AMCARF Project Status Report

This report will be used to communicate the progress, successes, and challenges of your AMCARF Funded project. The report will be used by the Review Committee to assess overall productivity of the project and its continued alignment with the AMCARF objectives. It will also be used to make future prioritizations of research and development efforts.

The report should not exceed 8 pages of text. Please include any additional attachments with key figures that may highlight critical findings.

Please submit your report to AMCA Executive Director, Megan MacNee at mmacnee@mosquito.org.

Use the following headings to build your report:

Individual filling out this form:

Email:

Report Type:

✓	Report Type	Report Deadline
	Progress Report	Friday, 17 July 2026
	Annual Report	Friday, 18 December 2026

Project Title: Improving mosquito control thresholds to maximize impact across species

AMCARF project number:

Project Cost: $27,904

Project Leader: Kelsey Lyberger, Assistant Professor, Arizona State University

Collaborators: (Include cooperating laboratories and AMCARF supported personnel and percent effort)

John Townsend, Vector Control Division Manager, Maricopa County Environmental Services Department

Project Objectives: (Bullets as stated in the approved proposal. Add new or modified objectives.)

1. Evaluate the impact of current trap-count thresholds and associated adulticide applications on subsequent mosquito abundance for primary mosquito vector species.

2. Compare adulticide-associated effects across multiple mosquito taxa and develop data-driven recommendations for mosquito control districts.

Total Project Progress:

Key Research Accomplishments: (Bulleted list of accomplishments from this project)

- Cleaned and linked Maricopa County mosquito surveillance and adulticide application records from routine trap observations and operational fogging events.

- Completed the proposed regression discontinuity analysis and used it to evaluate whether threshold crossings could support causal inference in this operational system.
- Developed and completed a panel regression/event-study analysis better suited to the structure of the surveillance and fogging data.
- Completed taxa-specific analyses for pooled *Culex*, *Cx. quinquefasciatus*, *Cx. tarsalis*, floodwater mosquitoes: *Psorophora* and *Ae. vexans*, and *Ae. aegypti*.
- Completed robustness checks testing sensitivity to sampling windows, spatial exposure definitions, event timing, model structure, and near-threshold restrictions.
- Presented preliminary findings at the Arizona Vector Conference in April 2026.
- Prepared a manuscript draft.

Reportable Outcomes:

Major outputs:

A manuscript is currently in preparation entitled "Taxa-specific effects of adulticiding on mosquito abundance from a decade of county-wide surveillance in Arizona." Preliminary findings were also presented at the Arizona Vector Conference in April 2026. The cleaned Maricopa County surveillance dataset will also support an additional manuscript in preparation on mosquito trap network design.

Scientific contribution to mosquito control:

This project provides a practical framework for evaluating adulticide-associated changes in mosquito abundance using long-term operational surveillance data. The revised panel regression/event-study approach accounts for repeated sampling, site-level differences, seasonality, and prior abundance across many traps, years, and taxa.

The main finding to date is that fogging is most clearly associated with short-term changes in *Culex* populations, which is in line with the primary goal of control for WNV in AZ. *Culex* growth was lower than in comparable unsprayed trap-weeks during the first week after spraying and was sharply reduced relative to the rapid increase immediately before treatment. In contrast, Floodwater mosquitoes and *Ae. aegypti* did not fall below comparable unsprayed trap-weeks after spraying, but both groups declined relative to their immediate pre-treatment increases. Overall, the results suggest that adulticide-associated population declines differ across taxa, with the strongest and clearest signal for *Culex* species.

Progress tied to approved objectives and deliverables:

Objective 1: Complete. The proposed regression discontinuity analysis was conducted and showed that threshold crossings were not a clean natural experiment in this operational dataset. I therefore developed a panel regression/event-study analysis that more appropriately evaluates adulticide-associated changes under current operational conditions. This revised analysis is complete and forms the basis of the manuscript draft.

Objective 2: In progress. Taxa-specific analyses have been completed for all major mosquito species in Maricopa County. Robustness checks have also been completed to evaluate sensitivity to sampling windows, exposure definitions, spatial scale, model structure, event timing, and near-threshold restrictions. Final operational recommendations still need to be refined with feedback from vector control collaborators.

Progress Assessment:

Objective 1: Regression discontinuity analysis. The proposed RD analysis was conducted and used to evaluate whether threshold crossings could support causal inference in this system. Although RD was not appropriate for this operational dataset, the analysis provides useful guidance for future applications of the method. RD may be feasible in districts with simpler rules, such as a single abundance threshold linked directly to one intervention type.

Objective 1: Revised panel regression/event-study analysis. This analysis now forms the basis of the manuscript.

Objective 2: Taxa-specific comparisons. Analyses have been completed for the major operational groups and focal species.

Objective 2: Robustness checks. Sensitivity analyses tested alternative sampling windows, exposure definitions, spatial scales, timing structures, model structures, and near-threshold restrictions.

Objective 2: Data-driven operational recommendations. (75% complete) In development. Preliminary conclusions are available, but final recommendations will be refined with feedback from Maricopa County collaborators.

Manuscript preparation. (75% complete) A manuscript draft has been prepared and will be revised before submission.

Plans for the following year: (1) Prepare a concise operational summary for vector control audiences. (2) Submit the manuscript to a peer-reviewed journal. (3) Present findings at the AMCA Annual Meeting.

Conclusion: This project remains on track and continues to address the AMCARF goal of improving evidence-based mosquito control decision-making. The completed analyses show that long-term operational surveillance and fogging records can be used to evaluate adulticide-associated changes across mosquito taxa when models account for repeated sampling, site-level differences, seasonality, and pre-treatment abundance. Fogging was most clearly associated with short-term reductions in *Culex* populations, while floodwater mosquitoes and *Ae. aegypti* showed weaker responses.

Supporting Data: See attachment.

Taxa-specific effects of adulticiding on mosquito abundance from a decade of county-wide surveillance in Arizona

Selected Results:

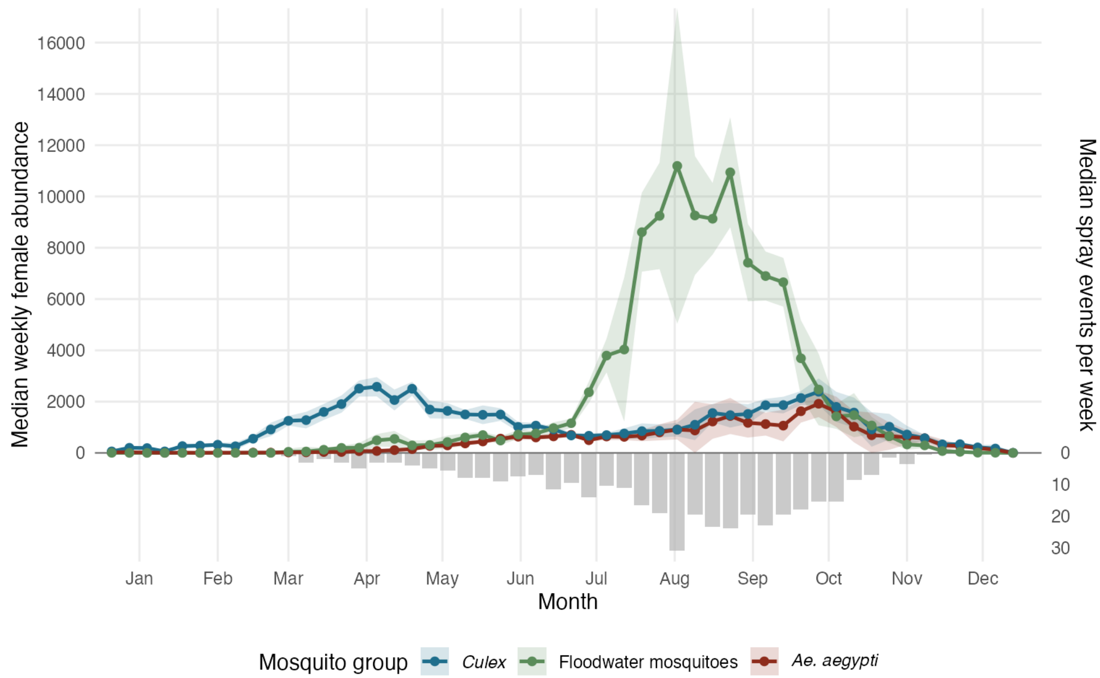

Figure 1. Weekly female mosquito abundance from routine traps, summarized across years by taxonomic group. Points and lines show the median weekly abundance, and shaded ribbons represent ±1SE across years. Gray bars at the bottom indicate the median number of adulticide spray events per week.

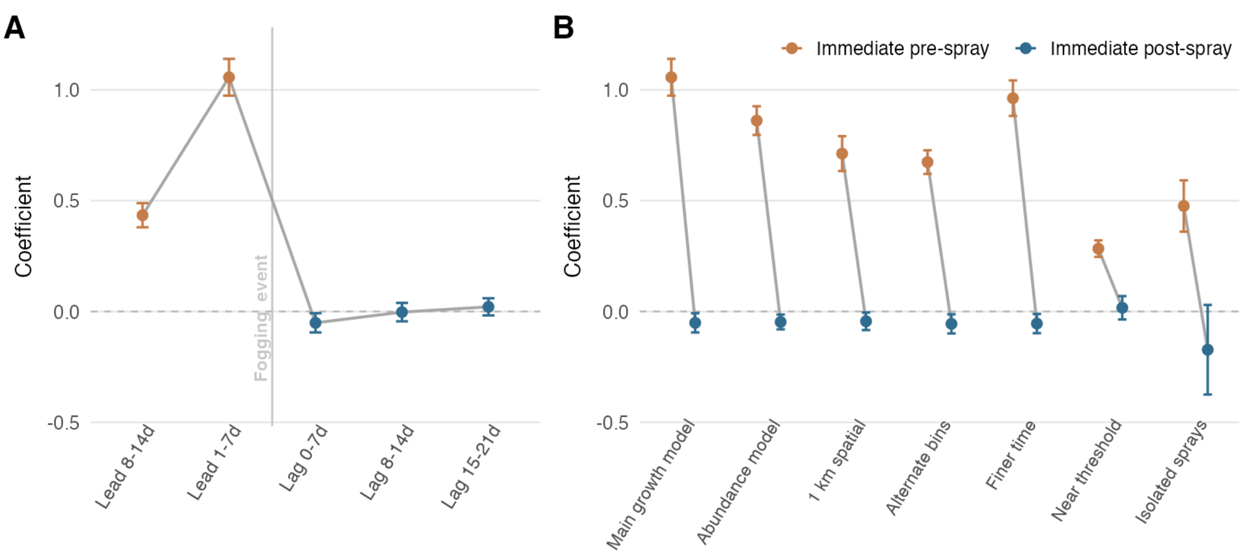

Figure 2. (A) Event-study coefficient estimates and 95% confidence intervals for pooled *Culex* from the primary panel regression model. Positive values indicate faster week-to-week change in mosquito counts relative to baseline. Orange points mark pre-spray periods and blue points mark post-spray periods. (B) Comparison of the immediate pre-spray (lead 11-7d) and immediate post-spray (lag 0-7d) pooled *Culex*

coefficients across the primary model and alternative specifications, including an abundance-outcome model, a 1 km spatial exposure model, alternate event bins, finer time controls, near-threshold restriction, and an isolated-spray model.

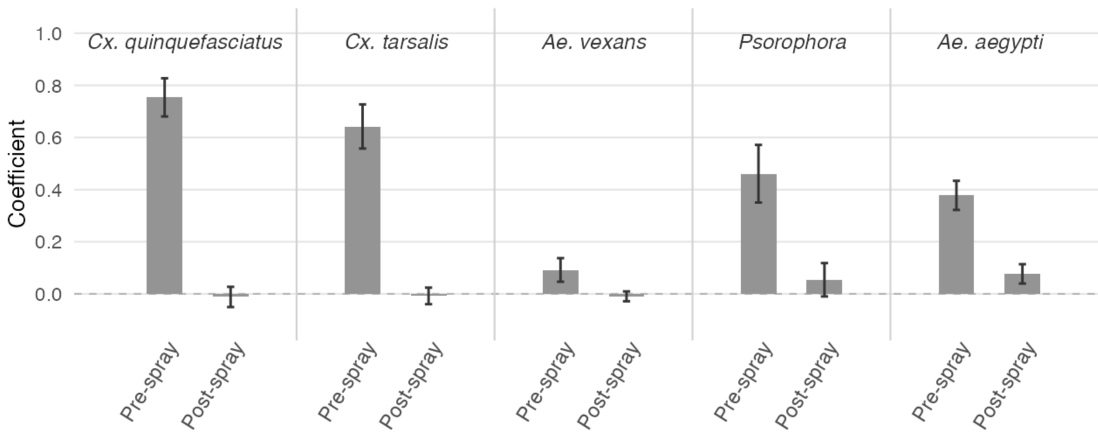

Figure 3. Species-specific immediate pre-spray (lead 11-7d) and immediate post-spray (lag 0-7d) comparisons. Bars show the estimated coefficients and error bars show 95% confidence intervals.