

# Investigating the Toxicity of Nonylphenol in Juvenile *Faxonius propinquus* Crayfish

Collin Trainor, Marlee Busalacchi, Haley Ryba, Natalie Rizza and Daniel Bergman  
 Department of Biomedical Sciences, Grand Valley State University, Allendale, Michigan, USA

## Introduction

- Nonylphenol (NP) is chemical known to accumulate in aquatic environments.
- Due to its chemical structure, it is a known endocrine disruptor in many animal species, including crayfish and other invertebrates.
- Previous studies have shown NP to reduce olfaction, reproduction, and molting frequency in crayfish. This can inhibit their ability to develop, find food, and locate potential mates.
- At sufficient concentrations, NP has been demonstrated to be lethal in adult crayfish.
- The concentration at which NP is lethal to juvenile crayfish has not yet been determined and may differ from that of adults.
- Previous studies have indicated NP concentrations of 0.30 ug/L and below to be non-lethal values in adult crayfish.
- This project hypothesized that juvenile crayfish are more susceptible to the lethal dosing effects of NP than adults.

## Methods

- Juvenile *Faxonius propinquus* crayfish were collected via a seine net from the Little Rio Grande river near Muskegon, Michigan.
- Juveniles were classified as individuals weighing less than 3.0 grams in this study.
- Subjects were individually isolated in their own tank for 2 days before 48-hour exposure to varying concentrations of nonylphenol or control acetone.
- Exposure groups had a sample size of 8 and were balanced between males and females.
- Dilute NP concentrations in acetone vehicle solution included 0.05 ug/L, 0.10 ug/L, 0.125 ug/L, 0.15 ug/L, and 0.30 ug/L.
- Subjects were monitored for 48 hours post-exposure to determine death rate.

## Results

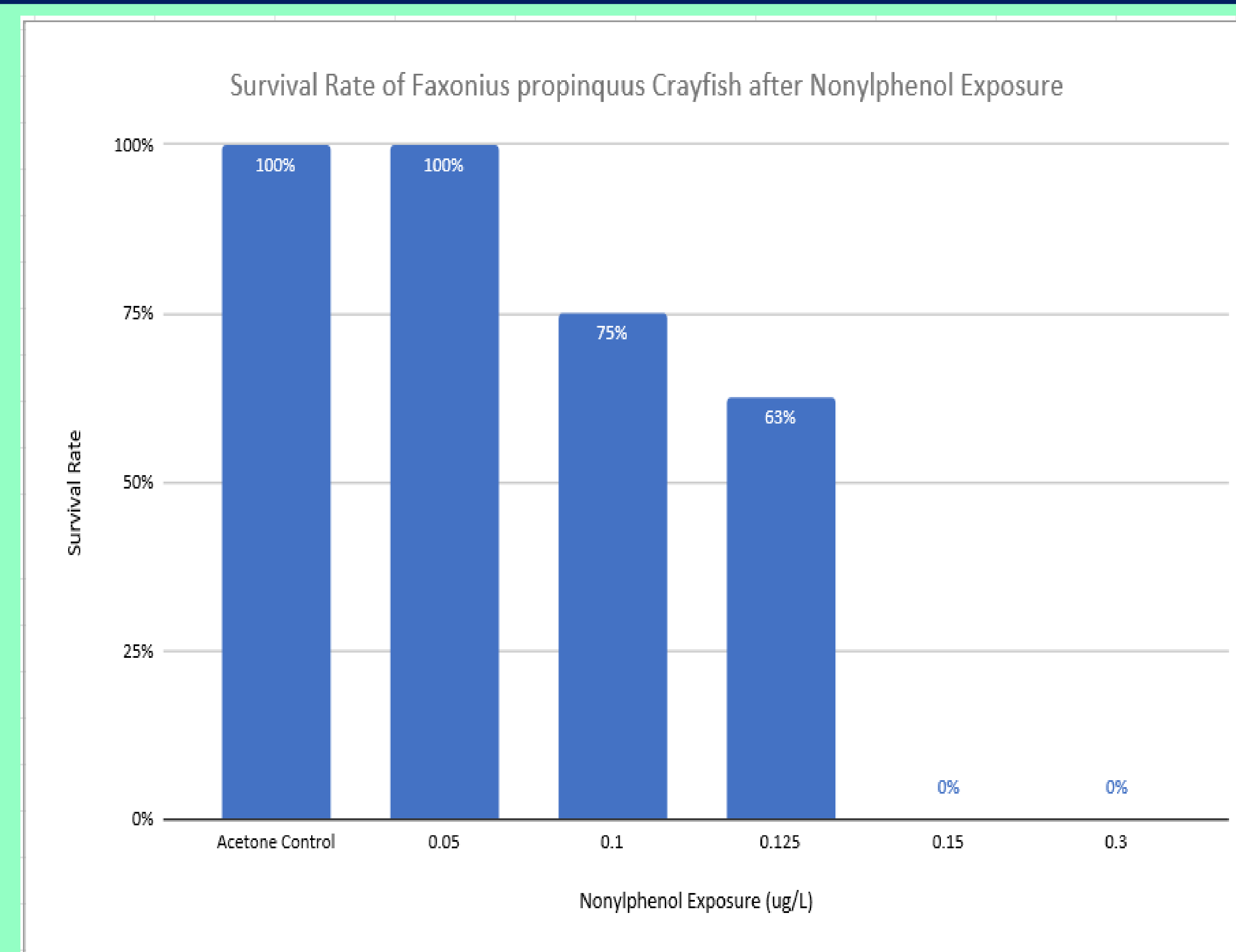


Figure 1: Survival Rate of *Faxonius propinquus* Crayfish after Nonylphenol Exposure

- Results indicate that 100% of juvenile crayfish exposed at 0.05 ug/L survived, 75% survived at 0.10 ug/L, 62.5% at 0.125ug/L, and 0% at or above 0.15 ug/L.
- According to these results, lethal effects of NP occur at very low concentrations.
- There was no significant difference was found in the survival rates between males and females at any concentration.
- Variation in weight values did not contribute any significant difference to survival rate.
- Crayfish survival rate did not change after the first 24 hours of exposure at any concentration; the majority of death activity occurred within 4 hours of exposure.
- Crayfish movement in the isolation tanks appeared to briefly increase immediately following initial exposure to NP.
- Presence of one or more claws missing did not have any significant difference on survival rate at any concentration.

## Discussion

- This study was conducted under IACUC approval and followed classical ethical guidelines for treatment of aquatic invertebrates.
- This study originally began as an experiment measuring hemolymph concentrations of NP after exposure but switched objectives when lethal doses were noticed to differ from values reported in previous studies and literature.
- All exposure concentrations of NP in this study are lower than environmentally reported values in the state of Michigan.
- Some subjects in this study were missing a claw before NP exposure. Death rate of these subjects did not significantly differ from others at any concentration.
- Because subjects were collected from natural Michigan rivers, there is a possibility they had previously been exposed to varying NP concentrations that could have bioaccumulated in subject tissues.

## Conclusions

- Juvenile crayfish are more susceptible to the lethal dosing effects of NP than adults.
- The lethal dose concentration (the concentration at which 50% of subjects die) of NP in juvenile crayfish may be between 0.125 ug/L and 0.15 ug/L.
- Future Directions: Further studies should be conducted to assess the impact of sub-lethal NP exposure on juvenile physiology.

## References

- MacKay, S. B. (2017). *Chronic Effects of Nonylphenol on Reproductive Behavior, Physiology, and Development of Crayfish* (Unpublished master's thesis). Grand Valley State University.
- MacKay, S.B., Trainor, C.P., Bergman, D. (2019). *Effects of Nonylphenol on Crayfish Molting Hormones* (Unpublished study). Grand Valley State University.