

A Novel Catch Basin Mosquito Emergence Trap

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Abstract

Urban catch basins provide a primary source of production for *Culex pipiens*, a vector of West Nile virus (WNV). These container habitats are targeted by mosquito abatement efforts and the effectiveness and longevity of larvicide are critical to the reduction of vectors and arbovirus transmission. Larval sampling of catch basins does not provide a good measure of adult production since commonly used (S)-Methoprene-based larvicides are designed to inhibit normal pupation, thus allowing the presence of larvae that will never emerge. We have developed a simple emergence trap designed to sub-sample emerging adult mosquitoes in treated and un-treated catch basins.

Methods

- We sampled *Culex* spp. mosquito larvae and pupae using sweep nets in urban catch basins in suburban Chicago, IL, July to September, 2009.
- We placed emergence traps in catch basins containing larvae for a minimum of ~48 hours (Figure 1).
- Emergence traps were collected after 48 hours and mosquitoes were processed as follows:
 - Sort females and males separately and count total numbers.
 - Verify species of mosquitoes as *Culex pipiens*.
 - Package mosquitoes into microfuge tubes.
- Empirical data collected in 2005 during this study was used to generate the average density of catch basins containing larvae.

Site	Catchbasin density (number/ha)
1	1.63
2	2.93
3	5.13
5	2.98
6	8.71
7	4.23
8	4.17
9	8.00
10	7.19
11	5.71
12	3.96
Average	5.07
Corrected*	1.88
# Emerge per ha per day	135.57

Table 2: Data collected in 2005 showing the average density of catch basins per study site and the corrected value representing the average density of catch basins per hectare containing larvae (27% of basins were found to have larvae, $5.07 \times .27 = 1.37$). The final estimate represents the total *Culex* mosquitoes emerging from catch basin sumps per hectare per day.

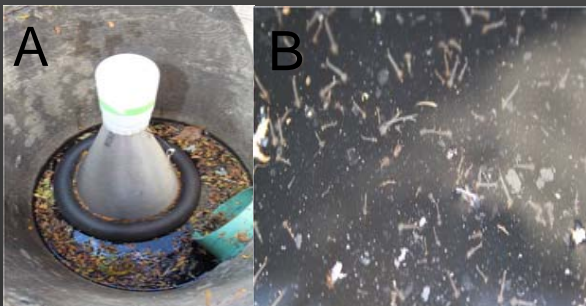


Figure 1. (A) Image of tall emergence trap deployed into catch basin near robin roost in southwest suburban Chicago. (B). Image of *Culex* 4th instar larvae and pupae in catch basin.

Results

- Emergence trap results**
 - We collected 469 *Culex* spp. adults within a total time of 37.09 days of the emergence traps deployed, which is equal to 12.64 mosquito adults per day (Figure 2).
 - The range of mosquitoes captured from all sites was 0-197 total adults (Table 1).
- Calculating catch basin productivity**
 - From previous studies done within the project, the average number of catch basins per hectare (ha) was 5.06 (Table 2).
 - We determined the percentage of mosquitoes that fly into the cup atop equal to ~69%.
 - Because only ~69% of mosquitoes are caught in the trap, and the traps covered varying degrees of surface area per catch basin, not all mosquitoes were successfully captured. Corrected values show some basins were found to support hundreds of emerging mosquitoes per day (P1, A6, A9).
 - The average number of *Culex* mosquitoes emerging from catch basins per day was 72, and average number of emerging mosquitoes corrected per hectare was ~373 per day. However, as noted in table 1, only 27% of basins contain larvae on average. The actual number of adults emerging from catch basins per hectare was 100.71 (Table 1 and 2).

Basin ID	# Days deployed	Totals ¹	Corrected ²	# Caught per day ³	Surface area of basin (cm ²)	Trap ID	% Area covered by trap	# Not in trap per day	# In basin per day
A1	2.02	33	43.23	21.56	2565.21	1	37%	35	57
A2	1.96	0	0.00	0.00	2918.64	1	33%	0	0
A3	2.00	2	2.62	1.32	2798.29	1	34%	3	4
A4	2.02	0	0.00	0.00	2680.48	1	36%	0	0
P1	1.79	35	45.85	25.79	18241.47	1	5%	462	488
A5	2.00	0	0.00	0.00	11674.54	1	8%	0	0
A6	3.77	197	258.07	68.96	2565.21	1	37%	115	184
A7	4.86	80	104.80	21.71	2918.64	1	33%	44	66
A8	2.02	8	10.48	5.23	2918.64	2	33%	11	16
A9	1.96	78	102.18	52.58	2565.21	2	37%	88	141
A10	2.00	1	1.31	0.66	2798.29	2	34%	1	2
A11	2.02	11	14.41	7.19	2680.48	2	36%	13	20
P2	1.79	4	5.24	2.95	11674.54	2	8%	32	35
A12	2.00	0	0.00	0.00	18241.47	2	5%	0	0
A13	4.88	20	26.20	5.42	11674.54	2	8%	60	65
		469	619.08	213.34				864	1077

Table 1: Catch basin data per site. ¹Totals based on 69% success rate of catching emerging mosquitoes under emergence trap. ²Corrected values based on adding other 31% of mosquitoes not captured under trap. ³Totals based on corrected values.

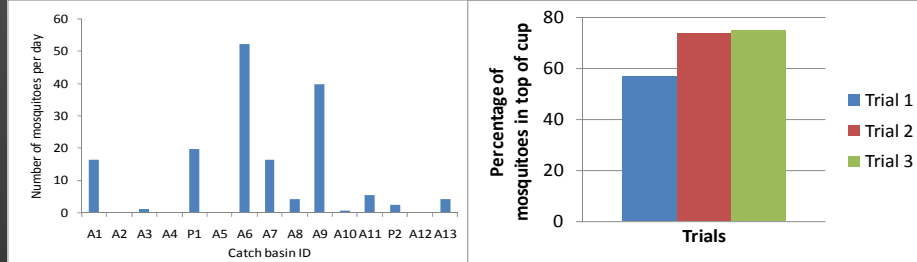


Figure 2. (A) Total number of mosquitoes captured per site. (B) Percentage of mosquitoes capture in cup. Calculations were figured by total number of adult mosquitoes captured in cup versus total number of pupae in emergence tray.

Trap #	Height (in)	Height (cm)	Diameter (in)	Diameter (cm)	Radius (cm)	Area (cm ²)
1	16.5	41.91	13.75	34.93	17.46	957.99
2	12	30.48	13.75	34.93	17.46	957.99

Table 2: Calculations for each type of emergence trap used in the field. There was no statistical evidence for a significant difference in data collected versus each trap.



Figure 3: Image of large emergence trap used in roadside catch basins before being placed on water.



Conclusions

- This emergent trap effectively captures adult *Culex* spp. mosquitoes emerging from catch basins and measures efficacy of (S)-Methoprene-based larvicides.
- Considering the emergence trap subsamples the adult mosquitoes in a catch basin, we were able to estimate the total contribution of *Culex* spp. mosquitoes coming from catch basin sumps.
- The estimate of 100 adult *Culex* mosquitoes emerging from catch basins per hectare per day demonstrates active mosquito abatement efforts in the region are not completely eliminating catch basins as a source for *Culex* spp. mosquitoes.
- This emergence trap will be utilized in future projects regarding efficacy of field trials of mark-recapture methods using stable isotopes Nitrogen-15 and Carbon-13 based from the traps capability to collect emerging mosquitoes.

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