Citizen Volunteer
Water Quality Monitoring
on Alabama's Coast

...protecting unique estuaries and streams

Weeks Bay

Alabama Water Watch
April 2001
Alabama’s coast is priceless in terms of the ecological, economic and social benefits it provides. Our vast coastal wetlands serve to naturally filter and purify water, and they provide essential habitat for a tremendous variety of plants and animals. Estuaries are where “the rivers meet the sea,” and these brackish water environments are nursery areas for many fishes, shrimp, crabs and other organisms. Alabama’s beaches are the source of millions of tourist dollars as people seek the rich recreational, historical and aesthetic qualities of our coast.

The benefits of living near the coast have attracted many new people, and the rapid increase in population and accompanying land use changes have resulted in major challenges for planners and coastal resource managers. For example, Baldwin County grew from about 98,000 people in 1990 to more than 120,000 in 2000. This rate of growth underscores the importance of understanding and protecting our coastal environments before they are irreparably damaged.

Much of the scientific information that is essential for the protection and restoration of Alabama’s coast is incomplete or is in technical reports that are not readily accessible or understandable to the general public and key decision makers. Since 1994, however, many citizen groups have been voluntarily collecting coastal water quality data as part of the AWW program. Their findings have already begun to provide valuable trend data that have been used to correct local problems and establish a baseline for assessing change. The purpose of this report series is to feature citizen data, establish their validity, interpret their meaning, and move toward community-based action strategies of how to best manage and protect our coastal environment.

Current Titles:
Volume 1 Weeks Bay

Future Titles:
Volume 2 Wolf Bay
Volume 3 Dog River
Volume 4 Threemile Creek
Volume 5 Perdido Creek
...and others!

Acronyms:
AU (Auburn University) ACES (Alabama Cooperative Extension System)
AWW (Alabama Water Watch) ADEM (Alabama Department of Environmental Management)
DO (dissolved oxygen) AWWA (Alabama Water Watch Association)
GSA (Geological Survey of Alabama) BMPs (Best Management Practices)
USA (University of South Alabama) NRCS (Natural Resource Conservation Service)
WBWW (Weeks Bay Water Watch) WBNERR (Weeks Bay National Estuarine Research Reserve)

Series Editor and Text: Dr. Bill Deutsch
Data Processing and Graphics:
Allison Busby and Eric Reutebuch
Design and Layout:
Wendi Hartup and Bill Deutsch
Series Advisor: Dr. Miriam Fearn, USA
Reviewers: Dr. John Jensen, AU
Randy Shaneyfelt, Patti Hurley and
Fred Leslie, ADEM
Allison Newell and Debbie Berry, AWWA

Cover photos: Top-left: Pitcher plants in a bog near the WBNERR; Top-right: Eve Brantley collecting a bacteriological (E. coli) sample on the Fish River; Bottom-left: Landsat Satellite photo of Weeks Bay; Bottom-right: Striped mullet (Mugil cephalus), a common fish of the Weeks Bay watershed.
Weeks Bay...Facts and Figures

• Weeks Bay is located in southwest Alabama in Baldwin County. The bay is connected to the greater Mobile Bay, and has two major tributaries: the Fish River and the Magnolia River. Weeks Bay has a surface area of 1,700 acres and its watershed is about 200 square miles (note: a watershed is the total land area which drains to a common point such as a bay, lake or larger river).

• Weeks Bay is designated as an ‘Outstanding National Resource Water’ or ONRW, because of its excellent condition and ecological importance. Only two other water bodies in Alabama are classified ONRW: the Sipsey River in the northwest, and the Little River in the northeast. No permitted point source discharges of waste water are allowed on ONRW waterbodies.

• The Weeks Bay National Estuarine Research Reserve is located on the northwest side of the bay, and is a premiere facility for public education, research and overall understanding of Weeks Bay. The Watershed Coordinators at the Reserve have been instrumental in establishing a group of citizen volunteer water quality monitors for the watershed.

• The citizen monitors are members of a group called Weeks Bay Water Watch. They formed in affiliation with AWW in 1994, and have continuously monitored about 20 sites in the watershed (see map at left).

• About two dozen citizens of WBWW have submitted 1,920 chemical data records and 1,320 bacteriological data records over the last seven years. They received an award in 1997 for collecting the most samples of all AWW groups statewide. Most of this information, including site maps and data graphs, has been entered into a statewide database and is posted on the AWW website.
What Do Volunteers Do?

- Citizen volunteers in WBWW 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 and bacterial concentrations (Deutsch et al. 1998a). All monitors attend an annual refresher course to maintain good sampling techniques and replenish their test kits with fresh chemical reagents.

- The volunteer monitors help the AWW program keep accurate water quality data, and present the information to watershed residents, regulatory agencies, policy makers and other interested citizens. The citizen data set has become one of the most important sources of water quality information for Weeks Bay.

- Staff of the WBNERR have become certified AWW Trainers and Quality Assurance Officers, and they regularly conduct workshops for the WBWW and citizens in the Mobile Bay and Coastal Plains watersheds.

- Eve Brantley (ACES) and Margaret Sedlecky (WBNERR) were recognized as Trainer and QA Officer of the Year, respectively, at the 2000 AWW Annual Meeting. Richard Coram (WBWW) received the “Second Mile” award at the 2001 ADEM Nonpoint Source Conference for his work in preventing and controlling polluted runoff.

- The Weeks Bay Citizen Advisory Committee is a group of concerned educators, business people, policy makers and other citizens who work to protect and restore the watershed and support the WBWW activities.

Everette Weeks, Vice-Chairman of the Weeks Bay Project Citizens Advisory Committee, pointing to the location of a beach restoration/shoreline stabilization project on Weeks Bay.

Harry Larsen of WBWW samples on the Magnolia River.

“`I’m not saying the Weeks Bay Water Watch group is solely responsible for maintaining water quality at state water quality standards. However, I do think they are playing an important role in the community as representatives and educators to the responsibility everyone has in natural resources stewardship.’’

- Richard Coram, WBWW Volunteer

Dan and Carmen Perkins enthusiastically participated in the 2000 Weeks Bay Watershed River Cleanup.
In addition to water quality sampling, several of the AWW monitors in the Weeks Bay watershed are active in educational outreach and advocacy for greater awareness of water quality issues.
What Have Volunteers Found?

- After several years of monitoring a site, a valuable record of water quality trends is established. The WBWW graphs on pages 6-9 document seasonal changes in water quality in the Fish and Magnolia Rivers and Weeks Bay over the last four to six years. Sources of these data come from AWW Annual Reports (see References). The gray, dashed line on the dissolved oxygen graphs represents the minimum (5 ppm) for waterbodies classified as ‘Fish and Wildlife’. The dashed line on the pH graphs represents the neutral value of 7.0. This important information reflects the dedication and concern of the WBWW volunteers who did all the testing!

In the Bay…

- The water temperature of Weeks Bay varied from about 32 C (90 F) in summer (July) to about 12-14 C (54 to 58 F) in winter. Dissolved oxygen concentrations fluctuated inversely with temperature (as expected) and ranged from 4-6 ppm (parts per million) in summer to about 11 ppm in winter. Except for a brief period in the summer of 1999, DO concentrations were above the 5 ppm minimum for waterbodies classified as ‘Fish and Wildlife’.

- The pH of Weeks Bay was relatively stable and varied from 5.5 to 9. Most of the time, it was in the “mildly alkaline” range (slightly above 7).

- Alkalinity is a measure of the “buffering capacity” of water, primarily influenced by the concentration of carbonates and bicarbonates. The alkalinity of Weeks Bay steadily increased over a four-year period, from a low of 10 mg/L to a high of 80 mg/L. This interesting trend detected by the citizen monitors probably reflects the drought cycle that has occurred in Alabama. Less flow of freshwater from tributaries and groundwater resulted in a concentration of dissolved substances in the bay, including carbonates and bicarbonates, thus raising alkalinity.
In the Magnolia River…

- The temperature of the Magnolia River was more stable and cooler in the summertime than in Weeks Bay. This was almost certainly because of large springs which create the river, and the riparian (streamside) tree canopy which shades the river. The DO of the river usually ranged from 6-8 ppm and only occasionally fell below the minimum standard for ‘Fish and Wildlife’.

- The pH of the Magnolia River was very consistent at about 6, indicating a “mildly acidic” environment that is characteristic of freshwater coastal wetlands. Decomposing vegetation produces organic acids which typically depress pH below neutral.

- The alkalinity of the river was much lower than the bay because the acidity of the river “consumes” its buffering capacity. Although alkalinity usually ranged from 10-20 mg/L during the six years it has been monitored, it rose to above 30 mg/L during the severe drought of 2000.
In the Fish River…

- Seasonal patterns of water quality at a site in the upper watershed of the Fish River were generally similar to those in the Magnolia River, although water temperature was usually lower and DO was usually higher in the Fish River. DO ranged from about 7-9 ppm and was consistently above the minimum standard.

- Alkalinity and pH in the Fish River were virtually the same as in the Magnolia River except that alkalinity did not seem to be affected as much by the drought of 2000. The good water quality at site 25 on the Fish River is attributed to its position in the upper, more forested, part of the watershed, with proportionately greater influence from springs and a shaded streamside zone.

- Although water quality at the three WBWW sites illustrated on pages 6-8 indicated that the bay and the two main rivers were generally healthy, certain tributaries of both rivers had poorer water quality that suggested subwatershed degradation. Page 9 explains these sites.
The graph and map on this page depict the dissolved oxygen patterns at tributary and bay sites monitored by WBWW. The numbers on the graph correspond to the site locations on the map. This information reflects a considerable sampling effort, totaling about 830 readings on each of the Fish River and Magnolia River subwatersheds from 1994 to 2000!

Bars are color-coded to represent stream oxygen levels in terms of a traffic light (see key). The bar length is the average DO reading at the site, and the line within a bar is the range of values. Bars are green if the average DO was above 5 ppm and the minimum was at least 3 ppm; yellow if the average DO was above 5 ppm and the minimum was below 3 ppm; and red if the average DO was below 5 ppm.

Six of the 10 sites monitored in the Fish River and three of the four sites on the Magnolia River had DOs that were sometimes or usually below standard.

Some of these sites may have naturally low DO because of their proximity to wetlands with a high degree of vegetative decomposition and relatively high temperatures. In addition, a monitor reported that Weeks Branch (Site 11) was a free flowing stream until a natural impoundment by beavers altered its characteristics to a shallow, stagnant pool.

Citizen data indicated that Turkey Branch (Fish River tributary, Site 9), on the northwest side of the bay, was stressed with low DO. A “stream walk” and land use analysis are warranted to determine the cause of this unusually low oxygen level before the problem becomes more serious.
Is the Volunteer Information Reliable?

- It is important to compare the citizen data of AWW volunteers with research data of universities and governmental agencies in order to determine their reliability. The graphs to the left compare WBWW data with data from ADEM and GSA at similar sites and times.

- Citizen data compared favorably with research data. For example, all data sources indicated that water temperature, dissolved oxygen concentration and pH were slightly higher at the Fish River site than at the Magnolia River site.

- These results are not intended to make generalizations about the water quality of the rivers as a whole, but to underscore the reliability of citizen data for use by coastal managers and regulatory agencies.

GSA and WBWW data were collected during 1998 from the Fish River near the Highway 98 bridge, the Magnolia River near the County Road 49 bridge, and the Perone Branch near the Highway 54 bridge. ADEM data were collected at the Fish River site (sources of information: GSA 1998, Deutsch et al. 1998c and Mobile Branch of ADEM Field Operations, personal communication). A bar represents the average readings (April through September) of a parameter, and the vertical line at the top of a bar represents the range of readings. About six samples of each parameter were compared per stream site.
In 2000, Scott Phipps, the Research Coordinator of the WBNERR, installed a Yellow Springs Instruments (YSI) electronic data logger near the site of a WBWW monitor on the Fish River near the Highway 98 bridge. This was an important “blind test” to determine the validity of citizen data.

The graphs compare the citizen data with those collected by the expensive, YSI equipment for three parameters over eight sampling dates, and they reveal the striking similarity between the two sources of water quality information.

When citizens are serious about good training, careful monitoring and quality assurance protocols, they produce credible and cost-efficient data. It’s time to bring WBWW data into full use by resource conservationists and managers!

Scott Phipps of WBNERR practices AWW water sampling techniques.
A Summary of Key Water Quality Issues

The issues presented on pages 12 and 13 are being addressed by WBWW volunteers and are meant to be points of discussion for all stakeholders in the watershed.

1. Sedimentation
   - How can BMPs for dirt roads and other sites of bare soil be implemented to prevent erosion and sedimentation of the streams and bay?

The graph above documents the rapid population growth of Baldwin County, AL, including projections to 2020. The maps below are of the upper Weeks Bay area and document the significant conversion of natural land cover to agriculture and urban development. What will this area look like in 2020?

2. Watershed Development
   - How can forest and farmland conversion be planned and managed to protect the watershed?
   - What is “sustainable development” within the Weeks Bay watershed?
   - Who plans watershed development and what additional information is needed?

Land use changes in the Weeks Bay watershed from... 1949 to 1986

Natural Vegetation
Converted Land
A land use map generated from a 1992 Landsat satellite image of the Weeks Bay watershed, with the Fish River and Magnolia River subwatersheds demarcated in black.

3. Low Dissolved Oxygen
- What is the cause of low DO in several tributaries of Weeks Bay?
- What are the sources of excess nutrients and organic matter that degrade water quality?
- How can degraded streams be restored?

4. Invasive and Endangered Species
- How can non-native plants and animals be controlled in the watershed?
- How can threatened or endangered species be monitored and protected?

5. Habitat Loss
- How can wetlands be more appreciated and conserved?
- How can tree canopy and streamside buffer zones be protected and expanded?

6. Stakeholder Action
- How can policy makers and the public be made aware of the condition and changes in Weeks Bay?
- What is the role of the citizen in protection and management of the bay?

“An improvement I can immediately recall is a decrease in turbidity of the Magnolia River after the application of crushed limestone on two dirt roads that were contributing heavy amounts of clay with each rain event. I saw an immediate improvement in water clarity with the use of alternative road surfacing.”

Carey Bentley, WBWW Volunteer

Spotted gar, Lepisosteus oculatus
Why Is Volunteer Monitoring Important?

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

Case Study... A Successful Partnership

In the headwaters of Weeks Creek (a tributary of the Magnolia River), high counts of E. coli, low dissolved oxygen, and high temperatures were consistently reported by citizen monitors. These volunteers were able to provide hard data to the NRCS, to the Fish and Wildlife Service, and to the farmer who allowed unrestricted access to the stream by his cattle. The stream banks were eroded, the creek was not shaded by vegetation, and untreated livestock waste was entering the stream. Data presented by Weeks Bay Water Watch assisted in organizing a project that led to restricting cattle from much of the stream, replanting streamside vegetation, and providing alternative water sources for livestock. Using existing cost-share programs to complement each other, an attempt was made to decrease the impacts to the stream and provide money to the farmer to accomplish the improvements.

Advantages of Local, Citizen-Based Water Monitoring

- large number of sampling sites
- frequent and consistent sampling
- ‘eyes and ears’ for waterbody changes and pollution... early warning system or first alert
- neighbor-to-neighbor persuasion of polluters
- local awareness and public outreach

- fast response time to detect and measure polluted runoff, invasive aquatic weeds and other changes
- important data supplement to agency and research studies
- leads to science-based, citizen-involved action plans
References


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“Although we have wanted to wring a few necks from time to time, mostly our problems have been solved in a cooperative spirit with Baldwin County, local farmers, local developers and watershed residents.”

- WBWW monitor

Mouth of Turkey Branch at the Fish River
For further information...

Weeks Bay Water Watch
11300 U.S. Hwy 98
Fairhope, AL 36532
Phone: (251) 928-9792
Fax: (251) 928-1792
Email: watershed.weeks@noaa.gov

Nolte Creek, a tributary of the Magnolia River

“The Alabama Natural Heritage Program’s Weeks Bay Watershed Conservation Assessment indicates that Weeks Bay and its tributaries are in a precarious situation, and the first and second order streams are showing the first signs of stress. This makes the Weeks Bay Water Watch volunteers an absolute necessity, working as ‘first alert’ for negative changes that could be addressed before more serious downstream impacts occur. They will become more and more important as the population explosion continues.”

- WBWW monitor

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.

Program:
Alabama Water Watch
Department of Fisheries
203 Swingle Hall
Auburn University, AL 36849
Toll Free: 1-888-844-4785
Fax: (334) 844-9208
Email: aww@acesag.auburn.edu
Website: http://www.alabamawaterwatch.org

Association:
Alabama Water Watch Association
860 Alford Avenue
Hoover, AL 35226

Executive Director: Allison Newell (arnawwa@aol.com)
President: Dan Murchison (danmurch@aol.com)

Program Manager: Dr. Bill Deutsch
Data Quality Coordinator: Allison Busby
Monitor Coordinator: Kim Johnson
Special Projects Coordinator: Wendi Hartup

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