LIMNOLOGY PRACTICUM POSTER SESSION 2017

STUDENT INDEPENDENT PROJECTS

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ABSTRACT BOOK

KETTLE LAKE PROJECTS

I Found Your Trash: A Survey of Microplastics in Onondaga and Song Lake

Steven Fenn

Microplastics are a cause for concern in aquatic ecosystems because they are growing in abundance and organisms are known to ingest these particles, which can bioaccumulate in the food web. This study looked at whether microplastics were present in Onondaga Lake and Song Lake. Due to the larger watershed, proximity to the city of Syracuse and inflow from the wastewater treatment plant, it was predicted that there would be more microplastics found in Onondaga Lake than Song Lake. Three surface tows at ~0.5km each were done in both lakes using an 80µm neuston net and later analyzed in lab. A total of 5 microplastics were found in Onondaga Lake and a total of 10 in Song Lake, all measuring less than 5mm. Future research could be done to determine the main sources of plastics in both lakes.

Comparison of the Nutrients Contributing to Phytoplankton Harmful Algal Blooms (HABs) in Song Lake (Preble, NY) and Tully Lake (Tully Center, NY)

Jennifer McElwain and Natalee Wrege

Song Lake, located in Preble, NY, and Tully Lake in Tully Center are kettle lakes subject to frequent harmful algal blooms (HABs). Many factors contribute to HABs in these lakes, including runoff from surrounding farmland, road infrastructure and increased shoreline development. Our goal is to determine which limiting nutrient or combinations of nutrients (nitrogen, phosphorus and trace metals) contribute most significantly to harmful algal blooms in Song and Tully Lakes. This study aims to evaluate if nitrogen has a larger impact on phytoplankton growth than phosphorus or trace metals. To determine this, we collected two water samples from each of the HAB and NON HAB sites from both lakes, Tully and Song. The water samples were prepared in bioassay bottles, incubated in the CIRTAS controlled lab and then filtered water was tested for chlorophyll a with acetone extraction. They were then transferred into borosilicate tubes and placed in a fluorometer for the fluorescence readings, which gave us the algal mass used to quantify the chlorophyll amount (%) for each treatment. Phytoplankton from a site on Song Lake that was experiencing a HAB were most stimulated by the “all” (containing N, P & trace metals) nutrient addition treatment. Tully NON HAB site phytoplankton were also stimulated by the ”all” treatment, while Song Lake HAB samples were found to be stimulated by N+P treatments. The individual N, P & metal additions did not impact chlorophyll concentrations as much individually compared to when they were added synergistically. This study could act as a foundation for future studies to help determine bloom specifications from identifying the species of phytoplankton that were stimulated and even how to mitigate runoff into the lake to decrease future blooms.

Potential Influence of Roads on Water Conductivity in the Cortland-Onondaga County Kettle Lakes Region

Casey Lennon

Specific conductance is a very useful parameter for estimating the influences of salts and ions from the watershed on the corresponding aquatic ecosystem. Pure water is a very poor conductor of electricity. As salt and ion concentrations increase, the ability of water to conduct electricity increases as well. Song, Tully, Crooked, and Little York Lakes were all formed through the same glacial deposition process and their close proximity makes them ideal to compare how different spatial trends in the watershed can influence water chemistry. These lakes were chosen because Song and Tully Lakes have smaller sub-watersheds with less road cover while Tully and Little York Lakes have larger basins with more road cover including the prominent Interstate 81. The corresponding conductivity values reflected these differences in spatial trends. Tully and Little York Lakes had significantly greater conductance values than Song and Crooked Lakes while there was no significant difference between the lakes within the same group. The relationship between road cover and conductivity however is not linear. This suggests that there are other factors contributing to the waters conductivity. The dynamic nature of hydrology, land use, and even weather patterns could have potential influences on this parameter.

Macrophyte Habitat Suitability and Zebra Mussel Distribution in Song Lake, Tully NY

Selene Muñoz, Tyler Duby, Miranda Ciardulli

Macrophytes are an essential aspect of a freshwater ecosystem because they provide habitat structure and complexity, therefore it is important to assess their limiting factors in a lake system. This study assesses the extent of Song Lake suitable for macrophyte growth based on light availability, as well as the current coverage and diversity of macrophytes in Song Lake. We also analyzed the quantity, distribution and sizes of invasive zebra mussels (*Dreissena polymorpha*) discovered incidentally while collecting vegetation samples. Vegetation samples and light data were collected at 23 sites throughout the lake. The percent abundance of macrophyte species found at each site was recorded and the extinction coefficient was calculated at each site to determine the euphotic zone. A map was created to demonstrate locations throughout the lake that are suitable for macrophyte growth based on light availability, which could be used to determine habitat for fish and other organisms.

I'm Addicted to You, Don't You Know that You're Toxic?

A Comparison of the Effects of Cyanobacteria on Gastropods Found in (Toxic) Algal Blooms vs. Non-Bloom Areas in Song and Tully Lakes

Julia Silva and Max Hermanson

There are concerns about harmful algal blooms (HABs) that have been occurring in both Song and Tully Lake. The blooms release toxins, which can have severe health impacts on the people and/or animals surrounding the lake, and thus are a concern to local residents. This experiment examines growth rates of snails from HAB and non-HAB sites in Song and Tully Lake when exposed to *Microcystis*. Fifty snails were collected from each site, with 20 being placed directly in 70% ethanol, while the other 30 were transported to SUNY ESF's CIRTAS laboratory. Snails were labeled individually, placed in site-specific tanks with water from their respective sites, and their dimensions were measured before and after the addition of *Microcystis*.

We predicted that the snails originating from HAB sites would be less affected (not as much decrease in weight, length, or width) than snails from non-HAB sites, based on prior selective pressure for adaptations to a HAB environment. Our results show that opposite trends occurred between the lakes. Snails from the HAB site of Song Lake had growth that was less stunted than the non-HAB site, while in Tully Lake, the HAB snails had negative growth and the non-HAB snails experienced positive growth.

Fish Assemblages of Song Lake and Onondaga Lake

Michelle Vasiloff & Zach Davis

Song Lake is a closed mesotrophic kettle lake found in the town of Preble, just south of Syracuse New York. The only inputs of water come from precipitation, runoff and ground water. There is no outlet for the water. This characteristic prevents the spread of different species like invasive milfoil or zebra mussels as well as fish. Recently the kettle lake association used a Grass Carp Remediation System to help reduce the macrophytes found in the system. The objective of this project was to see what other fish might be found in Song Lake. Looking at the fish assemblage we can discover information on the health and productivity of the ecosystem. If there is a large diversity of fish and the overall health of the fish are good, meaning that the fish have a good weight to length ratio, we can conclude that Song Lake is not being severely impacted by anthropogenic activities. Song Lake was then compared to Onondaga Lake, another local lake. The fish were collected using two different types of gear. Trap nets were set for twenty-four hours over two sites. Gill nets were set for seventy-five minutes and set at four sites. Fish species were recorded along with their lengths. Bluegill were also weighed. Song Lake Bluegill had a higher condition factor than Bluegill in Onondaga Lake (1.68 for Song, 1.06 for Onondaga). Onondaga Lake had a larger diversity index than Song Lake (0.941 for Onondaga, 0.898 for Song). The higher diversity of fish in Onondaga and the lower condition factor of Bluegill could be the result of the larger, open watershed and the long history Onondaga Lake has with pollution.

Balancing the Budget: Tracking Groundwater Seepage to Understand Song Lake Water Flows

Lillian Zemba

Song Lake is a kettle lake in Preble, NY. Inflows to the lake come from runoff and groundwater seepage; outflows come from evaporation and groundwater flow. In order to determine sources of groundwater to the lake, I calculated a water balance for the lake and took temperature samples to determine where groundwater inflow was occurring. I found that net groundwater flow into the lake was negative, and that groundwater flowed into the lake on the northwest side.

PROJECTS ON OTHER AQUATIC SYSTEMS

The impact of an urbanized watershed on elemental composition within streams

Maria Alfaro and Brenna Mosher

Rivers and streams have been impacted by anthropogenic sources, in particular land-use change. Urban development is a major source of contaminants due to stormwater run-off, discharge from wastewater treatment plants, the use of fossil fuels, and other complex combinations of municipal and industrial wastes. Increased concentrations of contaminants can lead to excess growth of aquatic weeds and algal blooms, low dissolved oxygen levels, and lower aquatic biodiversity. The objective of this study is to determine the impact development has on stream water quality compared to areas with less development within a watershed. Water samples were taken from three streams within the Onondaga Lake watershed: Onondaga Creek, Ninemile Creek, and Ley Creek. For each stream, two sampling locations were chosen. The first site (upstream) was an area with a lower concentration of urban development, which was determined using land-use data from the National Land Cover Database (NLCD). The second point (downstream) chosen was approximately 200 m upstream of where the creek entered Onondaga Lake, to ensure the data would not be altered by with water mixing from Onondaga Lake. Using Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES), elemental concentrations were determined for aluminum (Al), barium (Ba), calcium (Ca), iron (Fe), potassium (K), manganese (Mn), magnesium, (Mg), sodium (Na), and sulfur (S). All other elements were below detection and were not reported. An increase in the average elemental concentrations between downstream and upstream sampling areas was observed, with the highest percent change for Na (209.7%). Syracuse is known for having a brine aquifer, which has created a number of salt springs around the lake and throughout the Tully Valley. This is a major natural source of Na, particularly in Onondaga Creek. Increases in sodium concentrations can also be attributed to the use of deicing agents on impervious surfaces. These agents also contain calcium chloride, calcium carbonate, potassium chloride, and magnesium carbonate which could be potential sources for many of the other elements we measured. Other factors within urban developed areas include higher percentage of automobiles. Exhaust from these can include Ca, Mg, Na, SO4 and K. Based on these results, an average increase in all elements tested, urban development has decreased the total area of forested land, thereby reducing the natural filtering capacity of vegetation within the Onondaga Lake watershed.

Viability of Fluorescent Microbeads for use as a Marker in *Daphnia* Feeding Experiments

Andrew Bachteler and Alex Romer

Harmful cyanobacteria blooms are becoming more abundant due to anthropomorphic changes to freshwater ecosystems. This has many consequences for the ecological dynamics of aquatic ecosystems, including impacts on zooplankton. The feeding rates of a zooplankton (*Daphnia*) on a diatom (*Cyclotella*), a non-toxic, and a toxic cyanobacteria (*Microcystis*) were compared. To measure the relative feeding rates, we used microbeads to act as a proxy for amount consumed. *Daphnia* feed indiscriminately and will take up non-food particles while feeding. By letting the Daphnia feed for a set time on *Cyclotella*, nontoxic *Microcystis*, or toxic *Microcystis*, with a set concentration of neutrally buoyant microbeads, the average number of beads consumed should be correlated to consumption rate. 60 individual *Daphnia* were tested on each food type and were exposed in the beads/phytoplankton mix for 2 hours. The results showed that the *Daphnia* feed at a significantly higher rate on the *Cyclotella* (p-value = 0.007), but there was no statistical difference between feeding rates on the nontoxic *Microcystis* and toxic *Microcystis*. This may be a function of the particle size of *Cyclotella* being easier to consume than that of the small *Microcystis*, rather than of food quality. Future research could be done to measure the association between the mass of food consumed and the number of beads consumed, which would allow for consumption, rather than relative consumption, to be calculated.

Consumption of Toxic *Microcystis* vs Non-Toxic *Microcystis* by *Dreissena* Mussels

Andrew Bachteler and Alex Romer

Comparison of Three Reservoirs on Independent Tributary Branches of Oneida Lake

Anna L. Conklyn

Reservoirs accumulate water behind dams on riverine systems, resulting in turbid water flow to be greatly slowed, sedimentation and sequestration of most particulate suspended organic material and complexed nutrients out of the water. Due to the characteristically high amounts of organic matter stored in reservoirs, the outflowing waters are commonly depleted of oxygen and nutrients, and have accumulated reduced compounds that may be toxic to biota at high concentrations. The riverine system that drains into Maple Bay of Oneida Lake is composed of three dammed tributary branches, and the goal of this study is to demonstrate the impacts of damming on water quality by comparing the water chemistry of the reservoirs' inlets and outlets, and how the chemistry changes while moving through the watershed by comparing outflowing water to downstream sites where the tributaries merge and flow into Oneida Lake. Inductively coupled plasma atomic emission spectroscopy (ICP-OES) was used to analyze the water samples for a suite of dissolved elemental concentrations, and conductivity was measured using a YSI meter. There were no observed significant differences between inlet and outlet elemental concentrations or conductivity, which may be due to variability in combining all inlet and outlet data. However, there were many significant differences between upstream and downstream sites displaying the process of downstream accumulation of materials that may be disrupted if the practice of dam construction is expanded. Although not currently completed, analyses of total and dissolved macronutrients (N, P, and Si) is intended for the samples collected in this study, and will likely further display sequestration of materials from downstream accumulation that could hinder the productivity of those ecosystems.

Consumption of Toxic Microcystis vs Non-Toxic Microcystis by *Dreissena* Mussels

Adelaide Dumm

Skaneateles Lake recently has experienced harmful algae blooms; the algae that proliferate in the lake are cyanobacteria (blue green algae). The cyanobacteria, *Microcystis aeruginosa*, produces a cyanobacterial toxin, microsystin, which contributes to these Harmful Algal Blooms (HAB). Zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena bugensis*) are filter feeding organisms present in Skaneateles Lake. The hypothesis for this independent project is that *Dreissena* mussels from Skaneateles Lake consume cyanobacteria during HABs and they do not discriminate against toxic *Microcystis*. The methodology for this experiment included collecting mussels and water from Skaneateles Lake and testing the hypothesis by adding non-toxic cyanobacteria to three beakers and toxic cyanobacteria to three beakers, and monitoring consumption by the mussels over a 24-hour period. Water samples were then collected and analyzed using a hemocytometer for cell counts of initial and final concentrations. The average consumption of toxic *Microcystis* was 3.2 cells per mL in a 500 mL beaker over a period of 24 hours, compared to the average consumption of non-toxic *Microcystis* at 1.7 cells per mL in a 500 mL beaker over the course of 24 hours. Standard error was calculated for toxic and non-toxic strains, for both final and initial cell counts. From conducting a t test it was concluded that there was no significant difference in consumption between initial and final samples of toxic and non–toxic *Microcystis*. This supported the hypothesis of the experiment. The outcome of this experiment has contributed to the understanding and research of the best way to determine if bivalves are consuming toxic over non-toxic cyanobacteria. Future research can be conducted to determine if mussels show preference to toxic or non-toxic cyanobacteria in the event of harmful algae blooms.

DIEL vertical migration of zooplankton and dissolved oxygen in Onondaga Lake

Will Fernandez

Understanding how zooplankton move through the water column is important for food web dynamics. The effect that zooplankton may have on dissolved oxygen or dissolved oxygen on zooplankton shows how the productivity of lake affects its biota. The main two objectives for this study were to (1) search for a relationship between zooplankton abundance and dissolved oxygen concentrations, and (2) find patterns of diel vertical migration (DVM) in Onondaga Lake, Syracuse, NY. The samples of zooplankton were taken using a Schindler trap at the south end of the lake both during the day and night. On October 17, 2017, the zooplankton samples were taken at 12 pm (day) and then again at 7:30 pm (dark). The samples were taken depths of 1m, 5m, 10m, 15m, and 19m.The most abundantly found zooplankton were *Bosmina* spp., Cyclopoida, and Gastropidae. Dissolved oxygen concentrations were obtained through the Upstate Freshwater Institute (UFI). Much of the variability in dissolved oxygen concentrations is not accounted for by zooplankton abundances alone (Day R^2=0.41, Night R^2=0.22). There is a stronger correlation during the day than at night of dissolved oxygen concentration and zooplankton abundances. Overall the zooplankton do not appear to be migrating on a large scale. Onondaga Lake is an open system, and trying to make conclusions based on two variables is difficult. In the future relative phytoplankton and fish abundances should be considered.

Do *Daphnia* and Rotifera poo clog up the FluoroProbe? - The impact of zooplankton grazing on FluoroProbe readings

Rose Louk

The FluoroProbe is an instrument used to determine the class and quantity of phytoplankton in a sample of water. Upstate Freshwater Institute (UFI) reported false positives with the FluoroProbe where it detected Cyanobacteria that were not present for a sample in Conesus Lake located in Livingston County, NY. Debris were observed in these samples and it is predicted that excrement from zooplankton like *Daphnia* and rotifers might be the culprit. A lab experiment was conducted where *Daphnia* and rotifers grazed on Cyanobacteria (non-toxic *Microcystis*), Diatoms (*Cyclotella*), Chlorophyta (*Scenedesmus*), and a mixture of the three phytoplankton classes for 1-4 hours. FluoroProbe readings in these treatments were compared to those in the control for each phytoplankton treatment with no grazing. Four replicates were used for the controls, *Daphnia* grazing, and Rotifer grazing (n=48). It was hypothesized that phytoplankton readings would be significantly less than the controls after zooplankton grazing had occurred and there would be false positives observed in the Chlorophyta sample because it is a more favorable food source for zooplankton, so they would eat more of it and produce more excrement. There was significantly more grazing by the Rotifers in the Chlorophyta only sample and in the mixed phytoplankton sample. No zooplankton poop or false positives were observed in this study, so it is unlikely that zooplankton poop is impacting FluoroProbe readings.

A Comparative Study of the Benthic Macroinvertebrate Assemblage of Two Central Adirondack Streams

Carrick Palmer

Bacillus thuringiensis var. *israelensis* (Bti) is a bacterium that occurs naturally in soils, and the crystalline protein produced during sporulation is approved for use as an insecticide by the EPA to target black fly (Simuliidae) and mosquito (Culicidae) larvae in waterbodies. In the 1980s, SUNY ESF graduate student Jonathan Kennen examined the potential impacts of Bti on the assemblage structure of benthic macroinvertebrates in Big Sucker Brook and Little Sucker Brook in the Adirondacks. Using his data from August of 1987 as a baseline, this study made comparisons of the stream invertebrate assemblages to explore whether there were any changes in the 30 years since. Macroinvertebrates were collected with a standard Surber sampler and identified to order or genus using a stereoscopic dissecting microscope and taxonomic keys. Analysis of functional feeding groups and ecological indices showed no significant spatial or temporal differences in the benthic macroinvertebrates between Little Sucker Brook and Big Sucker Brook.