Understanding the effects of temperature on sex ratio in a sexually dimorphic fish species
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Abstract
The proportion of males to females in any given population is expected to be in equilibrium around 1:1. However, there are cases in nature of extremely skewed sex ratios. Several studies have suggested temperature to be associated with these skewed sex ratios. Here, I examined the relationship between sex ratio and temperature in the globally invasive mosquitofish. Mosquitofish exhibit sexual dimorphism, with females sometimes doubling males in body size. Following predictions from the temperature-size rule, smaller body sizes are expected at warmer temperatures. I therefore predict that hotter temperatures lead to an increase in the fraction of males. To test this prediction, I collected mosquitofish from geothermal ponds and streams in California and New Zealand. I the relationship between sex ratio and temperature. As predicted, examined I found that hotter sites had a greater proportion of males. My results show that temperature may be an explanation for skewed sex ratios in species showing sexual size dimorphism, such as mosquitofish. Results also suggest that increasing temperatures may cause sex ratios to change in nature, with potentially important ecological and evolutionary consequences.

Introduction
- Sex ratio is normally 1:1 in nature, however, variation exists with a range of explanations
- Prior studies have suggested temperature to be a principle driver of sex ratio variation
- The temperature-size rule states that increasing environmental temperature favors smaller body size
- Temperature may cause sexually dimorphic species to have skewed sex ratios
- Mosquitofish (Gambusia affinis) are a sexually dimorphic species that show extreme sex ratio variation and inhabit a wide range of temperatures

Objective
- Determine if temperature has an affect on mosquitofish sex ratio

Methods
- Collected mosquitofish from geothermal areas in California and New Zealand
- Determined population sex ratios and site temperatures
- Plotted the relationship across sites and within sites

Results
- Across all sites, we found hotter sites had more males. Sex ratio in CA stayed relatively constant around 0.6 M:F
- Temperature has a stronger effect on sex ratio in open sites than closed sites. However, in CA the opposite is true

Conclusions
- At the population level our results support our hypothesis, however, within open sites we see the exact opposite
- We believe there may be fitness advantages for giving birth in extreme temperatures such as decreased conspecific predation pressure and decreased food competition
- These results suggest that the ecological impacts of mosquitofish may be lessened with warming temperatures.
- Moving forward, a more comprehensive laboratory study of temperatures effects on sex ratio should be done. Specifically, over spatial and temporal scales.

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