

Mosquito & Mosquito Borne Disease Surveillance Report

2017/2018 Season

Local Government: Balonne Shire Council



Acknowledgements

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About this report

This report for Balonne Local Government Area outlines the findings from the GAT mosquito surveillance program and data from the Notifiable Conditions Register for the financial period 2017/2018. The report compares this data with the environmental factors (temperature and rainfall), to assess the risk of local transmission of dengue, chikungunya and Zika. The report also identifies the limitations with the data. The mosquito surveillance and the notifiable conditions data used in this report was extracted on 23 October 2018.

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Introduction

The Darling Downs Public Health Unit (DDPHU) has implemented a Gravid *Aedes* Trap (GAT) mosquito surveillance program with local governments within the Darling Downs Health (DDH) and South West Hospital and Health Service (SWHHS) areas. The GAT mosquito surveillance program assists public health authorities to determine the presence of *Aedes aegypti* and *Aedes albopictus*. The introduction, establishment and spread of invasive mosquito species within a region is of public health importance due to concerns over their role in the local transmission of mosquito borne diseases such as dengue, chikungunya and Zika.

The DDPHU monitors and evaluates the risk of transmission of notified imported mosquito borne diseases (like Zika and dengue) and local mosquito borne diseases (like Barmah Forest virus (BFV) and Ross River virus (RRV)) in its area of jurisdiction including the Balonne Local Government Area (LGA). Details of where mosquito surveillance activities were undertaken in the DDH and SWHHS areas can be found in appendix 1. This report outlines the findings from the GAT mosquito surveillance program and mosquito-borne diseases notifications data for Balonne LGA. It describes the climate of the region and evaluates the risk of local transmission of mosquito-borne diseases for the financial year period (01 July 2017 to 30 June 2018).

Emerging mosquitoes and mosquito-borne diseases as regional threat

Dengue, chikungunya, Zika and yellow fever are all transmitted to humans by the *Ae. aegypti* and *Ae. albopictus* mosquitoes (1). More than half of the world's population live in areas where these mosquito species are present. The presence of these mosquito species in areas where diseases such as dengue are not endemic creates the risk of local transmission in the event of an imported human case (1 & 2). *Ae. aegypti* is widespread throughout urban tropical north Queensland and has been detected during surveys in many towns in sub-tropical Queensland

as far south as Goomeri. *Ae. aegypti* has been detected in DDH and SWHHS areas, refer to appendix 2 for locations and the year of last detection.

Dengue, chikungunya and Zika are not endemic in Queensland (3); however, outbreaks may be triggered by imported viraemic cases entering a receptive area where the vector is present.

Outbreaks of potentially severe diseases, such as dengue and chikungunya, have increased in frequency in northern Queensland mainly in the Cairns and Hinterland Hospital and Health Service area, Townsville Hospital and Health Service area, and in the Torres and Cape Hospital and Health Service area (3 & 4). Between 1 July 2012 and 30 June 2017 there were 30 outbreaks of locally acquired dengue involving 531 cases and 1,360 notifications of overseas acquired dengue cases reported in Queensland (3). There were 65 cases of notified chikungunya in Queensland in this period with all cases acquired overseas and no notified yellow fever (3). Between 1 July 2012 and 30 June 2017 there were 50 Zika cases notified in Queensland. All these cases were confirmed overseas acquired infections (3).

In recent years there has been an increase in the number of exotic mosquito species detected at first ports in South East Queensland. This poses a public health risk as it may lead to the introduction of mosquitoes capable of transmitting serious mosquito borne viruses into highly populated areas and areas where they are currently not present. This demonstrates the importance of mosquito surveillance to ensure that relevant public health response can take place when required.

In addition to the GAT mosquito surveillance program, Balonne Shire Council staff have demonstrated an ongoing commitment to mosquito surveillance exhibited through their participation in other state-wide programs such as the 'Queensland Arbovirus Sentinel Surveillance System' Program.

The vector mosquito species that are targeted in the GAT mosquito surveillance program and the diseases spread by them are listed as table 1.

Table 1: Vector mosquito species and their relation to human diseases for Queensland

Mosquito species	Diseases in Humans						Vector for Dog heart worm
	Dengue fever	Zika Virus	Chikungunya	Ross River Virus	Barmah Forest Virus	Yellow Fever	
<i>Aedes aegypti</i>	✓	✓	✓	x	x	✓	x
<i>Aedes albopictus</i>	✓	✓	✓	x	x	✓	x
<i>Aedes notoscriptus</i>	x	x	x	✓	✓	x	✓
<i>Culex quinquefasciatus</i>	x	x	x	x	x	x	✓

GAT mosquito surveillance program

The GAT mosquito surveillance program helps the DDPHU to evaluate the risk of local disease transmission following the notification of imported mosquito borne diseases in the region. This program focuses solely on container breeding mosquitoes. The container breeding mosquitoes are those that breed in domestic environments such as bird baths and rainwater tanks in residential house properties. The mosquitoes can also be associated with commercial premises such as nurseries and tyre yards. The program also assists in the identification of high risk areas and high risk months for container breeding mosquitoes within DDH and SWHHS.

The GAT mosquito surveillance program commenced in DDH and SWHHS area in 2014/2015. GATs were chosen as the preferred surveillance method as they have been demonstrated to be easily transportable, cost effective and an efficient tool to conduct surveillance of container breeding mosquitoes. This program has enabled broad surveillance across DDH and SWHHS areas. This includes areas where container breeding mosquito surveillance has never been conducted before or has not been conducted for a long period of time. GATs were provided to local governments and training was provided by staff from the DDPHU. Balonne Shire Council joined the GAT mosquito surveillance program in 2014/2015 and has conducted surveillance every season since.

Although the objective of the GATs program was to identify and record information on *Ae. aegypti* and *Ae. albopictus*, information on other mosquito species that were trapped in the GATs (such as *Ae. notoscriptus* and *Culex quinquefasciatus* and other species) were also recorded. Species other than *Ae. notoscriptus*, *Cx. quinquefasciatus*, *Ae. aegypti* and *Ae. albopictus* were recorded as “other”. Mosquitoes that were unable to be identified such as those which were damaged were recorded as “non-identified”. Table 2 discusses information about each of the mosquito species.

Table 2: Species Information

Mosquito species	Species Information
<i>Aedes aegypti</i>	<ul style="list-style-type: none"> ▪ Container breeding mosquito and generally travels less than 200 meters from larval habitat. ▪ Currently, only found in Queensland and the only mosquito on the Australia mainland that is capable of transmitting dengue virus. ▪ Day time biter.
<i>Aedes albopictus</i>	<ul style="list-style-type: none"> ▪ Able to breed in both fresh water areas (bushlands) as well as

	<p>being a container breeder.</p> <ul style="list-style-type: none"> ▪ Is an aggressive and nuisance-biting mosquito and will bite during the day and in the evening. It has a substantial impact on the quality of life. ▪ In 2005, it was detected in the Torres Strait Islands and Government has implemented an intensive eradication program to prevent it from reaching the mainland. This species has been intercepted at several first ports.
<i>Aedes notoscriptus</i>	<ul style="list-style-type: none"> ▪ Container breeding mosquito. ▪ Generally, travels less than 200 meters from larval habitat. ▪ Often a severe nuisance pest that typically bites in the afternoon and at dusk. ▪ Found all over Australia.
<i>Culex quinquefasciatus</i>	<ul style="list-style-type: none"> ▪ Breeding is associated with urban freshwater habitats with high organic contents such as open drain and septic tanks. Breeding also occurs in domestic containers. ▪ Flight range is considered less than 2 kilometres. ▪ Considered a major nuisance pest and will bite humans both indoors and outdoors. ▪ Found all over Australia.

Methods

GATs mosquito surveillance data

Local government is responsible for the deployment of the GATs and collecting any trapped specimens. The GATs are serviced fortnightly and any specimens collected are sent to DDPHU for mosquito identification (species and gender), along with the relevant record sheets. This information was entered into the GAT mosquito surveillance program register. Mosquito surveillance data for this report was extracted from this register. Appendix 3 and appendix 4 outlines the locations of the deployed GATs.

Human mosquito borne disease notification data

Mosquito borne diseases are notifiable to Department of Health Queensland under the *Public Health Regulation 2018* (5) and collected information maintained in the Notifiable Conditions Register (NoCS) (3). This includes all alphavirus, bunyavirus, and flavivirus infections, and malaria. Queensland faces important public health threats from mosquito borne diseases, with the presence of *Ae. aegypti* in some LGAs (3). *Ae. aegypti* and *Ae. albopictus* are competent vectors for dengue, chikungunya, and Zika and their presence creates the risk of local transmission in the event of an imported human case (4).

From 1 January 2016, the national surveillance case definition for RRV infection was updated so that a single IgM positive serology result would no longer meet the case definition for infection, reducing the likelihood of false positive notifications (3). This is likely to have improved the validity of RRV infection notifications but makes comparisons with incidence rates in previous years more difficult. The reporting period for this report was not affected by this change in practice.

Notification data was extracted from NoCS for cases of mosquito borne diseases (valid or probable) with onset from 1 July 2017 to 30 June 2018.

Seasonal climate data

Monthly temperature and rainfall for the region was extracted from the Bureau of Meteorology (BOM) Australia for the reporting period (1 July 2017 to 30 June 2018). Financial years were analysed to best capture the seasonality of mosquito borne diseases, and to maintain consistency with state and national reporting conventions. Please note that no temperature data was available for Dirranbandi so St George data was used for this analysis.

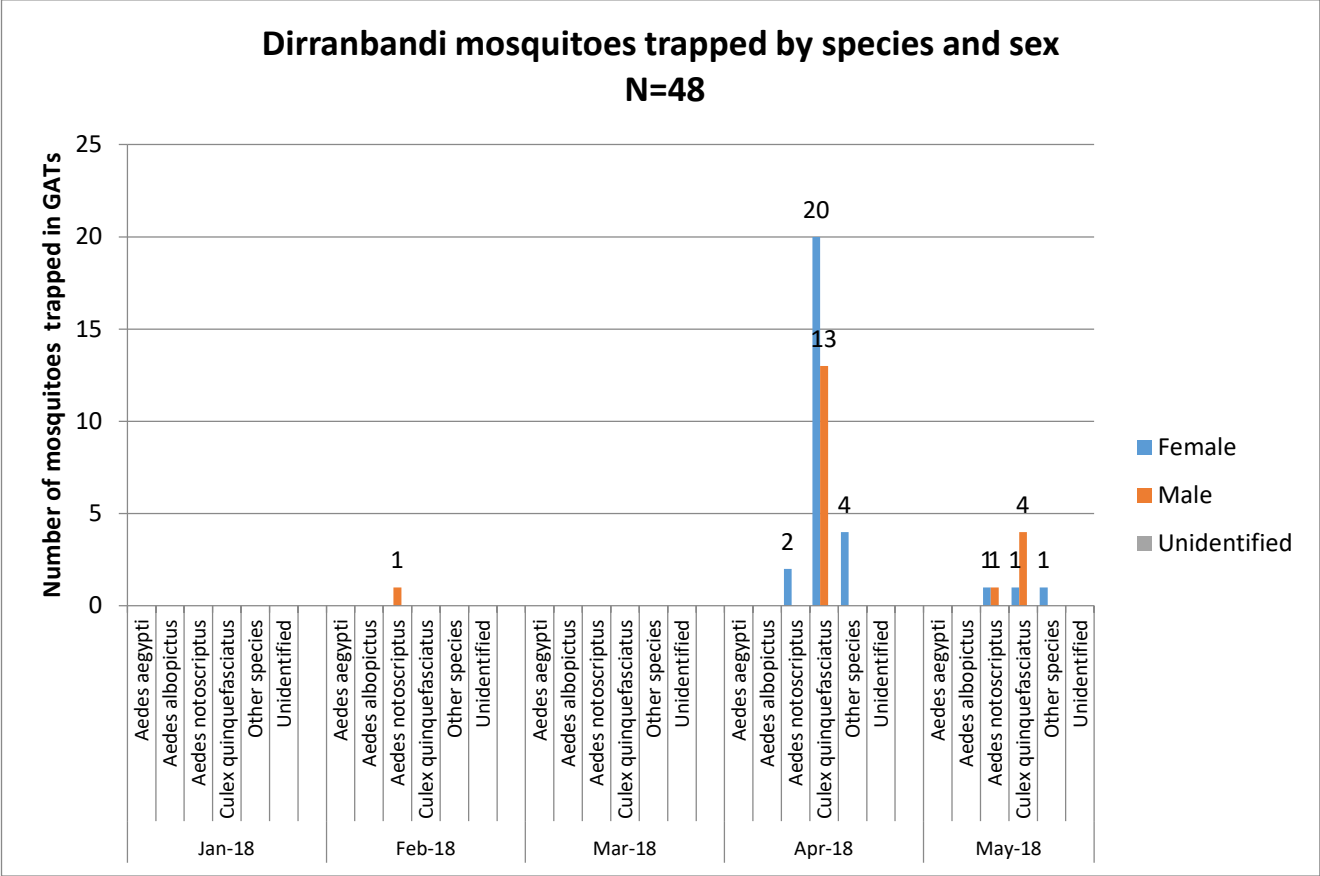
This report summarises the mosquito surveillance data and compares it to environmental factors such as climate (temperature °C) and rainfall (mm) by towns of surveillance using descriptive analytical methods. The report describes patterns of both vector and human disease using the notifications over the reporting period.

Results & Discussion

Dirranbandi - GATs Surveillance data

Balonne Shire Council conducted GAT surveillance between 16 Jan 2018 and 22 May 2018, at Dirranbandi, for the reporting period. Four GATs were deployed during this time. Three of the four deployed GATs trapped mosquitoes, with a total of 48 specimens collected. April recorded the highest percentage (81% - 39 mosquitoes) of mosquitoes trapped, followed by the month of May (17% - 8 mosquitoes). No mosquitoes were trapped in January or March. Refer to graph 1 and appendix 5 for details.

Graph 1: Dirranbandi: Mosquitoes trapped by species and sex.



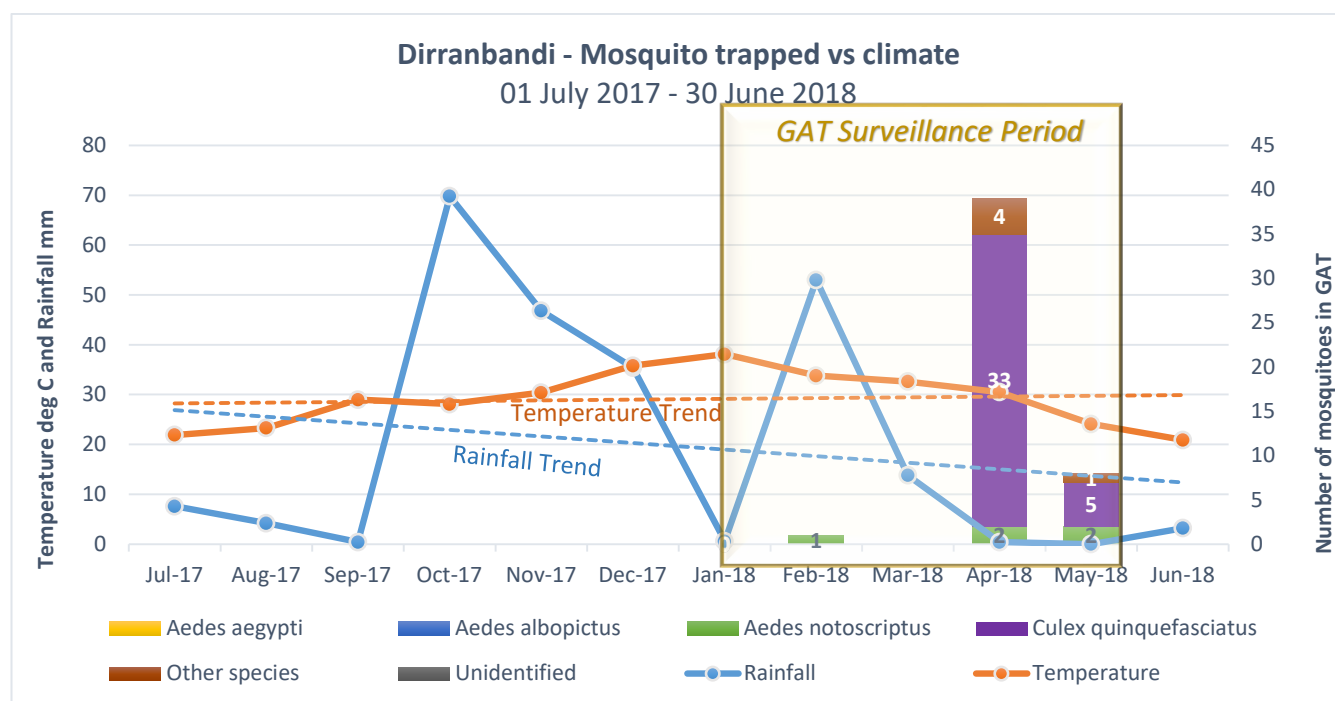
There were no *Ae. aegypti* or *Ae. albopictus* detected in the GATs for the reporting period. Sixty percent of the trapped mosquitoes were female. It is important to note that only female mosquitoes seek out a blood meal and therefore bite humans, which makes them responsible for the transmission of diseases. The most common mosquito trapped in Dirranbandi was *Cx. quinquefasciatus* (79% - 38 mosquitoes). Of these, 21 were female and 17 were male. There were five (10%) *Ae. notoscriptus* specimens trapped with three being female and two being male.

Trap D3, located at 10 Dawes Street, collected the majority (96% - 46 mosquitoes) of the specimens followed by trap D2, located at 70-72 Railway Street (2% - 1 mosquito) and trap D4, located at 1-57 Jane Street (2% - 1 mosquito). The large number of male mosquitoes (39% - 18) caught in trap D3 indicates that breeding sites were in close proximity to the trap, as males

have the tendency to not travel far from their breeding site. Trap D1, located at 1-9 Railway Street, did not collect any specimens in the surveillance period. More details on the mosquitoes caught by each trap can be found in appendix 5. The location of each trap site can be found in appendix 3.

Graph 2 compares the frequency of mosquitoes from the GATs surveillance with the seasonal climate for Dirranbandi for the financial year 2017/18.

Graph 2: Comparison of Dirranbandi Mosquito frequency to the climate of the region.



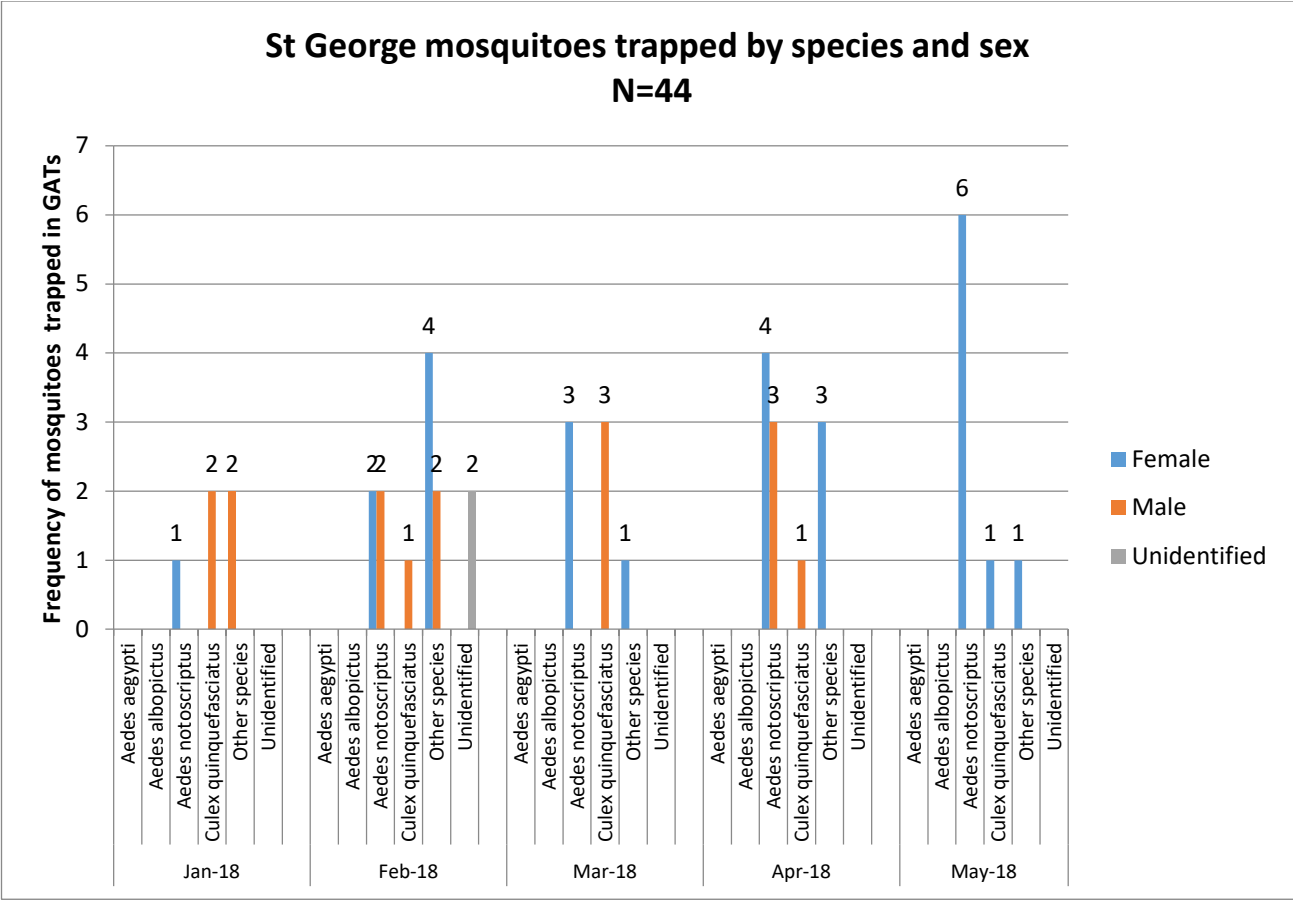
While the temperature of the region had a slight upward trend, there was a downward trend noted on the rainfall for the region (refer to graph 2). The highest monthly mean temperature for the region was 38.1 °C for the month of January and the lowest monthly mean was 20.9 °C for the month of June. April recorded the highest number of mosquitoes trapped (39) and had a mean temperature of 30.5 °C for the month. The months of January and March had no mosquitoes collected in the GATs and had a mean monthly temperature of 38.1°C and 32.6 °C respectively. The highest rainfall recorded for the period when GATs were deployed was 13.8

mm, in February. It was noted that no rainfall was recorded in April, but this month had the highest number of mosquitoes trapped, as previously discussed. Mosquito numbers found in the GATs were consistently high across the month. The lack of rainfall in this month and low rainfall in the preceding months indicate that domestic water use at the location where trap D3 was set and the presence of domestic water holding containers sustained mosquito breeding. Further trapping in June would have been useful to track the breeding trend over cooler months.

St George - GATs Surveillance data

Balonne Shire Council conducted GATs surveillance between 16 Jan 2018 and 22 May 2018 at St George, for the reporting period. Ten GATs were deployed during this time. Seven of the ten deployed GATs trapped mosquitoes, with a total of 44 specimens collected. February and April recorded the highest percentage of mosquitoes trapped with 30% (13) and 25% (11) respectively. Mosquitoes were trapped in all months. Refer to graph 3 and appendix 5 for more details.

Graph 3: St George Mosquitoes trapped by species and sex.

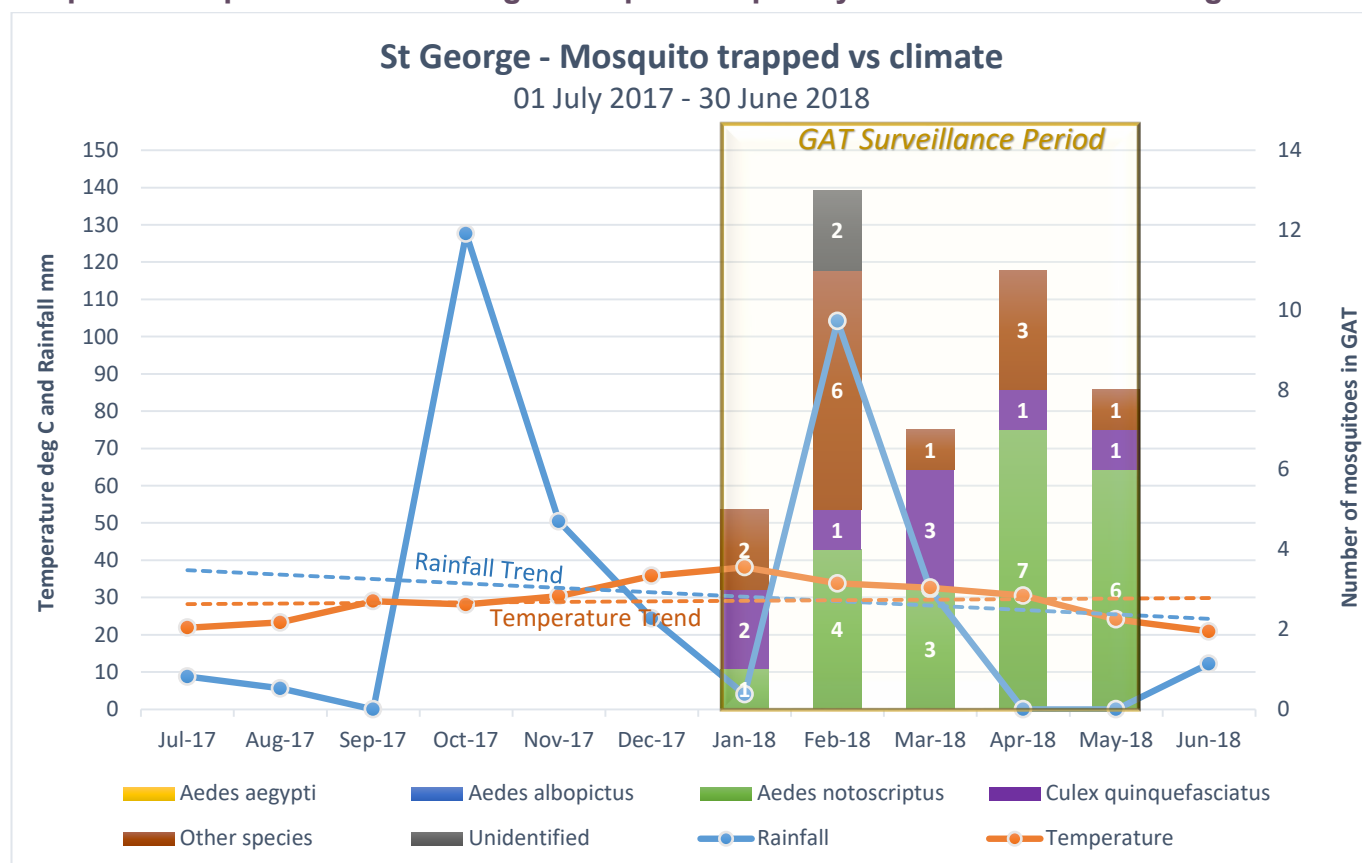


There were no *Ae. aegypti* and *Ae. albopictus* detected in the GATs for the reporting period. Fifty-nine percent (26) of the trapped mosquitoes were female. Please note that two (5%) specimens were unable to be identified, this included determining their sex. The most common mosquito trapped in St George was *Ae. notoscriptus* (48% - 21 mosquitoes). Of these, 16 were female and 5 were male. There were eight (18%) *Cx. quinquefasciatus* trapped with seven being male and one being female.

All but one of the ten GATs were deployed for the entire GATs surveillance program period. Trap 8 located at 53-57 Herbert Street was removed early, on 26 April 2018, and was not redeployed for the last month of surveillance. Trap 1 located at 36-42 Victoria Street collected the most (36% - 16 mosquitoes) specimens followed by trap 4 located at 22 Philip Street (27%-

12 mosquitoes) and trap 10 located at 2-14 McGahan Street (11% - 5 mosquitoes). No mosquito specimens were collected in trap 2 (9 Wattle Drive), trap 5 (96 Grey Street) and trap 7 (64 Barlee Street) for the surveillance period. More details on the mosquitoes caught by each trap can be found in appendix 5. The location of each trap site can be found in appendix 4.

Graph 4: Comparison of St George Mosquito frequency to the climate of the region.

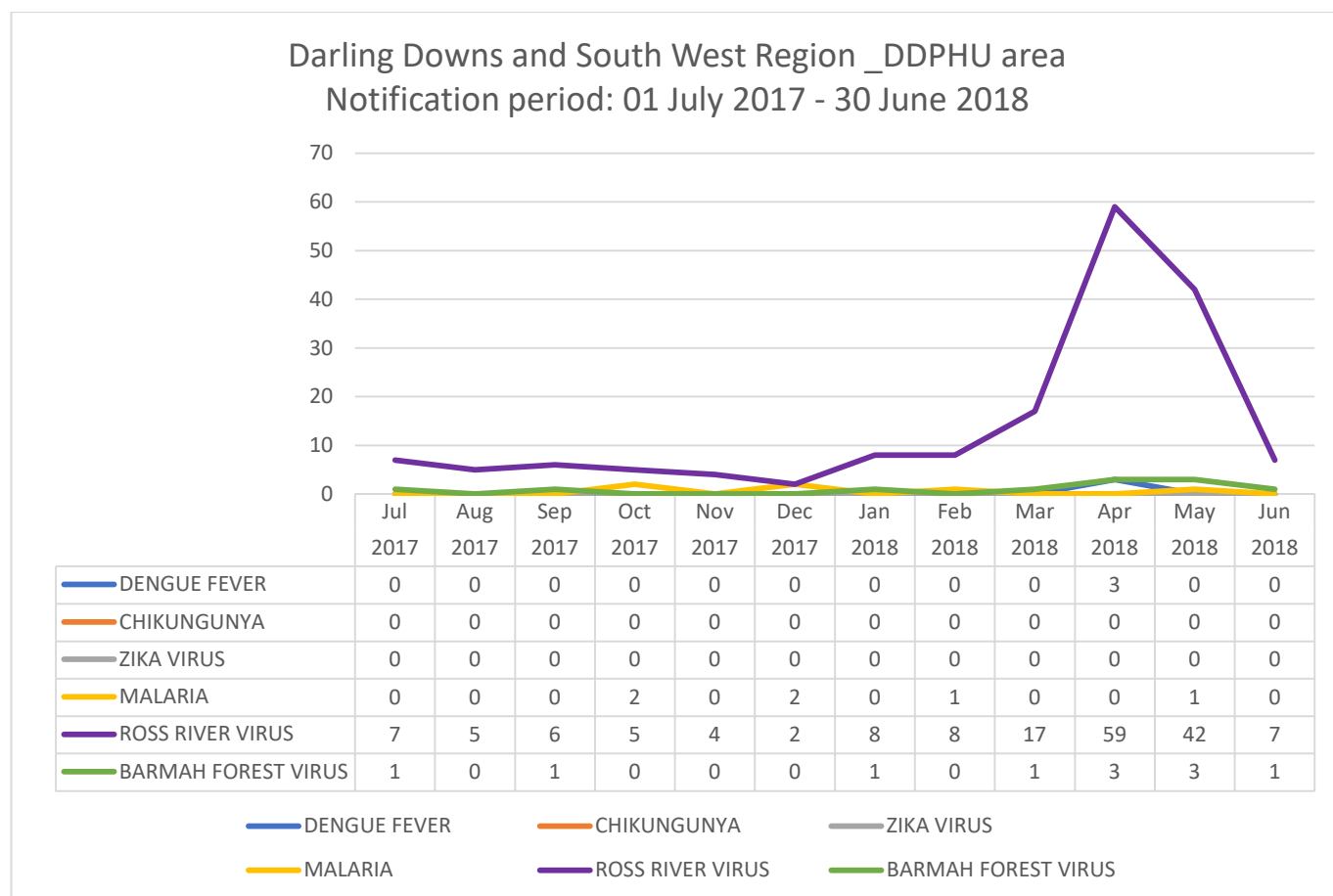


Graph 4 compares the frequency of mosquitoes from the GATs surveillance with the seasonal climate for St George for the financial year 2017/18. While the temperature of the town had a slight upward trend, there was a slight downward trend noted on the rainfall (refer to graph 4). The highest monthly mean temperature for the town was 38.1 °C for the month of January and the lowest monthly mean was 20.9 °C for the month of June. Mosquitoes were trapped in each month of the surveillance period with the highest number trapped in February (13) where the mean temperature was 33 °C. February had the highest rainfall with 104.2 mm. No rainfall was recorded in the months of April and May; however, 11 and eight mosquitoes were collected from the traps in these months. It is hard to conclude that temperature and rainfall impacted on mosquito behaviour in St George.

Mosquito borne disease notifications

The DDH and SWHHS regions had a total of 190 mosquito borne disease notifications for the financial year 2017/18. RRV, malaria, dengue and BFV were among the notified mosquito borne disease in the DDH &SWHHS region for the reporting period. Refer to graph 5.

Graph 5: Notifications of Mosquito borne diseases in the DDH and SWHHS regions for the financial year 2017/18



During this period five cases of RRV were notified from the Balonne LGA. One notification was received each month from January to May 2018. Three of these notifications were from St George, for the months of January, March and April, one notification from Dirranbandi, for the month of February, and one notification from Bollon, for the month of May. No other mosquito borne disease notifications were reported.

Mosquito Borne Disease Risk Assessment

Table 3: Balonne Mosquito Borne Disease Risk Assessment

Balonne Shire LGA	Mosquito borne disease in human Surveillance period: 01 July 2017-30 June 2018					Mosquito species GAT Surveillance period: 01 Jan 2018-31 May 2018			
	Dengue fever	Zika	Chikungunya	Ross River Virus*	Barmah Forest Virus	<i>Aedes aegypti</i>	<i>Aedes albopictus</i>	<i>Aedes notoscriptus</i>	<i>Culex quinquefasciatus</i>
Dirranbandi	x	x	x	✓	x	x	x	✓	✓
St George	x	x	x	✓	x	x	x	✓	✓
Bollon	x	x	x	✓	x	No surveillance data	No surveillance data	No surveillance data	No surveillance data

*There are many other species of mosquitoes that are vectors for RRV which are not container breeding mosquitoes.

Table 3 illustrates the presence of container breeding mosquito species and mosquito borne disease by towns in Balonne LGA. Dirranbandi, St George and Bollon were the three towns within the Balonne LGA that had mosquito borne disease notifications. There is negligible risk for dengue, chikungunya and Zika disease transmission in the region due to the absence of a vector (*Ae. aegypti* and *Ae. albopictus*) and the absence of the disease (imported cases).

The ubiquitous container breeding mosquito species *Ae. notoscriptus*, which has the same breeding behaviour as *Ae. aegypti*, is present in the region. *Ae. notoscriptus* can be used as a proxy to provide a measure of risk for *Ae. aegypti* being established in the area.

Limitation of the GAT surveillance

1. GAT surveillance targets container mosquito breeding species only. Mosquito borne diseases are also carried by non-container breeding mosquito species.
2. The GAT surveillance program period was from 16 January 2018 to 22 May 2018. It is difficult to determine mosquito behaviours outside this period as no surveillance data is available.
3. The location of the traps was limited to four sites in Dirranbandi and ten sites in St George.
4. Further surveillance was not possible due to the limited resources, such as staff time and number of traps, of Balonne Shire Council and DDPHU.

Conclusion

Mosquito-borne diseases are important contributors to the overall numbers of notifiable conditions in Queensland (3). There were no *Ae. aegypti* and *Ae. albopictus* detected from the GAT surveillance program for the financial year 2017/18 for the Balonne LGA. However, it is possible that *Ae. aegypti* may become established in the Balonne LGA, if it is introduced to the area, as it already has the presence of *Ae. notoscriptus* that breeds in a similar environment. While *Ae. aegypti* has not been detected in the Balonne LGA, the mosquito has been detected in the neighbouring Maranoa LGA and Western Downs LGA. Appendix 2 shows the distribution of *Ae. aegypti* in the DDH and SWHHS and the year when the mosquito was last detected. It is noted that the mosquito continues to be detected in Roma, including the 2017/2018 surveillance period. Due to established travel paths, such as highways, between the Balonne LGA and other parts of Queensland where *Ae. aegypti* has been found, there is a risk of the introduction, establishment and spread of this invasive

mosquito within the area. Continuation of the GAT surveillance program in the region will help in the early identification of exotic mosquitoes. This will also help assess the risk of local transmission of disease, in the event of an overseas acquired mosquito borne disease notification. GAT surveillance has demonstrated that cooler months such as April and May are more favourable for container breeding mosquitoes, which is similar for other areas of DDH and SWHHS. There is negligible risk for dengue, chikungunya and Zika disease transmission for the region. However, there is a risk of RRV through container breeding mosquitoes around the household. This, and the presence of competent vectors for dengue, Zika and chikungunya in the neighbouring LGA, reinforces the need for an ongoing GAT surveillance program for a timely public health response in Balonne LGA.

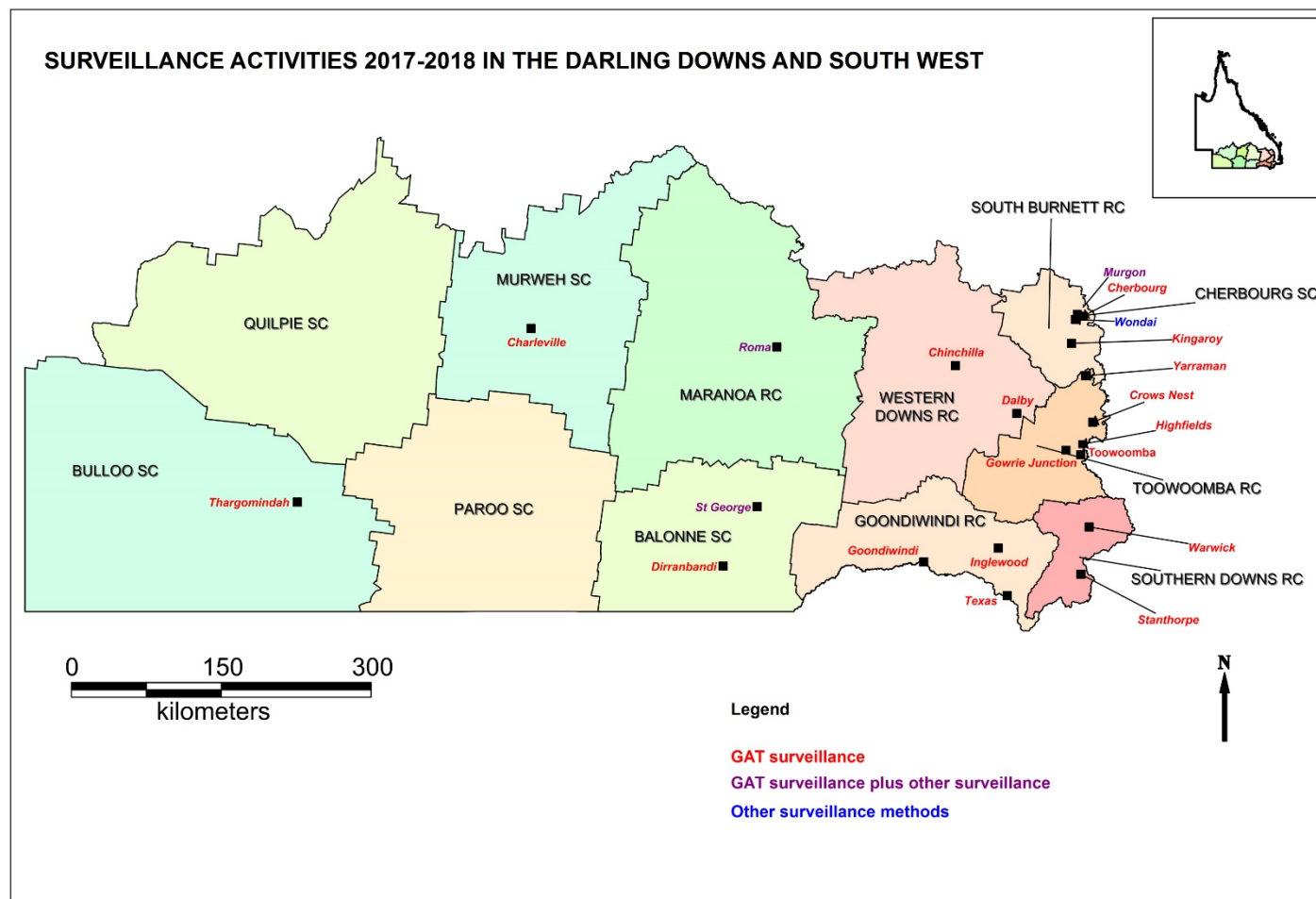
Recommendations for 2019

1. Balonne Shire Council continues to commit to an ongoing GAT surveillance program (container breeding mosquito) in partnership with the DDPHU.
2. Balonne Shire Council extends the surveillance period to cooler months to understand the presence of container breeding mosquitoes in cooler seasons.
3. Balonne Shire Council implement a public education campaign on preventative measures to reduce container breeding mosquitos around the house and to create public awareness on the potential disease risk (such as RRV and dengue) associated with container breeding species

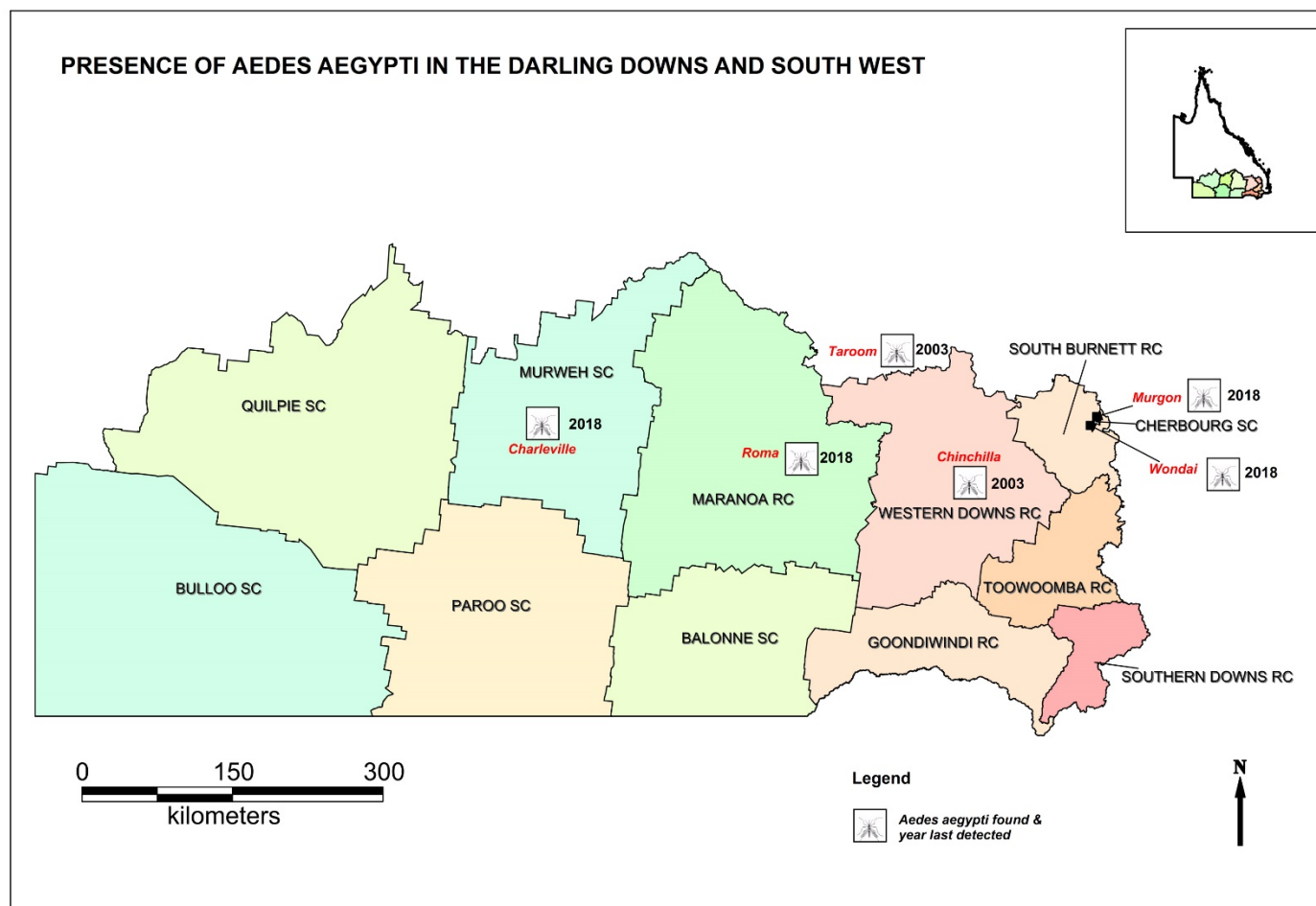
Reference

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<https://www.legislation.qld.gov.au/view/html/asmade/sl-2018-0117>

Appendix 1: Mosquito surveillance activities in DDH and SWHHS regions for 2017/2018



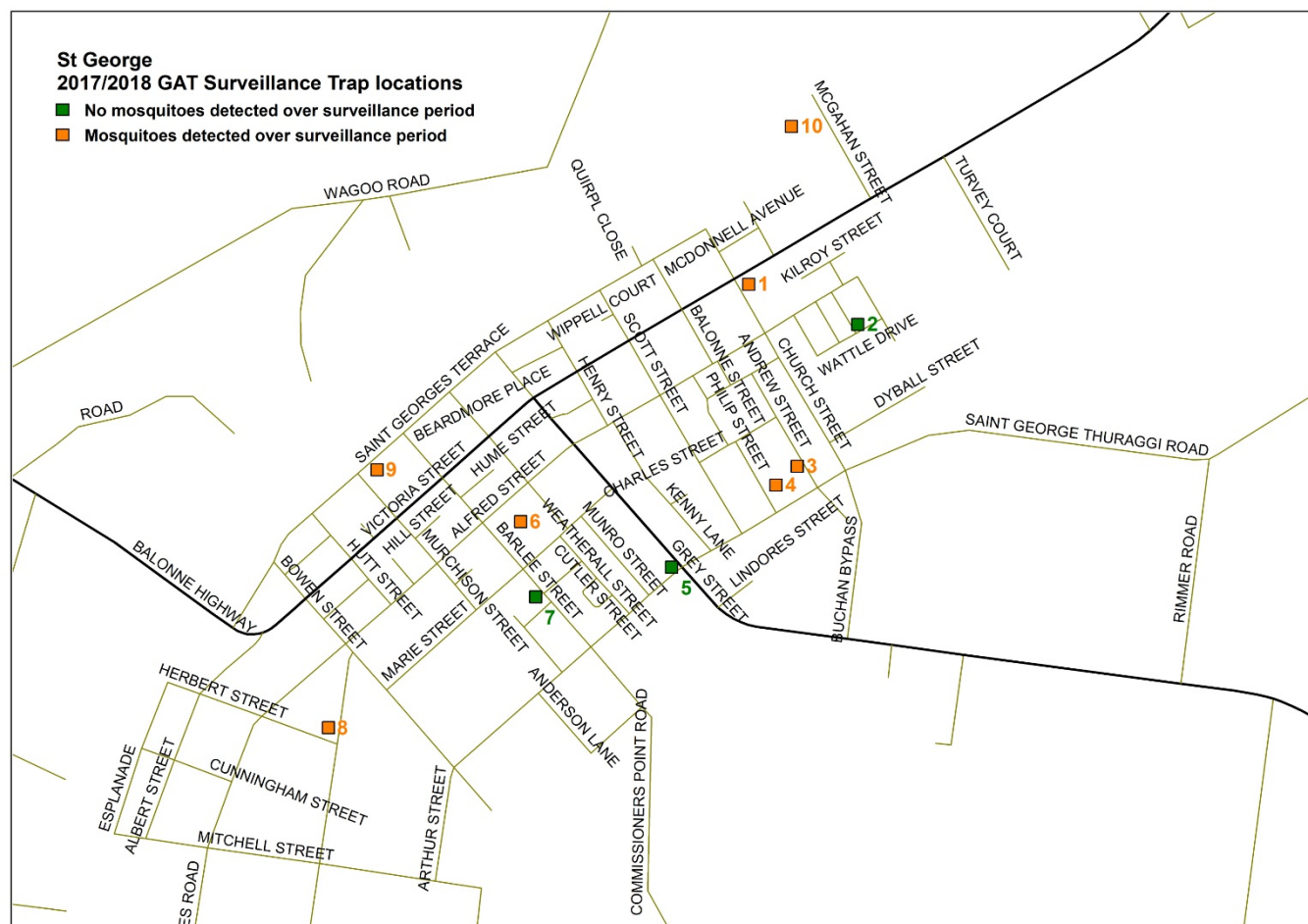
Appendix 2: Presence of *Ae. aegypti* in the DDH and SWHHS regions for 2017/2018



Appendix 3: GAT Surveillance Trap location for 2017/2018 at Dirranbandi



Appendix 4: GAT Surveillance Trap location for 2017/2018 at St George



Appendix 5: Mosquito species collected from GATs for surveillance period*

Town	Month	Trap ID	<i>Aedes aegypti</i>		<i>Aedes albopictus</i>		<i>Aedes notoscriptus</i>		<i>Culex quinquefasciatus</i>		Other species		Unidentified	TOTAL
			Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Unidentified	
Dirranbandi	Feb	D3	0	0	0	0	1	0	0	0	0	0	0	1
	Apr	D2	0	0	0	0	0	0	1	0	0	0	0	1
		D3	0	0	0	0	0	2	12	20	0	3	0	37
		D4	0	0	0	0	0	0	0	0	0	1	0	1
	May	D3	0	0	0	0	1	1	4	1	0	1	0	8
St George	Jan	1	0	0	0	0	0	1	2	0	2	0	0	5
	Feb	1	0	0	0	0	1	0	0	0	0	2	0	3
		3	0	0	0	0	0	2	0	0	0	0	0	2
		4	0	0	0	0	0	0	0	0	1	2	0	3
		6	0	0	0	0	1	0	1	0	0	0	0	2
		8	0	0	0	0	0	0	0	0	1	0	2	3
	Mar	1	0	0	0	0	0	2	2	0	0	0	0	4
		4	0	0	0	0	0	1	1	0	0	0	0	2
		8	0	0	0	0	0	0	0	0	0	1	0	1
	Apr	1	0	0	0	0	1	1	1	0	0	0	0	3
		10	0	0	0	0	1	1	0	0	0	3	0	5
		9	0	0	0	0	1	2	0	0	0	0	0	3
	May	1	0	0	0	0	0	0	0	1	0	0	0	1
		4	0	0	0	0	0	6	0	0	0	1	0	7
Dirranbandi Total			0	0	0	0	2	3	17	21	0	5	0	48
St George Total			0	0	0	0	5	16	7	1	4	9	2	44
Balonne Shire Council Total			0	0	0	0	7	19	24	22	4	14	2	92

*NOTE: This table does not include information on traps where no mosquitoes were collected