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The Influence of Sampling Frequency on Bee Species Richness

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Data collected by Bonoan et al., 2021-2023, unpublished. Providence College.

Gezon ZJ, Wyman ES, Ascher JS, Inouye DW, Irwin RE. 2015. The effect of repeated lethal sampling on wild bee abundance and diversity. *Methods in Ecology and Evolution*, 6: 1044-1054.

BACKGROUND

As one of Earth's most valuable pollinators, bees provide important pollination services to wild plant species and crops alike (Winfree 2010). But, in recent years, bee populations appear to be declining due to a variety of anthropogenic drivers (Potts et al. 2010). Quantifying the extent of bee population decline is difficult because there is currently a lack of a standardized protocol for how best to survey bee populations (Tepedino & Portman 2021). One of the commonly used survey methods is pan trapping, which involves leaving out yellow, white, and blue bowls filled with soapy water to passively sample the species richness of a certain location. While pan trapping is one of the most common methods for surveying bee populations, it is unknown if the frequency (i.e. trapping every two weeks) of pan trapping affects the experimentally determined bee species richness. In order to strive for more standardized survey practices, this study examines whether survey frequency affects the documented bee species richness in pan trapping surveys. I hypothesize that pan trapping survey frequency will not impact documented bee species richness.

METHODS

Data regarding species richness, as documented through pan trapping surveys, were collected in Colorado in 2012 and Rhode Island in 2021. In both states, pan traps were repeatedly left outside every two weeks at site locations for nine (CO) or twenty-four (RI) hours on appropriate weather days (without chance of rain). Pan traps were colored white, yellow, and blue to attract a variety of bee species, and were filled with soapy water to trap pollinators (Buffington 2020). After pan traps were collected, specimen contents of the traps were pinned and identified to genus and species.

Pan trapping bowl set up on Westerly Land Trust land. Rachael Bonoan, Flickr.

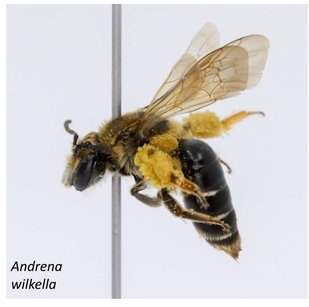
Bombus impatiens

Agapostemon virescens

Bombus griseocollis

Apis mellifera

Augochlora pura



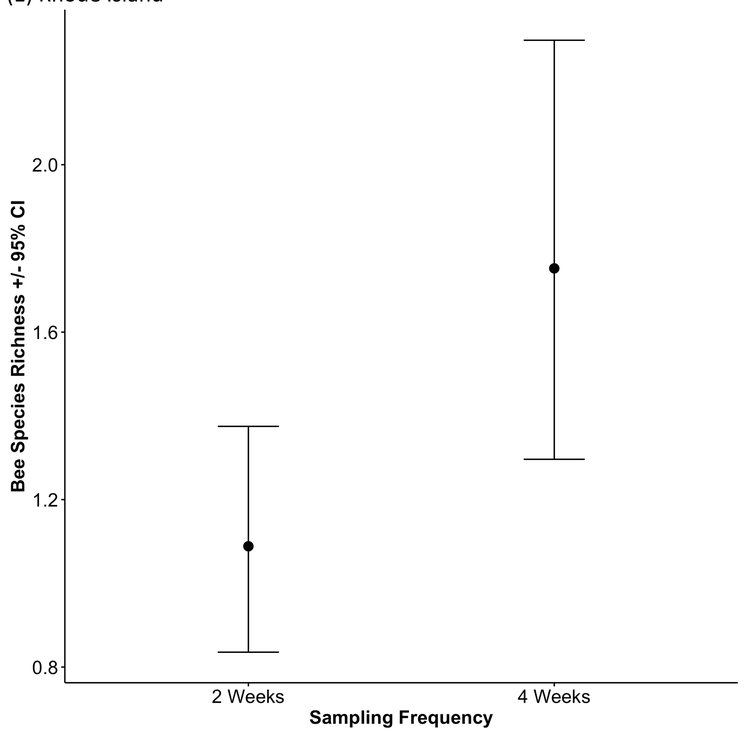
Andrena wilkella

Sample of bee species diversity collected from pan trapping sueveys in Rhode Island. Alexa Pudlo, Flickr.

RESULTS

In Rhode Island, sampling frequency significantly influenced the bee species richness that was documented by passive pan trapping surveys (ANOVA on GLMM, $X^2 = 10.36$, df = 1, $p < 0.001$). Higher species richness was documented when sampling occurred every four weeks (1.75, 95% CI: 1.30 – 2.31) rather than every two weeks (1.09, 95% CI: 0.84 – 1.37). In Colorado, sampling frequency did not significantly affect bee species richness as documented through pan trapping (ANOVA on GLMM, $X^2 = 2.71$, df = 1, $p > 0.05$). Similar species richness was recorded when sites were sampled both every two weeks (17.02, 95% CI: 13.85 – 20.81) and every four weeks (14.61, 95% CI: 11.63 – 18.16).

(1) Rhode Island



(2) Colorado

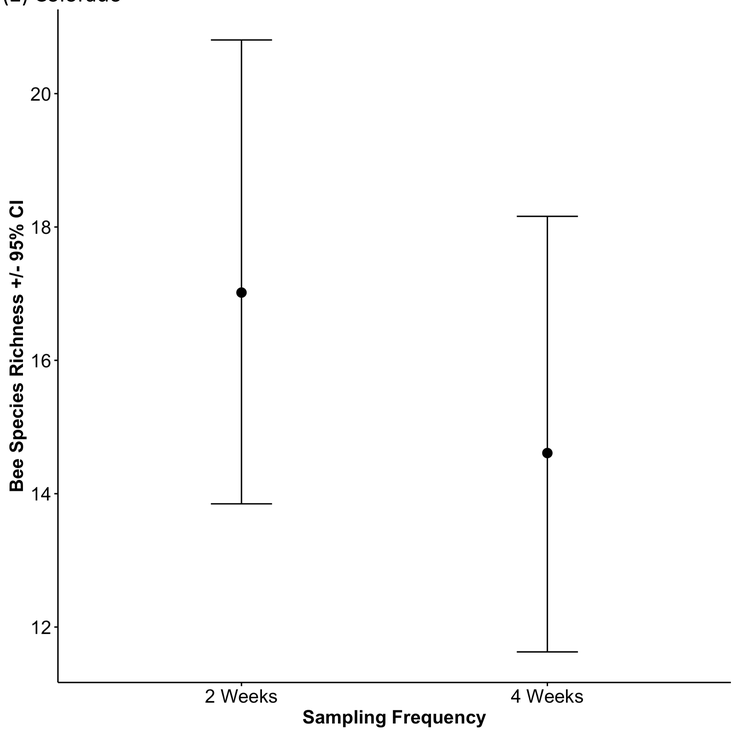


Figure 1 displays the influence of sampling frequency on bee species richness in Rhode Island as determined by passive pan trapping surveys. Figure 2 displays the influence of sampling frequency on bee species richness in Colorado as determined by passive pan trapping surveys.

CONCLUSIONS

This study suggests that passive sampling with pan traps every four weeks will not result in lower bee species richness when compared to sampling every two weeks (figure 1 and 2). Specifically, in Rhode Island, higher species richness was documented every four weeks, which suggests that sampling every two weeks does not allow for enough recovery time in populations before sampling occurs again. While this same result was not evident in Colorado, there was greater overall diversity in that data. Compared with Rhode Island, Colorado had about thirteen times greater species richness, which accounts for some of the variation in the results from these two locations. Further research is necessarily to see if this pattern of similar species richness when sampling every two weeks versus every four weeks continues.

ACKNOWLEDGMENTS

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