EPA

United States
Environmental Protection
Agency

Office of Water
Washington, DC 20460

EPA 503/9-90-009
August 1990

Rhode Island
Sea Grant College Program

The University
of Rhode Island

Narragansett, RI 02882

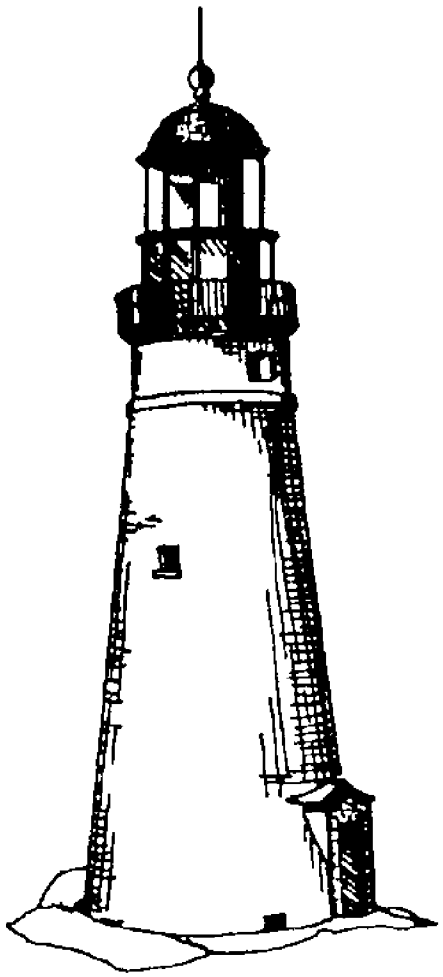
Courtesy of
Rhode Island
Sea Grant

P-1137 RIU-W-89-001

Citizen Volunteers in Environmental Monitoring

Summary Proceedings of the 2nd National Workshop

December 1989, New Orleans, Louisiana



This publication has been funded wholly or in part by the US EPA under Interagency Agreement DW 13934084-0 with NOAA's Sea Grant Program and the University of Rhode Island.

Citizen Volunteers in Environmental Monitoring

Summary Proceedings of the 2nd National Workshop

December 1989
New Orleans, Louisiana

Table of Contents

Preface

The second national workshop on "The Role of Citizen Volunteers in Environmental Monitoring" was held in New Orleans, Louisiana, in December 1989. Cosponsored by EPA's Office of Marine and Estuarine Protection and the Gulf of Mexico Program, the workshop was attended by 160 people representing many different kinds of volunteer monitoring programs and government agencies from all around the country.

This second workshop was designed to build on the accomplishments of the first one, which was held at the University of Rhode Island in May 1988 and provided an introduction to the wide variety of volunteer monitoring programs.

A primary objective of the second national workshop was to explore "how to provide useful information and how to encourage partnerships between citizen monitoring groups and state or regional government." The workshop was organized into five major panels focusing on the following themes: forging links with local and state government; providing quality assurance and quality control of the monitoring data; getting useful information out of debris cleanup programs; coordinating monitoring programs regionally; and designing management-oriented monitoring programs for estuaries and coastal waters (where volunteer monitoring is still a fledgling effort). In each panel, presentations were selected to represent different areas of the country, different types of environments (e.g., lakes, streams, beaches), and different kinds of monitoring (e.g., fish tagging, debris cleanup, water quality, education, enforcement).

In response to requests made at the first workshop, a special afternoon session was set aside for information and idea exchange among groups engaged in similar monitoring activities. Conference attendees could choose among the following discussion groups: Rivers, Lakes, Estuaries, Living Resources, and Debris. At the final session of the workshop these five groups presented summaries of their discussions, including an evaluation of progress and specific recommendations for exchanging ideas and techniques, enhancing links to government, and identifying solutions to problems. A great deal of information was also exchanged at the numerous poster displays throughout the three-day program.

A second major objective of the workshop was to introduce state and regional government officials to the achievements and potential of volunteer monitoring. Consequently, the workshop followed OMEP's second Annual National Coastal Programs Conference. Officials from EPA regional offices and state and local government who attended the earlier conference stayed to hear about different citizen monitoring topics, to see the excellent quality of programs represented at the poster sessions, and to join in discussions with citizen volunteer coordinators during meals and special joint events. The meeting was hosted in New Orleans because of the great interest in citizen environmental monitoring throughout the Gulf of Mexico region. In fact, during the workshop several attendees worked with local leaders to set up a citizen monitoring program for Lake Pontchartrain.

The third goal of the conference was to provide an opportunity for participants to meet and foster a national network of citizen volunteers. This purpose was fully met; results of the workshop already include:

- A third, greatly expanded edition of the National Directory of Citizen Volunteer Environmental Monitoring Programs.
- Publication of a newsletter for volunteer citizen monitors.

- Publication of EPA's guidance to state program officials on the use of volunteer monitoring data.

In addition, EPA's Office of Water highlighted volunteer monitoring for the Agency's Earth Day celebration.

The outstanding commitment, creativity, integrity, and energy that characterize citizen volunteer monitoring programs continue to be an inspiration to us. We are exceedingly grateful for the privilege of working with all of you.

Acknowledgments

We wish to thank the Gulf of Mexico Program and the EPA Office of Marine and Estuarine Protection for cosponsoring the workshop and the publication of the proceedings. Special thanks go to Tudor Davies, Tom Armitage, Michelle Hiller, Lore Hantske, Margherita Pryor, and William Whitson. We would also like to thank the EPA Office of Water Regulations and Standards for their participation in the conference and continued support of volunteer monitoring.

We appreciate the help of the organizing committee—Kathy Ellett, Tom Armitage, Tom Perlic, Dave Flemer, and William Whitson—for their assistance in the months of planning before the workshop. Thanks also to Ken Cooke for his talents in videotaping the workshop (copies are available from Virginia Lee or Tom Armitage).

Many thanks are due to LaVie McDonald for design and layout of the proceedings and to the Rhode Island Sea Grant Program for distributing this document.

■

Virginia Lee
Coastal Resources Center
Graduate School of Oceanography
The University of Rhode Island
Narragansett, RI 02882

Eleanor Ely
Information Office
Rhode Island Sea Grant Program
The University of Rhode Island
Narragansett, RI 02882

Workshop Goals

Michelle Hiller
EPA Office of Marine and Estuarine Protection

This afternoon we will be hearing from a wide range of citizen monitoring groups that have forged effective partnerships with environmental programs at the federal, state, and local levels. Our office is very pleased to be cosponsoring this meeting with the Gulf of Mexico Program. We believe that fostering citizen involvement is perhaps the most important thing we can do to ensure the success of our programs. There is much we want to accomplish during the workshops. I am confident that the group of talented and committed citizens and agency program managers gathered here can provide answers to many of our questions and challenging problems.

WORKSHOP GOALS

- Continue building and nurturing a national network of volunteer environmental monitoring programs.
- Find ways to get states working together in a basinwide approach to managing our nation's water bodies. Many of our estuarine waters are interstate.
- Develop new users of data collected by citizen volunteers, and new opportunities for citizens to become involved in environmental programs.
- Convince state program managers that data collected by citizen volunteers can be extremely useful in decision making. To do that, we must ensure that citizens are collecting the data the managers need.
- Determine what states need from volunteer monitoring programs, and what volunteer monitoring programs need from the states.
- Answer two questions: First, what pollution abatement and control programs can be evaluated by volunteer monitors? Second, can volunteer monitoring programs move further into the living resources arena where our biggest challenge lies?
- Determine what EPA and other government agencies can be doing to fully use the talents and energy of committed volunteers who are collecting environmental data.

■

Welcome & Introduction

Tudor Davies
Director, EPA Office of Marine and Estuarine Protection, Washington, D.C.

I'm here to begin the transition from the second Annual National Coastal Programs Conference into the joint conference session with the second National Citizen Volunteer Monitoring Workshop. With the help of the Gulf of Mexico program, we are for the first time holding these two conferences in conjunction with each other. As we thought about and planned this joint meeting, I think it surprised us all that we hadn't tried to do this before. There's a very logical tie that EPA has to a citizen monitoring program. One of the fundamental things EPA tries to do is involve the public and empower the public.

What you people can provide is a data-rich environment in which we can track the health and trends of the nation's waters. And what you are doing is building a further public consensus about the environment. You're very remarkable people.

The secret about volunteer monitoring is out. There is growing interest in using volunteers to monitor environmental conditions, and some states have established some very strong links with you and can testify as to how important what you do is. And it's important that they do testify because some were skeptical about the quality of the data you produce, and they have been converted into true believers.

And I'm sure that, after the first monitoring meeting, some of *you* were probably skeptical too—about whether EPA would follow through on some of the commitments we've made. Here's what EPA has done:

- We have published a national directory of citizen volunteer monitoring organizations (and there's been great demand for it).
- We have supported the publication of a national monitoring newsletter.
- We have promoted the use of citizen monitoring nationwide.
- We are preparing a document for state program managers that explains how to use data from citizen monitoring.
- Perhaps the biggest commitment is that we're back—we're having this second conference, and we're prepared to work with you.

"April 22, 1990, is the 20th anniversary of Earth Day. It's a good occasion for EPA to examine where it came from and where it's going. One of the things we'd like to do is to use this occasion to recognize the role of citizen volunteers."

Be a little patient with us because we're scientists and lawyers, and they're some of the most difficult-to-convince people in the world, but we're listening and we're hearing.

April 22, 1990, is the 20th anniversary of Earth Day. It's a good occasion for EPA to examine where it came from and where it's going. One of the things we'd like to do is to use this occasion to recognize the role of citizen volunteers.

One day recently I had a discussion with someone about what makes a successful program. He said there are three components: First, you need money; second, you need a consensus about what should be done; and third, you need a hero. I think you people, the citizen volunteers, are the people who are going to give us heroes. You can galvanize that political support. Politicians will listen when the public talks.

Vicki Arroyo
Assistant Chief of Staff of Environmental Affairs, Office of the Governor, Baton Rouge, Louisiana

"We are now experiencing marsh loss rates of 50 to 60 square miles per year in coastal Louisiana, and each year approximately 30 percent of our oyster-producing areas are closed due to the threat of pollution."

On behalf of the Governor, I would like to welcome you all to Louisiana. Louisiana is a state blessed with rich natural resources, yet we are also a state with an unfortunate history of environmental problems. Louisiana's coastline region contains millions of acres of wetlands and estuarine waters. Forty percent of the nation's coastal wetlands are here! Our state leads the country in commercial fisheries and our coastal marshes serve as the principal nursery for the fishery resources of the Gulf.

Yet here in Louisiana, as in other areas of the country, we are facing very difficult environmental problems—resulting from both natural and manmade causes—which seriously threaten our coastal wetland resources and their productivity. For example, we are now experiencing marsh loss rates of 50 to 60 square miles per year in coastal Louisiana, and each year approximately 30 percent of our oyster-producing areas are closed due to the threat of pollution. Contributing factors to these problems include coastal subsidence and saltwater intrusion, rising sea level, oil and gas exploration and production, agricultural and urban runoff, and industrial discharges.

All of these problems are complex and will take time and resources to address, but I am optimistic. In the year that I have been back in Louisiana, I have observed some striking changes in the attitude of the general public and state legislators in making the environment a priority.

But despite this unprecedented state commitment to the protection of our coastal resources, we recognize that we cannot do it alone. We welcome the opportunity to learn from those of you working on EPA's coastal programs.

I want to mention my enthusiasm for the participation today of citizen volunteers. In spite of my recent string of bureaucratic titles, I began my interest in the environmental field as a citizen (and student) concerned largely with water resource issues. After seeing the progress we have made since that time in passing environmental laws and regulations—and receiving the funding necessary for implementation—it is quite clear that none of this would be possible without the active support and involvement of our citizens.

■

Keynote Speakers

Dennis Weaver
Earth Communications Office, Los Angeles, California

I am really grateful for what all of you are doing to solve our environmental problems—because they're massive, as you know. We need your energy and commitment. This is probably the most exciting time to be living in the history of the species. It's also the most dangerous—maybe that's what makes it so exciting. We, as humans, have the ability to destroy that which allows us to live, and not only to destroy it for ourselves, but for every other creature that lives on this earth. So we're in a very responsible position.

Ten years ago, if you said you were an environmentalist, you would have been considered some kind of weirdo. Now public activism is high; but how do we get the environmental message out to people who don't know? Ignorance is the worst problem we have. It leads to apathy.

This summer, scientists and representatives of the media were brought together at a conference at the Smithsonian Institution. The theme was, "Are we overreacting to our environmental problems?" The answer that the scientists gave to the media people was, "No—we are *underreacting*."

But some people still want more studies. It reminds me of the experiment where they put a frog in a container of water. He could get out if he made a great effort, but he was comfortable, so he didn't try. Then they started heating the water very slowly—so slowly that the frog didn't notice. By the time he finally realized "Hey, I'm in real deep hot water," it was too late—he was too enervated and didn't have the strength to save himself. We're in the same way with this environmental crisis. Pollution has crept up so slowly that people have gotten used to polluted air and water. If we don't do something, we're going to end up like the frog. That's why we can't afford another study. What if it proves we were right?

"We, as humans, have the ability to destroy that which allows us to live, and not only to destroy it for ourselves, but for every other creature that lives on this earth. So we're in a very responsible position."

People ask, "What can I do as an individual? I'm just one little person." They think we have no power as individuals, but that's just not so. We have tremendous power and we're not using it as we should.

What can we do? First we need to examine the use of energy in our daily lives. There are many ways that we as individuals could save energy. We could use compact fluorescent bulbs in our homes. We could use low-flow shower heads that use two-and-a-half, rather than eight, gallons of water per minute. Every drop of water we conserve is energy conserved. And do you realize that heat escaping around leaky windows wastes more oil than the Alaska pipeline supplies in a year?

The obvious way to save energy is through the gasoline we burn in our automobiles. If the government would just raise the efficiency standards for cars by one mile per gallon, we would save 420,000 barrels of oil per day. Per *day!* That is twice the amount lost in the Alaskan oil spill. So there are things we can do, but they won't happen unless the public demands them. Detroit isn't going to make a fuel-efficient car unless there's a market for it. We who are involved must act as well as talk. Our actions are much stronger than our words. We must be an example. Changing *our* behavior will make other people change theirs. I just bought a car, a Geo Metro, that gets 52 miles per gallon. And don't think that I'm depriving myself, because that is a fun car to drive. My cruising range is over 500 miles!

Making these changes takes commitment; it takes stick-to-itiveness, perseverance. Commitment is that power that doesn't give up, that keeps looking for a solution. Commitment is different from involvement. Involvement is fine but it doesn't necessarily last. For example, take a plate of ham and eggs: the chicken obviously was involved, but the pig was *committed!*

There's another energy source we should be using: the sun. It's inexhaustible. Even if oil and gas were clean energy sources, there would still be a problem with relying on them because they will be gone. What are we going to do then? We have no vision; we don't look ahead. "Live for today" has been our philosophy. So my wife and I built a house where everything is powered by solar energy. We have photovoltaic cells that collect the energy from the sun and store it in batteries. The batteries power everything in our house—refrigerators, freezers, light bulbs, blenders, hair dryers, everything. It costs a little to begin with—but then you don't have an electric bill after that.

"My wife and I built a house where everything is powered by solar energy. We have photovoltaic cells that collect the energy from the sun and store it in batteries. The batteries power everything in our house—refrigerators, freezers, light bulbs, blenders, hair dryers, everything. It costs a little to begin with—but then you don't have an electric bill after that."

The house is not only solar; we've also demonstrated that we can use recycled materials. The house is made basically out of old tires and aluminum cans. Earth is packed into the tires with a sledge hammer until it forms a "tire brick" with a great thermal mass. After one year (the time it takes to be totally charged by the sun's energy), the house will maintain a constant temperature between 68 and 72 degrees with no heating or air conditioning. This is catching on: The first commercial building using the same method as my home is being constructed in Ridgway, Colorado.

One of the best means we have for solving the problems we face is that we have this great ability to communicate. If it weren't for that, I think the situation would be hopeless. So in Hollywood we have formed a group called ECO—Earth Communications Office—because we felt that the thing we were most capable of doing was communicating. It's a group of directors, actors, writers, and musicians. So you will be seeing more environmental issues on TV shows, in songs, in movies.

As we evolve toward our eventual good, let's be optimistic but practical. There's a story about an optimist: A man fell from the top of a 10-story building, and as he passed each window he waved at the people inside and said, "Don't worry—everything's all right so far!" So let us be optimistic, but not too optimistic. We need a dash of practicality too.

Throughout our history, we have gone through shifts in consciousness. Our biggest hope is that we are presently going through a shift that will bring us to greater truth, understanding, and knowingness. We are all connected, linked together. You can't hurt someone else and not hurt yourself too. If we acted from that understanding—that we can't have happiness for ourselves and exclude it from others—I believe it would change the world overnight. If we understood that, we wouldn't need armies.

The last shift in consciousness produced the Industrial Revolution. That was a great change; however, we are now paying the bill. It was a time of intense individualism and intense competition. It was exciting and possibly it was necessary—but it's yesterday's news. Today there are new ideas on the horizon: intense togetherness and intense cooperation.

Some say greed will always rule because we are motivated by self-interest. I agree that we are motivated by self-interest, but that doesn't mean greed cannot be eliminated. I believe that greed will go when we realize that it's in our own best self-interest for it to go. We will either arrive at the understanding that we are all parts of the same whole or we will destroy ourselves. We will learn to love one another or perish.

■

Keynote Speakers

John Costlow
Duke University Marine Laboratory, Beaufort, North Carolina

The presence of each of you this morning clearly affirms that you have an interest, and hopefully some level of involvement, in environmental issues involving individual citizens, citizen organizations, and agencies of the local, county, state, and federal governments. But how many of you have ever stopped to analyze the various components and interactions of a successful estuarine program? This morning would seem to be an excellent opportunity to "dissect" the machinery of such an effort.

(At this point—having been the mayor of the town of Beaufort, N.C., for two terms, and subsequently involved with some number of state, federal, and international groups concerned with the coastal/estuarine environments—I'd like to point out that the examples which I intend to develop are "purely academic"!)

It would be useful to consider first just who is involved in this machinery. Of course, there are individual citizens and groups or organizations of citizens and several levels of government. With that as a basic premise, one can progress to ask in what way can these groups be best integrated for maximum effectiveness?

For a change, let us first identify the actual owners of our natural estuarine systems, a point which is all too frequently overlooked. In spite of what you may hear, it is not "industry," it is not the "developers," and it is not "government," regardless of the level! Insofar as coastal estuarine systems are concerned, the owners are the citizens of that state—and, for the most part, the various levels of government have varying degrees of responsibility for managing these priceless areas for us, the citizens. At this point, it could be useful to identify, or categorize, the ways in which citizens organize themselves. I have listed a few which one could expect to find in the average community within most of the states of the Union. You will notice that I have also attempted to identify the level of "influence" (small, medium, or large) which that particular organization may have relative to estuarine programs, or, for that matter, any issue. (See pages 9 and 10.)

Unfortunately, some communities of citizens, while organized, tend to be totally polarized in a negative sense. There are groups of individuals banded together for some cause or another, but there is no interest in communicating with other groups. Most of you, having been involved in community efforts at one time or another, can identify the various organizations to which I refer. For example, there are the "AB's"—"Ag'iners-Because." It does not really matter what you may wish to initiate, they are always against it! Then there are the "DIM's"—"Don't Involve Me." This group is not really against anything, they just seem to feel that they have far more important things to do than become involved in an effort at the lowly level of the community! Closely related, but never working together, are the "ITB's"—the "I'm Too Busy" group. They may actually be too heavily involved to allocate further time to community effort, but frequently one wonders. And then, finally, there are the "IWW's"—"It Won't Work." In some ways this is the most irritating group, largely because they rarely permit you to even describe the project and invariably identify an unsuccessful effort on their part, 37 years ago, as an example of why it will not work!

CITIZEN'S GROUPS

Influence	Organization
S	Individual Citizens
M-L	Environmental Groups
S-L	Garden Clubs/Women's Clubs
M-L	ERA, NOW, League of Women Voters
S-M	Rotary, Kiwanis, Lions, Moose, I.O.O.F, Masonic Lodge, Knights of Columbus
M-L	Churches and Religious Organizations
M-L	AARP
M-L	Chambers of Commerce
M-L	Regional Scientific Organizations
M-L	Unions
M-L	Teachers Associations, Local Bar Associations, Local Historical Associations, Political Parties and Associations
M-L	Local Student Associations
S-L	Industry
M-L	Banks and Savings and Loans Associations
M-L	Developers' Associations
M-L	Local Press

LOCAL GOVERNMENT

Influence	Agency
M-L	Municipal Commissioners and Mayor
M-L	Municipal Agencies and Department Heads
S-M	Local Fire Departments/Local Rescue Squads
S-M	Water and Sewer Departments
M-L	Municipal Police Departments
S-M	Municipal Housing Authorities
S-M	Urban Development Authorities
S-M	Municipal Employees Unions

COUNTY GOVERNMENT

Influence	Agency
M-L	County Commissioners - Chairman
M-L	Sheriff's Department
M-L	Board of Education and Superintendent of Schools
M-L	Planning Commission
M-L	Zoning Commission
M-L	Health Department
M-L	Department of Social Services
M-L	Community Action Association
M-L	Tax Supervisor and Staff

STATE GOVERNMENT

Influence	Agency
	Executive
L	Office of the Governor
M-L	Individual Cabinet Members
M-L	State Health Department
M-L	Department of Natural Resources
M-L	Environmental Management Commission
M-L	Marine Fisheries Commission
M-L	Coastal Resources Commission
M-L	State Wildlife Commission
M-L	State Urban Development Commission
M-L	State Department of Social Services
M-L	State Highway Patrol
M-L	Department of Transportation
M-L	Department of Commerce
M-L	Department of Agriculture
M-L	Office of the Attorney General
M-L	Office of the Secretary of State
	Legislative
S-L	Individual Members of House
S-L	Individual Members of Senate
M-L	Special Study Commissions
M-L	Special Standing Committees
M-L	Finance Committee

FEDERAL GOVERNMENT

Influence	Agency
	Executive
L	EPA
L	NOAA-Sea Grant and NMFS
L	U.S. Army Corps of Engineers
L	U.S. Fish and Wildlife Service
L	U.S. Department of Interior (Park Service and Minerals Management Service)
L	U.S. Geological Survey
L	Branches of U.S. Military (Office of Naval Research)
L	National Science Foundation
L	Department of Energy
L	N.I.E.H.S.
	Legislative
L	Individual Members of House
L	Individual Members of Senate
L	Overview Committees of House and Senate
L	Individual Staff of Members of House and Senate
L	GAO
L	OMB
	Other
L	National Academy of Sciences
L	National Academy of Engineering
L	National Press (radio-television-magazines-newspapers)
L	National Environmental Organizations (Nature Conservancy, Sierra Club, Environmental Defense Fund)

Normally, at least in our country, where three or four citizens are gathered together, one finds a form of "local" government, established to manage the community and its needs. One form is that which includes a mayor, several elected commissioners, and then heads of some number of departments depending upon the size and needs of the community. This type is shown below.

Again, depending upon the size, geography, and heritage of the community, the next level of government is the "county," or, as in this state, the "parish." It would normally have some number of elected commissioners, one of which is identified as the Chairman, and then, as with the municipal government, some number of heads of departments to carry out the day-to-day operations of the county or parish.

"Unfortunately, some communities of citizens, while organized, tend to be totally polarized in a negative sense. There are groups of individuals banded together for some cause or another, but there is no interest in communicating with other groups."

On a much larger scale, many state governments are composed of the elected governor and the individuals that he appoints to serve as his "cabinet," responsible for the workings of particular components of the state government. Then, reporting to individual cabinet members, or Secretaries, there can be a seemingly endless array of department heads and agencies, frequently referred to as the bureaucracy of the government. It is here that we first encounter the problems associated with the "Executive" branch and the "Legislative" branch of the government. In most states, the legislative branch is composed of two "houses." From time to time, one finds that the element of "political philosophy," commonly referred to as "party," can be involved and it is possible for one "party" to dominate the "Executive" while an opposite philosophy dominates the "Legislative." Although one might hope that an issue of such importance as the environment would be above such party differences, there are occasional suggestions that this is not always the case!

And finally, last but certainly not least, we come to the federal government which, as you certainly well know, is organized along lines similar to that described for the state. Although most of us rarely have contact with the president, we should have contact with our congressmen, our senators, and, as evidenced here today, with members of the various agencies charged with specific roles relative to the estuarine/coastal environment—the Environmental Protection Agency, the National Oceanic and Atmospheric Agency, the Fish and Wildlife Agency, and the U.S. Army Corps of Engineers, to mention just a few. At this level of government, we encounter the same dichotomy we first identified within the government of the state—that is, two or more political philosophies and further subdivisions associated with the Executive and Legislative branches. (I recognize the third branch, the Judicial, is important, but most of us rarely have occasion to be involved in those hallowed halls.)

Ideally, there are strong interactions not only between the citizen groups and the local government, but also among elected commissions and department heads of county and state government, allowing for communication and cooperation.

■

Panel 1 Design and Implementation of Estuary Monitoring Programs

Panelists: *Richard Batiuk, EPA Chesapeake Bay Liaison Office; Alice Mayio, EPA Assessment and Watershed Protection Division; Jerry Neff, Battelle Ocean Sciences; Andrea Copping, Puget Sound Water Quality Authority.*
Moderator: *Tom Armitage, EPA Office of Marine and Estuarine Protection.*

Introduction to Estuary Management — Tom Armitage

We've heard that monitoring estuaries is a hot topic. At the recent International Estuarine Research Federation meeting in Baltimore, an entire session was devoted to estuarine monitoring. And at EPA's Water Quality Assessment Symposium that was held early this year, an entire day was spent on sessions on estuarine monitoring. The National Academy of Sciences has recently completed several studies on estuarine monitoring. They've looked at monitoring needs in the Southern California Bight and the Chesapeake Bay. And many of you have indicated that developing monitoring programs for estuaries is high on your list of priorities.

In many estuaries, monitoring programs are already in place for discharge permits. I think the challenge facing us is to build on existing monitoring efforts and to design effective basinwide monitoring programs.

Citizens have been playing a key role in monitoring two of the bodies of water we're going to be talking about on this panel—Chesapeake Bay and Puget Sound.

Before we begin discussing citizen volunteer monitoring, this panel of experts will discuss design and implementation of estuarine monitoring programs.

Richard Batiuk
Re-thinking Estuarine Monitoring

The multi-agency state/federal Chesapeake Bay Monitoring Program is now entering its seventh year. I would like to share some of our experiences with other estuary programs that are now planning their monitoring programs.

We need to start a re-thinking of estuarine monitoring. We need to think of the estuary in terms of the whole basin—the surrounding watershed and the tidal waters; and we need to think of monitoring not as simply routine data collection but as an evolving data-collection network and process.

The Chesapeake Bay Monitoring Program has the following objectives:

1. Water quality monitoring program

- Characterize existing water quality baywide.
- Determine trends in water quality that might develop in response to management actions or additional sources of pollution.
- Integrate the analyses of various monitoring components with a view toward achieving a more comprehensive understanding of the processes affecting water quality and the linkage with living resources.

2. Living resources monitoring program

- Document the current status of living resources and their habitats in Chesapeake Bay.
- Track the abundance and distribution of living resources and the quality of their habitats over time.
- Examine correlations and relationships among water quality, habitat quality, and abundance, distribution, and integrity of living resource populations.

Based on our experiences in the Chesapeake Bay Monitoring Program, I'd like to offer some specific recommendations in four areas—program design, data management, quality assurance, and data analysis.

1. Program design

Our experience:

We institutionalized the program through an effective committee/technical workgroup structure. We planned adequately for the water quality network design but *not* for living resource components. The monitoring of toxics still has not been fully addressed.

Recommendations:

- Establish a multi-jurisdictional monitoring committee.
- Clearly state the program objectives; use them in developing data quality objectives and network design.
- *Continually* seek long-term, stable funding sources.
- Integrate existing monitoring programs into the design of a coordinated monitoring program.
- Consider future modeling needs during network design.

2. Data management

Our experience:

We did not make adequate plans up front for our data management needs. We found that working with data submitted by numerous different organizations demanded specific data-submission formats and data-management requirements.

Recommendations:

- Plan adequate resources for data management prior to implementing the monitoring program.
- Seek consensus on, and *require* adherence to, specific data submission requirements.
- Clearly state objectives for database development up front, and adhere to them when structuring the database.
- Target acquisition of key historical data sets early on.
- Establish procedures for quality assurance of all data entered into a common database.

3. Quality assurance

Our experience:

For water quality samples alone, we eventually had more than 15 laboratories analyzing samples and contributing to the centralized computer database. A significant effort was required to ensure the use of comparable sample collection and analysis methods.

Recommendations:

- Establish quality assurance as an integral part of all monitoring program components.
- Set up a coordinated split-sample program between analytical laboratories.
- Seek technical consensus on sample collection and analysis procedures.

4. Data analysis and interpretation

Our experience:

Insufficient resources were devoted to data analysis. Direct links between information resulting from the program and management decisions were limited at first. Establishment of consensus on data-analysis priorities and sharing of data-management and data-analysis resources between agencies was necessary.

Recommendations:

- Dedicate resources for analysis and interpretation of monitoring data.
- Establish a tiered reporting system to force routine analysis and synthesis of data targeted toward various levels of agency managers and the public.
- Create a dependence on using results from the monitoring program for management decision making.

Q. *(from audience):* How do you create this dependence?

A. Pull together the existing information and see where the gaps are; then target those people who need that information. In our case, the question was whether the phosphate detergent ban was helping the estuary. Managers were able to look at the monitoring data, which showed that ambient phosphorus levels had decreased. Now they ask us every year, "Are we on target?" ■

Alice Mayio

EPA's Guidance Document for State Surface Water Monitoring Programs

The guidance is aimed at state water quality program managers. More than 20 contributors from the states, EPA, U.S. Geological Survey, U.S. Fish and Wildlife Service, Tennessee Valley Authority, and others are working on the document, which is expected to be ready for review by EPA regions and states in 1990.

Why did EPA decide to produce the guidance? First, a little of the history that led up to the decision.

In 1987, EPA completed a study (called "Surface Water Monitoring: A Framework for Change") of its surface water monitoring program. The study identified five emerging challenges facing state and EPA program managers:

1. **Toxics:** Need to develop quick, reliable, and inexpensive biological testing for toxics.
2. **Biology:** Need to increase the use of biological monitoring to characterize baseline water quality.
3. **Targeting:** Need to target control actions to where they will achieve results and need to show the effectiveness of those actions.
4. **Nonpoint source pollution:** Need to identify and characterize the impacts of nonpoint source pollution.
5. **Coastal:** Need to expand pollution identification and control efforts in near-coastal and ocean waters.

The study also noted the failure of managers to make adequate use of existing data in planning pollution control activities.

"Previous EPA guidance to states just wasn't hitting the right audience; it focused on technical issues and was aimed at those who run and manage monitoring programs, not those who make decisions on pollution control."

One of the study's recommendations was that the EPA should issue guidance to states on re-evaluating their surface water monitoring programs. Previous EPA guidance to states just wasn't hitting the right audience; it focused on technical issues and was aimed at those who run and manage monitoring programs, not those who make decisions on pollution control. The new guidance should be aimed at state environmental managers, such as those who permit point sources, assess nonpoint source pollution, and interact with the National Estuary Program.

The core of the guidance is its discussion of the uses of monitoring information in a number of state-level program areas. These program areas are:

1. Establishing and refining water quality standards.
2. Identifying problems and setting priorities for waters in need of controls.
3. Implementing management programs and making control decisions.
4. Evaluating the effectiveness of management actions through follow-up monitoring.

Follow-up monitoring will be undertaken by the National Estuary Program management conference to assess the effectiveness of comprehensive conservation and management plans.

Under each of these program areas, the guidance discusses the benefits to managers of using monitoring information; clarifies the objectives of monitoring and makes recommendations for data collection, analysis, and presentation; and discusses some of the resource requirements of monitoring.

The guidance goes on to make some general recommendations to the states on program design, such as:

- Conduct watershed-level assessments.
- Conduct integrated assessments (that is, use chemistry, biology, toxicology, and habitat evaluations).
- Maximize monitoring resources (for example, by using volunteers, by exploring alternate funding sources, and by making better use of available data).
- Involve citizens in identifying problems and working toward solutions.
- Interpret monitoring data and present it in a usable form.
- Improve water quality standards and criteria.
- Use environmental measures rather than administrative ones to set goals and track progress.

In conclusion, I'd like to point out that this monitoring program guidance is one of a number of EPA activities to improve water quality assessments. Among other activities are the development of a policy on the use of ecological assessment methods and biological criteria, technical guidance on biological assessment methods, and guidance on the use of volunteers in water monitoring.

EPA Guidance Manual for States to Use Volunteer Monitoring

EPA's recognition of the importance of volunteer monitoring came about from two fronts. First was the 1987 EPA study, "Surface Water Monitoring: A Framework for Change." Prompted by that study, EPA reviewed and evaluated existing volunteer monitoring programs. Our conclusion: Yes, a properly managed volunteer monitoring program *can* yield high-quality data that can be used by the states in assessing water quality and in making program decisions.

The second driving force was our concern about the relatively large percentage of the nation's waters that remains unassessed, and the limited state resources to assess those waters. According to state water quality assessment reports submitted to EPA in 1988, only about 30 percent of the nation's rivers and 40 percent of its lakes are actually being assessed for their ability to support uses like fishing and swimming.

"Volunteer monitoring can produce comparatively inexpensive, high-quality data that can be useful to the state, but in order to get that kind of data the state has to commit resources and personnel from the start, and carry that commitment through the life of the program."

EPA is currently developing two guidance documents: a guide for state managers on planning and implementing a volunteer monitoring program, and a methods manual for lake volunteer monitoring. I'll talk mostly about the first, a "parent" document to which the lake manual (and possibly others) will be a companion.

The guide for state managers is directed at skeptical state water program managers who currently don't make use of volunteer monitors. It is also useful to anyone interested in setting up a volunteer program. Its primary message is: Volunteer monitoring can produce comparatively inexpensive, high-quality data that can be useful to the state, but in order to get that kind of data the state has to commit resources and personnel from the start, and carry that commitment through the life of the program.

The guide starts off with an overview of existing volunteer monitoring programs. Then it discusses the steps a state should take in planning a program, such as:

- Establish priority goals for the program. Do you want it to supplement state water quality information, or to serve mostly as a public education/public awareness tool?
- Identify data users and data uses. Early in the planning stages, involve those who will use the data and those who will do the monitoring. Make sure expectations are realistic.
- Develop and stick to effective quality assurance/quality control procedures if you want the data to be used.
- Assign qualified staff to recruit and train volunteers, analyze data, produce reports, etc.

Next, the guide discusses steps in implementing a state-coordinated volunteer program:

- Begin with a pilot project.
- Train your volunteers.
- Conduct quality control sessions.
- Evaluate the results of the pilot before expanding.

Next, the guide goes into some detail on data management and presentation of results. It stresses the need for certain basic data management steps that are essential if the data are to be used with confidence. These steps include documenting data sets, screening the data, evaluating the data, and presenting results back to the volunteers.

Last, the guide discusses costs and funding. Citizen monitoring is cost-effective but it is

not free. Costs vary widely depending on program scope and administrative needs, with most programs in the $20,000 to $50,000 range. The guide touches on various funding options available to states. It concludes with case examples of successful state-managed volunteer programs. The guidance manual will be published in late 1990 and will be available from my office.

Now I'd like to switch tracks and say a few words about the methods manual for lake volunteer monitoring. The target audience is primarily volunteers interested in starting a lake monitoring program or modifying an existing program. It is much more of a nitty-gritty manual, giving details on parameters to monitor for, specific sampling methods appropriate for volunteers, equipment needs, etc.

In addition to these two guidance documents, some other EPA projects being considered are:

- A video on sampling methods for lakes, to accompany the lakes manual.
- A methods manual for rivers.
- Possible meetings with state managers to "sell" them on the concept of volunteer monitoring.

We are also encouraging states to establish volunteer monitoring programs by integrating the concept into our monitoring program guidance and other EPA documents, and including it in our discussions with regions, states, and interstate organizations.

In conclusion, I hope I have conveyed to you today that EPA's support for volunteer monitoring is strong, and that we are working on several fronts to encourage the establishment of more state-coordinated volunteer programs.

■

Jerry Neff

Designing an Estuary Monitoring Program

Monitoring and assessment programs are performed by state and federal agencies or by dischargers in order to produce information that can be used to quantify and evaluate the effects of human activities on the estuarine ecosystem. Ideally, these monitoring programs will provide decision makers and managers with the information they need to make appropriate management decisions about actions required to protect the estuary and its resources, and about the effectiveness of remedial and abatement activities being implemented to restore the environmental quality of the estuary.

Estuarine monitoring and assessment programs are a socio-political phenomenon. They are grounded in the perceptions and values of society, which find expression at the political level through government laws and regulations. The public concerns about estuarine ecosystems that motivate monitoring can be expressed as four questions:

1. Is it safe to swim in the estuary?
2. Is it safe to eat the local seafood?
3. Are fisheries and other living resources being protected?
4. Is the health of the ecosystem being safeguarded?

"It should be recognized from the outset that the public does not necessarily demand monitoring. What the public demands is environmental protection or restoration."

However, these questions alone are not specific enough to serve as the basis for the design of monitoring programs. They do not identify the parameters to be measured or the amount of change that should trigger management action.

It should be recognized from the outset that the public does not necessarily demand monitoring. What the public demands is environmental protection or restoration. Frequently the public, and even the scientific community, do not see the link between environmental monitoring and environmental protection. Often they would rather see money spent directly for protection or restoration.

This negative perception of the value of monitoring stems, in part, from the perception that managers do not effectively use the information gained from monitoring in managing the estuarine environment. Thus, it is important to design estuarine monitoring programs so

that they *will* generate the information managers need, and then to educate the public about the important role of monitoring in the protection and restoration of the estuary.

One approach to gaining public acceptance of monitoring is to get the public actively involved in the monitoring effort. Participation by citizen groups should be built into the design of the monitoring program at the outset.

"One approach to gaining public acceptance of monitoring is to get the public actively involved in the monitoring effort. Participation by citizen groups should be built into the design of the monitoring program at the outset."

As a first step in defining the conceptual framework for a monitoring program, it is necessary to define the following aspects of the estuary under investigation:

- The "valued ecosystem components," or resources that are to be protected.
- The marine constituents that reflect or lead to changes in the state or quality of these resources.
- The natural and human sources of perturbation that produce changes in these ecosystem parameters.
- The mechanisms, both direct and indirect, that link sources of perturbation to ecosystem changes.

The following conceptual pitfalls should be avoided:

- Thinking that there are no cumulative, overlapping, or interactive effects arising from multiple discharges or multiple uses.
- Thinking that measurements made to document the effects of a particular activity reflect the importance of only that activity and no others.

In designing an estuary monitoring program, a strategy should be developed to maximize the usefulness of the monitoring data already being generated by existing programs, as well as the data to be generated in the new monitoring program, for assessing the status and trends of environmental quality in the estuary as a whole. This can be accomplished in several ways:

1. Establish clear objectives and goals for the estuarine monitoring program in the pre-design phase. The goals and objectives should be achievable, scientifically and technically sound, and financially realistic. Mechanisms for measuring progress toward meeting the goals should be established.

2. Identify channels of formal and informal communication among all parties involved in the monitoring program. Make sure those channels remain open and are used.

3. Utilize existing monitoring activities in the design of an estuary-wide monitoring program. Whenever possible, stations already being monitored should continue to be monitored.

4. Maintain consistency in the parameters measured, the times and frequency during the year for making measurements, and the locations of stations. Methods for sampling, measurement, and analysis should also be consistent for the whole monitoring program. Uniform quality assurance and quality control procedures should be applied to all data-gathering activities.

5. Design and put in place a centralized, user-friendly data management system at the outset of the program. Allocate sufficient funds to allow for in-depth analysis and interpretation of the ever-growing database, and the generation of information useful to managers and the public.

■

Andrea Copping

Puget Sound Ambient Monitoring Program

The 1987 Puget Sound Water Quality Management Plan found that "there is currently no long-term comprehensive program to monitor Puget Sound and its resources." In response to this finding, the plan mandated that a comprehensive environmental monitoring program be developed for Puget Sound.

In 1988 the Puget Sound Water Quality Authority appointed an interdisciplinary committee, known as the Monitoring Management Committee, consisting of water quality professionals from federal, state, and local agencies, universities, tribes, industry, and members of the public. The Monitoring Management Committee developed a comprehensive monitoring program referred to as the Puget Sound Ambient Monitoring Program. The monitoring program includes a sampling design, an institutional structure, a data management approach, and a cost estimate. The draft design was reviewed extensively during public workshops, and by scientific and technical experts in the Puget Sound area.

The purpose of the Puget Sound Ambient Monitoring Program is to provide scientifically credible information that increases our understanding both of Puget Sound and its resources and of the effects of human activities over time. PSAMP has been designed to ensure that high-quality data are collected and analyzed, and that the results are made available to a wide audience.

The goals of PSAMP are to:

- Characterize the condition of Puget Sound, its natural resources, human uses, and contamination problems.
- Take measurements to support specific program elements identified in the Puget Sound Water Quality Management Plan (including the municipal and industrial discharge, nonpoint, shellfish, wetlands, and contaminated sediments and dredging programs).
- Measure the success of programs implemented under the Puget Sound Water Quality Management Plan.
- Provide a permanent record of significant natural and human-caused changes in key environmental indicators in Puget Sound over time.
- Support research activities through the availability of consistent, scientifically valid data.

The Puget Sound watershed is large, draining about 16,000 square miles. The design calls for coverage of all the marine and fresh waters of the Puget Sound basin and will complement existing monitoring programs in the Puget Sound basin. Standardized data formats and sampling and analysis protocols will enable PSAMP data to be used with data from other programs (such as the Puget Sound Dredge Disposal Analysis, ongoing urban bay studies, and National Pollutant Discharge Elimination System compliance monitoring). The findings will be used to trigger intensive surveys to identify and investigate emerging problems.

The monitoring program is now in the implementation stages. We are monitoring the following parameters:

Fish
- Bottom fish
- Recreational fish

Shellfish
- Shellfish abundance
- Tissue chemistry
- Bacterial content
- PSP

Marine water column

Nearshore habitat

Marine mammals

Birds

Fresh water
- Water column
- Fish tissue

This is an expensive program: Full implementation will cost about $3.2 million a year. We presently have a little over $1 million a year in implementation funds, almost all of it state funds.

The Monitoring Program is implemented by five state agencies: the Washington State departments of Ecology, Fisheries, Health, Natural Resources, and Wildlife. The program is managed by an interagency steering committee with representatives of the five implementing agencies plus the PSWQA, EPA, local governments, and tribes.

A citizens monitoring program is an important part of the Puget Sound Ambient Monitoring Program. This will be discussed later (Panel 2).

There are a number of important components that we feel have to be hard-wired into a regional monitoring program. They include:

- **Data management.** Our system is microcomputer-based. Each implementing agency has its own system, and staff at the PSWQA maintain the central database.
- **Quality assurance/quality control.** Each implementing agency is responsible for its own field and laboratory quality assurance, and must prove the quality of its data to the PSAMP steering committee.
- **Protocols.** PSAMP requires the use of uniform and consistent protocols.
- **Reports and uses of the data.** Each implementing agency writes an annual technical report on its monitoring activities. The PSWQA staff integrate these reports and write a public-release version of the information; the first one will be available in May 1990. Resource managers in state, federal, and local agencies have access to PSAMP data for use in management decisions. The data will also be used for research and for developing public information programs.

■

"The purpose of the Puget Sound Ambient Monitoring Program is to provide scientifically credible information which increases our understanding of Puget Sound, its resources, and the effects of human activities over time."

Panel 2 Forging Links to State Government

Panelists: R. Paul Wilms, North Carolina Department of Natural Resources and Community Development; John Kopec, Ohio Scenic River Stream Quality Monitoring Program; Kathleen Hentcy, Vermont Lay Monitoring Program; Scott Kishbaugh, New York Citizens' Statewide Lake Assessment Program; Andrea Copping, Puget Sound Water Quality Authority.
Moderator: Michelle Hiller, EPA Office of Marine and Estuarine Protection.

R. Paul Wilms
North Carolina Department of Natural Resources and Community Development

I hope I'm not the only regulatory official in the room, because I really want to talk to someone other than the saved. Are there any federal, state, or local regulatory officials in the audience?—Super. Any that don't already use citizen monitoring?—Great. I'm talking to you.

I've come to realize that, in a sense, citizens are always monitoring the environment. Anyone with eyes, ears, and/or a nose cannot help but note the quality of the environment around them. These observations can engender peace, contentment, and even joy, or, alternatively, concern and even outrage. Contentment is often left unexpressed, except by poets. On the other hand, outrage over environmental degradation is usually expressed—and usually not toward the person responsible for the degradation, but rather at the government environmental agency that is perceived, either rightly or wrongly, as having allowed the degradation to occur.

Being from such an agency, and having been on the receiving end (or, actually, continually being on the receiving end) of citizen complaints, I know that we often respond that we are doing the best job we can with the meager and insufficient resources we have. Such a defense may be valid, but it ignores the very real contribution that well-equipped and well-trained citizen volunteer monitoring groups can make to environmental assessment and protection.

In North Carolina, we have tried to harness the concern, commitment, and dedication of our citizens to enhance protection of the natural environment in a number of ways:

- In the late 1970s, we used volunteers to monitor the trophic status of the Chowan River, a tributary of Albemarle Sound. The data allowed the state to develop an algal index for the river as well as a predictive model for bloom events.
- In 1983, North Carolina began a "Stream Watch" program.
- More recently, commercial fishermen and residents immediately adjacent to the Pamlico estuary have been enlisted to collect water quality data and make qualitative observations of the environmental and fisheries status of the estuary.

"In North Carolina, we have tried to harness the concern, commitment, and dedication of our citizens to enhance protection of the natural environment in a number of ways."

The benefits of citizen monitoring are many. It increases the public understanding and appreciation of the complex web of physical and biological interrelationships that characterize any aquatic ecosystem. It results in a long-term commitment by citizens to the protection of the environment. It obviously expands the state's ability to monitor environmental quality and those activities that may affect it. Most importantly, it establishes a working partnership between citizens and government, wherein citizens move from being affected bystanders and sideline observers to being active and effective participants in the effort to protect environmental quality.

Let me say to those program manager colleagues of mine in the audience that do not now use citizen monitoring that if you launch into a citizen monitoring program, it must be more than gratuitous. If you're going to have citizens collect the information, you've got to use it.

And it will be good information. People who are committed enough to join a monitoring program are going to do an exemplary job. I haven't had a problem yet with quality assurance or reliability. Also, it must be a real partnership. The volunteer program can't be simply an adjunct to the state's program; it must be an equal partnership.

If you do those things, I'm convinced, from my experience, that the benefits will exceed any expectations you might have.

■

John Kopec

Ohio Scenic River Stream Quality Monitoring Program

I was asked to speak about how citizen volunteer monitoring programs have forged links with state government agencies. I would like to state for the record that in Ohio, our Stream Quality Monitoring Program has produced one of the most significant alliances between state government and the general public that supports that operation. We are frequently told by our volunteers that our program provides one of the best returns for the taxpayer's dollar. Ohio's stream monitoring program receives the lion's share of its funding through a state income tax refund check-off arrangement. If only we could convince our state legislators to provide us with a mere fraction of the state budget that is allocated for education (the justification being that the state's environmental education directive is being served through the environmental education message conveyed by the monitoring program).

I would like to give you a quick overview of Ohio's Stream Quality Monitoring Program, with an emphasis on the philosophy and value of the program rather than the procedural methods.

Ohio developed its Stream Quality Monitoring Program in 1983 to provide an easy and inexpensive method of determining general levels of stream health. We use a biological monitoring technique that we adapted from the Izaak Walton League's Save Our Streams Program. The technique involves the collection and examination of "indicator" organisms—20 taxa of stream macroinvertebrates such as snails, crayfish, clams, and aquatic worms and insects. Each taxon is assigned a point value based on its tolerance of pollution. By determining the composition and abundance of the macroinvertebrate community in a portion of a stream, we obtain a score or cumulative index value that relates to the aquatic health of the stream.

"We chose biological rather than chemical monitoring for several reasons. One is that biological monitoring provides a better assessment of long-term stream health, whereas chemical testing mainly gives information about the water quality at the time of sampling."

We chose biological rather than chemical monitoring for several reasons. One is that biological monitoring provides a better assessment of *long-term* stream health, whereas chemical testing mainly gives information about the water quality at the time of sampling. Another very significant advantage of biological monitoring is the relatively low cost of the equipment, which makes it possible to use a tremendous number of volunteers at any given time. The program annually involves more than 200 groups and organizations representing some 4-5,000 volunteers. The cost of a fine-mesh nylon seine, a plastic container, an inexpensive hand lens, a thermometer, pencils, and a few forms adds up to a very reasonable $25 for each group.

The one drawback of biological monitoring is that it requires a lot of training. We do provide visual aids and keys to help volunteers learn to identify the various species of macroinvertebrates, but nothing seems to take the place of personal attention, so the Stream Quality Monitoring Program employs four part-time seasonal employees. However, this requirement for a relatively large amount of training is really a blessing in disguise, because it forces us to be personally involved with each and every participant.

Gathering data on the health of Ohio's streams was the initial focus of the program and is still one of its most important functions. However, as more and more people become

involved each year, the feedback that we receive is that this is one of the most rewarding and entertaining activities that anyone has ever experienced. Teachers tell us that in-stream sessions with their classes seem to inspire their students—especially those most in need of inspiration. Scout leaders, Big Brothers and Big Sisters, school latch-key programs, and individual families are equally enthusiastic.

"Teachers tell us that in-stream sessions with their classes seem to inspire their students—especially those most in need of inspiration."

Our Scenic Rivers law is structured not only to provide for local input, but actually to be dependent upon local actions and attitudes to get the job done. What better way to gain that cooperation than to bring all social elements of the river community—schools, civic organizations, landowner associations, youth clubs, local agencies, and others—into a program such as stream quality monitoring which can really help to build a constituency of support through a much improved understanding and appreciation of the resource?

Does citizen monitoring attract media attention and garner public enthusiasm and support? You bet it does! And what better way to induce environmental consciousness in the business and industrial communities than to dramatically illustrate that level of public concern and action?

I can guarantee you that if you are able to entice your local TV station to give coverage of your citizen monitoring events, you stand a much better chance of attracting the attention of your state and local politicians.

■

Kathleen Hentcy

Vermont Lay Lake Monitoring Program

In 1979, the Department of Environmental Conservation, Division of Water Quality, had neither baseline data on Vermont lakes nor the monetary resources to collect such data. Yet anthropogenic eutrophication was and continues to be a major threat to Vermont's lake water quality. Basic nutrient enrichment data, therefore, were and are essential to protecting our lakes from continued degradation.

So the Vermont Lay Monitoring Program was born. Sixteen thousand dollars was bled from state funding sources to equip monitors on 32 lakes and 19 Lake Champlain stations, hire a part-time coordinator, and cover other expenses. In 1981, a federal 314 grant for $100,000 was secured, and since then all funding for the program has come from the state of Vermont. However, the monitoring program is used as matching funds for federal grant money, the most recent of which has been the EPA Lakes Assessment grant for $100,000 for the years 1989 and 1990.

"Eleven years have passed since the beginning of the Vermont Lay Monitoring Program, and this program continues to be the backbone of Vermont's water quality data collection both on Lake Champlain and on what we call our inland lakes."

Eleven years have passed since the beginning of the Vermont Lay Monitoring Program, and this program continues to be the backbone of Vermont's water quality data collection both on Lake Champlain and on what we call our "inland lakes." The lay monitoring data are the only data we have on many of our lakes. Sixty lakes and 30 stations on Lake Champlain have been part of the program.

Monitors typically collect Secchi disk clarity readings and chlorophyll *a* samples on a weekly basis from approximately June 1st through September 2nd. Some collect total phosphorus as well.

The equipment we provide to the monitors is pretty basic—we are very limited in our funds—but we give them everything they need down to pencils and paper clips. Monitors get an acid-washed garden hose that has been marked off in meters, with a line and two diving weights attached at the zero end; a Secchi disk; data sheets; lake map; an acid-washed plastic bucket with a lid; sample bottles; filtering apparatus; and filters. Monitors have only to supply a boat, an anchor, and their time.

Currently the program requires one part-time, year-round person, two summer field assistants, and two vehicles for sample pick-ups. Our monitors freeze their chlorophyll filters and

this necessitates our traveling to pick them up.

We've found the dedication of the volunteers to be impressive and their attention to detail worthy of scientific data collection.

The monitoring data have been used as the basis for four diagnostic watershed studies. One full-blown restoration was carried out on one of those lakes. Also, Vermont has recently designed a bistate workplan with the state of New York for carrying out a diagnostic watershed study on Lake Champlain's drainage basin. Again, the monitoring data were a major part of the justification for the study. The data are also being used extensively in our new Lakes Protection Program to target those lakes in the state most threatened by human-caused eutrophication.

I believe an important reason for our success with the program is the high level of contact we maintain with our monitors. Without such contact I don't believe a program would survive.

Volunteer monitoring programs are much more than a cost-saving method for securing large databases. I'd like to echo what Dennis Weaver said earlier this morning—that programs like this make the general public part of the solution instead of part of the problem, and to me that's one of the greatest benefits.

■

Scott Kishbaugh

New York Citizens' Statewide Lake Assessment Program

As we approach the 20th anniversary of Earth Day, it is clear that the face of the environmental movement has changed dramatically. In those early years, it was easy to blame the "heartless corporate polluter" for environmental problems. As the movement has become more sophisticated, some pollution problems have been controlled, if not eliminated. However, with increased sophistication comes an increased awareness that environmental problems ranging from toxic wastes and erosion to acid precipitation to the greenhouse effect are the summed effect of millions of people making individual decisions.

Over the next few days, you will hear how several programs have provided cooperation between government, environmental monitors, and laymen to resolve the conflict of too many threatened natural resources, too little time, and too few dollars. In New York State, the vehicle for cooperation has been the Citizens' Statewide Lake Assessment Program, known as CSLAP.

CSLAP is a cooperative effort between the New York State Department of Environmental Conservation and the New York Federation of Lake Associations (FOLA), a statewide nonprofit coalition of lake associations that comprises over 250 lake associations, corporations, and individual members. Funding for the program is provided through the state budget.

Using field and laboratory equipment provided by the state, volunteers from FOLA perform a series of in-lake and watershed analyses through procedures established in a sampling protocol document. Water samples are then processed and sent to a central laboratory, the New York State Department of Health, where they are analyzed for six chemical parameters. Volunteers also determine water transparency; macrophyte species coverage; and oxygen, precipitation, and lake levels. Sampling data are analyzed by the Department of Environmental Conservation, and summarized in annual reports to the participating lake associations. Results are used by lake associations, planning departments, and local government officials to develop lake and watershed management plans tailored specifically to the

"With increased sophistication comes an increased awareness that environmental problems ranging from toxic wastes and erosion to acid precipitation to the greenhouse effect are the summed effect of millions of people making individual decisions."

local community.

Although lay monitoring programs can be very cost-effective, it is clear that the management of a successful program involves both time and manpower, two commodities not found in great supply in most state agencies. Lay monitoring programs must be accountable and provide sufficient benefits to be deemed acceptable for government work. The following are three of the most significant reasons why CSLAP has been successful in New York:

1. **Collection of reliable data**
   With accurate data, standardized sampling procedures, reproducible methods, and adequate quality assurance/quality control, the results from lay monitoring programs can be deemed acceptable by state agencies.
2. **Problem diagnosis**
   Whether assessing the need for a dredging project in one lake, investigating the impact of a sewage treatment facility on another lake, or upgrading the best use classification for other lakes, the data from CSLAP have been useful in diagnosing problems in New York lakes.
3. **Education**
   The state of the environment is a function of millions of people making individual decisions. If the old adage that an ounce of prevention equals a pound of cure is true, then education to influence these individual decisions will provide a better method of protecting the environment. The educational component of CSLAP is two-way: Volunteers are learning about lakes and environmental protection, while the state agencies are learning about the specific water quality conditions in specific lakes.

It is clear from the experience in New York that lay volunteers and government officials can work together to develop a scientifically sound lake monitoring program. It is also clear that, in the days of the shrinking environmental dollar, there may be no other way to adequately protect our threatened natural resources.

■

Andrea Copping

Puget Sound Citizens Monitoring Program

I'm very pleased to be on this panel because the Puget Sound Water Quality Authority is involved in a citizen monitoring program that represents a bit of a different model from some of the ones we've heard about today. Also, ours is an entirely marine and estuarine program, which again is a little bit different.

We've been fortunate enough to have some cigarette tax money. This is the 8¢-per-pack tax on tobacco products in the state of Washington, which is used for water quality projects. Most of that goes toward building secondary treatment plants, but the Authority was given some small part of that money for public involvement and education projects (our so-called PIE fund). Over the last couple of years, we've been able to fund about eight citizen monitoring projects out of that. Some of those have ended because the funding was only for two years, but other groups have gone on to find continuing funding elsewhere.

The program that I want to talk about to you today is the Puget Sound Water Quality Authority citizens monitoring program, which is associated with the Puget Sound Ambient Monitoring Program, or PSAMP. PSAMP is a comprehensive environmental monitoring program for Puget Sound and the surrounding watersheds. The program is actually carried out by five state agencies in Washington State. We at the Puget Sound Water Quality Authority act as coordinators and data managers.

When PSAMP was designed in 1987 and 1988, citizen monitoring was very much an integral part of it; it was not an afterthought. Since we have over 2,200 miles of shoreline in Puget Sound, and a watershed of 16,000 square miles, it would be extremely difficult for state agency staff to monitor all of it.

As we see it, our citizen monitoring program is a state agency/citizens group coalition.

The money comes from the state cigarette tax, and we at the Authority contract with citizen groups to carry out specific parts of the program. The state agencies are responsible for training citizens and providing equipment, and they're also responsible for reporting back to the citizen groups with any information that is produced in the program.

One of our biggest problems has been the reluctance of some state agency people to accept the citizens' data. To overcome this, we set up our program so that the coordinating agencies have very strong roles in training, oversight, and reporting of data. I think we've succeeded in swinging most of the skeptics around.

"One of our biggest problems has been the reluctance of some state agency people to accept the citizens' data. To overcome this, we set up our program so that the coordinating agencies have very strong roles in training, oversight, and reporting of data. I think we've succeeded in swinging most of the skeptics around."

In deciding which parameters are suitable for monitoring by volunteers, the agencies emphasized those types of samples that are (1) easy to collect and (2) difficult to contaminate. For example, volunteers do not collect samples for toxics analysis because these are easy to contaminate and could also pose a danger to the volunteers.

Currently we have two citizens groups under contract. These groups provide volunteers to the PSAMP agencies for almost any PSAMP activities. The two groups represent different models of volunteer organization.

The first group, Adopt a Beach, is a traditional environmental group. Most of the Puget Sound Water Quality Authority money goes to pay the salary of a coordinator for the group. Since the group has volunteers based all around the Sound, there are few travel expenses.

The second group, Chautauqua Northwest, is a group of retired citizens. They have a long history of volunteer activities but were never involved with the environment before. There is a core group of people from this organization (they call themselves the "Anti-Dirty Dozen") who travel all around the Sound to do monitoring for us. With Chautauqua, most of our contract money goes to travel expenses.

Now I'd like to give you some examples of the types of projects that these two groups have done:

- Adopt a Beach worked on a project of groundtruthing nearshore habitat. We needed to have people out in the field all over the Sound at exactly the same time that a plane flew overhead doing a remote sensing survey. The volunteers checked for vegetation type, density, etc. It was a very labor-intensive project.
- Adopt a Beach volunteers also collect shellfish for PSP (paralytic shellfish poisoning) analysis. This is quite a commitment because the shellfish have to be collected at low tide, and at this time of year low tide comes in the middle of the night.
- For one project, Chautauqua Northwest volunteers caught fish by hook and line for chemical analysis. These fish were too deep for divers to reach.
- Chautauqua Northwest is also involved in collecting shellfish for bacterial analysis and collecting water quality samples for analysis of conventional parameters.

In summary, the message I'd like to leave you with is that you can be innovative. Don't restrict yourself just to the types of monitoring you've done in the past.

■

Panel 3 Quality Assurance & Quality Control

Panelists: Paul Godfrey, Massachusetts Acid Rain Monitoring Project; James M. Bellatty, Idaho Division of Environmental Quality; David Flemer, Friends of Perdido Bay.
Moderator: Michelle Hiller, EPA Office of Marine and Estuarine Protection.

Paul Godfrey
Massachusetts Acid Rain Monitoring Project

We began the Acid Rain Monitoring Project (ARM) with a presentation on acid rain at a local Massachusetts Audubon Sanctuary in the fall of 1982. I proposed that the assembled group of 20 or 30 people might organize an effort to measure pH and alkalinity in local lakes and streams. To my surprise, most of the people in the room stayed after the presentation to do exactly that.

The following six years have seen three phases of the ARM Project. Phase I sampled 1,000 surface waters monthly for 14 months; 79 professional labs volunteered their time and equipment. Phase II sampled 2,500 surface waters on two separate days. We reduced the number of labs to 20 because we could not manage to send quality control samples and provide personal attention to over 70 labs. Phase III is ongoing, with 300 volunteers sampling 800 surface waters quarterly and 17 labs performing the analysis.

The labs analyze the samples for pH and alkalinity. These determinations must be made within 24 hours of collection. Labs also provide two aliquots of sample water to the Water Resources Research Center lab (at the University of Massachusetts) for analysis of 30 additional parameters.

"We were very interested in quality assurance/quality control from the beginning. You have to remember that we were monitoring surface waters for acid deposition—that meant we were playing the same game as EPA, and it meant that if we were to have a credible effort, we had to meet EPA's standards. We also knew that the utilities and industries would question the data if we were not very attentive to quality control."

We were very interested in quality assurance/quality control from the beginning. You have to remember that we were monitoring surface waters for acid deposition—that meant we were playing the same game as EPA, and it meant that if we were to have a credible effort, we had to meet EPA's standards. We also knew that the utilities and industries would question the data if we were not very attentive to quality control.

In the first phase, we concentrated on quality assurance of the labs. Each participating lab received a blind quality assurance sample to analyze along with field samples. That approach allowed us to document quality and to make decisions on which data to retain, but it did not allow us to correct difficulties as they happened. At the end of the first phase, we had no choice but to eliminate the work of several labs.

To minimize the problem of excluding data of questionable quality, we adopted a more extensive quality assurance plan for the second and third phases. Three quality assurance samples were distributed to each lab. The first was sent a week prior to sampling. Labs analyzed the sample and reported by prepaid postcard. If we saw a problem with the results, we were able to give the lab advice (by phone or by visit) to correct the problem. On the sampling day, labs were given two additional quality control samples—the first to be run in duplicate prior to field sample analysis, the second to be run in duplicate after the last field sample was analyzed. A plot of the results for pH measured at the volunteer labs versus our measurements at the University of Massachusetts shows an excellent correlation—the slope of the regression is 0.995 and the intercept is 0.002 (compare to 1.0 and 0.0, which would be perfect agreement). Results for alkalinity were almost as good.

For many sampling dates another set of quality assurance samples was provided to the labs. These were labeled as if they were field samples. We had to demonstrate that field samples were not treated differently from the identifiable quality assurance samples. Human

nature suggests that the lab personnel would be more careful with the known quality assurance samples. Yet we found no significant differences.

In the third phase of the project, we began a program to monitor the performance of the monitors. During each sampling period, my staff collects a duplicate sample at one site visited by each volunteer. We collect our samples within hours of the volunteer collection and bring the samples to the same lab as the volunteer. Of the 800 sites regularly sampled, we have replicated 122 to date. The correlation between the volunteers' results and ARM staff results has been near perfect.

"People have gotten out of hospital beds, cut vacations short, fallen through ice, slid down hillsides, gotten stuck to the axles in mud, and been questioned by the police—and still continue to collect samples for the project."

There is one other aspect of quality control in volunteer efforts that also needs to be mentioned. ARM has encountered its share of skeptics who believe that volunteers simply cannot produce data of scientific quality. In recent months we have been surveying our volunteers in an effort to better understand who they are and why they participate. We have found that nearly all have some college education. They are very active in their communities. Most value the outdoors. In short, these citizen volunteers are some of the most active, successful, and educated representatives of our society.

It is crucial not to demean the abilities of the volunteers, and to allow some room for the volunteers to participate in the decision-making process. We did that initially by letting volunteers select sampling sites. We have let them be local spokespeople in the community. After eight years, I can flatly state that our volunteers continue to follow sampling protocols, do their homework by learning more about acid rain impacts, and accurately represent our efforts.

Many of the volunteers have been with the project since its inception. There has been greater staff turnover at the Water Resources Research Center than in our volunteers. Their motivation is astounding: People have gotten out of hospital beds, cut vacations short, fallen through ice, slid down hillsides, gotten stuck to the axles in mud, and been questioned by the police—and still continue to collect samples for the project. Most volunteers would like to do much more and our task is to find ways to tap this almost unlimited resource. If there is a danger in using citizens for environmental monitoring, it is in trying to keep up with them. ■

James M. Bellatty

Surface Water Quality Monitoring Program

The Idaho Division of Environmental Quality (IDEQ) established a statewide volunteer water quality monitoring program during the summer of 1987. The goals of the program are to meet an increased need for long-term water quality monitoring and to allow for public participation in the data-gathering process.

Currently, the volunteer water quality monitoring program covers eleven Idaho lakes and one river segment. The IDEQ tailors the different monitoring programs to the interests and financial resources of each volunteer group. Some groups perform mainly Secchi disk transparency depth measurements while others collect samples for nutrients, metals, and chlorophyll *a*.

This presentation will focus on how our volunteer monitoring program provides reliable water quality data and maintains quality assurance standards. The quality assurance program we have chosen consists of: (1) a training course, (2) an annual field audit, (3) collection of replicate samples, and (4) quality controls for laboratory analytical methods.

1. Training

At the beginning of each volunteer monitoring season (April through October), the volunteers attend a water quality training session presented by the IDEQ staff. At this outdoor workshop, the volunteers learn the proper use of their water quality sampling

equipment and practice their water quality sampling protocols. The IDEQ trains the volunteers to use a "cookbook" approach to ensure that volunteers systematically collect their samples in a step-by-step manner.

2. **Field audit**
   Each volunteer group is required to schedule a field audit with the IDEQ staff during the monitoring season. The purpose of this IDEQ visit is to take a nonthreatening look at sampling procedures and to provide constructive comments for improving water quality sampling techniques. The field audit includes an informal evaluation of the volunteers' organizational capabilities, preparation and labeling procedures, paperwork, consistency, meter-calibrating techniques, and ability to preserve and transport water quality samples in a timely manner.
3. **Replicate sampling**
   During the field audit, the volunteers also collect one set of replicate water quality samples. These replicate samples enable IDEQ to estimate the level of sampling precision, or the amount of reproducibility among individual measurements of the same parameter. Although IDEQ has not defined acceptable levels of precision for volunteer monitoring parameters, most of the replicate sampling results indicate low levels of sample variability.
4. **Laboratory quality controls**
   Volunteers transport their water quality samples to the Idaho Bureau of Laboratories for the appropriate chemical and biological analyses. Analyses are conducted in accordance with EPA and APHA (American Public Health Association) standards and are tested for estimates of analytical accuracy and laboratory precision.

"Each volunteer group is required to schedule a field audit with the IDEQ staff during the monitoring season. The purpose of this IDEQ visit is to take a nonthreatening look at sampling procedures and to provide constructive comments for improving water quality sampling techniques."

Although no single element in the quality assurance program would be enough to validate the results of a volunteer water quality monitoring program, we feel that a combination of several checks and balances is adequate to meet our program goals and objectives. Volunteer water quality monitoring data are primarily used for determining long-term water quality trends, rather than for regulatory or investigative purposes.

The water quality data generated from the IDEQ program complements existing water quality monitoring programs and helps agencies make informed water quality management decisions. As we look toward the future, the challenge for continued volunteer monitoring success will depend on our ability to retain volunteer interest, recruit new members, and assure quality data.

■

David Flemer
Friends of Perdido Bay

Perdido Bay, located on the Alabama/Florida border, is one of the smaller estuaries of the Gulf of Mexico. Wastewater discharges to the bay include those from several municipal sewage treatment plants (4.1 million gallons per day total), as well as those from the Champion International Corporation Paper Mill, which discharges 22 million gallons per day into Elevenmile Creek, a bay tributary.

In many ways, Perdido Bay's physical characteristics and environmental problems reflect the concerns about the Gulf Coast and its estuaries. Therefore, Perdido Bay was selected as the site of a pilot project under the EPA's Near Coastal Waters Program.

For nearly 30 years, various government agencies and industries have collected data documenting the physical and biological conditions in the bay and its tributaries. However, there was never a coordinated approach to bay investigations. On October 1, 1988, EPA, in cooperation with the U.S. Fish and Wildlife Service and the Environmental Coalition of Concerned Citizens' Organizations (ECCCO), began the Perdido Bay Cooperative Management Project. As part of this project, ECCCO and another local environmental group, the Friends of Perdido Bay, have organized a citizens monitoring program for Perdido Bay. A citizens monitoring program can deliver data of known quality to augment existing monitoring programs by (1) capturing short-lived phenomena of interest (e.g., storms), (2) sampling areas not routinely monitored, (3) providing observational information on weather, living

resources, and site conditions, and (4) contributing answers to short-term research questions.

The volunteer monitors are collecting hydrologic, water quality, and weather data related to Perdido Bay and are reporting it directly to state agencies, EPA, and other interested data users. The monitoring program has also purchased and maintains automated weather stations. It is believed that local weather conditions have a great deal of influence on the hydrology and water quality of Perdido Bay. Thus the data will be valuable in forming a picture of the dynamics of the Bay.

"From the outset, quality assurance has been an important consideration for the volunteer monitoring program. Volunteers undergo training in proper data-collection methods and adhere to a rigorous quality control/ quality assurance program."

From the outset, quality assurance has been an important consideration for the volunteer monitoring program. Volunteers undergo training in proper data-collection methods and adhere to a rigorous quality control/quality assurance program. The following are some of our quality control procedures:

Secchi disk. The accuracy of the depth markings will be checked before initial use and approximately every six months thereafter.

Thermometers. All stem thermometers will be compared to a standard ERL/Gulf Breeze National Bureau of Standards reference thermometer before initial use and approximately every six months.

Salinity titration (LaMotte kit). Each kit will be initially compared to an ERL/Gulf Breeze reference water sample. The kits will be rechecked approximately every six months.

Dissolved oxygen meters (YSI Model 57). Initially, and at three-month intervals, each meter will be calibrated by a Winkler titration. Meters will be air calibrated with every use.

Salinity-conductivity meter (YSI model 33). The meter will be checked initially and at six-month intervals with a reference coastal water sample or standard saline solution. Monthly checks will be made with a refractometer for the salinity endpoint. The thermistor will be checked when salinity checks are made.

"Tide" staffs. Primary water level staffs will be surveyed in by a licensed surveyor. Other staffs will be calibrated to a "fixed" structure (e.g., surface of pier) to provide a reliable relative reading.

Rain gauges. The collection will follow the guidance of U.S Weather Service on placement.

Wind speed indicator. Hand-held indicators will follow procedures provided by manufacturer. All indicators will be "calibrated" as a group against a U.S. Weather Station measurement.

Wind direction indicator. Readings will resolve eight points in the compass. The instrument will be calibrated against the "North Star" or compass reading.

In addition, precision and accuracy objectives for all of the above measurements have been set.

The Project Director funds a Quality Assurance Officer who reviews and initials each data sheet from volunteer monitors before it is sent to the data analysis and repository facility. Quarterly quality assurance reports are made to the Project Manager. Copies of the reports are submitted to the regular meetings of the Friends of Perdido Bay and to chairmen of the Technical Advisory Committee.

By the end of the two-year project, the information collected will provide a clearer picture of the present condition of Perdido Bay. The project will also be a model for involving local interest groups and government agencies in environmental management and for encouraging them to implement strong control programs.

■

Panel 4 Debris Cleanup

Panelists: Kathryn O'Hara, Center for Marine Conservation; Cindy Zipf, Clean Ocean Action; Judie Hansen, Get the Drift and Bag It; Ken Pritchard, Adopt a Beach.
Moderator: Virginia Lee, Coastal Resources Center, University of Rhode Island.

Kathryn O'Hara
Beach Debris and Pollution Prevention Program

America's shorelines and coastal areas were once famous for their beauty and biological richness. In recent years, however, our coastal areas have been most widely publicized for their concentrations of trash.

Beach debris is not merely unsightly—it is dangerous to human health and safety, and expensive for coastal communities burdened with repeated cleanup costs. But the litter on our coasts is just an indication of even greater amounts in the oceans, where it is less visible but deadly. Thousands of marine mammals, sea turtles, seabirds, and fish die every year from entanglement in debris items such as rope, nets, and monofilament fishing line, or from ingesting items like plastic bags and sheeting, mistaking them for food. This floating debris also poses a hazard to navigation by fouling boats' propellers. Plastic debris items, because of their buoyancy, strength, and long-lasting nature, pose the greatest threat to the marine environment.

Since 1986, the Center for Marine Conservation has conducted an extensive campaign based on what is the key to solving the marine debris problem—education. The Center's efforts have been directed at two primary groups: those who litter marine areas on shore, and seafarers who are accustomed to the centuries-old practice of tossing trash over the rail at sea. Citizen beach cleanups have become an important component of this education campaign.

"The litter on our coasts is just an indicat. n of even greater amounts in the oceans, where it is less visible but deadly."

During the opening remarks to this conference, Tudor Davies stated that every successful citizen monitoring program needs a hero. In the world of beach cleanups, we have many heros and heroines, including Judie Hansen. In 1984, Judie successfully organized a citizen beach cleanup in Oregon that attracted 2,000 volunteers. Her idea has inspired the nation. Today, I would like to describe how this idea has evolved.

History

In organizing the first statewide beach cleanup in Texas in 1986, the Center for Marine Conservation designed a method to obtain useful information on the types and quantities of debris collected. Beach cleanups, after all, provide only a temporary remedy to the debris problem. In order to develop permanent solutions, the sources of this debris need to be identified. Therefore, volunteers who participated in the 1986 Texas Coastal Cleanup were given a detailed data card to record specific information on debris. This data collection effort not only proved to be an educational experience for cleanup volunteers, but also helped to generate a significant amount of press coverage that reached others. The information was also used in support of U.S. ratification of MARPOL Annex V, an international treaty prohibiting the dumping of plastic garbage from ships at sea and regulating the distance from shore that all other solid waste materials may be dumped.

During the period of 1986-1988, cleanup campaigns spread to coastal areas throughout the country. There were "Trash Attacks" in New Jersey, "Lend a Hand in the Sand" in Mississippi, "Beachsweep" in North Carolina, and "Get the Trash Out of the Splash" in Alabama. Some states, such as Texas, integrated beach cleanups into "adopt-a-beach" programs.

When it became apparent that 1988 would be the last year to obtain baseline information on beach debris prior to the enactment of MARPOL Annex V, CMC solicited suggestions from states that were conducting beach cleanups in order to design a data card that could be used nationally. Subsequently, the Center for Marine Conservation initiated the National Marine Debris Database in the fall of 1988. Sponsored by the U.S. Environmental Protection Agency, the National Oceanic and Atmospheric Administration, and the U.S. Coast Guard, the database serves to involve citizens in the identification of specific debris problems in different parts of the country.

"In 1988, more than 47,500 volunteers in 25 U.S. states and territories participated in the National Marine Debris Database. These volunteers covered more than 3,500 miles of U.S. shorelines and collected nearly 1,000 tons of debris."

Results

In 1988, more than 47,500 volunteers in 25 U.S. states and territories (Alabama, Alaska, California, Connecticut, Delaware, Florida, Georgia, Hawaii, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Puerto Rico, Rhode Island, South Carolina, Texas, Virginia, the Virgin Islands, and Washington) participated in the National Marine Debris Database. These volunteers covered more than 3,500 miles of U.S. shorelines and collected nearly 1,000 tons of debris.

Volunteers used a standardized data card that was divided into eight major category types—plastic, glass, styrofoam, rubber, metal, paper, wood, and cloth. In total, the data card listed 65 types of debris items.

The volunteers reported finding a total of 1,973,995 debris items. The amount of plastic reported surpassed all other categories, accounting for 1,222,708 of the debris items, or approximately 62 percent. The remaining debris items consisted of approximately 11.8 percent paper, 11.4 percent metal, 9.5 percent glass, 2.3 percent wood, 1.8 percent rubber, and 1.3 percent cloth.

Collectively, twelve debris items constituted more than 56 percent of all debris items recorded. The Dirty Dozen of 1988 were as follows, in order of abundance:

1.	plastic pieces (or fragments)	134,685
2.	small foamed plastic (styrofoam) pieces	125,725
3.	plastic cups, spoons, forks, and straws	112,465
4.	metal beverage cans	99,847
5.	foamed plastic (styrofoam) cups	95,807
6.	glass beverage bottles	95,028
7.	plastic caps and lids	90,998
8.	paper pieces	85,864
9.	plastic trash bags	78,025
10.	miscellaneous types of plastic bags	74,672
11.	glass pieces	65,819
12.	plastic soda bottles	58,116

The information from the 1988 National Beach Cleanup and Marine Debris Database has been compiled into a final comprehensive report titled "Cleaning America's Beaches." The data in this report are presented in a national overview as well as state-by-state analyses.

Information from the 1988 report has been used by the U.S. Environmental Protection Agency and the U.S. Coast Guard in reports to Congress. State and local governments are also using these data for evaluating the marine debris problem. The data are also being used to inform marine industries of their contributions to the marine debris problem, in hopes that they will realize the need for proper disposal and compliance with federal regulations.

Data collected during beach cleanups cannot be used to estimate total amounts of debris or the precise sources of debris items. However, comparison of relative amounts of debris

can reveal important national, state, and local trends in the types and distribution of beach debris. In particular, citizen beach cleanups have helped to demonstrate the predominance of plastic waste on our nation's shorelines. Future beach cleanups will help to monitor legislative and other efforts to control the discharge of plastic wastes into marine areas.

Moreover, citizen monitoring of beach debris contributes greatly to the underlying theme of a beach cleanup—increased awareness. Those who participate in beach cleanups learn that marine industries are not the only sources of marine debris and that the solution lies with us all. Those who do not participate in beach cleanups hear about the results in the media. Knowing that someone is keeping count, they may consider proper disposal of their next six-pack ring or foamed plastic cup.

■

Cindy Zipf

Clean Ocean Action

Clean Ocean Action is a coalition of 130 organizations including women's groups, commercial fishermen, recreational fishermen, boating organizations, Kiwanis clubs, traditional environmental groups, unions, and—more and more, I'm happy to say—tourism industry groups.

While we represent about 400,000 people, Clean Ocean Action is really representing the fish, shellfish, and plants that live in the marine environment and have a terrible time getting to the public hearings to testify about the degrading condition of their habitat.

Clean Ocean Action is very committed to science. Because of that, and because we can back up what we say with facts, we have been able to open doors in New Jersey that might otherwise have been closed to "fish-huggers."

The metropolitan New York/New Jersey area is one of the most densely populated, urbanized areas in the country. Clean Ocean Action is based at Sandy Hook, which is at the receiving end of the pollutants entering into the New York/New Jersey estuary. Because the area is so densely populated and so old, we have a wide variety of problems, from decrepit infrastructure to toxic dumping. Medical waste, though given a lot of publicity, is not the major problem threatening the estuary.

"Using the data collected in the cleanups, Clean Ocean Action continues to push for state and federal initiatives to control floatable pollution. ...Once the debris gets into the marine environment, in a sense the battle is over. So our focus at Clean Ocean Action is on source reduction."

Clean Ocean Action's beach cleanup program, which is called Trash Attack, focuses on getting a diverse group of sponsors—particularly media sponsors. By including television, radio, and newspapers, we maximize our education opportunities and publicity for the cleanup.

We try to recycle as much as we can from the beach cleanups. Bottles and cans are easy, but other materials are not. Recently, Clean Ocean Action attempted to take advantage of McDonald Corporation's recycling program. We separated out all the styrofoam from the cleanup, then called and asked McDonald's to come and collect it and take it to their recycling plant in Brooklyn, N.Y. We called many McDonald's restaurants and they all refused to come—so we just shipped the styrofoam off to their national headquarters.

Using the data collected in the cleanups, Clean Ocean Action continues to push for state and federal initiatives to control floatable pollution. Several programs have started. Prisoners pick up debris in inner harbor areas, and skimmer boats collect "slicks" spotted by patrols.

However, many of our pollution problems are being addressed after the fact. Once the debris gets into the marine environment, in a sense the battle is over. So our focus at Clean Ocean Action is on source reduction. For example, we've been trying to get towns to pass ordinances banning polystyrene take-out packaging. We are also attempting to get legislation to ban certain products from New Jersey. We tried to get a bill passed to ban plastic tampon applicators, but it failed.

We're trying to get the litter laws enforced. If you can get a few people arrested and

fined for littering, you can get front-page coverage. We're also going into source-reduction programs—educating about the harmful effects of dumping motor oil or household toxics, and about lawn-care products.

Of course, if you can't recycle it and you can't get rid of it, you can re-use it. Making light of litter also helps. We make "tampoons"—fishing lures made from plastic tampon applicators. They work really well; they've caught bluefish, fluke, sea robins, and several other fish species.

We also built a "Tacky Town" out of materials that we collected on the beach. It has a florist shop (we collect a lot of plastic flowers), and of course there's a food store with all the food wrappers and potato chip bags, and there's a restaurant, and a tampon highway leading into the town. The press gets bored with "totals," so you can build something with your trash, make it a monument to the trash problem.

The moral to our story is that it can be difficult to "keep the fires burning" because it gets boring after awhile—so you do innovative things to keep it exciting.

■

Judie Hansen

"Get the Drift and Bag It"

"Going after marine debris as "litter" on the beaches does not have the same appeal as focusing on the issues of entanglement and ingestion by fish and wildlife. That focus has attracted the media and gotten new people involved."

In October 1984, I organized Oregon's first coastwide cleanup in an effort to determine the amount and type of plastic marine debris on our beaches. The motivation for conducting the cleanup came from increasing concern about the extent of injury or death to fish and other aquatic and terrestrial wildlife resulting from ingestion of or entanglement in plastic debris.

That first cleanup attracted 2,100 volunteers who collected 2,613 tons of debris in just three hours. On October 7 of this year, we conducted our 6th annual "Get the Drift and Bag It" coastal cleanup, and at the same time—as you heard from Kathy O'Hara—similar cleanups were held in all coastal states not blown away by Hurricane Hugo.

So, after six cleanups, what are my thoughts about this whole beach cleanup business? I feel the number one value of beach cleanups is raising public awareness. Almost to a person the volunteers remark, "I never realized how much stuff was out there until I had to spend time leaning over to pick it up." And the awareness sticks with them when they get back home.

Each year our data gathering gets a little more sophisticated. The first four years we had a very general, short questionnaire. It gave us bulk figures, because volunteers could write "some," "many," "lots," or "a few" under the category "number of pieces." Since 1988, we have used the Center for Marine Conservation questionnaire. The first year with the CMC form, the volunteers grumbled about having to be more specific, but this year they seem to be more familiar with the form. The CMC form is an excellent tool for recording what we find, and there is certainly a value in having debris data uniformly documented nationwide.

Prior to the cleanups, there was virtually no documentation on the amount or source of marine debris. So we have come a long way!

In the years prior to 1988, all the debris from Oregon's cleanup went directly into landfills, thanks to the generosity of the Oregon Sanitary Service Institute. In 1988 we asked volunteers to work in pairs and separate the plastic from other debris and place it in a special bag. After the cleanup, all the plastic and polystyrene foam was picked up by Environmental Pacific Corporation, taken to Portland, and analyzed to see how much of it could be recycled. This year we couldn't put a recycling package together, so it went to the landfills again.

Going after marine debris as "litter" on the beaches does not have the same appeal as

focusing on the issues of entanglement and ingestion by fish and wildlife. That focus has attracted the media and gotten new people involved.

A major value of the cleanups is networking with people in other coastal states working on marine debris. Having the cleanups clustered during one month in the fall gives everyone higher visibility with the public and news media.

One of my earlier recommendations was to get a media blitz in the popular press, not just obscure technical or professional journals. I am pleased to report that hardly a week goes by that I don't run across a marine debris article in a commercial fishing industry magazine, a conservation organization newsletter, or the newspaper. The state natural resource agency magazines and Sea Grant have also done an excellent job of documenting the problem through feature articles complete with color photographs.

I am really glad I had the foresight, in 1984, to write the "Nuts and Bolts Guide to Organizing a Beach Cleanup the Easy Way." I also made extra copies of all my handouts, posters, lunch tickets, instructions to zone captains, etc. The educational aspects of the cleanup have been tremendous. In the past five years I have distributed over 500 information packets to at least 40 of the 50 states and 20 foreign countries. I have always stressed that nothing I send is copyrighted—most of us have no budget for what we are doing, so it helps to be able to use existing artwork, recognized logos, or themes.

The 7-1/2-minute video, "Trashing the Oceans," produced by NOAA, is the best deal for schools because it gives a quick overview and then the discussion can turn to specific things, like showing examples of recycled plastic and how to set up milk-jug recycling projects.

In Oregon, our program of distributing information, working with the media, and organizing the cleanup statewide has been a one-person effort. My regular job (with the Oregon Department of Fish and Wildlife) does not involve public relations or working with volunteers, so the cleanup has been looked on as my "hobby." Now that I have "retired" and am moving to Indiana, our public affairs office is taking over the cleanup.

Q. *(from audience):* I did my first cleanup this year, and it was frustrating because you see all that garbage and you realize that in two or three months it's going to look exactly the same.

A. What's encouraging to me is that people are having their awareness raised. They used to be able to tolerate the dirty beaches, but now they are taking their own large bags to the beach with them so they can pick up the debris. The people who work at the state parks say that their beaches are a lot cleaner now, and their trash cans and dumpsters are full of big bags of trash.

■

Ken Pritchard
Adopt a Beach

Adopt a Beach started in 1985 and does a variety of educational, monitoring, and rehabilitation projects. In 1988 we started surveying marine debris in the state of Washington. This is to be a long-term (15 years) survey project. Presently we are engaged in a pilot project for the purpose of field-testing and refining our methodology.

The objectives of Adopt a Beach are:

- To collect raw data from beaches that are known to accumulate marine debris.
- To characterize the debris (in terms of distribution by type of material and type of use) on given units of beach over time.
- To diagnose probable sources of indicator debris and record their geographic occurrence and frequency.
- To provide raw data, data summaries, and descriptive statistics to the members of Washington State's Marine Plastic Debris Taskforce (members include local, state, and federal agencies) and other data users.

We caution data users that we are not providing certain information. For example:

- The survey provides no indication of daily accumulation.
- We don't provide information on "micro-debris" (small, broken-down debris such as polystyrene pellets).
- We don't provide inferential information (i.e., regional trends; trends by beach types; trends by types of local onshore and offshore uses).

"We are groping for a methodology that will be acceptable to the agencies in charge of monitoring marine debris, and hoping that agencies such as EPA and NOAA will aggressively undertake the creation of a national citizen marine debris program."

The biggest problem with marine debris surveys is trying to develop a method that is statistically valid. We have adopted our methodology and taxonomy from the Center for Marine Conservation surveys and the National Marine Fisheries Service (NMFS) Alaska survey. Briefly, our methods are as follows:

1. **Beach selection**
   We needed a criterion for selecting which beaches to survey—i.e., those beaches where debris is likely to be found. We used the "drift cell" concept. Predominant wind-driven shore currents tend to push sand in one direction along the shore until some ending point or terminus is reached, such as a sand spit, headland, or jetty. The area from the current's starting point to the terminus is called a drift cell. The terminus accumulates a lot of sand, and also a lot of debris, so it is a good place to survey. We visited over 30 beaches and selected 10 for our surveys. They are located in Puget Sound and the outer coast.
2. **Debris collection**
   Each beach is sampled quarterly. Survey sites are divided into 100-meter sampling units. Volunteers arrive at the beach and begin by measuring out their section. Then they sweep the section, collecting all non-wood human artifacts that are visible from a standing position. Two other types of surveys that are being conducted in parallel on some beaches are daily accumulation of debris and amount of micro-debris in a 1-meter quadrant.
3. **Debris sorting and classifying**
   Volunteers bring their bags of debris indoors for tallying. Sometimes when people first start, they say, "Why just clean 100 meters—why not the whole beach?" Then they find out that they spend three or four hours just classifying the debris from the 100-meter section. Debris is first sorted by type of material (e.g., glass, plastic, paper), shape (e.g., sheeting, container), and use, if known (e.g., personal-use aerosol can or recreational fishing gear). Then each piece is classified and assigned a five-digit code. In order to be diagnostic, it's necessary to go into a lot of detail. The form is quite complicated for the untrained volunteer.

We are groping for a methodology that will be acceptable to the agencies in charge of monitoring marine debris, and hoping that agencies such as EPA and NOAA will aggressively undertake the creation of a national citizen marine debris program. The first step should be to identify all current marine debris monitoring activities conducted by citizen groups, universities, and government. Without a proper infrastructure—including standardized methodologies, project development support, technical assistance, national and regional coordination, and a national data base—citizen monitoring will be fragmented at best and largely ineffective if not nonexistent as a national effort.

■

Panel 5 Regional Coordination of Monitoring Programs

Panelists: *Villere Reggio, Minerals Management Service, U.S. Department of the Interior; Mark Mitchell, Friends of the Rouge; John Tiedemann, American Littoral Society Fish Tagging Program; Karen Firehock, Izaak Walton League Save Our Streams Program.*
Moderator: *Virginia Lee, Coastal Resources Center, University of Rhode Island.*

Villere Reggio

Gulf of Mexico Marine Debris Subcommittee

There were two famous "M" men of history. One was Moses, who gave us 10 rules to live by. Then Murphy came along with just one law: If something can go wrong, it will. So, is the answer more laws? Yes and no. We have a lot of environmental laws already. We may need more laws, but even more we need the public will and determination to make the laws work.

Now I'll talk about a "G" man (government man). I'm a "G" man—I work for two government agencies. One is the Minerals Management Service, a part of the Department of the Interior. We have responsibility for offshore oil leasing and development in the Gulf of Mexico. A 1985 study by the state of Texas indicated that 90 percent of the debris on Texas beaches was due to the oil and gas industry.

I'm also a representative of EPA, where I am associated with the Gulf of Mexico program through the Marine Debris Subcommittee. This subcommittee has two goals:

1. To encourage compliance with the requirements of MARPOL Annex V, and also to strengthen that law by supporting Special Area Designation for the Gulf of Mexico.
2. To foster pride, stewardship, and increased understanding of the marine and coastal resources of the Gulf of Mexico, including increased awareness of the harmful effects of marine debris.

To support these goals, the committee facilitates the planning, organization, promotion, and coordination of a volunteer Gulf-wide coastal cleanup and marine debris monitoring program. Marine debris is tangible, it's visible, and it's a people-generated problem. It is a regional problem and it needs a regional solution.

"Marine debris is tangible, it's visible, and it's a people-generated problem. It is a regional problem and it needs a regional solution."

Now I'd like to tell you a little about the Gulf of Mexico. We have four major industries: petroleum, fisheries, merchant shipping, and recreation/tourism. Ninety percent of all U.S. offshore oil and gas production is taking place in the Gulf of Mexico. We have 7,500 commercial fishing boats, 6,000 of them shrimpers. The Gulf accounts for 40 percent of the total U.S. commercial fish catch. There are 33 major ports handling 45 percent of the nation's import/export shipping tonnage. We have 2 million registered private recreational boats in the five Gulf states; we also have Navy vessels, research vessels, and cruise ships.

The Gulf has over 1,000 miles of beaches. The point is that all the users we've just been talking about generate and dispose of garbage, some of which can and does end up on Gulf beaches.

So, why beach cleanups? Because a beach cleanup is the neutral ground where the Gulf of Mexico users, the regulators, the environmental groups, the civic groups, and the citizens can come together for a common purpose—participatory voluntary environmental action. What a beach cleanup does is:

- Builds understanding of the problem.
- Builds cooperation and support in seeking solutions.
- Builds commitment toward implementing solutions.
- Builds a database useful for monitoring progress.

For our 1987 Gulf-wide cleanup we had 11,000 volunteers; in 1988 we had 15,000; and

in 1989, 21,000. This didn't just happen. Here are some of the factors we think are important in generating and keeping productive volunteer support:

1. Target user groups and organizations. Try to get groups associated with the problem to become associated with the solution. One example is Conoco. Many of their employees helped with the cleanup, and when they saw all the styrofoam on the beach they went back and asked, "How come we're using all these styrofoam cups offshore?" Conoco ended up instituting a divisionwide policy banning the use of styrofoam cups offshore. Several other oil companies heard about this and have voluntarily adopted similar policies.
2. Encourage leadership and support from the highest levels of government, industry, and the private sector. When governors, mayors, regional directors, county supervisors, commissioners, park superintendents, refuge managers, base commanders, and company presidents get involved, all the logistics and support services just seem to fall into place, and volunteers come out of the woodwork. So don't be bashful about asking the people at the highest level to get involved.
3. Tabulate data on the debris. Volunteers will feel they are more than garbage collectors—they're contributing to an important investigation. Then let the volunteers know how the data are used.
4. Give recognition and awards to volunteers.
5. Develop a recognizable theme and logo (such as our "Take Pride Gulf-Wide" slogan and logo) to build identity and unity.
6. Have an annual coordinated regionwide or nationwide cleanup day.
7. Promote adoption programs to keep up interest and commitment over a period of time. The state government should sponsor these programs, with local government support. Texas gets the credit for getting this idea started.
8. Coordinate beach cleanups with other recognized events, such as Coastweeks or Earth Day. Community groups are predisposed to get involved with these events, and the press is looking for projects to promote when these events are going on.
9. Besides making cleanups meaningful, make them FUN. We work for about two hours; then we party for three hours. If people go away with happy memories, they will come back and bring others.

■

Mark Mitchell

Interactive Rouge River

"Public awareness of the pollution problem is high, partly because of a man who fell into the Rouge a few years ago and ingested some water. He died three days later. It turned out that he had ingested some leptospirosis bacteria, which can be transmitted through urine."

The Interactive Rouge River Water Quality Project, jointly administered by Friends of the Rouge and the University of Michigan's School of Natural Resources, is set in the Detroit metropolitan area. In case you've never been to Detroit (and I know that people have perceptions about Detroit already!), the Rouge is an extremely polluted watershed that is plagued by frequent combined sewer discharges.

Public awareness of the pollution problem is high, partly because of a man who fell into the Rouge a few years ago and ingested some water. He died three days later. It turned out that he had ingested some leptospirosis bacteria, which can be transmitted through urine. That really got to people—that a man fell in the river and he died.

The watershed is about 465 square miles in area, and within that area live about 1.5 million people. So it's a very concentrated, very urban place.

Students in over 40 high schools and middle schools currently participate in the Interactive Rouge River Water Quality Project. The project embraces three major activities: water quality monitoring, computer networking, and role-playing. The educational goals of the program are:

- To develop thinking skills.
- To develop problem-solving ability.
- To increase awareness about the river.
- To help students understand the complexity of a river ecosystem.

The students test nine water quality parameters at their sampling sites. We use mostly Hach kits and Millipore kits. The data are entered onto personal computers. All the participating schools are connected to a computer network. Students can communicate with

students at other schools via the network.

We're striving to make this an interdisciplinary program and one way is through the use of a social studies sourcebook that we've published. The sourcebook goes over the history of the river and the watershed, some of the economics of pollution control, and the agencies you might want to contact if you have a problem.

Last year we came up with something new: the C.R.A.P. game (Community River Action Plan). This is a role-playing game about a fictitious river that resembles the Rouge. Students can decide to play various roles—i.e., decision makers from EPA, taxpayers, business people, land-use planners, or environmentalists. There are three different game "cycles": a flood event, major development along the river, and a legal mandate to clean up.

Working with schools entails many challenges and pitfalls. I think we can learn from our "sorrys" as well as our "prouds." Based on our experiences, here are some recommendations for anyone contemplating working with schools:

- We get principals, teachers, and curriculum coordinators to sign a Letter of Agreement that outlines their responsibilities toward the program as well as what they can expect from Friends of the Rouge and the University of Michigan's School of Natural Resources.
- Recruitment of schools should target teachers, not the administrative structure (which takes too long).
- Link project goals to common educational goals of the school system, because teachers' curricula are too full as it is and new projects must be justified.
- Because lack of time and money are the most chronic constraints found among schools, it is important to provide a support system, including adequate funding and resource people who can assist teachers.

■

John Tiedemann

American Littoral Society Fish Tagging Program

After all that we've heard in the last two days, it's hard to believe that there are still fish out there—but there are! I'm a volunteer with the American Littoral Society Fish Tagging Program, which was started in 1965. The program was developed with the help of marine biologists at the NMFS Sandy Hook laboratory and is operated out of the ALS headquarters at Sandy Hook, New Jersey, by a single staff member, Pam Carlsen. (Anyone wishing to contact the program can write to: American Littoral Society, Fish Tagging Program, Highlands, NJ 07732; or call (201) 291-0055.)

Scientists have been tagging fish for probably more than 100 years. In terms of volunteer angler participation, it's been going on for at least a few decades.

The ALS tagging program encourages anglers to tag any fish that they are going to release. The program's purposes are to promote a conservation ethic among anglers and to provide scientific data on the migration, growth, and condition of important marine game fish.

All taggers must be members of ALS (annual dues are $20). Fishing clubs can join as a unit for $25. Individuals or clubs purchase the fish tagging kits, so the program is self-supporting. Kits cost $4 and contain 10 tags, 10 postcards (data cards) that correspond to the tags, a stainless steel insertion needle, and a set of instructions. When a kit is sold, its tag numbers are recorded along with the name and address of the tagger to ensure that ALS can get in touch with the tagger if necessary.

The tag is called a "spaghetti tag." You thread the tag into the needle and insert it through the fish's dorsal side near the tail. Then you fill out the data card with the species, date caught, length, weight (if possible), where released, tagger's name and address, and

any special comments. The card is returned to ALS where it is processed and coded for the NOAA/NMFS computer.

"The ALS tagging program encourages anglers to tag any fish that they are going to release. The program's purposes are to promote a conservation ethic among anglers and to provide scientific data on the migration, growth, and condition of important marine game fish."

When a fish is recaptured, both the fisherman capturing the tagged fish and the original tagger receive a letter containing tagging and recapture information and a patch. All returns are acknowledged in the tagging report column in each issue of the ALS magazine, "Underwater Naturalist."

Approximately 780 anglers and 75 fishing clubs from Maine to the Gulf of Mexico are currently participating in the program. Since the program's inception, 210,720 tags have been distributed and 101,043 fish have been tagged and released. A total of 4,012 recaptures have been recorded for a return rate of approximately 4 percent.

The ALS regards the participating anglers as partners in this program. A constant dialogue is maintained with the volunteers. All input from taggers is taken very seriously and all questions are answered as completely as possible.

Pam takes the time to hand-write a card to anybody who writes an interesting comment on a data card or writes for information. In fact, you might hear from her if you tag a large number of fish or an exceptionally large fish, or take a cub scout troop on a tagging expedition, or even if you get written up in the local papers for any reason—such as a new birth in the family.

ALS informs anglers about other tagging programs (such as those conducted by the Hudson River Foundation, the U.S. Fish and Wildlife Service, and NMFS) and coordinates its efforts with these other programs.

Probably the key to maintaining a program such as this one is a long-term commitment by the organization operating the program. The program must provide an accessible contact person who can ensure that all data are consistent and meaningful, and who will communicate with the volunteers and applaud their efforts.

■

Karen Firehock

Save Our Streams, Izaak Walton League of America

I've been with the Izaak Walton League of America (IWLA), as the Save Our Streams Coordinator, for about four and a half years. The League was founded in 1922 by a group of fishermen who organized to protect the Mississippi River. We have a long history of dedication to river issues—for example, we conducted the nation's first water pollution survey, for President Calvin Coolidge. The League is a national nonprofit organization with a current membership of 50,000 people in 400 chapters nationwide.

The League works on a variety of issues such as acid rain, clean air, wetlands protection, outdoor ethics, and clean water. One of our most popular programs is Save Our Streams, which is a grass-roots water quality protection program. Save Our Streams began in 1969 in Maryland IWLA chapters. It was spread nationwide by the "water wagon"—a large mobile lab piloted by former SOS coordinator Dave Whitney, who traveled to every state except Alaska and Hawaii and lectured to 2,000 people per day on SOS and stream protection. That's why Dave is now retired in Florida, even though I think he's only in his forties.

The IWLA uses a biological monitoring approach. We do benthic surveys of macroinvertebrates (aquatic insects large enough to be seen with the naked eye). The reason we do biological monitoring is that it tells you right off the bat whether the river is healthy—that is, whether it is able to support the diverse population that we would expect it to support if it was not polluted. Chemical testing gives a lot of valuable information but often does not

answer that question.

The purpose of this segment of the conference is to provide an overview of how to design and implement a regional or statewide water quality monitoring program. I am going to give some organizing tips based on how I set up networks in states.

Step 1. Convincing the state agencies that they need you

I was in a newspaper article last week as being a "professional nag" and now I'm getting calls from people who want nagging advice. What I do is call up state agencies and do some investigation. I ask them questions like how many permitted industries they have in the state, how many river miles they have, how many monitoring sites they have. For example, in West Virginia they have 28,000-plus river miles; they have 29 or 30 permanent monitoring stations and 30 ambient stations. You can imagine how many river miles are unprotected and unmonitored. That tells me that this state is going to be really receptive to a citizen monitoring program. You also need to find out about the principal water quality problems in the state and the level of funding.

"I was in a newspaper article last week as being a "professional nag" and now I'm getting calls from people who want nagging advice. What I do is call up state agencies and do some investigation."

Another way to get states to believe that they need you is through the new nonpoint source pollution management plans that states are putting into effect. The 1987 Clean Water Act amendments required that all states submit a management plan for controlling pollution by August 1988. The problem is, how are you going to come up with a plan if you've only been able to monitor 20 percent of your river miles? The states are also required to document the success of their plans. Citizen monitoring programs can help states with these nonpoint source management plans in two ways, because they can provide states with (1) the ability to assess their unknown waters now, in order to write the management plan, and (2) the ability to document whether their nonpoint pollution management projects are successful in the future.

It's also important to be familiar with federal protocols. For example, since the IWLA uses biological monitoring, the appropriate EPA guidance document is the May 1989 "Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Invertebrates and Fish." Being familiar with this document, I can go in to state agencies and say, "Our method is equivalent to protocol #2 in the federal guidelines." Knowing the federal criteria gives you credibility when dealing with state officials.

Basically, in setting up cooperation with state agencies you have to tell them what you can do for them. You say to them: You don't have data?—I've got it. You don't have citizen support, you don't have enough staff?—I'm going to get citizens interested in lobbying to get more funding for more staff.

Step 2. Setting up the volunteer monitoring network

Monitoring agencies are set up differently in each state. The various agencies have different political makeups and different degrees of familiarity with citizen monitoring. In some states I find that the Department of Natural Resources is really cooperative with me; in other states I have to go through the Department of Education and work with their Aquatic Resources people. In some states I find that I can work with the regulatory agency but can't work with the Department of Conservation. Other agencies to try are the agency in charge of nonpoint source pollution, or the Soil Conservation Service, or a scenic rivers program. Sometimes I end up setting up the whole citizen network and getting the program going for a year, and *then* telling the state that they need me.

The point is that there's always a way in the door—it may be around the back, or

through a window, or you might have to go down the chimney, but you can get in. You need to find that one sympathetic individual. I've found that most bureaucrats in state environmental agencies do care about the environment; that's where their hearts are at, and they're really looking forward to the opportunity to do something besides pushing reports around their desks.

Let the state agencies know that EPA supports the use of volunteer monitors. For example, use the EPA's 1989 publication, "Nonpoint Sources Agenda for the Future," which advocates the use of volunteer monitors in state nonpoint programs.

One book that is helpful—though very technical—is "Design of Networks for Monitoring Water Quality," published in 1988. Our office has a seven-page bibliography of publications on citizen monitoring, which you can obtain by writing to us and sending a dollar for postage.

You can vastly expand your network by working with other environmental or civic groups—the Sierra Club, Audubon chapters, scout troops, school groups, church organizations, and many others.

Step 3. Ensuring ongoing coordination for the program

Have the state designate a permanent liaison to provide technical advice to citizen monitors and to help get the monitoring data to the appropriate state agencies. Establish a variety of private funding sources for the program. This will prevent the program from being cut during the state budget process.

Step 4. Designing methods for data storage and retrieval

Computer storage of data is the best method because it allows both statistical analysis and rapid recall. A popular software to use in database design both for chemical and biological programs is dBASE III. Relational Report Writer is a commonly used program for generating reports from dBASE III databases. Reports must be generated regularly, and in a format that is easily understood and usable by state officials.

■

Recommendations to EPA from first volunteer monitoring workshop, May 1988

1. We recommend that EPA publicly endorse and encourage the use of citizen volunteers to collect and process information for assessing the status of the nation's environment.

- Highlight successful citizen monitoring programs through national promotions.
- Issue letters of commendation to programs recognizing their contributions.
- Sponsor annual conferences for information exchange among citizen monitoring programs.
- Sponsor a national networking newsletter with briefs on new programs and techniques and notices of workshops and meetings.

2. We recommend that EPA adopt policies that encourage states to develop and utilize citizen monitoring programs to help carry out their mandates for environmental monitoring as delegated from EPA under the Clean Water Act and MARPOL.

- Authorize states to use some portion of the federal funds provided under appropriate sections of the Clean Water Act for developing and implementing citizen monitoring programs. Encourage states to use volunteer monitoring results as part of the biennial State of States' Waters Reports.
- Request each state to designate a contact person to work with volunteer citizen monitoring program coordinators in that state.
- Develop a guidance document for state program managers with practical advice to assist them in successful recruitment of volunteers and management of citizen monitoring programs.

3. We recommend that EPA direct regional offices and research laboratories to support citizen monitoring activities by offering technical assistance.

- Request that the EPA Office of Research and Development provide guidance to laboratories on the types of activities that are appropriate for citizen monitoring programs.
- Develop training manuals and seminars for training citizen volunteers.
- Develop a standard methods manual that is appropriate for volunteer sampling and analytical procedures.

4. We recommend that EPA validate its endorsement and unify its approach to citizen monitoring by establishing a full-time staff position, directly reporting to the Administrator of the Office of Water, with the primary responsibility for coordinating and enhancing citizen monitoring programs throughout the country. Specific responsibilities of this person would include:

- Enhancing opportunities for citizen monitoring programs within EPA headquarters and among the regional offices.
- Fostering communication among citizen monitoring projects and among federal agencies.
- Forging new links between citizen monitoring and EPA program initiatives in freshwater, estuarine, and marine environments around the country.
- Providing technical assistance to states.

Ecosystem Discussion Group Reports

In response to requests by citizen volunteer groups at the first workshop (Rhode Island, May 1988), time was set aside to discuss the practical day-to-day challenges of monitoring specific types of ecosystems. Accordingly, all the attendees divided up into the following five "ecosystem discussion groups": streams and rivers, lakes, estuaries and tidal waters, living resources, and debris cleanup.

The purpose of the discussion groups was to give people monitoring similar ecosystems an opportunity to (1) exchange ideas, techniques, and solutions to problems; (2) talk about how states can use volunteer monitoring data and how better links can be forged between monitoring groups and states; and (3) review the list of recommendations developed at the first workshop (see opposite page), assess progress, and make further recommendations to EPA and to the workshop participants.

Following are the summary reports from the discussion groups.

Discussion Group 1 Streams & Rivers

Discussion leader: *Sarah Hubbard-Gray, Stream Team Program, Bellevue, Washington.*
Recorder: *Ken Cooke, Water Watch Program, Kentucky Division of Water, Frankfort, Kentucky.*

The groups represented at the streams and rivers discussion group were: 7 nonprofits, 5 educational institutions (colleges and high schools), 4 state governments, 3 local governments, and 2 federal representatives.

There were 11 "old hats" (in this business, an old hat is someone who's been involved for a year or more) and 10 new folks.

◆ Exchanging ideas, techniques, and solutions to problems

The group discussed the importance of maintaining positive relationships with volunteers. Empowerment is very important; so are good training and quality control. Agencies will respect well-trained volunteers. Some specific suggestions for maintaining positive relationships are:

- Agencies should establish who is responsible for which types of environmental problems, so volunteers know who to call.
- The monitoring coordinator should avoid assigning risky jobs to volunteers (i.e., jobs that involve handling hazardous materials or visiting facilities where there is a chance for encountering hostile violators).
- The monitoring project should involve companies and businesses when setting up the project, and work to build bridges with private industry.

◆ Enhancing links to state government

There are many ways that states can use volunteer monitoring data, and there are also other groups that can use the data. Possible uses for the data:

- State 305b reports
- Nonpoint source assessment
- Wild rivers or scenic rivers programs
- Soil and water conservation districts
- Health departments
- Enforcement cases
- U.S. Geological Survey
- Storm event studies
- University research studies
- Planning and zoning districts
- Forestry programs
- The citizens monitoring groups themselves

One important way to encourage states to use the volunteer data is to make the data user-friendly. Use the same forms as the state uses—for example, stream-site survey forms. Survey the state agencies by phone or by mail and see what they want—what kind of data, and in what format. Learn about the state's rules and regulations on data collection. Let the state help design the training program and participate in the training.

◆ Evaluating progress and making recommendations

The group expressed appreciation and compliments for what EPA has already done, and for the fact that we are here today. Recommendations are:

A. Re-recommend the recommendations of the first conference.

B. National conference

Hold another national conference. The West Coast would be a good location. It would be helpful to have workshops that are more "nuts-and-bolts"—how to fund-raise, how to do specific testing procedures, how to conduct training sessions, etc.

C. Regional meetings

Hold regional meetings in U.S. EPA regions.

D. Guidance documents

When EPA provides guidance documents to states, include information on where citizen monitoring data would be appropriate.

E. Newsletter

We liked the newsletter. We would like to see it produced every six months, preferably using recycled paper. We don't recommend rotating responsibility for the newsletter; that would involve too much re-inventing the wheel.

F. Liaisons at EPA offices

Establish liaisons at EPA regional offices to deal with citizen monitoring groups and states establishing programs.

G. Funding

Allow states to use 106g and 205j monies for establishing volunteer monitoring programs.

Discussion Group 2 Lakes

Discussion leader: Linda Taylor Green, Watershed Watch Program, University of Rhode Island, Kingston, Rhode Island.
Recorder: Judy Bostrom, Citizen Lake-Monitoring Program, Minnesota Pollution Control Agency, St. Paul, Minnesota.

◆ Exchanging ideas, techniques, and solutions to problems

A. Tax deductions and insurance for volunteers

Participants can be "reimbursed" for their contribution of time through federal income tax deductions. Also, liability insurance for volunteers is available through NALMS (North American Lake Management Society).

B. National Volunteer Center

The National Volunteer Center may be a way to get the program listed and the volunteers recognized.

C. Problems with volunteer monitors

- Problems can arise when monitors are trained by other monitors, instead of by the coordinating agency. It's important for monitors to be properly trained by the agency, in order to maintain good quality assurance and to project an image of accountability for the program and the data collected.
- One program had a problem of a volunteer talking to the media before sending in the data. To handle this, the program formed a "damage control" group.
- When participants lose interest in taking samples, but still want to be involved in the program in some capacity, some programs "graduate" these participants to the role of collectors/coordinators.

D. Staying in touch with volunteers

Agencies can stay in touch with volunteer monitors through annual lake conferences, meetings with groups of participants to discuss problems with results, and visits to the lakes during the year. Possibly EPA could issue Certificates of Appreciation as a way of giving recognition to volunteers.

E. Quality assurance/quality control

When "outliers" occur in the data, it is important to investigate the circumstances surrounding the taking of the sample to determine its validity.

F. Site selection

Carolyn Rumery Betz of Wisconsin's Self-Help Lake Monitoring Program said that they used the deepest hole of the lake as their monitoring location. In the case of a lake having more than one basin they chose the deepest hole in each of the separate basins. This method of site selection seemed to be the consensus of everyone present.

G. Methods for taking Secchi disk readings

Some programs use a view tube to reduce the influence of choppy water or surface glare. One way to avoid bias in the reading is to have one person lower the Secchi disk while another person watches for the disk to disappear from view.

H. Other water quality parameters

Several of the programs measure other water quality parameters besides Secchi depth. Some use turbidity, chlorophyll *a*, and phosphorus data to back up the Secchi disk data. Others do alkalinity and use calcium and magnesium analyses for corroboration. New York (CSLAP) does nutrient sampling (collected in Kemmerer bottles and sent to a lab). They also take dissolved oxygen measurements using a Nestor meter which has a permanent membrane, thus eliminating the need to change membranes.

I. Trophic Status Indices

It was noted that different programs use different intervals in measuring Secchi depth (New Hampshire measures to the nearest 0.1 meter, Wisconsin to the 1/4 foot, and Minnesota to the 1/2 foot). These differences appeared to be a function of the different trophic conditions of the lakes in the various regions. Where lakes are generally oligotrophic, it makes sense to use a finer unit of measurement. But where lakes are mesotrophic or eutrophic, measuring to the 1/4 or 1/2 foot is more reasonable. Therefore it was felt that the Trophic Status Indices should probably not be standardized nationally.

J. Comparability of data among programs

Participants were concerned about the comparability of data from different programs because not all programs sample during the same period of time. For example, Wisconsin samples from June through August; New Hampshire from May through October; and Minnesota from mid-June through mid-September. Also, programs have different intervals between readings.

K. Ties with other organizations

We could strengthen our ties with several other organizations: USGS, SCS (Soil Conservation Service), universities, and the American Society of Limnology and Oceanography. We felt, however, that NALMS should be the responsible party for strengthening its ties to us.

◆ Enhancing links to state government

Most of the groups represented in this discussion said that they had already forged links to state government. One program mentioned a concern that the state seemed "hungry" for data but didn't appear to be concerned about the quality of data. New Hampshire reported that the state has finally asked for the volunteer data for use in the 305b report.

A group in Virginia was the only one having problems in getting their efforts recognized—even though they have data comparable to the state's, are using the same sites, *and* monitor at additional sites not covered by state efforts. It was suggested that the state may see the group's efforts as competition. A possible solution might be to try to find a sympathetic ear within government at any level (i.e., county commissioner or planning and/or zoning administrator). Another suggestion was to get targeted people to join in on a sampling event.

The following suggestions were offered to those programs and states that do not yet have satisfactory links: (1) Programs could try contacting the state's Water Resources Research Center; (2) Programs should maintain a positive image in the community; (3) States should look at existing volunteer programs to avoid re-inventing the wheel; and (4) *All* offices of EPA, not just the Office of Water, should look at volunteer programs.

◆ Evaluating progress and making recommendations

A. Re-recommend all four of the recommendations made at the first volunteer monitoring conference.

B. Newsletter

- Consider mailing directly to the volunteers and not just to the coordinators.
- In articles, be sure to mention the name of the program and give the name and address of the contact person.
- Monitoring programs should be sure to put the person producing the newsletter on their mailing lists so that person is kept up to date on what we are doing.
- Possible sources of funding for the newsletter might be USDA or USGS.
- It might be worthwhile to contract the production of the newsletter to a non-

monitoring agency while having a monitoring agency retain the editing duties.
- Include a section listing any new publications and materials produced by the various programs.

C. Standard methods manual

1. The group made the following recommendations to EPA:
   - Take into account the variability of the regions (not necessarily EPA's regions) and include a *range* of methods.
   - Take into account the limitations of activities appropriate for volunteer monitoring.
   - Include a list of source materials.

2. We made the following recommendation to ourselves and to other monitoring groups: If we use a method other than those given in the manual, we should document the method on paper to convince the EPA of the quality assurance of the method and to show that the method is comparable with those in the manual.

D. Next conference

At the next citizen environmental monitoring conference we would like to hear programs talk about something other than their background; perhaps they could discuss one aspect of the program, such as quality control or demographics. The background of a particular program could be given in an abstract for those unfamiliar with the program. Suggested topics for the next conference are: "How We Use the Data" and "How Do Our Monitoring Activities Complement Other Groups (e.g., NALMS)?" It is a good idea to hold the conference in concurrent sessions with other groups (as this one was).

E. EPA encouragement of volunteer monitoring

One area where EPA could encourage and endorse volunteer monitoring is in its interagency council groups. Also, EPA could schedule talks about volunteer monitoring at other conferences besides this one. And EPA should tell the states that if volunteer-generated data meet state requirements, the state should use the data in the 305b report.

F. Organization for volunteer coordinators

The group discussed whether there is a need to set up a formal organization for volunteer coordinators. We should stress the need for a staff person at EPA and have that person be responsible for such an organization.

Discussion Group 3 Estuaries

Discussion leader: *Tom Perlic, Pamlico-Tar River Foundation, Washington, North Carolina.*
Recorder: *Diane Barile, Marine Resources Council, Florida Institute of Technology, Melbourne, Fla.*

◆ Exchanging ideas, techniques, and solutions to problems

A. Objectives of citizen volunteer monitoring

1. Provide a *positive* approach to pollution problems (i.e., define the purpose of the program in terms of improving the environment, not finger-pointing at polluters).
2. Determine the health and viability of the ecosystem.
3. Determine trends and baselines to aid decision making.
4. Determine pollution sources.
5. Monitor episodic events like storms or algae blooms (which state programs often cannot do).
6. Fill in data gaps in existing programs or provide broader coverage.
7. Provide public awareness and education through involvement.
8. Provide a reliable source of information to the press and researchers.

B. Ideas for laying the groundwork for a new volunteer monitoring program

1. Establish the need for the program. Help build a perception of need with public officials, the press, and citizens. At the same time, determine the specific data needs of government agencies.
2. Set clear objectives and a unified goal.
3. Establish a group or committee that includes all who have a stake in the area—i.e., environmental groups, developers, commercial and recreational fishermen, marine industries, government staff, schools, retirees, scientists.
4. Work with existing local groups and supportive government staff.
5. Establish a technical advisory board.
6. Find sponsors for funding and support. These could be:

   - "Friends of" the lake, river, or bay
   - Lake or watershed associations
   - National Estuary Program
   - National Estuary Research Reserve
   - Land trusts
   - Private or public corporations

C. Suggestions about how a new program can get started with the actual monitoring

1. Start off with what you can manage and do it incredibly well; then expand. Either start out monitoring only a few parameters, or start with a small pilot project and measure more parameters.
2. Pick the parameters you will monitor based on your program's objectives.
3. Expand from existing monitoring programs or coordinate with other agencies.
4. Determine whether citizens are to be involved only in collecting samples or in processing and reporting data.
5. Determine the data format; assure a system for data collection, storage, and retrieval.

D. Ways to attract, keep, and motivate volunteers

1. Respond quickly to volunteer requests for information or supplies.
2. Maintain personal contact; limit the number of volunteers to those you can serve.
3. Solicit volunteer ideas for improving the program.
4. Respect the time and talent of each individual. If a volunteer is not performing well in

one task, transfer him or her to another task. Put people in positions where they will shine.
5. Keeping volunteers informed is crucial. Hold regular meetings. Publish a newsletter. Distribute results regularly and keep volunteers informed as to how the data are being used.
6. Help volunteers keep learning and moving. Give advanced training sessions. Hold lectures and field trips to give them more information about the whole water body. See if you can get local colleges to provide credit for training.
7. Provide incentives and recognition to volunteers—cards, letters, patches, T-shirts, pins, or awards.
8. Increase your own effectiveness by delegating some of your responsibilities to proven volunteers.

E. Quality control and quality assurance

1. Training is the key to a successful program. It's essential to have good trainers. Try to involve state and federal agencies in the training.
2. Maybe EPA could set up a national certification process for citizen monitors.
3. Check all data sets. If a volunteer's data are inconsistent, retrain or shift to another task.
4. Have the data approved by a state agency. Use the state agency's forms.
5. Have volunteers use a checklist to assure complete procedures.

◆ Enhancing links to state government

A. How the data can be used by states

1. Track compliance of permits.
2. Monitor "hot spots."
3. Alert state agencies to problems such as storms, algae blooms, or spills.

B. Joint training program

The volunteer monitoring program can also include new or unskilled state staff as trainees.

C. Funding

We need to be sure that money allocated for monitoring goes to the volunteer program and not to building a greater bureaucracy at the state level. Money will go much further if it's put into equipment and people on the ground rather than into three state office people to administer the program.

◆ Evaluating progress and making recommendations

A. General recommendations to EPA

1. EPA should support citizen monitoring in the EPA regions and especially the states.
2. Citizen programs should not be used to replace existing state programs but to increase state coverage and responsiveness. There was concern that as citizen monitoring increases, states might cut back on their programs.
3. There needs to be EPA leadership in facilitating dialogues on shellfish monitoring with USDA, FDA, and the university extension programs.
4. Citizen monitoring programs need to have a program plan to take to states to show how citizen data can be used in state programs.
5. There should be more opportunities for interaction between monitoring agencies and groups to assure consistency of approach and compatibility of data.

B. Newsletter

1. Use recycled paper.
2. Have an annual update of new programs.

3. Use the newsletter as a resource catalog rather than for descriptions of a few successful programs. For example—list new publications and where to get them; give instructions for new methods.
4. Have a directory of technical materials for citizen monitoring.
5. Each program needs a local newsletter.

C. National meeting

Hold national meetings every two years, with regional meetings on the off year. "Regions" for meetings should be biogeographic, not necessarily EPA regions.

D. Earth Day

Earth Day could be a good opportunity to highlight citizen monitoring with the press.

Discussion Group 4 Living Resources

Discussion leader: *Carroll Curtis, Chesapeake Bay National Estuarine Research Reserve System, Virginia Institute of Marine Science, Gloucester Point, Virginia.*
Recorder: *Chris Swarth, Jug Bay Wetlands Sanctuary, Lothian, Maryland.*

◆ Exchanging ideas, techniques, and solutions to problems

The group determined that, with the exception of wetlands surveys, a few organized bird counts, and stream macroinvertebrate monitoring, there are relatively few situations where citizens are monitoring living resources as an indication of the health of the environment. In order to increase the monitoring of living resources by volunteers, the group recommends the following:

- Hold meetings with experts to identify species of special concern and indicator organisms that could be monitored by citizens. Ask experts to help produce identification keys to indicator organisms by region. We need to develop a counterpart to the key to stream macroinvertebrates that can be used for estuaries.
- Consult with experts for advice on literature, research procedures, and analytical techniques.
- In designing sampling protocols, consider carefully the objectives of the study.
- To maximize the effectiveness of biological monitoring, citizens can be used for routine, labor-intensive field studies. Call upon experts for training, quality assurance, and investigating anomalous data.
- Give careful consideration to the environmental sensitivities of the populations or habitats under investigation. Monitoring activities may inadvertently disturb or destroy sensitive organisms or fragile habitats. For example, birds that breed in colonies, like terns and herons, are extremely vulnerable to human disturbance during the breeding season.
- Design living resource monitoring with the data user in mind. It can be used both for environmental characterization and for applied studies. One example of an applied use is monitoring and evaluating mitigation projects.

◆ Enhancing links to state government

Links should not be limited to state agencies, but should also be forged with federal agencies, academia, local government, and the private sector. Similarly, funding for monitoring activities should come from a variety of sources.

◆ Evaluating progress and making recommendations

The discussion focused on the need for communication. We concluded that there is a lot

of good information "out there" that could be used by citizen monitoring groups, but it is often difficult to gain access to that information. Also, all the various monitoring groups are gaining good experience and we need more ways to share new ideas. To address these needs, the group recommends the following:

A. National meetings

National meetings such as this one are extremely beneficial and should be held at least every other year. It would also be useful to hold regional meetings in between the national meetings, perhaps in conjunction with annual meetings of scientific societies. Possible themes and ideas for the next national meeting are:

- **Volunteers:** Discuss how to get volunteers involved and how to keep them; how to organize and manage volunteer efforts; how to provide incentives and recognition for volunteers.
- **International perspectives:** Discuss what is being done in other countries; invite people from monitoring programs in other countries to participate in the meeting.
- **Communication:** Discuss ways to improve communication among monitoring groups as well as between monitoring groups and other agencies.
- **Training:** The meeting could include training sessions on specific monitoring techniques and field trips for hands-on experience with the methods.

B. National association

Create a national association of citizens environmental monitoring groups and affiliated government, university, and nonprofit groups.

C. National clearinghouse

Establish a national clearinghouse for information on citizens environmental monitoring activities and publications.

D. Guidance manuals

Continue to publish and update guidance manuals such as the one the EPA is currently developing.

E. Newsletter

Continue to publish a newsletter.

F. Computer network

Consider the feasibility of developing a computer network to link citizens monitoring groups.

Discussion Group 5 Debris

Discussion leader: *Angela Farias, Texas Adopt-A-Beach Program, Austin, Texas*
Recorder: *Patricia Haddon, Anne Arundel County, Volunteer Monitoring Program, Annapolis, Maryland*

◆ Exchanging ideas, techniques, and solutions to problems

A. Two-tiered approach to cleanup

Two important concerns about debris cleanups are that (1) the data are not totally valid and (2) the cleanups are not frequent enough. Both these problems could be solved by developing a two-tiered approach to debris cleanup.

- Level one would consist of large, grass-roots volunteer efforts like most current cleanups. These get beaches cleaned, raise awareness, involve many participants, and can contribute qualitative data to the data bank.
- Level two would be a more scientific, more quality-controlled, and more frequent collection of data by specially trained groups of volunteers. Adopt-a-Beach groups might be one good source of volunteers for this.

B. Quality assurance

Quality assurance needs to be improved. Coordinators need to field-check methods used and volunteer perceptions of debris categories. A guidance document is needed (see below, recommendations to EPA).

C. Recycling

Materials picked up during cleanups should be recycled. Options for recycling vary greatly from one area to another and there is no one formula.

D. Focus on wildlife protection

We need to focus more on the issue of protecting marine wildlife, not just getting the beach clean.

E. Source reduction

We need to involve more of the trash originators—recreational boaters, industry, commercial fishermen, etc.—and focus on source reduction.

◆ Enhancing links to state government

The group felt that good links with state governments already exist, since most cleanups are state programs. However, there is a need for more communication with local governments to find out how they can use the debris data.

◆ Evaluating progress and making recommendations to EPA

A. Standardize methodology

There is a lack of standardized methodology for debris cleanups. To address this, EPA should:

- Work with NOAA and the National Park Service to field-test and modify existing methods and come up with one overall model applicable to all areas.
- Design a new standardized data card.
- Publish a guidance document that would include sections on training, beach and debris classification, data recording, and quality assurance.

B. Publicity

We recommend that EPA better publicize debris cleanup programs.

C. Use results to protect marine wildlife

EPA needs to publicize the ways they are using the debris-cleanup results in order to protect marine wildlife.

D. Newsletter

- Make it a quarterly newsletter.
- It should be topical. The first one was more of a "PR" publication; not informative enough.
- Include specific information and in-depth articles. Possible topics for future newsletters: Where and how particular groups obtain funds; updates about specific programs and new programs; problems groups have had and how they were solved; accidents and liability and how to handle them.
- There should be one permanent, designated editor; contents can be contributed by various groups.

E. Future meetings

- Invite multiple potential user groups to meetings (i.e., state agencies, governor's offices, local government offices, legislators).
- Have shorter panel talks and more discussion time after panels.

F. Earth Day

Some debris cleanup groups are planning to provide materials to schools.

Closing Remarks & EPA Response

Ron Kreizenbeck
Acting Deputy Director, EPA Office of Marine and Estuarine Protection

EPA's Office of Water supports the use of citizen volunteers to collect environmental data, and we are pleased that this conference has been successful in meeting many of our planned objectives.

This second national conference has brought together state program managers and representatives from volunteer monitoring organizations across the United States. The meeting has provided a forum for the exchange of ideas among volunteer monitoring organizations, the states, and EPA. It has also strengthened an existing national network of citizen volunteers.

We are impressed with what we have heard during the past two days. The organizations represented at this conference have clearly demonstrated that volunteers are capable of providing a wide range of reliable environmental information. Participants at this conference have also demonstrated the strong commitment of many citizens to environmental protection. Citizen volunteers clearly represent a valuable resource that state, federal, and local environmental program managers can use to support their programs. We think that this message has been well received by the state and federal program managers in attendance.

National volunteer monitoring meetings such as this one must continue. We hope that sponsorship of, and participation in, future meetings can be broadened to include many federal agencies in addition to EPA. Future national meetings of citizen volunteers might effectively be held under the auspices of national volunteer monitoring associations, environmental organizations, or scientific associations. Regional volunteer monitoring meetings may also be useful.

EPA's Office of Water will continue to work with the states, other EPA program offices, and other federal agencies to explore how citizen volunteers can provide data to support environmental decision making.

EPA's Office of Water Regulations and Standards has produced a new citizen monitoring guidance document for state program managers. Through this guidance, EPA is encouraging the states to fund citizen monitoring programs using funds under Section 106 of the Clean Water Act.

EPA's Office of Marine and Estuarine Protection is continuing to offer training and support to newly organized volunteer groups established to monitor estuaries and near-coastal waters. Management conferences organized as part of EPA's National Estuary Program support a growing number of estuarine volunteer monitoring organizations.

These actions demonstrate the EPA Office of Water's commitment to involving citizens in environmental monitoring. However, if environmental data collected by volunteers are to be used in decision making, volunteer monitoring organizations must prove that their data are reliable. They must show government agencies how the data can be used. This is your challenge. You must continue to forge new links with state and federal agencies. You must speak at scientific meetings, publicize your successes, and build support for volunteer monitoring among the scientific and regulatory community. EPA cannot tell the states to

accept and use data collected by volunteers, but through national meetings such as this, and through the publication of Agency guidance, EPA will support your efforts to show how effectively you can assist state, federal, and local environmental programs.
■

CITIZEN MONITORING WORKSHOP ATTENDEES

(* = Speaker
** = Ecosystem Discussion Group Leader or Recorder)

Abberger, Will
The Conservation Foundation
P.O. Box 5958
Tallahassee, FL 32314

Alexander, Joy
National Toxics Campaign
37 Temple Place, 4th floor
Boston, MA 02111
617-482-1477

Arcuri, Mike
WV Dept. of Natural Resources
Rt. 6, Box 185
Charleston, WV 25311
304-348-2108

*Armitage, Tom
EPA Office of Marine and Estuarine Protection
(WH556F)
401 M Street, SW
Washington, DC 20460
202-475-7378

Armstrong, John
EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101

Arnold, Chester
Connecticut Sea Grant
43 Marne Street
Hamden, CT 06514

*Arroyo, Vicki
Assistant Chief of Staff of Environmental Affairs
State of Louisiana
Office of the Governor
Baton Rouge, LA 70804-9004

Ashford, Glenda
Corps of Engineers
CESAM-PD-EC
P.O. Box 2288
Mobile, AL 36628
205-694-4106

**Barile, Diane
Marine Resources Council
Florida Institute of Technology
150 W. University Blvd.
Melbourne, FL 32901

*Batiuk, Richard
Monitoring Coordinator
EPA Chesapeake Bay Liaison Office
410 Severn Avenue
Annapolis, MD 21403
301-266-6873

Batterton, Carroll V.
Texas Water Commission
P.O. Box 13087
Capital Station
Austin, TX 78711
512-463-7749

Beckett, Daniel
Texas Water Commission
P.O. Box 13087
Capital Station
Austin, TX 78711
512-463-8319

Beede, Susan
EPA Region 1
JFK Federal Bldg., WQE-1900C
Boston, MA 02203

*Bellatty, James
State of Idaho
Division of Environmental Quality
2110 Ironwood Pkwy.
Coeur D'Alene, ID 83814
208-667-3524

Bellinger, John
US Army Corps of Engineers
2911 Barber Street
Silver Spring, MD 20910

Beristain, Melissa
NY Sea Grant Extension Program
Dutchess Hall, Room 143, SUNY
Stony Brook, NY 11794

Betz, Carolyn Rumery
Self-Help Lake Monitoring Program
Wisconsin Dept. of Natural Resources
P.O. Box 7921
Madison, WI 53707-7921
608-266-8117

Bisterfeld, Ted
EPA Region 4
345 Courtland Street, NE
Atlanta, GA 30365

Blosser, Mark
Delaware Dept. of Natural Resources and Environmental Control
89 Kings Highway, P.O. Box 1401
Dover, DE 19903

**Bostrom, Judy A
Citizen Lake-Monitoring Program
Minnesota Pollution Control Agency
520 Lafayette Road N.
St. Paul, MN 55155
612-297-3363

Bowls, Rick
Texas Water Commission
1400 Woodway Drive
Waco, TX 76712
817-751-0335

Brierly, William
Delaware Dept. of Natural Resources and Environmental Control
89 Kings Highway, P.O. Box 1401
Dover, DE 19903

Brockbank, Marcia
San Francisco Estuary Project
P.O. Box 2050
Oakland, CA 94694

Brown, J.D.
Friends of Perdido Bay
400 Colbert Avenue
Pensacola, FL 32507
904-994-9582

Bunker, Stephen
Chesapeake Bay Foundation
162 Prince George Street
Annapolis, MD 21401

Campbell, Gayla
Alliance for the Chesapeake Bay
410 Severn Avenue
Annapolis, MD 21403
301-266-6873

Carlson, Renee
Texas Water Commision
P.O. Box 13087
Capital Station
Austin, TX 78711
512-463-8028

Choy, Brian J.J.
Hawaii State Dept. of Health
Five Waterfront Plaza, Suite 250
500 Ala Moana Blvd.
Honolulu, HI 96813
808-543-8337

Chritton-Meeker, Cindy
Louisiana Department of Environmental Quality
P.O. Box 44091
Baton Rouge, LA 70804

Conroy, Michael
Lake Ponchartrain Basin Foundation
3330 N. Causeway Blvd., Suite 400
Metairie, LA 70002

Cook, Dan
Texas General Land Office
1700 N. Congress Avenue, Room 730
Austin, TX 78701-1495

**Cooke, Ken
Kentucky Division of Water
Water Watch Program
18 Reilly Road
Frankfort, KY 40601
502-564-3410

*Copping, Andrea
Oceanographer, State of Washington
Puget Sound Water Quality Authority
217 Pine Street, Suite 1100
Seattle, Washington 98101
206-464-7320

*Costlow, John
Professor of Zoology and Director
Emeritus
Duke University Marine Laboratory
Beaufort, NC 28516

Crofts, Marjorie A.
Delaware Dept. of Natural Resources
and Environmental Control
89 Kings Highway, P.O. Box 1401
Dover, DE 19903

**Curtis, Carroll
Chesapeake Bay National Estuarine
Research Reserve System
Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, VA 23062
804-642-7156

Custer, Claude
NEFCO
969 Copley Road
Akron, OH 44320
216-836-5731

*Davies, Tudor
Director
EPA Office of Marine and Estuarine
Protection
401 M Street, SW
Washington, DC 20460
202-382-7166

Debenham, Patty
Center for Marine Conservation
1725 DeSales Street, NW, Suite 500
Washington, DC 20036
202-429-5609

Dewart, Mark
Park Tudor School
7200 N. College Avenue
Indanapolis, IN 46240
317-254-2700

DuCote, Gregory
Louisiana Dept. of Natural Resources
P.O. Box 44487
Baton Rouge, LA 70804

Ellett, Kathleen
Alliance for the Chesapeake Bay
410 Severn Avenue, Suite 110
Annapolis, MD 21403
301-266-6873

Ely, Eleanor
Rhode Island Sea Grant
The University of Rhode Island
Narragansett Bay Campus
Narragansett, RI 02882-1197
401-792-6843

Fahrer, Alison
Citizens Advisory Committee
P.O. Box 447
Islamorada, FL 33036
305-664-4704

Faigenblum, Jacques
Washington State Dept. of Ecology
EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101

**Farias, Angela
Texas Adopt-A-Beach Program
General Land Office
1700 N. Congress Avenue, Room 620
Austin, TX 78701-1495
512-463-5108

Finazzo, Barbara
EPA Region 2
28 Federal Plaza
New York, NY 10278

*Firehock, Karen
Izaak Walton League of America
1401 Wilson Blvd., Level B
Arlington, VA 22209
703-528-1818

*Flemer, David
EPA Gulf Breeze
Sabine Island
Gulf Breeze, FL 32561
904-932-5311

Gaffoglio, Robert
New York Department of Environmental
Protection
40 Worth Street, Room 1325
New York, NY 10013

Gates, Mark
Texas Water Commission
4301 Center Street
Deer Park, TX 77536
713-479-5981

Giordano, Joan
Albemarle-Pamlico Estuarine Study
P.O. Box 1507
Washington, NC 27889
919-946-6481

*Godfrey, Paul
Massachusetts Acid Rain Monitoring
Project
Blaisdell House
University of Massachusetts
Amherst, MA 01003
413-545-2842

Goodlander, Doug
Pennsylvania Dept. of Environmental
Resources
One Ararat Bldg., #214
Harrisburg, PA 17110

Goodwin, Mel
Harbor Watch
Charleston Harbor Estuary Committee
South Carolina Sea Grant Consortium
287 Meeting Street
Charleston, SC 29401
803-727-2078

**Green, Linda Taylor
Watershed Watch Program
210B Woodward Hall
The University of Rhode Island
Kingston, RI 02881-0804
401-792-2495

Gregutt, Peter
French Broad River Foundation
70 Woodfin Place
Suite 327
Asheville, NC 28801
704-252-1097

Gutierrez, Adriana
Adopt-A-Beach Program
Texas General Land Office
1700 N. Congress Avenue
Austin, TX 78711
512-475-1468

**Haddon, Patricia
Volunteer Monitoring Program
Anne Arundel County, Office of Planning and Zoning MS 6303
P.O. Box 2700
Annapolis, MD 21404
301-280-1270

Halsell, Nita
Lockheed Engineering and Science Corp.
1050 Flamingo Road
Las Vegas, NV 89119
702-734-3381

Halverson, Wes
Clear Clean Colorado River Assn.
3116 S. Congress Avenue
Austin, TX 78704
512-462-1588

Hansen, Ed
Division of Fish and Wildlife
607 State Office Bldg.
Indianapolis, IN 46204
317-232-4091

*Hansen, Judie
1502 S. County Road, 525 W.
Danville, IN 46122
317-745-2948

Hansen, Nancy
Puget Sound Water Quality Authority
217 Pine Street, Suite 1100
Seattle, WA 98101

Hantske, Lore
EPA Office of Marine and Estuarine Protection
401 M Street, SW
Washington, DC 20460

Harrison, Verna E.
Maryland Dept. of Natural Resources
Tawes State Office Bldg., C-1
Annapolis, MD 21401

Hawver, W. Dean
Park Tudor School
7200 N. College Avenue
Indianapolis, IN 46240
317-254-2700

*Hentcy, Kathleen
Vermont Department of Natural Resources
Water Quality Division
103 S. Main Street
Waterbury, VT 05676
802-244-5638

Hess, Carolyn
Citizens Volunteer Monitoring
Albemarle Environmental Foundation
Box 5346
Hertford, NC 27944
919-426-956

*Hiller, Michelle
Director, Technical Support Division
EPA Office of Marine and Estuarine Protection
401 M Street, SW
Washington, DC 20460
202-475-7102

Holloway, J.L.
HAM Industries
1425 Pecan Briar Drive
Jackson, MS 39212
601-762-8230

Holman, Robert
Albamarle-Pamlico Study
4209 Boxwood Road
Raleigh, NC 27612

**Hubbard-Gray, Sarah
City of Bellevue/Storm and Surface Water Utility
P.O. Box 90012
Bellevue, WA 98009
206-453-4895

Hunt, Dianne
Mississippi Marine Trash Task Force
Mississippi Bureau of Marine Resources
2620 Beach Blvd.
Biloxi, MS 39531-4501
601-385-5883

Hutcerson, Danny
Hach Co.
P.O. Box 389
Loveland, CO 80539
1-800-227-4224

Ireland, Diane Anderson
32911 River Road
Orange Beach, AL 36561

Jamison, Annie Marie
Keep America Beautiful
P.O. Box 908
Pascagoula, MS 39567
601-762-8443

Kahoe, Michael
California Environmental Affairs Agency
1102 Q Street
Sacramento, CA 95814

*Kishbaugh, Scott A.
New York State Department of Environmental Conservation
50 Wolf Road, Room 301
Albany, NY 12233-3502
518-457-7470

*Kopec, John S.
Ohio Scenic River Stream Quality Monitoring Program
Ohio Dept. of Natural Resources
Division of Natural Areas and Preserves
Bldg. 1889
Fountain Square Ct.
Columbus, OH 43224
614-265-6458

Kopfler, Fred
Chief Scientist
Gulf of Mexico Program Office
Building 1103
John C Stennis Space Center
Stennis Space Center, MS 39529-6000

Kramer, William
EPA Office of Municipal Pollution Control
401 M Street, SW
Washington, DC 20460

*Kreizenbeck, Ron
Acting Deputy Director
EPA Office of Marine and Estuarine Protection
401 M Street, SW
Washington, DC 20460

Krueger, Catherine
EPA Region 10, Puget Sound
1200 Sixth Avenue, WD-139
Seattle, WA 98101

*Lee, Virginia
Coastal Resources Center
The University of Rhode Island
Narragansett Bay Campus
Narragansett, RI 02882
401-792-6224

Levron, Al J.
Terrebonne Parish Government
P.O. Box 2768
Houma, LA 70361

Lindsay, Nancy
EPA Region 9
215 Fremont Street
San Francisco, CA 94118

Lirette, Donald J.
Gulf Program CAC
5347 G.C. Road
Dulac, LA 70353
504-563-7009

Livingston, Eric
Florida Dept. of Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32399

Lord, Robert
EPA Region 4
345 Courtland Street NE
Atlanta, GA 30365
404-347-2126

Lytle, Marv
Hach Co.
Houston, TX
713-292-7421

Mangan, Andy
Texas General Land Office
1700 N. Congress Avenue, Room 730
Austin, TX 78701

*Mayio, Alice
EPA Assessment and Watershed Protection Division
401 M Street, SW
Washington, DC 20460
202-382-7056

Mendelman, Krista
EPA Region 3
841 Chestnut Bldg.
Philadelphia, PA 19107

Mills, Bill
Alliance for the Chesapeake Bay
903 9th Street
Richmond, VA 23219
804-225-4355

*Mitchell, Mark
Friends of the Rouge
12763 Stark Road
Suite 103
Lavonia, MI 48150

Monroe, Michael
San Francisco Estuary Project
5535 Masonic Avenue
Oakland, CA 94618

Murchison, Mary E.
Friends of Perdido Bay
P.O. Box 1320
Foley, AL 36536
205-943-1579

Neff, Jerry
Battelle Ocean Sciences
397 Washington Street
Duxbury, MA 02332
617-934-0571

Nielson, Peter
Clark Fork Coalition
P.O. Box 7593
Missoula, MT 59807

Neumeier, Sally
Alliance for the Chesapeake Bay
6600 York Road
Baltimore, MD 21212
301-377-6270

O'Beirne, William
NOAA/OCRM
1825 Connecticut Avenue
Washington, DC 20235

O'Hara, Kathryn
Center for Marine Conservation
306A Buckroe Avenue
Hampton, VA 23664
804-851-6734

Olsen, Christine
Connecticut Department of Environmental Protection
122 Washington Street
Hartford, CT 06106

Payne, John
San Francisco BayKeeper
Building A, Fort Mason Center
San Francisco, CA 94123
415-567-4401

Pendergast, James
EPA Region 6
1445 Ross Avenue
Dallas, TX 75202

**Perlic, Tom
Pamlico-Tar River Foundation
P.O. Box 1854
Washington, NC 27889
919-946-9492

Perry, Michael J.
Southwest Florida Water Mgmt. District
7601 Highway 301 North
Tampa, FL 33637

*Pritchard, Ken
Adopt a Beach (Seattle)
Dexter Horton Bldg., Suite 730
710 Second Avenue
Seattle, WA 98104
206-296-6591

Pryor, Margherita
EPA Office of Marine and Estuarine Protection
401 M Street, SW
Washington, DC 20460
202-475-7176

Pursell, Robin
French Broad River Foundation
70 Woodfin Place, Suite 327
Asheville, NC 28801
704-252-1097

Putt, Rusty
U.S. EPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202
214-655-7145

Radde, Laura
EPA Region 6/Gulf of Mexico Program
1445 Ross Avenue
Dallas, TX 75202
214-655-6681

Reban, Alicia
Texas General Land Office
1700 N. Congress Avenue, Room 735
Austin, TX 78711-1495
512-463-2196

Redford, David
EPA Office of Marine and Estuarine Protection
401 M Street, SW
Washington, DC 20460
202-475-7179

*Reggio, Villere C.
Recreation Planner
U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico Region
1201 Elmwood Park Boulevard
Mail Stop LE-2
New Orleans, LA 70123
504-736-2780

Ruta, Gwen S.
EPA Region 1
JFK Federal Bldg.
Boston, MA 02203

Rylco, Michael
EPA Region 10
1200 Sixth Avenue
Seattle, WA 98107
206-442-4011

Sabins, Dugan
Louisiana Department of Environmental Quality
P.O. Box 44091
Baton Rouge, LA 70804

Sanzone, Stephanie
EPA Office of Marine and Estuarine Protection
401 M Street, SW
Washington, DC 20480

Schauffler, Flis
Coastal Communications Coordinator
Maine State Planning Office
Station 38
Augusta, ME 04333
207-289-3261

Schloss, Jeff
New Hampshire Lakes Lay Monitoring Program
University of New Hampshire Cooperative Extension
Durham, NH 03824
603-862-3848

Schneider, John
Delaware Dept. of Natural Resources and Environmental Control
89 Kings Highway, P.O. Box 1401
Dover, DE 19903

Schoen, Jerry
Hoosic River Watershed Assoc.
P.O. Box 268
North Adams, MA 01247
413-458-4094

Schueler, Tom
Metro Washington Council of Govts.
1875 Eye Street, NW, #200
Washington, DC 20006

Shipley, Frank
Galveston Bay NEP
Box 164, UH Clear Lake
2700 Bay Area Blvd.
Houston, TX 77058

Smith, Dave W.
Washington Dept. of Ecology
St. Martin's Campus, M.S. PV-11, Prudential Bldg.
Olympia, WA 98504

Snow, Patty
Oregon Dept. of Environmental Quality
811 SW 6th Avenue
Portland, OR 97204

Snyder, Chris
Mississippi Dept. of Wildlife and Fisheries
2620 Beach Blvd.
Biloxi, MS 39531
601-385-5860

St. John, John
HydroQual
384 Oakwood Drive
Wyckoff, NJ 07481

St. Pe, Kerry M.
Louisiana Dept. of Environmental Quality
P.O. Box 177
Lockport, LA 70374

Stacy, Gus III
Louisiana Coastal Management Division
P.O. Box 44487
Baton Rouge, LA 70804

Stancioff, Esperanza
University of Maine Cooperative Extension
375 Main Street
Rockland, ME 04841
207-594-2104

Steele, Greg
Indiana State Board of Health
1330 W. Michigan Street
Indianapolis, IN 46206

Stewart, Sharron
Galveston Bay NEP
P.O. Box 701
Lake Jackson, TX 77566

Stout, Martha
EPA Office of Wetlands Protection
401 M Sreet, SW
Washington, DC 20460
202-475-6745

Strunk, Janis W.
TVA Water Quality Dept.
2S-270C Haney Bldg.
311 Broad Street
Chattanooga, TN 37402-2801

**Swarth, Chris
Jug Bay Wetlands Sanctuary
Anne Arundel County
Department of Recreation and Parks
1361 Wrighton Road
Lothian, MD 20711

Teague, Ken
EPA Region 6
1445 Ross Avenue
Dallas, TX 75206
214-655-6681

Thomas, Carolyn
Smith Mountain Lake Lay Monitoring Program
Ferrum College
Life Science Division
Ferrum, VA 24088-9001
703-365-4368

*Tiedemann, John
New Jersey Sea Grant
Ocean County Extension Center
1623 Whitesville Road
Tom's River, NJ 08755

Turner, Eleana
Mississippi Department of Environmental Quality
P.O. Box 20305
Jackson, MS
601-961-5015

Tyrrell, Catherine
Santa Monica Bay Restoration Project
101 Centre Plaza Drive
Monterey Park, CA 91754

Walk, Marie Francoise
Massachusetts Acid Rain
63 Washington Street
Greenfield, MA 01301
413-545-4797

Walker, Alice
EPA Office of Water
(WH556)
401 M Street, SW
Washington, DC 20460
202-382-5683

Walker, Susan Wellington
Sarasota Bay NEP
1550 City Island Road
Sarasota, FL 34236

Watkins, Bill
St. John River Water Management District
P.O. Box 1429
Palatka, FL 32178-1429
904-328-8321, ext. 345

Watson, Carolyn
Prince Georges County Critical Area Program
County Administration Bldg., Dept. of Environmental Resources
Upper Marlboro, MD 20772

*Weaver, Dennis
Earth Communications Office
Imagine Studios
1925 Century Park East, Suite 2300
Los Angeles, CA 90067

Wetherell, Nancy
Rhode Island Salt Pond Watchers
59 Sunset Drive
Charleston, RI 02813
401-322-9007

Whitson, William
EPA Gulf of Mexico Program
Stennis Space Center
Stennis Space Center, MS 39529-6000
601-688-3726

Wieland, Mark
Clear Clean Colorado River Assn.
3116 S. Congress Avenue
Austin, TX 78704
512-462-1588

*Wilms, Richard Paul
Division of Environmental Management
North Carolina Department of Natural Resources and Community Development
P.O. Box 27687
Raleigh, NC 27611
919-733-7015

Wilson, Craig
California State Water Resources Control Board
901 P Street
Sacramento, CA 95814

Woo, Edward
EPA Region 1
JFK Federal Bldg., Room 2211
Boston, MA 02203

Yaggy, Calvin D.
Neuse River Foundation
108 Bowline Road
New Bern, NC 28562
919-638-6778

Ziegler, Sam
EPA Region 9
P.O. Box 2050
Oakland, CA 94604

*Zipf, Cindy
Clean Ocean Action
P.O. Box 505
Sandy Hook
Highlands, NJ 07732
201-872-0111

☆U.S. GOVERNMENT PRINTING OFFICE: 1990-261-069/24169

EPA

United States
Environmental Protection
Agency
(WH-556F)
Washington, DC 20460

Official Business
Penalty for Private Use
$300