



Substrate preference in *Orconectes rusticus*: Does size matter?

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Introduction

Invasive crayfish are a primary cause of declines, extirpations, and extinctions of native crayfish populations (Twardochleb et al., 2013). Exotic crayfish are among the most widely introduced organisms to freshwater ecosystems and their omnivorous feeding habits make them versatile invaders.

In Wisconsin, the aggressive and prolific rusty crayfish, *Orconectes rusticus*, can deprive native crayfish of habitat (Capelli, 1982). In particular, the use of rocky substrate shelter is vital for providing crayfish protection from predators. Yet little is known about how substrate preferences affect habitat use by rusty and native crayfish.

To better understand how *O. rusticus* select and utilize rocky substrates, we undertook a series of experiments to determine if substrate size and color affected habitat choice by rusty crayfish.

We also examined whether substrate preference changed with crayfish size, hypothesizing that crayfish may select different substrate sizes as they matured.

Methods

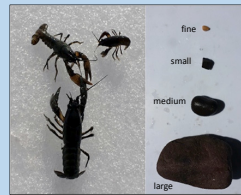
Rusty crayfish were collected from O'Neil Creek, Chippewa Co, WI.

Each crayfish had its length measured and recorded and was labeled with a marker.

12 crayfish were used in each substrate size choice trial and each trial was run twice.

4 different substrate sizes were used: fine (mean volume = 0.02 cm³), small (0.28 cm³), medium (13 cm³) and large (70 cm³).

For each experiment, crayfish were placed in a plastic tub with 1 L of water and containing two substrate sizes for 48 hours (we later determined crayfish made their choice within a day, so trials were subsequently shortened to 24 h).



The orientation of substrates (i.e., left or right side) were alternated across tubs in each experiment to control for crayfish directional bias.

Crayfish choice was determined by recording the substrate they inhabited at the end of each trial.

After pair-wise substrate trials were completed, we subjected crayfish to the three most favored substrates simultaneously and recorded their preference after 24 h

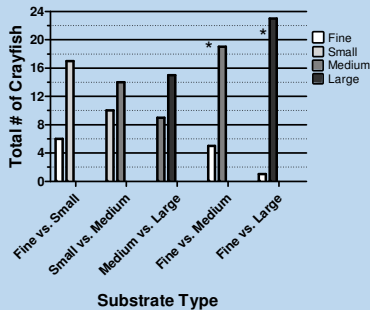
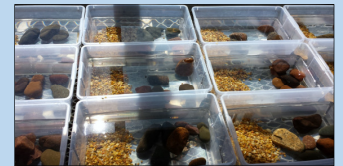
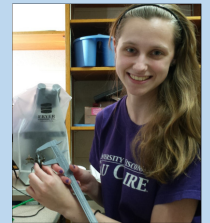


Figure 1. Substrate size preference of rusty crayfish. Each pair of bars represents the number of rusty crayfish choosing the indicated substrate type after 24 h. (*signifies pairs that are significantly different at $P < 0.05$ as determined by t-tests)

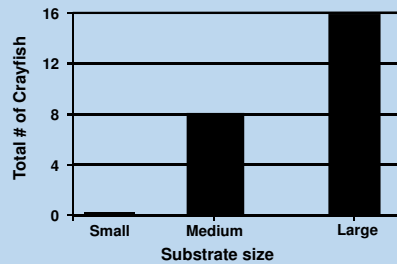


Figure 2. Substrate preference of 24 rusty crayfish presented with three different substrates after 24 h. Substrate selection differed significantly from the null expectation of no choice (Chi-square, $P = 0.0003$)

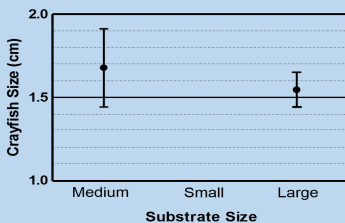


Figure 3. Substrate preference by different sized crayfish. Each point represents the mean crayfish size (± 1 SE) choosing each substrate size. No crayfish chose the small substrate and no preference was seen (ANOVA, $P > 0.05$).



Figure 4. Crayfish showed no preference for substrate color after 24 h ($n = 24$, t-test, $P > 0.05$).

Results

Rusty crayfish showed a preference for bigger substrates when the size difference was great (Fig. 1). This preference was significant for medium and large substrates when paired with fine substrate ($P = 0.01$; $P = 0.004$), whereas no preference was seen between fine vs. small, small vs. medium, or medium vs. large ($P > 0.05$).

When given a choice between the three larger substrates, rusty crayfish chose the "large" size twice as often as the "medium" size (Chi-square = 0.0003), and no crayfish chose the "small" size substrate (Fig. 2).

Regardless of their body size, rusty crayfish always preferred medium and large substrates over small (Fig. 3). There was a tendency for larger crayfish to prefer medium substrates, but the trend was not significant ($P > 0.05$).

No preference for light or dark substrate color was observed (Fig. 4).

Discussion

Rusty crayfish preferred larger substrates only if the size difference was great. It is unclear whether this preference for larger substrates has an upper size limit, but it likely reflects the volume of spaces between the rocks.

There was no relationship between rusty crayfish size and substrate preference, and no preference for substrate color. We hypothesized that the dark-bodied rusty crayfish would prefer dark rocks to allow them to blend in with the streambed. The lack of color preference may indicate either that rusty crayfish are unable to differentiate colors, or that color is not an important factor in their habitat selection.

Acknowledgements

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Citations

Capelli, G. (1982) Displacement of northern Wisconsin crayfish by *Orconectes rusticus* (Girard). *Limnology and Oceanography* 27: 741-45.
Twardochleb L., Olden J. and Larson E. (2013) A global meta-analysis of the ecological impacts of non-native crayfish. *Freshwater Science* 32: 1367-1382.

Next Steps

Continued trials with greater variation among substrate sizes, and examining native crayfish species' substrate preferences in the presence and absence of rusty crayfish.