

# Developing an Alternative, Lab-Based Diet for Hawaiian Ground Snails — Food Preference and Nutrient Analyses

Lilly Thomey,<sup>1,2,3</sup> Geneviève Blanchet,<sup>1,2</sup> and David Sischo<sup>1,2</sup>

<sup>1</sup>Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife, Snail Extinction Prevention Program

<sup>2</sup>University of Hawai'i at Mānoa and <sup>3</sup>Kupu AmeriCorps



## Introduction

Known as the 'extinction capital of the world,' the Hawaiian Islands have many rare and endangered species in dire need of creative and collaborative conservation strategies.

Hawaiian land-snails are some of the most extinction prone species in the islands, with many threatened due to invasive predators, habitat loss, and climate change. *Ex situ* captive propagation is an essential tool to recover snail species on the brink.

The objective of this research is to understand the wild diet of land snails in the Hawaiian endemic family Amastridae, so that captive diets can be optimized.

Amastrids are ground dwelling, semi-arboreal species that feed on decaying leaves of native Hawaiian plants (Figure 1). Extensive captive propagation and reintroduction efforts are underway for over 15 amastrid species.



Figure 1. *Amastra intermedia* are a species of rare ground snail endemic to the island of O'ahu. *A. intermedia* are detritivores and give live birth.

## Materials and Methods

- We used a buffet-style experiment to quantify food preference of *Amastra intermedia*.
- Twenty-five wild *A. intermedia* sub adults were collected from a predator-proof enclosure in the Wai'anae mountain range on O'ahu.
- Four plant species and *Cladosporium* sp., a cultured fungus used to supplement lab snail diets, were included in the study. Additionally, we included plain potato dextrose agar (PDA), with and without CaCO<sub>3</sub>, which is used to culture the fungus. A piece of plastic was used as a control.
- Snails were placed in a 'feeding arena' with equal amounts of the randomly placed food types (Figure 2 and 3).
- We videotaped five 24-hour trials, each with five different snails, marked to keep track of individual snail movements. We quantified the number of visits and the time spent on each food type (Figure 3).

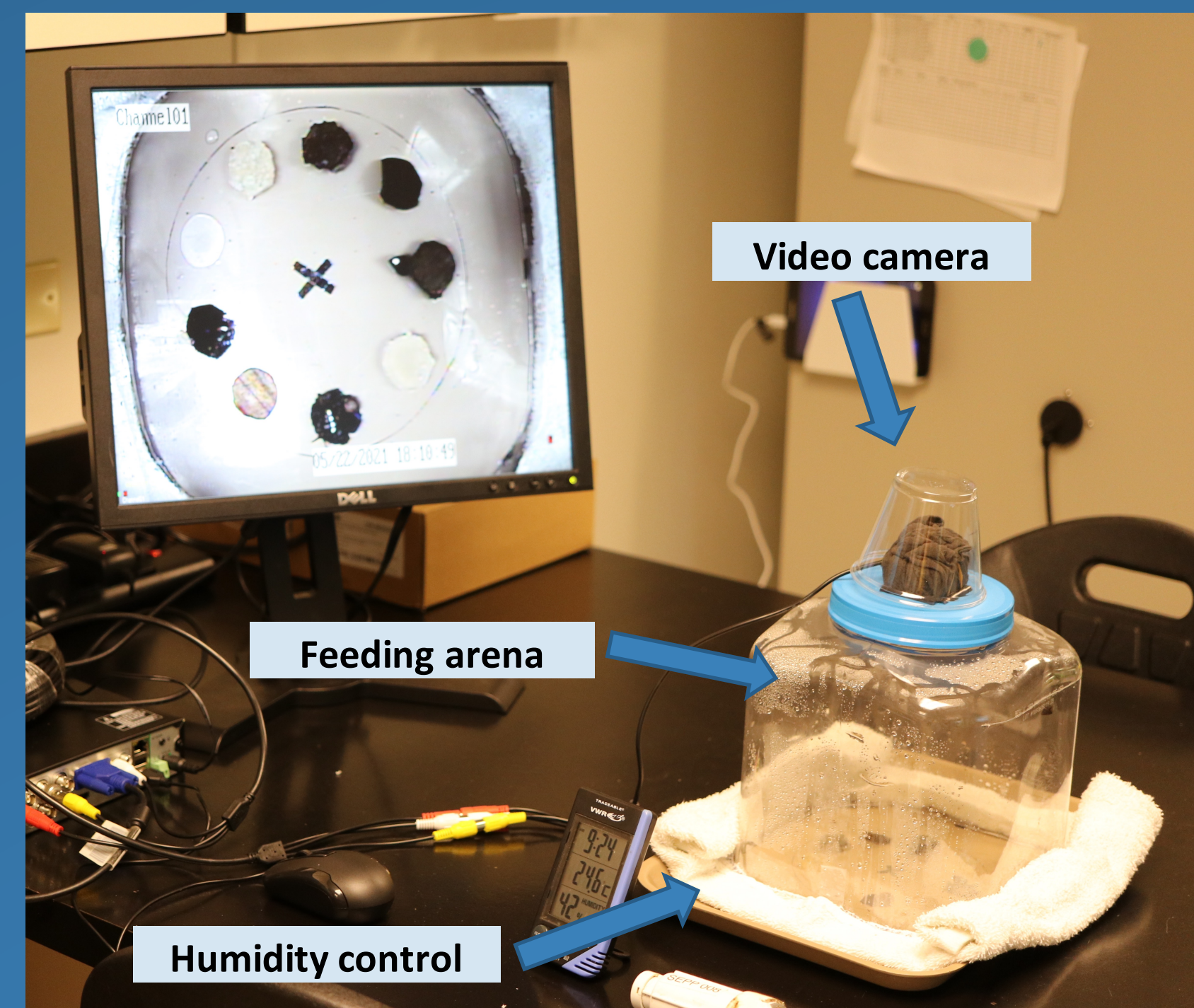


Figure 2. Experimental set-up for the buffet style food preference trials, showcasing the bird's-eye video camera, feeding arena, and humidity control.



Figure 3. Bird's-eye view of the feeding arena, encircled by equally spaced and randomly distributed food types. Five distinctly marked snails were placed in the center at the start of Trial #4.

## Results

- A. intermedia* repeatedly visited all food types across the five trials indicating foraging behavior (Fig. 4).
- The time snails spent interacting with each item was significantly different across the nine food types (Kruskal-Wallis rank sum test, p-value = 0.0015). Pairwise analyses against the control showed a significant preference (Figure 5; p-value << 0.05) for the native Hawaiian nettle species, *Urera glabra* and *Pipturus albidus*.

## Average Number of Visits Per Food Type

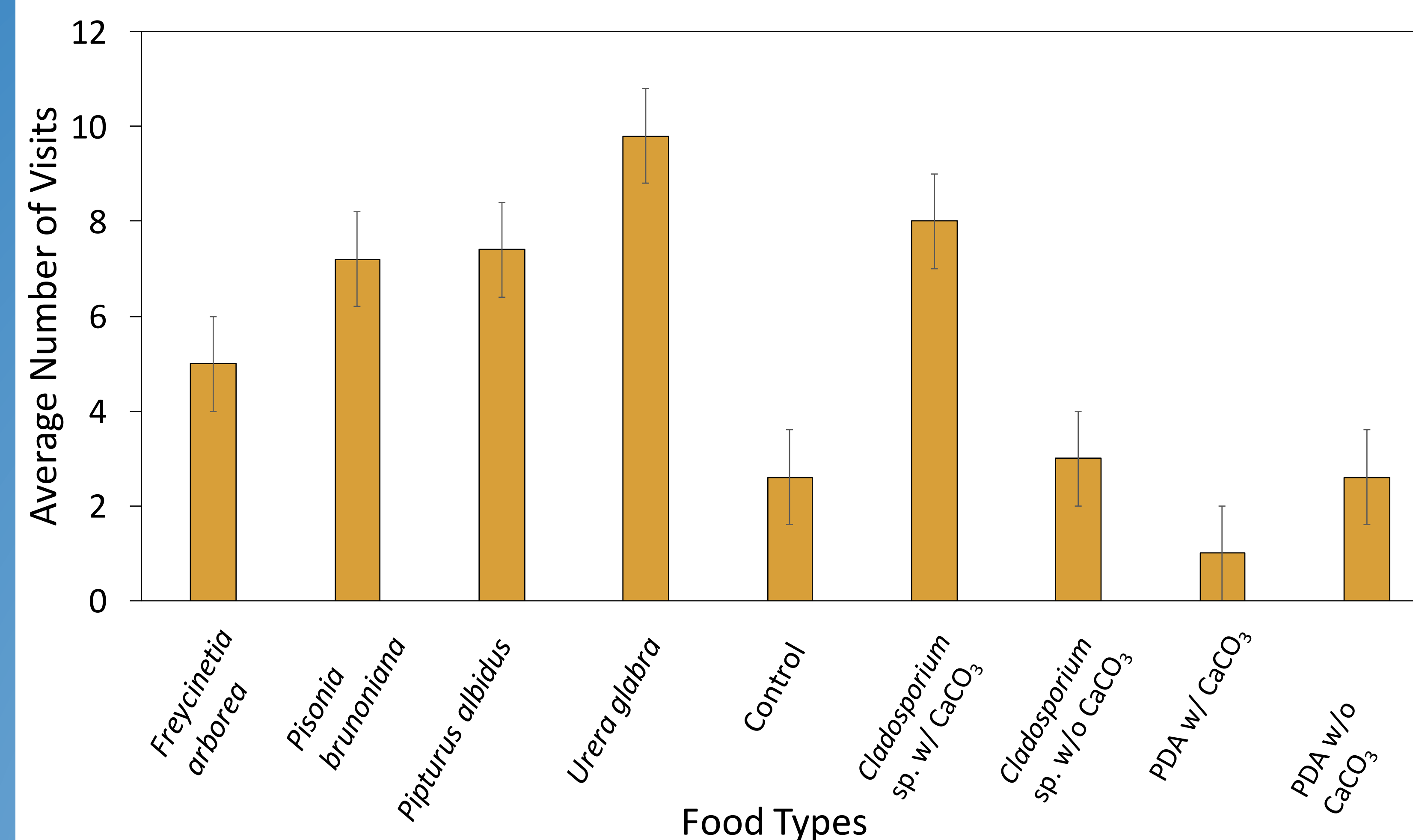


Figure 4. Average number of visits per food type across all five trials, with standard error included. *A. intermedia* tasted/interacted with all food types.

## Median Time Spent on Each Food Type

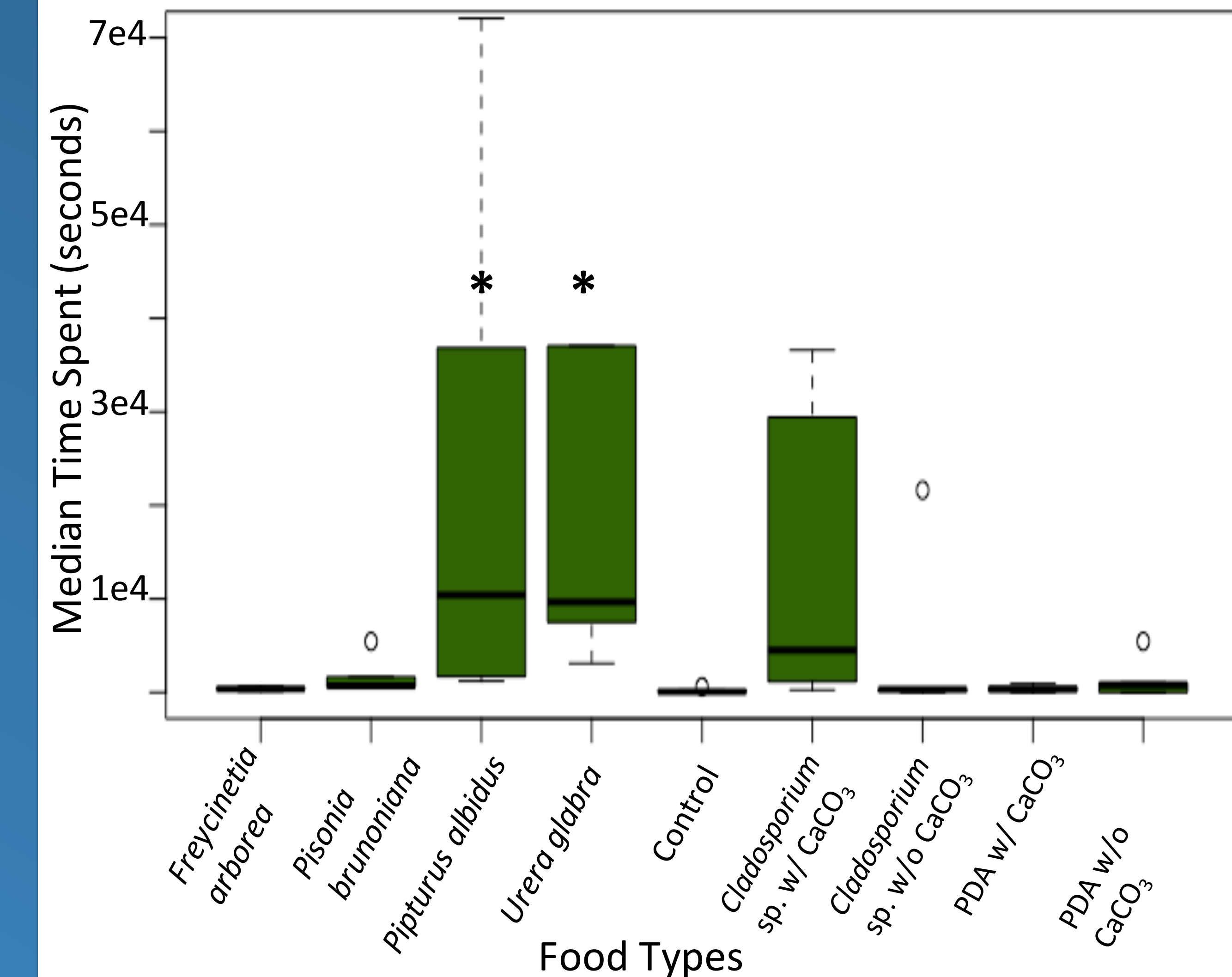


Figure 5. Median time spent on food type across all five trials, with min., first quartile, second quartile, and max included. '\*' denotes a significant difference in median time spent, i.e. both nettle food types, vs. the control.

## Conclusions

Our results indicate that *A. intermedia* tasted/interacted with all food types across trials. However, snails spent significantly more time on *P. albidus* and *U. glabra* (p-value = 0.0015). This suggests that *A. intermedia* prefer to feed on plants in the nettle family.

## Future Directions

- Compare nutrient composition of preferred food types.
- Replicate experiment with more food choices and with leaves in different stages of decomposition.
- Test commercially available food alternatives, possibly plants in the nettle family.
- Conduct similar buffet-style food trials with different snail species.

## Implications

Understanding food preference of imperiled species will allow us to optimize captive propagation diets.

Our ultimate goal is to identify commercially available ingredients that will allow us to manufacture a lab-based diet as an alternative to wild collected leaves. This would expand captive rearing potential to partners outside of the islands.

## Acknowledgements

Thank you to the entire SEPP team, Kupa'a Hee, Sidney Stiefel, Kimber Troumbley, Mariah Garrison, and Riley Nakasone, for letting me bounce ideas off of them and helping me from the very start of this research project. A huge thank you also goes out to the other SEPP folks, David Sischo and Geneviève Blanchet, for their experimental guidance, written edits, and statistical advice.