The Water Bulletin

Community Science Institute Newsletter

FALL 2016

DID YOU KNOW?

CSI volunteer data show that salt concentrations are increasing in groundwater throughout the Cayuga Lake watershed.

Some studies suggest that ≈85% of groundwater salt originates from road salt.

TO LEARN MORE:
If you missed CSI's most recent forum on salt in the Cayuga Lake watershed visit communityscience.org and check out our What's in Your Watershed? Series under "Resources."

The Value of Red Flag Monitoring

The creation of the Community Science Institute's Red Flag monitoring program was inspired by the prospect of unconventional gas wells and high volume hydraulic fracturing (HVHF, or "fracking") coming to the Upper Susquehanna River watershed. The idea behind the program was simple yet profound: Collect accurate baseline water quality data that would make it possible to document whether streams were impacted by fracking – or not. Since 2010, some three dozen teams of Red Flag volunteers have collected, and CSI staff have reviewed and entered in our public database at http://database.communityscience.org/monitoringregions/2, over 14,000 values for temperature, pH, dissolved oxygen, conductivity and total hardness at more than 100 locations on streams in twelve counties. Several teams retired from the program after the Cuomo Administration took fracking off the table at the end of 2014. Although it is still an impressive stream monitoring program by any measure, the question remains: Should the Red Flag monitoring effort continue now that fracking is no longer an imminent threat? CSI's answer is a resounding "yes," and here's why:

- For the vast majority of streams, our incredibly dedicated Red Flag volunteers are the sole source of water quality data.
- Fracking has not been banned by law in New York and could be back on the table if circumstances change.
- Long-term data sets make it possible to detect impacts on water quality, particularly cumulative impacts, not only from fracking but from a variety of sources.
- Red Flag volunteer teams are in a position to monitor additional chemicals that may present risks to water resources.
- The Red Flag program exemplifies how scientifically rigorous data collection by citizen volunteers can open a path toward managing local environmental resources effectively.
- The simple act of monitoring promotes awareness and stewardship of water resources within our communities and in our region.

Two Red Flag volunteers collect samples and record data along Catatonk Creek in the Chesapeake Bay watershed.

How good are Red Flag data? Volunteers perform standards and duplicates as quality controls each time they sample, and they split four samples a year with the CSI lab to compare and further validate their field measurements. CSI staff make sure that data quality objectives are met before entering results in CSI's public database. Recently Madeline Kwicklis, a student at Cornell University, used statistical analysis to evaluate how "tight" Red Flag baselines are at four stream locations. She found that, with 99%

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Red Flag Monitoring, continued

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confidence, monthly testing resulted in predicted baseline ranges from about +/- 75% to as "tight" as +/- 30%, depending on the location. For example, if the predicted baseline for specific conductance were 100 µS/cm +/- 30%, there would be a 99% chance that a sample measuring 150 µS/cm, or 50% higher than the baseline, indicates an impact. These preliminary analyses suggest that Red Flag data achieve the consistency needed to create robust baselines for detecting water quality impacts.

This year, in an effort to better understand New York's contribution to nutrient pollution of the Chesapeake Bay, CSI expanded our Red Flag monitoring partnerships to include certified testing at each stream location twice a year for three nutrient parameters: Total phosphorus, nitrate- + nitrite-nitrogen, and ammonia-nitrogen. Nutrient test results are now being posted in CSI's public database in addition to the five regular water quality indicators for each Red Flag location. Having started as a pre-fracking initiative, the Red Flag stream monitoring network is becoming more valuable, for more reasons, with each passing year.

Stay Tuned!

CSI staff have begun working to apply Madeline's statistical method to assess the robustness of water quality baselines at a number of Red Flag locations.

CSI Biomonitoring Partnerships Meet High Standards

Volunteers collect a BMI sample at Big Stream, which flows into Seneca Lake

Biomonitoring is a strategy for assessing the overall health of an ecosystem by examining a specific community of organisms. In streams, bottom-dwelling organisms called benthic macroinvertebrates, or BMI (see photo), are often used for this purpose. Government agencies and conservation organizations have established a variety of protocols for volunteer monitors that can be used for translating the composition of a BMI community into a water quality rating. BMI is an ideal realm for citizen science. Each group of volunteers is challenged to find its own unique balance between scientific rigor, educational value and time commitment. The Community Science Institute prides itself on empowering our volunteers as water stewards, and our protocols give high priority to scientific rigor and detailed results in the belief that the conscientious practice of science has educational value of its own. Those who've tried BMI with CSI know that it can be a time-consuming process. Is it worth the effort? After all, simpler protocols for assessing stream health through BMI do exist, for example, the Izaak Walton League's Save Our Streams or the New York State Department of Environmental Conservation's (DEC's) WAVE program.

CSI uses biomonitoring protocols and metrics that were developed with DEC input for a volunteer monitoring service organization called Hudson Basin River Watch. CSI has refined these protocols over time, and currently our results align very well with results obtained by the DEC Biomonitoring Unit. CSI volunteers use the same sample collection procedures as DEC professional teams. When it comes to sample analysis, our approaches diverge somewhat. The DEC collects one sample per location, pulls out 100 organisms and identifies them to genus and species. CSI volunteers generally collect two replicate samples per location, pull organisms from at least ¼ of each replicate sample and identify them to family level. This usually entails identifying many hundreds of organisms in each of two replicate samples from each location.

Benthic Macroinvertebrates (BMI) from a stream bio-monitoring sample – BMI include aquatic insects and other small stream-dwelling organisms. Pictured are three common stonefly nymphs (*Perlidae*)

Though time consuming, CSI's analysis probably gives a better picture of biodiversity in streams than the DEC's 100 organism approach, according to a recent conversation between the author and A.J. Smith from DEC's Biomonitoring Unit. Identification of BMI to genus and species does enable the DEC to determine the source of an impact to a stream, in some cases. With respect to the assessment of overall water quality, however, a paper co-

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authored by Smith (Smith and Bode, 2004) showed that most of the time, family level metrics are as accurate as genus/species level metrics.

CSI's volunteer biomonitoring partnerships generate reliable assessments of the health of stream ecosystems. It seems fair to say that the quality of the results obtained by our volunteer partnerships excels in the realm of citizen science and, while not exactly the same, are on a par with results obtained by DEC professionals. Moreover, by sorting and identifying large numbers of organisms, CSI volunteers are also documenting BMI biodiversity in local streams, information that could well prove to be a valuable baseline for future reference.

2004. Smith, Alexander J. and Bode, Robert W., "Analysis of variability in New York State benthic macroinvertebrate samples"

Want More?

To delve deeper into BMI, please visit the CSI website at communityscience.org and click on "Resources" then "Volunteer Resources" then scroll down to "BMI Resources" where you'll find a downloadable file called "Comparison of BMI Sampling Techniques."

BMI open lab hours are from 5pm - 8pm on Thursdays in the Winter. Check us out at communityscience.org for information and updates.

Volunteer Monitoring Service Organizations Offer Diverse Perspectives

As a volunteer monitoring service organization, the Community Science Institute (CSI) seeks to foster environmental stewardship. Our mission, though unique in its execution, is not a new concept. National environmental organizations, for example, the Sierra Club Water Sentinels and the Izaak Walton League of America (IWLA), also engage and empower the community through environmental monitoring and education. These groups are bound by a common purpose to educate the public and encourage participation in the scientific process, but they differ significantly in practice.

Since 2002, CSI has worked with groups of volunteers to assess water quality in the Finger Lakes region and the Southern Tier of New York. What started as a handful of locations has expanded to encompass over 200 active chemical, biological and physical monitoring sites. Throughout this expansion, CSI's mission to support environmental monitoring partnerships and the production of scientifically credible data has remained constant. CSI volunteers collect data in groups as a way of fostering cooperation and mutual support, a "community science" variation on the "citizen science" theme. Volunteer groups receive close logistical and technical support from staff and maintain an ongoing relationship with CSI's certified lab. Samples and field data collected by volunteers are processed by CSI staff who enter results into CSI's database at database.communityscience.org where they may be viewed, downloaded and referenced by anybody free of charge.

> "These groups are bound by a common purpose to educate the public and encourage participation in the scientific process."

The Sierra Club's national Water Sentinels program is carried out through many state and regional chapters. These chapters vary significantly with respect to monitoring programs, but they share a collective mission to educate the public on water quality issues and encourage volunteer monitoring. Volunteer-led chemical monitoring is common amongst many Water Sentinels chapters; for example, the New York chapter routinely monitors streams for conductivity and total dissolved solids. Nationally, monitoring projects vary greatly by region and include riparian zone maintenance, waterway cleanups and pollution incident reporting. In many chapters, training is conducted by an experienced volunteer who may have received his or her training from another volunteer monitoring service organization ("train the trainer" model). Field data are collected under the general direction of a group leader. Volunteers are responsible for data quality and enter their data directly into an online database, the contents of which may be shared with interested parties upon request.

The Izaak Walton League of America, while perhaps best known for its promotion of outdoor recreation, has successfully conveyed the importance of water quality preservation for almost 100 years through their Save Our Streams (SOS) program, which emphasizes BMI. Volunteers are trained by IWLA staff or IWLA certified trainers and are encouraged to asses streams in their communities. Information, a list of materials, instructions and data sheets are provided via the SOS website to support trained volunteers who wish to conduct biological, chemical, and/or physical monitoring. Volunteers may submit data to the IWLA if they choose or they may keep their results for their own personal use. In addition to monitoring by individual citizens, education and public engagement are central to IWLA's mission.

CSI, the Sierra Club Water Sentinels, and IWLA all seek to engage and educate the public, but each brings a different set of strategies and practices to the table. As a relatively small regional organization that operates a certified testing lab, CSI can provide volunteers with one-on-one support and maintain strict quality control standards and centralized data management. The Sierra Club Water Sentinels is a national program that possesses considerable flexibility and allows for diverse monitoring objectives. Finally, the IWLA's outreach strategies are tailored for youth and family engagement and education, an enduring approach to environmental stewardship.

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