The Volunteer Monitor

The National Newsletter of Volunteer Water Quality Monitoring
Vol. 10, No. 1, Spring 1998

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Issue Topic: Monitoring Wetlands

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Rotating co-editors

The Volunteer Monitor has a permanent editor and volunteer editorial board. In addition, a different monitoring group serves as co-editor for each issue.

This issue was coedited by the Alliance for the Chesapeake Bay. The Alliance's Citizen Monitoring Program, launched in 1985, is a regional network of over 145 trained volunteers who perform weekly water quality testing of rivers in Pennsylvania, Maryland, and Virginia. Since 1992, the volunteers'

data have been included in Virginia's Water Quality Assessment report to Congress and EPA (the 305(b) report).

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From The *Editor*

What's Thorny About Wetlands?

A funny thing happened at the planning meeting for this issue of the newsletter. Wetland experts from EPA, the Alliance for the Chesapeake Bay, Jug Bay Wetlands Sanctuary, and Maryland Department of the Environment were all at the table, brainstorming about potential articles on wetlands. And almost every time a new topic was raised, someone was bound to remark, "Well, that's a thorny issue."

The definition of a wetland? "That's a thorny issue." Wetland regulations? "That's another thorny issue." Mitigation? Classification? More thorny issues. Finally it got to the point where we decided an entire article would have to be devoted to thorny issues. Chris Swarth of Jug Bay Wetlands Sanctuary was brave enough to take it on; see his article, "Wetlands: Controversy and Confusion," on page 6.

Later I got to thinking: Why did this happen? I've been the editor of The Volunteer Monitor since 1990, and we've never needed a special "thorny issues" article before. What is it about wetlands, anyway?

Much of the confusion arises from the essentially dual nature of wetlands. Are they water bodies or land? They are neither and they are both. Nowadays we understand that being both water and land gives wetlands their unique value in the natural world. Wetlands can do things that no other type of landscape can do. Among other things, they provide a specialized living space for plants and animals, some of which can flourish nowhere else.

But it took a long time for humans to appreciate wetlands. In the meantime, wetlands (not called wetlands then, but swamps, marshes, and the like) were misunderstood, maligned, and abused. You couldn't boat them or farm them or build on them. They were viewed as wastelands, breeders of insects and disease. The best solution was to drain or fill them, to transform them into useful land. So for centuries Americans labored to take the "wet" out of wetlands, and the government helped out with grant programs and subsidies.

Then in the 1970s society rather suddenly woke up to the critical ecological importance of wetlands. We looked around and realized we'd already lost over half the wetland acreage in the lower 48 states. And we decided we had to do something about it -- immediately. The change in attitude was dramatic. As Matthew Witten, who recently completed a yearlong fellowship with EPA's Wetlands Division, puts it, "Regulators did a pirouette from 'useless and evil' to 'we have to do everything we can to save them.'"

Naturally the abrupt turnabout brought confusion and turmoil. For property owners, accustomed to viewing wetlands as developable land, the new wetlands regulations often seemed like an infringement on their rights. In her book *Discovering the Unknown Landscape: A History of America's Wetlands,* Ann Vileisis writes that "traditionally, land has been considered as private property and water as public property....Because wetlands are not simply land but land and water, regarding them simply as real property...has been a fundamental error in paradigm."

What's thorny about wetlands, it turns out, are our efforts to define and regulate them. The current tangle of federal, state, and local regulations--many of them inconsistent with each other--does indeed resemble a thicket of brambles. And while volunteers can monitor wetlands without venturing too far into that thicket, they should be aware that it is there. In particular, volunteers need to be sensitive when approaching private landowners, whose fear of getting tangled up in regulations may make them reluctant to have wetlands on their property identified and monitored.

Next issue:Estuary Monitoring

"Monitoring estuaries" is the topic for the next issue of The Volunteer Monitor, which will be coedited by Maine's Clean Water/Partners in Monitoring Program. Please contact the editor if you would like to contribute an idea or article.

About *The Volunteer Monitor*

The Volunteer Monitor newsletter facilitates the exchange of ideas, monitoring methods, and practical advice among volunteer environmental monitoring groups across the nation.

The Volunteer Monitor is published twice yearly. Subscriptions are free.

The Volunteer Monitor is also available on EPA's web site at http://www.epa.gov/volunteer/vm_index.html.

Reprinting material from *The Volunteer Monitor* is encouraged. Please notify the editor of your intentions, and send us a copy of your final publication.

Address all correspondence to: Eleanor Ely, Editor; ellieely@aol.com.

Correction

In my article "Salinity by Conductivity and Hydrometer" (Spring 1997), I inadvertently mistyped the equation for adjusting Magothy River hydrometer readings (HS) to give an estimate of conductivity readings (CS). The correct equation is: CS = (HS - 1.9807)/0.9257. I apologize for any confusion this may have caused.

Peter Bergstrom
U.S. Fish & Wildlife Service
Annapolis, MD

***V**olunteer **M**onitor*

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A Wetlands Primer

*by **Matthew Witten***

What's special about wetlands
Wetlands occur on coasts, next to rivers and lakes, in glacial depressions in the plains, in forest hollows, in floodplains, and in many other areas. They occur in an astonishing variety of types -- from a cedar swamp to a lily pond -- that may bear little resemblance to each other. What they have in common is the feature of wetness.


A New England bog.

Because they combine several highly beneficial attributes of terrestrial and aquatic ecosystem, wetlands are some of the most productive and useful ecosystems on earth. Where land and water converge in the same place, the land contributes vegetative cover and high availability of nutrients (from runoff and accumulation of organic materials) while the water provides stability of temperature and dispersal of larvae of fish, amphibians, and other aquatic animals. And, of course, plants and animals in a wetland have ready access to that necessity for all life, water.

The result of this combination of aquatic and terrestrial inputs is a community with unique characteristics. Wetland soils, because they are usually or often saturated, develop chemical properties different from terrestrial soils, which are more aerated.

Wetland plants display adaptations for growing in these saturated soils -- for example, grasses that can pump oxygen to their roots through their stems, or mosses that can live in the highly acidic conditions found in some wetlands. Certain animals, in turn, depend on the unique vegetative and hydrologic characteristics of wetlands. Many birds make use of the copious plants that emerge from marshes, and use wetlands as vital "way stations" during migrations. Amphibians lay their eggs in wetlands, which may offer more shelter from disturbance and predation than lakes or rivers do.

What are wetlands?
There are several definitions of wetlands, but in lay terms, wetlands are areas where the soils are saturated at or near the surface for a significant portion of the year.

One way to tell whether or not the soil has been saturated is to look at the color and structure of the soil itself. Gray subsoils are typically associated with wetlands. Also look for organic deposits (peat or muck), which accumulate on the soil surface under very wet conditions.

Another way to tell is to examine the vegetation. Based on decades of field research, biologists have categorized plants into those that tend to grow in wetlands (meaning they usually grow in saturated soils) and those that tend to grow elsewhere. Wetland ecologists can look at soils and plants on a single visit to a site, and use their observations and "best professional judgment" to determine whether or not the area fits the definition of a wetland.

How are wetlands classified?
Unfortunately, there is not a single, universally accepted classification scheme for wetlands. The most widely used in the United States is the "Cowardin" system developed by the U.S. Department of Fish and Wildlife; it is based largely on vegetation types. An example of a wetland type under the Cowardin system is "estuarine intertidal forested/shrub" wetland.

An increasingly used alternative classification scheme, the U.S. Army Corps of Engineers' "hydrogeomorphic" (HGM) classification, focuses largely on the abiotic features of wetlands and categorizes wetlands by their functions. The same wetland named above might be called a "low-gradient alluvial floodplain" wetland under the HGM classification scheme.

Why are wetlands important to us?
Many wetlands are connected to other surface waters (saltwater bays, rivers, and lakes), and those that are not are often connected to groundwater. Because of this connection, wetlands often serve the function of filtering sediment, nutrients, and pollutants from water before it enters their adjacent water bodies. (That is why they are sometimes

called the kidneys of the ecosystem.)

Wetlands that are adjacent to lakes and rivers also act as sponges or water collection basins that prevent flooding by absorbing or retaining storm waters and high tidal waters.

Volunteers study vegetation at Jug Bay Wetlands Sanctuary.

Most wetlands, whether or not they are connected to other water bodies, provide essential wildlife habitat. Those that are isolated from other surface waters offer to flora and fauna the advantages of an aquatic habitat amidst the forest or plains.

Many wetland functions provide critical services to human society. Improved drinking water quality (as a result of wetlands' filtering capacity) and mitigation of floods are two of the most obvious examples. As pockets of biodiversity, wetlands can be the habitat of plants from which medicines are derived. Fish provide protein for many humans on the planet, and most of these fish would be unable to reproduce without the presence of wetlands.

Some of the societal values that correspond with various wetland functions are shown in the box on the next page.

One circumstance that has increased the importance of wetlands is their rapid and extensive loss. Since the arrival of Europeans, wetlands have been drained, dredged, filled, leveled, and flooded to the point where the continental U.S. has lost half the wetlands that existed here in the 1700s. We are now learning that this loss of wetlands has reduced related functions. Catastrophic flood damage, dwindling water quantity and quality, and critical fish and wildlife habitat loss have all resulted partly from society's failure to preserve our wetlands adequately.

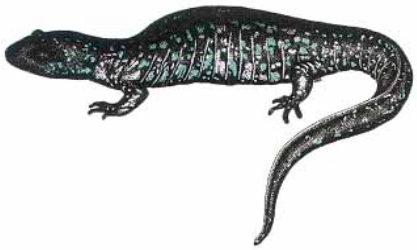
Function	Societal value
Sediment retention	Water clarity for swimming and fishing
Floodwater storage	Reduced property damage from floods
Wildlife habitat	Waterfowl for hunting and nature
Groundwater recharge	Maintenance of drinking water supplies

Filtering pollutants	Maintenance of drinking water quality
Support for acquatic life	Maintenance of fisheries

Why do we monitor wetlands?
The ultimate goal of monitoring wetlands is to help preserve and restore the functions and values that they offer. How can monitoring do this? Monitoring can provide information about how wetlands function, how they are changing, and how they are affected by human activities. For example, information about changes in water levels (hydrologic fluctuations) can help evaluate the effects of agriculture, forestry, and other land uses on a wetland. This information can be used to guide public policy, such as land-use regulations or watershed plans.

Monitoring data can also be used to:

- Reveal trends in wetland health (improvement or decline), in order that appropriate management decisions be made
- Correlate wetland conditions with land-use practices to determine if some of these practices need to be modified or halted


Blue-spotted salamander.

- Provide evidence that a particular wetland has important values to society and should therefore be protected
- Characterize natural, undisturbed wetlands to serve as models for the restoration of disturbed wetlands
- Determine whether or not a "restored" wetland is truly meeting the goals of the restoration plan or permit

Without solid information obtained from monitoring, few agencies or communities will be willing to invest time, energy, and money in wetland protection or restoration efforts.

Some commonly monitored parameters
Many parameters (measurable attributes) of wetlands can provide useful information to policy-makers and land-use decision-makers. Some that have been monitored by volunteers are:

Water levels

Dominant vegetation type
Vegetation cover
Exotic plant species encroachment
Amphibians (e.g., breeding surveys)
Macroinvertebrates
Physical and chemical water quality parameters
Bird counts
Adjacent impervious surface (e.g., pavement, roofs)
Tidal restrictions (in coastal wetlands)
Wetland appearance, extent, and "footprint" (through photos or maps)

A plea for getting to know wetlands

Reading Memorial High School students study a vernal pool.

Above is a reasoned exposition of why wetlands are important and why they need to be monitored. The answer for why to monitor wetlands, however, only partly resides in the public policy realm.

We humans live in an increasingly human-developed environment, and, as such, we can lose touch with the natural environment that sustains us. I sometimes take walks in the beaver-created wetlands below my house in Vermont, and derive pleasure and sustenance from these outings. This year, however, I am resolved to monitor some attributes of these wetlands, primarily to get to know them better.

My current leisure walks only scratch the surface of the wealth of activity and interconnectedness of this wetland complex. By monitoring, I will get to know a few things about my local environment in depth. Because I will need to make regular observations of these wetlands, I will visit them more often, and develop a keener sense of how the ecosystem is behaving. I believe that these deeper, more regular observations will lead to a greater understanding and communion with my valley. This is the stuff of life.

Some key references:

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Tiner, Ralph W. 1998. In Search of Swampland: A Wetland Sourcebook and Field Guide. Rutgers University Press, Piscataway, NJ.

Matthew Witten, who served in 1997 as a NOAA Sea Grant Fellow for the EPA Wetlands Division, continues this year as a graduate fellow for the Division. His current role is to promote wetland monitoring in New England, based at the University of Vermont. Contact: P.O. Box 145, Huntington, VT 05462; 802/878-6753; mwitten@zoo.uvm.edu.

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Tips for Success

*by **Elissa Ostergaard and Tina Miller***

Watershed Community Link was one of the most ambitious and intensive volunteer wetland monitoring projects carried out to date. In the course of just over one year, 132 volunteers performed 1,712 days of monitoring and gathered data on a wide variety of wetland characteristics (see box). Volunteers did everything from establishing transect lines and installing shallow groundwater wells to identifying amphibian egg masses and estimating plant cover.

By the end of the project, we had learned a lot about what worked and what didn't. For those about to embark on their own wetland monitoring projects, we offer the following observations and advice.

- **Avoid "learning overload"**

Our volunteers had to absorb a tremendous amount of information, including many specialized skills such as identifying plants and wildlife. To make the task manageable we broke the training up into small chunks that were spaced out over the course of the entire year. Training sessions were scheduled at the appropriate season for the task at hand--for example, training for the amphibian breeding survey was done in February, just before the breeding season in March and April. This ensured that the information was fresh in the volunteers' minds as they conducted the survey.

Volunteers had good things to say about the monitoring trainings. They especially

valued having different topics -- plant identification, amphibian surveys, soil characterization, etc. -- taught by experts in those fields.

- **Provide on-site assistance**

Each team received site assistance from program staff the first time they performed a new task. Site visits proved to be extremely useful in building a group's competence and confidence, especially for technically difficult procedures like establishing transects or surveying vegetation, and were well worth the 2-3 hours of staff time per visit.

- **Make use of "expert" volunteers**

The volunteer bird monitors were Audubon-trained master birders, and the plant monitors were assisted by Cooperative Extension-trained plant stewards. We highly recommend the use of such "expert volunteers," many of whom are especially glad to lend a hand since it helps them fulfill their required hours of community service.

- **Permanently mark all sites**

Transect lines and monitoring stations are initially established using benchmarks, compass bearings, and a tape measure. So if you take careful notes you should be able to come back later with a compass and tape and find your original site, right? Well, yes, in theory. In practice, locating the same spot is extremely difficult. The difficulty increases as time goes by: wetlands change, and different people may need to locate the site over the years.

Jessica Anderson pounds in rebar to permanently mark a photo point.

It's much better to use a permanent marker such as an 18-inch piece of rebar or 12-inch penny nail driven into the ground. The marker can be located by a metal detector, and is unlikely to be disturbed by vandals. For convenience, sites should also be marked with bright-colored flagging (but don't expect flags to last more than a season).

Mark everything -- transect lines, monitoring stations, photo points -- both in the field and on maps. Documenting change over time is one of the primary reasons for monitoring a wetland, and duplicating locations is the only way to do it accurately.

- **Only fully trained volunteers should collect data**

At one point in our project, some amphibian egg masses were misidentified by new volunteers who joined the program after the amphibian training had occurred. To prevent such problems, we established a policy that only volunteers who had attended

the appropriate training session could collect data. (Others can provide assistance, such as recording data.)

- **Check data promptly**

We conducted QA/QC (quality assurance/quality control) by having experts do parallel testing at 5 percent of the volunteer sample plots. Unfortunately, we waited until all the QA/QC results were entered into a database before we analyzed the data. Thus we lost the opportunity to give immediate feedback to volunteers and correct problems as we went along.

In retrospect, we realized that we could have instantly spotted some discrepancies by simply eyeballing the QA/QC data; there was no real need to wait for data to be input. Similarly, volunteer data sheets should get a quick once-over as they come in. For example, some of our volunteers recorded 10 dominant species of vegetation instead of the recommended 5, but we did not notice this until it was too late to provide useful feedback.

- **The value of the project goes beyond data collection**

Watershed Community Link accomplished far more than simply collecting information. The volunteers became wetland stewards and local teachers. They learned how to talk to county council members and how to write grant proposals. They produced brochures and invited community members to field days to build trails, clean up trash, and talk about the benefits and values of wetlands.

Watershed Community Link volunteers who monitored this site on Daniels Creek found an abundance of invasive plants, including blackberry, reed canary grass, and spirea.

Watershed Community Link lasted for only one year, but several groups continue to monitor and care for their wetlands. One, the Rainier Audubon Club, obtained a grant to restore a portion of their wetland that was burned in a fire. They also persuaded the roads department to install a gate to block car access, as a way to discourage dumping.

The data collected by Watershed Community Link is now being used to prepare long-term management plans, meet permit conditions, and document baseline conditions prior to development around the wetlands. We plan to monitor the same group of wetlands again in several years, to look for changes. Meanwhile we are monitoring two additional wetlands, and putting to good use the lessons we've learned.

For further information:

Miller, Tina, Chrys Bertolotto, Janice Martin, and Linda Storm. 1996. Monitoring Wetlands: A Manual for Training Volunteers. Available from Adopt a Beach, 4649 Sunnyside Ave. N., Rm 305, Seattle, WA 98103; 206/632-1390. $15.

Ostergaard, Elissa, Tina Miller, and Catherine Houck. 1997. *Watershed Community Link: Results of 1995-1996 Volunteer Wetland Monitoring Program at 12 Wetlands in King County*. Limited copies available from Elissa Ostergaard (address below).

Bertolotto, Chrys. 1996. "Monitoring Wetlands: A Flexible Approach," in *The Volunteer Monitor* newsletter, vol. 8, no. 2 (Fall 1995).

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Watershed Community Link

From July 1995 to September 1996, the Watershed Community Link project trained 132 volunteers to monitor 12 wetlands in King County, Washington. These were mainly natural wetlands, along with several that were created or restored, usually for mitigation. Working in teams (one team per wetland), volunteers collected data on birds, amphibians, vegetation, water level, and soils. They also observed and recorded land uses in a 200-foot zone surrounding the wetland, and took photographs to document wetland features. The methods used are described in (Miller et al., 1996).

Four organizations cooperated in running the project: Adopt a Beach, King County, WETNET, and Washington State University-Cooperative Extension.

While there were different goals for each wetland, the general purpose of the monitoring was to gather baseline information on the health, community structure, wildlife, and condition of each wetland, to be used for future comparisons and in evaluating the success of restored or created wetlands.

Wetlands Workshops

Two-day wetlands workshops are being offered around the country by the Izaak Walton League of America (IWLA) as part of the League's Save Our Streams (SOS) Wetlands Conservation and Sustainability Initiative. The goal of SOS's wetlands initiative is to encourage citizens to take a proactive role in conserving and restoring wetlands.

The workshops are geared toward citizens, educators, community and business leaders, and others with a non-science background. Morning sessions consist of classroom lectures on local wetland hydrology, vegetation, and soils; relevant regulations; and wetland functions and values. Afternoons will be devoted to field training sessions in which participants will learn techniques for setting up transects, monitoring vegetation, and sampling soils.

Participants will receive a copy of the *Save Our Streams Handbook for Wetlands Conservation and Sustainability* (see Volunteer Wetland Monitoring Manuals: An Annotated Bibliography for more on the handbook).

Groups that are interested in hosting a workshop in their area should contact IWLA to make arrangements. Please call Kelly Starinchak, SOS Projects Coordinator, at 800/BUG-IWLA (800/284-4952).

Coming Soon: Marshbird Monitoring Guidelines

In April 1998, 50 experts from the U.S. and Canada convened at a Marshbird Monitoring Workshop for an initial discussion of a nationwide Marshbird Monitoring Program. The program, which will be jointly developed by the U.S. Fish and Wildlife Service and USGS Biological Resources Division, will be designed to collect trend information on a variety of wetland-dependent bird species.

Secretive marsh birds such as rails, bitterns, moorhens, and gallinules are difficult to detect and often inhabit inaccessible areas. Because these species are not monitored well by the Breeding Bird Survey and other existing monitoring programs, their status is unknown. One objective of the Marshbird Monitoring Program will be to design standardized protocols for surveying marsh birds.

A report on the Workshop is expected by the end of summer 1998. It will be posted on the Web at http://www.mp1-pwrc.usgs.gov/marshbird.

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Wetland Monitoring

Wetlands: Controversy and Confusion

*by **Christopher Swarth***

Wetlands have been controversial since the 1970s when they first came under federal jurisdiction. Controversy ranges from such seemingly straightforward issues as definitions and boundaries to complex questions of regulation, multi-governmental jurisdiction, and wetland mitigation. Part of the confusion and debate is because a consistent national policy on wetlands protection has been lacking. In spite of ongoing efforts to resolve and clarify many of these issues, much remains in a state of flux.

While those interested in starting a wetland monitoring program don't need to be experts on wetland politics, a little background will be helpful. Of all the "thorny" wetland issues described below, mitigation is probably the most directly relevant for volunteer monitors, who can make an important contribution by monitoring mitigated sites.

What is a wetland anyway?
Swamp and overflow lands, mires, fens, marshes, bogs -- these are words that have been used for generations to describe what we today call wetlands. These traditional terms can be confusing since many are not scientifically defined, and terminology often differs from region to region. Moreover, they are weighted with negative connotations (ever been swamped, bogged down or mired in trouble?). The inclusive term wetland underscores the common features of all these ecosystems, as well as their common need

for protection. However, an exact definition of what constitutes a wetland remains a subject of debate and discussion. My "seasonal wetland" may be your "wet farm field."

The growing efforts to protect wetlands under federal regulation created an acute need for a precise, regulatory definition of wetlands. Unfortunately, formulating a definition that could be widely accepted has proven to be elusive. The quest has involved Presidential orders, Supreme Court decisions, congressional legislation, and a large handful of federal agencies.

A partial solution to the confusion came in 1977 when the Army Corps of Engineers published the definition that is in widest use today:

> The term wetland means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

Since the Corps definition and other legal definitions are designed primarily for regulation and assessment, in 1995 the National Research Council's Committee on Wetlands Characterization developed a broad definition that refers explicitly to the ecosystem concept of wetlands:

> A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The minimum essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical and biological features reflective of recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physiochemical, biotic, or anthropogenic factors have removed them or prevented their development.

This definition, plus a thorough discussion of delineation, functional assessment and other issues, is contained in the NRC's report, *Wetlands: Characteristics and Boundaries.*

Delineation

River, lakes, and even estuaries tend to have distinct borders. In a single step you can leave the terrestrial environment and enter the aquatic environment. Wetlands are rarely

so obliging. Because many occupy transitional areas between deep permanent water and drier uplands, their boundaries are blurry. Some are seasonal (wet at some times of the year, dry at others). To complicate matters more, wetland boundaries may change from year to year.

Yet, in spite of the inherent "blurriness" of wetland boundaries, political and social forces require humans to impose definite boundaries on them. Wetlands are subject to special regulations: activities or building projects that might alter a wetland could require permits, and some projects in wetlands could be prohibited. Landowners demand and deserve to know whether their development plans are allowed, which means they need to know exactly where wetlands are located on their property.

The process of determining the boundaries of a wetland is known as delineation. It involves assessments of hydrology, soils, and plant communities and is typically done by a trained wetland delineator. Many environmental consulting firms now practice wetland delineation, and training workshops in delineation techniques are offered widely.

Wetland regulation

Although there has been strong public interest since the 1970s in preserving wetlands, progress has been hampered by vague, contradictory, or nonexistent federal protection policies. Some agencies have had policies that promoted protection while others encouraged wetland destruction -- for example, until 1985 the U.S. Department of Agriculture subsidized wetland drainage by farmers.

A full recounting of governmental efforts to protect wetlands -- spanning 25 years and involving multiple agencies -- would be as complex as a wetland ecologist's food web diagram. And the story isn't over yet. For in spite of the enthusiastic national consensus that wetlands must be protected, we still lack a single national wetland protection law.

A Western Inland Marsh.

It is an ironic fact that wetlands are protected mostly by laws that were originally intended for other purposes. Section 404 of the Clean Water Act, which regulates dredging and filling, was designed to prevent activities that might be detrimental to navigable waters -- not necessarily wetlands as such. Yet Section 404 has become the primary tool for wetland protection and regulation. Today, any project that might permanently alter a wetland is subject to 404 regulation. Enforcement is provided mainly by the Corps with input from other federal agencies -- EPA, Natural Resources Conservation Service (NRCS), U.S. Fish and Wildlife Service (F&WS), National Marine Fisheries Service -- and state agencies.

Wetlands regulation continues to be highly controversial. In December 1997 a circuit court in Maryland declared federal regulation of some wetlands to be invalid. On another front, conservationists are working hard to modify the Corps's Nationwide Permit 26, which allows small wetland development projects to proceed.

Manual wars

The history of federal guidance manuals for wetlands illustrates once again the pervasive confusion over national wetland policy. Until 1986, the four federal agencies with regulatory authority over wetlands -- the Corps, EPA, F&WS, and NRCS -- each used separate technical manuals. Consultants, government agencies, and developers all looked to these manuals for guidelines on assessing wetland development projects and granting construction permits -- yet methodology and criteria for determining what is and what is not a wetland were not consistent. Clearly this was a frustrating situation.

In an attempt to unify government regulation efforts, in 1989 the four federal agencies listed above jointly published a new manual, the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands.* But politics soon collided head-on with science and the '89 manual was in newspaper headlines nationwide. Pro-development, anti-regulatory forces sought to change the criteria by which the '89 manual defined and delineated wetlands, claiming that the manual would extend regulation to lands that should not be classified as wetlands.

Politics was the winner in the first round and the outcome was the '91 manual, released by President Bush's White House (in an effort spearheaded by Dan Quayle). It proposed a set of strict new guidelines, narrowing the definition of wetlands. An assessment by the World Wildlife Fund and the Environmental Defense Fund concluded that if the criteria of the '91 manual were used, 50 percent of the remaining wetlands in the United States would cease to be identified as wetlands. Sustained criticism of the '91 manual by the scientific and conservation communities was so strong that it was abandoned in 1992 after Bill Clinton was elected president.

The rather anticlimactic ending to the "manual wars" was that all the federal agencies went back to the 1987 Corps manual, which is similar to the '89 manual although somewhat more restrictive in its definition of a wetland (i.e., some areas defined as wetlands by the '89 criteria would not be wetlands according the '87 manual). The 1987 manual remains in use today.

No net loss

One of most important results of the late-1980s efforts to develop a national wetland policy was the "no net loss" concept. The Conservation Foundation and the EPA

convened the National Wetland Policy Forum (a group including state governors, scientists, farmers, state and local resource agency chiefs, and others), which formulated the objective "to achieve no overall net loss of the nation's remaining wetlands base and to create and restore wetlands, where feasible, to increase the quantity and quality of the nation's wetland resource base." No net loss has become a cornerstone for wetland protection in the 1990s.

Wetland mitigation

Adoption of the no net loss policy did not mean that wetland destruction would end. It meant that if wetlands were to be destroyed, the impacts would be "mitigated" (i.e., lessened or softened). Compensatory mitigation can be accomplished through either wetland creation (the construction of wetlands where none existed) or restoration (the rehabilitation of a wetland that has been degraded or hydrologically altered).

Mitigation can range from simply creating a breach in a dike to extensive engineering and landscaping costing millions of dollars. Mitigated wetlands are often designed to be twice the size of the destroyed wetland (the appropriate size is determined by a formula) and are usually sited within the same or an adjacent watershed. A growing number of consulting firms, government agencies, and scientists are now involved in designing mitigated wetlands.

Mitigation is not a silver bullet -- though some people might like to believe that it is. Vivian Newman, a Sierra Club volunteer activist, is concerned that "the current emphasis on restoration and mitigation is creating a subtext that wetlands don't necessarily have to be preserved where they are now."

The science or "art" of mitigation is in its infancy and much remains to be learned. Compensatory mitigated wetland sites are supposed to replace those functions that are lost when a wetland is destroyed, but many scientists question whether this is really possible. Some mitigation sites have obviously failed, turning into lakes or uplands. In other cases, a mitigated wetland may look like a natural wetland . . . but does that mean it is functioning like one? Few studies have addressed this question.

Long-term monitoring of a variety of wetland functions (i.e., nutrient cycling, wildlife habitat, plant diversity) will be required to judge the true success of wetland mitigation. Since neither agencies nor developers can afford such studies, here is an excellent opportunity for volunteer monitors to step in and help provide an answer.

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"What's Out There"
A Look at Volunteer Wetland Monitoring

As new as volunteer monitoring of wetlands is, there are already quite a few active programs around the country. Some are profiled in various articles in this issue. Below, we take a quick look at a few more.

A longer listing of volunteer wetland monitoring programs is available from the Wetlands Hotline, 800/832-7828.

Many thanks to Matthew Witten, who gathered much of the information for this article during a yearlong Sea Grant fellowship at EPA's Wetlands Division.

Wetland Research in Maryland

Since 1985, volunteers at Jug Bay Wetlands Sanctuary in Maryland have worked with Sanctuary staff on more than a dozen long-term research projects, making this one of the longest-running and most productive volunteer wetland monitoring programs in the United States. Volunteers have monitored water quality, sediment, birds, fish, amphibians, turtles, and vegetation, all in the effort to better understand the ecology of the Sanctuary. (See page 20 for more on turtle monitoring.) Examples of the ongoing studies that Sanctuary volunteers participate in are:

- **Water quality and nutrient dynamics.** The question being investigated is: How

Getting wet: Volunteers measure submerged aquatic vegetation at Jug Bay.

are nutrients, especially nitrogen, transformed and cycled by wetland vegetation and sediment? Volunteers measure several physical and chemical water quality parameters.

- **Fish survey.** Using fish seines, volunteers capture, identify, measure, and release fish. The data help track the variety, abundance, and distribution of fish species.

- **Salamander migration.** Volunteers weigh, sex, and release migrating marbled salamanders that they have captured using draft fences and pitfall traps.

- **Plants.** Volunteers identify trees and plants and monitor their abundance and growth. The information is used to chart and predict longterm changes in the wetland plant community.

Contact: Christopher Swarth or Judy Burke, Jug Bay Wetlands Sanctuary, 1361 Wrighton Road, Lothian, MD 20711; 410/741-9330.

Bird & Amphibian Surveys in Great Lakes Basin

The Marsh Monitoring Program is a large-scale effort to survey birds and amphibians throughout the Great Lakes region. Jointly coordinated by Bird Studies Canada/Long Point Bird Observatory and Environment Canada, the program involves approximately 300 volunteers in both Canada and the United States. Bird surveying began in 1994, and amphibian calling surveys were added in 1995.

Volunteer bird surveyors stand for 10 minutes at a permanently marked station, called a "focal point," and record all species seen or heard within a 100-meter semicircle around

the focal point. To coax secretive birds to call, volunteers broadcast a tape with the calls of some elusive bird species. During 1995-96, volunteers recorded data on nearly 42,000 birds of 194 species; 48 of these species were marsh nesters.

Volunteers receive a training kit that includes audiotapes, tags to mark stations, data cards, and a manual (for more on manual, see page 26). The volunteers' data are used to track population increases or declines and investigate how well Great Lakes wetlands are performing their role as habitat for birds and amphibians.

Yellow Rail.

Contact: Kathy Jones, Bird Studies Canada, P.O. Box 160, Port Rowan, Ontario N0E 1M0; 519/586-3531; aqsurvey@bsc-eoc.org http://www.bsc-eoc.org.

Maryland: Mitigation Site Monitoring

Grading the site: The first step in constructing a wetland.

The Maryland Department of the Environment (MDE) "mitigation banking" program works like this: If a proposed development project will impact a wetland, in order to obtain a permit the developer must pay an amount of money into MDE's Nontidal Wetlands Compensation Fund. MDE then uses the fund to build and maintain new wetlands.

Because MDE currently has about 20 such created wetlands to oversee, and few staff members to monitor their success, the agency is developing a program to train citizens who live near the mitigation sites to monitor them. The hope is that citizen-collected vegetation and hydrology data will show whether the sites are meeting performance standards.

The volunteer monitoring protocols are described in a manual, to be published by the end of the summer, which includes methods for monitoring vegetation density, hydrology, and soils.

Contact: Christi Noble, MDE, 2500 Broening Hwy, Baltimore, MD 21224; 410/631-8094.

Rhode Island Volunteers Assess Salt Marsh Restoration Potential

In 1995, over 100 trained volunteers helped assess Narragansett Bay salt marshes for their "restoration potential." To evaluate the extent of human impact, the volunteers observed and recorded such characteristics as:

- extent of coverage of *Phragmites* (an invasive species)
- buffer or lack of buffer
- presence of tidal restrictions, such as roads or railroads
- presence of fill material
- evidence of discharges or dumping

Approximately 80 percent of the Bayls marshes were evaluated by volunteers. Among the findings: 62 percent (by area) of the marshes were affected by invasive species, 70 percent experienced tidal restrictions, and 63 percent were impacted by filling.

Volunteers use aerial photos to quantify impacts to the tidal wetlands.

The volunteersl results are being used to help identify potential marsh restoration sites and determine what type of restoration or protection efforts are needed.

Contact: Andy Lipsky, Save The Bay, 434 Smith St., Providence, RI 02908-3770; 401/272-3540; savebay@savethebay.org. (For information on the methods manual, see Volunteer Wetland Monitoring Manuals: An Annotated Bibliography).

Monitoring Salt Marshes in Maine

At the Wells National Estuarine Research Reserve (NERR) in Maine, college-student volunteer interns participate in a number of research projects on the Little and Webhannet River estuaries and their associated salt marshes.

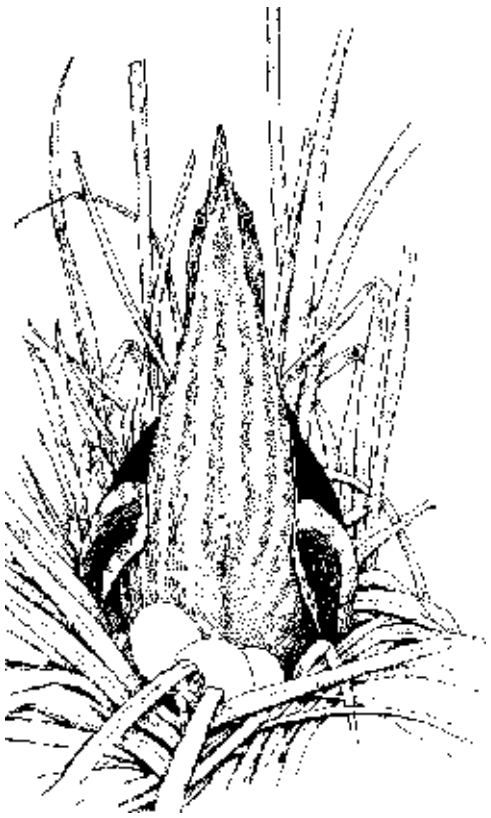
Volunteers establish a transect line in a salt marsh at wells National Estuarine Research Reserve.

Two wading bird species, great blue herons and snowy egrets, are the top predators in the salt marsh food web. Thus, these two species are good indicators of the overall health of the salt marsh ecosystem. Interns have been monitoring the number and location of great blue herons and snowy egrets at Wells NERR since 1991.

Volunteers also help monitor restored salt marshes at the Reserve. They measure water table levels and salinity, assess the vegetation (percent cover, stem density, biomass), monitor the fish community (density, species, length, biomass), and measure physical and chemical water quality parameters. These data are used to assess the success of restoration.

Contact: Michele Dionne, Wells NERR, 342 Laudholm Farm Road, Wells, ME 04090; 207/646-1555, ext. 36.

Oregon Volunteers Count Birds, Study Marsh Restoration



Bittern.

Since 1989, volunteers at Jackson Bottom Wetland Preserve in Oregon have done bird counts and bird banding. Their results are published monthly in Oregon's largest major daily newspaper, The Oregonian, and are also used by university scientists.

In addition, volunteers work on a variety of research projects, many of them related to marsh restoration. For example, in 1994 volunteers assisted with an experiment to evaluate whether herbicide application, with or without burning, would help get rid of reed canary grass (an exotic invasive species). Volunteers monitored three experimental sites. After three years, they observed 95% return of reed canary grass at all the sites, indicating that neither herbicide nor herbicide plus burning was effective in eliminating this invasive species.

The next experiment will be to try restoring the same sites to forested wetland. Once again, volunteers will help monitor the success of the project.

Contact: Pat Willis, Jackson Bottom Wetland Preserve, 123 W. Main St., Hillsboro, OR 97123; 503/681-6206.

Illinois WetlandWatch

This summer, volunteers in Illinois will begin "pre-piloting" WetlandWatch -- the latest addition to the Illinois Department of Natural Resource's (DNR) EcoWatch Network. EcoWatch is an ambitious statewide volunteer monitoring effort, coordinated in part by the Illinois Natural History Survey (INHS) division of DNR, that ultimately will encompass six programs: RiverWatch, ForestWatch, WetlandWatch, PrairieWatch, UrbanWatch, and SoilWatch (the first two are already up and running).

DNR has developed some innovative techniques for the WetlandWatch program. For example, to estimate the extent of different zones (open water, floating vegetation, and emergent vegetation), the citizen scientists will stand on 6-foot ladders and hold up a transparent logarithmic grid. By looking through the grid and counting squares, volunteers will be able to estimate the percent cover of each zone. INHS entomologist Michael Jeffords, who is coordinating WetlandWatch, explains that this technique will ensure the volunteers' safety and comfort and at the same time minimize impacts to the wetland. "Slogging through 100 yards of marsh is not the easiest thing to do," he says. "People didn't evolve in wetlands."

Volunteers will also be monitoring macroinvertebrates and vegetation.

Contact: Michael Jeffords, INHS, 607 E. Peabody Dr., Champaign, IL 61820; 217/333-5986.

Georgia Adopt-A-Wetland
Adopt-A-Wetland is the newest component of the Georgia Environmental Protection Division's statewide Adopt-a-Stream program. Like the three-tiered Adopt-A-Stream program, Adopt-A-Wetland will eventually offer volunteers three levels of involvement, each one requiring progressively more training.

Currently, Level 1 is in the pilot phase, with training workshops taking place around the state in 1998. In Level 1, volunteers adopt a wetland and begin to get to know it by performing simple observational monitoring four times a year. Once Level 1 is fully implemented, Levels 2 and 3 will be developed.

Contact: Michele Droszcz, Adopt-a-Stream Coordinator, 7 Martin Luther King Jr. Dr., Suite 643, Atlanta, GA 30334; 404/656-0099.

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"Fun, Sweaty, Stinky"
Teachers Monitor Oregon Wetlands

Would you respond to a flyer that promised a summer's worth of 10-hour days filled with strenuous work? Forty-five K-12 science teachers in Oregon did, and 23 of them were selected to participate in the Oregon Wetlands Study, a large-scale monitoring effort that collected data on 97 freshwater wetlands in the vicinity of Portland, Oregon, during the summer of 1993.

The teachers spent eight weeks measuring a broad spectrum of characteristics at both natural wetlands and mitigation sites. They paid particular attention to vegetation, identifying plant species and determining their abundance and percent cover. In addition, they characterized soils, hydrology, and site morphology.

Oregon teachers learn surveying techniques for mapping the boundary and topography of wetland sites.

The project was a cooperative effort between the USEPA's Wetland Research Program and the Center for Science Education at Portland State University (PSU-CSE), and was headed by Mary Kentula, a wetland ecologist at EPA's Environmental Research Lab in Corvallis.

EPA was especially interested in comparing natural wetlands with created or restored wetlands to help determine the success of mitigation projects. Noting that a number of mitigation wetlands have failed,

Kentula says, "The record suggests that we need better ways of measuring the outcome of wetland restoration."

The teachers provided EPA with a large body of high-quality data. Kentula says, "The teachers made it possible to sample many more wetlands than our small research staff could have."

For PSU-CSE, the project represented a whole new approach in science education. "The history of education has been to train teachers to Badminister' already-prepared curriculum," says Bill Becker, Director of PSU-CSE. In contrast, the Oregon Wetlands Study encouraged teachers to use their field experience to design their own classroom activities.

In return for their 400-plus hours of work, the teachers received graduate course credit from PSU, a stipend, a lot of knowledge (eight full days of training), and the chance to do real science.

EPA's recruitment flyer for the study promised teachers a close approximation to the life of a working scientist -- complete with "the excitement, the pain, the discipline." Apparently the project delivered on this promise. At the end, the teachers were asked what adjectives they would use to describe their experience. One wrote "intense, interesting, fun, frustrating, sweaty, stinky." Others chose such adjectives as messy, informative, challenging, beautiful, mind-expanding, difficult, and mucky.

But every teacher said they would do it again. "In a heartbeat," wrote one.

"This project was the best experience I've ever had in my whole teaching career," says participant Lynn Wilson. "It gave us real science, complete with quality control, that we could use in the classroom. Just as important, we knew our data would be put into scientific papers; that wetland managers would sit up and take notice. Our work would help answer questions about manmade wetlands -- like whether we're doing as good a job as Mother Nature."

For general information on the project, or to obtain a copy of the video "Citizen Science: The Oregon Wetlands Study," contact William Becker, PSU-CSE, Portland State University, P.O. Box 751, Portland, OR 97207; 503/725-4243; beckerw@PDX.edu. For specifically scientific questions, contact Mary Kentula, NHEERL-WED, 200 SW 35th St., Corvallis, OR 97333; 541/754-4478; kentula@mail.cor.epa.gov.

Note: The Oregon Wetlands Study methods were the basis for many of the methods described in Monitoring Wetlands: A Training Manual for Volunteers (see Volunteer

Wetland Monitoring Manuals: An Annotated Bibliography for information on ordering this manual).

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Minnesota Volunteers Explore Options

Three Ways to Monitor a Wetland

For five years, the Minnesota Audubon Council coordinated a Wetland Watch network, in which citizens reviewed and commented on wetland permits. The step from monitoring permits to monitoring actual wetlands was a natural one, and one that, for Audubon, was spurred by the new practice of "compensatory mitigation" -- that is, creating or restoring wetlands to replace wetlands destroyed by development.

Cheryl Miller, Wetlands Program Director for Minnesota Audubon, recalls that in the early 1990s a number of wetland scientists published technical papers on newly enacted "no net loss" policies and the concept of mitigation. The papers raised questions about the feasibility of recreating a high quality wetland ecosystem and stressed the importance of monitoring these projects to remedy problems that developed. At the same time, they acknowledged that short-staffed federal regulators had little time to oversee the construction, much less monitor the long-term survival, of these new, often experimental wetlands.

For Audubon, the situation presented an intriguing opportunity for volunteers to step in and fill the gap. Audubon approached EPA Region 5 with a proposal to investigate this opportunity. With EPA support, Audubon spent the next four years working with numerous government agencies and academics to develop field monitoring programs for volunteers. In all, three different approaches were developed.

The first project: Focus on mitigation

"In some ways, our first project was really public policy research," says Miller. The monitoring focused on the local Corps's compensatory mitigation program and was designed to find out (a) whether mitigation projects were being built at all; (b) if so, whether they generally conformed to permit requirements; and (c) whether any problems were evident at the sites.

Volunteers made a single visit to each of 42 mitigation projects, bringing with them a copy of the permit specifying what the created wetland was supposed to look like -- its size, the slope of the shoreline, water depth, type of vegetation cover, and so forth. Volunteers spent about three hours comparing what they saw on the ground to what was written in the specifications. Records of their observations, including problems that needed remedial action, were presented to the Corps, EPA, and any interested permittees.

Grading the site: The first step in constructing a wetland

Miller says, "The study raised questions in our minds -- as it has in many others' -- about compensatory mitigation. What we saw ran the gamut from beautifully contoured wetlands that fit well with their surroundings to 12-foot gravel pits surrounded with enormous piles of dirt. Some of the more promising sites were where abandoned forest roads had been removed to allow revegetation by the forest."

Although the study was limited by the "snapshot-in-time" approach -- a single visit made within 1 or 2 years after construction -- Miller says it was very effective in bringing several failing projects to the attention of responsible agencies. The project may also have caused the Corps to increase its own vigilance over mitigation projects. For Audubon members, the study vastly increased their ability to comment intelligently on mitigation proposals.

The second project: Broader, more ecology-based

After two seasons, the Council decided to broaden its approach. Instead of simply asking, How does the site compare to the permit specifications?, the second project investigated a larger question: How does a restored wetland recolonize with wildlife and vegetation?

Audubon started by calling government agencies that had created or restored wetlands (some for mitigation purposes, others voluntarily restored) and asking for permission to visit the sites. The response was positive: "We were astounded by how many people wanted our volunteers to come out and look at their projects," says Miller.

For this project Audubon recruited "expert volunteers" -- experienced birders and members of native plant societies. "One of our main objectives was to bring volunteers with real expertise together with landowners," says Miller. Volunteers visited each site several times each season for two years. They photographed the site, measured water levels, censused bird use, and assessed vegetation composition and abundance.

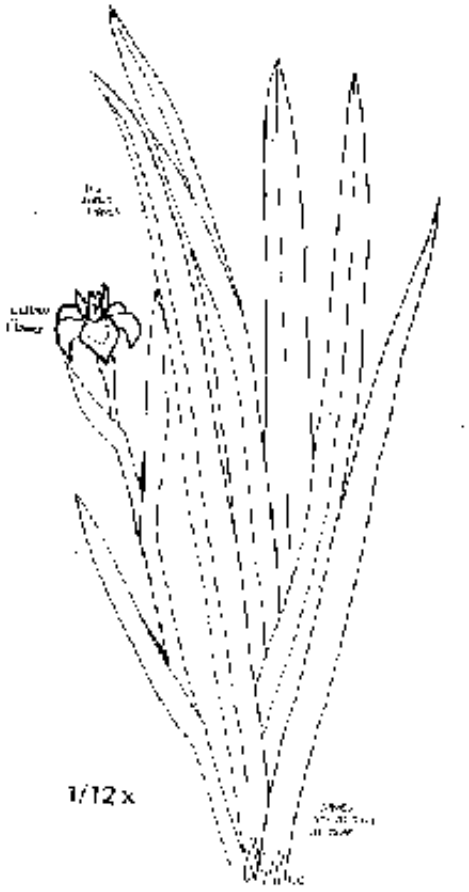
"It's surprising how little monitoring of big restoration and mitigation projects is being done," says Miller. "Surely more could be learned if expert volunteers were recruited to help."

The third project: Rigorous science, quantitative data

The third project, termed the Wetland Evaluation Project (WEP), took a major step in the direction of rigorous, quantitative methodology. This shift reflected increased involvement by Minnesota Pollution Control Agency (MPCA) scientists, who were independently developing bioassessment methods for natural wetlands. These bioassessments were adapted for use by the volunteers (for more on these methods, see page 14) . Because of MPCA's involvement, the focus of Audubon's volunteer monitoring turned to natural systems, although some mitigation and restoration sites from the previous study were included.

The bioassessments demanded a high level of expertise from the citizens, who had to master -- among other things -- the identification of different types of leeches and the difference between grasses and sedges. Accordingly, high school biology teachers were recruited to serve as team leaders for the volunteer teams. In addition to the bioassessments, the volunteers conducted frog and toad call surveys (adapted from Long Point Bird Observatory's Marsh Monitoring Program) and a vernal pool survey (based on Leo Kenney's work in Massachusetts).

Volunteers spent many days in the field, and after the monitoring season ended they spent



Wild iris.

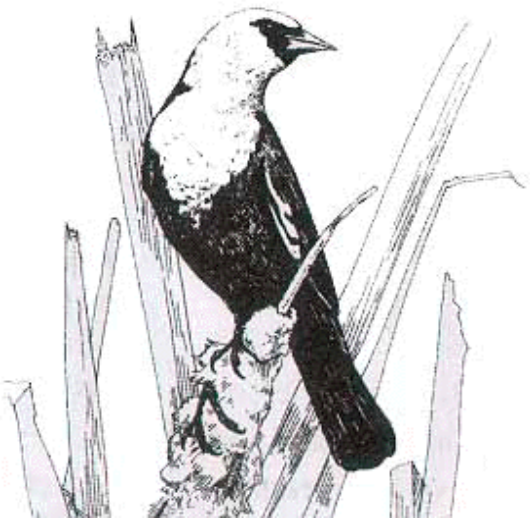
several evenings developing a presentation for local government officials. It was a hefty investment of time -- yet, according to Miller, "They saw it through. Their dedication was amazing."

The WEP generated quantitative data that could be used to identify the biological consequences for wetlands of different land and water management practices, or BMPs (best management practices). This information, in turn, can be used by cities or watersheds to evaluate whether certain BMPs -- such as stormwater inputs or buffers -- should be changed.

The tradeoff was that the bioassessments were time-consuming. "There are many, many wetlands in Minnesota," says Miller. "The trick will be to figure out how to target the monitoring to get the biggest payoff, and that -- very likely -- will be in monitoring the effect of different BMPs on valuable wetlands."

Taking stock

Minnesota Audubon's Council's direct involvement in citizen monitoring of wetlands ended -- at least for the time being -- in December 1997. The torch has passed to the county, which is sponsoring a continuation and expansion of WEP and plans to enroll 100 volunteers to monitor 30 wetlands in summer 1998.



Yellow-headed Blackbird.

Meanwhile, Miller is taking stock of what was learned in the three projects. Each had its own particular advantages and challenges, but one thing is certain -- each was valuable. Each generated information that could be used, be it to fix a problem in a specific wetland, to work with landowners adjoining a wetland, to provide public education, or to plan future projects. And each brought

community members into contact with local wetlands.

"No one goes into wetlands," says Helgen. "When we did the monitoring project, it was a mindblower for citizens and local officials to actually see the plants and animals living there." Observing these living things helped the community to, in Miller's words, "replace the Ôwasteland' perception of wetlands with wonderment and pride."

For more information, contact Cheryl Miller at the Minnesota Field Office of National Audubon Society, 26 East Exchange St., Suite 207, St. Paul, MN 55101; 612/225-1830; cmiller@audubon.org.

Giving Data Use "Equal Time"
by Cheryl Miller
This winter, in a darkened council chamber in a Midwestern city, a group of volunteers staged a presentation on wetlands in the community. As city officials watched, the volunteers projected slides of dragonflies and leopard frogs, of people knee-deep in cattail marshes, of wetlands surrounded by suburbia or deep in a community park. They explained a new wetland monitoring project in the city and why and how it was being done. Perhaps most importantly, they spoke personally: one volunteer expressed his surprise at the variety and abundance of life in wetlands he drove by daily; a teacher told how she was augmenting her high school classes with what she had learned; another person commended the city for its efforts to assess publicly owned wetlands.

When the lights came on, the effect of all this on the officials was obvious. They asked if more money was needed to continue the program; they wanted to know how to get more people involved; they asked what information was available on correcting water quality problems the volunteers had seen. They also speculated about some of the uses to which the information could be put -- uses like educating landowners, targeting funding, or seeing whether BMPs ("best management practices") were having the intended effect.

This presentation was, for me, the culmi-nation of years of work developing volun-teer monitoring programs in Minnesota (see accompanying article). Now we were testing how our monitoring efforts could be made relevant in the public policy arena.

I, sitting in the audience, was struck by what transpired between the volunteers and the commissioners. Instead of the confrontation between preservationists and developers that so often occurs in these settings, the

officials met a cross-section of community members who had collected information about a complex community resource and then initiated a dialogue with the city about their findings. Such an exercise bodes well for wetlands, and -- what I was amazed to realize -- it bodes well for democracy.

Data and democracy Volunteer monitoring coordinators, please consider: The environment -- polluted, converted, fragmented -- is arguably in better shape than democracy, or what passes for democracy in many city and county halls. If your volunteers tell you, as mine have me, that they get involved in monitoring lakes or streams or wetlands to (1) learn something and (2) make a difference, take them seriously and run your programs not just to collect data, but to teach people how to use that data to improve local resources.

All too often, at the end of a field season, exhausted volunteer coordinators collapse amid stacks of data sheets. It's hard to get the data entered into computers, let alone analyzed and written up. The time left over to work with volunteers to communicate their results in the public arena diminishes to nothing. And that's unfortunate because this last phase may well be the most critical.

Equal time An editor once explained the realities of publishing to me. He said that all the time and money spent soliciting and editing a manuscript, getting it printed and bound into jacketed books, was wasted if an *equal* amount of time and money was not spent getting those books out into the world. An equal amount, he said, or the book sits in the warehouse.

For the fruits of our labors to "make a difference" rather than sit in the warehouse, there must be greater equity between the effort spent *gathering* data and that spent *using* it. Think about it: if you halved the effort put into collecting data, and doubled or quadrupled the effort put into using it, how would that change your program? Think about how that redirected effort could be used:

- to build a dialogue with local officials about how volunteer monitoring can be applied to city concerns
- to integrate environmental monitoring with other city programs (one idea: a series of public programs about local natural resources, held during the monitoring "off-season")

- finally and most important: to train, encourage, and assist volunteers to participate in the democratic process.

You'll know you've succeeded when your volunteers are as confident in council chambers as they are in the field, and when their contributions in chambers become an important factor in the decisions made there.

Cheryl Miller directs the Wetlands and Watersheds Program at the Minnesota Field Office of National Audubon Society in St. Paul; 612/225-1830; cmiller@audubon.org.

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Wetland Bioassessment:
Volunteers on Cutting Edge

Wetland bioassessment is a new science. Wetland ecologists are just beginning to develop methodologies. And volunteer monitors are right there, on the cutting edge. In Minnesota, volunteers are already using macroinvertebrate and plant bioassessments to monitor wetland health. And in New England, a new wetland bioassessment manual designed for volunteers has just been published.

A caveat: Readers will note that the New England and Minnesota macroinvertebrate bioassessments use different metrics. This is due, in part, to differences between the two regions. Metrics must be custom-developed for different regions and different types of wetlands. Volunteer programs that want to do wetland bioassessments will need to work closely with ecologists in their region.

What is bioassessment?
Bioassessment techniques are based on the pioneering work of James Karr and others who developed biological indicators for stream health. The underlying idea is that the condition of living organisms in an aquatic system will reflect the extent of disturbances to that system. Almost any community of living things -- plants, fish, mammals, macroinvertebrates -- can potentially be used as ecosystem indicators.

In a typical bioassessment, investigators measure several aspects of the community -- for example, the presence, relative abundance, and/or number of different kinds of certain taxonomic groups. Such measurements are called metrics, and they are chosen

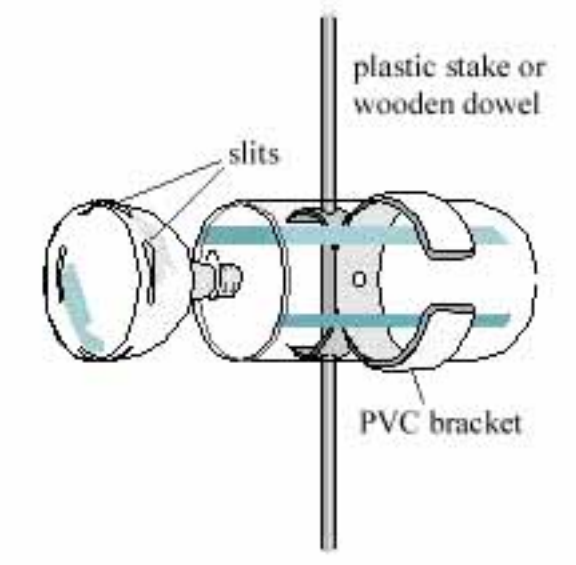
because they have been found to be reliable indicators of health in a given ecosystem. A metric might be "taxa richness" (the number of different taxa found), or "percent predators," or the presence of a particular organism. Metric scores from the test site are compared to scores from an unimpaired site (the reference site); the closer the match, the healthier the test site.

Working out the best set of metrics for a given ecosystem is an art as well as a science -- a time-consuming, trial-and-error process that involves making a lot of measurements in both high-quality reference sites and degraded sites, then comparing the two to find out which metrics give the best indication of human impacts.

Bottle Trap

WEP volunteers use traps made from clear plastic 2-liter beverage containers to capture large, actively swimming invertebrates (predatory beetles, bugs, and leeches). The traps are left in the wetland for 1 to 3 days. Organisms swim into the funnel opening and are unable to find their way back out.

The bottle traps were designed and manufactured by Don Wik, who perfected and patented a method for holding the inverted bottle top ("funnel") in place without the use of tape or clamps. This is important because tape or clamps increase the trap's visibility. Wik's trap is nearly invisible when viewed straight on.



Wik uses a hot wire foam cutting tool to make four slits near the bottom of the funnel. The slits cause the plastic to curl slightly, allowing the funnel to be snapped securely into place. "Fabrication is a little more difficult than it looks," says Wik. "The position and length of the slits are critical, as is the amount of heat."

For more information, or to purchase a sample, contact Don Wik at E4596 266th Ave., Menomonie, WI 54751. Cost is $25 plus shipping for one bottle trap complete with bracket and stake, plus a strainer for retrieving the organisms. A modified version useful for trapping amphibian tadpoles is

also available.

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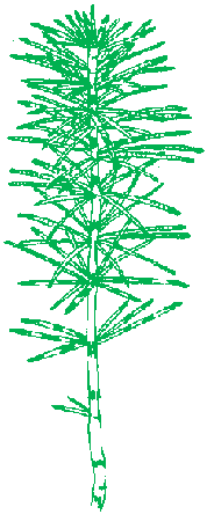
Minnesota

Macroinvertebrates and plants

Volunteers in Minnesota's Wetland Evaluation Project (WEP) project are using two bioassessments, one based on macroinvertebrates and one on plants. Both are specifically tailored for use in depressional wetlands in Minnesota. The methods were designed by Minnesota Pollution Control Agency (MPCA) ecologists Judy Helgen (macroinvertebrates) and Mark Gernes (plants), in conjunction with volunteer monitoring organizers Bruce Carlson and Cheryl Miller from Minnesota Audubon. (For more on WEP, see page 11.)

Why use two bioassessments? One reason is that sampling more than one type of living community gives a better overall indication of the wetland's condition. Another is that macroinvertebrate and plant communities reflect somewhat different aspects of wetland health. According to Gernes, macroinvertebrates are more directly linked to water quality whereas plants are more reflective of hydrological conditions and sediments. Also, the plant bioassessment can be used in drier wetlands, whereas the macroinvertebrate protocol requires at least a few centimeters of standing water.



Horsetail.

Macroinvertebrates

Volunteers who are used to monitoring macroinvertebrates in streams are in for some surprises with wetlands. To begin with, samples collected from wetlands will be full of vegetation and debris. "It's a royal pain," comments Helgen.

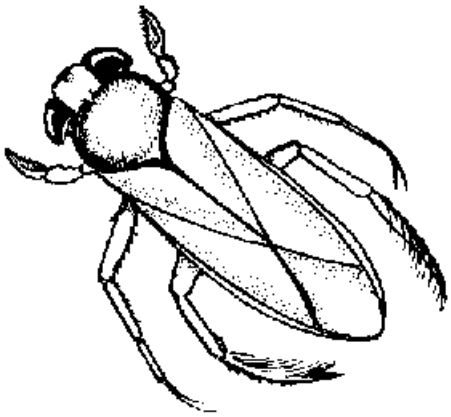
Common sideswimmer.

To deal with this problem, MPCA ecologists devised a technique they call the "dipnet-pan method." Material dipnetted from a wetland site is spread out over a screen placed above a pan of water. Over a period of 10 minutes (during which the debris is continually respread over the screen) the critters crawl out of the muck and drop or crawl into the water in the pan below. The pan contents are then poured through a sieve, and the invertebrates are preserved in alcohol. (For more complete instructions, contact Judy Helgen at the address below.)

Predator macroinvertebrates, such as beetles, are often missed in dipnet samples, both because they swim too fast and because many are night-active. To catch predators, the volunteers use a type of funnel trap, dubbed a "bottle trap" because it is made from plastic beverage bottles (see box).

Stream monitors will also find that wetlands are populated by a rather different assortment of macroinvertebrates. One glaring difference is that stoneflies (Plecoptera), a highly pollution-sensitive group whose presence is a hallmark of stream health, are usually absent from wetlands.

The WEP volunteers are using seven macroinvertebrate metrics specifically developed for Minnesota wetlands -- for example:



Water boatman.

ETSD: This metric is analogous to the EPT metric used in streams. (EPT stands for the pollution-sensitive groups Ephemeroptera, Plecoptera, and Trichoptera; common names mayflies, stoneflies, and caddisflies.) The "E" and "T" parts are the same in both metrics, but the "P" (Plecoptera) part of the stream metric has been dropped. Instead, two pollution-sensitive groups common in wetlands are used: fingernail clams, or Sphaeriidae ("S"), and dragonflies ("D"). A higher ETSD indicates a healthier site.

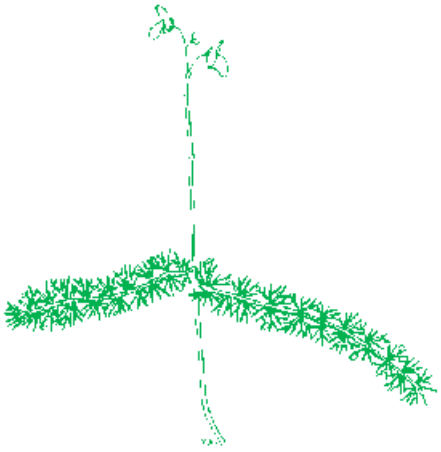
Amphibians: A metric measuring evidence of successful amphibian reproduction -- i.e., tadpoles, larval salamanders, or young newly metamorphosed frogs. Again, a high score indicates a healthy site.

Bugs: The relative abundance of Corixidae (water boatman) to the total number of true bugs and aquatic beetles. The boatmen are herbivorous; the other bugs and beetles are predators. A higher percentage of boatmen can indicate a disturbed or over-enriched site with lower water quality.

The other four metrics used are leech diversity, dragonfly-damselfly diversity, snail diversity, and total taxa. (Two new metrics that may be added are percent intolerant taxa and percent dominant two taxa.) The scores for the seven metrics are summed to arrive at an overall score of wetland health, called the invertebrate Wetland Index of Biological Integrity (WIBI).

Plants

For the plant bioassessment, volunteers identify and note the extent of cover of various kinds of plants in a standard-size plot. Seven metrics are used; for example:



Common sideswimmer.

Total number of kinds of grasslike plants: This metric measures the diversity of grasses and grasslike plants. A greater diversity suggests a healthy wetland.

Sedge cover: The score is based on the extent of the plot that is covered by sedges. Sedges are known to be sensitive to changes in wetland hydrology. The greater the extent of sedges, the healthier the wetland.

Presence of bladderwort: Bladderwort is a carnivorous plant whose presence suggests good health; its absence suggests that the wetland is stressed.

As in the macroinvertebrate bioassessment, the scores of the metrics are combined to obtain a vegetation WIBI.

On-the-ground experience

The WEP volunteers are trailblazers -- the first volunteer monitors in the country to attempt full-scale bioassessment of wetlands. Now that they have completed two sampling seasons (and are about to embark on the third), it's appropriate to ask, What has the on-the-ground experience been like?

The volunteers put in many hours, but they didn't seem to mind. "I think the bioassessment was a lot of fun for the volunteers," says Helgen. "Many are coming back in 1998 -- even though they are being told that it will be 40 or 50 hours of work."

"Having the volunteers work in teams of three to five was very valuable," comments Gernes, noting that team members' different areas of expertise tended to complement each other.

Helgen adds that having high school teachers as team leaders has been critical to the project's success. Not only do teachers have a high level of commitment and knowledge, they also can provide access to high school labs.

Common sideswimmer.

What about data quality? MPCA staff did parallel testing at 10 volunteer sites. For the invertebrate assessment, volunteer and staff results matched well for degraded wetlands but citizens tended to undervalue high-quality wetlands. Helgen says this was mainly because the citizens did not identify as many different types as the professionals.

To improve citizen results from high-quality wetlands, Helgen recommends (1) conducting training at high-quality as well as degraded sites; and (2) allowing more time for training, if possible. WEP's four days of training included just one day each for the two bioassessments. "The hard part is we throw so much at them in one day," says Helgen.

Gernes reports that, for the plant bioassessment, volunteer and staff results were typically very similar. When discrepancies did occur, Gernes believes they were due to problems in sample site location. Volunteer teams chose their own sampling sites within the wetlands -- and, as Gernes says, "it takes some experience to develop 'field eyes' -- to be able to pick out a site that is truly representative in terms of the vegetation." Improved training in how to select a sampling site should resolve this problem.

For more information, contact Judy Helgen at 612/296-7240 or Mark Gernes at 612/297-3363; both at MPCA, 520 Lafayette Rd., St. Paul, MN 55155. Note: A draft guidance manual is being prepared and should be ready by December 1998.

Macroinvertebrates

Macroinvertebrate biomonitor- ing protocols and manuals for streams and rivers are widely available for volunteer monitors. Recently much attention has been focused on the plight of wetlands, equally at risk to impact. The question has arisen, "Can invertebrates be used to monitor wetland conditions?" Because my Master's thesis was on wetland bioassessment, I was asked by the Environmental Protection Agency and Massachusetts Coastal Zone Management to examine just that question. After researching this question in Connecticut and on Cape Cod, I feel confident that the answer is YES.

The challenge was to design a methodology that was scientifically sound yet simple enough to be used by volunteers with suitable training. The result is the *Freshwater Wetlands Invertebrate Biomonitoring Protocol for the New England Region*, published in June 1997. Though the manual was written with the volunteer in mind, volunteers will need training and guidance from a trained wetland ecologist with an aquatic entomology background. A team leader with such a background could train and coordinate a group of volunteers.

To date, I have conducted several training sessions based on the manual. Trainees were EPA and state agency personnel, conservation commissioners, and university students. I estimate that it would take about five days to train volunteers with no previous experience.

Common sideswimmer.

Volunteer monitors familiar with stream invertebrate biomonitoring based on such manuals as *River Watch Network's Benthic Macroinvertebrate Monitoring Manual* or EPA's *Volunteer Stream Monitoring: A Methods Manual* will be familiar with the approach used in the manual -- but they will also notice some important differences.

Wetland sampling versus stream sampling

Wetlands have still waters, muddy substrates, and frequently dense vegetation. This makes sampling somewhat of a challenge. The kick seine, popular for stream sampling, can't be used since it depends on running water to wash organisms into the net. Artificial substrates are sometimes used, but they are difficult to transport into the field and must be left in place for several weeks for colonization to occur.

I favor the use of a D-net. It is very easy to carry, and by sweeping it through the water in a 180(DEGREE SIGN!!!)¡ arc you can sample the whole aquatic community: surface water, water column, vegetation surfaces, and top layer of soil substrate. I recommend taking three D-net samples at each station, at a water depth of approximately 18 inches. The disadvantages of this technique are: (1) samples are full of organic detritus, making it time-consuming to sort out the invertebrates, and (2) it is difficult to standardize the sampling.

The wetland invertebrate community

A typical New England freshwater wetland with a high diversity of vegetation supports an equally diverse macroinvertebrate community. At one of our training workshops, we collected 35 different families from a single station! (At a stream site, it would be quite unusual to collect as many as 20.)

Most of the insect families commonly found in streams, except for stoneflies, black flies, and a few others, also occur in wetlands, but their relative abundance is often quite different. For instance, the large amount of vegetation makes snails very common in wetlands. Detritivores like isopods, amphipods, and worms are also more common in wetlands, where they feed on the rich organic detritus at the bottom.

Oxygen levels in wetlands fluctuate widely over the course of a day, being very high in daylight and very low during darkness. (This phenomenon is natural, and is not an indicator of impact.) Thus water surface becomes an important habitat. Wetlands often have a high diversity of true bugs (Hemiptera) and beetles (Coleoptera), both of which are able to get air from the surface.

In any ecosystem, the top predators -- be they lions, wolves, or beetles -- are a key indicator of system health. In wetlands, the top predators are dragonflies, damselflies, and beetles.

What the manual covers

The New England manual is designed for freshwater wetlands with standing water present. Sampling methods for forested wetlands, wet meadows, and other wetlands with saturated soils are not included.

The bioassessment described in the manual requires identification of invertebrates to family level. It uses 11 metrics; for example:

EOT Richness: Total number of families of Ephemeroptera (mayflies), Odonata (dragonflies and damselflies), and Trichoptera (caddisflies). A greater number of families indicates better conditions.

Community Taxa Similarity Index: Shows the degree of similarity between the project site and the reference site. More similarity indicates a healthier site.

% Tolerant/% Intolerant: The ratio of pollution-tolerant to pollution-intolerant organisms. A high ratio is indicative of impairment.

Other metrics included are EOT/Chironomidae Ratio, Percent Composition of Dominant Group, Family Biotic Index, and five more. The metrics are summarized into an overall "Invertebrate Community Index."

The 37-page manual contains sections on sampling procedures, wetland characterization, quality assurance/quality control, and interpretation of results. Blank forms and data sheets are also provided. The manual does not include an identification key, but it does suggest taxonomic guides.

Copies of the manual can be obtained from: The Bulletin Distribution Center, Draper Hall, University of Massachusetts, Amherst MA 01003. Please enclose $3.00 for postage and handling.

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Monitoring Wetlands: Deciding What to Measure

by ***Tom Danielson***

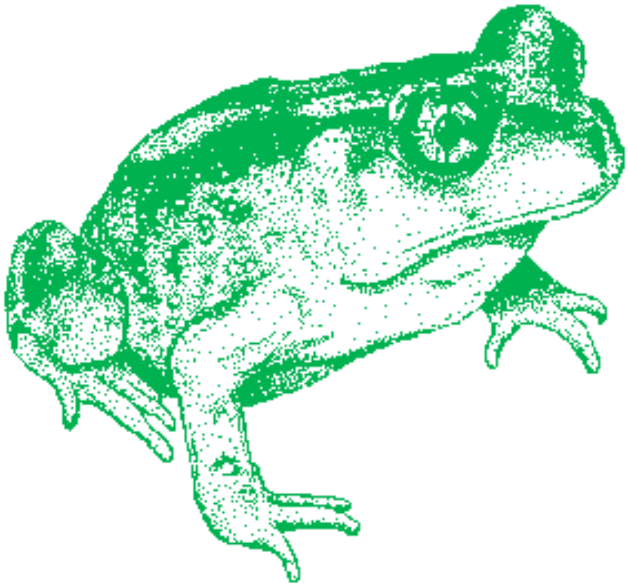
There is a rich tradition of volunteers monitoring the quality of streams, rivers, and lakes. Now, a growing number of volunteer groups are turning their attention to monitoring the quality of wetlands or the success of restoration activities. I often enjoy seeing the look on stream monitors' faces when they take their first step into a wetland. The bright glint of excitement is suddenly replaced by a worried expression as they sink to their ankles (or knees) in mud. You're not in a nice cobble stream anymore!

Obviously, monitoring wetlands comes with a new set of challenges. However, the benefits far outweigh the minor inconveniences. Wetlands include some of the most productive and diverse habitats in the world. The rich flora and fauna of wetlands can provide a lifetime's worth of beauty, exciting discoveries, and inspirational experiences. Besides, let's be honest, naturalists thrive on the "hardships" of becoming intimate with nature . . . and monitoring wetlands will provide no shortage of entertaining tales to share with your compatriots.

A variety of methods

There is no one "right way" to monitor wetlands. The purpose of this article is not to say that one method is better than another, but to introduce several types of methods and

their strengths and limitations. Wetland professionals use a variety of methods depending on the objectives of the monitoring programs. Some of these methods have been adapted by volunteer groups. In general, wetland monitoring methods can be clustered into four broad categories: (1) functional assessments, (2) habitat assessments, (3) wetland inventories and characterization, and (4) biological assessments.



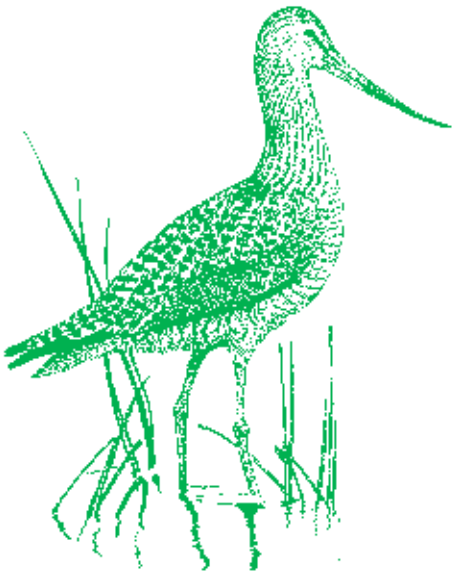
Spadefoot toad.

Functional assessments

To lake and stream monitors, the idea of a "functional assessment" may seem new and unfamiliar. Instead of measuring water quality parameters or characterizing biological communities, functional assessments attempt to estimate the ability of a wetland to perform various "functions," such as storing surface water, filtering water, and maintaining plant and animal communities.

Why is it that wetlands are sometimes evaluated in terms of function, while other water bodies usually are not? The reasons are complex; but a brief answer is that historically wetland policy has focused on protecting wetlands from being drained or filled. The main protection for wetlands has been under Section 404 of the Clean Water Act, which regulates dredging and filling and is administered by the Army Corps of Engineers. Since decisions on whether to issue dredge-and-fill permits take wetland function into account, methods were developed to assess functions. In contrast, protection for streams, lakes, and rivers historically focused on reducing the amount of chemicals discharged into them and maintaining their biological communities. The main protection for these water bodies has been state water quality standards. Only relatively recently have states started to develop bioassessment methods for wetlands and refine their water quality standards to better reflect conditions found in wetlands.

One of the first functional assessment methods was the Wetland Evaluation Technique (WET). This method failed to work as well as planned because it treated all wetland types the same and did not account for regional differences in wetland functions and values. The hydrogeomorphic (HGM) approach is a recent effort that is currently being developed by the Army Corps of Engineers. HGM actually consists of two parts: a wetland classification system and a series of regional functional assessment guide books for different wetland classes. By recognizing that wetland types can be very different and there can be large regional differences in wetlands, HGM is attempting to address two of the shortcomings of earlier functional assessment approaches.



Marbled Godwit.

In general, functional assessments tend to be "rapid" methods based on the "best professional judgment" of trained wetland professionals. Much of the information for the assessment can be obtained from maps and records. Only a single site visit is required and there is no need for exhaustive data collection in the field.

The same features that make functional assessments attractive also limit their use. The reliance on "best professional judgment" tends to limit this method's usefulness for volunteers, as well as for local governments and other organizations that don't have ready access to wetland experts. Also, these methods are sometimes subjective and difficult to reproduce from one professional to another. However, volunteers in Maine are using a modified functional assessment to monitor tidal marshes (see page 25).

Habitat assessments

Habitat assessment methods are based on the assumption that if the habitat is there, then the animals will be there. The classic model is the Habitat Evaluation Procedure (HEP), developed by the U.S. Fish and Wildlife Service to answer questions like "Would this be a good habitat for ducks?" (or any species of interest). For HEP, a team of biologists visits a wetland and judges the ability of the habitat to support the species in question.

Like functional assessments, habitat assessment methods require a trained biologist or wetland professional. However, volunteers can be trained to collect at least some of the needed data (e.g., vegetation type, number of snags). Perhaps the most limiting aspect of habitat assessments is that they tend to focus on only a small number of species and do not provide assessments of overall wetland quality. But they may be well suited for volunteer projects interested in protecting a single species, such as King Rails.

Wetland inventories and characterization

This approach has been the most widely used among volunteer monitoring groups. Some projects inventory just one or a few types of plants or animals. Volunteers with the Bird Studies Canada/Long Point Bird Observatory Marsh Monitoring Program, for example, monitor birds and amphibians.

Other projects in this category do extensive mapping and sampling of a variety of plant and animal communities, along with characterizing features like soils and hydrology. A

manual used by volunteers in Washington State, *Monitoring Wetlands: A Manual for Training Volunteers*, explains protocols for monitoring birds, amphibians, vegetation, hydrology, wetland buffer condition, soil types, and topography (see page 26 for ordering information). Volunteers at Jug Bay Wetlands Sanctuary in Maryland, one of the longest-running volunteer wetland monitoring programs in the country, survey fish, plants, birds, reptiles, and amphibians and study nutrient cycling. Citizen groups that follow such comprehensive approaches become intimately familiar with "their" wetlands and generate lots of useful data. However, these projects are often resource- and time-intensive, making them impractical for monitoring a large number of wetlands.

Biological assessments

In a biological assessment, investigators evaluate the condition of one or more biological "assemblages" (examples of assemblages are macroinvertebrates, plants, or fish). Since plant and animal assemblages reflect the cumulative effects of chemical, physical, and biological disturbances to a habitat, scientists can use them much the same way as a doctor would use a thermometer, blood pressure gauge, and other instruments in a physical exam.

Using biological communities as indicators is different from simply inventorying the biota, as described in the previous section. By evaluating the composition, diversity, and condition of a plant or animal assemblage, wetland scientists can determine the overall "health" of a wetland.

Fowler's Toad.

Bioassessments are designed to be a more rapid alternative to comprehensive inventories -- that is, you save time because you don't have to monitor everything. The tradeoff is that the bioassessment methods must be developed, tested, and validated by scientists before they can be used as a screening tool. In addition, the indicator organisms must be identified accurately, at least to family level, for the bioassessment to yield useful results. So for volunteers, there is a big investment up-front in training.

Many volunteer monitors are familiar with stream bioassessments using macroinvertebrates as indicators of stream quality. In this technique, macroinvertebrates from a stream sample are counted and identified (usually to family level). The data are then compiled into different "metrics," which are attributes that predictably change in value across a gradient from pristine sites to degraded sites. Common metrics include the number of mayfly, stonefly, and caddisfly families in a sample (EPT index) and the total number of families in a sample (taxa richness). Metric scores from the stream under study are compared to the metric scores in minimally impaired, or reference, sites. Through years of testing, stream scientists have chosen to use particular metrics because

they have been found to reflect human disturbances to stream ecosystems.

While protocols and metrics for stream bioassessment are well established, wetland bioassessment lags at least 15 years behind. (Nevertheless, some volunteers are already using bioassessments in wetlands; see page 14.) The challenge now for wetlands is to figure out what assemblages to monitor, what metrics to measure, and what sampling methods to use. To work on these problems, the U.S. EPA is coordinating an interagency "think tank" called the Biological Assessment of Wetlands Workgroup (BAWWG), which we fondly refer to as "bog." BAWWG has five focus groups, each investigating a different assemblage: algae, amphibians, birds, macroinvertebrates, and vascular plants.

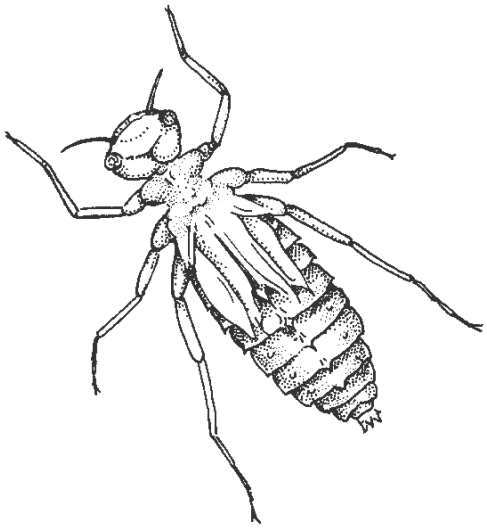
Each of these assemblages has strengths and weaknesses as a potential indicator of wetland health. For example, plants are good indicators because they are immobile (so they can't escape disturbances) and they are present in all wetlands. However, one drawback is that they often take a while before showing a response to a stressor. Birds are a perennial favorite because so many people care about them; but since they are highly mobile they are more reflective of conditions across a whole landscape rather than in a specific wetland. Amphibians are excellent sentinels of environmental condition, but their populations can naturally fluctuate from year to year. The boxes at right summarize some of the pros and cons for several assemblages.

The value of monitoring living things

As stated earlier, there is no single "right" way to monitor wetlands. But, as we've seen, volunteer groups who monitor wetlands most often focus on living things, whether through inventories or biological assessments -- and there is a good reason for this. "Critters are uniquely interesting to humans," notes Jon Kusler, director of the Association of State Wetland Managers. If a citizen group wants to raise community awareness of wetlands, they'll do better to talk about songbirds and frogs than about groundwater recharge and water storage capacity. As Kusler says, "People relate to things they can see, smell, taste, and hear; things they can count and list."

Judy Helgen, a wetland ecologist at Minnesota Pollution Control Agency and my colleague in the BAWWG workgroup, favors biological assessment because it focuses on the quality of the wetland itself, rather than on utilitarian functions or services that the wetland can provide to society. "We have no problem thinking about protecting lakes and streams for the sake of protecting the species that live there," she says, "but people don't always buy into the idea of protecting the ecological integrity of wetlands. Instead, people tend to look at wetlands as the ecosystem that cleans up human pollution before it gets to lakes and streams."

While wetlands do provide many values to society and are extremely important for



Dragonfly nymph.

protecting the health of streams, rivers and lakes, they also support unique communities of plants and animals that should receive the same protection. I encourage each of you to contact your state or local governments, nonprofit organizations, and schools to find out if you can help an existing wetland monitoring program. If they don't have one, ask why and offer your support in starting one. It is time to reawaken our childhood curiosities of searching for frogs among the lily pads and watching dragonflies whiz past our heads in a flash of color. Wetlands are beautiful and fascinating ecosystems and there is no better way to learn about them than to monitor them.

Resources

EPA Wetlands Division Website: http://www.epa.gov/owow/wetlands.

Adamus, Paul, and Karla Brandt. 1990. *Impacts on Quality of Inland Wetlands of the United States: A Survey of Indicators, Techniques, and Applications of Community Level Biomonitoring Data.* USEPA, Office of Research and Development, Washington, DC (EPA/600/3-90/073). Currently out of print but available at http://www.epa.gov/owow/wetlands/wqual.introweb.html.

Danielson, Thomas J. 1998. Wetland Biological Assessment Fact Sheets. USEPA, Office of Wetlands, Oceans, and Watersheds, Washington, DC (EPA/843/F/98/001).

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Potential indicators: Pros and cons

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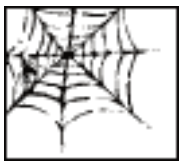

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Potential indicators: Pros and cons

Strengths and weaknesses of different assemblages that can be used as bioindicators for wetlands (based on Adamus and Brandt's 1990 report):

Birds

+ present in all wetlands
+ high recognition by society of their ecological importance
+ most are easy to identify
+ many highly skilled amateurs available
+ established sampling protocols available

- highly mobile and some are migratory, making it difficult to pinpoint causes of declines
- some are nocturnal (e.g.,

Macroinvertebrates

+ present in all wetlands
+ sampling methods fairly simple, except for wetlands that lack standing water
+ community can often be sampled yearround

- low recognition by society of their ecological importance
- sorting very laborious because of mud and plant matter

Vascular Plants

owls) or difficult to find (e.g., rails)
- some wetlands have only a few types, and many northern wetlands have very few birds in winter

- some wetlands have many (40+) macroinvertebrate families in a sample
- volunteers need extensive training to identify to family level

+ present in all wetlands
+ immobile and therefore reflective of site condition
+ standard sampling protocols well established
+ many regional identification keys available
+ sampling and identification relatively simple for woody plants and trees

- often a lag time in response to stressors
- only woody plant community can be completely characterized in dormant season
- sampling and identification difficult tfor some non-woody plants

Amphibians

+ some recognition by society of their ecological importance
+ adults are fairly simple to identify by sight or sound
+ sensitive to many environmental stressors

- adults may be in wetlands for short time only
- larvae can be difficult to identify

Algae

+ measurable in wetlands that lack survace water
+ generally immobile and therefore reflective of site conditions
+ sensitivity of many species to nutrient enrichment is well known
+ respond quickly to stressors
+ simple collections procedures

- low recognition by society of their ecological importance
- cannot be effectively sampled suring dormant season
- few wetland algae experts available to help

	- populations can be strongly influenced by natural environmental variations, making it difficult to determine the cause of a shift or decline	volunteer groups

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Monitoring Turtles in Wetlands

by ***Christopher Swarth***

When we think of conspicuous wetland animals, birds usually come to mind first. But don't forget that turtles are also abundant in many freshwater ecosystems, and a number of species are closely associated with wetland habitats. The wetland I study, at Jug Bay Wetlands Sanctuary in central Maryland, covers only about 1 square kilometer, yet it supports at least 400 turtles of five species.

Conservation focusing on wetland-dependent turtles has lagged behind projects aimed at other wetland animals (e.g. rails, songbirds, salamanders, and frogs), yet herpetologists agree that many turtles are suffering population declines. Habitat destruction, especially wetland loss, is considered to be a major cause. Unfortunately, basic information on natural history and geographical distribution that could be used to develop conservation plans is often lacking. Clearly there is an immediate need for studies focusing on turtles, and a role for volunteer monitors in helping to fill the many knowledge gaps.

If you're interested in monitoring turtles, start by gathering information about the turtles in your area -- review published texts and journals and contact experts at natural history museums, herpetological societies, university biology departments, or state and federal resource agencies. When you're ready to go into the field, consider the following monitoring techniques.

Basking turtle counts

Many turtle species bask at regular times of the day, usually between 10 a.m. and 2 p.m. Basking in the air serves to raise turtles' body temperature and also helps rid them of ectoparasites.

If you make regular counts of basking turtles, you will be able to estimate both population size and species diversity. Scout the area ahead of time to locate potential basking sites. Then position yourself in a location where you won't frighten the turtles into the water, and use a spotting scope or binoculars to make the counts. Here at Jug Bay we use a 20-power spotting scope to survey 15 basking sites which we can view from a single vantage point.

Blanding's turtle.

Make counts daily at the same location and time of day. Several counts at 30-minute intervals will give a better picture of turtle abundance than one single count. Weather conditions and environmental temperatures influence basking; these should be recorded at the time of the census.

Note that not all turtles bask regularly. A basking study will not be adequate for documenting the presence of infrequent baskers such as the Snapping Turtle and the Musk Turtle.

Trapping

Baited hoop traps, placed for several hours in suitable locations, are an excellent way to monitor turtle populations. Attracted to the bait (usually dead fish), turtles swim into the funnel-shaped trap and can't find their way back out. Traps must be placed with their tops exposed to the air, to allow trapped turtles to reach the surface to breathe.

Turtles are easily removed from the traps to be identified, inspected, and released. The turtles are not harmed in any way. (Note: Before efforts are made to trap turtles, contact your state resource agency to inquire about regulations and permits.)

Using these traps, volunteers and students working with me have captured and marked more than 200 turtles at Jug Bay Wetlands Sanctuary since 1995.

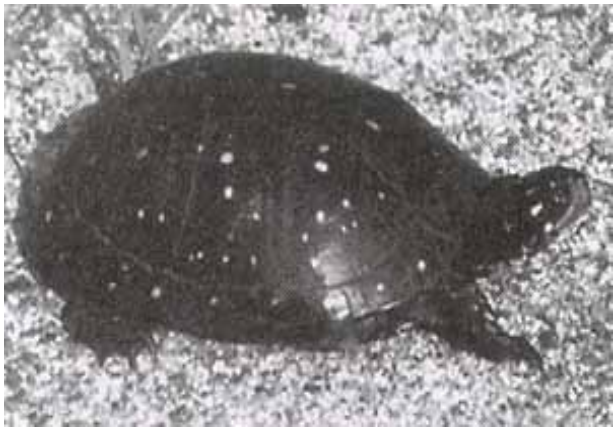
Monitoring destroyed turtle nests

Volunteer Terry Duckett sets out a hoop net to catch turtles at Jug Bay Wetlands Sanctuary.

In summer, many freshwater turtles venture briefly onto dry land to excavate nests and lay eggs. After the eggs are laid, the female covers the nest with soil and departs for the water, never to return to the nest. Quite often, raccoons, skunks, and oppossums dig up the nests to feast on the eggs.

While it may seem sad and morbid to monitor old dug-up turtle nests, volunteers can gather useful information on turtle populations by monitoring the magnitude of annual nest loss. Monitoring predated nests also helps to identify key areas used by nesting turtles.

Why not monitor intact nests? Basically because they are very hard to find, unless you're lucky enough to spot a female in the act of excavating and egg-laying (a 60-minute event). Destroyed nests, on the other hand, are easy to locate because the telltale eggshell fragments remain at the nest site for weeks after the eggs are eaten.



Spotted turtle.

Destroyed nests can be marked and their location mapped. Eggshell fragments should be collected in order to prevent counting them again later. Individual fragments could be inspected to make an estimate of clutch size or even to identify the species of turtle that laid them.

Resources

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Van Abbema, Jim, editor. 1997. *Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles: An International Conference*. New York Turtle and Tortoise Society. 494 pages.

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Organizations involved with turtle research and conservation:

Wetlands Institute, 1075 Stone Harbor Blvd., Stone Harbor, NJ 08247; 609/368-1236. Contact: Dr. Roger Wood.

New york tutrle and tortoise Society, P.O. Box 878, Orange, NJ 07051; 212/459-4803; http://www.erols.com/jvanabbema.

The Chelonian Research Foundation, 168 Goodrich St., Lunenburg, MA 01462; 978/582-9668; Rhodincrf@aol.com.

New England Herpetological Society, P.O. Box 1082, Boston, MA 02103; 617/789-5800.

Massachusetts Audobon Society, 208 South Great Rd., Lincoln, MA 01773; 781/259-9500. Contact Tom Tyning; ttyning@massaudobon.org.

Hudsonia Ltd., Bard College Field Station, Annandale, NY 12504; 914/758-1881. Contact Dr. Erik Kiviat (kiviat@bard.edu)

Institute for Herpetological Research, 1125 Mustang Dr., Santa Ynez, CA 93460; 805/693-0775. Contact: Brett Stearns.

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Amphibian Decline: Monitors Search for Answers

*by **Jude Griffin***

In the 1970s, an amazing kind of frog was discovered in Australia: the gastric brooding frog. The female swallowed her eggs, which would develop in her stomach until little froglets were ready to hatch...via their mother's mouth. Less than 20 years later, these frogs disappeared.

In the high mountains of Costa Rica, among pristine tropical cloud forests, the stunningly beautiful golden toad would appear every year in great numbers to breed. A spectacular event to behold, this beautiful display was legendary among locals. In the late 1980s, these toads disappeared. They have never been seen again.

All over the world, amphibians (frogs, toads, and salamanders) are disappearing. Some of the reasons are obvious. Most frogs and toads and many salamanders breed in wetlands, which have been destroyed at record rates. Even those wetlands which have theoretical protection under the law are not safe from the depredations of population sprawl and overdevelopment.

Amphibians respire through their skin. The porosity of their skin, so essential to survival, is also why amphibians can be exquisitely vulnerable to pollution in the soil, air, and water. Their bellies have a special patch which is even thinner and more porous.

So as they make their way through the water and mud, they become little environmental sponges, soaking up whatever is in their surroundings.

Amphibians must also contend with multitudinous assaults in the forms of acid rain and acidified soils, introduction of nonnative predators, formerly rare amphibian diseases now becoming more commonplace, and the disappearing ozone layer. The reduction of the ozone buffer around the planet means more and more UVB rays are penetrating our skies and us. UVB has been linked to deaths of amphibian eggs in the field and in labs. UVB might help explain why amphibians in remote, pristine areas are also disappearing.

Northern leopard frog

What makes the recent disappearances and extinctions so startling is that, for millions of years, amphibians have managed to flourish. They survived two major extinction episodes, including the one which saw the end of the dinosaurs. Yet now, herpetologists with 30 years of field experience are reporting that many frogs and toads are simply disappearing from large parts of their former range.

Why are they disappearing? How fast? What can we do to save them? All of these questions are of deep concern to the members of the Declining Amphibian Populations Task Force (DAPTF), which was formed by an international group of scientists in 1991 and now has over 3,000 members in over 90 countries committed to studying the causes of the declines and extinctions and learning how to halt them.

The North American Amphibian Monitoring Program

The nations of Canada, the U.S., and Mexico form DAPFT's North American component -- the North American Amphibian Monitoring Program (NAAMP), envisioned and designed over a series of meetings in the early nineties. The amphibians of North America are incredibly diverse, particularly in Mexico. Many of them are teetering on the edge of annihilation while others, like bullfrogs, seem to be doing okay. Since they live in wetlands, deserts, on high mountains, in our backyards, even within the Arctic Circle, the strategy for understanding what is happening with North American amphibians is necessarily a multipronged approach.

The five monitoring techniques that need to be implemented are:

- calling surveys

- terrestrial salamander monitoring
- aquatic surveys (includes surveying for egg masses and tadpoles)
- western North America surveys
- atlases

Calling surveys were chosen to be the first implementation priority of NAAMP because some states and provinces had already developed pilot programs and because the program could be carried out by volunteers. Calling survey programs began to be developed in 1995-96; currently 20 states and provinces have programs up and running, and 10 more are getting under way. In the summer of 1997, the terrestrial salamander program was launched.

The calling surveys, terrestrial salamander monitoring, and atlassing are overwhelmingly volunteer efforts. (To date there is less volunteer participation in the aquatic and western surveys, which often require more specialized knowledge, greater time commitments, and travel to remote regions.) Citizen volunteers are highly valued by NAAMP, not only because it would simply be impossible to monitor effectively without them, but because getting people out to learn more about frogs, toads, and salamanders is critical to amphibian conservation.

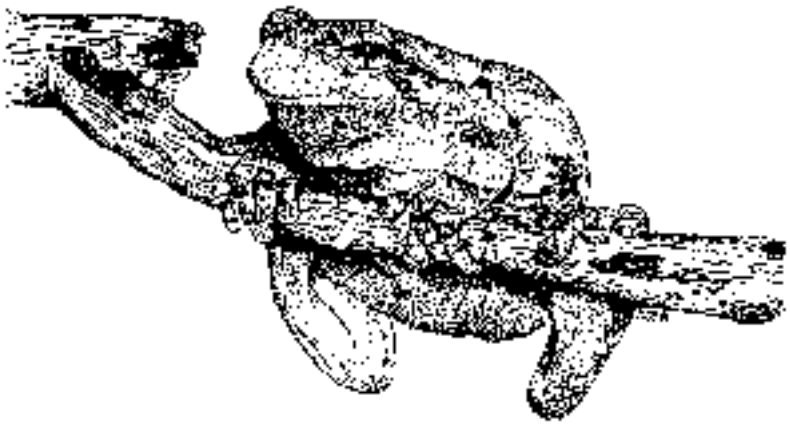
Calling surveys

Many species of frogs and toads, particularly in the eastern half of the country, call during their breeding season. Each species has a unique call, so through the use of training tapes, volunteers can quickly learn to identify the local calling amphibians in their area. Since different species breed at different times, there are usually only three to five species calling at any one time, so the number of calls to learn is quite manageable. Some calls you can hear once and always remember, like the grunting of the pig frog which sounds exactly like...a pig.

The surveys are run three to four times a year, usually about once a month from late winter to early summer. The scientists at NAAMP developed protocol guidelines, but each region must tailor its survey protocols to the particular breeding behavior of its local calling amphibians (see box).

Each volunteer runs a route, preferably with a partner. Routes have 10 stops at least 1/2 mile apart to avoid any overlapping of calls. To eliminate any biases associated with population demographics or participant preferences, routes are generated randomly by computer at the NAAMP office. These routes must then be groundtruthed by coordinators, since the computer sometimes generates routes that would require a boat,

plane, or passport to run. A volunteer in Maine, when asked if she had any equipment needs for the upcoming season, replied, "A bulldozer would help."



Gray treefrog.

Depending on the region, participants start their surveys 1/2 hour to 1 hour after sunset. They drive to their first stop, turn off the engine, wait quietly for about a minute in case the noise of their arrival disrupted calls, and then listen intently for three minutes.

Not everyone understands or even believes what the volunteers are doing. A Louisiana coordinator advises, "Try not to have the stops by private homes. A surprising number of people react very negatively to someone pulling up in front of their house at night, switching off their lights and engine and then standing there quietly in the dark." In Louisiana, volunteers have been stopped by law enforcement personnel who figured them for drug runners or even trysting lovers.

Surveyors note down all the species they hear and use a relative abundance code to estimate how many individuals of each species were calling.

Relative abundance code

0 - no individuals calling
1 - one or several calling; individuals easily distinguished, no overlapping of calls
2 - some overlapping of calls, but individuals can still be distinguished
3 - calls are constant and overlapping, individuals cannot be distinguished

The program is constantly undergoing fine-tuning by coordinators and volunteers. We are grappling with a number of issues, including predicting breeding times in an era of erratic weather patterns and how to check and maintain data quality.

Terrestrial salamander monitoring

The terrestrial salamander monitoring program, launched in summer 1997, uses citizen volunteers to conduct pioneering research on the lives and times of salamanders. Salamanders don't call as reliably or audibly as frogs and toads, so other techniques are used. Monitors set out arrays of cover objects (wood boards) in nearby forests where

salamanders are known to live, then check periodically to see who is hanging out under the boards and how many of them have gathered there.

Get involved

To learn more about what NAAMP is doing and how you can participate, visit us at http://www.mp1-pwrc.usgs.gov/amphibs.html (links to additional resources) or write us at the address below.

Jude Griffin is the USGS NAAMP Coordinator at the USGS Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, MD 20708-4038; naamp@usgs.gov.

Marbled salamander.

Windows of Opportunity

Each state has its own schedule for calling surveys, timed to correspond to the "windows" when different species are calling. This example is from Vermont.

Routes are to be run on rainy or humid nights during the following windows:

Window 1: Wood frogs and spring peepers. A 2-week period beginning after the first warm rains (> 42°F) in late March or April.

Window 2: Spring peepers, northern leopard frog, pickerel frog, American toad, and possibly gray treefrog. A 2-week period beginning May 1 in the south or at low elevations, and May 15 in the north or at high elevations.

Window 3: Gray treefrog, green frog, bullfrog, mink frog (northern half of state), and Fowler's toad (Connecticut River valley). A 2-week period beginning the last week of June (southern & valley areas) or the first week of July (northern & ridgetop areas).

New Volunteer Monitoring Listserver

Attention program coordinators! Want to spread the news about upcoming events and publications? Have a technical monitoring or program management question you'd like to discuss with other coordinators? The EPA has established a volunteer monitoring listserver for this purpose. Known as "volmonitor," it's designed to help monitoring programs post notices about events, conferences, and publications, and exchange information about monitoring methods, data management issues, volunteer organizing and training, and any related topics of interest.

If you'd like to subscribe, send an email message to: listserver@unixmail.rtpnc.epa.gov.

Leave the subject line of your message blank, and in the message type: subscribe volmonitor lastname firstname. You'll receive an acknowledgement and a welcome file by return email.

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Defending the Underdog: Volunteers Protect Vernal Pools

While wetlands of all types need protection, vernal pools are probably the most vulnerable of all. In the words of Mike Hayslett (who is currently working to protect these pools in his home state of Virginia), "Vernal pools are the underdogs of the wet land world."

Vernal pools -- also known by many other names (see sidebar, opposite) -- are easily overlooked and easily destroyed. They are by definition small, and isolated from other water bodies. Worse, they are temporary -- at certain times of year they dry up, ma king them all but unrecognizable.

Yet it is this very property of drying up that makes vernal pools such valuable habitat. Fish can't live in a pool that dries up, and for many small creatures a pool devoid of predatory fish is a very nice place to raise a family.

Lifestyles of vernal pool dwellers

Several kinds of animals -- notably fairy shrimp and certain species of amphibians -- are dependent on vernal pools for successful reproduction. These "indicator" vernal pool species have evolved special strategies to cope with the eventual disappearance of the water. Life in a vernal pool is a race against time -- so the eggs and larvae of vernal pool amphibians (salamanders and frogs) are capable of developing rapidly, to be ready to move onto land before the pool dries up. Fairy shrimp have a different strategy: they lay

resistant eggs that survive the dry period and hatch the following year (or even several years later) when the pool refills.

Massachusetts volunteers certify pools

Volunteer efforts to locate, identify, and protect vernal pools got a big boost in Massachusetts in 1987, when new state legislation gave special protection to vernal pools -- provided they were "certified" by the Massachusetts Division of Fisheries and W ildlife's Natural Heritage Program. In response, Massachusetts Audubon Society produced a manual, Certified: A Citizen's Step-by-Step Guide to Protecting Vernal Pools (first published in 1989), to help citizens locate vernal pools and get them officially certified.

"The certification legislation gave new impetus to volunteer monitoring," says Betsy Colburn, an aquatic ecologist with Massachusetts Audubon and the editor of Certified. "People got excited when they realized their efforts would lead to definite, concret e protection under the law."

The same vernal pool in early spring (above) and in late spring in a dry year. Spring is the best time to identify vernal pools, since biological activity peaks then. Often pools dry completely in summer; this ke eps them free of fish.

The procedures outlined in the manual are quite simple and straightforward. Basically, the citizen has three tasks: (1) locate potential vernal pools (not always easy because of the pools' small size and temporary nature); (2) find evidence that qualifies the pool as a vernal pool; and (3) send documentation to the Division of Fisheries and Wildlife.

In Massachusetts, a vernal pool must be a confined basin depression with no permanent above-ground outlet and must contain water for at least two months. The easiest way to get a pool certified is to document its use by so-called obligate, or indicator, v ernal pool species. It is also possible, though more difficult, to certify a vernal pool by documenting (a) its use by facultative species -- i.e., species that are often found in vernal pools but are not dependent on them -- and (b) the absence of fish.

In Massachusetts the indicator species are:

- fairy shrimp
- wood frog
- spotted salamander
- the blue-spotted salamander group (several closely related species)
- marbled salamander

Wood frog

Since fairy shrimp spend their entire life cycles in vernal pools, and can't live anywhere else, the presence of any fairy shrimp in a pool is sufficient grounds for certification.

The amphibian indicators are dependent on vernal pools for breeding, but don't spend their whole lives there. (An adult wood frog or spotted salamander hanging out in a pool might just be visiting; it might use another pond for breeding.) Thus, the volunt eer monitor needs to look for specific evidence of breeding in the pool -- for example, evidence of mating (calling wood frogs, mating salamanders or frogs), or presence of egg masses or immature young (wood frog tadpoles, salamander larvae, or metamorpho sing juveniles).

The *Certified* manual provides detailed guidance on observing, recognizing, and documenting egg masses, juveniles, and adults of common vernal pool species. It also explains how to complete the forms and maps required for certification, along with s upporting evidence (such as photographs), and submit them to the Division of Fisheries and Wildlife.

Students get involved

Shortly after *Certified* was published, biology teacher Leo Kenney attended a Natural Heritage Program workshop on pool certification. Kenney and his students at Reading Memorial High School had already been studying vernal pools for years, but now they decided to tackle the project of finding and certifying every vernal pool in the town of Reading, Massachusetts. "It was a two-year project to find the pools -- 65 in all -- get landowners' permission, collect evidence, and do all the paperwork to ge t them certified," says Kenney.

Reading Memorial High School students net for vernal pool fauna such as amphibian larvae and fairy shrimp.

The students enjoyed the project so much that they decided to form a club -- the Vernal Pool Association. ("Leo's students got so fired up, the project just took off -- it was incredible," says Betsy Colburn.) After certifying another 200 or so pools in a djoining towns, the VPA decided to put their efforts into educating other people. Over the past few years, Kenney and the students have conducted workshops, published articles and a manual (*Wicked Big Puddles;* see the Volunteer Wetland Monitoring Manuals: An Annotated Bibliography for ordering information), and created a Website (http://earth.simmons.edu/vernal/pool/vernal.htm), through which they have helped hundreds of teachers establish vernal pool projects with their classes.

Wood frog eggs.

A widening effort

"One of the best things that's happened is that the Massachusetts effort has spawned so much activity in other states," says Colburn.

Vernal pool manuals (based on Certified) have already been published in Maine and New Hampshire. Except for slight state-to-state differences in the species used as indicators, the procedures are very similar. Also, each state has different protective reg ulations for vernal pools (and only Massachusetts has the "certification" process).

Other New England states are now poised to begin vernal pool monitoring programs. Jim Kellogg, an aquatic biologist at Vermont Department of Environmental Conservation (DEC), explains that under Vermont law vernal pools are automatically protected, withou t a requirement for formal certification. There's a catch, though. "They're protected," says Kellogg, "but we have no idea where they are or how many there are. The first step is to put them on the map. I foresee a real strong volunteer component because that's the only way we can locate them." DEC plans to work with the Vermont Institute of Natural Science (VINS) to develop a statewide vernal pool mapping and monitoring project.

In Maine, volunteers will soon go beyond simply identifying vernal pools. Aram Calhoun, a professor in the University of Maine's Applied Ecology and Environmental Science Department and the author of Maine's vernal pool manual, plans to initiate a long-te rm volunteer monitoring program for vernal pools in the summer of 1998. "The goal is to get 30 vernal pools statewide monitored thoroughly and on a permanent basis," she says. Volunteers will monitor hydrology as well as vernal pool indicator species. Cal houn will analyze the data, looking for answers to questions like: Do all the pools dry up? When do they dry up? How much year-to-year variability is there in egg production? in hydrology? in successful maturation of amphibians?

Spadefoot toad.

Beyond New England

Volunteer monitoring of vernal pools is also moving beyond New England. In Minnesota, volunteers with the Wetland Evaluation Project are using techniques adapted from Certified and Wicked Big Puddles. "People come away amazed at the biological diversity t hey find in what appears to be a puddle in the woods or a tangle of old trees and grasses near the edge of a field," says Minnesota Pollution Agency ecologist Judy Helgen.

Clearing around a vernal pool damages both the pool itself and surrounding upland habitat for vernal pool amphibians.

Helgen, who recently developed a bioassessment technique for Minnesota wetlands (see page 14), is currently looking at potential indicator organisms that could be used for bioassessment in vernal pools. One intriguing candidate is the "egg bank" in the so il. Helgen explains that resting eggs of invertebrates such as fairy shrimp, Daphnia, rotifers, and mosquitoes can be found in the soil at the bottom of pools. She is investigating whether the number of kinds of eggs might be an indicator of pool health.

In Virginia, biologist Mike Hayslett is working to establish a "Schools for Pools" program in which middle and high school classes will adopt nearby vernal pools. Hayslett points out that vernal pools offer teachers and students "ecology in a bowl" -- wit h opportunities for integrating learning activities in

such diverse areas as biology, hydrology, conservation, journalism, community education, and land use history.

Through the use of "compressed video conferences" (live two-way talk sessions), Hayslett plans to link up vernal pool experts with schools around the state. "The vision is to get every pool in Virginia adopted," he says.

Out in California, volunteer monitoring of vernal pools is just getting started. California vernal pools -- unlike those in the East -- are notable as much for their distinctive flora as for their fauna. California contains a number of plant species that are restricted to vernal pools, and many of these species are threatened or endangered. At Jepson Prairie Preserve in Solano County, California, volunteers go out one day each year to monitor the population of two species of endangered grass (both of them specific to vernal pools) and track the invasion of a nonnative perennial.

Mike Hayslett notes that the recent upsurge of interest in wetlands, and especially concerns over amphibian declines, are helping to bring vernal pools some long-overdue attention. "And not a minute too soon," says Hayslett, pointing out that "the majorit y of these mini-ecosystems are found on privately owned lands and can disappear before they're even discovered."

Because they are usually small, vernal pools often fall through the cracks of protective legislation. Typically, federal regulations do not require any permits or impact reporting for filling or draining a wetland with an area of less than 5,000 square fe et. "Who's going to speak up for wetlands that don't fit the traditional categories?" asks Hayslett.

Put it all together -- small temporary pools that often go unnoticed, specialized animals whose survival is dependent on these pools, and a lack of protective legislation -- and the critical need for citizen monitoring and protection becomes all too clear .

Spotted salamander larvae.

For more information on the vernal pool manuals mentioned above, please see the Volunteer Wetland Monitoring Manuals: An Annotated Bibliography.

What is a vernal pool?

Literally, "vernal pool" means "spring pool," and in many parts of the country these pools do tend to fill in spring and dry up in summer, but the name also includes pools that fill at other times. The important point is that biological activity (amphibia n breeding, in particular) peaks in spring.

In general vernal pools are small, temporary, and isolated, and they provide essential breeding habitat for certain animals that are dependent on them. Not all vernal pools dry up completely; the essential requirement is that the pond is free of fish. A p ond that becomes too shallow and hot in summer for fish to survive could be a vernal pool.

Some states have developed very specific legal definitions of vernal pools for use in regulatory and protective legislation. These differ from state to state, and may specify criteria such as the minimum length of time water must be present or which speci es are defined as indicators.

The Case of the Disappearing Pond (Aliases: Hogwallow, Prairie Pothole, ...)

*by **Michael S. Hayslett***

"You got any 'disappearing ponds' on your place?" This may be among the questions a landowner is asked by a vernal pool detective. But the detective should be well versed in local vernacular, for the names used to refer to these pools are as varied as the regions where they are found. They may be called hogwallows, whale wallows, buffalo wallows, prairie potholes, sinkholes, or numerous other and equally colorful colloquial names. (A more scientific -- though considerably less poetic -- name would be "sea sonally ponded isolated wetland.")

In southern California's Mediterranean-like environment, the term "whale wallows" is used to describe desert depressions where prehistoric-looking tadpole shrimp -- not whales -- wiggle in the shallow waters. Down south, Georgia "granite flatrock pools" c an be mountain-top rock depressions that hold rainwater and support endemic fairy shrimp and rare plants. Out in the "prairie pothole" regions of Canada and the Midwest, in places like Minnesota, millions of protein-rich fairy shrimp provide sustenance ea ch year for half of this continent's waterfowl. And in the coastal Carolinas,

"Carolina bays" hold shallow fresh waters and provide habitat for vernal pool amphibians and a myriad of other organisms. I coined the phrase "disappearing ponds" a while back t o imply both the temporal and tenuous nature of these ephemeral and rare habitats.

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Maine Tidal Marshes: Assessing Functions and Values

by ***Rob Bryan***

Maine's tidal marshes provide essential habitat not only for a number of resident species but also for many migratory species of great conservation value, such as black ducks, peregrine falcons, and striped bass. Although these marshes currently enjoy strong protection under state and federal regulations, historical activities that occurred on or in tidal marshes pose a continued and growing threat.

Structures like this road crossing often restrict tidal flows in coastal marshes. This can affect the plant community above the restriction, leading to the spread of invasive species.

The biggest problem is the presence of numerous roads, culverts, bridges, and other structures that cross the marshes and restrict tidal flows. These tidal restrictions often result in lower salinity, which in turn encourages the spread of invasive species that replace native salt marsh plants. There is evidence that the most aggressive of these plants, common reed (Phragmites australis), is spreading in tidal marshes along Maine's extensive coastline.

Tidal restrictions also impede the ability of

marshes to keep up with sea level rise. Over the last 4,000 years, sediment transported by incoming tides has allowed New England salt marshes to keep up with rising sea levels, but now tidal restrictions are preventing suspended sediments from reaching the marsh surface.

Tidal marsh manual

Recognizing that local awareness and support are essential for successful conservation and restoration of tidal marshes, Maine Audubon Society published the Maine Citizens Guide to Evaluating, Restoring, and Managing Tidal Marshes in 1997. This manual, which was adapted from a similar guide produced by the Audubon Society of New Hampshire, describes a method that local land protection groups, conservation commissions, and other nonprofessionals can use to analyze tidal marshes and initiate conservation actions at the local community level.

The core of the guide is the tidal marsh evaluation process, which consists of seven separate assessments. The first two evaluate ecological integrity (an indication of the degree of human impact on the marsh ecosystem). The remaining five assessments each focus on a different function or value of the marsh. They evaluate how well the marsh is performing certain ecological functions, such as providing habitat for wildlife, or providing certain benefits to society, such as recreational or educational oppor-tunities.

As can be seen from the example in the box at right, the questions used for the assessments can be answered by a combination of simple visual observations of the marsh and information obtained from maps and aerial photographs. Thus the method does not require extensive training or a large commitment of time.

The manual also helps citizens take action on problems discovered in the assessment. For example, say an assessment identifies tidal restrictions that are leading to a degradation of the marsh surface. The manual provides guidance on contacting the appropriate state and federal agencies that could provide financial and technical assistance with a restoration project.

What the method does -- and doesn't do

The strength of the assessment technique described in the manual is that it allows an observer to quickly capture the "big picture." It is a good tool for obtaining a relative measure of overall wetland health, locating problem areas, and identifying sites for potential restoration. The information gathered is useful for guiding management decisions on such actions as:

- improving recreational or educational access

- restoring degraded sites
- revising zoning regulations to protect upland buffers
- prioritizing land protection projects

Phragmites.

On the other hand, the assessment provides only limited, descriptive information on wetland characteristics. Volunteers record the presence of different estuarine habitat types (e.g., high marsh, low marsh, flats) as well as wildlife observations. However, the method does not include an inventory of particular animals or plants (except a few invasive species). Nor is it designed for long-term monitoring or to assess trends. For such purposes, the more in-depth approaches described elsewhere in this newsletter (e.g., Oregon Wetlands Study, Wetland Evaluation Project in Minnesota) would be more appropriate. Of course, these more comprehensive studies also require considerably more time, both for training and for data collection.

Lessons learned

During 1997 Maine Audubon conducted four workshops and trained approximately 60 potential volunteers in the use of the manual. Overall we found that most workshop participants came out of a general desire to learn more about tidal marshes. We had hoped that attendees would go on to initiate their own assessment projects, but we found that most did not do so, except in cases where there was a clearly recognizable threat. In one community, for example, we are working with volunteers and the University of New England to evaluate the impacts of a tide gate that is keeping almost all saltwater out of a small marsh.

Managing Natural Resources is often more a matter of managing the people who make decisions that affect the resource.

Why didn't more projects result from the workshops? It seems likely that the seven-part assessment process was a bit daunting for volunteers. A great deal of information must be gathered, yet the connection between the information and actual problems is not always clear.

We have learned from our experience to date and plan to take a more focused approach in 1998. For example, we will:

- Initially use just one of the seven assessments -- the assessment of "ecological integrity of the marsh." This assessment directly addresses the two issues -- tidal restrictions and invasive species -- that are usually of greatest local concern.

- Focus on those communities that have expressed the most interest, and limit the number of projects to those we can effectively coordinate and monitor.

- Break the assessment process down into manageable tasks. Volunteers, like the rest of us, usually have too many demands on their time. To make the most of their interests and abilities, we will assign volunteers specific projects that are finite and easily taught. For more complex tasks, Maine Audubon staff will take the lead but involve volunteers as field assistants.

Most of us involved in conservation were trained in biology or related natural sciences. However, managing natural resources is often more a matter of managing the people who make decisions that affect the resource. Our goal at Maine Audubon is to build bridges between local citizens who want to protect and restore tidal marshes and government agencies who may have the statutory authority, technical expertise, and funding to make projects happen. A knowledgeable public armed with sound information is nature's best defense.

Copies of the Maine Citizens Guide to Evaluating, Restoring, and Managing Tidal Marshes *are available for $13 (Maine residents add 60¢ sales tax) from Jennifer Morin at the Maine Audubon Society.*

***Rob Bryan** is a Forest and Wetland Habitat Ecologist with Maine Audubon Society, P.O. Box 6009, Falmouth, ME 04105; 207/781-6180 ext. 235; rbryan@maineaudubon.org.*

[*Editor's note:* Volunteers in Rhode Island recently used a very similar assessment technique; see Rhode Island Volunteers Assess Salt Marsh Restoration Potential]

How the assessment works

For each assessment, the *Maine Citizens Guide to Evaluating, Restoring, and Managing Tidal Marshes* takes the evaluator through a series of questions. The answers are assigned a "Functional Index" (FI) score which ranges from 0.1 (worst condition) to 1.0 (best condition).

For example, Assessment 1, which evaluates "ecological integrity of the marsh ecosystem," consists of five questions; three of them are shown below:

FI score

- Number of tidal restrictions

(a) None	1.0
(b) One	0.5
(c) More than one	0.1

- Fill on marsh surface

(a) <5% filled	1.0
(b) 5-15% filled	0.5
(c) >15% filled	0.1

- Dominance of invasive species

(a) <5%	1.0
(b) 5-15%	0.5
(c) >15%	0.1

Interpretation: After all items are answered for a given assessment, the Functional Index scores are averaged to obtain an Average Functional Index (AFI). For the above assessment, a high AFI indicates a high degree of ecological integrity. On the other hand, a low AFI indicates a marsh that has been heavily impacted by human activity; such a site might be a good candidate for restoration.

The guide also contains assessments for:

- Ecological integrity of the zone of influence
- Wildlife, finfish, and shellfish habitat
- Recreational and commercial potential
- Aesthetic quality
- Educational potential
- Noteworthiness (e.g., significant historical or archaeological sites)

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Volunteer Wetland Monitoring Manuals: An Annotated Bibliography

*by **Matthew Witten***

This bibliography is a slightly modified version of one I prepared for USEPA Division of Wetlands. (A longer version will be published by the EPA later this year; it will also be available on the EPA Wetlands Website at www.epa.gov/owow/wetlands.) For each manual, I have tried to give an indication of the degree of scientific rigor, the methods covered, and the orientation (i.e., whether the manual is specific to a particular geographical region and/or wetland type). The first two manuals listed are broad in scope and cover a variety of different methods; the others are more specialized.

Miller, T., C. Bertolotto, J. Martin, and L. Storm. 1996. *Monitoring Wetlands: A Manual for Training Volunteers.* Adopt a Beach, Seattle, WA. 106 pages plus appendices.

For an A to Z manual on organizing volunteer teams to conduct an array of wetland field surveys, this is the book to have. Based on the methods used in the Oregon Wetlands Study (see page 10) and field-tested by Watershed Community Link (see page 5), the manual includes step-by-step instructions on establishing baselines and transects; documenting land uses; assessing conditions in wetland buffer areas; and monitoring wetland hydrology, soils, vegetation, topography, birds, and amphibians. It also covers volunteer training and safety, and quality assurance.

The style is sufficiently technical for field use, yet clear, concise, and easy to read.
Features:

- Based on field experience; includes actual case studies
- Examples of data forms (completed as well as blank)
- Thorough appendices including references, glossary, and further instructions

Orientation:

- Somewhat specific to the Pacific Northwest

To obtain: Adopt a Beach, 4649 Sunnyside Ave. N., Rm 305, Seattle, WA 98103; 206/632-1390. $15.

(*Note:* To accompany the manual, Adopt a Beach has produced a set of six videos, intended for trainers. Though not professionally produced, the videos contain some useful information, particularly the demonstrations of specific techniques -- such as building a staff gauge or establishing transect lines. The set may be purchased for $60, or rented for one month for $15 plus a $45 refundable deposit.)

Williams, C., K. Firehock, and J. Vincentz. 1996. *Save Our Streams Handbook for Wetlands Conservation and Sustainability*. Izaak Walton League of America, Gaithersburg, MD. 175 pages plus appendices.

In contrast to the other manuals listed here, which are based on specific monitoring projects, the Save Our Streams handbook pulls together information and techniques from a variety of sources. Aimed primarily at the beginning wetland explorer and advocate, the book provides a good introduction to wetland issues and to the scope of monitoring approaches that are available. Once a group decides which techniques they plan to use, they will probably want to supplement the information in this handbook with other references and/or advice from local experts.

(*Note:* A revised 2nd edition of the manual will be available in August 1998.)

Features:

- Very good primer on wetland definition, values, and functions
- Ideas for educational activities and citizen action

- Thorough, annotated bibliography
- Numerous sample data forms

Orientation:

- National in scope

To obtain: Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878-2983; 800/284-4952. $35 + $5 S&H.

(*Note:* Save Our Streams is offering 2-day workshops based on the manual; see Wetland Workshops.)

Pritchard, K. 1991. *A Field Guide to Wetland Characterization and Wetland Plant Guide.* Washington State University Cooperative Extension, King County, Seattle, WA. 95 pages.

This small booklet is intended for "people who are curious about wetlands but have no formal training in field biology." Using the guide, the observer can determine whether or not an area is a wetland (and, if so, what type of wetland it is), and can gain some insight into the wetland's condition, including evidence of human impact. The guide goes step-by-step (in dichotomous key fashion) through the same observational and reasoning processes that a wetland ecologist goes through in characterizing a wetland. Its approach is unique (characterization with no invasive or instrumental monitoring) and invaluable.

Features:

- Extremely condensed and concise, yet also clear and vivid
- Fine and detailed drawings
- A field-savvy document, with appropriate cautions for the beginner

Orientation:

- Methods are entirely observational; no sampling
- Specific to Oregon and Washington

To obtain: Washington State University Cooperative Extension, King County, attn: WSU Publications, 700 5th Ave., Suite 3700, Seattle, WA 98104; 206/296-3900. $4 (WA residents add 34¢ sales tax).

Marsh Monitoring Program. 1997. Instruction booklet for volunteers. Long Point Bird Observatory and Environment Canada. 40 pages.

This instructional booklet was specifically written for volunteers in the Marsh Monitoring Program in the Great Lakes Basin. Addressed directly to the volunteer, it sets forth clearly and in detail the Marsh Monitoring Program's protocol for monitoring birds and amphibians. Features:

- Highly focused and detailed, yet easy to follow
- Thoroughly field-tested and very user-friendly Orientation:
- Designed for Great Lakes basin (although methods could be applied elsewhere)
- Specific to freshwater marshes To obtain: Bird Studies Canada/Long Point Bird Observatory, P.O. Box 160, Port Rowan, Ontario N0E 1MO; 519/586-3531. $15 (free to Marsh Monitoring Program volunteers).

Bryan, R., M. Dionne, R. Cook, J. Jones, and A. Goodspeed. 1997. *Maine Citizens Guide to Evaluating, Restoring, and Managing Tidal Marshes.* Maine Audubon Society, Falmouth, Maine. 87 pages plus appendices.

This guide sets forth a method (adapted from the New Hampshire Coastal Method by R.A. Cook et al., 1993) for assessing salt marshes for overall ecological health as well as important functions and values. Not intended for long-term scientific monitoring, the assessment method is geared toward collecting observational data that can be used to guide local planning efforts (for more on the method, see article on page 25). Although the manual is quite technical and detailed, it is very methodical and includes clear definitions and explanations.

The guide also includes sections on tidal marsh ecology, regulatory protection, using information from aerial photographs and maps, and marsh restoration and conservation.

Features:

- Detailed instructions on mapping, including use of National Wetland Inventory maps

- Thorough appendices, including a brief summary of the US Fish and Wildlife Service's wetland classification system (Cowardin system)

Orientation:

- Tidal wetlands
- Emphasis on Maine contacts and regulations, but otherwise applicable elsewhere

To obtain: Maine Audubon Society, P.O. Box 6009, Falmouth, ME 04105-6009; 207/781-6180 ext. 235. $13 (Maine residents add 60¢ sales tax).

Lipsky, A. 1996. *Narragansett Bay Method: A Manual for Salt Marsh Evaluation.* Save the Bay, Providence, RI. 22 pages.

Like the Maine manual described above, this manual is based on the New Hampshire Coastal Method and outlines a partly paper, partly observational evaluation of salt marshes and adjacent uplands. The manual is short and informal (photocopied), and was designed for use by Rhode Island volunteers to help gauge the restoration potential of altered and degraded salt marshes in Narragansett Bay.

Orientation:

- Tidal wetlands
- Somewhat specific to Rhode Island

To obtain: Save the Bay, 434 Smith St., Providence, RI 02908-3770; 401/272-3540. Free.

United States Environmental Protection Agency. 1996. *Wetland Walk Manual: A Guidebook for Citizen Participation* (EPA 910/R-009). USEPA Region 10, Seattle, WA. 16 pages.

This is a bare-bones guide for citizens to record some systematic visual observations of wetlands. While it is a good introduction to wetland observation for volunteers who do not have a lot of time to invest, a monitoring program that expects reliable and useful results would probably not base their training on this manual.

Orientation:

- Pacific Northwest focus

To obtain: USEPA, Region 10, 1200 Sixth Ave. (ECO-081), Seattle, WA 98101-9797, 206/553-6686. Free.

Vernal pool manuals
The manuals listed below all contain very complete instructions, including numerous illustrations of vernal pool fauna, to help citizens locate, identify, map, and study vernal (ephemeral) pools. The Massachusetts Audubon manual, Certified, was produced first (first edition, 1988), and the other three manuals are all based on it. (Note: For more on vernal pool monitoring, see Defending the Underdog: Volunteers Protect Vernal Pools.)

Colburn, E.A., ed. 1997. *Certified: A Citizen's Step-by-Step Guide to Protecting Vernal Pools*, 7th ed. Massachusetts Audubon Society, Lincoln, MA. 109 pages.

Massachusetts regulations afford special protection to vernal pools that are "certified" by the state Division of Fisheries and Wildlife. This manual provides all the information a citizen needs to complete the certification process.

Also available: 52-page curriculum companion for grades 3-12: *Vernal Pool Lessons and Activities.*

To obtain: Massachusetts Audubon Society, 208 South Great Rd., Lincoln, MA 01773; 781/259-9506 ext. 7255. Manual $9 +$2 S&H; curriculum guide $7.50 + $2 S&H.

Kenney, L.P. 1995. *Wicked Big Puddles: A Guide to the Study and Certification of Vernal Pools.* Reading Memorial High School--Vernal Pool Association, Reading, MA. 58 pages plus appendices.

Aimed at Massachusetts high school students but useful to anyone interested in vernal pools, this highly readable manual is filled with practical tips for making field observations and includes a large number of photographs and drawings.

Also available: *Diving Into Wicked Big Puddles: A Teacher's Resource Kit* with 80 slides of vernal pools and their biota, plus accompanying script and classroom activities.

To obtain: RMHS-VPA, 62 Oakland Road, Reading, MA 01867-9135; 617/942-9135. Manual $10 + $3 S&H; teacher's kit $70 + $5 S&H.

Calhoun, A. 1997. *Maine Citizen's Guide to Locating and Describing Vernal Pools.* Maine Audubon Society. 65 pages plus appendices.

A very thorough guide; geared toward Maine fauna and regulations.

To obtain: Maine Audubon Society, Gilsland Farm, P.O. Box 6009, Falmouth, ME 04105; 207/781-2330. $10 + $3.50 S&H.

Tappan, A., ed. 1997. *Identification and Documentation of Vernal Pools in New Hampshire.* NH Fish & Game Dept., Nongame and Endangered Species Program. 72 pages.

To obtain: NH Fish & Game, 2 Hazen Dr., Concord, NH 03301; 603/271-3422. $6.95 + $2 S&H.

***Matthew Witten** served as a NOAA Sea Grant Fellow for the EPA Wetlands Division (1997). He is currently a graduate fellow for the Division, and is based at the University of Vermont. He may be reached at 802/878-6753; mwitten@zoo.uvm.edu.*

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OTHER WETLAND RESOURCES

Wetland Resources from EPA

Wetlands Hotline: 800/832-7828. Answers requests for information about wetlands protection, restoration, regulation, legislation, and policy; wetlands functions and values; and related agricultural issues.

Wetlands Fact Sheets: EPA-843-F-95-001. Series of fact sheets covering wetlands protection, economic benefits of wetlands, regulations and enforcement (Section 404, mitigation banking, etc.), government programs, and more. To obtain, call the Wetla nds Hotline or visit http://www.epa.gov/owow/wetlands/contents.html.

Website: http://www.epa.gov/owow/wetlands. Maintained by EPA's Wetlands Division; provides access to numerous documents, plus information on volunteer monitoring and links to many other sites.

Resource guide: *Wetlands Information Resource Guide* (EPA-902-K-94-001). Published in 1994 by Region 2 Water Management Division, New York, NY. While slightly out of date, this guide lists most of the key resources for all kinds of wetlands information, from regulations to scientific books to citizen-action guides. It is attractive, well organized, and not cumbersome. To obtain, call the Wetlands Hotline.

Wetland-related Websites

- Society of Wetland Scientists: http://www.sws.org. Features numerous links to other wetland-related sites.

- U.S. Fish and Wildlife Service: http://www.nwi.fws.gov. "The National List of Vascular Plant Species That Occur in Wetlands" can be downloaded from this site.

- U.S. Army Corps of Engineers: http://www.wetlands.com/coe/87manapd.htm. Lots of technical information, including definitions and methods.

Restoration video

"Wetland Restoration: Steps to Success," a 21-minute video created by The Wetlands Conservancy in Portland, OR, contains specific techniques and suggestions for successful wetland restoration projects. The video covers site assessment, project planning, p lant selection (especially the use of native plant species), when to plant, and animal-proofing of plants. Available through The Wetlands Conservancy at 503/691-1394. $20.

Publications

Audubon Society of New Hampshire. 1990. Five fact sheets: introduction to wetlands, wetland functions and values, wetland terms, coastal wetland types, and tidal marsh restoration. Available from NH Audubon, 603/224-9909; $1 for set.

Tiner, R.W. 1998. *In Search of Swampland: A Wetland Sourcebook and Field Guide.* Rutgers University Press, Piscataway, NJ. 264 pages.

Designed for readers with little or no training in wetland science, this guide begins with a "wetland primer" covering wetland ecology, causes of wetland loss, and strategies for protection. The field guide portion (oriented toward the Northeast) includes illustrations and identification keys for over 300 wetland plants and 200 animals, and 39 color plates showing plant morphological adaptations, wetland types, and hydric soils. Available from Institute for Wetlands and Environmental Education and Researc h, P.O. Box 288, Leverett, MA 01054; 413/548-8866. $26 + $4 S&H.

Yates, S. *Adopting a Wetland: A Northwest Guide.* 1989. 22 pages plus appendices.

This introductory booklet gives a basic summary of wetland types, values, and benefits, and discusses such issues as wetland loss and mitigation. It contains a good boiled-down history of wetlands regulations, and exceptionally clear drawings that illustr ate wetland plants and wildlife and the different types of wetlands. Available from Adopt-A-Stream Foundation, 600 128th St. SE, Everett, WA 98208; 425/316-8592. $5 + 75¢ S&H.

Green Teacher Magazine: Special Monitoring Issue

GREEN TEACHER is a 52-page quarterly magazine filled with ideas and advice from environmental educators in Canada and the U.S. The Spring 1998 special issue focuses on the theme of environmental monitoring and features articles on community mapping, river monitoring, the GLOBE program, and student monitoring of amphibians, plus an extensive listing of resources and organizations.

Single copies are $5.50 (free sample copy to monitoring organizations considering bulk orders for teachers). Bulk prices also available. Subscriptions: $22/year or $38/2 years. Contact Green Teacher, P.O. Box 1431, Lewiston, NY 14092; 416/960-1244; ggreentea@web.net; http://www.web.ca/~greentea/

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Regional Conferences Galore in '97

Last year, in three different parts of the country, regional volunteer monitoring conferences gave people the opportunity to network and swap information about their monitoring projects. If your own region wasn't one of them, maybe now is the time to start planning! (But note this tip from veteran conference organizer Bob Kirschner: "If you're planning a conference for the year 2000, book your space soon! Nearly every organization that's *ever* had a meeting will be doing some sort of event to ring in the new millennium.")

New England
In June 1997, 250 people attended the first New England Volunteer Monitoring Conference, held at the University of Rhode Island (URI). Actually it was a double event -- the monitoring conference was combined with the Fourth New England Lakes Conference, an annual meeting sponsored by the New England chapter of the North American Lake Management Society (NALMS).

"The combination helped bring in attendees," reports conference organizer Elizabeth Herron (of URI Cooperative Extension's Watershed Watch Program). "The volunteers benefited from the technical expertise of the lake managers and the lake managers learned more about what volunteers are doing."

Major funding for the conference came from EPA Region 1, Watershed Watch, and the RI Department of Environmental Management.

The merging of the two conferences was so successful that the model is being repeated in 1998, with a joint conference in June at the University of New Hampshire in Durham, NH.

Mid-Atlantic
EPA Regions 2 and 3 joined forces to hold a Mid-Atlantic volunteer monitoring conference last November. The joint effort made sense since many watersheds (e.g., Chesapeake Bay, Delaware River) are shared by states in both regions.

"This conference represents the first time that we have looked at ourselves as Ôthe Mid-Atlantic' in terms of promoting and furthering volunteer monitoring," says Abby Markowitz, one of the conference organizers. "Political boundaries took a back seat to watershed boundaries."

Over 100 people attended the two-and-a-half day conference, which was funded primarily by U.S. EPA.

Great Lakes
"We weren't originally planning a regional volunteer monitoring conference," says Minnesota Audubon Council's Cheryl Miller. The Council had started off with the more modest goal of hosting a workshop to spread the word about its pilot wetland monitoring projects. But soon the goal widened: "We decided to bring in other monitoring groups in the Great Lakes region and have them give workshops too," says Miller. "We wanted cross-fertilization -- everyone learning from each other."

The one-day conference was sponsored by the Minnesota Audubon Council and the Great Lakes Regional Office of the National Audubon Society, and funded by U.S. EPA.

A particularly valuable activity was a group brainstorming session on ways to use volunteer data to influence public policy.

Upcoming: Region 6 in '99

Utilizing a grant from EPA Headquarters, matched by the Office of the Oklahoma Secretary of the Environment, the State of Oklahoma will host a regional volunteer monitoring meeting March 26Ð28, 1999, at the Oklahoma University Biological Research Station on the northern shore of Lake Texoma, located on the Oklahoma-Texas border.

The volunteer monitoring conference will be held back-to-back with the Oklahoma Clean Lakes Association meeting, scheduled for March 23--25. Participants are encouraged to attend both meetings.

For more information, contact Sylvia Ritzky at OSE, 405/530-8996; saritzky@owrb.state.ok.us.

National Volunteer Monitoring Conference Postponed

As this issue of *The Volunteer Monitor* goes to press, it appears that the next national volunteer monitoring conference is going to be postponed due to EPA budget constraints. There will be an EPA-sponsored regional volunteer monitoring conference in Oklahoma in spring 1999 (see above), and a number of statewide (and possibly regional) meetings are likely in coming months. Subscribers to *The Volunteer Monitor* will be notified as soon as a national conference is scheduled. If you have any questions, feel free to contact Alice Mayio at 202/260-7018, mayio.alice@epa.gov.

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National Survey Results: A Profile of Volunteer Monitoring

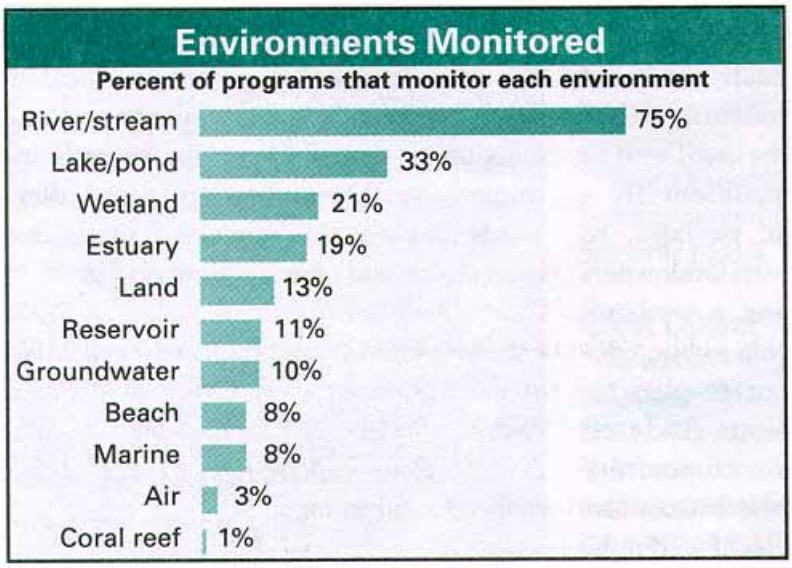
Many readers of *The Volunteer Monitor* participated in the EPA-sponsored national survey of volunteer monitoring groups conducted last fall and winter to gather information for a new (fifth) edition of the *National Directory of Volunteer Environmental Monitoring Programs.* The survey responses have been entered into a database, allowing us to generate a number of useful statistics about volunteer monitoring activities across the U.S. The statistics below are based on surveys from 768 volunteer monitoring programs. (Note: The number of programs in the final database may differ, but only very slightly.)

The volunteer monitoring database will be available in August 1998 on EPA's volunteer monitoring website (http://www.epa.gov/owow/monitoring/vol.html) and will also be linked to EPA's Adopt Your Watershed web site (http://www.epa.gov/surf/adopt/).

The printed Directory will be available in October, and will be mailed automatically to every program listed in it. The Directory will include numerous statistics, graphs, and maps giving a detailed portrayal of the current status of volunteer monitoring nationwide. Below, we take a brief look at some of the major findings.

Environments volunteers monitor
As was found in the survey for the previous edition of the Directory (conducted in 1993), streams and rivers are by far the most common environment monitored by

volunteer programs: three-fourths of the programs surveyed include stream and river monitoring among their activities. Lakes come in second, and are monitored by one-third of the programs. Wetlands are monitored by about one-fifth -- a small increase from 1993, when 16 percent reported that they monitored wetlands.



Click on picture for larger image.

Reflecting the trend toward monitoring whole watersheds, slightly over half the programs reported that they monitor more than one environment, and over a quarter monitor three or more different environments.

Parameters monitored

The top 12 parameters monitored by volunteers are generally similar to what they were in 1993. Now as then, the "big three" are temperature, dissolved oxygen, and pH. (*Note:* Since responses from all programs are combined for the table, and since so many programs monitor streams, parameters commonly measured in streams tend to dominate the top of the list.)

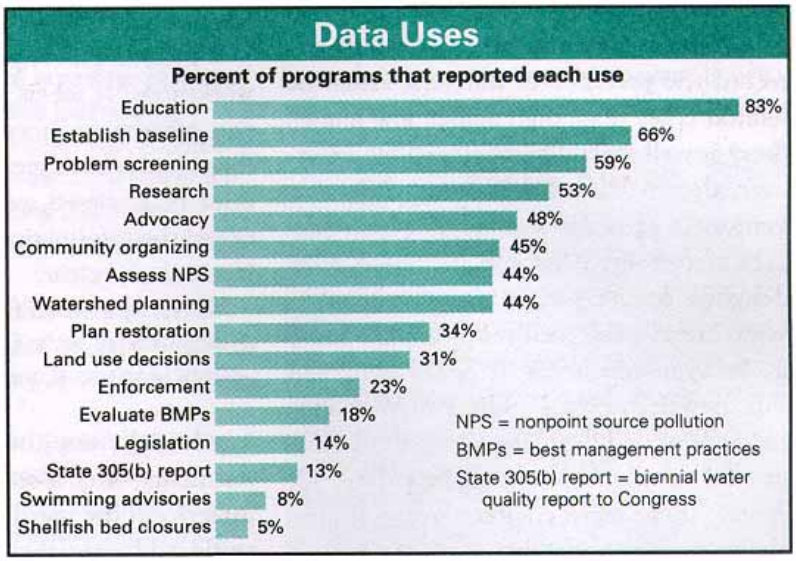
Other activities

Most volunteer monitoring programs don't restrict themselves solely to monitoring. Of the programs surveyed, 41 percent conduct debris cleanups, 31 percent are engaged in restoration activities, and 21 percent stencil storm drains.

Use of data

The great majority of programs (85 percent) make use of their own data. More than half also reported that local entities -- local and state government, and community organizations -- use their data.

Education is the top use of volunteer data (83 percent of programs). "Education" can



Click on picture for larger image.

mean raising the level of awareness of the volunteers themselves, local residents, teachers and students, town council members, city planners, government agency staff, el ected officials . . . the list goes on and on.

Large numbers of programs also use their data for establishing baseline conditions, screening for problems, research, advocacy, community organizing, assessing nonpoint source pollution, and watershed planning.

To order the new Directory (5th edition), please contact Alice Mayio, National Volunteer Monitoring Coordinator, USEPA, 4503F, 401 M St., SW, Washington, DC 20460; 202/260-7018; mayio.alice@epa.gov.