

# LEAD EXPOSURE IN FATHEAD MINNOWS

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## ABSTRACT

The purpose of this experiment was to test the effects of lead nitrate, a common toxic substance in the United States, on the reproductive behaviors of fathead minnows. The minnows were observed without any knowledge of which ones were exposed to lead or which ones had been treated with DMSA. Each tank was observed for exactly 5 minutes to form accurate results. The results found that the minnows exposed to lead, showed a definite decrease in both secondary sex characteristics as well as reproductive behaviors. And the DMSA agent in each tank slightly increased the reproductive activity, regardless of exposure to lead. Through the findings of this fathead minnow experiment, it can be better understood that lead poisoning in humans and other mammals can not only cause adverse psychological effects, but also physiological and reproductive issues.

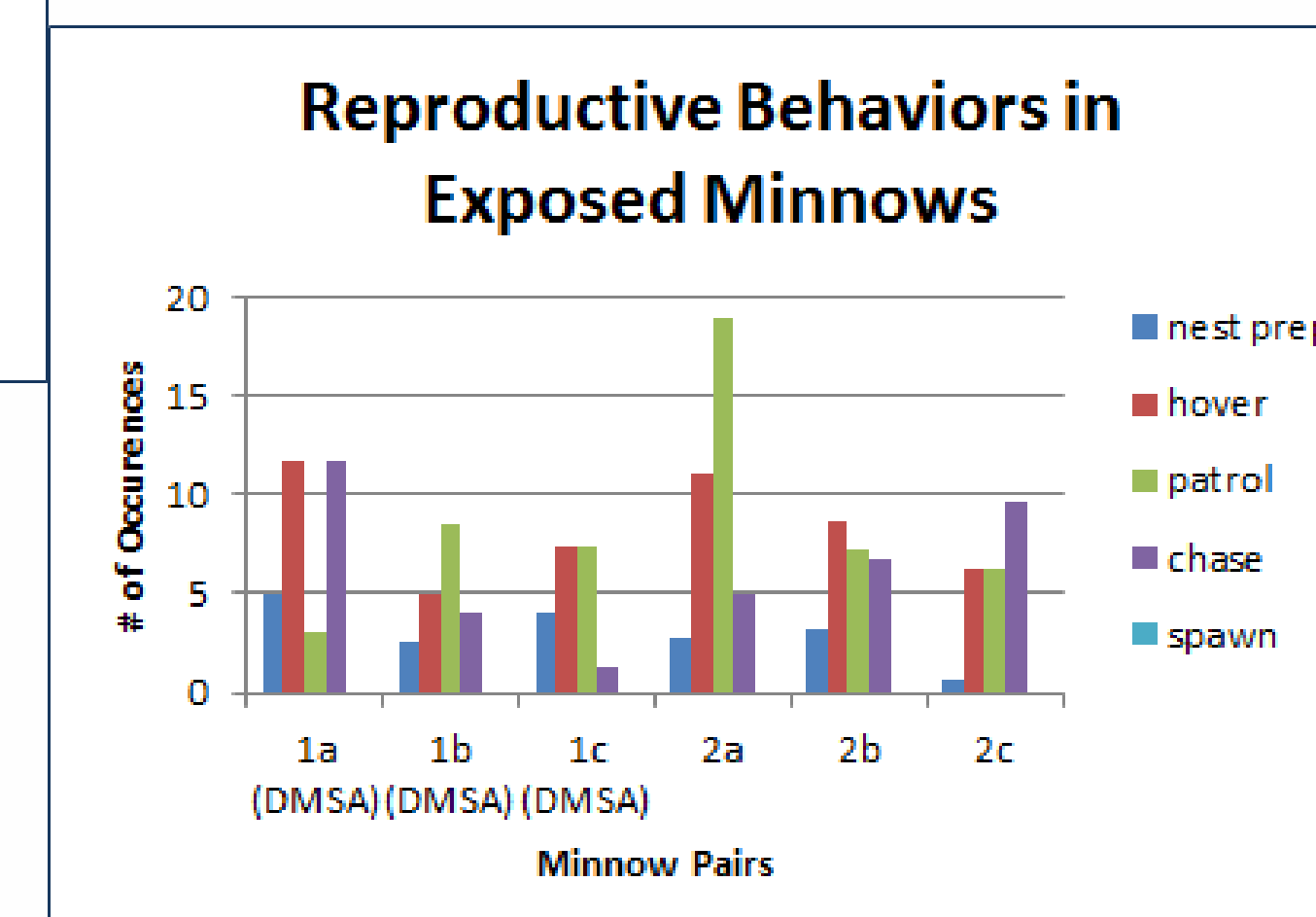
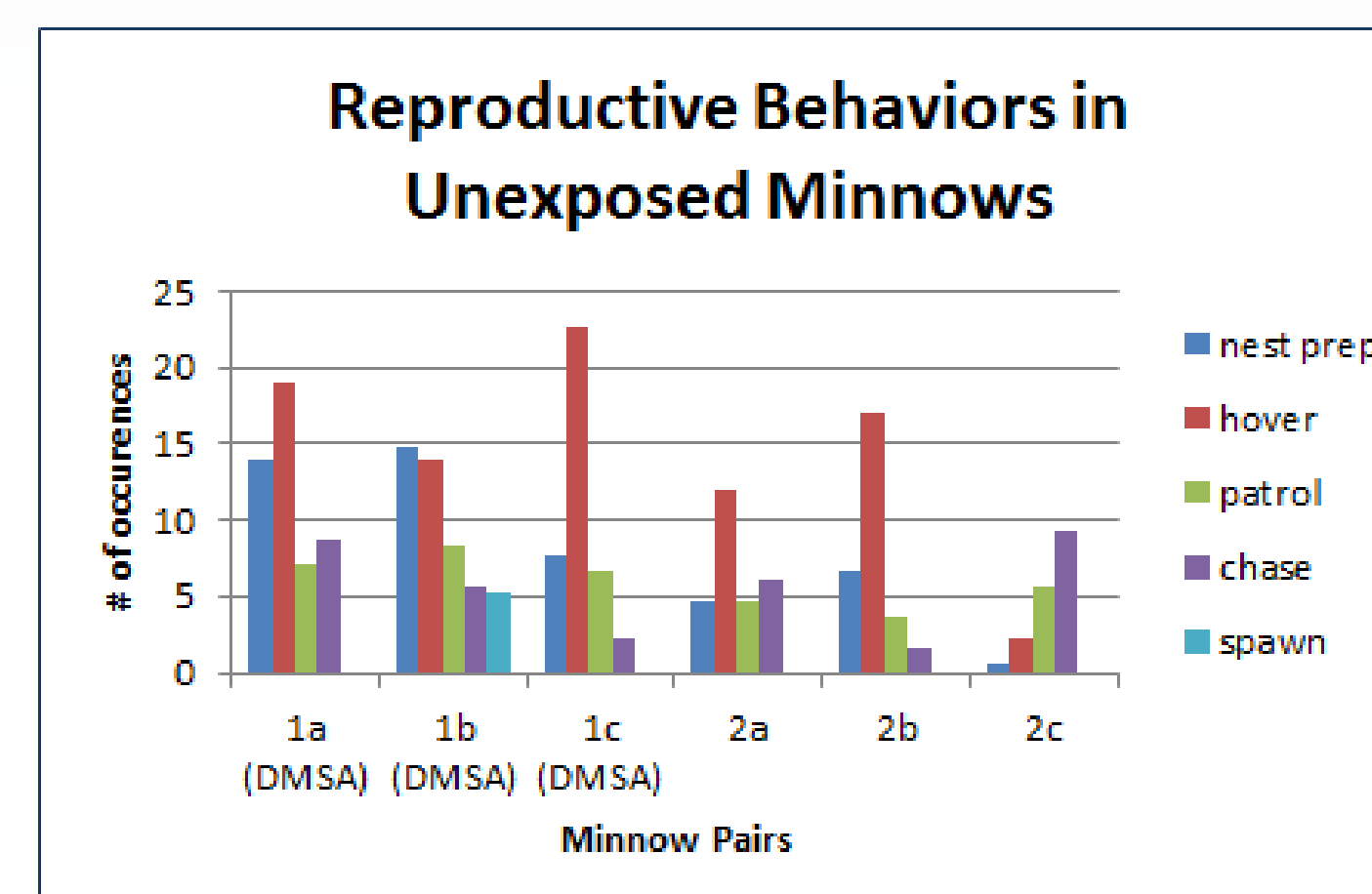
## INTRODUCTION

Lead is a naturally occurring inorganic metal found in earth's crust, but present in almost all parts of the environment. It is a malleable, but heavy metal used in a variety of ways. The most common uses for lead are paint, pipes, gasoline, batteries and select cosmetics. Since 1980, regulatory laws have reduced the amount of lead in consumer products as health concerns began to arise, but lead poisoning still remains a prominent issue in the United States. It has been proven that lead exposure, even found at low blood levels, can cause adverse effects, such as lowered IQ, hearing impairment, and peripheral nerve function impairment in children. There is a drug named DMSA (Dimercaptosuccinic acid) that has been used to attempt to treat lead poisoning. Although it does not reverse permanent damage, it has been shown to reduce the lead levels in blood. It is being used to test whether it will improve the minnow's behaviors. Not much research has been done on lead's effects on the reproductive system, and in this experiment, the fathead minnows are used to gain a better understanding of the reproductive changes with lead. The male fathead minnows exhibit many secondary sex characteristics when preparing to reproduce, such as a dorsal fin spot, a head pad, side bars, and tubercles, and show frequent reproductive behaviors, such as nest preparing, hovering, chasing, patrolling and spawning. These easily tracked characteristics and behaviors make the fathead minnows a good species to observe when determining the effects of lead exposure on reproductive behaviors. It has been found that prolonged lead exposure causes a decrease in testosterone production, which is responsible for developing the secondary sex characteristics of the fathead minnow, as well as a decrease in sperm count. It is hypothesized that minnows exposed to 1 ppm of lead for two weeks, will have underdeveloped sex characteristics and decreased reproductive behaviors.

## MATERIALS AND METHODS

1. For two weeks, half of the 12 male minnows were exposed to 1 ppm of lead nitrate.
2. After dividing the tanks into 3 separate areas (A, B, and C), one half of a PVC pipe, one male, and one female were placed into each section. The first 2 tanks contained minnows that were not exposed to lead and one of them also contained the DMSA agent. The next two tanks held the minnows that had been exposed to lead, and one of those tanks contained a DMSA agent as well.
3. Every other day, for 7 days total, 3 sections of certain red or blue tanks were observed. First, noting the presence or absence of the male sex characteristics, and then tallying for each male reproductive behavior for 5 minutes.
4. Data was collected in a data sheet and then traded with one other group, to form an accurate spread of data in the all of the tanks

## RESULTS



The independent variable in this experiment was whether or not the minnows were exposed to lead or the DMSA. The dependent variable was the presence of secondary sex characteristics and the number of reproductive behaviors shown by the fish. The results from our experiment clearly showed that lead nitrate did, in fact, have an effect on the reproductive behaviors of the male fathead minnows. The most notable behavior difference was the spawning. The minnows were only seen spawning in the tanks that were not exposed to the lead nitrate. Additionally, the minnows that were exposed to the lead nitrate were seen hovering significantly more than those that were not exposed. From the data we collected we determined that the group A (red) tanks were the control minnows and were not exposed to the lead nitrate. The group B (blue) tanks were the minnows that were exposed to lead nitrate. And in both groups, tank number one was treated with the DMSA while the tank number two was untreated.

## DISCUSSION

According to the hypothesis, we predicted that the minnows that were exposed to the lead would show a decrease in not only the secondary sex characteristics, but also the amount of reproductive behaviors observed. The data that both groups collected supports this data. Some errors that occurred during the duration of this experiment included that the females in the first blue tank kept swimming into other sections of the tank and therefore, accurate data could not be collected from that part of the tank. Another aspect that could have negatively affected the data that we collected was the fact that we only collected data for five minutes for seven days. A solution could have been to collect data for a duration longer than seven days in order to get a more accurate data collection. The information collected from this experiment could reveal not only to scientists, but also the general public, that lead can harm such an important system such as the reproductive system.



A male and female fathead minnow, front to back, not exposed to lead.



A male fathead minnow in the lead exposed tank.

## WORKS CITED

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