

# Identifying refugia on Schoodic Peninsula using the phenology and abundance of three-toothed cinquefoil (*Sibbaldiopsis tridentata*)

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## Background

Refugia are areas protected from the effects of climate change and serve to maintain habitat for species that would otherwise become locally extinct.<sup>1</sup> These are regions where the surrounding landscape plays a large role in controlling the climate. The Schoodic Peninsula may contain refugia for certain species due to its proximity to the ocean, which helps to moderate air temperature.<sup>2</sup> This study aims to determine if Schoodic contains refugia for three-toothed cinquefoil (*Sibbaldiopsis tridentata*) through the evaluation of its phenology and abundance on the Peninsula. These two characteristics inform where cinquefoil may be in the best condition now and in the future. Three-toothed cinquefoil is a low growing, woody plant that typically grows along exposed bedrock in alpine regions. It is also a species of significance for restoration projects.<sup>3</sup>



Three-toothed cinquefoil plant from above.

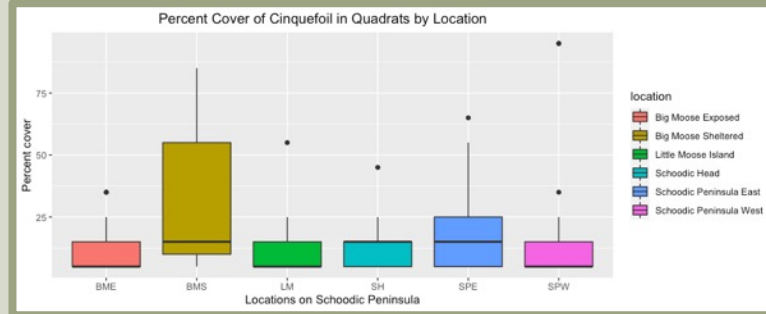
## Methods

We located three-toothed cinquefoil at 192 points along the coast of the Schoodic district of Acadia National Park, from Frazer Point to Buck Cove. These points were then grouped into six geographically distinct regions of the peninsula for better analysis: Big Moose Exposed and Sheltered, Little Moose Island, Schoodic Head, and Schoodic Peninsula East and West. Exposed and Sheltered are characterized by amount of wind and wave action. At each point a ½ meter quadrat was placed over a patch of cinquefoil. ArcGIS Survey123 and iNaturalist were used to record coordinates, percent cover (abundance), and presence or absence of flower buds, open flowers, unripe fruit, and ripe fruit. Data collection took place between June 12<sup>th</sup> and September 2<sup>nd</sup>, 2021.<sup>4</sup>



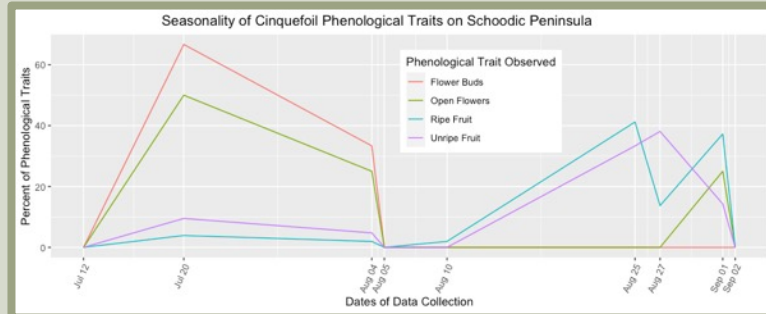
iNaturalist observations of three-toothed cinquefoil taken between Jun 12<sup>th</sup> and Sept 25<sup>th</sup>, 2021.<sup>4</sup>

## Results



**Figure 1.** Box and whisker plot of percent cover of three-toothed cinquefoil by location. Black dots show outliers, and the black bars represent the median. This graph only shows data from three days of sampling (Aug 25<sup>th</sup>, Aug 27<sup>th</sup>, and Sep 1<sup>st</sup>, 2021).

Big Moose Sheltered shows the highest percent cover within quadrats at over 50%. All other locations showed a less than 25% cover within quadrats.



**Figure 2.** Line plot of percentage of each phenology trait observed for throughout through the season. Data were collected on 9 different days from July 12<sup>th</sup> to September 2<sup>nd</sup>, 2021.

More than 70% of the flower buds and open flowers were observed before August 4<sup>th</sup>. More than 50% of the unripe and 90% of the ripe fruit were observed after August 10<sup>th</sup> this season. All phenological traits except flower buds were observed throughout the entire season.

## Conclusion

The preliminary abundance results indicate that Big Moose Island Sheltered, and Schoodic Peninsula East are potential refugia for three-toothed cinquefoil (Figure 1). The preliminary phenology data are too coarse to make conclusions about individual locations. However, they do provide a baseline for the phenology of cinquefoil on Schoodic Peninsula as a whole (Figure 2).

Overall, more data on both phenology and abundance are necessary to understand where three-toothed cinquefoil is found on Schoodic Peninsula. Both percent cover and phenology data were collected sporadically over the course of the summer. In coming years increased duration and quantity of data collected throughout the season should be a priority. Consistent monitoring of cinquefoil will allow us to track the effects of climate change, and make better conclusions as to where refugia might exist.



Image of author (Emily) sitting next to a quadrat of three-toothed cinquefoil.

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