How Do Dif ferent Types of Water Affect an Earthworm's Burrowing Time?

Marge Richburg
Christ King School

2022

Abstract

Water has been a very important resource throughout the history of the earth because all living things need water to survive. There is exactly one oxygen and two hydrogens that compose water. This investigation focused on the effect of different types of water on earthworms. To make this experiment possible, we first had to soak a paper towel into one type of water we were testing, and then we placed the worm in the towel and timed it for one minute. After that, we placed them into a cup and timed how long it would take them to burrow. Following this, the average burrowing time for worms that were placed in salt water was 128 seconds, boiled water was 143 seconds, river water was 106 seconds, snow water was 41.8 seconds, and tap water was 98.3 seconds. Humans consume water every day and the results of this experiment supports the idea that polluted water can have a negative effect on someone. However, clean water is needed for everyone's body and is very significant to our earth.

Introduction

Our research topic is how do different types of water affect earthworm burrowing time? Specifically, humans use water to drink, cook, bathe, clean, water plants, and in recreational activities (CDC, n.d.). Overall, humans use water for agriculture, industry, and electricity (CDC, n.d.). Water is extremely important to study because it plays a main role in the function of all living things (AMNH, n.d.). All organisms need and use water every day because it is essential to survival (AMNH, n.d.). Wherever water is, there are organisms. (AMNH, n.d.).

The chemical that we are testing is water. The chemical formula for water is H_2O (Zumdahl, 1998). Water has been a very important resource throughout the history of the earth, because all living things need water for survival. Water not only acts as a drinking source for

animals, plants, fungi, cells, humans, and other organisms, but it also provides a home to millions of water dependent animal species (Francl, 2017). Through many stages of development, people believed that water was either a gift or a curse from ancient gods (Francl, 2017). The active ingredients that are in water are hydrogen and oxygen (National library of medicine, n.d.). There is exactly one oxygen and two hydrogens that compose water. The difference between water and most of all of the other liquids is that water is odorless and colorless, and water is the most common and natural liquid on the entire earth, meanwhile other liquids are composed of different chemical compounds (Madhu, 2011).

This chemical affects humans by supplying oxygen to blood cells, water helps animals, plants and fungi grow, which are humans main food resources, and it can kill bacteria and germs (Nolan, 2021). We are studying worms instead of humans because they share some similarities between humans and that way, we know what will happen and how to cure diseases and can observe what happens to worms before testing on humans (Lal, 2018). On the other hand, Earthworms and humans share many similarities. One similarity is that they have similar nerves and spinal cords (Lal, 2018). They both have blood vessels and nerve cords, and they both have brains that control their nervous systems (Lal, 2018). Earthworms and humans also have many differences such as when a human spinal cord is damaged, it cannot be fixed, and if the worm's ventral nerve cord is damaged, it can be healed easily and quickly (Lal, 2018).

Water will move laterally in the soil if there is enough pore space in that soil (Hartsig, 2016). This movement is aided by the capillary action of water in small spaces (Hartsig, 2016). The water will bind to the edges of the pores and slowly move laterally and even upward if the voids are small enough (Hartsig, 2016). Water can also come into soil through precipitation

(Hartsig, 2016). Soil with healthy microbiomes are good for plants, giving them the nutrients they need (Orwig, 2021). Polluted water can be a serious threat to humans since they can cause toxicity, mutagenesis, carcinogenesis, and teratogenesis for humans and other organisms (*Water and Soil Pollution*, 2019). Also, too much water can cut off the air supply to the roots of plants (*Water and Soil Pollution*, 2019).

Our hypothesis is that the salt water will cause the longest burrowing time, and the tap water will cause the shortest burrowing time. We think salt water will cause the longest burrowing time because worms' skin has a high sensitivity to salt and can even cause their skin to be destroyed (Thota, n.d.). This information leads us to believe that the earthworms will be disoriented after being in salt water and burrow slowly. We think that the tap water will cause the shortest burrowing time because tap water is filtered very well and contains helpful minerals that the worms may like (Yetman, 2021).

Methods

First, we gathered our materials. The materials that were needed for this experiment were salt, tap, river, snowy, and boiled water. Some other materials were eight different worms, jars for each liquid, a stopwatch, a clear cup of dirt, five paper towel squares, a tray, and goggles. Then, we soaked one paper towel in tap water. We grabbed a worm and rolled it in the paper towel. We started the stopwatch and then took the worm out when the time hit one minute. Next, we placed the worm in the cup of dirt and started the stopwatch. We then waited and stopped the stopwatch when the worm began burrowing into the dirt. After that, we used seven more worms doing the same thing. Following this, we did all of these steps four more times using salt, snow,

boiled, and river water. After we had all of our data recorded, we found the averages and made a graph using google sheets. Finally, we did the T-Test using Google Sheets.

Results

We tested 5 different liquids on different earthworms. As seen in Graph 1 and Table 1, the average burrowing time for tap water was 98.29 seconds. The average burrowing time for snow was 41.8 seconds. The average burrowing time for river water was 105.57 seconds. The average burrowing time for boiled water was 143 seconds. Finally, the average burrowing time for saltwater was 127.86 seconds.

The independent variable is the different water types that we tested. The dependent variable is the time it takes for the worm to burrow. The controlled variables were the paper towel, the soil, the environment, the cup, and the amount of time they soaked in the liquid.

The statistical test we used was a T-Test. We used this because it showed us the significance in our results. The P-value for the snow and river T-Test was 0.008675057905. The P-value for the tap and snow water T-test was 0.15319176. The P-value for tap and river water T-test was 0.8324169769. The P-value for the tap and boiled water T-test was 0.4377048591. The P-value for the tap and saltwater T-test was 0.5018251912. The P-value for the snow and boiled water T-test was 0.06398647568. The P-value for the snow and saltwater T-test was 0.04277744431. The P-value for the river and boiled water T-test was 0.4032503086. The P-value for the river and saltwater T-test was 0.5258106607. The P-value for the boiled and saltwater T-test was 0.7912438803. As seen in Graph 2, snow and river water and snow and saltwater were proven significant because the P-value was under five percent. Whereas, tap and

snow water, tap and river water, tap and boiled water, tap and saltwater, snow and boiled water, river and boiled water, river and saltwater and boiled and saltwater were proven insignificant.

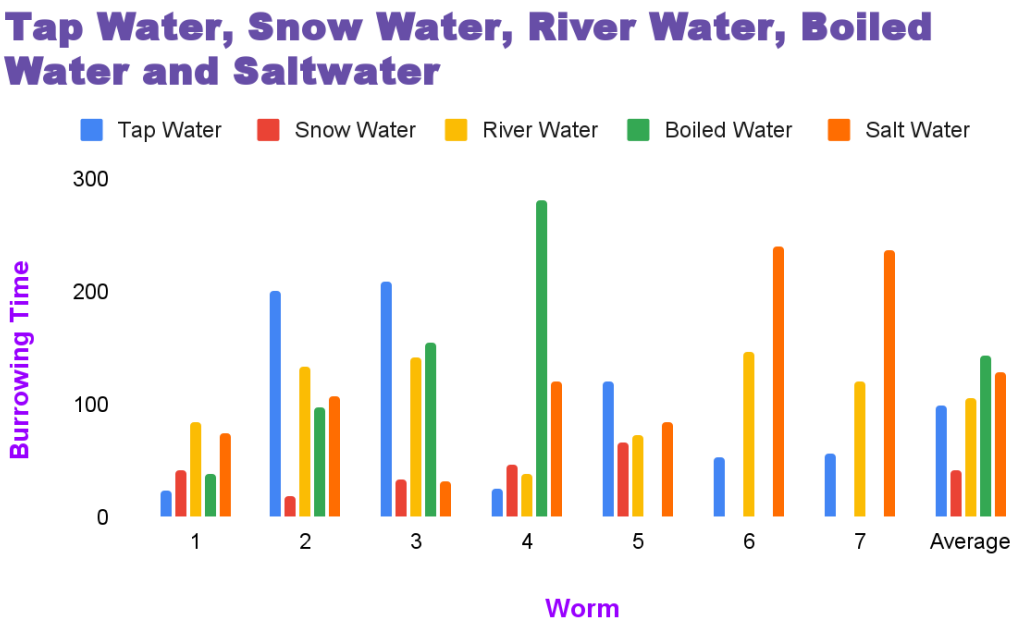
Table 1: Burrowing Time for Each Type of Water

Worm	Tap Water	Snow Water	River Water	Boiled Water	Saltwater
1	24	42	84	39	75
2	201	19	134	98	107
3	208	34	142	155	32
4	25	47	39	280	120
5	120	67	73		84
6	53		146		240
7	57		121		237
Average	98.28571429	41.8	105.5714286	143	127.8571429

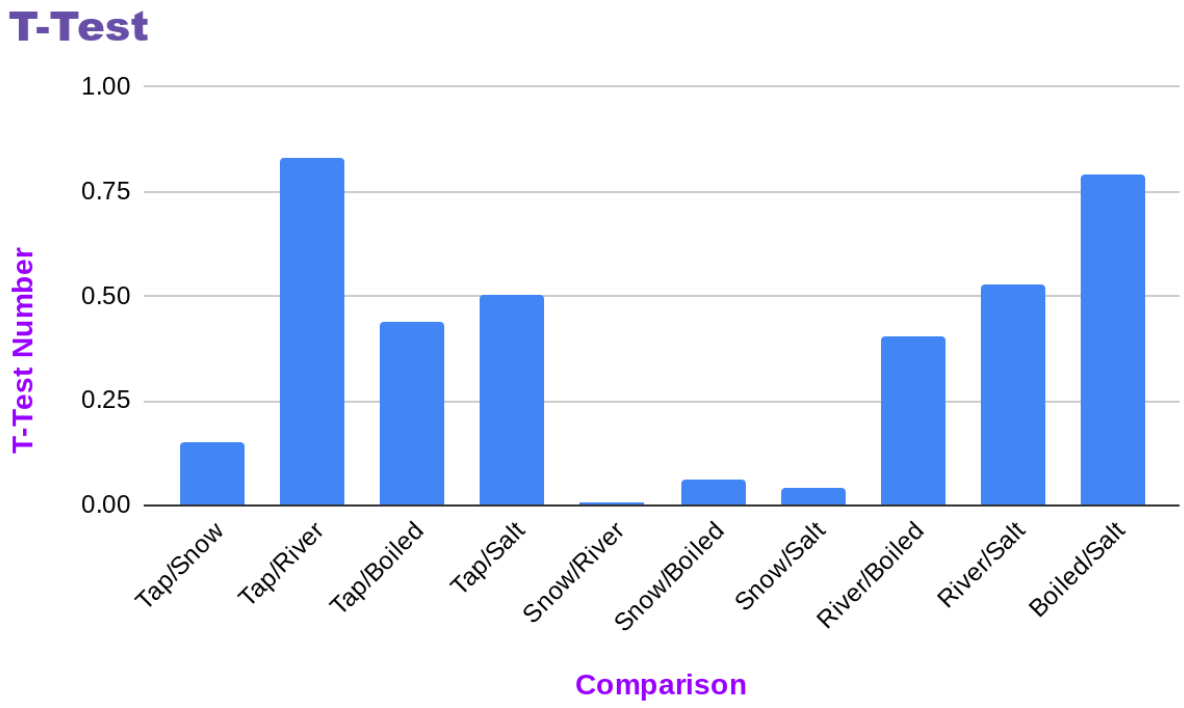
Table 2: T-Test

	T-Test
Tap/Snow	0.15319176
Tap/River	0.8324169769
Tap/Boiled	0.4377048591
Tap/Salt	0.5018251912
Snow/River	0.008675057905
Snow/Boiled	0.06398647568
Snow/Salt	0.04277744431
River/Boiled	0.4032503086
River/Salt	0.5258106607
Boiled/Salt	0.7912438803

Graph 1: The amount of time it took each worm to burrow in different types of water.



Graph #2: T-Test



Conclusion

Our hypothesis that saltwater will cause the longest burrowing time and tap water will cause the shortest burrowing time was not supported by our results because boiled water caused the longest burrowing time and snow water caused the shortest burrowing time. Snow water had a significant difference when compared to both river water and salt water. This might be because of the extra chemicals found in snow gathered outside. Our results matter to the world because we use water in our everyday life and it is important to know the effects that different types of water have on someone's body.

One limitation to our experiment is that we did our experiment on two separate days so it could affect the outcome of our results. Another limitation is that we did not have enough time to finish the snow water or boiled water so there are less trials for those than the other types of water. If we were to do this experiment again, we would get water from more polluted rivers to see if that affects the burrowing time of the worm.

Acknowledgements

We would like to give a big thanks to Ms. Vanchena, our science teacher, for making this experiment possible. Also we would like to thank UWM for giving us the opportunity to learn and experiment, and also taking time out of their day to judge our poster. We give thanks especially for the judges feedback to increase our scientific knowledge.

Works Cited

AMNH. (n.d.). *What is Water? | AMNH*. American Museum of Natural History. Retrieved February 14, 2022, from https://www.amnh.org/explore/ology/water/what-is-water

CDC. (n.d.). *Other Uses and Types of Water | Healthy Water*. CDC. Retrieved February 14, 2022, from https://www.cdc.gov/healthywater/other/index.html

Francl, M. (2017). *A Brief History of Water | Bryn Mawr Alumnae Bulletin*. Bryn Mawr College. Retrieved February 14, 2022, from https://www.brynmawr.edu/bulletin/brief-history-water

Hartsig, J. (2016, May 15). *How does water move through soil? – Soils Matter, Get the Scoop!* Soils Matter, Get the Scoop! Retrieved February 14, 2022, from https://soilsmatter.wordpress.com/2016/05/15/how-does-water-move-through-soil/

Madhu. (2011, February 10). *Difference Between Water and Liquid*. Compare the Difference Between Similar Terms. Retrieved February 14, 2022, from https://www.differencebetween.com/difference-between-water-and-vs-liquid/

National library of medicine. (n.d.). *Water | H2O*. PubChem. Retrieved February 14, 2022, from https://pubchem.ncbi.nlm.nih.gov/compound/Water

Nolan, J. (2021, March 19). *How does water affect our lives? A fresh look at H2O*. Concern Worldwide US. Retrieved February 15, 2022, from https://www.concernusa.org/story/how-does-water-affect-our-lives/

Orwig, C. (2021, May 5). *Soil health is the new sustainability: Why companies should care about soil*. CO nxt. Retrieved February 14, 2022, from

https://co-nxt.com/blog/soil-health-is-the-new-sustainability-why-companies-should-care-about-soil/

Thota, L. (n.d.). *Effect of Different Concentrations of Road Salt on Earthworm Burrowing*.

Water and soil pollution as determinant of water and food quality/contamination and its impact on female fertility - Reproductive Biology and Endocrinology. (2019, January 13). Reproductive Biology and Endocrinology. Retrieved February 14, 2022, from https://rbej.biomedcentral.com/articles/10.1186/s12958-018-0448-5

Yetman, D. (2021, September 9). *Is Tap Water Safe to Drink in the US, Canada, and Mexico?* Healthline. Retrieved February 15, 2022, from https://www.healthline.com/health/is-tap-water-safe-to-drink

Zumdahl, S. S. (1998, July July 20). *water | Definition, Chemical Formula, Structure, Molecule, & Facts*. Encyclopedia Britannica. Retrieved February 14, 2022, from https://www.britannica.com/science/water