

# Taking Your Monitoring to the Next Level: Incorporating Real-Time Microscopy into Community Sampling Programs for Harmful Algal Blooms

Greg Boyer (SUNY-ESF, Syracuse)

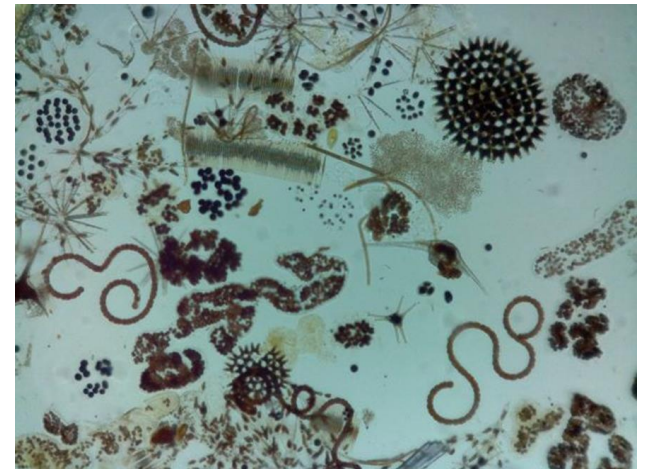
Terry and Dorothy Gronwall (Honeoye Lake)

Doug and Jane Conroe (Chautauqua Lake)

Bob Crichton (Cazenovia Lake)

Patty Matson (Craine Lake)

Sally Napolitano (Canandaigua lake)



Light image by D. Derminio, Lake Neatahwanta

# Can you recognize a Harmful Algal Bloom?



# Many blue-green algal strains can produce Microcystin-toxins:

*Microcystis aeruginosa*

*M. veridis*

*M. botrys*

*M. ichthyoblabe*

*Dolichospermum flos-aquae*

*D. lemmermannii*

*D. circinale*

*Anabaena cylindrical*

*Anabanopsis arnoldii*

*A. millerii*

*Aphanizomenon flos-aquae*

*Calothrix parietina*

*Cylindrospermopsis raciborskii*

*Fischerella sp.*

*Geitlerinema sp.*

*Haphalosiphon hibernicus*

*Leptolyngbya boryanum*

*Merisopedia sp.*

*Nodularia spumigena*

*Nostoc. species*

*Oscillatoria limosa*

*Planktothrix agardhii*

*P. rubescens*

*P. mougeotii*

*Spirulina sp. (marine strain)*

*Synechococcus lividus*

*Trichodesmium erythraeum*

*Trichormus variabilis*

*Woronocinia naegeliana*

# Why do cyanobacteria bloom?



LIGHT

NUTRIENTS

Nutrients (N,P) usually come from the land as run-off.



WARM TEMPERATURE

Water > 60 F



CALM WINDS



Seed Population



Algal GROWTH

GRAZING ↑↓

Many of these factors will increase in current climate change models.

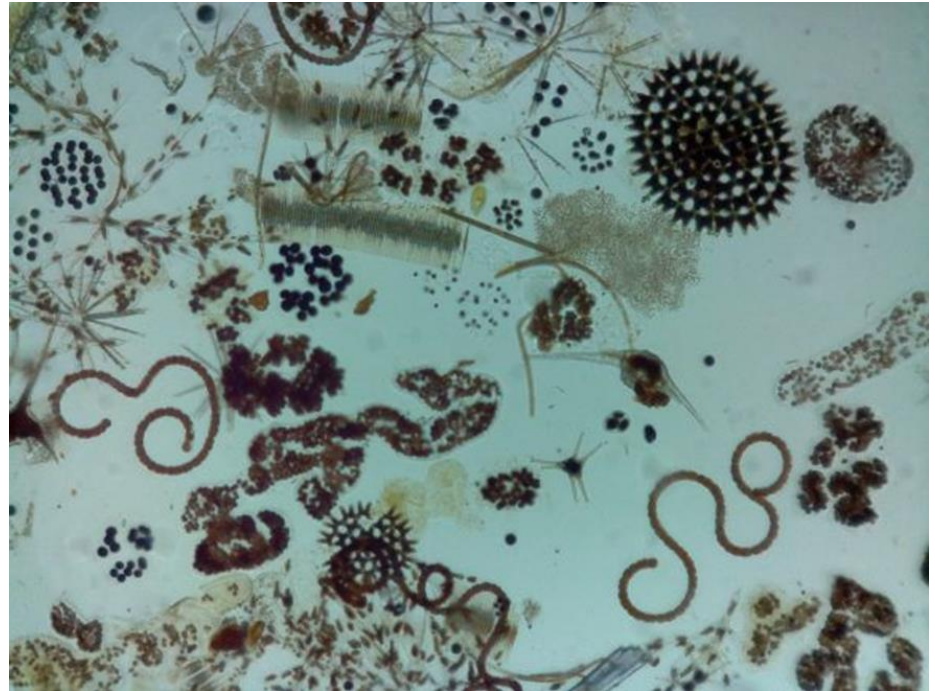


# Logic

- Current DEC/DOH monitoring approach is based on appearance of a surface bloom,
  - Not all harmful algal blooms actually form surface blooms
  - However, there are currently about 8000 species of cyanobacteria, of which only 200 (~1-2%) are considered toxic (Harmful). Thus for those interested in studying why toxic cyanobacteria blooms form, as opposed to any cyanobacteria bloom, more information is needed.
  - Complicating the issue, *Microcystis* taxonomy is based on colony shape. This information is lost when cells are transported.
  - Resource limitations prevent us from sampling every bloom personally.
- Solution; Provide citizen scientists with in-expensive, in-field microscope camera that can obtain high resolution images in real time to allow for species determination in blooms.

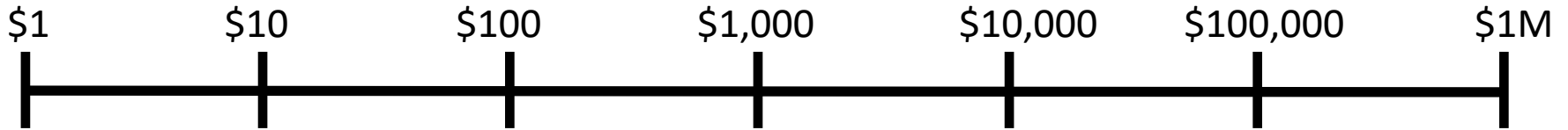
# Why should I be interested?

- If interested in your lake – most of the action happens in the water.
- Algae are fun to look at
- Communities are very diverse.
- Very visual for young adults.
- Learn a lot of basic Lake ecology



Iolight image by D. Derminio, Lake Neatahwanta

# Microscopes are like cars.....



**Iolight  
Microscope  
falls in the  
middle  
price range**



Main differences are quality of image and ease of use

# Basic equipment for the ioLight program

- Iolight Microscope coupled to your personal cell phone.
- Nitex screening is used to concentrate the water sample



Capture images on the cell phone and email them to [cyanoHABs@esf.edu](mailto:cyanoHABs@esf.edu)



# Questions we can answer: Is my bloom cyanobacteria?

- Images can be submitted to DEC via their HAB reporting portal



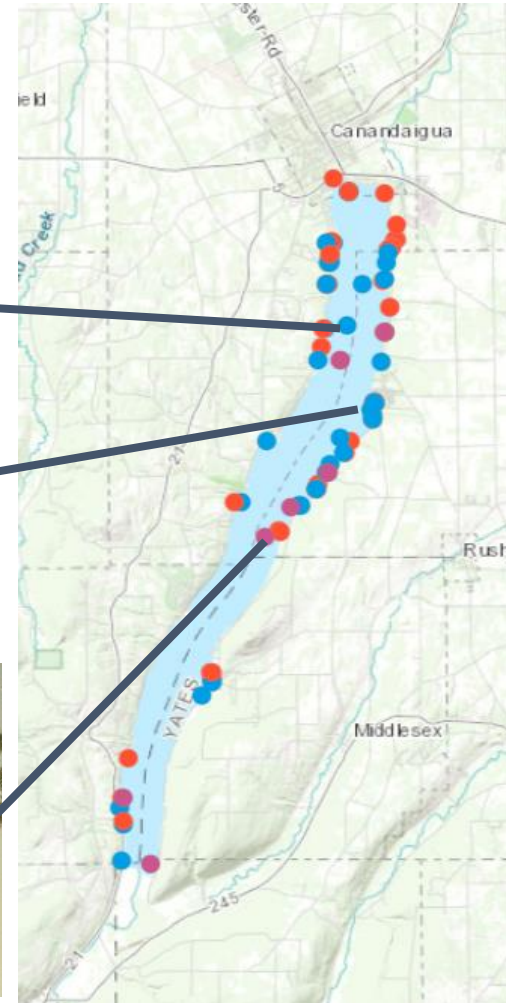
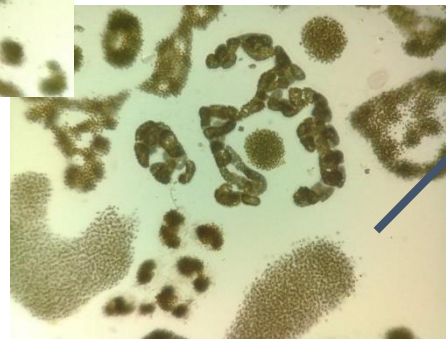
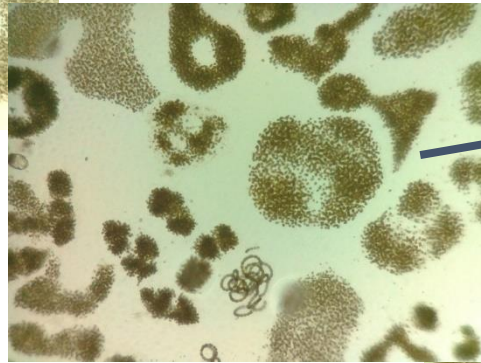
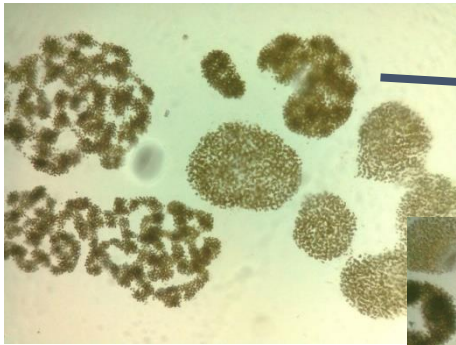
Terry Gronwall, Honeoye Lake, September 13, 2021

# Equally important – Is my bloom NOT blue green algae



Red Euglena

# Is the same bloom Lake-wide?

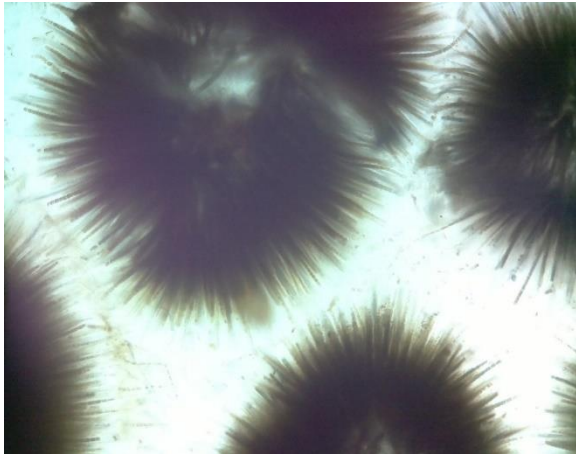


We saw a similar distribution of species at five different sampling sites in Canandaigua Lake

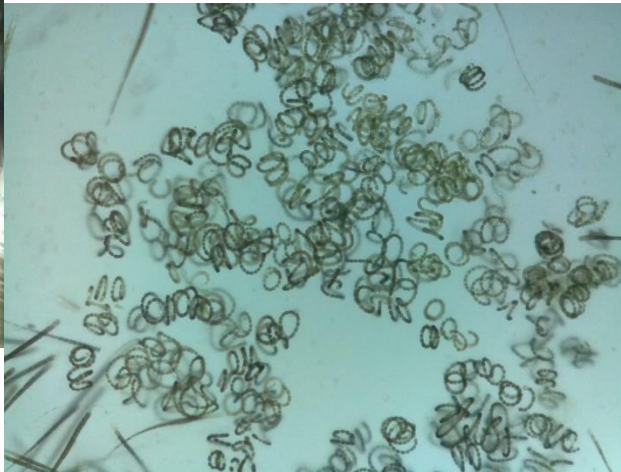


# How do my blooms change with time?

*Gleotrichia* early in season



*Dolichospermum* with traces of declining *Gleotrichia* in late summer



*Microcystis* species in fall. Note the presence of *Limnoraphis birgei*



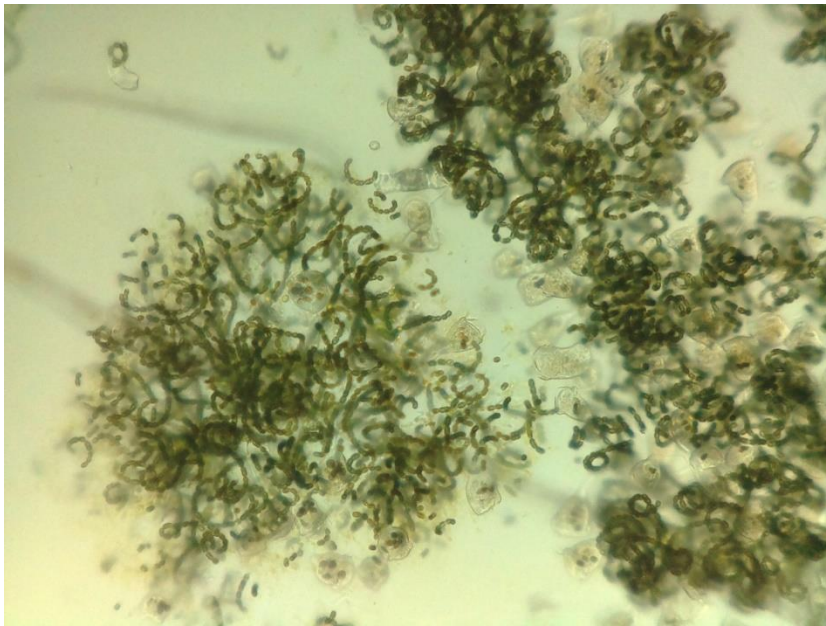
This is very important for academic research where we need to sample a particular type of bloom and for management of a bloom.

Images by Doug Conroe, Chautauqua Lake, July 8, September 1, and October 2021

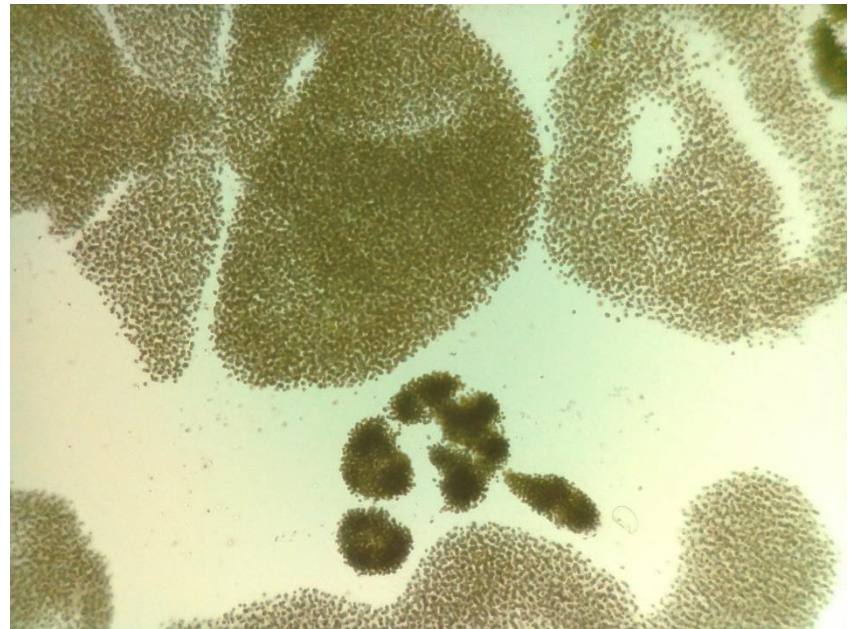


# Is my bloom of special interest?

*Dolichospermum lemmermannii*  
(probably non-toxic),  
Bob Crichton, Cazenovia lake  
October 14, 2021

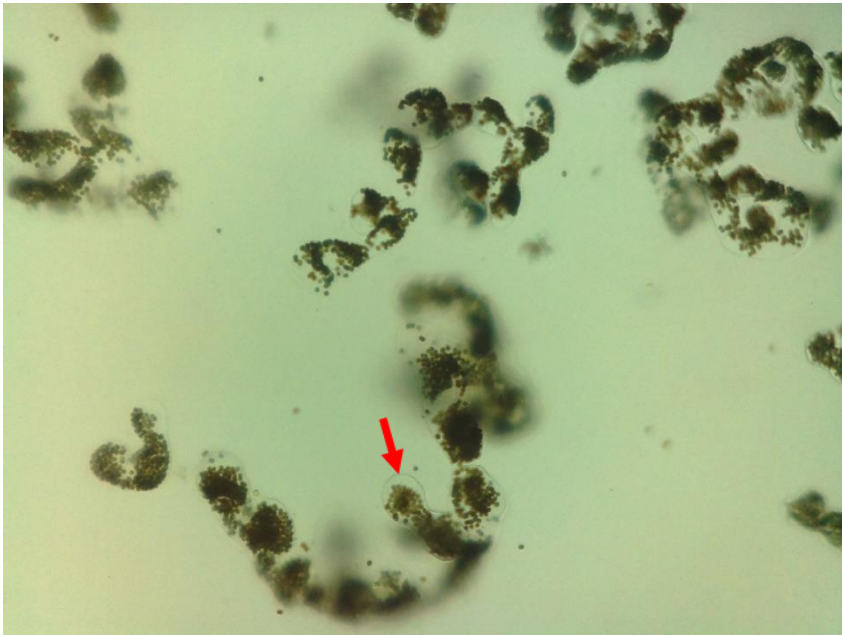


*Microcystis smithii* with small amount  
of *M. botryis* (toxicity unknown),  
image by Sally Napolitano,  
Canandaigua Lake, September 23,  
2021

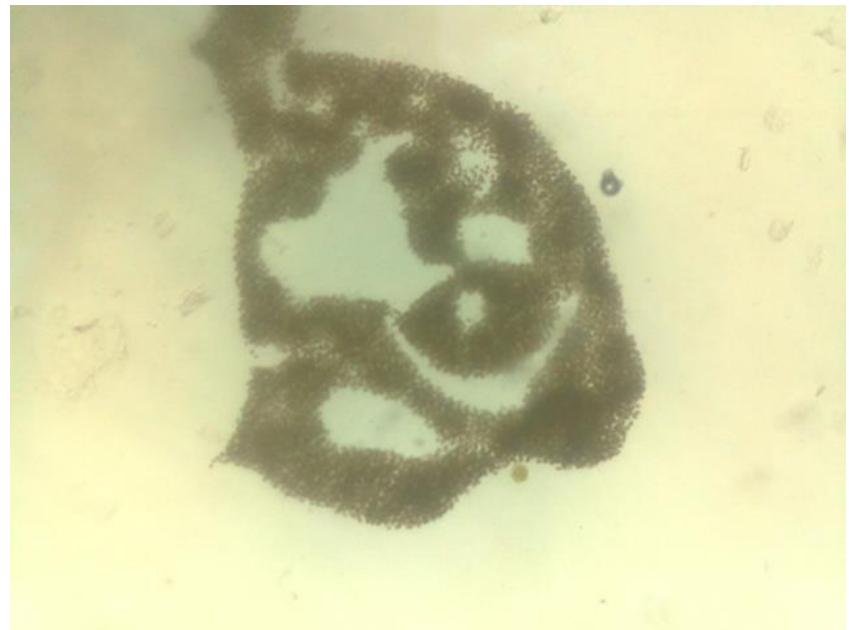


# Question we cannot answer: Is my bloom toxic?

*Microcystis wesenbergii* (probably non-toxic), G. Boyer, Lake Neatahwanta, February 25, 2021



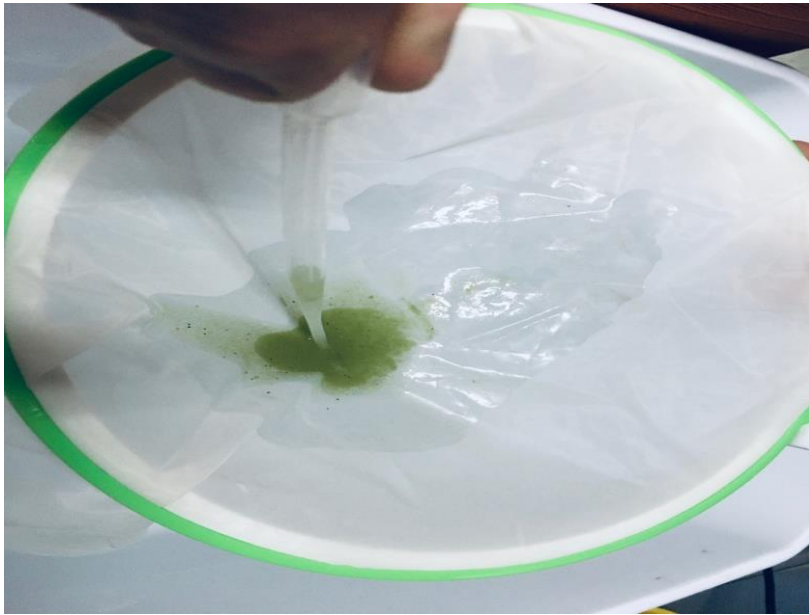
*Microcystis aeruginosa* (probably toxic)  
Terry Gronwall,  
Honeoye Lake, October 14, 2021



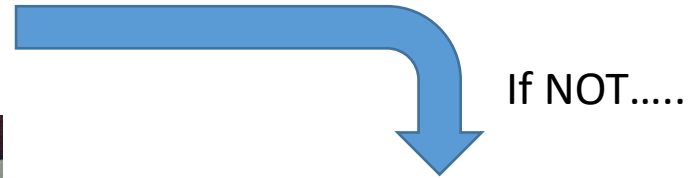
In most cases, you cannot determine toxicity from a visual image.

# Question I cannot answer: How much bloom is present?

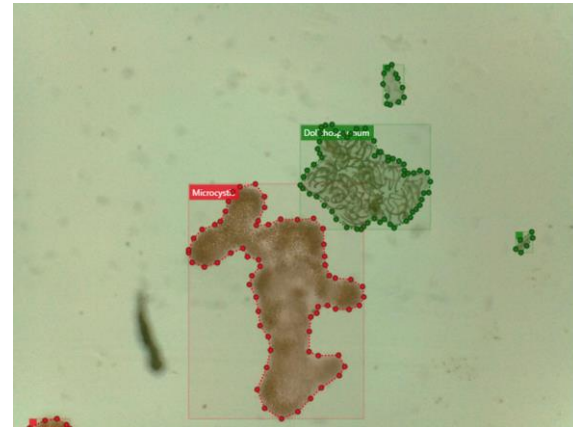
Remember we pre-concentrate samples through Nitex mesh:



We are interested in WHO is there,  
not necessarily how MUCH.



See the next talk by BloomOptix:  
*Real-time HAB monitoring via  
Artificial Intelligence enhanced  
Digital Microscopy*



# Pros and Cons of the ioLight

- System is relatively inexpensive and easy to use. Works with iPad, iPhones and android systems.
  - Easy to send the image to cyanohabs@esf.edu for review.
  - Totally field portable – no laptop computer, no kitchen table necessary.
  - Images can be included in the DEC HAB reports for bloom confirmation.
  - Allows community scientists to partner with other scientists to address scientific questions regarding HABs (move past just monitoring).
    - You can learn a lot about your lake by seeing who is there.
- 
- Some training is required to get good high quality images. There is a cost in both time and money. It is not for everyone.
  - ioLight has limited resolution; 1 mm screen (40x) or 2 mm (10x), hence some questions are simply below the resolution of the equipment.
  - Someone has to look at the images.
  - Currently – our sampling, by design, is qualitative not quantitative.
  - Currently - Does not replace toxicity testing.





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HEALTHY WATER SOLUTIONS

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

# Acknowledgements:



The many Lake Associations that have assisted our work over the past 20 years;

Current iolight project partners:

- Terry and Dorothy Gronwall (Honeoye Lake)
- Doug and Jane Conroe (Chautauqua Lake)
- Bob Crichton (Cazenovia Lake)
- Patty Matson (Craine Lake)
- Sally Napolitano (Canandaigua lake)

*As always; You can reachout to [GLBOYER@esf.edu](mailto:GLBOYER@esf.edu) with questions*