

# Lethal Doses of Fluoride in Shrimp

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## Abstract

The objective of this experiment was to determine the lethal dose (LD) of fluoride in the Waco Wetland *Palaemonetes paludosis* (grass shrimp) population. This level of fluoride was found by way of gradually increasing fluoride concentrations within the habitat water. To determine the LD of fluoride in the specified shrimp population, shrimp were divided into 3 identical trials. Dosage was increased by 0.01 mg/L twice a week for each container, with the exception of the controls. Results indicated some statistical evidence of negative effects of fluoride on the survival of shrimp but required additional studies to establish a positive trend. The positive correlation confirmed research on the issue that discussed the neurotoxic effects of the chemical on larger organisms (Mullenix, Phyllis). Therefore, it can be said conclusively that the species *Palaemonetes paludosis*, although resilient in nature, is subject to similar chemical risks and indicates a fatal reaction to fluoride specifically.



## Introduction

This study examined the effects of fluoride on the survival of the species *Palaemonetes paludosis* (grass shrimp). The hypothesis for this study was that increased fluoride levels would have a negative impact on the survival of shrimp. The average concentration range was 0.27ppm (range 0.18-0.35ppm) in the Waco Wetlands; this was a factor in deciding the extent to which the fluoride concentration should be increased and determined the base amount for all containers at the start of the study (0.035 mg/L). The experiment ended with 0.042 mg/L in the highest concentrated containers and a significant amount of shrimp fatalities, indicating that a fluoride level higher than the natural level for Waco Wetland shrimp was toxic to their health.

The purpose of this experiment was to determine the lethal dose of fluoride in the Waco Wetland grass shrimp population, premising the data used and derived based on established fluoride levels, as stated on the Waco Water website's 2008 Water Quality Report (Water Quality, 8). Although the LD50 of rats and various other organisms was widely reported via online resources, there were no stated results on the research of an LD50 in smaller organisms such as shrimp. Literature reviewed for this experiment stated that highly increased levels of fluoride act as a neurotoxin to the affected organism, eventually leading to death (Mullenix, Phyllis). Therefore, this experiment served to provide data for the lethal dose of fluoride in grass shrimp, particularly those native to the Waco Wetlands and to explain results, consistent and inconsistent with the hypothesis and proposal previously presented.

## Materials and Methods

The shrimp used in this study were collected from the Lake Waco Wetlands; after testing the amount of fluoride present in the water sample, the shrimp were then separated into 12 containers (four containers per trial). They were provided with water, algae, oxygen and fluorescent lighting; subsequently, 0.01 mg/L of fluoride was added to each container. A total of 56 shrimp were collected from the Lake Waco Wetlands and placed in 12 containers (Table 1). Table 1 represents the containers with respective shrimp at the beginning of experiment. A water sample was collected from the Waco Wetlands and tested for the amount of fluoride present. The initial concentration added to each container (A1, B1, and C1) was 0.01 mg/L; containers (A2, B2, and C2) each received 0.02 mg/L; containers (A3, B3, and C3) received 0.03 mg/L and containers (A4, B4, and C4) served as the control group. Twice a week .01 mg/L of fluoride was added to all the containers with the exception of the control group. For the next three weeks, additional fluoride was added and decreases in survival were recorded.

## Contingency Analysis of Status

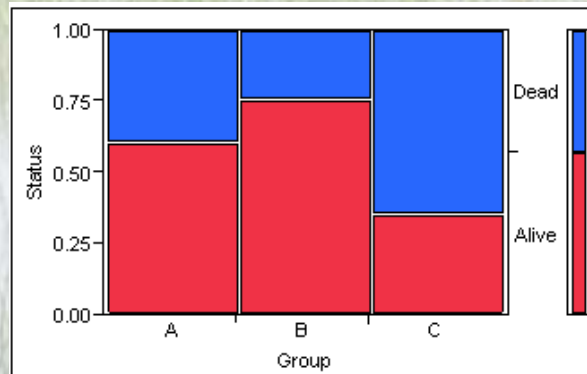


Table 1

## Results

The data [Table 1] showed that there were more deaths in some groups than in other groups. At the end of the test period for the experiment, slightly more than half of the shrimp were still alive in Group A, approximately 75 percent of the shrimp survived in Group B, and only slightly more than 25 percent of the shrimp stayed alive in Group C. The data presented indicated shrimp fatality, yet not at as a great a rate as initially suggested, and not by increased fluoride concentration.

## Discussion and Conclusion

There was a significant amount of deaths per trial, but the percentage of survival [Table 1] does not correlate, though the groups were identical in amounts of fluoride added. Some inconsistencies in the data can be attributed to shrimp escape due to lack of sufficient cover and unexpected water evaporation. This indicates that all deaths recorded were not direct results of fluoride intoxication. Although there is some indication of a positive trend of shrimp death to increased fluoride concentration, this is a preliminary study and requires further investigation to gain stronger proof for this trend. Running a subsequent experiment can verify that fluoride does indeed have a negative impact on the survival of *Palaemonetes paludosis*.

Erica Nichols checks to see how many shrimp are still alive.



Grace Butler fishes for shrimp in the Waco Wetlands.

## Acknowledgements

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