Stream of Consciousness

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Alliance for Aquatic Resource Monitoring

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The second semester 2022 team take advantage of a surpringly warm spring day with an outdoor staff meeting.

Building Capacity At ALLARM

By: Prerana Patil '24

While I am at the beginning of my time working at ALLARM, the thing that has struck me every time I work on a project, or go to a team meeting, is the warmth of the environment cultivated in the office. It seems to shout, "we will provide all the support you need (through workshops, availability for questions, tools, quality control etc.), but you *can* and *do* have the ability to do this work." This community, spearheaded by Director Julie Vastine, Outreach Manager Phoebe Galione and Community Science Specialist Stephanie Letourneau, pushes and supports volunteers and students alike to add dynamism to ALLARM's functions and to build capacity.

My time at ALLARM has been the story of slowly uncovering the organization's intricacies: the organizations it works with, its abilities, its frameworks, and its extensive volunteer base. Through this slow uncovering, I have learned that this focus on capacity building is at the core of ALLARM and its work, it's by design. Capacity building is the development and strengthening of skills. To build capacity is to ensure a future for your organization by reinforcing the ability of the volunteers and staffers.

The capacity-building framework begins with the staffers and the community within ALLARM's walls. An ALLARM student watershed coordinator gets a truly co-curricular model of learning (learning through experiences and work that acts as an extension of learning in the classroom). English classes and persuasive writing skills are harnessed for writing informational blogs or publications such as the Stream of Consciousness newsletter. Chemistry and biology classes are brought into context in the lab and during volunteer training workshops. Public speaking and presentation skills are pushed when presenting to classes and are expanded into outreach. No skill is left unpracticed. Moreover, when I interviewed Director Julie Vastine, they underscored in our conversation that ALLARM is often watershed coordinators' first professional position. It is their first opportunity to engage with stakeholders, first publications, first training events, or first lab experiences. The opportunity to try all these firsts in a space that does substantial work, under the guidance of full-time staff, creates a sense of confidence in oneself and one's ability. That sense of confidence breeds a sense of place. That sense of place then propagates within students the willingness to teach others, to take on leadership roles, and to spearhead new projects. In short, the co-curricular workplace design of ALLARM builds capacity.

This confidence is essential for an equitable and engaging workplace as this system of support does not just grow capacity, it

helps instill the feeling/sense of being intrinsically capable. Imposter syndrome, or the feeling that one does not belong in an environment, plagues students of color, women, and LGBTQ+ individuals. These students and workers all have capacity and may grow it through the new experiences provided to them, but without a community and workplace that scaffolds these new opportunities with warmth and guidance and respect, this capacity is built into someone who may lack an understanding of their own worth and ability. This distrust in one's intuition and ideas, can inhibit participation and kill new/diverse/cool ideas before they are even said aloud, stunting growth and ability for the organization. Thus, the culture of ALLARM and the sense of community it builds is just as crucial to building engaged and proficient individuals.

The capacity building model is also the foundation of the entire volunteer program. "The community drives the agenda," Julie Vastine told me, which is truly telling of how ALLARM is focused on their role as supporters and foundation builders. Volunteers generate the goals of the monitoring program and, with the help of the ALLARM team, the monitoring program is devised. First, an ALLARM-supported study design is used to assess the goals and the ability of the organization in question. ALLARM does a bottom-up analysis of the organization's goals and what they can do to help, but the agenda is set by the local group. The regional group and ALLARM work together to assess the needs of the watershed in question. Then, ALLARM provides even more technical assistance by creating workshops to learn the necessary scientific procedures and making sure adequate equipment is provided. This approach creates an environment suitable for capacity building as there is a focus on taking self-conceived goals and learning the skills one needs to meet those goals – creating more capable and aware individuals who contribute to every step of the process. ALLARM exists to strengthen and educate the people who need assistance and resources to set up their own success.

Let's take a closer look at ALLARM's Stream Team program. Every Stream Team volunteer goes through the same process. This first year is used for program orientation, equipment orientation, first workshop, and the first quality control sample analysis. After that first year, the learning continues with macroinvertebrate and data integration workshops, slowly building ability and confidence in increased areas of watershed monitoring. Volunteers are always encouraged to share what they have observed, what they experienced and what they have learned, reinforcing their undisputed value, and acknowledging their special "know-how" and connection to their sites. Check out the winter monitoring guidelines for ideas that Stream Team volunteers generated.

The capacity building focus allows the organization to meet people where they are and be open to ideas and feedback for improvement. An example that comes to mind is a recent invention from Jeff & Tina Gleim from York County Stream Team, a floatation device that allows for temperature readings to be taken without bending down – making an aspect of stream monitoring more accessible!

Tina Gleim (volunteer) shows off the DIY probe float which allows for monitoring without having to bend down or put hands into cold, winter waters.
Photo credit to Jeff Gleim

This proficiency building model has really set ALLARM apart in my opinion. I have never been in a workplace quite like it, nor do I feel as safe in any of my classes. I believe other non-profit organizations can look to the ALLARM model and really benefit. The ALLARM model builds communities and encourages workers and volunteers alike to grow and become more mindful members of their environments. I think similar initiatives in other non-profit spheres can help strengthen the provision of aid and create more effective, equitable and engaging organizations. The ALLARM team had the opportunity to speak with a founder of SUNRISE, Varshini Prakash, and she noted that moving forward, the SUNRISE organization was oking to create resources so each new team would have adequate foundations to learn and be more involved at a higher level. This rang familiarly with me as a delocalization of power within the organization and an attempt to do what ALLARM had been doing: empowering their workers and growing, both literally and metaphorically, a sustainable organization.

The Story of the NFWF Grant; Making Community-Based Restoration Science Possible

By: Claudia Bonaccorsi '22

Near the beginning of the COVID-19 pandemic, conversations took place between the National Fish and Wildlife Foundation (NFWF) and the Alliance for the Chesapeake Bay (Alliance) to explore how volunteers could help collect macroinvertebrates specimens for lab analysis to help assess restoration projects. Liz Chudoba, the Water Quality Monitoring Initiative Director at the Alliance, wrote to her Chesapeake Monitoring Cooperative (CMC) colleagues and inquired if anyone would be interested in connecting to this new possible project. Immediately, Julie Vastine, Director of the Alliance for Aquatic Resource Monitoring (ALLARM) and a partner in CMC, saw exciting potential in this project. Julie, who was interviewed for this article, wanted to align the NFWF goals of generating macroinvertebrate data with the ethos of ALLARM to deepen the role of volunteers in data collection and data use. As Julie started working on the proposal, there was a question circulating in their head: how can we make restoration monitoring community-accessible? After drafting ideas, Julie brought them to the other staff at ALLARM and to the Alliance. Both teams were enthusiastic! The next step was to bring the grant proposal to NFWF, who supported a broadened idea to develop a community-based restoration monitoring protocol. In March 2021 the project was awarded.

With the grant in place, the first phase of the project began: research. ALLARM was tasked with preliminary research and created annotated bibliographies that investigated different aspects of restoration and what could be assessed – ranging in topics from birds as indicators to different methodology for classifying stream substrate. "We are developing a new tool that NFWF wants to, eventually, implement nationally, so the research phase was crucial" said Julie, one should "never go lightly into developing a new protocol" (J. Vastine, personal communication, January 2022). ALLARM's senior watershed coordinators (Hiba Aoid, Phoebe Galione, Isabel Ruff, Olivia Spildooren, Angelo Tarzona, and Shante Toledo) conducted research in the spring of 2021 and presented their findings to the CMC team that April.

In the summer of 2021, NFWF reviewed their list of best management practices and identified the top ten practices they wanted the community-based protocol to focus on. The three general categories of BMPs selected, included stream restoration (bank stabilization, floodplain reconnection), dirt and gravel roads improvements, and riparian buffers. In late summer 2021, came the development and distribution of a survey coordinated by the Izaak Walton League of America to ask restoration managers about their monitoring needs. Once those data were in, a Knowledge Exchange Forum was organized by ALLARM in the fall of 2021. The Knowledge Exchange Forum brought together scientists, restoration experts, NFWF, and CMC, to teach participants about the different priority research types and provide feedback for the development of a community-based stream restoration protocol.

Members of The Alliance for the Cheapeake Bay, Izaak Walton League of America, and ALLARM pose together after a successful field test of the Restoration Monitoring protocol.

The next phase of the grant began with study design sessions in January and February of 2022. Liz Chudoba and Julie facilitated the meetings with NFWF, Chesapeake Bay Program, Stroud Water Research Center, and CMC. After three, 3-hour sessions, the team landed on the primary research question of "how are the BMPs working?" with the secondary question being "how do BMPs relate to instream water quality?" Biological, chemical/physical, and visual indicators will be monitored and measured by volunteers and experts to generate long-term data to answer these questions.

Currently, the project is in protocol development and field testing. Fall 2022- 2023 will focus on developing training materials and piloting the protocol with volunteers and community partners at five different sites. After which, further refinement and development of the monitoring protocol will take place before a larger rollout in 2024.

Throughout the Chesapeake Bay Watershed, there are individuals and organizations working tirelessly to reduce pollutant loads. BMPs have been identified as a promising solution and restoration projects are being heralded across the watershed. This is where the NWFW grant comes in and provides an essential opportunity to standardize the evaluation of whether these BMPs are being maintained and are contributing to a change in macroinvertebrate communities. "Currently, there isn't a standardized way of capturing the stories, the pictures and the data, to show whether or not there is a difference," Julie stated in the interview, "with the NFWF grant, we will have stories and examples to show the differences before, during and after restoration projects."

The grant brings a new kind of monitoring program to ALLARM and the ability to work with new partners. There will be new research needed and new data-driven solutions to problems encountered, and ALLARM is ready for the challenge! "For ALLARM, we focus so much on the health of our waterways and identifying places that restoration needs to address things" said Julie, "this will be our first time being able to assess how those suggestions make an impact on the land and water quality."

Julie stated that "the most exciting thing is engaging with a new type of collaboration. We are meeting new people, bringing colleagues we have not seen in years to the table, and we are all thinking through what the best ways are to answer questions related to restoration effectiveness. Everyone is bringing a lens of expertise and we are leveraging their collective strengths. I love it!". Cheers to development of the Community-based Restoration Monitoring Protocol made possible by the NFWF grant and to the ambitious collaborative work and the future of this program!

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Recognition, Respect, and Resilience: Working with the Indigenous Communities of the Chesapeake Bay to Promote Justice and Sustainability

By: Charlotte Kratovil-Lavelle '24

The Chesapeake Bay Watershed covers roughly 64,000 square miles, contains more than 150 rivers and streams, and is home to nearly 17 million people (National Park Service, 2018). I myself call the Chesapeake Bay home, having grown up on Kent Island, Maryland. I now spend most of my time in Carlisle, Pennsylvania, where, though I may not be physically surrounded by water, I am still surrounded by the historical, cultural, and environmental significance of the Bay.

Unfortunately, the history of this land is a tragic and violent one. For at least 12,000 years, Native peoples have called the lands we know today as "Pennsylvania" home (National Park Service, 2018). It was not until the 17th century that European settlers began to colonize this area. Indigenous communities, including those of the Susquehannock, the Seneca, the Shawnee, the Conestoga, and the Lenape, faced violence and oppression from settlers (Pennsylvania Youth Congress, 2021). By 1760, most Native peoples had been exterminated, pushed away from their lands, or forced to assimilate (Licht et al, 2021). Between 1879 and 1918, over 10,000 Native children from more than 140 tribes were forced to attend the Carlisle Indian School where they were intentionally stripped of their Native connections and cultural identities (National Park Service, 2021).

The harsh reality of what happened here in Pennsylvania echoes the stories of Indigenous peoples throughout the Chesapeake Bay Watershed and across the United States. Indigenous communities today continue to fight for recognition and sovereignty and often face disproportionate social, environmental, and economic challenges. Out of the tens of thousands of Indigenous peoples living in the Chesapeake region, only some are a part of tribes that have state recognition ("Indigenous Peoples of the Chesapeake," 2022). Even fewer have federal recognition, a designation that allows their reservations to be put into trusts and federally protected ("Federal Acknowledgement," 2022). Across the Chesapeake watershed, many tribal lands, especially waterfront territories, are at risk of environmental degradation, climate change, and rising sea levels. These examples are just some of the modern challenges Indigenous communities face. As we seek to remedy the historical and contemporary wrongs committed against Indigenous communities, we must take active steps to move forward as a community to dismantle the systems of oppression that have existed for centuries. First and foremost, tribes must be recognized on the state and federal level. Next, federal lands, notably those designated as wildlife sanctuaries or nature preserves, must be returned to the tribes who originally inhabited them. Voluntary land taxes, in which residents of an area voluntarily pay "rent" to the Indigenous community whose land they reside on, and other forms of reparations should be explored and encouraged. Finally, we must work with existing tribes to promote justice and sustainability.

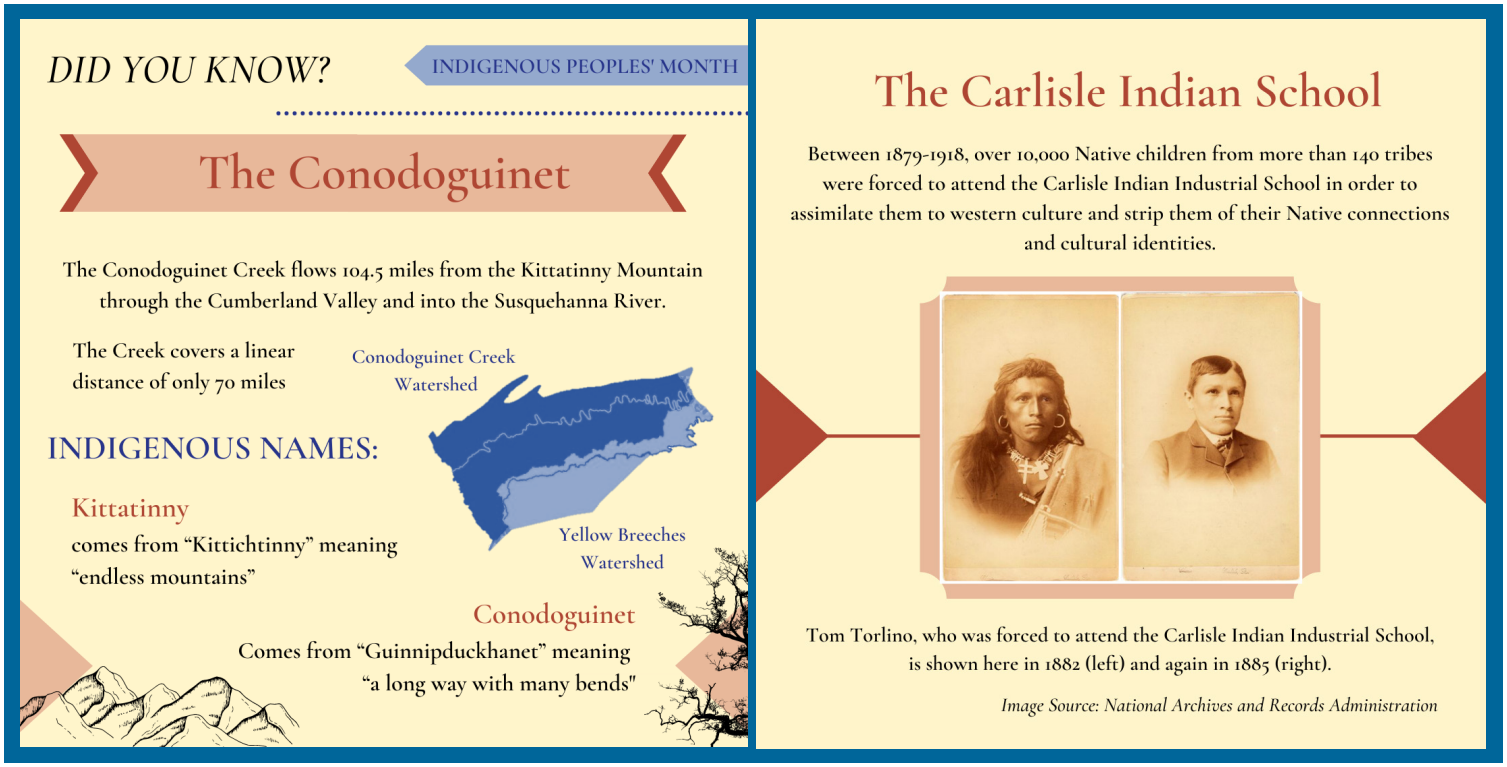
Indigenous sovereignty, cultural preservation, and environmental health are interconnected ideas in which promoting one often leads to promoting another. Ensuring tribes have federal recognition, and not just state recognition, is perhaps the most basic way to promote Indigenous sovereignty.

Returning land achieves this same goal by preserving culturally important sites.

Additionally, Indigenous communities often maintain the land in a way that protects and conserves the local ecosystem, which benefits environmental health (Robbins, 2021). In December of 2021, Virginia appropriated $3.5 million for the return of Mamanahunt, a historic site of over 800 acres along the Chickahominy River, to the Chickahominy Tribe (Office of the Governor, 2021). Dana C. Adkins, the Chickahominy Tribal Environmental Director, said of the re-acquisition, "we know that our role as good stewards of Mamanahunt is vital for its preservation, so education of our youth on environmentally significant events that impact us and education on ways to protect our environment is of great importance to us and will play a key role in helping to preserve our culture and continuing to tell our story" ("Va. Tribe Reacquires," 2022).

Governments and organizations can further promote justice and sustainability by working with Native communities to address the social, economic, and environmental challenges they face. Crucially, tribes must be at the forefront of the decision-making process for identifying and solving these issues. Not only does this reinforce their sovereignty, it provides the opportunity to utilize the knowledge these communities have because they have resided on their lands for centuries. Such a model was discussed by Dr. Nicole Hutton during the 16th annual Chesapeake Watershed Forum held in October of last year. Hutton's work with the Pamunkey Tribe of Virginia focused on utilizing traditional ecological knowledge (TEK), implementing climate mitigation and adaptation methods, and preserving cultural values and traditions. Dr. Hutton emphasized the need to address the priorities set forth by tribes, rather than having universities and research centers at the forefront of goal setting. The mitigation strategy created in collaboration with the tribe included planting native vegetation to prevent erosion, utilizing prescribed burning, and implementing traditional beaver and muskrat hunting practices. Hutton reiterated that these strategies have relied on the knowledge provided by tribal members (Hutton, 2021).

To date, Pennsylvania has no state or federally recognized tribes despite 2020 census records reporting an American Indian and Alaskan Native population of 1.5% of the state's over 13 million population (America counts staff, 2021).



This past year, Charlotte Kratovil-Lavelle '24 researched the Indigenous history of the Conodoguinet and local Carlisle region, creating a slide deck for social media sharing. These are two of the slides above.

Some state officials have defended the failure to formally recognize tribes with concerns over the establishment of casinos as a consequence of state recognition (Budoff, 2003). Such justification is simply unacceptable. State recognition not only shows respect to Indigenous communities, it also makes tribes eligible for scholarships, government benefits, federal housing, education, and job training assistance (Budoff, 2003). Federal recognition establishes a tribe with sovereign powers and a trust relationship with the government in which the tribe's lands will be protected ("Federal Acknowledgement," 2022). Without recognition, there can be no sovereignty, and consequently, a loss of the social, economic, and environmental benefits to Indigenous peoples and our larger community.

I am happy to call the Chesapeake home, but I cannot in good faith do so without acknowledging the history of this land and how I can contribute to a remedy. The actions of our ancestors can be hard to grapple with, but we know they cannot be changed. Fortunately we are in control of our own actions and therefore have the power to affect what happens next in our country's history. After centuries of oppression and violence, it is time to move forward as a community. We must return land to Indigenous communities and work alongside them to preserve their heritage and culture, address environmental challenges, and ensure that they have the resources to tell their story for generations to come.

"We believe that our vision of life in harmony with creation offers hope for our nation and our world. We believe that our people can help lead the way into a better future" ("Our vision for the future," 2022).

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Left: Phoebe Galione sits with waders in a stream; Right: Phoebe Galione holds a stonefly collected in the Yellow Breeches.

Meet Phoebe Galione, Our New Outreach Manager

By: Michelle Cao '25

Not long after graduation, the Alliance for Aquatic Resource Monitoring (ALLARM) welcomed Phoebe Galione back as the organization's new Outreach Manager. Previously, Phoebe was involved in ALLARM as a student watershed coordinator for three years and graduated from Dickinson College in May of 2021 with a bachelor's degree in Environmental Science.

As a New Jersey native, Phoebe's love and passion for aquatic science and water chemistry was fostered by her frequent visits to the Jersey Shore throughout her childhood. Coming to college, she knew that she wanted to continue exploring her interests in water but was unsure how to tie it into her college experience in a land-locked state. However, during her sophomore year, after learning about ALLARM in one of her classes, she joined the team as a student watershed coordinator, where she worked on the laboratory and outreach team. She credits her time at ALLARM for sparking her love for freshwater resources and for introducing her to the world of community science. It was her combined role on both the lab and outreach teams throughout her three years as a watershed coordinator that spurred her interest in science communication. She said, "science should not just be for the scientist, but for all who are interested in connecting and engaging with their environment" (P. Galione, private interview, 2022).

Phoebe is excited to work towards her long-term goal of making science more accessible to all audiences. In her current work as ALLARM's Outreach Manager, she manages, designs, and edits outreach material for ALLARM's social media platforms such as their Instagram, blog, and the newsletter you are reading now. Through social media, Phoebe is garnering attention and reaching larger audiences with aesthetic infographics about important topics made by herself and the student watershed coordinators. Most recently, she has collaborated with students in creating macroinvertebrate materials, catering to both social media and informational guides, in preparation for future sampling. She also uses these platforms to uplift the voices of partner organizations and to ultimately build a stronger network in the community science space.

Phoebe expressed her enjoyment in the diverse forms her work takes on. In addition to outreach, Phoebe is also helping leads the data organization and interpretation process for Stream Team volunteers. The data organization component entails going through the volunteers' collected data to ensure consistency and validity of the numbers while the interpretation portion involves visualizing the data into graphs that can more easily be interpreted by volunteers than raw data. By sharing information and optimizing their local expertise, Phoebe aims to show volunteers how to find the stories hidden within their monitoring data and to help interpret any changes over time. Phoebe is also the diversity, equity, justice, inclusion and accessibility point person on staff. She is looking forward to finding ways to make the ALLARM offices an even more welcoming space on campus while also finding ways to collaborate with, and learn from, diverse partners within the Chesapeake Bay Watershed. She hopes that in the future, communities that have historically been underrepresented, as well as (and often including) those who are being disproportionally and adversely affected by water quality issues, will be given the space to have a more amplified voice in the restoration of the Chesapeake Bay watershed.

Outside of ALLARM, Phoebe is a freelance artist, amateur astronomer and avid hiker. She is incredibly talented and brings others and her own ideas to life through her traditional paintings and digital drawings. On a nice weekend, she will often go to local hiking trails to enjoy the adventure and photograph birds and plants for future art projects. She also enjoys learning about space and will never turn down the opportunity to gaze at stars on clear nights. Phoebe's optimistic and easy-going personality combined with her interest in stream health, passion for community science, and vision for outreach, is apparent in her work. She goes beyond in her work and helps to train and engage student watershed coordinators in her work as well. The ALLARM community is incredibly excited to see what Phoebe accomplishes next.

Conquering the Data Universe with R

By: Nhu Truong '22

After an initial training, Stream Team volunteers start their monthly monitoring, the findings of which get uploaded to the Chesapeake Data Explorer, a data repository run by the Chesapeake Monitoring Cooperative. After a minimum length of twelve months of monitoring, it comes time to look at the volunteers' data and explore what the findings mean. Preparation for one of these data exploration meetings has gotten the entire team involved in the ALLARM office recently. The process is intense and involves checking errors (like rounding, data input, or precision) in volunteers' data, summarizing data with statistics such as maximum and minimum values, and visualizing trends over time in graphs. The results of this organization process was then shared with volunteers in virtual packets and discussed during ALLARM's Data Exploration Workshop on Wednesday, April 13th.

This academic year, Phoebe Galione, ALLARM's Outreach Manager, further developed detailed instructions on data analysis in Excel based off of preliminary data interpretation meetings that had happened for Cumberland stream team in early 2021. The process was divided into two phases: organization, and visualization. Following Phoebe's guides, I spent the last few weeks of the Fall semester and parts of my winter break working on downloading data, checking for errors, and generating statistics for multiple sites. When the Spring semester came, other ALLARMies picked up the process and transferred into the second phase, visualizing the data.

While Phoebe walked me through the process of data organization and visualization using Excel, I noticed repetitions in the task since as we need to redo all of the steps for each of over 50 sites when we transitioned into the next volunteer's data. Even though the task was not difficult, replicating the same procedures for

each volunteer takes up a lot of time, and all ALLARMies had to get involved in in order to meet the deadline.

Seeing room to build in efficiencies, I developed R script to streamline the process which ALLARM can apply to future data organization and interpretation processes. I learned programming in R when I was working on my independent research with my advisor, Professor Douglas. She had introduced me to R as a tool to manipulate, transform, perform statistical tests, and present data. Learning to program in R is similar to acquiring a new language. According to Prof. Douglas, the learning slope is very steep at the beginning as there are so many things that the learner has to get familiar with in the first few lessons. However, when the learner has obtained basic tools, they can rapidly apply R coding skill to create products and resolve problems. Programming has the advantage of helping us reduce workload and complete tasks more efficiently and with higher accuracy. Furthermore, when it comes to data visualization, R provides more diverse types of graphs and a wide range of tools to edit the graph such as color schemes or arranging elements compared to Excel.

The fact that I was able to make this connection between my independent research and the work I was doing at ALLARM I attribute to not only my increasing familiarity with programing, but also to my full comprehension of a data interpretation project and the targeted outcomes. The latter is highly important to further incorporate and employ R programming skills in different projects. The logic of programming is working backward from the envisioned products to the raw data. When I understood ALLARM's goals for the data interpretation process, I was able to gather skill sets and tools and build a structure using codes that taught the program to replicate the tasks that we have done in Excel and even more to continue performing the tasks whenever I import a new dataset. With the R scripts, data analysis can be carried out in a shorter time and with a greater accuracy. With the time being saved, ALLARM can speed up the preparation for data interpretation workshop and have all data organized and presented clearly for volunteers. In the future, if the data interpretation goals shift, the scripts can be adapted to make the changes accordingly, and the new adjustments will be reflected in all volunteers' data within a few clicks. To all the current and future ALLARMies, the scripts that I developed is not the optimal approach. There are spaces to further improve this project, and as you learn more about R and acquire other skills, I encourage you to be creative and give your ideas a try. Who knows what it might bring.

The result of these organized data are individualized data packets organized by site, one slide of which is shown here.

Chesapeake Monitoring Cooperative: Six Years in and Another Six to Go!

By: Michelle Hom '24

What an exciting time for the Chesapeake Bay as we near the 2025 deadline for improving its health. A lot has changed in the past thirteen years since President Obama signed his executive order to clean up our nation's largest estuary. A key lesson learned from the past decade of work is data collection is vital to help track cleanup efforts and assess water quality. Recognizing the need for additional data to track Bay improvement efforts, it was crucial to integrate all data to paint the full picture. Originally formed in 2015 to promote non-traditional (community-based, non-agency) data collection and to integrate community data throughout the watershed, the Chesapeake Monitoring Cooperative, or CMC, has achieved many of its goals over the past six years.

After receiving grant money from the Chesapeake Bay Program-Environmental Protection Agency, the cooperative formed in 2015 with five organizations: Alliance for the Chesapeake Bay, Izaak Walton League of America, University of Maryland, Virginia Institute of Marine Science, as well as Dickinson's Alliance for Aquatic Resource Monitoring (ALLARM). CMC is the first program in the nation to promote data collection and integration for a regional watershed, which includes six states and the District of Columbia. As a result, in 2016, CMC worked to create the foundation of their program and tools to facilitate data integration and use for partners using diverse equipment and methodology. This involved the development of a tiered framework to match sensitivity of data with potential data uses as well as the creation of Quality Assurance Project Plans (QAPPS). The following year, 2017, was huge for the cooperative since Data Explorer, or the database for water parameters, was established and the first data points were added into the system. Liz Chudoba, who is the Project Manager of CMC and Initiative Director of the Alliance for Chesapeake Bay, described the addition of the database as, "a key piece that brought everything together." From there, "the CMC gained more momentum, and it got people excited to contribute more data" (L. Chudoba, private interview, January 2022)

> For ALLARM, being a part of CMC allowed us to work closely with partners in both Pennsylvania and New York. Another highlight of 2017 was beginning our first NY partnership with the Ostego County Conservation Association in Cooperstown, New York. Due to budget cuts, monitoring data had not been collected in the county for over a decade, creating the need for data but also an opportunity for community engagement and education. In 2017, ALLARM supported OCCA in creating a study design and then went on to train the volunteers in diverse water quality techniques. Using grant funds, ALLARM was also able to loan the equipment to the volunteers. At the end of 2020, ALLARM held a data interpretation workshop after several years of data collection and today monitoring still takes place at seven sites throughout the county.

At the outset of CMC, the team facilitated a prioritization process with state agencies and watershed partners to identify potential needs and areas of focus. In Pennsylvania it was highlighted that are significant data gaps in the middle and lower Susquehanna River and data were needed in high intensity agricultural areas. To help address this need, with support from the Campbell Foundation, ALLARM worked with watershed specialists, the Lower Susquehanna and the Middle Susquehanna Riverkeepers, and Penn State's Master Watershed Stewards program to develop the Susquehanna Stream Team, launched in December 2018. To date, we have 140 volunteers, monitoring 74 sites within ten counties.

After passing quality control, volunteers learn to log their data in the Data Explorer. Back in September 2021, my first meeting as an ALLARM watershed coordinator was a Cumberland County Stream Team follow up meeting where I got to meet some of the volunteers. I loved seeing how passionate they were about their monitoring site, wanting to monitor more sites, and the critters they saw when taking their measurements!

As mentioned above, the Data Explorer is a crucial tool to house water quality data from volunteers and non-agency partners from the 64,000 mi^2 watershed. In 2019, the Data Explorer hit a record high for the number of data points added in a year with a total of 100,000! (Currently there are over 670,000!) The following year, 2020, was a special year for the Data Explorer when CMC partnered with Booz Allen Hamilton to create a virtual six-week event called Hack the Bay hackathon. Over 400 people participated and were divided into four challenges to see how the data from Data Explorer could be used to represent the entire Chesapeake region. The challenges were 1) Restoration, 2) Filling in Data gaps within the CMC, 3) Modeling, and 4) Report Card indicators. Liz Chudoba stated that challenge two was the most helpful since the CMC could see the locations where data was successfully collected in comparison to locations that needed additional tools "to fill in the gaps". Liz Chudoba also discussed one submission that stood out to her which looked at varying temperatures and their relationship to climate change. The submission then allowed the CMC to dive deeper by splitting the Chesapeake into the upper and lower watershed as well as the different seasons.

Finally, in 2021, the CMC reached many milestones including the addition of over 500,000 data points in Data Explorer and completing more than 70 workshops and trainings. New partnerships have also formed with the Chesapeake Bay Trust and NFWF.

The CMC has had a variety of lessons learned and successes throughout its six years and is looked to as a model for partnership and community data integration. The CMC has been included in national and international case studies including Alberta, Canada as well as the United Kingdom. Like many programs, the CMC has had to be resilient and creative to navigate community-based data collection during a pandemic.

Part of the CMC team gathered together for an in-person planning meeting in August of 2022.

The Future is Bright for CMC

In 2021, the Chesapeake Monitoring Cooperative received a second grant award from the Environmental Protection Agency to implement a second phase for the next six years or until 2027. One new goal this grant is to focus on diversity, equity, inclusivity, and justice to ensure that CMC is supporting all communities and cultivating equitable and inclusive pathways for engagement.

In addition, the CMC stives to provide additional data sources before the six-year time frame. This includes SAV monitoring where discussions about funding have been addressed in February 2022. Finally, CMC hopes to focus on data interpretation and use. Both supporting volunteers in understanding and using their own data as well as hosting a second Hackathon.

The CMC is looking bright for the future. I still find it amazing that the CMC is the first regional project of its kind within the United States, and other groups are trying to emulate the cooperative. As ALLARM Citizen Science Specialist Stephanie Letourneau stated, "The CMC is such a diverse team. It is great to exchange ideas and find a common ground despite coming from different states." I have no doubt that the CMC will continue to do amazing things in the future.

Two Worlds Collide: Science and Social Media

By: Darcy Bromley '22

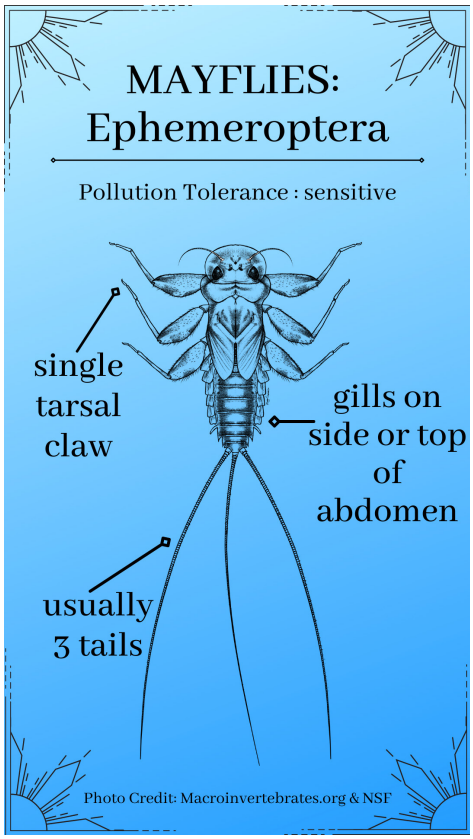
The digital age is upon us, and for more than a decade, people have been using social media platforms as a means of communication and information dissemination. Social media creates a unique avenue for scientists and researchers to educate the public on a broader scale than was available in the past. It is, however, important to consider how diverse different forms of social media are, and what aids effective communication across these platforms. How information is conveyed dictates how it will be received, so understanding what types of information to share on separate platforms is paramount. Defining what social media sites do, plays an important role in how we use them, so placing platforms into categories allows users to know what to share on different sites.

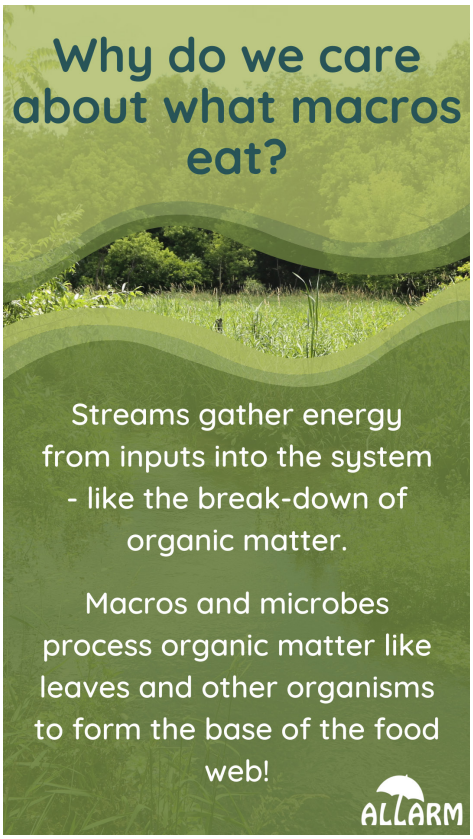
Researchers suggest that there are two types of media platforms typically used to present information to the public – those specifically meant for research and those geared toward connecting people (Hunter, 2020). Research-based media includes GoogleScholar and ResearchGate, whereas connection-based social media include sites like Twitter, Instagram, and Facebook. People tend to use both types of media with varying regularity, students being the main prolific users of both platforms. The Journal of Undergraduate Neuroscience Education found that students, on average, spend between 2.5 to 8 hours on social media and about 5.5 hours per day doing academic activities like studying or attending class. Additionally, researchers demonstrated that platforms geared toward social connection can also become a place for education (Valentine, & Kurczek, J., 2016). The mixing of social media and science education has already been utilized by many; Twitter was found to help students find information to cite in research through posts by scientists and Facebook had high levels of engagement on posts about research funding (Hunter, 2020). This shows that both students and the public can use any type of social media to learn, but if information is not presented effectively or with enough pull, the goal of education will not be achieved.

Knowing what to post and where to post it, affects whether the information is communicated effectively. Jarreau et al. conducted a study of 1,080 Instagram posts by science museums to see how education-based programs disseminate information (2019). It was found that only 10% of posts had significant scientific information, while 70% had promotional materials (2019). While it is important to engage with one's direct audience (to advertise events or in-person learning opportunities) through promotional materials, education-based organizations can use social media to effectively communicate with a much wider audience, unrestricted by location. Koivumäkii et al. suggest that the best way to communicate information is by "tailoring messages and highlighting common ground" (2020).

They surveyed social media users and scientists alike to understand why people may have a bad perception of scientific information, and the results were clear. People felt that there was too much jargon and impassive language, which made it harder to connect with the material and enjoy reading it (2020). With the negative perception of scientific information shared via social media, many considerations need to go into each post to ensure that the target audience is reached and that the information is shared successfully. The solution to these issues can be implemented in a variety of ways; using more graphics, simplifying the information so that it's easy to understand without a scientific background, and including more lighthearted humor to make the information more enjoyable. These are all tools that ALLARM uses to make our social media as user-friendly and engaging as possible. ALLARM actively shares to various social media platforms including the ALLARM Blog, Instagram, Twitter, YouTube, and Facebook. Posts to Instagram, Twitter, and Facebook tend to be short informational blurbs or infographics that share our current events, student research, or other topics of interest worth amplifying. Information on these sites is easily accessible regardless of prior knowledge because it is catered to our volunteer groups and community members – we use short and accessible phrasing, and all posts are accompanied by visuals which help convey the message of the information being presented.

The most recent student social media projects presented on these platforms include our "Did You Know" series, which highlights student research and other topics essential to understanding ALLARM and community science. One recent edition addressed Indigenous communities of Pennsylvania and their history while another focuses on civic engagement and a sense of place within ones community. Another series I spearheaded is "Macro Mondays," which are visual informational guides for volunteers to learn identification techniques for commonly seen macroinvertebrate orders. Both series are conducive to education through social media – they are accessible infographics which engage viewers with visuals.

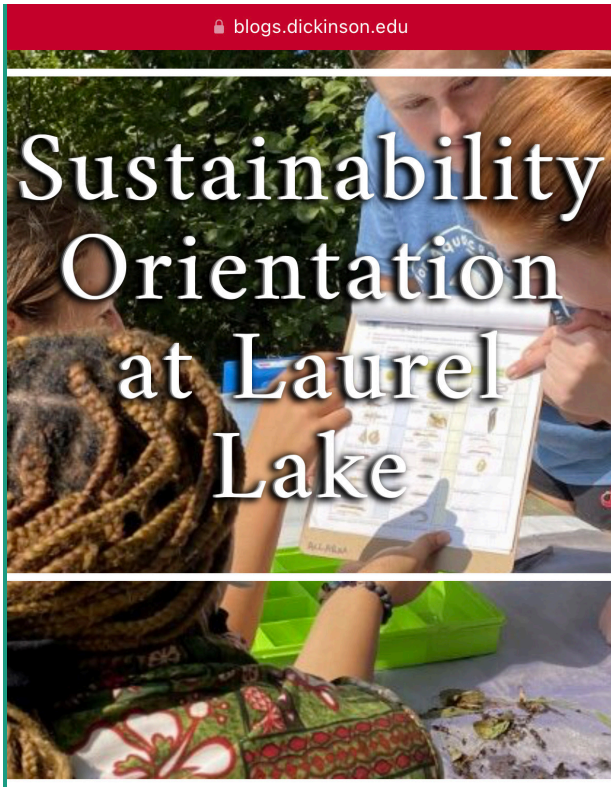




Three slides from the "Macro Mondays" social media series created by Darcy Bromley '22
Mayfly Illustration Source: Macroinvertebrates.org, NSF

We then have the ALLARM Blog which allows for more thorough information shares. Blog posts are written by student watershed coordinators and provide first-hand accounts of the events that ALLARM participates in, and spotlight student research. Student projects like blog posts are important because they intersect student-volunteer education; we are typically learning about research topics brought up by our volunteers themselves.

Lastly the ALLARM YouTube account creates one more avenue for science education. In the past, ALLARM has recorded informational and instructional videos ranging from step-by-step monitoring procedures to webinars discussing macroinvertebrates and their role in stream ecosystems. For visual learners interested in in-depth instruction, our YouTube is the perfect platform to look at. ALLARM is a community-based science organization which strives to educate not only our volunteers, but the general public about issues of water quality, so keeping our social media both up to date and user friendly is paramount. Aiding the learning process in a way that works for everyone is at the forefront of what we do and allows science to be effectively communicated to the public. Be sure to follow us at @allarmwater!



by Darcy Bromley '22 | Sep 27, 2021

Title image of a blog post written by Darcy Bromley '22

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Using Plants to Mitigate the Effects of Stormwater

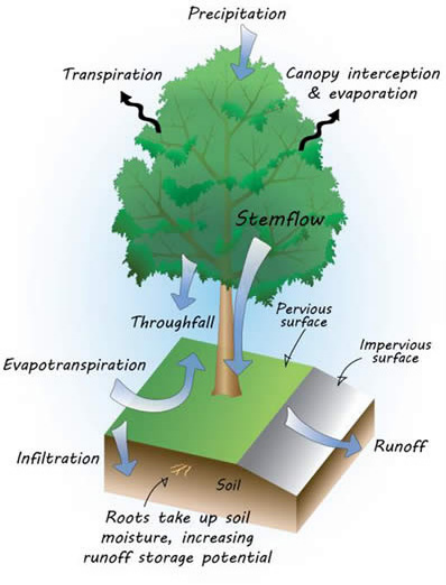
By: Cat Dickman '22

It has been a long-term goal of ALLARM to monitor, protect and restore local waterways. As part of ALLARM's partnership with the Carlisle borough, ALLARM must participate in public outreach and produce and distribute a certain amount of stormwater education resources per year. Examples of past initiatives include festivals, movie theater posters, and rain barrel workshops and installation. Solving stormwater runoff issues can often seem like a fruitless pursuit when faced with the fact that the nonpoint sources of stormwater pollution cannot easily be eliminated. It can also be discouraging to feel like there is nothing one can do on their own to make real change in the community. That is why it is so important to keep promoting options that allow community members to make their own informed decisions, on their own terms, and to their own capacities. It is also important to make the resources on how to execute positive action available. One way of helping mitigate the impact and range of pollution in stormwater is through the use of plants on private property. However, to make this individual solution accessible and enticing, one must understand the benefits of planting for the homeowner, as well as the steps to carry out in order to be successful.

In developed areas, runoff is a significant problem. One of the major reasons for the increase of runoff has to do with the high amount of impervious surfaces present, or surfaces that are not able to absorb water. Examples of impervious surfaces include traditional pavement, sidewalks, roofs, and traditionally planted lawn grass species with shallow roots. While many urban areas have sewer systems to divert some of this water, during heavy precipitation events, they often get overwhelmed and do not have enough capacity to store all the water, leading to flooding and debris build up. Additionally, it is common for sewer systems to drain directly into local waterbodies, so they ultimately do not function to prevent pollution.

To understand why runoff should be prevented in the first place, it is important to first establish why it is such a problem. Runoff is water that is literally "running off" the Earth's surface and is not absorbed into soil or intercepted by objects during its fall. As this water travels over impervious surfaces, it accumulates the pollutants it runs through. Such pollutants include car oil, fertilizers, trash, and pet waste. These can harm waterbodies by producing harmful bacteria and/or generating an excess amount of nutrients in a waterbody, which can in turn create toxic algal blooms that suffocate plants and wildlife (GRACE, 2017). Additionally, the temperature of water can increase as runoff travels over impervious pavements that store heat, especially in the summer months. This can negatively impact the biotic life that are extremely sensitive to stressors like changes in water temperature (EPA, 2021; Chithra et al., 2015). Luckily, there are specific actions that homeowners can take to reduce effects of urban runoff. Minimization of impervious surfaces through green spaces can help combat these problems at the source (Verbeek et al., 2014).

Planting trees and shrubs in backyards is one of the more accessible ways to create a green space and aid in negating the impacts of runoff. Trees and shrubs support water cycles through natural processes by intercepting water before it becomes runoff. While this number can vary due to circumstantial factors, one study has shown that only 5–15% of rainwater runs off the ground in vegetated areas, with the rest evaporating or infiltrating into the soil (Bolund & Hunhammer, 1999). Restored areas with trees and shrubs can have higher infiltration rates which means that more water will be able to soak into the ground and return back to natural underground aquifers instead of into waterbodies and sewer systems. Interception of rainfall provided by plants' leaves also helps prevent flooding, as less water reaches the ground and is eventually evaporated by sunlight (Janney & Giles, 2018; Yang et al., 2019). The deep root systems of trees, shrubs, and other native plants can uptake more water than a traditional turf grass and filter out pollutants through the processes of root nutrient uptake in Rhizofiltration and break down chemicals through Phytoremediation (Abdullahi, 2015; Beans, 2017). In other words, plants are able to adsorb excess nutrients, metals, and other pollutants through their roots, and therefore filter out what had been swept up by runoff. They then transpire purified water back into the atmosphere through leaf pores (Slatyer, 1960).



Left: Stormwater flooding on road outside of Dickinson College's Kaufman Hall due to impervious surfaces and clogged drains
Right: The many natural water processes associated with trees and shrubs. Source: Stormwater to Street Trees, EPA

For those who don't have extensive yard spaces for trees and shrubs, there are still elements of green infrastructure that could be implemented into spaces at your disposal. One such example would be planter boxes. Planter boxes are contained bioretention areas that are usually located near a road or sidewalk, or other impervious area with low water retention rates. There are multiple kinds of planter boxes, some of which can drain back out onto pavements through a pipe, or some that extend right into the soil below. More complex versions even drain into sewer systems. Those that extend into the soil below allow water to infiltrate back into ground. With the right plants, they can provide environmental benefits while adding aesthetic value to an outdoor area. Like the filtration processes described previously, planter boxes can provide a smaller scale filtration of water (Cahill et al. 2018). Depending on the type of planter box, water can be filtered while passing through the substrate that comprises the layers of the planter box. Additionally, water is temporarily contained and slowed from reaching the pavement while going through the planter boxes, which helps to keep sewer systems from getting overwhelmed at the peak of storms. Water temperature can also be reduced in the process of passing through the soil, and is prevented from increasing by not running along impervious surfaces (Cahill et al. 2018). More options such as vertical gardens and green roofs also exist and are viable options with informed execution.

More sources for how to implement plants in your own yard can be found through resources like Pennsylvania DEP website, your county extension office (which can be searched through Pen State Extension) or by visiting a local gardening center that is knowledgeable on native plants. Through an informative worksheet and possible future workshops, ALLARM will also continue to aid in providing resources for community members to stay informed and take action on stormwater issues. ALLARM has continually been involved with this topic by training community members to monitor changes to water quality, which of course often happens as a result of stormwater runoff. Engaging communities to monitor the health of their own streams and planning worksheets and possible workshops to teach community members how to reduce runoff in their own yards will continue this effort.

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QA/QC is the Way to Be!

By: Nhu Truong '22

What is QA/QC?

According to "ISO9000:2015: Quality Management Systems – Fundamentals and Vocabulary," quality assurance (QA) and quality control (QC) are both under the umbrella of quality management (ASQ, n.d.). In short, quality control entails a wide range of activities to ensure that a product or service satisfies requirements for quality. QA/QC are key processes to help ensure that data are of known quality.

What does QA/QC look like at ALLARM?

QA/QC at ALLARM is documented in a Quality Assurance Project Plan (QAPP). QAPPs outline details of these processes from preparing a monitoring kit, checking precision of equipment to assessing data. This document is required by the

EPA for any projects that collect and use environmental data and are funded by the agency (EPA, 2021), and this category includes ALLARM. ALLARM's federally approved QAPPs are coordinated through our Chesapeake Monitoring Cooperative project. Director of ALLARM ,Julie Vastine, shared that the CMC QAPP is updated every five years or whenever a new technique is introduced. Additionally, while QAPPs are not required for projects that are not funded by the EPA, ALLARM's recommendations surrounding monitoring practices are always rooted in Standard Methods or procedures outlined in our QAPPs.

QA/QC takes place throughout the monitoring program and is a team effort of the ALLARM staff, student watershed coordinators, and our volunteers. The process starts with the Study Design process, where decisions around quality management are made and then recommended practices are detailed in ALLARM's volunteer method manuals. All volunteers are required to participate in methods trainings and follow recommended practices, including calibrating their equipment, preparing kit, conducting monitoring, and sending results and water samples to ALLARM. Jinnie Monismith, ALLARM Assistant Director, explained in an ALLARM lab tour that once data and water samples from volunteers arrive at the office, the staff and watershed coordinator students perform all tests on the water samples using the same procedures and exact equipment that ALLARM provides volunteers with (private video, 2021) as well as equipment with additional sensitivity. Results of our analysis are then compared with volunteer's data to check for conformity and are later shared with the volunteers. When QA/QC is carried out throughout the monitoring effort, the data we generated at the end will be proven to be credible resources for further analyses of stream health.

Why are QA/QC and QAPP important?

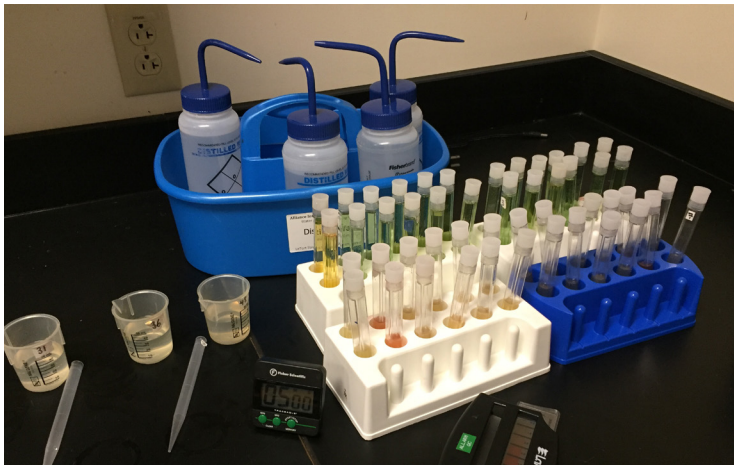
QA/QC as well as its document – QAPP – all help ALLARM and community partners generate credibility in our programs and the output that we generate. This is achieved as they establish transparency and ensure consistency in our monitoring effort, which furthermore fosters collaborations with and supports other citizen science groups when those organizations use our data or apply our methodology.

Given that the QAPP lays outs details of all steps involving in the data collection and is accessible to the public, ALLARM is transparent to our staff, our partners, and the larger communities about how we are conducting monitoring. This builds trust in the quality of our programs and our output, which, to the public, encourages collaborations in citizen science (NACEPT, 2018). Indeed, for anyone who finds our data helpful to answer their questions or even more, want to replicate our technique for their own projects, they can easily review our procedures and data.

In addition to transparency, following QA/QC guidelines verify that our data are produced with a consistency in methodology (Monismith, 2021). The consistency helps us – the operators – troubleshoot as we can quickly detect errors when current measurements are greatly shifted among operators or different from previous records. This is evident when ALLARM staff and student watershed coordinators re-run tests on volunteers' sample. Knowing that ALLARM and the volunteers stick to the same procedures, if ALLARM finds any significant differences between our results and volunteer's, we try to identify the potential error and then provide advice for improvement.

With transparency and consistency in monitoring,

QA/QC does not only benefit us – the data collectors – but also the larger field (including potential data users).



pH and nitrate testing performed for Stream Team QC

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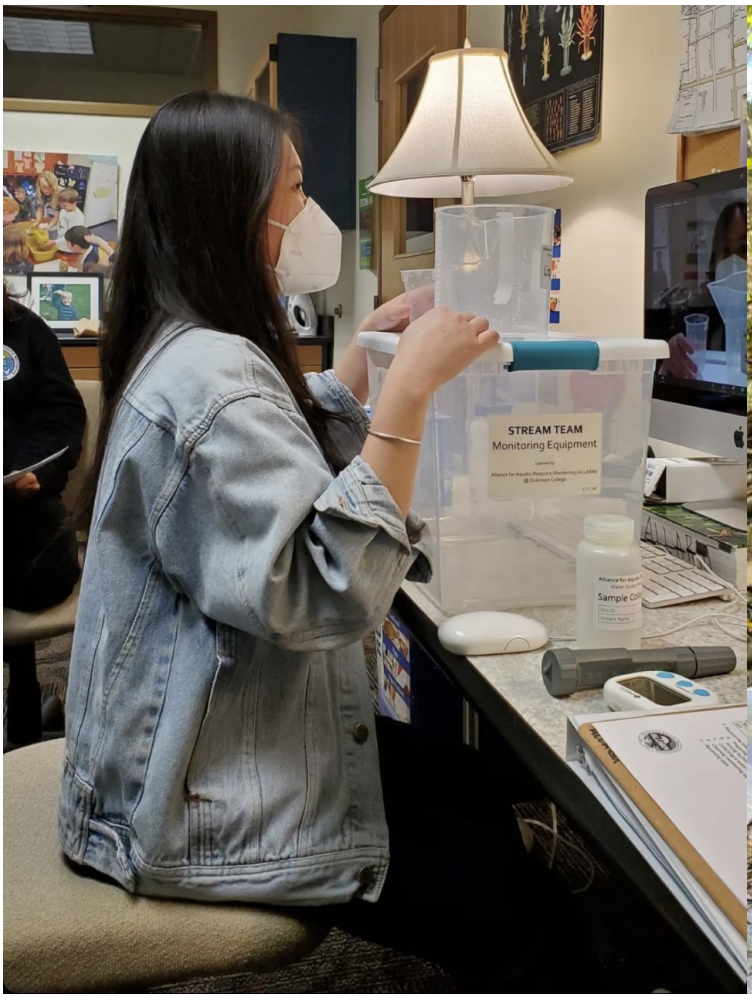
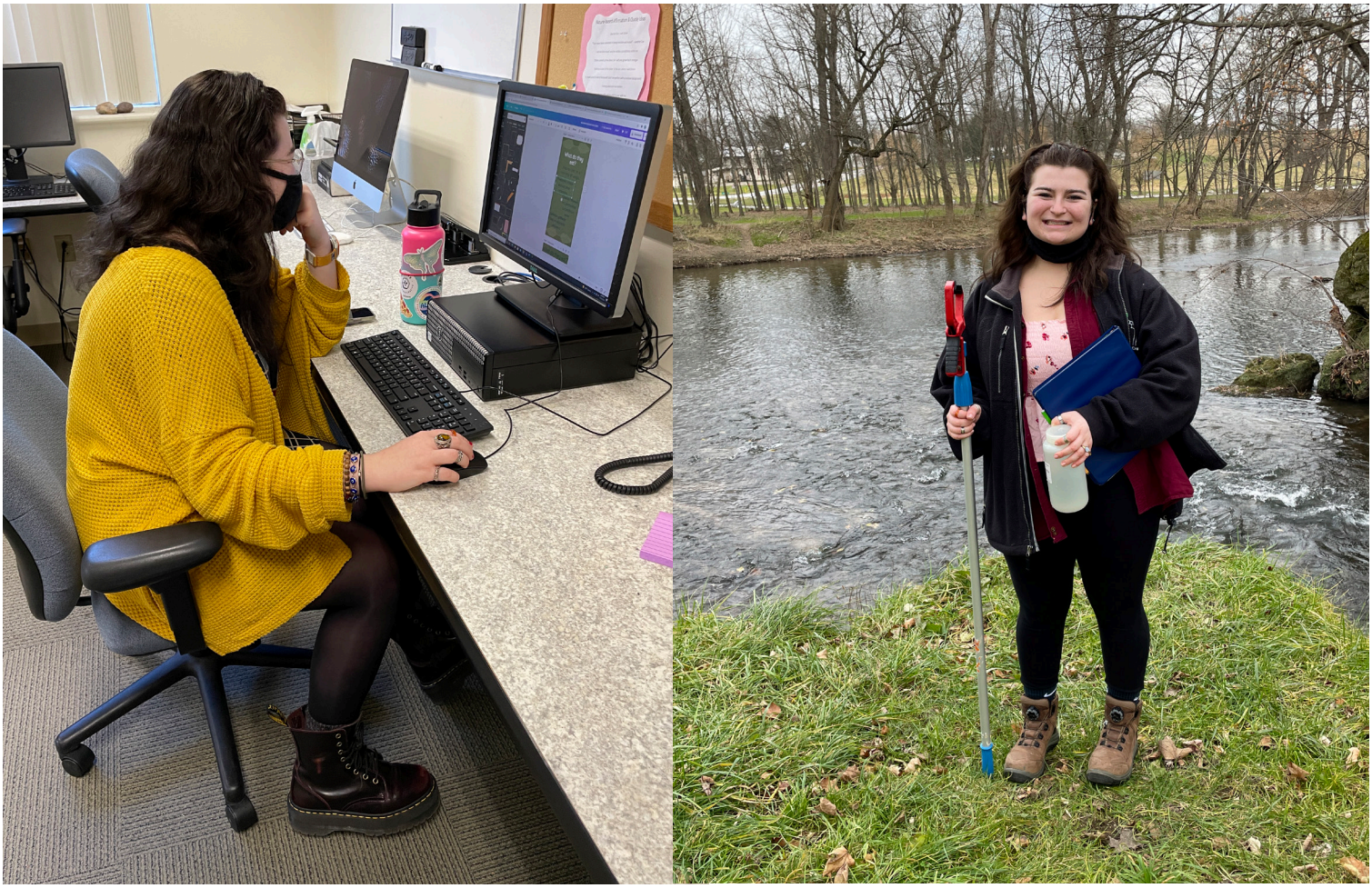
Senior Reflections from the Class of 2022

Nhu Truong

Be empowered and empower. Over the past three semesters, I have not only improved my own skills, but I have also contributed to the communities where I have temporarily lived. My participation in lab work, volunteer training, and data organization step-by-step has helped me overcome my fear of public speaking and has encouraged me to become a creative thinker. ALLARM's openness to new ideas has incentivized me to bring in and incorporate the diverse knowledge and skill sets that I have acquired from different experiences. In addition to personal growth, working at ALLARM has connected me with local residents and allowed me to apply what I have learned in the classroom to support communities in understanding water quality issues. Different community science projects I have been exposed to at ALLARM have broadened my understanding of how scientists can communicate scientific information to a wider public with diverse knowledge bases. Whenever I heard volunteers sharing their monitoring experiences, I felt that I was part of a larger effort – an effort to break down the distinction between scientists and the public. As people build capacity to solve their challenges, it gives me hope that we are not as powerless as we think, that we are capable of making positive changes to the world. Lastly, I would not have experienced this growth without the ALLARM family. I truly appreciate the mentorship from the full-time staff and the support from my colleagues, and I am so grateful to be a part of



Left: Nhu Truong '22 walks Stream Team volunteers through the equipment cleaning process during an online workshop
Right: Nhu Truong '22 picks through sediment on a kick net to sort out any macroinvertebrates.



Left: Darcy Bromley '22 working on the "Macro Monday" social media series, introducing macorinvertebrates to our following
Right: Darcy Bromley '22 standing along the confluence of the LeTort Spring Run and the Conodoguinet Creek

Darcy Bromley

As I finish up my year at ALLARM, I reflect on what an incredible experience it has been, truly allowing myself to grow. ALLARM provides students with a safe space to learn and allows us to create our own experiences through education. Being able to train volunteers, monitor the LeTort, test protocols, and create informational guides, among so much more, has allowed me to understand the importance of civic engagement and science communication. My favorite moments from my time at ALLARM include being in the office and catching up with other ALLARMies (both how they are, and what they're working on) as well as going on trips with each other. I've had the opportunity to travel throughout PA for monitoring workshops, and the time these trips have created to talk with fellow staff members and volunteers has been enjoyable and educational. Fostering my connections with the PA community has been invaluable. Although many of our volunteers do not have a background in the sciences, the people I've met have been involved in environmentalism in so many ways. From students educating themselves, to activists litigating environmental issues, to watershed stewards, the people we connect with have diverse perspectives on both water quality issues and how they should be addressed. Seeing our volunteers in action makes me look forward to my future in environmental science and the exploration of issues I intend to undertake. I would like to thank my fellow ALLARMies – both watershed coordinators and full-time staff – for such an amazing year at ALLARM and the many opportunities I've had the pleasure of partaking in.

Cat Dickman

When I started working at ALLARM during the fall of my senior year, I did not expect that I would have enough time while working there to gain such a wide range of experiences. I have been able to gain experience in social media outreach through writing blog posts, in writing a newsletter article, in stream monitoring and monitoring workshops, in participating in a macroinvertebrate collection workshop, in research on trees and shrubs, and so much more. In my classes at Dickinson, I had already been learning about topics like aquatic ecosystems, environmental justice, and the importance of community science. But ALLARM provided me with a space for the application of all these concepts and ideas I was learning about. I was able to see how organizations can carry out complex goals and ideas realistically. The diverse range of experiences that I have been involved with at ALLARM has given me a base knowledge for future jobs in the environmental sphere, both by letting me develop communication, teamwork, and critical thinking skills, but also by allowing me space to experience new things and determine what I am interested in personally. ALLARM helped me in developing new skills by gently pushing me out of my comfort zone. For example, when I started preparing for teaching volunteers at monitoring workshops, I had little practice in using the monitoring equipment and felt nervous about needing to use it in a presentation. After practicing though, I felt more knowledgeable and comfortable. I was able to grow my range of experiences through these opportunities that ALLARM has allowed me to experience.

Left: Cat Dickman '22 practicing how to use the Stream Team equipment during ALLARM Orientation
Right: Cat Dickman '22 working with volunteers to collect macroinvertebrates using a d-net

Left: Claudia Bonaccorsi '22 ready with a Stream Team kit to assist in a virtual training and refresher
Right: Claudia Bonaccorsi '22 presenting at the Climate Teach In hosted by Dickinson College

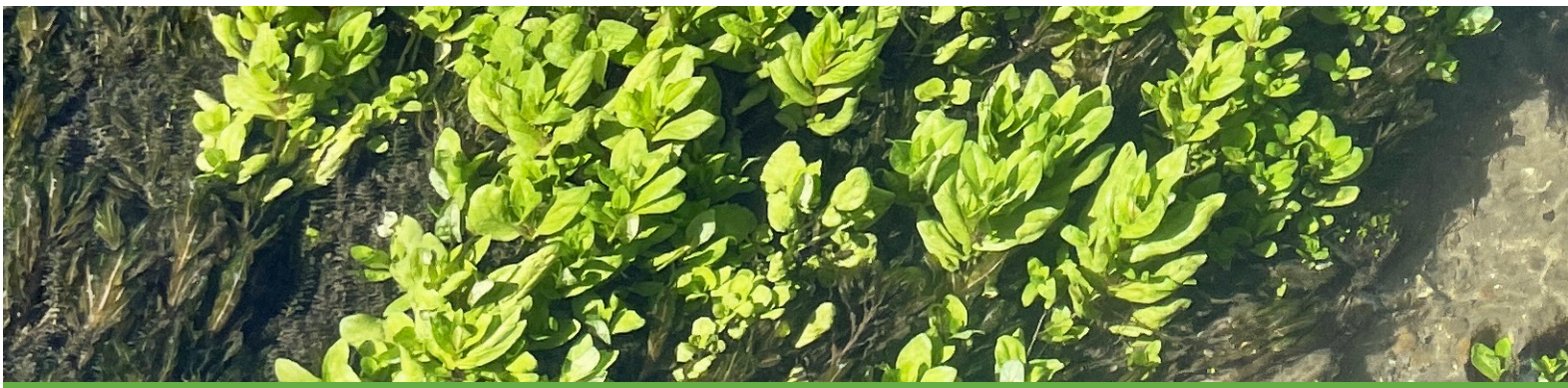
Claudia Bonaccorsi

In the summer of 2021, I anticipated with excitement the beginning of my role as a Watershed Coordinator at ALLARM. I had never engaged with community science before, and I was incredibly thrilled to be introduced to a whole new field. I imagined my upcoming role to be full of new perspectives, experiences, connections, and friendships. Reflecting now over this past year, I was indeed exposed to exciting new ideas, connections, skills, and opportunities. What I could not have anticipated, however, was how deeply I would connect with the mission of ALLARM and the realm of community science. After a year spent engaging with enthusiastic volunteer monitors and passionate ALLARMies, I understand the importance of ALLARM as an organization that can transform the lives of volunteers, aquatic species, and the health of watersheds. Being a senior environmental studies major at Dickinson, I have investigated the role of community engagement in tackling environmental and social issues, but working for ALLARM has expanded exponentially my knowledge and interest in community-based work. When I assisted with a macroinvertebrate collection training in York, Pennsylvania this past fall, I witnessed how engaged the volunteers were in the monitoring training and how artfully the full-time ALLARM staff designed and facilitated the experience. The event introduced me to the thorough, important, and joyful innerworkings and outputs of this ALLARM team. Even though I will be diverging from ALLARM in a few months – off to teach English in Brescia, Italy for a year – I foresee a future for myself in which I reconverge with community science and continue along this career path. Reflecting on my initial understanding and excitement for ALLARM, I see that I was rightfully enthusiastic; the experience has been everything I was hoping for, and more!

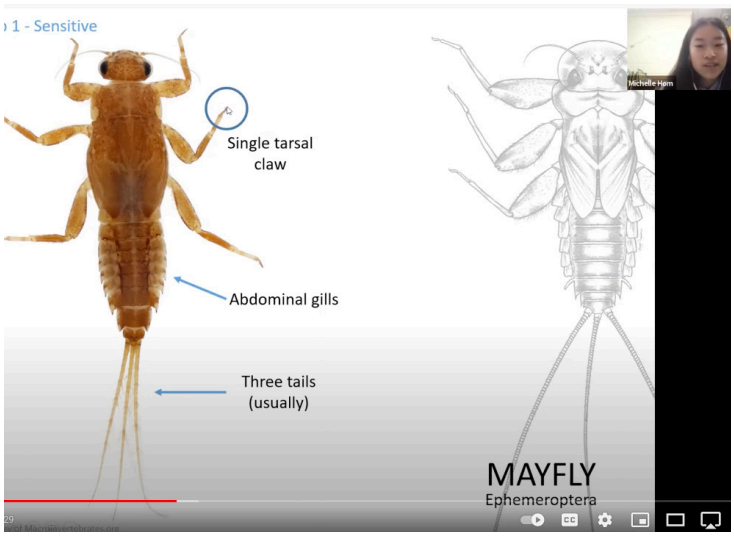
ALLARM in Pictures

Left: The graduating seniors and senior staff pose together after their celebratory final staff meeting.
Right: Nhu Truong '22 and Stephanie Letourneau smile, ready for a presentation at the Bosler Memorial Library.

Left: York County Stream Team volunteers practice a new Chesapeake Bay Program macroinvertebrate collection method.
Right: Cumberland County Stream Team volunteers gather together for an in-person meeting.



Left: Members of ALLARM and Chesapeake Monitoring Cooperative work on developing instructions for benthic macroinvertebrate collection; Right: Watershed Coordinator Nick Bradbury '23 uses a probe to assess dissolved oxygen levels in the local LeTort Spring Run.



Left: Members of the Pennsylvania Lake Erie Watershed Association pose together after a successful meeting. Right: Screenshot from the Macroinvertebrate Workshop hosted by ALLARM;
image source: Macroinvertebrates.org, NSF

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