



Cayuga Lake Technical Advisory Meeting

Cayuga Lake Technical Advisory Committee

January 15, 2014

Ithaca NY Meeting Notes

Introduction

Jay Bloomfield opened the meeting and briefly reviewed the objectives and ground rules. He requested all participants to be succinct in their questions and answers. What follows is a summary of the information presented, including links to the actual presentations and recap of questions and responses.

Background Information for Cayuga Lake, Trophic State and Related Issues

[Tripton, Trophic State Metrics, Near-shore vs. Pelagic Zone \(more\) - Effler \(PDF 1.14 MB\)](#)

Reviewed background data and information about Cayuga Lake, focusing on phosphorus (P), sediment particles, and trophic state indices in nearshore (shelf) and open waters (pelagic). Question the extent to which algal particulates (bioeston) affect the lake's water clarity. Reviewed time series of data, noting when wastewater treatment plants (WWTP) had reduced phosphorus loading.

- Particulate P varies with weather (stormwater inputs)
- Increase in SRP at depth of LSC intake (73 m)- about 50% increase from 2003 to 2013
- Total dissolved P (TDP) reduction reflects increased P removal at WWTP
- Chlor-a not different, shelf and pelagic; Secchi disk transparency (SDT) and total P different
- Chlor-a explains only about 26% variability in SDT, even in main lake, which is less affected by tributary sediment loads
- Most particulate material in water column clay-sized particles
- Shelf has SRP input, but not more algae- short water residence time on shelf?

Q&A on session: none

[Selected Material From Other Earlier Papers and Reports - Effler \(PDF 387.3 MB\)](#)

- Continued review of background material. UFI provided CLTAC members with binders of published material.
- Briefly reviewed literature regarding the origins of sediment inflows to Cayuga Lake. Referenced Greg Nagel's work using tracers to differentiate surface runoff from bank erosion.
- Nagel calculated bank erosion as the most significant source (accounting for 76% of sediment load in Sixmile Creek & Cayuga Inlet; 52% in Fall Creek; 53% in Salmon Creek.
- Noted that wetland loss means that more sediment will reach the lake.
- Reviewed estimates of sedimentation rate from various investigators.

Q&A on session - none

New Papers Based on Pre-2013 Data, Partitioning Effects of Minerogenic Particles

Prestigiacomo/Effler-

- Described investigations designed to partition the contribution of biogenic -defined as organic (algae and other bioeston)- and minerogenic- (inorganic materials) to particulate phosphorus and water clarity in Cayuga Lake.
- Used LSC data, 1999-2006, plus additional UFI research.
- Described development and performance of a 2 component model that partitions the organic/inorganic fractions of particulate P. Noted spatial variation (shelf vs. pelagic).
- UFI researchers used SAX (scanning electron microscope interfaced with imaging and x-ray diffraction technology) to confirm nature of particles suspended in water samples- most are clay minerals.
- Developed stoichiometric model to estimate contribution of organic/inorganic particles to turbidity (on shelf, 70% minerogenic as an annual estimate). Concluded that shelf has higher particulate P and turbidity compared to pelagic; but there is no difference in shelf/pelagic for chlorophyll-a.

Q&A on session - clarifying question from Dave Bouldin regarding axes of graphs

Partitioning Particulate Phosphorus (PP) and Turbidity- Effler (continuation)- (PDF 1.56MB)

- Showed history of partitioned TP (muds and organic material) on shelf and pelagic.
- Demonstrated that when the TP guidance value (20 ppb, June 1 - Sept 30 average) is exceeded on the shelf, due to minerogenic particles.
- Question of bioavailability of particulate P (i.e., does the mud grow algae?).
- Implications for the CLMP: importance of characterizing the external sediment loading; importance of longitudinal segmentation of the model; importance of estimating bioavailability.

Q&A on session - clarifying question from Patrick Reidy regarding nature of the bioeston- refers to algae plus other living material. Measured as chlorophyll-a, assuming it's primarily phytoplankton

Partitioning Light Scattering and Secchi Depth (Clarity) - Peng (PDF 1.54MB)

- Explained the SAX technology and its applications.
- Particles affect light scattering and water clarity- muds are more effective in scattering light.
- Described the 2 component model - separating mineral and organic, shelf and pelagic- decent closure.
- Presented a detailed look at 2003 data; demonstrating that variation in turbidity was driven by minerals dominated by clay-sized particles.
- Noted calcite spike at site 3 in summer (whiting event). Conclude that 1-10 μ m is the median size of particles that are important for light scattering in Cayuga Lake.
- The SAX analysis indicates that Secchi disk transparency is almost completely driven by minerals.
- Model can be used in a predictive manner- i.e., how would SD respond to different scenarios such as a 50% reduction in chlorophyll-a.

Q&A on session - Dave Bouldin asked about the calcite particles, whether they are separate particles or Ca-enriched; and whether they wash into the lake from the tributaries or are produced in-situ. Feng Peng explained that she tests the particles before and after an acid treatment (acid dissolves calcite precipitate). Concludes that particles are calcite, precipitating around a nucleus that can be organic or inorganic. Produced in-situ, during summer periods with warm water and active photosynthesis, pH increases. Question- how much phosphorus is in the particles? Steve Effler does not yet know, will be included in 2014 analysis. Ron Entringer

asked why there is no bioavailability testing of the LSC return flow. Steve Effler explained that there are not enough particles in the hypolimnetic water cycled through the LSC facility- the phosphorus is primarily dissolved.

Monitoring/Process Studies/Modeling to Support a P TMDL

Quality Assurance Project Plan (QAPP) - Effler (PDF 1.90MB)

- Reviewed the approved QAPP for the CLMP.
- Stated that the project is on schedule, and the planned sample and data analysis will proceed- UFI taking the lead on the lake, and Todd Walter taking the lead on the streams/watershed.
- Summarized activities that were not specified in the QAPP.

Q&A on session - none

Paleolimnological P Inference - Rowell (PDF 745KB)

- Described how estimated historical conditions in lake quality (as inferred from diatoms preserved in dated sediment core) can be compared to hindcast of a mechanistic model.
- This is an empirical approach, based on correlation of diatom assemblages (from many northeastern lakes) with water quality conditions (assign tolerance to eutrophication to species).
- Preliminary core from Cayuga Lake not deep enough (i.e., old enough), will re-sample in May 2014.
- Objective is to get an 80 cm core from deep lake.

Q&A on session - Steve Effler- what is the reason Hank Mullins cites for increased CaCO₃? John Halfman stated this is related to acid rain (peak in 1960s, prior to emission controls on power plants). Pat Reidy asked if Cayuga Lake has always been P limited. Nelson Hairston cited a Norwegian study of hyper-oligotrophic lakes- concluding that atmospheric N tends to drive lakes to P limitation.

Minerogenic particles, approach and implications - Effler (PDF 453KB)

- Noted that the CLMP framework could also support a sediment TMDL

Q&A on session - none

Early Presentations on Selected Features

Plankton-Hairston (PDF 847KB)

- Outlined the work program for phytoplankton and zooplankton, and summarized findings to date.
- There is a long-term record of phytoplankton community at the LSC site, can indicate whether the detailed 2013 findings are representative.
- Outlined the importance of understanding zooplankton dynamics- consume algae.

Q&A on session - John Halfman asked if Cercopagis (predator of Daphnia) might be suppressing Daphnia and thus the clear-water phase. Lars Rudstam noted that alewives are likely to be preying on Daphnia. He has not looked recently at the lake alewife population. Lars noted that the zooplankton community (so far) does not include Bythotrephes (spiny water flea)- now in Great Lakes and other NY inland waters.

Dreissenids-Watson (PDF 4.89MB)

- Could dreissenid mussels (zebra and quagga mussels) affect hypolimnetic SRP concentrations? Mussels are ecosystem engineers.

- Outlined program in CLMP to quantify mussel density, species composition, and spatial distribution.
- Lab experiments to estimate excretion rates; compare to literature values. Underwater photos show extent of colonization of substrate.
- Preliminary indications that quagga mussels have a lower excretion rate than zebra mussels (more efficient?). Analysis and calculations will continue.

Q&A on session - Pat Reidy asked if the mussels could account for the increased hypolimnetic SRP? Jim Watson responded that he does not yet know the answer (needs to complete analysis and calculations). Ron Entringer asked about the temperature dependence, noting that the deep waters of Cayuga Lake remain cold year-round. Jim Adams asked about the timing of the population shift from zebra to quagga mussels, and if there was a massive die-off of the zebra mussels. Quagga mussels are found in much deeper waters (zebra usually less than 20 m). Jim Watkins stated that the history/timeline of the change in species composition is not known- have 2000 data (not species differentiated) and 2007 (quaggas dominate). Could changes in N ratio make a difference? Jay Bloomfield noted that there may be DNA-typing analysis tools (mud). Roxy Johnston noted that the impact of dreissenid on nearshore quality (including algal and cyanobacterial blooms) of lakes has been investigated, citing the work of Joe Makarewicz. Is it possible to age the individuals, and thus estimate how long they had been present at certain depths? John Halfman reported that the biomass of dreissenids in Seneca Lake appears to be declining (noted that this is based on a limited number of samples).

Trophic State Metrics - O'Donnell (PDF 103.MB)

- Compared the 2013 monitoring data (lakewide) to historical data,
- Offered preliminary insights regarding longitudinal and year-to-year differences in trophic state metrics
- Phosphorus partitioning.

Q&A on session -Roxy Johnston asked about the depths of stations and how that affects measured Secchi disk. Sue explained that the SD was visible on the lake bottom at times. Lars Rudstam recommended that observations with SD on lake bottom be deleted from graphs (biased).

W-2 (2-Dimensional) Hydrodynamic/Transport Model - Gelda (PDF 1.67)

- Explained that UFI will apply the 2D (laterally averaged) model CEQUAL-W2.
- Described the input requirements and showed how the grid is segmented for Cayuga Lake- smaller cells in the south.

Q&A on session - none

Shelf Flushing/3-Dimensional model - King (PDF 15KB)

- Explained the rationale for the 3D modeling, model theory, and how it will be applied to the CLMP. Interface with UFI on the 2D model. Will estimate shelf water residence time (flushing).

Q&A on session- none

Tributary Concentrations - Prestigiacomo- (PDF 1.16MB)

- Presented results of tributary sampling program, which was successful in capturing events. Summarized median and high values for water quality parameters in streams.

Q&A on Session - Steve Penningroth requested clarification of what chemical forms of phosphorus are measured as total dissolved P. Steve Effler responded.

Adjournment

Chairman Jay Bloomfield asked the CLTAC for any additional questions or discussion. Hearing none, he adjourned the meeting at 3:10 pm.

Attendees:

TAC Members: Jay Bloomfield (Chairman); John Halfman, Rosella O'Connor, Richard Yager, Roxanna Johnston, Aaron Ristow

NYSDEC Representatives: Jeff Myers; Ron Entringer, Steve Gladding (phone), Chandler Rowell, Dan Hayes
Cornell: Jim Adams, Liz Moran, Vicki Davis, Lars Rudstam, James Watkins, Nelson Hairston, Todd Walter,
Allie King, Erin Menzies, Cliff Kraft, Bob Johnson, Dave Bouldin, Wendy Paterson, Seth Schweitzer

Upstate Freshwater Institute: Steve Effler, Dave Matthews, Feng Peng, Tony Prestigiacomo, Sue O'Donnell,
Rakesh Gelda

Community Stakeholders: James McGarry, Steven Penningroth, Brian Eden, Brent Cross, Darby Kiley, Jose Lozano, Hilary Lambert, Bill Foster, Elaine Quadroni, Pat Reidy