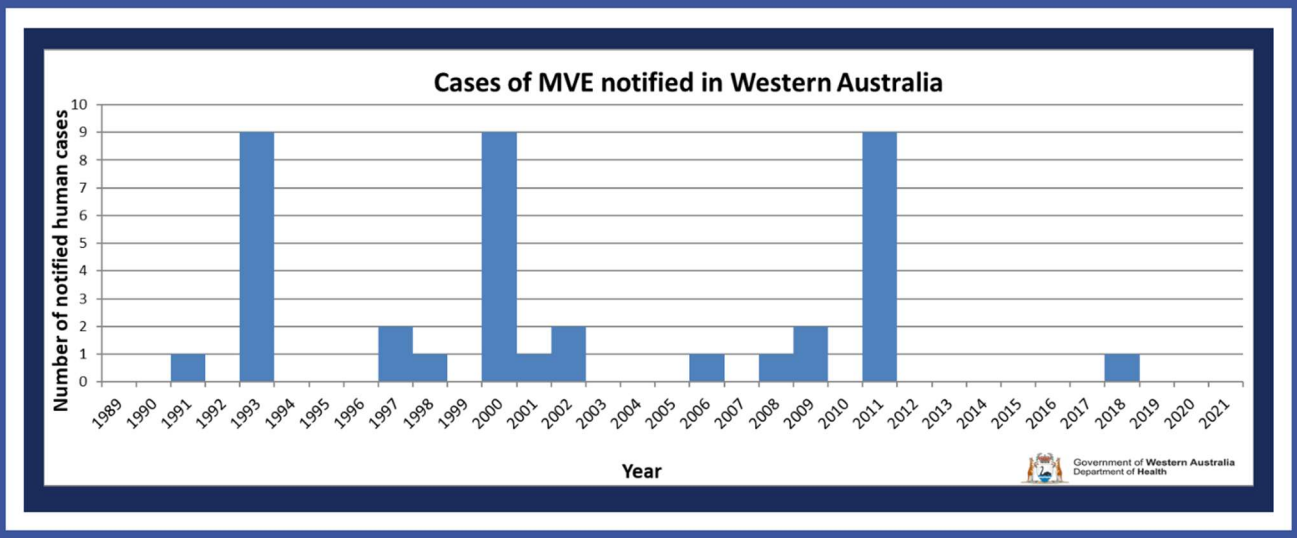
For all disease data tables in this report, the Crude Rate (CR) represents the number of disease notifications per 100,000 population in each region and the Age Standardised Rate (ASR) adjusts for differences in the age distribution between the regions to enable direct comparison of the rates across regions. The highest CR of 25.0 per 100,000 was recorded from the Kimberley region, while the highest ASR of 24.0 per 100,000 was recorded from the Gascoyne region.

2.3 Murray Valley encephalitis

Murray Valley encephalitis virus and West Nile (Kunjin) virus disease case data summary

Western Australia 2020-21

Data reflected in this summary of mosquito-borne disease is taken from the Western Australia Notifiable Infectious Disease Database (WANIDD) and includes enhanced surveillance data collected by Population Health Units and local governments (only locations with notified cases of disease are shown in tables and figures).



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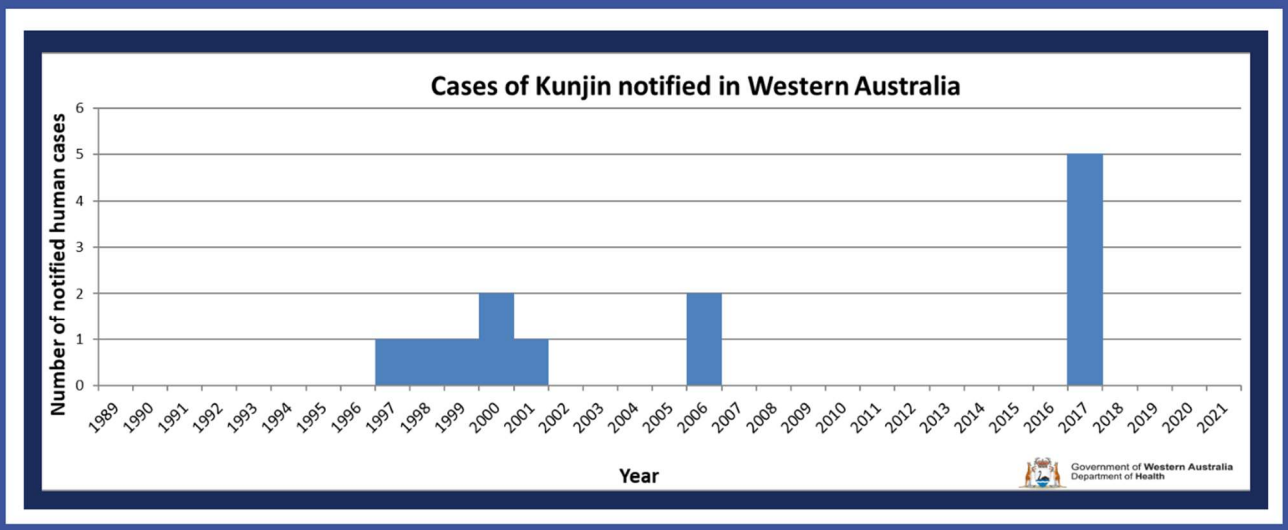
cases of MVE and KUNV

reported between 1 July 2020 and 30 June 2021 in WA



The rare but potentially fatal Murray Valley encephalitis (MVE) virus is endemic in the Kimberley region and epidemics can at times extend further south into the Pilbara. The virus is occasionally active in regions further south, including the Gascoyne, Goldfields and Midwest.

Only 1 in 1000 people bitten by a mosquito carrying the virus will develop disease symptoms. In young children, symptoms of MVE can include fever, floppiness, irritability, excessive sleepiness and fits. In older children and adults, symptoms can include fever, drowsiness, confusion, headache, stiff neck, nausea, vomiting, muscle tremors and dizziness. Patients with severe MVE infections become ill very quickly with confusion, worsening headaches, increasing drowsiness and possible seizures. Patients can slip into a coma, suffer permanent brain damage or die.

In 2020-21, there were no MVE cases notified in WA (Figure 2). The last confirmed case of MVE was acquired in June 2018, although it was not possible to definitively determine the location where the infection was acquired. This was likely to be either the Kimberley, Pilbara or Northern Territory. Prior to 2018, the last confirmed cases of MVE in WA occurred in 2011, with nine cases reported between January-May.

2.4 West Nile virus Kunjin strain

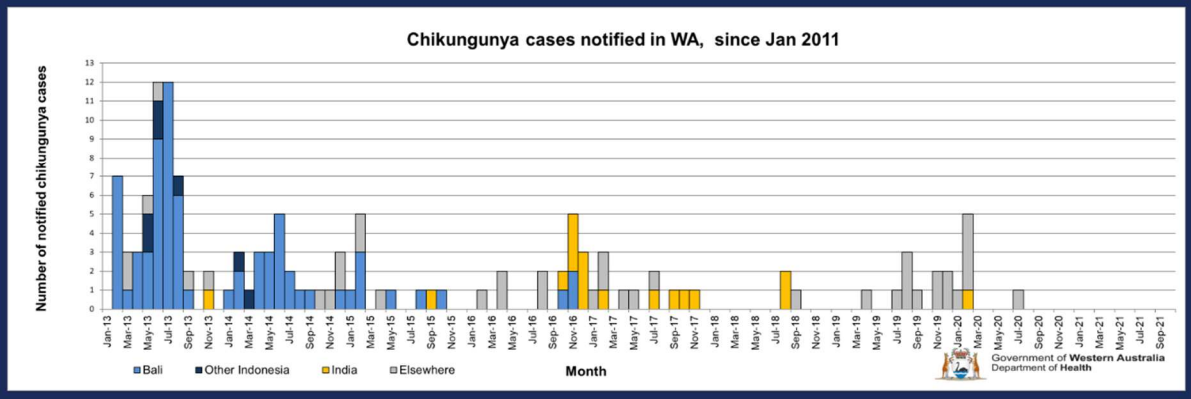
West Nile virus Kunjin strain (WNV_{KUN}) is closely related to MVE virus. Symptoms of Kunjin (KUN) disease are similar to, but generally less severe, than MVE although it is often associated with joint pain. In 2020-21, there were no KUN cases notified in WA. The most recent cases were acquired between April - June 2017, with five cases notified.

3.0 Exotic mosquito-borne diseases

Exotic Mosquito-borne Diseases

2020-21 Summary

Data reflected in this summary is taken from the Western Australia Notifiable Infectious Disease Database (WANIDD) and includes enhanced surveillance data collected by Population Health Units. The displayed exotic diseases are not acquired in WA, but are typically notified from WA residents and others being diagnosed in WA after international travel.



10

exotic mosquito-borne disease cases

have been reported between 1 July 2020 and 30 June 2021 in Western Australia

CHIKUNGUNYA

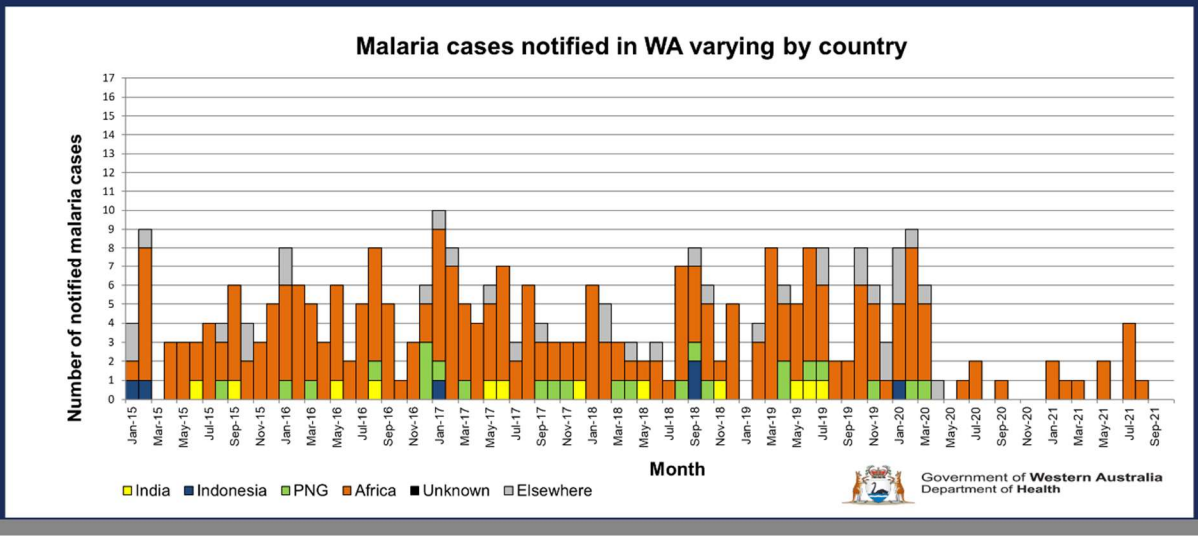
1 CASE

- Notified in WA during 2020-2021, acquired in Africa.
- Symptoms of CHIKV disease are similar to RRV, including fever, chills, muscle aches, and rash on the limbs and torso. Many patients experience joint pain in the hands or feet.
- Major vectors of CHIKV are *Aedes aegypti* and *Aedes albopictus* mosquitoes, neither of which are present in WA.
- Local mosquito species suspected of transmitting CHIKV.
- Infection usually occurs in Africa and Asia, recently Pacific islands.

MALARIA

9 CASES

- Notified in WA during 2020-2021, acquired mainly in Africa.
- Caused by infection with Plasmodium parasite species transmitted through bites from infected Anopheles mosquitoes.
- Malaria symptoms can include fever, chills, headache, sweats. Some infections can be fatal.
- Treatment relies on early diagnosis and specific anti-malarial medication.
- Infection risk is present in tropical Asia, Africa, Central & South American regions.



Exotic Mosquito-borne Diseases

2020-21 Summary

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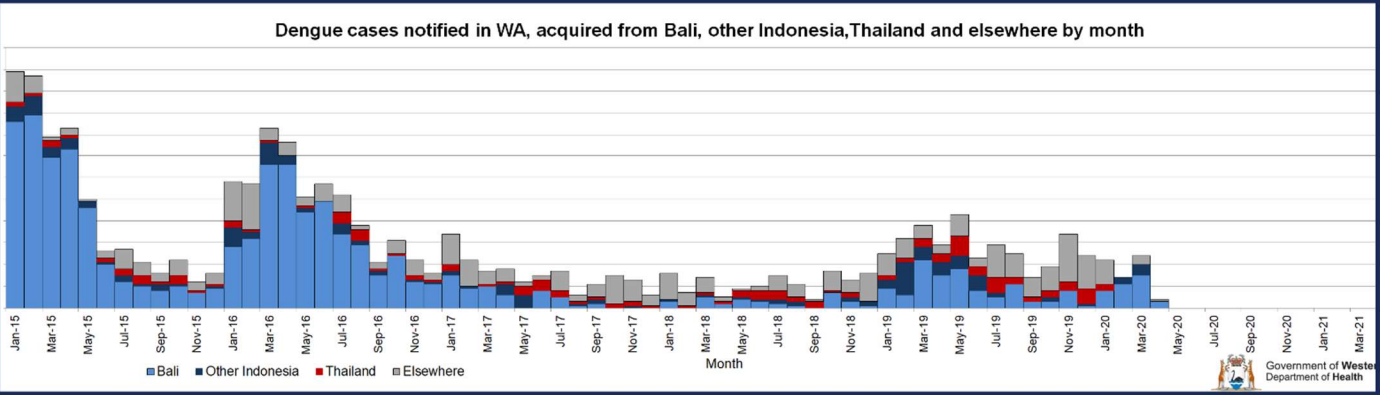


JAPANESE ENCEPHALITIS

0 CASES

- Estimated total of 68,000 cases worldwide per year, with up to 30% being fatal.
- Symptoms range from mild febrile illness to severe encephalitis and death.
- JE virus is present through most tropical Asian regions.
- JE virus is not endemic to WA although the mosquito vector *Culex annulirostris* is present.
- The most recent case of JE notified in WA was in 2018 acquired in Thailand.

DENGUE

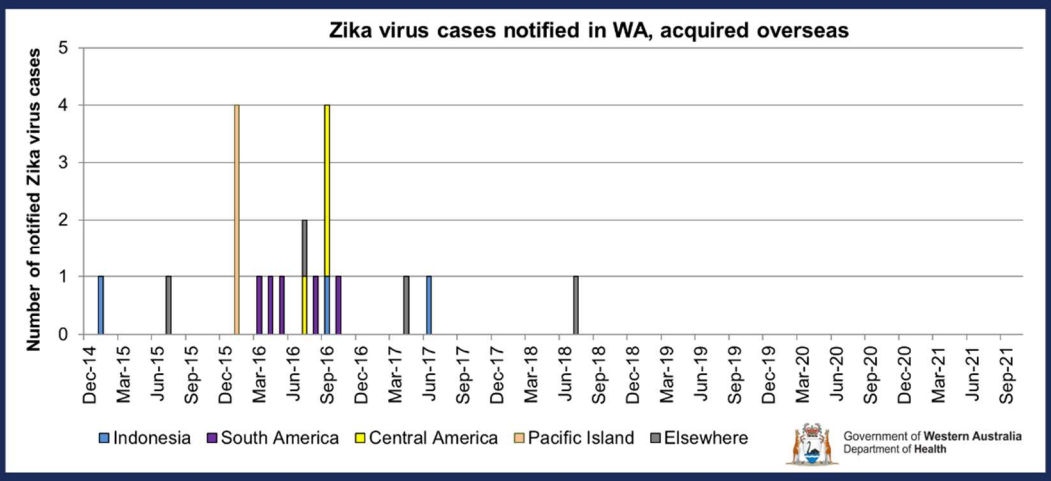
0 CASES

- 4 serotypes of dengue virus
- Dengue fever symptoms include fever, headache, muscle & joint pain, and rash.
- Subsequent infections can lead to potentially fatal dengue haemorrhagic fever and shock syndrome.
- DENV spread by infected *Aedes aegypti* and *Aedes albopictus* mosquitoes, neither of which are present in WA.
- **Due to COVID-19, international travel has all but stopped to and from Australia, which has also dramatically decreased rates of exotic disease cases.**

ZIKA VIRUS

0 CASES

- Zika virus is typically present in Africa with occasional outbreaks in Asia.
- Since 2015, virus activity spread to Pacific Ocean, South America, Central and North American regions.
- Research suggests that ZIKV infection in pregnant women can be linked to abnormal foetal brain development and microcephaly.
- ZIKV infection symptoms include fever, rash, conjunctivitis and muscle & joint pain.
- Research also indicates that ZIKV can be sexually transmitted between humans



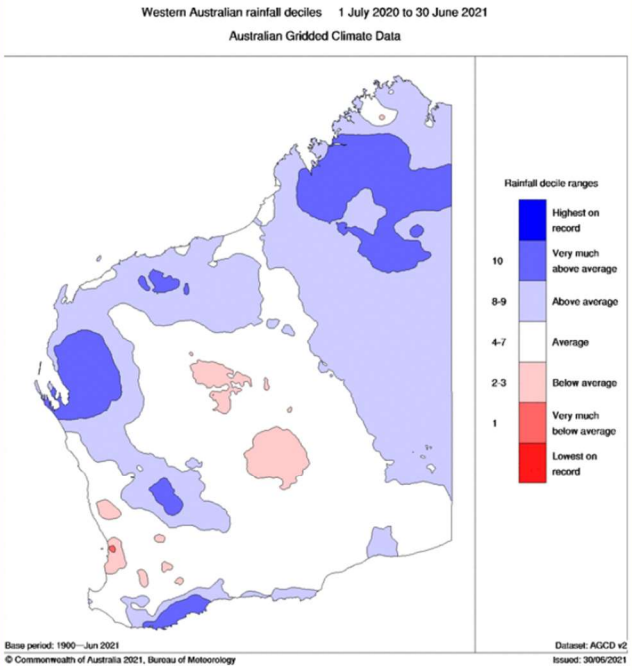
4.0 Climatic conditions

WA CLIMATIC CONDITIONS

2020-21 Summary

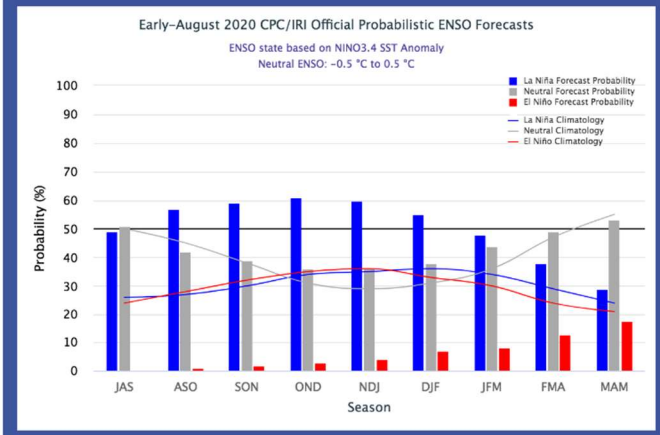
RAINFALL

Rainfall from July 2020 to June 2021 was above average, mainly during Spring and Summer months which is typical of a La Niña pattern.
A succession of tropical low weather systems brought heavy rainfall to coastal and inland areas in the Kimberley, Gascoyne and Great Southern regions.



EL NIÑO - SOUTHERN OSCILLATION (ENSO)

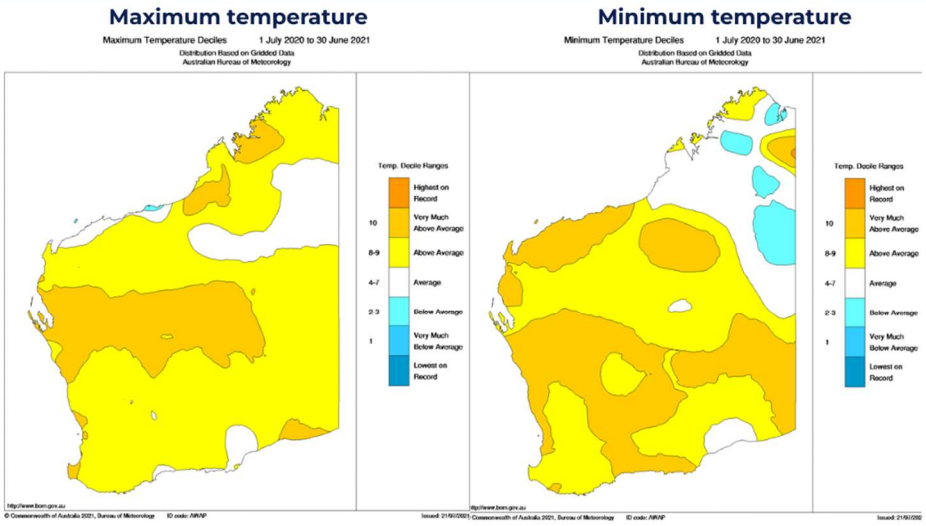
The Southern Oscillation Index has remained predominantly neutral during 2020 with some sporadic La Niña conditions during Spring and Summer months.
A La Niña event is often associated with increased rainfall and tidal events in some parts of Australia. The Indian Ocean Dipole remained mostly neutral for the majority of 2020 and 2021.



El Nino-Southern Oscillation (ENSO) prediction model forecast for the second half of 2019 and early 2020. Source: International Research Institute for Climate and Society.

TEMPERATURE

The majority of the state experienced above average temperatures during the year. Overall WA in the west experienced dry conditions and wet in the northern and central parts.



Temperature values for the 2020-21 financial year (data source: Commonwealth Bureau of Meteorology)

4.1 El Niño-Southern Oscillation (ENSO)

El Niño refers to extensive warming of the central and eastern tropical Pacific that leads to a major shift in weather patterns across the Pacific. La Niña refers to extensive cooling of the central and eastern tropical Pacific Ocean and is sometimes considered the opposite of El Niño. La Niña events are associated with increased probability of wetter conditions over much of Australia and has been correlated with higher numbers of tropical cyclones during cyclone season. Importantly for WA, La Niña conditions translate to increased occurrence and magnitude of high tides (including an increased frequency of 'king' tides). This is particularly important in the South West of WA, where the majority of mosquito egg-hatching is tidally driven.

During 2020-21, WA experienced mostly neutral, with some sporadic La Niña conditions during spring and summer months. These conditions were associated with above average rainfall patterns and an increase in the frequency and magnitude of tidal surges. Overall, mosquito populations were above average in many of the high-risk areas of WA (including the South West and Kimberley regions) compared to recent years.

4.2 Rainfall

During 2020-21, the overall rainfall pattern was above average, particularly during spring and summer months, which is typical of a La Niña pattern. By comparison, winter and autumn months were below average for most of the state.

The quarterly rainfall breakdown (Figure 4A-D) indicates the vast areas of above average rainfall that were attributed to a succession of tropical low weather systems that brought significant amounts of rainfall to WA.

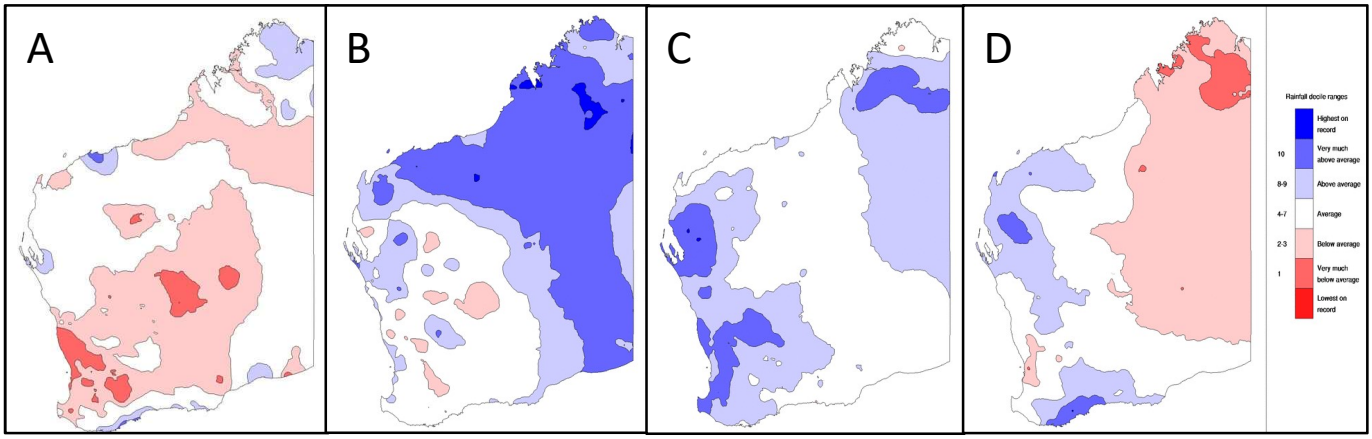


Figure 4 A-D: Three-monthly summaries of Western Australian rainfall deciles. A: July-September 2020; B: October-December 2020; C: January-March 2021; D: April-June 2021 (source: Commonwealth Bureau of Meteorology)

4.3 Temperature

4.3.1 Maximum temperature

Maximum temperature deciles were the highest on record for much of WA during winter and spring, with most of the State experiencing maximum temperatures above average, to the highest on record (Figure 5). Maximum temperatures remained high for the northernmost and southernmost regions of WA during all quarters. Coastal and interior regions experienced some

below average temperatures during summer months. Combined with above average rainfall, WA experienced one of the coolest, wettest spring and summer seasons in recent years.

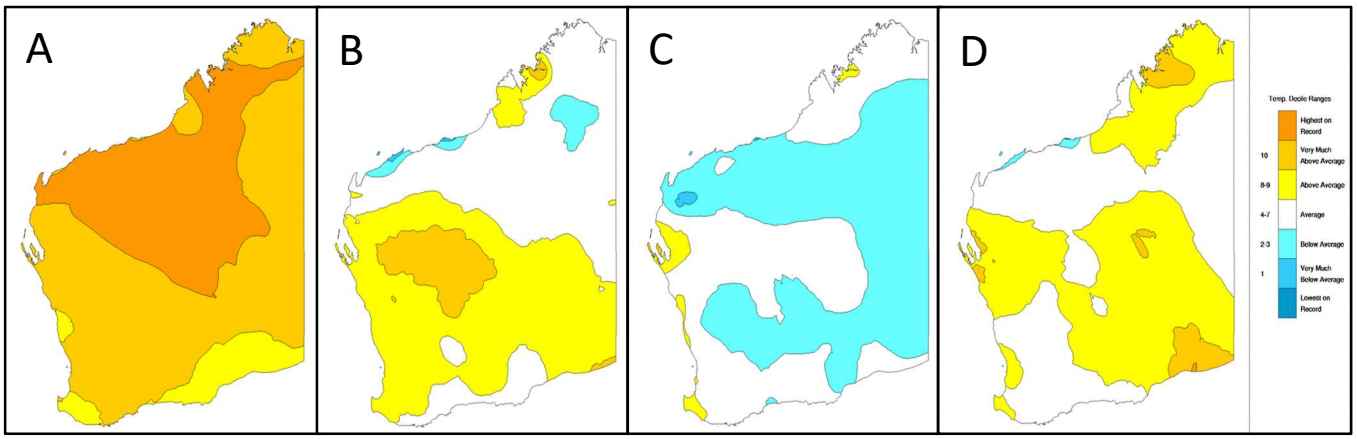


Figure 5 A-D: Three-monthly summaries of Western Australian maximum temperature deciles. A: July-September 2020; B: October-December 2020; C: January-March 2021; D: April-June 2021 (source: Commonwealth Bureau of Meteorology)

4.3.2 Minimum temperature

Minimum temperatures were typically average to above average across WA during 2020-21 (Figure 6), while summer and autumn in the north eastern regions was below to very much below average. With temperature and rainfall above average this season, conditions for mosquito breeding were more supportive than in 2019-20, leading to increased mosquito and virus activity.

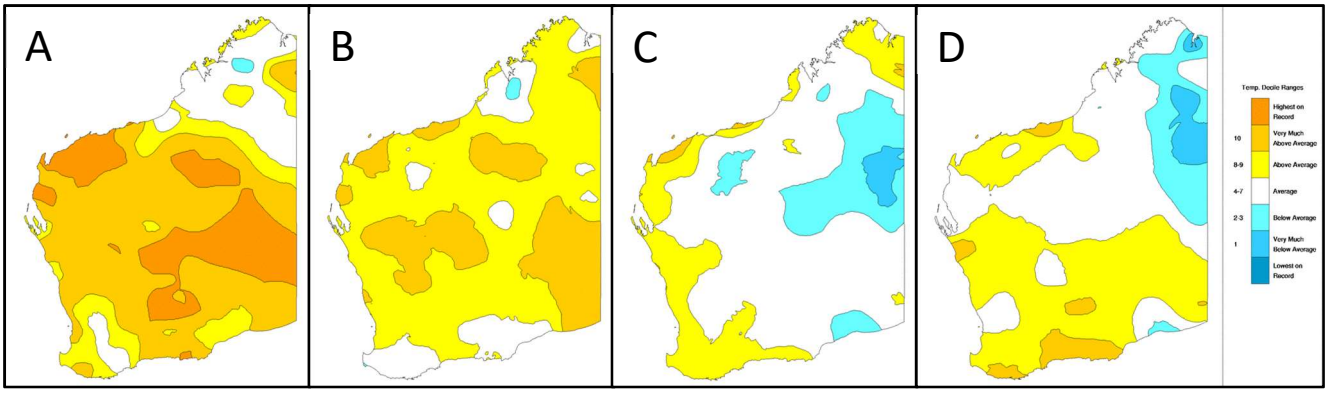


Figure 6 A-D: Three-monthly summaries of Western Australian minimum temperature deciles. A: July-September 2020; B: October-December 2020; C: January-March 2021; D: April-June 2021 (source: Commonwealth Bureau of Meteorology)

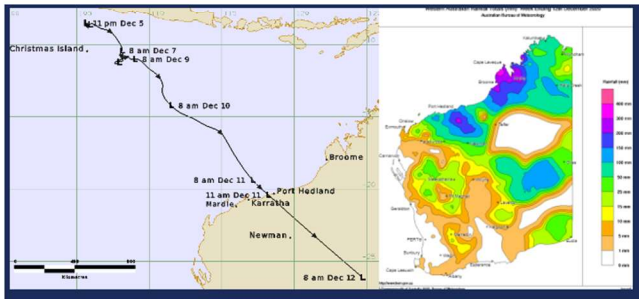
4.4 Australian tropical cyclone season summary

WA CLIMATIC CONDITIONS

2020-21 Summary

CYCLONES and WEATHER SYSTEMS

Tropical Cyclone (TC) Seroja was the only ***severe*** *tropical cyclone to make landfall in the northwest of WA in the 2020-2021 season. Tropical Low 02U, 08U and 12U were other weather systems of note that influenced heavy rainfall and storm surges in the northwest, coastal and southern regions of WA.*

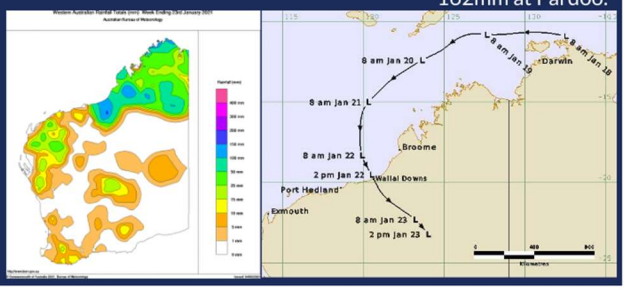


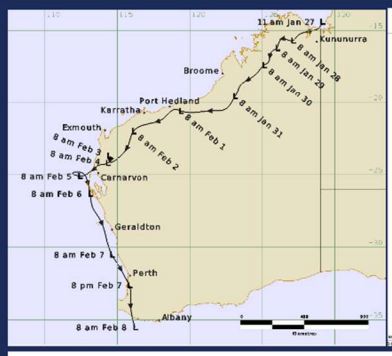
A weak tropical low formed to the north of Christmas Island on 5 December 2020. It made landfall west of Port Hedland on 11 December with heavy rainfall across the west Kimberley and Pilbara regions. The highest 24 hour rainfall total was 163mm at Carraba south of Port Hedland. Several days of continued heavy rain led to major flooding of the Nullagine River, Coongan River and Shaw River.

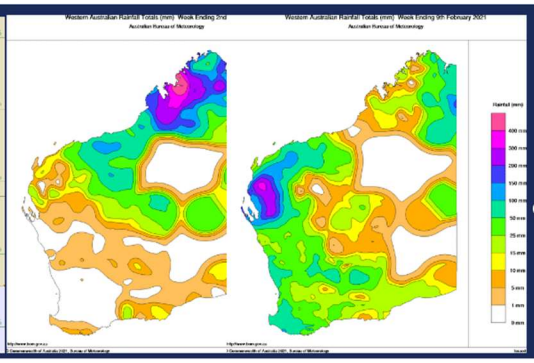
Tropical Low 02U

Tropical Low 8U

A tropical low formed north of the Northern Territory on 18 January and moved south then southeast towards WA. It crossed the coast near Wallal Downs on 22 January, producing heavy rainfall through the Kimberley and Pilbara regions. The highest 24 hour rainfall total was 162mm at Pardoo.





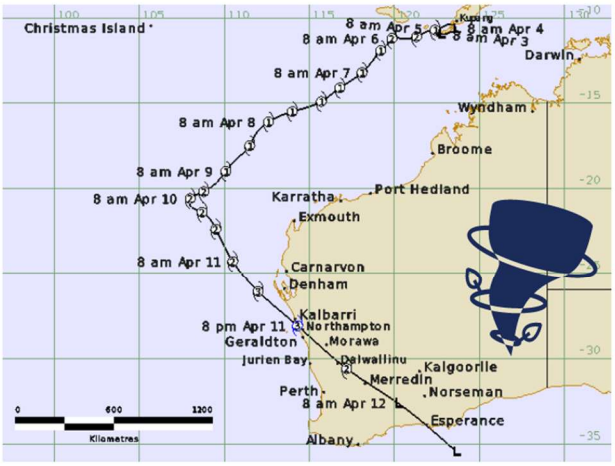


Tropical Low 12U

A tropical low developed near the WA/NT border on 27 January and tracked southwest over land. It moved slowly SW through the regions then over water near Carnarvon 9 days later before moving in a southerly direction towards Perth. It produced extended periods of heavy rainfall as it moved over the Kimberley, Pilbara and Gascoyne regions, flooding rivers and roads across the districts. The highest 24 hour rainfall total was 153mm at Hill Springs. Many locations between Jurien Bay and Derby recorded at least 90mm within a 24 hour period.

Tropical Cyclone Seroja

This slow moving tropical low developed near Timor on 3 April. As it moved towards Australia it impacted with another tropical low that briefly developed into TC Odette. Odette moved to the north and dissipated, while Seroja intensified and moved south towards the WA coast. It made landfall south of Kalbarri and finally dissipated inland near Merredin. Storm surges and heavy rainfall were recorded from Kalbarri and Northampton, while increased rainfall was experienced by many locations in the Wheatbelt and Goldfields regions.



Cyclone track maps and information summaries for the 2020-2021 financial year (data source: Commonwealth Bureau of Meteorology)

5.0 Mosquito-borne disease surveillance programs

MOSQUITO SURVEILLANCE PROGRAMS

2020-21 SUMMARY

SOUTH WEST WA Mosquito Trapping Data

76%

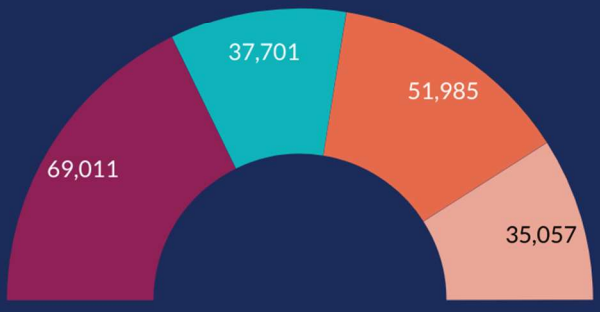
of all mosquitoes trapped were *Aedes camptorhynchus*

Fortnightly mosquito trapping at 23 permanent coastal trap sites between Mandurah and Dunsborough allows for the surveillance of RRV and BFV in mosquito populations across one of the highest risk areas for these diseases in WA.

193,754

Adult mosquitoes collected

Mosquito collections by region



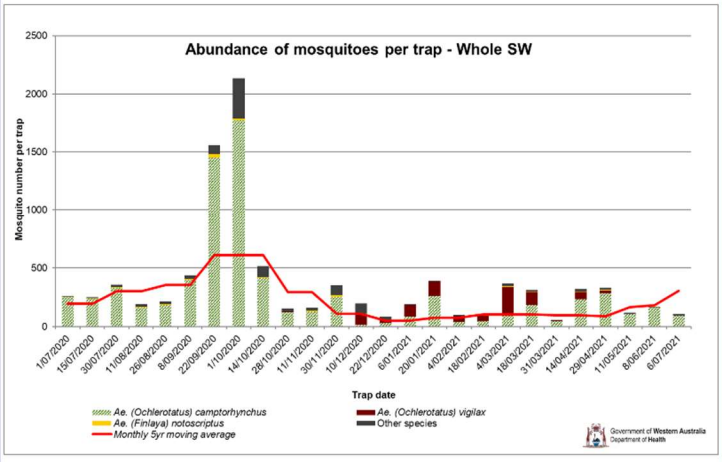
Peel (35.62%) Leschenault (19.46%)
Busselton (26.83%) Capel (18.09%)

Peel region comprises - Mandurah, Murray, Rockingham, Waroona Shires

Leschenault region comprises - Bunbury, Dardanup and Harvey Shires

Geographe region comprises - Busselton and Capel Shires

There were widespread detections of RRV in the Peel, Leschenault and Geographe regions of WA through the 2020-21 year. RRV was detected at the majority of sites, with *Aedes camptorhynchus* being the predominant vector species. BFV was detected twice during the 2020-21 season, also from *Ae. camptorhynchus*. Mosquito specimens were collected by Medical Entomology and processed by PathWest Laboratory Medicine.

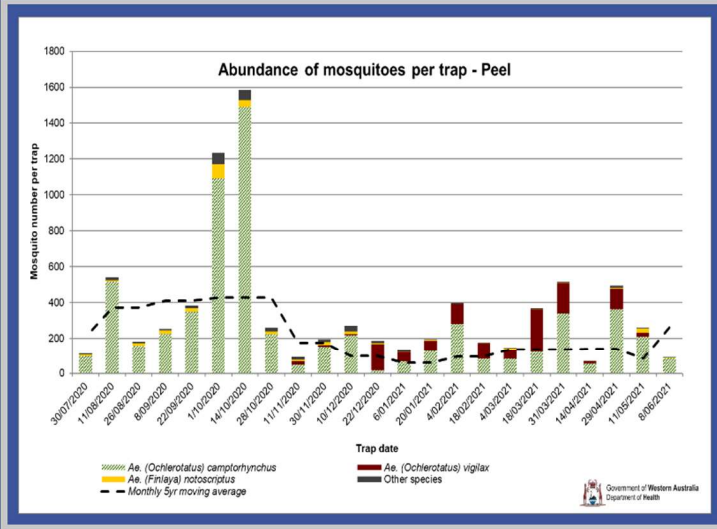


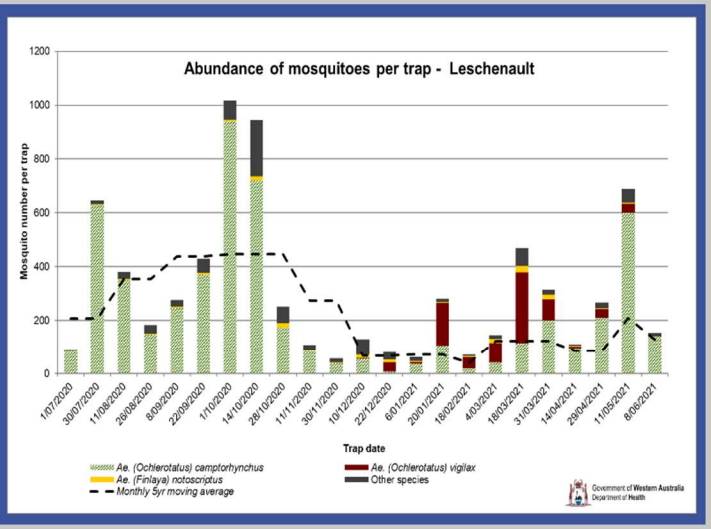
5.1 South West arbovirus surveillance program

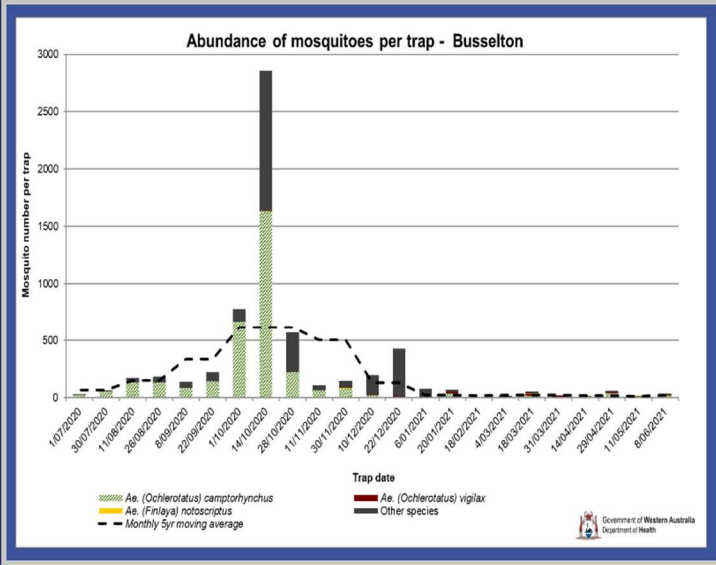
SOUTH WEST WA MOSQUITO TRAPPING DATA

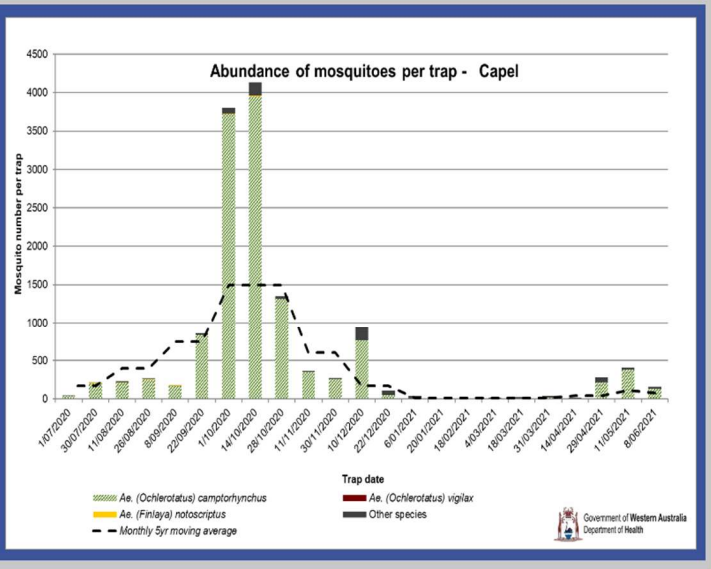
Outbreaks of RRV and BFV occur in the South West region every three to five years. The Department undertakes regular arbovirus surveillance in this region, from Mandurah to Busselton, to monitor virus activity and provide an early warning of increased disease risk. Monitoring of mosquitoes and mosquito-borne virus activity in the South West region commenced in 1987.

The stronger La Nina weather conditions resulted in some early above average mosquito abundance across the South West region with significant increases in some months. These increases were due to ideal spring weather conditions and increased tidal activity causing larger than usual hatching events.
The dominant species collected around the Peel region were *Aedes camptorhynchus*, *Ae. notoscriptus and Ae. vigilax*.
Aedes camptorhynchus and the spring species *Ae. clelandi* and *Ae. hesperonotius* were the dominant species at sites further south.
High numbers of *Ae. vigilax* are usually observed from December onward, however this did not occur during the 2020-2021 summer.









5.2 MVE and WNV_{KUN} virus surveillance

In WA, the Department monitors flavivirus activity primarily via its sentinel chicken program. This surveillance program is also supported by an annual mosquito survey.

The aim of this program is to provide an early warning system for the detection of MVEV and WNV_{KUN} activity in WA's north. This in turn helps to inform LG mosquito management efforts, as well as the development and release of media statements advising the general public to take personal protection measures against mosquito bites.

5.2.1 Sentinel chicken flavivirus surveillance program

Chickens are bled by trained environmental health officers, veterinarians or volunteers and the blood samples are sent to PathWest to detect antibodies to these viruses.

When MVEV or WN_{KUN} virus is detected, the information is used by the Department to issue a media statement warning residents and travellers to the affected regions of the increased risk to public health and the need to take personal protection measures to prevent mosquito bites. The confirmation of virus activity is reported to LGs, who can then undertake appropriate management activities to reduce mosquito numbers and the potential for virus transmission.

It is only through the integrated program involving the Department, PathWest and LGs that the system can be effective in providing an early warning detection of these mosquito-borne viruses and protect the public from potentially fatal mosquito-borne diseases.

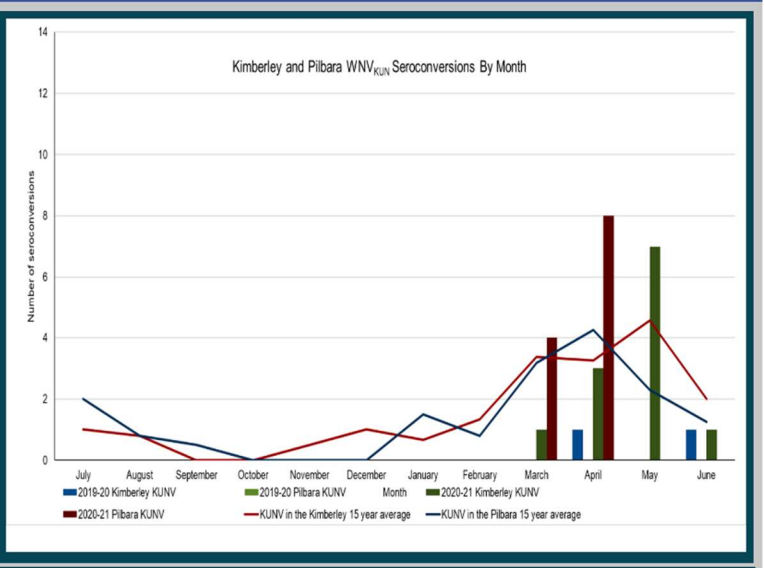
Photo courtesy of ME – Officer checking welfare of sentinel chicken flock in the Kimberley region of WA.

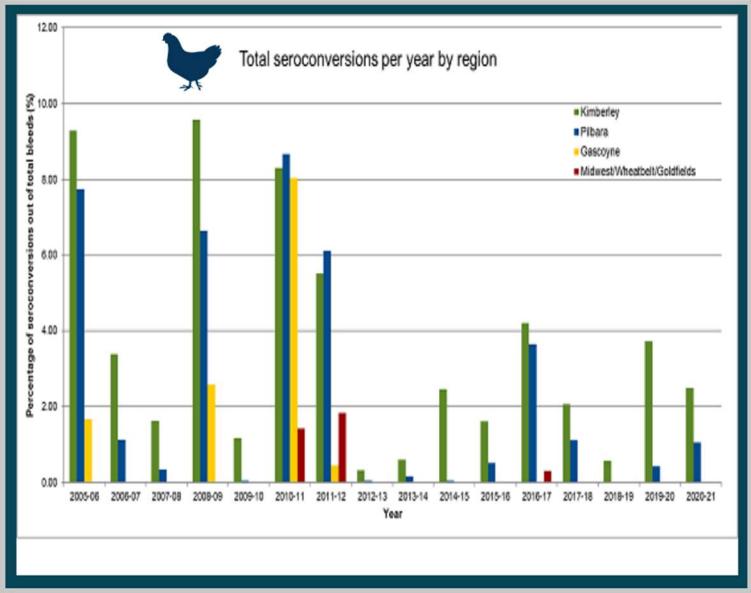
2020-21 Sentinel chicken surveillance data

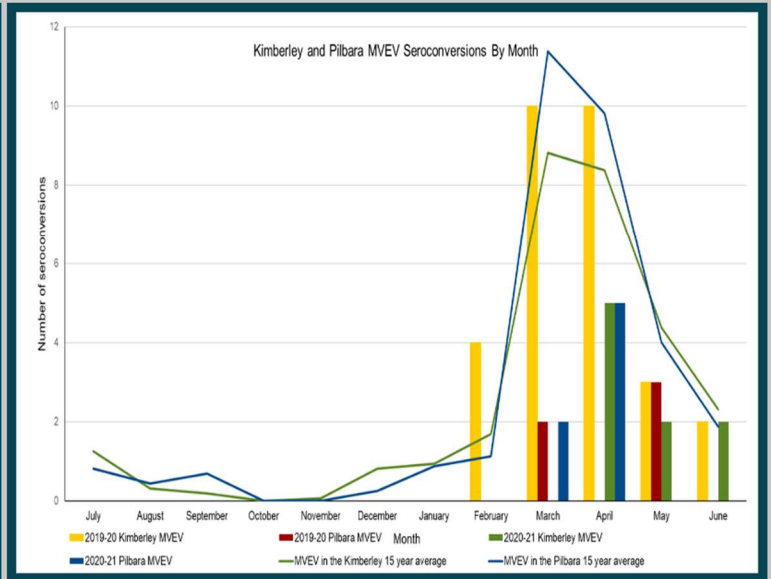
23 Sentinel chicken flocks located throughout WA

2660 Blood samples taken

43 Seroconversions detected







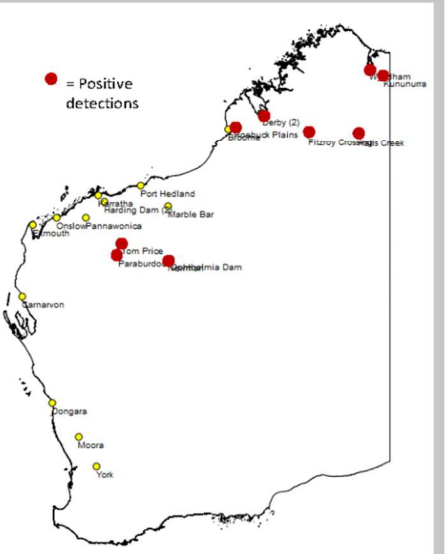
Seroconversions were detected in 43 of the 2660 samples tested (1.62%).

Flavivirus activity in sentinel chickens across northern WA in 2020-21 was higher than the 2019/20 season, with virus activity detected in all Kimberley sites , and as far south as the central Pilbara.

2020/21 Seroconversions

(1 July 2020 - 30 June 2021)

	Site	MVEV	KUN	MK	FLAVI	Total
KIMBERLEY	Wyndham	0	2	0	0	2
	Kununurra	3	1	2	1	7**
	Halls Creek	0	0	1	1	2
	Fitzroy Crossing	1	1	0	0	2
	Derby site 1	0	0	0	1	1
	Derby site 2	0	3	1	5	9
	Broome	0	0	0	0	0
	Roebuck Plains	1	1	0	0	2
PILBARA	Pt. Hedland	0	0	0	0	0
	Marble Bar	0	0	0	0	0
	Karratha	0	0	0	0	0
	Harding Dam	0	0	0	0	0
	Pannawonica	0	0	0	0	0
	Onslow	0	0	0	0	0
	Tom Price	1	0	1	0	2
	Paraburdoo	0	1	0	0	1
	Newman	0	3	0	0	3*
	Ophthalmia Dam	2	4	3	0	9
GASC.	Exmouth	0	0	0	0	0
	Carnarvon	0	0	0	0	0
MIDWEST - WHEATBELT	Dongara	0	0	0	0	0
	Moora	0	0	0	0	0
	York	0	0	0	0	0
	TOTAL	8	16	8	8	40



* One Seroconversion preliminary positive, excluded from total as confirmatory sample not submitted

** Two Seroconversions preliminary positive, excluded from total as confirmatory sample not submitted

5.2.2 Northern arbovirus surveillance program

2020 Northern mosquito survey

50

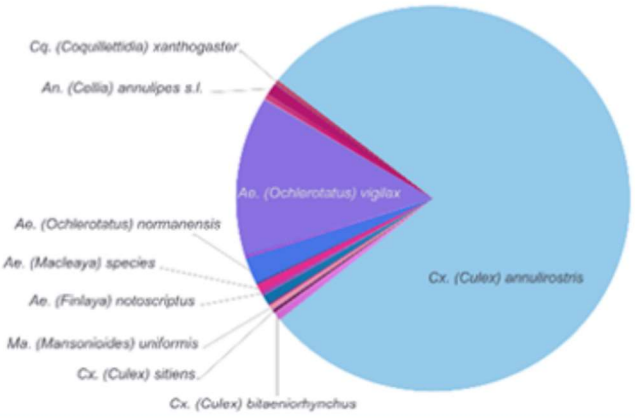
Mosquito species collected during trapping period from Kimberley region only.
(Trapping period March 2020)

11 of the 50

mosquito species were significant disease vectors or major pests impacting amenity.

Mosquitoes of public health significance collected in 2020

Trap abundance of mosquito species: 2020 Northern WA survey



92%

were vector species

the majority of mosquitoes collected were of 2 main vector species

Culex annulirostris

Aedes vigilax

Full list of collected mosquito species:

- *Ad. (Aedeomyia) catasticta*
- *Ae. (Finlaya) britteni*
- *Ae. (Finlaya) pecuniosus*
- *Ae. (Macleaya) tremulus*
- *Ae. (Neomelanoconion) lineatopennis*
- *Ae. (Ochlerotatus) E.N. Marks' species No. 71*
- *Ae. (Ochlerotatus) normanensis*
- *Ae. (Ochlerotatus) pseudonormanensis*
- *Ae. species (unidentified) - new or difficult to ID species*
- *An. (Cellia) amictus*
- *An. (Cellia) hilli*
- *An. species (unidentified) - new or difficult to ID species*
- *Cx. (Culex) annulirostris*
- *Cx. (Culex) crinicauda*
- *Cx. (Culex) near E.N. Marks' species No. 92*
- *Cx. (Culex) sitiens*
- *Cx. (Culex) starckeae*
- *Cx. (Lophoceraomyia) cylindricus*
- *Cx. (Lophoceraomyia) hilli*
- *Hodgesia E. N. Marks' species No. 157*
- *Mimomyia (Eto) elegans*
- *Unidentifiable Aedes sp. (too damaged/features missing)*
- *Unidentifiable Culex sp. (too damaged/features missing)*
- *Ur. (Uranotaenia) paralateralis*
- *Ve. (Verrallina) funerea*
- *Ae. (Aedimorphus) alboscutellatus*
- *Ae. (Finlaya) notoscriptus*
- *Ae. (Macleaya) species*
- *Ae. (Mucidus) alternans*
- *Ae. (Ochlerotatus) E.N. Marks' species No. 159*
- *Ae. (Ochlerotatus) E.N. Marks' species No. 85*
- *Ae. (Ochlerotatus) phaecasiatus*
- *Ae. (Ochlerotatus) vigilax*
- *An. (Anopheles) bancroftii*
- *An. (Cellia) annulipes s.l.*
- *An. (Cellia) meraukensis*
- *Cq. (Coquillettidia) xanthogaster*
- *Cx. (Culex) bitaeniorhynchus*
- *Cx. (Culex) E.N. Marks' species No. 92*
- *Cx. (Culex) quinquefasciatus*
- *Cx. (Culex) squamosus*
- *Cx. (Culiciomyia) pullus*
- *Cx. (Lophoceraomyia) fraudatrix*
- *Cx. species (unidentified) - new or difficult to ID species*
- *Ma. (Mansonioides) uniformis*
- *Tripteroides (Polylepidomyia) punctolateralis*
- *Unidentifiable Anopheles sp. (too damaged/features missing)*
- *Ur. (Uranotaenia) albescens*
- *Ur. species*
- *Ve. (Verrallina) reesi*

2020-21 northern mosquito trapping

During 2020-21, mosquito collections were conducted in the Kimberley region of WA from 18 March to 11 April 2021. The trip was timed to coincide with the end of the wet season in the region. The trap sites were selected based on historical data of mosquito abundance, virus detection, proximity to sentinel chicken flocks and proximity to mosquito breeding habitats.

Traps were set at Meekatharra, Newman, Tom Price, Pt Hedland, Beagle Bay, Lombadina, Broome, Fitzroy Crossing, Warmum, Willare, Kununurra, Wyndham, Halls Creek and Derby, and surrounds. The mosquitoes were collected using dry ice (carbon dioxide) baited EVS (encephalitis virus surveillance) traps. The traps were set at or before sunset and retrieved close to or after sunrise the following morning. The mosquitoes were then frozen on dry ice and transported to the ME laboratory in Perth. It is estimated that almost 403 570 mosquitoes were collected over 261 traps.

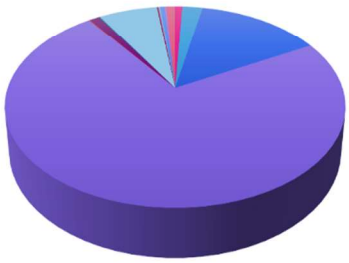
The mosquitoes are still being identified to species level in the ME laboratory. They will then be screened for detection of specific arboviruses of public health significance including RRV, BFV, MVEV and WNVKUN. Additionally, detection of a range of other alpha and flaviviruses, that may or may not cause illnesses in humans, can be screened.

The 2020-21 mosquito collections are still being processed and results will be reported in the 2021-22 Annual Report.

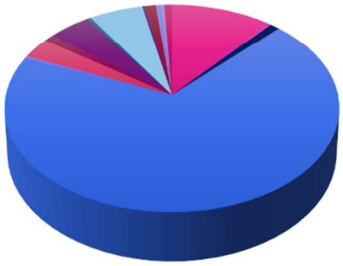
Virus detection results from 2018 and 2019 northern surveillance trips are included in the 2020-21 annual report as the mosquito identification was undertaken and provided by PathWest during the reported period.

2020 Northern mosquito survey

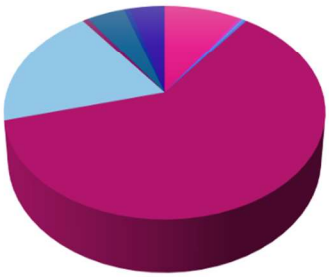
Diversity of mosquito species collected at a selection of trap sites as a result of variation in habitat



Derby - Willare



Halls Creek



Marble Bar

Main vector: *Aedes vigilax*

Main vector: *Aedes normanensis*

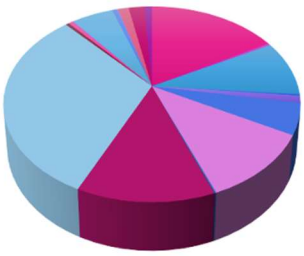
Main vector: *Anopheles annulipes*

A range of trap sites were selected to survey both built and natural environments. Therefore, some sites have very different mosquito species and proportions collected.

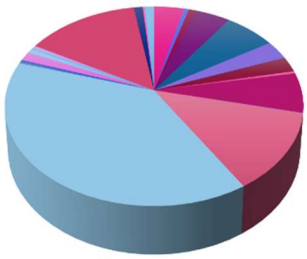
Main vector: *Culex annulirostris*

- Ae. (Finlaya) notoscriptus
- Ae. (Finlaya) pecuniosus
- Ae. (Macleaya) species
- Ae. (Ochlerotatus) normanensis
- Ae. (Ochlerotatus) vigilax
- Ae. species (unidentified) - new or difficult to ID species
- An. (Cellia) amictus
- An. (Cellia) annulipes s.l.
- An. (Cellia) hilli
- Cx. (Culex) annulirostris
- Cx. (Culex) quinquefasciatus
- Cx. (Culex) sitiens
- Cx. (Culiciomyia) pullus
- Cx. species (unidentified) - new or difficult to ID species
- Tripteroides (Polylepidomyia) punctolateralis
- Unidentifiable Aedes sp. (too damaged/features missing)
- Unidentifiable Anopheles sp. (too damaged/features missing)
- Unidentifiable Culex sp. (too damaged/features missing)
- Ve. (Verrallina) funerea

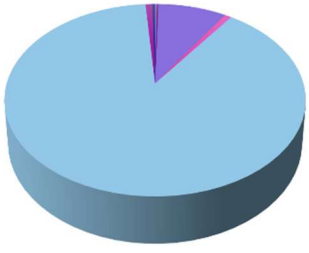
Derby - Willare



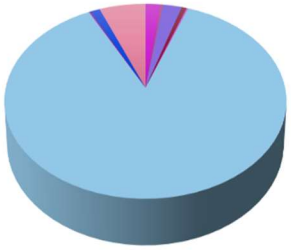
Millstream-Chichester



Kununurra



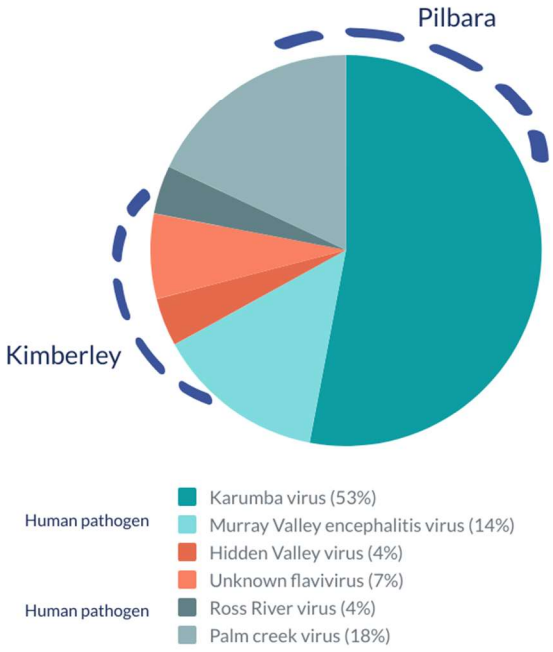
Wyndham & Ord River Floodplain



Coastal Pilbara

2018, 2019 Northern WA mosquito virus detection summary

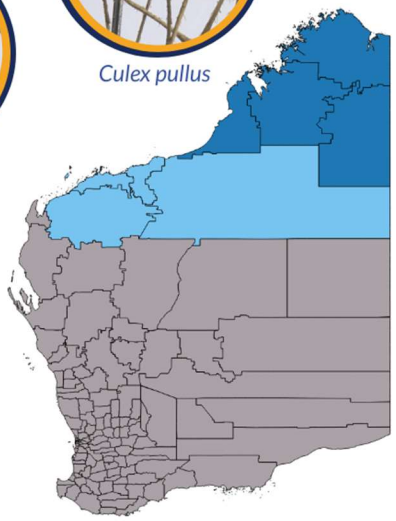
Proportion of arbovirus in positive Northern WA mosquito pools in 2018.
3,218 mosquito pools were tested by PCR - mosquitoes collected in March-April 2018.
28 pools (0.87%) were positive for a flavivirus or alphavirus.



Main vector: *Culex annulirostris*

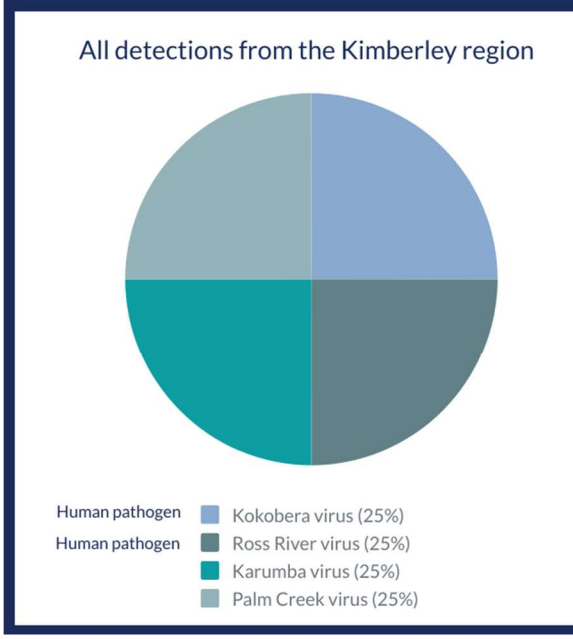
Culex sitiens

Culex pullus



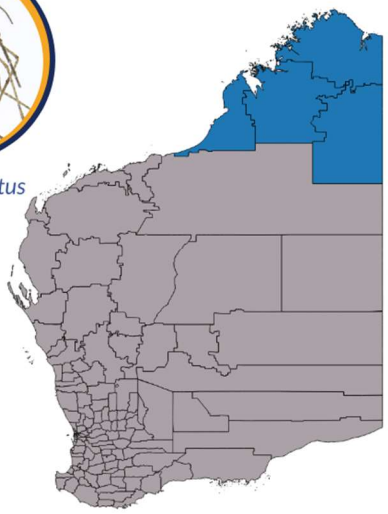
MVEV and RRV were detected in three mosquito species:
Culex annulirostris - both
Culex sitiens - MVEV
Culex pullus - MVEV

Proportion of arbovirus in positive Northern WA mosquito pools in 2019.
1,099 mosquito pools were tested by PCR - mosquitoes collected in March-April 2019.
4 pools (0.36%) were positive for a flavivirus or alphavirus.



Main vector: *Culex annulirostris*

Anopheles amictus



KOKV and RRV were detected in two mosquito species:
Anopheles amictus - RRV
Culex annulirostris - KOKV

6.0 Exotic mosquito detections in Western Australia

During 2020-21, the exotic mosquito surveillance program employed by the Commonwealth Department of Agriculture Science Support Program detected three importations of exotic mosquitoes. ME confirmed the identifications as *Aedes albopictus,* collected twice at Dampier seaport on a vessel and in oversized tyres, and *Cx. pipiens* species complex collected in a routine inspection of oversized tyres at an approved arrangement facility located in Perth. ME provided technical assistance and advice on mosquito control treatments and ongoing monitoring.

7.0 Aerial larviciding program across the South West of WA

The Department funds the use of a helicopter for aerial application of mosquito larvicide (https://ww2.health.wa.gov.au/Articles/A_E/Aerial-application-of-mosquito-larvicide) in high mosquito-borne disease risk areas in the South West of WA. The aerial larviciding program is an important preventative public health activity.

Annually, the coastal South West region experiences RRV and BFV activity. In some years this can lead to significant outbreaks of disease among local residents and visitors. By controlling vector mosquito populations with larvicide, the program aims to reduce the number of cases of both diseases.

Mosquito breeding is determined by environmental and climatic factors such as temperature, rainfall and tidal activity. LG staff monitor mosquito breeding habitat within their jurisdictions and assess when mosquito numbers need to be controlled. LG request aerial larvicide treatments by submitting a pre-treatment form to the Department.

The Department reviews the data and notifies the helicopter contractor of the proposed treatment date. LG staff record treatment details and conduct a post-treatment survey to confirm that the treatment was effective.

In 2020-21, the Department spent $674,663.67 (including contractor retainer cost) on the provision of aerial larviciding treatments through the procurement of helicopter services in the South West region. A total of 48 aerial larvicide treatments covering over 11,190 hectares were completed (Table 4). The larvicide products used were granulated forms of (S)-methoprene and *Bacillus thuringiensis israelensis* (Bti).

The Department has funded aerial larviciding for the control of mosquitoes and mosquito-borne diseases in the South West since the 1990's under contract with third parties. In 2019, a new procurement process was initiated by way of a public tender. The process was delayed considerably, with senior team members including the Contract Manager and Chairperson for the tender evaluation panel seconded to duties relating to COVID-19. Due to the highly specific nature of the program only one tender submission was received and subsequently declined, as there were substantial reservations regarding the respondent's ability to fulfil the contract requirements and it was not considered value for money.

In late 2020 a second procurement process was initiated with a significant revision of the specifications for the tender request, particularly with regards to the options for procuring specialised equipment necessary for the proposed work. Two submissions were received and evaluated by a panel, consisting of three ME officers and a Procurement Manager from the Department of Finance. The A/DG approved the evaluation panel's recommendation that Ag West

Pty Ltd be the preferred respondent and, following negotiations, the contract was awarded on 25 May 2021 for a 3-year term, with the possibility of two one-year extensions.

Table 4: The number of aerial larvicide treatments and area treated, by region, during 2020-21

Region	Treatments	Area treated (ha)
Peel	25	6,828
Leschenault	12	426
Geographe	11	1,999
Total	**48**	**9253**

8.0 Contiguous Local Authorities Group (CLAG) funding scheme

The Contiguous Local Authorities Group (CLAG) funding scheme (https://ww2.health.wa.gov.au/Articles/A_E/Contiguous-local-authority-group) is a mechanism to assist LGs with management, funding and advice on the technical aspects of health-driven mosquito control, in an effort to reduce the risk of mosquito-borne disease throughout WA.

CLAGs are comprised of one or more (contiguous or adjacent) LGs that share a common mosquito problem, usually in the form of natural or man-made habitat that breed mosquitoes which subsequently impact on surrounding communities.

The CLAG funding guidelines were revised in 2018-19, to reflect the importance of integrated mosquito management. The scheme now provides:

- 50% funding towards mosquito management costs related to chemicals, equipment, physical and cultural control (public education) strategies,
- up to 100% mosquito management related training costs, and
- 100% of the helicopter costs associated with the aerial larviciding program in high risk regions of WA's South West.

During 2020-21, the WESROC (Western Suburbs Regional Organisation of Councils) was endorsed by the MCAC, and there are now 19 active CLAGS in WA (Figure 7):

- Ashburton (Shire of Ashburton),
- Broome (Shire of Broome),
- Carnarvon (Shire of Carnarvon),
- Derby-West Kimberley (Shire of Derby-West Kimberley),
- East Pilbara (Shire of East Pilbara),
- East Swan River (Towns of Bassendean and Victoria Park, and Cities of Bayswater, Belmont and Swan),
- Esperance (Shire of Esperance),
- Exmouth (Shire of Exmouth),
- Geographe (City of Busselton and Shire of Capel),
- Halls Creek (Shire of Halls Creek),
- Leschenault (City of Bunbury and Shires of Dardanup and Harvey),
- Karratha (City of Karratha),
- Peel (Cities of Mandurah and Rockingham and Shires of Murray and Waroona),
- Port Hedland (Town of Port Hedland),

- South Coast (City of Albany),
- Southern Metropolitan (Cities of Cockburn and Kwinana),
- Swan-Canning Rivers (Primary members - Cities of South Perth, Canning, Melville and Perth;
- WESROC (Western Suburbs Regional Organisation of Councils) – Principal members are the Cities of Nedlands and Subiaco, Subsidiary members are the Towns of Claremont, Cottesloe and Mosman Park,
- Wyndham/East Kimberley (Shire of Wyndham East Kimberley).
- The Shires of Broomehill-Tambellup, Katanning and Gnowangerup began the process of forming the Upper Great Southern CLAG, however, it will not be formally endorsed by the MCAC until 2021-2022.

Due to carryover funds held by CLAGs from 2019-20 and some withheld funds pending future requirements being met, the Department was only required to provide $284,091.35 in new funding for the 2020-21 financial year. The amount each CLAG received was dependent on their unique requirements.

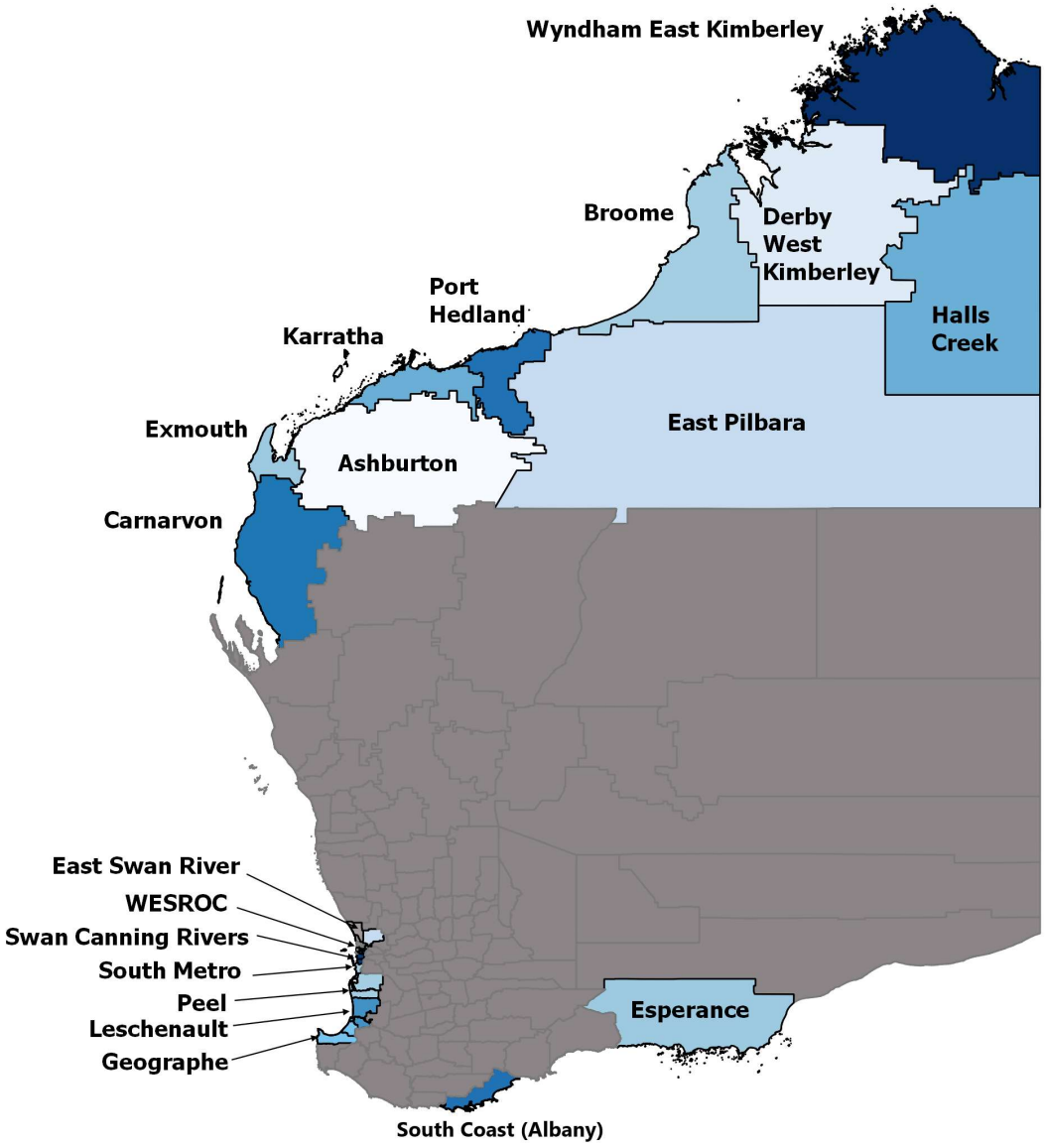


Figure 7: Map of Western Australia showing Contiguous Local Authorities Group (CLAG) boundaries of local governments participating in the CLAG funding scheme during 2020-2021

9.0 Fight the Bite

Fight the Bite (FTB) is a public awareness campaign coordinated by the Department, and promoted by LG, to actively raise awareness of mosquitoes and mosquito-borne disease in WA. The campaign was launched during 2015-16 and has evolved in the years since that time. A large number of LGs both in and outside of the CLAG scheme proactively work to promote the campaign throughout the State.

During 2020-21, A suite of new Fight the Bite (FTB) social media infographics has been developed in consultation with environmental health officers. These resources target specific mosquito management issues, unique to individual local government jurisdictions throughout WA. The resources were used by both the Department of Health and local government to promote mosquito awareness and are now available on the Fight the Bite campaign page (https://ww2.health.wa.gov.au/Articles/F_I/Fight-the-Bite-campaign).

The Department's FTB campaign continues to be promoted at a broader range of commercial and community outdoor cinemas across metropolitan and regional WA. Patrons attending outdoor cinemas may be at increased risk of mosquito exposure as the spring/summer timing of the cinema season, combined with the dusk screening of movies, coincides with the peak period of mosquito activity. Furthermore, outdoor cinemas are often surrounded by vegetation that provides harbourage for mosquitoes. For this reason, community and outdoor cinema stakeholders are supplied with a visually effective, counter-top display box designed to house brochures and bulk repellent for communal use. At many locations, FTB advertising is played prior to the movie as a timely reminder of the need to apply repellent. The Department also began trialling the use of permanent repellent dispenser stands at all Telethon Community Cinemas and a small number of engaged commercial outdoor cinemas. This allows repellent to be positioned strategically around the cinema site and also prevents theft of the repellent product. The stands have been very well received and will likely be used more widely to support FTB's repellent initiative into the future.

10.0 Other projects

10.1 Updating mosquito identification resources on DOH website?

More mosquito species were imaged and used to update training resources, including regional photographic keys and species description sheets that are now available on the DOH website Adult mosquito identification (https://ww2.health.wa.gov.au/Articles/J_M/Mosquito-identification-adult) .

11.0 Training workshops and forums

11.1 Mosquito management course

ME conducted a 2½ day mosquito management course that was hosted by the Shire of Broome from 24 – 26 March 2021. The course included theoretical and practical components, providing participants with the knowledge and skills required to develop and implement a mosquito management program for their jurisdictions.

The course was well attended by local government, industry, Water Corporation and Aboriginal environmental health service providers. Lectures were presented on topics such as mosquito biology, mosquito-borne diseases, mosquito control, and mosquito surveillance. Participants gained hands-on experience undertaking larval/mosquito surveillance and identification. A survey of participants indicated they really enjoyed the course and felt the knowledge acquired would enable them to confidently develop mosquito management plans for their local areas.

Photo courtesy of ME – Group photo of the 2021 Department of Health Mosquito Management Short Course, Broome

11.2 CLAG Forum 2021 – Back to Basics

In June 2021, the Biological and Applied Environmental Health Hazards Unit (Medical Entomology program) hosted the 9th Annual Combined CLAG forum as a one day event in Meadow Springs, Mandurah. This followed the previous one held in 2019 with last year's one being cancelled due to COVID.

A total of 67 participants attended on the day, including personnel from 21 Local Governments, Department of Health, Water Corporation and the South Eastern Regional Centre for Urban Landcare.

The key theme was "Back to Basics" focusing on the fundamental aspects of mosquito management- including chemical and cultural methods. CLAGs also presented by providing seasonal updates and sharing their experiences with both challenges and successes in mosquito management.

This forum was popular with and provided a forum for LGs to connect and share knowledge and advice with each other. Positive feedback received included;

"I thoroughly enjoyed the forum and left feeling very inspired. Well done for a successful and very informative CLAG Forum."

"It was my first Forum, it is an excellent avenue for networking with regional LGs/EHOs, and to get a feel for what other CLAGs are dealing with."

This gives evidence that this one-day event remains a high priority for many LGs around Western Australia. It is hoped that the information presented at the forum will be used as a tool by participants to improve current mosquito management programs throughout the State.

Photo courtesy of ME – participants at CLAG Forum 2021

11.3 Medical entomology and on-line refresher workshop recording

Following interest from CLAG members, as the 2020 CLAG Forum was not held due to COVID restrictions, an on-line one hour workshop was held for local government EHOs on 8 Dec 2020 on how to use the Atlas of Medical Entomology/Mosquito Monitoring App (https://medical-entomology.gaiaresources.com.au/atlas/home/). This forms part of the Atlas of Environmental Health, which provides a central repository for environmental health data, facilitates sharing of data between all levels of Government and enables Local Government Authorities to assess environmental health risks within their jurisdictions.

The Atlas can be used to input and review mosquito surveillance data including adult and larval mosquito collections as well as producing reports on human cases of mosquito-borne diseases. The field guide is a valuable resource that will assist users in correctly identifying mosquito species and fine-tuning surveillance efforts. Further, a public complaint register allows users to record details of public complaints and provides mapping tools to view cases within real-time to further assess the need to take appropriate action.

More than 30 participants from across WA attended live and a recording was made available for those not able to attend at the time. This can be accessed at https://youtu.be/WJ0SjicJSIg.

***IMPORTANT NOTE:* CONFIDENTIAL INFORMATION IS CONTAINED WITHIN THIS VIDEO RECORDING**

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To obtain more information or access to the Atlas, please contact medical.entomology@health.wa.gov.au

12.0 Impact from COVID-19 pandemic

The operations of the ME team were not impacted as significantly in 2020/21 due to COVID-19, compared to the previous year. Whilst two senior ME staff members remained seconded on COVID-19 related work, all positions in the team were able to be backfilled. Mosquito surveillance/control activities remained largely unaffected and LGs were able to access the aerial larviciding program, as required. Opportunities for LG to actively engage with the community and promote *Fight the Bite* still remained somewhat limited, but did improve significantly following the move to Phase 4 COVID restrictions. In-person CLAG meetings and the annual CLAG Forum were able to return, allowing individuals to once again network with one another.

This document can be made available in alternative formats on request for a person with disability.