

LIMNOLOGY PRACTICUM POSTER SESSION 2011

STUDENT INDEPENDENT PROJECTS

12 ILLICK HALL, 14 DECEMBER 2011

ABSTRACT BOOK

(and supplementary summary of Song Lake Groups' recommendations)

SONG LAKE PROJECTS

Incomplete Picture? Investigating Physical Limnological Characteristics for Sampling Site Selection in Song Lake

Dean Ellsworth and Matt Isles.

There is a perception among some property owners on Song Lake that conditions in the lake vary geographically. The existence of such variability might support lake management options at odds with those options that would be supported by greater uniformity in lake conditions. The objectives of this project were:

1. To determine whether the current CSLAP data-gathering procedures provide data that are representative of conditions throughout Song Lake.
2. If current procedures do not provide representative data, to provide suggestions for alterations to sampling protocols that are practicable for CSLAP volunteer data collectors.

The hypothesis for this research was that due to complete mixing of Song Lake waters, there would be no significant differences in measurements of temperature, specific conductance, dissolved oxygen, pH and turbidity between 20 sites distributed throughout Song Lake.

The results of this project tend to support the existence of spatial variability of physical limnological characteristics in the lake, under fully mixed conditions. Data showed a range of values for most parameters measured in Song Lake. This suggests that in order to accurately capture the range of conditions, multiple sampling sites should be used. CSLAP sampling protocols should be reviewed to ascertain whether increasing the number of sampling sites is feasible. Researchers recommend a minimum of 3 sampling sites, including CSLAP site (site 6), one site in the north (e.g., site 16), and one site in the south (e.g., site 2) of the lake. Findings and a review of previously collected data also support a sampling regimen that captures lake parameters under different mixing conditions. Future research on Song Lake should explore whether the lake site groupings formulated in this study (north, south) exhibit similar patterns of zonation at other times of year.

Analysis of Song Lake Monitoring Sites Based on Phosphorus Concentrations

Robert Murphy and Kathryn Ives

The purpose of our project was to determine if the CSLAP monitoring site for Song Lake accurately represents the entire lake's parameters. Within this study, we tested for the concentration of phosphorus throughout 20 evenly distributed sites across the lake. It was determined that the north sites were significantly higher than the southern sites, but that there was also a significantly higher concentrated phosphorus region around Site 10. The area with the highest concentration could be a result of wind currents blowing from south to north and causing phosphorus to accumulate in the bend of the lake. We concluded that although the CSLAP monitoring site did not accurately represent the entire lake, it could be used for a south site. However, Site 2 and Site 16 would be ideal to monitor both the south and north areas of the lake respectively. The region around Site 10 should also be monitored carefully since the first signs of an algal bloom would most likely develop in that area of the lake.

Chlorophyll a Levels in Song Lake: Do The Variations In Chlorophyll a Levels In Song Lake Indicate Different Regions For Sampling?

Karl Reinhold

Song Lake is a private, closed system lake. There are a number of homes along the lake, and the residents like to use the lake recreationally. Song Lake is mesotrophic, so there is concern that with the increase of property owners, eutrophication could occur. Sampling of chlorophyll a levels can be used as a method for indicating if blooms or eutrophication is occurring. Currently, the lake is being managed by the Song Lake Property Owners Association (SLPOA) and the DEC's CSLAP. They have been sampling the lake for several years from the deepest part of the lake. The objective of this study was to determine if this sample site was sufficient, or if, and how many more sites would be necessary. The study was performed by sampling chlorophyll a from twenty sites covering the entire lake. The results from the analysis show that there was a lot of variability throughout the lake, especially in near shore sites and sites in the northern half of the lake. Site 10 was found to have an exceptionally high reading for chlorophyll a that would be typical in a eutrophic lake. The CSLAP site was found to not be representative of the lake average. It had one of the lowest readings for chlorophyll a. It is recommended that more sample sites be added for a more accurate assessment of the lake's chlorophyll a levels, in addition to the current site.

Zooplankton of Song Lake

Ceili Bachman & Emily Ogburn

Zooplankton are important in lake food webs; they serve as food for fish and are also the main grazers of phytoplankton. Zooplankton in freshwater lakes are known to have a heterogeneous horizontal distribution. This so-called "patchiness", could be caused by a variety of factors. Behavioral responses to other zooplankton or other organisms (social, reproductive, or predator-prey relationships); water movement; differences in reproduction rate; or spatial variability in food resources could be contributing factors. Also, considerable differences in near-shore and off-shore zooplankton communities are common. The objectives of this study were to examine zooplankton distribution in Song Lake, located in Tully, NY, and to determine a sampling design that will give a complete representation of the community in the lake. Differences in total zooplankton density, richness, and diversity between shallow (0-2m) and deep (4-6m) sites were found. Taxa richness and diversity were significantly different between the two groups—both being greater in the shallow sites. There were no small cladoceran zooplankton found in the deep sites, but small cladocerans were common in the shallow sites. It was determined that sampling from multiple sites of varying depths and from different distances from shore will provide the most complete representation of the zooplankton community in Song Lake.

The Effects of Future Shoreline Development on Phosphorus Levels in Song Lake

Matt Clegg and Peter Jerdo

Song Lake is a kettle lake located in Northern Cortland and Southern Onondaga counties in the state of New York. The lake has no inlet or outlet, but receives inputs from precipitation, surface water runoff, and ground water. These characteristics promote a long residence time and make Song susceptible to eutrophication from nutrient loading. The addition of limiting nutrients such as phosphorus has increased the frequency of harmful algae blooms (HABs) in the lake. Harmful Algae Blooms produce natural toxins that can harm other organisms and negatively impact the ecosystem. The spike in primary production renders the lake unusable for swimming, fishing, and other recreational activities. Based on data gathered from the Census, the USDA, and a study of eutrophication by E. Gus Fruh, the objective of the study was to determine the impact that phosphorus loading would have on the trophic state of Song Lake under four future

land use scenarios. The results of the study could provide insight into predicting the effects of future shoreline development on the eutrophication of the lake and the likelihood of the occurrence of (HAB's). For each of the predicted scenarios, water was collected from the lake, placed into flasks, and spiked with the corresponding value of phosphorus. The samples were incubated for a period of one week and filtered. The filters were chilled and placed in an acetone solution for 24 hours before being analyzed with a fluorometer for chlorophyll A concentrations. The results showed a trend in chlorophyll A growth in the predicted population simulations. High chlorophyll A concentrations in the control suggest that fall mixing may have selected for a phytoplankton community that consist primarily of diatoms and small flagellates. The similar chlorophyll concentrations recorded in the 50 year growth and average farm simulations suggest that the phytoplankton reach a saturation point in regards to phosphorus absorption and growth subsequently levels off. Recommendations for future research include sampling in the late summer when cyanobacteria are prevalent to obtain a more accurate prediction of the likelihood of (HAB's) and increasing the sample size. Obtaining current research on phosphorus loading estimates and specifics regarding the hydrology and chemistry of the Song Lake watershed would create a more accurate model of predicted eutrophication.

The Effect of Turbidity on the Natural Ability of Fecal Coliform Disinfection in the Surface Waters of Song Lake in Tully, NY

Nathan T. Barlet, Ryan M. Campbell, James W. Katz

Human development around bodies of water often leads to increased nutrient and sediment inputs into the aquatic ecosystem. These changes can have adverse ecological effects such as eutrophication as well as decreased water quality. Other anthropogenic inputs that can have dire consequences for human and environmental health include the increased presence of microbial pathogens such as the fecal coliform *Escherichia coli* in the surface waters. Sources of fecal contamination include urban/suburban runoff, agricultural runoff, leaky septic systems, as well as local wildlife. Aquatic ecosystems have the ability to naturally remove or inactivate these pathogenic organisms through multiple processes. This study focused on the effectiveness of solar UV irradiation and microbial predation on the removal of fecal coliforms from the surface waters of Song Lake in Tully, NY. It was observed that the coupled processes of solar UV irradiation and microbial predation were able to significantly reduce the concentration of total coliforms from the inoculated lake water samples. It was also observed that anthropogenic increases in turbidity can have a negative effect on an aquatic ecosystem's natural ability for pathogen disinfection.

Age and Growth Analysis of Yellow Perch A Comparison of Onondaga Lake, Song Lake and Deer Pond

Danielle Blumrick, Samuel Brockdorff and Einat Sandbank

This study was conducted to gain an understanding of the growth rates of Yellow Perch (*Perca flavescens*) under various conditions. The three sites studied, Onondaga Lake, Song Lake and Deer Pond, all have unique conditions that we expected to play a role in the fishes' development. Fish were captured using a type of gear called a trap net. Conditions of the lakes can be assessed based on fish size and growth. Size measurements were taken after capture, while growth was calculated using scales. Measurements taken include: weights, lengths, weight to length ratio, and growth rate. Onondaga had the longest and heaviest fish, with the lowest length to weight ratios indicating them to be the healthiest. The highest lengths to weight ratios were found in Song Lake. This means that for their size they are the skinniest. Scale samples were examined by measuring the length to each annuli (yearly mark caused by slowed growth during the winter) to calculate their age and growth rates. Onondaga was found to have the highest growth rate and Deer Pond, the lowest.

Zooplank-tivity

The Effect of Zooplankton on 5 Tully Kettle Lakes' Productivity

Jessica Lee Tobia

This experiment was performed in response to questioning whether *Daphnia* and other herbivorous zooplankton significantly affect algae biomass. Zooplankton are the main herbivores in the pelagic zone in Northern Temperate Lakes. In this experiment, 5 lakes with similar climate, depths, geology/underlying bedrock, formation/age and location were observed. Located in central New York, in Cortland and Onondaga counties the studied lakes include: Song, Tully, Crooked and Little York lakes and Gatehouse pond. Data were collected on the levels of chlorophyll a and the zooplankton abundance and diversity within the metalimnion of each lake. The total phosphorus content data for the three lakes for which there is data, was retrieved from the Citizen's Statewide Lake Assessment Program (CSLAP) from 2 years ago. Overall, the analysis from the data and the graphs supported my hypothesis that indeed, lakes with high *Daphnia* and other herbivorous zooplankton populations experience lower algae biomass than lakes with lower herbivorous zooplankton populations.

PROJECTS ON OTHER AQUATIC SYSTEMS

The Effect of Lime Treatment on Aquatic Insect Communities in the Five Ponds Wilderness

David Andrews

A comparison of aquatic insect communities was performed between a limed and stocked pond and a pond that has never been limed or stocked. Tamarack Pond was limed three times, in 1978, 1990 and 2006, and a stocking program for brook trout just ended in 2010. Slender Pond has historically never held fish and so has never been limed or stocked. Two hundred aquatic insects were collected from each body of water and identified to genus. Using this data a Sorenson's Community Comparison, Simpson's Diversity Index of each pond and a qualitative assessment of evenness of feeding groups was performed. It was found that Tamarack Pond was dominated by a few feeding groups and was less diverse than Slender Pond which had a much more even insect community. The two ponds were found to only about 43% similar despite sharing a water source and having similar niches.

The Benthic Continuum of Limestone Creek

Robert Biel

Observations of the benthic invertebrate community in Limestone creek were compared to the common river continuum theory to see if this system fits the predicted model. Insects were collected using standardized methods at five sites correlating to stream order and input from runoff. The benthic continuum of Limestone stone creek is similar to that predicted by the river continuum; however the sediment type and slop of the land seem to have more of an effect on the insect community than the stream order. Coarse particulate organic matter did not fit the river continuum and may also have correlation to slope and sediment type.

Utilization of a Eutrophic Lake by Brown Trout (*Salmo trutta*) in Response to Stratification and Oxygen Conditional Changes

Curt Karboski

Onondaga Lake in central New York has long been subject to anthropogenic influences, and it was once considered the most polluted lake in the United States. The degradation and subsequent restoration of the system, however, has given researchers a unique opportunity to study the recovery of a highly perturbed lake. The ways in which certain species interact with the system may help elucidate the state of its recovery. Epilimnetic temperature and hypolimnetic oxygen were used to predict brown trout utilization of Onondaga Lake over the summer months. Gill net catch per unit effort and sonic telemetry data were collected to determine presence or absence of brown trout. Results showed a precipitous decline in brown trout numbers at the end of June which corresponded with the loss of cold, highly oxygenated water. It is likely that there are other factors affecting this behavior; however, it is possible that these two parameters are a useful tool for determining cold water species' utilization of the lake.

Who, What, Where?

Seasonal Variations of Littoral Fish Communities in Onondaga Lake, New York

Natalie Scheibel

The littoral fish community of Onondaga Lake is dynamic and complex. This study was aimed to link seasonal changes to the changes in the structure of the near shore fish community. From June 2011 through October 2011 there were 49 trapnets set and checked. Ten different sites throughout the lake had a trapnet set for one overnight each month. Fish were identified, counted, and measured. Seasonal differences were found in the abundance, greater numbers of fish caught during September and October compared to earlier in the summer. Greater numbers of centrachids inhabited the near shore area in midsummer, while planktivores dominated in September and October. During the summer when water temperatures are increased near shore and there is higher biomass, the largemouth bass juveniles were tolerant of the warmer temperature and were able to take advantage of the coverage. Later in the season, the macrophytes were beginning to die off and the water temperature declined, bringing in more fish that were out deeper for most of the summer months. These results help to support the need for on-going biomonitoring to continue in order to better understand the lake, as well as any positive effects remediation may be having.

SUPPLEMENT: STUDENT SUMMARY OF SONG LAKE GROUPS' RECOMMENDATIONS

I. Chlorophyll a in Song Lake

Karl Reinhold

Hypothesis

Due to regional differences in the lake, more than one site is necessary for understanding lake conditions.

Results

- There were varying levels of chlorophyll a among the sites.
- The CSLAP site had one of the lowest amounts of chlorophyll a.
- Site 10 had drastically more chlorophyll a than any other site.
- Sites 7 & 9 averaged together are the closest to the entire lake average.
- The southern part of the lake (sites 1-6) had lower and more consistent data, whereas the rest of the lake (sites 7-20) was highly variable.
- The near shore sites (<2m) were much more variable than the off shore sites (>2m).

Recommendation

The CSLAP site had one of the lowest levels of chlorophyll a. Given concerns about eutrophication and blooms, Site 10 is the most important site to sample. The optimum amount of sites to sample would be multiple sites that cover the entire lake both spatially and in shallow and deep sites. However, if sampling had to be restricted to a minimum, sites 2,6,10, and 16 should be done, at the least.

II. Zooplankton in Song Lake

Ceili Bachmann and Emily Ogburn

The zooplankton distribution was found to be heterogeneous throughout the lake, with the greatest differences between deep and shallow sites. To get a complete representation of the zooplankton community in Song Lake, three to five sites of varying depth (shallow= 0 – 2m, intermediate= 2 – 4m, deep= 4+m) should be sampled that are located at different parts of the lake.

III. Incomplete Picture? Investigating Physical Limnological Characteristics for Sampling Site Selection in Song Lake

Dean Ellsworth and Matthew Isles

Hypothesis

The hypothesis for this research was that due to complete mixing of Song Lake waters, there would be no significant differences in measurements of temperature, specific conductance, dissolved oxygen, pH and turbidity between 20 sites distributed throughout Song Lake.

Summary of Results

- The lake is fully mixed
- Measurements of dissolved oxygen, pH, and temperature show clear physical differences between the north and south ends of the lake
- Measurements of conductivity and turbidity exhibit less distinct patterns

Conclusions

This research found a range of values for most parameters measured in Song Lake under fully mixed conditions. This suggests that in order to accurately capture the range of conditions, multiple sites should be used. CSLAP sampling protocols should be reviewed to ascertain whether increasing the number of sampling sites is feasible.

Recommendation: a minimum of 3 sampling sites,
CSLAP (site 6)
North (e.g. site 16)
South (e.g. site 2)

Findings and a review of previously collected data also support a sampling regimen that captures lake parameters under different mixing conditions. Future research on Song Lake should explore whether the lake site groupings formulated in this study (north, south) exhibit similar patterns of zonation at other times of year.

IV. Analysis of Song Lake Monitoring Sites Based on Phosphorus Concentrations:

The purpose of our project was to determine if the CSLAP monitoring site for Song Lake accurately represents the entire lake's parameters. Within this study, we tested for the concentration of phosphorus throughout 20 evenly distributed sites across the lake.

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We concluded that although the CSLAP monitoring site did not accurately represent the entire lake, it could be used for a south site. However, Site 2 and Site 16 would be ideal to monitor both the south and north areas of the lake respectively. The region around Site 10 should also be monitored carefully since the first signs of an algal bloom would most likely develop in that area of the lake.