**Analysis Tutorial Prospectus**

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**1. Title**

Interactive Shiny App for Comparative Analysis of Circadian Activity in Two Mosquito species Using LAM Data

**2. Research question(s)**

How do daily activity patterns differ between two mosquito species within the Culex complex? Can a dynamic tool (such as a Shiny application) help identify species-specific differences in activity peaks and overall circadian rhythm?

**3. Objective(s)**

i. Create a R Shiny app built to analyze LAM (Locomotor Activity Monitor) data from individual mosquitoes across time.

ii. Visualize and compare temporal activity patterns between two *Culex* species (or treatments).

iii. Provide reusable code that enables researchers to explore behavior by time of day, individual ID, or species.

iv. Generate plots like actograms, heatmaps, and activity histograms from user-selected filters.

**4. Approach**

Circadian activity and behavioral rhythms in mosquitoes play a key role in understanding vector behavior and disease transmission patterns (Clements et al. 1999). LAM-based behavioral analysis has been widely used in insects like *Drosophila* to assess biological clocks (Rosato & Kyriacou 2006), and the same approach can be extended to mosquitoes. This project will utilize raw activity data collected from individual mosquitoes using a LAM system. The system outputs data with each column representing an individual mosquito's activity, recorded every 30 minutes over a period of five days. I will develop, through conversation in ChatGPT (Merow et al. 2023), an interactive R Shiny app that allows users to load a dataset, reshape into a tidy format, filter the data by character (mosquito ID, treatment, species, etc), and output their desired visualization. The app will be developed using R and rely on packages such as tidyverse, ggplot2, lubridate, and shiny and will have the ability to compute summary statistics (total activity, peak periods, average hourly activity) and display visualizations including actograms, heatmaps, and smoothed time series plots. This application will aid researchers by streamlining the process from data collection to publishable figures.

**5. Selected References**

Clements, A. N. (1999). The Biology of Mosquitoes: Sensory Reception and Behaviour. CABI

Publishing.

Rosato, E., & Kyriacou, C. P. (2006). Analysis of locomotor activity rhythms

in Drosophila. Nature Protocols, 1(2), 559–568. https://doi.org/10.1038/nprot.2006.79

Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis. Springer.

Merow, C., Serra-Diaz, J. M., Enquist, B. J., & Wilson, A. M. (2023). AI chatbots can boost

scientific coding. Nature Ecology & Evolution, 7(7), 960–

962. https://doi.org/10.1038/s41559-023-02063-3