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Third Herring Brook Watershed

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Norwell High School, Norwell, Massachusetts (2004). *Third Herring Brook Watershed*. In Watershed Access Lab Projects. Project 14.
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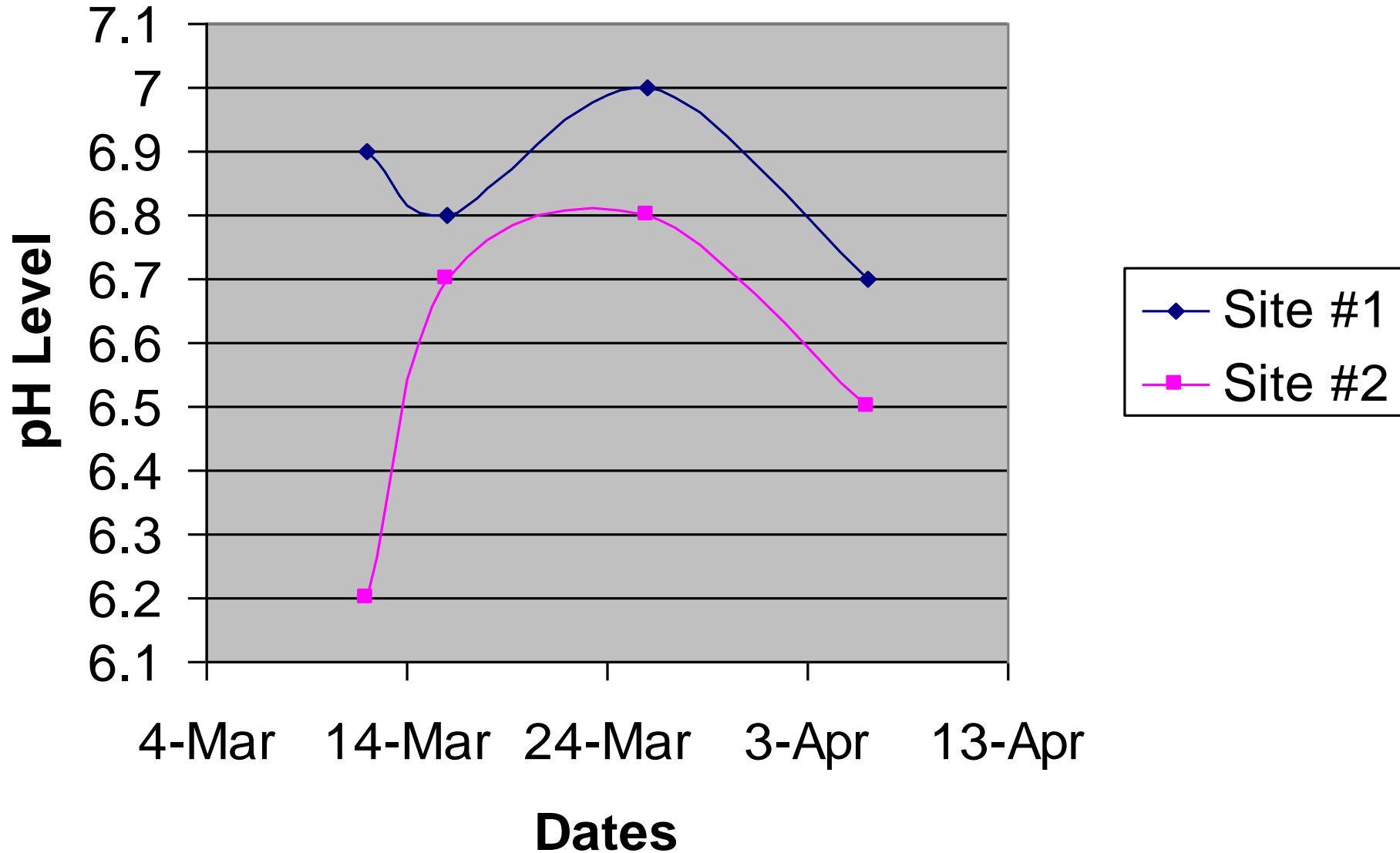
Third Herring Brook Watershed

By: Peter Merzbacher, Michelle
Macheras, Chris Riihimaki, Dan
Greene, Devan Dolabany, & Marissa
Dalferro

Procedure for collecting pH and temperature data

- The Pasco probes used were calibrated ahead of time.
- Several times we visited 2 different sites in the watershed and collected data.
- To collect the data for temperature and pH levels, we put the probes in the water for 30 seconds and waited for them to level off.
- The data collected was recorded in a journal.

pH Levels of Third Herring Brook



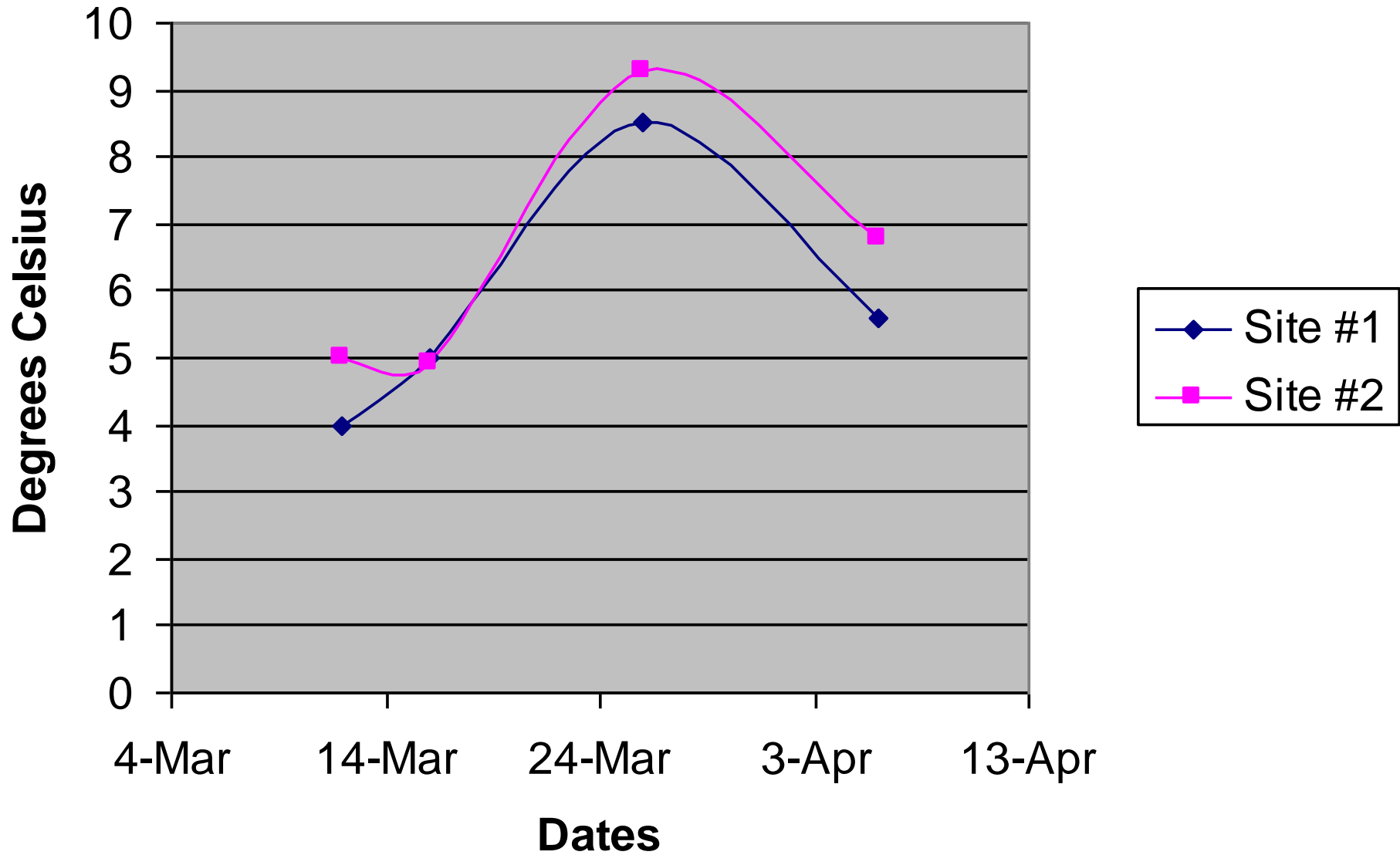
pH

- pH is the degree of a solution's acidity
- The water molecule (H_2O) breaks apart to form Hydrogen molecules (H^+) and Hydroxide molecules (OH^-).
- Neutral water - water with equal concentration of Hydrogen and Hydroxide (pH is 7)
- Acidic water - water with a higher concentration of Hydrogen than Hydroxide (pH lower than 7)
- Basic water- water with a higher concentration of Hydroxide than Hydrogen (pH higher than 7)

What affects pH? What does pH affect?

- pH levels are easily changed by chemical pollution.
- Soil pH levels affect the water because the water runs through soil with varying pH levels.
- The plants in the watershed are affected by the pH level of the soil because they absorb different nutrients depending on the pH of the soil.
- Low pH- plants absorb toxic concentrations of nutrients including aluminum and manganese which become more soluble
- High pH- mineral salts necessary for plant growth become less soluble and can't be absorbed by the plants.

Temperature for Third Herring Brook



What affects temperature?

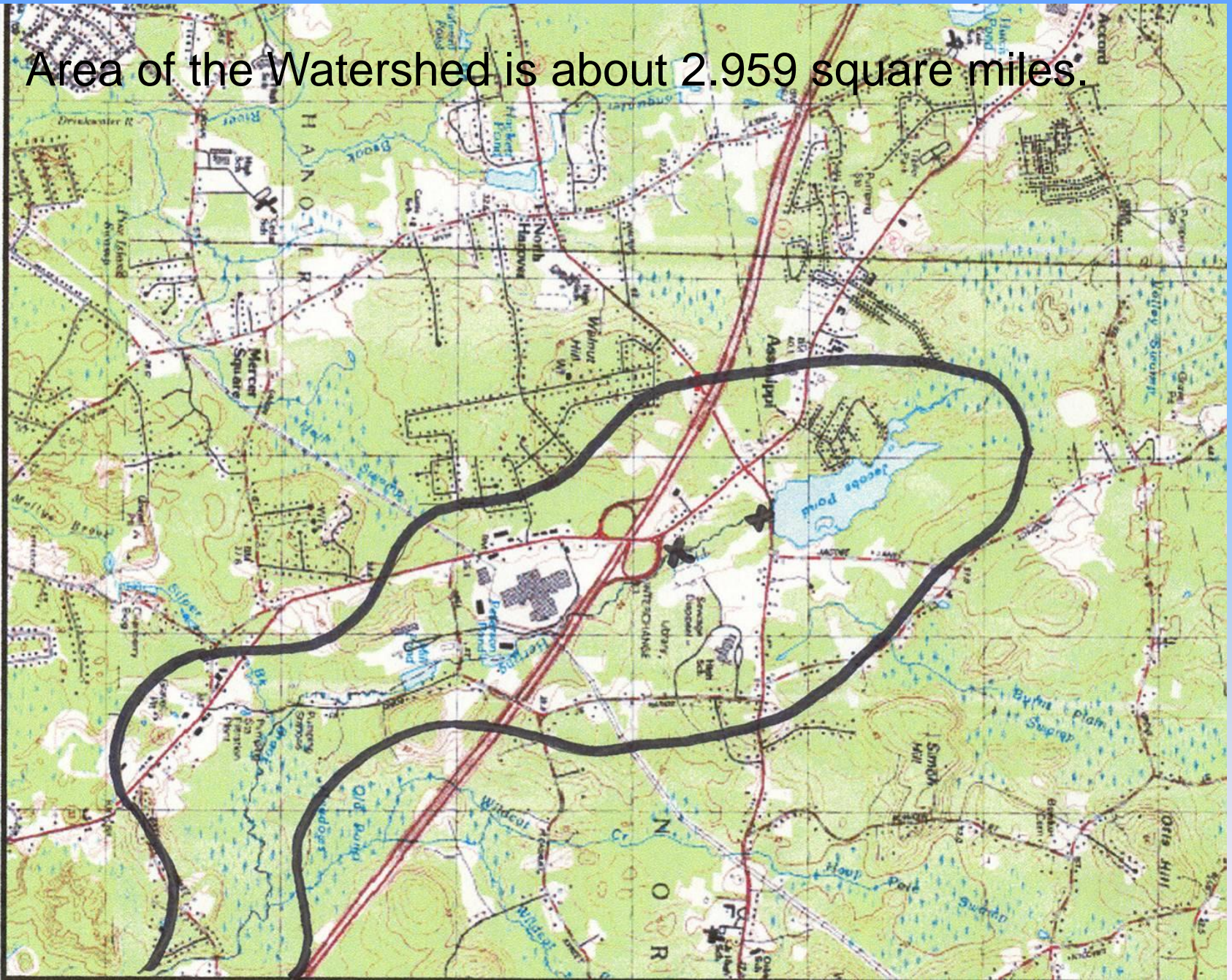
- Heat-total amount of kinetic energy
- Temperature-average of all of the kinetic energy
- Specific heat-amount of energy needed to raise 1 gram of water 1 degree Celsius (measured in calories)
- Water has a high specific heat because the strong hydrogen bonds need to be broken
- Temperature affects the dissolved oxygen level
- Temp is controlled mainly by the season or time of day or the climate in general.

What does temperature affect?

- Long term changes in temperature can affect the organisms living in the water
- Thermal pollution occurs in lakes and streams
- It is caused by unseasonably warm or cold water
- Caused by: impoundments (dams), discharge of hot water (cooling operations), urban storm water, or warm or cold ground water.

Basic Outline of Third Herring Brook Watershed

Area of the Watershed is about 2.959 square miles.



Physical Characteristics of Third Herring Brook

Site #1

- Near culvert
- Surrounded by trees
- Rapidly flowing water
- Rocky bottom
- Near a main road
- Near a mall
- Upstream of Site #2

Site #2

- Next to a highway
- Gravel bottom
- Surrounded by lots of trees
- 1 rapid
- Shallower than Site #1

Fecal Coliform Analysis of Third Herring Brook

By:

Chris Riihimaki & Dan Greene

What is Fecal Coliform?

- Fecal coliform are microorganisms that live in the gut of warm blooded animals and their fecal matter.
- They aid in the digestion of food.
- They grow best in high temperatures with abundant sources of food.
- The primary sources for fecal coliform are sewage treatment facilities, faulty septic systems, and animal waste.
- The most common type of fecal coliform bacteria are *Escherichia coli*.

Humans and Fecal Coliform

- If there is presence of fecal coliform in the water, it has been contaminated. The primary sources for this are sewage treatment facilities, faulty septic systems and animal waste.
- When these are found, there is a possibility that the water has been contaminated by a disease causing bacteria or virus which can exist in fecal matter.
- There are potential health risks for people exposed to the contaminated water.
- Some diseases caused by these pathogens are gastroenteritis caused by bacteria.
- So the presence of fecal coliform organisms, should send off a warning signal for health officials and the problem should be taken care immediately.

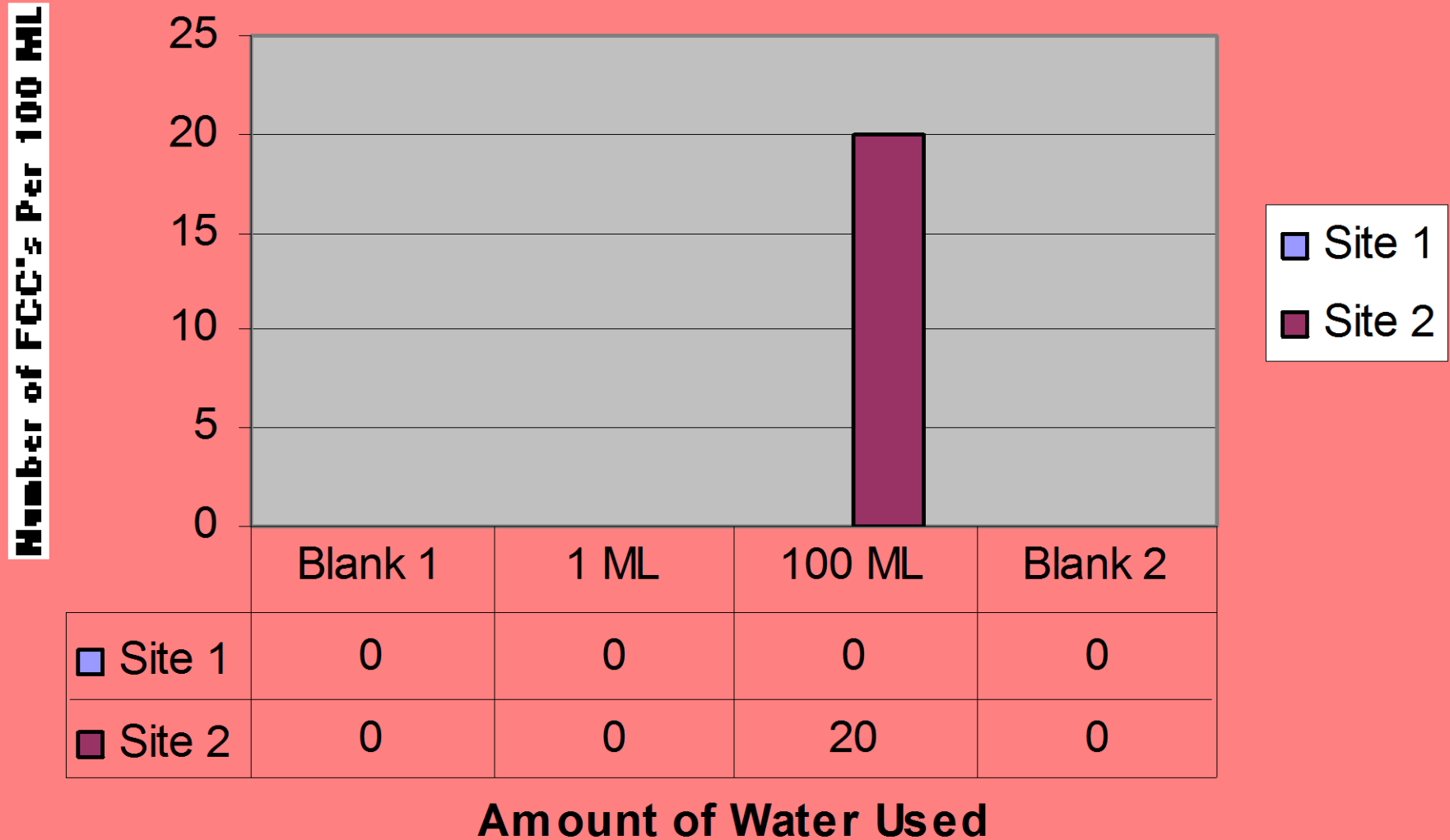
Acceptable Levels of Fecal Coliform Colonies

- According to the Massachusetts Department of Environmental Protection (MADEP), the limit of the amount of fecal coliform colonies per 100ml is less than 200, with no more than 10% of the samples containing more than 400 colonies.
- The fresh water standards for Rhode Island state that fecal coliform colonies (fcc's) cannot exceed 200 colonies per 100ml.

Procedure

- ❖ First, we collected a sample from each site.
- ❖ Then, we ran the samples through a filter at various amounts of water. They were 1 ml and 10 ml.
- ❖ The filter captured any fecal bacteria that was in the water.
- ❖ Then, the filters were placed in petri dishes that contained a media that is excellent for growing fecal bacteria.
- ❖ Then, the petri dishes were placed in a water-type incubator that was specifically designed for fecal coliform growth. The temperature was set at 44.5 degrees Celsius.
- ❖ After approximately 24 hours, the dishes were removed and we counted the number of colonies per dish
- ❖ All tools and lab equipment were sterilized.

Amount of FCC's



Conclusions

From our findings, we have concluded that Third Herring Brook passes the state regulation for amount of fecal coliform in water. We have also found that third herring brook is being contaminated between the two sites. This brook, even though it passes the state regulation, may contain harmful bacteria or viruses that live in fecal matter. So, we do not recommend drinking, or swimming in this water.

The water has most likely been contaminated by faulty septic systems/leaching pools used for the stores in the area. It also may have been contaminated by animals living in the area. We recommend that the stores check their septic systems for any problems.

Analysis of Fecal Coliform

There are some problems with the data that we might have been able to fix. We extrapolated the data from our 10ml sample to find out how many colonies there would be in 100ml of water. This extrapolated amount could be faulty. So, we should have used 100 ml from the start. Also, we only used one sample per site for our data. This is a problem because it does not provide enough information to draw concrete conclusions. We should have taken a sample from each site more often. The data may not be accurate due to contamination of the filter by human error.

Health Risks from Nitrates

- Methemoglobinemia is like a slow suffocation in infants
- If the baby (under 6 months) consumes for than 10 milligrams per liter
- The nitrites enter the child's stomach and binds with hemoglobin, changing it to methemoglobin
- This affects the blood's ability to carry oxygen to its tissues
- This occurrence is rare and rarely fatal
- High nitrate levels consumed by pregnant women are also linked with birth defects
- Studies have shown that high levels of nitrates are also linked with gastrointestinal cancer
- The possibly combination of amines in the body and N-nitroso is however a controversial association

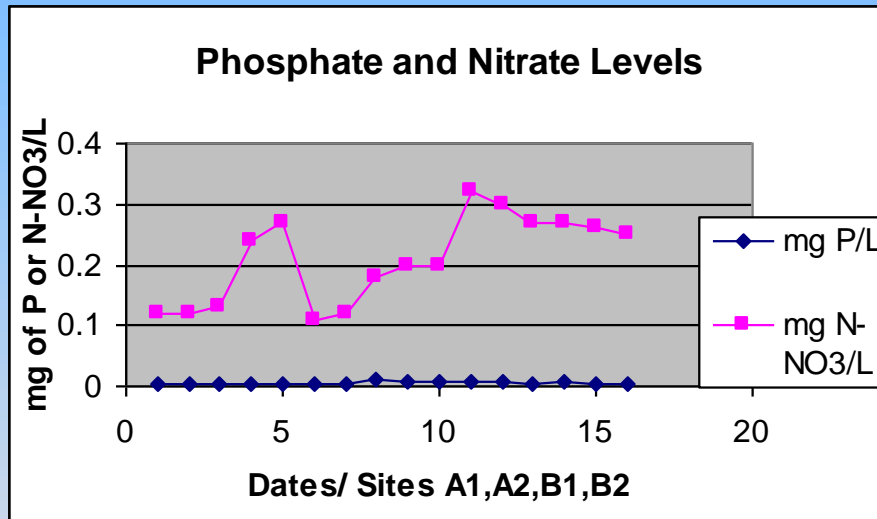
Sources of Nitrates

- Nitrates are a nitrogen/oxygen compound that naturally occurs in low concentrations of ground water
- The vast majority of nitrates in the diet is from cured meats, spinach, lettuce, beets, and carrots
- The recommended level of nitrates in drinking water is 10 milligrams per liter

Phosphates

- Phosphates are an important water quality factor
- Enter the water supply from household detergents and fertilizers
- High phosphate levels in warm water can cause an algae bloom
- Phosphates are made of phosphorus
- Phosphorus is a plant nutrient needed for growth and a fundamental element in the metabolic reactions of plants and animals

Phosphate and Nitrate Levels



Sample ID	mg P/L	mg N-NO3/L
A1 3/23	0.004	0.12
A1 3/23	0.004	0.12
A2 3/23	0.004	0.13
B1 3/23	0.005	0.24
B2 3/23	0.004	0.27
A1 3/26	0.005	0.11
A1 3/26	0.005	0.12
A2 3/26	0.013	0.18
B1 3/26	0.007	0.2
B2 3/26	0.007	0.2
A1 4/2	0.006	0.32
A2 4/2	0.006	0.3
A2 4/2	0.004	0.27
B1 4/2	0.006	0.27
B2 4/2	0.005	0.26
B2 4/2	0.005	0.25

What Are Nitrates

- Derived from nitrogen
- When it enters the soil, it is converted to nitrates by microorganisms
- Usually most important for determining water quality
- Levels of nitrates increase in the decomposition of plant and animal materials
- Normally only small amounts are found in water
- Levels can increase with septic systems, fertilizer runoff, and improperly treated wastewater
- Can be found in the human waste.

Can Nitrates Affect Humans

- People who have well water need to monitor their nitrate levels
- Consumed water that is high in nitrates can affect the individuals red blood cells to carry oxygen
- An infant who has consumed the water may appear bluish due to lack of oxygen
- The high levels of nitrates in water are mostly due to careless human tendencies

Can Nitrates Affect Water Quality

- The presence of nitrates usually does not have an effect on aquatic insects or fish
- However, excess levels of it can prove to be a problem
- The level of nitrites affects the rate at which algae grows
- Large amounts of algae can affect the levels of dissolved oxygen
- By day, the large amounts of algae will produce a lot of oxygen
- But at night, dissolved oxygen levels greatly decrease due to the fact of large numbers of oxygen consuming bacteria feeding on dead or decaying algae and other plants

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