**Investigating Niche Width of Invasive Crayfish in Chicago Using Stable Isotope Analysis**

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### Background

Invasive species have harmful impacts on local ecosystems, outcompeting native organisms and decreasing biodiversity. In Chicago, the red swamp and rusty crayfish are two such invaders. Although invasive crayfish populations have been established since the 1990s, few studies have been done to qualify their impact on Chicago waterways or on their interactions with native crayfish, especially concerning food competition.

Understanding species niche width is one way to characterize invasive and native crayfish competition. Species niche summarizes the ecological conditions needed for a species to succeed, as well as important interactions with other organisms such as predation and competition. One ecological tool to determine a species' niche is stable isotope analysis. This chemical analysis uses carbon and nitrogen isotopes found in an organism's muscle tissue to assess their diets, a key component in understanding niche.

### Focus Species

For this study, four species of crayfish were sampled: red swamp crayfish (*Procambarus clarkii*), rusty crayfish (*Faxonius rusticus*), virile crayfish (*Faxonius viridis*), and northern clearwater crayfish (*Faxonius propinquus*). Zebra mussels (*Dreissena polymorpha*) were sampled in the same areas.

### Methodology

**Data Collection**

Over the course of 3 months (Aug 2021-Nov 2021), the Keller Lab collected crayfish from the North Shore Channel and Lake Michigan. Figure 6 shows a map of data collection points. Cylindrical, mesh baited traps were used to passively catch crayfish, and SCUBA diving was utilized to actively catch organisms by hand. Zebra mussels were also collected as a baseline during data analysis. In total, 138 crayfish and 19 bags of mussels were caught in the areas marked in Figure 6.

Samples were kept frozen in the lab.

**Sample Preparation**

Muscle tissue dissections were performed on the frozen crayfish and mussels. For the crayfish, tissue was taken from the abdomen. Each tissue sample was dried using a drying oven and ground into a powder. For each mussel, the entire interior including the mantle and foot were taken out. These samples were then shipped on dry ice to the University of Georgia’s Center for Applied Isotope Studies for further analysis.

**Data Analysis**

The prepared samples will undergo stable isotope analysis to determine each sampled organism's carbon and nitrogen isotope ratio compared to a standard organism—the zebra mussel—samples whose isotopic ratios are known. These ratios will help determine the species niche of the crayfish samples. Results are expected in Spring 2022.

### Anticipated Benefits

With the stable isotope analysis data, I will be able to further analyze and summarize results in RStudio. All this information will allow me to:

- Compare the niche widths of native crayfish and invasive crayfish of the Chicago area
- Determine if these niches are different and therefore leading to increased food competition

Further studies within the Keller Lab will need to be conducted to assess competition levels and health among native and invasive crayfish of Chicago. One way of continuing this research will be to assemble a food web of the North Shore Channel that would summarize invasive and native crayfish interactions as well as their interactions with species in higher and lower trophic levels. These studies will provide the framework on how to appropriately respond to local species’ invasions and how to predict the spread of these species.

### References


### Questions

- Do invasive and native crayfish of Chicago have similar niche widths?
- Are the major components of the invasive and native crayfish diet overlapping?

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