The Volunteer Monitor
THE NATIONAL NEWSLETTER OF VOLUNTEER WATERSHED MONITORING
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maine volunteers PARTNER with regulatory agencies

by Sarah Gladu

FRIENDS OF MEDOMAK WATERSHED

Sarah Gladu trains clammers (and the Shellfish Warden's daughter) to take water samples in the Medomak estuary.

When the Friends of Medomak Watershed (FMW), a small citizens' group in midcoast Maine, began monitoring, a number of concerns were raised—particularly since the group hoped to have their bacterial data used by regulatory agencies responsible for septic system inspections and clam flat classification.

Among the concerns were doubts about whether the agencies would actually use the citizen data, and fear that if the agencies did use the data, communities might perceive the volunteers as serving the regulatory agencies.

As the coordinator of FMW, it has been my role to provide encouragement and support to counteract the skeptics who pull people, and their energy, away from what is potentially possible. In just three years, FMW has amply proved that we can successfully work with the regulatory agencies and at the same time maintain the trust of the community.

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Using Volunteer Data at NJ DEP

A Tiered Approach

by Eleanor Ely

Like their counterparts around the country, New Jersey volunteer monitors have long wished that their state environmental agency had in place a simple, systematic mechanism to take the mystery out of when and how volunteer data could be used by the state. Their wish is now close to becoming a reality, as the New Jersey Department of Environmental Protection (DEP) puts the finishing touches on a "four-tiered" approach that

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STEVE JACOBUS, NJ DEP

A volunteer sorts "bugs" at a NJ DEP macroinvertebrate training workshop.

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Agency Partnerships

The Volunteer Monitor

The Volunteer Monitor is a national newsletter, published twice yearly, that facilitates the exchange of ideas, monitoring methods, and practical advice among volunteer monitoring groups.

Next Issue:
The partnership theme will continue in the next issue (see "From the Editor," at right). Please send article ideas to Eleanor Ely, Editor, 50 Benton Ave., San Francisco, CA 94112; 415-334-2284; ellieely@earthlink.net.

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From the Editor

Partnership Theme to Continue in Next Issue

Our call for articles on "agency partnerships" elicited a large and enthusiastic response—so much so that the newsletter editorial board decided to devote two issues to this topic. The current issue focuses primarily on partnerships involving state agencies. In the Summer 2004 issue we'll look at volunteer monitoring partnerships with local agencies, as well as with businesses and corporations, schools, and other organizations. Please send ideas for articles to the editor (see contact information at left).

To the Editor

Streamflow and Impervious Surfaces

The article on "Measuring Streamflow" [Summer 2003] was superb. I want to elaborate on the utility of monitoring flow as an excellent way to measure the effects of land development as we pave the landscape.

Those of us who want to protect our surface waters often focus on the pollution that comes from the built environment, but the change in the path of stormwater caused by impervious surfaces (roofs, pavement, and compacted lawns) also has grave consequences. In natural areas, stormwater is able to infiltrate into the earth, wetlands, and floodplains. But in developed areas a greatly increased amount of stormwater rushes over impervious surfaces and through storm sewers, directly into streams. The stream level rises rapidly, creating a forceful flow that erodes stream banks, increases flooding, and destroys stream habitat.

Our volunteer monitoring program recently began a project to measure streamflow carefully in order to characterize the impact of development on the landscape and on our water resources. We received a small grant to purchase the necessary equipment: a Marsh-McBirney flow meter and an Odyssey Dataflow Systems pressure transducer.

While the $3000 Marsh-McBirney meter was expensive, it enables rapid, trouble-free measurements, essential when the discharge is changing quickly. (The "bucket wheel" meter that we formerly used required time-consuming spin tests to verify accuracy at each stream location, and frequent tinkering by an experienced operator.)

A pressure transducer measures water pressure, which is directly related to water level. Essentially the transducer provides the same information as a staff gauge, with the advantage that readings are taken automatically around the clock. The pressure transducer sits on the streambed and can be set to record water pressure at whatever time interval you choose. (We set the interval at 10 minutes for a small flashy urban stream. A longer interval could be used for a stream or river that rises more slowly.) We download the information once a month. The model we used cost $300 and performed excellently even in a Michigan winter.

In order to convert water pressure to flow, you need to establish a rating curve that relates the pressure reading to flow measurements under a wide variety of flow conditions.

A combination of patience, commitment, and reliable equipment enabled several teams of residents to spend hours at a time, sometimes *during* storms, to measure flow at seven sites on Millers Creek. They discovered that this tiny urban creek is being torn apart by runoff. Close to the headwaters the water rises from a few inches to over 3 feet during a brief storm and drops again within a few hours after the rain stops. Midway downstream the force of this rapid storm flow is cutting the channel, resulting in a small stream with 7-foot-tall banks, while near the end of its 2-mile length the creek floods a flat meadow, depositing the sediment it cut from the banks upstream.

Knowing how streams respond to a storm allows communities to recognize the need to protect their waterways by requiring new development projects to manage stormwater and adding stormwater infrastructure whenever streets are repaired or other opportunities to retrofit arise. When volunteers collect the data, the community gains the added value of widespread education. Many of our volunteers are learning about the effects of stormwater for the first time. The topic is complicated but made vivid when they measure the power of the flow. Several of our volunteers have become active spokespersons for the river following this experience.

—Joan Martin
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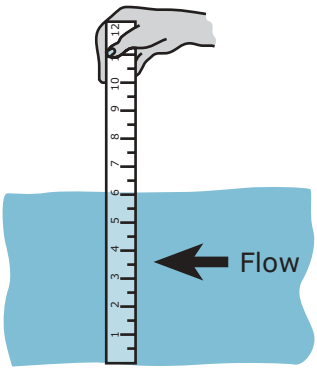
Head Rod Method for Stream Velocity

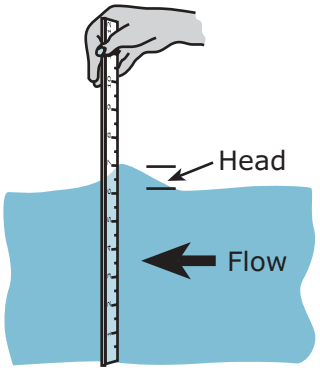
The article "Measuring Streamflow" in the previous (Summer 2003) issue of *The Volunteer Monitor* discussed two methods for determining stream water velocity: by using a current meter, or by the low-tech float method, in which an orange or other object is floated for a specified distance. Another low-cost, low-tech option, which was not covered in that article, is the use of a head rod.

The following brief description of the head rod method is adapted from the *WaterWatch Australia National Technical Manual*, available on the Web at www.waterwatch.org.au/. According to the manual, the method is limited to use in relatively shallow streams with velocities between 0.5 and 2.5 meters per second.

The WaterWatch program uses a 1-meter stainless steel ruler, or wooden ruler with a beveled edge, as the head rod. Five to 10 measurements are taken at approximately equal intervals across the stream.



1. With the thin edge of the ruler facing into the current, measure and record the height (in meters) of the water against the rod.
2. Rotate the ruler 90° so the flat side faces the current. The water will "jump" above its normal depth where it hits the side of the ruler. Measure and record the new height, then subtract the height obtained in step 1. This gives the height of the jump, or head. Stream velocity is proportional to the height of the head.
3. Calculate the average head from all the measurements taken across the stream.
4. Average velocity in meters per second is the square root of (2gh), where g is the gravitational constant of 9.81 and h is the average head. For example, if the average head height is 0.5 m, the average velocity is the square root of (2 x 9.81 x 0.5), or 3.13 m/second.



Nifty Stuff from Massachusetts

Last summer, faced with sampling several deep-water stations on the Connecticut River, Massachusetts Department of Environmental Protection biologist Peter Mitchell came up with a homemade sample collection rod to help keep himself dry. The device consists of an aluminum pole that extends from 4 feet to 8 feet in length, attached to a clamp that holds the sampling bottle. All necessary materials are readily available for a total cost of about $20. Mitchell advises, "I strongly recommend that you take your sample bottles to the store with you, to be sure you get the right size clamp." Instructions for building the rod are available at the Massachusetts WaterWatch Partnership (MassWWP) website (see below).

Meanwhile, MassWWP has developed Excel-based utilities for organizing and graphing chemical and macroinvertebrate data. Each is accompanied by a guidance document. The macroinvertebrate utility includes automatic calculation of statistical summaries of a dataset, including various metrics.

MASSACHUSETTS DEP

Complete instructions for making the sample collection rod, and downloadable files for the data management utilities, can both be found on the MassWWP website at www.masswwp.org (look under the "What's new?" section); or contact Marie-Françoise Walk at 413-545-5531.

MASSACHUSETTS DEP

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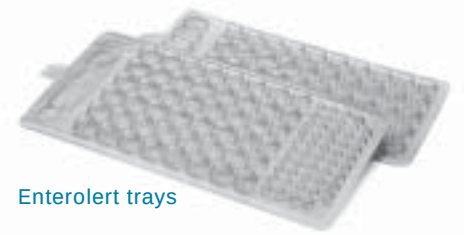
A vested interest in water quality

The Medomak watershed drains 109 square miles and includes land in 10 rural towns. Water quality in the 740-acre Medomak estuary is of vital economic importance to local communities. In Waldoboro, for example—a community of approximately 5,000 individuals—clam harvesting provides the primary income for about 150 families, and the clam industry is worth about $1.2 million annually. Every year, clammers lose many days of potential income when large areas of the estuary are "conditionally closed"—that is, closed to harvesting whenever there is over 1 inch of rainfall, due to high levels of bacterial contamination.

Monitoring for bacteria

FMW volunteers monitor for bacterial contamination in streams that run into the estuary. Our goal is to provide data that will help focus surveys of septic and gray water systems conducted by Maine Department of Environmental Protection (DEP) and municipal Code Enforcement Officers. The ultimate aim is to get these sources cleaned up so that currently conditionally closed clam flats can be reclassified. The selection of monitoring sites was guided by Maine Department of Marine Resources (DMR) recommendations regarding bacterial "hot spots."

We are using the Enterolert method from IDEXX. This variation on the "most probable number" method uses sterile plastic trays with wells (see below). Enterococci are the indicator. Results are available after 24 hours incubation at 41°C. Volunteers perform both sample collection and lab analysis, using the University of Maine Cooperative Extension (UMCE/Healthy Coastal Beaches Program) lab. We chose the Enterolert method because it is easy to learn and perform, and contamination is unlikely. The downside is the cost—it cost us about $4,000 to set up the lab, including the purchase of a $3,000 sealer for the Enterolert trays. The ongoing supplies cost comes to just over $5 per sample.



Enterolert trays

DEP and DMR have been supportive of our efforts because they themselves have limited capacity to do regular comprehensive monitoring on streams in the watershed. Although we are using a noncertified lab and noncertified personnel to perform the bacterial testing, DEP, DMR, and the municipalities have agreed to honor FMW recommendations based on our results. This is largely thanks to UMCE's tradition of success, going back more than a decade, of establishing community labs with excellent quality control.

Initial concerns

At the 2001 meeting that launched FMW, people were already asking, "If citizens provide data, will anyone with regulatory authority really pay attention?" This was a critical question since we wanted our data used for decision making and to guide regulatory action. Although at that first meeting I could not give any definite assurances that the data would be used, I was able to provide examples of other groups' accomplishments as inspiration.

Later, when we invited clam harvesters to participate in the bacterial monitoring, they had a new twist on the same question: "Will agencies trust our data, given our economic interest in demonstrating that the water is clean?" Despite this reservation, the harvesters did join forces with the other volunteers—a major boon for our efforts, since they were able to use their boats to sample many areas we would not otherwise have been able to access.

FMW volunteers also had some misgivings about their ability to interpret the data correctly. Interpreting bacterial data is notoriously tricky, involving as it does the requirement to collect a certain number of samples in order to calculate geometric means; the different interpretation criteria for wet events and dry events; and the need to consider influences of local hydrology. Knowing that their information would be used by regulatory agencies to identify pollution sources, which potentially could lead to significant repair costs for homeowners, the volunteers were highly motivated to ensure data reliability. They were anxious to avoid providing inaccurate information that not only could lead regulatory officials astray and waste their time, but also could lose the support of local homeowners and partnering organizations for the monitoring effort.

> DEP immediately made use of FMW data to locate several failed septic systems.

Many of these concerns were soon laid to rest. Once the volunteers had collected and analyzed 12 to 15 samples at each site, they carefully considered whether they had enough information to make recommendations, and decided—after some consultations with technical experts—that they did. When DEP staff were shown the FMW data, they immediately made use of it to locate several failed septic systems, confirming the volunteers' suspicions about those sites. This went a long way to raise the confidence level of the volunteers. According to John Glowa, Environmental Specialist with DEP, "FMW is doing a great job of identifying areas with water quality problems and making our job of finding and documenting specific problems much easier."

Community perceptions

For communities to trust FMW to provide unbiased data, it is critical that volunteers not be perceived as having an agenda or providing a regulatory service to state agencies. One way that FMW has maintained a positive relationship with the community is through our longstanding policy of respecting private property. Volunteers have sent letters or used personal contacts as a way to gain access to land for monitoring purposes.

FMW's partnership with the local land trust, which serves as our fiscal agent, makes it particularly critical that our volunteers are never seen as regulatory agents or even as participating in a regulatory process. Any volunteer monitoring group that partners with a nonprofit organization in a small community needs to be sensitive to the partner's need to maintain a positive public image. Com-

ing into conflict with homeowners, business, or industry could damage the nonprofit's capacity to interact successfully with the community. FMW has therefore focused exclusively on providing data. Our organization, and our volunteers, are not involved in any regulatory action that may be taken. As a result, the land trust feels comfortable about its close affiliation with FMW.

Municipal government partners

It's important for FMW to partner with municipal governments as well as state agencies, because local government support is needed to provide follow-up inspections and site visits of failed or questionable septic systems. From the beginning, the Shellfish Warden (the municipal official who enforces state laws and local ordinances regarding shellfish harvesting) has been supportive of our efforts. His expert knowledge of the region helped us determine some of our sampling locations, and he has encouraged clammers to participate as volunteers. Involving the Shellfish Warden has also had the desirable effect of validating FMW's work, and reinforcing the need for this work, in the eyes of the Code Enforcement Officer (the municipal official who provides local oversight of septic system inspections) and the Town Manager.

Future possibilities

In just three years FMW has made modest but significant steps toward water quality improvement in our watershed. Given the enthusiastic outlook of our volunteers, our emphasis on quality data, and our effective partnerships with state agencies, municipal governments, and local nonprofits, monumental achievements seem possible in the future. With every small success, volunteers are becoming more assured that their efforts are valuable to the community and the watershed. And that is why they became volunteers in the first place.

Sarah Gladu is the Water Quality/Phytoplankton Coordinator for the University of Maine/Sea Grant. She also coordinates the Friends of Medomak Watershed. She may be contacted at sgladu@umext.maine.edu; 207-832-0343. For related information please see www.ume.maine.edu/ssteward/.

NEW JERSEY, continued from page 1

will define different levels, or tiers, of volunteer data collection and specific data uses corresponding to each tier.

This groundbreaking effort to facilitate meaningful state agency use of volunteer-collected data has been spearheaded by Danielle Donkersloot, New Jersey's first full-time statewide Volunteer Monitoring Coordinator. Donkersloot took on the coordinator position just a year ago, but was able to hit the ground running since her previous job doing community outreach and education for DEP had included conducting volunteer trainings. Through this experience Donkersloot had gained an appreciation of volunteer monitors' capabilities.

> "THE BEAUTY OF THE TIERED APPROACH IS THAT IT GOES FROM THE MOST BASIC ASSESSMENTS UP THROUGH A RIGOROUS QUALITY-ASSURED PROGRAM, AND EACH OF THE TIERS IS VALUABLE AND IMPORTANT."

Since 1998 DEP had been offering training workshops in visual and biological stream assessments to volunteer monitors, but the agency viewed these activities as primarily educational. Donkersloot saw a greater potential. "I had a vision of a corps of volunteers that could help the department in a variety of ways, from characterizing water resources to identifying problems and detecting water quality trends," she says. With the enthusiastic support and assistance of her supervisor, Education and Outreach Manager Kerry Kirk Pflugh, Donkersloot threw herself into the task of realizing that vision.

Getting organized

As it happened, Pflugh was herself a member of a community organization, the Pohatcong Watershed Association, that was collecting data using the same methods (EPA Rapid Bioassessment) as the DEP's Freshwater and Biological Monitoring Unit—yet the group's data was not being used by the state. "I knew there were other monitoring organizations in New Jersey just like the Pohatcong Watershed Association, but we needed to do some homework to get the details," says Donkersloot. That "homework" consisted of a statewide survey that identified 35 groups, involving a total of about 770 volunteers engaged in visual, chemical, and/or biological monitoring of freshwater and estuarine systems. Just as Donkersloot had anticipated, many of these groups were using the same collection techniques as the state.

The next task was to organize a network of professional monitors, volunteer monitoring program coordinators, volunteers, water resource managers, scientists, and instructors. Out of this group developed two committees that would advise and guide the DEP volunteer monitoring program (now christened Watershed Watch Network). One committee, the Internal Advisory group, consisted of DEP data users. Volunteer program coordinators and volunteer monitors made up the second committee, which became known as the Watershed Watch Network Council.

Tiered approach

Meanwhile, Donkersloot was busy learning as much as she could about volunteer monitoring programs in other states. Perusing the Pennsylvania DEP's volunteer monitoring handbook, she came upon a description of a four-tiered approach. The basic concept was simple: four tiers, A through D, represent increasing levels of scientific rigor and quality assurance, corresponding to different potential data uses. Both Donkersloot and Pflugh recognized this approach as the key to helping volunteer groups submit useful data to the department.

"The beauty of the tiered approach," says Pflugh, "is that it goes from the most basic assessments up through a rigorous quality-assured program, and each of the tiers is valuable and important. We wanted to give people different options. We wanted to be clear about what kinds of data the department could and could not use, and at the same time we didn't want to discourage volunteers from collecting data for their own purposes."

While the tiered approach is not a new concept, what is new is that New

continued on next page

Jersey is linking defined data-collection protocols to specific responses by DEP. "We showed the Pennsylvania model to the Watershed Watch Network Council," says Pflugh, "and they told us, 'This is fine but it's not enough, it still doesn't tell us what DEP needs and how we can provide DEP with data they can use.'"

> While the tiered approach is not a new concept, what is new is that New Jersey is linking defined data-collection protocols to specific responses by DEP.

So Donkersloot met with staff in different DEP programs to nail down very specifically the data requirements for each tier and the ways that DEP will use data from a given tier. There are at least five programs within DEP that are potential users of volunteer monitoring data: the Nonpoint Source Program, the Watershed Assessment Team, the TMDL workgroup, the 319(h) Grants Program, and the Watershed Planning Bureaus.

As an example of how the tiered system will work, consider the case of a group that follows a quality assurance project plan (QAPP) approved by DEP's Office of Quality Assurance, and also meets other requirements such as annual "refresher" training. This group would be assigned to Tier D, meaning that their data could be used for regulatory response, such as listing a water body on the state's "Integrated List." (Note: In New Jersey, the biennial 305(b) water assessment report and 303(d) list of impaired waters are combined into a single report called the Integrated List.)

It's not just the highest quality data that will be used by DEP. For example, Donkersloot expects that the 319(h) Grants Program, which reviews grant applications for nonpoint pollution implementation projects, will be able to use data from Tiers B, C, and D. "The 319(h) Program can use big-picture information, like whether or not a riparian buffer is present," she explains. Data from various tiers, including visual assessment data, could also be used by the TMDL workgroup and Watershed Planning Bureaus to identify problems ranging from high fecal coliform counts to the presence of large numbers of geese, and to guide the selection of best management practices and other protection and restoration efforts.

Pflugh says that the system is very close to implementation: "It's just a question of having the different data users sign off on the final definitions for the data quality requirements and data uses."

Last November, when the tier concept was presented at the DEP-sponsored statewide Volunteer Monitoring Summit, participants responded enthusiastically. "A lot of monitoring groups have already started to reformat their program to fit into the tiered approach," says Pflugh.

NJ DEP

NJ DEP staff members Marcedius Jameson and Danielle Donkersloot at a macroinvertebrate training session.

NJ DEP

New Jersey volunteer uses a D-frame net to collect macroinvertebrates.

A shining example

When she speaks with agency staff about potential uses for volunteer monitoring data, Donkersloot likes to hold up the Pequannock River Coalition as a shining example. In response to a fish kill caused by high temperatures, the Coalition began monitoring temperature in the Pequannock River in the mid-1990s, using a data logger. In 2001, the volunteers were certified by the NJ DEP Office of Quality Assurance. The tier system, of course, was not yet in operation, but if it had been the data would have qualified as Tier D.

DEP paid attention to the Coalition's data. In fact, based on the volunteers' work, DEP added a standard for temperature to the state's Water Quality Standards and then used the volunteer temperature data as the basis for listing the Pequannock River as a "water body of concern" on the Integrated List. In addition, DEP's 319(h) Grants Program awarded the Pequannock River Coalition $23,100 for a restoration project that will help control temperature in the river.

Recently, Donkersloot received new encouragement when staff in DEP's Freshwater Biological and Monitoring Unit approached her and asked whether she thought volunteers would be interested in helping collect lake data. "This tells me," she says, "that DEP is starting to take volunteer monitors seriously as potential partners, and that we are getting closer to the goal of solidifying the role of volunteer monitoring within DEP."

For more information, contact Danielle Donkersloot, New Jersey State Volunteer Monitoring Coordinator, New Jersey Department of Environmental Protection, Trenton, New Jersey; Danielle.Donkersloot@dep.state.nj.us; 609-633-9241; or visit www.nj.gov/dep/watershedmgt/volunteer_monitoring.htm.

World Water Monitoring Day

Lone Star State Shines

by Jason Pinchback and Ed Moyer

No matter where you live, who you are, or what you do, clean fresh water is a vital element of life. This is the message of World Water Monitoring Day. Inspired by the 2002 U.S. National Water Monitoring Day, which marked the 30th anniversary of passage of the Clean Water Act, World Water Monitoring Day 2003 involved participants from all 50 states and almost two dozen countries. Participants monitored dissolved oxygen, acidity (pH), temperature, and clarity. These four tests are safe and easy to perform, even for the most inexperienced volunteer. October 18th, 2003, was the official day, but data collected between September 18th and October 18th was eligible to be entered on the World Water Monitoring Day website, www.worldwatermonitoringday.org.

World Water Monitoring Day is not limited to data collection. Watershed education is also an important component. The prime theme for World Water Monitoring Day events is the awareness that we are all part of a larger system, and that we can collectively act to improve environmental conditions.

According to World Water Monitoring Day's sponsors—America's Clean Water Foundation and the International Water Association—Texas ranked fourth in the nation with 337 monitoring sites officially registered. Iowa was first with 643 sites, followed by Florida with 386 and Pennsylvania with 374.

For World Water Monitoring Day 2003, Texas Watch, the statewide volunteer water quality monitoring program (www.texaswatch.geo.swt.edu), was involved with three watershed education activities. The city of Laredo celebrated the day by hosting a Texas Watch training that included personnel from both the city of Laredo and the city of Nuevo Leon, Mexico. In the true spirit of World Water Monitoring Day, the training was a collaborative effort to help an international watershed.

The City of Dallas Storm Water Protection team and U.S. EPA Region 6 sponsored an educational outreach event with two local schools on October 15th. Students collected water quality data using the World Water Monitoring Day kit and compared the results from the $20 kit to a $7,000 water quality sonde. They were delighted to discover that their results were very similar to the results of the meter.

In the Austin area a new "Stream Savers" festival was created through the combined efforts of the Lower Colorado River Authority's Colorado River Watch Network, Austin Youth River Watch, The Nature Conservancy, and Texas Watch. Monitors staffed a biology and chemistry station on the banks of Barton Creek. Other "eco-edutainment" activities included a kids' watershed activities station and an environment-themed art and poetry area where individuals brought paintings, poetry, and songs to inspire participants. Local businesses pitched in to provide food, beer, signs, raffle items, lights, sound equipment, and volunteers.

Planning is already under way for the next World Water Monitoring Day on October 18, 2004. Stay posted at www.worldwatermonitoringday.org. Save the date!

Jason Pinchback is the Volunteer Coordinator for Texas Watch. Ed Moyer is World Water Monitoring Day Coordinator for America's Clean Water Foundation.

JASON PINCHBACK

JASON PINCHBACK

The Austin area celebrated World Water Monitoring Day with a Stream Savers Festival at a natural preserve. The event featured a "benthics table" (above) where participants could examine stream macroinvertebrates, and a water quality monitoring demonstration.

Changing Partners
The **Power** of Informal Alliances

by Steven Hubbell

Partnerships come in all shapes and sizes, with all ranges of expectations and productivity. I have experienced everything from chatty alliances to formal contracts with the state and federal governments, and the only way I know to determine whether a partnership is appropriate is to weigh its costs and benefits in light of my program's mission and current needs. Some partnerships may have a brief life cycle, such as advisory service contracts or seed-money grants. The most effective partnerships both support long-term objectives and help the program meet immediate demands.

Partnerships evolve along with programs. What we need today may be quite different from what we needed ten years ago. Therefore, programs that experience sustained vitality are likely to engage in a series of diverse partnerships. This has been the case with the program I coordinate, the Colorado River Watch Network (CRWN), begun in 1988 by a local non-profit citizen group called the Clean Clear Colorado (CCC), with the support of a few inspired Austin teachers. From its inception, CRWN sought support from the Lower Colorado River Authority (LCRA), a conservation and reclamation district mandated to protect the quality of the lower Colorado River. LCRA initially responded by providing kits and trainers, later expanding its support to include paying staff. Then, in 1992, LCRA accepted full responsibility for sustaining and administering the program. The CRWN program moved lock, stock, and monitor over to the LCRA. For a summary of our partnerships and major supporters from that point on, see sidebar box.

Accepting governmental monies

CRWN has had experience with both nonprofit funding, such as the Colorado River Foundation, and with government funding, such as EPA Clean Water Act (Section 319) and Texas Clean Rivers Program (CRP) funding, obtained via contracts with the state environmental agency. Support from private and non-government organization (NGO) funders generally has fewer strings attached than funding from government agencies. On the other hand, governmental funding is often more dependable, and in addition, a formal contract with an agency can enhance a volunteer monitoring program's credibility with that agency.

Agency partnerships that satisfy mutual objectives are healthy and worthwhile, as long as other priority objectives are not affected in the process. Programs can suffer when the objectives of the funding entity are not aligned with the program's mission. To comply with one early grant (1993-94), CRWN agreed to conduct four quality assurance visits (as compared with our current standard of one to two site visits) per year on every monitoring site. At the end of the grant, the intense focus on certain monitors left many monitors unattended. As a result, reporting consistency from those monitors who were not visited declined. By diverting our resources, we hurt our ability to fulfill our own goals. When this grant funding ended, we elected not to seek renewal of the grant, choosing instead to seek alternative funding sources that would allow us to best serve the monitors.

In subsequent years, CRWN has made similar decisions relating to other funding sources, but always for the same reason: the funding sources made it difficult to maintain close ties to the monitors we exist to serve. The greatest challenges I have experienced in satisfying government grant requirements are: (1) reporting to multiple recipients (sometimes as many as three, quarterly), (2) meeting documentation requirements (photos, signatures for group events), and (3) periodic modifications in the reporting structure which increase the level of reporting detail requested.

Fortunately for us, we have been able to identify alternative sources of funds to help support CRWN. This year, another sponsor stepped in: the local nonprofit Colorado River Foundation. This

LOWER COLORADO RIVER AUTHORITY

Cameras roll on Earth Day 2000 as CRWN volunteers and Anderson High students conduct water quality tests in Austin. The event was coordinated by the Austin Area Volunteer Monitoring Coalition.

timely partnership renewal is well aligned with our program priorities.

In short, when dependable resources and agency credibility are desired, formal contracts with state and federal agencies may be appropriate and mutually beneficial. But when this structure affects the ability to meet other critical demands (such as sustaining satisfied monitors), new coalitions may be more appropriate.

Informal partnerships

Once a volunteer monitoring program has formed the basic alliances required to sustain it and fulfill its mission, a new horizon appears. Fresh opportunities emerge for less formal partnerships, built more on mutual respect and common vision than on predefined deliverable products.

For CRWN, a stellar example of this kind of partnership is the Austin Area Volunteer Monitoring Coalition (AAVMC), formed in 1996 as an informal alliance of peers bound by the common goal of helping citizens protect the integrity of our shared watershed. Participants are typically individuals involved in water quality monitoring with their respective organizations, and attend as friends and colleagues—nothing more and nothing less. Over the years, the group has included representatives from CRWN, LCRA and the Texas Clean Rivers Program, Texas Parks and Wildlife Department, the City of Austin, the Austin Youth River Watch, 4empowerment.com, Texas Watch, the Texas Commission on Environmental Quality, the Barton Creek-Edwards Aquifer Conservation District, Travis County, and citizen groups including the Bull Creek Foundation and the Sierra Club.

The coalition has no pre-arranged schedule for meeting and no formal organizational structure. There is no president, no chairperson, no secretary, no parliamentarian, no rules of order. There are no fees. No money is exchanged. The group meets when an issue is identified that would benefit from collective reasoning and pooled resources. And the group tackles each issue with resolve, concluding with a plan of action. Accountability is based on the integrity of our relationships, and experience has taught us what is reasonable to expect and what is not. As in any partnership relationship, we identify needs, determine who is able and willing to help meet the needs, and calculate the cost and the benefits associated with each potential partner. The trick is to walk away satisfied that (a) the partnership has accomplished current objectives, and (b) the potential for future productive partnerships remains intact.

What can such a loose alliance accomplish? Plenty—much of which occurs outside the context of the coalition itself. The experience of working together to solve specific challenges has fostered many partnership opportunities between and among the representative organizations. Specific tasks accomplished by the coalition include: (1) developing a strategy to provide monitoring information, training, and sustained support for Austin-area citizens and schools; (2) initiating a basinwide Earth Day monitoring effort in 1999; (3) coordinating efforts for the first statewide Earth Day monitoring event in 2000; (4) hosting field trips for the 2000 National Volunteer Monitoring Conference; (5) co-editing the Spring 2000 issue of *The Volunteer Monitor* newsletter; and (6) conducting a watershed festival for the 2003 World Water Monitoring Day.

With an informal coalition like the AAVMC, everyone is an equal partner and we focus on common goals. When one partner has more power, it becomes less likely that you're pursuing common ground, because the partner with the power can dictate what ground you're going to be working on.

When selecting partners, it comes down to choosing the right tool for the job. At this time, CRWN's priority is to work within a framework of flexible alliances to address the growing complexity of watershed protection challenges identified by its monitors and their communities. Right now, our primary concern is to be responsive to the local concerns of local communities as we work to preserve a healthy watershed. Therefore, local partners and local sponsors make the most sense. Right now.

CRWN Partnership Chronology

1988-89
The Clean Clear Colorado Foundation, with assistance from individual teachers, the Austin Independent School District, and the Kellogg Foundation, initiates the CRWN monitoring program at local schools. LCRA matches this financial assistance and provides training support.

1989-92
The nonprofit Colorado River Watch Foundation (CRWF) is established to assume responsibility for CRWN. LCRA continues to provide support through CRWF.

1992-94
LCRA assumes full responsibility for CRWN. In 1993, a two-year EPA 319 grant is procured to help CRWN create a Quality Assurance Project Plan, develop a biomonitoring manual, and increase the size of the network. The grant is administered by the Texas Commission on Environmental Quality.

1994-96
In 1994, a newly formed nonprofit group called Friends of the Colorado River Foundation ("Friends") raises money to supplement LCRA funding for CRWN.

1996-2002
In 1996, CRWN hosts the first Austin Area Volunteer Monitoring Coalition meeting. The same year, CRWN joins other LCRA programs as part of a Texas Clean Rivers Program grant. CRWN participates in this grant program from 1996 to 2003.
CRWN receives additional support from the "Friends," now renamed the Colorado River Foundation (CRF), and LCRA's Fayette Power Project facility's "Good Neighbors" program.

2003-present
In 2003, CRF offers to help sponsor CRWN as one of two "signature" programs the foundation wants to support. LCRA continues to manage CRWN and currently serves as its principal funding source.

Steven Hubbell is Program Coordinator for the Lower Colorado River Authority's Colorado River Watch Network in Austin, Texas, and a member of The Volunteer Monitor newsletter editorial board. He may be reached at steven.hubbell@lcra.org; 800-776-5272, ext. 2403.

Lessons Learned:
Illinois RiverWatch Looks Back

by Shelly Fuller

It has been ten years since the Illinois Department of Natural Resources (IDNR) first piloted the RiverWatch volunteer monitoring program. During that time RiverWatch has trained over 1,500 volunteers to perform biological monitoring on more than 500 stream sites. The program's success has served as the inspiration, model, and springboard for the EcoWatch Network, an ambitious statewide volunteer monitoring program that incorporates RiverWatch, ForestWatch, PrairieWatch, and UrbanWatch.

From this vantage point of success and accomplishment it's instructive to look back to the early days of RiverWatch, trace the steps we took to get to where we are today, and summarize the valuable lessons and guiding principles that we learned along the way.

Don't underestimate volunteers

One lesson we learned early on was "Never underestimate the capabilities of volunteer monitors." During the planning stages of RiverWatch, IDNR, in collaboration with the Illinois Natural History Survey and Illinois Environmental Protection Agency (IEPA), developed a fairly rigorous methodology for volunteer stream habitat assessment and macroinvertebrate monitoring. The objective was to obtain valuable scientific information that would enable agencies and researchers to identify problems and track long-term trends. The RiverWatch protocol required volunteers to collect at least 100 stream macroinvertebrates (small aquatic insect larvae, as well as worms, snails, etc., that are visible to the naked eye), preserve them in alcohol, and later identify them in a laboratory under a microscope. Many of the insects had to be identified to family level.

When the RiverWatch program was officially launched in 1995, agency staff had some concerns about how volunteers would react to these methods. Feeling that we might be asking too much, we offered volunteers a choice between the rigorous protocol and a simplified version that would yield lower quality data. Somewhat to our surprise, most opted for the more demanding procedures. Not only did they relish the challenge, but more important, they wanted to collect high-quality, usable data because they wanted their efforts to count for something. The next year, we dropped the "lite" protocol.

> We offered volunteers a choice between the rigorous protocol and a simplified version. Somewhat to our surprise, most opted for the more demanding procedures.

JUDY FITCHETT

RiverWatch volunteers with the DuPage River Coalition collect stream macroinvertebrates.

Cultivate data users

Perhaps the most fundamental lesson to come out of the RiverWatch experience is the importance of engaging data users right from the start. We spent two years in the development phase for RiverWatch, starting with planning how IDNR was going to integrate the volunteer data. IDNR's data needs then guided the selection of RiverWatch monitoring protocols.

Taking the necessary steps to ensure that volunteer-collected data will be used is closely tied to the "don't underestimate volunteers" principle discussed above. "People who put in the time and effort for training and monitoring don't want their commitment treated lightly and they don't want their data treated lightly," says EcoWatch Network Coordinator Dana Curtiss. "You are doing your volunteers a disservice if you don't first cultivate data users."

A skewed dataset

As the volunteer data began coming in, they were carefully analyzed for accuracy, reliability, and repeatability (i.e., whether different volunteers using the same methods came up with the same results). After a couple of years, it was clear that all the care that had gone into method selection, volunteer training, and quality assurance procedures was paying off. The volunteers were doing a good job of determining water quality at their sites. But in spite of that, there was a

problem: the RiverWatch data were not providing a representative picture of stream conditions statewide. This was because most of the sites were volunteer-selected, and given the choice, volunteers were picking sites that were aesthetically pleasing and located in protected areas such as forest preserves and parks. The result was a dataset skewed toward high-quality sites.

This experience provided another lesson: To get truly representative data, we would need to use a random site-selection process.

Challenges of random sampling

Fortunately, our recognition of the need for random sampling dovetailed nicely with the development of another IDNR project known as the Critical Trends Assessment Program (CTAP). CTAP had been initiated a few years earlier, after state agencies realized that they did not have enough statistically adequate data to assess the condition of Illinois's major ecosystems, including streams, forests, grasslands, and wetlands. The program called for data collection by both professional scientists and citizen volunteers, following a systematic, statistically reliable sampling design.

In 1997, RiverWatch was incorporated as CTAP's volunteer stream monitoring component. RiverWatch gained the rigorous site-selection process it needed, while CTAP was able to expand the number of monitored stream sites from a few dozen per year to literally hundreds. (Based in part on the success of the RiverWatch-CTAP merger, the various EcoWatch Network programs were created and added as CTAP's volunteer component for other ecosystems.)

IL ECOWATCH NETWORK

IDNR hosts lab sessions all over the state, giving volunteers access to microscopes and expert assistance for identifying macroinvertebrates.

RiverWatch now faced the challenge of maintaining annual data collection at our already-established sites while working toward a goal of adding 100 randomly selected sites. We soon learned another lesson—a lesson about the surprising amount of time and effort that goes into following a truly randomized site-selection process.

At first glance, 100 does not sound like an astronomical number of sites, especially considering that over 300 volunteer-selected sites were established during RiverWatch's first four years. But the fact is that we are only now nearing the goal of consistently monitoring 100 randomly selected sites. Now we understand why not many volunteer programs attempt strictly random sampling!

A quick review of the process illustrates why it is so time-consuming. To select the 100 RiverWatch sites, scientists at INHS began by randomly ranking all the public land survey sections that contain streams with drainage areas greater than 10 square miles. Within each of these sections, several potential monitoring sites were randomly selected using the state's land cover database.

With over 90 percent of the state privately held, it can take weeks to identify a landowner and get permission to monitor at a site. Fortunately, hundreds of private landowners have supported the program by allowing property access. Unfortunately, this is only the first hurdle. The sites must pass a number of criteria for volunteer monitoring—for example, sites must be wadeable during the monitoring season, must be safely accessible, must contain water year-round, must not be within 100 feet of a bridge nor immediately below a wastewater treatment outfall, and so on. Approximately five sites are screened for every one that passes.

Once a site passes we have to find the right volunteer for it. It's easy to assign sites that happen to be in a state park but far more challenging to find and motivate a volunteer to monitor a drainage ditch in the middle of a cornfield.

The payoff

The random site-selection process was difficult, but the ultimate lesson is that it was well worth the years of effort we put into it. Now we are getting to the payoff. We have enough data on many sites to start establishing trends. Not only that, but as the dataset has expanded, so have the data uses. IDNR is looking more and more to data from RiverWatch, EcoWatch Network, and CTAP to help with watershed planning. And outside users, like the Shawnee National Forest, private consultants, and local and regional planning agencies, are using our data to a degree that we never anticipated at the beginning.

If one of the first principles for establishing a volunteer monitoring program is to have at least one data user onboard at the outset, a corollary is that a successful program will evolve beyond the initial users. It's a safe bet that whoever coined the phrase "If you build it, they will come" wasn't thinking about a monitoring database—but if you build a solid database on the foundation of a well-planned study design, data users will come.

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For more information about RiverWatch and the EcoWatch Network, including a downloadable pdf version of the RiverWatch Macroinvertebrate Identification Key, visit the Illinois EcoWatch Network home page at http://dnr.state.il.us/orep/ecowatch.

River Rally

May 21-May 25, 2004

River Network's National River Rally 2004 will be held in Wintergreen, Virginia, May 21st through 25th, 2004. This annual event brings together hundreds of river monitors, stewards, guardians, and others involved in watershed protection and restoration. The program includes advocacy training, technical tools for watershed protection, media skills, "Funders' Forum," and more. For more information and to register, see www.rivernetwork.org/rally or call 208-853-1893.

Pennsylvania Partnerships: Three Models

by Cheryl Snyder

If you can picture a wheel composed of many spokes, you have an idea of what the Pennsylvania Department of Environmental Protection's (DEP) Citizens' Volunteer Monitoring Program (CVMP) looks like. Although the program's name might seem to suggest a statewide group of volunteers monitoring for the agency, in fact the CVMP is more like a support network for community volunteer monitoring groups across Pennsylvania. The CVMP, which was initiated by DEP in 1996, operates out of DEP's Watershed Support Section in the Bureau of Watershed Management and works with volunteers on a variety of projects.

CVMP's flexibility and ability to serve as a liaison between DEP programs and volunteers have led to volunteer monitoring partnerships and projects that meet both agency and participant needs. These projects can be classified into three broad categories or models: agency-driven projects, projects that come about through a combination of volunteer and agency initiative, and volunteer-initiated projects.

Agency-driven

The CVMP Bacteria Monitoring Project is a good illustration of an agency-initiated project. It was set up by the DEP in 2001 to supply the Department with information that could determine whether a surface water body is suitable for recreational uses like boating and swimming. DEP's Assessments and Standards (A&S) Division gave CVMP a list of 400 stream segments needing bacteria data. CVMP's role is to provide volunteers with training, protocols, and supplies to collect samples and transport them to the DEP lab for analysis. A&S takes the data and reviews it for use in the 305(b)/303(d) process for recreational use suitability. (Note: The "305(b)/303(d) process" refers to the preparation of two reports that all states are required to submit to Congress every two years: the 305(b) assessment of the state's waters, and the 303(d) list of impaired waters.)

KERILYNN FREY, PA DEP

CVMP Volunteer Lake Monitoring Project participant John Fiala filters a sample for chlorophyll while Cheryl Snyder looks on.

Agency projects tend to be rigid, requiring volunteers to follow specific procedures and protocols. In the case of the Bacteria Monitoring Project, one set of five samples is needed within a 30-day period, sometime between May 1 and September 30. The downside of this kind of prescriptive process is that there is no place for volunteer creativity and input into the project design. On the other hand, some volunteers like to have a "recipe" to follow; and in addition, volunteers realize that if the agency is asking for help, the data are more likely to be used.

We have found that volunteers with the Bacteria Monitoring Project tend to be people with an interest in bacteria monitoring, and that most are pleased to have the opportunity to assist DEP with a project that both has a set goal and produces usable data. The volunteer data are being used not only in the 305(b)/303(d) process but also by the Philadelphia Sewer Authority to check for leaking sewer lines.

Combination agency/volunteer

Lake residents are concerned about the water quality of their lake, particularly as it affects fishing, swimming, and boating. At the same time, DEP's Clean Lakes Program (a program supported by the Department's Nonpoint Source Management Section) is interested in obtaining water quality and biological information on private lakes that DEP would not normally sample. This joint interest led to the formation, in 2001, of a volunteer Lake Monitoring Project based on a partnership between CVMP, the Clean Lakes Program, and volunteers.

The CVMP, with support from the Clean Lakes Program, provides volunteers with a specific protocol, training, supplies, and equipment on loan, and gives volunteers copies of their monitoring results. The volunteers provide lake access, a boat, and manpower. They take readings of Secchi depth and pH, use a YSI Model 52 meter to take dissolved oxygen/temperature profiles, and collect water samples that are sent to the DEP lab to be analyzed for nutrients and chlorophyll *a*. The Clean Lakes Program submits the resulting data for use in the 305(b)/303(d) process.

In some ways the Lake Monitoring Project is very rigid since a specific protocol needs to be followed in order to provide the Clean Lakes Program with usable data. However, where this project differs from the bacteria project is that interested lake volunteers can work with the CVMP to look

at other lake issues of their choice. The CVMP helps volunteers develop a monitoring plan, or study design, to meet their needs. To facilitate this process, the CVMP is providing lake volunteers with a study design workshop. The workshop will help the volunteers focus their activities and give them a heads-up on where to go for assistance.

The only problem encountered so far with the Lake Monitoring Project is that a few volunteers have told us they found the monitoring too difficult and time-consuming. In the future, we intend to spell out project expectations more clearly in initial discussions with potential volunteers.

This project is a win-win situation for the volunteers and the Department. The volunteer lake monitors are very excited about taking part in a study that not only provides them with information about their lake but also provides data that DEP can use. The broadening scope of the project has helped volunteers gain an understanding of their lake and has started them in the direction of lake stewardship.

DIANE WILSON, PA DEP

Volunteers learn how to perform chemical water quality testing during a training session in Allegheny County, Pennsylvania.

Volunteer initiative

As an example of a volunteer-initiated project, let's consider the issue of using volunteer data in the 305(b)/303(d) process. As we have seen, DEP does use volunteer data from the Bacteria Monitoring Project and the Lake Monitoring Project for 305(b)/303(d) purposes, because those data are collected according to DEP-specified protocols. But the situation is different when volunteers come to us with data they have collected, often over a period of years, and express an interest in having their data used in the 305(b)/303(d) process. Data collected for use in this process must meet very strict data collection procedures and quality protocols, and volunteer data often do not meet those requirements. In addition, volunteer data are still looked upon with some degree of skepticism. This has been a challenging issue for the CVMP.

To address this issue, the CVMP worked with A&S to set up a process for volunteers to submit credible and usable data for the 305(b)/303(d) process. For example, data must be submitted on a specific data-submission form and accompanied by a QA/QC plan, study design, or quality assurance project plan (QAPP). Guidelines for water chemistry data include a requirement for a minimum of 24 samples. For macroinvertebrate data, identification must be to family level and volunteers must be trained by DEP. Volunteer groups submit the data and required documentation to CVMP; we screen it for completeness and then pass it along to A&S.

To inform volunteer monitors of this opportunity, A&S and CVMP sent out a joint mailing, including the data-submission form and the strict data requirement guidelines. Announcements were also made at meetings, by email, and in newsletters.

Perhaps not surprisingly, the prescribed data-submission process and data quality requirements have proved to be cumbersome and difficult for volunteers. This is evidenced by the fact that we received just two submissions for the 2004 305(b)/303(d) process, of which only one was complete and forwarded to A&S.

How do we resolve the 305(b)/303(d) dilemma? The CVMP is continuing to work with A&S to revise and refine the submission process. CVMP also continues to act as a liaison between A&S and community groups, helping volunteers gain a better understanding of the 305(b)/303(d) process. In some cases volunteers collect data without a specific goal in mind and then decide to submit it for the 305(b) report. After the fact they find out that their data does not meet the strict EPA guidelines that A&S is required to follow. In the future CVMP is planning to offer workshops to help volunteers design studies with the specific goal of 305(b)/303(d) data use in mind.

Partnerships with the CVMP are helping volunteer monitors throughout the Commonwealth provide reliable data and show watershed improvements. Through these efforts, the integration of volunteer data with professional programs is starting to take shape in Pennsylvania.

Cheryl Snyder is Citizens' Volunteer Monitoring Coordinator for the CVMP in Pennsylvania DEP's Bureau of Watershed Management. She may be reached at chesnyder@state.pa.us; 717-772-5640.

Resource

Designing Your Monitoring Program: A Technical Handbook for Community-Based Monitoring in Pennsylvania. Prepared by River Network and the Pennsylvania Department of Environmental Protection, Bureau of Watershed Management, Citizens' Volunteer Monitoring Program. Revised April 2001. Online version available at www.dep.state.pa.us (DEP keyword: volunteer monitoring); for printed copy call 717-772-5807.

minnesota stream program
Builds on Lake Success

by Victoria Schlesinger

A state with 92,000 miles of river and 11,842 lakes, each over 10 acres in size. A state with more water than any other in the Lower 48. It's no coincidence Minnesota also has the longest-running volunteer lake monitoring program in the nation. This spring some volunteers will receive awards honoring their 30 years of commitment to the Citizen Lake-Monitoring Program (CLMP), run by the Minnesota Pollution Control Agency (MPCA).

The success of the lake monitoring program recently prompted the MPCA to initiate an innovative Citizen Stream-Monitoring Program (CSMP) that uses a monitoring device called a transparency tube. No other state has used this device on such a broad scale. The MPCA hopes the new program will help them monitor the impact of agricultural and urban runoff, the state's leading cause of water pollution.

Early beginnings: Lake program

The lake monitoring program was started in 1973 by Joe Shapiro, a professor at the University of Minnesota. Shapiro taught Minnesotans concerned about the increasingly common problem of water pollution how to measure a lake's transparency by taking Secchi depths readings. Successfully revealing declines and improvements in the clarity of numerous lakes, the data became a tool for associations and the state to address local problems.

In the program's first five years, the volunteers and scientists collected data on 78 lakes from various regions in the state, producing one of the largest bodies of information about water quality in Minnesota. But Shapiro only intended to plant the seeds for the CLMP, not to run it long-term, so in 1978 he passed the program's reins over to the MPCA. The agency was eager to take on the volunteers. "It's a really good way to get information, and a very cost-effective solution. There's no possible way we could ever get the volume of data they're getting," said Jennifer Klang, CLMP's project manager.

Today, CLMP organizes and trains 1,281 volunteers and routinely monitors 839 lakes with a total of 1,297 sites. In addition to solving local problems, the CLMP transparency data are an integral part of MPCA's statewide water quality assessment report (305(b) report), submitted to Congress every other year. These assessment reports, which are mandatory from every state, are used to track water quality trends in the nation's surface waters.

Although the CLMP contributes invaluable person-power to the MPCA, for two decades it was an unfunded operation. Gaylen Reetz, manager for the agency's environmental monitoring and reporting division, explains that for years the agency didn't allot official monies to the program or assign anyone to run it, but despite this, staff committed to the program simply did the additional work.

ALEC DONALDSON

Minnesota's first volunteer lake monitors, back in 1973, used an all-white Secchi disk, and the program has continued using white disks for the sake of consistency. The indentations on the side of the disk allow the line to be wrapped around the disk for storage. Here, volunteer Donna Donaldson and her dog Homer check the clarity of Lake Ossawinnamakee.

Thanks to the Minnesota Lakes Association, in 1993 the staff no longer needed to shoulder the CLMP as an extracurricular job. The Association successfully lobbied the state legislature to designate ongoing funds for a new fulltime program manager. The Association's enthusiasm and effective lobbying demonstrated to the legislature how the CLMP could galvanize citizens and engage them in water quality policy.

The CLMP's success, while buoyed by staff commitment, can also be traced to the Secchi disk's ease of use and the limited training needed. New volunteers receive instructions, background, and a Secchi disk in the mail and are asked to take between 8 and 10 measurements each summer. Volunteers can then either mail in their results or enter the information into an online system that links to the EPA's water quality database (STORET). The searchable MPCA database allows volunteers to view data of other CLMP volunteers and scientists working around the state.

In 2001 the MPCA created an expanded version of CLMP, which is offered in one county each year. In

the CLMP Plus program, volunteers measure phosphorus and chlorophyll in addition to collecting the basic data. The MPCA supplies volunteers with the monitoring materials and connects them with local groups. Volunteers work with local water planners, sending them their surface water samples for assessment. This kind of partnership between local agencies and the MPCA is key to the program's success, says Klang.

New direction: Stream monitoring

The idea for a statewide stream monitoring program came about gradually. Lee Ganske, a watershed project manager at MPCA, traces the process back to the day, sometime in the mid-1990s, when "someone dropped a copy of *The Volunteer Monitor* newsletter on my desk, with an article about the Australian turbidity tube." [Fall 1994 issue, p. 22.] Ganske and his colleague Bill Thompson were intrigued with the tube's potential to help both professional and volunteer monitors gather more data on what is arguably the state's No. 1 pollution problem: sediment from agricultural and urban runoff. "In terms of agriculture, you don't get much more intensive than southern Minnesota," says Ganske. "Plus, there are also areas of rapid urban and suburban growth. Sediment is a huge issue here, both for its direct impact on transparency in streams and for its indirect influence on lakes, where it causes nutrient enrichment."

> THE AUSTRALIAN TUBE REPRESENTED A TOOL THAT WAS PRACTICAL FOR STREAMS AND ALMOST AS SIMPLE TO USE AS A SECCHI DISK.

Secchi disks, for all their ease in lakes, don't work well in streams. Flow is a problem, and an even greater drawback is that most streams are so shallow that the disk will hit bottom before it disappears from view. The Australian tube represented a tool that was practical for streams and almost as simple to use as a Secchi disk.

While the Australians call their invention a "turbidity tube," in the U.S. it has been redubbed a "transparency tube" because in principle it is more similar to a Secchi disk, which measures transparency. Turbidity (or "cloudiness") is caused by the scattering of light by suspended particles, whereas transparency (visual water clarity) measures how much light passes through water. Their inverse relationship means that if turbidity is high then transparency will be low and vice-versa. [*Editor's note:* For a fuller discussion, see the article "Measuring Clarity: Transparency, Turbidity, and TSS" on page 17 of this issue.]

Ganske and Thompson began tinkering with the tube's design. A major improvement was adding a release valve at the bottom so that water could be slowly let out until the target image (a miniature Secchi disk) just became visible. They also began handing out tubes to volunteer stream monitoring groups around the state. At that time, MPCA provided general encouragement and support to stream volunteer monitors but had no coordinated program. But as more volunteers began using the transparency tubes, the agency came to recognize that this new tool was ideally suited to form the basis of a statewide stream monitoring program analogous to the CLMP. Ganske says, "We had the sense that the general public was not attuned to the problem of runoff and stream turbidity, so we wanted a volunteer stream monitoring program that not only had the potential to 'put data on the table' but also to raise awareness of that issue."

LAURIE SOVELL

Maple River Elementary School student uses transparency tube on Minnesota's Big Cobb River.

In 1998 Laurie Sovell was hired as coordinator and the Citizen Stream-Monitoring Program (CSMP) was officially launched. In that first pilot season, just 17 volunteers were equipped with transparency tubes. The very next year, the program expanded to 143 volunteers monitoring 177 sites, and in 2002, 326 volunteers submitted transparency data from 436 stream sites.

> "VOLUNTEERS CAN START TO SEE THE RELATIONSHIP BETWEEN RAINFALL, RUNOFF, FLOW, AND TRANSPARENCY OF A STREAM."

The stream volunteers are asked to take transparency readings at regular intervals and also, whenever possible, following storms. Volunteers also monitor rainfall, using a rain gauge placed on their property. "Volunteers can start to see the relationship between rainfall, runoff, flow, and transparency of a stream," says Steve Heiskary, a research scientist with the MPCA.

The standard MPCA transparency tube is 60 cm long (about two feet). "In most of Minnesota, if we get readings that are 60 cm or greater, we consider that the quality of the water is pretty good," says Ganske. However, some volunteers are trying out a 100-cm-long tube for monitoring clear-running streams, mostly in the northern reaches of the state.

Using the stream data

Minnesota lake and stream volunteers are measuring the same parameter—transparency—but interpretation of the data is

continued on next page

different for streams than lakes. For one thing, a decrease in lake water transparency is most often associated with algal growth, whereas a stream's transparency is typically reduced by sediment and soil that come from bank erosion, agriculture, urban runoff, or improperly managed construction sites. More problematically, turbidity in a stream fluctuates dramatically with rainfall, usually reaching a peak right after a storm when runoff is high.

Ganske explains, "In lakes you can feel confident that the average of weekly Secchi readings over the summer provides a solid indication of the status of that lake. We are still struggling with how to boil down stream transparency data in a way that is as meaningful." Ganske is quick to point out that the same problem arises even with professionally collected data, and even if measurements are made with a nephelometer.

In spite of these challenges and complexities, Sovell is determined that the 305(b) report Minnesota submits to Congress in 2006 will incorporate transparency tube data collected by volunteers (although assessments will not be based on transparency tube data alone). "Making this happen is my No. 1 priority!" says Sovell. Because Minnesota's water quality standard for streams is currently based on turbidity, the transparency data will have to be converted to turbidity before they can be used in the 305(b) report. As an important first step, the CSMP has been able to demonstrate a close correlation between transparency tube readings and turbidity. Further comparison studies are being conducted to determine whether a single formula can be used statewide to convert transparency tube readings to turbidity, or whether there are significant regional differences that would require region-specific conversion formulas.

Already the stream monitoring data are being used by local groups to resolve local issues. Sovell points out that the data are useful for screening a watershed for problem areas and helping track down sources of sediment.

Events at Big Birch Lake provide a particularly inspiring example because volunteer lake and stream data were used in tandem to address a problem of declining water clarity in the lake. Over a period of 20 years, CLMP volunteers documented a decline in Secchi depth from 13 feet to 6 feet. To mitigate the problem, local farmers agreed to plant a buffer zone of grass along the banks of a creek that runs into the lake. Now volunteers are using transparency tubes to monitor the success of the new grass strips.

For more information on the CLMP contact Jennifer Klang at jennifer.klang@state.mn.us; 800-657-3864. For more information on the CSMP, contact Laurie Sovell at laurie.sovell@pca.state.mn.us; 800-657-3864.

Victoria Schlesinger is a freelance writer based in San Francisco, CA.

Secchi Dip-In

June 26-July 11, 2004

From June 26 until July 11, 2004, the Great North American Secchi Dip-In celebrates its 10th anniversary of collecting transparency data. The Dip-In began in 1994 as a pilot study in six Midwest states with funding from the EPA's Clean Lakes Program. Since then more than 375 programs and 10,000 volunteers in the U.S., Canada, and several other countries have generated 30,000 records. These data are used to map regional differences in transparency and to detect trends.

The Dip-In accepts data from all types of turbidity instruments, including transparency tubes, and from all types of water bodies, not just lakes. Monitoring programs are encouraged to use the Dip-In as a midsummer event to draw attention to their monitoring efforts. Various programs have had governors, federal and state representatives, and local officials "doing the Dip"—and doing a little public education as well.

The Dip-In website (dipin.kent.edu/) contains all the information you need to participate, along with data and trend analyses from past years and technical information on different methods of measuring transparency.

BOB CARLSON

Kent State University students Triniti Anderson (left) and Jacky Gorman are members of the Secchi Dip-In staff.

measuring CLARITY
transparency, turbidity, AND TSS

by Jeff Schloss and Eleanor Ely

Pure water is clear (although not all clear water is pure!). The clarity of environmental waters—lakes, rivers, estuaries, wetlands—is reduced by substances in the water. The substances include particles—such as soil (silt, clay, sand), algae, zooplankton, bits of decaying matter, or sewage—as well as dissolved substances.

While the notion of water clarity is intuitively simple, measuring it quantitatively can become somewhat complicated. A rough indication of water clarity can be obtained by visual inspection, assigning such categories as "clear," "cloudy," or "murky." For a more precise measurement, three basic techniques are widely used, but the results are not fully interchangeable because each measurement is affected somewhat differently by different types of material in the water. These three measurements are:

Transparency
Turbidity
Total suspended solids (TSS)

Transparency, or visual water clarity, is a measure of how much light passes through water. It has traditionally been measured by lowering a disk (called a Secchi disk after its 1865 inventor) into the water until it disappears from view. The Secchi depth is the average of the depths of disappearance and reappearance. The standard Secchi disk used in lakes today is 20 cm (8 inches) in diameter with alternating black and white quadrants. Because of their simplicity and cost effectiveness, Secchi disk readings are probably the most commonly collected measurement among both professional and volunteer lake water quality monitoring programs.

The Secchi disk is usually impractical for use in streams and rivers due to both the current and the lack of depth, so until recently transparency was not often measured in flowing waters. Then in the early 1990s volunteer monitors in Australia began using a long tube with a painted target on the bottom, into which stream water could be poured until the target disappeared. Currently such "transparency tubes" are being increasingly used in U.S. streams.

Turbidity is a measurement of the amount of light scattered by particles in the water. Originally it was measured by viewing the image of a candle flame through a tube filled with a water sample. Now it is measured using an electronic light source and a light sensor (or sensors). The instrument most commonly used is a nephelometer, which costs between $300 and $1000. Nephelometer readings are reported in "NTUs" (nephelometric turbidity units).

TSS directly measures the suspended particles in the water by weight. The sample is run through a pre-weighed filter, and the filter is dried in an oven set to a standard temperature and then weighed. For pristine waters, this test is less practical than the optical approaches (transparency and turbidity) because it will take a lot of water volume to get measurable TSS results.

Both turbidity and TSS are inversely related to transparency (as turbidity and TSS increase, transparency will decrease).

Comparing the measurements

Although transparency, turbidity, and TSS are closely related, they are not completely interchangeable, as mentioned above. Of the three, transparency is the most "integrative" because it is a function of both the scattering of light by particles and the absorption of light by dissolved colored substances (chemicals from plants or soils). For example, water that is stained dark brown by humic and other acids from the dark peat materials in bogs or wetlands will have reduced transparency. Dissolved colored substances will lower Secchi disk or transparency tube readings but will not affect turbidity or TSS measurements since these only detect particles.

BETH HANSEN

Volunteer with Friends of Chesterfield's Riverfront measures Secchi depth on Swift Creek in Chesterfield County, Virginia.

Turbidity and TSS both provide an estimate of the amount of suspended particles, but turbidity measures the light-scattering characteristics of those particles while TSS measures their weight. Thus, a water sample with a high concentration of planktonic algae might have a similar turbidity to a sample containing a lot of mud, but the muddy sample would have a significantly higher TSS because soil particles are much heavier than algal cells.

continued on next page

Because of such discrepancies, it is not possible to devise a universal formula for converting, for example, transparency to turbidity or turbidity to TSS. However, it is possible to make such conversions for a single water body, or for water bodies of similar characteristics within a particular ecoregion. The conversion formula is arrived at empirically after making a series of paired measurements with the two methods in question.

Lakes vs. streams

In many lakes, algae will be the dominant factor in determining water clarity. Flowing water, on the other hand, is less likely to experience algal blooms but does have the capacity to suspend heavier particles of soil and other matter. Thus, the practical application and significance of water clarity measurements are somewhat different for lakes and streams.

For the typical algae-dominated lake, Secchi depth correlates closely with chlorophyll and nutrient levels, and in fact Secchi data are often used as a surrogate for these more complicated and expensive measurements. Most lake monitoring programs monitor Secchi depth at routine intervals—say, biweekly. Over the course of a year, the data reflect patterns of algal blooms. If a trend of decreasing Secchi depth from year to year is noted, the most likely explanation is an increase in nutrient concentration in the lake, leading to greater algal growth.

Not every lake is algae-dominated; there are some lakes in which Secchi depth is most influenced by sediments, and some very clear lakes where dissolved color plays a major role in Secchi depth. Sometimes a little sleuthing is needed to determine the cause of a decline in Secchi depth. For example, volunteers with the New Hampshire Lakes Lay Monitoring Program measure Secchi depth, chlorophyll, and dissolved color. When a significant decrease in Secchi depth was observed on a lake with no corresponding increase in chlorophyll or dissolved color, it could be inferred that sediment was responsible. Investigation confirmed that erosional runoff from a construction project was the source.

For streams, changes in water clarity tend to be closely tied to precipitation. Runoff and water turbulence from a major storm may increase turbidity tenfold or more. This is potentially bad news for volunteer monitors, who may not be enthusiastic about sampling in the rain.

Stream transparency or turbidity data can be used to screen a watershed for problem areas. High turbidity can be an indication that nearby land uses such as agriculture, road construction, or logging are causing erosion in the watershed.

Excessive suspended material can cause a number of problems for a stream or river. The particles absorb heat, raising the water temperature, which in turn reduces dissolved oxygen concentration. Suspended particles harm fish by scraping and clogging their gills and by interfering with their ability to see and capture their prey. When the particles settle on the bottom they can smother fish eggs and degrade macroinvertebrate habitat.

GLOBE

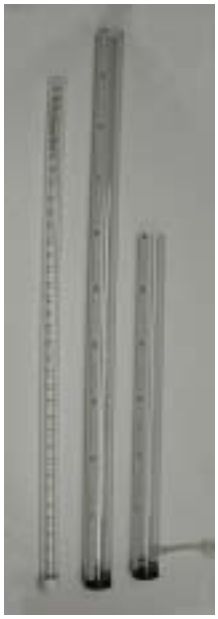
Nepalese students participating in the GLOBE Program use a transparency tube. For more information on GLOBE, an international environmental monitoring and education program, see www.globe.gov.

Can transparency tubes predict turbidity and TSS?

It is much easier and cheaper to make a transparency tube reading than to measure turbidity or TSS. Therefore, the potential to predict turbidity or TSS from transparency has great appeal, especially for volunteer programs. For example, the Minnesota Pollution Control Agency (MPCA) would like to use transparency tube data from its Citizen Stream Monitoring Program in determining whether streams meet the state's water quality standard for turbidity (25 NTU). But first the agency must demonstrate a predictable relationship between the tube readings and corresponding turbidity measurements. Studies to date indicate a strong correlation. (See article on page 14.)

A recent study by Paul Anderson and Robert Davic at the Ohio Environmental Protection Agency should be of great interest to any volunteer group contemplating the use of transparency tubes. Anderson and Davic evaluated three transparency tubes used by volunteer monitoring programs—the MPCA tube, the GLOBE Program tube, and a tube developed in Ohio termed the Ohio Sediment Stick—for their ability to predict TSS and turbidity in northeast Ohio streams. In their paper, which will be published in an upcoming (2004) issue of *Lake and Reservoir Management*, they report that the three tubes performed similarly and that all were able to "estimate both TSS and NTU turbidity with a high degree of statistical confidence over a wide range of concentrations." They also note that the transparency tube, because it is a simple and inexpensive field method, makes possible a number of data-intensive investigations, such as quantifying rapid changes in suspended solids in a stream during and after precipitation events.

The problem of converting transparency data to turbidity or TSS could become something of a moot point if the recommendations of R. J. Davies-Colley and D. G. Smith gain widespread acceptance. In the October 2001 issue of the



PAUL ANDERSON

Three different styles of transparency tube—the Ohio Sediment Stick (left), GLOBE tube, and Minnesota Pollution Control Agency tube—were compared in a study by Anderson and Davic at Ohio EPA.

Journal of the American Water Resources Association, these authors argue that visual clarity has "immediate environmental relevance to aesthetics, contact recreation, and fish habitat," and they recommend "formulation of environmental water quality standards in terms of visual water clarity, recognizing its environmental relevance and significant practical advantages over both SSC [suspended sediment concentration] and turbidity."

TECHNICAL CONSIDERATIONS: GETTING THE BEST RESULTS

Secchi disk

Although the Secchi disk is as old as the science of limnology, surprisingly there is still no universally agreed-upon protocol for making the measurement. Even the definition of Secchi depth varies, with some practitioners using the depth at which the disk is "just visible" while others use the depth at which the disk disappears. Most current limnology manuals recommend using the average of the depth of disappearance and the depth of reappearance (as the disk is raised).

There is widespread agreement on some points—for instance, that the disk should have a matte rather than a glossy finish and that a non-stretching line is essential if marks on the line are to be used in making the measurement. As for sun angle, measurements should be made as close to noon as possible, so that most of the sunlight is penetrating the water rather than reflecting off the water surface. Many programs recommend taking readings between 10 a.m. and 2 p.m. (true time, not daylight saving time). Whatever protocol is used, it is important to document water surface and sun conditions at the time of the reading.

More controversial questions include whether the reading should be taken on the sunny or shaded side of the boat and whether a "viewscope" should be used. A viewscope is a long tube, usually Plexiglas-bottomed and sometimes with a face seal at the upper end, that helps eliminate interference from glare and choppy water. Several studies have shown that the scope allows for better precision between observers and also more sensitive measurement of deep Secchi depths (transparency of 6 meters or more).

A recent study at the University of New Hampshire, involving both Lakes Lay Monitoring Program volunteers and UNH researchers, investigated the precision and sensitivity of Secchi disk measurements made with and without a viewscope, on the shady versus the sunny side of the boat. The most reliable volunteer results were obtained on the sunny side using the viewscope. The difference between readings with and without a viewscope became greater (often in excess of 15-20%) as the lake surface became rougher. Similar results were found among professionals who monitored in New York reservoirs (see Smith, 2000, in Resources, page 22).

When a viewscope is not used, it may be easier to obtain readings from the shady side of the boat to reduce the glare from reflected light. However, the shadow from the boat may create a shaded water area of some depth. This can greatly affect shallow depth reading accuracy.

If a program already has several years of Secchi data collected without a viewscope, should they switch to a viewscope now? In many cases, it may be preferable to stick with the established protocol for the sake of maintaining data consistency over time. But for a pristine lake, it may be worthwhile to make a comparison study over a range of conditions to determine whether the viewscope gives more accurate results, and whether a conversion formula could be used to compare readings taken with the viewscope to earlier data obtained without the viewscope.

Transparency tube

Transparency tubes may be filled directly by holding the tube in the water with the open end facing upstream, or alternatively the water sample may be collected in a bucket. In either case, it is desirable to sample as far from the streambank as possible, and to avoid collecting bottom sediments. If a bucket is used, the water should be gently stirred or swished (without introducing air bubbles) until it is homogeneous, then poured into the tube. When taking the reading, the observer's back should be to the sun.

ELIZABETH HERRON

URI Watershed Watch volunteer looks through a viewscope to make a Secchi depth reading.

The previously discussed study by Anderson and Davic included comparing the performance of three tubes with somewhat different designs. The Ohio tube is narrower, with an inside diameter of 1 inch (2.54 cm) compared to 4.5 cm for the MPCA and GLOBE tubes. The GLOBE and Ohio tubes are both

continued on next page

Watch Out for Stretching Secchi Lines!

MD COASTAL BAYS MONITORING

Some types of line tend to stretch, especially when wet, making the Secchi measurements marked on the line inaccurate. Wire core line (or a similar-performing line) is recommended to avoid line stretching. Alternatively, some programs use an unmarked line and instruct volunteers to mark the points of Secchi disappearance and reappearance with clothespins, then use a ruler to measure the line.

To check for possible stretching, volunteers at Maryland Coastal Bays Monitoring quality assurance sessions use a ruler to check their Secchi line markings (see photo).

Make Your Own Secchi Disk

MARK HOLSTON

Flathead Basin Commission volunteer prepares to use the program's homemade Secchi disk.

Although Secchi disks are fairly inexpensive to buy, some programs find it worthwhile to make their own, especially if they need several dozen or more. One such group is the Flathead Basin Commission (FBC) in Northwest Montana. Their disks, shown in the photo at right, are made from 1/4"-thick plate steel disks with a 3/8" hole drilled in the center, purchased from a local welding shop. FBC staff spray paint the disks white, then attach a 50- or 100-foot (depending on lake depth) carpenter's measuring tape. They use Keson brand measuring tapes, which retract conveniently into a handheld case with a crank and handle.

A 1/4" eye bolt is inserted through the hole and fastened with 1/4" nuts and washers. The end of the tape is looped through the eye, then stapled or glued and wrapped with duct tape.

Mark Holston, Volunteer Monitoring Program Coordinator for FBC, says, "These disks are quite heavy. The benefit is that they sink quickly and tend to drop vertically even if the boat is drifting. Because of the weight, the tape must be attached very securely to the disk." For more information on constructing the disks, contact FBC at fbc@digisys.net or call 406-752-0081.

Instructions for a slightly different style of disk, made from acrylic and painted in black and white quadrants, can be found at the University of Rhode Island Watershed Watch website, www.uri.edu/ce/wq/ww/resources/secchi.pdf.

CLARITY, continued

approximately 1 meter in length, and the Minnesota tube is shorter at about 60 cm. The target design at the bottom of the Ohio tube is a 1 cm black dot, while the MPCA and GLOBE tubes use a mini-Secchi disk pattern as the target.

Anderson and Davic found that the different target patterns performed equally well. The longer length of the Ohio and GLOBE tubes allowed better detection at low levels of suspended solids. The smaller diameter of the Ohio tube helped particles stay in suspension longer; Davic cautions that when using the wider tubes it's important to shake the sample well and take the reading quickly before the large particles settle.

Of the three tubes, only the Minnesota tube is equipped with a valve or "spigot" at the bottom, which allows the user to slowly let the water out until the endpoint is reached. Anderson and Davic found that this release valve not only made measurement more convenient but also increased the precision of the endpoint.

Nephelometer

There are a number of laboratory "benchtop" and field nephelometers available. It is important to note that not all meet current EPA approval for water and stormwater monitoring. Lower-priced models tend to use LED

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Aussie Invention Catching On in U.S.

In the Fall 1994 issue of *The Volunteer Monitor,* an article titled "Nationwide Turbidity Testing in Australia: 'Too Thick to Drink, Too Thin to Plough,'" by Terry White of the Australian Waterwatch Advisory Committee, introduced newsletter readers to a new piece of monitoring equipment invented by an Australian farmer named Noel Morgan. Morgan's original design was simply a large plastic soft drink bottle with a black and white symbol drawn on the bottom, which he and his neighbors used to monitor local creeks during heavy rains. Morgan's bottles could register only highly turbid waters, but a few years later Waterwatch Australia produced a 2-foot-long version made from polycarbonate tubing and began distributing it for nationwide use. The tubes were calibrated in NTUs (nephelometer turbidity units), using the same standard formazin solution that is used to calibrate nephelometers.

Two years after White's article appeared, several members of Waterwatch Australia attended the 5th National Volunteer Monitoring Conference in Madison, Wisconsin, in August 1996. After making several presentations about their program and teaching conference participants all the verses of "Waltzing Matilda," they returned home, leaving in their wake some of their turbidity tubes.

American volunteer monitoring groups began experimenting with the tubes, and soon decided to substitute a centimeter scale for the NTU scale. The NTU scale is nonlinear, making interpolation between calibrated marks difficult. More important, the tube is actually more similar to a Secchi disk than a nephelometer in terms of the underlying measurement optics, and therefore it makes more sense to call it a "transparency tube" and to report the measurement in units of length.

Over the past several years, transparency tubes have been steadily gaining in popularity around the U.S. Perhaps as a sign of Yankee ingenuity or independence, many groups have made their own modifications on the design. Three versions—the Minnesota Pollution Control Agency tube, the GLOBE tube, and the "Ohio Sediment Stick," are described in the accompanying article (see pages 19-20). The Water Action Volunteers program in Wisconsin constructs their own transparency tubes from fluorescent light bulb shields. The bottom of the tube is plugged with a rubber stopper to which is attached the target image, a Plexiglas mini-Secchi disk. For more information contact Kris Stepenuck, kris.stepenuck@ces.uwex.edu; 608-265-3887.

KRIS STEPENUCK

Wisconsin's Water Action Volunteers use a homemade transparency tube.

In Tennessee, volunteers with the Harpeth River Watershed Association used a 122-cm-long tube (about four feet) to conduct a 2-year study of sediment in the watershed. One reason for the study was to collect data for upcoming sediment TMDLs (total maximum daily load) in the watershed. David Wilson, one of the volunteers, designed and built stands from aluminum rod and scrap lumber to make it easier to handle the long tubes. The tubes, which were purchased from Ben Meadows Company, have a drainage tube with a pinch clamp at the bottom. A volunteer working alone can adjust the pinch clamp so that water is flowing slowly, then observe through the top of the tube until the image at the bottom (a Secchi disk pattern) just becomes visible.

For more information, including instructions for building the stands, contact David Wilson at 734-699-7623, david.j.wilson@vanderbilt.edu; or the Harpeth River Watershed Association at 615-790-9767, hrwa@harpethriver.org.

A final caveat: Tubes made of different materials and/or with different designs may not give equivalent readings. All the volunteers in a particular program should use the same type of tube, and caution should be used when comparing the results to measurements made with tubes of a different design.

HARPETH RIVER WATERSHED ASSOCIATION

The Harpeth River Watershed Association used this 122-cm-long tube for a sedimentation study in the Nashville, Tennessee, region.

CLARITY, continued from page 20

light sources and may or may not compensate for dissolved color interferences. Approved models typically have a bulb light source, correct for dissolved color using a second light sensor that measures transmitted light, and will only read out at the designated sensitivity level. Mid-priced models often rely on the use of an oil coating on the glass sample vials to minimize the interference from minute scratches. It is important to always use that coating and also to keep the orientation of the vial in the instrument consistent to get the most accurate readings.

Clarity for all

For many decades, the Secchi disk has provided lake monitors with a measurement tool that not only yields valuable information but also is highly intuitive in terms of how it works and what it means. No wonder then that its newly arrived cousin, the transparency tube—which offers similar advantages for water clarity monitoring in streams—is being enthusiastically adopted by volunteer monitoring programs around the country, and even around the world. In the words of Vivian Williams, who runs GLOBE teacher training workshops at the Stroud Water Research Center in Pennsylvania, "Everyone loves the transparency tubes because they are simple to use and their purpose is clear, even if the water inside them is not!"

Jeff Schloss is an Extension Professor in Zoology and Water Resources Specialist at the University of New Hampshire. He also coordinates the New Hampshire Lakes Lay Monitoring Program and serves as an editorial board member for The Volunteer Monitor newsletter. He may be reached at jeff.schloss@unh.edu; 603-862-3848. Eleanor Ely is the editor of The Volunteer Monitor newsletter.

Restoration Monitoring: Two New Manuals

Streams

Delaware Riverkeeper Network is pleased to announce the release of the *Adopt-A-Buffer Toolkit: Monitoring and Maintaining Restoration Projects,* a 133-page manual describing inexpensive, effective volunteer-based monitoring techniques to assess and maintain stream restoration projects. Monitoring protocols covered include visual assessment, photo-monitoring, macroinvertebrate monitoring, bank pin and stream cross-section monitoring, and a wildlife survey. Delaware Riverkeeper Network has field-tested the protocols with volunteer monitors and is using them to help monitor over 80 restoration projects in the Delaware watershed.

Copies of the Toolkit are available for $15 plus shipping, or electronically on CD for $5, by calling 215-369-1188; or download a free pdf version from www.delawareriverkeeper.org/monitoring/monitoring.htm. For more information, contact Faith Zerbe, Monitoring Coordinator for Delaware Riverkeeper Network at faith@delawareriverkeeper.org.

Estuaries and coasts

The first in a two-volume series titled *Science-Based Restoration Monitoring of Coastal Habitats* has just been released by the National Centers for Coastal Ocean Science (NCCOS) at the National Oceanic and Atmospheric Administration (NOAA). Volume One, *A Framework for Monitoring Plans Under the Estuaries and Clean Waters Act of 2000,* focuses on the process of developing a restoration monitoring plan. It defines and describes 15 different types of coastal habitat, and includes several matrices to help guide practitioners in the selection of appropriate monitoring parameters.

The second volume, which is due for release later in 2004, will delve deeper into monitoring approaches and techniques, including reference site selection and case studies.

Volume One (97 pages) can be downloaded in pdf format from http://coastalscience.noaa.gov/ecosystems/estuaries/restoration_monitoring.html. For printed copies or additional information contact restoration.monitoring@noaa.gov or Teresa A. McTigue, Ph.D. (a coauthor of the manual), NCCOS, Silver Spring, MD, 301-713-3020, ext. 186.

Resources

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White, T. 1994. Nationwide turbidity testing in Australia: "Too thick to drink, too thin to plough." *The Volunteer Monitor* Fall 1994, p. 22. Available online at www.epa.gov/volunteer/fall94/wtrshd19.htm.

Equipment sources

Water Monitoring Equipment and Supply. Secchi disks, viewscopes, transparency tubes. (This company makes the MPCA and GLOBE tubes, as well as custom tubes). 207-276-5746; www.watermonitoringequip.com.

LaMotte Company. Secchi disks, nephelometers. 800-344-3100; www.lamotte.com.

Forestry Suppliers. Secchi disks, viewscopes, nephelometers. 800-647-5368; www.forestry-suppliers.com.

Ben Meadows. Secchi disks, viewscopes, nephelometers. 800-241-6401, ext. 2750; www.benmeadows.com.

Lake Soil and Water Conservation District, Painesville, OH, constructs and sells the "Ohio Sediment Stick" (currently $8 plus $3 shipping). Call 440-350-2730 or visit http://www.lakecountyohio.org/soil/other%20neat%20stuff.htm.

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Chattanooga, TN, May 17-21, 2004

Come to Chattanooga, Tennessee, May 17-21, and take advantage of an outstanding opportunity to participate in technical programs and training, share successes, discuss issues, and network with colleagues in the water monitoring community. The fourth national monitoring conference, hosted by the National Water Quality Monitoring Council (NWQMC), will explore the expertise, innovations, and strategies that strengthen and sustain monitoring programs at the local, state, regional, and federal levels.

Although this conference is not specific to volunteer monitoring, issues related to volunteer monitoring will be well represented in the conference agenda. There will be a number of sessions and posters specifically devoted to volunteer monitoring, such as:

- The role of the state-managed volunteer monitoring program
- Volunteer monitoring programs that balance educational and data goals with tiered approaches
- Partnerships between volunteer programs and colleges/universities

In addition, many other conference sessions will feature presentations by volunteer monitoring coordinators and others on topics of interest to volunteers, including: monitoring as a tool for building community capacity; long-term monitoring efforts; database design; indices and indicators; communicating with the public; lessons learned for sustaining programs; and TMDL development.

For more information, including the conference agenda and online registration, visit www.nwqmc.org, or contact the conference coordinator at nwqmc2004@tetratech-ffx.com, 410-356-8993.