The Effect of Sound Lure Frequency and Habitat Type on Male *Aedes albopictus* (Diptera: Culicidae) Capture Rates With the Male *Aedes* Sound Trap

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Abstract

The global distribution of *Aedes albopictus* (Skuse) is rapidly expanding which has contributed to the emergence and re-emergence of dengue and chikungunya outbreaks. Improvements in vector surveillance are necessary to facilitate optimized, evidence-based vector control operations. Current trapping technology used to target *Ae. albopictus* and other *Aedes* species for vector surveillance are limited in both scale and scope, thus novel tools are required. Here, we evaluated the Male *Aedes* Sound Trap (MAST) for its capacity to sample male *Ae. albopictus*. Aims of this study were twofold: 1) to determine the most effective frequency for capturing male *Ae. albopictus* and 2) to investigate fine-scale variations in male *Ae. albopictus* abundance. MASTs which produced sound lure frequencies between 500 and 650 Hz captured significantly more male *Ae. albopictus* than those with sound lure frequencies set to 450 Hz. Further, the higher sound lure frequency of 700 Hz significantly reduced catches relative to 650 Hz. MASTs placed in woodland habitats captured significantly more male *Ae. albopictus* than MASTs placed near houses. These results provide baseline information for optimizing sound lure frequencies and placement of the MAST to sample male *Ae. albopictus* in remote areas.

Key words: *Aedes albopictus*, sound lure, male, wing beat frequency, mosquito surveillance
Ae. albopictus could be useful for evaluating mosquito abundance in areas before and following releases. Only two studies have tested the relative attraction of Ae. albopictus to specific sound lure frequencies: one study in the laboratory (Balestrino et al. 2016), the other in the field (Ikeshoji and Ogawa 1988). Balestrino et al. (2016) found no significant difference in attraction of male Ae. albopictus to sound lure frequencies set to 545, 600, and 649 Hz. Ikeshoji and Ogawa (1988) tested sound lure frequencies set to 400 and 900 Hz and found significantly more male Ae. albopictus were captured at 400 Hz (average of 5.5 male/day) than 900 Hz (average of 0.3 male/day). It is likely that 900 Hz is outside the range of attractive frequencies for male Ae. albopictus.

Determining specific sound lure frequencies which Ae. albopictus are attracted to, under field settings, is an important step toward developing an optimized and field-ready sound trap.

The MAST was developed to primarily catch male Ae. aegypti (L.) (Staunton et al. 2020b) and the capacity of the MAST for capturing male Ae. albopictus has yet to be determined. Thus, the first objective of this study was to determine the efficacy of different sound lure frequencies to lure male Ae. albopictus to be captured in the MAST.

Within a landscape, the abundance of mosquitoes are naturally highly heterogeneous (Burkot et al. 2018, Staunton et al. 2020a). Fine-scale variations in mosquito abundance is likely driven by a combination of factors including microclimate (Murdock et al. 2017) and environmental factors (Staunton et al. 2019b, 2020a). Understanding fine-scale variations in vector abundance is essential for effectively targeting vector control operations, such as vegetation barrier sprays (Li et al. 2010, Muzari et al. 2017) and also for understanding the fine-scale risk of mosquito exposure to residents. For example, Ae. albopictus have been shown to preferentially rest in vegetated areas (Rey et al. 2006); with BG-Sentinel (BGS) traps placed in shaded locations capturing significantly more Ae. albopictus, than those placed in locations without shade (Crepeau et al. 2013). The second objective of this study was to investigate fine-scale variations affecting male Ae. albopictus abundance and how MAST placement influences catch.

Here, we report field experiments which advance basic understanding of both the utility of the MAST and the comparative effect of sound lure frequencies and habitat type on capture rates of male Ae. albopictus with the MAST.

Methods

Study Site

The Torres Strait lies between the northernmost mainland point of Australia (Cape York) and the southern border of Papua New Guinea. This locality contains over 100 islands, of which 18 are inhabited (Stewart 2015). Aedes albopictus has been recorded on 14 of 17 surveyed islands in the Torres Strait (Muzari et al. 2019). On the islands of Erub, Badu, and Masig, a series of dengue outbreaks attributed to Ae. albopictus occurred between 2016 and 2017 (Muzari et al. 2019). Presently, operational mosquito surveillance by Queensland Health is limited to the two most populous islands (Horn and Thursday islands) owing to the challenging logistics and associated costs to trap mosquitoes in remote islands of the Torres Strait (most outer islands are more than 800 km from the closest mainland city of Cairns).

The Torres Strait region experiences distinct ‘dry’ (May–October) and ‘wet’ (November–April) seasons. Owing to its tropical location, temperatures vary marginally throughout the year. Average minimum and maximum temperatures are 24.4°C and 30.9°C for the ‘dry’ season and 25.8°C and 32.2°C for the ‘wet’ season respectively (Bureau of Meteorology 2020). Annual rainfall is estimated to be 1,452 mm, of which the vast majority falls in the ‘wet’ season (Bureau of Meteorology 2020).

Masig Island is in the central island group of the Torres Strait and is a low-elevation coral cay, 2.7 km long and 800 m at its widest point (Fig. 1). The island has a population of ca. 270 people (Australian Bureau of Statistics 2016). The major regional ecosystem on Masig Island consists of Casuarina equisetifolia woodland to

![Fig. 1. Masig Island (9.7516° S, 143.4082° E), Torres Strait, Queensland, Australia. Inset with pink circle indicates location of the Torres Strait. Orange square indicates approximate location of the frequency experiments. Blue square indicates approximate location of the habitat type experiment. Map was produced in QGIS with the World Geodetic System 1984 projection and the World Imagery (2020) layer.](https://academic.oup.com/jme/advance-article/doi/10.1093/jme/tjaa242/5976069)
open forest, sometimes with an understory of vine thicket species (Regional Ecosystem 3.2.6b; Neldner et al. 2019). The island has one principle village, with houses being typically bordered by a variety of native and ornamental vegetation as well as swathes of introduced weeds.

**Study Period**

Three experiments were conducted on Masig Island during the wet season from 22 March 2019 to 8 April 2019 and 11–25 March 2020. There is no Bureau of Meteorology climate station on Masig Island, thus climate information were obtained from Poruma (Coconut) island, ~50 km from Masig Island. Total rainfall for the 2019 and 2020 sampling periods were 169 mm and 189 mm, respectively (Bureau of Meteorology 2020). During the 2019 sampling period, the average daily minimum and maximum temperatures were 25.6°C and 31.4°C. This was similar to the 2020 sampling period, for which the average daily minimum and maximum temperatures were 25.4°C and 31.8°C (Bureau of Meteorology 2020).

**Male Aedes Sound Trap**

The trap used in this study has been described previously (Staunton et al. 2020b). Two versions of the MAST have been developed: the MAST Sticky and the MAST Spray. The MAST Spray was used in these experiments. In brief, the MAST consists of a large black plastic base upon which sits a clear plastic rectangular container that houses captured mosquitoes. The base of the MAST was made from two inverted black buckets, one placed on top of the other. The black base serves as a visual attractant for male mosquitoes, while the sound lure (housed inside the clear container) attracted nearby male mosquitoes to fly inside the clear container (Fig. 2). Lures were programmed to produce a sinusoidal tone for 30 s on, 30 s off playback. Each lure contained a photodetector, which disabled playback between dusk and dawn. Rain guards, cut from plastic card holders (60 mm × 90 mm, Rexel, China) were placed over the lip (top of the container where the lid attaches) of each container. One day prior to the commencement of each experiment (i.e., experiment 1, 2, or 3), the inside of every clear container was sprayed once for 3 s with residual insecticide (Mortein multi-insect killer fast knockdown aerosol: 1.0 g/kg Esbiothrin 0.3 g/kg Permethrin 0.2 g/kg Imiprothrin) to prevent captured insects from escaping.

**Field Trials**

**Impact of sound lure frequencies on catch rates of male Ae. albopictus**

The aim of these experiments was to determine the comparative efficacy of different sound lure frequencies to lure male *Ae. albopictus* to be captured in the MAST.

**Experiment 1.** The range of effective sound frequencies that have previously captured male *Ae. albopictus*, being between 400 and 650 Hz, was used as initial guidance (Kanda et al. 1987, Ikeshoji and Ogawa 1988, Ikeshoji and Yap 1990, Kusakabe and Ikeshoji 1990, Balestrino et al. 2016). A 4 × 4 Latin square design was utilized and simultaneously replicated across three different locations. The three locations were all situated in coastal heath, dominated by *C. equisetifolia*, *Terminalia muelleri*, and *Spinifex sericeus*. Within a location, four stations were designated, each station being at least 15 m apart. One MAST was set at each station, being a total of 12 MASTs across all three locations (Fig. 3A). In each Latin square, four MASTs playing different sound lure frequencies (450, 500, 550, and 600 Hz) were compared. The four MASTs were randomly rotated between stations of a single location daily. The entire experiment was replicated two times (*n* = 24).

**Experiment 2.** The sound lure frequency range was expanded to 450, 600, 650, and 700 Hz to determine the relative catch rate of male *Ae. albopictus* in MASTs containing sound lures set to higher...
Influence of habitat type on catch rates of male *Ae. albopictus*

The aim of this experiment was to investigate fine-scale variations in male *Ae. albopictus* abundance and how trap placement influences catch.

Experiment 3. Three defined habitat types were selected: woodland, woodland edge and house habitats (Figs 2 and 3B). Woodland and woodland edge habitats were characterized by *C. equisetifolia* woodland to open forest, with a dense sub-canopy of vine thicket and woodland edge habitats were characterized by *C. equisetifolia* woodland edge and house habitats (Figs 2 and 3B). Woodland Experiment 3. Three defined habitat types were selected: woodland, woodland edge and house habitats (Figs 2 and 3B). Woodland

Influence of habitat type on catch rates of male *Ae. albopictus*

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Experiment 3. Three defined habitat types were selected: woodland, woodland edge and house habitats (Figs 2 and 3B). Woodland and woodland edge habitats were characterized by *C. equisetifolia* woodland to open forest, with a dense sub-canopy of vine thicket species, including *Aglaia elaeagnoides*, *Cyclophyllum* spp., *Drypetes deplanchii*, *Diospyros maritima*, *Planchonella obovate*, *Premna serratifolia*, and *Millettia pinnata* (Regional Ecosystem 3.2.6b; Neldner et al. 2019). Hereafter, this regional ecosystem is referred to as a woodland ecosystem. Stations in woodland edge habitats were within 5 m from the boundary of the woodland ecosystem. Stations in woodland habitats were located at least 30 m from the boundary of the woodland ecosystem. House habitats were inside the perimeter of an inhabited property. These properties were adjacent to a boundary of the woodland ecosystem. Stations in house habitats were placed within 5 m of either the front or back door. Twelve stations were selected: four in woodland, four in woodland edge, and four in house habitats. The experiment ran over a period of 7 d (*n* = 28). All traps were set to 600 Hz, based on results of experiment 1. The base of the MAST trap was made from two inverted black buckets, one placed on top of the other.

### Statistical Analyses

Graphs were produced in GraphPad Prism 8 (ver. 8.4.2), and data were analyzed in R Studio (R Core Team 2017, ver. 3.5). To investigate the impact of sound lure frequency on male *Ae. albopictus* catch rates (experiments 1 and 2) a generalized linear mixed model with a negative binomial distribution (Poisson models were consistently overdispersed) and a log-link function was performed using the `lme4` R package (ver. 1.1, Bates et al. 2015). The `aods3` R package (ver 1.1, Lesnoff and Lancelot 2018) was used to analyze overdispersion. Each frequency experiment was modeled separately. The parameter ‘frequency’ (fixed effect) was fitted to total daily catch of male *Ae. albopictus* by trap frequency, with ‘day’ and ‘station’ treated as random effects in the model. To investigate the influence of habitat type on catch rates of male *Ae. albopictus* (experiment 3), the parameter ‘habitat type’ (fixed effect) was fitted to total daily catch of male *Ae. albopictus* by habitat type with ‘day’ and ‘station’ treated as random effects in the model. For all experiments, the predictor variables were analyzed with an analysis of deviance using the `car` R package (ver. 3.0, Fox and Weisberg 2018). Finally, post-hoc tukey comparisons to determine significant differences among the estimated marginal means (least-squares means) of treatment groups were performed using the `emmeans` R package (ver. 1.4.6, Lenth et al. 2020).

### Results

#### Impact of Sound Lure Frequencies on Catch Rates of Male *Ae. albopictus*

In total, 312 and 360 male *Ae. albopictus* were captured in experiments 1 and 2, respectively (Table 1). Other mosquito species captured included six male *Ae. scutellaris* (Walker), one male *Verralina funerea* (Theobold) (Diptera: Culicidae) and individual females of *Ae. notoscriptus* (Skuse), and *Ae. albopictus* (Table 1). The most abundant other invertebrates for both experiments were ants (Formicidae) and fruit flies (Drosophilidae) (Table 1).

#### Experiment 1

Sound lure frequency significantly influenced the average daily catch of male *Ae. albopictus* (*χ²* = 39.4, *df* = 3, *P* < 0.0001, *n* = 24;
Fig. 4A; Supp Table S1 [online only]). Traps with sound lures set to 450 Hz captured significantly less male *Ae. albopictus* (mean ± SEM; 0.96 ± 0.22) compared to traps with sound lures set to either 500 Hz (3.08 ± 0.68), 550 Hz (4.25 ± 0.86), or 600 Hz (4.75 ± 0.84). Significant differences between average daily catch of male *Ae. albopictus* were not found when sound lures were set at 500 Hz, 550 Hz and 600 Hz (Fig. 4A).

**Experiment 2**

Sound lure frequency significantly influenced the average daily catch of male *Ae. albopictus* ($\chi^2 = 22.9$, df = 3, $P < 0.0001$, $n = 36$; Fig. 4B; Supp Table S2 [online only]). Traps with sound lures set to 450 Hz (1.0 ± 0.31) captured significantly less male *Ae. albopictus* compared to traps with sound lures set to 600 Hz (3.2 ± 0.92) and 650 Hz (3.7 ± 0.99). Traps with sound lures set to 700 Hz (2.1 ± 0.52) captured significantly less male *Ae. albopictus* compared to traps with sound lures set to 650 Hz (Fig. 4B).

**Experiment 3**

In total, 393 male *Ae. albopictus* were captured among the three habitat types (Table 2). Other mosquito species captured included: 39 male *Ae. scutellaris*, 3 female *Ae. scutellaris*, 5 male *Tripteroides magnesianus* (Edwards) (Diptera: Culicidae), and 4 female *Ae. notoscriptus* (Table 2). The most abundant other invertebrates for both experiments were ants (Formicidae) and fruit flies (Drosophilidae) (Table 2).

Table 1. Total taxa captured during the frequency experiments

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Experiment 1 (Hz)</th>
<th>Experiment 2 (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>450</td>
<td>500</td>
</tr>
<tr>
<td><em>Aedes albopictus</em> male</td>
<td>23</td>
<td>74</td>
</tr>
<tr>
<td><em>Aedes albopictus</em> female</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Aedes scutellaris</em> male</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Aedes notoscriptus</em> female</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Verrallina funerea</em> male</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Formicidae</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Diptera: Drosophilidae</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>Orthoptera</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Coleoptera</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Diptera (other)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blattodea</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Araneae</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>547</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 4. Average daily catch (± SEM) of male *Ae. albopictus* by frequency (Hz) for (A) experiment 1, and (B) experiment 2. Different letters indicate significantly different groups ($P < 0.05$, Tukey HSD, $n = 24$ for A, $n = 36$ for B).
Table 2. Total taxa captured by habitat type (experiment 3)

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Woodland</th>
<th>Woodland edge</th>
<th>House</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ae. albopictus</em> male</td>
<td>188</td>
<td>196</td>
<td>9</td>
<td>393</td>
</tr>
<tr>
<td><em>Ae. scutellaris</em> male</td>
<td>13</td>
<td>26</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td><em>Ae. scutellaris</em> female</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><em>Ae. notoscriptus</em> female</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Tripteroides magnesianus</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Formicidae</td>
<td>19</td>
<td>9</td>
<td>17</td>
<td>45</td>
</tr>
<tr>
<td>Diptera: Drosophilidae</td>
<td>13</td>
<td>7</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Orthoptera</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Coleoptera</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Diptera: Sciaridae</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>243</td>
<td>243</td>
<td>29</td>
<td>515</td>
</tr>
</tbody>
</table>

Fig. 5. Average daily catch (± SEM) of male *Ae. albopictus* by habitat type for experiment 3. Different letters indicate significantly different groups (P < 0.05, Tukey HSD, n = 28).

**Supp Table S3 [online only].** Stations at house habitats (0.32 ± 0.16) captured significantly less male *Ae. albopictus* compared to stations set at both woodland edge (7.0 ± 1.6) and woodland (7.29 ± 1.3) habitats (Fig. 5). No significant difference between average daily catch of male *Ae. albopictus* was found between woodland edge and woodland stations (Fig. 5).

Discussion

This is the first comprehensive field study investigating catch rates of male *Ae. albopictus* relative to a range of sound lure frequencies. This work demonstrated the ability of the MAST to capture male *Ae. albopictus*. This is a promising outcome for the MAST, as it is highly selective relative to other mosquito traps, including the BGS trap. Future studies concerning male *Ae. albopictus* could compare the efficacy of the MAST in capturing male mosquitoes overall, relative to well-established traps such as the BGS trap.

Low by-catch in both the present study and Staunton et al. (2020b) is supportive of the MAST being highly selective toward capturing both male *Ae. aegypti* and *Ae. albopictus*. Limited by-catch is likely a result of the MAST design. By-catch reduction by not utilizing an olfactory lure or fan to indiscriminately attract and capture insects. Subsequently, less by-catch could reduce time involved in sorting through traps, of benefit for researchers and mosquito release programs.

The most effective sound lure frequencies for capturing male *Ae. albopictus* were between 500 and 650 Hz in these experiments on Masig Island, and this is supported by previous research. For capturing male *Ae. albopictus* under field conditions, Balestrino et al. (2016) found no significant difference in male *Ae. albopictus* catch rates for sound frequency sweeps between 500 and 650 Hz against a BGS trap with BG sentinel lure. Under laboratory conditions, Balestrino et al. (2016) found that sound frequency sweeps between 500 and 650 Hz captured significantly more male *Ae. albopictus* than fixed frequencies of 545 Hz, 600 Hz, and 649 Hz. Here, fixed frequencies were studied, where the same frequency was played for 30 s continuously. Sound frequency sweeps between 500 and 650 Hz could increase male *Ae. albopictus* catch rate with the MAST. Future studies could determine the catch rate of male *Ae. albopictus* with fixed and sound frequency sweeps of the MAST under field conditions.

Both this present study and Balestrino et al. (2016) found that frequencies above 500 Hz were effective at capturing male *Ae. albopictus*. The initial average female *Ae. albopictus* wingbeat frequency recording of 462 Hz (Ikeshoji 1981) was used as a reference for most of the earlier sound trap studies, which largely tested 400 Hz and 480 Hz for capturing male *Ae. albopictus* (Ikeshoji 1987, Kanda et al. 1987, Ikeshoji and Ogawa 1988, Ikeshoji and Yap 1990, Kusakabe and Ikeshoji 1990). Later work by Brogdon (1994) recorded mean female *Ae. albopictus* wingbeat frequency between 536 and 544 Hz. Our results support greater male *Ae. albopictus* attraction at these higher frequencies and that frequencies below 500 Hz are suboptimal for attracting male *Ae. albopictus*. The range in frequencies attractive to male *Ae. albopictus* may reflect a plausible range of female wing beat frequencies found under field conditions,
encompassing different larval rearing conditions, age of females and environmental conditions (e.g., temperature), as such factors have been demonstrated to influence female wingbeat frequencies in laboratory conditions (Costello 1974, Mukundarajan et al. 2017, Villarreal et al. 2017, Staunton et al. 2019a).

Results from this study suggest that characteristics from the woodland and woodland edge habitat types were associated with high numbers of male 
\( Aedes albopictus \). At least five times more male 
\( Aedes albopictus \) were captured at stations in woodland and woodland edge than at stations near houses. All traps were placed within the flight range of 
\( Aedes albopictus \) (>200m; Marini et al. 2019, Vavassori et al. 2019), which indicates that 
\( Aedes albopictus \) had a preference for inhabiting the vegetated areas within close proximity of the village. This is likely a result of these habitats being more shaded, higher in humidity and likely plentiful oviposition sites available. Previous research on 
\( Aedes albopictus \) found more eggs in oviposition traps situated in areas with vegetation and trees than in areas without vegetation and trees (Hawley 1988, Rey et al. 2006, Honório et al. 2009, Cianci et al. 2015). Shade and vegetation may thus be an important determinant of catch rate success with the MAST, as it was for both male and female 
\( Aedes albopictus \) using BGS traps (Crepeau et al. 2013). For optimizing MAST placement, future studies should investigate environmental factors important in influencing catch (e.g., amount of shade, vegetation type, and distance to households) with both the MAST and the BGS trap, as has been undertaken for optimizing BGS trap catches of 
\( Aedes aegypti \) following ‘rear and release’ programs (Staunton et al. 2019b, 2020a).

\( Aedes scutellaris \) was occasionally captured with MASTs in the woodland (\( n = 13 \)), woodland edge (\( n = 26 \)) and in one frequency experiment (\( n = 6 \)). This is the first report of this mosquito being attracted and captured in a sound trap. In 2002, \( Aedes scutellaris \) was recorded as the only container-breeding \( Aedes \) species on Masig Island (Ritchie et al. 2002), but subsequently was likely displaced by 
\( Aedes albopictus \) (Ritchie et al. 2006). A 2016 larval survey across the Torres Strait, showed that \( Aedes scutellaris \) was as widespread as 
\( Aedes albopictus \), albeit at considerably lower abundance (Muzari et al. 2019). Our result most likely reflects catch of \( Aedes scutellaris \) under a low abundance setting. Futures studies concerned with the use of sound to capture \( Aedes scutellaris \) should focus on setting MASTs in areas where this mosquito is found at higher population abundances.

Additional development of the MAST could include telemetric options, involving sensor, photographic and communication equipment, to allow traps to continuously record and upload data. This would allow traps to be ‘set-and-forget’ and would be of considerable benefit for vector surveillance in remote areas. If further suppression or mosquito control of 
\( Aedes albopictus \) was to occur in the Torres Strait, MASTs could potentially be used to remotely monitor the success of various control strategies. Additionally, MASTs could be used as a low-power surveillance tool by countries for monitoring incursions of 
\( Aedes albopictus \) and potentially other \( Aedes \) species.

**Conclusion**

We found that sound lure frequencies at or above 500 Hz but below 700 Hz could be used for optimizing the capture of male 
\( Aedes albopictus \) on Masig Island. MASTs may therefore provide a useful tool for male 
\( Aedes albopictus \) surveillance throughout similar locations within the Torres Strait. Additionally, MASTs placed in woodland and woodland edge habitats captured at least five times more male 
\( Aedes albopictus \) than MASTs placed at house habitats. Understanding small scale variations in vector abundance is essential for effectively targeted vector control operations. Current suppression of 
\( Aedes albopictus \) on Horn and Thursday islands, by residual harborage spraying with lambda-cyhalothrin to well-shaded vegetation below 2 m in height and leaf litter at potential harborage sites (Muzari et al. 2017), could also be an appropriate tool for 
\( Aedes albopictus \) suppression on the outer islands of the Torres Strait.

**Supplementary Data**

Supplementary data are available at Journal of Medical Entomology online.

**Acknowledgments**

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**Data Availability**

Data and HTML output supporting the conclusions of this article are available from the JCRU Research Data repository: doi.org/10.25903/s23b0447ed8 (Swan 2020).

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