To Skip or Not to Skip: Exploring the Connections Between Oviposition Behavior and Density-Dependence in *Aedes Albopictus* Mosquitoes

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Introduction

- *Aedes albopictus* larval habitat conditions impact fitness throughout all life stages.
- Conspecific density in larval habitats is one important factor affecting adult fitness, as it drives competition for food and space.

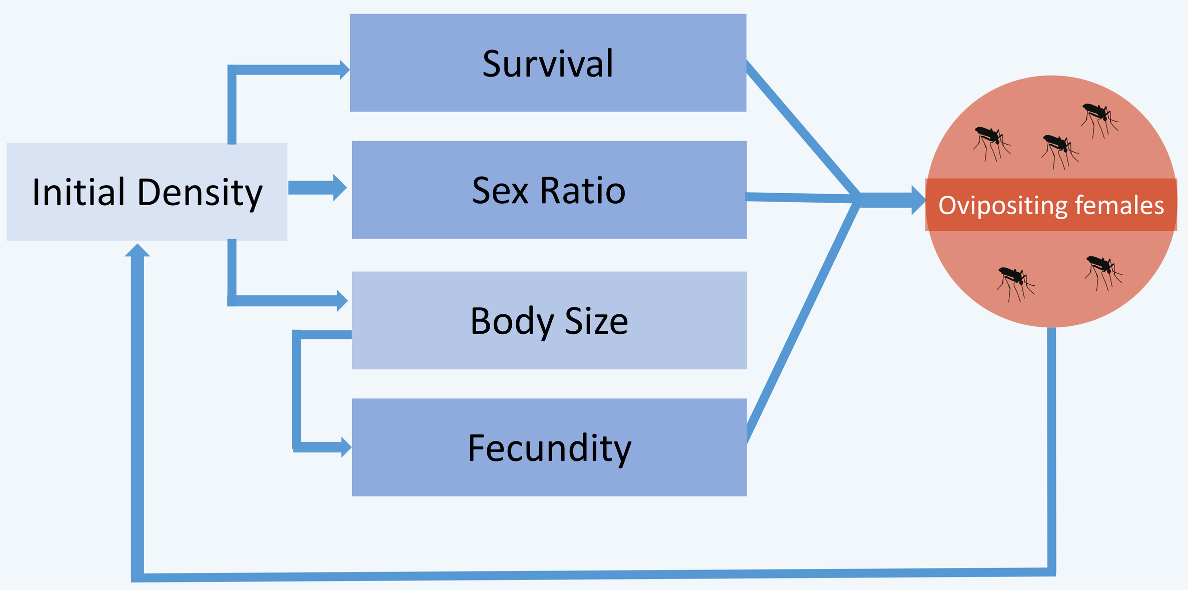


Figure 1. Flowchart of the density-dependent outcomes that drive short-term population dynamics.

- Blood-fed, mated females typically lay between 20 and 80 eggs, and their choices of where to oviposit and whether to skip-oviposit determine larval habitat densities.

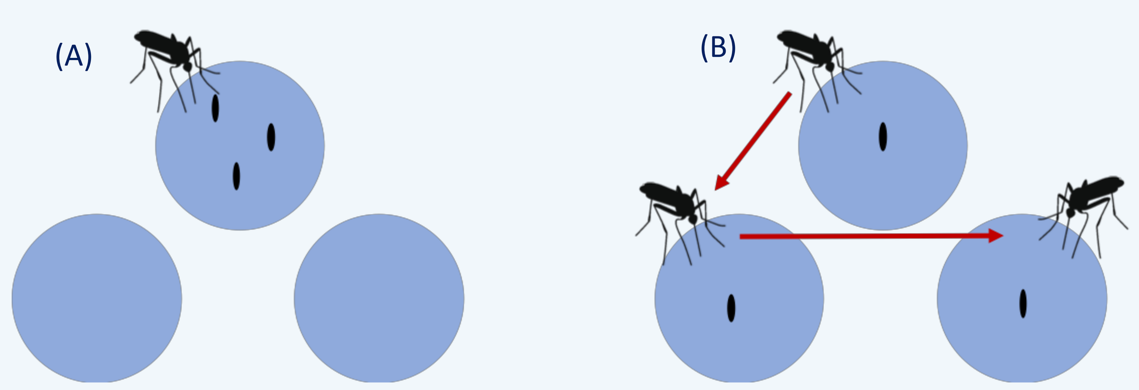


Figure 2. Diagram of (A) non-skip- (laying all eggs in one habitat) versus (B) skip- (spreading eggs among multiple habitats) oviposition behaviors. Black ovals represent eggs.

Research Question

How do different oviposition behaviors impact short-term population dynamics through density-dependence in larval habitats?

Methods

Larval Density Experiment

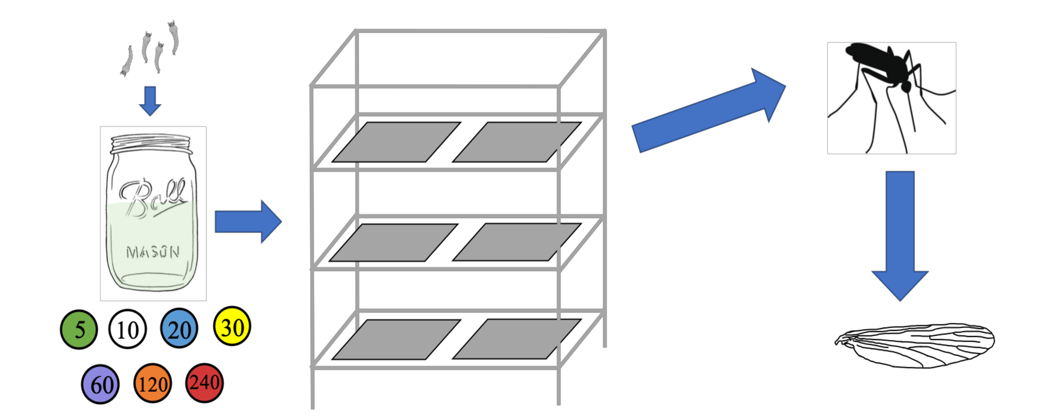
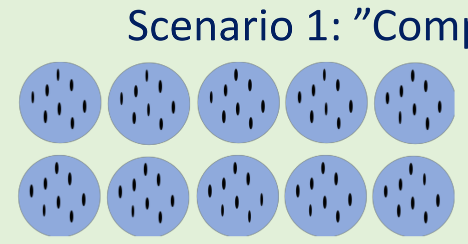


Figure 3. Larval density experimental design. Regressions on data from this experiment (Figure 4) were used to build equation 1.

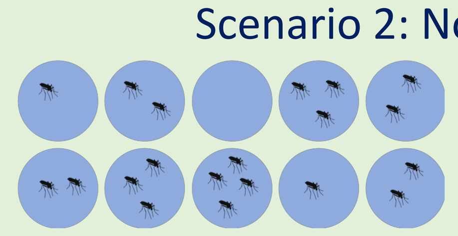
Oviposition Simulation

Scenario 1: "Complete" Skip-Oviposition



Each female distributes 50 eggs evenly between the available habitats.

Scenario 2: Non-Skip-Oviposition



Each female randomly chooses one larval habitat in which to oviposit all 50 of her eggs.

The resulting number of eggs in each habitat (E_1) was plugged into the following equation to predict the number of eggs that the next generation is expected to produce (E_2):

$$E_2 = S(H(E_1)) * R(H(E_1)) * F(W(H(E_1))) \quad (1)$$

H, S, R, and W represent proportion of eggs hatched, proportion of larvae survived to adulthood, proportion of emerged adults that are female, and wing length of emerged females, respectively. F is fecundity as a function of wing size (Armbruster and Hutchinson, 2002).

Results

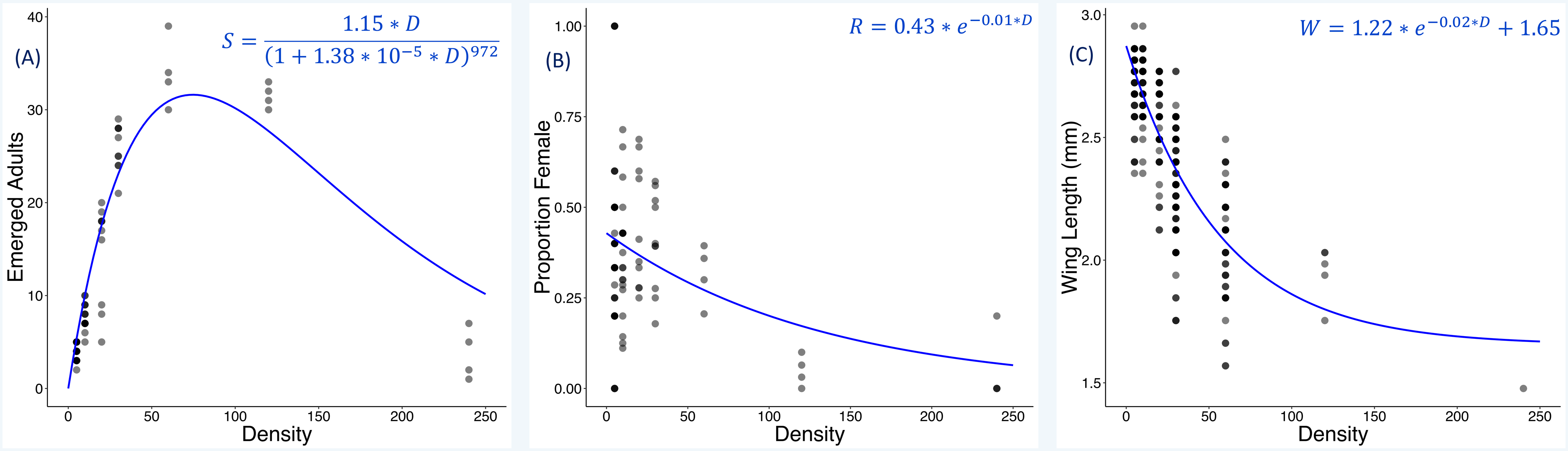


Figure 4. (A) Number of successfully emerged adults, (B) proportion of emerged adults that were female, and (C) wing length of emerged females by larval density. Nonlinear regressions and their equations are shown in blue; a Shepherd recruitment function was used in (A) and exponential decay equations were used in (B) and (C).

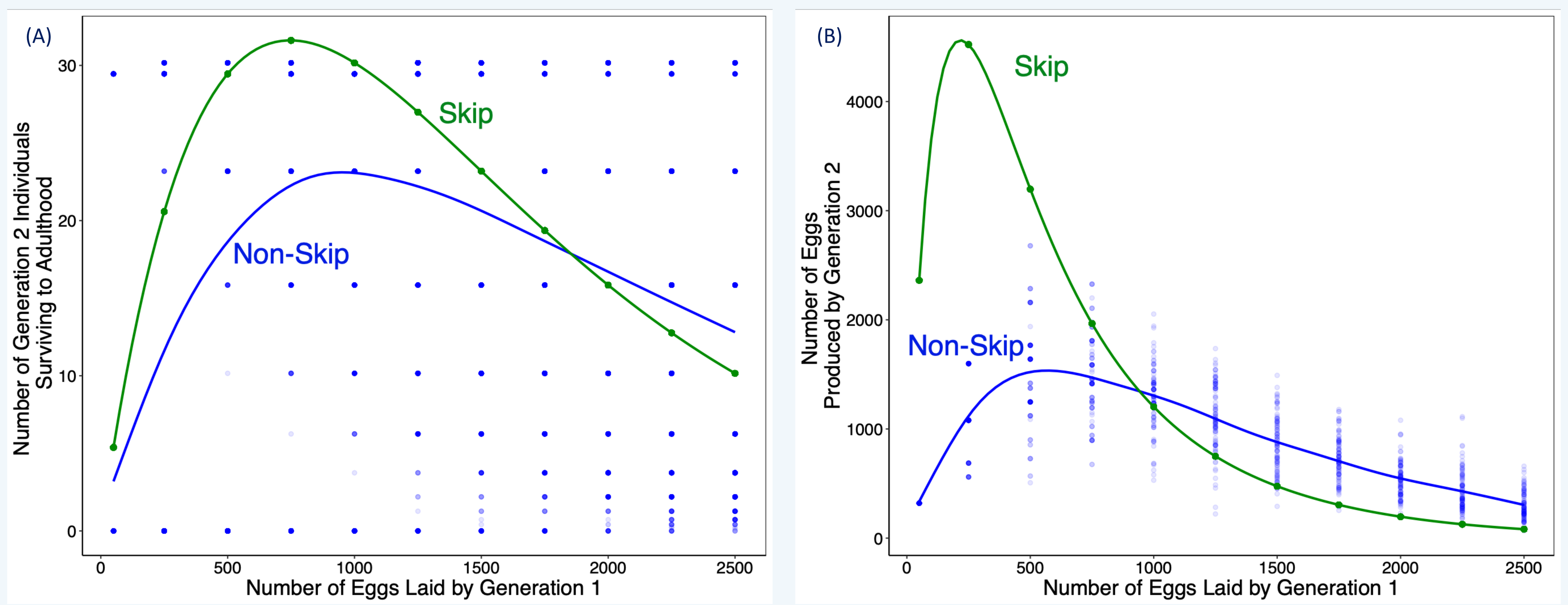


Figure 5. (A) Intermediate step in the oviposition simulation, predicting the number of individuals surviving to adulthood from the eggs laid. (B) Final output of the simulation, using equation 1 to predict the number of eggs produced by generation 2. "Non-skip" and "complete-skip" scenarios are shown in blue and green, respectively.

At low densities of ovipositing females, skip-oviposition produces more short-term population growth than non-skip-oviposition. At higher densities, non-skipping becomes more productive than skipping, though there is less divergence between the outcomes.

Conclusions and Future Directions

- Due to density dependence in larval habitats, individual females' oviposition behavior could have consequences for short-term population dynamics.

Oviposition Choice Experiment (in progress)

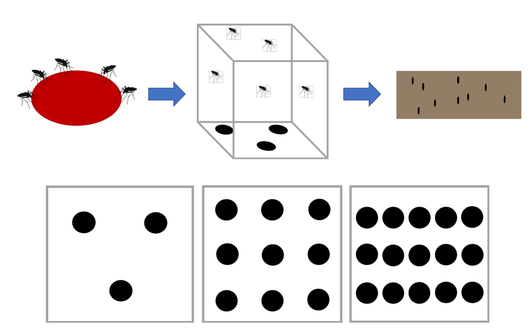


Figure 6. Oviposition choice experimental design.

- Our ongoing oviposition experiment will produce data describing actual oviposition behavior, of which we can predict the population-level consequences using equation 1.
- Future research could investigate the motivations of different oviposition behaviors on the individual level, to predict the conditions under which different short-term population dynamics might play out.

Acknowledgments

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References

Armbruster, P. and Hutchinson, R. 2002. Pupal Mass and Wing Length as Indicators of Fecundity in Aedes albopictus and Aedes geniculatus (Diptera: Culicidae). *Journal of Medical Entomology*, 39(4), 699-704.