

The Adirondack Effects Assessment Program

Program Update & New Research Directions

Charles W. Boylen

James W. Sutherland

Jay A. Bloomfield &

Sandra A. Nierzwicki-Bauer

**Darrin Fresh Water Institute, Rensselaer Polytechnic Institute &
Bureau of Watershed Assessment and Management, NYS DEC**

Presentation Outline

- **AEAP Background**
- **Current Data**
- **Brooktrout Lake**
Biotic Trends
Fish Restoration Project

The Adirondack Effects Assessment Program

Since 1994 a study of water quality trends in acidified lakes and ponds in the Adirondack Mountain Region of New York State with a concomitant effect on biota funded by the US EPA

AEAP Scientific Collaborations representing state, federal and university investigators

- **Darrin Fresh Water Institute, RPI**
- **State University of NY at Oswego & Syracuse**
- **NYS DEC**
- **Academy of Natural Sciences in Philadelphia**
- **Marist College**
- **NYS Museum**
- **US Geological Survey**
- **University of Maryland**



**Lawrence Eichler, James Harrison, Sascha Percent,
David Winkler**

Darrin Fresh Water Institute

Robert Bombard

NYS Department of Environmental Conservation

Gregory Lawrence

U.S. Geological Survey

Robert Daniels

NYS Museum

William Shaw

Marist College

Don Charles and Frank Acker

Academy of Natural Sciences

Bahram Momen

University of Maryland

Myron J. Mitchell

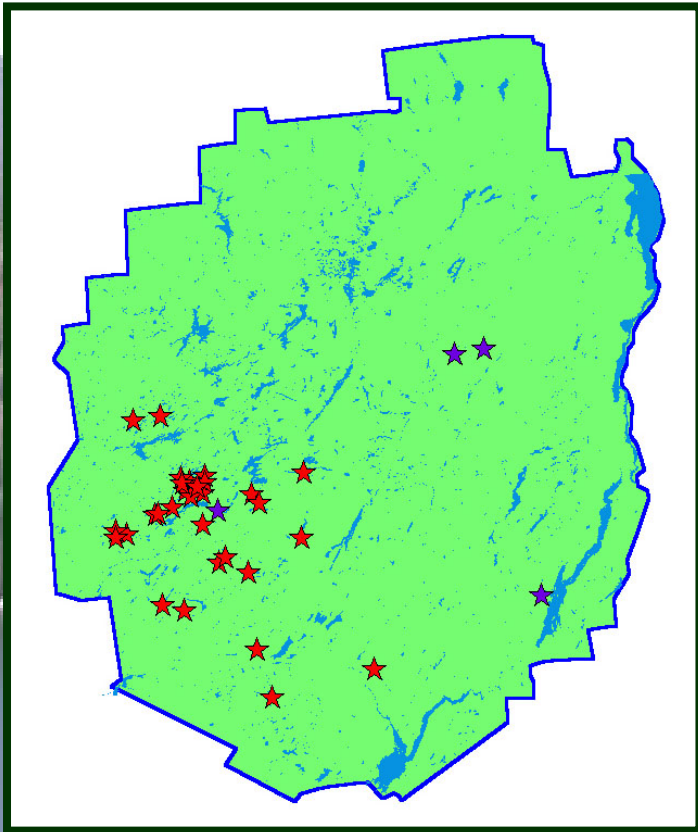
SUNY-ESF

Alfred Stamm

SUNY Oswego

Acknowledgments

Study Sites



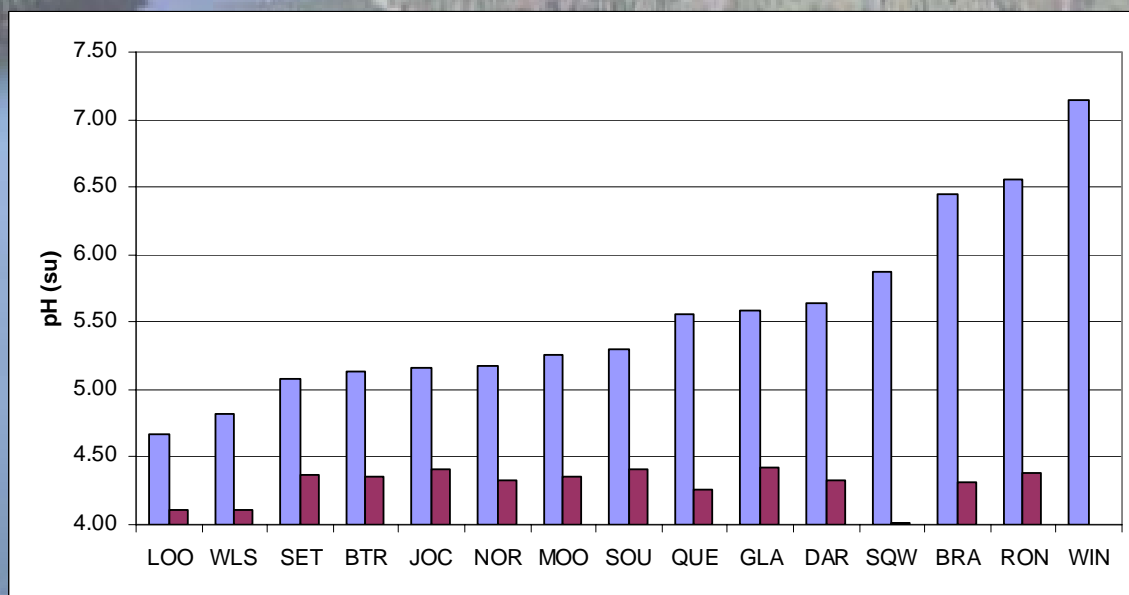
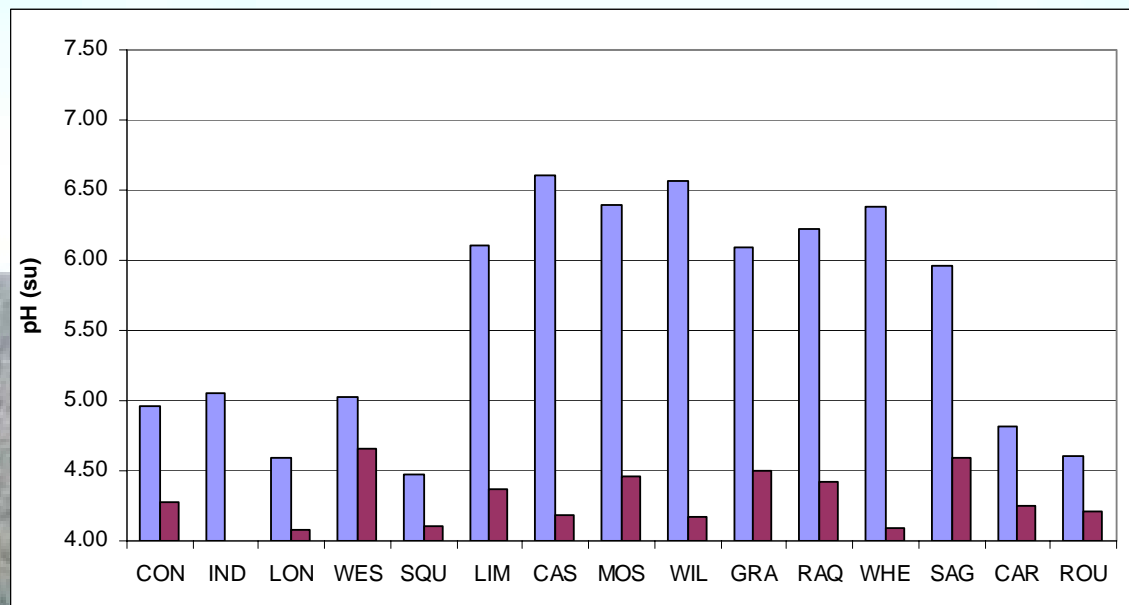
- Southwest quadrant of Adirondack Park
- 30 lakes and ponds initially selected
- Sites are different hydrologic types
- A subset of ALTM Program waters

Sampling Strategy

- **Mid-summer during thermal stratification**
 - most stable part of growing season
 - ability to detect temporal changes in chemistry and biota
- **Vertical profiles – temp, DO, light**
- **20 chemical analytes including pH, ANC, NO₃, SO₄, TP, PO₄, Al**

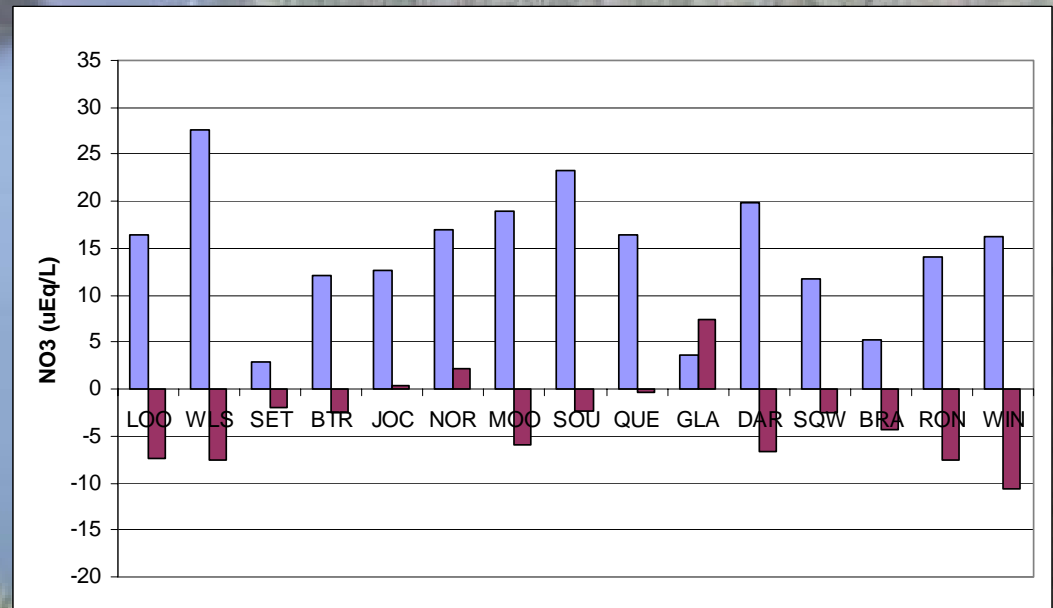
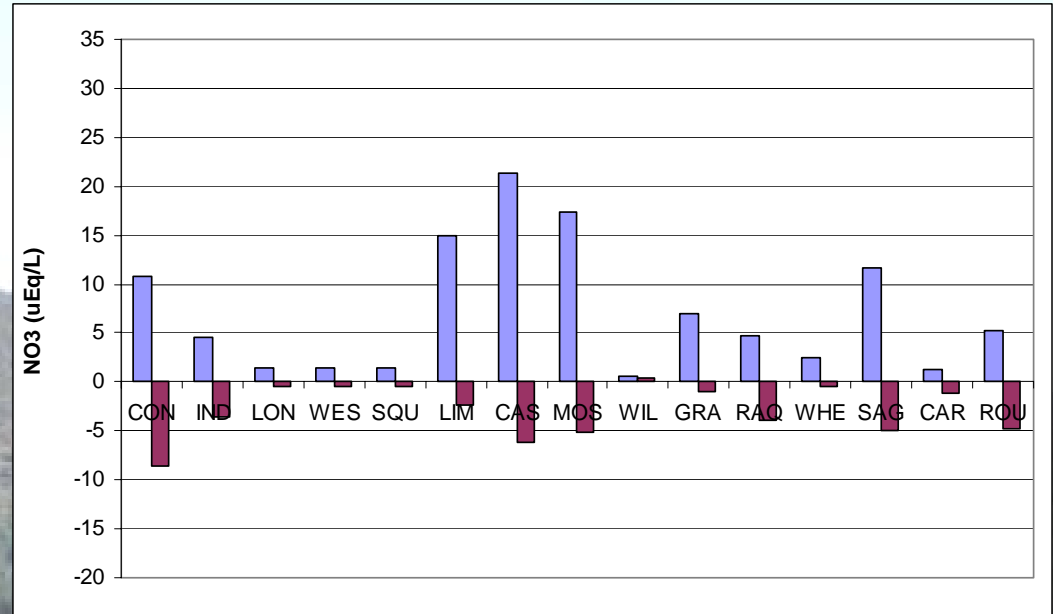
Net Trend in pH since 1994

The blue bar is the mean 1994 pH for each lake; the maroon bar is the net increase in pH through the 2004 sampling season



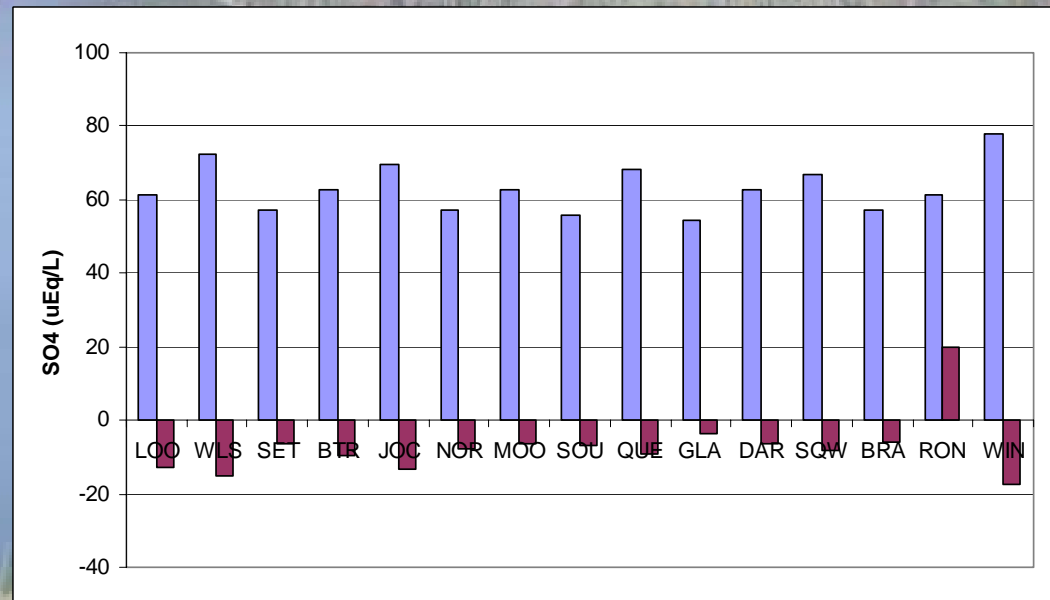
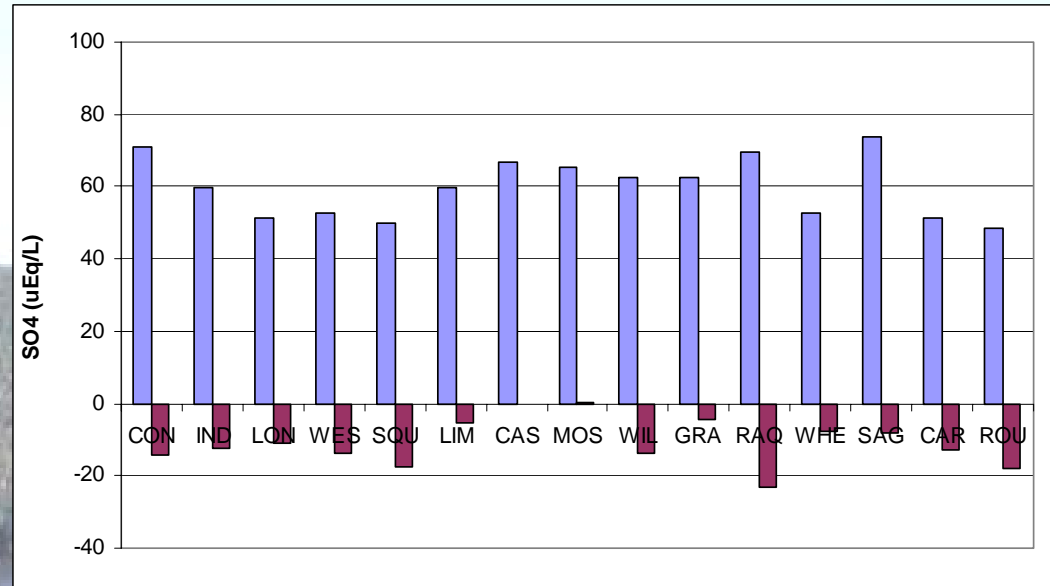
Net Trend in NO₃ since 1994

The blue bar is the mean 1994 NO₃ concentration for each lake; the maroon bar is the net increase (above x-axis) or decrease (below x-axis) in NO₃ through the 2004 sampling season

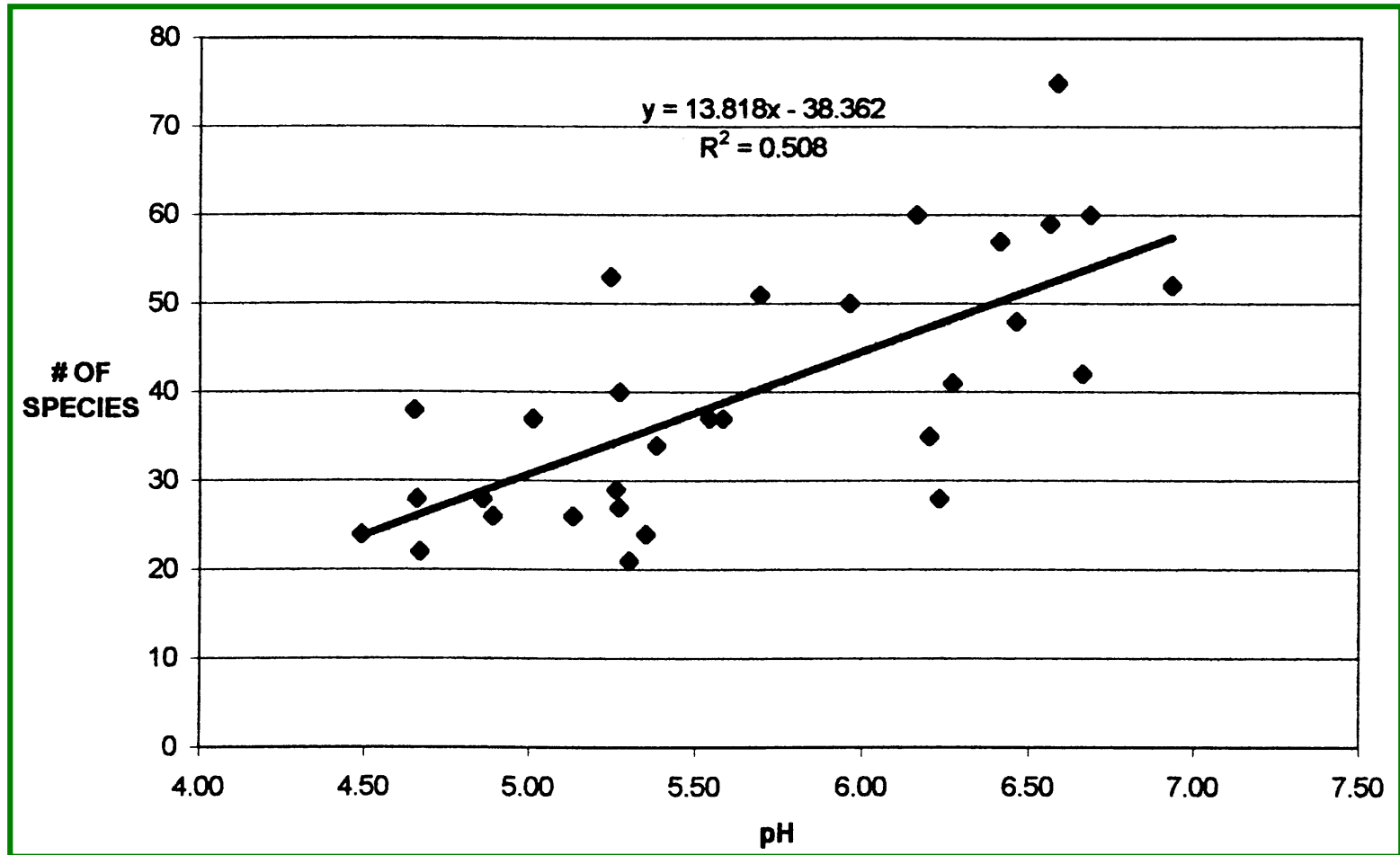


Net Trend in SO₄ since 1994

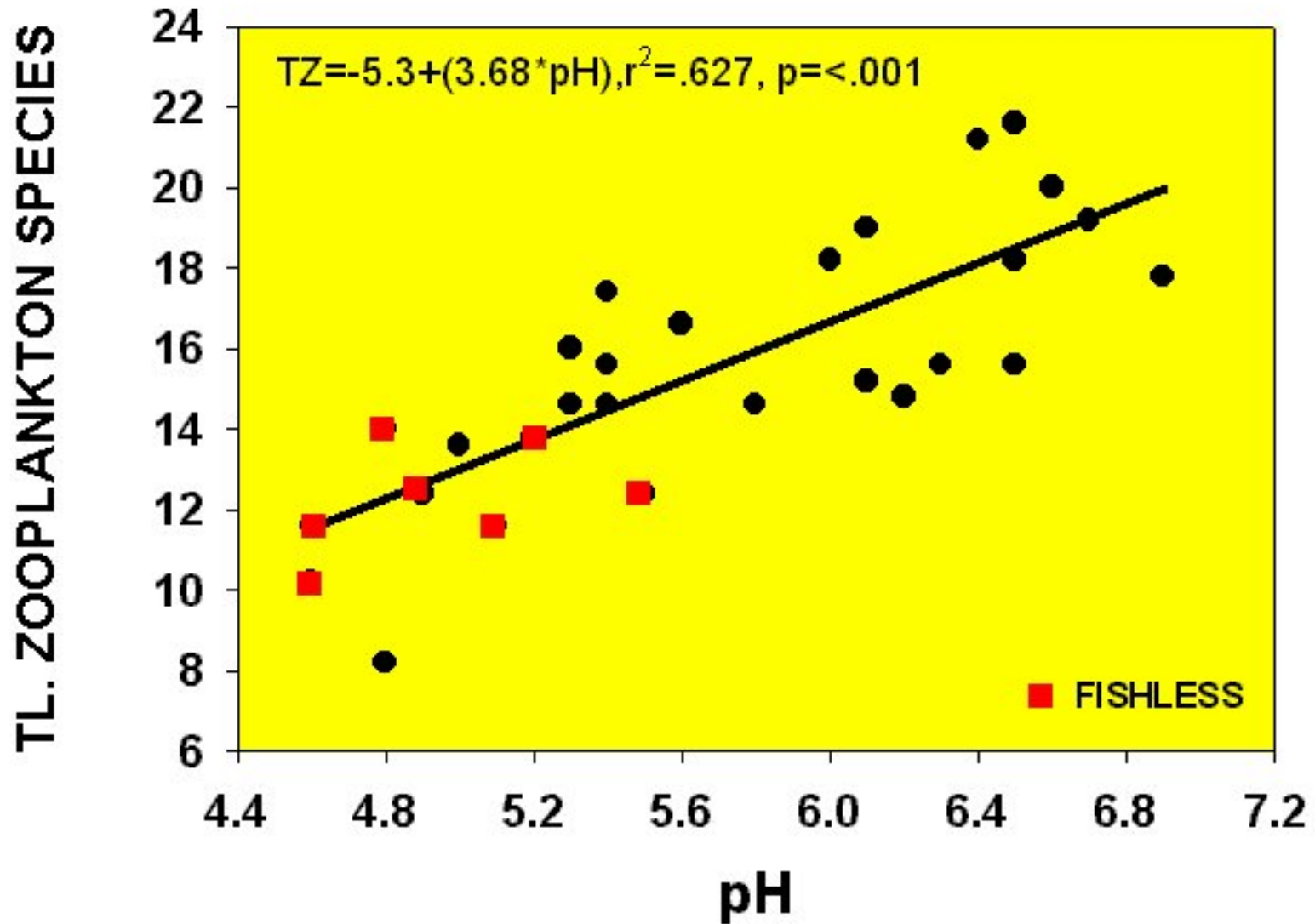
The blue bar is the mean 1994 SO₄ concentration for each lake; the maroon bar is the net increase (above x-axis) or decrease (below x-axis) in SO₄ through the 2004 sampling season



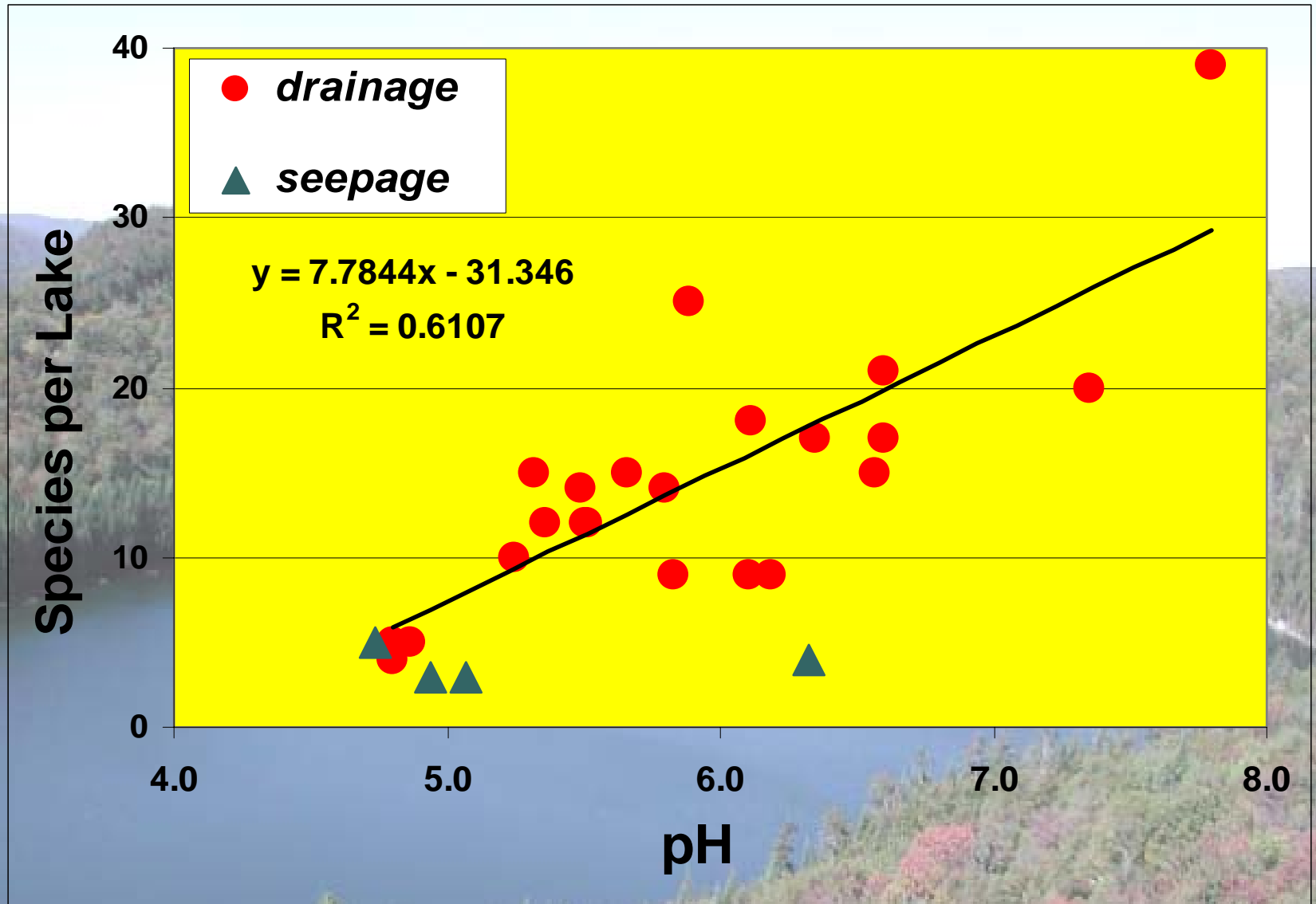
Phytoplankton Species vs pH



5 Year Average Number of Zooplankton Species vs. pH



Aquatic Plant Species vs pH



Summary of Biotic Trends of the 30 Study Lakes

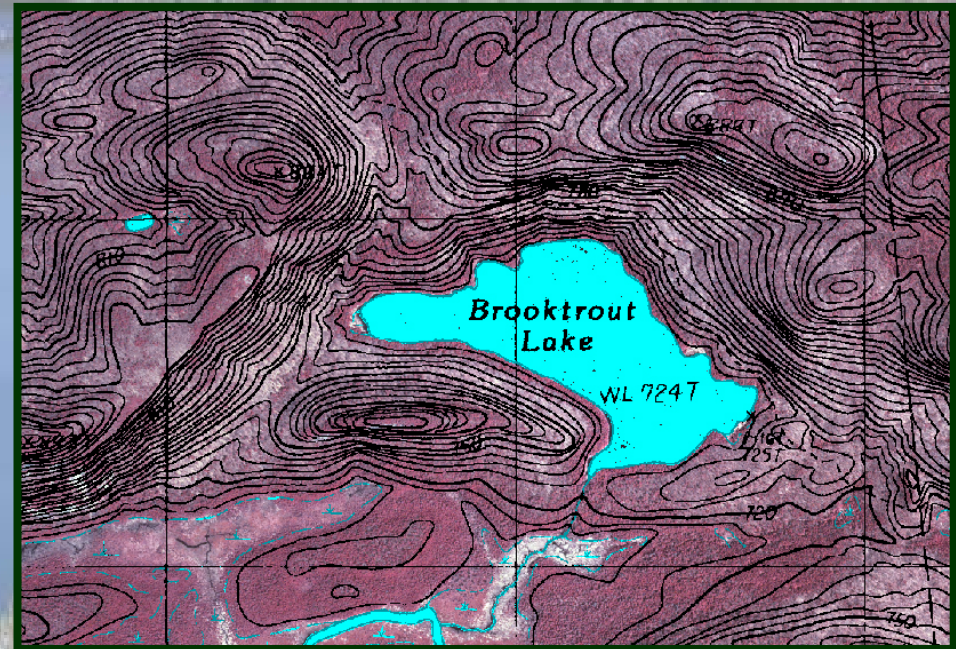
As pH and ANC gradually increase in some of the study lakes, documented shifts are beginning to occur in the major trophic levels of these lakes towards more circum-neutral species with the disappearance of strictly acid tolerant species.

Case Study: Brooktrout Lake

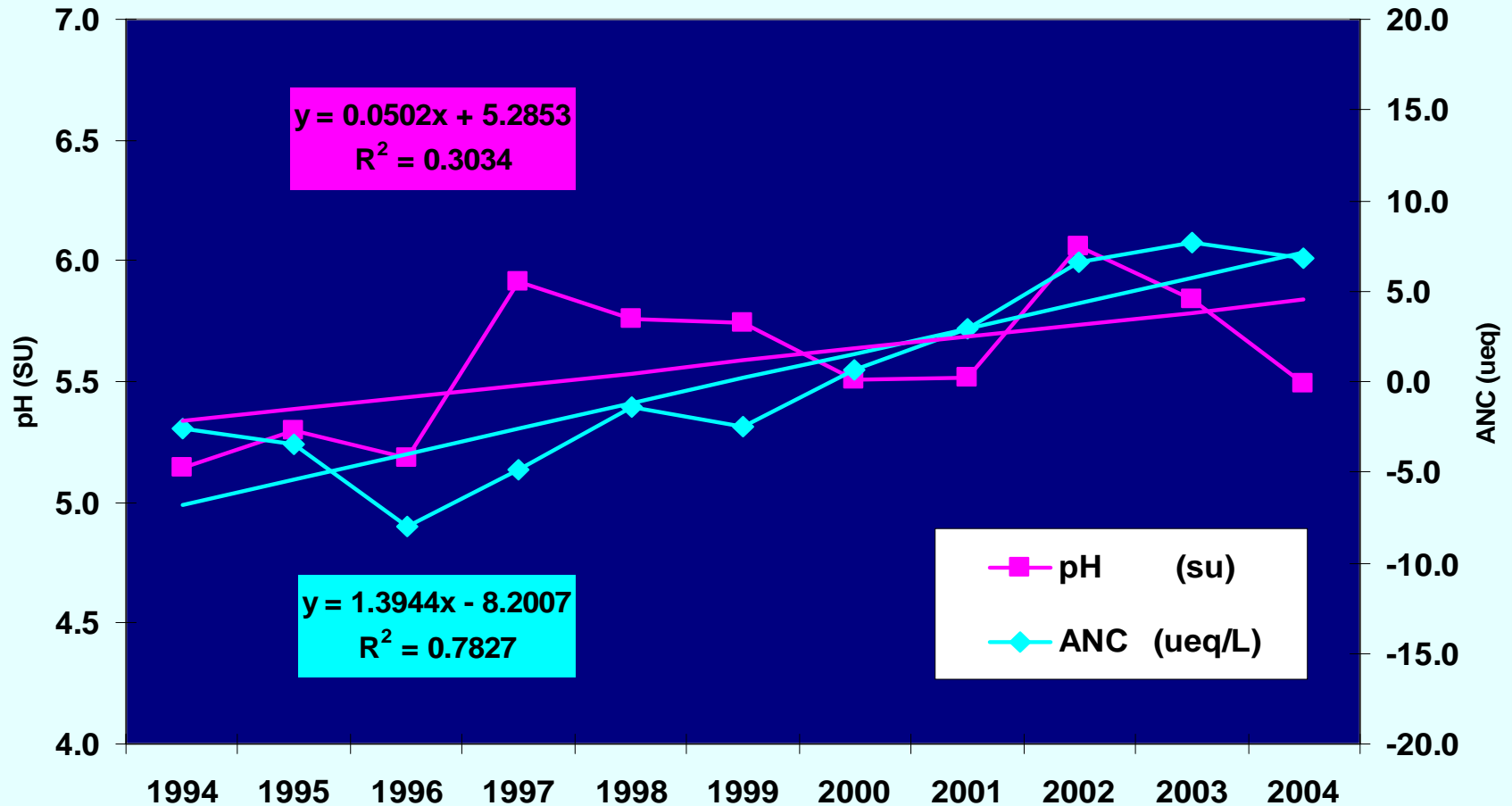


Brooktrout Lake

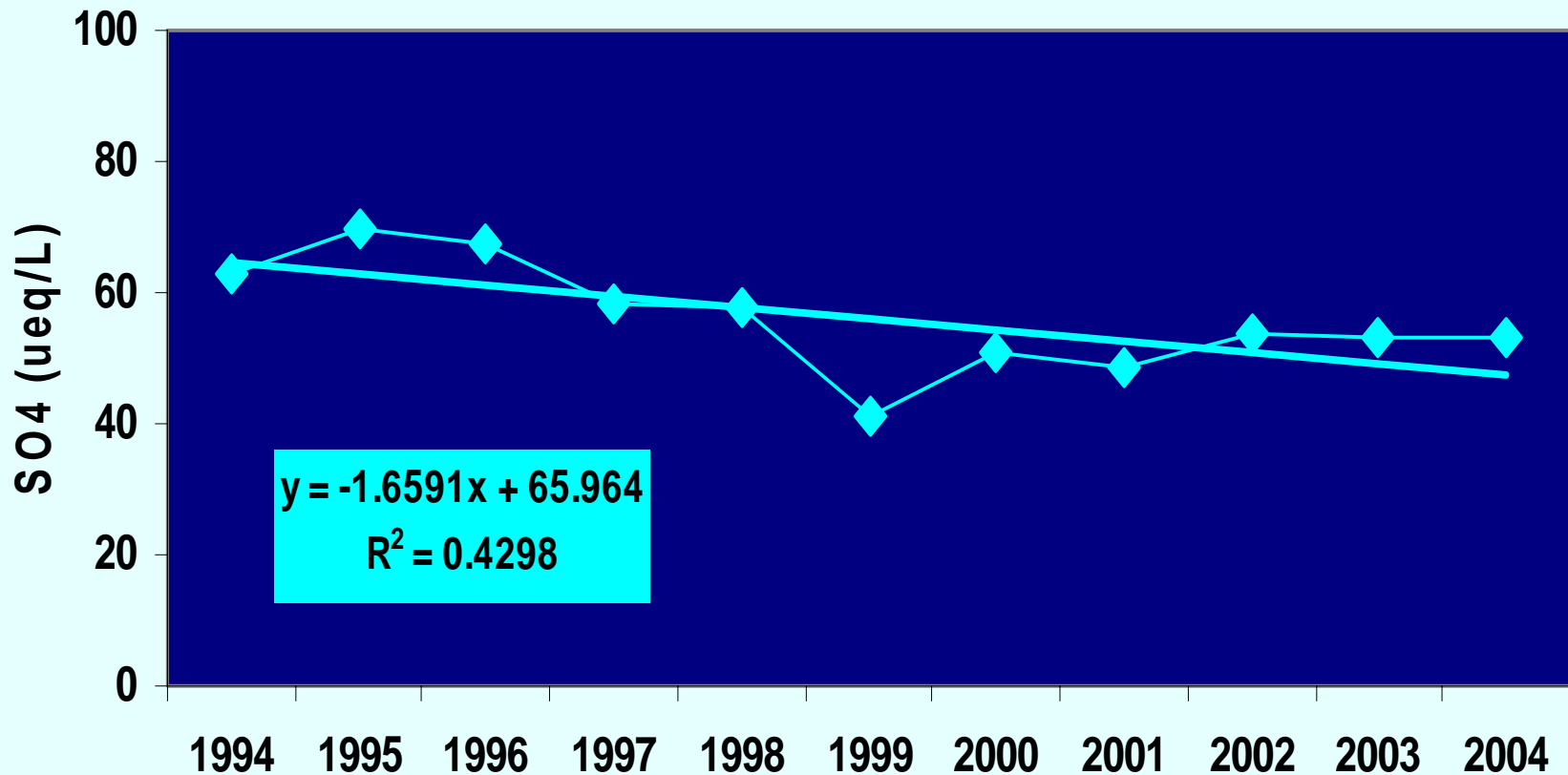
- Watershed Area: 176.9 ha
- Lake Volume: $2.41 \times 10^6 \text{ m}^3$
- Lake Area: 28.7 ha
- T_{hyd} : 1.4 yr
- Annual Runoff: 89 cm
- Mean Depth: 8.4 m



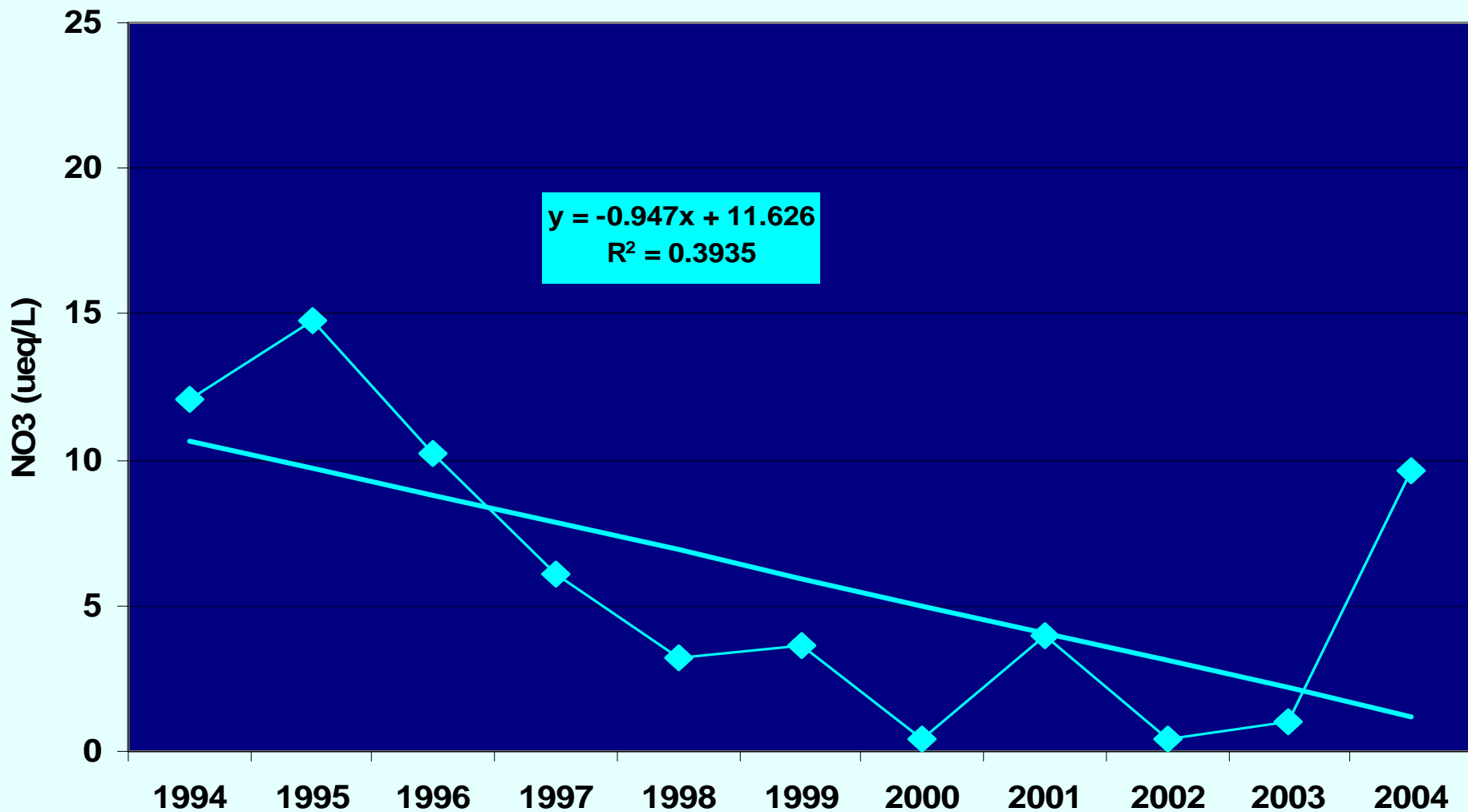
Brooktrout Lake pH & ANC Trends



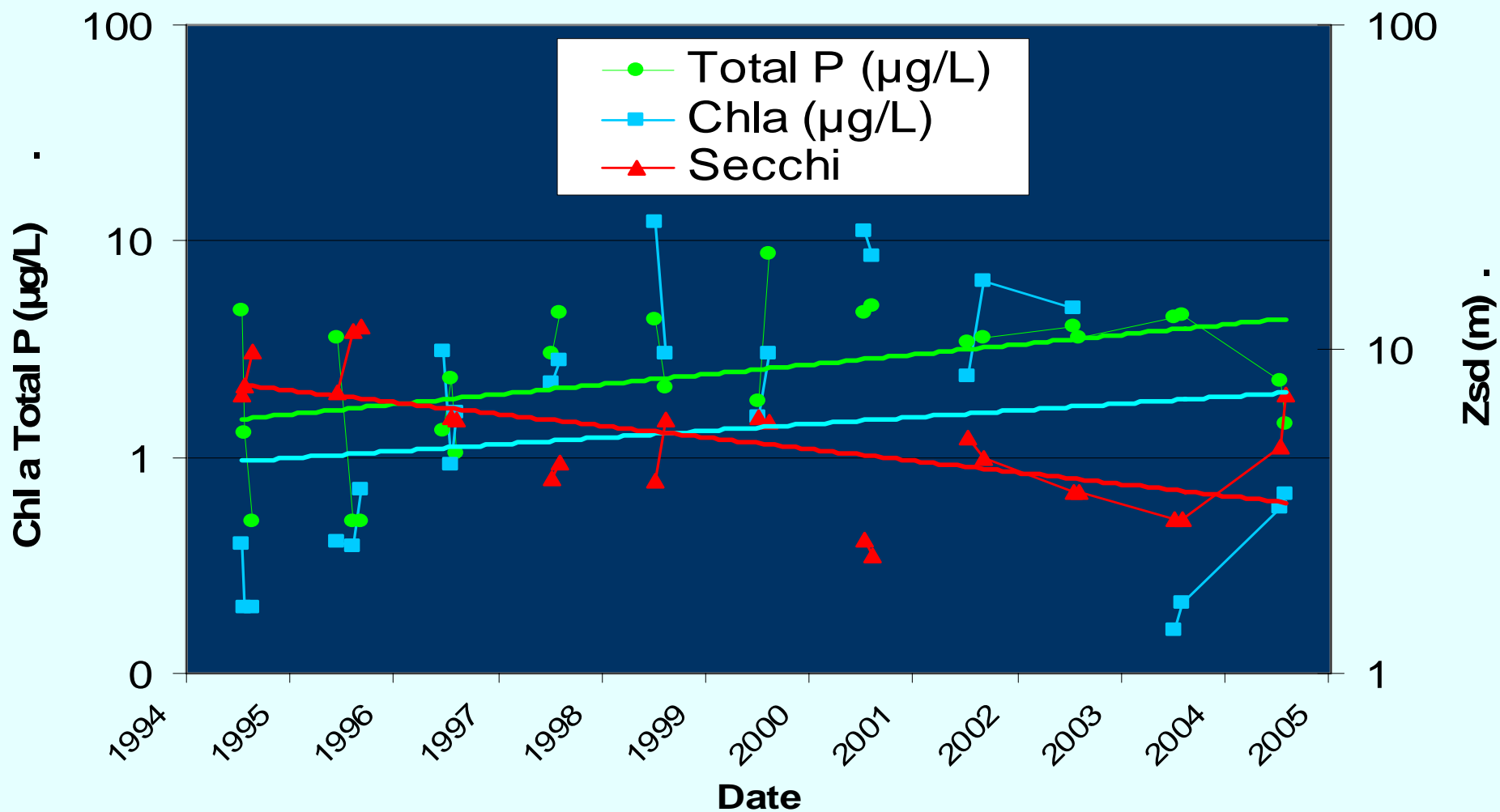
Brooktrout Lake SO₄ Trend



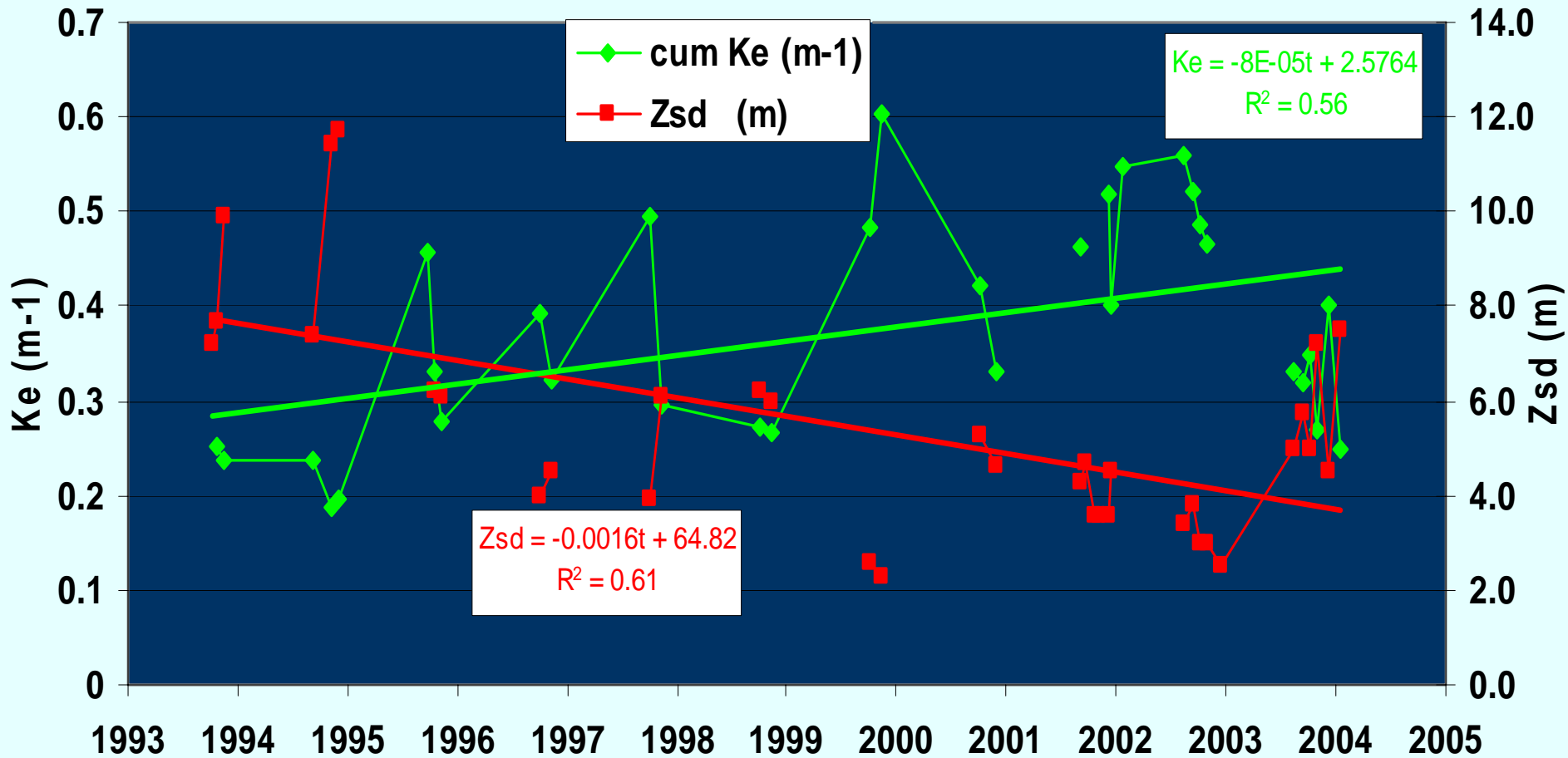
Brooktrout Lake NO₃ Trend



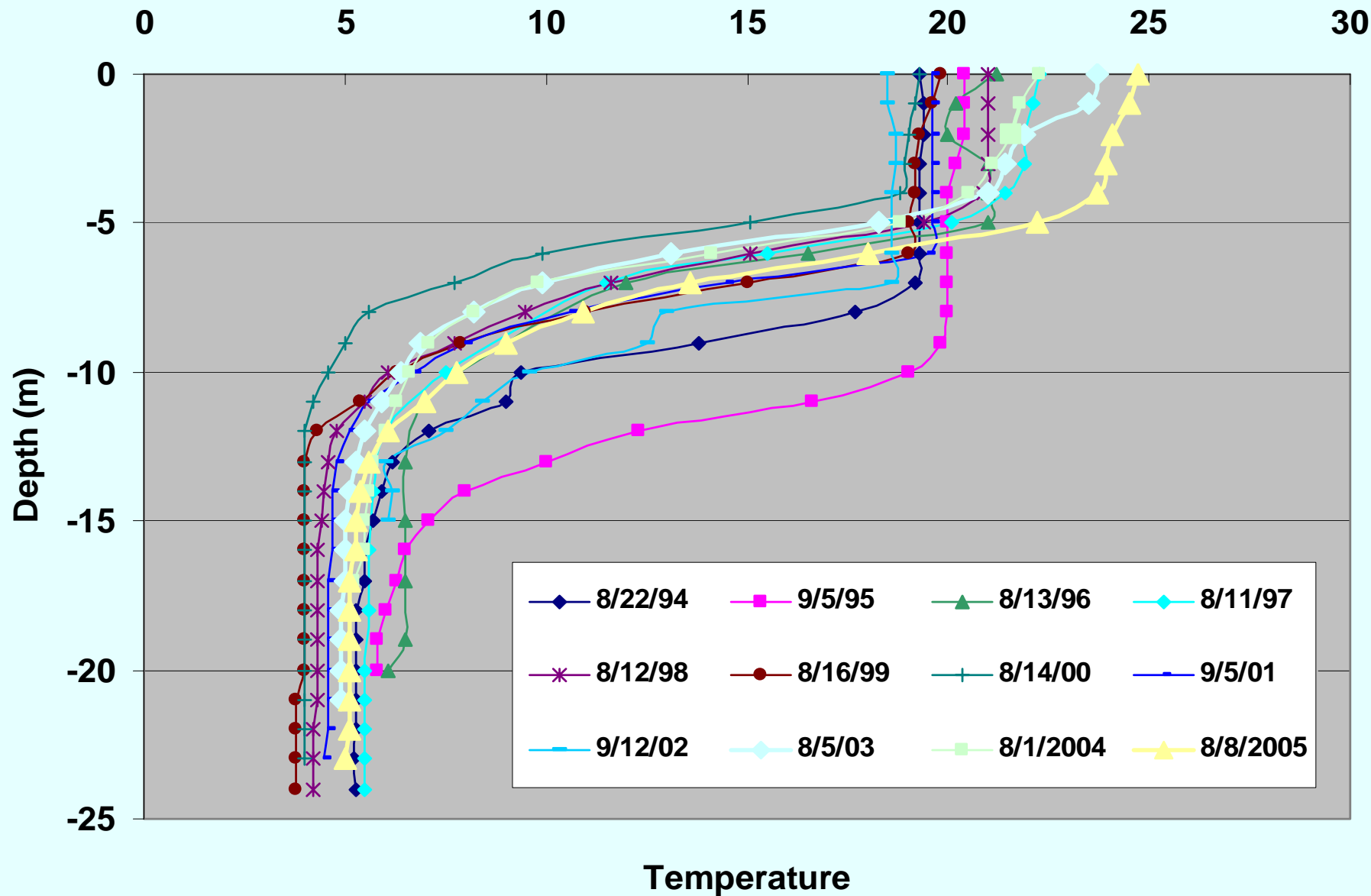
Brooktrout Lake Trophic State Trends



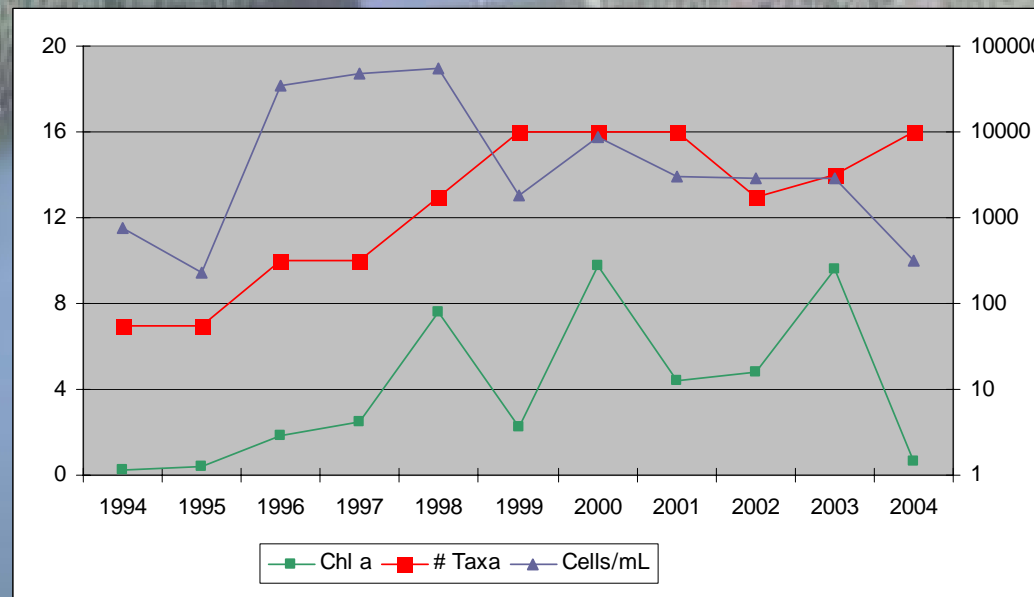
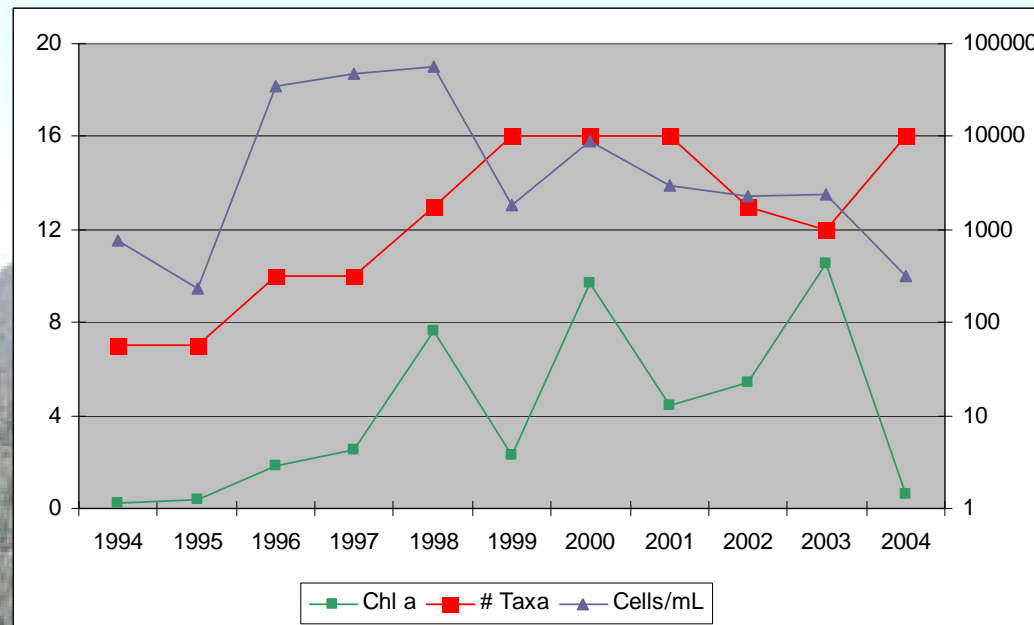
Brooktrout Light Extinction Profiles



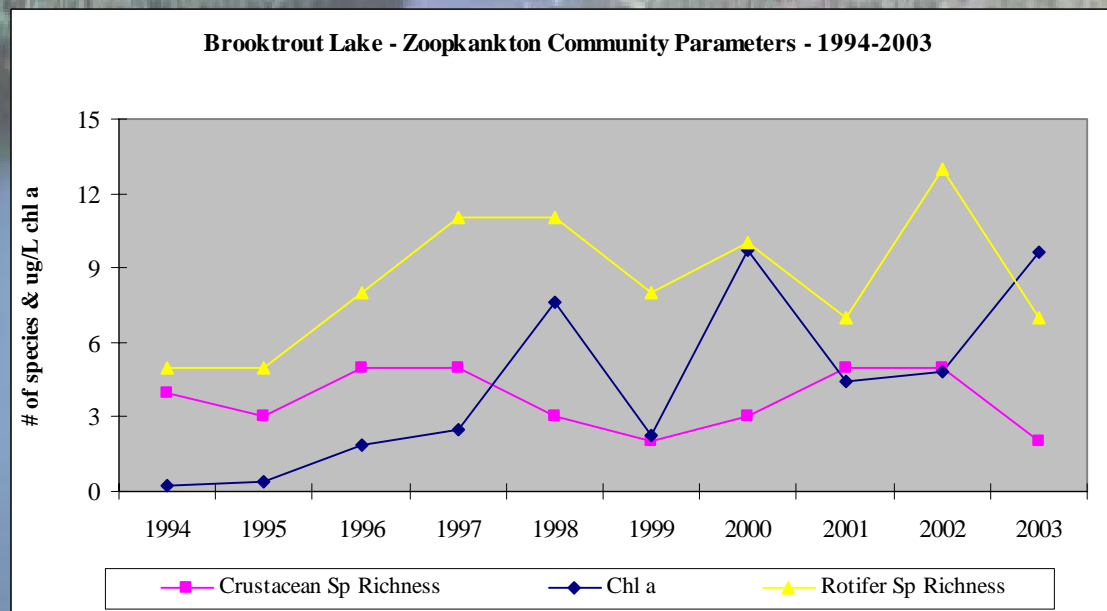
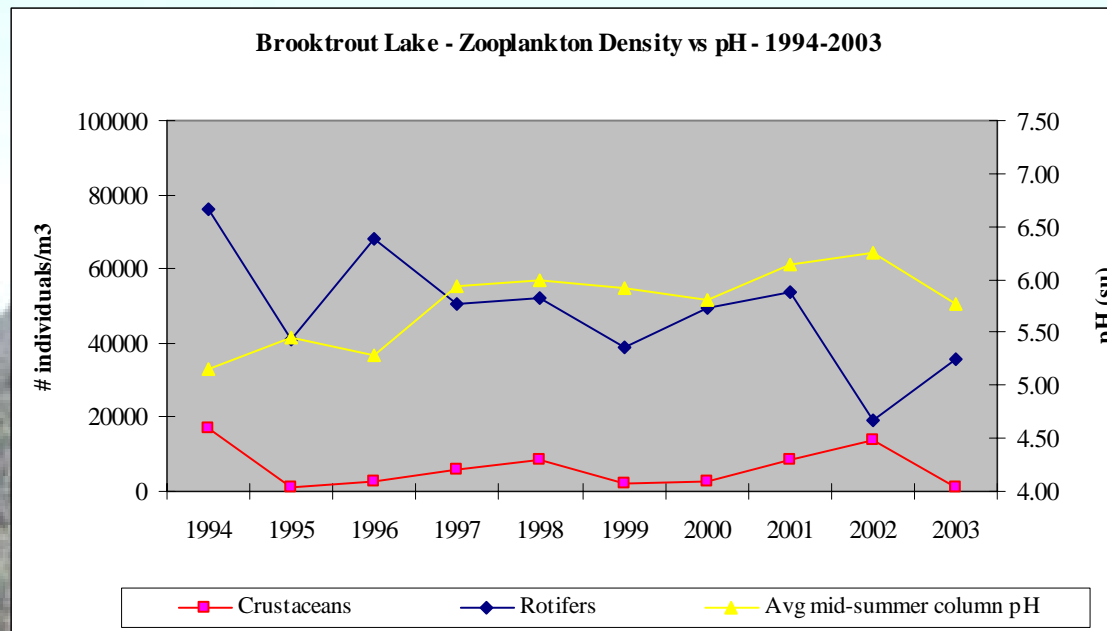
Brooktrout Lake Temperature Profiles



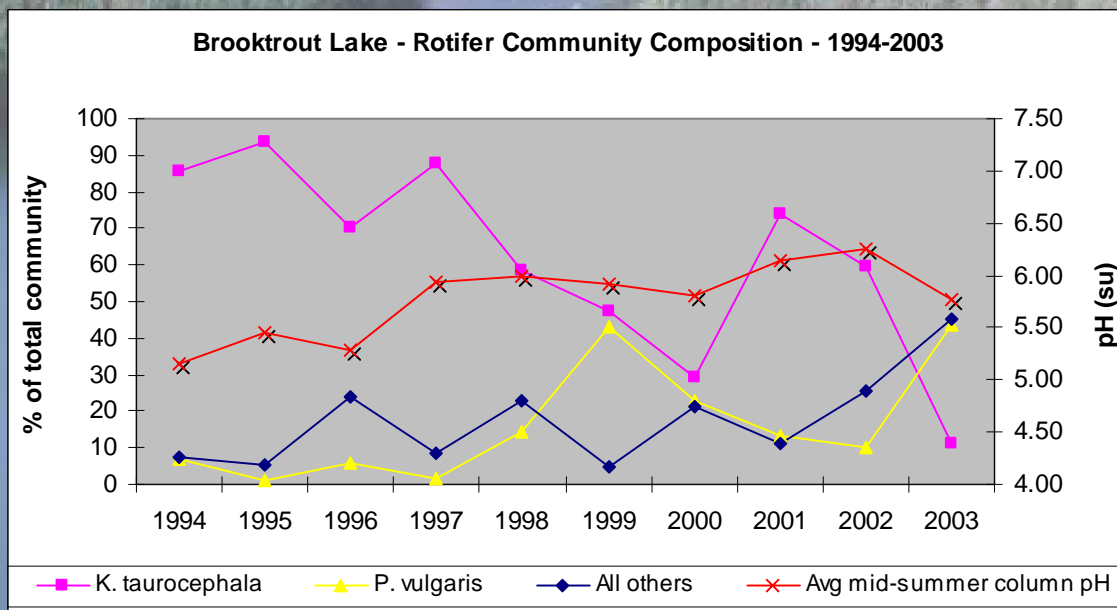
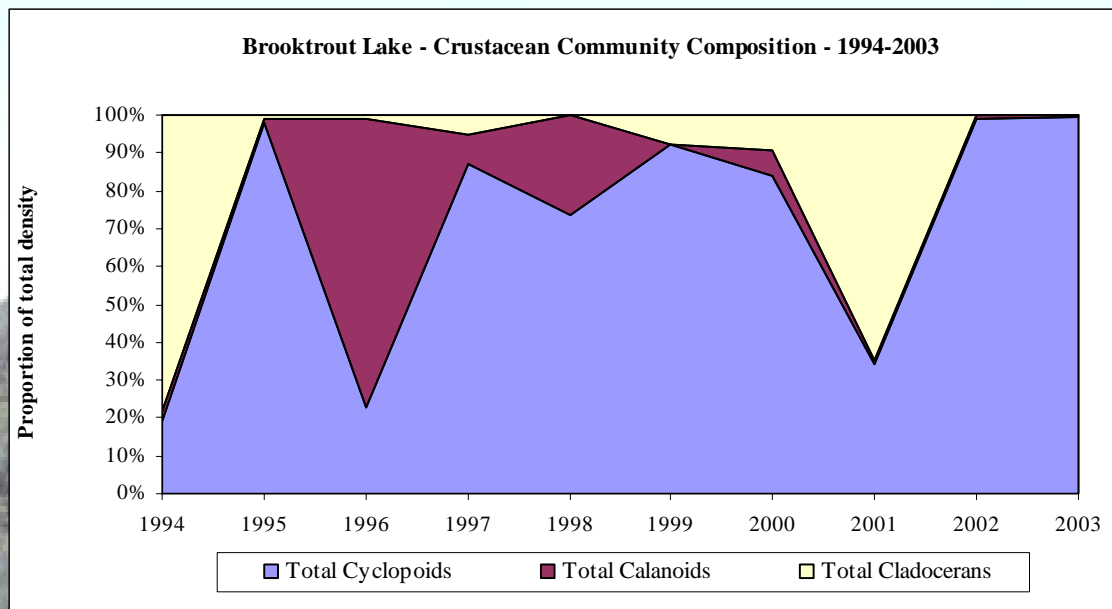
Brooktrout Lake Phytoplankton Trends



Brooktrout Zooplankton Densities & Community Parameters



Crustacean & Rotifer Community Composition



Brooktrout Lake Conclusions

- As SO_4 deposition has declined, starting around 1996, BTL has experienced an increase in pH from around 5.00 to 6.00. Transparency, Al species, NO_3 and reactive Si have also declined. Chl a and Total P have also increased.
- Although 13 other AEAP lakes have shown slight declines in NO_3 during the same time period (confirmed by the more-detailed ALSC LTM dataset), only BTL has shown a substantial NO_3 decline during the summer months, coincident with increases in trophic state parameters.
- Preliminary evidence from the 2003 BTL macrophyte survey also indicates an increase in macrophyte densities.
- Both phytoplankton & zooplankton community composition have also changed.
- Although piscivorous birds (for example, loons) have been observed at BTL in recent years, no evidence of fish has been noted.

Fish Restoration Project

Collaborating Institutions

- **Darrin Fresh Water Institute**
- **NYS Department of Environmental Conservation**
- **NYS Museum**
- **Cornell University**

Project Description

In November 2005 the DEC will stock Horn Lake strain brook trout:

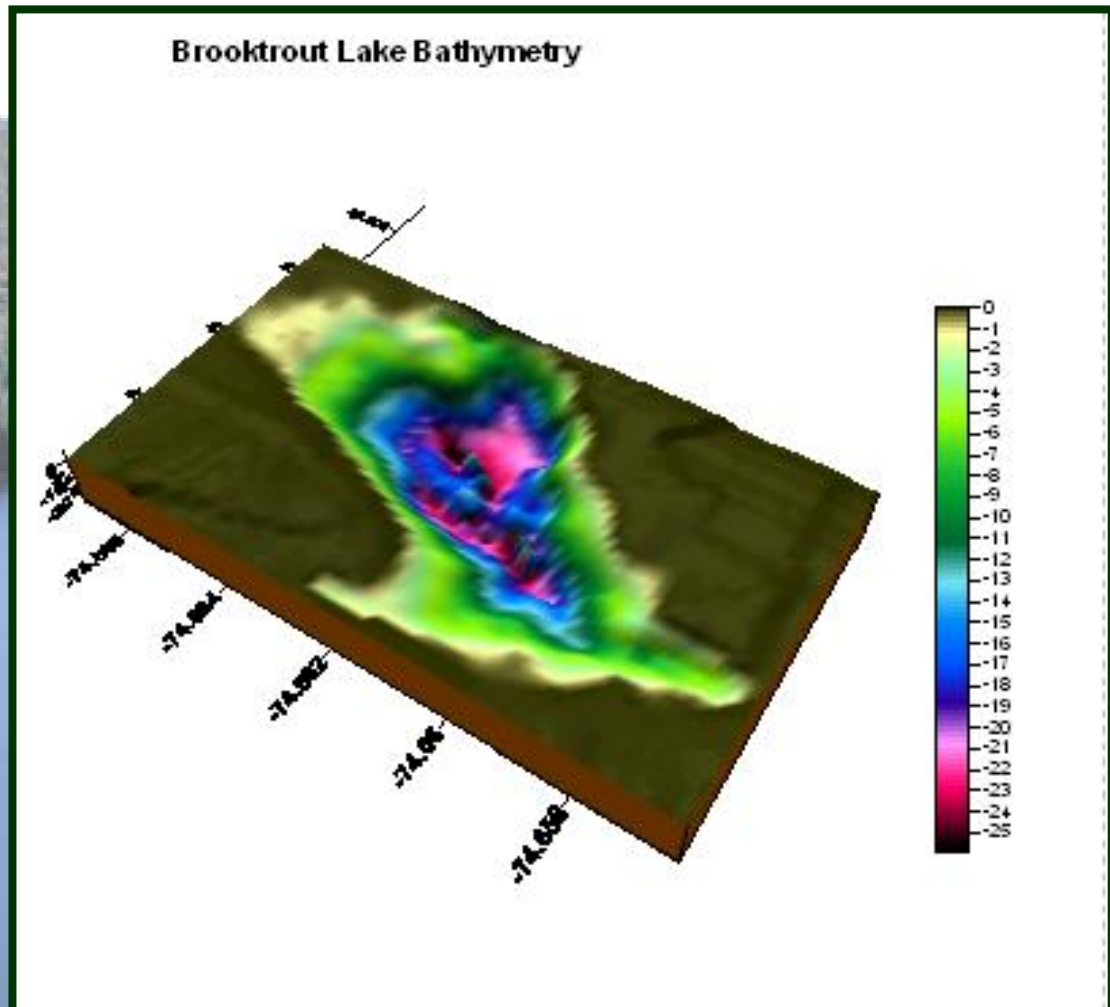
1,500 fall fingerlings (3-4" average size) each year 2005, 2007, 2008, 2011, 2012

Consideration given to stocking 20-40 older fish of different age classes this fall depending on Region 6 staff netting success from Horn Lake

Fish will be stocked by aircraft and fin clipped

Chemistry, phytoplankton, zooplankton & macroinvertebrates (both water column & benthic) sampled through growing season

BioSonics Advanced Digital Hydroacoustics Technology

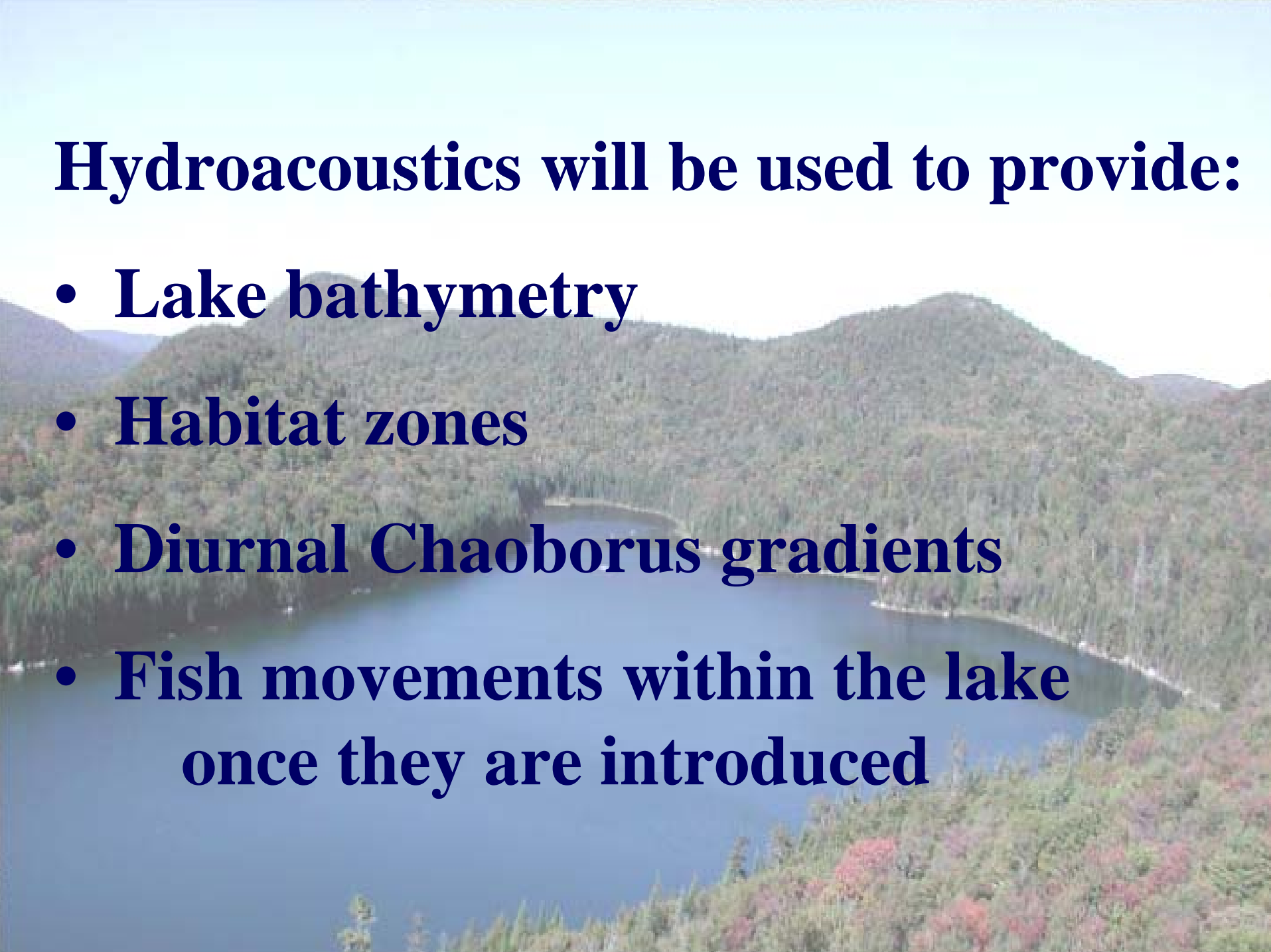


Use of Hydroacoustic Technology

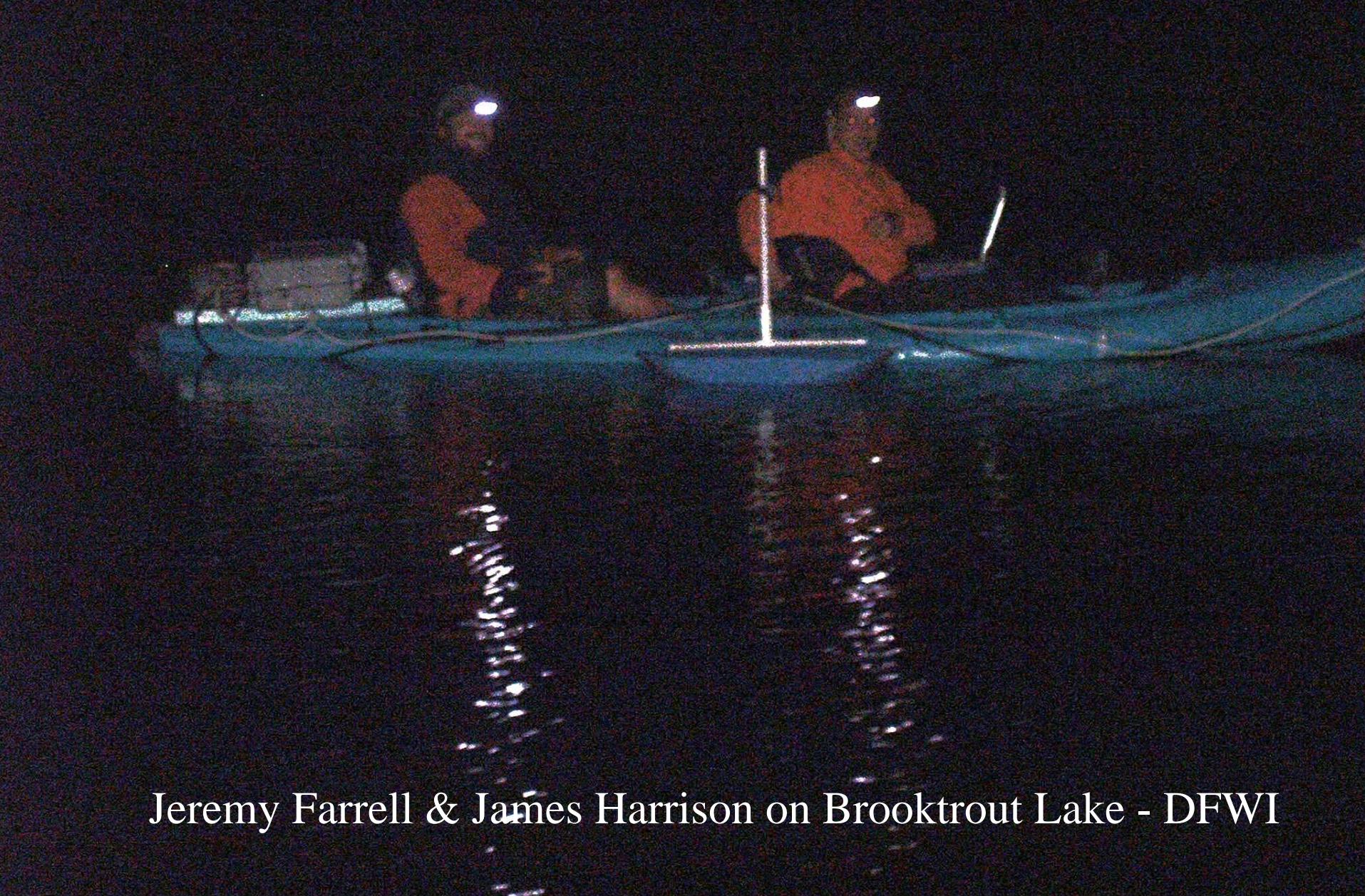


Hydroacoustics will be used to provide:

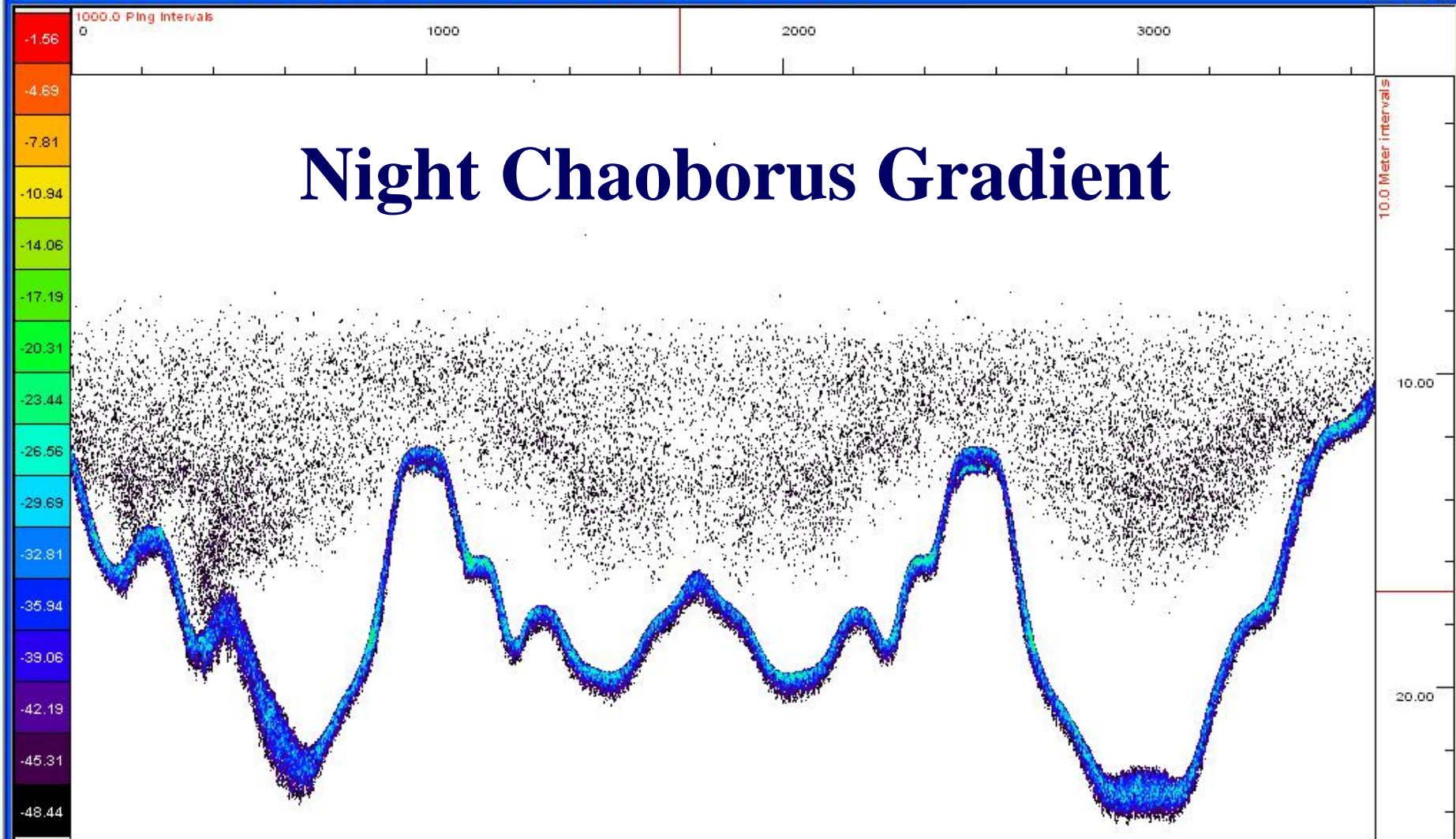
- Lake bathymetry**
- Habitat zones**
- Diurnal Chaoborus gradients**
- Fish movements within the lake
once they are introduced**



Night Hydroacoustic Profiling



Jeremy Farrell & James Harrison on Brooktrout Lake - DFWI



Ping: 1711, Depth: 16.94 meters

10/05/05 23:31:34

43° 36.1143' N

74° 39.5366' W

Ready

TVG: 40

Thresh: -50.0 dB

Abs: 0.05746 dB/m

Cal: 0.000 dB

Anticipated Project Results

- Use of hydroacoustic will be first 'state-of-the-art' investigation of fish population recovery in the Adirondack Park
- Documentation of the population of the population dynamics of the introduced species
- Allow evaluation of survival following introduction and the in-lake reproduction by the older introduced individuals
- Demonstrate the effect of the introduced fish on the Chaoborus population as well as other water column macroinvertebrates
- Observe the interaction between the introduced fish and the resident loons on the lake