

# The Effect of Lead Exposure on Reproductive Activity and Sex Characteristics In Male Fathead Minnows

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## Abstract:

Exposure from lead negatively impacts humans, causing impaired growth and limitations on reproductive behavior. This experiment was conducted to test the effects of lead on the male fathead minnow sex characteristics and reproductive behaviors. The results of the experiment regarding the reproductive behaviors did not prove our hypothesis that male fathead minnows exposed to lead will show a delay in activity. However, the secondary sex characteristics data does support our hypothesis.



**Image:** This image shows a lead exposed male Fathead minnow on top of the breeding chamber.

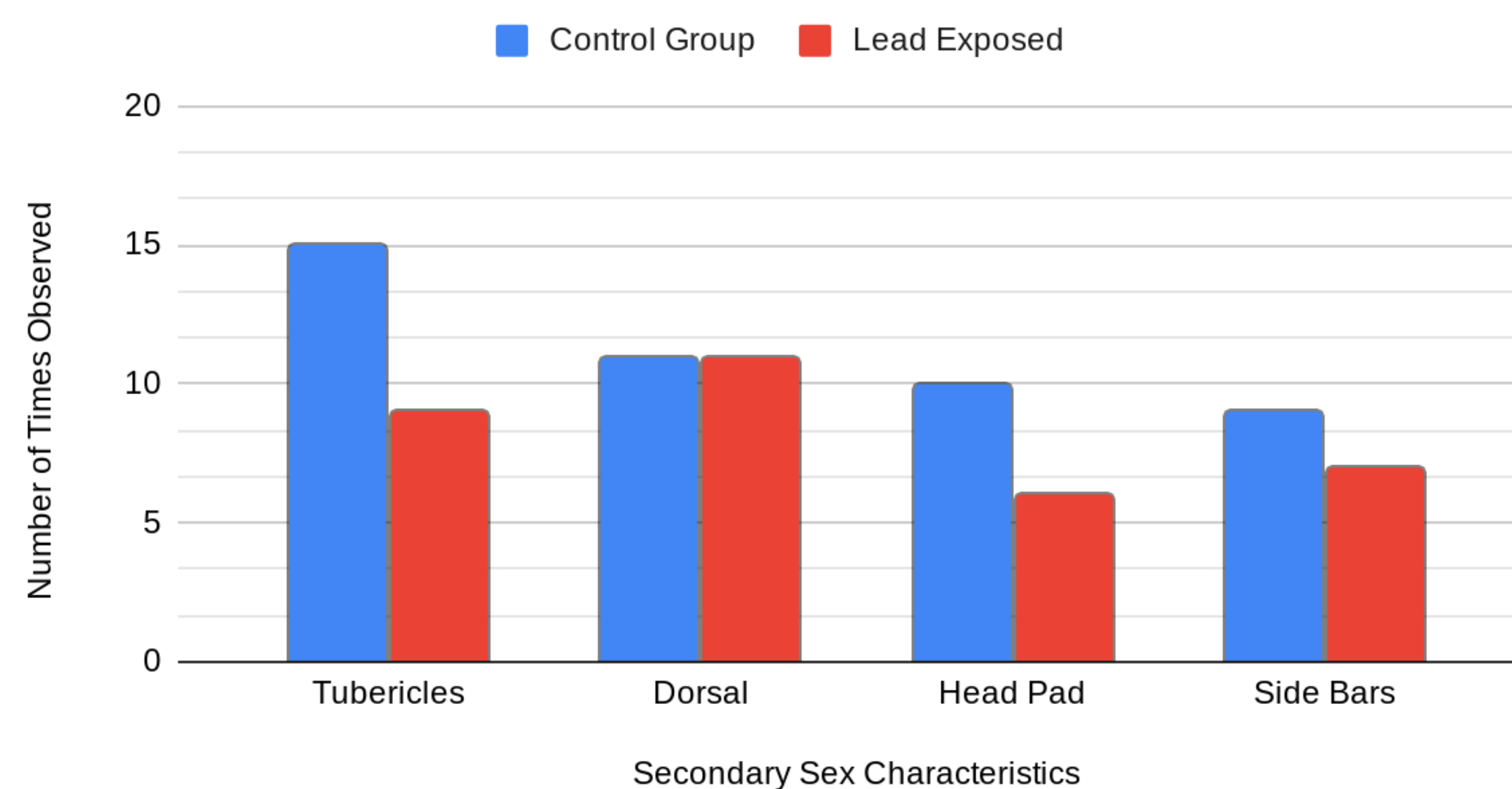
## Introduction:

Lead is a natural element that can be found in an organism's environment, such as water and soil. Although lead is not toxic to the touch, it can be extremely harmful when ingested. Lead can negatively affect a human's health and day to day lifestyle. Some of the effects from lead exposure include, behavior and learning problems, lower IQ and hyperactivity, slowed growth, and possibly death (1). Similar to humans, when male fathead minnows are exposed to lead they can experience negative effects. Lead negatively impacts a fathead's reproductive behaviors and sex characteristics, specifically a males behaviors. Additionally, lead affects the spermatocyte production, suppressing it (2). This can cause lower testosterone levels, reducing reproductive behaviors. Some of these reproductive behaviors include a male fathead minnows ability to nest properly and their maintenance to the nesting site (2). It can be hypothesized that male fathead minnows exposed to lead will show reduced activity and natural habits during reproduction along with not showing the secondary sex characteristics. Additionally, the males not exposed to lead will have normal reproduction habits and secondary sex characteristics.

## Materials and Methods:

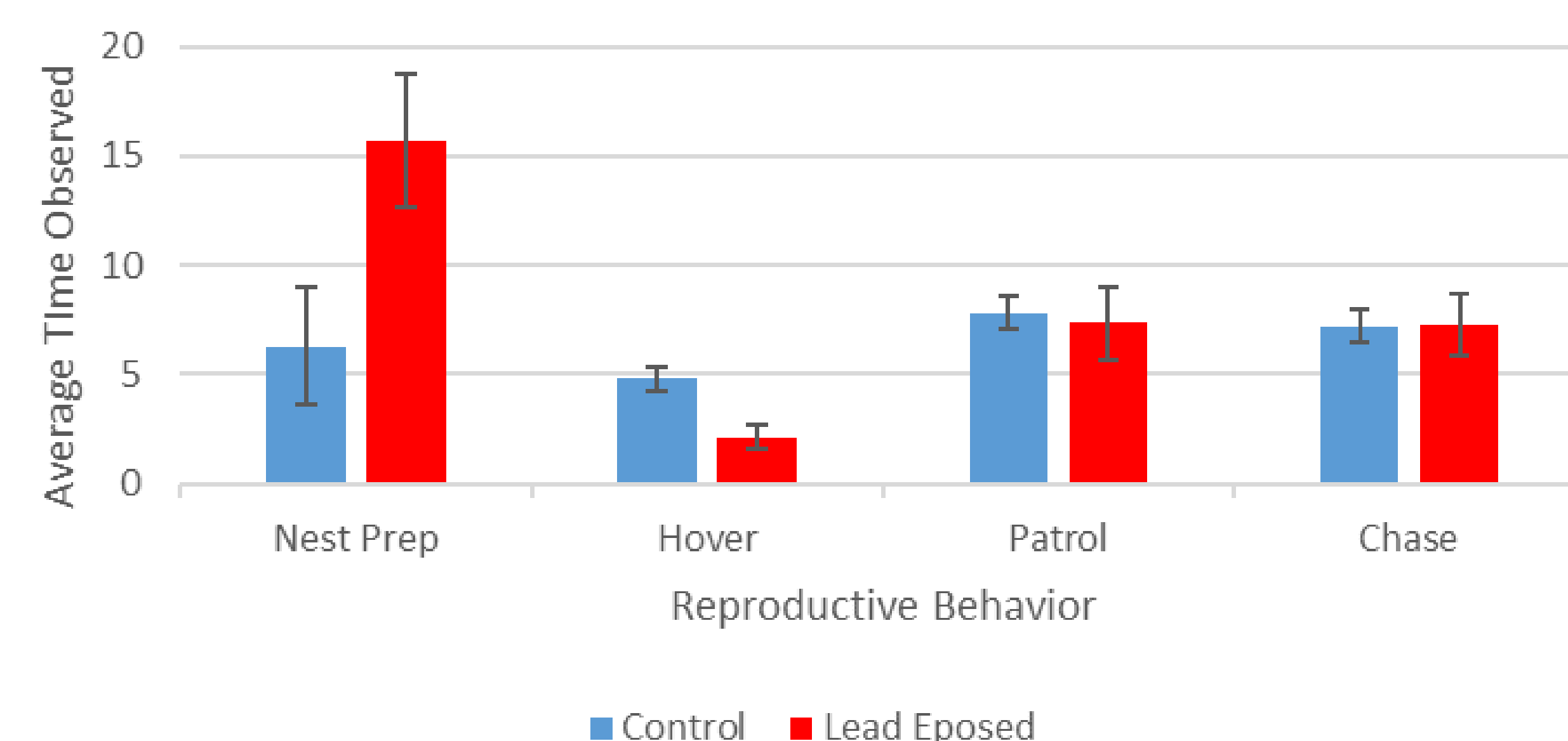
At the UWM School of Freshwater Sciences, a group of Fathead Minnows were in a tank that exposed them to a concentration of 1ppm of lead nitrate for two weeks prior to coming to Muskego High School. At Muskego High School, they were placed into two different tanks that were divided into three sections. Since this was a blind study, students did not know which tank the lead exposed were in, and which tank the control group which was not exposed to lead were in. For our experiment, we viewed three sections of Fathead Minnows for five minutes each, for seven days. Observations were done by looking at the male minnows and recording which of their secondary sex characteristics were visible. These secondary sex characteristics (dorsal fin spot, head pad, side bars, and tubercles) were observed first, followed by 5 minute behavior observations. Following this, we tallied each behavior shown (nest prep, hover, patrol, chase, spawning). We used a Fisher Test and Standard Error of the Mean Test to determine the significance of our data. In order to get more reliable data, we used data from another group of lead exposed minnows and another control group from another set of tanks to expand our sample size.

**Control vs. Lead Exposed Male Fathead Minnow Secondary Sex Characteristics**



**Figure 1:** The graph results indicate that the group not exposed to lead has increased significantly in the categories: tubercles, head pad, and side bars compared to the lead exposed group. The P value equaled 0.1180.

**Control Vs. Lead Exposed Fathead Minnows Reproductive Behavior**



**Figure 2:** The results indicate that the group exposed to lead has increased significantly in the categories: nest prep, and chase. And decreased significantly in the category hover. Error bars indicate 1 SEM.

## Results:

In this experiment, lead exposure was the independent variable, and the characteristics and behaviors were the dependent variables. As shown in the first graph, the male Fathead Minnows in the control group showed no significant difference in secondary sex characteristics (tubercles, headpad, sidebars) than the males in the lead exposed tank. However, looking at the second graph it is shown that the males in the lead exposed tank showed more reproductive behaviors (chase, nest prep, spawning) and the males in the control group showed more hovering than the lead exposed group.

## Discussion:

This data shows that males that have been exposed to lead, show a reduction in secondary sex characteristics. However, the males that were exposed to lead, show a decrease hover and a increase in nest prep and no significant difference in patrol or chase.. These results partially support our hypothesis that males exposed to lead will show a reduction in activity during reproduction along with not showing the sex-linked characteristics. One limitation of this experiment was sample size. We were only able to view one group of lead exposed minnows and one group of minnows not exposed to lead. This data can be used to inform communities that live in a place where lead poisoning is a dangerous possibility. By collecting and analyzing this data we can inform people of the dangerous effects of lead poisoning.

## Sources:

- <https://www.epa.gov/lead/learn-about-lead> “Learn about Lead.” *US EPA*, United States Environmental Protection Agency, 15 July 2021, [www.epa.gov/lead/learn-about-lead](https://www.epa.gov/lead/learn-about-lead).
- <https://pubmed.ncbi.nlm.nih.gov/8247408/> Weber, D. “Exposure to Sublethal Levels of Waterborne Lead Alters Reproductive Behavior Patterns in Fathead Minnows.” *PubMed*, PubMed, [pubmed.ncbi.nlm.nih.gov/8247408](https://pubmed.ncbi.nlm.nih.gov/8247408/). Accessed 27 Jan. 2022.