Synergies Between Citizen Science, College Student Research Projects, and Lake Associations: Lessons Learned

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NYS Federation of Lake Associations Annual Conference

Lake George, NY

Collaboration 2010 - 2025

State University of NY

College of Environment and Forestry

ESF State University of New York College of Environmental Science and Forestry

Limnology Practicum Class

- EFB 525 – geared to seniors (with one or two beginning graduate students most years
  (students either have taken Limnology Lecture – EFB 424/624 the year before, or take it concurrently)

Song Lake POA

And the Kettle Lake Associations

Song Lake

Tully Lake

Crooked Lake

Little York Lake

Tully Green Lake

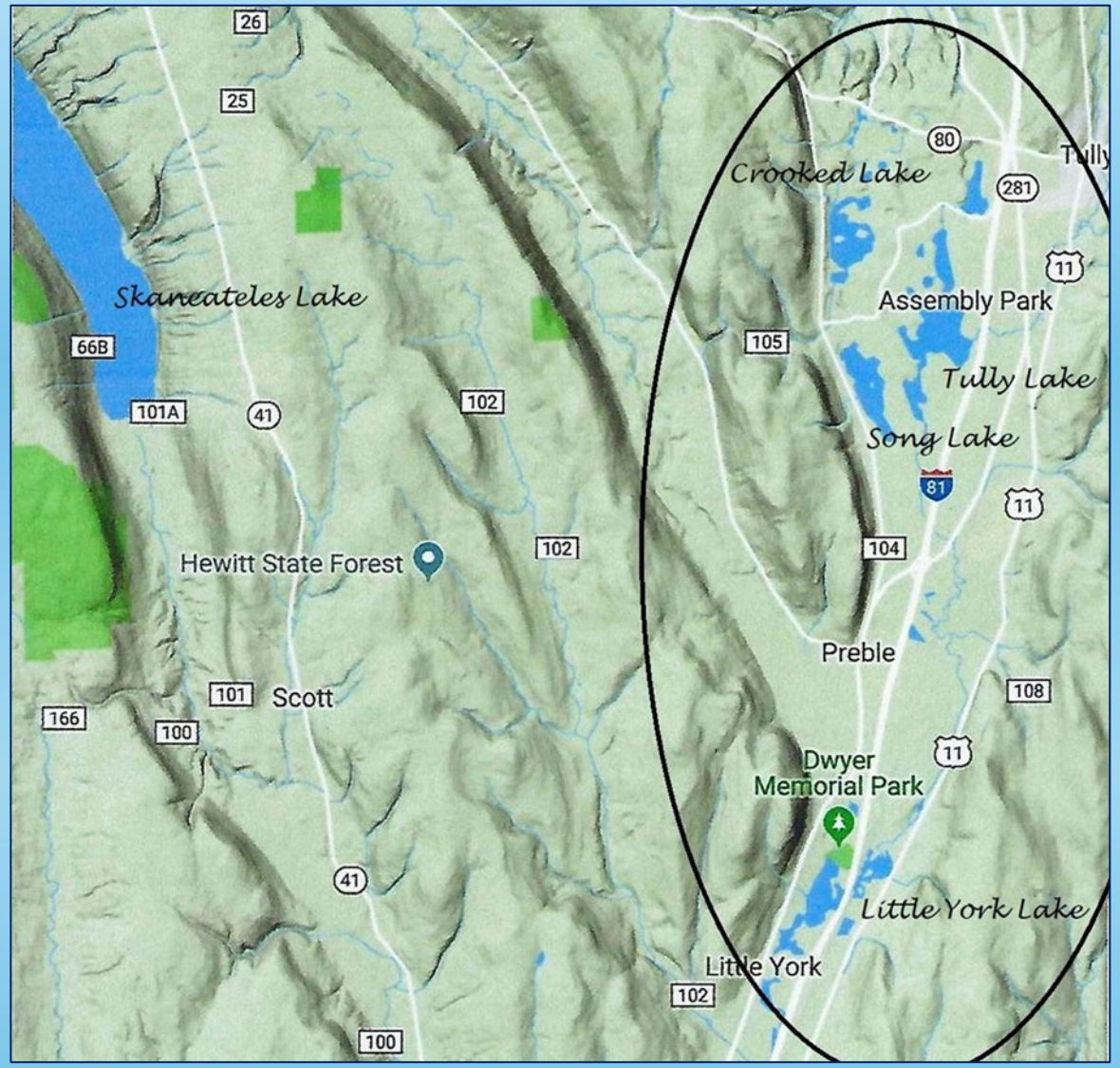
KETTLE LAKES
CORTLAND-ONONDAGA FEDERATION OF KETTLE LAKE ASSOCIATIONS

SUNY ESF Limnology – Incorporating Lake Associations & Citizen Science

- New York is a great place to study lakes
  - Diversity of lake types compared with other regions – good systems to help students understand how lake shape & watershed use affect important lake properties (e.g., water chemistry, organism ID, HABs)
  - Visited different lakes and learn lab and field analyses;
  - Students compared lakes – links among parameters
  - Added student-driven short studies or experiments and lab exercises
  - After Schulz interacted with the Song Lake association in 2009, Song Lake was included as a sample lake, and students heard about questions homeowners had – inspired a few projects. Students were enthusiastic about working with citizen stakeholders and surprised about their knowledge…learned about citizen science
  - Song Lake and ESF Limnology Practicum decided to partner in 2010

ESF students sampling in the ADKs

Kettle Lake Associations in Central New York



Citizens Statewide Lake Assessment Program

CSLAP is a volunteer lake monitoring partnership between NYSFOLA, the NYS DEC and local lake associations

Water temperature,
Clarity (Secchi transparency),
Conductivity,
pH,
Color,
Total phosphorus,
Nitrogen (total, NOx, ammonia),
Chlorophyll a,
Calcium and chloride.

Volunteers also do field observations for invasive species, harmful algal blooms, and other surveys they may choose to be important for their lake.

NYSFOLA

Founded in 1983, the New York State Federation of Lake Associations is a not-for-profit coalition of lake associations, individuals, and corporate members dedicated to protecting and managing lakes in NY.

NYS DEC

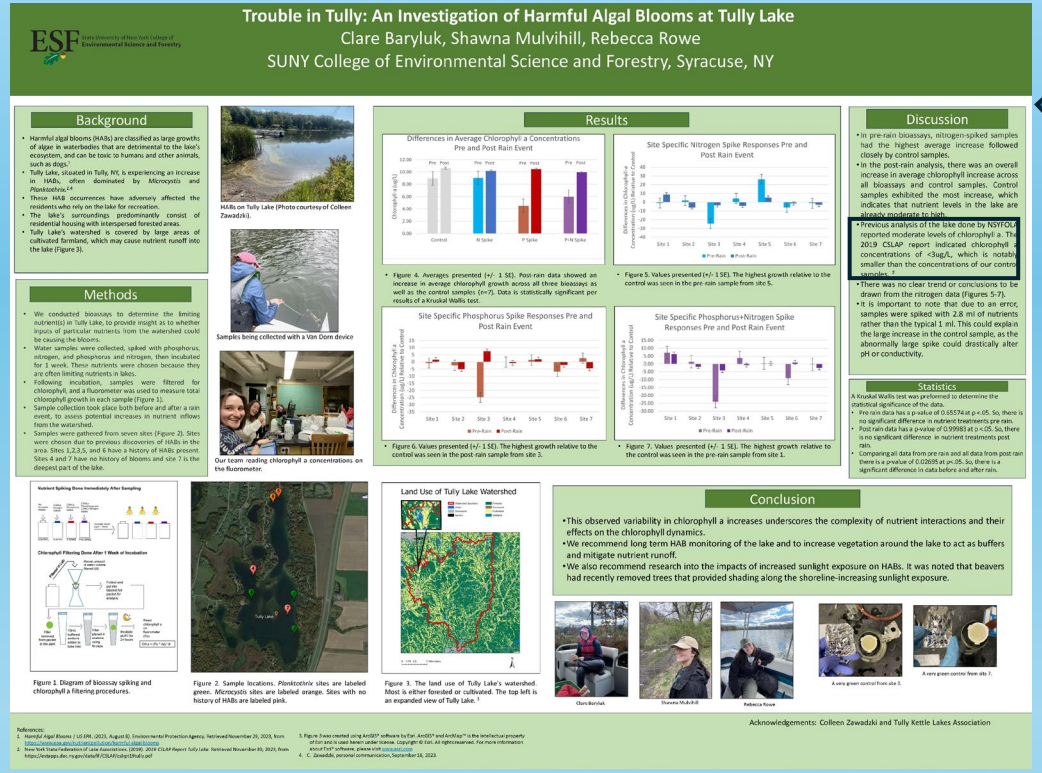
The New York State Department of Environmental Conservation provides funding, staff, data management, and guidance. The Agency utilizes the data to assess waterbody conditions and to evaluate long term trends.

NY LAKE ASSOCIATIONS

Lake communities provide the volunteers and are instrumental in affecting lake management efforts and public education using their CSLAP data.

Citizens Statewide Lake Assessment Program

- Also provides valuable data that can inform student research projects
- Helps students realize that nutrients and other parameters aren't just academic, but "real people" living around lakes care about these factors



Trouble in Tully: An Investigation of Harmful Algal Blooms at Tully Lake

Clare Baryluk, Shawna Mulvihill, Rebecca Rowe

SUNY College of Environmental Science and Forestry, Syracuse, NY

Background

- Harmful algal blooms (HABs) are classified as large growths of algae in waterbodies that are detrimental to the lake's ecosystem, and can be toxic to humans and other animals, such as dogs.[1]
- Tully Lake, situated in Tully, NY, is experiencing an increase in HABs, often dominated by *Microcystis* and *Planktothrix*.[2,4]
- These HAB occurrences have adversely affected the residents who rely on the lake for recreation.
- The lake's surroundings predominantly consist of residential housing with interspersed forested areas.
- Tully Lake's watershed is covered by large areas of cultivated farmland, which may cause nutrient runoff into the lake (Figure 3).

HABs on Tully Lake (Photo courtesy of Colleen Zawadzki).

Methods

- We conducted bioassays to determine the limiting nutrient(s) in Tully Lake, to provide insight as to whether inputs of particular nutrients from the watershed could be causing the blooms.
- Water samples were collected, spiked with phosphorus, nitrogen, and phosphorus and nitrogen, then incubated for 1 week. These nutrients were chosen because they are often limiting nutrients in lakes.
- Following incubation, samples were filtered for chlorophyll, and a fluorometer was used to measure total chlorophyll growth in each sample (Figure 1).
- Sample collection took place both before and after a rain event, to assess potential increases in nutrient inflows from the watershed.
- Samples were gathered from seven sites (Figure 2). Sites were chosen due to previous discoveries of HABs in the area. Sites 1,2,3,5, and 6 have a history of HABs present. Sites 4 and 7 have no history of blooms and site 7 is the deepest part of the lake.

Samples being collected with a Van Dorn device

Our team reading chlorophyll a concentrations on the fluorometer.

Results

Differences in Average Chlorophyll a Concentrations Pre and Post Rain Event

Figure 4. Averages presented (+/- 1 SE). Post-rain data showed an increase in average chlorophyll growth across all three bioassays as well as the control samples (n=7). Data is statistically significant per results of a Kruskal Wallis test.

Site Specific Nitrogen Spike Responses Pre and Post Rain Event

Figure 5. Values presented (+/- 1 SE). The highest growth relative to the control was seen in the pre-rain sample from site 5.

Site Specific Phosphorus Spike Responses Pre and Post Rain Event

Figure 6. Values presented (+/- 1 SE). The highest growth relative to the control was seen in the post-rain sample from site 3.

Site Specific Phosphorus+Nitrogen Spike Responses Pre and Post Rain Event

Figure 7. Values presented (+/- 1 SE). The highest growth relative to the control was seen in the pre-rain sample from site 1.

Discussion

- In pre-rain bioassays, nitrogen-spiked samples had the highest average increase followed closely by control samples.
- In the post-rain analysis, there was an overall increase in average chlorophyll increase across all bioassays and control samples. Control samples exhibited the most increase, which indicates that nutrient levels in the lake are already moderate to high.
- Previous analysis of the lake done by NSYFOLA reported moderate levels of chlorophyll a. The 2019 CSLAP report indicated chlorophyll a concentrations of <3ug/L, which is notably smaller than the concentrations of our control samples. [2]
- There was no clear trend or conclusions to be drawn from the nitrogen data (Figures 5-7).
- It is important to note that due to an error, samples were spiked with 2.8 ml of nutrients rather than the typical 1 ml. This could explain the large increase in the control sample, as the abnormally large spike could drastically alter pH or conductivity.

Statistics

A Kruskal Wallis test was preformed to determine the statistical significance of the data.

- Pre rain data has a p-value of 0.65574 at $p < .05$. So, there is no significant difference in nutrient treatments pre rain.
- Post rain data has a p-value of 0.99983 at $p < .05$. So, there is no significant difference in nutrient treatments post rain.
- Comparing all data from pre rain and all data from post rain there is a p-value of 0.02695 at $p < .05$. So, there is a significant difference in data before and after rain.

Nutrient Spiking Done Immediately After Sampling

Chlorophyll Filtering Done After 1 Week of Incubation

Figure 1. Diagram of bioassay spiking and chlorophyll a filtering procedures.

Figure 2. Sample locations. *Planktothrix* sites are labeled green. *Microcystis* sites are labeled orange. Sites with no history of HABs are labeled pink.

Land Use of Tully Lake Watershed

Figure 3. The land use of Tully Lake's watershed. Most is either forested or cultivated. The top left is an expanded view of Tully Lake.[3]

Conclusion

- This observed variability in chlorophyll a increases underscores the complexity of nutrient interactions and their effects on the chlorophyll dynamics.
- We recommend long term HAB monitoring of the lake and to increase vegetation around the lake to act as buffers and mitigate nutrient runoff.
- We also recommend research into the impacts of increased sunlight exposure on HABs. It was noted that beavers had recently removed trees that provided shading along the shoreline-increasing sunlight exposure.

Clare Baryluk

Shawna Mulvihill

Rebecca Rowe

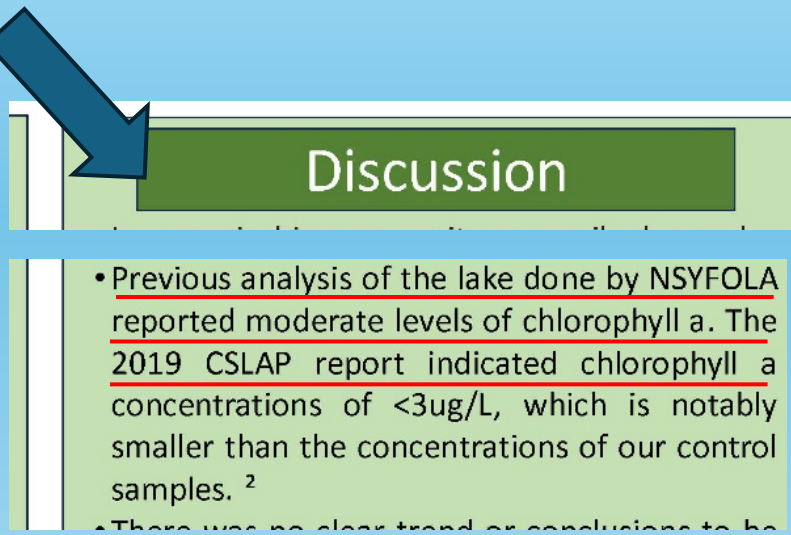
A very green control from site 3.

A very green control from site 7.

References:

1. *Harmful Algal Blooms / US EPA*. (2023, August 8). Environmental Protection Agency. Retrieved November 29, 2023, from https://www.epa.gov/nutrientpollution/harmful-algal-blooms
2. New York State Federation of Lake Associations. (2019). *2019 CSLAP Report Tully Lake*. Retrieved November 30, 2021, from https://ecdepp.dec.ny.gov/data/R7/CSLAP/cslap19tully.pdf
3. Figure 3 was created using ArcGIS® software by Esri. ArcGIS® and ArcMap™ is the intellectual property of Esri and is used herein under license. Copyright © Esri. All rights reserved. For more information about Esri® software, please visit www.esri.com
4. C. Zawadzki, personal communication, September 16, 2023.

Acknowledgements: Colleen Zawadzki and Tully Kettle Lakes Association



Student- Resident Interactions

September through December

- Classroom introductions to the lakes starting on the first day of the class
- Personal meetings with the lake residents and the lakes; often they sample COFOKLA lakes on the first field trip on an early weekend
  - These generally took place at a residence on Song Lake first, and later rotating to different lakes or other venues in Tully
- Refreshments, presentations and discussions about our collective and individual lake concerns

The students have the opportunity to talk with the lake residents and share ideas and contact information.

Student- Resident Interactions

September through December

- Onto the lake and shorelines to begin their limnology work for Professor Schulz (generally, two of the four lakes the class compares are now COFOKLA lakes)

Student- Resident Interactions

September through December

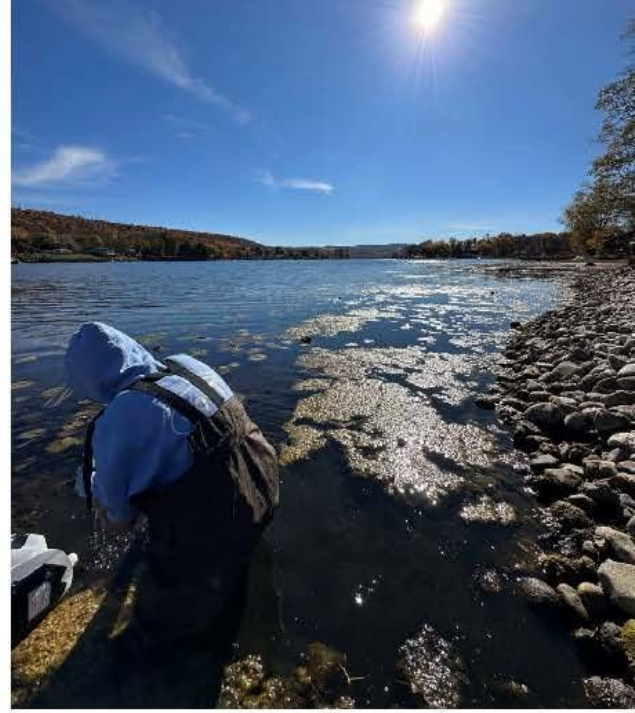
- Once projects are approved (an iterative process) about 2-3 weeks after the field trip, Prof Schulz and the students begin corresponding with the lake contact person to discuss needs and times. The teaching assistants are also invaluable

.

- Several weeks of periodic interactions depending on project.

SUNY ESF Projects

- Sometimes lab experiments in CIRTAS (shared use lab – 5 growth chambers)
- Costs of many analyses are prohibitive for class budgets and that may increase over time; engaging students in the budget process increasingly, to provide additional real-world experience…learn creative ways to get things done – hone the skill of MacGyvering sometimes ☺



You are invited to the:

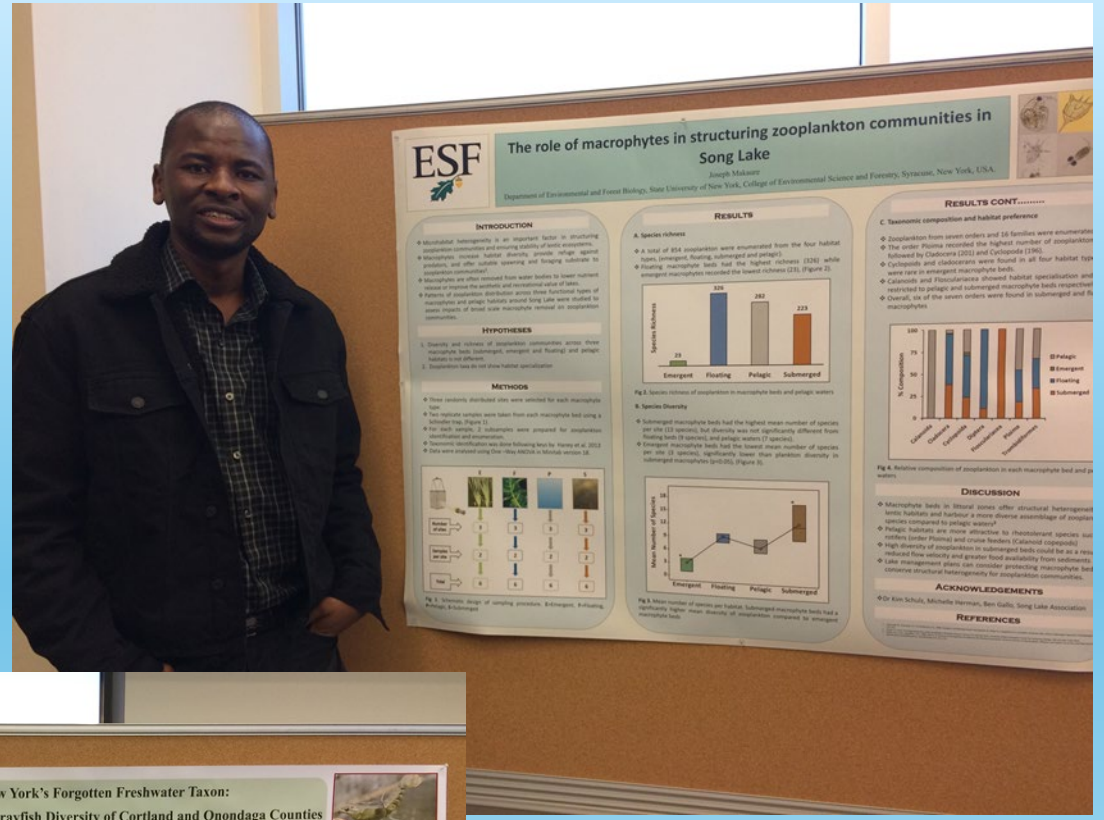
2024 SUNY ESF Limnology Practicum Poster Session

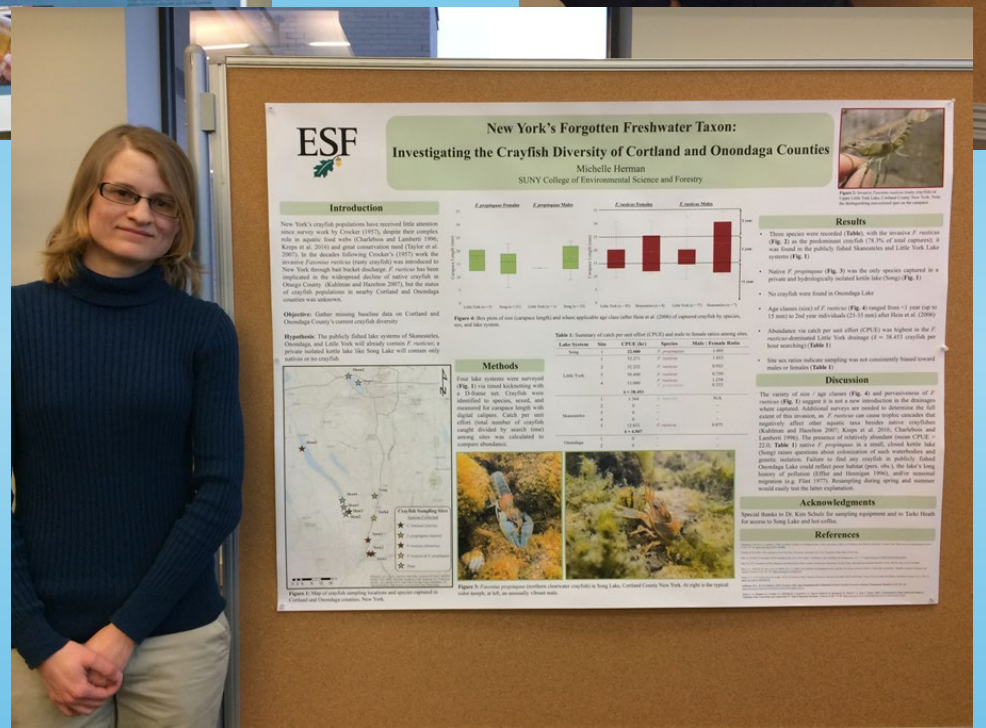
- **Wednesday, December 4; 2:30-5:00 PM; 408 Baker Hall**
- Many projects collaborating with COFOKLA (lake association)
  Come for any length of time! Light snacks will be provided.
- **Topics include:**
  - Factors favoring native vs. invasive macroinvertebrates
  - Effects of herbicides on native and invasive plants
  - Water quality, invasive mussels, and algal blooms
  - Benthic invertebrates in Onondaga and Otisco Lakes
  - Zooplankton migration and ecology

SUNY ESF Project Analysis

- Lots of potential types of analyses – physical, chemical, biological, etc.
- Students work with Schulz and the TAs as well as other college-wide analytical labs at SUNY ESF
- They learn some basic statistics and presentation skills

Project Analysis → Poster Session

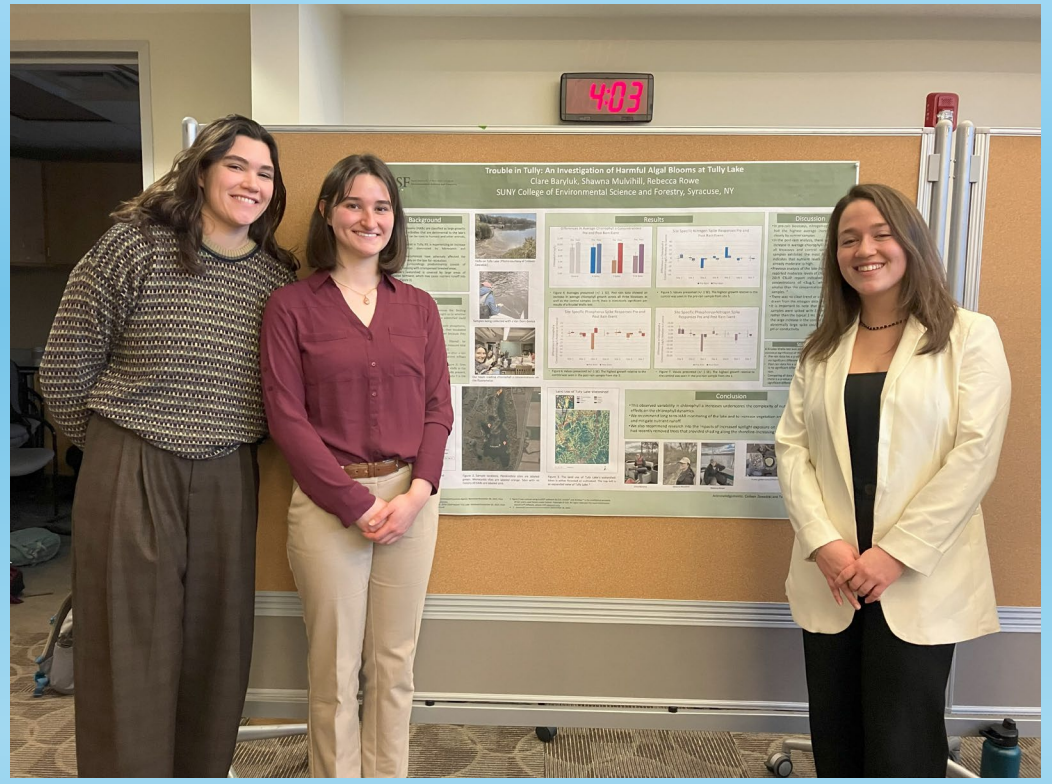




Depth and breadth of projects

Poster Session

- December at the college to view all the students' final poster projects and talk with others. More time to share refreshments and make further contacts.
- One year we had students give posters in Tully and that was better for COFOKLA, but difficult logistically at the end of the term, and not as good for showing other students the possibilities and getting other faculty willing to help with some analyses…we need some hybrid solution!



Song Lake Carp

ESF
State University of New York
College of Environmental Science and Forestry

Hey Carp Get Off My Lawn:

The Age Determination Of Grass Carp To Verify the Presence of Reproduction

Eric R. Johns, Robert E. Alexander and Derek A. Gerber
State University of New York College of Environmental Science and Forestry, 1 Forestry Dr. Syracuse, NY

Objectives:

-To survey Song Lake for presence of grass carp.
-Age opercle samples to determine the possibility of triploid grass carp reproduction.
-Determine length at age to indicate if reproduction has occurred.

Background

There have been concerns over the possible reproduction of previously stocked triploid, grass carp in Song Lake, Tully NY. Grass carp that are stocked in New York State are required to be triploid, which should make them sterile. A survey of grass carp was conducted, with the assistance of the Song Lake Association, between October and November 2012 in an attempt to capture and determine age. The purpose of determining the age was to see if there were any carp that could have resulted from reproduction between stocked fish. Between 1996 and 2006, 2,557 grass carp were stocked to control macrophytes (e.g., milfoil). After a number of years grass carp decreased macrophytes, which may have increased algal blooms.

Figure 1. (top left) Eric Johns holding the two largest grass carp caught in the trap-nets.

Figure 2. (top right) Derek Gerber posing as our boat captain in 30 degree weather

Figure 3. (bottom right) One of the lake chubsuckers that were caught in lake

Methods

Figure 4. Map of study site with trap net locations. Surface area 109 acres, mean depth 13ft and max depth 28ft

1. Four trap nets were placed in Song Lake (Figure 4.)

Figure 5. (top) and 6 (bottom). Fish being counted and measured

2. Nets were checked eleven times over a 21 day period. Captured fish were counted, grass carp were removed and measured, all other fish were released (Figures 5 and 6).

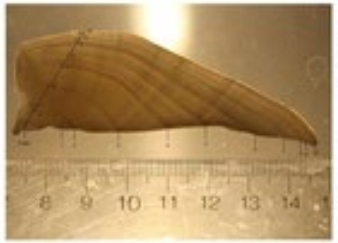


Figure 7. Photo of an opercle using image j to back calculate age. Each numbered dash represents one annuli showing one year growth.

3. Opercles were obtained from grass carp and cleaned of any tissue. Then they were placed under a strong light and their annuli were counted with the naked eye (Figure 7.).

4. ImageJ was used to calculate the distance of each annuli from the origin. Measurements were used in the Dahl-Lea direct proportion equation to back calculate the age of each carp. This increased our effective sample size from 5 to 58 data points.

5. A logarithmic growth curve was created for length at age using excel. The minimum length was determined using the equation of the line (Figure 11.). A logarithmic best fit line was used to determine length at age

Figure 8. (above) Extracting the "hard parts" for analysis

Figure 9. Shows the last three grass carp that were caught on the 7th day of sampling November 4 2012

Figure 10. Shows the first two grass carp that were caught on the very first day of sampling October 21 2012

Results

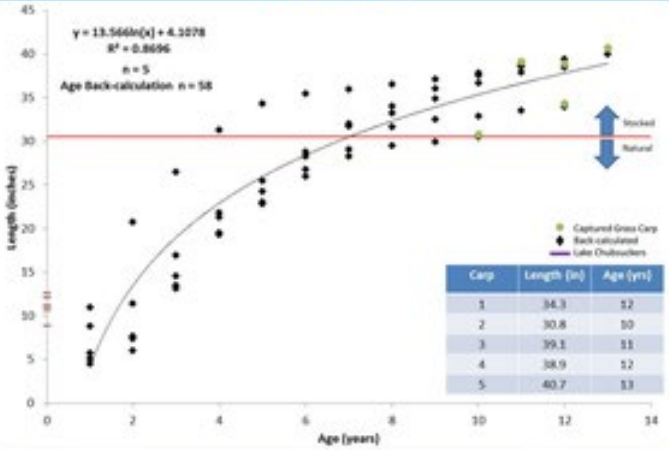


Figure 11. Age at length for grass carp. Green circles represent the length at age for the five captured grass carp. The black diamonds are the back-calculated lengths at age using the opercle to increase sample size to 58. Orange dashes represent the length of all lake chubsuckers captured. Inserted tables shows the length and ages of the 5 grass carp that were caught.

- The youngest carp was 10 years old and the oldest was 13.
- The minimum length of a naturally reproducing grass is below 30.5 inches and less than 8 years old (last known stocking date).

Table 1. List of notable fish species and number that were captured during sampling. * represents a New York state threatened species

Species	# Caught
Grass Carp	5
* Lake Chubsucker	6
Walleye	4
Smallmouth Bass	5
Black Crappie	288

Conclusion

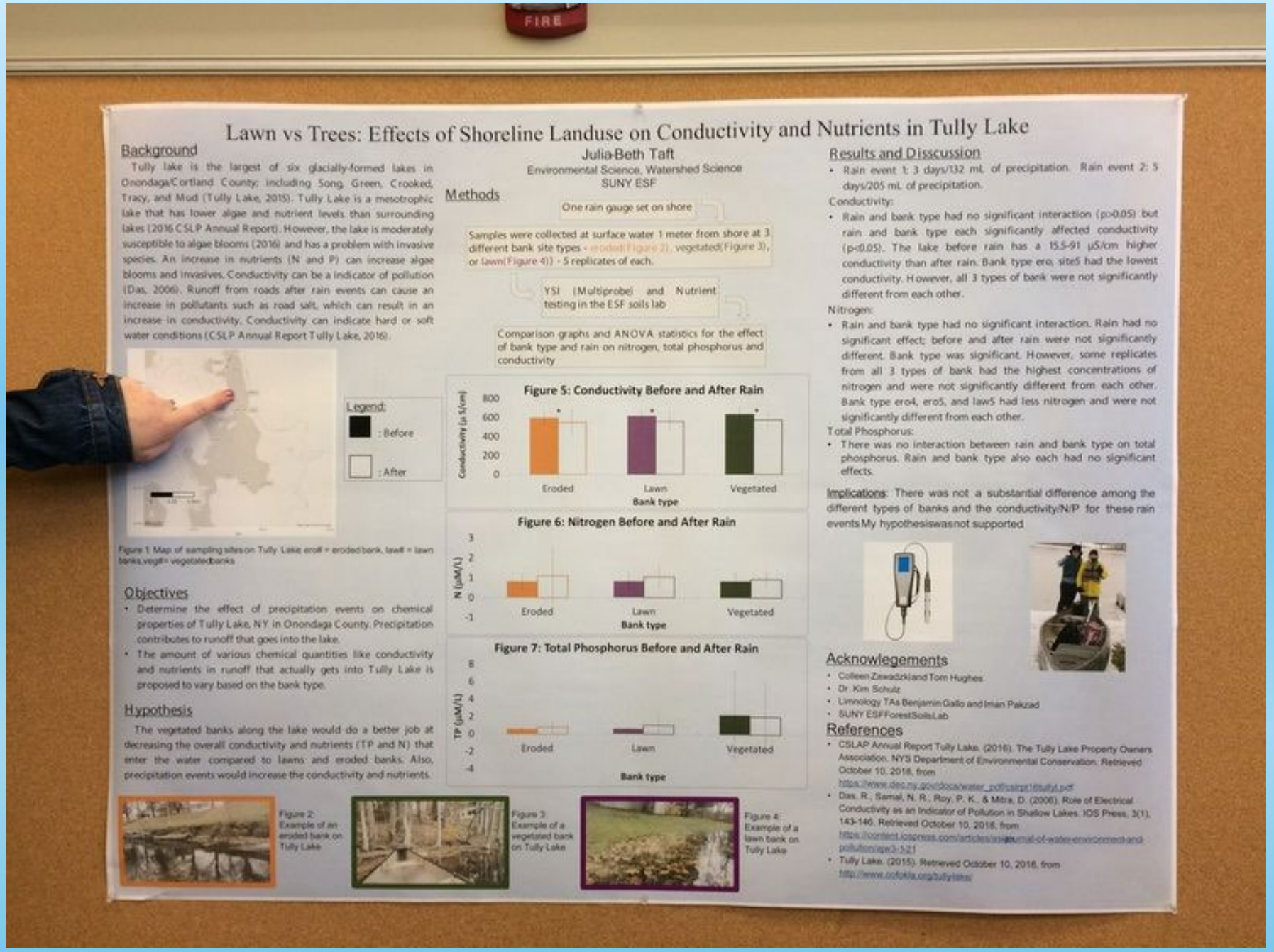
- We concluded that all fish captured were stocked fish.
- Lake Chubsuckers were captured in our nets. When seen submerged in shallow water they appear to look like small grass carp. If chubsuckers were seen in the shallows, this could have aided the notion that the grass carp were reproducing. Chubsuckers ranged from 9 to 12 inches and could be confused for a 2 or 3 year old carp.
- Grass carp that are stocked even though are sterile still participate in spawning activity and produce eggs and sperm. These eggs and sperm, however, are not fertile and aren't viable to produce larvae. Lake residents may have thought spawning carp were actually reproducing but that's unlikely given these data.

Acknowledgments

Special thanks to Kim Schulz, Eric Bauer, Kevin Kapuscinski, DEC and Andrew Brainard for supplying us with the equipment and knowledge to successfully complete this project. Also to Jenna Stanford, Nate Sanger and Trevor Gokley for getting their hands wet, dirty, and numb for science! A very special thanks to Carl and Marjorie Grillo for use of their boat and property to facilitate our research.

References:
Carlander, K.D. 1969 Handbook of freshwater fishery biology volume 1. Iowa Univ. Press, Ames.

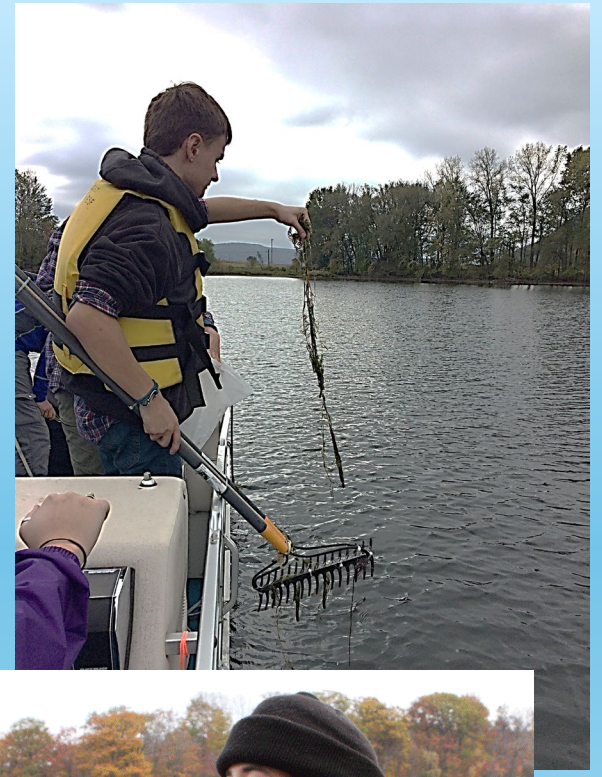
Tully Lake Riparian and Tree Planting Projects



Benefits

Residents

- Deeper understanding of their role as stewards.
- Practical application of knowledge learned about their lakes to share with others, and ecology issues – what other questions are there?
- Enhancing efforts for BMPs and analysis of mitigation efforts for best outcomes. especially CSLAP data and field observations they obtain over the years.
- Opportunity to investigate specific questions they may about their lake.
- Excitement at new findings – Positive or Negative
- Nurturing young minds
- Enhancing water quality



Obstacles

Residents

- Short time scale of projects.
- Inconclusive or contradictory results.
- Scheduling, weather, and access.
- Attending the presentations on campus.

Benefits

Students

- Motivation and excitement about projects that are ‘new science’ and/or of interest to the public.
- Often their first chance to interact with the public as ‘experts’- mutual respect.
- New experience having to combine their scientific knowledge with observations of homeowners that might not fit the things they learned in class or textbooks – how to reconcile these and how to deal with the differences in designing their projects as well.
- Makes the students feel invested in their own work and proud they can help others.
- Mix of majors working together.

Obstacles

Students

Limitations of previous data; limitations of previous projects.

- Difficulties in translating ideas of the public and their own ideas into feasible projects; often public goals would be hard to address.
- Intra-group issues – different years, majors, backgrounds…
- How to convey their project information to both scientists and the public.
- What to do when findings were upsetting to homeowners (e.g., finding of zebra mussels).
- …but these are all “real world” scenarios

Synergies

- Introductory sessions culminating in poster presentation session.
- Sharing informally around food and formally around presentations.
- Mutual respect – reciprocal.
- Understanding of lake residents and their interactions around a lake – variety of interests and sometimes competing mind-sets (real-estate vs. ecology).
- Sharing real world issues.

Synergies

Marjorie Grillo, Song Lake,

“I appreciate knowing what’s in our lakes beyond the obvious from fish counts to plant species. I also believe the students benefit from interacting with residents on the lakes regarding concerns and interests we have. Seeing their final projects gives us a chance to see the results of their work and for them to hear our appreciation comments on their work. It’s personalized.

It’s a privilege to have this connection to Kim and her student’s expertise. I think we all benefit.”

Synergies

- Responses from Stradder Caves, Luke Gervase:

- Critical thinking and “read-world” applications

- Stakeholder exposure – Face to face with those connected to the lake
  “Interactions from citizen science and CSLAP volunteer
  to providing more historical and personal experiences.”
  “Saw residents with the same passion for the environment
  as the professionals.”

- Enjoyed the connections and conversations.
- Exposure to a variety of lakes
- Precursor to professional decision-making
- Long lasting relationships

Lessons Learned

- Need for very clear-cut expectations from students and for them to know the project expectations (and that not all projects answer the question they set out to answer and what to do then)
- The value and the limitations of citizen and student science
- It would be beneficial to share more of the students' work with the residents – beyond the poster presentation project.
- Real world systems have more variables and uncertainties than class labs – how do we manage uncertainty as scientists

Questions

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