

Aedes aegypti Population Sampling Using BG-Sentinel Traps in North Queensland Australia: Statistical Considerations for Trap Deployment and Sampling Strategy

CRAIG R. WILLIAMS,^{1,2} SHARRON A. LONG,³ CAMERON E. WEBB,⁴ MORITZ BITZHENNER,⁵ MARTIN GEIER,⁵ RICHARD C. RUSSELL,⁴ AND SCOTT A. RITCHIE^{1,3}

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ABSTRACT BG-Sentinel mosquito traps were trialed as a tool for the rapid assessment (24-h collections) and routine monitoring (72-h collections) of adult *Aedes aegypti* L. populations in north Queensland. Analysis of *Ae. aegypti* collections using BG-Sentinels set in suburban Cairns for 24 h permitted the calculation of sample size for a range of precision levels. Clusters of houses with BG-Sentinels operating continuously for 15 d, with collections every 72 h, also permitted required sample size calculation. Evidence of *Ae. aegypti* spatial clustering at the house scale was revealed, with statistically significant effects detected for all collection days. Less variation was detected at each trap location, with only nine of 32 trap locations revealing significant clustering over time. Trap-out effects through continuous BG-Sentinel operation at a fixed location were absent. The findings support fixed position sampling at 72-h intervals for routine monitoring of *Ae. aegypti* populations in Cairns. Despite the relationship between collections of adult vectors and the incidence of disease remaining unknown, BG-Sentinel collections provide an alternative and less labor-intensive abundance measure for assessing risk of dengue virus transmission and success of dengue vector control programs.

KEY WORDS *Aedes aegypti*, BG-Sentinel, heterogeneity, spatial, sampling

The container-breeding mosquito *Aedes aegypti* (L.) is the sole vector of dengue viruses in Cairns, north Queensland, Australia, where regular epidemics occur (Ritchie et al. 2002). In response to dengue cases, vector control officers conduct source reduction and deploy lethal ovitraps (Zeichner and Perich 1999) within a 200-m radius of the case house, and interior insecticide spraying within 100 m (Ritchie 2005). This is an effective way to limit further dengue transmission (Ritchie et al. 2002, Ritchie 2005, Russell et al. 2005), but there is a need to develop an improved adult *Ae. aegypti* surveillance program to further enhance dengue management in north Queensland.

Because of the logistical limitations of larval and pupal sampling, our goal is to develop *Ae. aegypti* surveillance based upon adult collection. Although the sampling of *Ae. aegypti* immature stages has been successfully used in Vietnam to identify productive containers and estimate *Ae. aegypti* abundance (Kay

et al. 2002), this approach in north Queensland is limited by the cryptic nature and high diversity of breeding containers among houses (Kay et al. 2000, Hanna et al. 2001, Montgomery and Ritchie 2002). Indeed, many hard-to-reach cryptic sites, such as roof gutters and septic tanks, will not be inspected let alone sampled. Furthermore, established larval abundance indices (Breteau, House, and Container indices) have limited use in assessing adult abundance or dengue transmission risk (Focks 2003). More recent analyses have shown that the Breteau index is not strongly related to dengue infection prevalence (Chadee et al. 2005); thus, larval abundance is a poor measure of entomological risk, whereas the number of female *Ae. aegypti* adults per person can be a risk factor for dengue infection (Rodriguez-Figueroa et al. 1995).

Ideally, *Ae. aegypti* adult surveillance programs should include two components. Rapid assessment of abundance to allow for targeting of particular areas for vector control operations and evaluations, and routine collection over several months to provide a measure of population dynamics in relation to dengue virus activity.

The BG-Sentinel mosquito trap (Biogents GmbH, Regensburg, Germany) is a highly effective *Ae. aegypti* sampling device, capturing both males and females in similar quantities (Kroecel et al. 2006, Williams et al. 2006). Abundance and frequency data from investigations in Cairns (Williams et al. 2006) indicated the

¹ School of Public Health and Tropical Medicine, James Cook University, P.O. Box 6811, Cairns, Queensland, 4870 Australia.

² Corresponding author: Sansom Research Institute, University of South Australia, GPO Box 2471, Adelaide, South Australia, 5000 Australia (e-mail: craig.williams@unisa.edu.au).

³ Tropical Population Health Unit, Queensland Health, P.O. Box 1103, Cairns, Queensland, 4870 Australia.

⁴ Department of Medical Entomology, University of Sydney, ICPMR, Westmead Hospital, Westmead, NSW 2145, Australia.

⁵ Institut für Zoologie, University of Regensburg, Universitätstrasse 31, 93040 Regensburg, Germany.

device could be useful for both rapid assessment and routine monitoring of local *Ae. aegypti* populations.

The aim of this study was to first determine required sample sizes (i.e., number of BG-Sentinels) for a range of precision levels when sampling *Ae. aegypti* populations in Cairns. This will provide guidance on designing future *Ae. aegypti* population sampling strategies in the form of determining required sample size for a fixed precision, or conversely to determine the likely level of precision achievable if the number of traps is predetermined by logistical considerations (e.g., trap cost, acceptance by homeowners). An understanding of precision in population sampling is useful for evaluating what difference in relative abundance will be detectable, either between two or more different locations, or at a single location over time. This was done by investigating the relationship between mean and variance values for *Ae. aegypti* collections in BG-Sentinels deployed for 24 h (rapid abundance assessment) and 72 h (routine monitoring).

Second, to determine whether routine monitoring should be conducted at fixed or randomly selected new positions with every deployment, we investigated the extent of spatial and temporal heterogeneity of *Ae. aegypti* adult abundance among houses. Fixed position trapping is commonplace in rural mosquito monitoring programs using New Jersey (e.g., Easton 1987), EVS (e.g., Russell et al. 1991), and CDC traps (e.g., Andreadis et al. 1994). However, for *Ae. aegypti*, a domestic species with generally low density levels (Reiter and Gubler 1997), continuous trapping at a fixed location may cause localized population reduction, thereby affecting data. Alternatively, spatial heterogeneity in abundance among nearby houses may be too great to permit randomized redeployment of traps. We investigated both of these factors using BG-Sentinels in Cairns. We also determined the most appropriate data transformation procedure for non-normally distributed data from BG-Sentinel collections.

Materials and Methods

Required sample size for rapid abundance assessment (24-h collections). BG-Sentinel traps (Biogents GmbH, Regensburg, Germany) were deployed on 10 occasions at noncontiguous houses dispersed over ≈ 2 km² in suburban Cairns. Traps were set outdoors in areas sheltered from wind, direct sunlight, and rain between 1000 and 1400 h, and retrieved 24 h later. Traps were deployed during the wet season, on each of three dates in December 2005 (48 houses with one trap each), February 2006 (26 houses), and four dates in April 2006 (23 houses on three dates, 25 on the fourth date). On each sampling date, the variance (s^2) – mean (m) relationship was examined using Taylor's power law, $s^2 = am^b$ (Taylor 1961), which can be log transformed to the linear equation $\log_{10}(s^2) = \log_{10}(a) + b \log_{10}(m)$. Linear regression of $\log_{10} s^2$ on $\log_{10} m$ values from each collection day provides values for $\log_{10}(a)$ (intercept) and b (slope). The value

a is a scaling factor related to sample size, whereas b is a measure of aggregation (Taylor 1961). Values of a and b were then used to calculate the minimum sample size (n , number of BG-Sentinels) required to sample *Ae. aegypti* with a chosen precision, using the expression $n = am^{(b-2)} * (t/D)^2$, where m is the expected mean number of *Ae. aegypti* per trap per 24 h, $t = 1.96$, and D is the desired precision level (standard error/mean) (Southwood and Henderson 2000). Calculations were made for precision levels ranging from 0.10 to 0.35, which we considered an amount of variation that would allow biologically significant abundance differences to be apparent (e.g., a precision of 0.25 would allow an approximate doubling or halving of sample means to be detected). A similar range of precision levels has been used previously for sample size calculations for mosquito populations (Ritchie and Johnson 1991, Zhou et al. 2004) and those of other insects (e.g., Allsopp and Fischer 1999). Calculations were made for predicted means ranging from 1 to 20 *Ae. aegypti* per trap, as this was the range of collection sizes commonly encountered when using BG-Sentinels in Cairns (S.A.R. and C.R.W., unpublished data). The above-mentioned calculations were performed for female *Ae. aegypti* collection data only.

The most appropriate data transformation was determined through the calculation of p using the formula $p = 1 - b/2$ (Taylor et al. 1978) and previously determined b values. If $p = 0$, the appropriate transformation for a given data set would be logarithmic, whereas if $p = 0.5$, a square-root transformation is more appropriate.

Experimental Design for Determining Routine Monitoring Strategy (72-h collections). To determine required sample size, and whether fixed or nonfixed sampling locations should be used, BG-Sentinel trapping was performed at two clusters of houses. To define each cluster, a central house was selected, and all houses within a 75–100-m radius formed the cluster. When permission from residents was refused or the house was unoccupied, the adjacent house was selected. The result was a cluster of almost contiguous houses around the case house; the two clusters were made up of 15 and nine separate residences, respectively.

Each cluster received 16 traps, with one to two traps set at each house, depending on the size of the house and the block of land it was on. Traps were set outdoors in areas sheltered from rain and wind, and they were operated continuously for 15 d, commencing on 6 and 26 May 2005 (late wet season/early dry season) for the two house clusters, respectively. The collection bags were changed every 72 h, providing five time-wise collections from each property (days 3, 6, 9, 12, and 15).

To calculate required sample size for 72-h collections, the same procedure as for 24-h collections was used, i.e., on each sampling date, the $s^2 - m$ relationship was examined using Taylor's power law. The resulting a and b values were then used in sample size calculations (Southwood and Henderson 2000) for precision levels from 0.10 to 0.35. Values of a and b

Table 1. Required sample size (number of traps) for four levels of precision, *D* (standard error/mean), when sampling *Ae. aegypti* populations by using BG-Sentinels set for 24 and 72 h

Mean/trap	24-h collections				72-h collections			
	<i>D</i> = 0.10	<i>D</i> = 0.15	<i>D</i> = 0.25	<i>D</i> = 0.35	<i>D</i> = 0.10	<i>D</i> = 0.15	<i>D</i> = 0.25	<i>D</i> = 0.35
1	862	383	138	70	2283	1015	365	186
3	354	157	57	29	671	298	107	55
5	234	104	37	19	380	169	61	31
7	178	79	29	15	261	116	42	21
10	134	59	21	11	176	78	28	14
15	96	43	15	8	112	50	18	9
20	76	34	12	6	81	36	13	7

calculated for the two combined house clusters were used to make the sample size calculations as broadly applicable as possible. The calculation of *p* as above was used to determine the most appropriate data transformation for 72-h collections. The above-mentioned calculations were made for female *Ae. aegypti* collection data.

To determine whether *Ae. aegypti* was distributed nonrandomly within a cluster, descriptive statistics (mean, standard deviation, and variance) for total collections (i.e., males and females combined) from 16 traps were calculated for each collection day. The index of dispersion (*I_d*) was calculated for each collection day and tested for significance using the chi-square distribution and *n* - 1 degrees of freedom (Southwood and Henderson 2000). Significant results (*P* < 0.05) indicate deviations from randomness among houses. To determine whether *Ae. aegypti* was distributed nonrandomly over time at each house within a cluster, descriptive statistics were calculated for each trap over the 15 d of sampling. *I_d* values were calculated for each trap and tested for significance as described above.

Control traps were used to determine whether the continuous operation of BG-Sentinels over 15 d in a cluster of houses was causing localized *Ae. aegypti* population reduction. For both clusters, matching controls were operated concurrently at 12 dispersed, noncontiguous houses in the same suburb, ≈700–1000 m away from the cluster, for only 24 h at a time every 3 d to coincide with trap collections in the cluster. Thus, controls were only operated for one third of the time at scattered houses, which was thought sufficiently infrequent and dispersed to prevent local *Ae. aegypti* population reduction. Time-wise collections from scattered control traps and those in house clusters were tested for significant time-treatment interactions using a repeated measures analysis of variance (ANOVA) procedure with a general linear model in SPSS statistical software, release 11.0.1 (SPSS Inc., Chicago, IL). Data were log (*x* + 1) transformed to normality before analysis. The Premise condition index (PCI) (Tun-Lin et al. 1995) and Breteau index (number of positive containers per 100 houses; BI) were determined for both clusters and their control houses immediately before sampling to determine whether any major disparity in *Ae. aegypti* production in treatment and control areas existed.

Results

Twenty-Four-Hour Collections for Rapid Abundance Assessment. In total, 1,905 female mosquitoes were captured in BG-Sentinels set for 24 h. *Ae. aegypti* formed 75.4% of the collections, with *Culex quinquefasciatus* Say (17%) and *Aedes notoscriptus* (Skuse) (4.3%) the other most common species. The mean ± SE 24-h female *Ae. aegypti* collection per trap (*n* = 316) was 4.5 ± 0.2. Taylor's power law regressions were all highly significant (*P* < 0.001), giving the following values (CI₉₅): log *a* = 0.35 (0.02; 0.68), *b* = 1.19 (0.68; 1.70), and *r*² = 0.78. These enabled calculation of required sample sizes (Table 1). As the expected mean *Ae. aegypti* collection increased, the required number of BG-Sentinels (sample size) decreased for a given precision level. Taylor's *p* (0.41, CI₉₅ 0.15; 0.66) was distinguishable from zero and close to 0.5, indicating that the square-root transformation was most appropriate. To verify this, both square root and logarithmic ln (*x* + 1) transformations were carried out on non-normal female *Ae. aegypti* 24-h collection data (seven of 10 collection days). Both transformations normalized all seven data sets as determined by Shapiro-Wilks normality tests in SPSS.

Seventy-Two Hour Collections for Routine Monitoring. In total, 652 and 287 female mosquitoes were captured in the respective house clusters. *Ae. aegypti* formed 74.2 and 42% of the mosquito fauna in the two clusters, respectively, with *Cx. quinquefasciatus* (16 and 38.3%) and *Ae. notoscriptus* (5.5 and 13.9%) the other most common species. Linear regressions using Taylor's power law were all highly significant (*P* < 0.05), giving the following values (CI₉₅): log *a* = 0.77 (0.43; 1.12), *b* = 0.89 (0.29; 1.48), and *r*² = 0.60. Sample size calculations for fixed precision sampling (Table 1) showed that as mean *Ae. aegypti* collection increased, required sample size decreased. Increased levels of precision require larger sample sizes.

Taylor's *p* was close to 0.5 and distinguishable from zero by 95% confidence intervals (0.56, CI₉₅ 0.26; 0.86), indicating that the square-root transformation was the most appropriate for skewed data collected using BG-Sentinels set for 72 h. As for the 24-h collections, both square root and log (*x* + 1) transformations normalized 72-h collection data sets as determined by Shapiro-Wilks normality tests in SPSS.

Examination of *I_d* values (Table 2) revealed a large amount of variation between traps on each collection

Table 2. Summary statistics of 72-h total *Ae. aegypti* collections in BG-Sentinel traps set for 15 d in two clusters of houses in Cairns

	<i>n</i> ^a	Mean	SD	Variance	CV ^b	I _d ^c	<i>P</i> ^d
Cluster 1							
day 3	14	15.4	13.8	0.9	0.90	162.22	0.00001*
day 6	14	10.9	7.1	0.7	0.66	60.58	0.00001*
day 9	16	13.9	11.2	0.8	0.81	135.67	0.00001*
day 12	15	10.9	5.8	0.5	0.54	43.96	0.0001*
day 15	15	9.5	6.2	0.7	0.66	57.23	0.00001*
Overall	74	12.1	9.4	87.8	0.77	530.02	0.00001*
Cluster 2							
day 3	15	2.7	6.8	2.6	2.56	245.00	0.00001*
day 6	16	3.0	6.4	2.1	2.12	216.00	0.00001*
day 9	16	1.7	2.0	1.2	1.19	38.41	0.0013*
day 12	16	1.9	4.3	2.3	2.29	158.19	0.00001*
day 15	16	1.8	2.9	1.6	1.63	75.40	0.00001*
Overall	83	2.2	4.7	22.2	2.15	150.56	0.00001*

Data are sorted to demonstrate variation within a day amongst houses.

^a *n* < 16 due to interference with trap.

^b Coefficient of variation is SD/mean.

^c Index of dispersion (Southwood and Henderson 2000). This index is distributed similarly to the chi-square distribution.

^d Probability that distribution is Poisson, based on I_d and *n* - 1 degree of freedom by using the chi-square distribution. *P* < 0.05 indicates a non-Poisson distribution in space (marked by *).

day. Very low *P* values ($\ll 0.05$) indicated significant departures from a random distribution in space, and were evidence of spatial clustering (Table 2).

There was less evidence of nonrandom distribution of *Ae. aegypti* over time in each trap (Table 3). Values for I_d were typically low, with significant aggregation (*P* < 0.05) seen in only eight of 16 traps in cluster 1 and one of 16 traps in cluster 2. Traps that showed significant time-wise aggregation of *Ae. aegypti* were those with higher mean catches (8.4–24.0 *Ae. aegypti* per trap per collection).

No evidence of population reduction in house clusters was seen compared with concurrent collections from control traps (Fig. 1). This was verified by repeated measures ANOVA, which revealed no significant treatment–time interactions for cluster 1 (*F* = 1.24, *df* = 4, *P* = 0.33) and cluster 2 (*F* = 2.18, *df* = 4, *P* = 0.11). These results indicated that there were no significant differences in the way that collection numbers fluctuated in control and cluster traps. Breeding container surveys revealed that cluster 1 (PCI = 5.3 ± 1.7, BI = 40) and its matching control houses (PCI = 4.6 ± 0.9, BI = 63) were similar in premise condition and *Ae. aegypti* breeding container density. However, cluster 2 (PCI = 4.7 ± 1.5, BI = 25) differed slightly from its matching control houses by having fewer active *Ae. aegypti* breeding sites (PCI = 6.1 ± 1.1, BI = 90.5).

Discussion

Required sample sizes for a range of precision levels can be used not only to plan how many BG-Sentinels are required for a given level of precision but also, conversely, to determine what level of precision is likely when the number of available BG-Sentinels is limited. The 0.25 and 0.35 precision levels seemed to

Table 3. Summary statistics of 72-h total *Ae. aegypti* collections in BG-Sentinel traps set for 15 d in two clusters of houses in Cairns

	<i>n</i> ^a	Mean	SD	Variance	CV ^b	I _d ^c	<i>P</i> ^d
Cluster 1							
Trap 1	3	7.00	3.00	9.00	0.43	2.57	0.2765
Trap 2	5	24.00	10.70	114.50	0.45	19.08	0.0008*
Trap 3	5	8.40	5.37	28.80	0.64	13.71	0.0083*
Trap 4	3	3.00	2.65	7.00	0.88	4.67	0.097
Trap 5	5	21.60	6.07	36.80	0.28	6.81	0.146
Trap 6	4	8.75	6.55	42.92	0.75	14.71	0.0021*
Trap 7	5	13.20	2.59	6.70	0.20	2.03	0.7302
Trap 8	5	21.40	11.78	138.80	0.55	25.94	0.00001*
Trap 9	5	10.60	2.51	6.30	0.24	2.38	0.6667
Trap 10	5	9.20	7.36	54.20	0.80	23.57	0.0001*
Trap 11	5	11.60	7.70	59.30	0.66	20.45	0.0004*
Trap 12	5	3.80	1.30	1.70	0.34	1.79	0.7744
Trap 13	4	2.75	2.63	6.92	0.96	7.55	0.0564
Trap 14	5	11.20	8.04	64.70	0.72	23.11	0.0001*
Trap 15	5	22.60	12.52	156.80	0.55	27.75	0.00001*
Trap 16	5	6.20	3.11	9.70	0.50	6.26	0.1807
Cluster 2							
Trap 1	4	2.00	1.83	3.33	0.91	5.00	0.2873
Trap 2	5	1.00	1.22	1.50	1.22	6.00	0.1991
Trap 3	5	0.00	0.00	0.00			
Trap 4	5	1.00	1.00	1.00	1.00	4.00	0.406
Trap 5	5	1.80	1.10	1.20	0.61	2.67	0.6145
Trap 6	4	0.00	0.00	0.00			
Trap 7	5	0.20	0.45	0.20	2.24	4.00	0.406
Trap 8	5	2.20	1.30	1.70	0.59	3.09	0.5429
Trap 9	5	1.40	1.14	1.30	0.81	3.71	0.4467
Trap 10	5	4.60	2.51	6.30	0.55	5.48	0.2415
Trap 11	5	0.20	0.45	0.20	2.24	4.00	0.406
Trap 12	5	0.20	0.45	0.20	2.24	4.00	0.406
Trap 13	5	0.00	0.00	0.00			
Trap 14	5	1.20	1.10	1.20	0.91	4.00	0.406
Trap 15	5	18.20	8.38	70.20	0.46	15.43	0.0039*
Trap 16	5	1.40	0.89	0.80	0.64	2.29	0.6826

Data are sorted to demonstrate variation over time for each trap.

^a *n* < 5 due to interference with trap.

^b Coefficient of variation is SD/mean.

^c Index of dispersion (Southwood and Henderson 2000). This index is distributed similarly to the chi-square distribution.

^d Probability that distribution is Poisson, based on I_d and *n* - 1 degree of freedom using the chi-square distribution. *P* < 0.05 indicates a non-Poisson distribution over time (marked by *).

be the only feasible levels, because sampling *Ae. aegypti* at 0.10 and 0.15 precision would require several hundred BG-Sentinel traps for the lowest densities. Given the unit cost of BG-Sentinels, their size (35 cm in diameter by 40 cm in height) and power requirements (12 V, d.c.), the deployment of several hundred units simultaneously would be problematic.

Our analysis indicated that the square-root transformation should be used to normalize skewed data from BG-Sentinels. The log (*x* + 1) data transformation also worked and could be used, but overall the square-root transformation seemed to be most appropriate for dealing with non-normally distributed data from BG-Sentinels.

When conducting routine monitoring with 72-h BG-Sentinel collections, whether traps should be set at fixed positions or at randomly reallocated ones, will depend upon the amount of spatial aggregation of *Ae. aegypti* locally and whether the continuous operation of a BG-Sentinel at a fixed location causes localized trap-down effects. Our studies at the two house clusters revealed

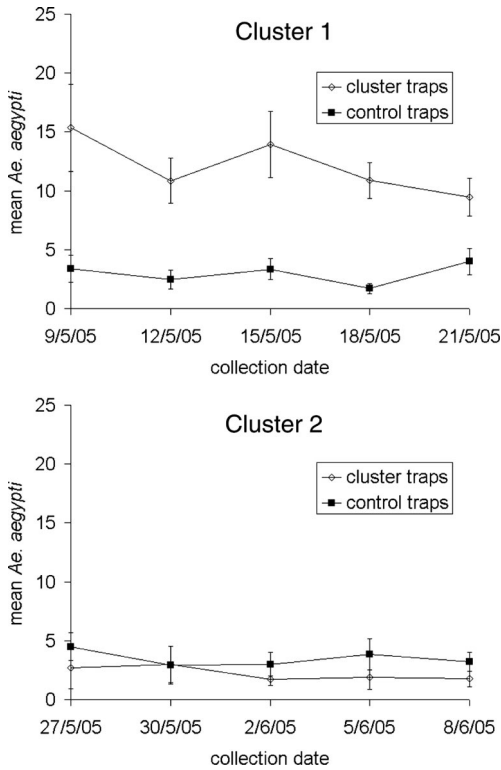


Fig. 1. Mean \pm SE total *Ae. aegypti* captured in BG-Sentinels in house clusters and contemporaneous control traps. Traps in clusters are 72-h collections, control traps are 24-h collections.

that a significant amount of spatial aggregation existed, even between houses in a small cluster. This was consistent with the adult *Ae. aegypti* spatial clustering at the house scale (≈ 10 m) reported by Getis et al. (2003) in Peru; however, the amount of time-wise aggregation at fixed locations in this Cairns study over 15 d was much less pronounced. Furthermore, there was no evidence of localized population reduction through the continuous operation of a BG-Sentinel at a fixed location, suggesting that emigrants from outside the trapping cluster infiltrated the area. These two results indicate that fixed position placement for routine monitoring of *Ae. aegypti* populations in north Queensland is appropriate. Trapping at fixed positions will avoid some of the highly significant variation between nearby houses reported here, and by minimizing variation the ability to detect changes in *Ae. aegypti* abundance is maximized.

The cause of the spatial clustering observed here may be explained in part by the patchy distribution of breeding sites within house clusters. Also, the placement of each trap in proximity to harborage sites for *Ae. aegypti* will affect collections. Thus, spatial patchiness of *Ae. aegypti* production and nonrandom short-range dispersal (Russell et al. 2005) within the cluster are likely contributors to the spatial heterogeneity observed here.

Given that adjacent houses may have vastly different *Ae. aegypti* abundance, indices that are valid at

larger scales such as the BI may be of limited importance. The disassociation between houses with high pupal abundance and high adult abundance reported by Schneider et al. (2004) in Peru supports this assertion. *Ae. aegypti* indices based on a smaller scale (e.g., the house unit) may prove more useful in assessing entomological risk. This was well illustrated during a DENV-2 epidemic in Cairns in 2003, when after large-scale vector control operations reduced *Ae. aegypti* collection rates (Ritchie et al. 2004), sporadic transmission continued at previously uninspected houses, each with a small number of breeding sites. The spread of dengue cases was also found to be significantly clustered at the individual house level during an epidemic in Puerto Rico (Morrison et al. 1998).

Although we have provided evidence to guide the sample size and trap placement strategy for rapid abundance assessment and routine monitoring of *Ae. aegypti* populations using BG-Sentinels, the spatial scale over which this should be done has not been assessed here. We have reported spatial clustering at the house scale, which has implications for the number of BG-Sentinels required to make population abundance assessments. However, the spatial scale for rapid abundance assessments, necessary for guiding resource allocation for vector control, will depend upon the spatial distribution of dengue cases, and the short-range dispersal of *Ae. aegypti* in Cairns (Russell et al. 2005). BG-Sentinels can be used to help target source reduction campaigns. Using 24-h collections, traps can be moved daily to help locate households with high immature productivity, especially in cryptic sites. Sciarretta et al. (2005) used such an approach, termed an "Adaptive Population Management Scheme," to optimize tsetse fly trap locations and control in Ethiopia. However, determining the spatial scale for routine monitoring is more problematic. A detailed spatial analysis of dengue transmission in Cairns that reveals potential "indicator" premises for dengue epidemics should help to clarify this.

Because the breeding ecology of *Ae. aegypti* varies significantly throughout its geographic range, its spatial distribution among houses is also likely to differ between regions. The use of BG-Sentinels as population abundance measures outside of Australia is therefore contingent upon an initial evaluation of spatial patchiness, because this has implications for required sample size (number of BG-Sentinels).

BG-Sentinels have potential as an *Ae. aegypti* population sampling tool, and they provide for the development of an alternative abundance index to the traditional labor-intensive *Aedes* indices for assessing disease risk and the success of vector control programs. However, the relationship between collections of adult mosquito vectors and the amount of disease transmission remains unknown (Focks 2003). It now remains for researchers to determine the relationship between BG-Sentinel collections and dengue infection risk so that epidemiologically relevant *Ae. aegypti* indices can be developed.

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