

Factors for Trap Effectiveness

The Impact of Bait and Water Levels on Attracting Mosquitoes

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STEM Enhancement in Earth Sciences Internship

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Abstract

There are many different factors that go into attracting mosquitoes to traps. Some conditions can be so drastic that no mosquitoes will be attracted to traps at all, despite the traps being in an area with a high mosquito population. This experiment is intended to help future interns build more successful traps in order to gather the most accurate data possible. Using the GLOBE Observer Mosquito Habitat Mapper app to document my data, I counted the mosquitoes I had gathered each week in an attempt to determine if there was a correlation between the water level on attracting mosquitoes. As the weeks passed, however, I also began testing different amounts of bait used to try and find correlations with that factor as well. I also found a small amount of data related to light exposure levels, however this was outside the scope of my testing. To continue this project, I would have liked to have tested a broader range in water levels that extends to deeper levels than I had tested. Future weeks would also let me find a sort of “sweet spot” with the amount of bait used. To further help interns create the most optimal traps as possible, another experiment should be done related to different light exposure levels to try and find a relevant correlation between light and mosquitoes.

Research Question

Upon beginning my experiment on mosquito traps, my initial research question was “Does the amount of water in a mosquito trap impact the amount of mosquitoes attracted to the trap?” However, after my research continued I began testing for a second research question of “Does the amount of bait in each trap impact the amount of mosquitoes attracted to the trap?” The purpose of these questions was to try and help find areas with high mosquito populations. Being able to more easily identify areas with high mosquito populations would help greatly for predicting potential areas for outbreaks of mosquito-borne diseases, and then working to prevent said outbreak. I hypothesized

that higher levels of water would attract more mosquitoes, and also that higher amounts of bait would also lead to an increase in mosquito attraction.

Introduction

Unexpected outbreaks of mosquito-borne diseases can wreak havoc on a population, and recognizing areas that have a higher mosquito population can help predict areas where an outbreak could occur. This is what led me to try and research contributing factors to find areas of high mosquito population. Using the GLOBE Observer Mosquito Habitat Mapper, I began to track what caused higher counts of mosquito larvae in my traps. There are a plethora of different factors, and my research has only partially addressed two of them, so further research needs to be done on this topic. I began my experiments only testing for the factor of water depth, however certain findings in my research led to my testing of different amounts of bait.

Setting up the Experiment

To begin my experiment, I chose five identical 900mL containers to fill with varying amounts of water. The containers ranged from one to three cups of water, increasing by a half cup of water for each successive container. I then chose a small corner of my backyard that gets shade for a large majority of the day, as earlier research has shown that shade helps mosquito larvae survive (Parker, et al. 2020).



Photo of 900mL trap containers



Surrounding area in which the traps were placed

I also added ten pieces of my dog's food into each of the traps to use as a form of bait to attract mosquitoes. I clipped a popsicle stick to each of the traps, as not all mosquitoes lay eggs directly on the surface of the water, and I was unsure of what species of mosquitoes lived in my area. Finally, I placed a rock into each trap just to avoid wind blowing them over and preventing results.

Weeks One and Two

After the first week, I returned to my traps to check for any mosquito larvae, and had found none. Originally, I hypothesized that the lack of larvae was due to the large amount of thunderstorms that had occurred that week. All five of the traps had largely been flooded, and the water had turned to an extremely dark color. In addition to this, there was debris that had fallen into the traps, which also may have warded off mosquitoes. After repeating this setup for the second week, the same results occurred despite the fact that the traps had received no rainfall during the second week.



Mosquito traps after the first week

The second week showed that the thunderstorms were not the cause for the lack of mosquitoes, and so I then hypothesized that there were no mosquitoes because I had put too much dog food into the traps, and that the dog food had dissolved in the

water, which is the cause for the water darkening. With this new hypothesis in mind, I changed my setup for the third week.

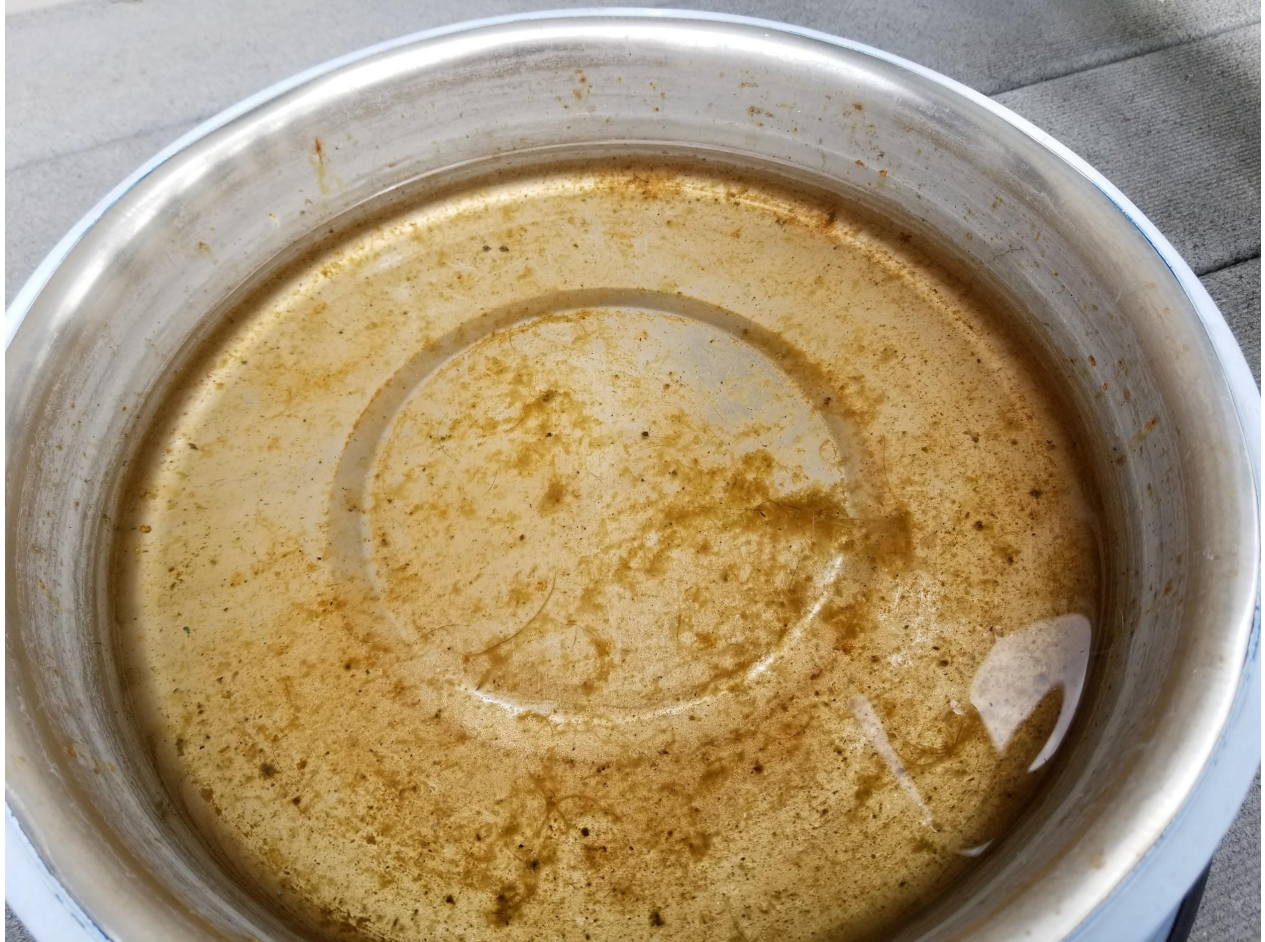
Weeks Three and Four

For week three, I drastically lowered the amount of dog food from ten pieces down to one. In addition to this, I moved the location of the traps to underneath a picnic table in my backyard, as an attempt to shelter them from rainfall that was forecasted to occur. This change in setup was shown to be largely successful, as I found many mosquito larvae at the end of the third week. Additionally, after repeating this setup for the fourth week, I received similar results.



Trap setup for the third week

After setting my traps back up for the fourth week, I noticed on my way back inside my house that there was a large amount of larvae in the water dish that my dog uses. The water dish did not contain any bait at all, however mosquitoes were still attracted to it enough to lay their eggs on the water in the dish. This made me decide that for my fifth and final week, I should put no bait in any of my traps at all, to try and see if bait has any relevance to the amount of mosquitoes attracted to the trap.



Water dish that my dog uses

Week Five

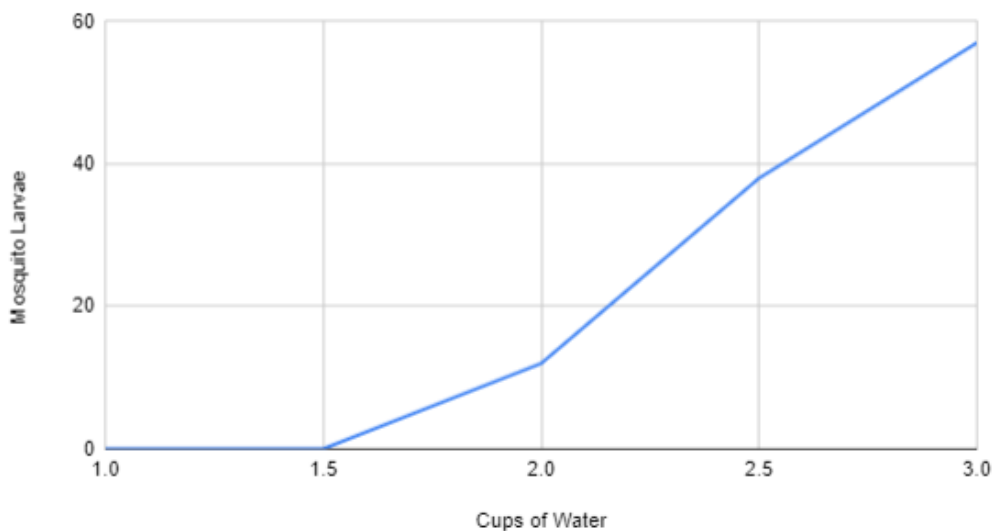
For the fifth week, I placed no bait into my traps at all. By the end of the fifth week, there were still clearly mosquito larvae in my traps, however there were clearly less mosquitoes than when I only had a single piece of dog food. Unfortunately, I never got the chance to repeat this experiment for a sixth week, as my internship was coming to an end and there simply was not enough time to do any more experiments. Due to this, the data collected this week could be an outlier, and further testing would be needed to show whether or not this is the case.

Results

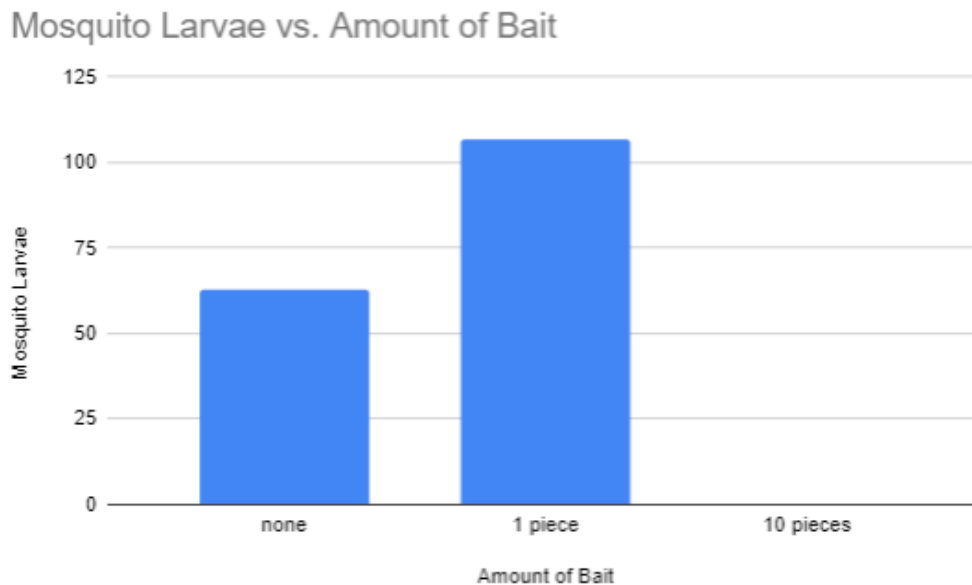
The experiment conducted over the course of my internship was attempting to find a correlation between both water level and the amount of bait on the attractiveness for mosquito traps to attract mosquitoes. The first two weeks both resulted in no mosquito larvae at all, however after decreasing the amount of bait mosquitoes were attracted to the traps. However, decreasing the amount of bait to zero only attracted about half the amount of mosquitoes.

After mosquitoes were attracted to my traps in the third and fourth weeks, I was able to gain data on the impact of the water level. Even after the change in setup, the containers with 1 cup and 1½ cups still never attracted any mosquitoes at all. However, as the amount of water increased beyond 1½ cups, the amount of mosquito larvae in each trap also increased.

Mosquito Larvae vs. Cups of Water



Average mosquito larvae in traps from weeks three and four



Average amounts of mosquito larvae amongst all five traps

Conclusions

Based on the data collected over all five weeks, I have concluded that my first hypothesis about higher water levels attracting more mosquitoes is supported by the experiment. However, my experiment only tested up to three cups of water, and if far higher amounts are tested, there may be a turning point where more water begins to attract less mosquitoes than the lower amounts did. Further experimentation is required to determine if this turning point exists.

My hypothesis that higher amounts of bait would attract more mosquitoes is refuted by the data collected in my experiment. Although one piece of bait attracted more mosquitoes than no bait at all, when increased to ten pieces no mosquitoes were attracted to my traps. This data shows that there is a turning point where more bait will begin to prevent the attraction of mosquitoes, however I simply did not have enough time to find where this turning point is. Additionally, I was not able to repeat the

experiment with no bait in any of my traps, and so the single week of testing could be an outlier. Due to this, further testing should be conducted to conclusively say that bait increases the attractiveness of a trap to mosquitoes at all.

In conclusion, my research is incomplete due to a lack of both time, in terms of the amount of bait, and scale, in terms of the amount of water. Not only should further research be done on these two factors, there are a plethora of factors that I did not test for, such as light exposure or different types of bait, which would also help to identify mosquito rich environments more easily.

Bibliography

Parker, A.T., McGill, K., Allan, B.F. (2020). Container Type Affects Mosquito (Diptera: Culicidae) Oviposition Choice, *Journal of Medical Entomology*, Volume 57, Issue 5, 1:1459–1467,

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