ABSTRACT

"Tributary Wary"
A study conducted using GLOBE protocols for analyzing water samples in search of usable alternative drinking water sources.
Kaylee J. Stephenson - 5th grade
Alpena Middle School, Alpena, AR USA

The purpose of this project was to test water samples from local creeks, Long Creek, Crooked Creek, Bear Creek, Yocum Creek, and Bobo Creek, to determine drinkability. This information would be useful in the occurrence of city water contamination, a filtered water shortage or a natural disaster. It was predicted that Long Creek would be the most drinkable.

Water samples were collected from the creeks and then tested for pH, Ammonia, Nitrite, Phosphate, Temperature, T.D.S, and E.C., Salmonella, Staphylococci, e-Coli, and bacteria in general.

BEAR CREEK: (EC)=394uS/cm, Ammonia=0.25ppm, Nitrite=0.1mg/L, Phosphate=1.0mg/L, (TDS)=175ppm, 27˚C, 8.0pH, negative for staph, e-coli, & salmonella. CROOKED CREEK: (EC)=310uS/cm, Ammonia=0.50ppm, Nitrite=0.0mg/L, Phosphate=0.5mg/L, (TDS)=136ppm, 27˚C, 8.0pH, staph=14 colonies, e-coli=2, no salmonella. YOCUM CREEK: (EC)=380uS/cm, Ammonia=0.50ppm, Nitrite=0.0mg/L, Phosphate=1.0mg/L, (TDS)=174ppm, 27˚C, 7.5pH, staph=30 colonies, e-coli=42, salmonella=58. LONG CREEK: (EC)=180uS/cm, Ammonia=0.25ppm, Nitrite=0.1mg/L, Phosphate=0.5mg/L, (TDS)=91ppm, 26˚C, 7.5pH, staph=89 colonies, e-coli=53, salmonella=48. BOBO CREEK: (EC)=132uS/cm, Ammonia=0.25ppm, Nitrite=0.1mg/L, Phosphate=0.0mg/L, (TDS)=77ppm, 27˚C, 7.0pH, staph=17 colonies, e-coli=1, salmonella=0.

The hypothesis was not supported by the data. The results gave Bear Creek the top choice. It was the only water source which did not test positive for e-coli, salmonella, or staphylococci bacteria. However, all water sources did test positive for some sign of bacteria. If the creeks were ever needed for drinking purposes, it would be recommended to boil water first.

Tributary Wary

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Alpena, AR

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May 3, 2019

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RESARCH QUESTIONS AND HYPOTHESIS:

INTRODUCTION

In the past, I've done projects involving water. This year, I thought it would be interesting to do a project about water that could possibly benefit people who use city or rural water, in case their water systems broke down or became contaminated and they did not have access to filtered water. In other countries around the globe, they have special portable water filtering devices to filter and purify water so that it's drinkable. In an emergency, where local water systems might break down, those devices might be hard to find locally where I live. Sometimes water pipes burst underground and we have to boil the water or not use it for drinking at all. When this happens the stores can quickly run out of bottled water. This made me wonder, "Since we have several creeks in the area, could they be a good option to use for an alternative source of drinking water in times of an emergency?"

QUESTION

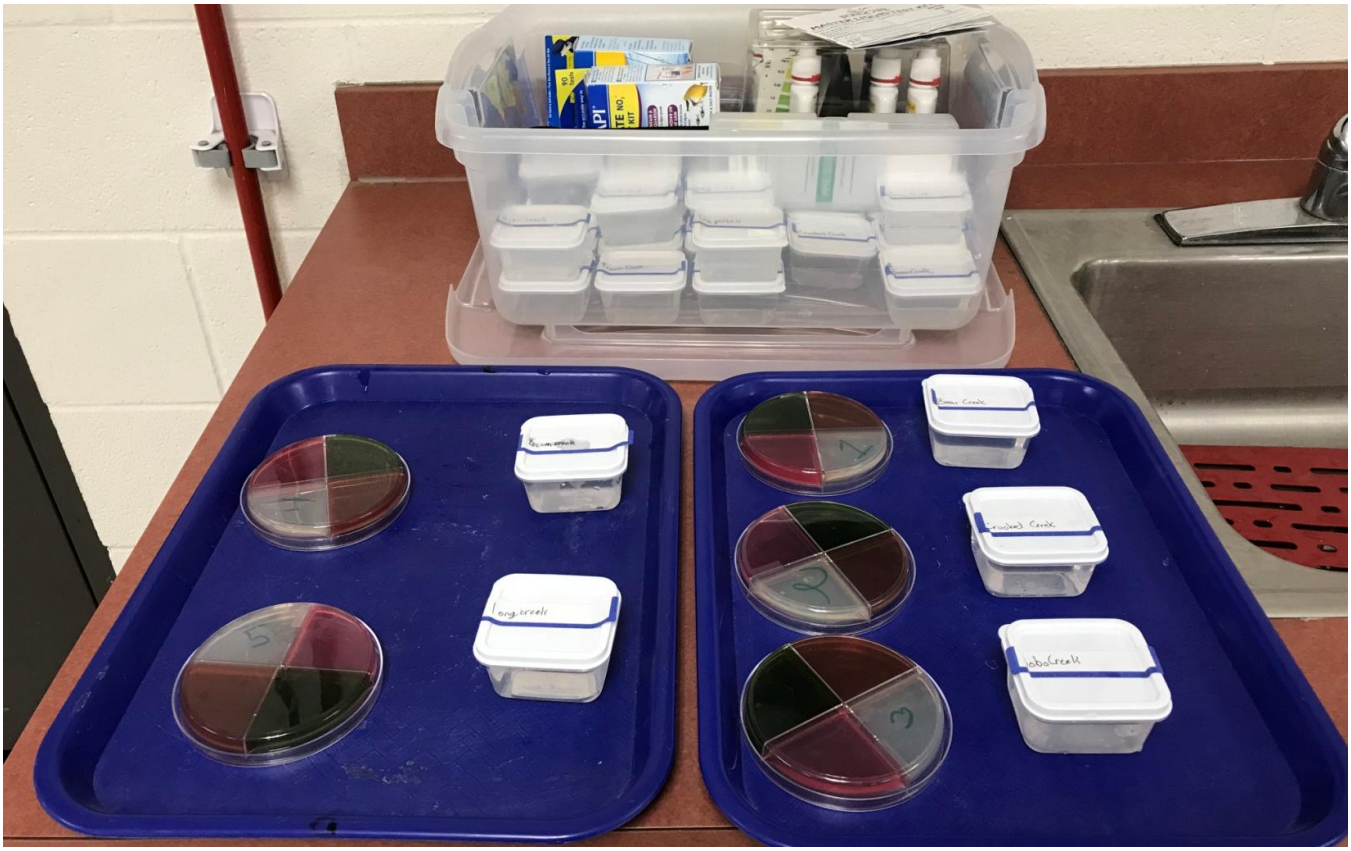
This project is the result of an investigation to use GLOBE procedures for testing water from local creeks to determine if they might be suitable to use as an alternative source of drinking water in the event of an emergency. The purpose of this project is to test water samples from local creeks to determine drinkability. This information would be useful in the occurrence of city water contamination and filtered water shortage or a natural disaster. The research question being addressed in this project is; will the water in local creeks be considered drinkable based on testing results of different variables?

HYPOTHESIS

The hypothesis is that all the local creeks tested will be drinkable. However, Long Creek is expected to be the top choice based on the samples being gathered outside of a small town instead of in or around a larger town/city, which might have more pollution.

MATERIALS:

Water Test Kit for Phosphates, Nitrites, Ammonia, & pH.
Digital Total Dissolved Solids (TDS) tester
Digital Thermometer & Digital Timer
Digital Electrical Conductivity (EC) tester
Sterile Water Sample Containers
Plastic Beakers

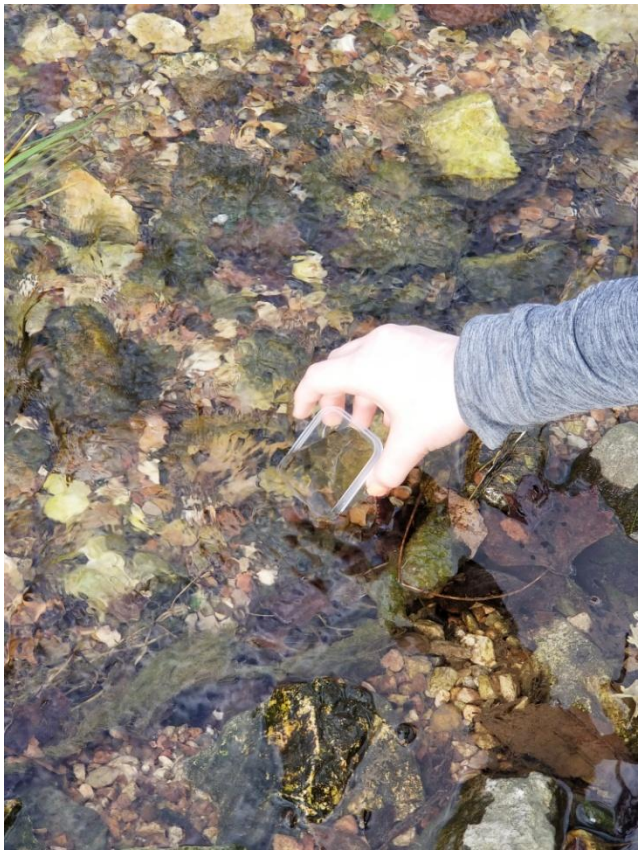


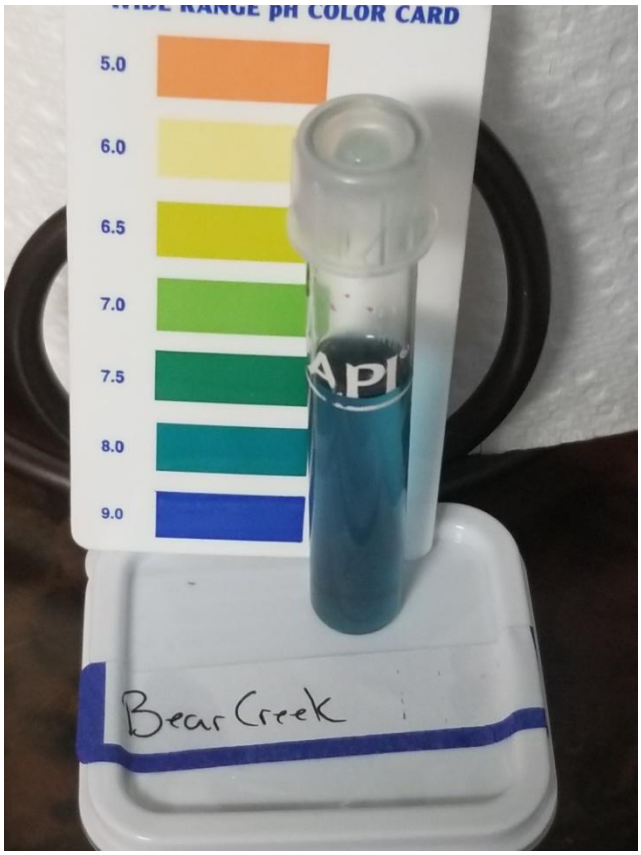
DETAILED METHODS & PROCEDURES:

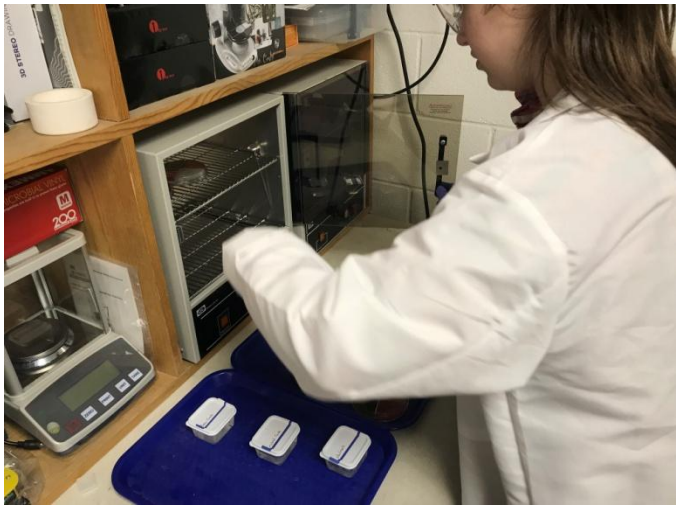
The researcher determined tributaries to be the locations for collecting water samples, BoBo Creek, Long Creek, Bear Creek, Yocum Creek, and Crooked Creek. Following the instructions in the GLOBE protocols for water sampling, the samples were collected in clean sterile plastic containers with lids. Once samples were collected they were analyzed for pH, Nitrates, Phosphates, and Ammonia, using a home-use API chemical test kits for water. Digital electronic meters were used to analyze the water samples for Total Dissolved Solids, Electrical Conductivity, and Temperature. All of the chemical testing, of the water samples, was conducted at home under the direct supervision by a designated supervisor. The researcher was trained by the middle school science teacher for appropriate safety procedures, the collection, testing, and analysis of water samples using the home-use test kit. Testing was conducted on an open counter lab table type setting, and protective clothing, gloves and eye protection were used according to the directions for the home-use water test kit. The designated supervisor disposed of the water samples, once they have been tested according to the directions provided on the home-use API water test kit. All unused chemical reagents, from the water test kits, were placed back into the original container and taken back to the middle school science lab for storage and later use by the middle school science teacher. The sterile water samples were taken to the middle school science lab where the testing for unknown microorganisms was conducted. There, each water sample was slowly be poured from the sterile collection container onto a 4-section agar plate. The water was swirled around for 5 seconds on the agar plate, then poured down the sink drain. The agar plate was also held upside down for 3 seconds, then the lid was placed back on it. The agar plates were then sealed and placed in the incubator in the middle school science lab for 48 hours. After 48 hours the agar plates were taken out and the number of bacteria colonies visible for each were counted for each section. When there was a lot of bacteria, the percentage of bacteria coverage for each section was used. The results for each unknown bacteria section on the agar plate were recorded. All of the testing for unknown microorganisms was conducted in the middle school science lab under the direct supervision of the science teacher/ designated supervisor who is trained in appropriate lab safety procedures and in the collection, culture and decontamination of bacteria samples. The student researcher was properly trained in standard microbiological testing practices. The unknown microorganism were cultured in a plastic 4-section agar plates. During the procedures, the agar plates remained sealed throughout the experiment. The bio-safety risk level is BSL-1, and the designated supervisor conducted the decontamination of the bacteria samples by treating them with a 10% bleach solution chemical disinfectant, and dispose of them according to the school's biohazard materials procedure.

Risk and Safety: Exposure to chemical testing reagents used in testing the chemical composition of the water samples. In order to minimize risk, a designated supervisor instructed the researcher in proper testing techniques to be used in analyzing the water samples. All chemical test for the water samples were conducted, with an API home-use water test kit, under the direct supervision of the designated supervisor. Culturing unknown bacteria samples from water, on agar differentiation plates prepared by the science teacher in order to calculate the average number of bacteria colonies or the percentage of bacteria coverage per sample for each type of unknown bacteria.

Data Analysis: Once the data had been collected it was analyzed by calculating the mean for each of the water compositions tested. Charts and graphs were created to help analyze the data further.




pH COLOR CARD
5.0
6.0
6.5
7.0
7.5
8.0
9.0
Bear Creek

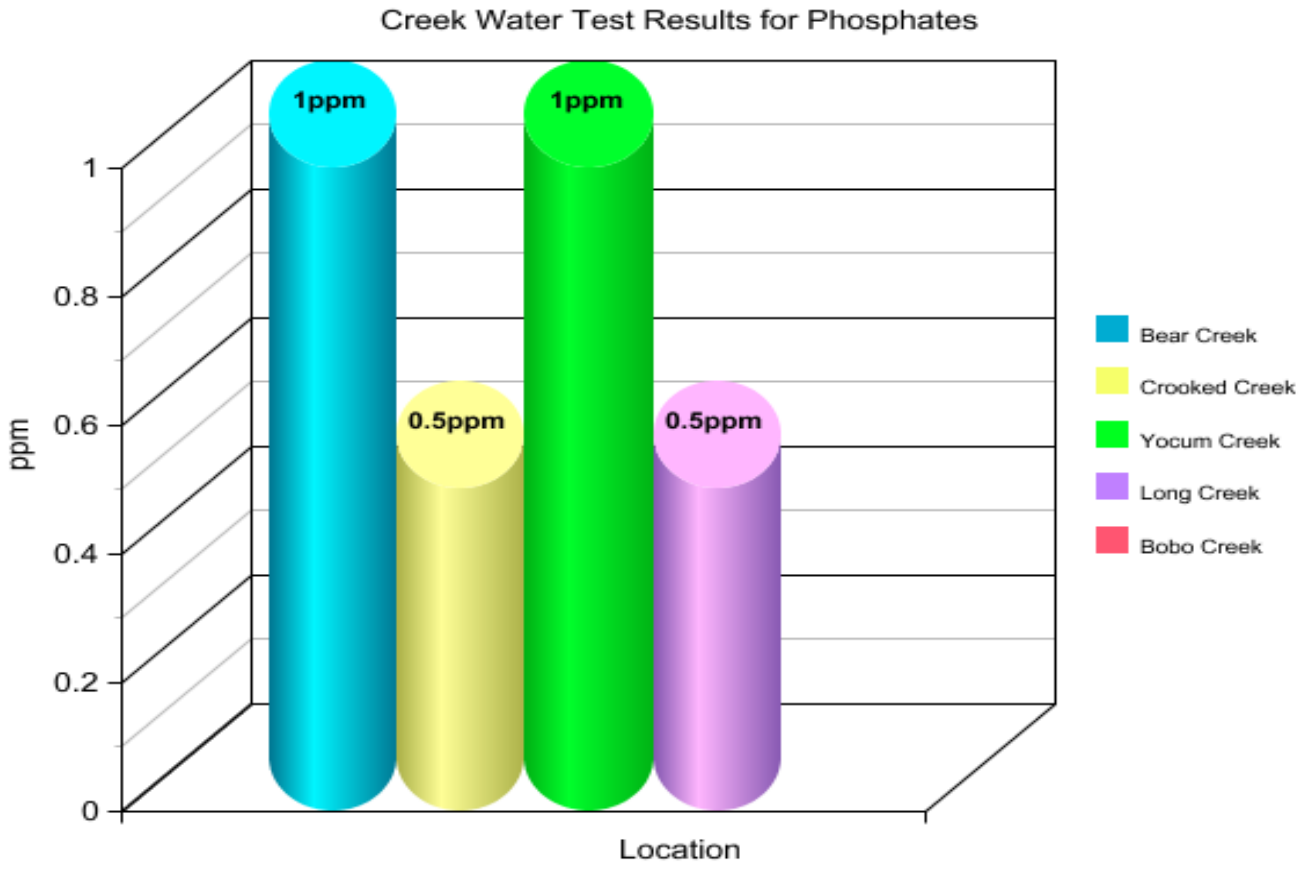


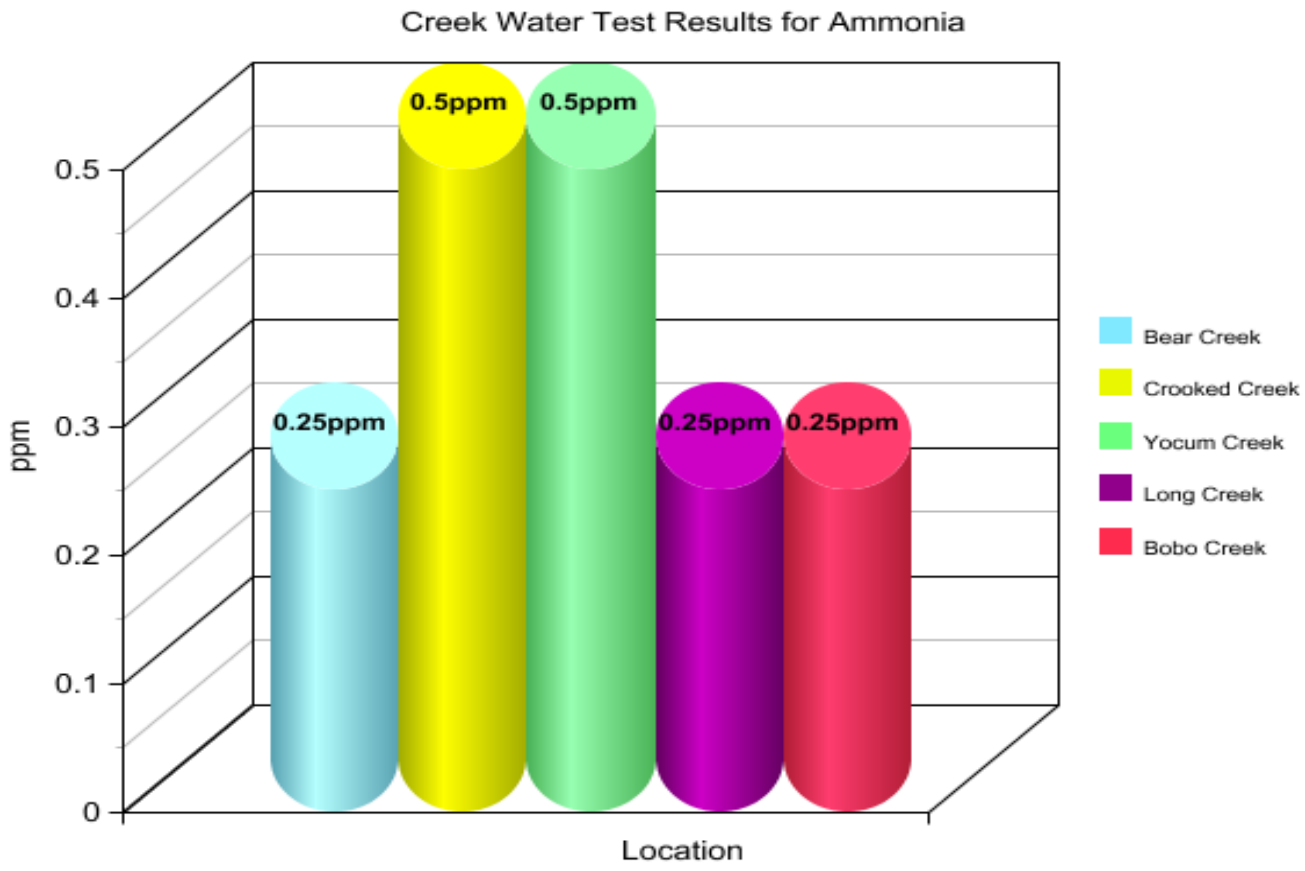
DATA SUMMARY:

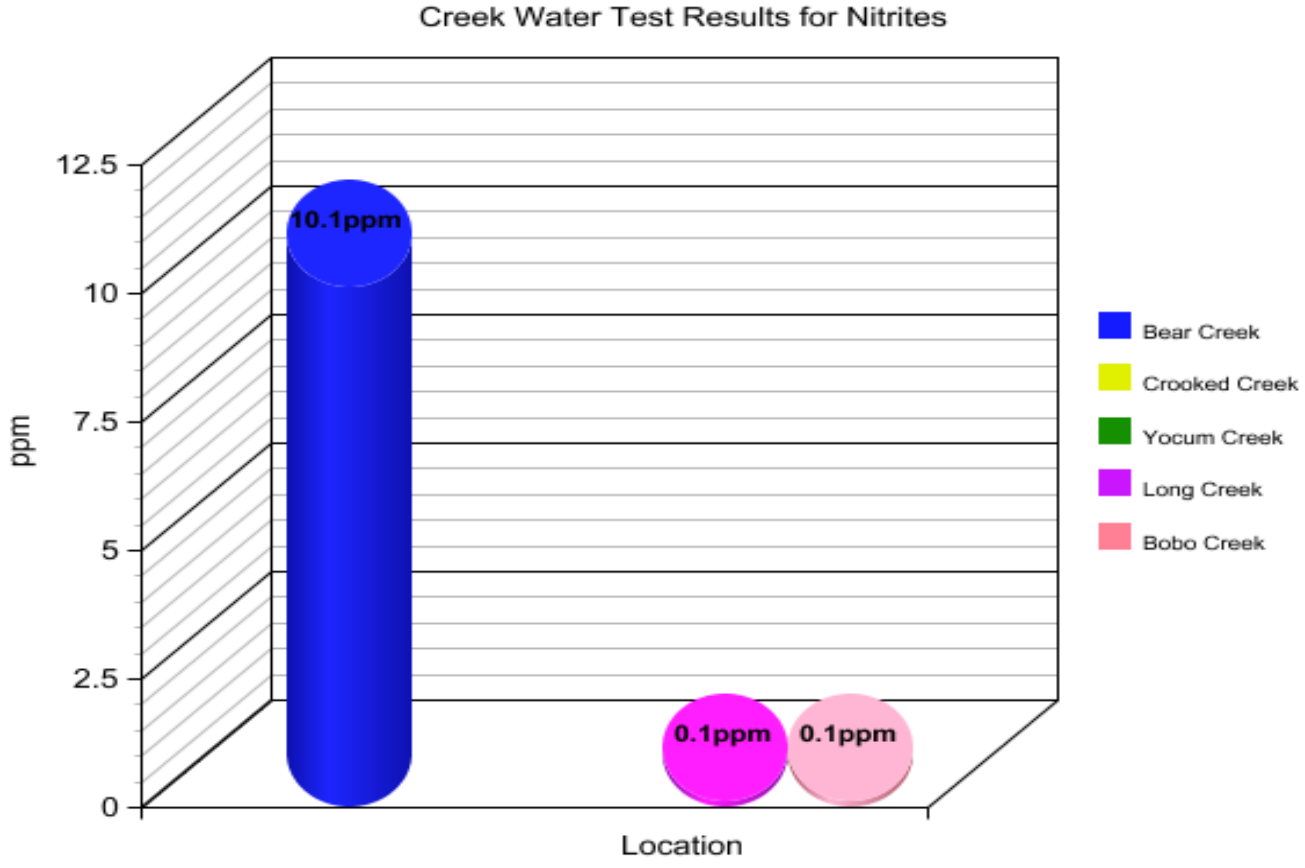
BEAR CREEK: (EC)=394uS/cm, Ammonia=0.25ppm, Nitrite=0.1mg/L, Phosphate=1.0mg/L, (TDS)=175ppm, 27˚C, 8.0pH, negative for staph, e-coli, & salmonella. CROOKED CREEK: (EC)=310uS/cm, Ammonia=0.50ppm, Nitrite=0.0mg/L, Phosphate=0.5mg/L, (TDS)=136ppm, 27˚C, 8.0pH, staph=14 colonies, e-coli=2, no salmonella. YOCUM CREEK: (EC)=380uS/cm, Ammonia=0.50ppm, Nitrite=0.0mg/L, Phosphate=1.0mg/L, (TDS)=174ppm, 27˚C, 7.5pH, staph=30 colonies, e-coli=42, salmonella=58. LONG CREEK: (EC)=180uS/cm, Ammonia=0.25ppm, Nitrite=0.1mg/L, Phosphate=0.5mg/L, (TDS)=91ppm, 26˚C, 7.5pH, staph=89 colonies, e-coli=53, salmonella=48. BOBO CREEK: (EC)=132uS/cm, Ammonia=0.25ppm, Nitrite=0.1mg/L, Phosphate=0.0mg/L, (TDS)=77ppm, 27˚C, 7.0pH, staph=17 colonies, e-coli=1, salmonella=0.

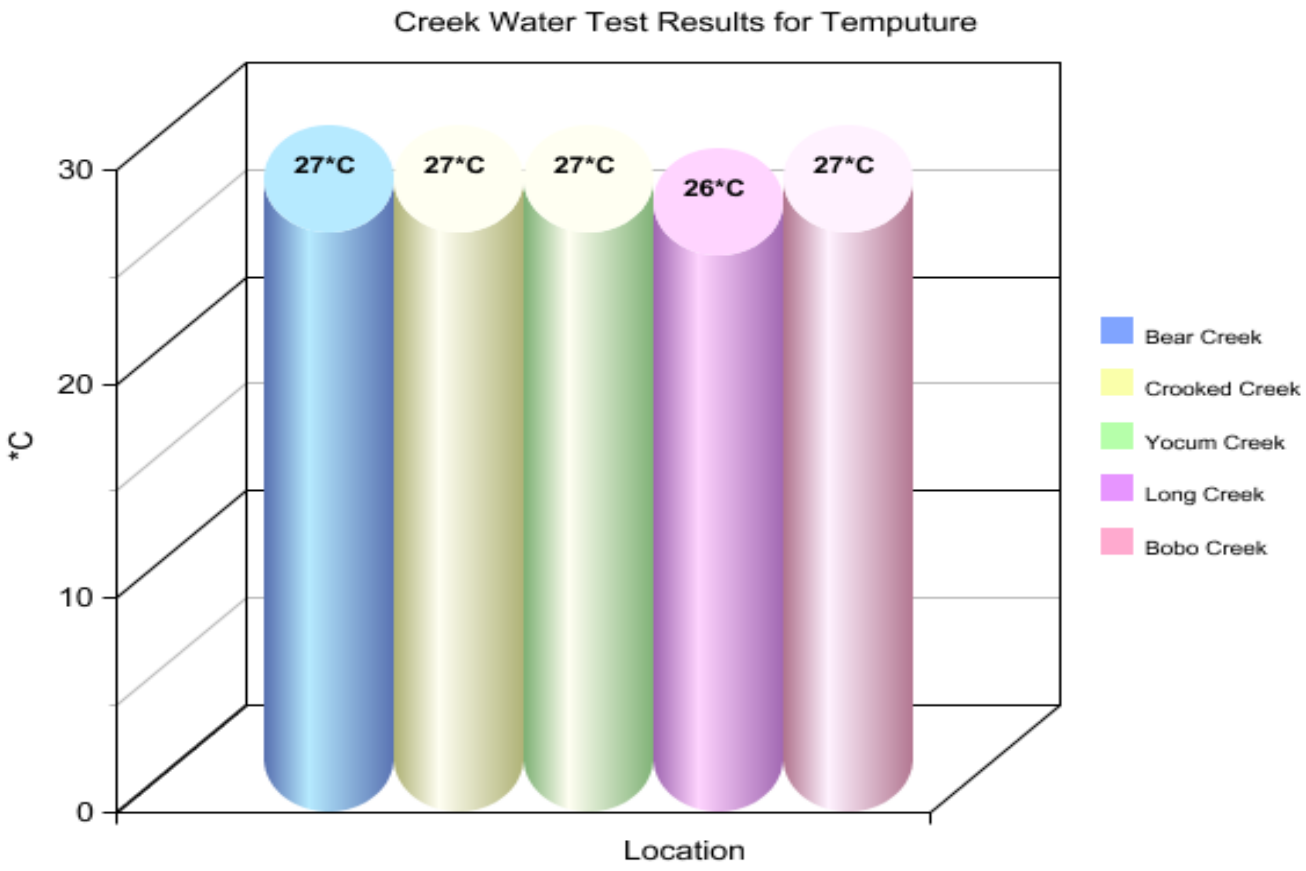
RESULTS:

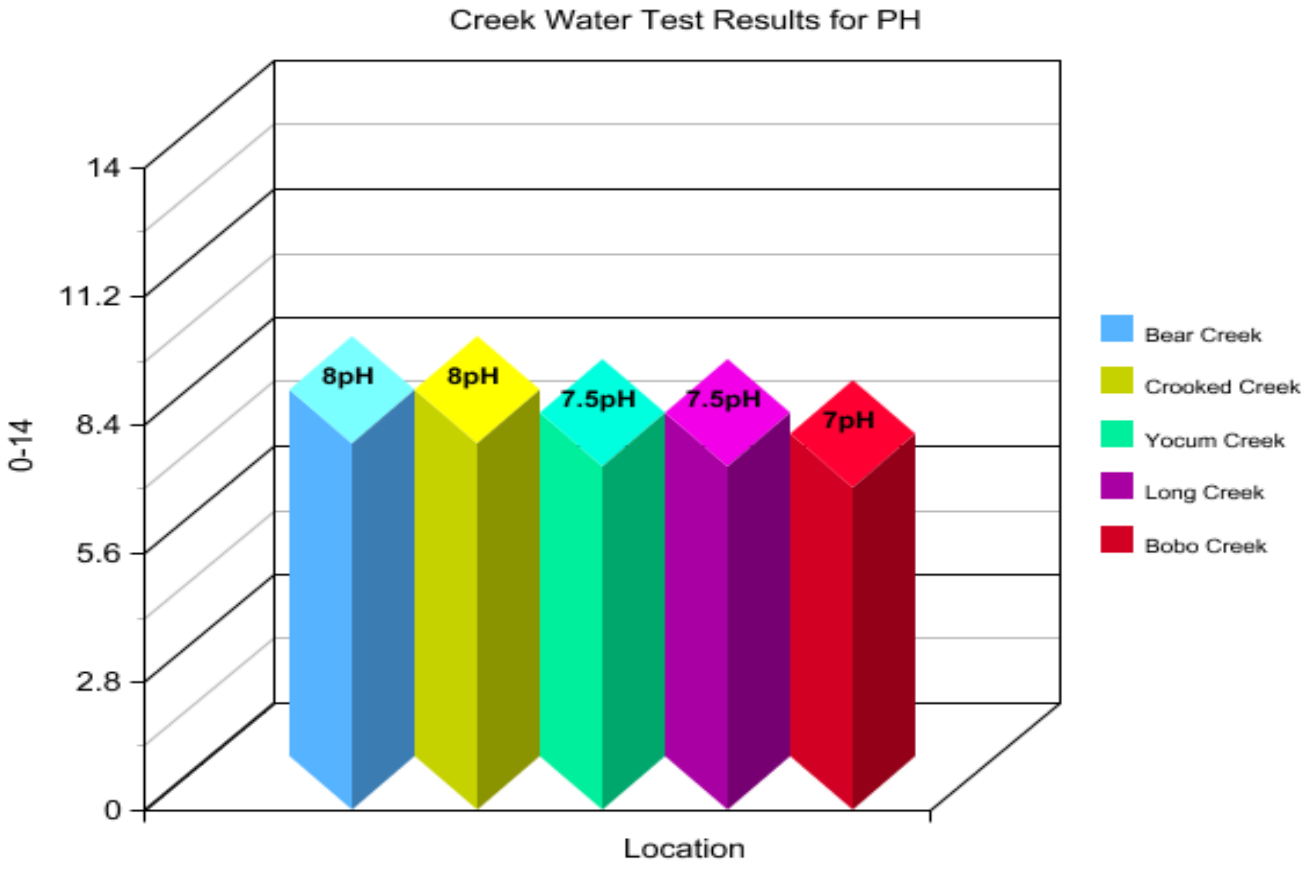
Creek Water Test Results for Unknown Bacteria				
Creek Location	**General Bacteria (% of Coverage)**	**e-Coli Bacteria (# of colonies)**	**Salmonella Bacteria (# of colonies)**	**Staphylococci Bacteria (# of colonies)**
#1	80%	0	0	0
#2	88%	2	0	14
#3	52%	42	58	30
#4	90%	53	48	89
#5	50%	1	0	17

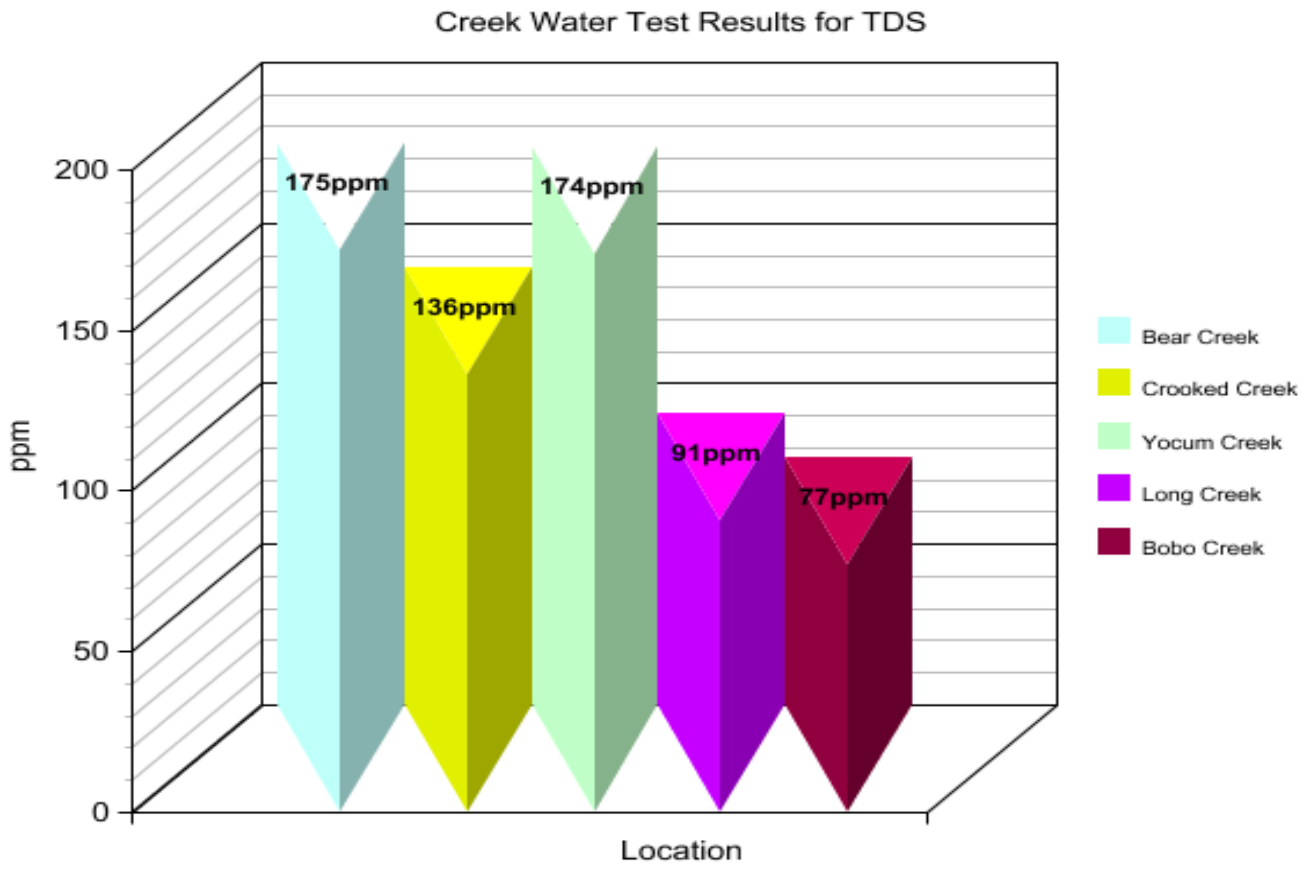


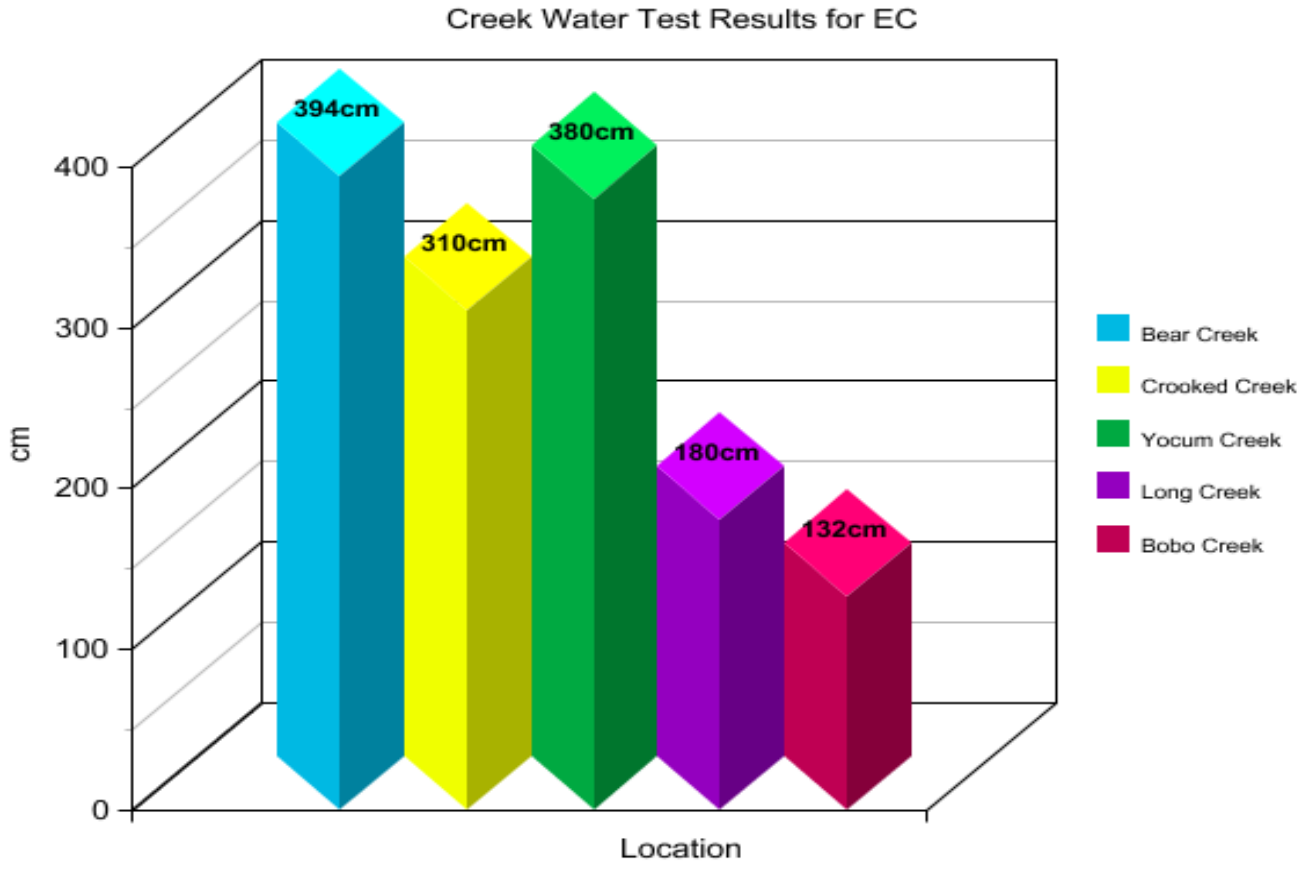

Creek Water Test Results for Ammonia
0.5ppm
0.5ppm
0.25ppm
0.25ppm
0.25ppm
0.5
0.4
0.3
0.2
0.1
0
ppm
Location
Bear Creek
Crooked Creek
Yocum Creek
Long Creek
Bobo Creek


Creek Water Test Results for Nitrites
10.1ppm
0.1ppm
0.1ppm
12.5
10
7.5
5
2.5
0
ppm
Location
Bear Creek
Crooked Creek
Yocum Creek
Long Creek
Bobo Creek


Creek Water Test Results for Temputure
30
20
10
0
*C
27*C
27*C
27*C
26*C
27*C
Location
Bear Creek
Crooked Creek
Yocum Creek
Long Creek
Bobo Creek


Creek Water Test Results for PH
14
11.2
8.4
5.6
2.8
0
0-14
8pH
8pH
7.5pH
7.5pH
7pH
Location
Bear Creek
Crooked Creek
Yocum Creek
Long Creek
Bobo Creek


Creek Water Test Results for TDS
200
150
100
50
0
ppm
175ppm
136ppm
174ppm
91ppm
77ppm
Location
Bear Creek
Crooked Creek
Yocum Creek
Long Creek
Bobo Creek


Creek Water Test Results for EC
400
300
200
100
0
cm
394cm
310cm
380cm
180cm
132cm
Location
Bear Creek
Crooked Creek
Yocum Creek
Long Creek
Bobo Creek

CONCLUSION:

The hypothesis was not supported by the data. The results gave Bear Creek the top choice. It was the only water source which did not test positive for e-coli, salmonella, or staphylococci bacteria. However, all water sources did test positive for some sign of bacteria. If the creeks were ever needed for drinking purposes, it would be recommended to boil water first.

DISCUSSION:

Based on test results and research on performed variable results, Bear, Crooked and Yocum Creeks tested drinkable for all seven test performed. BoBo and Long Creeks tested drinkable for all test, excluding Electric Conductivity. Crooked Creek would be the top choice as far as test results performed during this project. Due to only testing seven variables, if the seven tributaries were needed for drinking purposes, it would be recommended to boil the water first to get rid of any bacteria that may exist. To further explore this project idea, the researcher could possibly test the same tributaries at different times through the year or at multiple point along the same tributary to see if there is a difference. Also testing and comparing results of ponds, lakes, wells, springs, and rain water to see if there is a difference in multiple naturally according fresh water sources.

ACKNOWLEDGEMENT:

The researcher was assisted in her project by her parents who took her around to collect the water samples and monitored as she conducted the chemical testing of the samples. The researcher's teacher, Mr. Rose, instructed the student in conducting the bacteria testing of the water samples and supervised the testing in the science lab. Mr. Rose also taught the researcher how to use the computer program to create the graphs for the project.

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