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

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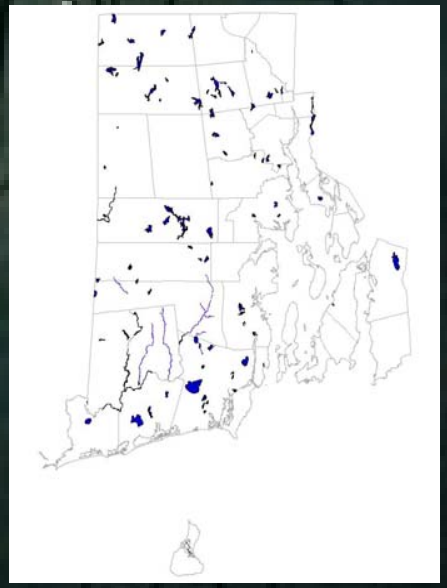
CSREES Volunteer Water Quality Monitoring National Facilitation Project

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 Lake Parameters

Field

- Secchi Depth
- Water Temperature
- Dissolved Oxygen
- Chl. - a Processing

Laboratory

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

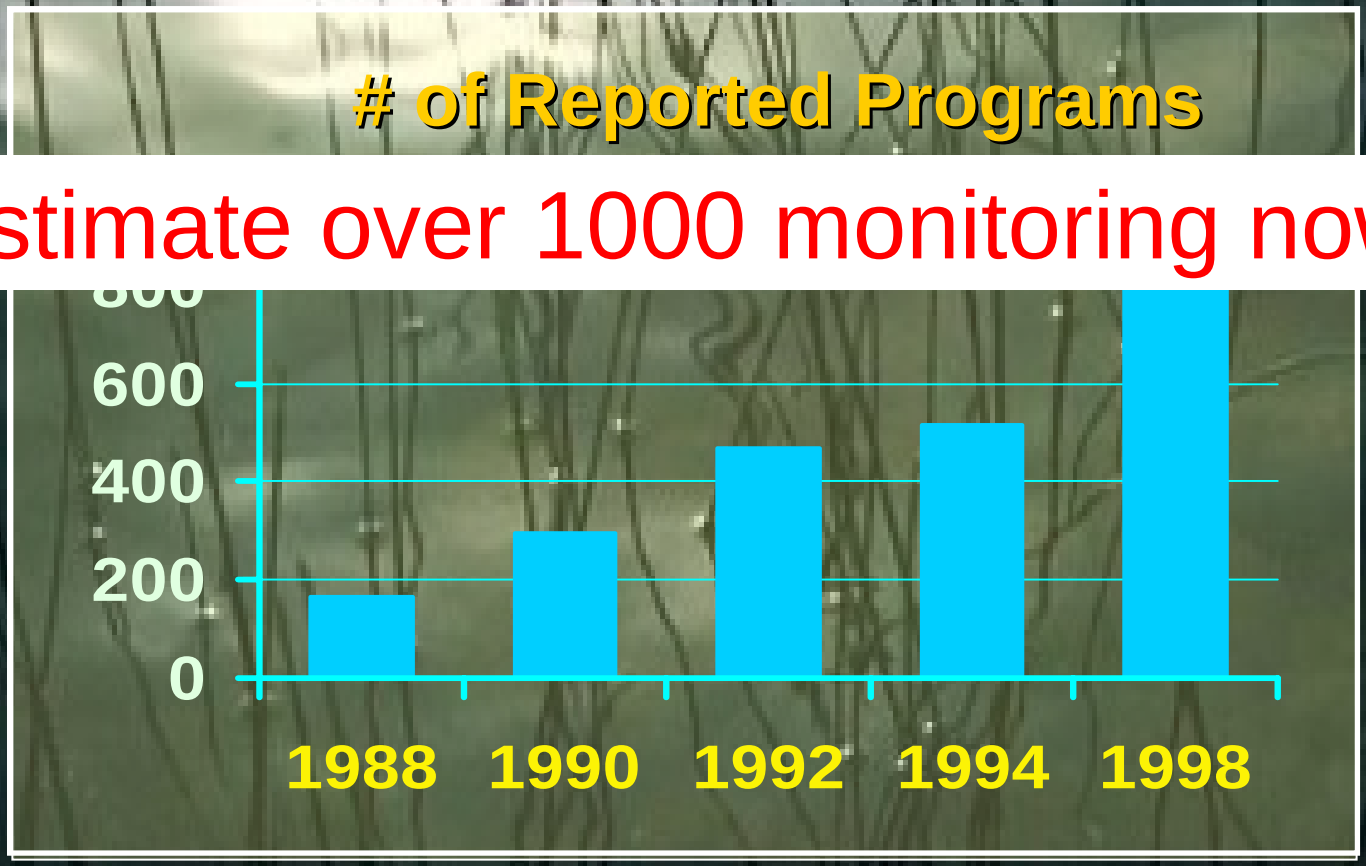
- estuary monitoring

1988 1st National Volunteer Monitoring Conference - 85 attend

1989 1st Issue of *The Volunteer Monitor* Newsletter

- 8 pages, 3000 copies

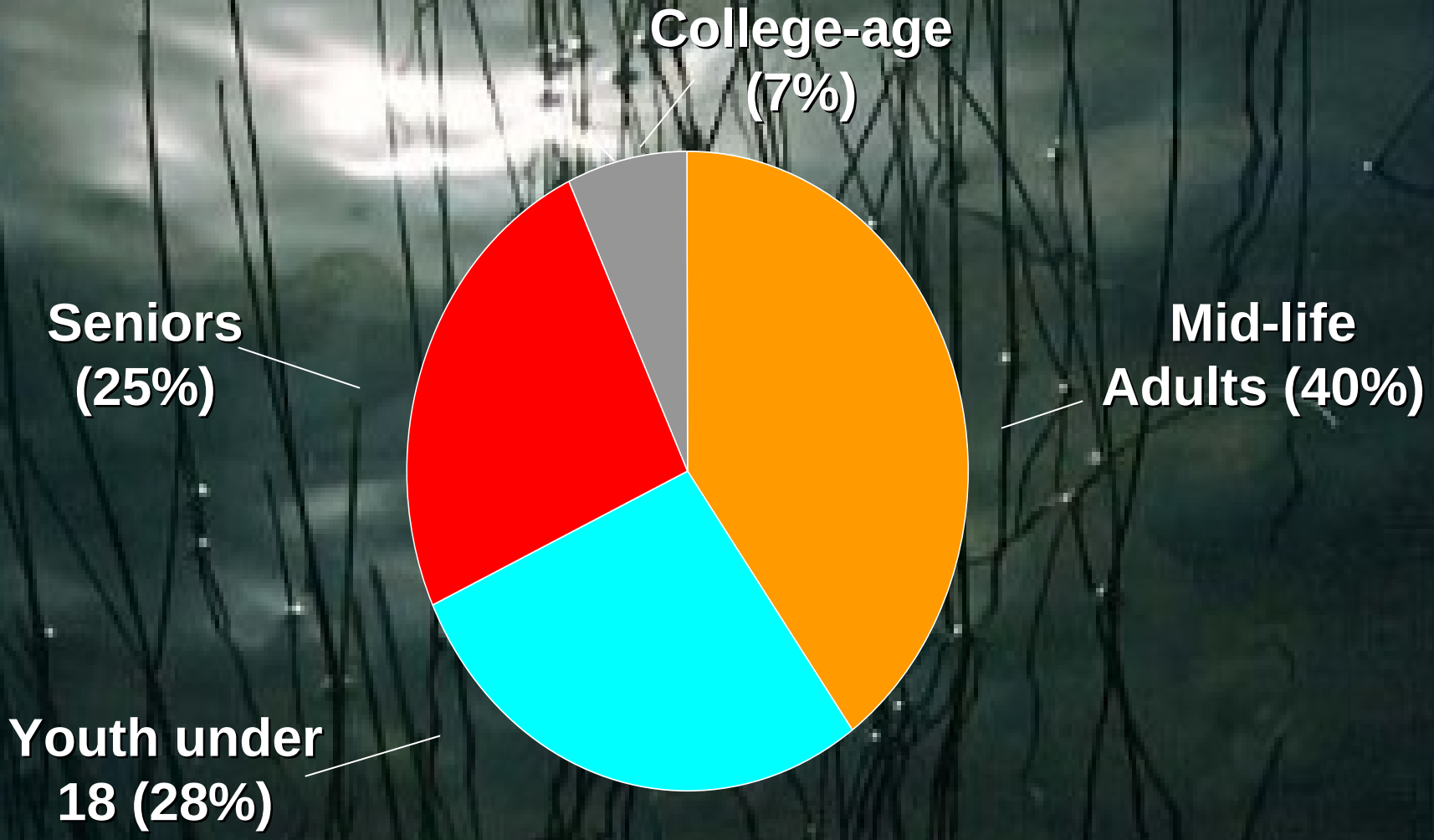
Volunteer WQ Monitoring Came of Age in the 1990s*



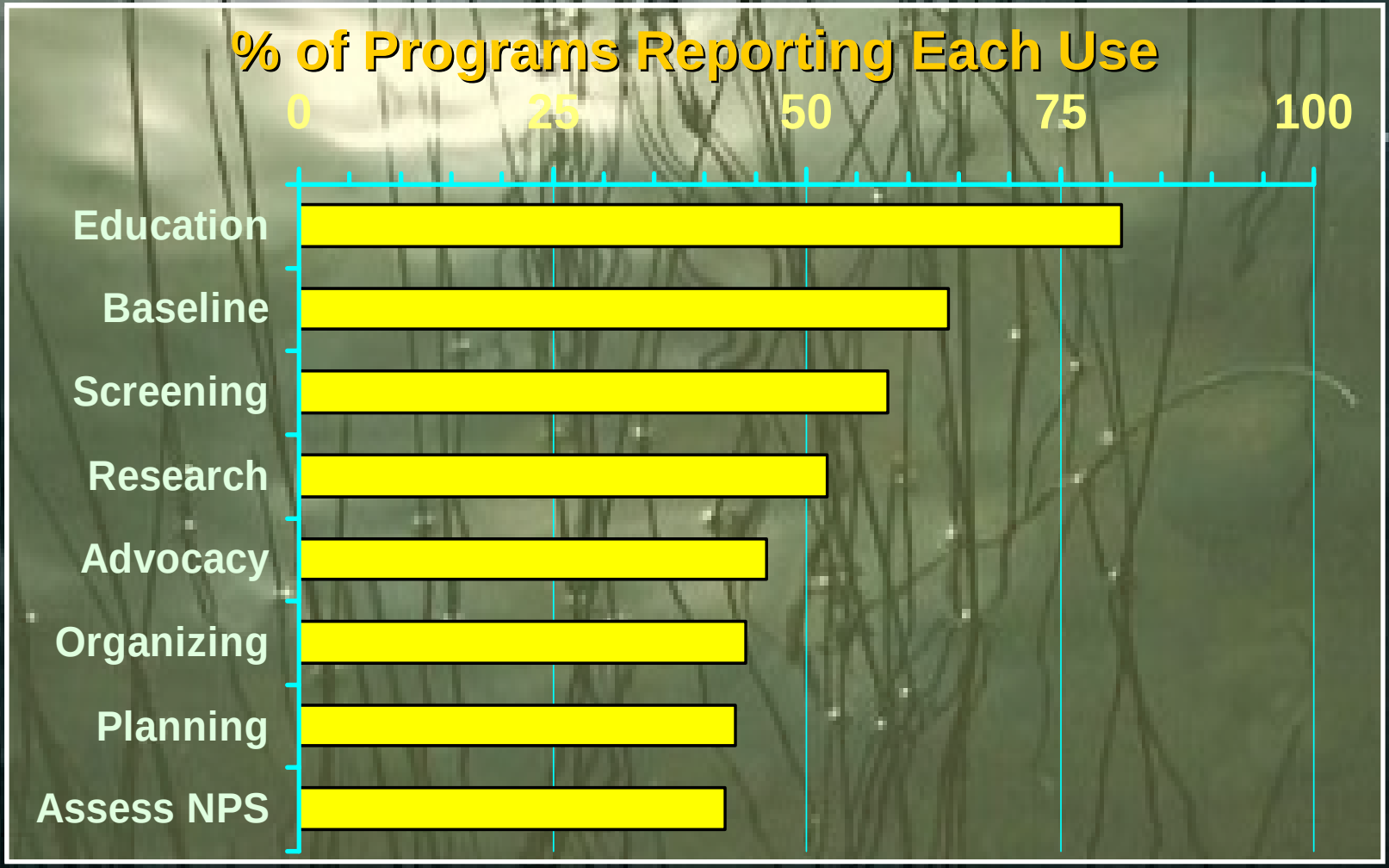
Estimate over 1000 monitoring now

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

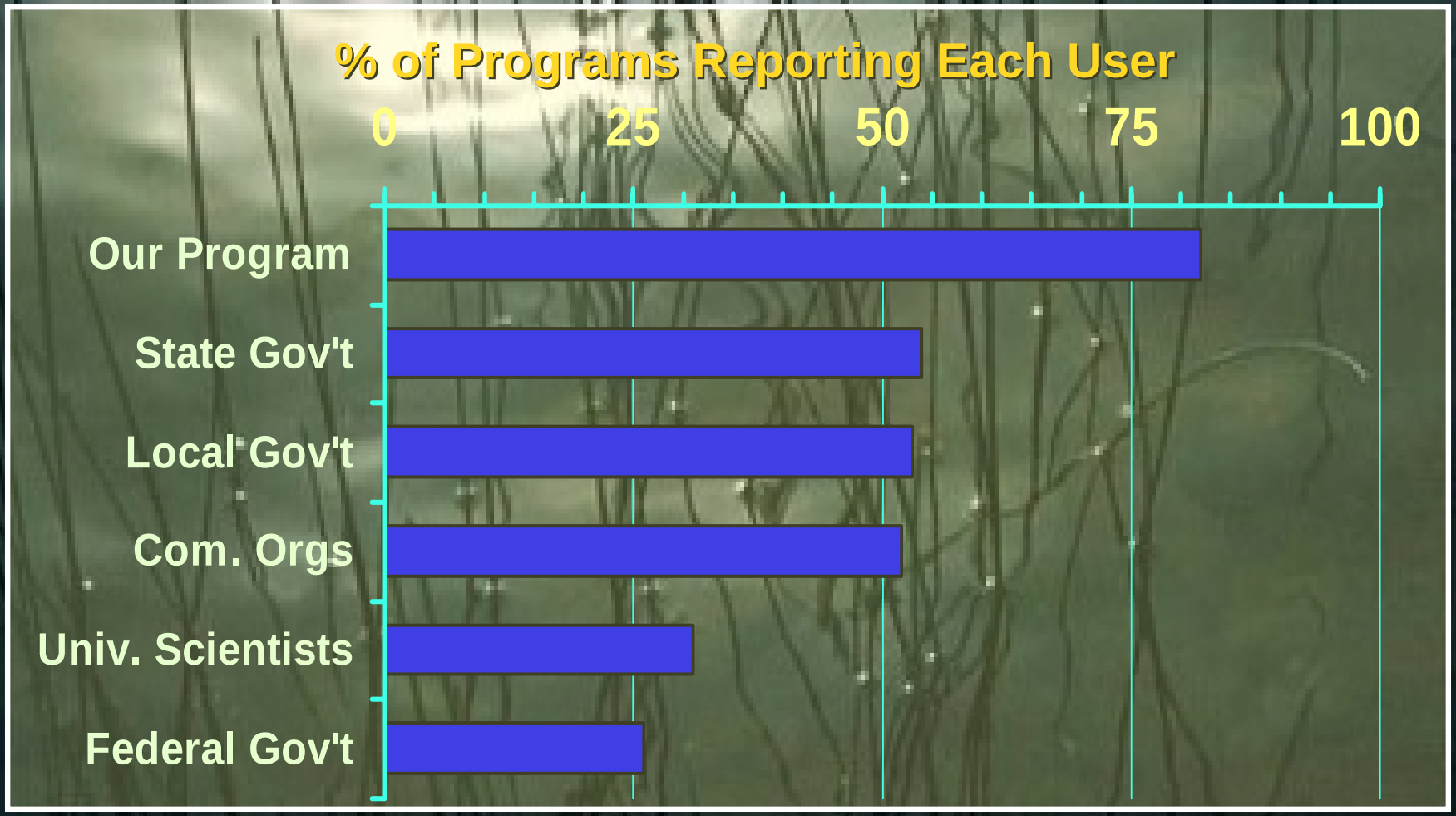
Who Are These Volunteers?



How Are the Data Being Used?



Who Is Using the Data?



Top Parameters Lakes
(% of groups monitoring this parameter)

- Secchi Depth Transparency (88%)
- Water Temperature (74%)
- Phosphorus (66%)
- Dissolved Oxygen (58%)
- Chlorophyll (51%)
- pH (45%)

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

The Continuum of Monitoring Data Use

Education/ Awareness → **Problem ID, Assess Impairment, Local Decisions** → **Legal & Regulatory**

Increasing Time - Rigor - QA - Expense $$

Geoff Dates, River Network

Total Maximum Daily Load (TMDL)

Volunteer lake data are used to

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

MOUNT WASHINGTON OBSERVATORY

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

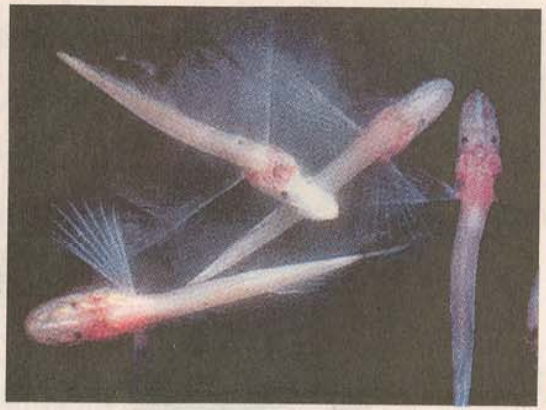
Family Science Project Yields Surprising Data About a Siberian Lake

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.



60 Year Record of ~WEEKLY Data

THE NEW YORK TIMES

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

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

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

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.

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

Volunteers can be valuable partners in lake assessment!
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