URBAN ADELAIDE CONSTRUCTED WETLANDS MOSQUITO MONITORING PROGRAM 2018-19

A mosquito monitoring program for constructed wetlands, at varying stages of development, throughout the Adelaide metropolitan area.

A report prepared for The Adelaide and Mount Lofty Ranges Natural Resources Management Board, the City of Marion, City of Holdfast Bay, City of Charles Sturt, City of Salisbury, Port Adelaide Enfield, Campbelltown City Council, City of West Torrens, City of Unley. By Stephen R. Fricker, Seamus Doherty and Craig R. Williams

University of South Australia

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1. Introduction.

Constructed wetlands are generally large, semi-permanent water bodies of high quality and most wetlands have a natural mosquito presence. Adult mosquitoes are not only responsible for nuisance biting but can pose potential health risks through the spread of diseases.

In South Australia, mosquito-borne diseases of concern in urban areas are those caused by viruses including Ross River virus (RRV), Murray Valley encephalitis (MVE) and Barmah Forest virus (BFV). Kunjin virus (KUNV), a subtype of West Nile Virus (WNV) isolated in Australia, can also be transmitted to humans and horses by mosquitoes. Mosquitoes are also responsible for the transmission of canine heartworm (*Dirofilaria immitis*).

The mosquito lifecycle consists of four main stages beginning with the egg, proceeding through larval instars, pupation and then adult emergence. The presence of water is essential for the larval stages of development, where eggs hatch and the resulting larvae continue through four larval stages prior to pupation. Therefore, the presence of large water bodies such as constructed wetlands in urban environments can often cause concern among residents.

Constructed wetlands however, due to associated healthy populations of predatory aquatic invertebrates (e.g. dragonfly larvae, beetles etc.) and vertebrates (fish) within the wetlands, have relatively low numbers of mosquito populations within the main water body.

This report outlines the findings of a 6-month monitoring survey of nuisance mosquito populations in the vicinity of several constructed wetlands at varying stages of development. Mosquito trapping and surveillance was undertaken between October 2018 and March 2019 in order to determine the composition of adult mosquito populations and to identify potential larval breeding sites. This study has been carried out by the Healthy Environments, Healthy People Research Group at the University of South Australia, on behalf of the Adelaide and Mount Lofty Ranges Natural Resources Management Board, with the purpose of conducting pre- and post-construction mosquito monitoring of the different urban wetland sites.

Our aim was to assess 12 wetland sites (Figure 1), at varying stages of development for the following:

- Monitor mosquito populations during the wetland construction and completion phase (where relevant)
- Assess wetland performance in relation to managing nuisance mosquito populations
- Address resident concerns in relation to the potential for artificial wetlands to increase biting mosquito populations on their property
- Monitor mosquitoes as an indicator for ecosystem health.

The 12 wetland sites were:

1. Unity Park Wetland
2. Old Port Road Wetland
3. West Lakes Golf Course/Cooke Reserve
4. St Clair wetlands
5. Grange Golf course
6. Royal Adelaide golf course
7. Felixstow Reserve

8. Glenelg Golf course
9. Ridge Park
10. Oaklands Park
11. Warriparinga
12. Watson Avenue GPT and Brown Hill Creek Linear Wetland

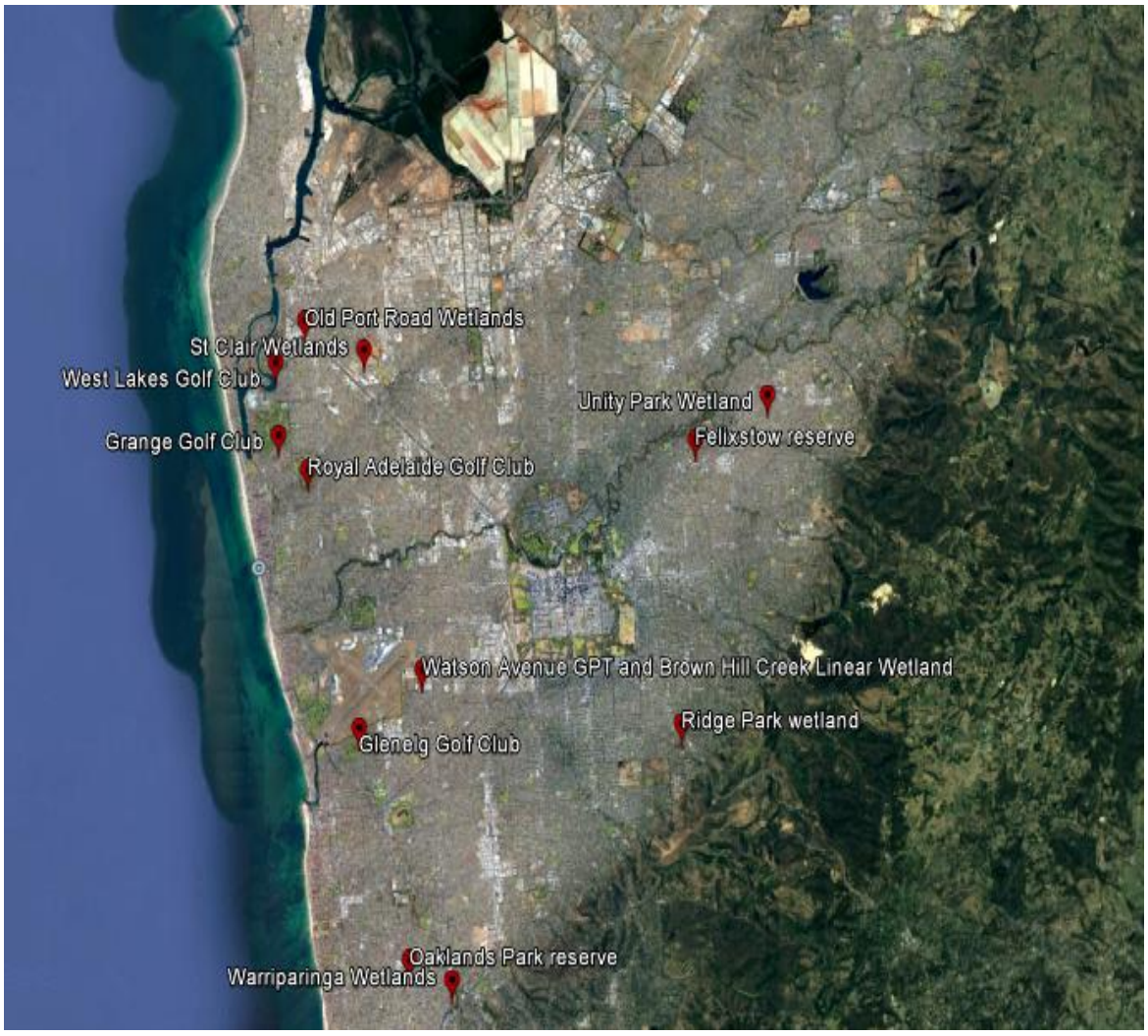

Figure 1: The location of the twelve wetland sites within the Adelaide metropolitan area.

2. General Methods.

2.1. Adult mosquito monitoring

2.1.1. Adult mosquito abundance

Monthly trapping for adult mosquitoes was conducted at each of the wetland sites. Each trapping period involved overnight deployment of three to five carbon dioxide-baited, encephalitis virus surveillance (EVS) miniature light traps (Figure 2) at each site. Trapping began in October 2018 and concluded in March 2019. Traps were set both in the surroundings of the wetland sites and adjacent to nearby residential properties or industrial sites. Trapped mosquitoes were taken to the laboratory where they were preserved and later counted and identified using the standard mosquito adult identification keys (Russell 1993).

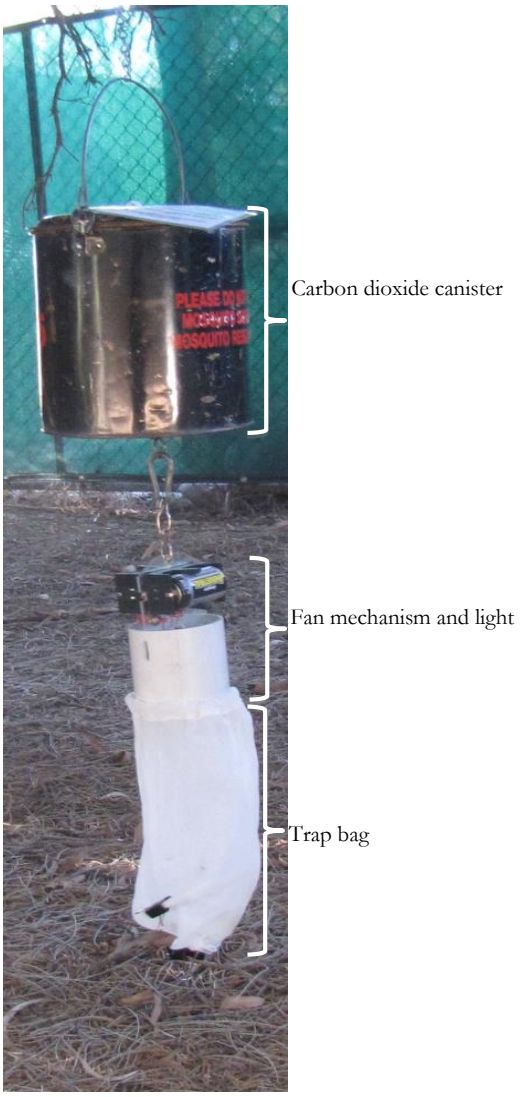

Figure 2. Carbon dioxide-baited EVS miniature light trap

2.1.2. Trap failure.

Occasionally, in the unfortunate event of wind interference (e.g. blowing the trap bag from the fan mechanism), or mechanical failure (causing the fan mechanism to fall out or the light to go out), failure of a trap to capture any attracted mosquitoes may occur. The Healthy Environments, Healthy People Research group has continued to use the upgraded trap mechanisms for this season to minimise trap failures. Consequently, throughout this trapping season, only a very small number of trap failures occurred.

2.2. Mosquito larvae monitoring.

Using the standard dipping technique Russell (1993) potential larvae habitats, which include any containers collecting water, water hazards, drains and irrigation valve pits, identified at each site were sampled for mosquito larvae abundance throughout the monitoring season. Quantification of larval numbers was obtained by standardising the volume of water collected per sample. Larval collections were identified using the standard mosquito larvae identification keys (Russell 1993). No mosquito larvae were detected at any of the monitoring sites during this work in 2018-19.

2.3. Water quality analysis.

At established wetland sites and sites consisting of accessible permanent water bodies, three basic water quality parameters were assessed, for correlation with obtained adult mosquito abundance data. The parameters tested for were pH (Table 2.1), electrical conductivity (EC) (Table 2.2) and nitrate (Table 2.3).

The Hanna Microprocessor Conductivity/TDS meter (calibrated according to product instruction manual) was used to assess electrical conductivity (µS/cm) as well as pH levels in the water. The Hanna Aquaspex Nitrate-N microtest kit was used to calculate available nitrate levels (mg/L) in the collected water samples for this trapping season as it showed to be more sensitive in detecting nitrate ranges below 0.2 mg/L in previous monitoring seasons.

The following ranges were used (common standards) to assess water quality:

Table 2-1. pH ranges for water quality analysis (adapted from ANZECC and ARMCANZ 2001)

pH	Result
< 5	Acidic and toxic to aquatic plants and animals.
6.5 - 9	Healthy range for survival of aquatic plants and animals. Desirable range for mosquito breeding.
>9	Alkaline and toxic to aquatic plants and animals.

Table 2-2: Electrical conductivity ranges for water salinity analysis (adapted from ANZECC and ARMCANZ 2001)

µS/cm	Range	Result
0 – 730	Very low	Same as rain and tap water
740 – 2700	Low	Healthy level for aquatic invertebrates and plants
2710 – 5300	Medium	Maximum drinkable level for livestock
5310 – 10, 000	High	Some freshwater animals and plants cannot survive
>10,000	Very high	Most freshwater animals and plants cannot survive
46,000 – 70,000	Extreme	Same as sea water

Table 2-3: Nitrate ranges for water quality analysis (adapted from ANZECC and ARMCANZ 2001)

mg/L	Range	Result
0.05 – 0.2	Very low	Naturally occurring levels in waterways
0.4 – 0.8	Low	Slightly elevated above natural levels
1	Medium	A risk for environmental harm
2	High	Algal blooms and excessive plant grow likely
4	Very high	High risk for environmental harm

3. Unity Park Wetland, Pooraka

3.1. Background

The Unity Park Wetland reached the final stages of construction in early 2011. Vegetation of the wetland and surrounding areas is well established and weeding and cleaning of the area by conservationists and volunteers was observed throughout the trapping season 2018-2019. A variety of bird life that has settled in and around the wetland site.

3.2. Site descriptions

3.2.1. Adult mosquito traps

There are three adult mosquito trap sites at Unity park wetlands (Figure 3.1, Table 3.1).

Table 3-1. The GPS-coordinates for the three adult trap sites at Unity park wetlands.

Site:	Latitude:	Longitude:
Unity park site 1	-34.83568780124180	138.61744291149000
Unity park site 2	-34.83565159142010	138.61736169084900
Unity park site 3	-34.83597538433960	138.61556318588500

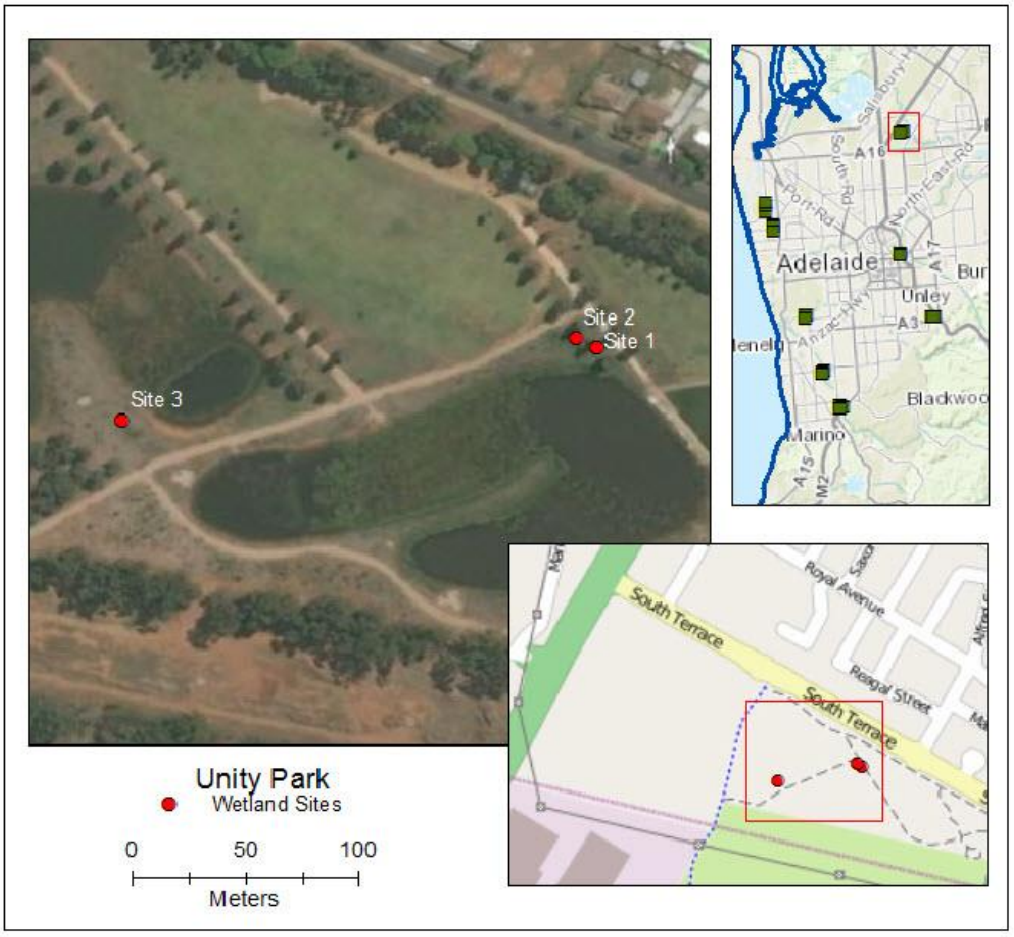

Figure 3.1. The location of the three sites at Unity park wetlands.

3.2.2. Positive larval dipping sites.

No mosquito larvae were detected at this site during monitoring.

3.2.3. Water quality sites.

Water samples were collected at the pond by trap site 1 (Figure 3.1). All ponds at the site were inspected for larval breeding. No positive larval breeding sites could be identified this season.

3.3. Results.

3.3.1. Adult mosquito traps.

A total of 10 mosquito species were caught throughout the monitoring season, showing the similar diversity as previous seasons. *Aedes camptorhynchus* and *Aedes notoscriptus* were the predominant types. Mosquito abundance was low, although in the context of urban wetlands in Adelaide, could be considered 'moderate'. (Figure 3.2, Appendix 16.1).

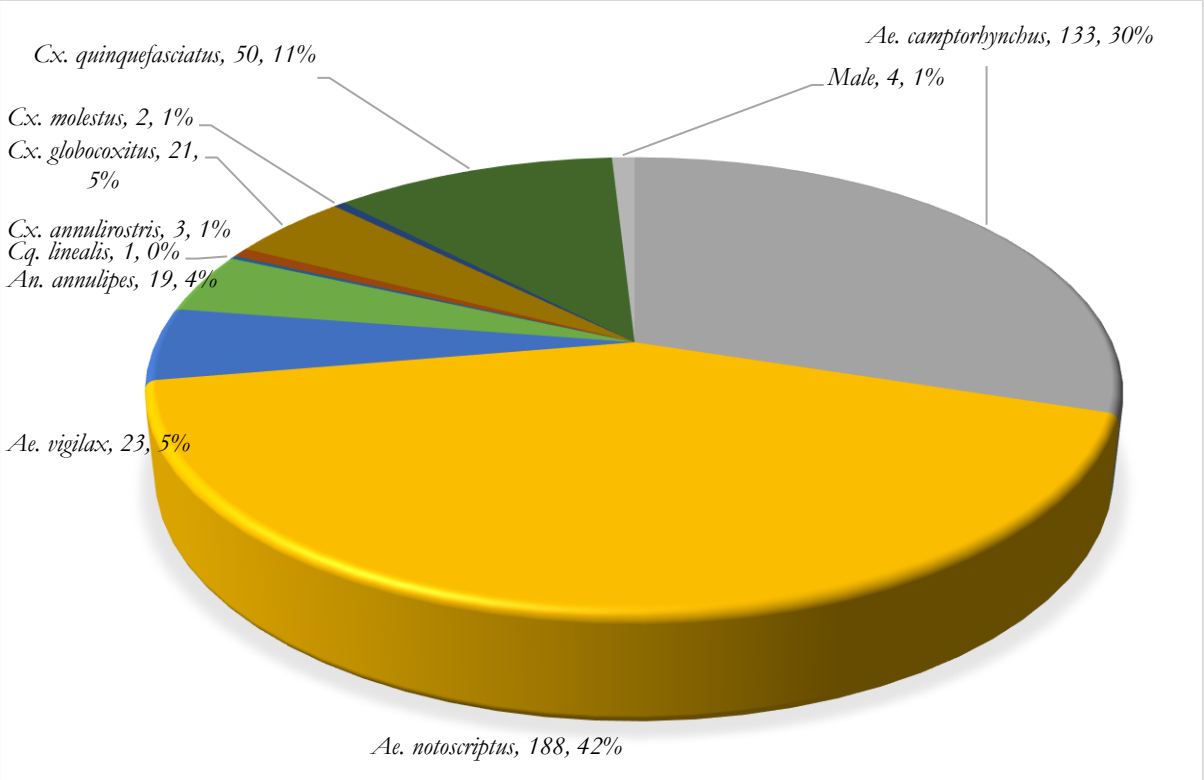

Figure 3.2 Total number of mosquitoes caught at the Unity Park for each of the species during monitoring season 2018-2019.

Unity Park recorded a total of 440 adult female mosquitoes compared to 107 last season (2017-18), which shows an overall increase of mosquito numbers of 311%. *Aedes camptorhynchus* populations peaked during October 2018 (Figure 3.3). *Aedes camptorhynchus* increases in population numbers are mainly associated with flooding of brackish temporary pools that are created by spring tides or rainfall on the marsh lands.

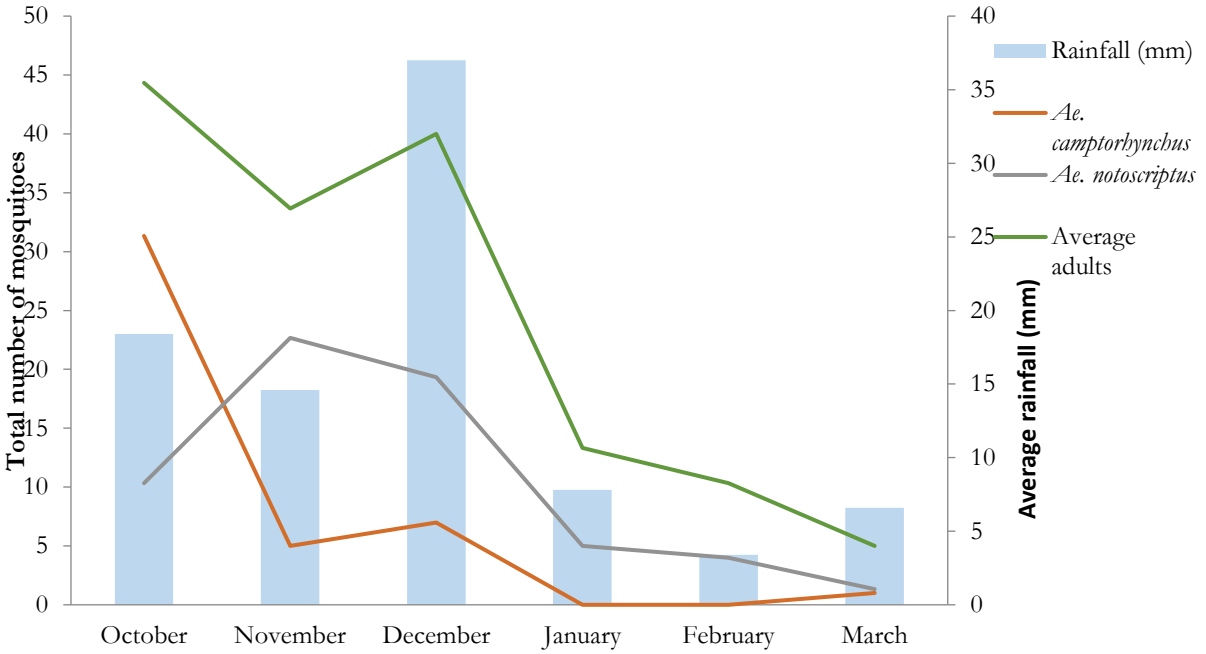

Figure 3.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at Unity Park with total rainfall (mm) for the corresponding months.

3.3.2. Dipping for larval mosquitoes.

No mosquito larvae were detected at this site during monitoring.

3.3.3. Water quality analysis.

Electrical conductivity at the site was highest during March but fluctuated slightly within the lower ranges for most of the season. The EC levels throughout the 2018-19 monitoring season were considered very low to low, a healthy level for aquatic invertebrates and plants. Nitrate levels remained very low throughout the trapping season and pH levels remained within the healthy range for the survival of aquatic plants and animals.

Table 3-2 Water quality variables for Unity park wetlands during monitoring season 2018-2019.

Date	pH	EC(mS/cm)	Nitrate (mg/l)
16/10/2018	9.45	1.21	0.2
20/11/2018	8.64	0.31	0.01
11/12/2018	8.91	0.49	0.01
22/01/2019	9.27	0.36	0.05
12/02/2019	9.37	0.87	
25/03/2019	8.96	1.08	

3.4. Discussion

A total of 10 different mosquito species were caught during the 2018-19 monitoring season. This was slightly more than in the previous season, and similar to that reported over a number of years (Faull *et al.* 2012).

As during monitoring season 2017-2018, *Ae. camptorhynchus* was a common species collected. This species is able to breed in fresh and brackish waters and is often responsive to rain. However, the populations subsided soon after, consistent with this species' seasonality (Williams *et al.* 2009).

The other abundant species *Aedes notoscriptus* breeds mostly in artificial containers and is characteristic of urban areas.

Although electrical conductivity fluctuated slightly throughout the trapping season with a peak March, all measured parameters remained within the healthy ranges for the survival of aquatic plants and animals.

Despite *Ae. camptorhynchus* adults being collected on site, no potential breeding sites were identified. Adults of this species were most likely blown in from regions adjacent to site 3 (Figure 3.1). It is unlikely that the Unity Park wetlands are producing nuisance levels of mosquitoes.

Following continuous monitoring of this well-established wetland, it appears to be functioning well in relation to basic water quality, presence of predatory aquatic invertebrates, and overall low mosquito abundance.

4. Old Port Road

4.1. Background

Construction of the Old Port Road Wetland had commenced before the beginning of the 2011-2012 trapping season. This site is a fully established and functioning wetland. No water quality testing was done at this site due to access restrictions.

4.2. Site descriptions

4.2.1. Adult mosquito traps

There are three adult mosquito trap sites at the Old Port Road Wetlands (Figure 4.1, Table 4.2)

Table 4-1 The GPS-coordinates for the three adult trap sites at Old Port Road.

Site:	Latitude:	Longitude:
Old Port Road site 1	-34.86224497680000	138.50650560200000
Old Port Road site 2	-34.86008065750000	138.50344807500000
Old Port Road site 3	-34.85936335500000	138.50369785400000

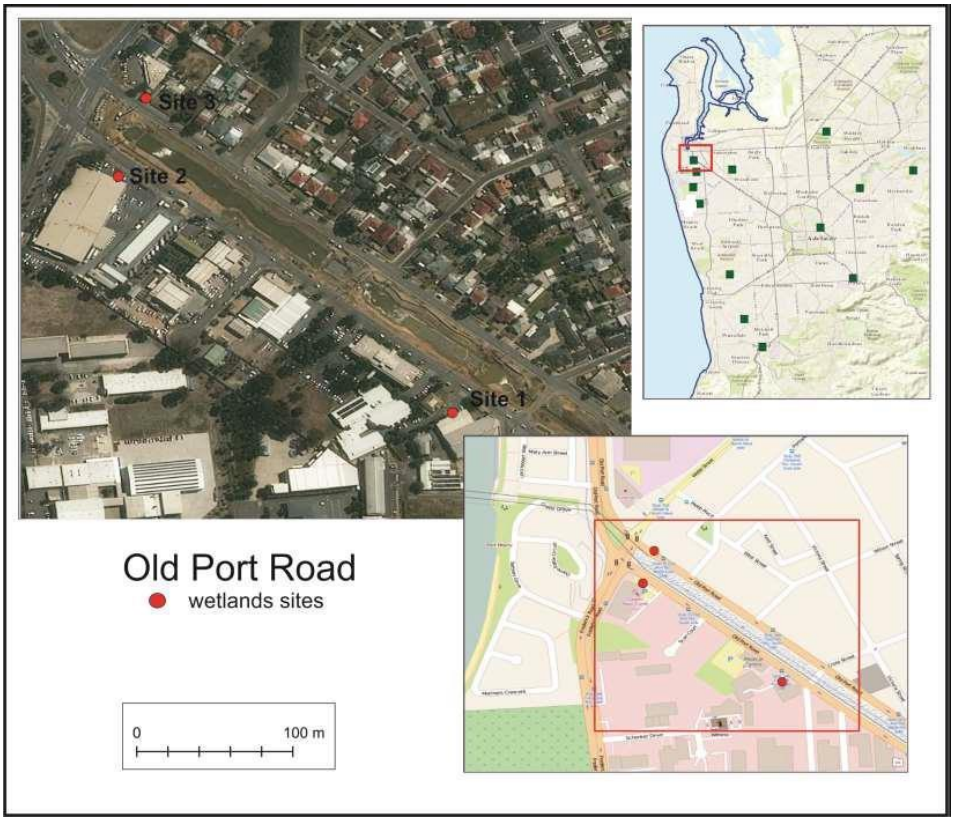

Figure 4.1. The location of the three sites at the Old Port Road Wetlands.

4.2.2. Positive larval dipping sites

No mosquito larvae were detected at this site during monitoring.

4.2.3. Water quality site

Due to limited access, water quality analysis was not applicable at this site throughout the 2018-19 season.

4.3. Results

4.3.1. Adult mosquito traps

A total of five mosquito species were sampled throughout the trapping season, over half of all individuals caught at this site during this season was *Cx. quinquefasciatus*, followed by *Ae. notoscriptus* which made up a nearly a quarter of all individuals (Figure 4.2).

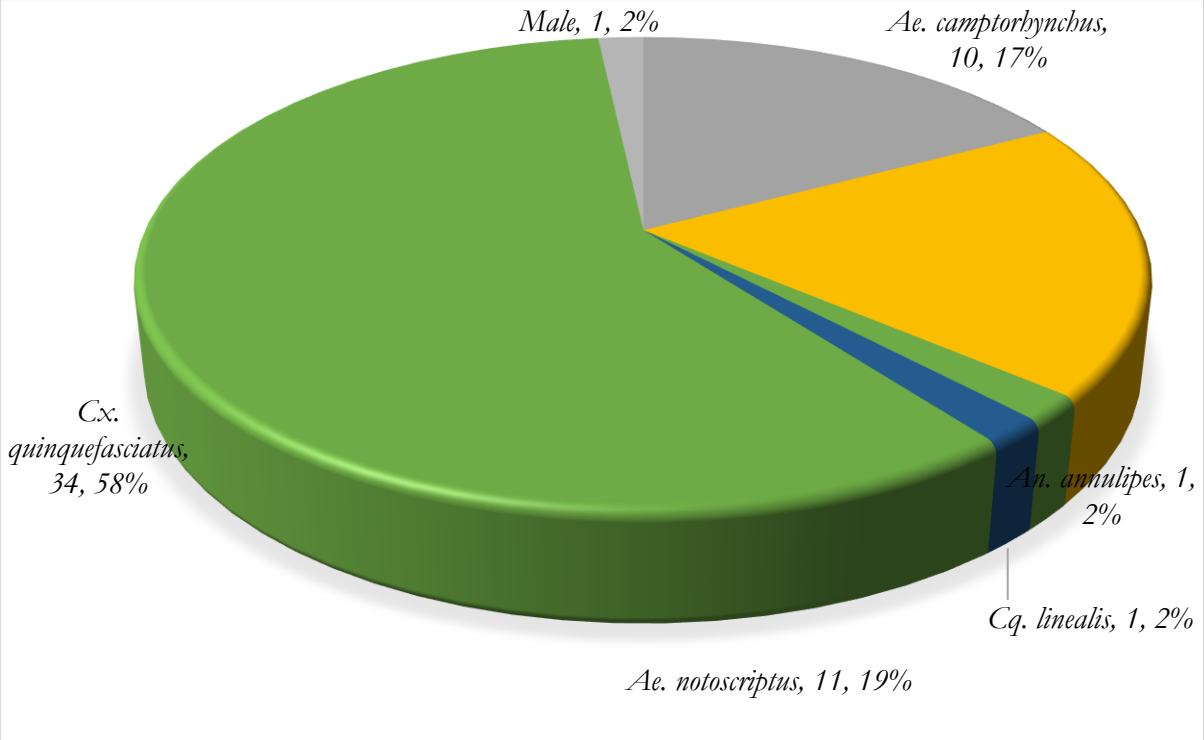

Figure 2 The total number of mosquitoes caught at the Old Port Road Wetlands for each of the species during monitoring season 2018-2019.

Like last season, mosquito numbers at the Old Port Road wetlands were very low (57 total in 2018-19, compared with 19 in 2017-18). This level is comparable to the 2015-16 season where only 31 individuals were recorded (Mincham, Orre-Gordon et al. 2015). This season there were no significant rain events to influence mosquito numbers. Rather mosquito numbers including the dominant species remained low over the season although slightly higher numbers were trapped in the month of December (Figure). Raw data are presented in Appendix 16.3.

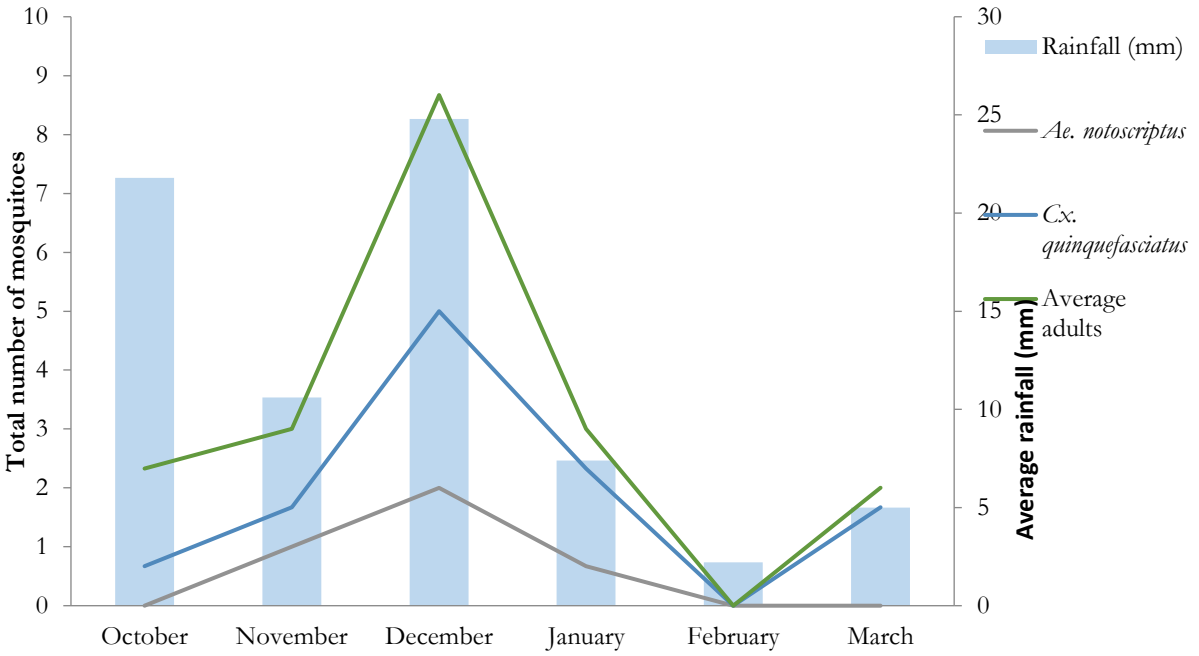

Figure 4.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at Old Port Road Wetlands with the rainfall (mm) for the corresponding months

4.3.2. Dipping for larval mosquitoes

No mosquito larvae were detected at this site during monitoring.

4.4. Discussion

Low levels of peri-domestic mosquitoes, *Cx. quinquefasciatus* and *Ae. notoscriptus* characterised the mosquito fauna at this site. No distinct peak in mosquito abundance was observed, although more individuals were caught in the month of December 2018 (Figure 4.3). Overall the mosquito community lacked diversity and of relatively low abundance.

Ae. notoscriptus and *Cx. quinquefasciatus* captures were greatest at site 1 and 2 (Figure 4.1). While adults of both species were collected on site, no potential breeding sites were identified. Adults of the species were most likely associated with breeding sites adjacent to site 1 and 2, both being close to neighbouring properties. The wetland is completely established and it is unlikely that the wetland is producing these species of nuisance mosquitoes.

5. West Lakes Golf Course/Cooke Reserve

5.1. Background

Construction of the West Lakes Golf Course (previously known as Riverside Golf Course) Wetland commenced during the 2012-13 season. At the beginning of the 2012-2013 season, trap 2 was moved closer to the Cooke Reserve to better encompass the area where earthworks were taking place. Trap 2 is now placed in the Richard Russell Reserve, immediately adjacent to the Cook Reserve on the southern side of the site. The trap sites have remained the same this season. This site was excluded from the monitoring program in 2013-14 but was reintroduced in season 2014-15.

5.2. Site descriptions

5.2.1. Adult mosquito traps

There are three adult mosquito trap sites at West Lakes Golf Course/Cooke Reserve (Figure 5.1, Table 5.1).

Table 5-1 The GPS-coordinates for the three adult trap sites at West Lakes Golf Course/Cooke Reserve.

Site:	Latitude:	Longitude:
West Lakes golf course site 1	-34.8722178	138.5027122
West Lakes golf course site 2	-34.87030879	138.5058441
West Lakes golf course site 3	-34.86950566	138.5055042

Figure 5.1 The location of the three sites at the West Lakes Golf Course/Cooke Reserve.

5.2.2. Positive larval dipping sites

No mosquito larvae were detected at this site during monitoring.

5.2.3. Water quality site

No water quality analysis was carried out at this site.

5.3. Results

5.3.1. Adult mosquito traps

A total of five mosquito species were sampled throughout the trapping season, with the dominant species being *Cq. linealis, Cx quinquefasciatus and Ae. notoscriptus* (Figure 5.2).

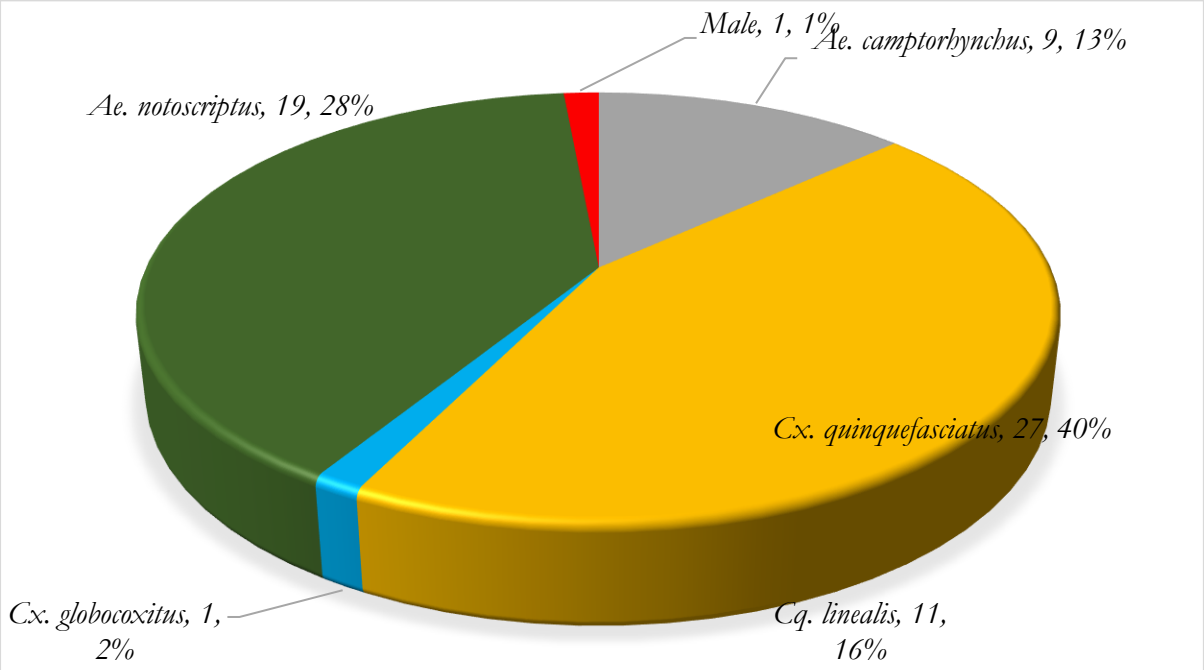

Figure 5.2 The total number of mosquitoes caught at the West Lakes Golf Course Cook Reserve for each of the species during monitoring season 2018-2019.

Overall, mosquito numbers were lower than the previous season with 71 individuals trapped over the season compared to 106 individuals the previous season. Rainfall in the region peaked during October and December 2018 (Figure 5.3).

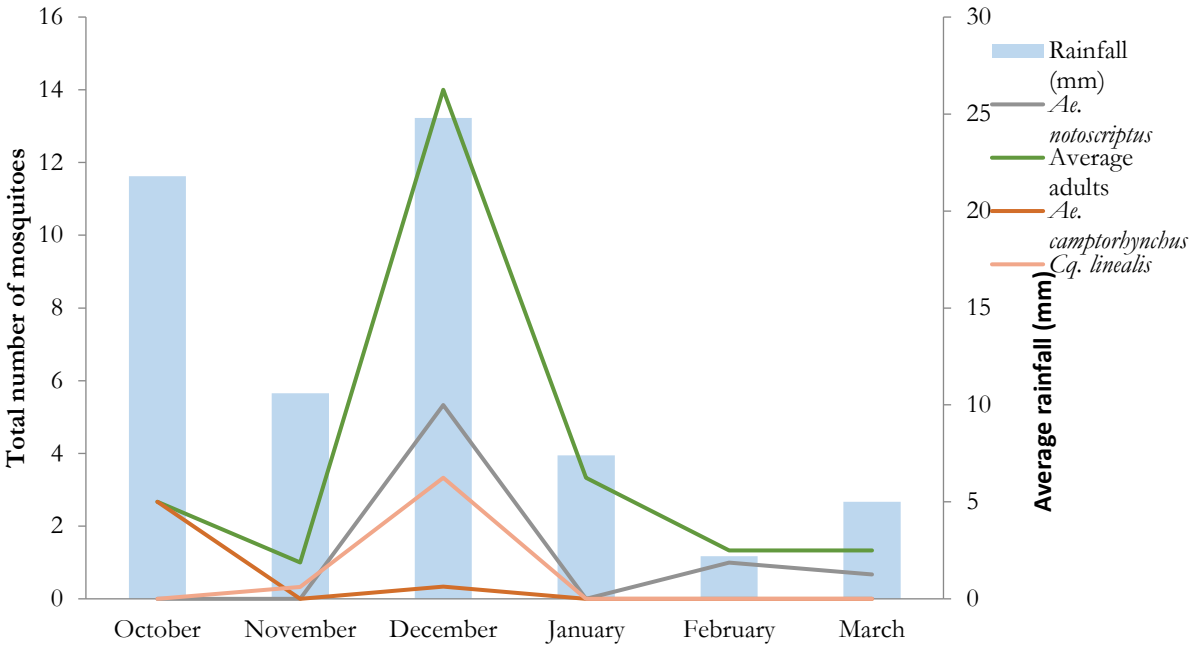

Figure 5.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at West Lakes Golf Course/Cook Reserve with the rainfall (mm) for the corresponding months.

5.3.2. Dipping for larval mosquitoes

No positive larval sites were detected during dipping at this site.

5.4. Discussion

A total of five different mosquito species were caught during the monitoring season. The abundance of adult *Cq. linealis* is generally influenced availability of suitable habitat. The larva of this species utilises emergent vegetation with small clearings. The larva has modified siphons that they use to pierce the roots of emergent vegetation, this allows them access to oxygen and avoid predation. In this sense this species is a true wetland species, although numbers appear to be only moderate.

The mosquito community was of relatively low diversity and abundance of all other species recorded was very low and is therefore unlikely to cause any biting nuisance. The establishment of vegetation allows for diverse populations of predatory aquatic invertebrates, and associated with healthy water quality, provided the wetland is maintained and the emergent vegetation is prevented from becoming overgrown the wetlands are unlikely to contribute to the abundance of existing mosquito populations.

6. St. Clair Wetlands

6.1. Background

The St Clair wetlands are a joint development plan in association with the City of Charles Sturt, in the suburbs of Cheltenham and Woodville. All the major wetland bodies have been established within St Clair. Five traps were set at this site compared to the three at the other wetland sites due to the size of this site and to allow most effective coverage of the existing mosquito fauna to be sampled. This is the third year that this site has been included in the monitoring program.

6.2. Site descriptions

6.2.1. Adult mosquito traps

There are five adult mosquito trap sites at St Clair Wetlands (6.1, Table 6-1).

Table 6-1 The GPS-coordinates for the five adult trap sites at St Clair Wetlands.

Site:	Latitude:	Longitude:
St Claire site 1	-34.51564200000000	138.31515700000000
St Claire site 2	-34.51519800000000	138.31463900000000
St Claire site 3	-34.52779000000000	138.32112000000000
St Claire site 4	-34.52125100000000	138.32105600000000
St Claire site 5	-34.87262373110000	138.53222593200000

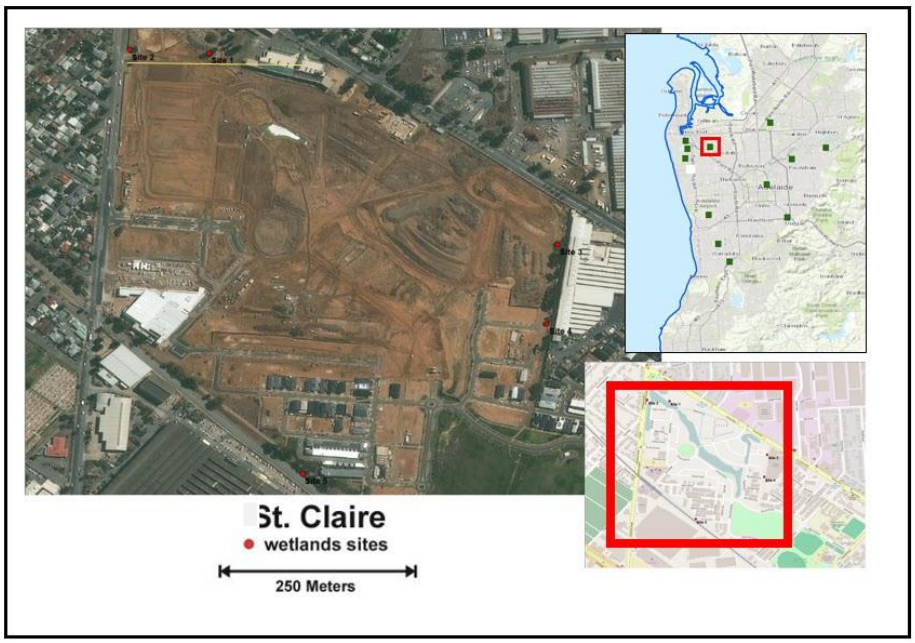

Figure 6.1 The location of the five sites at the St Clair wetlands.

6.2.2. Positive larval dipping sites

No positive larval dipping sites were recorded during the 2018-19 trapping period. Various drains at John Lette Place and along Derby Lane were again inspected for potential breeding sites but no positive larval dipping was recorded.

6.2.3. Water quality site

No water quality analysis was carried out at this site as the joint partners of the wetland project at this site are conducting such analysis already.

6.3. Results

6.3.1. Adult mosquito traps

A total of seven mosquito species were detected throughout the trapping season. A number of species were prominent at this site, which had moderate numbers of mosquitoes. *Ae. camptorhynchus, Cx. quinquefasciatus* and *Cq. linealis* were all present in moderate numbers (Figure 6.2).

All raw data for this location are collated in Appendix 16.4.

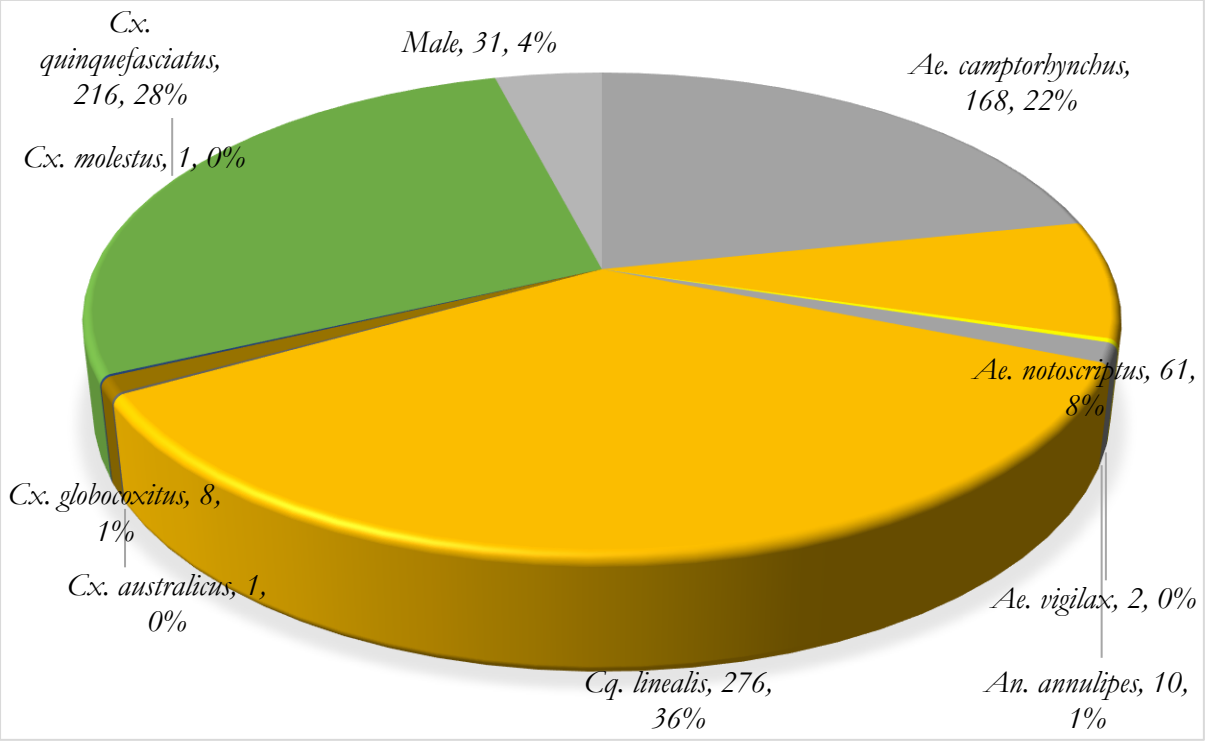

Figure 6.2. The total number of mosquitoes caught at the St Clair Wetlands for each of the species during monitoring season 2018-2019.

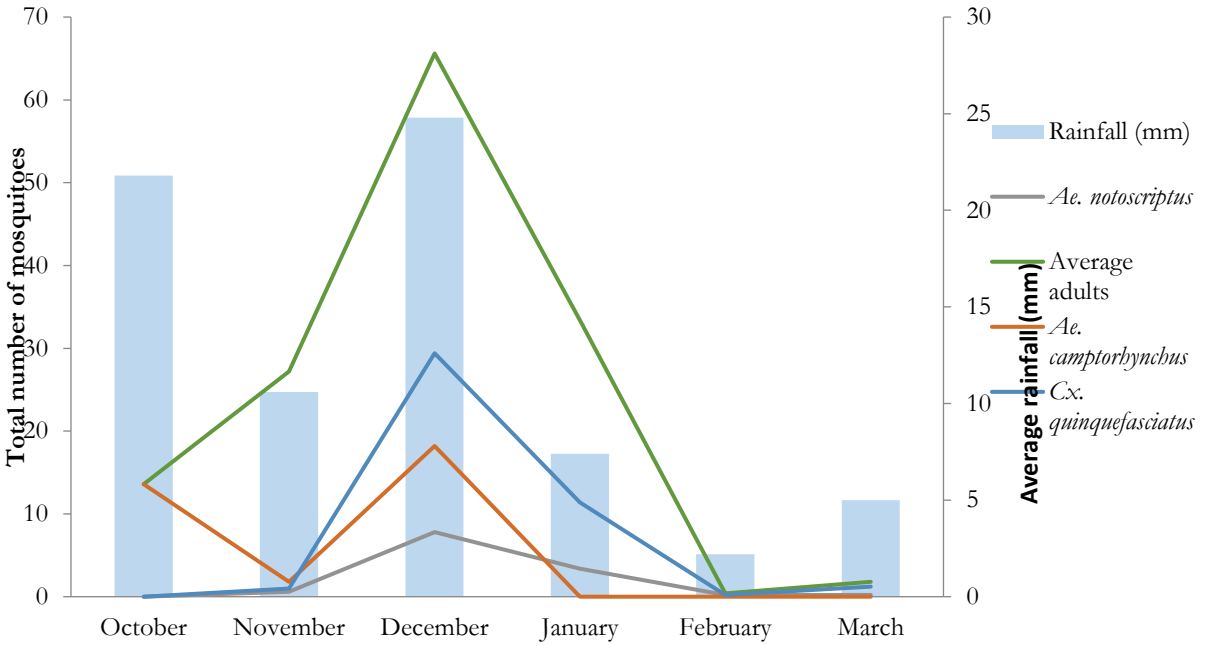

Figure 6.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at St Clair wetlands with the rainfall (mm) for the corresponding months.

6.3.2. Dipping for larval mosquitoes

No positive larval sites were detected during the inspections of potential larval breeding sites.

6.4. Discussion

A total of seven different mosquito species were caught during the monitoring season. *Ae. camptorhynchus* is noteworthy in collections, but was virtually undetected after Christmas.

Cx. quinquefasciatus and *Ae. notoscriptus* are generally associated with smaller water bodies such as containers and rain water tanks. It is possible that species such as *Ae. notoscriptus* are being produced from wetland projects such as this, however, the larvae are not found in the water bodies themselves. The larvae of this species would be found in tree hollows and other locations, and are much more likely to originate in domestic or industrial locations

Aedes camptorhynchus is likely produced at nearby coastal marshland sites and migrates into the area from outside. *Cq. linealis* is most likely produced in the wetland itself, although the numbers are not high enough to suggest biting problems. Overall the mosquito community was of medium diversity of species with low abundance and is therefore unlikely to cause any biting nuisance.

7. Grange Golf Club

7.1. Background

The mosquito community at Grange Golf club was initially investigated during wetland construction in the season of 2006-2007. While the Grange golf club wetlands are now well established (including vegetation), construction work began onsite, adjacent to the wetlands in late April, 2011 and had been completed prior to the 2011-2012 mosquito surveillance season. The construction involved removal of a green keeper's compound adjacent to the eastern access gate, and redesign of the fairways running parallel with the wetlands.

7.2. Site descriptions

7.2.1. Adult mosquito traps

There are three adult mosquito sites within the Grange golf club wetlands (Figure 7.1 ,Table 7-1).

Table 7-1 The GPS-coordinates for the three adult trap sites at Grange golf club.

Site:	Latitude:	Longitude:
Grange golf course site 1	-34.88771829754110	138.50351046770800
Grange golf course site 2	-34.88337278366080	138.50276472978200
Grange golf course site 3	-34.88175650127230	138.50259784609000

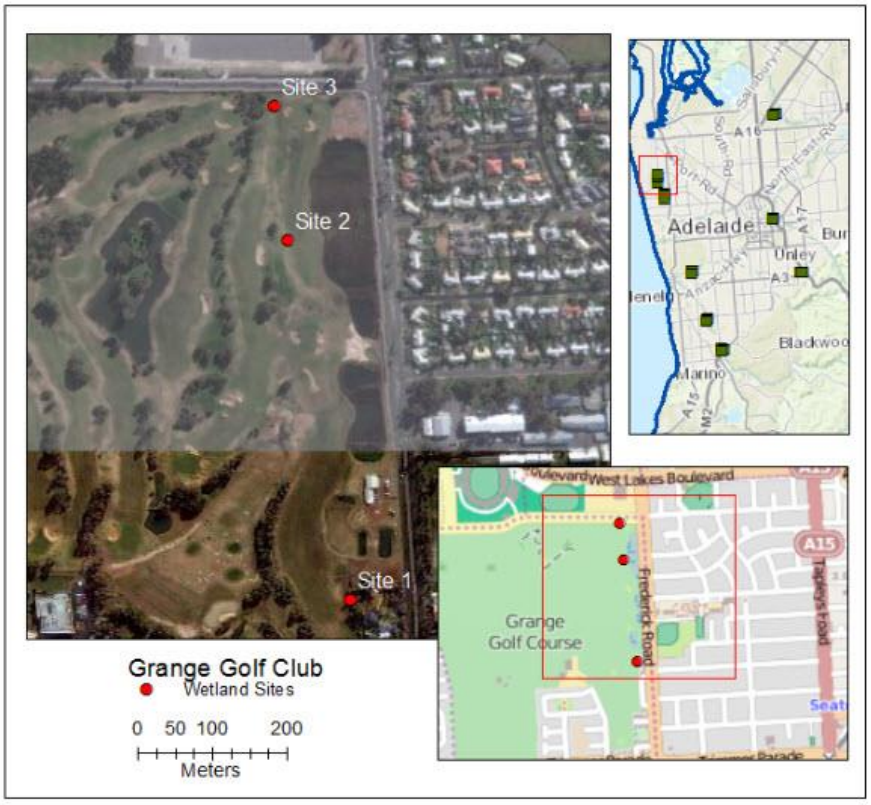

Figure 7.1 The location of the three sites at Grange golf club.

7.2.2. Positive larval dipping sites

No larvae were observed during dipping at this site.

7.2.3. Water quality site

Water samples for water quality analysis were taken by the pump house located between trap sites 1 and 3 (Figure 7.1).

7.3. Results

7.3.1. Adult mosquito traps

A total of four mosquito species contributed to the small collection of only 33 individuals from Grange Golf Club over the trapping season. The dominant species collected at this site was *Ae. notoscriptus* (Figure 7.2). *Aedes notoscriptus* made up over half of all the individuals caught in traps set at this location. Raw data are presented in Appendix 16.5.

Overall the mosquito abundance was slightly higher than the previous season (2017-2018, 24 mosquitoes). Peak numbers occurred in December, coincident with a peak in rainfall in that month (Figure 7.3).

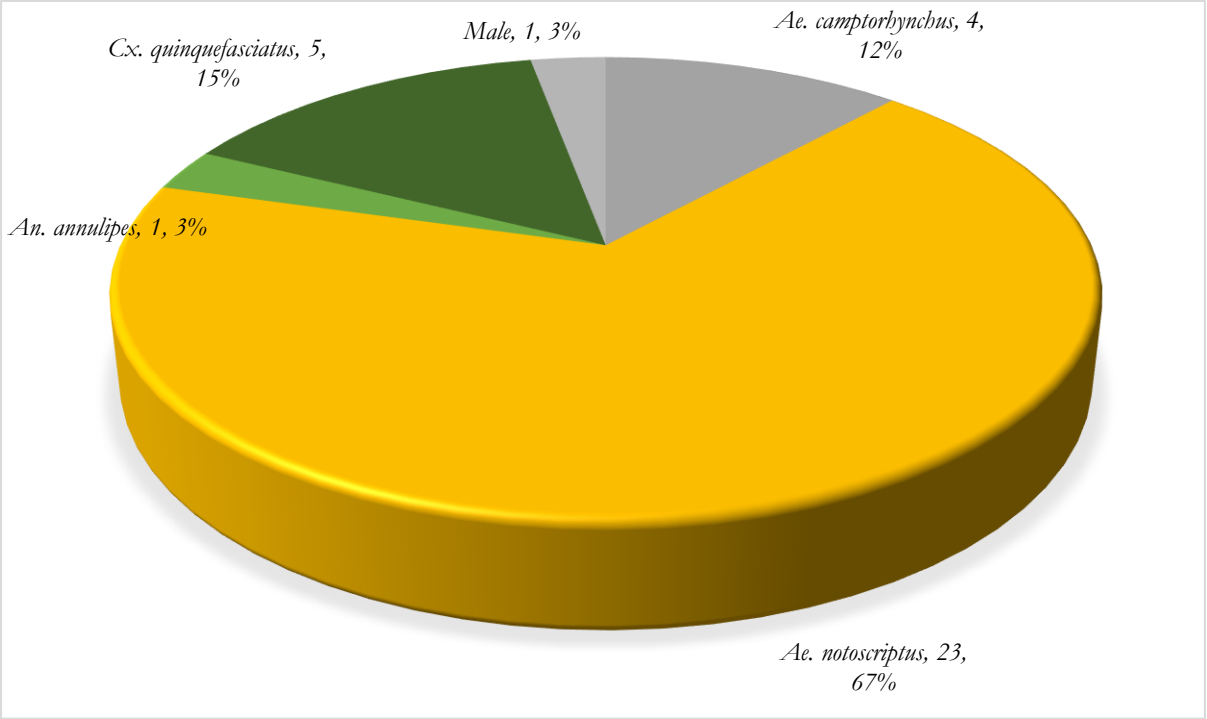

Figure 7.2 Total number of mosquitoes caught at the Grange golf club for each of the species during monitoring season 2018-2019.

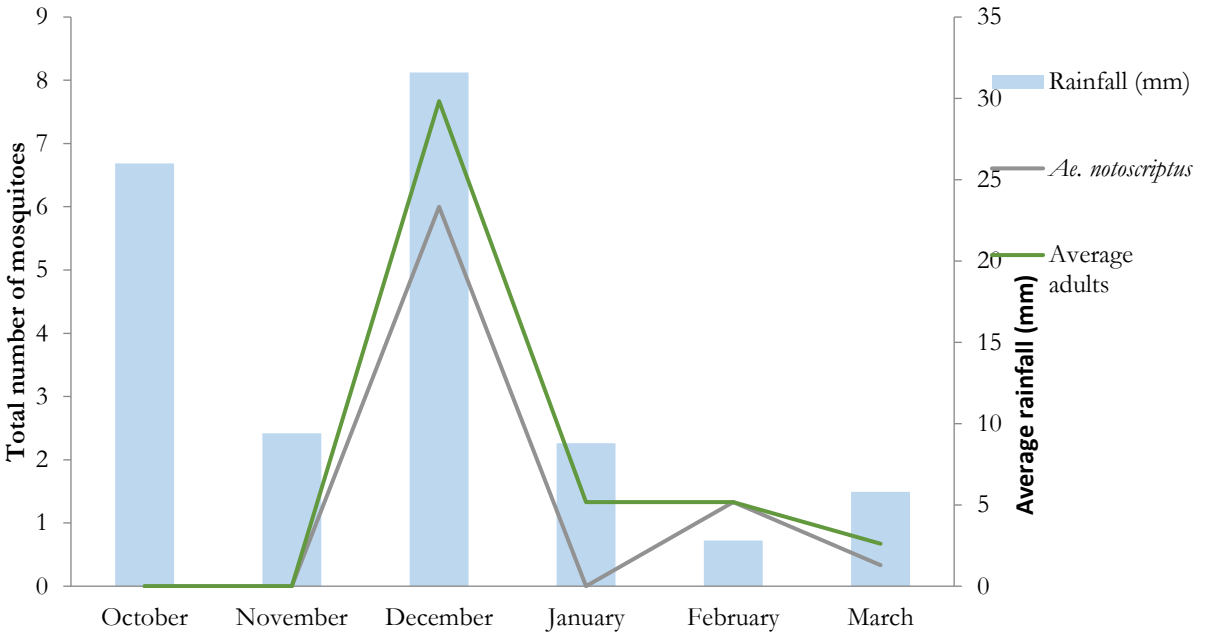

Figure 7.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at Grange golf club with rainfall (mm) for the corresponding months.

7.3.2. Dipping for larval mosquitoes

No larvae were observed during the routinely larval inspections at this site.

7.3.3. Water quality analysis

The wetland's pH remained between low 8.45 and high 8.83, levels considered healthy for aquatic invertebrates and plants (Table 7-2). Nitrate levels within the Grange Golf club wetlands were at a very low level throughout the monitoring season. Electrical conductivity fluctuated, with very low to low readings again this season.

Table 7-2 Water quality variables for Grange golf club monitoring season 2018-2019.

Date	pH	EC(mS/cm)	Nitrate (mg/l)
17/10/2018	9.1	0.36	0.01
22/11/2018	8.91	0.45	0.01
11/12/2018	7.52	0.51	
24/01/2019	8.8	0.86	

7.4. Discussion

The diversity and abundance of mosquitoes at Grange Golf club was low with only 33 individuals collected, a similar number to that collected in season 2017-2018. This low mosquito abundance is in line with most preceding monitoring seasons. The small number of *Ae. notoscriptus* collected are almost certainly from surrounding houses, and only a small number of *Ae. camptorhynchus* immigrating from outside the wetland were detected.

Due to the presence of well-established predatory aquatic invertebrates observed in the Grange Golf Club wetland bodies, and due to water quality measures showing consistent healthy observations, it is very unlikely that this wetland is contributing to the mosquito nuisance problems within the area.

8. Royal Adelaide Golf Club

8.1. Background

The Royal Adelaide golf club wetlands are completely established, including vegetation. A species of *Gambusia* fish was introduced into the wetland system prior to the 2011-2012 trapping season. The introduction of the fish has not resulted in any disturbance to the wetland pools over the last nine mosquito monitoring seasons. Dense vegetation was observed around the wetland bodies this season.

8.2. Site descriptions

8.2.1. Adult mosquito trap sites

There are three adult mosquito trap sites within the Royal Adelaide golf club wetlands (Table 8-1, Figure 8.1).

Table 8-1 The GPS-coordinates for the three adult trap sites at Royal Adelaide golf club.

Site:	Latitude:	Longitude:
Royal Adelaide golf course site 1	-34.89708130247890	138.50964325480100
Royal Adelaide golf course site 2	-34.89796232432120	138.50867690518400
Royal Adelaide golf course site 3	-34.90051360800860	138.50870188325600

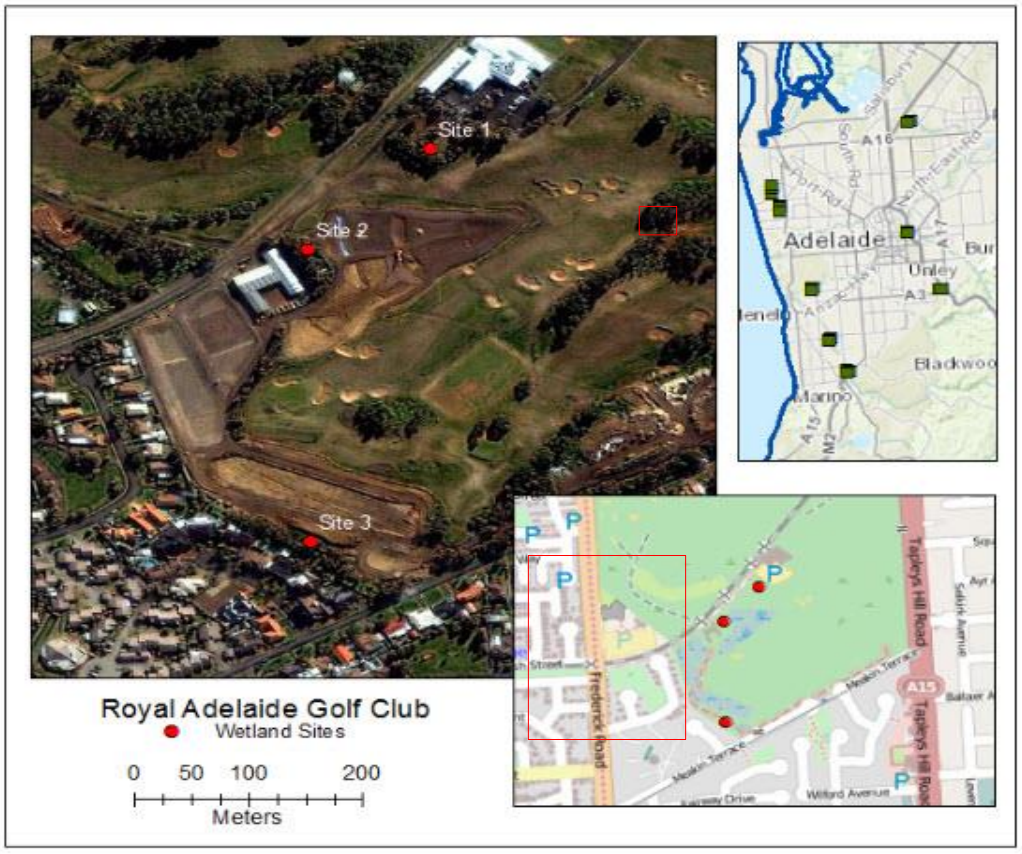

Figure 8.1. The locations of the three sites at Royal Adelaide golf club.

8.2.2. Positive larval dipping sites

No mosquito larvae were detected at this site during monitoring.

8.2.3. Water quality site

Water samples were collected at two sites. One water collection site was on the other side of trap 2 opposite to the greens keeper's shed and one water collection site was at the sedentary basin past trap site 3 (Figure 8.1).

8.3. Results

8.3.1. Adult mosquito traps

A total of only 53 female mosquitoes, belonging to six species, were collected in 2018-19 (Figure 8.2). *Ae. notoscriptus* was the most numerous species sampled and constituted over half of all mosquitoes collected. The highest number of mosquitoes were caught in December. The remaining collections were broadly divided amongst the remaining species, albeit with low numbers. Collection data is presented Appendix 16.6.

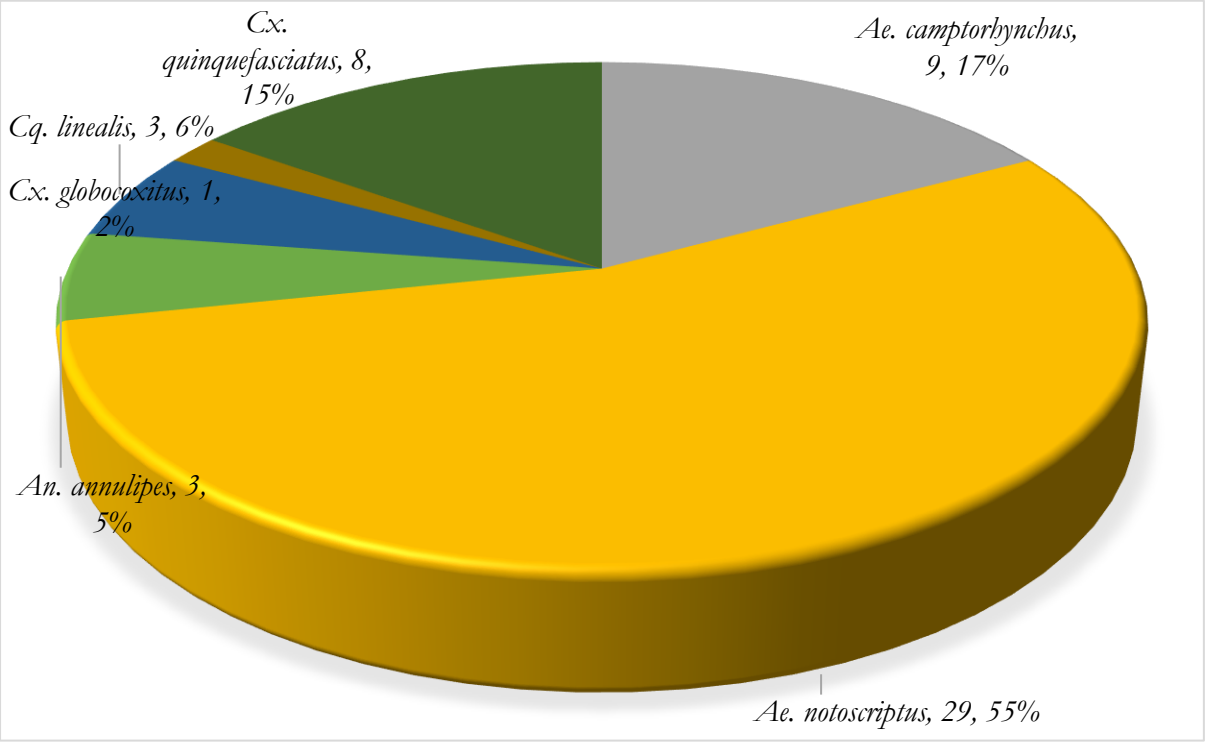

Figure 8.2. Total number of mosquitoes caught at the Royal Adelaide golf club for each of the species during monitoring season 2018-2019.

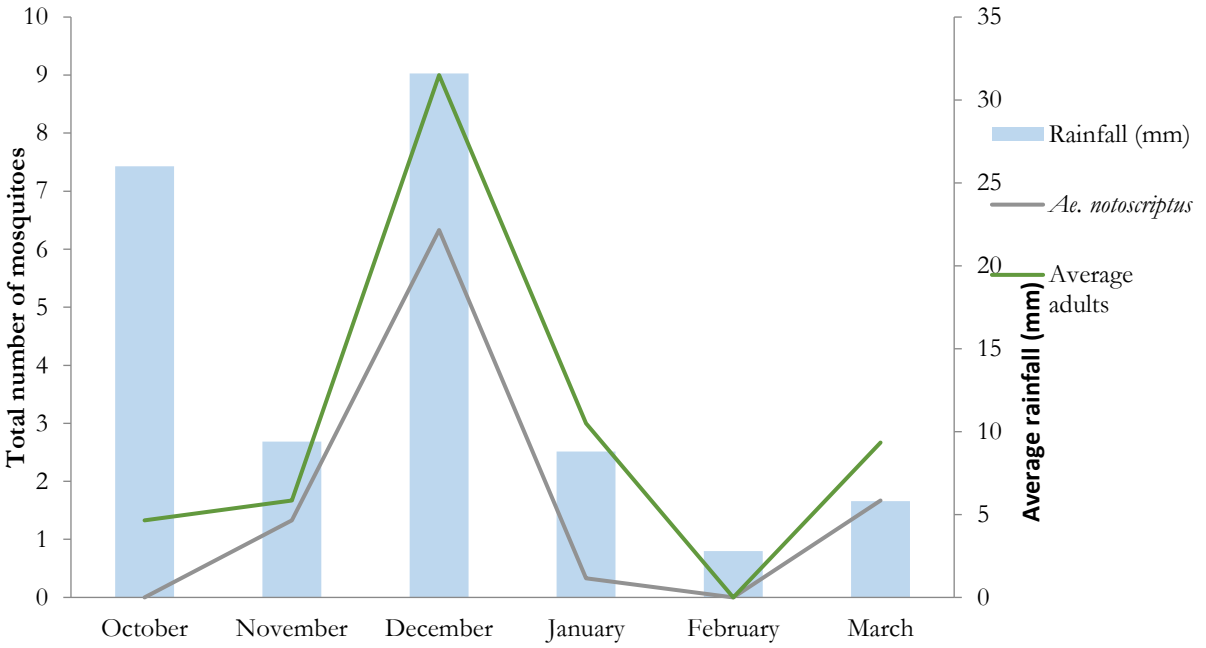

Figure 8.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at Royal Adelaide golf club with rainfall (mm) for the corresponding months.

8.3.2. Dipping for mosquito larvae

No positive larvae sites were detected throughout the monitoring season.

8.3.3. Water quality analysis

Electrical conductivity within the Royal Adelaide golf club wetlands ranged between very low to low, fluctuating throughout the season. Nitrate levels were low at both sites and remained at a healthy level throughout the trapping season. The wetland's pH ranged between 7.3 and 9.04. Levels above a pH of 9 show a more alkaline environment in the wetland bodies which could potentially lead to a toxic habitat for the aquatic plants and animals.

Table 8-2 Water quality variables for Royal Adelaide golf club monitoring season 2018-2019.

Date	pH	EC(mS/cm)	Nitrate (mg/l)
17/10/2018	9.1	0.061	0.01
21/11/2018	9.04	0.45	0.01
11/12/2018	7.3	0.55	0.01
24/01/2019	8.31	0.54	
13/02/2019	7.88	1.13	
25/03/2019	8.62	1.85	

8.4. Discussion

Mosquito numbers at Royal Adelaide Golf club were low. Despite the number being collected this season (53) being more than for 2017-18 (24), it remains a small number of mosquitoes, and thus likely to cause no significant biting or disease risk. Peak numbers occurred in December 2018 (Figure 8.3).

While *Aedes notoscriptus* was the most numerous species collected at this site, no potential breeding sites were detected. It is likely that these individuals are originating from domestic sources such as discarded containers or tree holes rather than the wetland itself. While wetland species *Cq. linealis* and *An. annulipes* were represented in collections, both species only contributed a small number of individuals and are unlikely to be causing any management issues at this time.

9. Felixstow Wetland

9.1. Background

The Felixstow Reserve is bounded by the River Torrens Linear Park on the northern site, Riverside Drive on the western side and the Langman Drive on the southern site. The construction of the Felixstow Reserve is part of the Waterproofing Eastern Adelaide Stormwater Harvesting and Re-use Project (ERA Project). The Felixstow wetland is part of the Felixstow Reserve, its construction phase commenced in May 2014. This is the fourth season that this site has been included in the monitoring program. This season construction work was carried out at some parts of the site.

9.2. Site descriptions

9.2.1. Adult mosquito traps

There are two adult mosquito trap sites at the Felixstow wetland (Figure 9.1, Table 9-1).

Table 9-1 The GPS-coordinates for the two adult trap sites at Felixstow wetland.

Site:	Latitude:	Longitude:
Felixstow site 1	-34.88415582	138.6493552
Felixstow site 2	-34.88429363	138.6460889

Figure 9.1. The location of the two sites at Felixstow wetlands.

9.2.2. Positive larval dipping sites

No positive larval sites were recorded during dipping at this site over the trapping season.

9.2.3. Water quality site

Water samples were collected in the stream by trap site 2 (Figure 9.1).

9.3. Results

9.3.1. Adult mosquito traps

The Felixstow wetlands recorded a total of 124 adult female mosquitoes. A total of six mosquito species were caught throughout the monitoring season. *Aedes notoscriptus* was the dominant species in the 2018-19 monitoring period, contributing 79% of total mosquito collections this season. Populations of *Ae. notoscriptus* peaked in January (Figure). *Cx. quinquefasciatus* and *Cq. linealis* were also collected, albeit in small numbers (Figure 9.2, Appendix 16.7).

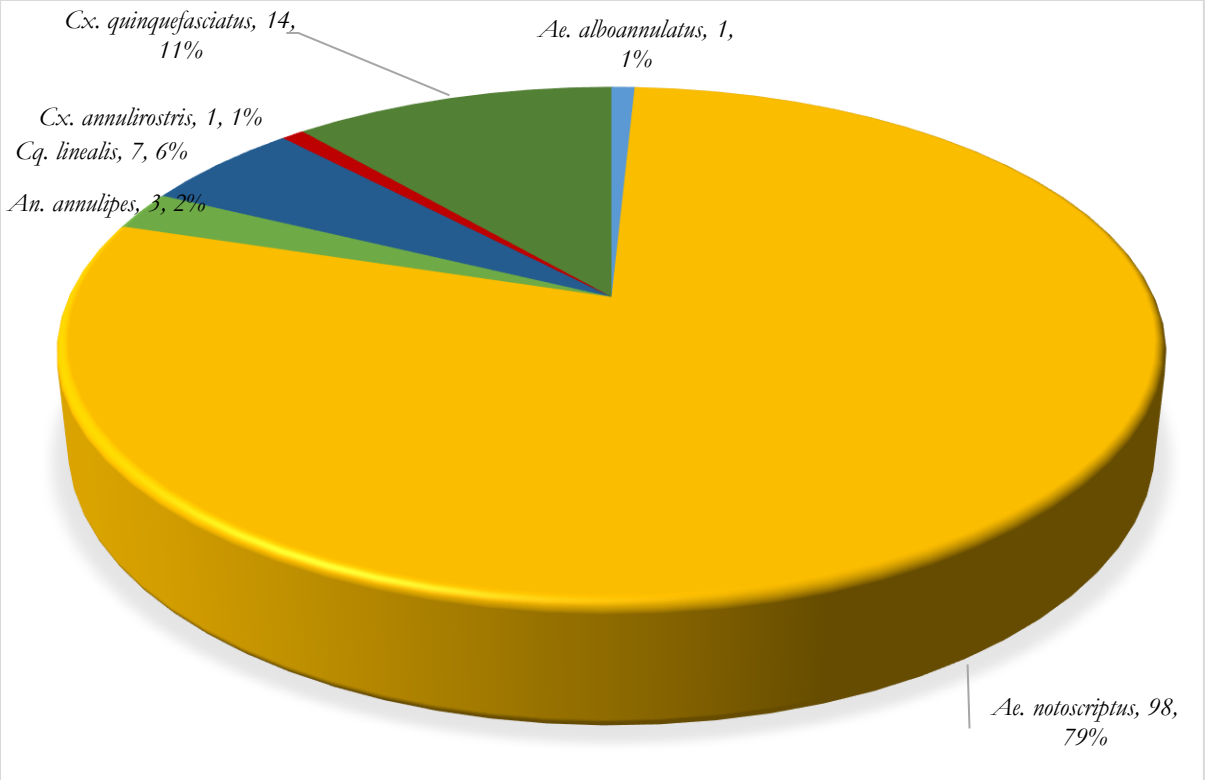

Figure 9.2. Total number of mosquitoes caught at Felixstow for each of the species during monitoring season 2018-2019.

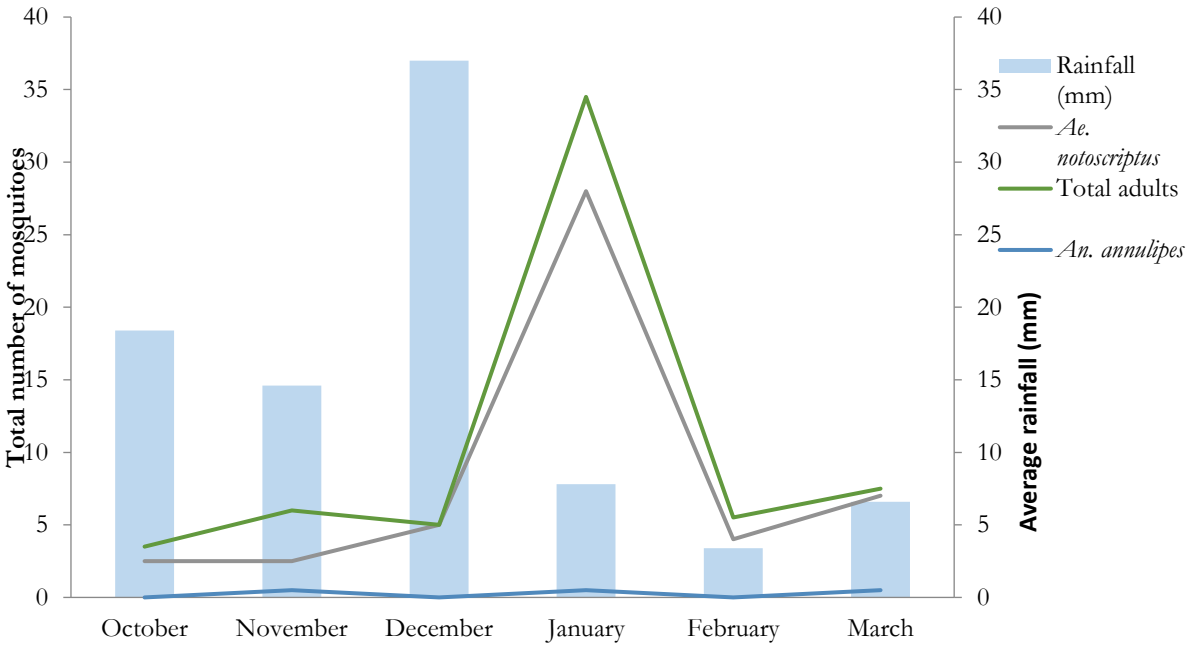

Figure 9.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at Felixstow with total rainfall (mm) for the corresponding months.

9.3.2. Dipping for larval mosquitoes

No mosquito larvae were detected at this site during monitoring.

9.3.3. Water quality analysis

Electrical conductivity at the site was highest in March 2019, at the very end of the hot summer months. Nitrate levels remained very low throughout the trapping season and pH levels remained within the healthy range for the survival of aquatic plants and animals recording levels between 7.85 and 9.01.

Table 9-2 Water quality variables for the Felixstow wetland during monitoring season 2018-2019.

Date	pH	EC (mS/cm)	Nitrate (mg/l)
20/11/2018	7.85	0.29	0.01
11/12/2018			
12/02/2019	8.41	1.18	
25/03/2019	9.01	2.14	

9.4. Discussion

A total of six different mosquito species were caught during the monitoring season, with the mosquito numbers only considered at a moderate level. Generally speaking, mosquito numbers were low throughout the sampling period, with a single peak month in January. The total mosquitoes collected (124) was greater than for the 2017-18 season (55).

The pre-construction mosquito surveillance conducted at this site in the 2014-15 season (first time included in the program) confirmed an existing mosquito community with moderate diversity of six mosquito species. Again, this season moderate diversity was observed and water quality analyses showed a healthy environment for aquatic plants and a variety of invertebrate species.

Although electrical conductivity fluctuated slightly throughout the trapping season with a peak in December, all measured parameters remained within the healthy ranges for the survival of aquatic plants and animals. Adult captures were clearly dominated by *Ae. notoscriptus*. While *Ae. notoscriptus* adults were collected on site, no potential breeding sites were identified. Adults of the species most likely originate from properties adjacent to the trap sites as this species is a container breeder utilising any water filled containers, pot plant bases with standing water among others generally found around properties or gardens. It is very unlikely that the wetlands are producing nuisance levels of mosquitoes.

10. Glenelg Golf Club

10.1. Background

The Glenelg Golf Club wetlands and associated vegetation are completely established. Construction occurred in late 2007. Prior to this, an assessment of the mosquito community was carried out in 2006-2007 as well as a post-construction assessment in 2007-2008. The presence of nuisance biting midge (Ceratopogonidae) populations at the site has been described in a previous report. No biting midges were recorded during this current season. A concrete-lined drain (from Brownhill Creek, feeding the River Torrens 250 north of the site) runs along the eastern boundary of the Glenelg Golf Club.

10.2. Site descriptions

10.2.1. Adult mosquito traps

There are three adult mosquito trap sites at the Glenelg Golf Club (Figure 10.1, Table 10-1).

Table 10-1 The GPS-coordinates for the three adult trap sites at Glenelg Golf Club.

Site:	Latitude:	Longitude:
Glenelg golf club site 1	-34.96043994	138.5338112
Glenelg golf club site 2	-34.95844455	138.5343723
Glenelg golf club site 3	-34.95837799	138.5332401

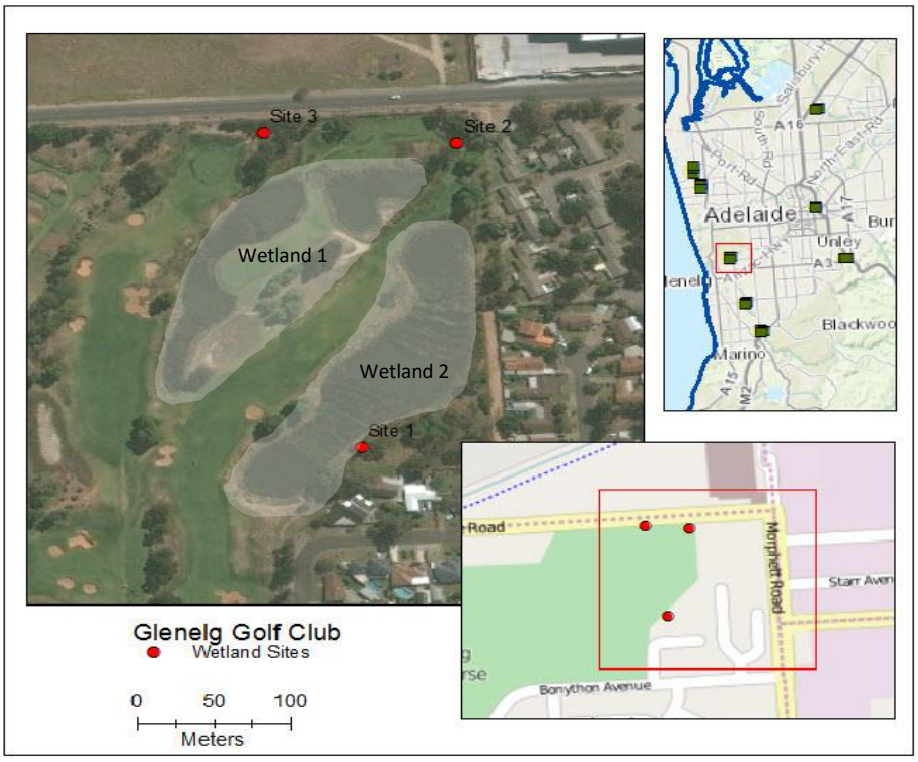

Figure 10.1. The location of the three sites at Glenelg Golf Club.

10.2.2. Positive larval dipping sites

No positive larval sites were recorded during dipping at this site over the trapping season.

10.2.3. Water quality site

Samples were taken from wetland 1, adjacent the rock weir (Figure 10.1).

10.3. Results

10.3.1. Adult mosquito traps

In the 2018-19 trapping season, Glenelg Golf Club recorded a total of 21 mosquitoes belonging to six species. Mosquito collections peaked in January 2019 following the increased precipitation recorded in December 2018 (Figure). Very small numbers of a variety of mosquito species were recorded. These were all species previously documented at the site, namely *Cq. linealis* (commonly associated with wetlands in this work), *Ae. notoscriptus* with 18 individuals was caught at this site this season representing around a third of total collections and *Cx. globocoxitus*.

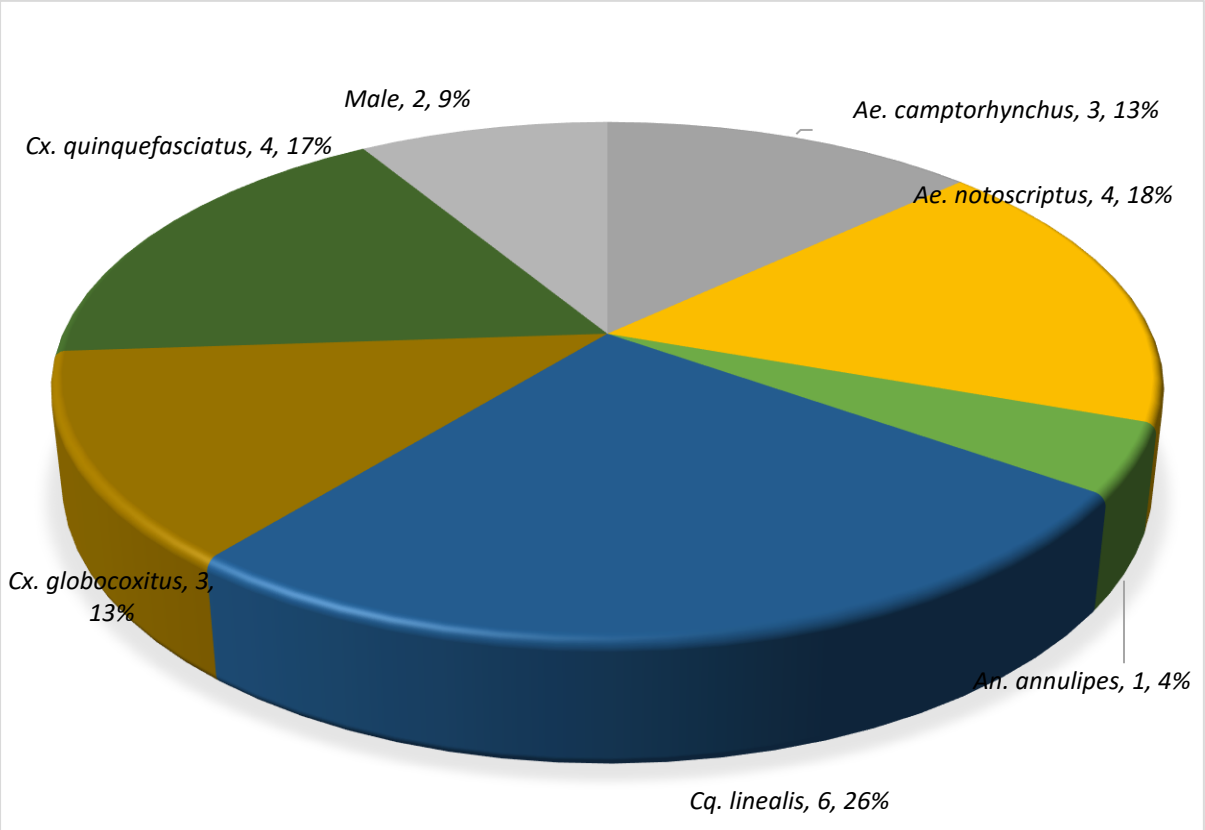

Figure 10.2. Total number of mosquitoes caught at the Glenelg Golf Club wetlands for each of the species during monitoring season 2018-2019.

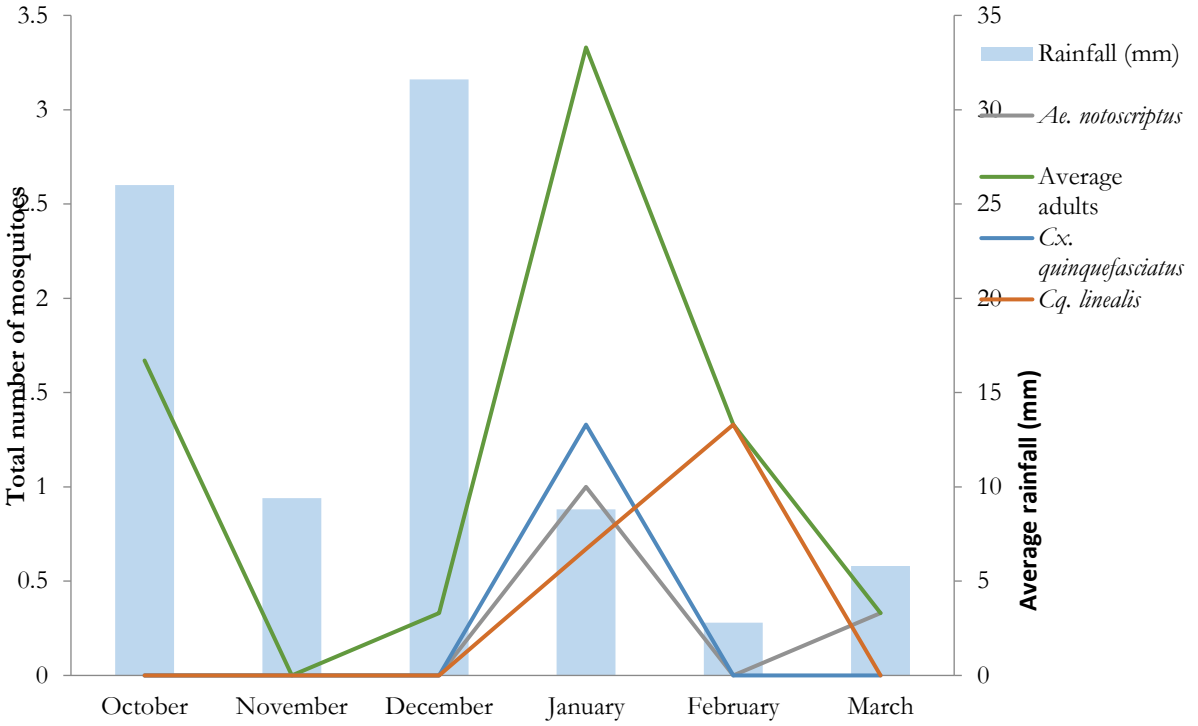

Figure 10.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at Glenelg Golf Club with total rainfall (mm) for the corresponding months.

10.3.2. Dipping for larval mosquitoes

No mosquito larvae were detected at this site during monitoring.

10.3.3. Water quality analysis

Nitrate levels recorded for Glenelg Golf club wetland were consistently low, representing naturally occurring levels in waterways. Electrical conductivity within the wetlands fluctuated but remained within the low to very low range throughout the season, which are healthy levels for aquatic invertebrates and plants. The wetland's pH fluctuated within the range of 7.76-9.2 which also is within a healthy range for survival of aquatic plants and animals. No levels of concern were recorded.

Table 10-2. Water quality variables for Glenelg golf course monitoring season 2018-2019.

Date	pH	EC (mS/cm)	Nitrate (mg/l)
1/10/2018	9.2	0.68	0.01
22/11/2018	9.14	1.26	0.01
11/12/2018	7.76	0.69	0.01
24/01/2019	9.08	0.65	
13/02/2019	8.41	0.83	
25/03/2019	7.79	2.13	

10.4. Discussion

The mosquito fauna of the Glenelg Golf Club site is small in number, and unremarkable in diversity. Fewer mosquitoes were collected this season (21) compared with the previous year (57 from 7 species in 2017-18).

Combined with the healthy populations of predatory aquatic invertebrates, again observed during larval dipping, together with established vegetation and healthy water quality variables, the Glenelg Golf club wetlands are unlikely to be producing nuisance populations of mosquitoes. The mosquito abundance recorded at this site continues to remain very low compared to previous seasons.

Larvae sites of most species collected are likely arise from different areas within or adjacent to the wetland site such as gutters and other water filled containers. The two exceptions are *Cq. linealis* and *An. annulipes*, the larvae of both species are found in association with wetland habitats.

11. Ridge Park

11.1. Background

Ridge Park is a well-established wetland. Ridge Park has one main creek running through the centre of the park near Trap 2. This creek has remained dry this monitoring season allowing no water quality sample collections.

11.2. Site descriptions

11.2.1. Adult mosquito traps

There are three permanent adult mosquito trap sites at Ridge Park (11.1, Table 11-1).

Table 11-1 The GPS-coordinates for the three adult trap sites at Ridge Park.

Site:	Latitude:	Longitude:
Ridge park site 1	-34.96109490282830	138.63831267692100
Ridge park site 2	-34.96156747452910	138.63947113975800
Ridge park site 3	-34.96169320307670	138.64020916633300

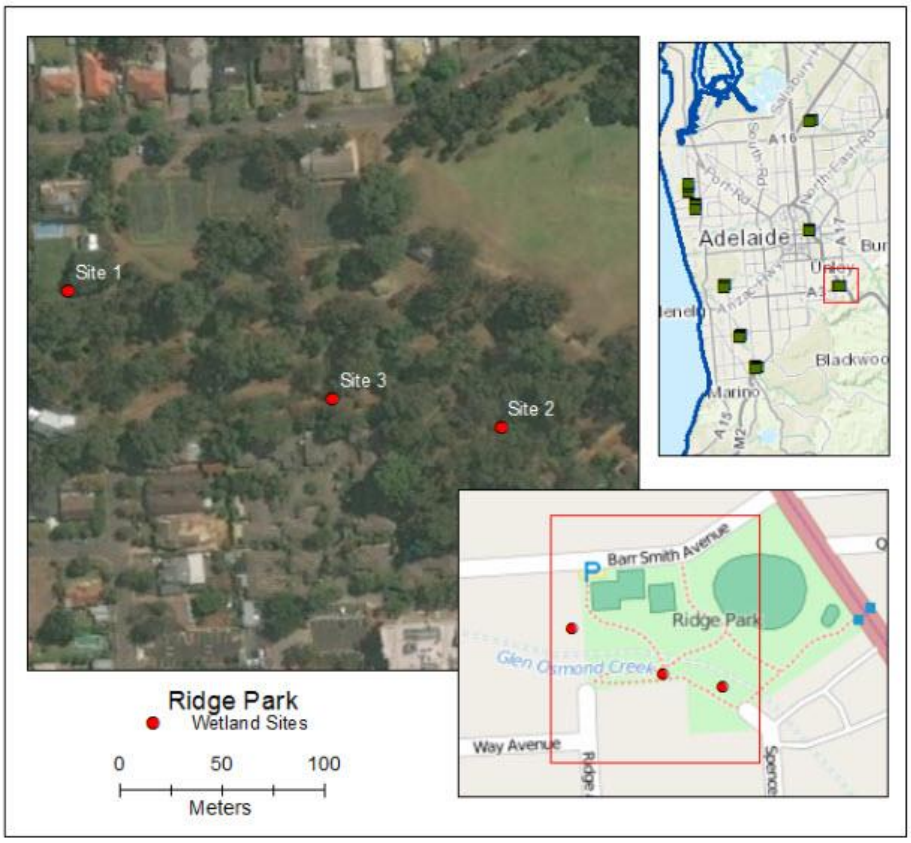

Figure 11.1. The location of the three sites at the Ridge Park.

11.2.2. Positive larval dipping sites

No positive larval sites were recorded during dipping at this site over the trapping season.

11.2.3. Water quality site

Not enough water was present to collect samples (Figure 11.1), the stream and sedentary pond remained mainly dry throughout this monitoring season.

11.3. Results

11.3.1. Adult mosquito traps

A total of 573 adult female mosquitoes from six species were collected at Ridge Park over the 2018-19 season. Collections were dominated by the small *Aedes* species, *Ae. notoscriptus* which constituted 67% of the all mosquito collections from this site (Figure 11.2, Appendix 16.9). This season there were strong mosquito numbers from December 2018 through to February 2019 (Figure 11.3).

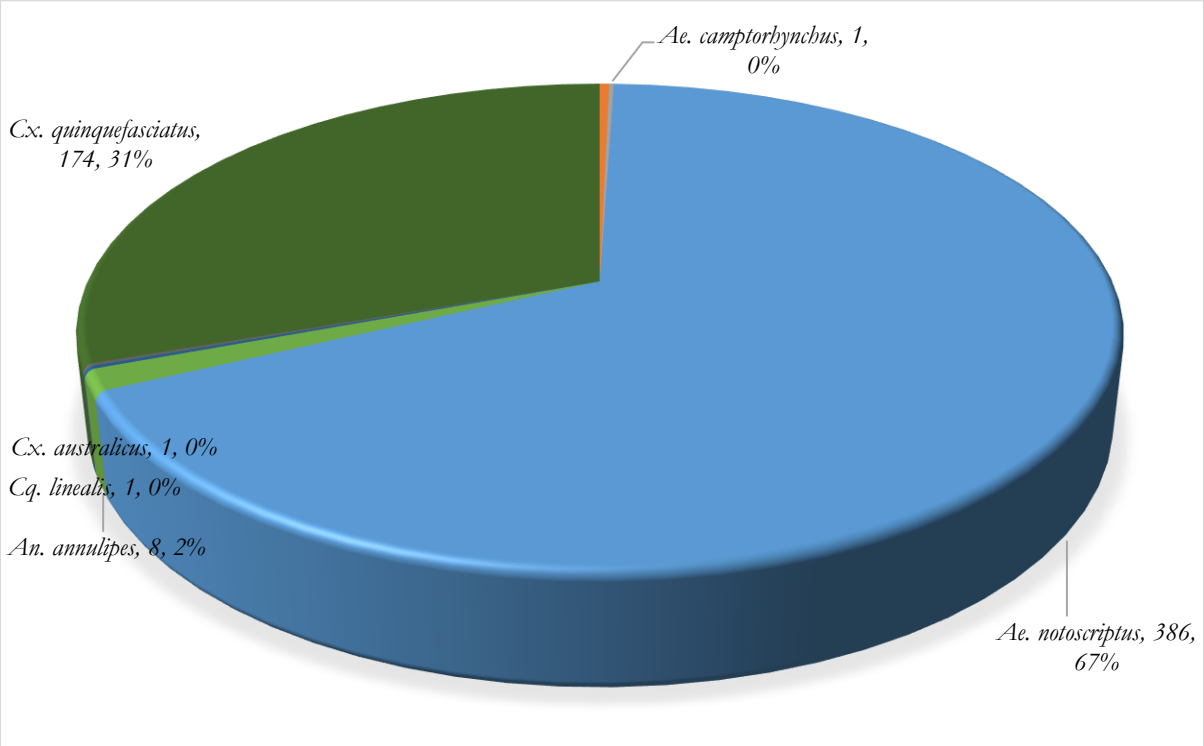

Figure 11.2. The total number of mosquitoes caught at the Ridge Park for each of the species during monitoring season 2018-2019.

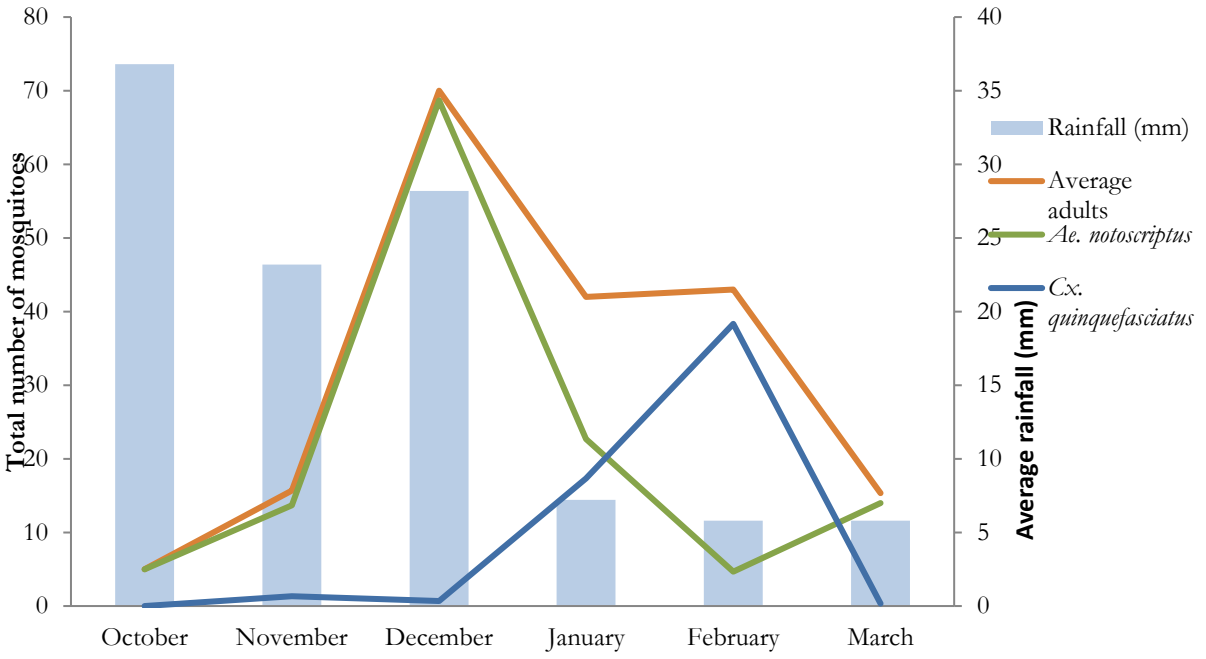

Figure 11.3 Monthly total number of mosquitoes and total number of females caught of the dominant species at Ridge Park with the rainfall (mm) for the corresponding months.

11.3.2. Dipping for larval mosquitoes

No mosquito larvae were detected at this site during monitoring.

11.3.3. Water quality analysis

Not enough water was present to collect samples; the stream and sedentary pond remained mainly dry throughout this monitoring season.

11.4. Discussion

11.4.1. Mosquito community and seasonality

Overall mosquito abundance was much higher this season compared to the previous when a total of 276 individuals were caught. The mosquito abundance at this site was higher than for any other location sampled in this work. That said, *Ae. notoscriptus*, is a freshwater container breeder that does not utilise large water bodies such as wetlands and it is therefore likely that this common urban container-breeder is breeding in adjacent residential properties.

The mosquito community was of low in diversity but quite high in abundance compared to other wetland sites. The dominant species tends to bite humans on the feet and hands around dusk when residents are tending to the garden or eating outdoors and is often causes residents to complain due to this disruptive habit. At the numbers trapped during peak periods this mosquito is likely to be causing residents some discomfort in the form of nuisance biting, however this species has also been implicated in urban Ross River Virus transmission (Watson and Kay 1998, Flies, Toi et al. 2015). Some community education regarding monitoring containers around properties could benefit the residents adjacent the wetland project. The lack of permanent water in the wetland and be an issue following fresh inundation as the lack of established invertebrate predators may result in a rapid increase in mosquito numbers.

12. Oaklands Park

12.1. Background.

Construction of the Oaklands Park wetlands has reached near completion. Due to the final stages of constructions all trap sites were relocated from the previous season in 2013-14 to cover all areas of the newly established wetland. Some minor construction work was undertaken in the 2016-17 season. The trap sites have remained the same as for the previous monitoring season.

12.2. Site descriptions

12.2.1. Adult mosquito traps

There are three adult mosquito trap sites at Oaklands Park (12.1.,Table 12-1).

Table 12-1 The GPS-coordinates for the three adult trap sites at Oaklands Park

Site:	Latitude:	Longitude:
Oaklands park site 1	-34.99637693	138.5475305
Oaklands park site 2	-34.99687884	138.54701
Oaklands park site 3	-34.99817292	138.5463323

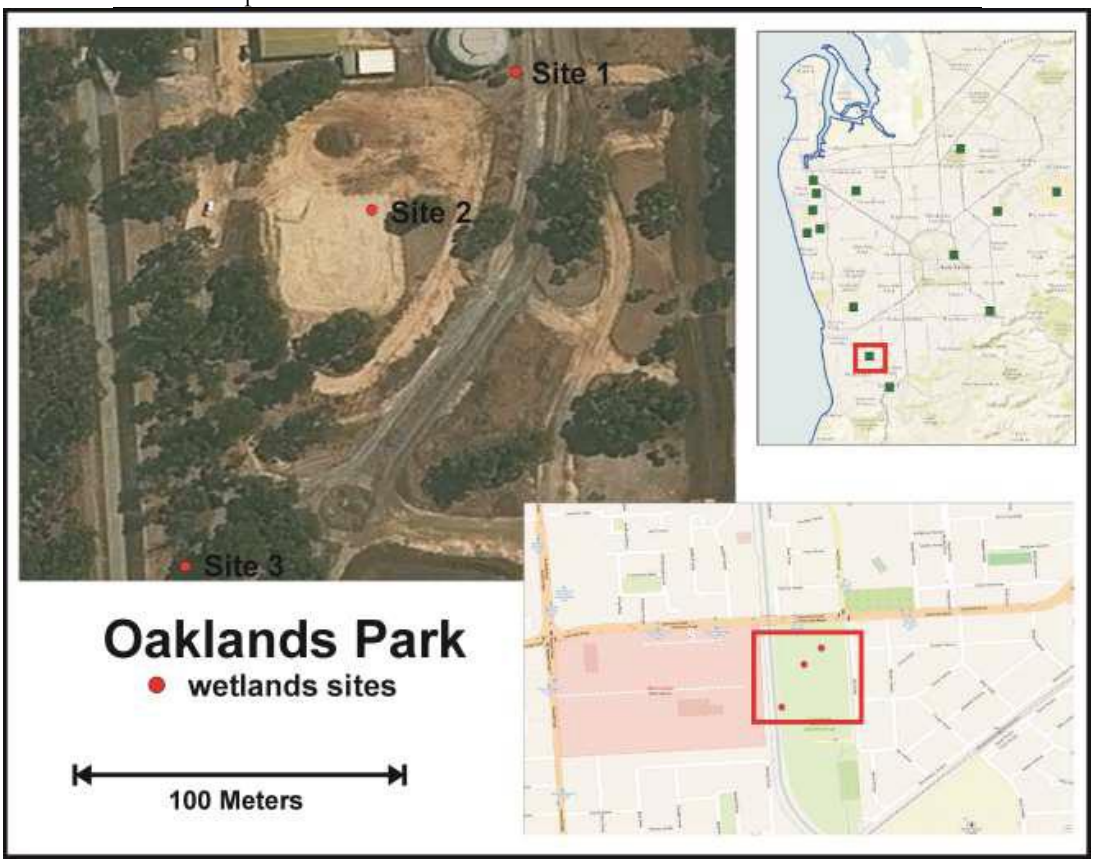

Figure 12.1. The location of the three sites at the Oaklands Park

12.2.2. Positive larval dipping sites

No larvae were observed during the larval surveillance work at this site.

12.2.3. Water quality site

Samples for water quality testing were collected at two sites. One located by trap site 1, along the board walk and the other one to the right of the sedentary basin located to the left on the way to trap site 3 (Figure 12.1.).

12.3. Results

12.3.1. Adult mosquito traps

A total of 83 adult female mosquitoes belonging to five species were collected at the three Oaklands Park traps this season. The dominant species collected at this site was *Ae. notoscriptus* which made up almost the entire collection (Figure 12.2, Appendix 16.10). The remaining species where collected in only small numbers sporadically over the season (Appendix 16.10). The peak in rainfall occurred in during December 2018, which coincided with the small peak in mosquito abundance (Figure 12.3.).

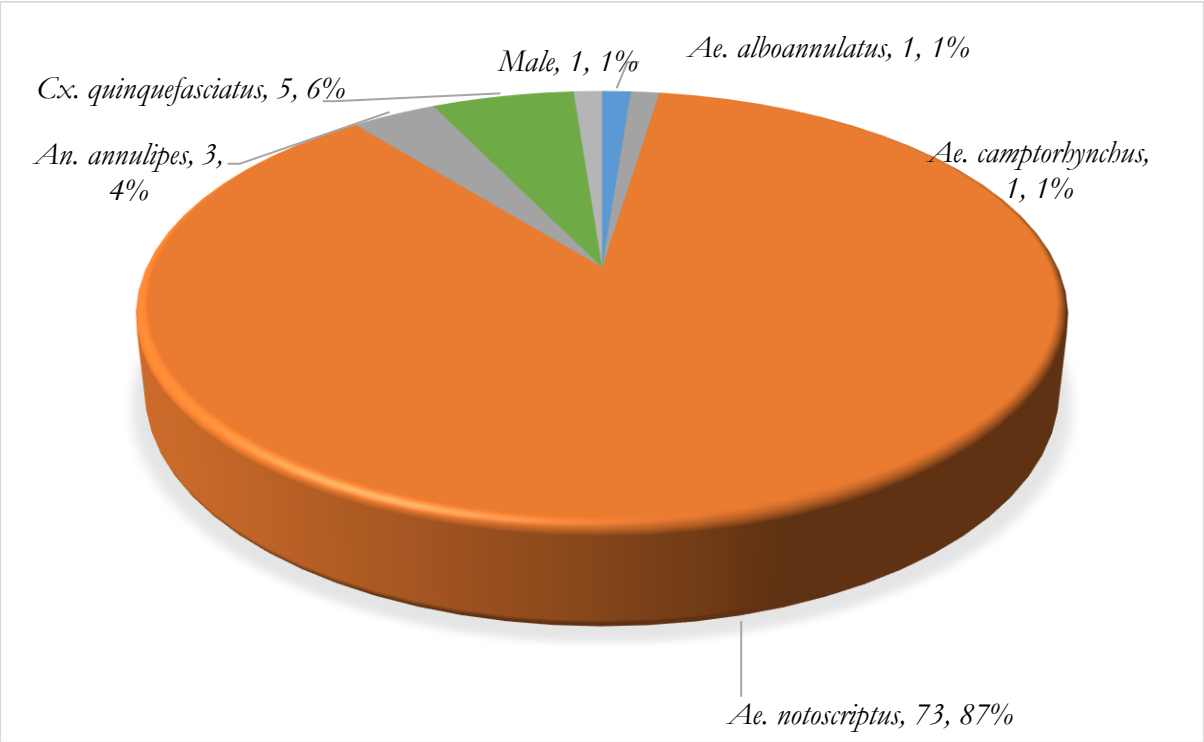

Figure 12.2. The total number of mosquitoes caught at the Oaklands Park for each of the species during monitoring season 2018-2019.

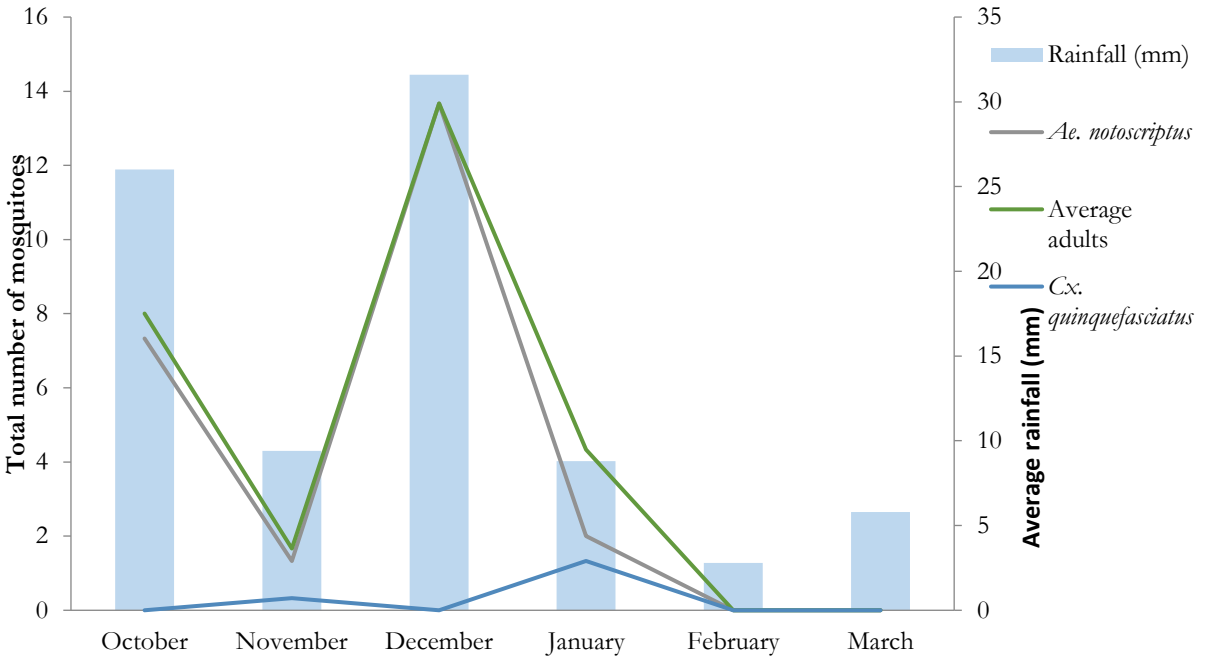

Figure 12.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at Oaklands Park with the rainfall (mm) for the corresponding months.

12.3.2. Dipping for larval mosquitoes

No positive larval sites were detected during dipping at the sites.

12.3.3. Water quality analysis

Electrical conductivity at the site fluctuated throughout the monitoring season but remained at a healthy level for aquatic invertebrates and plants. Nitrate levels showed very low levels and pH levels fluctuated between 7.73 and 9.28. All the measured pH levels of the wetlands remained within the healthy range for the survival of aquatic plants and animals.

Table 12-2 Water quality variables for Oaklands Park during monitoring season 2018-2019.

Date	pH	EC(mS/cm)	Nitrate (mg/l)
13/10/2018	7.73	1.36	0.01
20/11/2018	8.75	0.75	0.01
11/12/2018	7.96	0.65	0.01
23/01/2019	8.33	0.7	0.01
12/02/2019	7.85	0.82	
28/03/2019	9.28	1.63	

12.4. Discussion

The dominant mosquito species collected this season was *Ae. notoscriptus*, which has been the case in previous seasons. This species is not being produced in the wetland itself, but rather is immigrating into traps from surrounding housing. Total collections were greater in 2018-19 (83) than the previous year (when only 40 mosquitoes were collected). Nevertheless, the mosquito abundance at this site remains low.

The mosquito community of Oaklands Park was of relatively low diversity and abundance of all other species was low and very unlikely to cause any biting nuisance to the community. The increased vegetation allowed the establishment of many diverse populations of predatory aquatic invertebrates, and the associated healthy water quality, make it very unlikely for this wetland to contribute to the abundance of existing mosquito populations. The existing water bodies at this site have not shown thus far to produce problematic mosquito populations and only natural fluctuating numbers of mosquito populations have been recorded at this site over the different monitoring seasons.

13. Warriparinga Wetlands

13.1. Background

The Warriparinga wetland was constructed in 1999 and it is a very established wetland. Sturt River runs throughout the length of the wetland.

13.2. Site descriptions

13.2.1. Adult mosquito traps

There are three adult mosquito trap sites at Warriparinga (Figure 13.1., Table 13-1).

Table 13-1 The GPS-coordinates for the three adult trap sites at Warriparinga.

Site:	Latitude:	Longitude:
Warriparinga site 1	-35.0399	138.8344
Warriparinga site 2	-35.0208	138.5625
Warriparinga site 3	-35.0221	138.5598

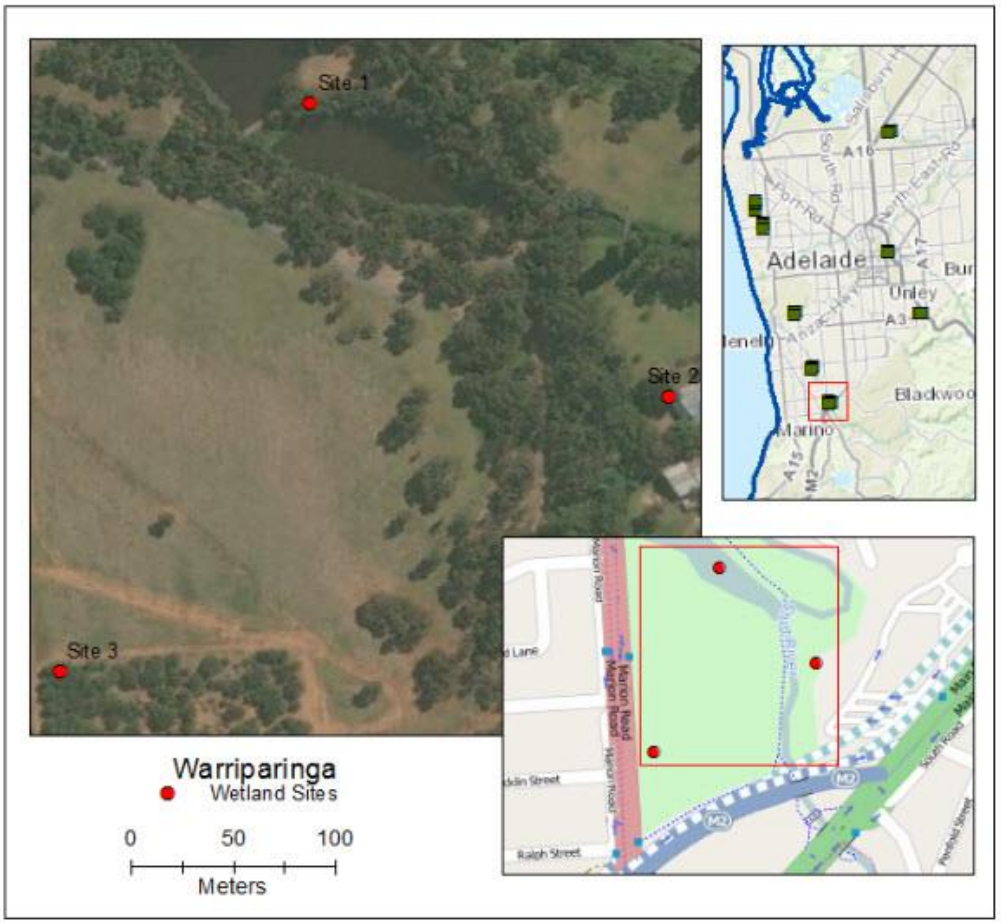

Figure 13.1. The location of the three sites at Warriparinga.

13.2.2. Positive larval dipping sites

No positive larvae were recorded during the larval inspection this monitoring season at this site.

13.2.3. Water quality site

Water quality samples were collected from the pond just north of site 3 (Figure).

13.3. Results

13.3.1. Adult mosquito traps

This season a total 50 adult female mosquitoes were collected, belonging to seven species. Low levels of a number of species were detected, chief amongst them being *Cx. quinquefasciatus* and Ae. notoscriptus. Both of these species have been collected from Warriparinga in the past. Mosquito numbers peaked in January 2019, although the total number of mosquitoes at that time was still very low. The other species caught were low in abundance.

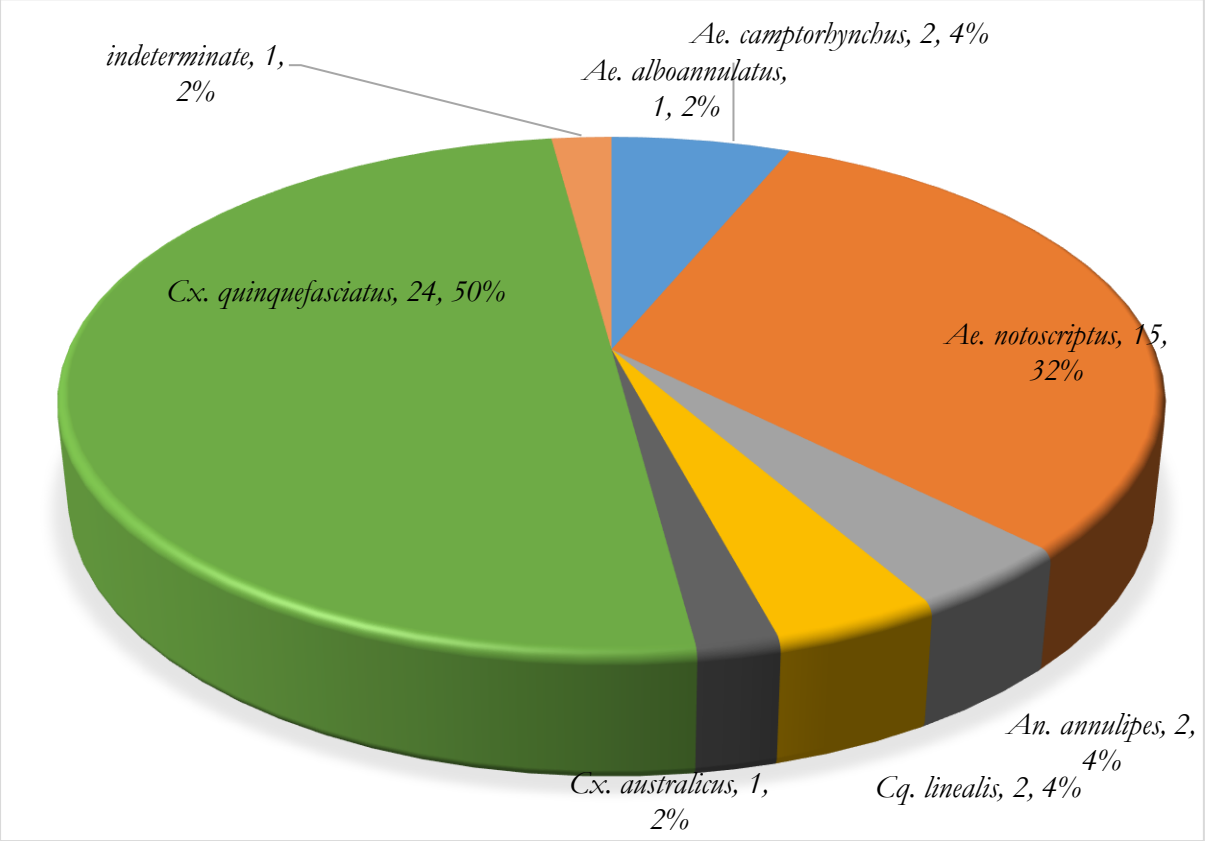

Figure 13.2. The total number of mosquitoes caught at Warriparinga for each of the species during monitoring season 2018-2019.

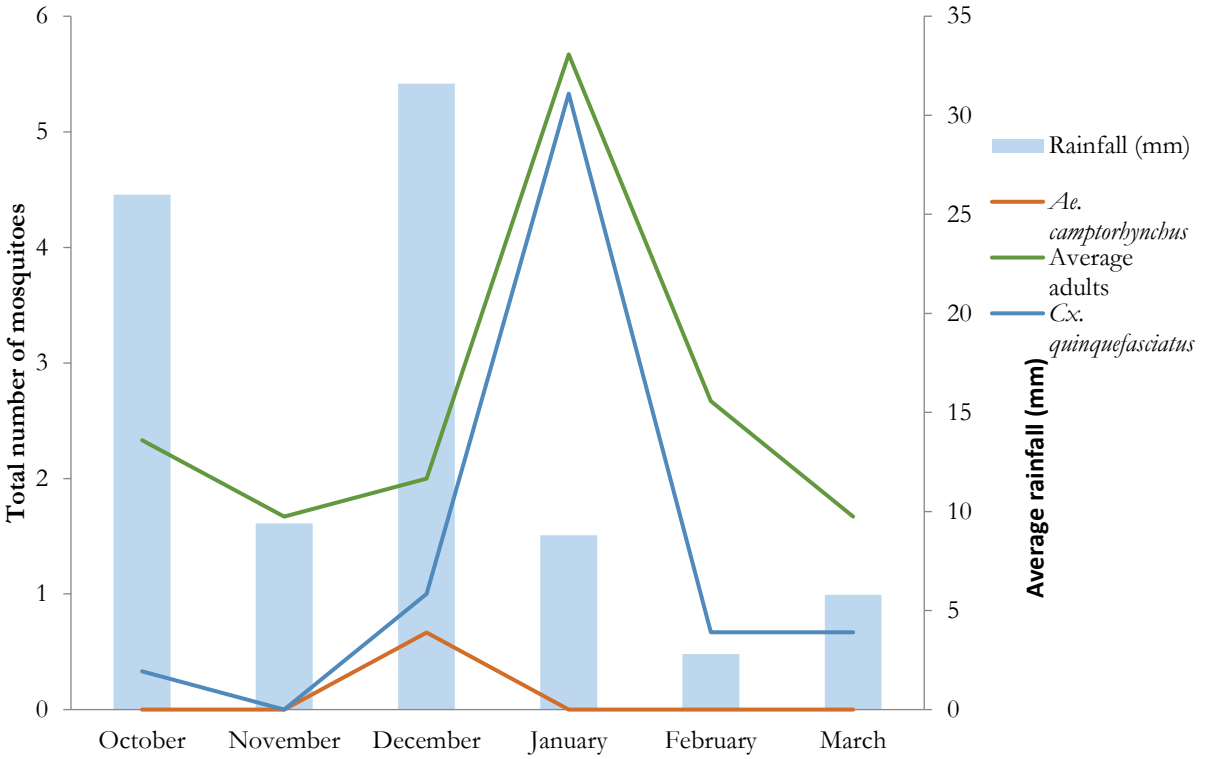

Figure 13.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at Warriparinga with the rainfall (mm) for the corresponding months.

13.3.2. Dipping for larval mosquitoes

No positive larval sites were detected during dipping at this site.

13.3.3. Water quality analysis

Electrical conductivity at the site fluctuated but remained within the low readings throughout the monitoring season reflecting a healthy level for aquatic invertebrates and plants. Nitrate levels showed very low levels and pH levels fluctuated between 7.98 and 9.6. Overall the pH levels of the wetlands remained within the healthy range for the survival of aquatic plants and animals.

Table 13-2. Water quality variables for Warriparinga during monitoring season 2018-2019.

Date	pH	EC(mS/cm)	Nitrate (mg/l)
13/10/2018	8.15	1.44	0.01
20/11/2018	9.14	0.84	0.01
11/12/2018	7.68	0.75	0.01
23/01/2019	8.19	1	0.01
12/02/2019	7.71	2.12	
28/03/2019	9.01	2.31	

13.4. Discussion

Overall abundance (48 mosquitoes) was very similar to the 2017-18 season, when 50 mosquitoes were collected. The mosquito community was of medium diversity and abundance of all species was low and unlikely to cause any biting nuisance within the surrounding community. In addition, no larval sites being detected within the wetland system, small heavy rainfall events filling containers could have contributed to the increases in *Cx. quinquefasciatus* and to a lesser extent *Ae. notoscriptus* populations in January 2019. The establishment of vegetation has allowed for a more diverse populations of predatory aquatic invertebrates to be attracted to the wetland and this wetland appears to be well established with healthy bodies of water and is therefore less likely to contribute to the abundance of existing mosquito populations. The mosquito species *Cx. quinquefasciatus* and *Ae. notoscriptus* do not utilise large bodies of water for larvae rearing, it is therefore more likely that the species utilise sites lie adjacent to the Warriparinga Wetlands. The saltmarsh mosquito *Ae. camptorhynchus* is also unlikely to originate from the wetland, this species disperses great distances for the preferred costal saltmarsh habitat where it rears its larvae. Monitoring this site for thirteen seasons pre- and post- establishment of the site, has shown that natural existing mosquito fauna does not contribute to a nuisance problem and overall mosquito abundance remains low at this site.

14. Watson Avenue GPT and Brown Hill Creek Linear Wetland

14.1. Background

The Watson Avenue GPT and Brown Hill Creek Linear Wetland was included for the first time to the mosquito monitoring program over the 2016-2017. The Brown Hill Creek Linear Wetland runs adjacent to the Adelaide Airport.

14.2. Site descriptions

14.2.1. Adult mosquito traps

There are two adult mosquito trap sites at Watson Ave & Brown Hill Creek Linear Wetland (Figure 14.1.,Table 14-1).

Table 14-1 The GPS-coordinates for the two adult trap sites at Watson Ave & Brown Hill Creek Linear Wetland

Site:	Latitude:	Longitude:
Watson Ave 1	-34.5655	138.3239
Watson Ave 2	-34.5717	138.3216

Figure 14.1. The location of the two sites at the Watson Avenue & Brown Hill Creek Linear Wetland.

14.2.2. Positive larval dipping sites

No mosquito larvae were detected at this site during monitoring.

14.2.3. Water quality site

Water quality samples were collected from the Sediment Basin at the end of Watson Avenue near trap 1 and from the small creek bed running along trap 2 (Figure 14.1).

14.3. Results

14.3.1. Adult mosquito traps

A total of 133 mosquitoes belonging to four species were collected in the 2018-19 season. Moderate levels of *Cx. quinquefasciatus* and *Ae. notoscriptus* were both collected, and were present in numbers that occasionally may provide nuisance biting.

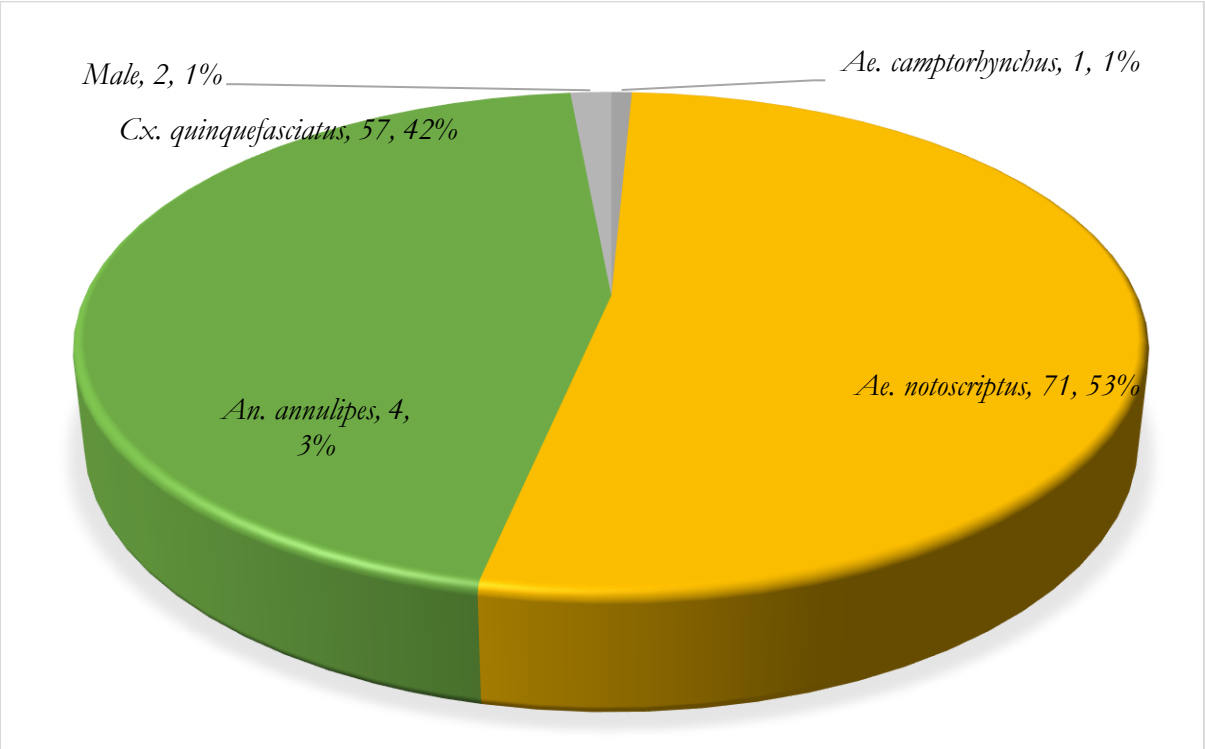

Figure 14.2. The total number of mosquitoes caught at the Watson Avenue & Brown Hill Creek Linear Wetland for each of the species during monitoring season 2018-2019.

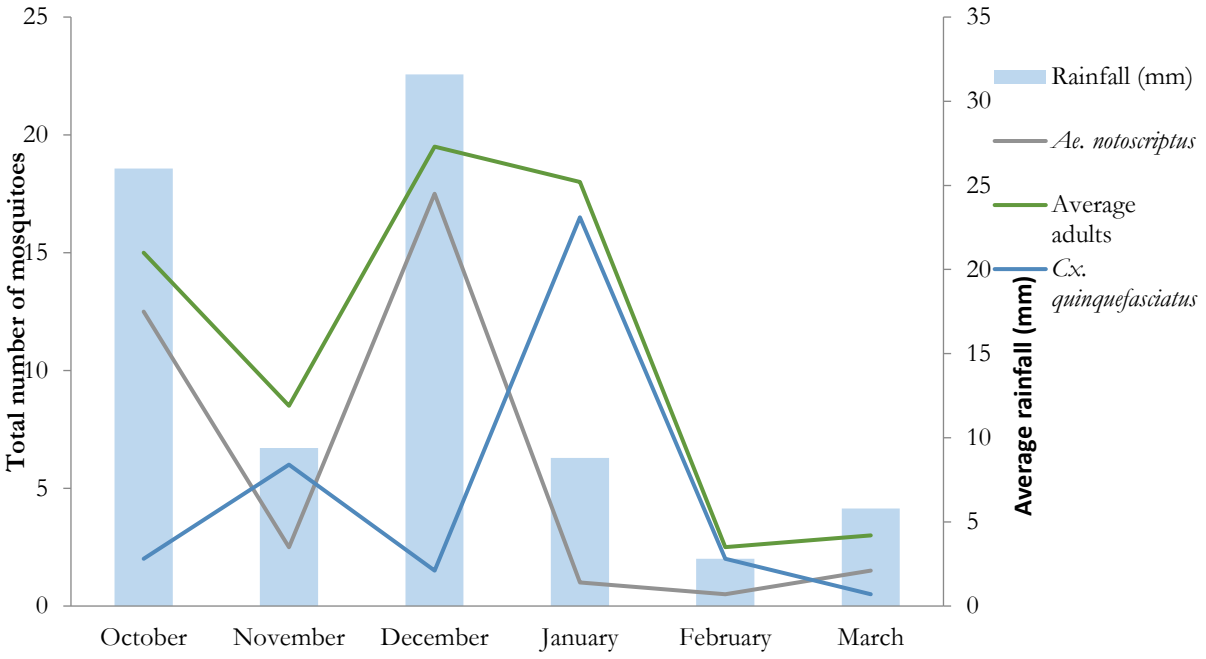

Figure 14.3. Monthly total number of mosquitoes and total number of females caught of the dominant species at the Watson Avenue & Brown Hill Creek Linear Wetland with the rainfall (mm) for the corresponding months.

14.3.2. Dipping for larval mosquitoes

No mosquito larvae were detected at this site during monitoring.

14.3.3. Water quality analysis

Electrical conductivity at the site fluctuated but remained within the low readings throughout the monitoring season reflecting a healthy level for aquatic invertebrates and plants. Nitrate levels showed very low levels and pH levels fluctuated between 6.75 and 9.45. Overall the pH levels of the wetlands remained within the healthy range, except for in December when they were slightly acidic (despite technically being within the healthy range).

Table 14-2 . Water quality variables for Watson Avenue & Brown Hill Creek Linear Wetland during monitoring season 2018-2019.

Date	pH	EC(µS/cm)	Nitrate (mg/l)
13/10/2018	7.48	0.58	0.01
21/11/2018	9.45	0.14	0.01
11/12/2018	6.75	0.23	0.01
24/01/2019	8.27	0.57	0.05
13/02/2019	7.34	0.41	
28/03/2019	8.14	0.42	

14.4. Discussion

Mosquito abundance has increased since the previous year (57 collected in 2017-18) and was characterised by the common urban pests, *Cx. quinquefasciatus* and *Ae. notoscriptus*. Mosquito numbers were greatest in was the dominant mosquito species sampled at this site, with the greatest population peak in December 2018 and January 2019. The remaining species were caught in small numbers primarily latter in the season.

No larval detections were made in the constructed water bodies, so it is most likely that mosquito production originates in the surrounding suburbs.

The site has been newly included into the monitoring program and further monitoring of the site is advisable to be able to detect any changes in mosquito abundance or diversity as well as to be able to eliminate potential mosquito breeding sites or nuisance problems in the future.

15. References

Literature referred to for the purpose of compiling this report are as follows:

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Mincham, G., S. Orre-Gordon and C. R. Williams (2015). Mosquito monitoring program for constructed wetlands, at varying stages of development, throughout the Adelaide metropolitan area. A report prepared for The Adelaide and Mount Loft Ranges Natural Resource Management Board. Adelaide, South Australia, Australia, The University of South Australia.

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Williams, C. R., S. R. Williams, J. Nicholson, S. M. Little, J. Riordan, S. R. Fricker and M. J. Kokkinn (2009). "Diversity and seasonal succession of coastal mosquitoes (Diptera: Culicidae) in the northern Adelaide region of South Australia." Australian Journal of Entomology **48**(2): 107-112.

16. Appendices

16.1. Unity Park raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	UP1	UP2	UP3	UP1	UP2	UP3	UP1	UP2	UP3	UP1	UP2	UP3	UP1	UP2	UP3	UP1	UP2	UP3	UP1	UP2	UP3	
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	42	52	0	5	7	3	8	7	6	0	0	0	0	0	0	0	3	0	0	0	0	
Ae. notoscriptus	15	16	0	39	17	12	9	16	33	7	2	6	2	2	8	1	3	0	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	1	1	1	4	5	8	3	0	0	0	0	0	
An. annulipes	0	1	0	1	2	1	1	1	5	1	2	4	0	0	0	0	0	0	0	0	0	
Cq. linealis	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	2	2	0	2	3	0	8	3	0	0	0	0	0	0	0	1	0	0	0	0	0	
Cx. molestus	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	2	0	8	0	0	21	1	0	10	4	0	0	0	0	2	2	0	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	Annual
Trap failure													ü									Total
Total for the month			133			101			120			40			31			15			0	440

16.2. Old Port Road raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	OP1	OP2	OP3	OP1	OP2	OP3	OP1	OP2	OP3	OP1	OP2	OP3	OP1	OP2	OP3	OP1	OP2	OP3	OP1	OP2	OP3	
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	0	4	1	0	0	1	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	0	0	0	0	0	3	6	0	0	2	0	0	0	0	0	0	0	0	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	
Cq. linealis	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	2	0	5	0	0	9	5	1	6	1	0	0	0	0	4	1	0	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Annual
Trap failure																						Total
Total for the month			7			9			26			9			0			6			0	57

16.3. West Lakes Golf Course/Cooke Reserve raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	WL 1	WL 2	WL 3	WL 1	WL 2	WL 3	WL 1	WL 2	WL 3	WL 1	WL 2	WL 3	WL 1	WL 2	WL 3	WL 1	WL 2	WL 3	WL 1	WL 2	WL 3	
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	0	0	0	0	0	0	0	11	5	0	0	0	3	0	0	0	1	1	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cq. linealis	0	0	0	0	1	0	0	9	1	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	0	0	0	0	1	0	6	9	0	8	2	1	0	0	0	1	1	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	Annual Total
Trap failure				ü						ü				ü	ü							
Total for the month	8			3			42			10			4			4			0			71

16.4. St Clair raw data 2018-2019.

	October					November					December					January				
Species	StC1	StC2	StC3	StC4	StC5	StC1	StC2	StC3	StC4	StC5	StC1	StC2	StC3	StC4	StC5	StC1	StC2	StC3	StC4	StC5
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ae. camptorhynchus	1	50	6	1	10	3	6	0	0	0	20	26	20	9	16	0	0	0	0	0
Ae. notoscriptus	0	0	0	0	0	1	1	0	1	0	3	6	6	4	20	0	0	4	6	7
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
An. annulipes	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	4	0
Cq. linealis	0	0	0	0	0	69	42	0	2	0	22	22	1	0	6	11	65	3	0	3
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cx. australicus	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cx. globocoxitus	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Cx. quinquefasciatus	0	0	0	0	0	3	0	0	1	1	1	0	18	14	114	0	2	23	21	11
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Male	0	0	0	0	0	2	4	0	0	0	0	6	2	0	0	0	0	0	0	0
Trap failure										ü										
Total for the month					68					136					328					167

February					March					April				
StC1	StC2	StC3	StC4	StC5	StC1	StC2	StC3	StC4	StC5	StC1	StC2	StC3	StC4	StC5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	29	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	2	2	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	6	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	15	1	1	0	0	0	0	0	0	0
				2					9					0

16.5. Grange Golf Club raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	GG 1	GG 2	GG 3	GG 1	GG 2	GG 3	GG 1	GG 2	GG 3	GG 1	GG 2	GG 3	GG 1	GG 2	GG 3	GG 1	GG 2	GG 3	GG 1	GG 2	GG 3	
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	0	0	0	0	0	0	14	0	4	0	0	0	1	0	3	1	0	0	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
Cq. linealis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	1	0	0	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Annual Total
Trap failure																						
Total for the month			0			0			23			4			4			2			0	33

16.6. Royal Adelaide Golf Club raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	RA1	RA2	RA3	RA1	RA2	RA3	RA1	RA2	RA3	RA1	RA2	RA3	RA1	RA2	RA3	RA1	RA2	RA3	RA1	RA2	RA3	
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	0	0	4	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	0	0	0	0	4	0	0	12	7	0	0	1	0	0	0	0	4	1	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	
Cq. linealis	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	0	0	1	0	0	2	1	0	0	3	1	0	0	0	0	0	0	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Annual
Trap failure										ü												Total
Total for the month			4			5			27			9			0			8			0	53

16.7. Felixstow raw data 2018-2019.

	October		November		December		January		February		March		April		
Species	FS1	FS2	FS1	FS2	FS1	FS2	FS1	FS2	FS1	FS2	FS1	FS2	FS1	FS2	
Ae. alboannulatus	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	3	2	4	1	0	10	56	0	8	0	5	9	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	1	0	0	0	1	0	0	0	1	0	0	0	
Cq. linealis	0	1	0	0	0	0	5	0	1	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	1	0	6	0	0	0	7	0	0	0	0	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Annual
Trap failure					ü										Total
Total for the month		7		12		10		69		11		15		0	124

16.8. Glenelg Golf Club raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	GL1	GL2	GL3	GL1	GL2	GL3	GL1	GL2	GL3	GL1	GL2	GL3	GL1	GL2	GL3	GL1	GL2	GL3	GL1	GL2	GL3	
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	1	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
Cq. linealis	0	0	0	0	0	0	0	0	0	2	0	0	1	1	2	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	Annual
Trap failure																						Total
Total for the month			5			0			1			10			4			1			0	21

16.9. Ridge Park raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	RP1	RP2	RP3	RP1	RP2	RP3	RP1	RP2	RP3	RP1	RP2	RP3	RP1	RP2	RP3	RP1	RP2	RP3	RP1	RP2	RP3	
Ae. alboannulatus	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	1	0	14	17	6	18	25	54	127	4	47	17	3	6	5	5	3	34	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	0	1	0	0	0	1	1	3	0	0	0	1	0	1	0	0	0	
Cq. linealis	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	0	0	1	2	1	0	1	1	8	29	15	3	110	2	0	1	0	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Annual
Trap failure																						Total
Total for the month			15			47			210			126			129			46			0	573

16.10.Oaklands Park raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	OK 1	OK 2	OK 3	OK 1	OK 2	OK 3	OK 1	OK 2	OK 3	OK 1	OK 2	OK 3	OK 1	OK 2	OK 3	OK 1	OK 2	OK 3	OK 1	OK 2	OK 3	
Ae. alboannulatus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	2	1	19	0	0	4	0	0	41	0	0	6	0	0	0	0	0	0	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	
Cq. linealis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Annual Total
Trap failure															ü	ü		ü				
Total for the month			24			5			41			13			0			0			0	83

16.11. Warriparinga raw data 2018-2019.

	October			November			December			January			February			March			April			
Species	WA 1	WA 2	WA 3	WA 1	WA 2	WA 3	WA 1	WA 2	WA 3	WA 1	WA 2	WA 3	WA 1	WA 2	WA 3	WA 1	WA 2	WA 3	WA 1	WA 2	WA 3	
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	0	4	2	1	1	0	0	0	1	0	0	1	0	2	1	1	1	0	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	
Cq. linealis	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	0	1	0	0	0	0	0	3	10	1	5	1	1	0	0	0	2	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Annual Total
Trap failure								ü														
Total for the month			7			5			6			17			8			5			0	48

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16.12.Watson Avenue and Brown Hill Creek Linear Wetland raw data 2018-2019.

	October		November		December		January		February		March		April		
Species	BH1	BH2	BH1	BH2	BH1	BH2	BH1	BH2	BH1	BH2	BH1	BH2	BH1	BH2	
Ae. alboannulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. alternans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. camptorhynchus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ae. notoscriptus	22	3	3	2	35	0	2	0	1	0	3	0	0	0	
Ae. vigilax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
An. annulipes	0	0	0	0	1	0	0	1	0	0	2	0	0	0	
Cq. linealis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. annulirostris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. australicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. globocoxitus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. molestus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cx. quinquefasciatus	0	4	2	10	3	0	0	33	4	0	1	0	0	0	
Ma. uniformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
indeterminate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Male	0	0	0	0	0	0	0	0	0	0	2	0	0	0	Annual
Trap failure						ü						ü			Total
Total for the month		30		17		39		36		5		6		0	133

17. A short guide to common mosquito species in South Australian built environments

Aedes notoscriptus

This species is not currently considered a major vector of arboviruses, although it is suspected of some role in Ross River virus transmission in urban areas. However, *Ae. notoscriptus* is a major vector of dog heartworm, and a major nuisance around homes in urban and rural areas. This species is a container breeder utilizing tree holes, old tyres, self-watering pots, rainwater tanks etc. *Aedes notoscriptus* does not disperse far from larval sites and will seek refuge in cool shaded areas. This species usually bites around dusk, attacking humans on the feet and hands. Having such a predictable biting behaviour assists in identifying the species remotely. The adults of *Ae. notoscriptus* are readily identifiable; they are small and dark with a silver lyre pattern on the scutum, a black proboscis with a silver band around the mid-point; a pleuron speckled with clumps of silver scales and black legs with basal white bands. The larvae have a short siphon, and head hairs 5 and 6 are single. The anal papillae are asymmetric with the upper somewhat longer than the lower; a distinctive feature of this species.

Figure 45. Adult female *Aedes notoscriptus*

Aedes vigilax

This species is generally associated with brackish and saline coastal waters generally near mangroves and saline swamps. The abundance of adult *Ae. vigilax* is generally influenced by temperature and tidal cycles in coastal regions. However, *Ae. vigilax* occurs in various locations along the River Murray. This species is considered an efficient vector of several arboviruses and is an opportunistic feeder, biting a variety of hosts including humans, other mammals and birds during the day and at dusk.

Adults can be recognised by straight basal bands on the dorsal abdomen, distinctive lateral abdominal scaling, and a dark tipped proboscis.

The larvae generally have a short siphon, head hairs 5 and 6 are single and the anal papillae are small. The larvae are generally associated with coastal saline or brackish ground pools, particularly during warm weather.

Figure 46. Adult female *Aedes vigilax*

Aedes camptorhynchus

This species is generally associated with brackish and saline coastal waters generally near mangroves and saline swamp and is the most common mosquito in southern and eastern SA during autumn, winter and spring. The abundance of adult *Ae. camptorhynchus* is generally influenced by rainfall and is higher during cooler weather. This species is considered an efficient vector of several arboviruses and is an opportunistic feeder, biting a variety of hosts including humans, other mammals and birds during the day and at dusk.

Adults can be recognised by triangular basal bands on the dorsal abdomen and a mottled appearance. Larvae have a short, black siphon.

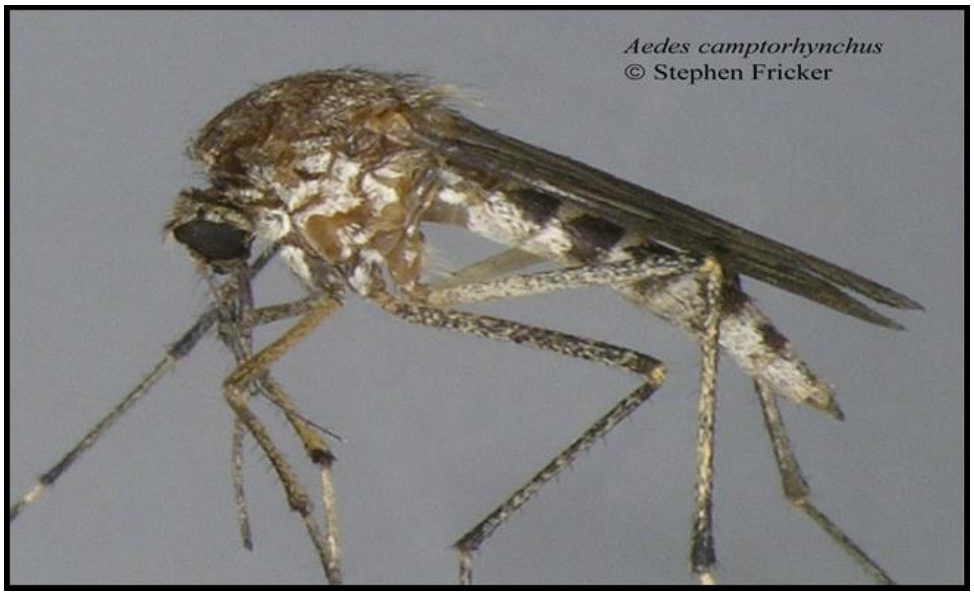

Figure 47. Adult female *Aedes camptorhynchus*

Coquillettidia linealis

This species has a patchy distribution, being locally abundant close to suitable larval sites, and increasing in abundance as the weather warms in late spring. *Coquillettidia linealis* can be a local pest around breeding sites. Although there are reports of biting throughout the day it has been found to be active predominantly at sunset then through the night in SA (in a study near Paringa). Management of this species is problematic as the larval habitat can be difficult to identify. The reason for this is that the larvae undertake gas exchange through plant tissue, attaching to the roots of emergent vegetation and obtaining oxygen directly from the plant. This is a mechanism that has evolved to avoid predation and results in larvae being difficult to collect. This species is known as a competent vector of arboviruses, including Ross River virus.

Adults have a distinctive lateral pale stripe on the hind tibia, and apical dark bands extending medially on the ventral abdomen.

The larvae can be difficult to find and quite distinctive with a siphon modified with plant-piercing valves.

Figure 48. Adult female *Coquillettidia linealis*

The *Culex pipiens group*

There are four members of the *Culex pipiens* complex found in SA, a closely related group of species that can be difficult to distinguish visually as adults. These are *Cx. quinquefasciatus, Cx. globocoxitus*, *Cx. molestus* and *Cx. australicus*. The larvae of each species are difficult to identify to the untrained eye. Internationally, members of this species group are known vectors of arboviruses (e.g. West Nile virus) and lymphatic filariasis (*Wuchereria bancroftii*). However, these pathogens are not a problem in Australia.

Figure 49. Adult female *Culex globocoxitus*