Volunteer Water Quality Data – An Effective Tool for Water Resource Management

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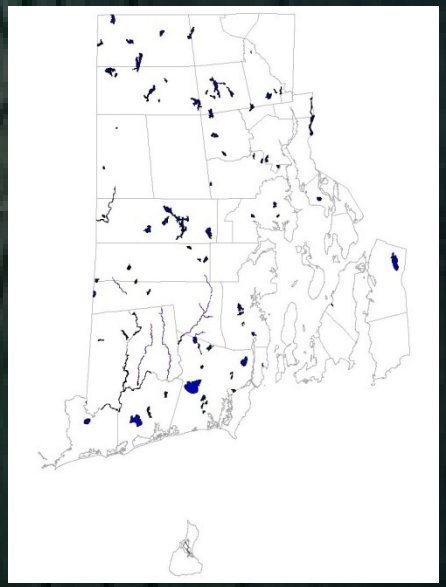
URI Cooperative Extension

CSREES Volunteer Water Quality Monitoring National Facilitation Project

UNIVERSITY OF Rhode Island

URI Watershed Watch (URIWW)

- Begun in 1988 with 14 lakes
- Now monitors +200 sites on ~100 waterbodies with ~350 volunteers
- Provides ~90% of RI's lake multi-year baseline data



~ 10 lakes with >20 years of data

URIWW WQ Parameters

Field

- Secchi Depth
- Water Temperature
- Dissolved Oxygen
- Chl. - a Processing
- Salinity (tidal)
- Aquatic Invasive Plants (lakes)

Laboratory

- pH
- Alkalinity
- Total & Dissolved Phosphorus
- Total, nitrate and ammonium nitrogen
- Chlorophyll - a
- Chloride
- Bacteria

A Brief History of Volunteer Environmental Monitoring

1890 National Weather Service
- 11,500 volunteers, 500 stations, +100 years

1900 National Audubon Society
- Christmas Bird Count

1954 National Marine Fisheries Service
- game fish tagging

1969 Izaak Walton League
- SOS, river & stream monitoring

A Brief History of Volunteer Environmental Monitoring

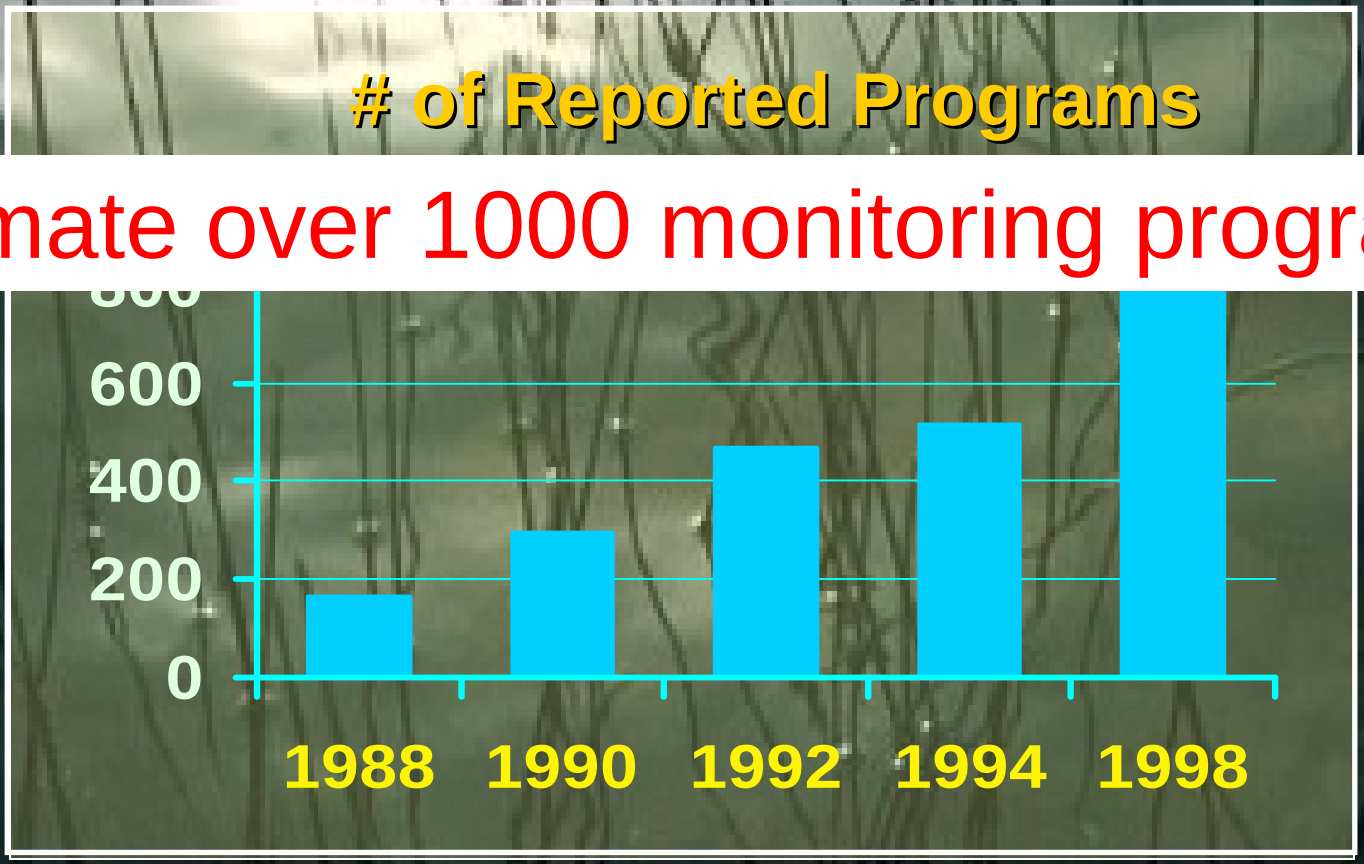
1971-78 Maine, Minnesota, Michigan and NH
- statewide lakes monitoring

1985 RI and Chesapeake Bay
- estuary monitoring

1988 1st National Volunteer Monitoring Conference - 85 attend

1989 1st Issue of *The Volunteer Monitor* Newsletter
- 8 pages, 3000 copies

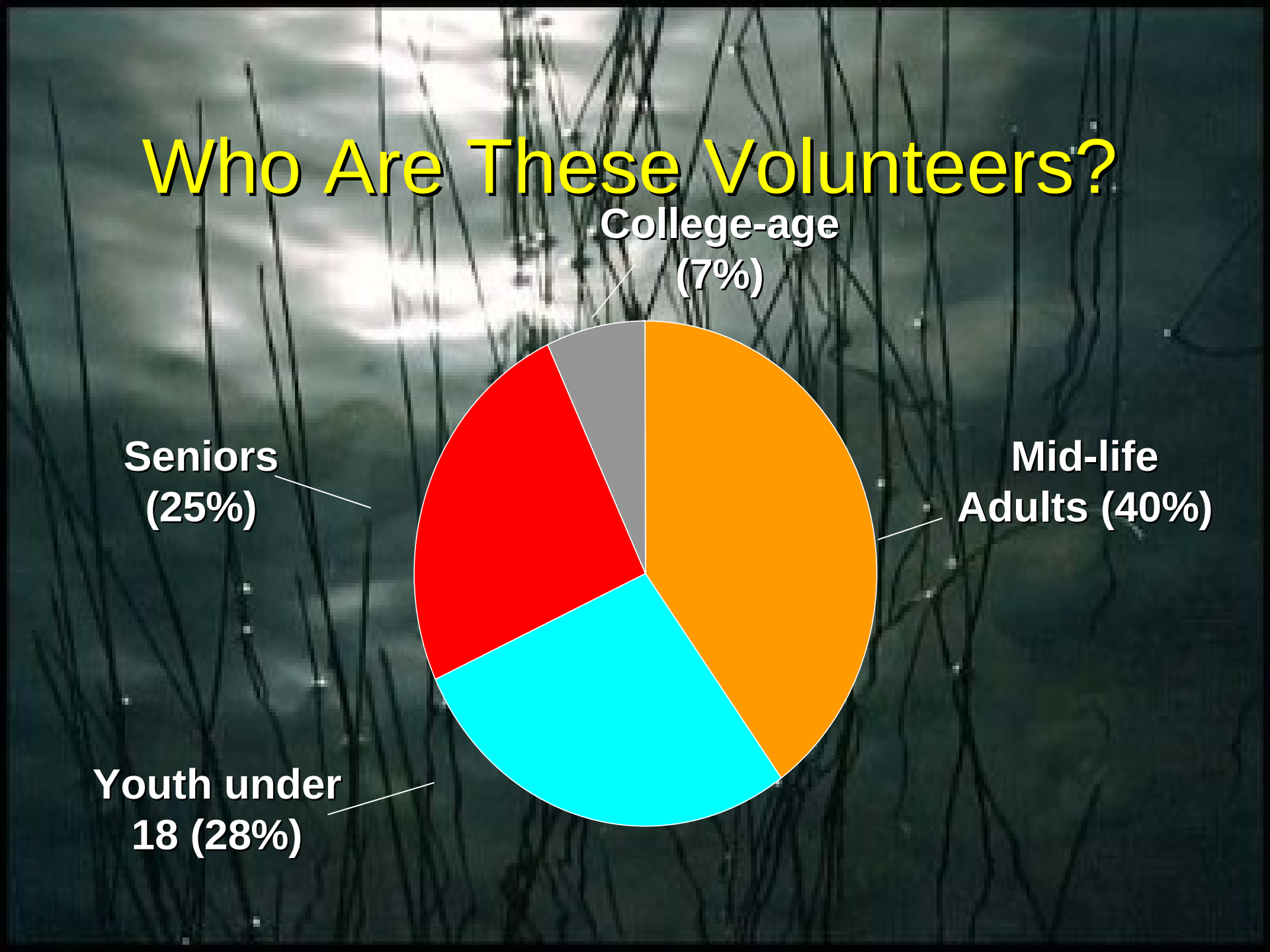
Volunteer WQ Monitoring Came of Age in the 1990s*



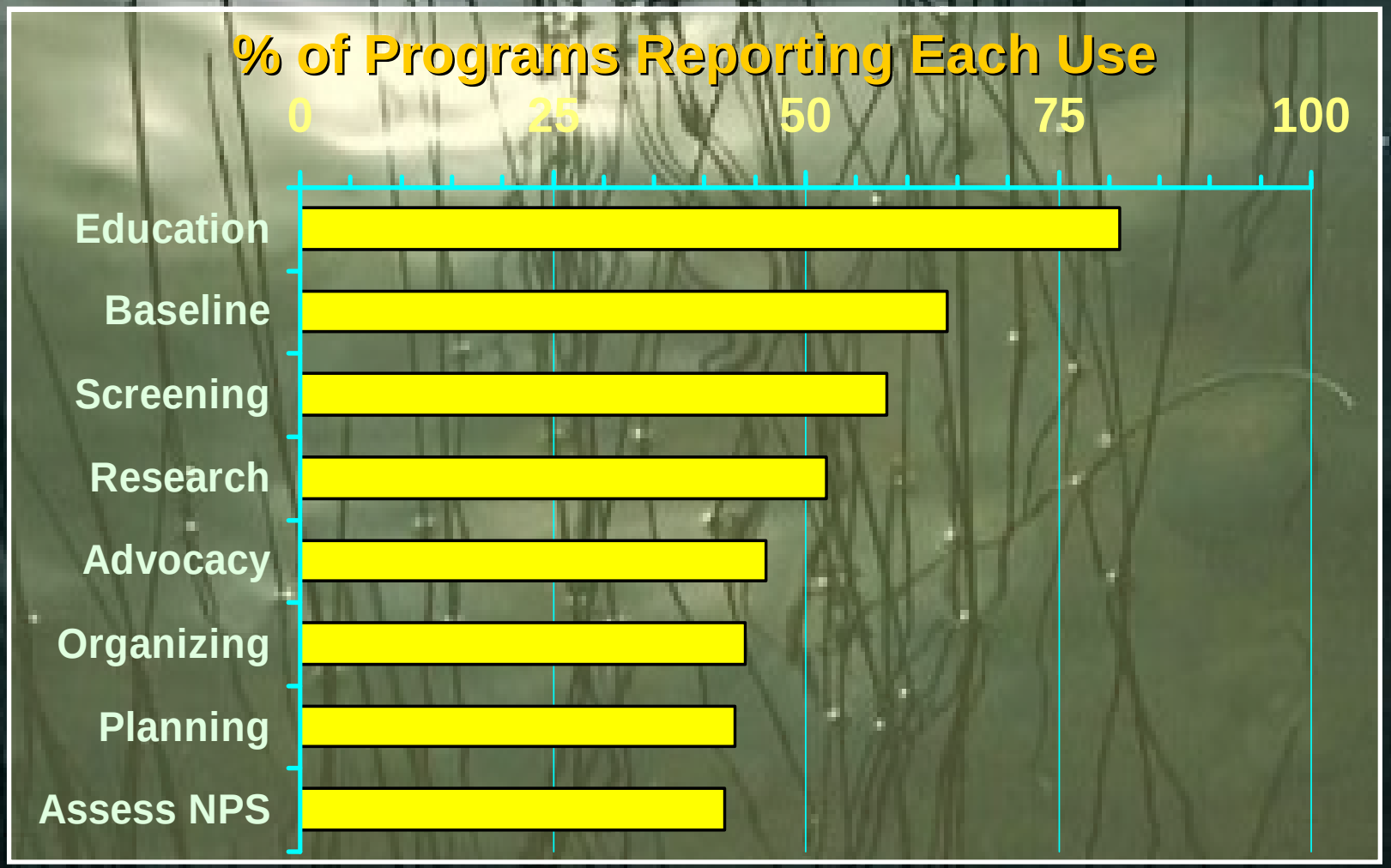
Estimate over 1000 monitoring programs

* Nat'l Dir. of Envir. Mon. Progs. - 5th Ed.

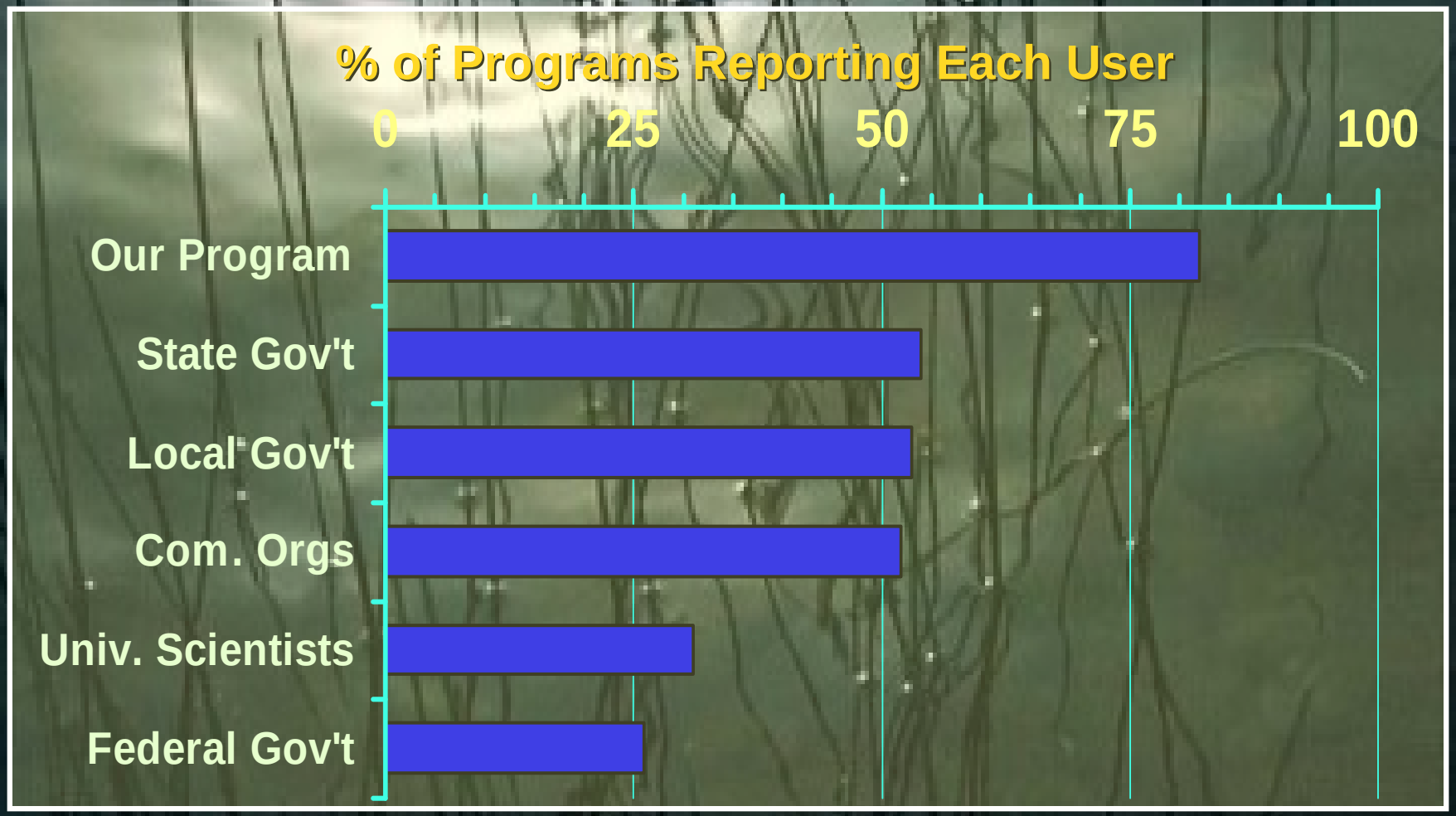
Who Are These Volunteers?



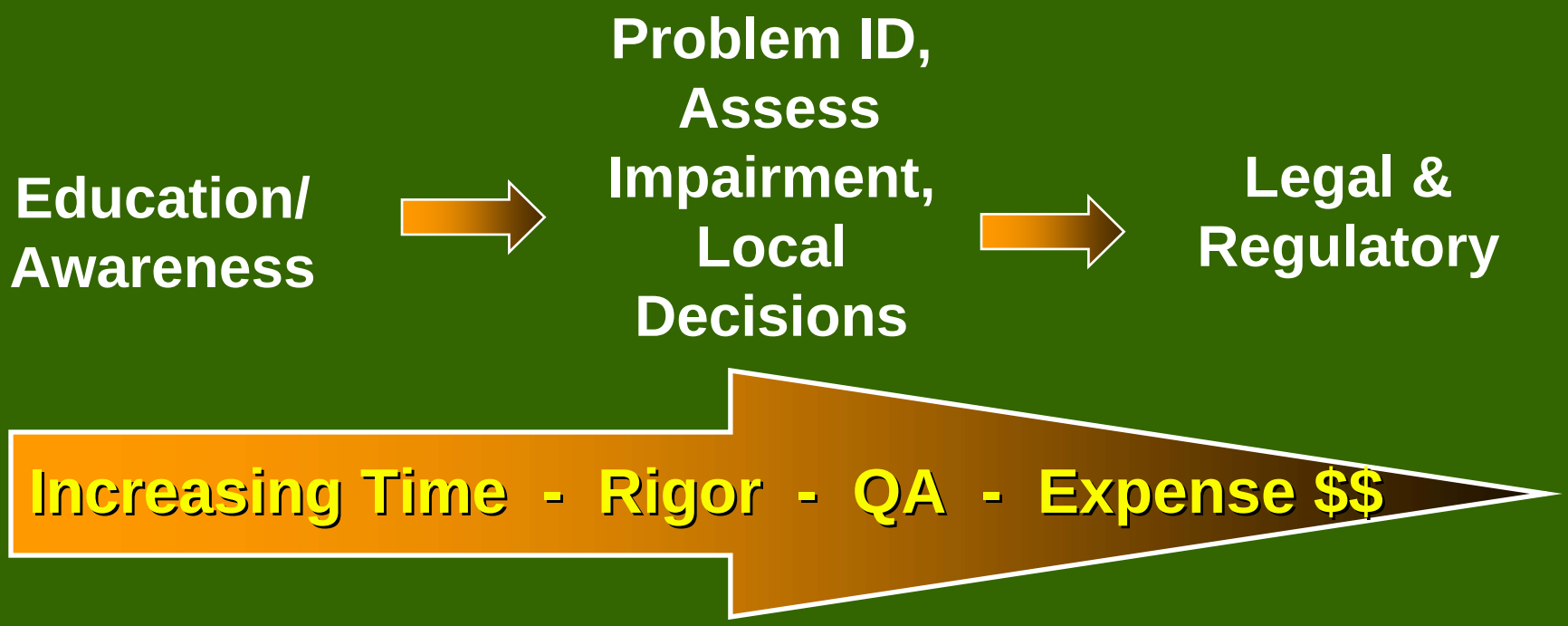
How Are the Data Being Used?



Who Is Using the Data?



The Continuum of Monitoring Data Use



Geoff Dates, River Network

Methods and Tools

- Volunteers use well established monitoring methods (i.e. Standard Methods) adapted to the resources and skills of the programs,
- Lower cost kits and meters for water chemistry and physical parameters,
- Biological methods (macroinvertebrates, bacteria, plants, fish, etc.) sometimes to lower level of resolution.

Credible Data

- Volunteer methods and tools have been rigorously tested:
  - Side by side comparisons
  - Samples split with certified labs
  - Programs have been evaluated
- Many programs have approved QAPPs
- Data extensively used by USEPA and many state agencies

Total Maximum Daily Load (TMDL)

Volunteer lake data are used to

- **Assess impairment**
- **Develop TMDL and community “buy-in”**
- **Monitor effectiveness upon implementation**

NH Lakes Lay Monitoring Program

- Lake Chocorua, volunteers documented a water quality decline due to highway runoff.
- Multi-agency taskforce, including Extension, the Natural Resource Conservation Service (NRCS), and state agencies, collaborated to design and implement a series of Best Management Practices to mitigate the road runoff.
- NHLLMP Post implementation monitoring showed an 84 to 92 percent reduction in phosphorus loads to the lake from highway sources.

URI Watershed Watch Program

- Stafford Pond, volunteers documented significant increase in chlorophyll levels causing drinking water quality concerns
- 319 Grant obtained
  - Diagnostic study
    - NRCS – Livestock management plan implementation
    - RIDOT – Stormwater BMPs installation
  - Public Education Project
    - Home*A*Syst
    - Community targeted factsheets
    - Residential guide
- Post implementation monitoring documenting improvements

Chloride Trends

- Volunteer data has been used to identify trends of increasing lake chloride levels
  - ✓New England
  - ✓New York Finger Lakes Region
  - ✓Great Lakes Region
- Linked to changes in land use including increased road miles and winter salt usage, septic systems, and water softeners

Invasive Species

- Calcium / alkalinity levels to help assess susceptibility to zebra mussels
- Nutrient, pH and alkalinity used to identify lakes of concern for the spread of variable leaf milfoil
- Volunteers also frequently first to report pioneer infestation – whether trained “weed watchers” or not

Pre and Post Treatment Monitoring

- Volunteers often provide essential pH, dissolved oxygen, water clarity and nutrient data both before and after aquatic herbicide and other in-lake treatments
- Usually provide the ONLY long-term post treatment monitoring

Elevated Mercury

- USEPA lab analyzing fish tissue mercury levels used volunteer data to begin determining why similar atmospheric deposition resulted in different mercury levels in various lakes
- Preliminary data suggests pH, chloride Secchi depth explained 65% of the variation

National Facilitation of CSREES Volunteer Monitoring Efforts Project Objectives

- Identify existing Extension voluntary monitoring programs, and expand volunteer opportunities by strengthening state and local capacity for such programs;
- Develop training materials and offer training programs;
- Improve the knowledge-base by acquiring, synthesizing and transmitting the current research in the field;
- Develop Internet and Web-based tools;
- Increase collaboration and cooperation through enhanced networking and communication; and
- Enhance stakeholder involvement by strengthening regional capacity to incorporate volunteer monitoring to address programmatic priorities.

CSREES Volunteer Water Quality Monitoring National Facilitation Project

View Favorites Tools Help

Search Favorites

http://www.usawaterquality.org/volunteer/

Search Web 133 blocked AutoFill Options

CSREES Volunteer Water Quality Monitoring National Facilitation Project

Applying knowledge to improve water quality

VOLUNTEER WATER QUALITY MONITORING
National Facilitation Project

This Volunteer Water Quality Monitoring National Facilitation Project is designed to build a comprehensive support system for Extension volunteer water quality monitoring efforts across the country. The goal is to expand and strengthen the capacity of existing Extension volunteer monitoring programs and support development of new groups.

Volunteer Monitoring National Facilitation Project

- Project Description (382 K pdf file)
- Outreach Materials and Activities
- Nationwide Inquiry
- Online Databases
- Training Sessions and Materials

Extension Volunteer Monitoring Programs

Related Research and Educational Efforts

Other National Facilitation Projects

- NEMO
- Best Education Practices

Guide for Growing Programs

- Getting Started (311 K pdf file)
- Why Monitoring Makes Sense (582K pdf file)
- Designing Your Monitoring Strategy (1.6 M pdf file)
- Monitoring Matrix (80 K pdf file)
- Effective Training (986 K pdf)
- Monitoring Equipment Suppliers (437KB pdf file)
- Direct Links to Monitoring Programs' Manuals (online)
- Quality Assurance (1.5 M pdf file) NEW!
- Volunteer Management
- Outreach Tools
- Locating Support and Funding

Special Topics

- Highlighted Program NEW!
- Highlighted Program Archives

CSREES Volunteer Water Quality Monitoring National Facilitation Project

Applying knowledge to improve water quality

CSREES NATIONAL Water Quality Program

Cooperative Extension Volunteer Water Quality Monitoring Programs

Initiatives

Project Description (382 K pdf file)
Outreach Materials and Activities
Nationwide Inquiry
Online Databases
Training Sessions and Materials

Extension Volunteer Monitoring Programs

Related Research and Educational Efforts

Guide for Growing Programs

Using the Guide (803 K pdf file)
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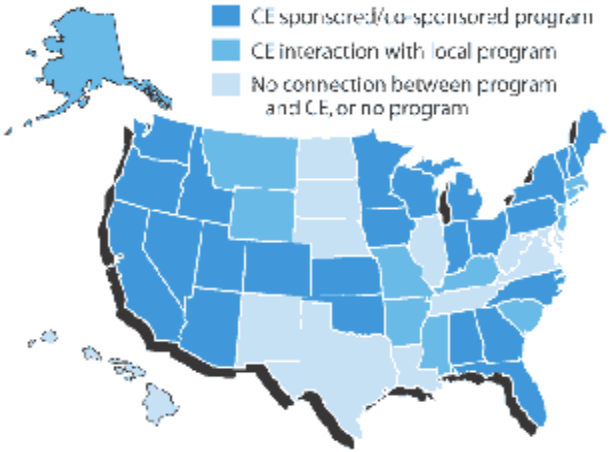
Monitoring Matrix (80 K pdf file)
Effective Training (986 K pdf)
Monitoring



When we first started this project we identified 27 volunteer water quality monitoring programs sponsored or co-sponsored by Cooperative Extension in the United States and its territories. Now we are up to 38! We are always looking for programs we have missed and have had help from people across the country to find 'new' programs. Our latest change to this page was to identify which programs are sponsored or co-sponsored by Cooperative Extension and which are affiliated in other ways -- such as by providing technical assistance with trainings, educational materials, equipment, or meeting space for volunteer monitoring events.

The map above shows where and to what extent Cooperative Extension is involved in volunteer water quality monitoring across the nation. Not shown is an Extension co-sponsored program in American Samoa.

The first of these programs began in 1978, the most recent this year. In parentheses next to each program's name is the year that the program began. Program volunteers are monitoring a wide range of aquatic habitats including rivers, streams, lakes, ponds, wetlands, estuaries, and drinking water wells.

Related Research and Educational Efforts

Universities across the nation are involved in educational programs and research that consider and involve volunteer water quality monitoring.

Information on this page will provide you with a general overview of such activities, and whenever possible will provide you with links or contact information for those most intimately involved with these projects so that you can learn more about them.

We'll be adding to the information provided on this page as we learn about programs and research, so please let us know if you know of or are involved with research or educational efforts related to volunteer water quality monitoring.

Nationwide

The national newsletter of volunteer water quality monitoring, *The Volunteer Monitor*, sponsored in part by the U.S. Environmental Protection Agency, has been published for a number of years and allows for the exchange of ideas, sharing of monitoring methods among volunteer monitoring groups across the nation. A number of Cooperative Extension connected programs were highlighted in recent issues of the newsletter, including Florida LAKEWATCH, Alabama Water Watch, New Hampshire's Lakes Lay Monitoring Program, Washington State University's Beach Watchers, and this national faciliation project on volunteer water quality monitoring. Check out recent issues of *the Volunteer Monitor* at: http://www.epa.gov/owow/monitoring/volunteer/issues.htm.

We have also provided links to articles about specific programs from the Winter 2003 issue Volume 15 Number 1 edition of the newsletter:

Cooperative Extension/Volunteer Monitoring Partnerships

New Hampshire Participatory Research

Reliability of Florida LAKEWATCH data

CSREES
Volunteer Water
Quality Monitoring
National Facilitation Project

Applying knowled[illegible] quality

CSREES NATIONAL Water Quality Program

Highlighted Program- St. Louis River - River Watch

Initiatives

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Extension Volunteer Monitoring Programs

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Monitoring Equipment Suppliers (437KB pdf file)
Direct Links to Monitoring Programs' Manuals (online)
Quality Assurance
Volunteer Management
Outreach Tools
Locating Support and Funding
Overcoming Networking Barriers

The St. Louis River – River Watch project is a youth-based water quality monitoring program for the St. Louis River and its tributaries in northeastern Minnesota. This project aimed at secondary school students promotes and inspires stewardship of the largest U.S. tributary to Lake Superior and other area streams. The St. Louis River is the largest United States tributary to Lake Superior. Its 3,634 square mile watershed is one of the largest in Minnesota. The river and its tributaries flow through diverse landscapes and land use areas, including remote forested areas, flat wetlands and farmlands, and both small communities and industrialized cities. Currently, students and teachers in 30 public, private, tribal, home, and alternative schools enthusiastically gather chemical, physical, and biological data twice per year at river sites located throughout northeastern Minnesota. In most participating schools, these activities are integrated into the secondary science curriculum. An estimated 900 youth per year strengthen scientific skills while working together to serve their communities and their watershed. Since 1997, Fond du Lac Tribal and Community College in Cloquet, Minnesota has coordinated this monitoring effort.

Program Objectives

- to provide environmental education opportunities to students and their teachers by offering a hands-on approach to learning about the natural and cultural history of the St. Louis River watershed
- to cultivate a life-long sense of stewardship toward the river and the river communities
- to collect and interpret baseline water quality data using sound scientific

Guide for Growing CSREES Volunteer Monitoring Programs

- Why Volunteer Water Quality Monitoring Makes Sense for CSREES;
- Getting Started: Finding Resources in the *Guide…*;
- Designing Your Monitoring Strategy: Basic Questions and Resources to Help Guide You;
- Training Volunteer Water Quality Monitors Effectively;
- Building Credibility: QA and QC for Volunteer Monitoring Programs;
- Volunteer Management and Program Support;
- Tips from the Trenches – Presentation Tools;
- Fundraising for Volunteer Monitoring, and
- Effective Outreach.

CSREES Volunteer Water Quality Monitoring National Facilitation Project

December 2004
Factsheet VI

Building Credibility:
Quality Assurance and Quality Control for Volunteer Monitoring Programs

University of Rhode Island — University of Wisconsin

Elizabeth Herron, Linda Green, Kris Stepenuck and Kelly Addy

The ultimate goal of most volunteer monitoring programs is to ensure that well-trained volunteers collect high quality data and that the data are used. Despite decades of demonstrating that volunteers can and do collect representative data, government agencies, scientists and often the general public are sometimes reluctant to use data not collected by "experts". Therefore volunteer water quality monitoring programs must work especially hard to build and maintain credibility – some have even said, "twice as hard for half the recognition." This factsheet provides an overview of quality assurance and quality control issues and provides examples of methods used by Cooperative Extension and other volunteer monitoring programs to substantial the credibility of their data.

Water quality monitoring data are typically gathered to support decision-making, whether it is for encouraging waterfront residents to convert lawns into vegetated buffers, for enacting local ordinances to strengthen wetlands protection or storm water management, or for regulatory action. In order to be useful, monitoring data must provide relevant information – if the concern is potential bacterial contamination, measuring turbidity or dissolved oxygen won't help much. And the data must be credible, which usually means that it is documented and defensible. Data of unknown quality are essentially useless, and useless data can potentially corrupt the decision-making process. Therefore incorporating a Quality System into your monitoring program is necessary for generating useful data.

Quality System Components:
Assurance, Control and Assessment

Generating reliable data requires adherence to an overall quality policy or system, but what exactly makes up that system? The **Quality System** can most easily be thought of in terms of what you need to do *Before, During* and *After* your monitoring effort (Table 1). Three elements combine to form the Quality System: Quality assurance, control and assessment[1]. Developing your Quality System should be an iterative process and focused on how you intend for the data to be used. This system should be incorporated into every aspect of your monitoring program - the bedrock upon which your program is based.

Table 1. Data Quality System

Before - Plan	During - Implement	After - Assess
Quality Assurance	Quality Control	Quality Assessment
Study design Quality Assurance Project Plan Develop training program and materials	Training Follow the written monitoring manual Follow standard operating procedures (SOPs) Document changes Proficiency testing	Data proofing/review Outside performance evaluation Reconcile data with objectives Revise SOPs as needed

This is the sixth in a series of factsheet modules which comprise the Guide for Growing CSREES Volunteer Monitoring Programs, part of the *National Facilitation of Cooperative State Research Education Extension Service (CSREES) Volunteer Monitoring Efforts* project. Funded through the USDA CSREES, the purpose of this four-year project is to build a comprehensive support system for Extension volunteer water quality monitoring efforts nationally. The goal is to expand and strengthen the capacity of existing Extension volunteer monitoring programs and support development of new groups. Please see http://www.uwexstreamquality.org/volunteer/ for more information.

Guide for Growing CSREES Volunteer Monitoring Programs

- Produced in modular form (factsheets)
- Serves as 'gateway' to expertise from a variety of sources
  - Includes many URLs
  - Active links in the pdf
- Promotes Cooperative Extension by highlighting many of its excellent programs
- Regularly updated and expanded

CSREES Volunteer Water Quality Monitoring National Facilitation Project

Taking the CSREES Network to the Next Level

- Helping programs to better use their monitoring data by
- Integrating technology (GIS, web data sharing and analysis)
- Expanding the monitoring toolkit
- Other suggestions??

www.usawaterquality.org/volunteer/

CSREES Volunteer Water Quality Monitoring National Facilitation Project

Family Science Project Yields Surprising Data About a Siberian Lake

By CORNELIA DEAN

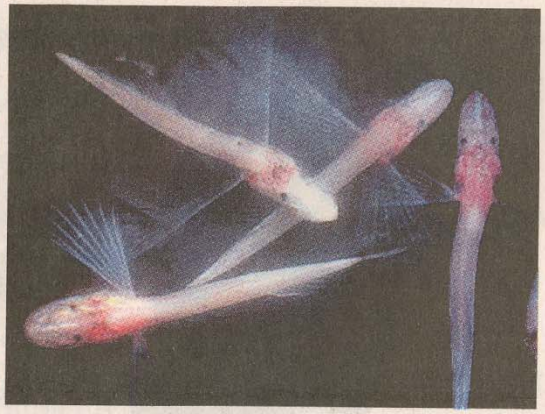
In 1945, when Stalin ruled the Soviet Union, Mikhail M. Kozhov began keeping track of what was happening under the surface of Lake Baikal, the ancient Siberian lake that is the deepest and largest body of fresh water on earth.

Every week to 10 days, by boat in summer and over the ice in winter, he crossed the lake to a spot about a mile and a half from Bolshie Koty, a small village in the piney woods on Baikal's northwest shore. There, Dr. Kozhov, a professor at Irkutsk State University, would record water temperature and clarity and track the plant and animal plankton species as deep as 2,400 feet.

Soon his daughter Olga M. Kozhova began assisting him and, eventually her daughter, Lyubov Izmesteva, joined the project. They kept at it over the years, producing an extraordinary record of the lake and its health.

Now Dr. Izmesteva and scientists in the United States have analyzed the data and concluded, to their surprise, that the water in Lake Baikal is rapidly warming. As a result, its highly unusual food web is reorganizing, as warmer water species of plankton become more prevalent. These shifts at the bottom of the food web could have important implications for all of the creatures that live in the lake, they say.

Although Dr. Kozhov is famous among scientists who study lakes — his 1961 book "Lake Baikal and Its Life" is



THE NEW YORK TIMES

L.R. IZMESTEVA (TOP LEFT); VISUAL UNLIMITED (TOP RIGHT); STEPHANIE HAMPTON (ABOVE RIGHT); VADIM KANTOR/GREENPEACE (LEFT)

LEGACY Lyubov Izmesteva with her grandfather, Mikhail M. Kozhov, who kept a record of Lake Baikal, home to species like the golomyanka, top center, and the freshwater water flea. The Baikal seal, above, and a view from a research vessel.

She led the work along with Dr. Izmesteva who, like her mother and grandfather before her, is a professor at the university and a researcher at the biological field station it established in Bolshie Koty in 1918. Their findings are being reported this month in the journal Global Change Biology.

Like others who have seen the data, Dr. Hampton said in an interview that she was in awe of the people who had collected it. "Even in the spring, summer and fall, this is tough," she said. "In the winter to go out a mile and a half on the ice and break through it to take water samples, in a year-round effort for 60 years, is pretty amazing to me. Every time I think about it I am humbled."

Marianne V. Moore, an ecologist at

tor said had been drawn from a 60-year record. "I thought he had made a mistake," Dr. Moore recalled. "So I basically ignored it."

When she returned with another class two years later and another scientist mentioned the data, "my jaw

downs of nature. The center in Santa Barbara financed the collaboration.

Baikal is a place of unusual biodiversity, with many species found nowhere else. Among them are giant shrimp, bright green sponges that grow in shallow water forests and the Baikal seal, the world's only exclusively freshwater seal. In 1996, the United Nations Educational, Scientific and Cultural Organization, or Unesco, designated the lake a World Heritage Site.

Although it is known that warming is more intense at high latitudes, as in the Baikal area, and that water is warming in other major lakes, including Lake Tahoe in Nevada and Lake Tanganyika in central Africa, many scientists had thought that Lake Baikal's enormous

ly because ice forms later in the year. The database, including data on chlorophyll that the family started collecting in 1979, suggest that the "growing season" for plankton and algae has lengthened in the lake. Chlorophyll levels have tripled since measurement began, the researchers said.

Ordinarily, the researchers said in their report, this increased plant growth would be accompanied by decreases in water clarity, but that is not what the data show at Lake Baikal. This finding, they said, "highlights the importance of establishing monitoring for 'early warming' before a need for monitoring may be perceived visually."

Now, Dr. Hampton said, she and other researchers are examining how the Kozhov family's data fit with records of ecological phenomena elsewhere. So far, she said, "the data correlate well."

"You could not make up something like this," she added.

Dr. Moore said Dr. Kozhov died in 1968 and his daughter Olga died in 2000. The family persisted in their work through years of political, economic and social turmoil, especially the collapse of the Soviet Union after the fall of the Berlin Wall in 1989 when, Dr. Moore said,

60 Year Record of ~WEEKLY Data

Volunteers can be valuable partners!