

Florida LAKEWATCH: Citizen Scientists Monitoring Florida Lakes

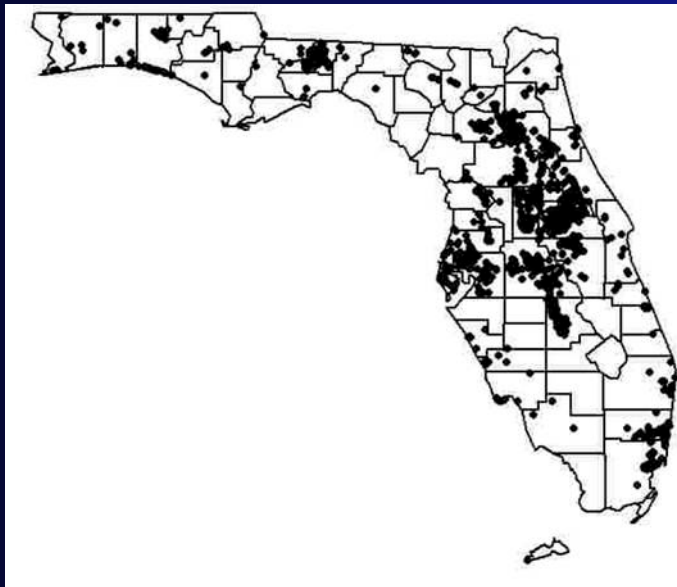
Mark V. Hoyer

And

Daniel E. Canfield Jr.



Florida LAKEWATCH



**Volunteer Monitoring
Program (1986 to 2012)**

**Currently maintaining
580 Lakes, 129 Coastal
Sites, 124 River Sites
and 5 Springs**

Objectives:

- **Land Grant University Mission:**
1) Research, 2) Extension and
3) Teaching
- **Baseline Data and Trend Analysis**



Core Baseline Data and Trend Analysis

- **Train and Equip Volunteers**
- **Total Phosphorus and Total Nitrogen**
- **Chlorophyll and Visibility (Secchi)**
- **Laboratory Analysis**
- **Trend Analysis**

Total Phosphorus and Total Nitrogen



Chlorophyll



Secchi



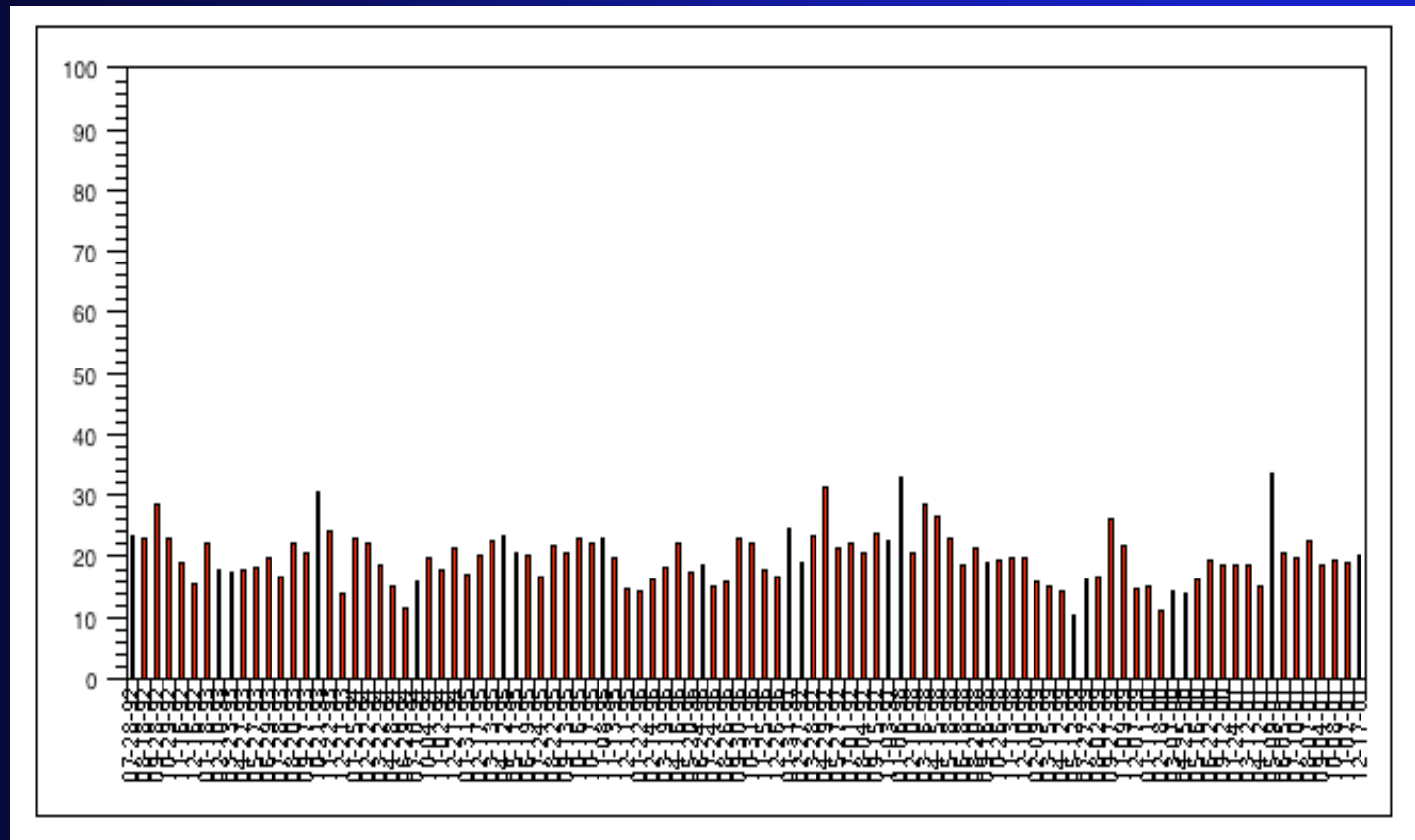
Filtering

Water Chemistry Analysis



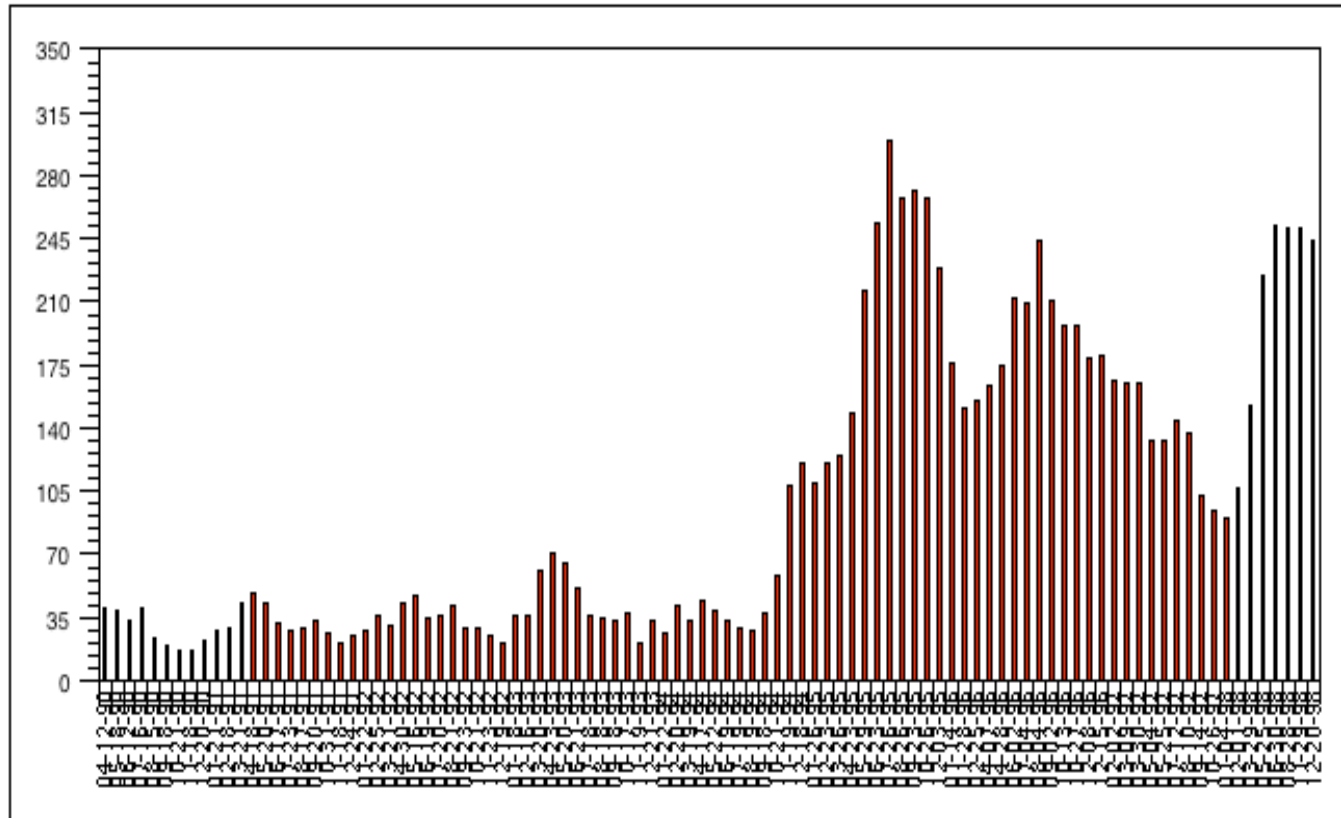
Trend Analysis

Total Phosphorus Lake Bennett in Orange County



Trend Analysis

Total Phosphorus Lake Redwater in Putnam County



1) Research

- Bathymetric maps
- Fish survey
- Plant survey
- Bacteria survey
- Bird survey
- Angler diaries
- Hydrilla
- Augmentation
- Muck Removal
- Nutrient Criteria

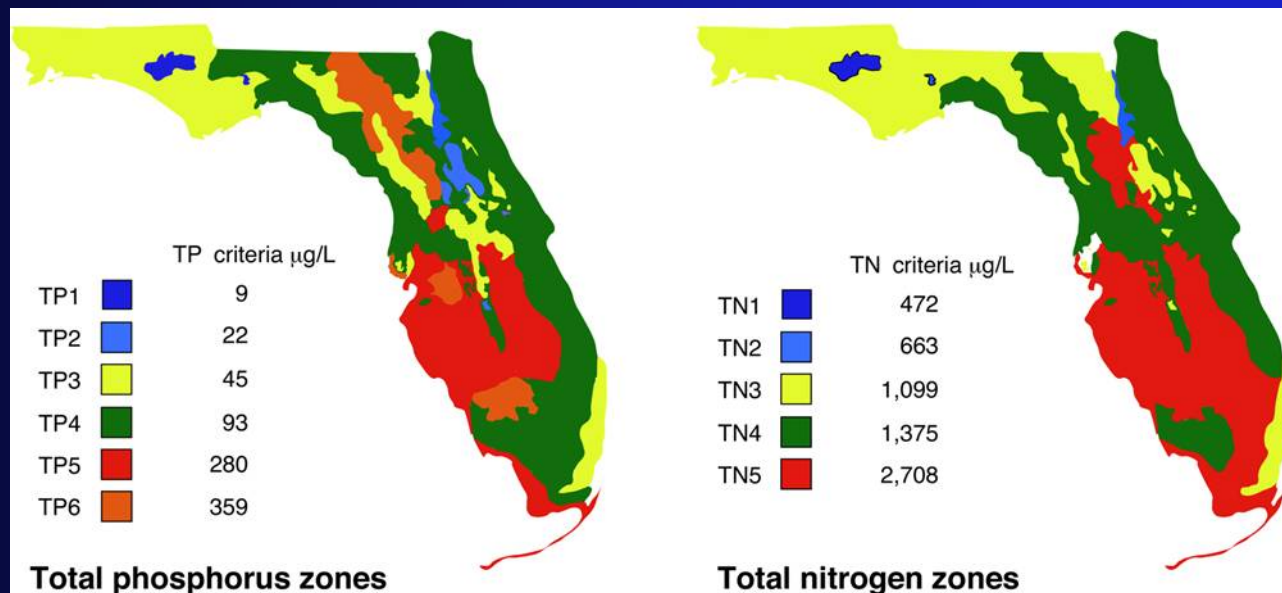


Many Scientific Publications



- Lake and Reservoir Management: 10
- Hydrobiologia: 8
- Canadian Journal of Fisheries and Aquatic Science: 3
- Transactions of American Fisheries Society: 3
- Journal Fish Biology: 1
- Journal of Aquatic Plant Management: 2
- Freshwater Biology: 1
- Limnology and Oceanography: 1
- Ecology: 1

Nutrient Criteria for Florida Lakes



Bachmann RW, Bigham DL, Hoyer MV, Canfield DE Jr. 2012a. Factors determining the distributions of total phosphorus, total nitrogen and chlorophyll a in Florida lakes. Lake Reserv Manage. 00:00-00.

Bachmann RW, Bigham DL, Hoyer MV, Canfield DE Jr. 2012b. Phosphorus, nitrogen and the designated uses of Florida lakes. Lake Reserv Manage. 00:00-00.

Bachmann RW, Bigham DL, Hoyer MV, Canfield DE Jr. 2012c. A strategy for establishing numeric nutrient criteria for Florida lakes. Lake Reserv Manage. 00:00-00.

2) Outreach/Extension

- **Regional Meetings**
- **Questions (Telephone, E-mail etc..)**
- **Information Circulars**
- **Web Site**
- **TEAM: Lake Management Plans
(Together for Environmental
Assessment and Management)**

Regional Meetings



Information Circulars

- Oxygen and Temperature
- Fish and Trophic State
- Aquatic Plants
- Organic Color
- Fish Kills
- Bacteria in Lakes
- Symbols and Conversion Factors
- Lake Morphometry
- Water Clarity
- Nutrients
- Lake Management Definitions



Lake Management Plans



Lake Management Plans

Hoyer, M. V., C. A. Horsburgh and D. E. Canfield Jr., 1999. A Tsala Apopka Chain-of-Lakes management plan. Final Report. Citrus County Aquatic Services, Lecanto Florida and Southwest Florida Water Management District, Tampa, Florida

Hoyer, M. V., D. E. Canfield Jr., and C. A. Horsburgh. 2002. Historical information and pros and cons of issues identified by citizens and professional regarding the future management of East Lake. Report. Hillsborough County Public Works Department, Engineering Division, Stormwater Management Section. Tampa, Florida.

Hoyer, M. V., D. E. Canfield Jr., and C. A. Horsburgh. 2002. Findings from a workshop on citizens' concerns regarding the future management of Lake Wailes. Report. City of Lake Wales. Lake Wales, Florida.

Hoyer M. V., M. D. Netherland, M. S. Allen, and D. E. Canfield. 2005. Hydrilla management in Florida: A summary and discussion of issues identified by professionals with future management recommendations. Proceeding of a Special Symposium. Florida LAKEWATCH, Gainesville, FL.

Florida LAKEWATCH. 2006. A management plan for Forest Hills Lakes. Hillsborough County Public Works Department, Engineering Division Stormwater Management Section. Tampa, FL.

Hoyer M. V. and D. E. Canfield, Jr. 2008. Findings from workshops on citizen's concerns regarding the future management of Walton County Coastal Dune lakes. Report to Chactawhatchee Basin Alliance and Coastal Dune lakes Advisory Board. Florida LAKEWATCH, Department of Fisheries and Aquatic Sciences, University of Florida/Institute of Food and Agricultural Sciences. Gainesville, FL.

3) Teaching: Fishing for Success



Teaching: Multiple Graduate Students



Florida State Statute (1993)

1004.49 Florida lakewatch Program.--The Florida lakewatch Program is hereby created within the Department of Fisheries and Aquaculture of the Institute of Food and Agricultural Sciences at the University of Florida. The purpose of the program is to provide public education and training with respect to the water quality of Florida's lakes. The Department of Fisheries and Aquaculture may, in implementing the lakewatch program:

- (1) Train, supervise, and coordinate volunteers to collect water quality data from Florida's lakes.
- (2) Compile the data collected by volunteers.
- (3) Disseminate information to the public about the lakewatch program.
- (4) Provide or loan equipment to volunteers in the program.
- (5) Perform other functions as may be necessary or beneficial in coordinating the lakewatch program. Data collected and compiled shall be used to establish trends and provide general background information and shall in no instance be used in a regulatory proceeding.

History.--s. 196, ch. 2002-387.

Florida State Statute (1993)

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History.--s. 196, ch. 2002-387.

Reliability of Volunteer Data

Environmental Management 18(1):1-9, 2002.
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Volunteer Lake Monitoring: Testing the Reliability of Data Collected by the Florida LAKEWATCH Program

Daniel E. Canfield, Jr., Claude D. Brown, Roger W. Bachmann
and Mark V. Hoyer

*Department of Fisheries and Aquatic Sciences
University of Florida
7922 NW 71st Street
Gainesville, Florida 32653 USA*

ABSTRACT

Canfield, D. E., Jr., C. D. Brown, R. W. Bachmann and M. V. Hoyer. 2002. Volunteer lake monitoring: Testing the reliability of data collected by the Florida LAKEWATCH program. *Lake and Reservoir Manage.* 18(1):1-9.

Because the use of volunteer samplers is a very cost-effective way to collect large amounts of information on lakes across space and time, we tested the reliability of the protocols used by the Florida LAKEWATCH program. We found that refrigerated extractions with Tenax® had given values that were no different from those collected with the standard method of grinding with acetone. In a comparative study of 125 lakes we found the data collected by volunteers were comparable to those collected by professionals. Mean Secchi disk depth, TP, TN, and chlorophyll values obtained by the citizens were strongly correlated ($r > 0.99$) to the mean values obtained by the professionals. To determine if freezing was a valid method of preserving water samples prior to analysis, we compared estimates of chlorophyll, TP, TN, pH, total alkalinity, and specific conductance obtained from fresh samples with estimates obtained from samples frozen up to 150 days. We found there was little difference in chemical measurements made in samples preserved by freezing for different lengths of time, and various statistical tests indicated that freezing was a valid method of preserving lake water samples prior to analysis. Water quality data produced by volunteer samplers following the LAKEWATCH protocols were just as good as those from samples collected by professional biologists and handled using standard methods of sample preservation. The fact that volunteers can collect credible data means that lake management agencies could simplify their limited budgets by using volunteer monitoring, to sample more lakes and to sample them more frequently.

Key Words: volunteer lake monitoring, sample preservation, frozen water storage.

In the 1970s and 1980s various U.S. management agencies and private groups established innovative programs using volunteers to sample large numbers of lakes on a relatively frequent basis. The University of Florida began the Florida LAKEWATCH program in 1986 with the goal of collecting credible total phosphorus (TP), total nitrogen (TN), chlorophyll and Secchi disk data from a large number of lakes on a monthly basis, and by 1991, the Florida LAKEWATCH program was so successful that the Florida Legislature established LAKEWATCH as a state (Florida Statute 240.5329). The Florida Department of Environmental Protection (FDEP) estimated in 2000 (Jim Hubbard, FDEP, pers. comm.) that Florida LAKEWATCH over the past 5 years, as a single organization provided the State of Florida more information on lakes (89% of total) than any individual professional agency other than FDEP (28% of total).

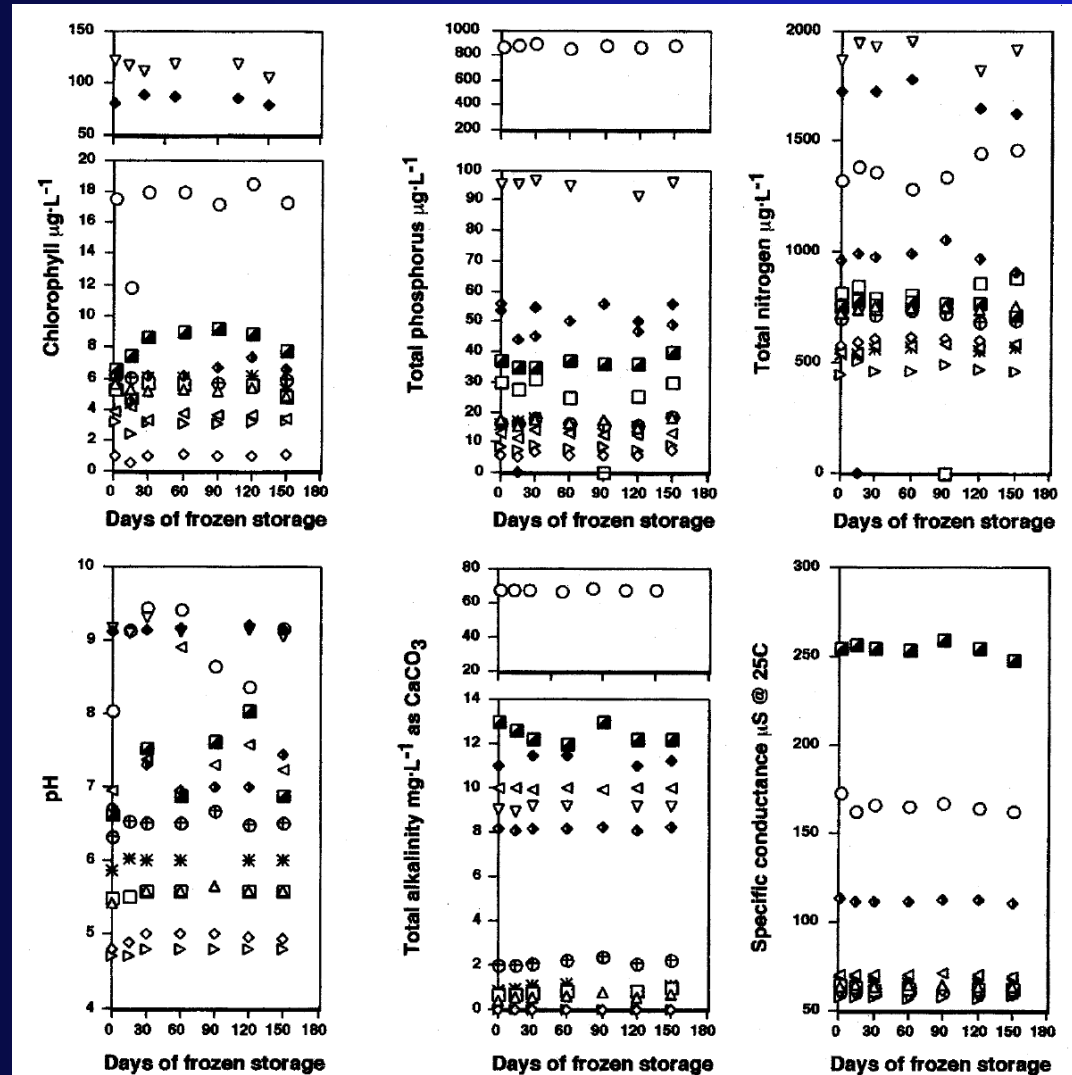
The use of volunteer samplers is a very cost-

effective way to collect large amounts of information over space and time and has the added benefit of getting citizens involved in the monitoring of their lakes. However, questions are sometimes raised about the reliability of the data, since professionals do not take the samples and some of the sample preservation techniques do not follow standard procedures. In this paper, we discuss the sampling protocols used by Florida LAKEWATCH and a series of tests that we made to check the reliability of the data.

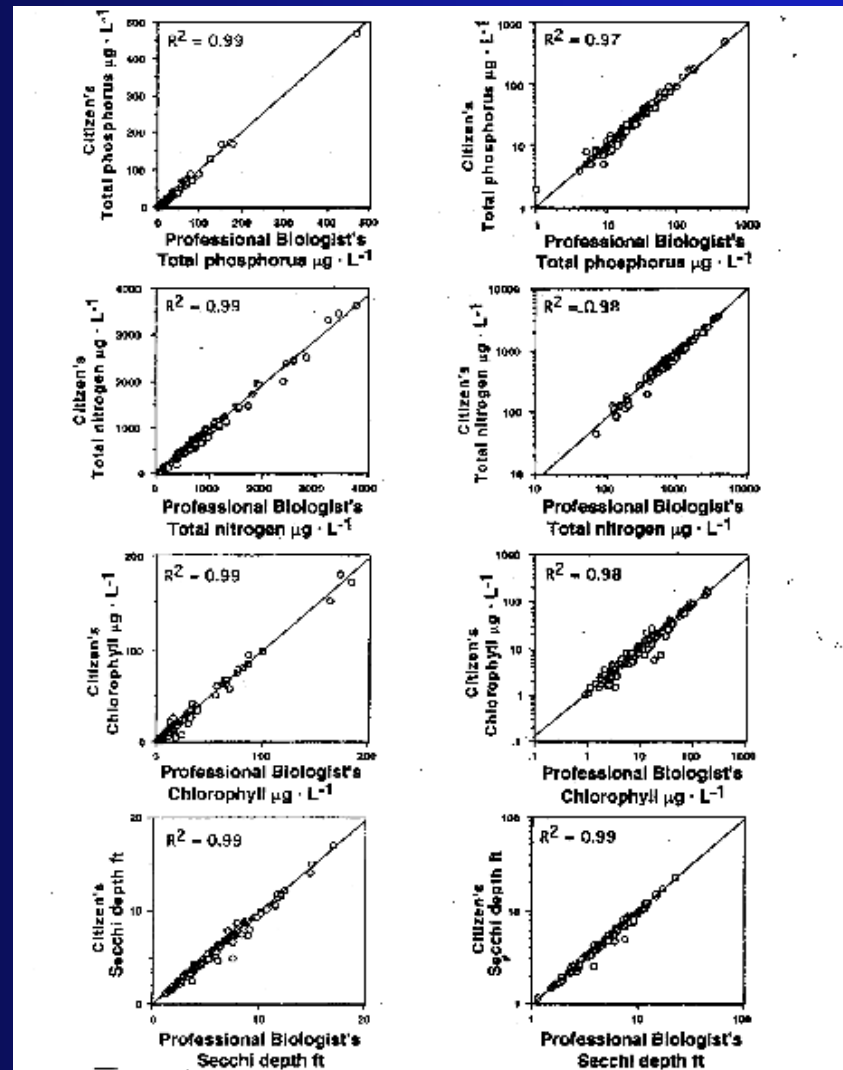
Our first objective was to determine if there were any differences between the water quality data collected by the Florida LAKEWATCH program and data collected by professional biologists and handled using standard preservation techniques. The second objective was to determine if freezing was an effective method of preserving lake water samples prior to analysis. LAKEWATCH selected freezing as the method of sample preservation for TP and TN be-

Canfield, D. E., Jr., C. D. Brown, R. W. Bachmann and M. V. Hoyer. 2002. Volunteer lake monitoring: Testing the reliability of data collected by the Florida LAKEWATCH program. *Lake and Reservoir Manage.* 18(1):1-9.

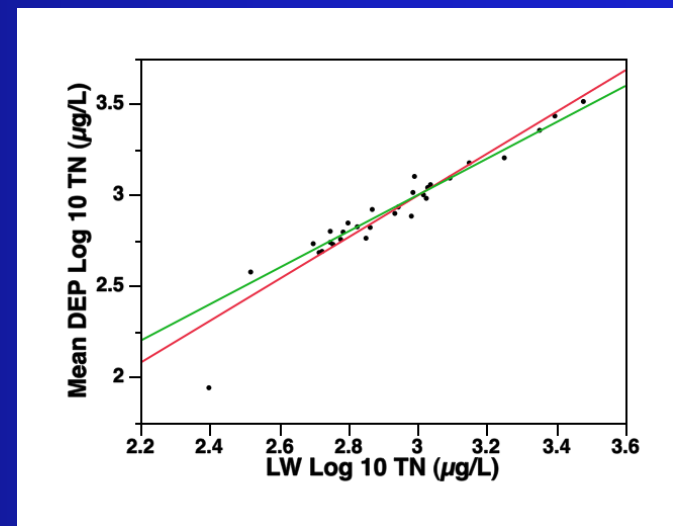
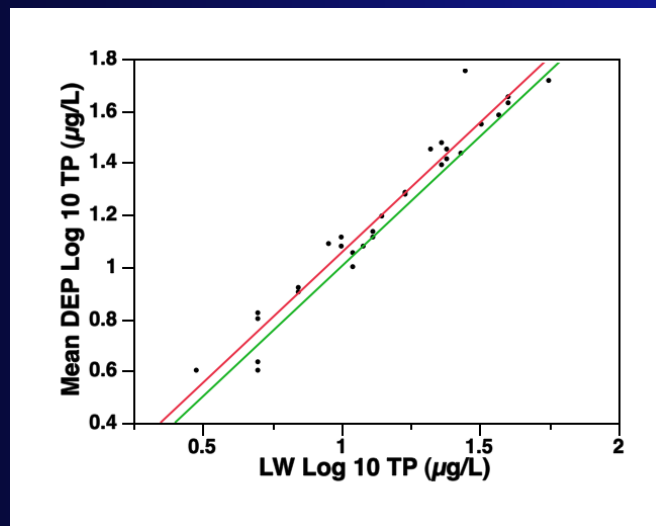
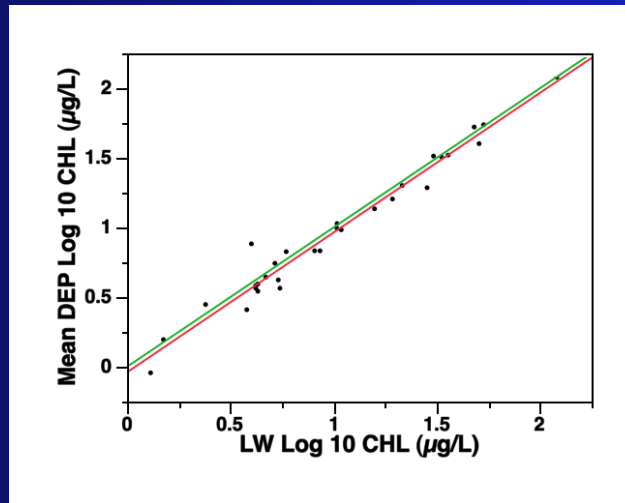
Freezing Versus Fresh Samples



Volunteer Versus Professional



Volunteer Versus FDEP Professional 2011



Variance Component Analyses

FDEP Data (Reps Within Station)

Log 10 Total Phosphorus ($\mu\text{g/L}$)			
Component	Var Component	% of Total	Sqrt(Var Comp)
Lake	0.111	99.6	0.333
Rep[Lake]	0.000	0.4	0.020
Error	0.000	0.0	0.000
Total	0.111	100.0	0.333

Log 10 Total Nitrogen ($\mu\text{g/L}$)			
Component	Var Component	% of Total	Sqrt(Var Comp)
Lake	0.085	99.2	0.291
Rep[Lake]	0.001	0.8	0.026
Error	0.000	0.0	0.000
Total	0.085	100.0	0.292

Log 10 Uncorrected Chlorophyll ($\mu\text{g/L}$)			
Component	Var Component	% of Total	Sqrt(Var Comp)
Lake	0.252	99.0	0.502
Rep[Lake]	0.003	1.0	0.051
Error	0.000	0.0	0.000
Total	0.254	100.0	0.504

Variance Component Analyses LW Data (Stations Within Lake)

Log 10 Total Phosphorus ($\mu\text{g/L}$)			
Component	Var Component	% of Total	Sqrt(Var Comp)
Lake	0.109	96.4	0.330
Station[Lake]	0.004	3.6	0.064
Within	0.000	0.0	0.000
Total	0.113	100.0	0.336

Log 10 Total Nitrogen ($\mu\text{g/L}$)			
Component	Var Component	% of Total	Sqrt(Var Comp)
Lake	0.066	97.5	0.256
Station[Lake]	0.002	2.5	0.041
Within	0.000	0.0	0.000
Total	0.067	100.0	0.260

Log 10 Uncorrected Chlorophyll ($\mu\text{g/L}$)			
Component	Var Component	% of Total	Sqrt(Var Comp)
Lake	0.245	98.9	0.495
Station[Lake]	0.003	1.1	0.052
Within	0.000	0.0	0.000
Total	0.248	100.0	0.498

National Science Foundation 2011

- Title: Engaging the “Citizen Scientist” in Environmental Research
- Quote: *To successfully pursue an environmental agenda, the public must be actively engaged by the scientific research establishment in many different aspects of their work*

Questions?

