From Patten Stream to the Kitchen Tap: Monitoring Water Quality Above and Below Ground in Surry, Maine

School: Surry Elementary School

Grade Level: 7th

Teacher: Sarah Dunbar

Project Partners: MDI Biological Laboratory, Healthy Acadia, Washington Hancock Community Agency, Dartmouth College, Downeast Salmon Federation

Teacher Profile: Sarah Dunbar is a middle level math and science teacher at Surry Elementary. She has taught there for five years. A common theme in her class is finding ways to make a difference, and protecting our natural environment.

Summary:

Surry Elementary school is located right on Patten Stream in Surry, Maine. The elementary school has a short nature trail that allows students to access Patten stream. Patten Stream is home to an active beaver population that changes the flow and appearance of the stream. Patten Stream is also home to alewives. In recent years, an alewife ladder was built to help support the fish population. For all these reasons, monitoring the water quality in Patten Stream is a very important and valued project. Students learned this year that some water that we depend on is out of sight, but should not be out of mind. In addition to exploring water quality in Patten Stream, the 7th grade class tested water quality of ground water by taking samples at the kitchen tap.

Students learned about the life in a small stream like Patten Stream and learned how to test the water quality and why we test. They learned that Patten Stream is a healthy stream and we were satisfied with the results of our water quality tests. They also learned about following procedures, being respectful of the natural environment, and learned about how and why testing stream water quality is important. They also learned that water can look clean, but still contain toxic substances. By testing their tap water, they discovered that some households in their community have high arsenic, uranium, and lead levels. The students were eager and enthusiastic about the project and would be very interested in continuing the water quality monitoring, both in the stream and from household well water supplies in their communities.

Introduction:

Stream testing: Students tested for dissolved oxygen, nutrients, bacteria, and temperature at five sites in Patten Stream.

Well water testing: Students tested 35 samples which were from 21 different wells. It is widely known because of the granite bedrock that Surry has high arsenic levels. Arsenic can also leach into groundwater from sites that were exposed to arsenic laden pesticides in the past.

This project connected the testing of well water with the importance of monitoring our own streams and rivers

Project Details:

- This project started with a pre-unit questionnaire about student understanding of well water and water quality.

- The class then had a discussion about the importance of water quality monitoring and testing well water for contaminants. The students read an article about Flint, Michigan and the water crisis that this community has been faced with. The article was from DoGoNews.com. This was a good article because it was about a current event and was also written for this particular age group. I also read some excerpts and showed some images from Time Magazine that featured the Flint, Michigan water crisis. This current event sparked a robust conversation about this crisis. Students were able to empathize with the families in Michigan. They felt angry and frustrated that something like this could happen. I was impressed with the compassion that the students showed.
- We discussed the importance of testing well water, and many students had a lot to contribute to this discussion because they know that they have arsenic in their wells at home. Some were able to discuss remediation that they use at their home, while others discussed their use of bottled water for drinking and cooking.
- After we collected and sent the well water samples, we started to study why and how to test the water quality of Patten Stream.
- In preparation for our filed monitoring we read about watersheds and stream chemistry.
    - Students read chapter one, What is a Watershed?, in Watersheds, a Practical Handbook for Healthy Water
    - Students then read chapter two, How a Watershed Works. Students worked in groups of four to create posters of the nutrient cycles (phosphorus, carbon, nitrogen, water).
    - Students read chapter three, Parts of a Watershed
    - Students read chapter six, Water Pollution
    - We read chapter four, Physical Characteristics, and chapter five, Stream Chemistry, in Watershed Dynamics. We focused on the water quality testing parameters we would be doing at Patten Stream. These include temperature, pH, phosphates, nitrates, and dissolved oxygen.
    - I selected groups for each of the five sites on Patten Stream. Before we began testing, students did site observations. They then wrote narratives describing the characteristics of their sites. As

a class, we developed a list of questions we wanted to answer through our water quality testing of Patten Stream:

- What differences will we notice between site 1 and 2
- How will dissolved oxygen be different at site 5? Higher because of the rapids?
- Will nitrogen be lower near "rapids" and higher near site 3 and 4?
- What is coming out of the white pipe near site 1? Does it drain more after rain?
- Are our results within normal range?
- Will water temperature impact dissolved oxygen and nitrates?

Patten Stream Water Quality Monitoring Average Results

Site location	Dissolved Oxygen	Phosphate	Nitrate	Temperature (degrees Fahrenheit)	PH
1	10 ppm	0 mg/l	0ppm	60.6	5.6
2	15ppm	0 mg/l	2.5 ppm	60	6.5
3	11 ppm	0 mg/l	.5 ppm	55.3	6.25
4	8ppm	0 mg/l	0	64	6.75
5	14.33 ppm	0 mg/l	1 ppm	57.6	4.8

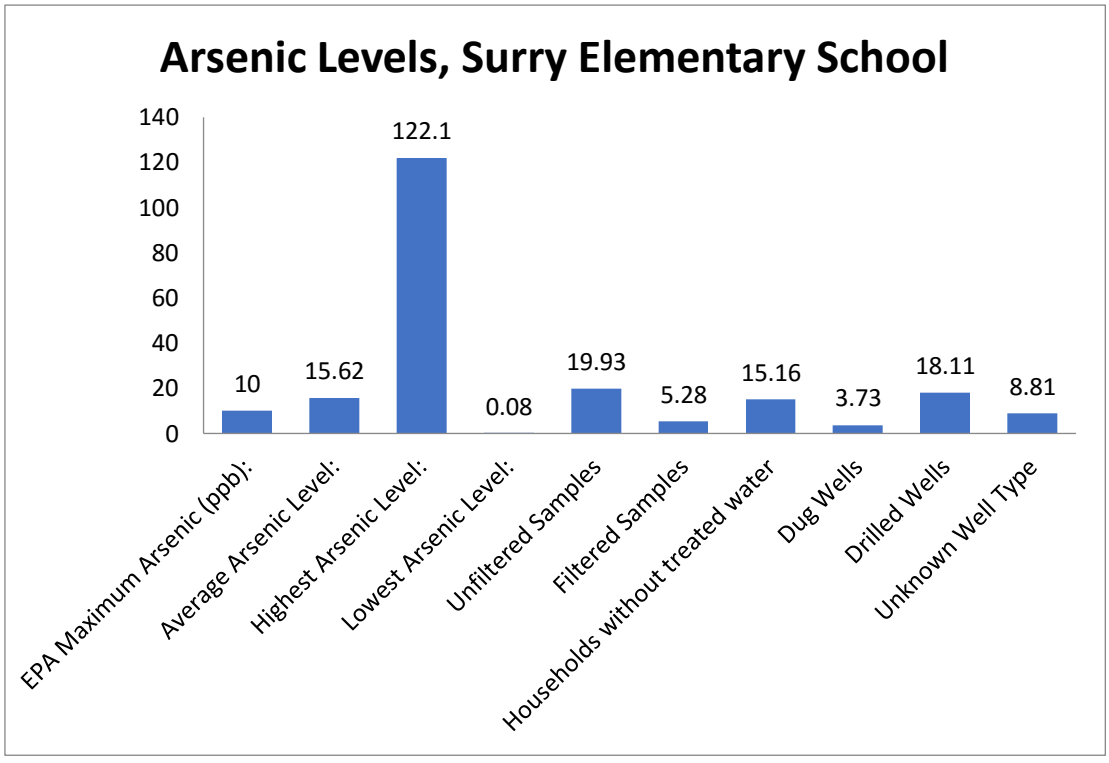
- We did weekly water quality testing of the five sites.
- During this time, we also read the book *Flush*, by Carl Hiaasen. This book is a fictional story of a family in Florida who discovers that a casino boat is dumping sewage into the ocean instead of properly disposing of the waste.
- In art class, students created water themed art projects. These were displayed at the community night.

(Water themed art projects)

- Students prepared presentations for the Arsenic in Well Water community event. The students decided on topics that they would like to research and report on:
    - What is arsenic?
    - Arsenic and animals
    - Why, when and how to test for arsenic.
    - Remediation
    - Surry Data

- The community event took place during the Surry Community Improvement meeting. At the community event, students presented their posters and gave community members a chance to have their well water tested. There was a great turn out at the community event. We gave attendees an opportunity to take vials to test their water, and 25 people took vials and 22 returned their sample. Project lead, Jane Disney, and community partners Maria Donahue and Bobbi Harris spoke briefly about the importance of having your water tested and what support their agencies can provide.

Number of Samples:	**35**
EPA Maximum Arsenic (ppb):	**10**
Average Arsenic Level:	**15.62**
Highest Arsenic Level:	**122.1**
Lowest Arsenic Level:	**0.08**
Unfiltered Samples	**19.93**
Filtered Samples	**5.28**
Households without treated water	**15.16**
Dug Wells	**3.73**
Drilled Wells	**18.11**
Unknown Well Type	**8.81**



Discussion:

What my students learned:

Through this unit, my students have learned so much. My students have learned about field monitoring, and understanding the importance of testing water quality. The have learned about following procedures, making observations, recording data, and analyzing data. My class also learned about researching a topic, determining what was relevant information to share. Giving and receiving constructive criticism and making revisions was also practiced. Far beyond these skills, this class learned about being part of a community. When they found out that there was an arsenic problem in Surry, my students felt compelled to let the community know. I feel that this is the most valuable lesson that they learned.

What I learned:

I have learned a lot about how capable and excited my students are about learning. I was so thrilled to have my students come into class asking if we would be taking water samples, or sharing articles or stories that they had about water quality. I also learned about slowing down and taking the time to have conversations, listening to what students have learned, and helping them reflect on the process.

What I would do different:

One of the biggest challenges for me was time. If I were to do this project again I would allow more time. I also did this project at the end of the school year and that introduced a lot of time constraints. I think that it was a very busy and stressful time for the students to be preparing their community presentations. I had originally planned to have the English teacher read Flush with the class, but she found it difficult to fit into her end of year schedule. I feel that because we had so much going in our science class, the reading of Flush did not get the attention that it should have. When I originally planned this unit, I liked the idea that it became a cross curricular unit focusing on water quality. If I were to do this project again, I would want to leave more time and possibly test the water in both the spring and fall.

Conclusion:

While I do see many things I would have done differently with this project, I also see this project as a huge success. My students became community advocates and helped to shed light on a potential health issue to the residents of Surry. They knew the value of the work they were doing and because of this, I noticed their work ethic and drive to produce quality work was the best I had ever seen. The class knew that they had an audience of community members that they needed to inform about the arsenic problems in Surry. I was so impressed with my students and how hard they worked on this project, it was truly inspiring.

References:

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