2023 Poster Session Abstract Submission Synthesis

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Volunteer

Victoria Clower, GA Southern University, Ogeechee Riverkeeper, Institute for Water and Health

Title: Release of VOCs, gasses, and bacteria from contaminated landings and creeks of Ogeechee River
Advisor/Teacher: Melanie Sparrow

Background: River landings are common public grounds, visited by many everyday. The aftermath of visiting these locations may be unsettling since most trash is left behind and scattered. As litter collects with each rain or high wind, trash has a better chance of ending up in our streams, rivers, creeks, and our oceans. The main purpose of this study is to measure both air and water quality to determine how each is impacted by trash. **Methods:** Ammonia, methane, and volatile organic compounds (VOCs),temperature, and humidity were measured for air quality. Water quality parameters for this study were derived from the Georgia Adopt-A-Stream method. Conductivity, dissolved oxygen, pH, water temperature, and Escherichia coli counts were taken every two weeks at Rocky Ford Landing, Rocks River Landing, and Little

Lotts Creek. Each Monday, from January 17, 2022, to May 17, 2022, air measurements were sampled ten times at each location.

Results: *Escherichia Coli* and airborne bacteria were highest at Rocks River Landing and Little Lotts Creek with averages of 233.33±50.85 CFU/100mL and 316.3±305.48 CFU/100mL, respectively as well as 634.9±851.9 CFU/m^3 and 666.3 ±1034.1 CFU/m^3, respectively. **Conclusion**: Data shows higher trends in air and water pollution where trash is found the highest with Rocks River Landing and Little Lotts Creek showing trends that trash may impact these areas. The potential contamination of river landings and creeks may contribute to increased levels of airborne and waterborne gas levels and microbial loads near river water surfaces.

Debra Dooley, Upper Oconee Watershed Network (UOWN)

Title: Using Technology Resources to Improve Access, Interactions and Interpretation of Long-term Water Quality Data Generated Through Citizen Science
Advisor/Teacher: Not listed

The Upper Oconee Watershed Network (UOWN) has been collecting surface water quality data quarterly since 2001 in response to concerns about increased urbanization within the upper Oconee watershed. We present here the use of various technologies and data resources to improve access, visualization, and modeling with this long-term data. Using tools such as Microsoft Power BI and ArcGIS the long-term data can be shared and analyzed in a way that promotes visibility of the work that is being done by water quality monitoring entities and may help target locations of concern. Thus far these tools have been employed such that users can input any address, locate the nearest sampling site, and access the data for that site. The sampling sites and companion data are represented geographically through the interface. Tools such as Microsoft Power BI can also be used to illustrate long term trends in water quality variables such as conductivity, turbidity, and pH. Again, these tools allow the user to have a visual representation of potential change over time. Lastly, these more recent tools allow for the user to perform predictive analytics which would help identify sites of concern based on the data available. Using technologies such as these improves data accessibility and usability which promotes connections and direction for citizens scientis concerned about water quality.

Undergraduate

Sahil Bardai and Melis Akkan, Adopt-A-Stream at KSU

Title: Water Quality Monitoring using Cutting-Edge Technology in DNA Sequencing
Advisor/Teacher: Todd Pierson

Water Quality Monitoring using Cutting-Edge Technology in DNA Sequencing Adopt-A-Stream at KSU; Sahil Bardai*, Melis Akkan*, Corene Fuller* *All Authors Contributed Equally Microbiology is the study of all living organisms that are too small to be seen with the naked eye. The microbiome present in water can be an indicator of the quality of the stream. For example, the microorganisms present in a water sample can tell us a lot about the species of animals that excrete feces in the water. One method used for characterizing microbiomes is DNA sequencing, and new methods allow for the real-time sequencing and analysis of stream samples. Here, we describe the results from a pilot study in which we demonstrated this process and attempted to identify the bacteria present in the site adopted by KSU's Stream Team.

First, we collected 1L of water from the site and returned to the lab. Then, we filtered the water using a vacuum-filtration technique and a special filter paper to filter the bacteria from the water, and we extracted DNA from this filter paper. Then, we conducted PCR (Polymerase Chain Reaction) to amplify a variable genetic locus using readily available PCR primers. Then, we ligated adapters onto the PCR products, and we sequenced them on an Oxford Nanopore MinION sequencer. This machine generated the nucleotide sequences, and we used bioinformatic analyses to identify some of the bacteria species in the water. This technique and technology have the potential to help water researchers efficiently conduct exciting research, which can potentially help solve some pressing issues in nature.

Madeline Gregory, Kathleen Stephens, Cierra Kimbrell, GA College and State University

Title: The effects of heavy metals on water quality in Champion Creek, Middle Georgia
Advisor/Teacher: Dr. Allison Vandevoort

Clean, safe water is one of the most important resources that the Earth has to offer, however, the process to determine water quality is not easy. Samples of water were taken from Champion Creek in Baldwin County, Georgia, which is part of the lower Oconee River watershed. For this research project, we assessed dissolved oxygen, pH, and the heavy metals chromium, iron, and copper. Dissolved oxygen is significant because it is required by aquatic organisms such as fish, and macroinvertebrates like insect larvae and clams. Heavy metals can pollute water bodies through chemical reactions in aquatic environments, and direct toxicity to organisms. Macroinvertebrates are a bioindicator of water quality due to their varying degree of sensitivity to dissolved oxygen levels and pollution. We gathered samples using a stratified random sampling method at two different sites within Champion Creek. One site contained a silty bottom, the other a sandy bottom. We collected samples over the span of three days, spread across a five-week period in fall 2022, usually around 1-4 pm. Each sampling day had differing weather and seasonal patterns, creating variability in our results. Data were analyzed using Adopt-a-Stream standards, and statistical tests including ANOVAs, and 2 sample t-tests. From these methods, we were able to determine that neither chromium nor copper were present in significant amounts, and that there was nothing that indicated poor water quality. This implies that the water quality in Champion Creek has fair health, based on both chemical and bioindicator assessment.

Bloo Mitchel and Pricilla Dickey, Dalton State College

Title: Assessment of the macroinvertebrate community and water quality in Mill Creek
Advisor/Teacher: Dr. John Lugthart

Assessment of the macroinvertebrate community and water quality in Mill Creek Bloo Mitchell & Priscilla Dickey The Conasauga River and its tributaries are home to a diverse assemblage of fish and invertebrates; however, researchers have noted a decline in local biodiversity over recent decades. These declines occur downstream in areas where agriculture, industry, and residential and commercial development are the primary land uses. Although specific causes for these declines are uncertain, it is hypothesized that high levels of nutrients, pesticide pollution, sedimentation, or a combination of these stressors may be responsible. A local project, known as the Park Creek Elementary Restoration Project, aims to improve native fish, plant, and pollinator habitats around a portion of Mill Creek and an associated tributary that is the habitat to a federally threatened fish called the trispot darter (Etheostoma trisella). To ascertain a baseline of the water quality in this area, measurements of water quality and physical in-stream habitat characteristics were made, and three macroinvertebrate sampling methods were utilized over a four-month period at three sites (two sites adjacent to the restoration area - a Mill Creek site and an ephemeral

tributary site - and an upstream reference site). The results of this study indicate that the downstream site is impaired, and the adjacent tributary is highly impaired, with stark differences in macroinvertebrate diversity between sites. Higher conductivity levels over the length of the study and a sharp reduction in dissolved oxygen in the warmer months was observed at the tributary site. These data will serve to track the progress of the Park Creek Restoration Project in improving water quality.

Imani Vincent, Piedmont University

Title: Factors that Influence Groundwater Chemistry from a Wetland Environment
Advisor/Teacher: Piedmont University
This research is a continuation from previous work and details the sampling of groundwater via wells scattered throughout Piedmont University's wetlands to analyze aqueous ion concentrations for potential municipal use and expand on the influence of factors such as precipitation events and various topographical locations. It was hypothesized that:

1. Low precipitation would yield higher concentration of aqueous ions in all wells sampled.
2. Proximity to wetlands would buffer ion concentrations.

Groundwater from the former Lake Demorest, GA, U.S. lakebed was collected from beneath substrates of impounded and free-flowing aquatic environments using a homemade test tube apparatus at 6 different locations and 3 replicates were analyzed for each location at 3 different times. Concentrations were measured using an Atomic Absorption Spectrometer (PerkinElmer AAnalyst100). It was determined that there were significant differences in the Iron, Calcium and Magnesium, Sodium, and Potassium concentrations statistically analyzed using a one-way ANOVA (SPSS version 25) comparing the absorbance values measured for the aqueous ions. However, the data suggests that aqueous ion concentrations vary with amount of short-term precipitation (3-4 months before sampling) and proximity to permanent surface water. Based on this research there is no location within the Camp Creek wetland basin appropriate for municipal use.

High School

Chantel (Theresa) Boney and Jasmine Crouch, Newton College and Career Academy

Title: A New Generation of Pollutions: The Quantification of Microplastics of Local Watersheds
Advisor/Teacher: Ms. Laura Lambert

The decomposition of consumer and industrial waste products results in microscopic plastic pollutants (microplastics) smaller than 300 micrometers. Microplastic pollution has led to the bioaccumulation of 553 particles/per capita/per day in humans. The Alcovy and Yellow Rivers, used in Newton County's public water system, were selected for this study. Results show that there are microplastics present in both rivers. Water was filtered through 1-micron nets at the Alcovy and Yellow Rivers for thirty minutes and one hour. At both rivers, 80 oz of water was collected and stored in sterile containers. Net samples were digested with NaOH for 48 hours, then neutralized to a pH of 7. Samples were then quantified under a microscope. Container samples strained through filter paper and analyzed with a digital microscope. The majority of the microplastics found were fibrous and brightly colored. The Alcovy samples contained more microplastics than the Yellow samples. Alcovy samples collected for thirty minutes contained an average of 7.1 microplastics, while Yellow samples contained an average of 6.1. Alcovy samples collected for one

hour contained an average of 20.3 microplastics, while Yellow samples contained an average of 19.6. There was not a substantial difference between the number of microplastics found in either river. However, there was a statistically significant difference between the number of microplastics present in samples collected for thirty minutes than those collected for one hour. This indicates that the time spent collecting significantly impacts the amount of microplastics found in the sample.

Kyleigh Conley, Elite Scholars Academy

Title: Does Freshwater Location Affect Dissolved Oxygen?
Advisor/Teacher: Not Listed

The purpose of this experiment is to investigate the dissolved oxygen levels of a constructed wetland and a nature preserve, notating if one had higher levels than the other over a course of three days. First I added 8 drops of Manganous Sulfate Solution to the sampling bottle, then added 8 drops of Alkaline Potassium Iodide Azide. After this, I added Sulfuric Acid, then capped and mixed till the precipitates dissolve. Once my sample was fixed I poured 20mL into a test tube, and filled my titrator with 10g of Sodium Thiosulfate, I titrated the sample until it turned pale yellow.Then, I added 8 drops of Starch Indicator, to which the sample turned a blue like color. With the leftover Sodium Thiosulfate in the titrator, I continued titrating until the blue sample turned colorless. Finally, I read the titrator for the ppm and documented number. I continued for the other sample and for two more days. The data showed that both the nature preserve and constructed wetland retained a similar ppm during the three days of testing, with each staying in ranges of 7.0-8.0 ppm. The dissolved oxygen levels were 8.0, 7.4, and 7.0 for the three samples from the nature preserve, and 7.4, 7.4 and 7.0 in the constructed wetland. In conclusion, my hypothesis was incorrect because the two testing subjects showed no abnormalities, especially the wetland, which I assumed would have a potentially lower amount of dissolved oxygen.

Simon DePina, Rockdale Magnet School for Science and Technology

Title: The Effect of Ocean Acidification on P. Fusiformis
Advisor/Teacher: Ms. Roger

Studies have shown that bioluminescence is present among key microorganisms which sustain the biogeochemical cycles that help maintain carbon dioxide (CO2) and oxygen (O2) levels at stable levels. Ocean acidification occurs when high levels of dissolved CO2 decrease the pH of the water which may negatively affect organisms. In this experiment P. Fusiformis was used as the sample organism because they produce bioluminescence and are microorganisms. The organisms were split into 4 groups representing each treatment (Control – 8pH, Treatment 1 – 7pH, Treatment 2 – 6pH, Treatment 3 – 5pH) with each group having 3 trials. White distilled vingear was used to maintain the pH. Every other day the pH of each trial was measured using a pH probe. A picture was taken of the bioluminescence and analyzed to produce the average brightness of blue pixels on ImageJ. There was a positive correlation between luminescence and pH with a R2 value of 0.15. This indicated a weak correlation and as pH decreased bioluminescence increased. However, when pH values of >7 were isolated and analyzed, a negative correlation was present with a R2 value of -0.29. This indicates a weak relationship but, as pH decreased the luminescence increased. The research could be improved by having more control of the environment and using another method to decrease the pH. Understanding ocean acidification and its impact further will help us combat it.

Joshua Chatham Pate, Coastal Plains Charter High School

Title: An Evaluation of Estuarine Macroinvertebrate Sampling and its Implementation in Monitoring the Health of Georgia's Coastal Environments.
Advisor/Teacher: None

In order to evaluate the differences of macroinvertebrate populations in freshwater and estuarine environments and in an attempt to assess the health of environments along the coast of Georgia, several sites located on the Golden Isles were sampled. These samples were taken of sediment and along vegetative margins using a d-frame net. Northern krill made up the majority of the macroinvertebrates sampled, while Marsh crabs and several unidentified worms were found in smaller quantities. None of the macroinvertebrates listed on the Adopt-A-Stream database were found, as it only contains those that live in freshwater environments. The samples taken were meant to provide the basis for a long term monitoring project and the development of a separate database recording macroinvertebrate samples taken in coastal environments. This is an ongoing project, and more data on these estuarine macroinvertebrate populations will be gathered by the end of January.

Nathaniel Phelps, South Paulding High School

Research will be completed by Confluence

Title: Bacterial Monitoring of Paulding County's Natural and Man-made Water Systems
Advisor/Teacher: Tema Hoskins

With less than 3% of the world's water being freshwater, maintaining potable surface water sources is important to human development. Polluting a freshwater source can have devasting impacts on the communities that rely on it. The purpose of this study is to examine the water quality of local water systems. Water sources that will be monitored include the Spartan Swamp, High Shoals Falls, Pumpkinvine Creek, and Sweetwater Creek. Data collected from these water systems will be used in tandem with Georgia's Adopt-A-Stream water quality database to determine which, if any, water systems need the attention of restorative efforts. This will continue the practice of recording water quality data that Adopt-A-Stream water quality has been supporting and organizing since 1993. To determine harmful pathogen levels in the water E. coli will be used to as an indicator species. To find E. coli levels, water samples will be incubated in a controlled environment for 24 hours. Other water quality measuments like dissolved oxygen and Ph levels will be taken to further determine water system characteristics. Through the results found in the data, we could deduce whether or not our local waters are safe for the livings things that depend on it.

Emily Grace Royal, Rockdale Magnet School for Science and Technology

Title: The Effect of Kelp and Basalt on Ocean Acidification
Advisor/Teacher: Laura Rogers

The oceans are in danger from the threat of rising levels of carbon dioxide (〖CO〗 _2). This can lead to ocean acidification, which harms the ecosystem by lowering the abundance of carbonate ions (the material shellfish and other organisms use to build their shells and skeletons). This project explored the

possibility of using kelp and basalt to mitigate ocean acidification by absorbing carbon dioxide. Testing was done in four saltwater tanks over a two-week period. Each tank contained mantis shrimp as a model organism. One tank had just shrimp, one shrimp and rockwool (a substitute for basalt), one shrimp and Acetabularia (an aquarium algae to represent kelp), and one with all three additives. The experiment focused on the amount of 〖CO〗_2 absorbed by measuring pH levels. Each tank started the experiment with varying levels of acidity, with Tank 4 & Tank 3 being the most acidic and Tank 1 being most basic. All tanks ended the experiment with a pH within 8 and 8.1, which matches with the current average pH of the ocean. Overall, Tank 3, with Acetabularia alone had the most impact, since it experienced the most change between its final and initial values. In contrast, the results involving the rockwool were below average compared to previous studies. An ANOVA was run and found the p-value to be 0.009, proving this data as significant. It is important to continue this research because of the potential impact on the environment and people who rely on said ecosystems.