Wagait Beach mosquito investigation 14-15 January 2015
Allan Warchot, Nadine Copley and Nina Kurucz, Medical Entomology, CDC, Darwin

Abstract
Following receipt of a mosquito enquiry from Wagait Shire Council on 9 January 2015, Medical Entomology staff undertook a mosquito field investigation at Wagait Beach. Adult mosquito trapping showed moderate to high levels of the northern salt marsh mosquito, *Aedes vigilax*, a potential vector for Ross River virus (RRV) and Barmah Forest virus (BFV). Site investigations revealed extensive *Ae. vigilax* breeding in coastal sand dune depressions at the northern fringe of Wagait Beach. Aerial photography suggested large seasonal mosquito breeding sites exist nearby to Wagait Beach, not only for *Ae. vigilax*, but also for *Culex annulirostris*, the principal vector for RRV, BFV, Murray Valley encephalitis and Kujjin virus and for *Anopheles* mosquitoes, the potential vectors for malaria. The most feasible mosquito mitigation measures for Wagait Beach residents are likely to be personal protection and mosquito avoidance.

Key words: Wagait Beach, mosquito, vector, personal protection

Background
Medical Entomology (ME) of the Northern Territory (NT) Department of Health received a mosquito enquiry from Wagait Shire Council on 9 January 2015. The enquiry was received at a time of high salt marsh mosquito (*Aedes vigilax*) numbers in the Darwin northern suburbs, and other coastal areas in the Top End. However, in light of a lack of recent mosquito data from Wagait Beach, a mosquito investigation was carried out by ME on 14-15 January 2015, to determine mosquito species causing the problem, the number of mosquitoes compared to the most affected suburbs in Darwin and the likely sources of the problem mosquitoes.

Methods
Five adult mosquito trap sites, within close proximity to potential mosquito breeding sites, were chosen for this investigation (Figure 1). The traps used were carbon dioxide baited Encephalitis Vector Survey traps, which were set in the late afternoon on 14 January and collected the following morning.

On the same day, field surveys for mosquito larvae were also conducted at 7 potential

Figure 1. Wagait Beach overnight mosquito trapping 14-15 January 2015

Figure 2. Wagait Beach larval mosquito survey 14 January 2015
mosquito breeding sites as shown in Figure 2. Potential mosquito breeding areas were identified by examining high resolution aerial photography and are indicated in Figure 1.

Results

Adult mosquito trapping

The results of the adult mosquito trapping for the 5 most abundant species collected are shown in Table 1. Overall there were a total of 1641 adult female mosquitoes collected from the 5 traps representing a total of 14 different mosquito species. It is only the female mosquito that bites and can spread mosquito borne diseases. Therefore although some male mosquitoes were recorded during trapping, they are not of importance except to suggest the proximity of nearby breeding sites.

*Aedes vigilax* was the most abundant mosquito accounting for 77% of all mosquitoes collected. Highest numbers were collected at trap site 3 near the large brackish water swamp at the end of De Lissa Drive. This result is typical of the early wet season in coastal areas when *Ae. vigilax* predominates. Overall all trap sites recorded what is considered to be moderate to high levels of this mosquito.

*Culex annulirostris* was the second most abundant mosquito, accounting for 11% of all mosquitoes collected. Highest numbers were collected at trap site 5 on Charles Point Road, with potential breeding sites located to the north and south of this trap site. Overall abundance was considered minor for this species at all trap sites.

The 3 other mosquitoes indicated in Table 1 were recorded in minor numbers for these species. The container breeding mosquito *Aedes notoscriptus* was only recorded in the traps set adjacent to residential lots, suggesting the presence of artificial breeding sites in nearby residential yards. *Ae. notoscriptus* can also breed in natural containers such as tree holes and small rock pools.

Larval mosquito survey

The results of the larval mosquito survey are shown in Table 2.

Mosquitoes found during the larval survey included *Ae. vigilax*, which was collected in moderate to high numbers in the beachfront paperbark lined sand dune depressions at the NW corner of the township (Wagait Larval 05), and NE of De Lissa Drive (Wagait Larval 02). *Culex annulirostris* and *Culex sitiens* were collected in high numbers at a grassy sand dune depression site NE of De Lissa Drive (Wagait Larval 01).

The remaining 4 sites surveyed did not find breeding mosquitoes, but are likely to be mosquito breeding sites during other periods of the year.

Discussion

Northern salt marsh mosquito, *Aedes vigilax*

The high adult mosquito numbers at Wagait Beach in January 2015 were typical of coastal areas of the NT in early January. *Ae. vigilax* appears in high numbers 9 days after a flooding

<table>
<thead>
<tr>
<th>Trap location</th>
<th><em>Ae. (Och) vigilax</em></th>
<th><em>Cx. (Cux) annulirostris</em></th>
<th><em>Ae. (Fin) notoscriptus</em></th>
<th><em>Ve. (Ver) funerea</em></th>
<th><em>Cx. (Cux) sitiens</em></th>
<th>Other</th>
<th>Totals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wagait Beach Site 1</td>
<td>312</td>
<td>28</td>
<td>15</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>369</td>
<td>22.49</td>
</tr>
<tr>
<td>Wagait Beach Site 2</td>
<td>174</td>
<td>12</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>208</td>
<td>12.68</td>
</tr>
<tr>
<td>Wagait Beach Site 3</td>
<td>366</td>
<td>21</td>
<td>41</td>
<td>37</td>
<td>31</td>
<td>4</td>
<td>500</td>
<td>30.47</td>
</tr>
<tr>
<td>Wagait Beach Site 4</td>
<td>239</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>280</td>
<td>17.06</td>
</tr>
<tr>
<td>Wagait Beach Site 5</td>
<td>174</td>
<td>88</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>9</td>
<td>284</td>
<td>17.31</td>
</tr>
<tr>
<td>Totals</td>
<td>1265</td>
<td>182</td>
<td>69</td>
<td>50</td>
<td>46</td>
<td>29</td>
<td>1641</td>
<td>100.00</td>
</tr>
<tr>
<td>%</td>
<td>77.09</td>
<td>11.09</td>
<td>4.20</td>
<td>3.05</td>
<td>2.80</td>
<td>1.77</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Wagait Beach larval mosquito survey results 14 January 2015

<table>
<thead>
<tr>
<th>Trap location</th>
<th>Water presence</th>
<th>Breeding area (m²)</th>
<th>Average no of larvae per dip</th>
<th>Species</th>
<th>Total no in sample instar</th>
<th>1st instar</th>
<th>2nd instar</th>
<th>3rd instar</th>
<th>4th instar</th>
<th>Pupae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wagait Larval 01 NE of lot 8</td>
<td>Pooling</td>
<td>40</td>
<td>100</td>
<td>Cx. (Cux) annulirostris</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>De Lissa Drive, Interdunal beachfront</td>
<td></td>
<td></td>
<td></td>
<td>Cx. (Cux) sitiens</td>
<td>16</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wagait Larval 02 NE of lot 10</td>
<td>Pooling</td>
<td>5</td>
<td>50</td>
<td>Ae. (Och) vigilax</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>De Lissa Drive, Interdunal beachfront</td>
<td></td>
<td></td>
<td></td>
<td>Nil mosquitoes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wagait Larval 03 Lot 2 Cox Drive, Swamp on N boundary</td>
<td>Pooling</td>
<td>0</td>
<td>0</td>
<td>Ae. (Och) vigilax</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wagait Larval 04 Lot 76 Cox Drive, Cox Country Club, Swamp NE corner</td>
<td></td>
<td></td>
<td></td>
<td>Nil mosquitoes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wagait Larval 05 NW corner of township, interdunal area behind beach front, Wagait Larval 06 Lot 227 Vangemm St, E edge of swamp on lot</td>
<td>Flowing</td>
<td>N/C</td>
<td>4</td>
<td>Ae. (Och) vigilax</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Wagait Larval 07 Lot 133 Erickson Cres, Swamp at rear of lot</td>
<td>Pooling</td>
<td>0</td>
<td>0</td>
<td>Nil mosquitoes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
| or heavy rain event, and survives up to 2 weeks, depending on humidity. Adult mosquito trapping at Wagait Beach occurred about a week after extreme pest levels were experienced (P. Wanrooy pers. comm.) and while the traps recorded appreciable levels of this species, it is likely that collections would have been much higher if traps were set a week earlier. The Ae. vigilax numbers recorded in Wagait Beach township were considered high for a residential area. BFV. Macropods such as wallabies are presumed to be the natural host for RRV, and in areas such as Wagait Beach, which is surrounded by relatively undeveloped land, wallaby hosts are likely to be abundant. Therefore, the RRV risk at Wagait Beach might be higher compared to Darwin and Palmerston, and probably similar to mosquito prone areas in Litchfield Shire. The BFV risk at Wagait Beach is also likely to be similar to other mosquito prone areas in Litchfield Shire.

The presence of extensive potential Ae. vigilax breeding habitat around Wagait Beach is most likely resulting in seasonal pest problems over many months of the year. Upper tidal swamps and drainage lines are likely to cause most of the Ae. vigilax problems from September to early January, while breeding in sand dune areas would occur in May after unseasonal rainfall or very high tides. However May peaks are usually much lower than September to January peaks due to residual wet season freshwater ponding restricting the size of available Ae. vigilax breeding habitat.

Ae. vigilax is the principal pest mosquito in coastal areas of the NT from September to January. It is aggressive and bites in shaded areas during the day as well as at night. This species is also a known vector for RRV and Other mosquito species

The common banded mosquito Cx. annulirostris is likely to be seasonally present in numbers sufficient to result in potential mosquito borne disease transmission. The mid wet to post wet season is likely to be the peak period for this mosquito. It is less of a pest species compared to Ae. vigilax as it only bites at night, and is more timid in the presence of lights and personal protection. Further trapping after the wet season is required to determine the seasonal peak of this species at Wagait Beach. Cx. annulirostris is considered the principal vector for Murray Valley encephalitis, Kunjin, RRV and BFV in the NT.

Although no Anopheles mosquitoes were detected during this survey, they are likely to be...
seasonally present at Wagait Beach, with the late wet to mid dry season likely to be the peak period. Further trapping is required during this period to determine the seasonal peak of Anopheles species. However due to the presence of potential breeding habitat, it is likely that this mosquito would at least be present in sufficient numbers to pose a potential risk of malaria transmission, if a person infected with malaria is bitten by Anopheles species mosquitoes at Wagait Beach. The malaria risk however is not likely to be any higher than in other areas of the NT, with the NT Department of Health surveillance systems in place to minimise the potential for local malaria transmission.

Verrallina funerea is likely to pose a very high seasonal problem to residents living next to brackish water paperbark swamps and dune depressions, with January to March the likely peak season. This mosquito does not venture far from dense vegetation at the breeding sites, and is not thought to be involved in RRV transmission in the NT, and therefore would be a localised pest problem only.

Freshwater pest mosquitoes such as Coquillettidia xanthogaster and Mansonia uniformis (not collected on 14th January) may occur in sufficient numbers to cause seasonal pest problems, most likely in the early to mid-dry season. As they are not known to be involved in human disease transmission they would only pose a pest problem to residents of Wagait Beach.

**Mosquito mitigation measures**

The best form of mosquito control is habitat modification to remove breeding sites or to shift the ecological balance in favour of mosquito larvae predators (e.g. fish). Feasibility, as well as environmental factors, would need to be considered prior to habitat modification measures being implemented. However due to the low density living at Wagait Beach, it is unlikely there would be support for such action.

Aerial larval mosquito control of the large tidal swamps within a few kilometres of Wagait Beach is an option to reduce *Ae. vigilax* numbers. Tidal swamps and depressions within 5km of the residential area, would need to be regularly sprayed with a suitable target specific larvicide, which kills mosquito larvae but has no deleterious effect on other aquatic organisms. An aerial larval mosquito control program such as this could also reduce numbers of other problem mosquito species, such as *Cx. annulirostris*, but might not be an economically viable option at Wagait Beach.

The annual maintenance of stormwater drains would reduce *Ae. vigilax* numbers to some extent, by ensuring drains are clear of obstructions that could otherwise cause high tide/early wet season water ponding and mosquito breeding. Shallow sand filling of the dune depressions could also be carried out to fill the depressions to above the wet season water table.

The use of residual barrier insecticides, such as bifenthrin or alpha-cypermethrin, is likely to reduce adult mosquito numbers around residences when applied to mosquito harbourage areas, such as shrub vegetation and outdoor shaded areas. However, the insecticide is non target specific and toxic to aquatic organisms. Therefore, if barrier spraying is to be considered, it is recommended to engage a qualified pest controller to apply the insecticide.

Personal protection, such as insect screens in houses, the use of outdoor mosquito lanterns, mosquito coils and personal insect repellents, is likely to be the most effective long term measure for residents to reduce exposure to mosquitoes. Medical Entomology also produces annual pest calendars for *Ae. vigilax* based on tide events, and issues media warnings when significant pest mosquito problems are expected, or when there is an elevated risk of mosquito borne disease. These would all apply to Wagait Beach.

**Acknowledgements**

Medical Entomology would like to thank Pam Wanrooy from Wagait Shire Council for providing access, and for proving general knowledge on the location of swamps and seasonally flooded areas within and adjacent to the Wagait community.

**References**


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