

The Effects of Lead Exposure on Fathead Minnows

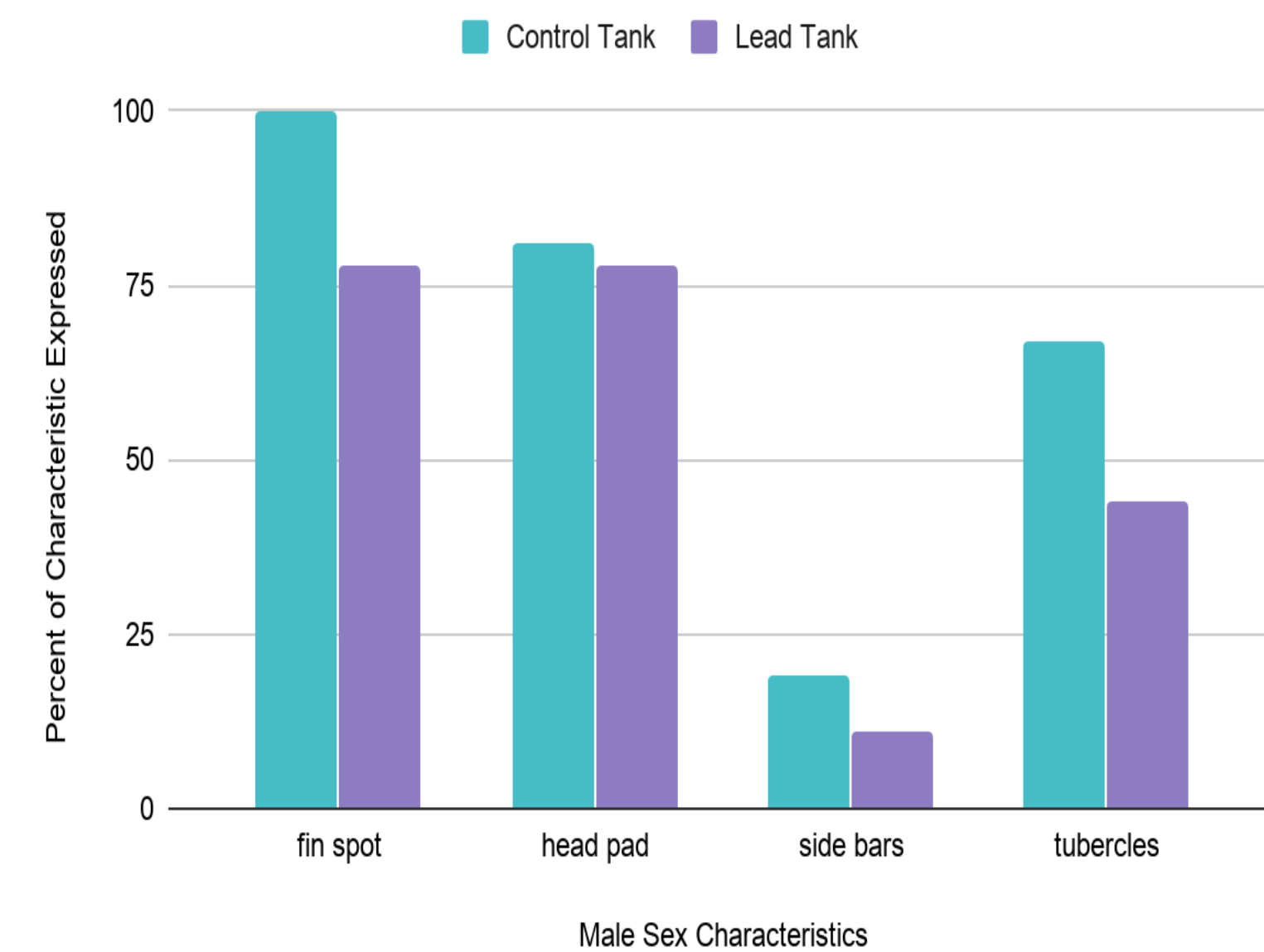
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Introduction

Lead exposure comes from the environment an organism is living in. In humans, exposure to lead causes adverse effects on the body. Some of the symptoms include reduced fertility, heart disease, nausea, and possible memory loss. (1) When fathead minnows are exposed to lead they also receive adverse effects. Lead reduces the number of times one sees reproductive behavior (2). Along with seeing fewer reproductive behaviors, the sexual characteristics are seen less when exposed to lead. These reductions are due to the lower levels of testosterone that are caused by lead exposure (3). We hypothesize that lead exposure would decrease the number of times a male fathead minnow shows reproductive behavior and sex characteristics.

Methodology

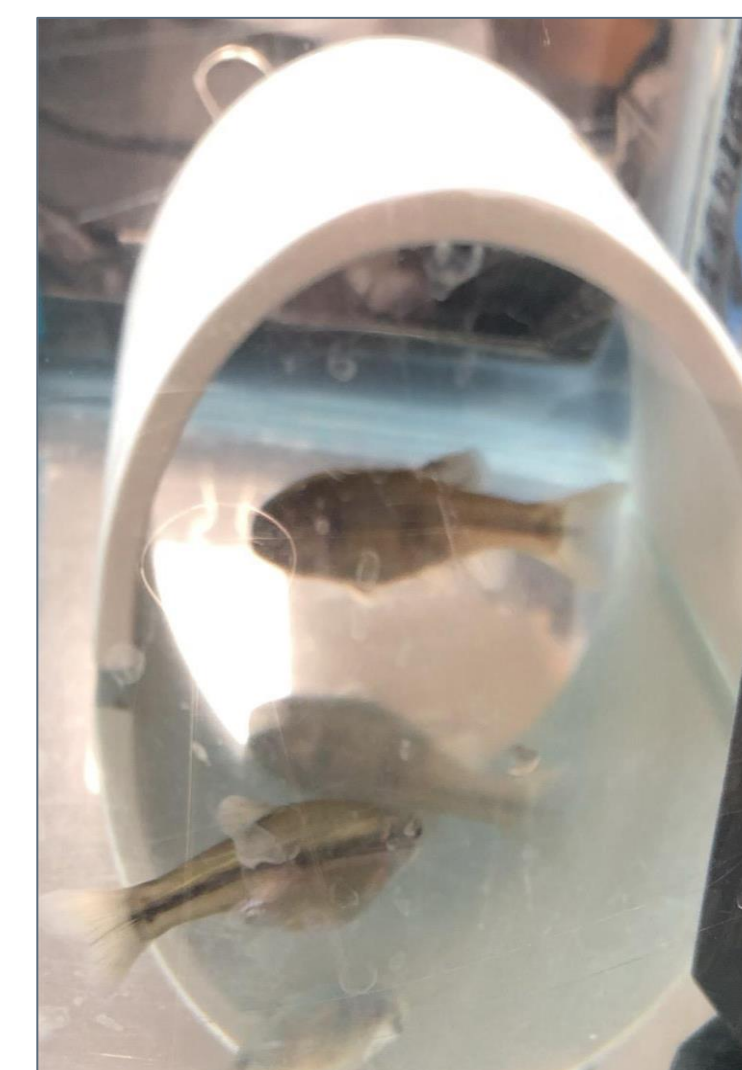
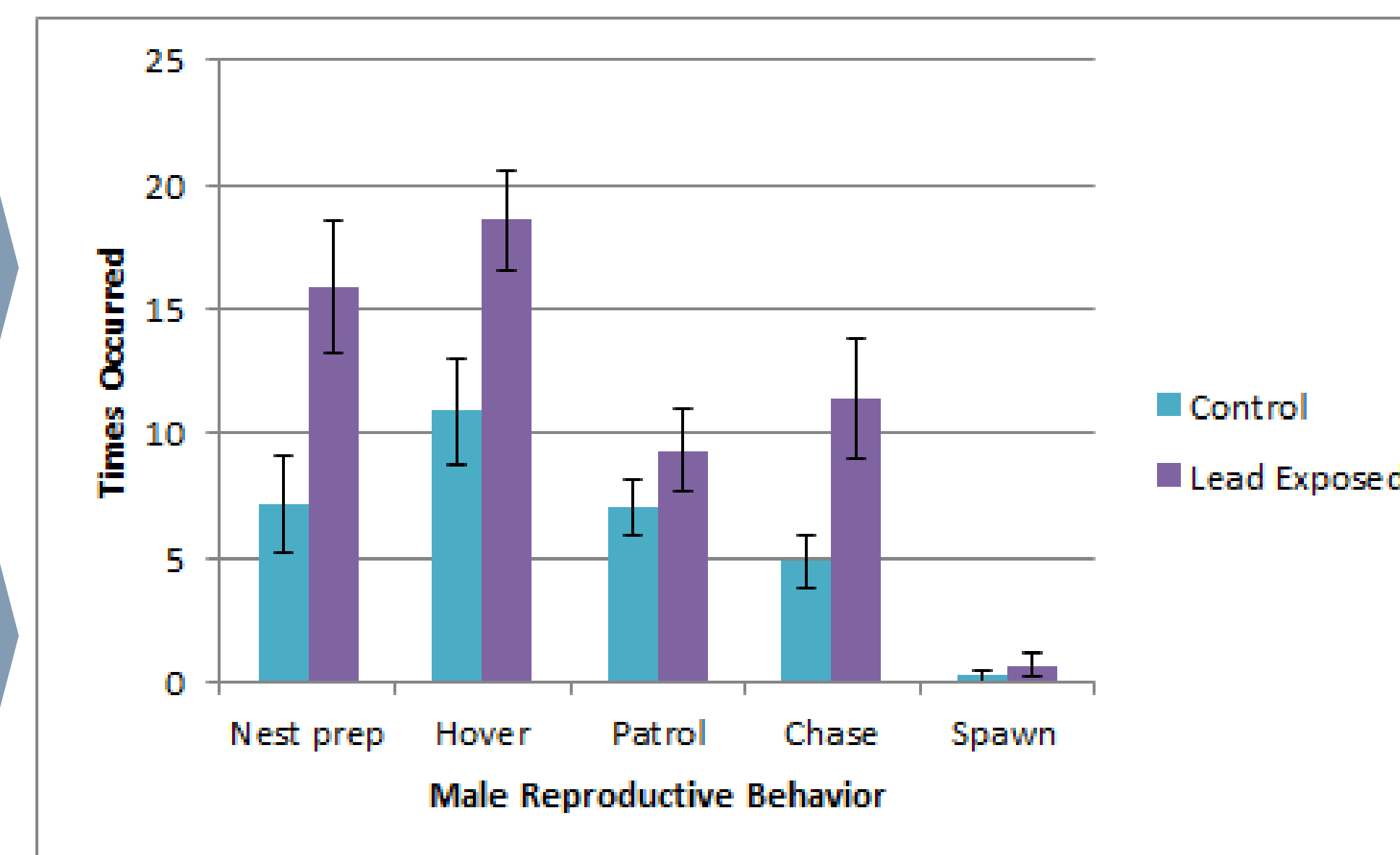
Two tanks of fathead minnows were set up in a single-blind format. The independent variable was the lead exposure and the dependent variable was the expression of sex characteristics and reproductive behaviors. The experimental tank fish were exposed to lead nitrate (1 part per million) for 2 weeks before observations started. Five minute observations of the male sex characteristics and reproductive behaviors were made three times a week for two and a half weeks. Once results were found, standard error of the mean and Fisher's exact test were used to analyze the data.



The number of times the male minnow reproductive behaviors were observed is displayed in the graph. Standard error of the mean bars are given for each behavior to demonstrate the significance of the difference between the control and lead tanks. Based on the error bars, there is significantly more observations of the nest prep, hover, and chase behaviors in the lead tank.

Results

The number of minnows who expressed a given characteristic out of all the observations of the minnows in that tank is illustrated in the graph as a percentage. When Fisher's Exact Test was used to determine the significance of the difference between the lead and control tanks, the difference was determined insignificant for all characteristics.



A male and female minnow from the control tank where the male fish expresses side bars.



A male minnow from the lead tank that lacks some of the male sex characteristics and looks similar to a female fathead minnow.



A comparison of a control tank male and female fathead minnow when they are not exposed to lead.

Abstract

This experiment was conducted to test the effects of lead on fathead minnow reproduction. Lead causes adverse effects on organisms and should be avoided. The results of our experiment did not support our hypothesis that lead decreases the reproductive behaviors and sexual characteristics of fathead minnows. Contrary to previous research, our experiment does not show a decrease in reproductive behaviors and characteristics in the presence of lead.

Discussion

Based on the data of our experiment, we fail to reject the null hypothesis. The differences in the sex characteristics were not significant. Some of the reproductive behaviors were performed significantly more in the lead tank minnows. The reason why the difference was not significant may be due to error in accurate identification of behaviors and characteristics in our observations. Additionally, our small sample size may not have provided an accurate representation of normal fish behavior. Overall, these insignificant differences found in between lead and control minnows can not be used to support our hypothesis or draw further conclusions about the result of lead exposure. However, potential errors in our experiment means the possibility cannot be ruled out completely.

References

- 1.) "CDC - Lead: Health Problems Caused by Lead - NIOSH Workplace Safety and Health Topic." Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, 18 June 2018. www.cdc.gov/niosh/topics/lead/health.html.
- 2.) Alados, Concepción L., and Daniel N. Weber. "Lead Effects on the Predictability of Reproductive Behavior in Fathead Minnows (*Pimephales Promelas*): A Mathematical Model." *Setac*. John Wiley & Sons, Ltd. 2 Nov. 2009. setac.onlinelibrary.wiley.com/doi/full/10.1002/etc.5620181038.
- 3) Weber, D N. "Exposure to Sublethal Levels of Waterborne Lead Alters Reproductive Behavior Patterns in Fathead Minnows (*Pimephales Promelas*)." *Neurotoxicology*. U.S. National Library of Medicine, 1993. www.ncbi.nlm.nih.gov/pubmed/8247408.