2020 Poster Abstract Synthesis

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Volunteer

Luke Morneault and Ken Morneault, Oconee Water/Upper Oconee Watershed Network

Title: **Analysis of Macroinvertebrates found in Upper Oconee Watershed: 2001 - 2016**

The Oconee River originates in Hall County and flows south to join the Ocmulgee River on the border of Montgomery/Jeff Davis/Wheeler Counties to form Georgia's largest river – the Altamaha which flows to the Atlantic Ocean. The Upper Oconee Watershed Network (UOWN) is dedicated to protecting water resources and improving stream health in the upper Oconee River watershed through community-based advocacy, monitoring, education and recreation. UOWN was formed in 2000 and its volunteers have collected long-term (21 years) water quality data in support of assessing instream health across a four-county area. UOWN does physical, chemical and biological monitoring on a quarterly basis. It uses Georgia Adopt-a-Stream (AAS) protocols for the biological (macroinvertebrate) monitoring. Macroinvertebrate monitoring is a standard method used to assess aquatic health. At each UOWN quarterly monitoring, some number of sites are selected for biological monitoring. The presence and abundance of taxa are recorded on Georgia AAS Macroinvertebrate monitoring forms and the Water Quality Index score is added to the UOWN dataset. For this project, the Georgia AAS Macroinvertebrate forms from 2001-2016 were reviewed and presence of macroinvertebrate taxa were entered into a separate dataset. This dataset was then analyzed using the python programming language to understand temporal and spatial trends in macroinvertebrate taxa between 2001-2016 for the upper Oconee watershed. The results of this analysis could be useful for other Georgia AAS volunteer groups.

Graduate

Philip W. Moore, North Carolina State University
Title: **Impacts of climate change on stream temperature in the southern Blue Ridge**
Teacher: Dr. Helena Mitasova

The impacts of climate change on surface water temperatures in the upper Hiwassee River watershed were evaluated. Adopt-A-Stream data collected by volunteers at multiple sites in the upper Hiwassee over several years were used to develop a regression model to predict water temperature given ambient (air) temperature. Climate projections under both moderate-emissions and high-emissions scenarios were then fed into the model to predict surface water temperatures in the year 2099. Assessments were completed in a geographic information systems environment by digitizing temperature data as raster surfaces.
The results of the study support prior research conclusions that water temperature can be effectively predicted from air temperature with relatively simple linear regression models, and that even moderate carbon emissions are a threat to surface water temperatures and coldwater fisheries. For the month of August 2099 (the warmest month per the results of the model), no stream sites are predicted to have optimal temperatures for brook trout and other coldwater aquatic life under the moderate emissions scenario; 32 percent of sites are marginal under the scenario, and 68 percent are nonsupporting. While additional and more in-depth research is warranted, this study strongly implies that rising global temperatures are a serious threat to the health of coldwater aquatic ecosystems in the southern Blue Ridge Mountains. Preserving the integrity of these habitats will likely require both mitigation and adaption strategies to address climate change.

Undergraduate

D. Filiccichia, B. Kenney, M. Escamilla, B. Campbell, E. Howell, M. Cowart, J. Nachtrieb, J. Howington, M. Downs, Young Harris College
Teacher: Dr. Johnathan G. Davis
Co-authors/project partners: Joseph Pate, Young Harris College Department of Outdoor Leadership; Callie Moore, Western Regional Director, MountainTrue

Title: **Connecting Volunteerism, Science, and Community Engagement to Protect Water Quality in a Southern Appalachian Watershed**

The Hiwassee River watershed is experiencing increased land use changes as a retirement and tourist destination. Shifting land use pressures have stressed water resources, which provide short-term economic benefits but represent long-term economic and social costs. In many cases, there is a lack of water quality data available to determine the magnitude of effect of land use practices. Young Harris College collaborated with MountainTrue to analyze data collected by Georgia Adopt-A-Stream volunteers throughout the watershed to determine impact of land use on water quality such that data-driven recommendations can be developed for the community to balance economic development with protection of water quality. Data, including conductivity, dissolved oxygen, water temperature, and pH, from 41 sites across 5 subwatersheds was used. Landscape development characteristics, such as forested cover, agriculture, impervious surface, land area, and stream slope, were collected from the USGS StreamStats database for each site. Significant differences in conductivity ($P = 0.025$) and DO ($P = 0.023$) existed between watersheds. Conductivity ($P < 0.001$) and DO ($P = 0.012$) were significantly correlated to forested cover. Conductivity was also correlated to developed area ($P < 0.001$) and impervious surface ($P < 0.001$) upstream. When accounting for differences in site characteristics, impervious area was a significant predictor ($P < 0.001$) of conductivity, and developed area was a significant predictor of DO ($P = 0.009$) and pH ($P = 0.001$). Thus, developed and impervious landuse strongly affect this watershed. Results can identify problem sites and watersheds, guide management and restoration, and support future grant acquisition.

Rachel Pesaresi and Rachel Tempia, University of North Georgia
Teacher: Margi Flood
Co-authors/project partners: William Teitjen, Jeremy Miller, Gabriel Pierce, Magan Free

Title: **A Comparison of Benthic Invertebrates in the Etowah River 1958 & 2018**

The Etowah River originates in Lumpkin County, northwest of Dahlonega. It flows south then west across North Georgia joining the Oostanala to form the Coosa River. It is famous for its biodiversity and is home to many endangered aquatic species.
Landscape use in North Georgia has changed in the past 100 years, shifting from agriculture to secondary regrowth of forests to increasingly large pockets of urbanization. This project examines benthic invertebrate composition change over sixty years in a small section of the Etowah.
Monthly benthic samples were taken at three locations in the section of the Etowah that borders Dawson Forest from October 1958 to September 1959. Organisms were identified to the lowest possible taxa level. These were the 'before' samples for a project to assess radiation impact on the river from an unshielded reactor. The project and the reactor were shut down and the data was stored.
We replicated equipment and collection sites from September 2017 to September 2018. Organisms were identified to lowest possible taxa. September through November 2017 samples have been analyzed.
There does not seem to be a huge difference in composition which may be due to the fact that the watershed was recovering from heavy agricultural use in the 1950s and has been relatively protected since then. This is changing rapidly with urbanization.
The discussion of species loss and baseline shifting is in the news now. Our present day understanding of what is here is very different from what was here.

Kelly Jackson, Clayton State University
Teacher: Dr. Aubrey Dyer
Title: **A Small Stream with Big Problems: A chemical investigation into the contaminated headwaters of the South River**
The milky blue waters of the South River in East Point, Georgia have been a neighborhood concern for over thirty years. The odd color of the water can even be seen from satellite pictures. Preliminary Georgia Adopt-A-Stream testing was done at four locations, beginning at the headwaters and proceeding several miles downstream. Testing results showed lower pH and fewer macroinvertebrates further upstream on the South River. We followed the pollution to the headwater's watershed and discovered two sites with ominous histories: one site is listed as a Class 1 hazardous site and one is listed as a Class 3 hazardous site, by the Georgia EPD. This watershed is littered with over one hundred years of chemical, battery, glass, fertilizer, and alum manufacturing waste, as well as a burned down cotton mill and a landfill. The river is surrounded by urban area, and much of it has been placed underground and is not reachable from surface level. Two tributaries that feed into the headwaters have been identified, and water and soil samples were obtained and analyzed to find contaminates. The historical industries and their wastes have been compared to the chemical analysis results, to find correlation. This information may be able to help find a cleanup solution for this city river.

High School

Bodey Gray, South Paulding High School
Teacher: Tema Hoskins

Title: ***E. coli* in Spartan Swamp**

Fecal coliform bacteria are indicator species whose presence in natural waterways communicate the potential existence of numerous strains, including those that threaten human health, of *Escherichia coli* (*E. coli*). Beginning in October 1, I sampled three different sites in Spartan Swamp, Adopt-A-Stream's officially registered wetland area on South Paulding High School property. I used Georgia Adopt-A-Stream's bacterial monitoring procedures and worked alongside Paulding County Water Department environmental specialist (lab analysis) Eric Eberly throughout my research. Every other week, I took a sterile sample from each of the three sample sites in the "Spartan Swamp" wetland area. I dropped 100 mL of sterile de-ionized water onto a 3D Petrifilm plate as a control group. I also dropped 100 mL of sample water onto three 3D petrifilm plates per sample site and incubated all plates at 35 degrees Celsius for 24 hours. After 24 hours, I counted the number of colony forming units and recorded the data that communicates the quality of the wetland water in regards of *E. coli*. According to my results, the wetland does not display abnormal levels of fecal coliform bacteria, an indicator of *E. coli*. The proximity of the wetland to our school's septic system leach field intrigued me to research, study and publish the data of the microbiology of Spartan Swamp at the headwaters of Sweetwater Creek in the Chattahoochee River Basin of west Georgia.

Aubree Goff, South Paulding High School

Teacher: Tema Hoskins

Title: **Dissolved Oxygen and Chlorophyll Patterns in Spartan Swamp**

Water is home to a countless number of living organisms. These organisms grow and change over time, resulting in changes to the water itself. Water has the capacity to change in many ways; the pH, temperature, turbidity, and dissolved oxygen are some examples of the manner in which water can change. This semester I have studied the chlorophyll production in photosynthetic organisms, both phytoplankton and zooplankton, in relation to the levels of dissolved oxygen in the same area. This study was conducted with water samples in varying areas, noting photosynthetic organisms and levels of dissolved oxygen with a Water Quality Meter (AZ 86031). The levels tend to vary based on season but doing multiple tests throughout one season allows a pattern to form. This pattern seems to correlate with other seasons. This study allows students to link the functions of biotic and abiotic organisms within an ecosystem while also noting the patterns of dissolved oxygen and chlorophyll within a system.

Kimiya Rezaiamiri, Woodward Academy
Teacher: Tram Van

Title: **Water Contamination in Atlanta Area**

Several recent studies have found evidence of arsenic in local drinking water, including the water found in Dekalb County and Atlanta prison areas. Arsenic, which causes increased risk for diseases like cancer, cardiovascular and stroke is a clear danger to Atlanta communities. Hoping to expand the data available on the local water supply, I tested for the presence of arsenic in nine rivers and streams within a fifteen-mile radius of Atlanta, including the Yellow River and the Chattahoochee River. Over a course of month in November of 2019, I used rapid arsenic tests to study the level of arsenic in each sample. Of the nine rivers and streams, none was found to have toxic levels of arsenic as defined by EPA. However, one source, South River showed borderline high level of arsenic in all three samples. This allowed me to conclude that most free public waters in Atlanta area have low level of arsenic, but that in the South River, which is by the airport, may require remediation in the future. Additional studies and larger samples are necessary on an ongoing basis to confirm that arsenic levels remain low in potential drinking water in the Atlanta area.