

FINAL CASE STUDY 2023

Project Title: MDI-area drinking water quality

School: College of the Atlantic (COA); Conners-Emerson (MDI)

Grade Level: undergraduate; 7th grade

Teacher: Sarah Hall (COA); Lynn Hanna (MDI)

Project Partners:

Lynn Hannah – Conners-Emerson School (MDISS)

Mike Gurtler – Town of Bar Harbor

Jane Disney – MDI Biological Laboratory

Sergio Carhueque – Defend Our Health

Teacher Profile:

I am a geoscience professor with specific training in surface processes, however I teach a wide range of Earth Science classes to students majoring in Human Ecology. Since becoming a geoscience professor in 2009 I've worked with many students on independent study projects on many different geoscience topics around their interests. Most recently, my undergraduate students have created sub-projects to the All About Arsenic project to investigate additional questions such as: Are arsenic levels elevated in local produce? Do local orchard soils have elevated arsenic levels? Are there spatial patterns in ground water chemistry? And most recently: Are there any elements of concern in our local public drinking water? I am passionate about teaching students how to make observations of the natural world and to use those observations to make interpretations. I aim to help them communicate their findings and ideas through various pathways: poster presentations, oral presentations, graphics and visualizations, written reports, and public dialogue. I am very excited to be involved in the All About Arsenic project. Since 2016 it has been an amazing opportunity for my students and I to engage with our community members, build our professional networks, learn new tools, and participate in a societally relevant local project.

Summary: Provide a 500-word summary of your project. Describe the curriculum. How were arsenic monitoring and data literacy integrated into that curriculum? Provide specifics (# samples collected, what the samples were analyzed for, etc).

During 2022-2023, I focused on three components:

- 1) **Work with my teacher partner, Lynn Hanna, and her students to offer free well water testing to Bar Harbor residents.** Building on our work from the prior year, Lynn Hanna and I partnered with Mike Gurtler, Jane Disney, and Sergio Carhueque to offer free water testing kits to our community. This work is not directly part of the All About Arsenic project, but grew out of it. Inspired by the work of many MDI students, the town of Bar Harbor wanted to provide testing opportunities to all residents with private wells. Ms. Hanna's students prepared pamphlets, posters and handouts to alert people to the need for testing. My students helped to proofread and fact-check the materials. Jane Disney and I offered direct feedback to the students to help them revise their work before distribution to the public. On election day, the students, Lynn, Jane, and I staffed a table at the election hall to hand out water testing kits. I also distributed a few additional kits to folks who requested assistance in sampling. This two-year effort resulted in about 150 samples collected.
- 2) **Work with current undergraduate students to conduct a high-resolution study of public water quality by testing 43 different taps throughout the COA campus.** Multiple undergraduate students assisted in

collecting water samples from campus taps, analyzing and visualizing the data, and reporting our findings via a poster presentation, multiple oral presentations, and a written report prepared for the campus community (attached). We also used the data to prepare Tuva Datasets and accompanying worksheets for other teachers to use with their students. Our motivation for this work was to expand the focus of study beyond private water sources to include public water sources as well. With this high-resolution study we hope to offer a model to other schools, businesses, households, etc. relying on public water sources for how to monitor and mitigate issues related to building infrastructure. For the COA campus, we found only a few taps with slightly elevated levels of lead – all within buildings with aging infrastructure or from outside garden taps. Working with campus building and grounds personnel we worked quickly to mitigate the issue with filters and signage.

- 3) **Dissemination of our findings through a) the development of Tuva Datasets based on our data, b) poster presentations at conferences, c) discussion of the topic/project/findings with various undergraduate students via my courses, and d) the development of manuscripts reporting our findings.** With many subprojects arising since my initial involvement with All About Arsenic since 2016, my students, colleagues, and I have presented our findings at many local/regional conferences. We are beginning to prepare our findings for publication in peer reviewed journals. We are preparing Tuva datasets for our different subprojects: College campus taps, filter efficacy, impacts of high precipitation events on groundwater chemistry, and the spatial patterns of groundwater chemistry.

Project Details:

Students: Three work-study students were involved in the campus taps and Tuva Datasets development projects: First year student, Delphine Delmaisy took the lead in developing the Tuva Datasets and presenting our work to the All About Arsenic community through Office Hours. She worked with Tuva experts to improve the datasets and worksheets before distribution. Third year student, Ludwin Moran led the campus taps study. He collected, analyzed, and interpreted data, and presented our findings to the campus community and during Office Hours. Ludwin also assisted in data analysis and dissemination of our filter efficacy study (see attached poster). Second year student, Lily Dutton helped to improve our work by offering feedback and participating in weekly discussions.

Products:

- Tuva datasets and worksheets: currently in preparation for multiple datasets, complete datasets are available here:
<https://drive.google.com/drive/u/1/folders/1Lp8eoz7BXqYkGhI5qGwkw-5uGv-hdKli>
- Community Outreach:
 - Election day, 2022 – free sample offering and information dissemination
 - COA Campus – multiple presentation: through All College Meeting, Campus Planning and Building Committee, and the Landscape Subcommittee. All products available here:
https://drive.google.com/drive/u/1/folders/11bFqyv0kyfw_iSmci43waWkRmPVklyBN
- Abstract references for student poster presentations to date are available:
<https://www.coa.edu/shall/geoscience/biography.html>
- Manuscripts in preparation:
 - “Well Stories” from a coastal Maine community: considering arsenic and other contaminants one well at a time.
 - Precipitation-Mediated Fluctuations of Well Water Arsenic in Hancock County, ME
 - Influence of different water treatment systems on arsenic concentrations in private well groundwater: A view from MDI, ME
 - Spatial and temporal patterns of private well water quality: a view from coastal Maine

Discussion:

As in past years, I have been excited to hear more and more people talking about water quality in various settings. With the on-campus taps study happening during 2022-2023, there was a lot of ongoing discussion of campus water quality throughout the year. My students and I found that many community members were interested in our findings and followed up with questions and suggestions. We are now completing a second phase of the study to include the off-campus student/faculty residences as well. Through this work we are expanding the conversation about water quality to folks relying on public water. The written report to the community is attached. The report includes links to the data and shared resources (Tuva datasets, presentations, etc.)

Conclusion: I am grateful to be a part of this ongoing project. Offering students and community members a chance to be involved in data collection for a relevant community public health project is not only very rewarding, but is aligned very well with my own professional and research interests. I look forward to completing the many in preparation manuscripts during the coming year.

References: References can be found embedded within the linked reports, posters, and datasets.

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