Effects of Microplastics on Multiple Variables on the Red Crayfish, *Procambarus clarkii.*

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Abstract

Our study measured and compared feeding rates, righting times, claw strength, weight change and mortality rates for *Procambarus clarkii* (the red crayfish) in groups exposed to microplastics and groups not exposed. No significant differences were found for any of the five variables.

Introduction

Microplastics are an increasing concern for aquatic ecosystems. They do not naturally biodegrade, and they are often accidentally or purposely consumed by many organisms (Anderson, et al. 2016). Microplastics can build up in the guts of organisms and block waste from exiting the organism (Rochman, et al. 2015). Microplastics are capable of absorbing chemicals and spreading these chemicals across ecosystems through the food web (Chua, et al. 2014). Crayfish can be used as bio-monitors in ecosystems and have been studied to accumulate trace metals within the organism, which could be similar with microplastics (Fialkowski et al. 2008).

Previous research indicates that benthic organisms, such as crayfish, are vulnerable to the effects of microplastics due to the tendency for microplastics to sink into the sediment that these organisms live and feed on (Mahon, et al. 2017). Little research has been done on the effects of microplastics in freshwater ecosystems, or in arthropods. In this study the effects of microplastics on *Procambarus clarkii*, the red crayfish were examined. Claw strength, righting time, weight, feeding rates, and death rate among *Procambarus clarkii* fed microplastics and *Procambarus clarkii* not exposed to microplastics were recorded for the duration of three weeks.

Methods

Two separate tanks were set up in the lab, one for microplastics, and another for non plastics. Six *Procambarus clarkii* were tested in each tank. The individuals were obtained from Carolina Biological Supply company. *Procambarus clarkii* were fed every 2-3 days. Each were fed one gram of Mazuri omnivore aquatic gel. The *Procambarus clarkii* within the microplastic tank were fed the gel mixed with microplastics from boiled Teavana tea bags. Teavana tea bags are documented to shed high levels of microplastics. For every feeding day leftover food was blot dried and weighed on a top loading scale. The leftover food was then subtracted from the total and divided by the amount of days last fed to calculate feeding rate. Righting times were measured by individual *Procambarus clarkii* being flipped over on their backs and let go. How long it took for the individual to right itself was timed with a stopwatch. Individuals were tested in a large tupperware container away from the other *Procambarus clarkii*. The tupperware contained water from the individual's respective tank. To test claw strength, individuals were held within the tupperware container and allowed to hold a plastic cover slip which had been roughed using sandpaper. The cover slip was tied with a string to a strain gauge. As the individual held the cover slip another person pulled with a strain gauge, and the results were recorded. Each individual was blotted dry and weighed on a top loading scale in grams every week to determine weight changes. Righting, claw strength, and weight were recorded once a week.

Red Crayfish (*Procambarus clarkii*)

Results

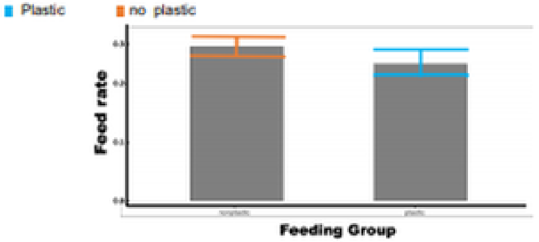

Figure 1. Microplastics in food did not significantly affect feeding rates (t test, $p>0.05$). Mean feeding rates (g per individual per day) ± 1 SE are depicted.

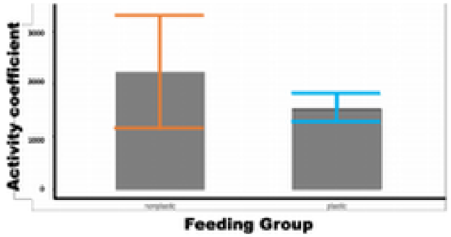

Figure 2. Microplastics in food did not significantly affect activity coefficients (t test, $p>0.05$). Mean activity coefficients (1/righting time * 1000) ± 1 SE are depicted.

Figure 3. Microplastics in food did not significantly affect claw strength (t test, $p>0.05$). Mean claw strength (g) ± 1 SE are depicted.

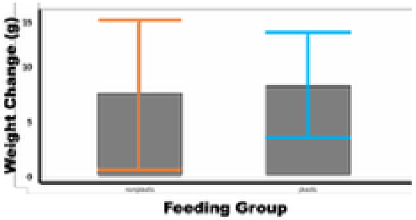

Figure 4. Microplastics in food did not significantly affect weight change (t test, $p>0.05$). Mean weight change (g) ± 1 SE are depicted.

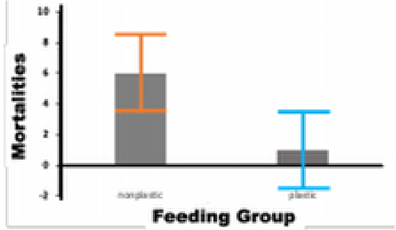

Figure 5. Microplastics in food did not significantly affect mortality (t test, $p>0.05$). Mortality counts ± 1 SE are depicted.

Discussion

Our results suggest no significant differences in any of the five variables tested. Due to the small sample size of the study there may have been different results with a large sample size. Feeding rates, percent weight difference, claw strength and righting times were ended but the study of mortality continued.

A previous study suggests that microplastics caused developmental problems in the offspring of crustaceans exposed to microplastics (Anderson, et al. 2016). Another previous study determined that many benthic freshwater organisms, including crayfish experienced reduced fitness when exposed to microplastics (Haab. 2016). It is possible that if the study continued, that similar effects may have been recorded. Further research is needed to make any definitive conclusions.

Acknowledgments

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