

# Effects of Lead and DMSA on Fathead Minnow Reproductive Behaviors

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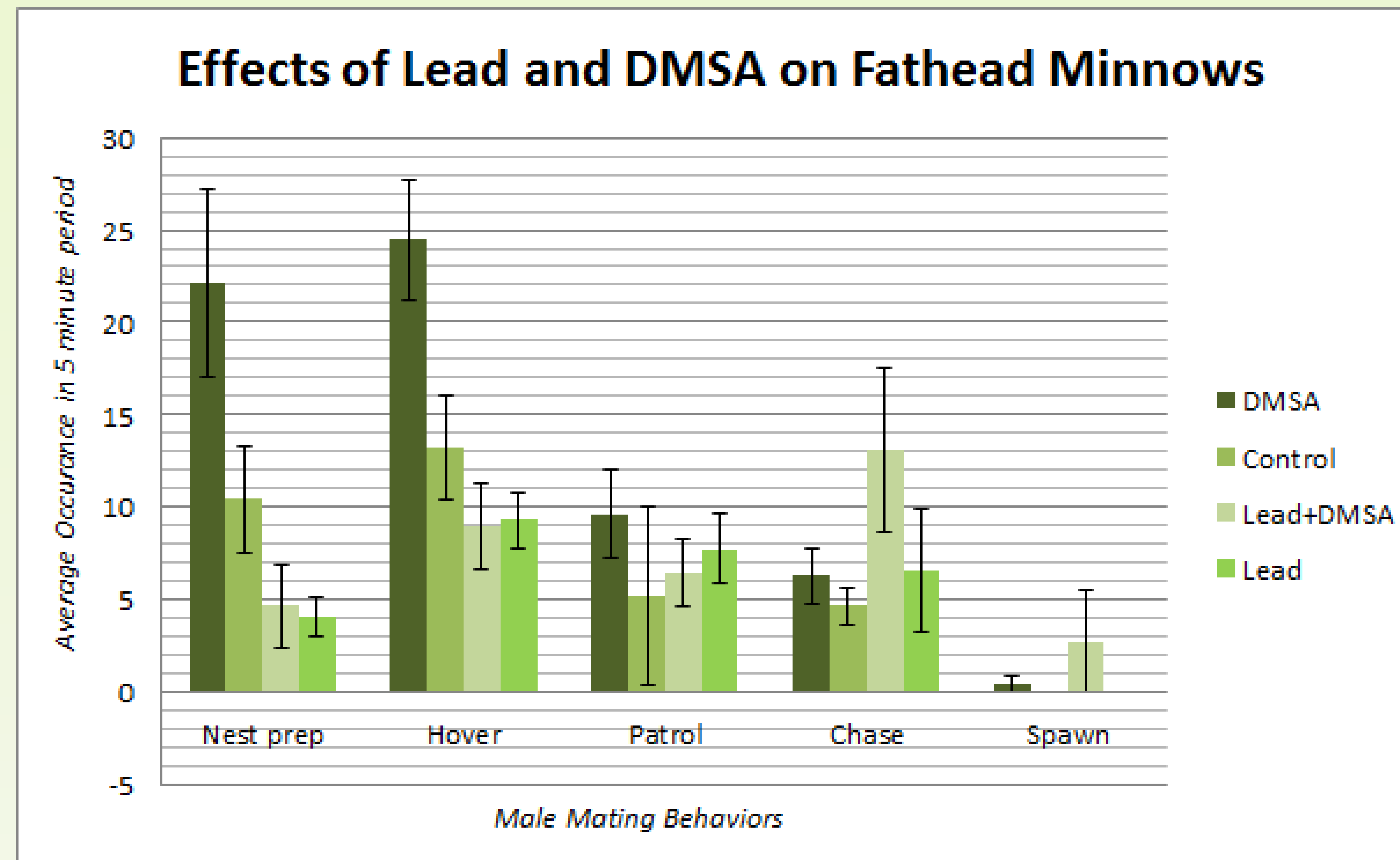
## Abstract

The purpose of this experiment was to see the effects that lead has on fathead minnow's reproductive patterns. In our project we also tested how the medicine DMSA, Dimercaptosuccinic acid, can treat the fish from lead poisoning and whether its presence changed their reproductive behaviors in any way. The importance of this project is significant because the information we gain from doing this can help see how DMSA works and how greatly it affects the fish, exposed to lead or not. Our findings were that the fish exposed to lead showed less reproductive activities than our control group and that the lead exposed fish were more aggressive because of the high amount of chases. Combined, all lead exposed fish averaged 19.66 chases compared to 10.99 for all other fish. Overall, the findings were inconclusive, except for that DMSA by itself heightens reproductive activity compared to control fish. For humans, this result may suggest that DMSA is a treatment for Lead Poisoning without serious side effects.

## Introduction

Lead has a variety of negative effects on all organisms. Exposure to lead can occur through dust, lead in paint, soil, and water pipes. Lead inhibits the ability of the body to make hemoglobin and causes anemia, which results in less oxygen carried throughout the body. This creates fatigue, causing issues with learning and motor function. Long term effects of lead accumulation can impact red blood cell production, can decrease ability to learn, and can increase behavioral and health problems (Danylchuk). Fathead Minnows are a small species of fish that can be found throughout North America. Females lay their eggs under rocks in order to shelter them from the surrounding environment (Danylchuk). Exposure to lead can cause detrimental effects to the nervous system and kidney function. Lead resembles calcium in the brain and binds with certain proteins helping with this development. This is why people and animals exposed to lead experience a multitude of detrimental effects (Lowry). Calcium is an important part of the electrical signals within the nervous system so if it is missing a variety of negative symptoms will appear. DMSA is a medication used in chelation therapy of humans to treat lead poisoning. Treatment using this medication assists in excretion of lead from the body (Lowry). It is important to test both the lead and the medication to see not only the adverse effects of lead, but also possible side effects of DMSA and overall benefits of medicating. We predict that the lead exposed fish will show behaviors of slowed reproductive activities and that the lead exposed fish being treated with DMSA will get somewhat better, but will not fully recover from the prolonged effects of the lead that is in the bones of the fish.

## Graph



Lead exposed fish on day 5

This graph compares the amount of time a fish from each tank would, on average, display each reproductive behavior within a 5 minute time period over six days of observation.

## Discussion

Overall, the data fails to completely support the hypothesis. The major significant difference is that DMSA actually increased reproductive behavior in Nest Preps and Hovers, instead of having adverse effects. Lead+DMSA exposed fish showed a significantly higher number of chases than the control fish, suggesting more aggressive behavior. The data fails to support the hypothesis because the fish exposed only to lead did not, overall, show significantly less reproductive activity than the control fish. The lead+DMSA exposed fish also failed to show significantly more reproductive behaviors than the lead exposed fish. A significant trend difference may be possible to see if the Control and DMSA tank numbers are combined against the numbers of both tanks exposed to lead. Limitations of this experiment include sample size, because all of the fish studied in one condition were in the same tank. If something went wrong during preparation of the tank, then all of the fish would be negatively impacted. Sample size may also have affected data points such as the abnormal amount of spawning in one set of fish in the Lead+DMSA tank because the actions of one fish effect the data points more the less fish that are observed. Another source of error may be that the pH of the tank water was actually 8.4 instead of 7. Since we did not see any significant differences between the lead+DMSA fish and the lead fish we can not conclude whether or not the DMSA medicine is effective

## Materials/Methods

1. Four 10 gallon tanks were acquired, each containing 3 males and 3 females with the male/female pairs separated by porous partitions.
2. The tanks were: 1 tank was exposed to lead, 1 tank was exposed to DMSA, one tank was exposed to both, and the control tank was exposed to neither chemical.
3. Lead exposure occurred prior to observation at 1 ppm of  $PbNO_3$  for 2 weeks
4. DMSA exposure occurred during observation, these tanks were exposed to 20mL/day of 10mM DMSA in .1M NaOH in 20 L.
5. Everyday of observation, 6 groups of fish, spanning all 4 tanks, were observed. Physical characteristics of the males were noted, and their reproductive behaviors scrutinized for 5 minutes.
6. Each male was observed for 3 5-minute periods throughout the experiment
7. These results were tallied in charts by day observed.

## Data Analysis

Standard Error of the Mean was used to insert error bars in order to estimate the variability between samples of multiple data sets. This was used because data was collected on a variety of days and then averaged together, and the variation between the days needs to be accounted for.

## Results

The independent variable in this experiment is the exposure of lead and the medicine DMSA. The dependent variable in this experiment is the behaviors we observed as a result from the lead and DMSA treatment. The control groups show how normal fathead minnows generally reproduce and the behaviors they do as a result of reproduction. The other control group was the fathead minnows being treated only with DMSA. This shows the effects DMSA has on fish separate than the effects of lead exposure. The results show that the DMSA by itself appears to increase reproductive behaviors (Nest Prep, Hover, and Patrol) compared to the control tank. The fish exposed to lead and lead+DMSA show less reproductive activity than the control fish in Nest Preps and Hovers, but more in Patrols and Chases. Fish exposed to Lead+DMSA had greater occurrences of Nest Preps and Chases, but less Hovers and Patrols than those exposed just to lead.

## References

1. Danylchuk, Andy J., William M. Tonn, Cynthia A. Paszkowsk, and University of Alberta, Department of Biological Sciences. "Online Fishes of Wisconsin." *Fishes of Wisconsin*. N.p., Oct. 2011. Web. 02 Feb. 2017.
2. Lowry, Jennifer A., MD. "Oral Chelation Therapy For Patients With Lead Poisoning." N.p., Dec. 2010. Web. Jan. 2017.