

The Effects of Lead Exposure on Fathead Minnows

Abstract

In this experiment we looked at the effects of lead in fathead minnows. Our research told us the health concerns on humans and how that can correlate towards fathead minnows. We had measured the sex characteristics and reproductive behaviors on the fathead minnows to see if the fathead minnows exposed to the lead tanks had any major differences. Our findings did not exactly prove our hypothesis correct, as most of our data was not statistically significant on our graphs. But this experiment did make us think about lead impact on our lives. Humans that are exposed to lead can have damage to the human body.

Introduction

Lead is a metal that in some ways can be useful in products for everyday use; however, exposure to lead compounds can be harmful in humans. Exposure to high levels of lead may cause anemia, weakness and kidney and brain damage. Very high lead exposure can cause death¹. Similarly, fathead minnows exposed to lead may experience changes in their reproductive lifestyle. Known Pb-induced changes in hormonal activity may account for changes in observed reproductive and nest maintenance behaviors². In this experiment, the effects of lead exposure on fathead minnows was tested by observing their sex characteristics and reproductive behaviors. All things being equal, one would expect to see more facilitated breeding going on in the undivided tanks. The reason is that within the undivided tanks, the release of chemicals by a pair of mating fathead minnows is more likely to influence other fish to breed as well. The minnows provided a close to accurate representation to humans, since the fish have similar sex organs as people. Therefore, it was hypothesized that lead exposed fish will show fewer sexually developed characteristics and behaviors than of the fish in pure water.



Methods/Materials

We have established the male secondary sex characteristics shown (dorsal fin spot, head pad, side bars, and tubercles) and male behaviors (nest prep, hover, patrol, chase, and spawn). We made count of the behaviors of each fish for five minutes in each tank (control and lead exposed).

The materials we used were four tanks of six fathead minnows each (three male and three female). Two tanks had separation bars and two tanks had no separation bars. We first recorded the sex characteristics that the fish showed. Then for five minutes we kept track of the male behaviors shown, keeping track of how many times they exhibit these characteristics.

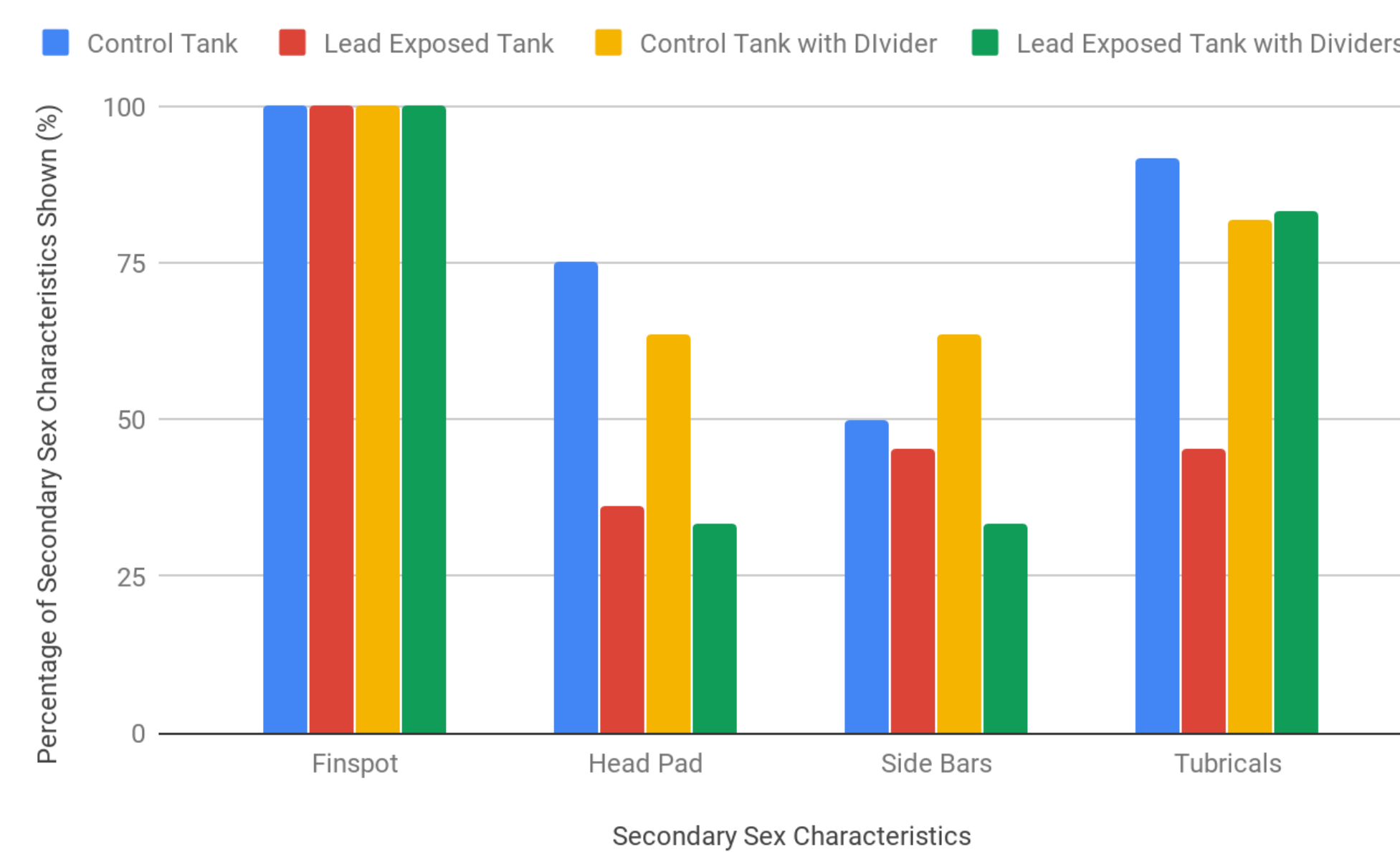


Figure One: Shows the secondary sex-linked characteristics in both divided and undivided tanks.

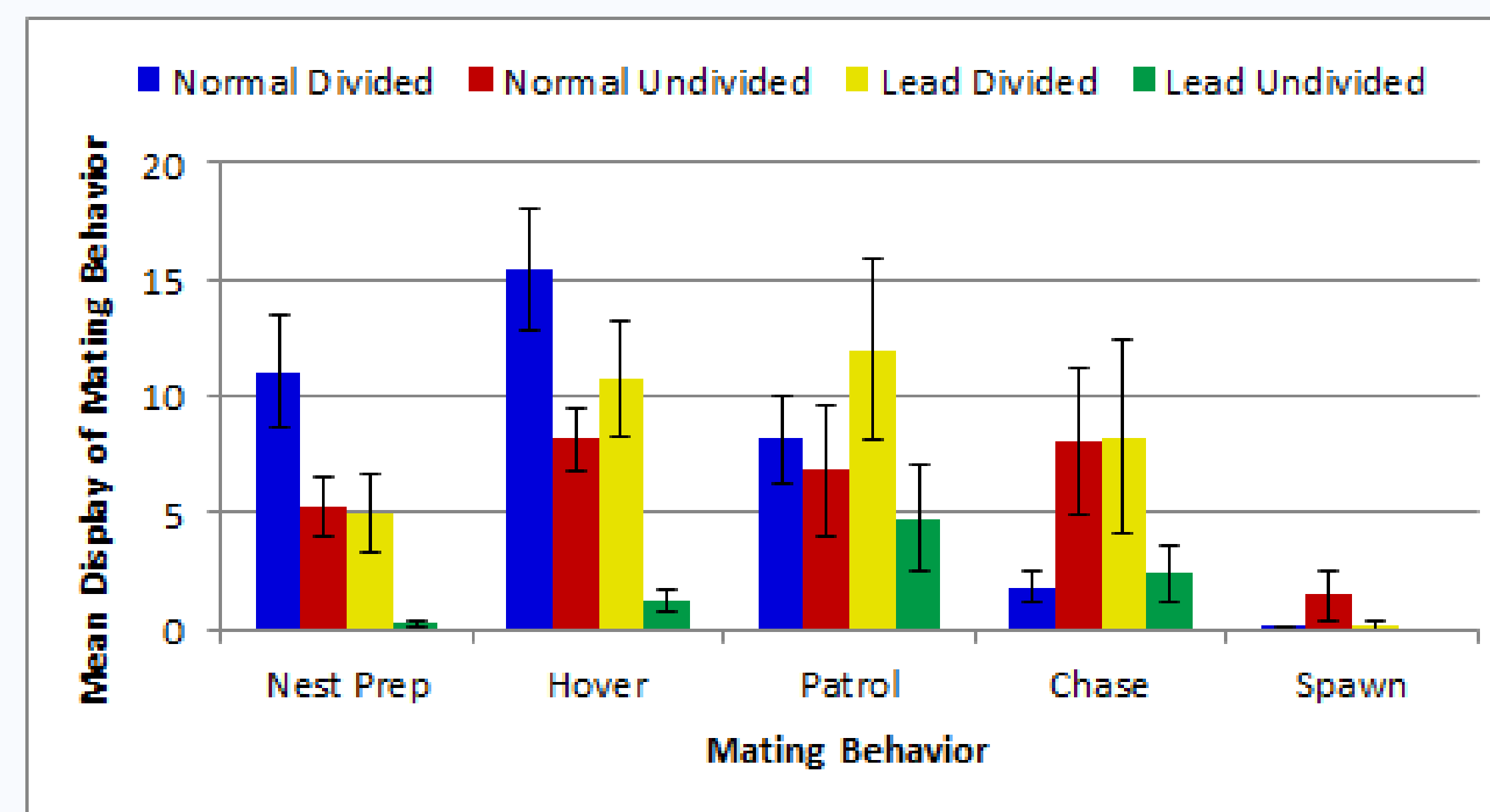


Figure Two: Shows the mean display of mating behavior in divided and undivided tanks.

Results

The experiment consisted of four tanks, two with lead exposure and two being the control. Also two tanks had separation bars and the other two did not. In this experiment, the independent variable would be the lead and the dependent variable would be sex characteristics and behaviors. Our results do not exactly match our hypothesis stating that the lead exposed fathead minnows would show less sex characteristics and behaviors. Figure one shows the effects of lead on secondary sex characteristics. To make this graph, we separated out the characteristics from each tank. Then we counted how many times each tank was observed. Next, divided how many times each characteristic was shown by the number of times that tank was observed to get our percentage of secondary sex characteristics in each tank. Analysis of the effects of lead and division on fathead minnow reproductive behaviors. There is a significant difference between lead divided and lead undivided for all reproductive behaviors. +/- standard error for the mean was used to calculate the error bars. The number of behaviors we observed was averaged over the number of fish we observed over a two week period. They were observed for five minutes each.

Discussion

Shown in Figure One and Two the fish in the control and lead exposed tanks acted somewhat the same. We saw that lead exposed fish had a drastically lower display of mating behavior in all categories except for patrolling (figure 2). When comparing lead to lead and control to control, there is a significant difference between divided and undivided tanks. Undivided tanks experience a significant decrease in mating behaviors. Fish not exposed to lead were found to have significantly more nest preps, and significantly fewer chases when divided and significantly higher when undivided. Due to the lack of significance between most mating behaviors in divided tanks, we fail to reject our null hypothesis. There was also an observed increase in spawning and chasing in the undivided tanks. The finspots were consistent throughout all the tanks. This is because it is the first characteristic that appears in minnows. The limitations in this experiment pertaining to the quantity of the fish we observed including the duration of time the observation of fish took place. Furthermore, the errors in our experiment include the observation of the same fish numerous times and other minnows not as often. Many of the fish had died during our experiment in the lead exposed tanks. The opportunity to spend more time on this experiment would provide better data for more concrete conclusions.

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, 2018, www.cdc.gov/niosh/topics/lead/health.html.
2. Alados, C L, and D N Weber. "Lead Effects on the Predictability of Reproductive Behavior in Fathead Minnows (Pimephales Promelas): A Mathematical Model." Current Neurology and Neuroscience Reports., U.S. National Library of Medicine, Oct. 1999, www.ncbi.nlm.nih.gov/pubmed/29857634/.