



Photographs: Dori L. Hess

To Monitor or Not to Monitor

Creating a citizen science team to collect baseline data on a local watershed

By **Dori L. Hess**

ALL OF LIFE DEPENDS ON WATER, and all of us are citizens of a watershed¹. Approximately 70 percent of the Earth's surface is covered by water². The demand for ongoing water testing creates an excellent opportunity for adolescent students (and adults) to experience the world of science beyond the walls of the classroom by getting involved in a citizen science water monitoring program. With this in mind, a group of 15-17 year old students organized the first citizen science water monitoring group in Carroll County Ohio.

We all live in a watershed and every action we take has a direct effect on all biotic and abiotic factors within that watershed³. So the earlier we start teaching our youth how to become active in preserving the aquatic world around them, the more likely it is that they will develop an intrinsic desire within themselves to make a lifetime commitment to preserving what they have in their own community. "Citizen science projects have been remarkably successful in advancing scientific knowledge⁴," and through volunteer efforts students can learn how the quality of surface waters and ground waters are altered by their everyday actions, and how they

can educate their community on local water quality issues. Volunteer water monitoring is an excellent way to introduce our youth to environmental education and the joy of learning in the great outdoors⁵!

How do you get started?

The Cornell Lab of Ornithology (CLO) has designed the following model for developing and implementing a citizen science project⁶:

1. Choose a scientific question
2. Form a scientist/educator/evaluator team
3. Develop, test and refine protocols, data forms and educational support materials.
4. Recruit participants
5. Train participants
6. Accept, edit, and display data
7. Analyze and interpret data
8. Disseminate results
9. Measure outcomes

Choosing your questions

Most likely your first question will be, “where will we test water?” Identifying the water source that your group will test may be as easy as collecting water from the creek that runs through the neighborhood park. To Monitor or Not to Monitor (TMNM), our water quality monitoring group, recognized that there were several watersheds within their own community that had never had any testing conducted on them. So, their first question became, “Should we monitor or not?” The second question evolved from the first: “what are the baseline tests that we can do on these watersheds?” As the students became more involved in water testing training, they developed further questions that they could research in the future.

Forming the team

Local soil and water commissions can be an excellent starting point for a new citizen group. They will be the experts within your area and can provide guidance and training for you and your group. Harnessing the expertise of a local resource is also an ideal way to introduce your students to specialty scientists in their own community. TMNM contacted the Carroll County Soil and Water Commission (CCSWC) who indicated that they were in the process of developing a water monitoring team and invited our group to take part. TMNM was responsible for conducting water quality tests on 5 of the 9 sites that were monitored along Indian Fork Watershed⁷.

Protocols and educational materials

The easiest way to create your protocols is to revisit your key questions. Use these questions as a guide as you lay out your plan of action and determine what tests you will perform and what data you will use. TMNM members examined their original questions and realized that their project fit in nicely with the CCSWC, so they adopted the protocol that was designed for the “Cold Spring Run-Indian Fork Watershed Project.” The advantage to partnering up with another

nascent group is that there is a high level of excitement, and most volunteer members will be at introductory level and eager to seek out proper training. It is also helpful to have a diverse group of people involved in any conservation minded team, because each person will bring their own area of expertise to the entire group.

Recruiting participants

A water monitoring program can readily become part of an environmental science curriculum. The advantage to collecting samples as part of a class is that composite samples (i.e. those taken over a period of time) can be taken versus grab samples (i.e. those that are taken at the same time). If your school has not yet adopted a program in which students could become members of a monitoring team as part of their coursework, then advertising for volunteers will become necessary.

We solicited out team members through school announcements, posters and newspaper articles. Interested participants were invited to attend an informational meeting about the program, letters were sent home to inform parents of their child’s potential interest, along with consent and medical release forms. Initially 15 students signed up to take part in this new program. Once training started, some participants dropped out due to time constraints. We have found it best to recruit as many interested members as possible, with the understanding that if some can’t take an active role right away, they may come back next season with a new sense of commitment.

Training participants

Proper training is essential for all volunteers who work with any program. Training materials must be clear, easy to understand and of interest to the reader. Groups or individuals can contact their local governmental agencies to see if materials, testing supplies and possibly training may be available at a reduced rate. The National Facilitation Project has been developed to assist with the setup of monitoring programs, and they provide easy to read literature. The World Water Monitoring Organization has also developed

Resources:

- The EPA website <water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/index.cfm> includes information for water sources within ones own state. One interesting way to use the EPA information is to look for the TMDL maps of water sources within your state. These maps show the total maximum daily load of pollutants of waterways and will identify which waters have already been tested and which have not.
- *What’s up with our Nation’s Waters?* is an older EPA (2002) manual, but is geared towards younger students¹¹.
- *Volunteer Stream Monitoring: A Methods Manual* is put out by the EPA (2012) and provides thorough step by step guidelines on how to set up your program¹².
- In Canada, the responsibility for water management is shared by the federal, provincial, and municipal governments, and in some instances, by the territories and by Aboriginal governments under self-government agreements, which often necessitates close cooperation and collaboration among all levels of government, Aboriginal peoples, and the public¹³. This shared sense of responsibility for water quality has led to the development of many citizen science groups that dedicate their time to sustaining healthy waters. To learn more about these opportunities, visit the following:

Nature Watch: <www.naturewatch.ca/english/>

Waterkeepers Canada: <www.waterkeepers.ca>

training guidelines for scout troops⁸.

TMNM members were fortunate to receive a generous donation from the Appalachian Foundation, which allowed the team to purchase a backpack water testing kit. Team members were then trained on the proper usage of the equipment in the field, and then practiced using the equipment prior to collecting official data. Through the connection with CCSWC, students were invited to take part in a Level I Water Quality Testing program through the US EPA.

Type of tests

The type of training you receive and one's financial constraints will most likely mandate the types of tests that your team will conduct, amidst a wide variety of possible water tests. Simple, inexpensive tests include testing for pH, temperature and macro invertebrates. Testing equipment can be purchased through any laboratory supply company, and kits are also available through the World Water Monitoring Group.⁹

Analyzing data & disseminating results

The protocol will help you to determine what data you will accept and what you should disregard. Keep in mind that all data collected is an important part of the learning process. Displaying data will be important so members of the group can examine and compare their results.

Depending on the educational background of the members of the group and the complexity of the tests that the group has chosen to conduct, analyzing the data may require assistance from a mentor or a water quality professional. Collaborating with other professionals on data analysis and interpretation is also a wonderful way for students to see how scientists work together in the field.

Organizing a community education night is a wonderful way to help instill a sense of ownership in the members of the group. Such a night helps them disseminate the data that they have collected and excite potential volunteers. In addition, your group may want to share their data on a larger scale¹⁰.

The TMNM Team held a community educational night in order to educate their peers, parents and other community members about their plans, training and future data dissemination. Beyond this, our group will share our data with the Carroll County Soil and Water Commission, possibly the EPA, along with The World Water Monitoring Organization and Cornell Citizen Science Center.

Measuring outcomes

Measuring the outcomes of your project will help to determine the impact and benefits of the data collected. However, data should not be the only measurable factor in a citizen science water monitoring team. Advisors should also examine the qualitative factors, such as: team building, development of interpersonal communication skills, and the development of scientific literacy and environmental science skills in students. Measuring outcomes should be an ongoing process, keeping in mind that it is important for volunteers to see the impacts of their hard work and time. By giving students the opportunity to see how they are making an impact on the environment, they are more likely to develop an intrinsic sense of concern for the planet they live on. TMNM is in its

early stages of testing, but students are already making comparative analysis of the data that they have, and are beginning to develop their own hypothesis about what may cause changes in water chemistry.

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7. If you don't have a local soil and water commission, the Department of Natural Resources, Watershed Restoration Partnership, Inc., The Metroparks System, or local NGOs may be other beneficial resources. Individuals can also find helpful information at the following websites: <www.birds.cornell.edu/citscitoolkit/projects/find/waterquality/atct_topic_view?b_start:int=20> <www.worldwatermonitoringday.org/default.aspx> <<http://ga.water.usgs.gov/edu/>> <www.environment.gov.au/water/policy-programs/nwqms/> <www.ec.gc.ca/eau-water/default.asp?lang=En&n=E05A7F81-1>
8. <www.worldwatermonitoringday.org/default.aspx>
9. <http://www.worldwatermonitoringday.org/Order_Kits.aspx>
10. If this is the intent of your group, contact the World Water Monitoring Organization at <www.worldwatermonitoringday.org/memberlogin.aspx> for more information.
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