Introduction

The Climate Variability Hypothesis (CVH) states that organisms in more climatically variable environments are adapted to withstand a wider range of climatic conditions than organisms in less variable environments. The CVH and its consequences have been well studied in the tropics, where temperature is stable, and tropical organisms have been shown to be adapted to a narrow range of temperatures and therefore sensitive to climate change. Studies on the CVH have not been brought to similar, thermally-stable systems like coastal environments. Due to marine influence, coastal areas have little variability in temperature relative to inland areas (Fig. 1). Using both phylogenetic and experimental methods, we plan to study if coastal populations of *Mimulus guttatus* are adapted to a more narrow range of temperature, if this has limited the evolution of their thermal niche, and if coastal populations are more sensitive to climate change.

Methods

- Retrieved phylogeny of populations of *M. guttatus*.  
  - Categorized population habitat as coastal if less than 5 miles from coast, otherwise inland. Retrieved climatic data from Worldclim: temperature annual range, mean diurnal range, and temperature seasonality.  
  - Estimated phylogenetic signal (Blomberg’s K) and rates of habitat transitions.  
  - Performed ancestral state estimation of habitat and climate.

Results

- Habitat type and climate variability exhibit a strong phylogenetic signal ($D$= -1.08 and $K$=1.78 respectively), meaning closely related population have more similar habitat and climate than expected randomly.  
- Coastal populations are associated with smaller temperature range and temperature seasonality, coastal populations do experience less climatic variability (Fig. 2).  
- Rates of change were greater from inland to coast than from coast to inland (1.97 and 0.42 respectively).

Future Directions

- Perform growth chamber experiment to measure performance of populations under a range of temperature treatments (0-40 ºC).
- Using data from growth chamber experiment, build thermal performance curves to see if coastal populations perform well under a smaller range of temperatures than inland populations (Fig. 3).
- Use thermal performance data and niche modelling to predict how populations may respond to climate change (Fig. 3).

References


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