

# Citizen Volunteer Water Quality Monitoring of Alabama's Reservoirs



...special lakes  
worth protecting



## Volume 1: Lewis Smith Lake

Alabama Water Watch  
October 1999

# Introduction to the Alabama Water Watch Reservoir Series

Alabama has few natural lakes, but from the 1920s to the 1960s, about 40 large reservoirs were constructed on several major rivers throughout the state. These “man-made lakes” were primarily created for hydroelectric power, navigation, flood control and irrigation. Over the years, they also have become increasingly important for lakefront real estate, drinking water sources and recreation points for fishing, boating and other water sports. Because of their high economic, social and ecological value, Alabama’s reservoirs have been extensively studied by power companies, governmental agencies, universities and others. Too often, however, this important information remains in technical reports that are not easily understandable or accessible to the general public and key decision makers.

Since 1993, many citizen groups have been voluntarily collecting water quality data on reservoirs as part of the Alabama Water Watch (AWW) program. Most of these groups are established lake associations or “Home Owner, Boat Owner” organizations (HOBOS) which have strong interests in the safety and quality of “their lake”. The purpose of this report series is to present a summary of lake conditions and trends that have been found by AWW groups, along with identification of key issues that will lead to further discussion and action. Whenever possible, the citizen information is supplemented and compared with professional data to give a more complete picture of lake quality.

These reports are intended for policy makers, educators and all citizens who are concerned about our lakes. You are invited to read, ponder and comment on this information. Better yet, become an AWW water quality monitor and join a growing group of dedicated citizens who volunteer thousands of hours per year to learn about and protect our magnificent lakes!

## Future Titles:

Volume 2 Lake Martin  
Volume 3 Lake Logan Martin  
Volume 4 Weiss Lake  
Volume 5 Lake Mitchell  
Volume 6 Lake Jordan  
Volume 7 Lake Wedowee  
Volume 8 Lake Gunterville  
...and others!

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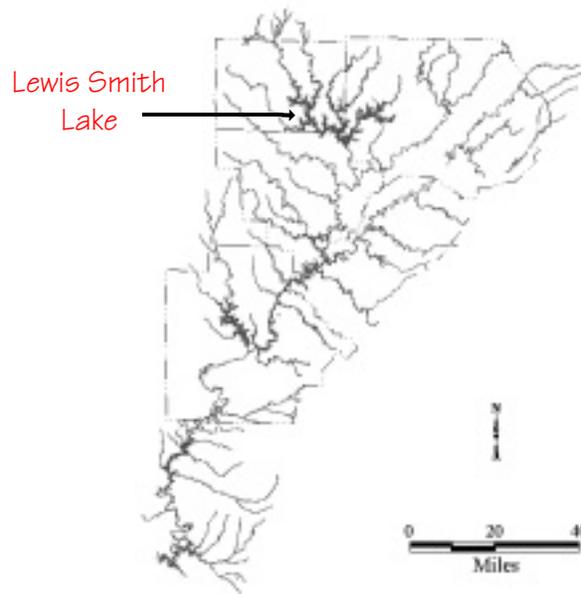
Cover photos: Top, Howard Adcock and Hollie Sandlin monitoring water quality on Smith Lake. Middle, aerial view of Smith Lake dam.

# Lewis Smith Lake...A Jewel of Alabama

- The lake is located in north Alabama in Cullman, Winston and Walker Counties, with the watershed also in parts of Lawrence and Franklin Counties (note: a watershed is the total land area which drains to a common point, such as a lake, a larger river or the ocean).

*“Even in the man-made bodies of water like Smith Lake, there is something special that takes place when nature has time to erase its previous canvas and paint a new picture.”*

Randy Grider, Managing Editor  
Cullman Times



Lewis Smith Lake is located in the headwaters of the Black Warrior River watershed.

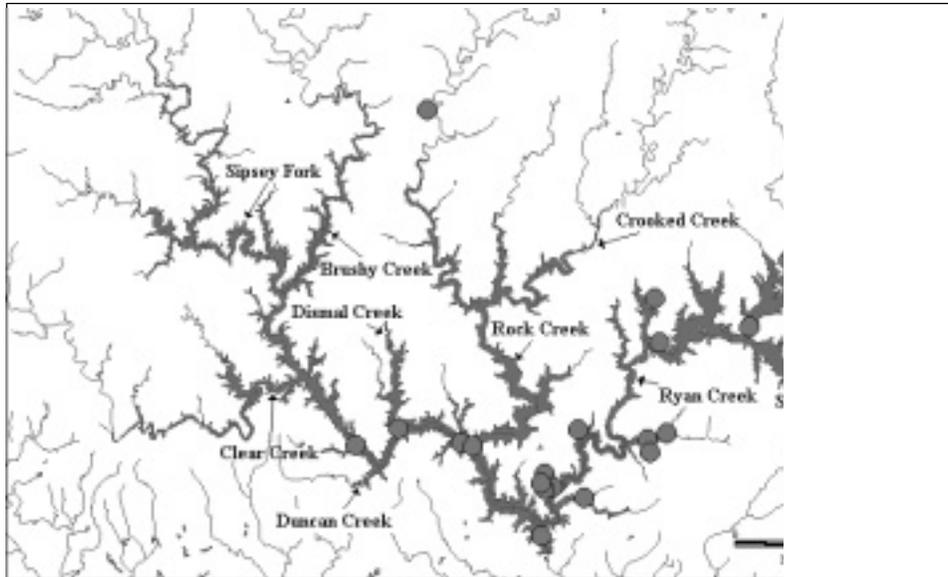
- The lake is the deepest in the state, created by a 300-foot, earthen dam that was completed in September 1961 after four years of construction. It has a surface area of 21,200 acres, a watershed of over 900 square miles and more than 500 miles of shoreline.
- The lake and its tributaries are part of the Black Warrior River watershed which is, in turn, part of the greater Mobile River Basin. The water of Smith Lake eventually flows to the Gulf of Mexico through Mobile Bay.



- The lake is home to the world's largest night bass fishing tournament and the Red Cross Spring Bass Classic. Several world records are held by Smith Lake anglers, including the youth world record striped bass set in the spring of 1998.



## What Do Volunteers Do?



AWW water quality sampling sites on Smith Lake

- Citizen volunteers attend one or more Alabama Water Watch workshops to become certified monitors of water quality. In the workshops, participants learn simple techniques for measuring various chemical, physical and biological characteristics of water, such as dissolved oxygen and bacterial concentrations (Deutsch et al. 1998a). All monitors attend an annual refresher course to maintain good sampling technique and replenish their test kits with fresh reagents.
- Two citizen groups, the Smith Lake Environmental Preservation Committee (SLEPC) and the Smith Lake Civic Association (SLCA), are the primary lake monitors. Student groups have also tested Smith Lake as part of the Hanceville High School Envirothon Team.
- There are about ten certified monitors on the lake who have sampled one or more sites about once per month for almost three years. Twenty-nine lake and tributary sites have been monitored since 1996, and information from more than 250 samples has been submitted to AWW for entry into the statewide water quality database.
- The volunteer monitors help the AWW program keep accurate water data, and present the information to watershed residents, regulatory agencies, policy makers and other interested citizens. The citizen data has become one of the most important sources of water quality information on Lewis Smith Lake.

# Groups keeping eye on area lake

A local environmental group is keeping a close eye on Smith Lake.

The Smith Lake Environmental Preservation Committee decided in order to help protect Smith Lake and its tributaries it must first determine the current health of the watershed.

In order to gather base line and trend data about the water quality in the Smith Lake watershed, several volunteers attended Alabama Water Watch training workshops and were certified as citizen water quality monitors.

Currently there are 20 citizen monitored sites in the Smith Lake watershed.



Lake monitors from the Smith Lake Preservation Committee and the Smith Lake Civic Association met recently to exchange information and in an Alabama Water Watch training session.



Smith Lake is no secret when it comes to fishing. Several state records have been pulled from the lake.

## Smith Lake provides outdoor adventure

By Rich Martin  
The Callman Times

Swimming lazily across Walker, Winston and Calhoun counties, Lewis Smith Lake is a major recreation spot for residents of North Alabama.

The deepest lake in the state, Smith Lake was created by a 300-foot high dam that was completed in September of 1961 after four years of construction.

The dam project created a reservoir of more than 21,200 acres of shoreline of over 500 miles.

Spring Bass Classic and the world's largest night bass fishing tournament, the Alabama Bait Boat Classic, The Pickin' Plan, an annual fundraiser in which boaters donate the lake for playing cards to build a winning hand, is also a major draw.

Several world records are held by Smith Lake fishermen, the most recent being a young world record set by Seth Lacey, 23.61 pounds.

## Water quality concerns prompt public meeting

By Jimmy Simms  
The Callman Times

Concerned over the quality of water found in the Rock Creek and Crooked Creek watersheds of eastern Winston County and western Callman County, the Smith Lake Environmental Preservation Committee is urging public participation in a stakeholders meeting set for Feb. 9.

The meeting will be held beginning at 6 p.m. at the Water Valley Community Center located off Highway 278 west, approximately 10 miles west of Interstate 85.

Large with the Smith Lake Environmental Preservation Committee and a lab technician at Wallace State Community College for many years, water quality data will be presented by the Alabama Department of Environmental Management (ADEM) with an open discussion of the data to follow.

Calvert further explained the Clean Water Act requires each state to list, every two years, the stream segments that do not meet the criteria for the Clean Water Act. "After listing the non-supporting stream segments, the agency must then prepare a TMDL analysis showing the level for certain pollutants that it would be necessary to obtain the applicable water quality standards," Calvert said. "Segments of Rock Creek and Crooked Creek were listed on the 1996 Clean Water Act list as not fully supporting or meeting the water quality criteria for the Fish & Wildlife classification."

Calvert said he and others hope to make Saturday's clean-up day a fun time for everyone involved. "It's important to note that you don't have to be a member of the preservation committee to help in the clean-up effort," Calvert said. "Everyone's help will be greatly appreciated and it'll give you a chance to come out and do something positive for the environment and maybe even enjoy a hot dog with us."

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## Preservation committee organizing clean-up effort

By Jimmy Simms  
The Callman Times

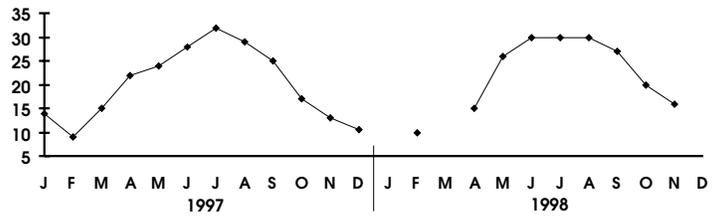
With maintaining the water quality of Smith Lake their number one concern, members of the Smith Lake Environmental Preservation Committee will host a lake clean-up effort Saturday morning at 9 a.m. at the old store building at Trimbles.

According to Ed Calvert, director at the Smith Lake Environmental Preservation Committee, "If you are interested in becoming a water quality monitor or about the organization, please contact me at 278-278-1234."

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In addition to water quality sampling, several of the AWW monitors on Smith Lake are active in lake clean-up efforts and in organizing public meetings for greater awareness of lake issues.

# What Have Volunteers F



Site 10010002 - Smith Lake below mouth of Dismal Creek

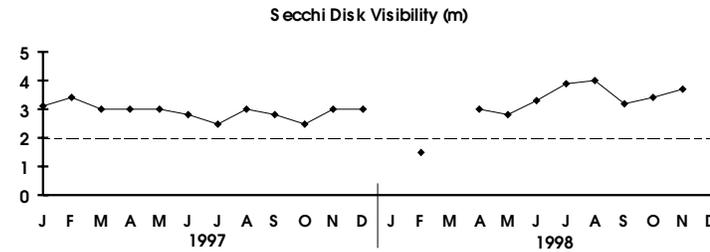
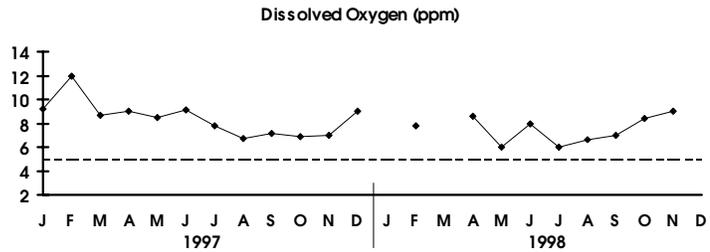
Citizen Monitor: Jim Beason (SLCA)

After several months of monitoring a particular site, a valuable record of water quality trends is established.

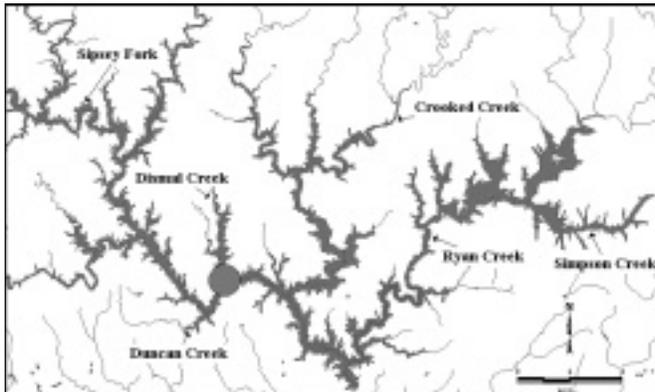
Data from this site on the western side of the lake (see map below) indicated that in 1997-98, the surface water temperature fluctuated from about 10 C (50 F) in the winter, to about 30 C (86 F) in the summer.

Dissolved oxygen (DO) concentrations varied from about 8-12 ppm (parts per million) in the winter to about 6 ppm in the summer. Such seasonal changes in DO are typical; the solubility of oxygen in water is inversely related to temperature.

DO concentrations at this site are consistently above 5 ppm (dashed line on graph), which is the minimum allowable for a water body that is classified as “Fish and Wildlife” by ADEM and EPA.



Sources: Deutsch et al. 1998b, 1999



Secchi disk visibility is a measure of water clarity, determined by lowering a small disk into the water until it disappears to the naked eye. Visibility decreases when the water becomes more turbid because of increases in suspended soils or in “blooms” of microscopic plants called algae.

Secchi disk visibility at this site was usually around 3 m (about 9 feet), which indicates good water clarity.

## Site 10011001 - Smith Lake at Berry Dock on Simpson Creek

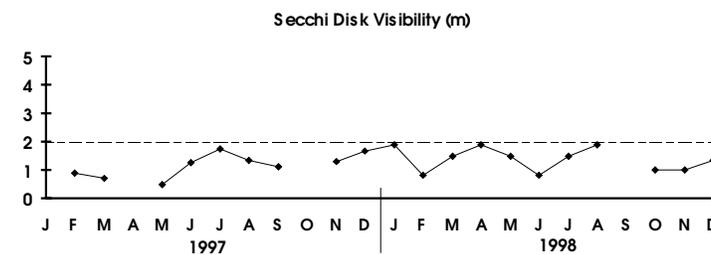
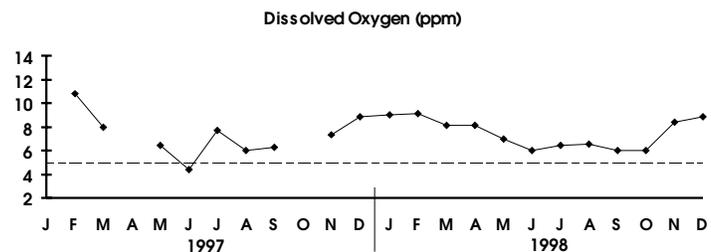
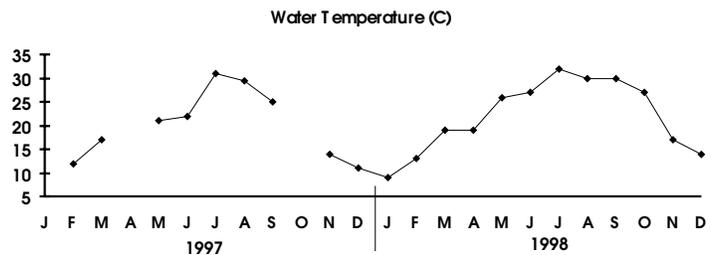
Citizen Monitor: Debbie Berry (SLEPC)

Data from this site on the eastern side of the lake (see map below) indicated that surface water temperatures were very similar to the western site in both annual ranges and pattern.

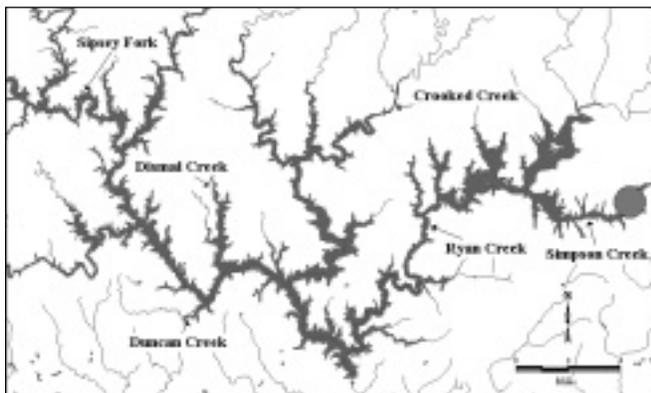
Seasonal changes in oxygen concentrations were also generally similar to the western site, with DOs higher in the winter and lower in the summer. Oxygen concentrations were slightly lower at the eastern site, and more often approached the minimum required to maintain the “Fish and Wildlife” classification.

A notable difference in water clarity occurred between the two sites. This site had much less clarity than the western site, with Secchi disk readings ranging from less than 1 m (about 2-3 feet) to 2 m (about 6 feet).

A 2-meter Secchi disk reading (dashed line on graph) is generally thought to be the minimum that an unpolluted lake should have. Low Secchi disk readings at this site suggest that the water has excess amounts of suspended soils, algae, or both.



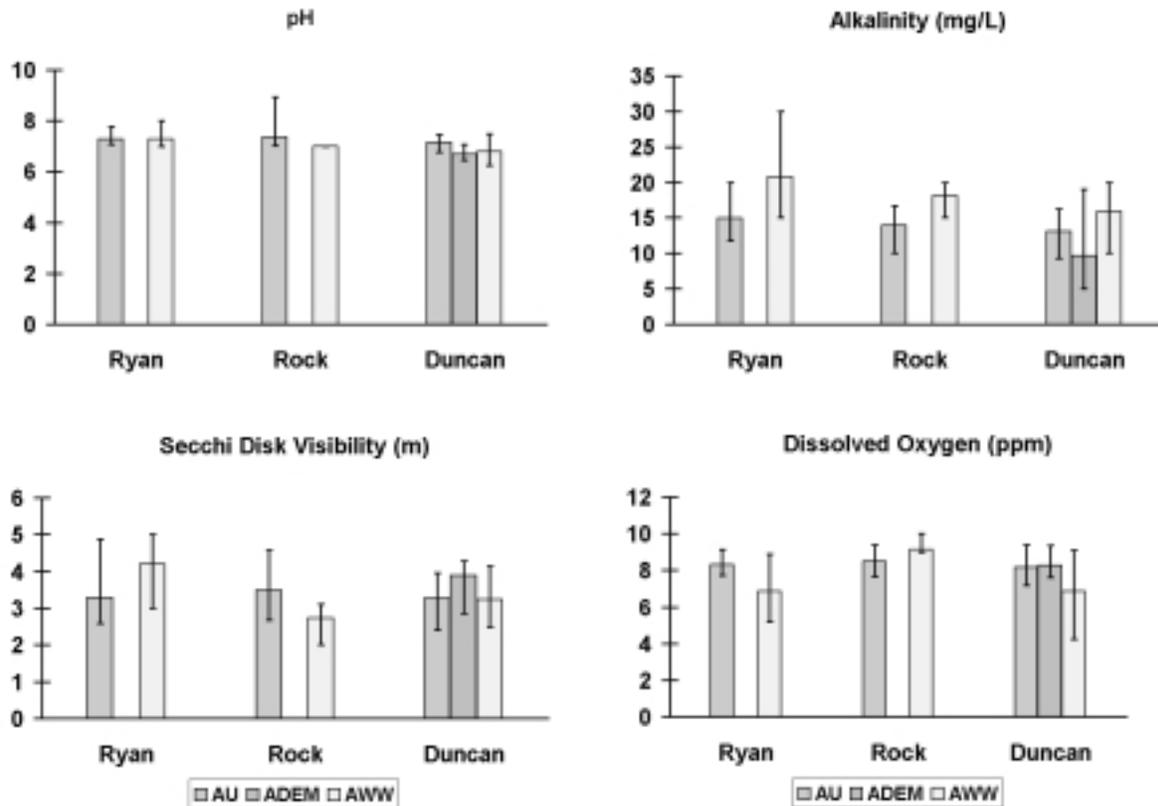
Sources: Deutsch et al. 1998b, 1999



This water quality information reveals the importance of sampling several sites on a lake. Water quality often varies from place to place because of natural factors or pollution. Gathering data from many sites leads to a better lake assessment and better lake management.



## Is the Volunteer Information Reliable?



Smith Lake water quality data collected from 1995-98 by Auburn University, ADEM and AWW monitors near Ryan, Rock and Duncan Creeks. A bar represents the average reading (April through October) of a parameter, and the vertical line at the top of a bar represents the range of readings. About 15-20 samples of each parameter were compared per lake site.

- It is important to compare the citizen data of AWW volunteers with research data of universities and governmental agencies in order to test its reliability. The pH readings are a measure of how acidic or basic the water is, and samples from all testing groups were very similar. The pH at all three sites averaged about 7 (neutral), with mildly acidic readings (slightly less than 7) occasionally taken by all groups at the Duncan Creek site.
- Alkalinity readings indicate how well the lake is buffered against changes in acidity. Overall, alkalinity ranged from about 5 to 30 mg/L (all sites and groups). These measurements all indicate the relatively low buffering capacity of the lake. Secchi disk visibilities averaged about 3-4 m at all sites, and ranges of readings overlapped among sampling groups, indicating a general similarity. Dissolved oxygen (DO) readings averaged about 7-9 ppm, with occasional, low DO concentrations (5 ppm) detected by AWW monitors near Duncan Creek (AU and ADEM DOs measured at five feet; AWW DOs measured on surface).
- Overall, citizen data compared favorably with research data, underscoring its reliability for use by lake managers and regulatory agencies.

## What Does the Information Mean?

- AWW citizen volunteer data confirms the general impression that Smith Lake is clean.
- Citizen information also indicates that the lake is being polluted at certain creek inflows, and that there are occasional, large variations in lake quality among sites. Monitors have detected lake and tributary surface DOs at or below 5 ppm more than 30 times.
- Besides the data collected with test kits by certified monitors, citizens have made important, qualitative observations, such as fish “gulping” for air at the lake surface (indicating low oxygen levels), occasional fish kills in some embayments, and high turbidities from green “scums” (algal blooms) and eroding soils.
- Public concern for the future of the lake is growing, and citizens have shown an eagerness to learn about lake trends.

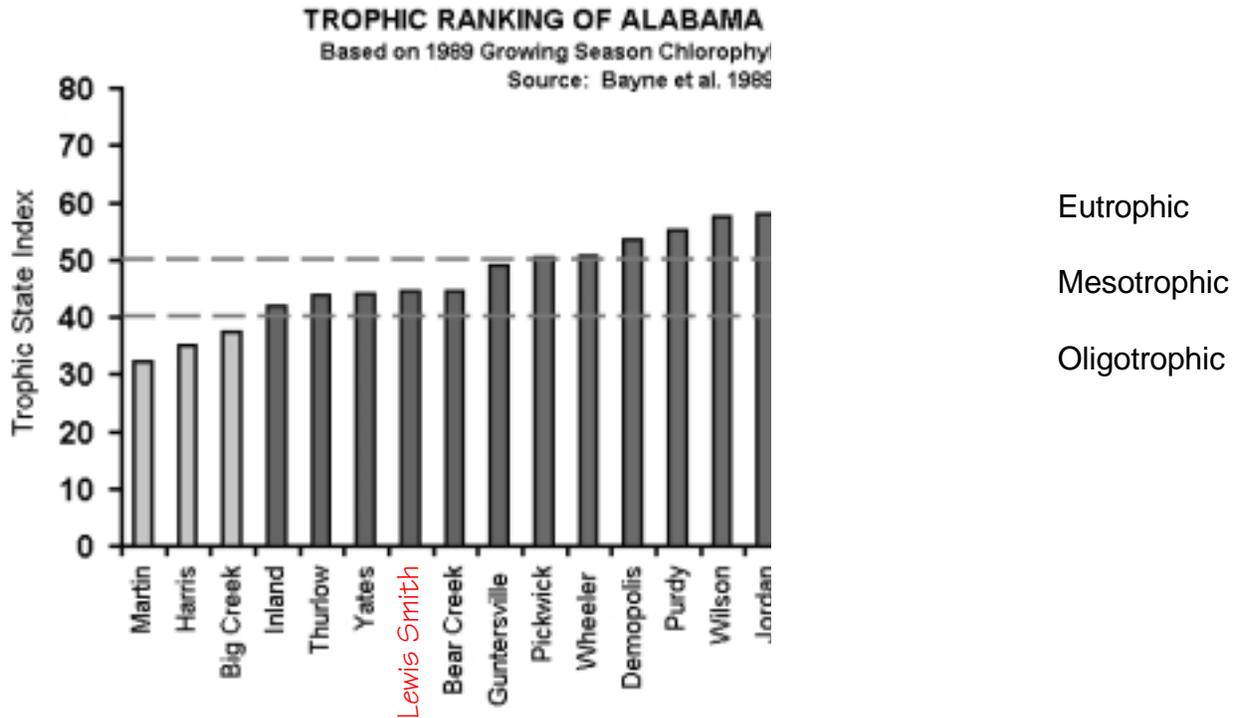
“Our livelihood, home and business are located just below Smith Lake dam on Alabama’s only cold water trout fishery. The water of Smith Lake, and everything in it, flows through our property, and the health of the lake is one of the most important factors in our lives.”

Elizabeth and John Eisenbarth, President  
Alabama Chapter of Trout Unlimited



A group of about 30 concerned citizens met to learn about and discuss the water quality of Smith Lake in August 1998.

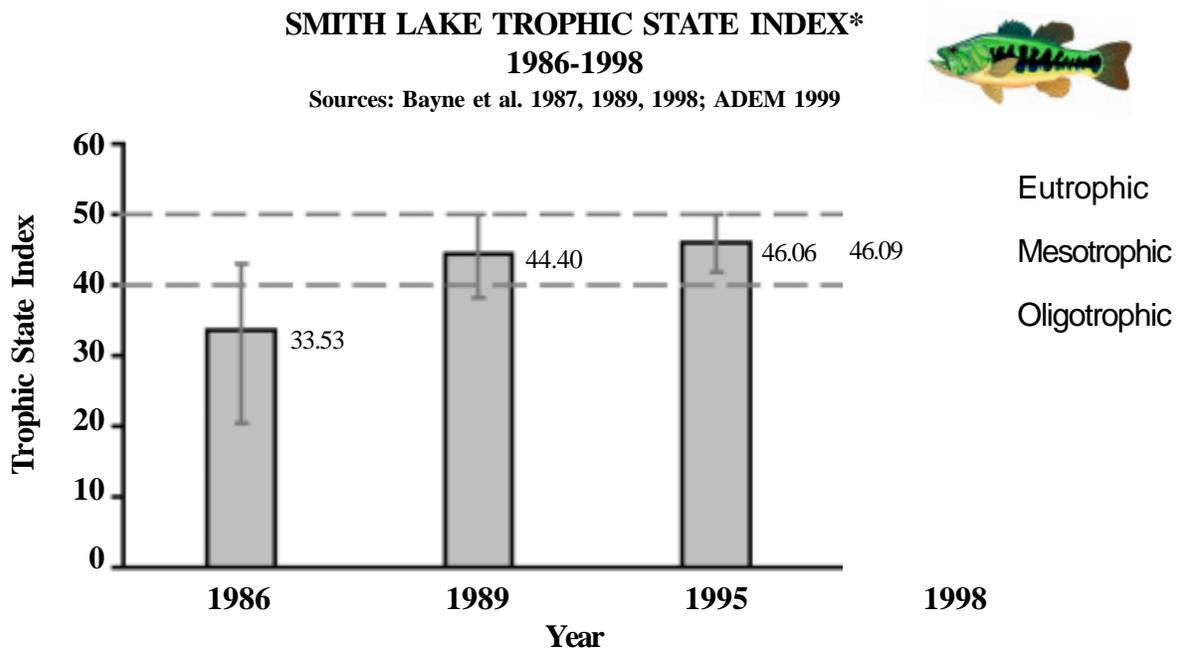
## How Does Lewis Smith Lake Compare to Other Lakes?



- Lakes are commonly rated and compared according to their “trophic state.” This is related to algal densities stimulated by the amount of nutrients (especially phosphorus) received from the watershed. “Oligotrophic” lakes have low levels of nutrients, “mesotrophic” lakes have moderate levels, and “eutrophic” lakes have high levels (AFA 1998).
- It is generally believed that concentrations of an aquatic plant pigment, called “chlorophyll a,” is the best parameter to use for calculating the Trophic State Index (TSI). When TSIs are above 50 (eutrophic), this usually means that a lake is becoming polluted by too many fertilizers and other nutrients.
- Phytoplankton biomass of Smith Lake more than doubled from 1986 to 1995, and primary productivity also increased significantly (Bayne et al. 1998). This trend information suggests that the lake is receiving excess amounts of phosphorus and nitrogen. Sources may include boat and household sewage, animal manure and lawn fertilizers.
- An Auburn University study indicated that in 1989, Smith Lake was “mesotrophic.” By comparison, lakes in the Tallapoosa River watershed (e.g., Martin, Harris, Thurlow and Yates) had generally lower TSIs than Smith Lake, and lakes in the Coosa River watershed (e.g., Jordan, Weiss, Logan Martin, Neely Henry, Lay and Mitchell) had generally higher TSIs (see graph above).

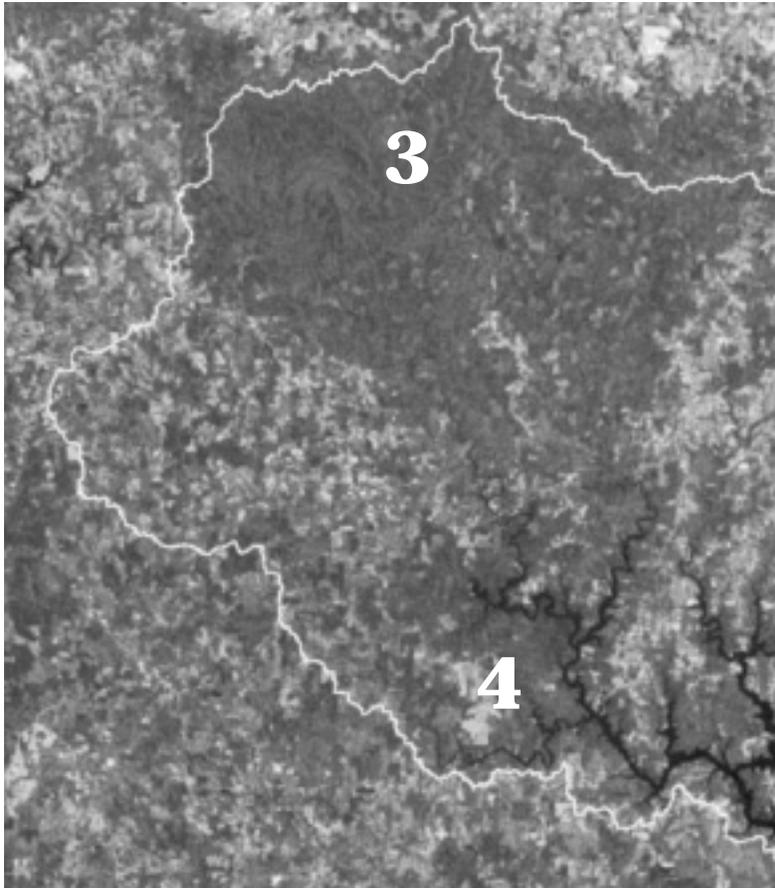
# What Are the Water Quality Trends of Lewis Smith Lake?

- From 1986 to 1989, Smith Lake’s TSI increased by more than 30%, from about 33 to 44 (see graph below). From 1989 to 1998, the TSI of the lake has increased slowly, and is approaching a “eutrophic” condition. Eutrophic lakes often have large fluctuations in plankton blooms, dissolved oxygen concentrations and other water quality parameters. This, in turn, stresses fish and can lead to fish kills.
- Chlorophyll *a* concentrations and algal growth potential have been at eutrophic levels in the lake embayments of Crooked and Rock Creeks (see map on page 3). These two creeks have recently been classified by ADEM as “impaired”, and they have been placed on the “303(d) list”, indicating that their quality is below what it should be for “Fish and Wildlife”.
- Both research data and AWW data indicate that Smith Lake is generally clean, but may become polluted because of the things people are doing in the watershed. It is very important that the public and policy makers are aware of these trends, and that they collectively work toward protecting Smith Lake from further degradation.
- There is no such thing as a single trophic state that is “optimal” for all lakes. Ideally, each lake should be managed according to the objectives of *all* stakeholders, including watershed residents and governmental agencies.



\*For year-to-year comparisons, all chlorophyll *a* values were standardized with analytical methods used prior to 1990.

Color infrared, Landsat Satellite photo of July 1995. The red areas indicate forest cover, pink indicates pastures and lawns, turquoise indicates cleared land (bare soil, asphalt, etc.), and black indicates Smith Lake. The white line marks the border of the Smith Lake watershed. Numbers on the map correspond to general locations of watershed issues at stake. The image was enhanced by Sandra Holm, AU Fisheries Department.



1. Urban/Suburban
2. Agriculture
3. Forestry
4. Mining
5. Lakefront Development

The Smith Lake watershed has many land uses that affect the lake, including agriculture, mining and ever increasing development. It is important that lake trends be monitored for early detection of pollution problems.

# What Are Some Key Water Quality Issues at Stake?

## 1. Urban/Suburban

- storm water runoff (oils, litter, etc.) from streets and parking lots
- municipal and industrial waste water effluents into streams
- disposal of industrial and household toxic chemicals

## 2. Agriculture

- excess fertilizers and bacteria from animal wastes
- runoff of pesticides and other chemicals from cropland and pastures
- soil erosion causing stream and lake turbidity and sedimentation

## 3. Forestry

- forests as important land cover for stabilizing rainfall runoff
- forest cutting practices and soil erosion
- Sipsey Wilderness and biodiversity conservation in the watershed

## 4. Mining

- soil erosion, turbidity and lake sedimentation
- acidic water from active or abandoned mines
- toxic metal runoff and lake pollution

## 5. Lakefront Development

- nutrient and bacterial pollution from septic systems and boat sewage
- erosion and sedimentation from construction sites
- lawn and garden fertilizer runoff
- litter

What will be the **long-term** effect of our land and water use decisions?

*“Smith Lake has an average water retention time of 435 days...the longest of any Alabama lake. Anything that is spilled, leached or dumped into the lake will remain there for over a year.”*

**Debbie Berry, President  
Smith Lake Environmental  
Preservation Committee**

# Why Is Volunteer Monitoring Important?

Several lake residents want to be personally involved with lake monitoring and protection, to determine lake quality near their homes or favorite swimming and fishing sites, and be a part of lake and watershed development decisions.

*“We don’t have the manpower to keep a constant watch on all the bodies of water in the state. Alabama Water Watch citizen monitors are our eyes and ears.”*

Charles Horn, Chief  
Water Division, ADEM



Advantages of local, citizen-based water monitoring:

- large number of sampling sites
- sampling frequency and consistency
- “eyes and ears” for lake changes and polluters
- fast response time to detect and measure polluted runoff
- local awareness and public outreach
- neighbor to neighbor persuasion of polluters
- important supplement to agency and research studies
- science-based, citizen-involved action plans

An ADEM map (Sisk 1998) which features AWW sites (red dots) as part of an overall plan for the Smith Lake watershed. This is one of the first examples of ADEM using AWW citizen data in their efforts to manage lakes, restore 303(d) listed streams, and determine standards for total maximum daily pollution loads (TMDLs) of Rock and Crooked Creeks.



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## Alabama Water Watch

Alabama Water Watch is a citizen volunteer water quality monitoring program centered at Auburn University that provides training, data management, information exchange and other means of support for the public to become personally involved in water issues. The AWW Association is a nonprofit affiliation of water monitoring groups, and other interested citizens, that promotes the AWW program and advocates better water quality and water policy in Alabama.

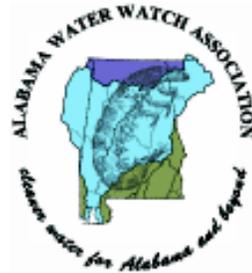
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