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### The Quequechan River Project: A Study of the Effects of Burying a River Underground

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## The Quequechan River Project



A Study Of The Effects Of Burying A  
River Underground

Hello! Our project is about the Quequechan River, how the river has been abused, what its current condition is, and what is being done to save it.

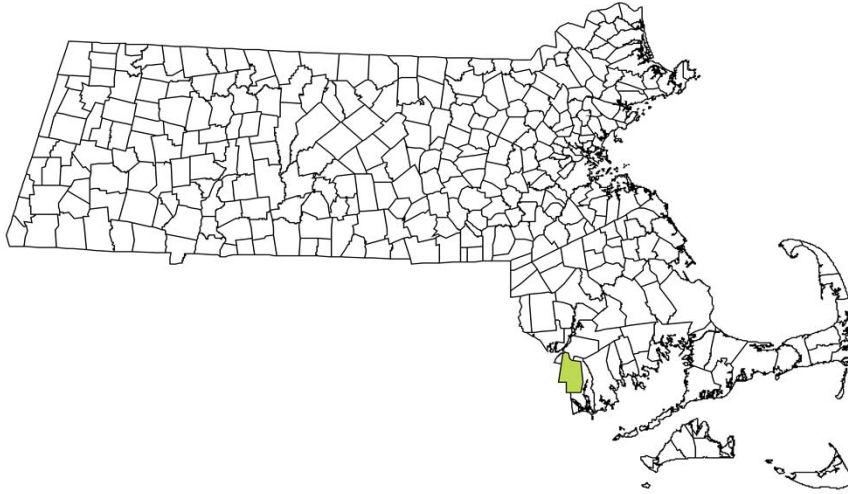
## The Kuss Middle Team



Here are a few of our hard working Kuss Middle School Environmental Club members: Jamie and Sarah are the tall ones in back. Mike, Tyshell, Brittney, and Christina are in front.

## Fall River in Massachusetts

Fall River is located in  
the southwest corner of  
the Massachusetts  
south coast.



Fall River is located in the southwest corner of the  
Massachusetts south coast.

## Fall River from above

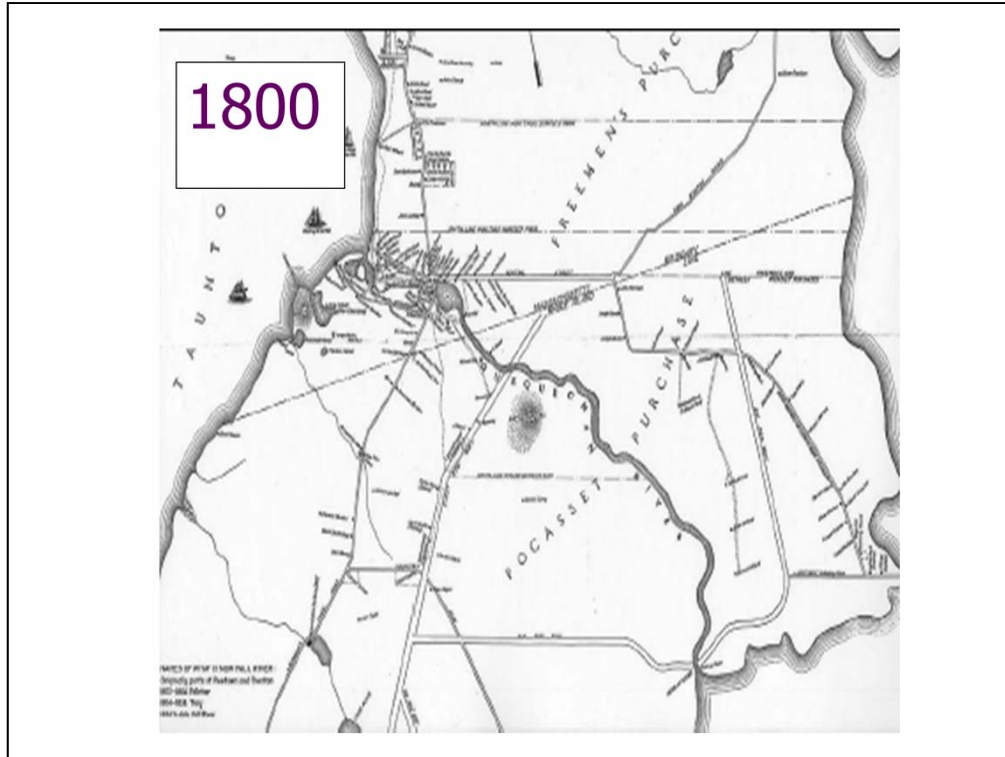


The Quequechan River runs through the heart of Fall River, flowing from the Watuppa Pond at the top left of the picture, underneath route 195, underneath city hall, until it is about 3 miles from the pond, when it flows down to Battleship Cove and the Taunton River at the bottom right of the picture.

## The Falls

The Quequechan once culminated in a spectacular series of waterfalls that cascaded a total of 132 feet before the river flowed into the Taunton river.

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As late as 1800, the Quequechan still had the look of a river. (The river flows up and to the left in this map, from the Watuppa Pond to the Taunton River).

## Mills along the river



The young city grew up along the river, and Quequechan's power provided the energy to run the textile mills built along the river's edge. At the time of the civil war, Fall River was the largest textile producing city in the country. Unfortunately, with the advent of steam power, the river was increasingly ignored. It soon became nothing more than a dump for the mills that lined the river's shores. Few objected when it was covered over by a growing city!



## The Culvert



As new sources of energy were found, and the mills no longer relied upon the river for power, the beautiful river and its spectacular falls were forced underneath the city until it re-emerges near the Taunton River. Here is a culvert where the river is forced to travel underground.

## Quequechan "Pond"

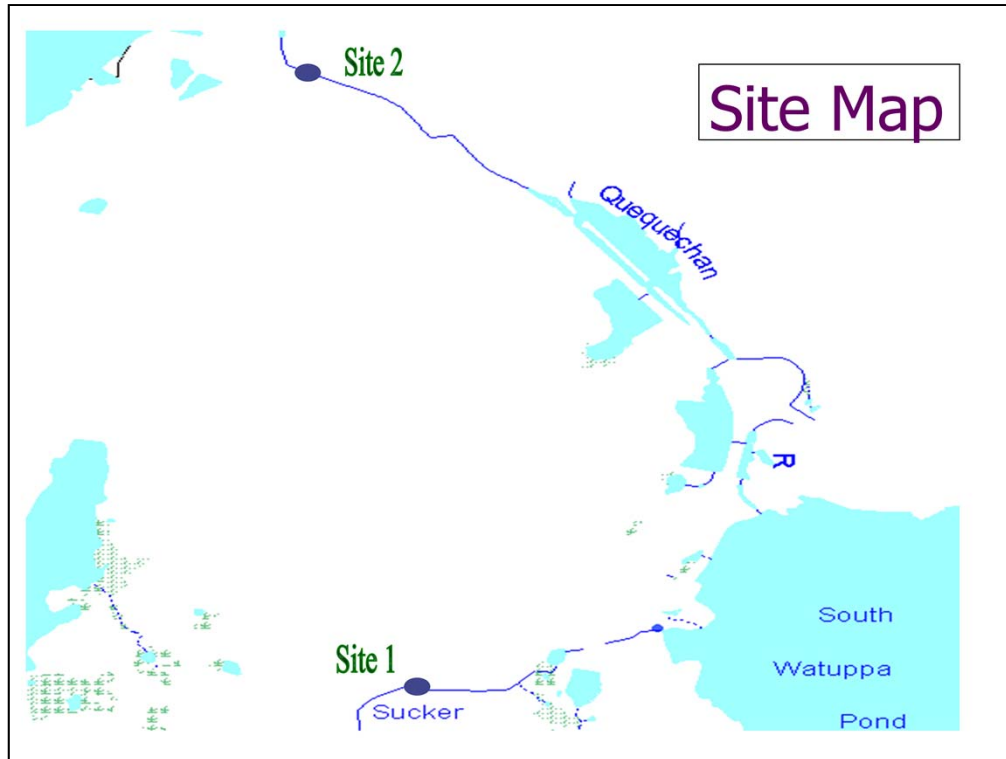


In front of the culvert there is almost no current flow, making it impossible for us to select a site upstream to study. We had to select a site that flows into Watuppa pond near the head of the Quequechan. In the distance you can see the highway and the mills that once got their power from the river.

## Emerging River



Here the river emerges from underneath a textile mill in downtown Fall River. The supports for highway ramps and the Braga Bridge are decorated with graffiti.



Here you can see our first site at Sucker Brook near the bottom of the screen. The brook is located outside of Fall River in a rural area. It flows into Watuppa Pond near the head of the Quequechan River. Our second site is located at the top of the screen. It is below the city's center where the river emerges from underground.

## Our Question

- ◆ What effect does flowing through the center of Fall River have on the water quality of the Quequechan River?

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## Current Conditions



What is the current state of the Quequechan?

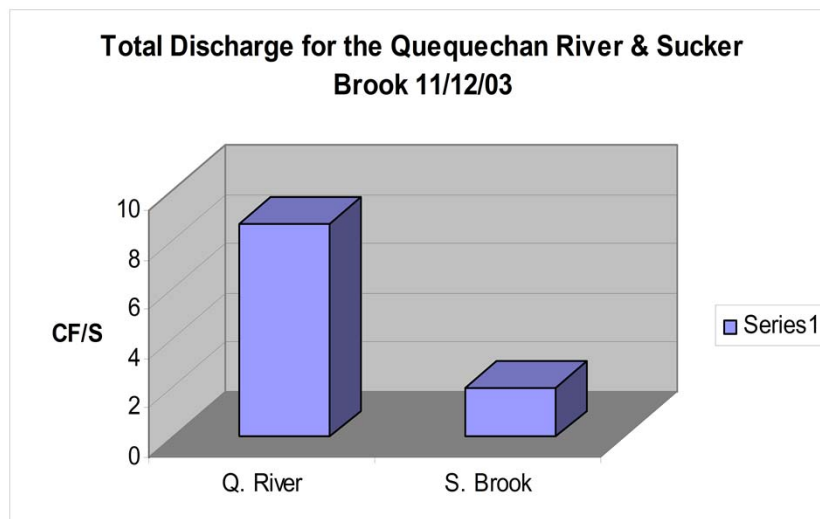
## Determining Flow



Evan, Sarah, and John collect flow data.



## Total Discharge

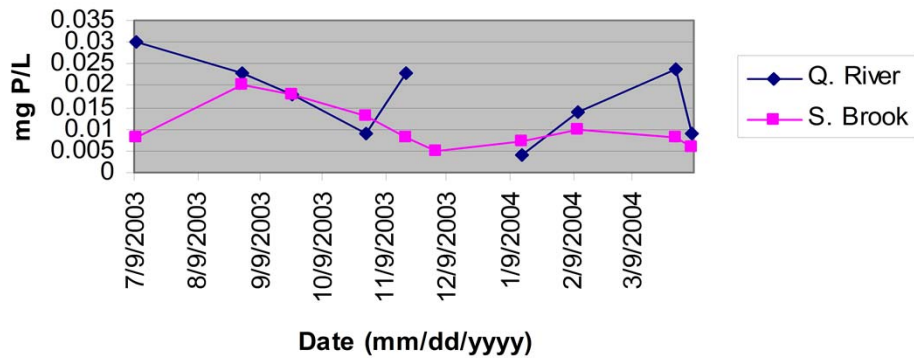


The total Discharge for the Quequechan River was 8.7 cubic feet of water per second. Total discharge for Sucker Brook was only 2 cfs. (You may remember that we measured the flow of the Q. River and S. Brook during a dry period. Measuring flow at such a time is not a normal flow and could skew our discharge and nutrient load.)



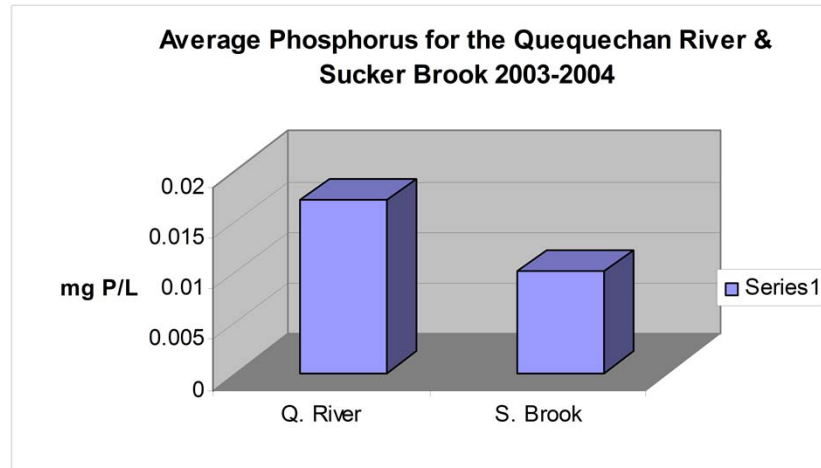
## Dissolved Phosphorus 7/03-4/04

Phosphorus at the Quequechan River & Sucker  
Brook 2003-2004



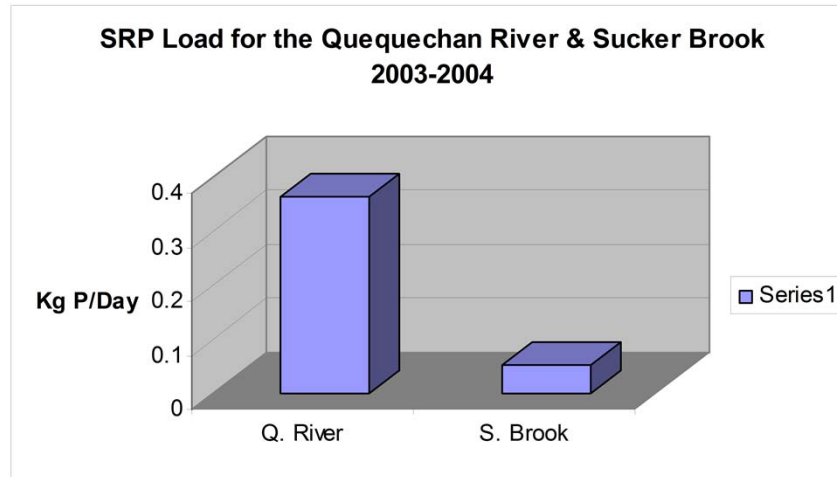
The level of dissolved Phosphorus in both the Quequechan and Sucker brook was generally low. But there were three spikes in the Q. River in July and Nov and March.

## Average Dissolved Phosphorus Levels 7/03-4/04



Average dissolved phosphorus levels were slightly higher at the Quequechan River than they were for the same time period at Sucker Brook.

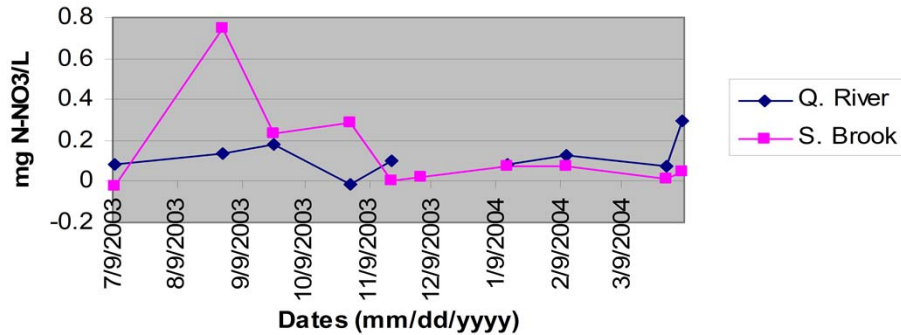
## Phosphorus Load 2003-2004



The Quequechan River carried a larger load of phosphorus because it had a much larger total discharge of water and a greater average concentration of dissolved Phosphorus.

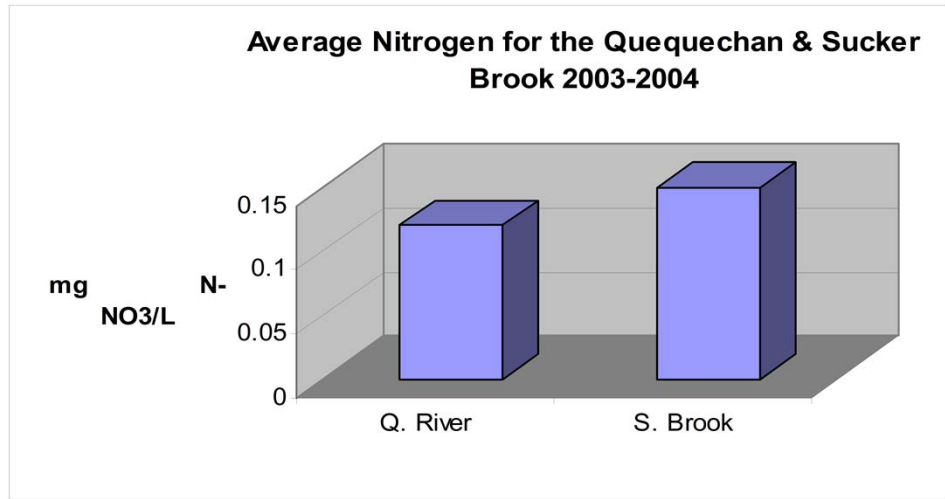
## Nitrogen Concentrations 7/03-4/04

Nitrogen at the Quequechan River & Sucker Brook  
2003-2004



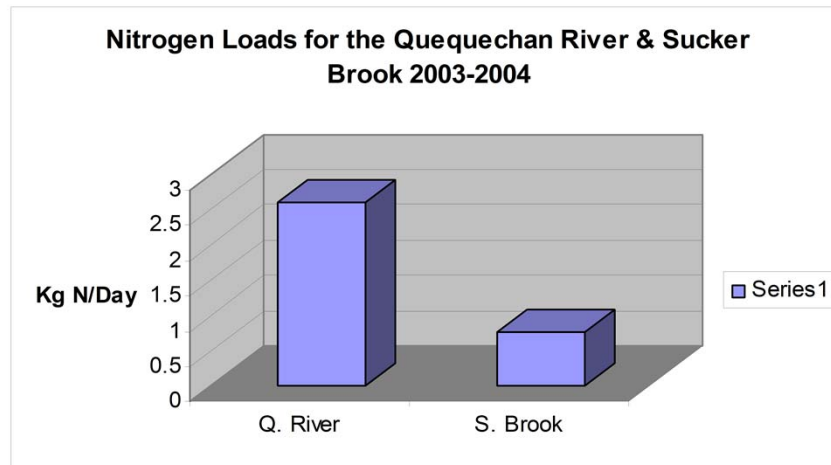
Once again this year, Sucker Brook had high nitrogen levels in Aug. then it dropped down to more acceptable levels by Sept.. This high level in Aug. may indicate septic tank overflow from summer cottages around a pond located above the sample site.

## Average Nitrogen Levels 7/03-4/04



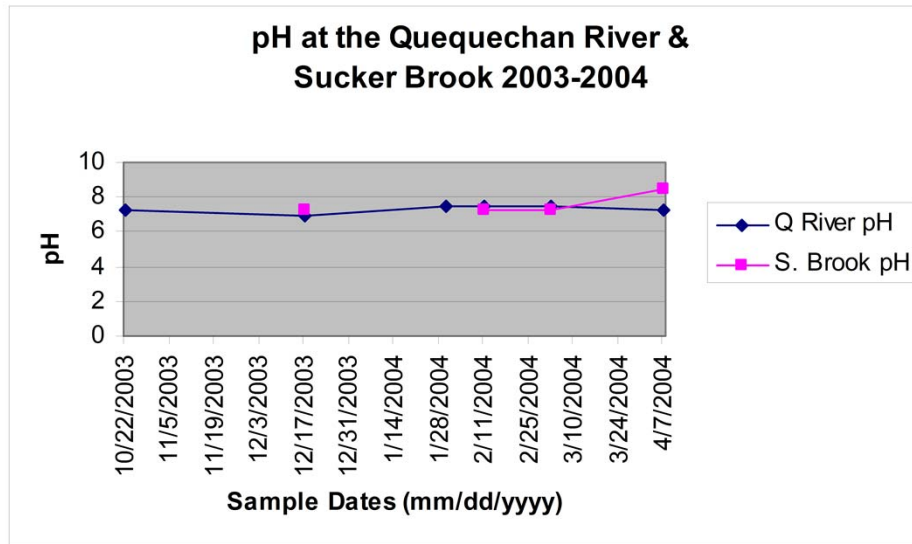
Concentration levels of nitrogen were higher at Sucker Brook than they were over the same time period at the Quequechan River mainly due to the high summer concentrations at the brook.

## Nitrogen Load



The nitrogen load is much greater for the Quequechan River even though its ave. % concentration was less than Sucker Brook's because the river's higher discharge of water. (Load #'s are based on the flow data we gathered on 10/12/03 at Q. river & 11/19/03 at S. brook).

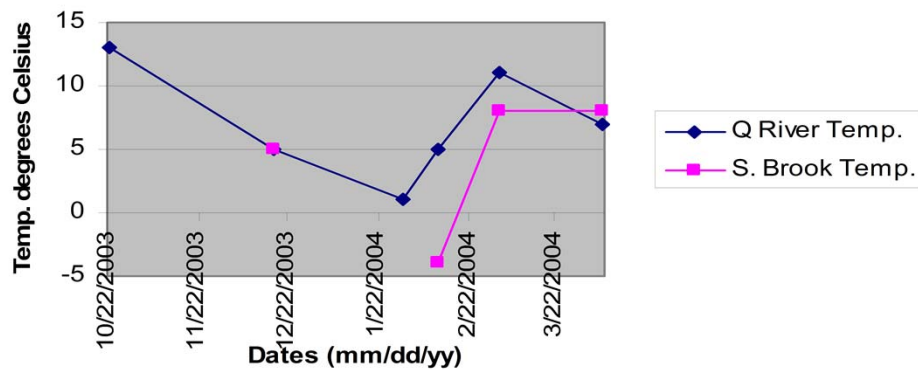
## pH 10/22/03-4/7/04



Both the Quequechan River and Sucker Brook had slightly Alkaline pH readings. (We recalibrated our pH meter every time we used it, but perhaps we should have crosschecked our data with a chemical pH test).

## Temperature 10/22/03-3/22/04

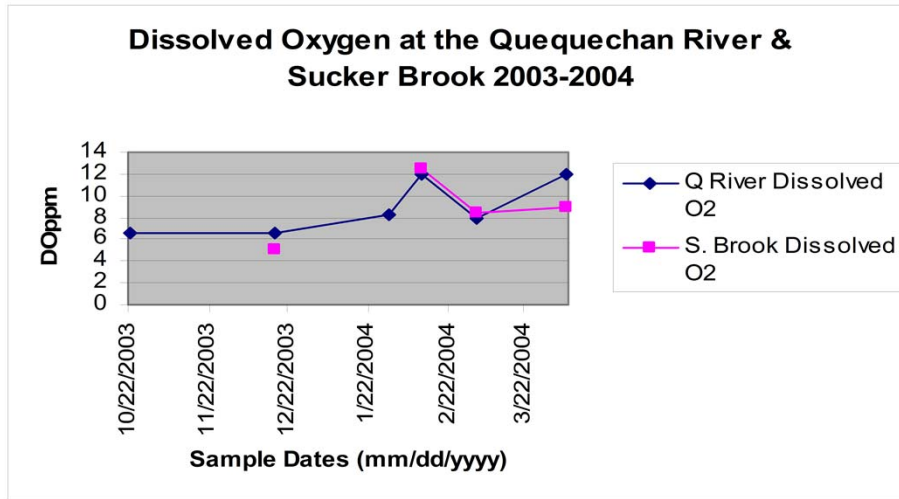
**Temperatures at the Quequechan River &  
Sucker Brook 2003-2004**



The average temperature was 7 degrees Celsius for the Q. River and 4.25 degrees Celsius for Sucker Brook. (The pond-like part of the Q. river above the culvert probably heats up the Q. river more than S. brook which would make the brook water colder).

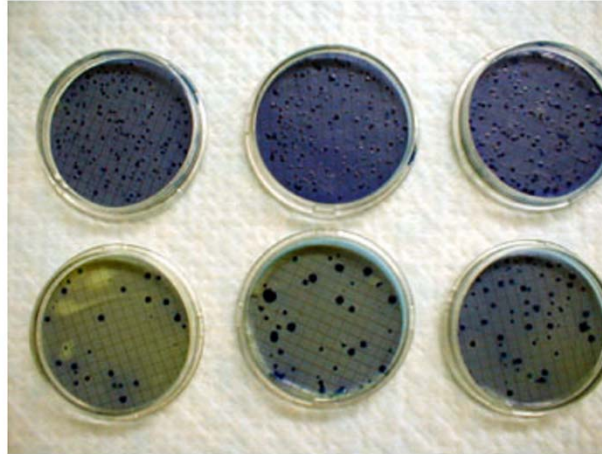


## Dissolved Oxygen 10/22/03-3/22/04



The average dissolved oxygen was 8.9 parts per million for the Quequechan River, and 8.8 ppm for Sucker Brook.

## Fecal Coliform Bacterial Growth 3/17/04

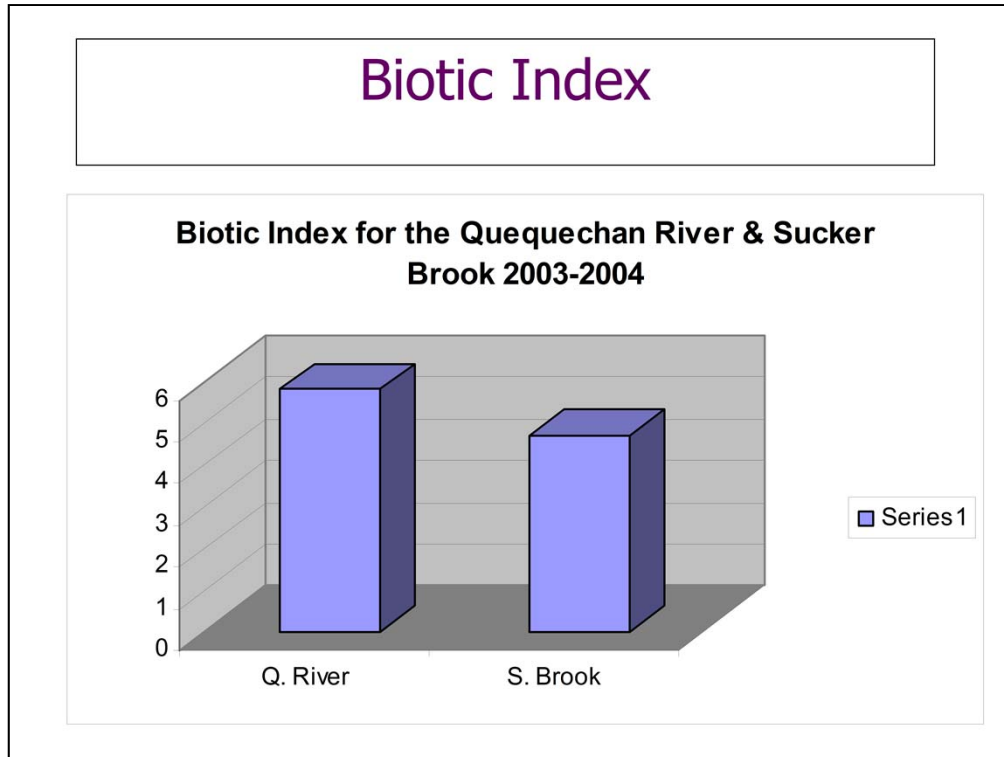


While the results for fecal coliform bacteria at Sucker Brook were negative, we had an average of 9000 to 11,500 colonies in a 100 milliliter sample from the lower (under the Braga Bridge) Quequechan River!

## Collecting Macroinvertebrates



Here Sarah, Mike, and Jamie collect some bugs!



Sucker Brook had a biotic index of 4.7 indicating that it was a moderately impacted stream. The Quequechan River had an index of 5.8 indicating that it was a moderately impaired river. (The lower the index number, the healthier the river is. A index of 6.5 or more shows a severely damaged river because the animals living there a tolerant of pollution. 3.76-6.50 is the moderately impaired range. Less than 3.76 indicates a healthy river. The index is important because animals live in the river all year, so it's more like a video of river conditions over time instead of a snap shot. However, the samples we collected were weak because we were unable to collect a large enough sample of macroinvertebrates.)

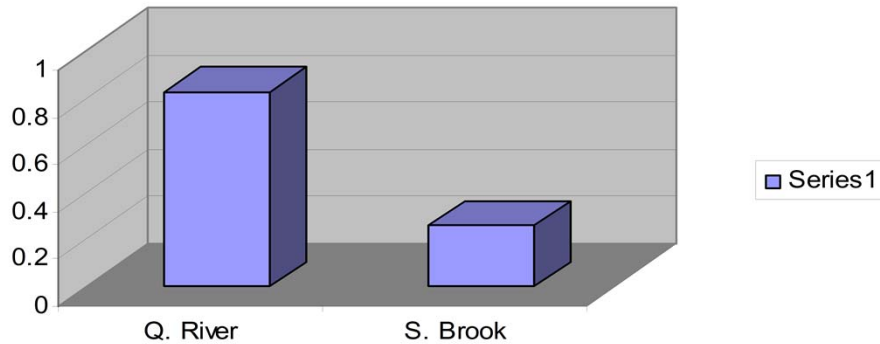
## Sorting Bugs



Jamie, Sarah, and Mike sort river macroinvertebrates.

## Percent Dominance

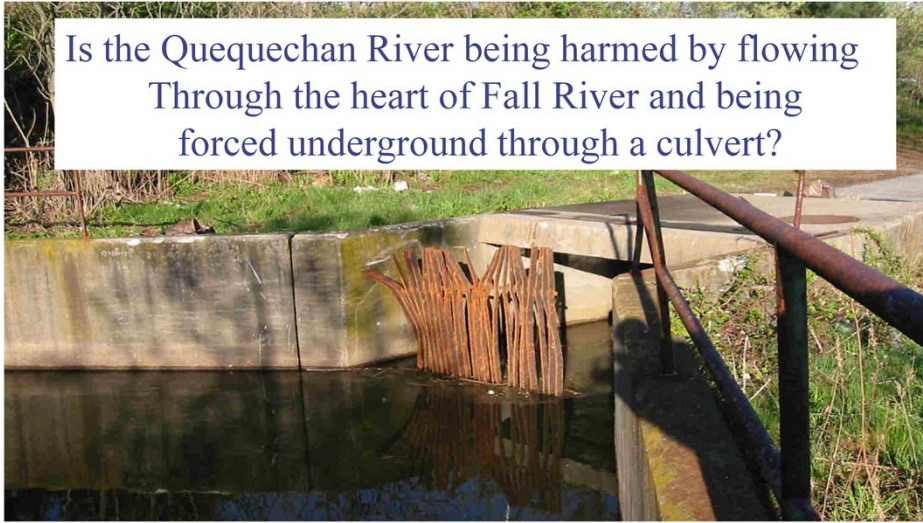
**Percent Dominance for the Quequechan River & Sucker Brook 2003-2004**



83% of the organisms we found at the Quequechan River were scuds. (tolerant of pollution) 26% of the organisms we found at Sucker Brook were scuds.

## Summary

Is the Quequechan River being harmed by flowing  
Through the heart of Fall River and being  
forced underground through a culvert?



Is the Quequechan River being harmed by flowing  
through the heart of Fall River and being forced  
underground through a culvert?



## Biological implications

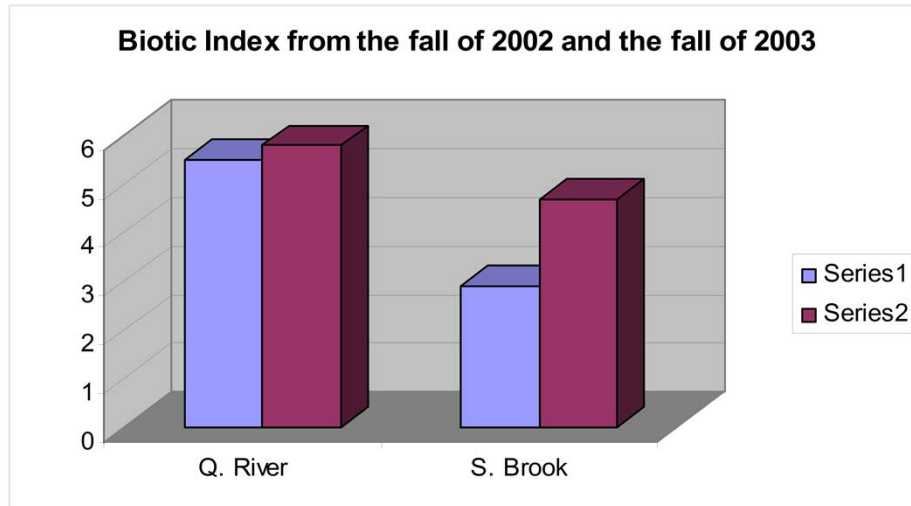
- ◆ The Quequechan River had a biotic index of 5.8 indicating a river moderately impaired.
- ◆ It also had an abundance of shrimp, scuds, and snails – all tolerant of polluted conditions. Upstream, Sucker Brook had a 4.7 biotic index indicating a moderately impaired stream. It's dominant organism also changed from a large stonefly population who are intolerant of pollution to a large scud population tolerant of pollution.

Biological implications - The Quequechan River had a biotic index of 5.5 indicating a river moderately impaired.

It also had an abundance of shrimp, scuds, and snails – all tolerant of polluted conditions. Upstream, Sucker Brook had a 2.9 biotic index indicating a healthy stream. It also has a large stonefly population who are intolerant of pollution.



## Biotic Index for 2002 & 2003



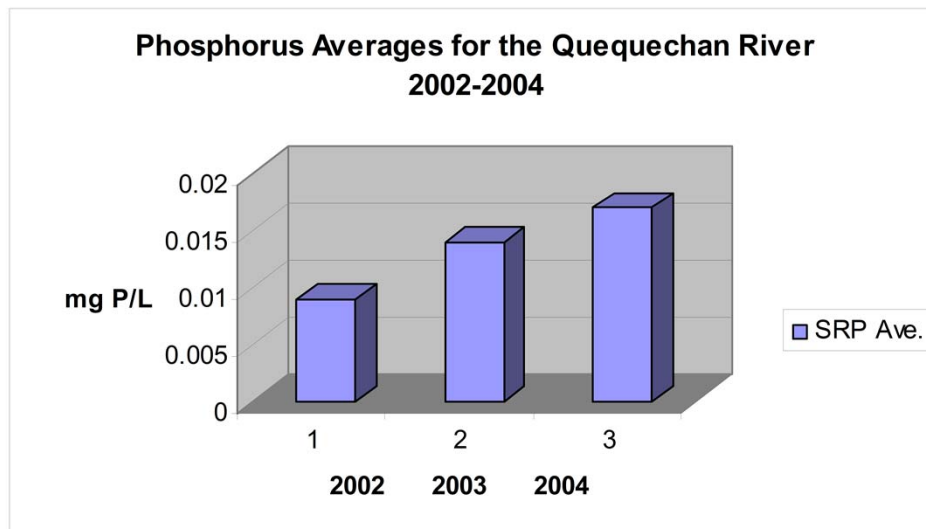
This graph shows a slight decline in the quality of organisms living in the Quequechan River from last year, and a dramatic decline of quality organisms for Sucker Brook.

## Nutrient Evidence

- ◆ However, a high reading of 0.8 mg/L of N-NO<sub>3</sub> in August at Sucker Brook could be the result of vacationers staying at summer cottages around an upstream pond. Septic systems may have flowed into the brook.
- ◆ Phosphorus and Nitrogen levels were both fairly low at both the Quequechan River and Sucker Brook.

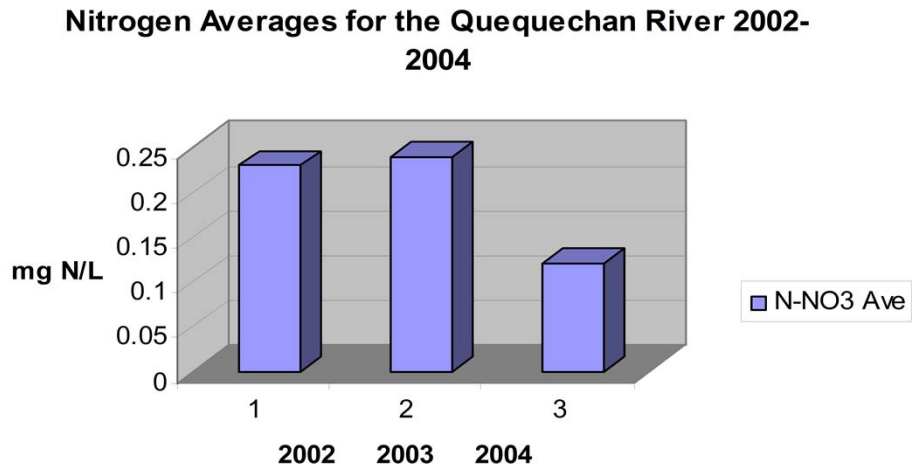
Nutrient Evidence - Phosphorus and Nitrogen levels were both fairly low at both the Quequechan River and Sucker Brook. However, a high reading of 2.7 mg/L of N-NO<sub>3</sub> in August at Sucker Brook could be the result of vacationers staying at summer cottages around an upstream pond. Septic systems may have flowed into the brook.

## Historical Averages for Phosphorus in the Quequechan



This graph shows a steady increase in dissolved phosphorus levels in the Quequechan River from 2002 to 2004.

## Historical Averages for Nitrogen in the Quequechan River



This graph shows an encouraging decline in Nitrogen concentration in the Quequechan this year.

## Fecal Coliform Bacteria Evidence

State health officials consider levels over 200 fecal coliform colonies/100 milliliters of water to be an unacceptable level of bacteria at swimming areas.

The Quequechan River showed an extremely high level of bacteria indicating a serious pollution problem.

The test sample was collected after a major rain storm. It could be that city sewers overflowed into the river as a result of the storm, pouring sewerage into the river.

However, this is the second year in a row of unacceptable bacterial levels.

State health officials consider levels over 200 fecal coliform colonies/100 milliliters of water to be an unacceptable level of bacteria at swimming areas. The Quequechan River initially showed an extremely high level of bacteria indicating a serious pollution problem. A later test showed an acceptable level. The first test sample was collected after a major rain storm. It could be that city sewers overflowed into the river as a result of the storm, pouring sewerage into the river.

## Conclusion

- ◆ Clearly, the absence of any pollution intolerant organisms living in the Quequechan river indicates a moderate level of impairment.
- ◆ The degrading of a tributary, Sucker Brook, does not bode well for the Quequechan.
- ◆ Also, the high level of bacteria found in the river after a rain storm requires further investigation. It is likely that city sewerage is polluting the river.
- ◆ The effect of the culvert on the Quequechan is still unclear.

Conclusion - Clearly, the absence of any pollution intolerant organisms living in the Quequechan river indicates a moderate level of impairment.

Also, the high level of bacteria found in the river after a torrential rain storm requires further investigation. It could be that sewerage is polluting the river.

The effect of the culvert on the Quequechan is still unclear.

## Improving the Quequechan

- ◆ The city of Fall River and many of its citizens are beginning to understand what a wonderful resource is flowing through the heart of downtown.



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## The Great Tunnel Project

- ◆ The city of Fall River understands that the pollution caused by storm-sewer overflows cannot continue. They have committed \$55 million to a tunnel project to go across the city from the bay to the Wattuppa Pond. The tunnel will capture and hold sewer water during storms and hold the water until the sewage treatment plant can handle it.

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## Cleaning Up



The environmental club led a class from Kuss Middle School on a trip to clean up the river. Students were overwhelmed by the amount of litter there was along the river's shore! "We need the whole school to come and clean this river!", one student exclaimed. Not a bad idea.

## Bike Path Plan



Last fall Urban River Visions and Green Futures, a local environmental group, sponsored a cherette about the Quequechan River. A comprehensive plan was created which included the plan for a bike path along the river that you see here. The master plan also includes a landing area for canoes, a circuit walk around part of the river, and daylighting the river and its spectacular waterfalls.

## Our Hope



We believe that as more people begin to use this wonderful resource, they will care for their river. And the neglect and abuse of the Quequechan River will be a thing of the past.