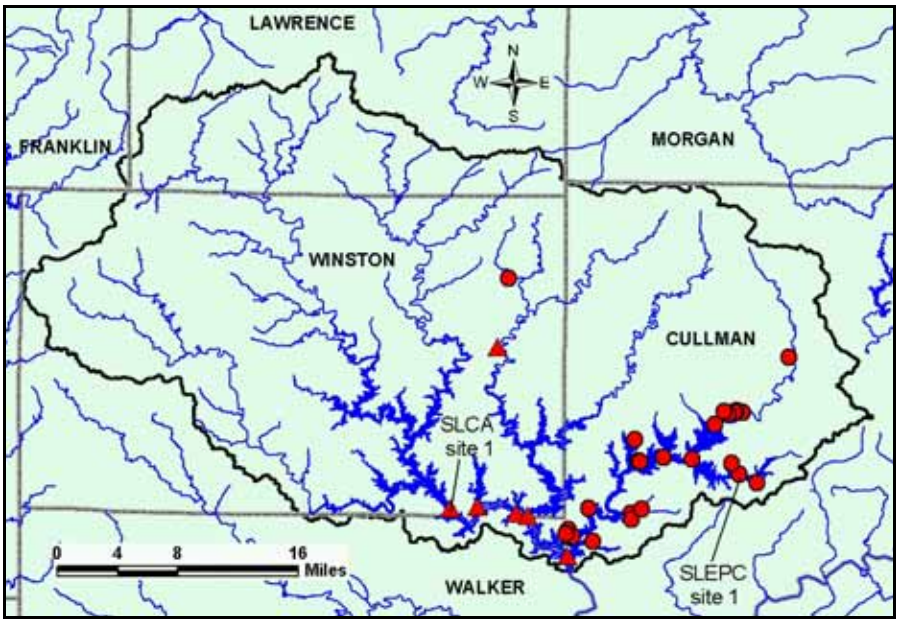
Citizen Volunteer Water Monitoring on Smith Lake

Lake Facts and Figures

Lewis Smith Lake (or Smith Lake) is located in north-central Alabama about 20 miles northwest of Birmingham in Cullman, Walker and Winston counties (see map below). The 300-foot high dam, completed in 1961 by Alabama Power Company, impounds the Sipsey Fork of the Black Warrior River to form the lake. Smith Lake has a surface area of 21,200 acres, 500 miles of shoreline, a watershed area of 944 square miles, a retention time of 435 days, and a maximum depth of 264 feet. The western side of the lake's watershed is crowned by the 180,000-acre Bankhead National Forest, which blankets the deeply dissected southern edge of the Cumberland Plateau. The Sipsey Fork of the Black Warrior River, Alabama's only "Wild and Scenic River," flows through the Bankhead National Forest. The Sipsey Wilderness, "Land of a Thousand Waterfalls," lies within the Bankhead National Forest and is home to Alabama's largest tree, a tulip poplar with a 21-foot circumference at its base.

West Fork of the Sipsey River in the Bankhead Forest
PHOTO: Linda Wilson, www.alabamatrailsasso.org

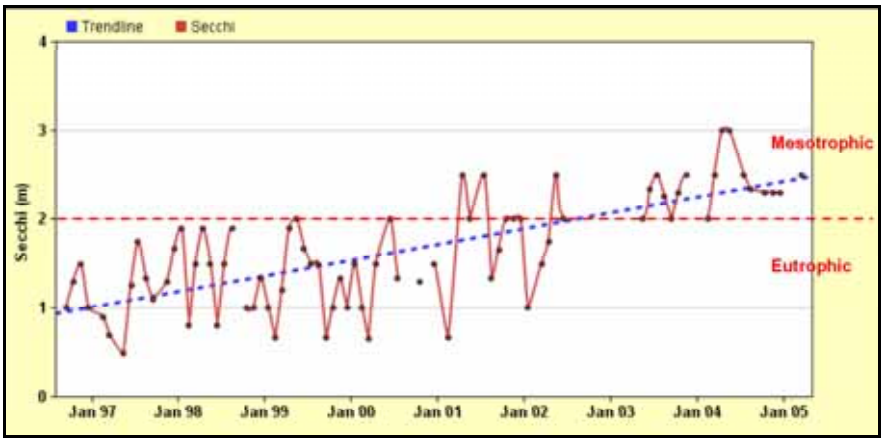


The SLCA (▲) and SLEPC (●) water quality sampling sites on Smith Lake, SLCA site 1 and SLEPC site 1 are labeled (data shown on next page)

Two local citizen groups monitor the waters of Smith Lake as a part of Alabama Water Watch. The Smith Lake Civic Association (SLCA) formed in 1976 on the Sipsey Fork (west side) of the lake, and the Smith Lake Environmental Preservation Committee (SLEPC) formed in 1995 on the Ryan Creek arm (east side) of the lake. Both groups are working to preserve and enhance the water quality of Smith Lake and the tributary streams flowing into the lake. Primary activities of the two groups are 1) water chemistry testing of several sites (eight active sites) on the lake by citizen monitors (see map), 2) Styrofoam and trash clean-ups twice a year by both groups, and 3) interaction with various agencies to positively impact the lake's watershed management policies.

Long-term Trends in Lake Water Quality

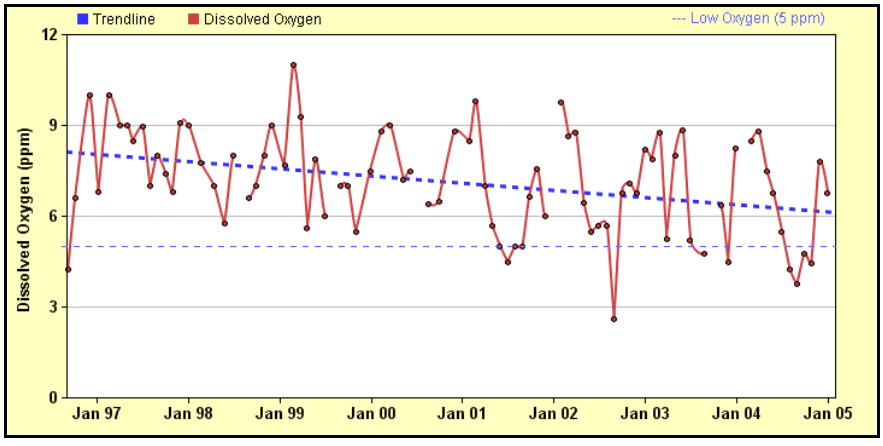
Citizen monitors of both SLEPC and SLCA have been trained and certified by Alabama Water Watch (AWW) to test water quality. To date, the two groups have submitted 718 water chemistry records measured from 29 lake and stream sites in the Smith Lake Watershed to the AWW office for entry into its statewide database. The Smith Lake monitors regularly measure five water quality parameters: water temperature, dissolved oxygen, alkalinity, hardness and pH, as well as Secchi disk visibility. Long-term trends in lake water quality are emerging from this rich database. Many lakes throughout Alabama are experiencing decreased water clarity from nutrient enrichment and soil erosion, both of which can adversely affect fish and other aquatic life as well as interfere with lake recreational uses and the quality of drinking water. In general, the muddier (from soil erosion) or greener (from increased nitrogen and/or phosphorus) a lake becomes, the lower the water clarity and Secchi disk visibility readings. Fortunately, the eight-year trend in Secchi visibility shown below (blue dashed line) documents a steadily improving condition in water clarity in Simpson Creek Embayment (east side of lake, see map on page 1).



Secchi visibility in Simpson Creek Embayment of Smith Lake (SLEPC site 1)

Deb Berry and assistant testing the water at their site on Smith Lake

Dissolved oxygen (DO) is an important parameter measured by AWW monitors. All fish and most other aquatic creatures depend on oxygen from the water. Oxygen dissolves better in cold water, so its concentration tends to be naturally higher in winter and lower in summer. An oxygen level of at least 5 parts per million (ppm) is required for streams and lakes that are classified by ADEM as "Fish and Wildlife." The eight-year trend of DO shown below (dark blue dashed line) indicates a decline in the 'health' of the lake at the Duncan Bridge sample site (west side of lake, see map on page 1). Since 2001, local monitors have measured summer-time DOs below 5 ppm at this site. These low DO values stress fish and may result in reduced aquatic biodiversity.



Dissolved oxygen in Smith Lake at Duncan Bridge (SLCA site 1)

Jim Beason testing the water at Duncan Bridge

Impacts on the Lake and What's Being Done About It

Although Smith Lake is often referred to as one of the cleanest lakes in Alabama, several developments within its watershed threaten the quality of its waters. Point sources of pollution are relatively few, and include discharges from municipal wastewater treatment plants and factories. Nonpoint sources of pollution are much more common and difficult to control. They include excess nutrient (nitrogen and phosphorus), sediment, bacterial, and chemical runoff from rural and urban land (Cullman County is home to over 120 million chickens according to the Soil and Water Conservation Committee). Some lakeside development is a source of erosion and sedimentation into the lake. Faulty septic tanks and houseboats often result in bacterial and nutrient pollution. The magnitude of many of these threats increases with population (from 1990-2000, the population of Cullman and Winston counties increased by 14.6% and 12.7%, respectively, according to the U.S. Census Bureau).

A coalition of lake residents, local businesses, municipalities, county commissioners, the game warden, the county health office, the local Sheriff's office, local landfills, Captain Jon Owens, Borden & Brewster Contractors and Alabama Power (*Renew Our Rivers*) team up twice a year to clean-up Smith Lake. Recent yield in solid waste, mostly deteriorated Styrofoam floatation broken loose from boat docks, has been about 500 tons per year. These efforts clearly beautify the lake and make it safer.

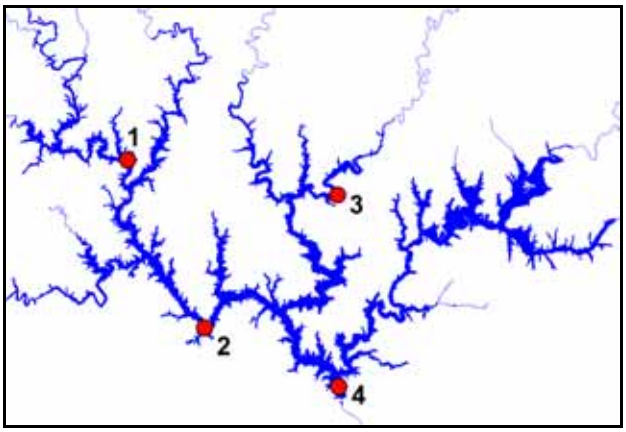
SLEPC has sponsored a *State of the Lake Address* every year since 1997. Staff from the Alabama Water Watch office are treated to a great breakfast at the Brushy Pond Restaurant, then give an evaluation of lake water quality based on the most up-to-date data collected by local citizen monitors as well as data collected by the Alabama Department of Environmental Management (ADEM). Over the years, several seasonal and long-term (multi-year) trends have emerged from the citizen data collected on Smith Lake. Armed with these data, local residents can better manage their lake through outreach activities and influencing local watershed management policies.

SLEPC members at the 2004 *State of the Lake Address*

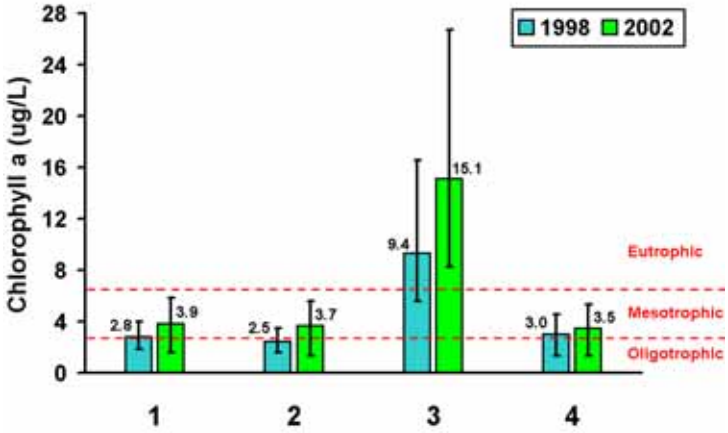
Troubled Waters

Based on the amount of algae (measured as chlorophyll *a*, the plant pigment used to estimate algal biomass) just upstream of the dam (dam forebay), ADEM's 2004 *Integrated Water Quality Monitoring and Assessment Report* ranked Smith Lake as the fifth cleanest lake in Alabama. Other areas of the lake don't fare as well. Crooked and Rock creeks, significant tributaries of the lake, were put on ADEM's 303(d) list of impaired waters in 1992 and 1996 respectively for excessive organic enrichment, low dissolved oxygen, excessive ammonia levels and pathogens. Total Maximum Daily Load (TMDL) documents, which establish limits on the amount of pollutants allowed to enter each creek and still support healthy fish and wildlife populations, were finalized by ADEM for Crooked Creek in 2002 and for Rock Creek in 2003. Upon completion of the TMDLs, the streams were removed from the 303(d) list in accordance with EPA regulations and guidance. Unfortunately, the chlorophyll graph below indicates

that enrichment from pollutants has increased in recent years, especially in Crooked Creek (site 3, growing season chlorophyll concentration increased 61% from 1998 to 2002). Reversing this trend of enrichment and restoring the waters of Crooked and Rock creeks will require a concerted watershed approach of all stakeholders in the implementation of corrective measures outlined in the TMDLs.



ADEM sites: 1 = Sipsey Fork, 2 = mainstem at Duncan Creek, 3 = Crooked Creek, 4 = dam forebay



Average chlorophyll concentrations at four ADEM sites (see map), vertical lines on bars represent range of values

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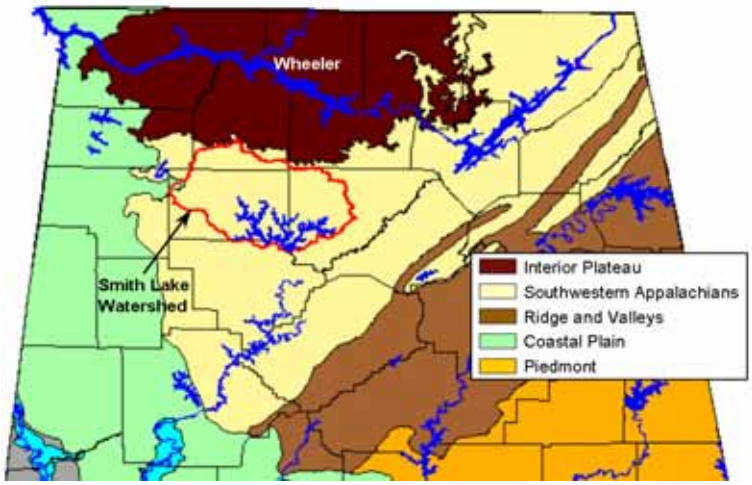
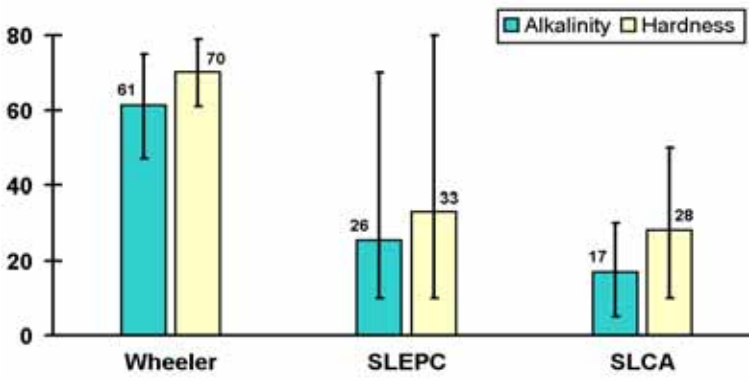
Watershed-level Water Quality Differences





Average alkalinity and hardness (mg/L) of Wheeler Reservoir, the east side of Smith Lake (SLEPC data) and the west side of Smith Lake (SLCA data)

The figure to the left indicates differences in alkalinity and hardness of Wheeler Reservoir (TVA data, 54 readings, 2000-2004) on the Tennessee River due north of Smith Lake compared to the Ryan Fork (SLEPC data, 294 readings) and Sipsey Fork (SLCA data, 410 readings) of Smith Lake, data from 1996-2005. The alkalinity and hardness of Wheeler Reservoir averaged 61 and 70 mg/L respectively, which was more than twice the alkalinity and hardness of Smith Lake. Wheeler Reservoir's higher alkalinity and hardness values result from the waters of the Tennessee River draining the limestone-rich soils of the Interior Plateau (Limestone County area, dark brown area of map) compared to the relatively limestone-poor sandstone-shale-coal soils of the Southwestern Appalachians (yellow area of map) of the Smith Lake Watershed, delineated in red. The citizen monitors have detected lower alkalinities and hardness on the west side of the lake flowing from the Sipsey Wilderness (SLCA data) compared to the lake's east side (SLEPC data). These naturally occurring low alkalinities of Smith Lake make it more susceptible to certain pollution impacts because of the low buffering capacity of its waters.

Timeline of AWW, SLCA and SLEPC

The 300-foot tall Lewis Smith Dam is one of the largest earth and rock-filled dams in the eastern United States

Jim Sanders measuring pH at the mouth of Rock Creek on Smith Lake

Seth Lucas, at age 10, set a new world record for the largest (23-pound, 6-ounce) landlocked striped bass caught in the boy's smallfry division of the International Game Fish Association in March 1998 from Smith Lake

The Flow of SLCA, SLEPC and Alabama Water Watch

1976
- SLCA forms

1992
- AWW Program begins

1993
- First AWW Workshop to train citizen monitors in water chemistry testing
- AWW Association forms
- Five AWW monitoring groups form

1994
- First SLCA clean-up on Smith Lake
- EPA approves AWW water chem. protocols
- AWW receives 1,000th water chem. record

1995
- SLEPC forms
- First AWW Training of Trainers Workshop

1996
- SLCA and SLEPC members get certified as AWW water chemistry monitors
- AWW introduces *E. coli* testing
- AWW develops BIO-ASSESS game

1997
- AWW launches AWWareness listserve
- SLEPC holds first *State of the Lake Address* for Smith Lake

1998
- First SLEPC clean-up on Smith Lake
- Alabama Power joins in lake clean-up
- AWW launches website
- AWW receives 10,000th water chem. record

1999
- EPA approves AWW bacteria protocols
- 1st AWW Reservoir Series Report published, featuring Smith Lake

2000
- SLCA acquires boat for lake clean-up with Walker Area Community Foundation grant
- Auburn University offers Continuing Education Units for AWW workshops

2001
- SLEPC partners with Wallace State Community College to begin lake phosphorus testing
- AWW develops relational database for online data entry and data access

2003
- SLEPC launches website

2004
- AWW develops MacroMania game
- AWW receives 30,000th water chem. record
- AWW completes five volumes of *Citizen Guide to Alabama Rivers*

2005
- AWW initiates 6-page Waterbody Reports
- AWW conducts its 1000th workshop

Alabama's Rich Water Resources and AWW

Alabama has over 75,000 miles of streams, including more navigable river miles than any other U.S. state. If these streams could be connected end-to-end, they would extend three times around the Earth! Alabama streams and rivers convey about 8% of the surface water that flows through the continental United States. Not only are our streams and lakes abundant, but they also vary tremendously in both physical and biological characteristics. Alabama's waters cut through Appalachian valleys and ridges, prairie soils of the Black Belt, sandy soils of the Coastal Plain and other physiographic provinces. All this physical diversity leads to an impressive biological diversity. Alabama streams have been described as a "biodiversity hotspot" because they have some of the largest variety of fishes, snails, mussels and other "aquatic critters" in the world. Some of these organisms are endemic, meaning that they only occur in Alabama. Human health, environmental health and quality of life are increasingly threatened by pollution. Many citizens feel it is their right and responsibility to become actively involved in protecting and restoring Alabama's water resources. Since 1993, more than 230 groups have participated in AWW and have collected data from about 700 water bodies statewide. The goal of this report series is to feature AWW groups, describe their activities and concerns, document the importance of their water data and invite you, the reader, to join in community-based action strategies for management and protection of your watershed.

Thompson Creek in the Sipsey Wilderness PHOTO: Linda Wilson, www.alabamatrailsasso.org

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Concerned citizens now have a powerful, new tool to answer the fundamental questions of water testing: *Is my water body getting better or worse, and why?* Hundreds of summary graphs and maps of water data, training opportunities, special meetings and other aspects of water monitoring are available via the AWW website at **www.alabamawaterwatch.org.** Certified monitors can enter their data online and custom graphs and statistical trends of statewide water quality data can be easily generated. Timely dissemination of quality-assured data in clear and meaningful ways is a vital element of a successful monitoring program. It is important to apply water quality information collected by citizen volunteers to local activities such as environmental education, protection and restoration activities, and development of watershed management plans. You are welcome to become a part of AWW and a local water-monitoring group.

Alabama Water Watch

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