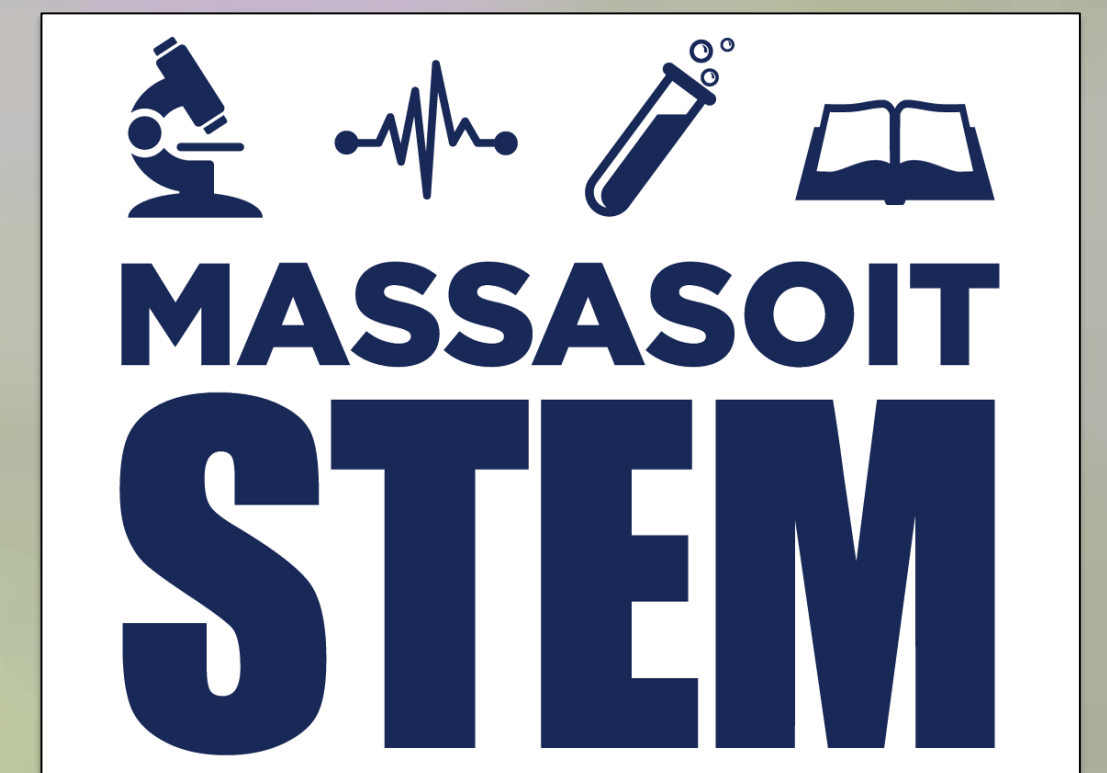
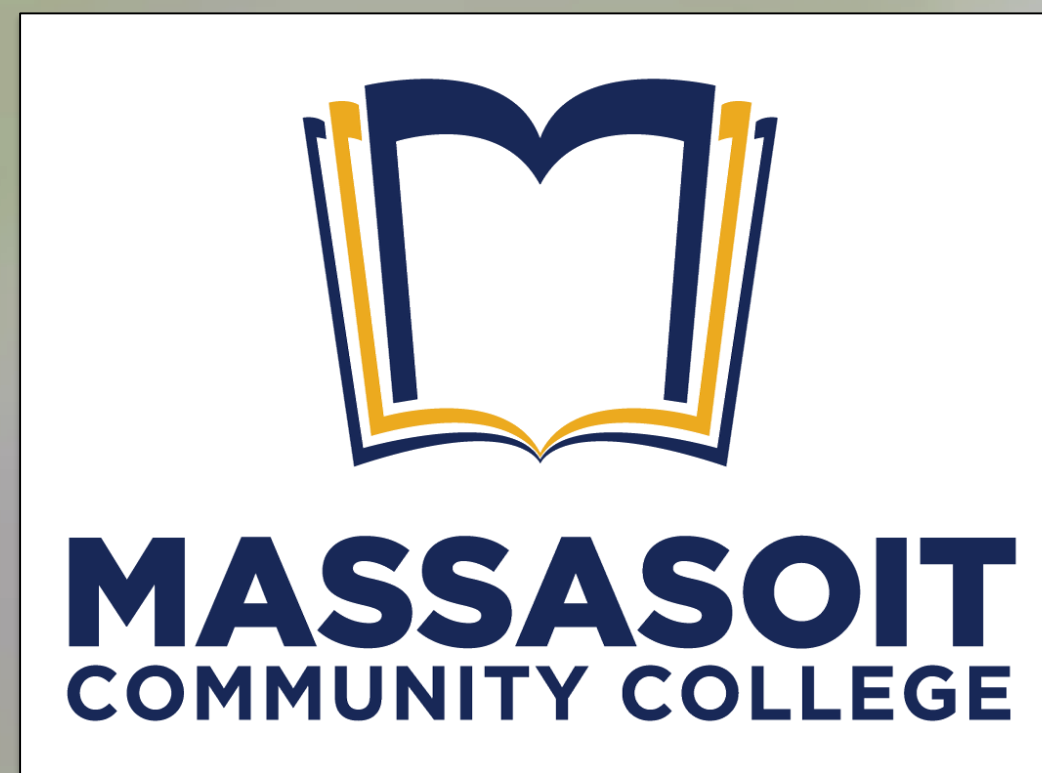


Determining an Efficient Wild Bee Sampling Schedule

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Introduction

- Wild bees provide essential pollination services to ecosystems, and there are increasing concerns about the potential decline of these keystone organisms (Meiners et al., 2019).
- Rigorous, well-controlled, season-long monitoring is necessary to fully assess changes in the wild bee community (Callahan, 1984).
- This ongoing wild bee monitoring study's bi-weekly, thaw-to-frost sampling schedule fully assesses seasonal trends and phenology, but is very labor-intensive.
- Therefore, the present analysis uses a six-year, biweekly sampling result to retrospectively evaluate a subsampling schedule with regard to wild bee genera richness and evenness.

Methods

- Sampling occurred biweekly at six sites in Southeastern Massachusetts from 2016-2021, in early spring to late fall. Wild bees were captured using pan traps and sweep netting as reported elsewhere (Roulston et al., 2007; Popic, 2013).
- Time bins across the six years were put into half months (e.g. "early or late July"). All time bins were ranked in order of unique contribution to genera richness, and ties were broken by total abundance.
- The sub sampling schedule was created from the fewest number of sampling sites that achieved 100% of the richness observed over the full sampling schedule.
- Evenness was calculated using Shannon Index (Gaunle, 2023).

Pros & Cons

Pros	Cons
The subsampling schedule matched cumulative richness with a greater than 50% reduction in sampling effort	The subsampling method does not achieve the same evenness score, and thus, is less reliable than the full sampling schedule for assessments that involve taxa distribution
The subsampling schedule adequately represents the maximum seasonal bee abundance and has a generally similar pattern to the full sampling schedule for the entire bee community	The subsampling method underrepresents seasonal dips in overall bee abundance
The subsampling schedule adequately represents the maximum seasonal bee abundance and has a generally similar pattern to the full sampling schedule for individual genera	The subsampling method underrepresents seasonal dips in individual bee abundance
This subsampling method is a good option for monitoring abundant genera or genera that follow common abundance trends of the rest of the bee community	Likely not a good method for monitoring seasonal patterns of rare bees, bees that have unique seasonal abundance patterns, and phenology

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Results

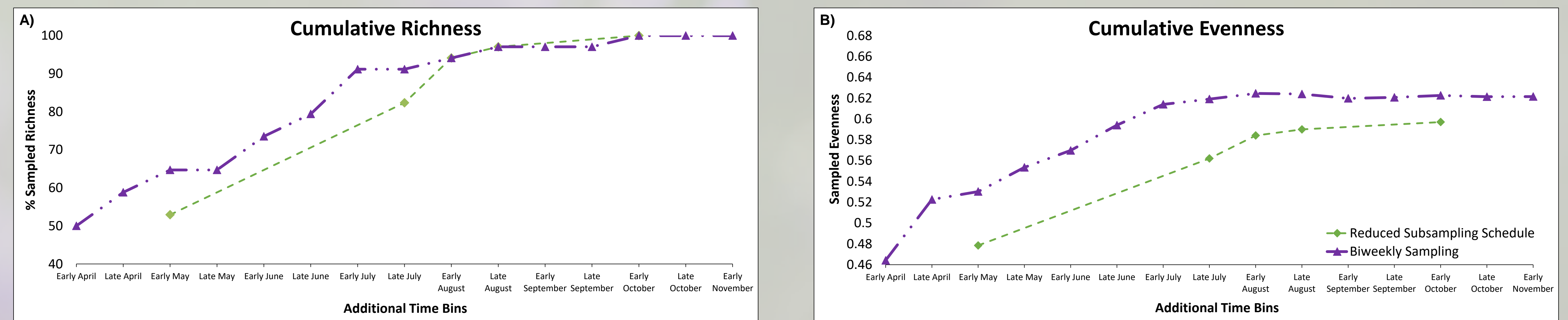


Figure 1. A) Cumulative genera richness for the full sampling schedule and subsampling schedule using the half-month richness over six years. B) Cumulative evenness for the full sampling schedule and subsampling schedule using the half-month evenness over six years.

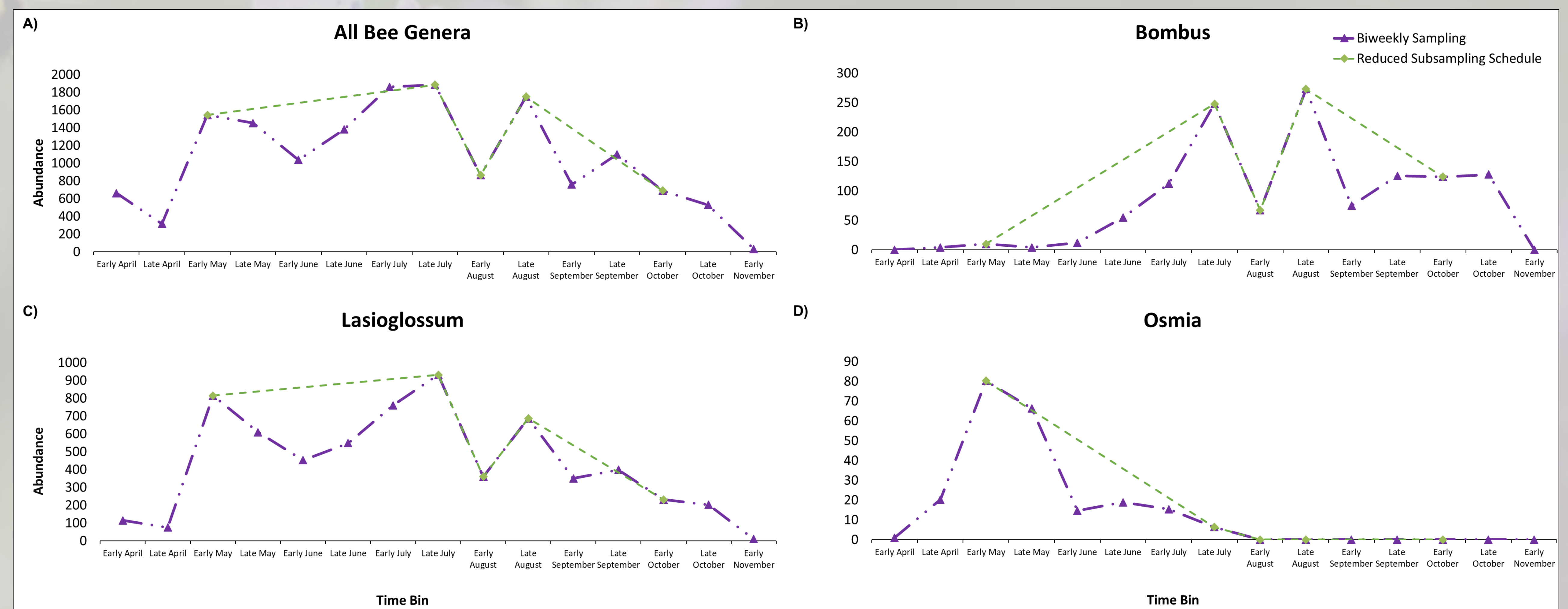


Figure 2. The distribution of wild bee abundance collected over time when sampling continuously from early spring to late fall compared to the distribution of abundance when sampling only the five time bins in the subsampling schedule. A) All bee genera, B) *Bombus*, C) *Lasioglossum*, D) *Osmia*.

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