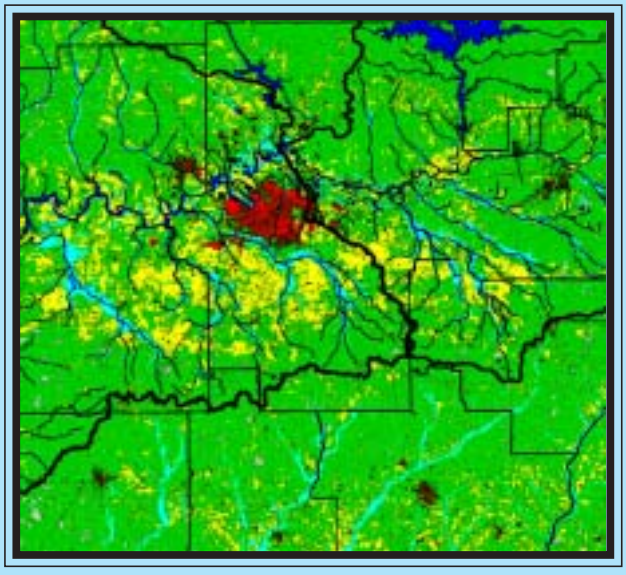
Citizen Volunteer Water Quality Monitoring on Alabama's Streams



...protecting 75,000 miles of aquatic treasures

Tri-River Region

(Montgomery Area)

Alabama Water Watch

February 2003

Introduction to the Alabama Water Watch Stream Series

Alabama has over 75,000 miles of streams, including more navigable river miles than any other state. Imagine that if these streams could be connected end-to-end, they would extend three times around the Earth! All together, the state's streams convey about 8% of the surface water that flows through the continental United States. To say that Alabama is "water blessed" is almost an understatement!

Not only are streams abundant, but they vary tremendously in both physical and biological characteristics. Our waters cut through Appalachian valleys and ridges, prairie soils of the Black Belt, sandy soils of the Coastal Plain and other physiographic provinces. All of 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.

Many citizen groups feel it is their right and responsibility to become actively involved in protecting and restoring Alabama streams. Since 1993, about 180 groups have participated in Alabama Water Watch and have collected data from hundreds of stream sites statewide. The AWW database has some of the most extensive and consistent water quality information for an increasing number of streams.

The purpose of this report series is to feature AWW stream 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 stream management and protection.

Current Titles:

Volume 1 Tri-River Region

Future Titles:

Locust Fork River
Dog River
Choctawhatchee, Pea, Yellow Rivers
Saugahatchee Creek
Five Mile Creek
Uphapee Creek
...and others!

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Striped Shiner, *Luxilus chrysocephalus*

Abbreviations:

TRRWW (Tri-River Region Water Watch)
AWW (Alabama Water Watch)
AU (Auburn University)
EPA (Environmental Protection Agency)
MWWSSB (Montgomery Water Works and Sanitary Sewer Board
ADEM (Alabama Department of Environmental Management)
AWWA (Alabama Water Watch Association)
ACWP (Alabama Clean Water Partnership)
ACT (Alabama, Coosa, and Tallapoosa River Basins)

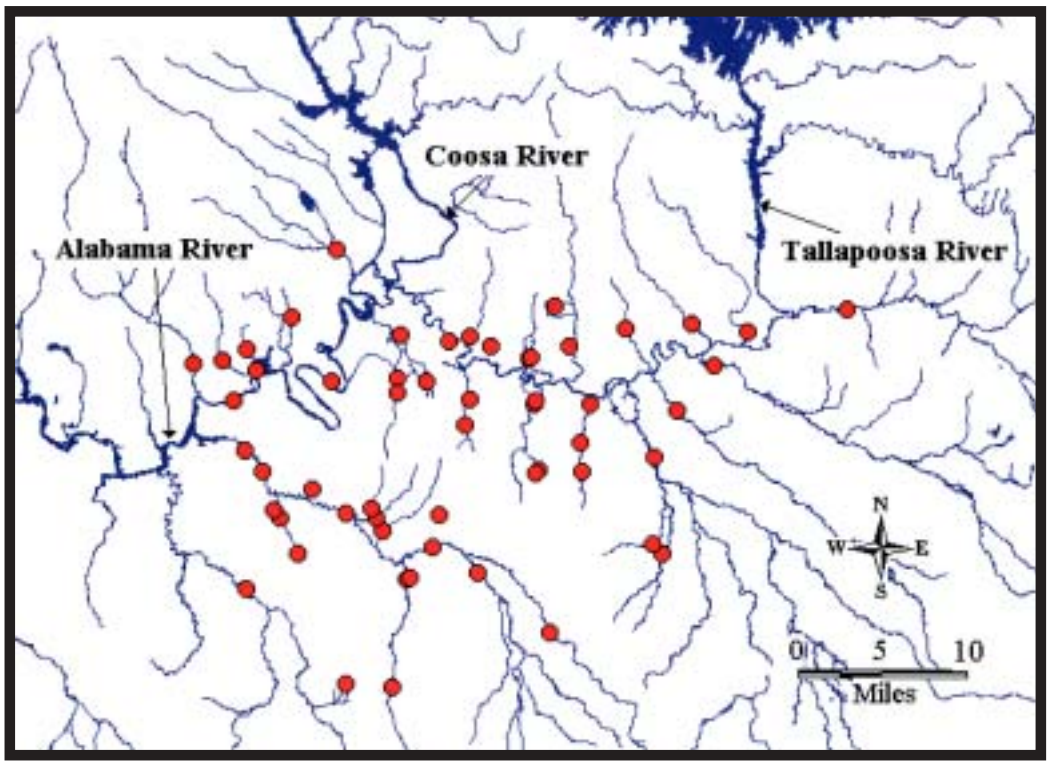
Cover photos: Top left: TRRWW Volunteers conducting a stream biological assessment; Top right: View of the Alabama River and downtown Montgomery; Bottom left: Enhanced Landsat Satellite photo of Tri-River Region; Bottom right: Tallapoosa darter, *Etheostoma tallapoosae*, endemic to the Tallapoosa River system of the Mobile Basin.

Tri-River Region...Facts and Figures

Tri-River Region (circled) showing the Alabama, Coosa and Tallapoosa River Basins

- The Tri-River Region of central Alabama is where two large rivers, the Coosa and Tallapoosa, come together to form the Alabama River. At this point, waters from as far away as western Georgia and southern Tennessee meet and continue flowing to the Gulf of Mexico. Collectively, these three mighty rivers form the Alabama-Coosa-Tallapoosa (ACT) Basin.

- The ACT Basin has more than 170,000 surface acres of water, including 16 major reservoirs that are multi-million dollar resources for hydropower generation and recreation. The basin is an area rich in history and natural history that has experienced great changes. A more detailed description of the extended Tri-Rivers Region may be found in the recently published Citizens Guide to the ACT Basin (AWW 2002a).



Tri-River Region Water Watch sampling sites (●)

- The Tri-River Region includes portions of Montgomery, Autauga and Elmore Counties. There are nearly a quarter of a million people living in Montgomery County alone, and the water needs of the city are immense. Tributaries of the three rivers flow in and around the city, transecting rural, suburban and urban land. The flow pattern and quality of these streams reflect the soil types and large variations in land use activities on the watersheds.

- The Tri-River Region Water Watch group (TRRWW) is made up of citizen volunteers from the Montgomery area who are committed to understanding water issues and doing what they can to protect aquatic resources. This is a very challenging task! Balancing economic growth and urban expansion with environmental protection requires creative ways to educate the general public, educators, children and municipal officials. This is a primary goal of TRRWW.

Bluegill, *Lepomis macrochirus*

What Do Volunteers Do?

- TRRWW volunteers attend one or more AWW 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 (DO) and bacterial concentrations (AWW 1998). All monitors attend recertification sessions to maintain proper sampling techniques and replenish their test kits with fresh chemical reagents.

Amanda Fleming and Bill Sims at a Water Chemistry Training workshop

- The volunteer monitors help the AWW program keep accurate water quality data and present the information to watershed residents. Some TRRWW members have become certified AWW Trainers and Quality Assurance Officers to better serve the needs of volunteers in the Tri-River Region. As a result of training and monitoring activities, the citizen data set has become one of the most important sources of water quality information for the region.

- TRRWW has set the following objectives:

  Provide recreational opportunities that promote the importance and beauty of the river.

  Introduce the importance of water quality monitoring to youth by participating in school events like the Montgomery County Water Festival, a hands-on educational field trip for 4th Graders.

  Build public awareness of the values of the river through public meetings and displays at environmental/Earth Day events and the Alabama National Fair.

  Establish volunteer water quality monitoring points along streams.

  Conduct regular meetings and annual information sessions.

  Promote litter cleanup activities to beautify the areas along the streams as well as keep them free of contaminants.

Boy Scouts learn kayaking on the Coosa River with Tri-River Region volunteers

Curtis Miyasaka collecting litter near White's Slough in the Catoma Creek Watershed, Montgomery

- TRRWW volunteers are active in the Alabama and Tallapoosa River Basin Clean Water Partnerships and the Catoma Creek Watershed Management Group. This involvement increases the chance of citizen data and opinions having a positive impact on watershed protection.

"Because we are all chemists at Montgomery Water Works, we are constantly asked 'how's my water'? Volunteer water quality monitoring is a way we can be involved in educating the public as well as a way for them to become involved."

-Amanda Fleming, Debbie Whitaker, and Ginger Taylor TRRWW Monitors

In addition to water quality sampling, several of the AWW monitors in the Tri-River Region are active in educational outreach and advocacy for greater awareness of stream and watershed issues.

What Have Volunteers Found?

Site 22 Monitor, Jim Graham

- Tri-River Region Water Watch has collected more than 1,330 chemistry records and 130 bacteria records from 61 sampling sites. They are ranked third among 180 citizen groups statewide for the amount of water data. All of this information is stored in the statewide AWW database.

- After several years of monitoring a particular site, a valuable record of water quality trends is established. The graphs on pages 6-8 document water chemistry at three creeks over the last three to seven years (AWW annual reports). This information represents some of the most consistent water monitoring among the many TRRWW sites and documents how physical conditions and land use strongly influence water quality.

- The water temperature of **Catoma Creek** ranged from about 26 C (79 F) in summer to 5 C (41 F) in winter. Dissolved oxygen (DO) concentrations fluctuated inversely with temperature, as expected, from 2 ppm (parts per million) in summer to almost 12 ppm in winter.

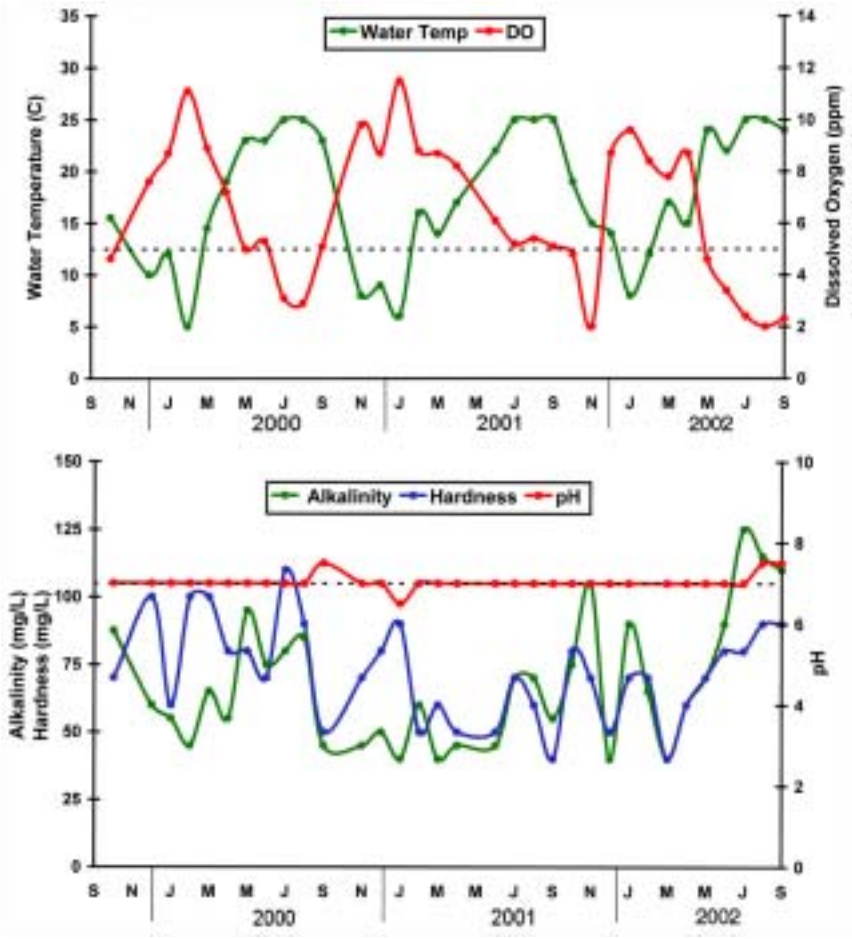
- The summertime DOs in Catoma Creek were often below the minimum of 5ppm required for streams that are classified as "Fish and Wildlife" (dashed line on graph). Low DO often leads to fish kills and generally reduces stream biodiversity.

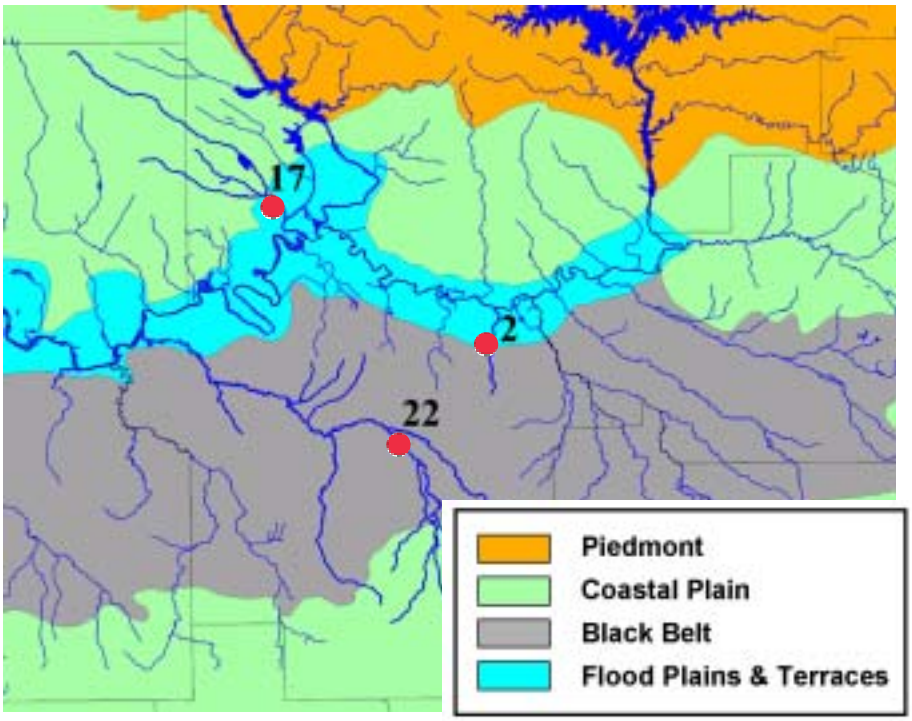
- Because the creek does not meet the standard it is classified for, it is currently on a registry of impaired streams called the 303d list. ADEM has indicated that Catoma Creek is polluted by excess nutrients (nitrogen or phosphorus) that may come from livestock waste, faulty septic systems, urban storm water runoff and other sources. TRRWW data confirm that the stream is still impaired, even in its headwaters at Site 22.

- Total alkalinity and hardness values at Site 22 were relatively high and ranged from 40 to 125 mg/L. The site is within a band of the Black Belt, prairie soils that are rich in dissolved minerals and buffers (see soils map p.7). Stream pH remained stable at about 7.0, the neutral value (dashed line on graph).

Stonefly, Family Perlidae

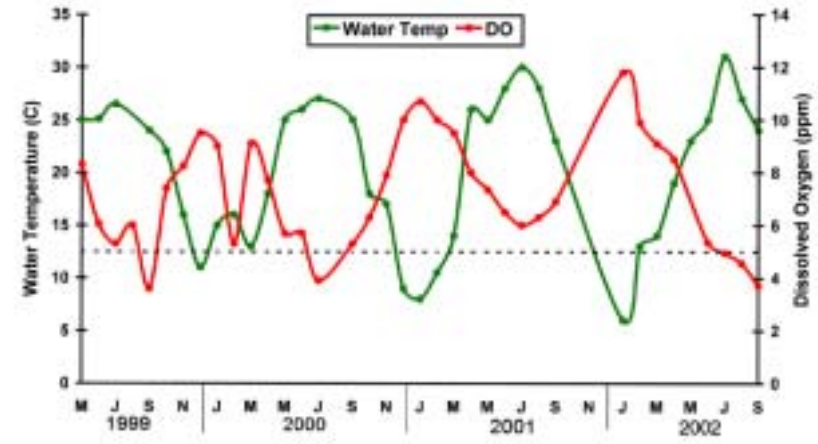
Site 22 (01001022) - Catoma Creek

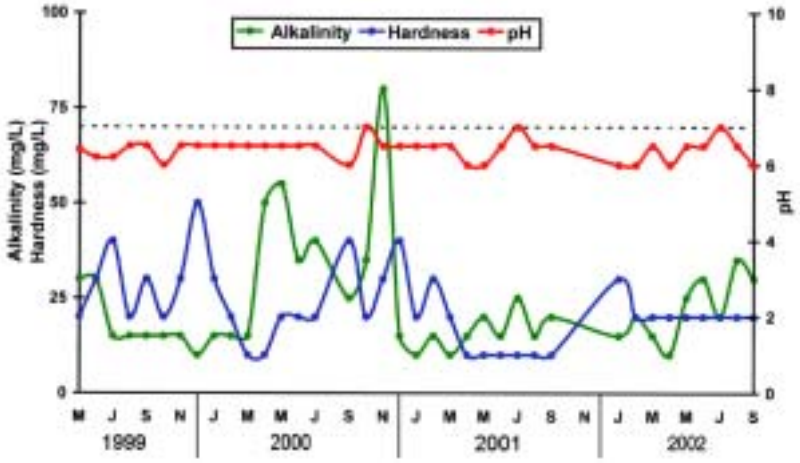




Soils map of the Tri-River Region with Sites 2, 17 and 22

Site 17 (01001017) - Mortar Creek





- The water temperature and DO of **Mortar Creek** exhibited typical, seasonal inverse cycles, however, the amount of DO in the creek seems to have increased from 1999 through 2002. This improvement may be because of observed increases in stream flow from an upstream reservoir. The greater flow could have reduced stream stagnancy and introduced more oxygen by increased turbulence.

Monitor, Mary Bass Belmont at Site 17

- The increasing seasonal range in water temperature may be related to increased surface water releases from the upstream reservoir. It may also indicate the clearing of streamside buffer zones which shade streams and moderate temperature flucuations.

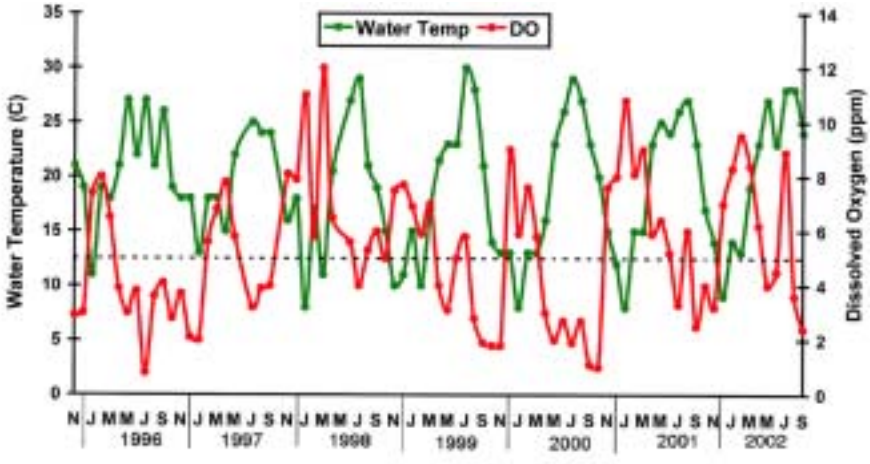
- Total alkalinity and hardness at this site were usually about 15 to 50 mg/L, only about one half of those found in Catoma Creek. The soils map above reveals that water quality at Site 17 is primarily influenced by poorly buffered Coastal Plain soils. This accounts for relatively low alkalinity and hardness and a mildly acidic pH (usually below 7.0).

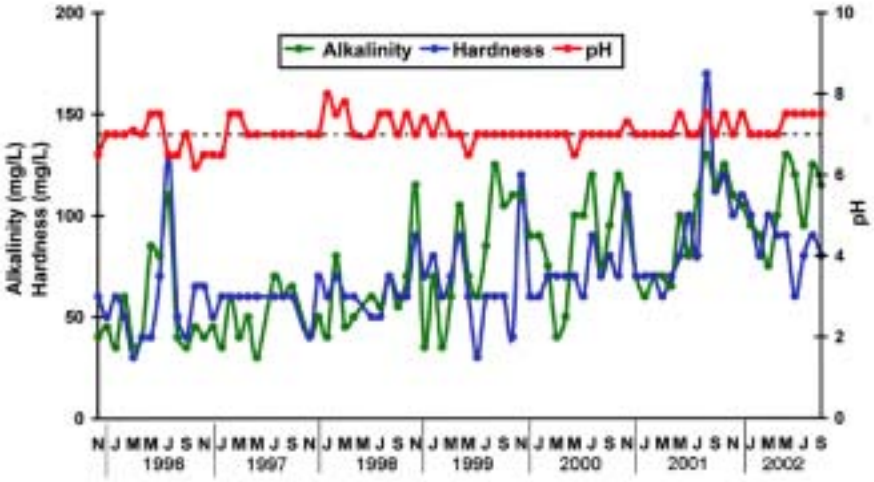
- Alkalinity and hardness did not follow similar patterns in Mortar Creek, suggesting that one or both of these parameters is affected by human impacts. The apparent changes in water quality at Site 17 warrant further monitoring and watershed observations.

- The data set from **Millie's Creek** (Site 2) is the largest and most consistent from the Tri-River region. This valuable record, unfortunately, documents stream impairment with summertime DO values that regularly drop below the 5 ppm minimum needed for supporting a healthy stream.

Site 2 Monitor, Patti Hurley, is also an AWW certified trainer and ADEM employee

Site 2 (07009002) - Millie's Creek





- Millie's Creek is not currently on the 303d list, but is nevertheless degraded and in need of remediation. It is an example of how citizen monitoring can identify stream segments that should be considered impaired.

- The alkalinity and hardness of the creek increased from about 50 mg/L to over 100 mg/L between 1997 and 2001. Although this trend was not observed at the Catoma or Mortar Creek sites, it was similar to patterns that citizen monitors observed on tributaries of Weeks Bay and Wolf Bay during this period (AWW 2001, 2002b). The trend at the coastal sites was attributed to a multi-year drought that caused low stream flows and a higher concentration of dissolved minerals.

- More seasonable rains in 2001-02 increased stream flows and probably caused alkalinity and hardness to return to more typical levels in Millie's Creek.

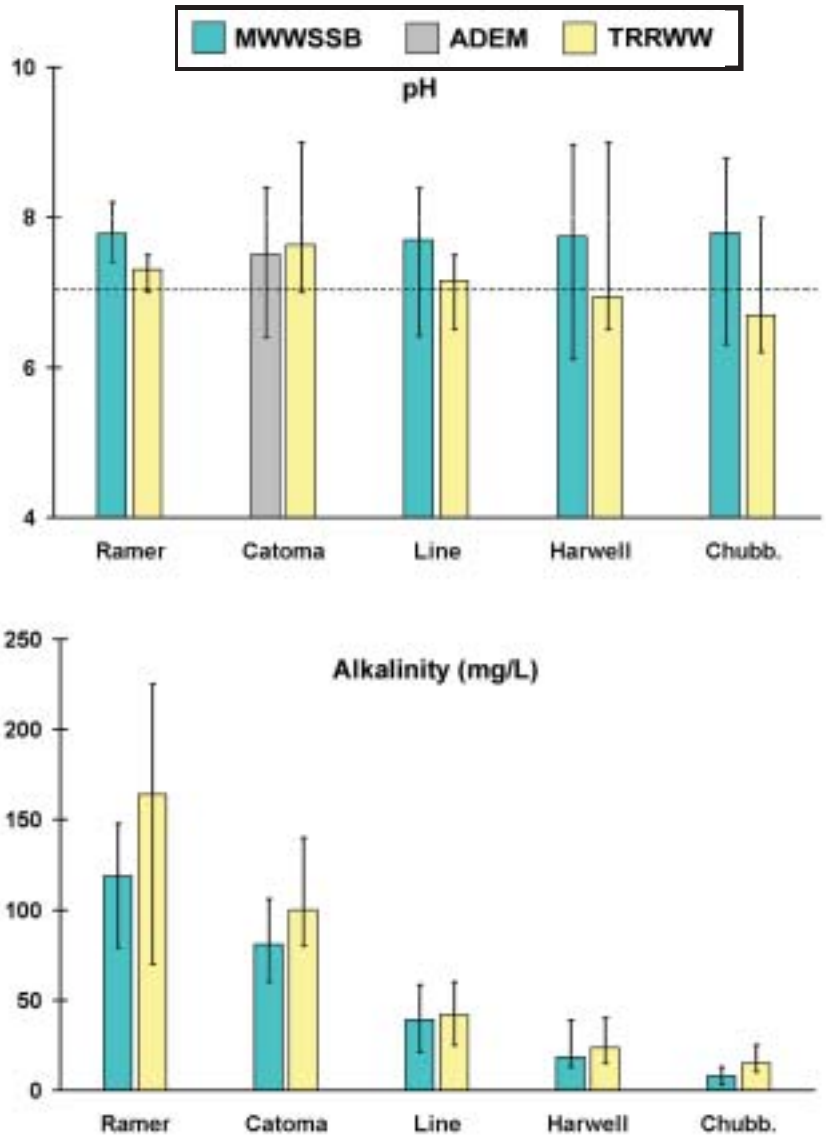
- Additional information about the site is presented on page 11.

Is the Citizen Information Reliable and Useful?

- It is important to compare the water information of AWW volunteers with professional data of universities or governmental agencies to determine its reliability. In the following graphs, 125 records of TRRWW data collected from 1999 to 2002 were compared with 134 data records from ADEM (2002) and Montgomery Water Works and Sanitary Sewer Board (MWWSSB, personal communication).

- The sites represent both the Alabama and Tallapoosa River Basins. Ramer Creek is in the Black Belt, Harwell Mill and Chubbehatchee Creeks are in the Coastal Plain, and Catoma and Line Creeks cut across these two physiographic provinces.

TRRWW Volunteers renewing their certification with hands-on testing



Bars represent the average value of a parameter. Lines within bars represent the range of values.

- TRRWW and agency data sets were generally similar and indicated that the pH was least variable in Ramer Creek and most variable in Harwell Mill Creek. The TRRWW data indicated that pH ranged from mildly alkaline at the Black Belt site to mildly acidic at the Coastal Plain sites.

- Both TRRWW and MWWSSB data were consistent in revealing the large variation in alkalinity of the five streams. This pattern may best be explained by soil types of the subwatersheds: Black Belt soils are well-buffered with carbonate and bicarbonate deposits whereas Coastal Plain soils are poorly buffered. This also explains the gradient of pH across the sites observed by TRRWW volunteers and the relative stability of pH in Ramer Creek.

- The agreement of TRRWW and agency data demonstrates that trained and conscientious citizens can collect valuable information for water resource protection and management.

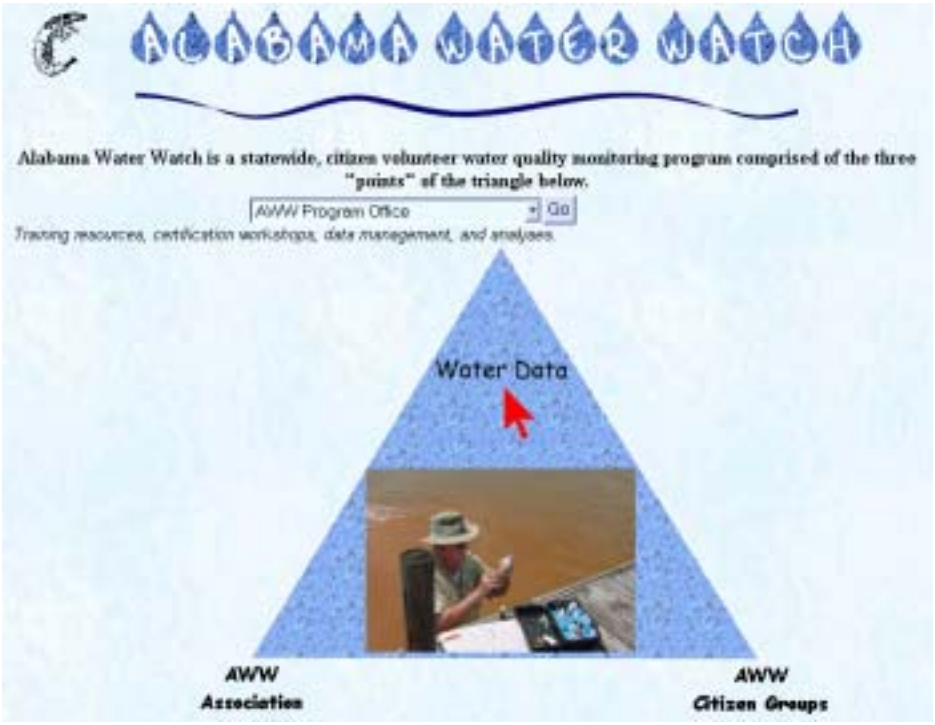
Channel catfish, *Ictalurus punctatus*

How Can the Use of AWW Water Data be Improved?

- The timely dissemination of quality-assured data in clear and simple ways is a vital element of a successful monitoring program. A relational database has recently been developed by the AWW Program to store, analyze and graph the vast amount of water data submitted by volunteers.

- Citizen monitors now have a powerful, new tool to determine the fundamental questions of water testing: Is the waterbody getting *better* or *worse*, and *why?*

- Anyone with Internet access can now view hundreds of summary graphs and maps of water data, and learn about training opportunities, special meetings and other aspects of AWW. They can also generate custom graphs of statewide water quality data and determine statistical trends. Certified monitors receive special privileges to enter their water data and add sampling site photos online.



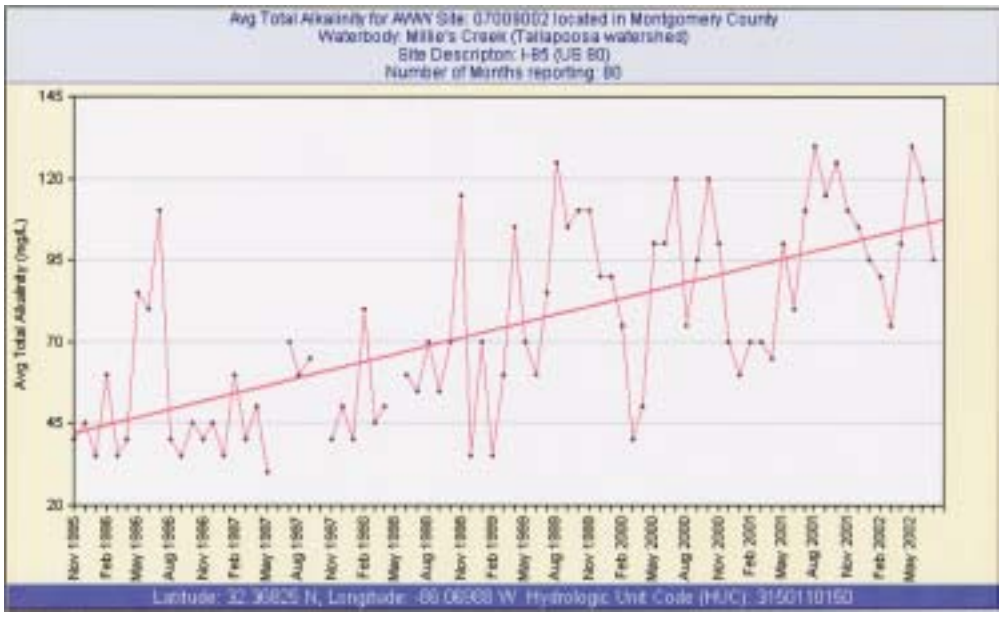
The Database is accessed through the "Water Data" link on the AWW homepage (http://www.alabamawaterwatch.org). More than 1,500 visits were made to the new database in the first three months.

Select Site Code	Waterbody Name	Site Description	Latitude	Longitude	HUC 11	# Chem Recs	# Bac Recs	# Bio Recs	Last Sampling Date	Site Status
07009001	Millie's Creek	Hwy 110, M-1, or Vaughn Rd, Peacock Property	32.3426	-86.0679	3150110150	52	32	0	9/12/2002	Active
07009002	Millie's Creek	I-85 (US 80)	32.3683	-86.0699	3150110150	80	40	0	9/12/2002	Active
07009004	Jenkins Creek	J1, Railroad Bridge	32.4004	-86.1159	3150110170	4	0	0	7/29/1995	Inactive
07009007	Jenkins Creek	J4, Ware's Ferry bridge	32.4031	-86.1143	3150110170	30	0	1	3/28/2002	Active
07009008	Jenkins Creek	J5, Vaughn Road	32.3437	-86.1120	3150110170	6	0	0	1/25/2002	Active
07009010	Johnson's Creek	Hwy 110	32.2722	-85.9859	3150110140	6	0	0	6/4/2000	Inactive

A searchable online list of TRRWW sites in the Tallapoosa watershed

- TRRWW was one of three pilot groups who assisted the AWW program with the online data entry project. This feature was premiered for use by all monitors on October 18, 2002, the 30th Anniversary of the Clean Water Act. By the end of 2002, monitors had already submitted about 400 data records.

- Citizen groups like TRRWW will continue to work with the AWW program to improve the database. This should greatly enhance the understanding of watershed trends among the general public and maximize the use of citizen data for improving water quality and policy.



Multi-year alkalinity data and trend line from Millie's Creek

A variety of maps are accessible through the AWW Database to help citizens understand water data and watershed characteristics. The two maps below are of the Millie's Creek watershed, about 20 km east of Montgomery. The red arrows indicate the location of TRRWW Site 2 (AWW Site 07009002).

Topographic map (TopoZone)

A 1998 aerial photo (MWWSSB)

A Summary of Key Water Quality Issues

A recent survey of people associated with TRRWW identified the following topics as important for discussion and action by all stakeholders in the watershed.

Urban / Suburban / Rural Interface

- How will the interface between the urban, suburban and rural areas be effectively managed?
- Will Phase I and II stormwater regulations improve stream quality?

Inventory of Environmental Assets

- Which areas are rich in mineral resources, wetlands, soils and biodiversity?
- What is the value of these resources and how much does each subwatershed and ecoregion possess?

Litter / Illegal Dumps

- What can be done about litter problems and illegal dumping in both rural and urban areas?
- How can controls and enforcement be created and maintained, along with continued public education?

An illegal trash dump at Baldwin Slough, which runs through Montgomery

Watershed Development

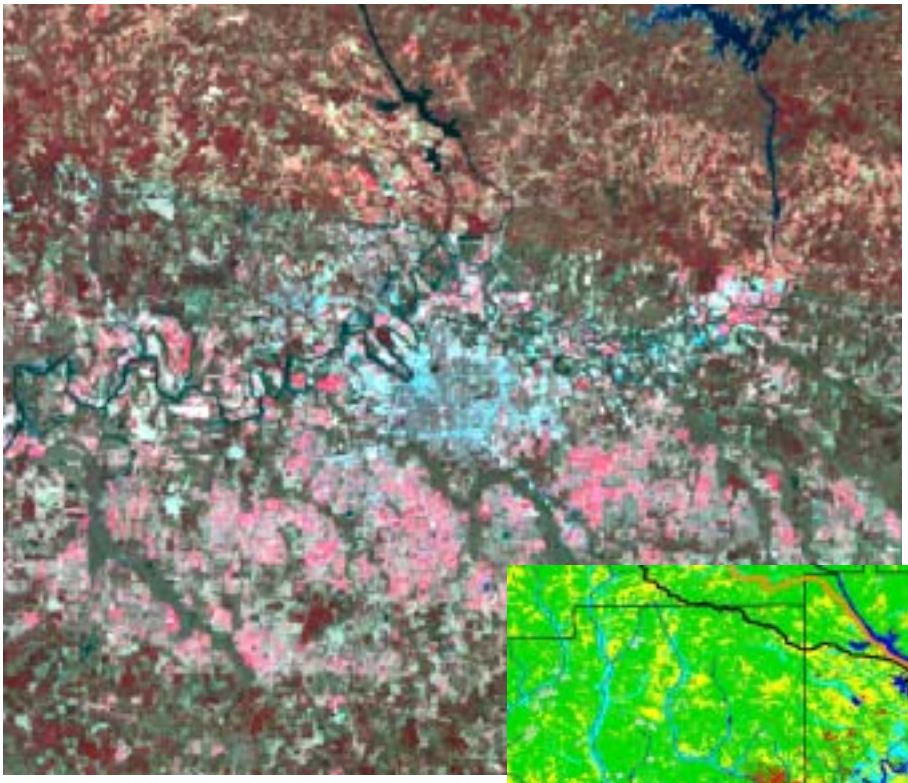
- How can the continuing growth in the Tri-River Region be planned and managed to protect local wetlands and other water resources?
- Who plans watershed development and what additional information is needed to make wise decisions?

TRRWW members meeting to discuss water issues in the Tri-River Region

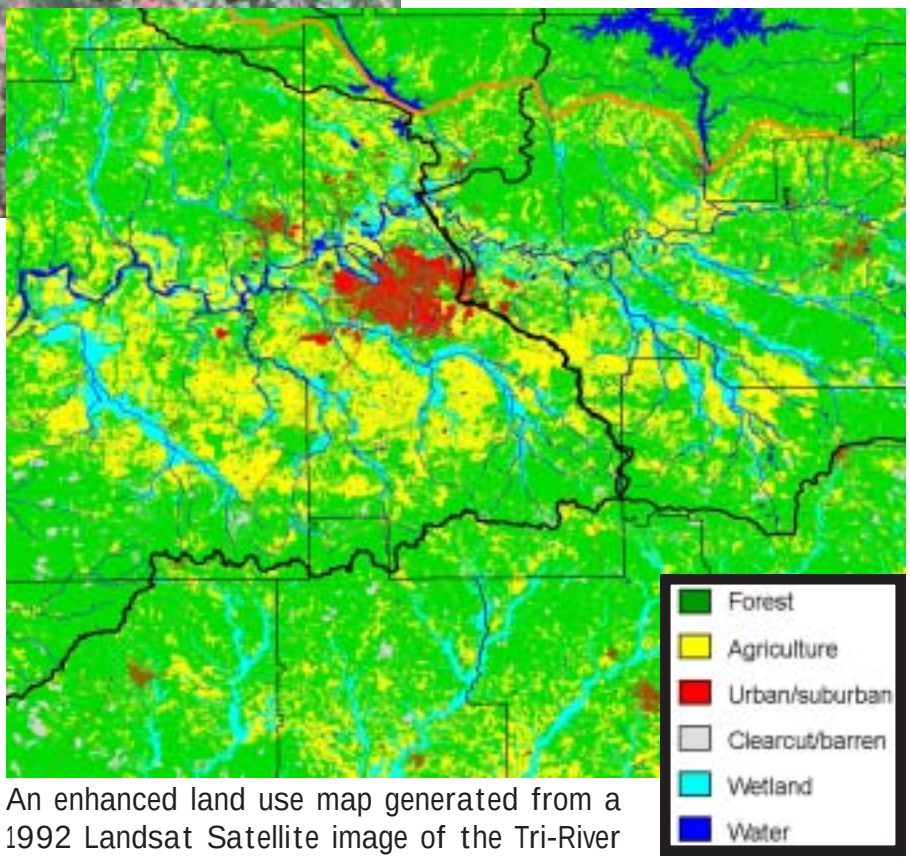
Stakeholder Action

- How can enforcement and authority of existing regulations be increased?
- What is the role of citizens in protection and management of local water resources?
- How can policy makers and legislators best be educated, along with the general public?

Satellite imagery is used to analyze changes in land use and environmental quality over a large scale. The images below indicate the great variety of land use in the Tri-River Region.



This image was made from an elevation of 915 km (596 miles). Specialized photography can detect and designate land areas with natural vegetation (red), agriculture (pink), and urban areas (light blue).



An enhanced land use map generated from a 1992 Landsat Satellite image of the Tri-River Region. Black lines indicate the three major subwatersheds (hydrologic units). Many changes have occurred over the last 10 years, particularly greater urbanization. The Fall Line (border between the Piedmont and Coastal Plain) is indicated (orange) in the upper right portion of the image.

Why Is Volunteer Monitoring Important?

There are several advantages of local, citizen-based water monitoring:

- frequent and consistent sampling
- 'eyes and ears' for waterbody changes and pollution... early warning system or first alert
- fast response time to detect and measure polluted runoff, invasive aquatic weeds and other changes
- neighbor-to-neighbor persuasion of polluters

Mike Jones testing the pH of the Alabama River

- local awareness and public outreach
- teaching the importance of water quality to youth
- important data supplement to agency and research studies
- leads to science-based, citizen-involved action plans

"Water is the essence of life. Without safe drinking water and ambient water, the quality of life as we know it will stop."

-Buddy Morgan,
General Manager, MWWSSB

Some members of the Tri-River Region Water Watch

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Citizen Guide to Alabama Rivers: Alabama, Coosa, and Tallapoosa. Alabama Water Watch, Auburn University. 16pp.

AWW. 2002b.
Citizen Volunteer Water Quality Monitoring on Alabama's Coast: Wolf Bay. Alabama Water Watch, Auburn University. 16pp.

Monitor Jim Liner measures Dissolved Oxygen at Corn Creek

"With more industries moving into our area, we want to work harder to educate and branch out to those newly developed areas and sign up volunteers to monitor water quality."

-Ginger Taylor, Amanda Fleming, and Debbie Whitaker TRRWW Monitors

Acknowledgments

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- Auburn University Environmental Institute
- Auburn University Agricultural Experiment Station
- CRAFTMASTER Printers, Inc.

Monitor Ann Thweatt getting recertified

For further information...

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TRRWW Mission Statement

"To determine the quality of water resources in the Tri-River Region through monitoring and assessment, educate the public about the quality of these water resources and recommend activities to protect and/or restore the streams and creeks in central Alabama."

The Tallapoosa River near Montgomery in the Coastal Plain

Alabama Water Watch

Alabama Water Watch is a citizen volunteer water quality monitoring program based 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 Alabama Water Watch Association is a nonprofit affiliation of water monitoring groups and other interested citizens, that promotes the AWW Program as well as advocates better water quality and water policy through monitoring, education and outreach.

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