Sofia Chacón

Title: How Does Lead Poisoning Affect the Behaviors of Male Fathead Minnows Over the Course of 10 Days?

Abstract:

Throughout this experiment, lead-poisoned and non-lead poisoned fathead minnows were observed in the hopes of determining whether the minnows were lead poisoned and if the lead had any effects through the frequency of their reproductive behaviors. To answer the question of, "How does lead poisoning affect the behaviors of male fathead minnows over the course of 10 days?" the behaviors of male fathead minnows were observed and tracked to see how lead affected the minnows. Fathead minnows were used in this experiment because of their simple body composition and how their bodies can easily be changed. For this experiment, 2 tanks were split into 3 sections, each section containing 1 male and 1 female fathead minnow. The reproductive behaviors of hovering, spawning, chasing, patrolling, and nest preparation were observed. These behaviors were easily distinguished and easy to point out. After observing the minnows, data was taken on the frequency of each behavior and the characteristics of the tanks. After 10 days of observing, the data was analyzed and made into graphs. Using the data and graphs students had to decide whether either of the tanks were lead poisoned and what reproductive behaviors were affected. Based on the data collected over the course of the 10 days, it was concluded that lead poisoning affected only some of the reproductive behaviors. For example, chasing was affected by lead poisoning because it had notably lower amounts in tank 2 than tank 1. This experiment was very important because it showed how fathead minnows were affected by lead poisoning, which can easily be connected to how humans are affected by lead poisoning as well.

Introduction:

In this experiment, the actions of male fathead minnows were studied over the course of 10 days. This experiment was carried out to determine whether the minnows were affected by lead poisoning, then figuring out how the lead affected the minnows through observing their behaviors such as spawning, chasing, hovering, patrolling, and nest preparation.

What Is Already Known About Lead Poisoning

When a person is exposed to lead, it can affect their brain negatively. Some of the most extreme outcomes are lower IQ, coordination issues, lack of motivation, and learning disabilities (In what ways does lead damage the brain? | Columbia University Mailman School of Public Health, n.d.). Lead can easily be found in older homes because these homes typically contain older pipes that can have a substantial amount of lead. The lead from the pipes is then dissolved into drinking water and then consumed by humans. Also, in older homes, there might be painted walls containing lead. As this paint gets older, it has a higher chance of flaking or creating dust that can later be inhaled by the occupants of the home (Services, n.d.). Additionally, lead can cause people to be violent and irritable, resulting in violent behaviors and crimes (Feilden, 2013).

Purpose For Performing This Experiment

The purpose of this experiment was to observe the behaviors of male fathead minnows when the lead is introduced in their water. Fathead minnows are great to use for this experiment because they are living things that have simple body makeup that can be easily altered. Also, fathead minnow's actions are easy to observe and interpret. Fathead minnows were also a great model for this experiment because they can help demonstrate and compare to how lead may affect humans.

Hypothesis

If lead is introduced to minnows, then they will not complete normal amounts of behaviors such as spawning, hovering, chasing, nest preparation, and patrolling, because according to the CDC, lead can cause movement and coordination problems in humans. Minnows will be affected in similar ways as humans because they are living things that have very simple body compositions that can easily be changed.

Materials and methods:

Procedure

First, the materials needed were 2 tanks, 4 plastic tank dividers, 2 thermometers, 6 male fathead minnows, 6 female fathead minnows, food for the minnows, 6 breeding chambers, two iPads for recording videos, two people, and two datasheets - one to record the amount each behavior is exhibited and another to record the characteristics of the tank. While taking any data (male behaviors - spawning, hovering, chasing, patrolling, nest preparation and observations of the tank) throughout the whole experiment, it was important not to cross the red line that was on the ground because lead was present in some of the tanks and this could be dangerous to the researchers. When the research was started, characteristics of the tank were observed first by both of the researchers, (how much algae was present in the tanks - if any, if the minnows were alive, current water temperature, and the number of eggs produced by the female - if any). Then, a video of each tank was recorded for 5 minutes on an iPad, one person recorded one tank and the other person recorded the other tank. After both of the videos were taken, the researchers watched each video 3 times (one time for each section of the tank - 6 times total between the two researchers). While the researchers watched the video, a tally was put for each time the male minnows showed the actions of spawning (both the male and the female were in the breeding chamber and were flipped upright), hovering (the male is in the center of the breeding chamber), chasing (the male is swimming after the female), patrolling (the male leaves the breeding chamber - may interact with the female), or nest preparation (male touches the inside of the breeding chamber). This data was put into a second datasheet. This procedure was followed for 10 days. After the 10 days were over, the data was into a google sheets document and graphs were made out of the data to later be analyzed.

Results

The data taken revealed that tank two had lead poisoning. Tank 2 had an increased amount of algae, and the amount of chasing and spawning actions by the minnows was lower than tank 1. In tank 1, the collected data of chasing over the span of 10 days ranged from 40-115, and in tank 2 the collected data of chasing ranged from 12-55. The collected data of spawning in tank 1 over the course of 10 days ranged from 0-20, while tank two ranged from 0-5. In tank 1, the collected data of hovering ranged from 60-115, and tank 2 ranged from 34-125. In tank 1, the collected data for patrolling over the span of 10 days ranged from 15-85, and in tank 2 the collected data for patrolling ranged from 25-105. In tank 2, the collected data of nest prep ranged from 27-94, and tank 2 ranged from 20-105. The T-test results are 0.01188059135, which shows the behavioral data is significant since the number was under 5.

Graphs/Tables

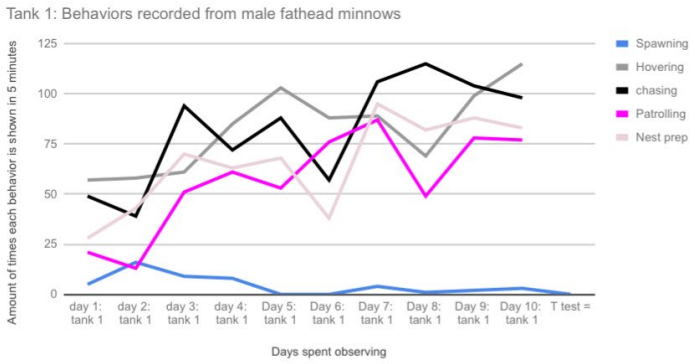

Figure 1: Tank 1, Frequency of Reproductive Behaviors in Male Fathead Minnows

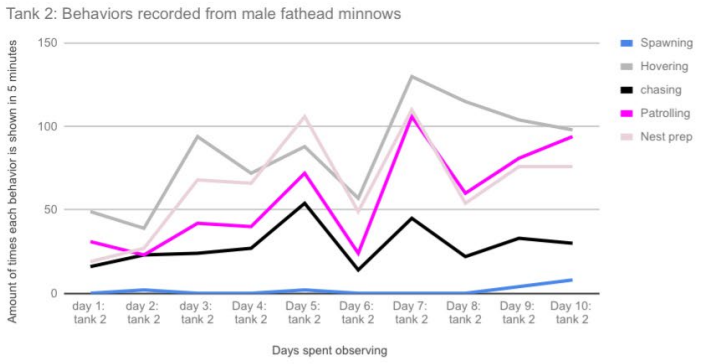

Figure 2: Tank 2, Frequency Reproductive Behaviors in Fathead Minnows

Discussion

From the data that was collected from observing the male fathead minnows, it was concluded that lead poisoning caused a reduced number of times the minnows demonstrated the behaviors of chasing and spawning. From this conclusion, the original hypothesis of "If lead is introduced to minnows, then they will not complete normal amounts of behaviors such as spawning, hovering, chasing, nesting, and patrol because according to the CDC, lead can cause movement and coordination problems in humans. Minnows will be affected in similar ways as humans, because they are living things that have very simple body compositions that can easily be changed," was decidedly rejected. This hypothesis was rejected because though chasing and spawning amounts in tank 2 were lower than tank 1, hovering and patrolling occurred more times in tank 2 than tank 1, following with nest preparation staying about the same for both tanks. The hypothesis was not rejected because of the T-test, it was rejected because for the hypothesis to work, all of the behaviors observed would have to decrease, which they didn't.

Chasing was believed to be lower because the male minnows might have been exhibiting irritability towards the female minnow. Irritability is a sign of lead poisoning consistent with human symptoms (Feilden, 2013). Chasing most likely took a lot of energy that the minnow just didn't have. Also, the low amount of times the male minnows of tank 2 showed spawning was most likely because they were unmotivated due to how the lead affected their bodies (In what ways does lead damage the brain? | Columbia University Mailman School of Public Health, n.d.).

Hovering and patrolling were probably shown is higher amounts in tank 2 than in tank 1, since spawning and chasing were in lower numbers. That left a lot of time for the minnows to hover and patrol. Hovering and patrolling didn't appear to require the same amount of energy that chasing and spawning did, therefore, it was easier for the minnows to just hover or patrol as opposed to spawning or chasing.

Nest preparation was shown to be about the same in the data of tank 1 and tank 2 since it didn't require interactions with the female, which could make the male minnow irritated and since it didn't require much coordination to correctly exhibit, weak coordination was a symptom of lead poisoning consistent with humans (In what ways does lead damage the brain? | Columbia University Mailman School of Public Health, n.d.).

Another factor that was considered in the rejection of the hypothesis was the fact that tank 2's behavioral data didn't have as clear of a trend as tank 1's data. Tank 1's behavioral data clearly shows all of the behaviors recorded (except for the low-numbered spawning) that the numbers increased as time went on. Additionally, the data from tank 1 had relatively the same range in numbers throughout the whole experiment. Which tank 1 appeared to have more consistent data, tank 2 didn't. There was not a clear trend in the data and some behaviors that were observed would have a very high amount one day and the next day would have a very low amount.

Overall, throughout this experiment, it was learned how lead can affect not only humans, but also animals such as fathead minnows. The fathead minnows were believed to be affected by decreased amounts of chasing and spawning, an increased amount in hovering and patrolling, leaving nest preparation unaffected. Additionally, from this experiment, a greater knowledge of lead poisoning effects was introduced. Before this experiment, minimal understanding of the long-term consequences was known about this topic. New information such as, how lead poisoning can make a person violent, have a lower IQ, have issues with coordination, and how they can become easily irritated were not known before this experiment was conducted. Information such as how lead affects the brain negatively and how the lead was prominent in the materials used in older homes was already known. This experiment brought up rising concerns about lead in drinking water because if fathead minnows can be significantly affected by lead in their water over the course of 10 days, similar outcomes will affect humans according to this experiment.

Errors With Recording The Data

Some errors that came up while taking the behavioral data were that it was typically difficult to record the minnows on an ipad at the correct angle so that it was possible to completely see the minnows throughout the entire video. Also, it was challenging to record what behaviors the minnows were doing at times because sometimes the minnows would do multiple behaviors very quickly. 0

References

Feilden, T. (2013, January 9). Does lead poisoning make you violent? BBC News. https://www.bbc.com/news/health-20961241

In what ways does lead damage the brain? | columbia university mailman school of public health. (n.d.). Retrieved January 18, 2020, from https://www.mailman.columbia.edu/public-health-now/news/what-ways-does-lead-damage-brain

Services, D. of H. & H. (n.d.). Lead exposure and your health. Retrieved January 18, 2020, from https://www.betterhealth.vic.gov.au:443/health/healthyliving/Lead-exposure-and-your-health