

***MONITORING
WATER QUALITY AT THE
EPICENTER OF
AQUATIC BIODIVERSITY***

***2010 National Water Quality Monitoring
Conference***

Presentation Outline

- **Alabama Water Resources**
- **Alabama Aquatic Biodiversity**
- **Monitoring Water Quality in Alabama**

The River (Delta) State



✓14 Basins

✓629 Subwatersheds

✓77,248 river/stream miles

✓490,472 acres in 43 reservoirs and lakes

✓3,600,000 acres of freshwater wetlands

✓390,398 acres of estuaries, tidal waterways, and bays (Mobile Delta: Second largest intact river delta system in US)

Alabama Water Resources

Municipal, Industrial, Agricultural Uses



Alabama Water Resources

Recreation



Alabama Water Resources

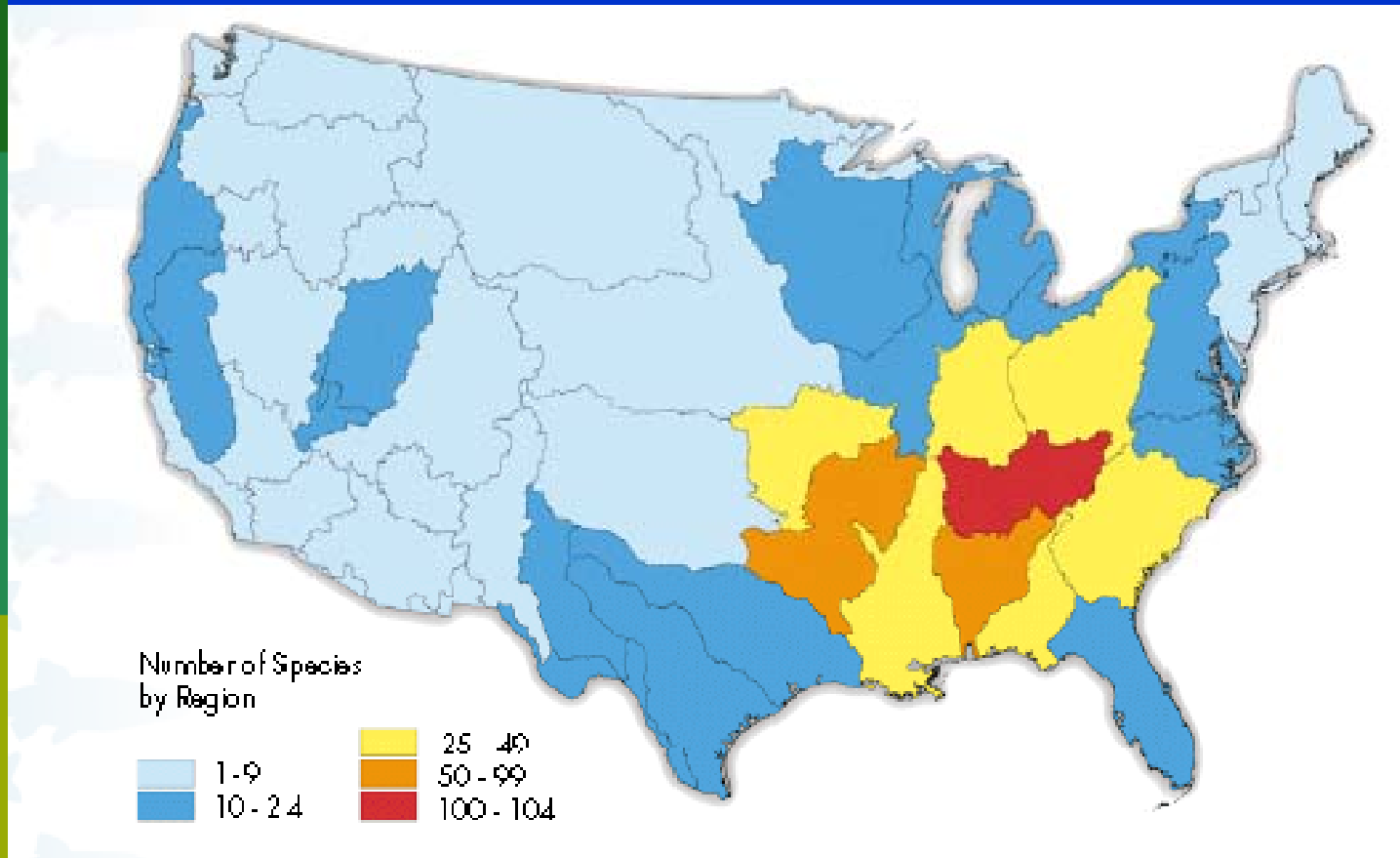
Aquatic Biodiversity



Aquatic Biodiversity of Alabama

National Importance

Biological Hotspots



Banded Darter
Etheostoma zonale



Alabama's Rich Biodiversity

National Rankings
#5 total diversity
#1 aquatic diversity

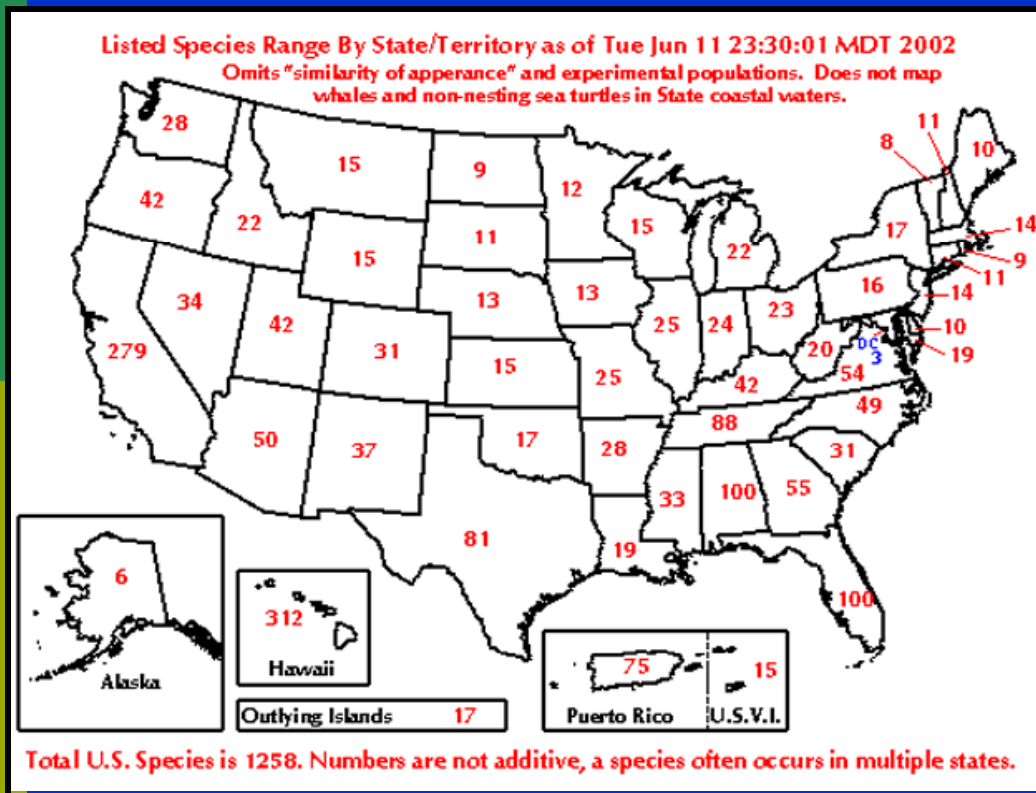


Etowah Darter - Endangered

Freshwater mussels



Tulotoma snail - Threatened



Distributions of Freshwater Species in Selected Southeastern States

	<i>Mussels (301)</i>	<i>Snails (702)</i>	<i>Crayfish (338)</i>	<i>Fish (1021)</i>	<i>Amphibians (163)</i>
<i>Alabama</i>	<i>178</i>	<i>204</i>	<i>85</i>	<i>308</i>	<i>69</i>
<i>Tennessee</i>	<i>132</i>	<i>87</i>	<i>62</i>	<i>298</i>	<i>66</i>
<i>Georgia</i>	<i>118</i>	<i>83</i>	<i>53</i>	<i>219</i>	<i>81</i>
<i>Kentucky</i>	<i>103</i>	<i>62</i>	<i>47</i>	<i>220</i>	<i>49</i>



Procambarus sp. - Endangered
Bouge Chitto Burrower
Perry County, Alabama

Why So Special?

Prehistory

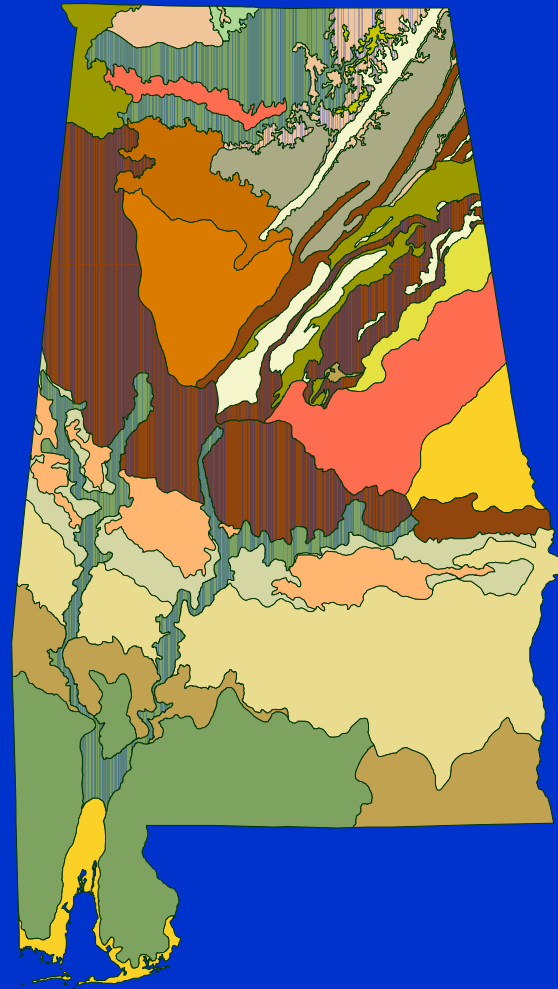


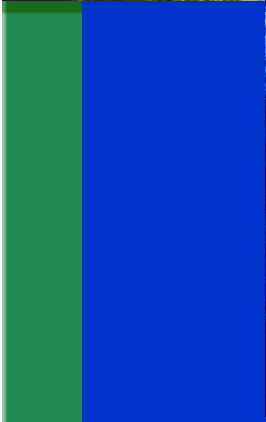
- **No glaciation during the Ice Age**
 - Temps not as cold in SE
 - Species displaced to the south

- **Varied geography with a unique range of habitats**
 - Cumberland Plateau mountain streams to Gulf of Mexico coastal plains
 - Knobs and ridges, valleys and swamps.
 - Five major physiographic regions.

Alabama's Physiography: Ecoregions

- *Highland Rim*
- *Cumberland Plateau*
- *Alabama Valley and Ridge*
- *Piedmont Upland*
- *East Gulf Coastal Plain*





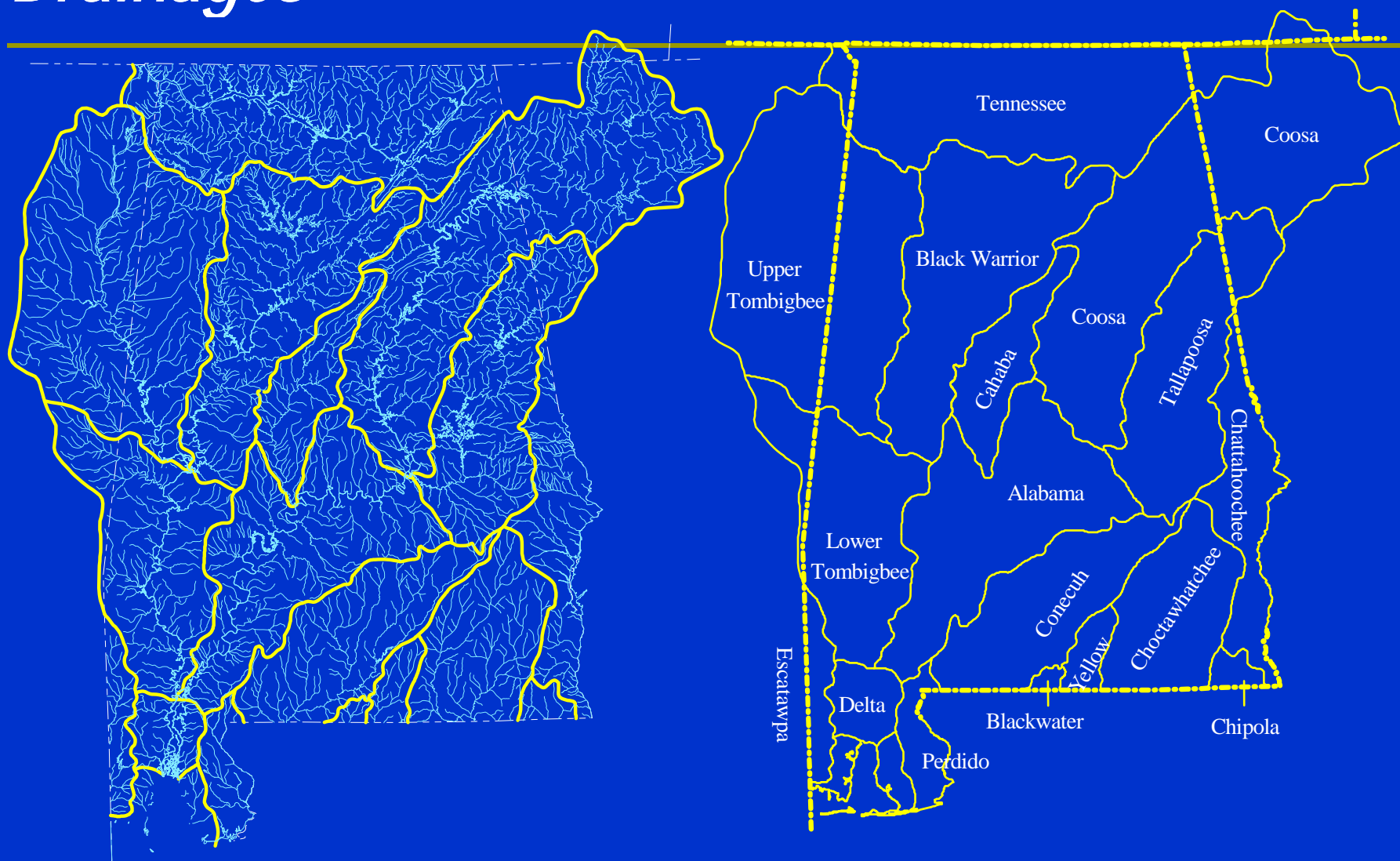


Why So Special?

A Lot of Water in Alabama

- **77,000 miles of river and stream channels**
 - First in the nation in navigable channels (1438 miles)
- **500,000 acres of major lakes and reservoirs;**
- **3.6 million acres of wetlands;**
- **Daily water yield per square mile of drainage basin**
 - Mobile River basin = 0.94 mgd/mi²
 - Mississippi River basin = 0.34 mgd/mi²
 - Columbia River basin = 0.70 mgd/mi²
 - Apalachicola River basin = 0.86 mgd/mi²

Drainages



Alabama Fishes

Redbanded Darter



Rainbow Darter



Gulf Sturgeon

Diversity of Fishes

- ❑ **308 native freshwater species**
 - 61 species endemic
- ❑ **85 marine and estuarine species**
 - Mobile Delta and freshwater tribs to Mobile Bay
- ❑ **Diversity higher than any other N. AM. political unit;**
- ❑ **One of largest faunas for any comparable area of the temperate world**
 - 54% of extant freshwater species of SE US
 - 38% of extant freshwater species of entire US and Canada combined

Southern Walleye
Sauger vitreus



Alabama Fishes



Trispot darter



Alabama darter



Slackwater darter



Alabama sturgeon

Alabama Crayfishes

- ❑ Most biologically diverse state in the US.
- ❑ 85+ species
- ❑ 23% of North American diversity



Procambarus sp.
Bogue Chitto Burrower



Cambarus diogenes



Procambarus clarkii

Alabama Crayfishes



Cambarellus puer



Cambarus girardianus



Faxonella dypeata



Orconectes erichsonianus

Alabama Mollusks



- ❑ 178 species historically found in Alabama.
- ❑ Highest diversity & number of species in US.
- ❑ 43% of native freshwater snails & 60% of native freshwater mussels in the US.
- ❑ 77% of snails and 34% of mussels endemic to Alabama river systems.

Alabama Freshwater Gastropods

Photo: Chris Luthgart

Pleurocera canaliculata

Brown Hornsnail



204 species historically found in Alabama
29% of North American species

Alabama Snails



Lioplax pilsburyi



Lithasia armigera



Tulotoma magnifica



Pomacea paludosa



Gyrotoma excisa



Lithasia geniculata



Io fluvialis

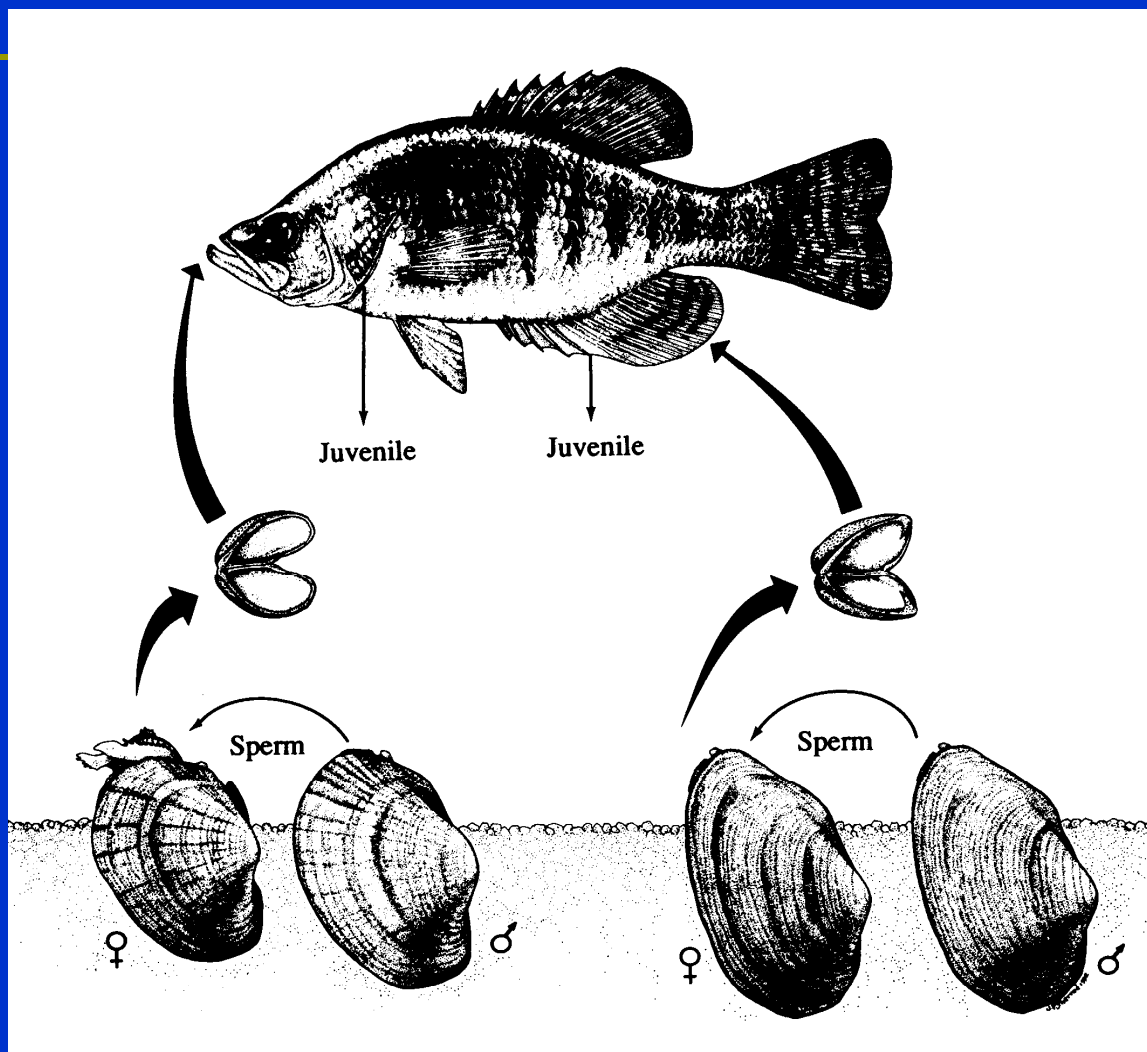


Campeloma decampi



Tulotoma magnifica colony , Coosa River, Elmore County, Alabama.

Life Cycle of a Freshwater Mussel



- ◆ *Host Fish Dependent*
- ◆ *Immobile*
- ◆ *Filter Feeders*
- ◆ *Long Lived*

Mussel Courtship: “fishin’ for a host”

Orangenacre mucket
Hamiota perovalis



Lampsilis ornata
Southern Pocketbook



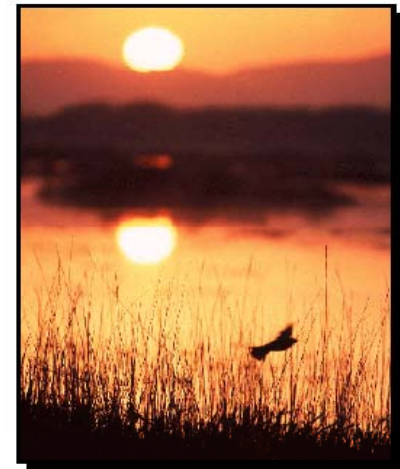
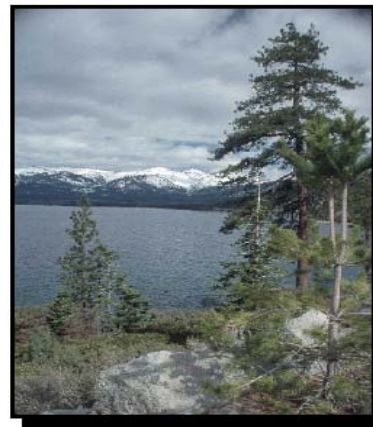
*Monitoring the Quality
of Alabama Water
Resources*

EPA
Monitoring
Strategy
Requirements



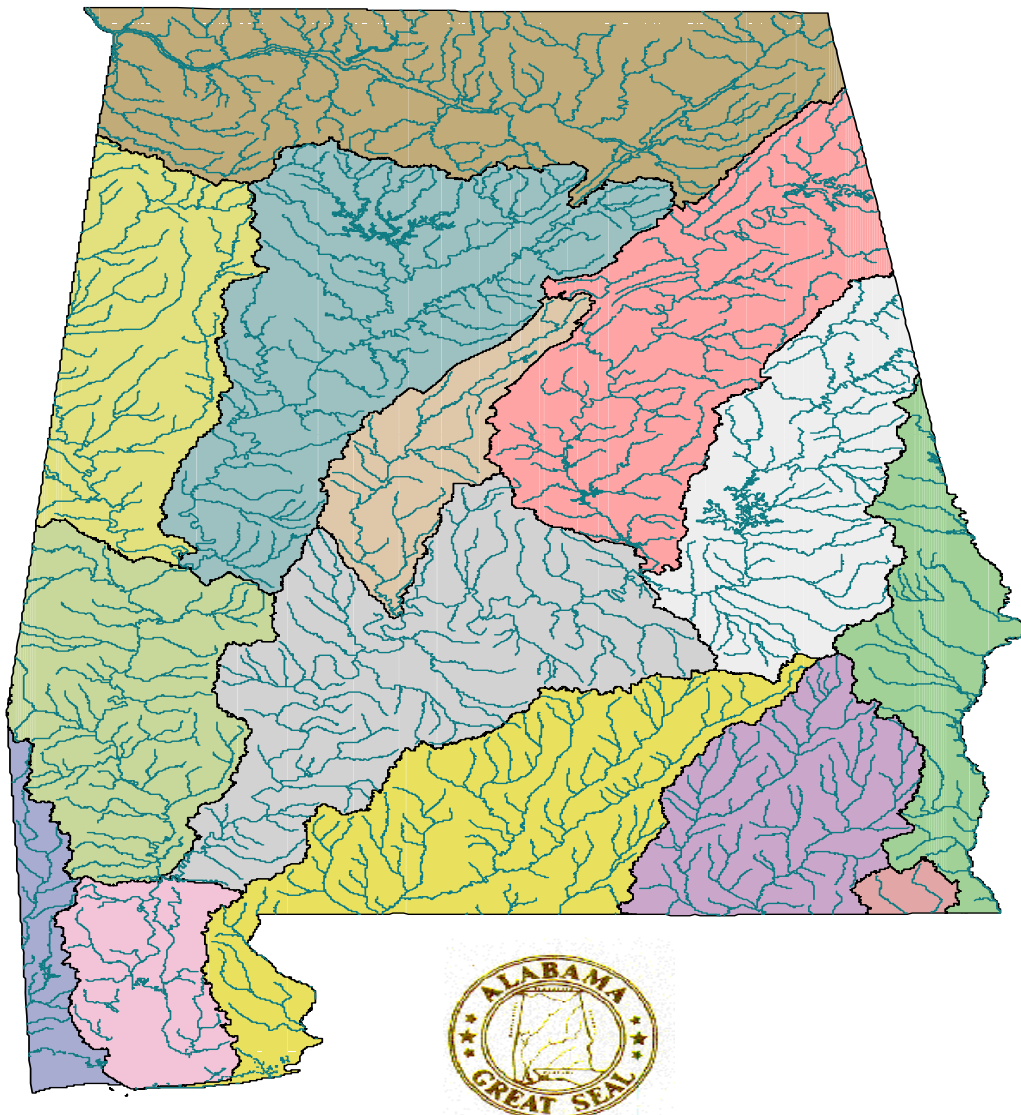
**Elements of a State Water
Monitoring and Assessment
Program**

March 2003



ADEM
Monitoring
Strategy
2005

State of Alabama
Water Quality Monitoring Strategy

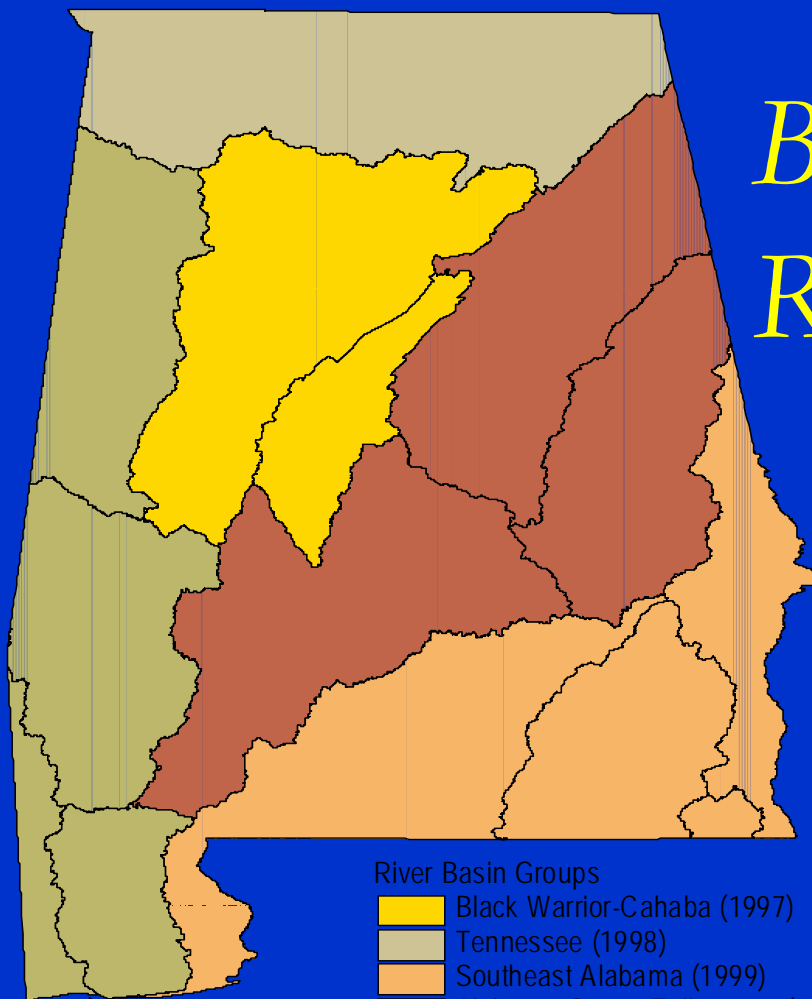


Alabama Department of Environmental Management
July 12, 2005

ADEM

Water Quality Monitoring

Basin Rotation Strategy



River Basin Groups

- Black Warrior-Cahaba (1997)
- Tennessee (1998)
- Southeast Alabama (1999)
- Alabama-Coosa-Tallapoosa (2000)
- Escatawpa-Mobile Bay-Tombigbee (2001)



ADEM Monitoring Strategy

Goals

- ❑ **Water quality criteria development**
- ❑ **Water quality criteria attainment**
- ❑ **Water quality trends**
- ❑ **TMDL development**
- ❑ **Categorize waters for the Integrated Report**

Coordination, Communication, Collaboration: Water Division, Field Operations, NPS Program

- ❑ Starts or ends here!
- ❑ Integral to a successful monitoring program
 - Everyone works together





ADEM Water Quality Monitoring

□ Field Operations Division

■ Montgomery Branch

- Biological Assessments**
- Bioassays**
- Rivers & Streams Program**
- Rivers and Reservoirs Program**
- Fish Tissue Monitoring Program**
- Water Quality Monitoring Coordinator**

■ Mobile Branch

- Coastal Monitoring**
 - Estuaries**
 - Streams and Rivers**

■ Birmingham Branch

■ Decatur Branch

□ Water Division

- Special Studies**
- Criteria/Standards**
- Assessment/Listing Methodology**
- Wasteloads/Modeling**
- TMDLs**
- Integrated Assessment Report (305b/303d)**

□ Nonpoint Source Program

- Section 319 Grants**
- Nonpoint Source BMPs**
- Watershed Management Plans**
- Stream Restoration**

Coordination, Communication, Collaboration



□ State

- ADEM
- ADPH
- ADCNR
- GSA
- SWCC

□ Federal

- USEPA
- USGS
- NOAA
- TVA
- USDA/NRCS

□ NGOs

- Alabama Water Watch
- Clean Water Partnership
- Many, Many Others

□ Universities

□ Business and Industry

Water quality monitoring



Mollusk surveys

ADEM

Fish movement and passage studies



ADEM Monitoring Programs

Rivers & Streams Monitoring Program



Rivers & Streams Monitoring Program (RSMP)



- ❑ Established 2005 *
- ❑ Objectives
 - Estimate overall water quality
 - Categorize waters
 - Develop criteria and BCGs

Rivers and Streams Monitoring Program

- Basin Assessment
- Reference Reach Monitoring
- Ambient Trend Monitoring
- Targeted Monitoring
 - 303(d) Monitoring
 - Use Attainability Assessments
 - Special Studies
 - NPS Intensive Surveys
 - Clean Water Partnership Requests

Rivers & Reservoirs Monitoring Program (RRMP)



ADEM Rivers and Reservoirs Monitoring Program



- Established 1990 (RWQM)
- Objectives:
 - Develop a comprehensive water quality database
 - establish long-term trends
 - conduct biennial assessments of water quality
 - CWA Section 314

ADEM Rivers & Reservoirs Program



- ▣ Basin Assessment
- ▣ Critical Period
- ▣ Compliance Monitoring
- ▣ Ambient Trend Monitoring

Fish Tissue Monitoring Program





Fish Tissue Monitoring Program (FTMP)

- ❑ Established 1991
- ❑ Cooperative Effort
 - ADEM < > ADPH < > ADCNR < > TVA
- ❑ Objectives
 - Focus basin
 - Repetitive exceedance sampling
 - "New" areas.

Target Parameters

□ Pesticides

- 4,4-DDD, DDE, and DDT
- 2,4-DDD, DDE, and DDT
- Chlordane
- Chlorpyrifos
- Dieldrin
- Endosulfan I and II
- Endrin
- Lindane
- Heptachlor
- Heptachlor epoxide
- Hexachlorobenzene
- Mirex
- Toxaphene

□ Metals

- Arsenic
- Cadmium
- Selenium
- Mercury
- Lead

□ Other

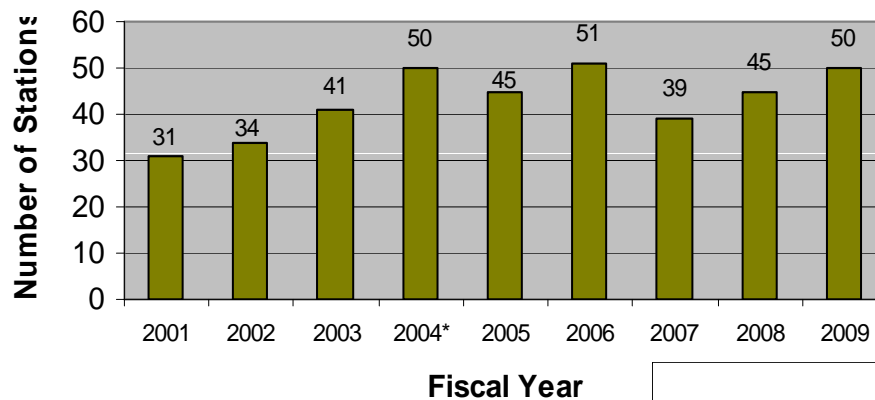
- PCBs
- Dioxin
- PFOA/PFOS

FTMP

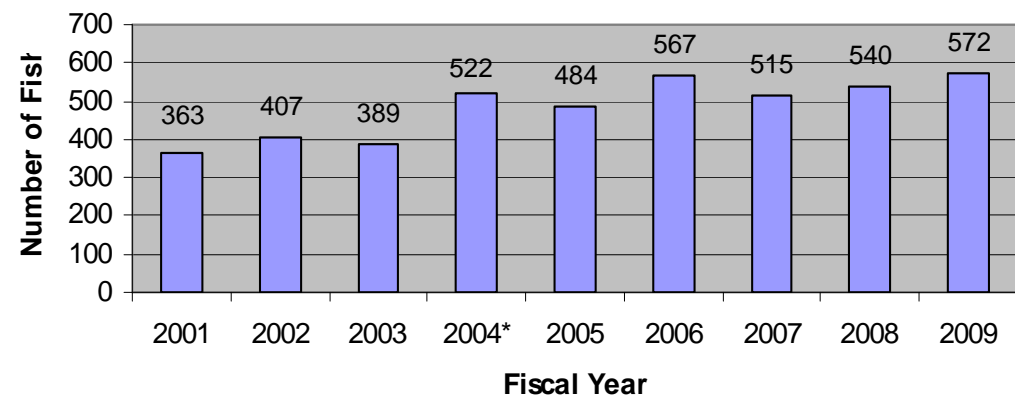
Annual Effort



Stations Sampled per Year



Fish Collected per Year



*EPA NFTS: 50 fish

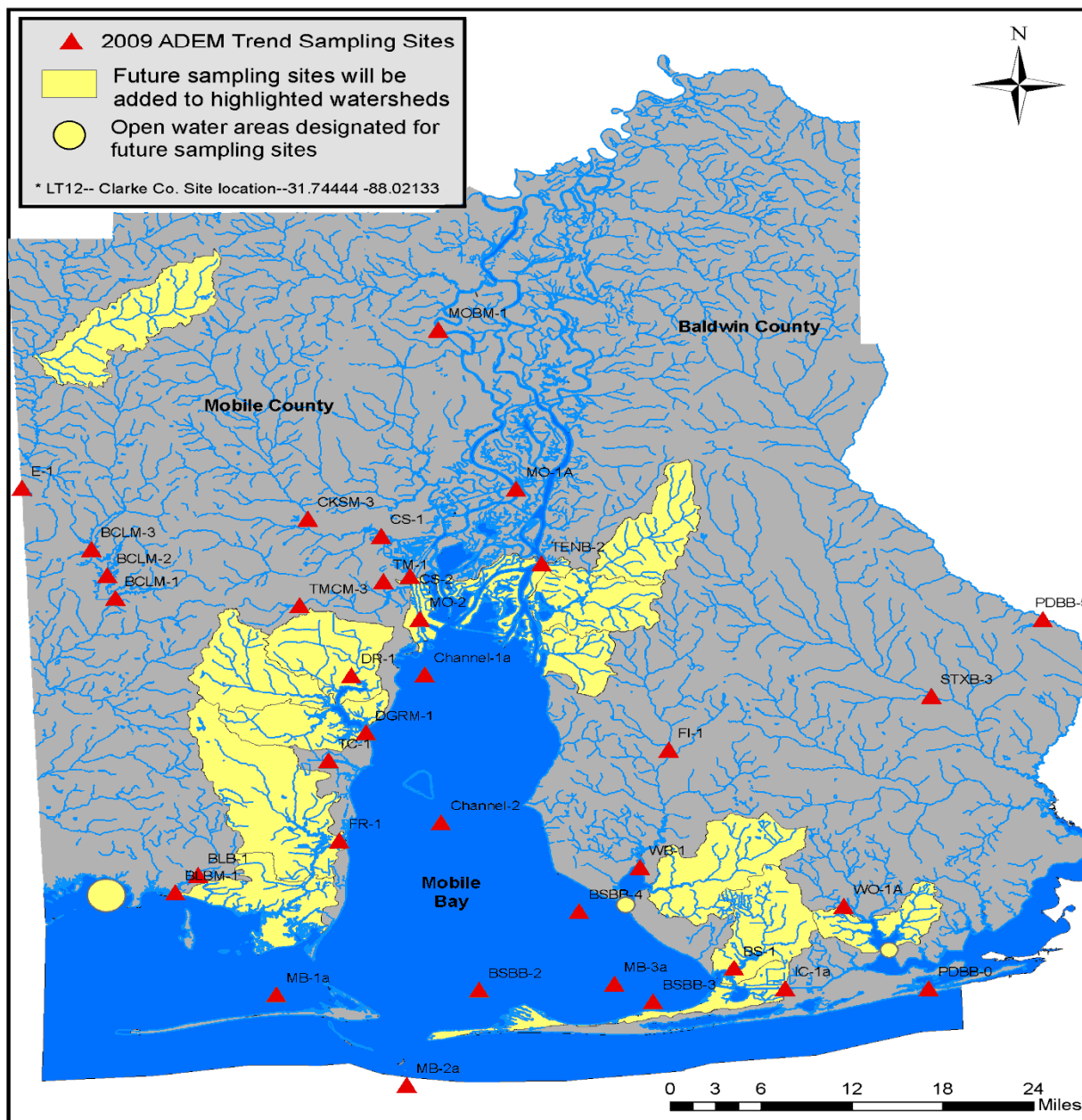
Coastal Monitoring Program



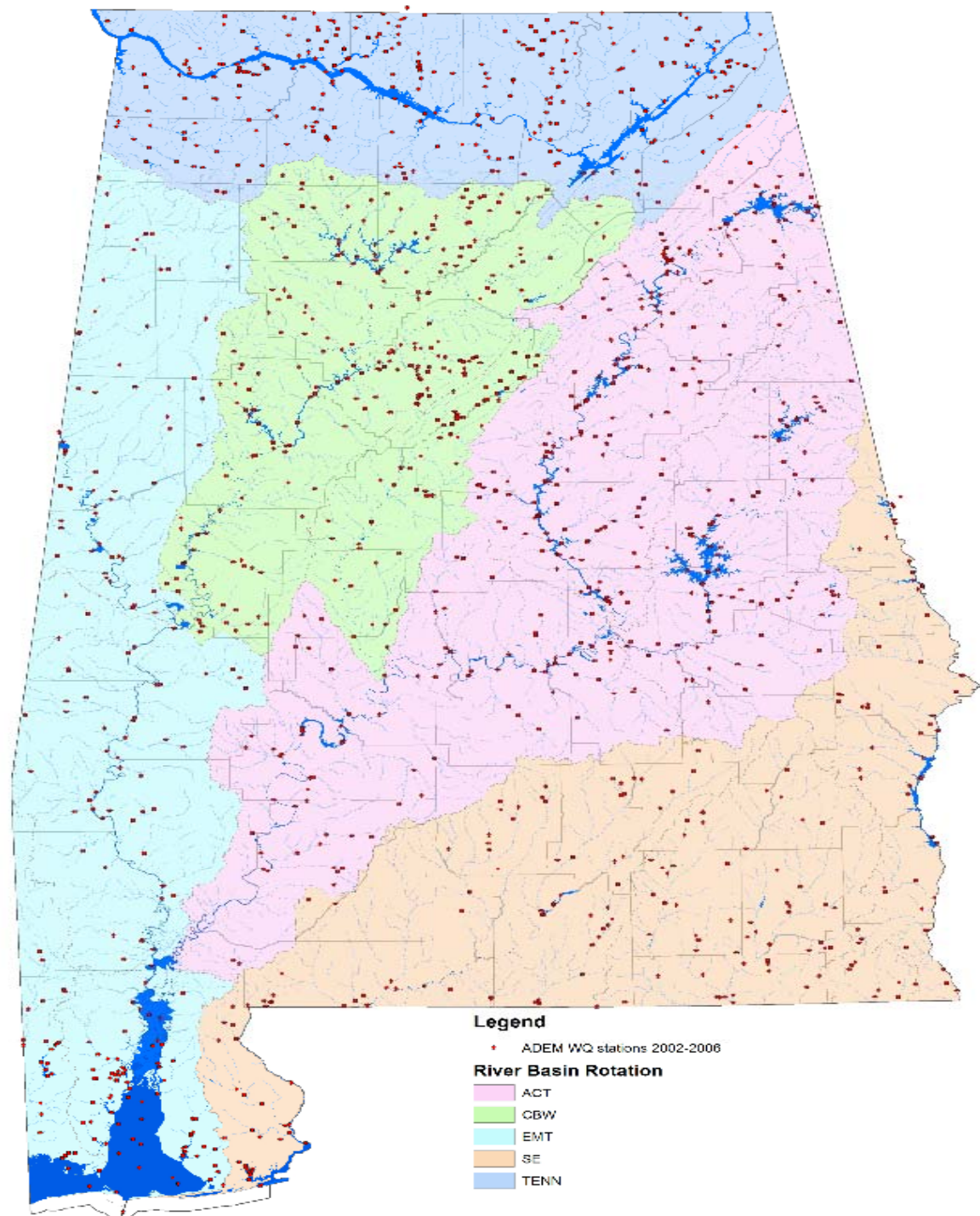
- ❑ EPA National Coastal Assessment 2010
- ❑ BEACH Monitoring
- ❑ Coastal Monitoring Program 2011
 - Expand Existing Trend Network
 - Coastal Watershed Assessments

ADEM Coastal Monitoring Program

ADEM Coastal Monitoring Sites 2009



*Basin
Rotation
II
1504
Stations*



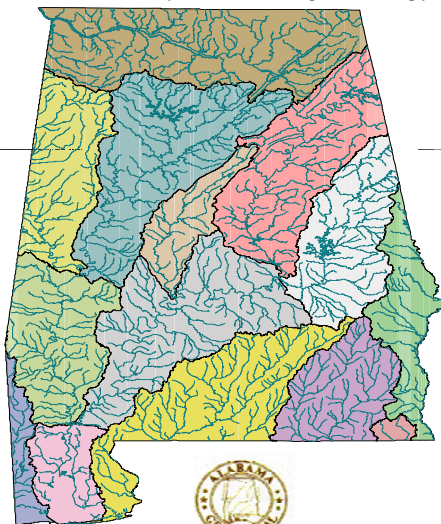
ADEM Water Quality Monitoring Under Development.....



2010 Strategy



State of Alabama
Water Quality Monitoring Strategy



Alabama Department of Environmental Management
July 12, 2005



Stream Bioassessments



Wetlands Assessments



River Bioassessments



Freshwater Species Recovery Efforts In Alabama

Tulotoma magnifica





*Alabama Aquatic Biodiversity Center
May 2009*

Alabama Aquatic Biodiversity Center

- *Species Culture*
- *Species Planning & SHU's*
- *River Conservation*



Fallicambarus danielae
Speckled Burrowing Crayfish

Etheostoma trisella
Tri-spot Darter



Lithasia geniculata
Helmet Lithasia



AABC Support : Non-game Recovery Efforts

- ***Monitoring of reintroduction efforts***
- ***Complete survey efforts for target species***
- ***Facilitate basic research and data collection***
- ***Data collection point for recovery activities***
- ***Coordination center for recovery partners***



Mussel Survey Paint Rock River



Mussel Monitoring Elk River

Key Issues

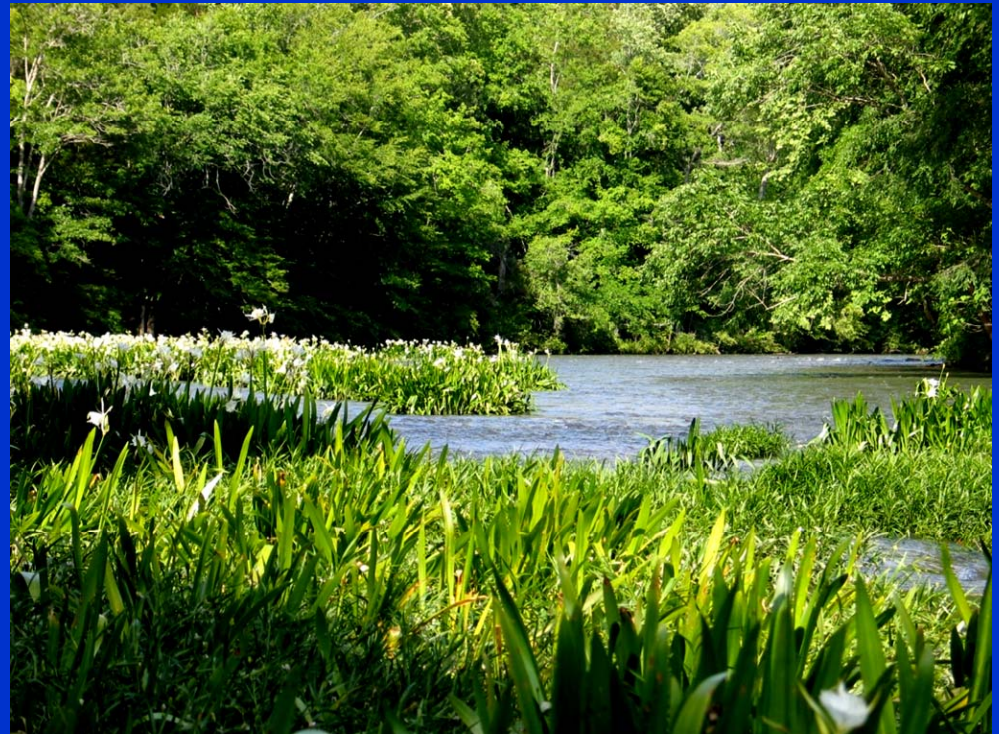
*Habitat Fragmentation /
Connectivity*



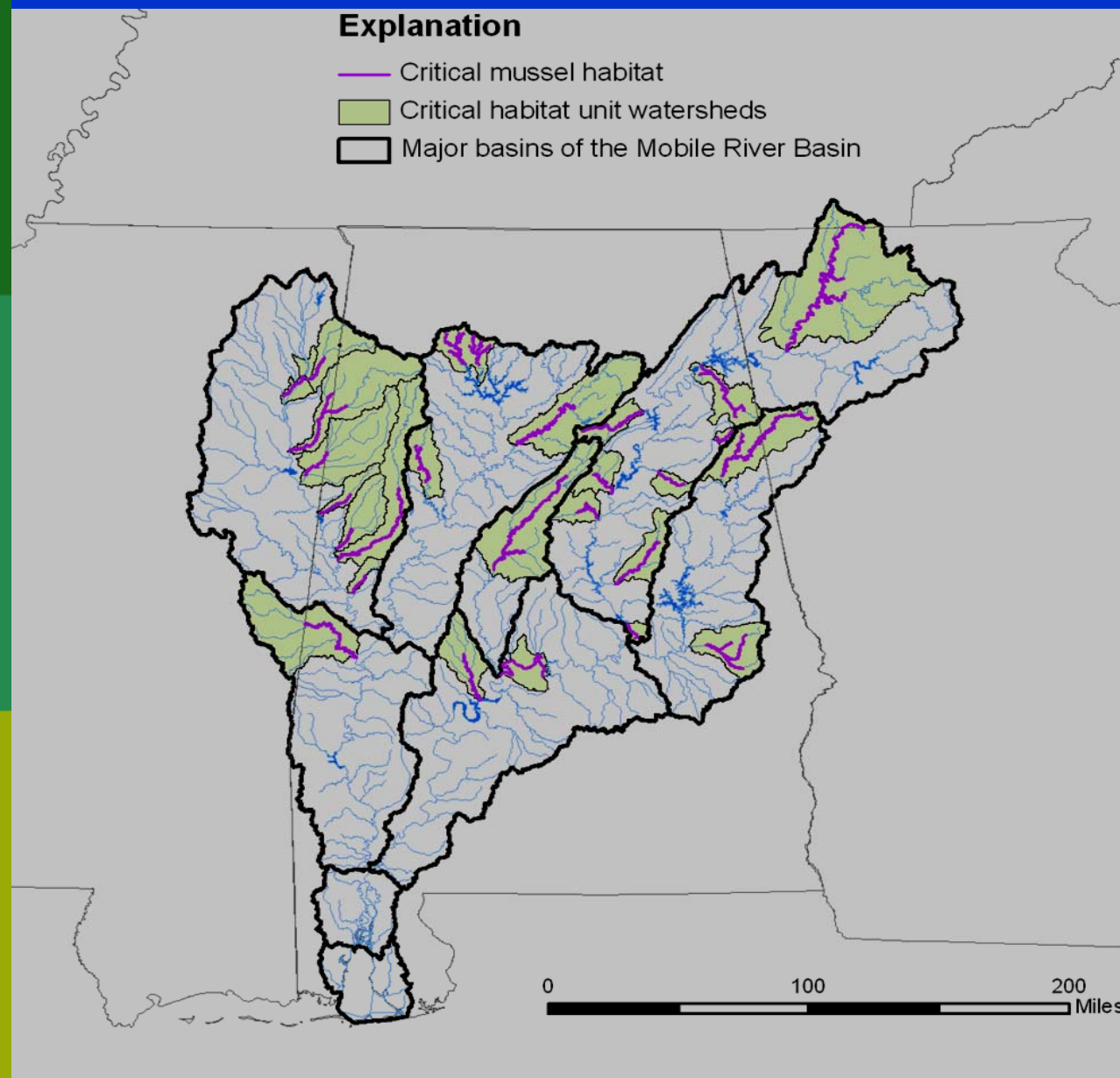
*Protection/Conservation of
High Quality Habitats*



Impaired Water Quality



Delineating critical habitat segments





Berry H. (Nick) Tew, Jr.
State Geologist

Critical Habitat Units for Threatened and Endangered Mussels in the Mobile River Basin

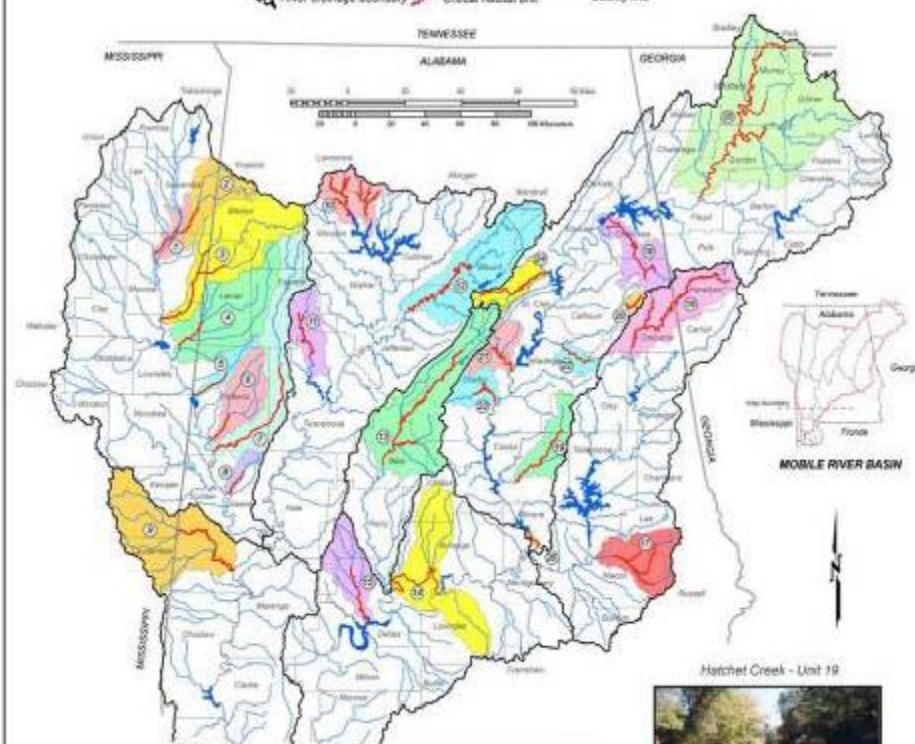
by Patrick E. O'Neil, Stuart W. McGregor, and E. Anne Wynn of the Geological Survey of Alabama
and Jeffrey R. Powell of the U.S. Fish and Wildlife Service

Prepared in cooperation with:



Explanation

- Contributing watershed
- Stream
- State line
- River drainage boundary
- Critical habitat unit
- County line



The U.S. Fish and Wildlife Service has designated 26 river and stream segments (units) in the Mobile River Basin (59 FR 40094) as critical habitat for three threatened and eight endangered freshwater mussel species (table 1) under the Endangered Species Act of 1973, as amended. The habitat units encompass approximately 1,093 miles (1,760 kilometers) of stream and river channels in four states. Although this is a small portion of each species' historic range, the habitat units include a significant part of the Mobile River Basin's remaining high-quality, free-flowing rivers and streams and reflect the variety of small stream to large river habitats once occupied by these species. The 26 habitat units were selected based on best available information about the essential habitat components required by these 11 species including: (1) geomorphically stable stream and river banks and channels; (2) a stream flow regime sufficient for normal behavior, growth, and survival of all life stages of mussels and their fish hosts; (3) acceptable water-quality conditions necessary for normal behavior, growth, and viability of all life stages; (4) sand, gravel, and/or cobble substrates with low amounts of fine sediment and low amounts of attached filamentous algae; (5) the presence of fish hosts with adequate living, foraging, and spawning areas; and (6) few or no competitive or predaceous nonnative species. Detailed descriptions of critical habitat reaches given below (table 2) allow accurate location on larger scale maps. The colored polygons on the map to the left represent contributing watershed areas to the critical habitat unit reaches depicted in red.

Table 1. Threatened and endangered freshwater mussel species in the Mobile River Basin.

Scientific name	Common name	Rank ¹	Critical Habitat Unit in the Mobile River Basin																									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
<i>Epiplatys spilargenteus</i>	spotted cownosefish	2																										
<i>Epiplatys spilargenteus</i>	southern cownosefish	2																										
<i>Lampsilis silioides</i>	shiny pocketbook	2																										
<i>Lampsilis persimilis</i>	orange mussel	7																										
<i>Modiolus acadianus</i>	Acadian pocketbook	7																										
<i>Modiolus persimilis</i>	Coke pocketbook	5																										
<i>Platystrophia acuminata</i>	southern clubshell	6																										
<i>Platystrophia acuminata</i>	blue pigtoe	6																										
<i>Platystrophia acuminata</i>	southern pigtoe	6																										
<i>Platystrophia acuminata</i>	ovate clubshell	6																										
<i>Platystrophia acuminata</i>	transverse clubshell	6																										

¹Endangered; 2-Threatened

Table 2. Detailed descriptions of critical habitat units in the Mobile River Basin.

Critical Habitat Unit	Name	State/County	Reach
1	East Fork Tombigbee River	Miss. Monrovia, Lawrence	East Fork of Tombigbee River main stem from Max. Hwy. 278 upstream to the confluence of Mill Creek
2	Big Mountain Creek	Miss. Lawrence	Big Mountain Creek main stem from Max. Hwy. 278 upstream to U.S. Hwy. 90
3	Big Mountain Creek and Spivey Creek	Miss. Lawrence, Monrovia, Ala. Lenoir	Big Mountain Creek main stem from its confluence with Tombigbee River upstream to the confluence of Spivey Creek; Spivey Creek main stem from its confluence with Tombigbee River upstream to the confluence of Spivey Creek
4	Louisiana Creek and Yellow Creek	Miss. Lawrence, Ala. Lenoir	Louisiana Creek main stem from its confluence with Tombigbee River upstream to the confluence of Yellow Creek; Yellow Creek main stem from its confluence with Tombigbee River upstream to the confluence of Louisiana Creek
5	Little Creek	Ala. Polk	Little Creek main stem from its confluence with Tombigbee River upstream to the confluence of Little Creek
6	Little Creek	Ala. Polk	Little Creek main stem from its confluence with Tombigbee River upstream to the confluence of Little Creek
7	Spivey Creek	Ala. Greene, Polk, Lawrence	Spivey Creek main stem from its confluence with Tombigbee River upstream to the confluence of Spivey Creek
8	Spivey Creek	Ala. Greene	Spivey Creek main stem from its confluence with Tombigbee River upstream to the confluence of Spivey Creek
9	Spivey Creek	Ala. Greene	Spivey Creek main stem from its confluence with Tombigbee River upstream to the confluence of Spivey Creek
10	Spivey Creek	Ala. Greene	Spivey Creek main stem from its confluence with Tombigbee River upstream to the confluence of Spivey Creek
11	North River and Clear Creek	Ala. Tuscaloosa, Fayette	North River main stem from its confluence with Tombigbee River upstream to the confluence of Clear Creek; Clear Creek main stem from its confluence with Tombigbee River upstream to the confluence of North River
12	Locust Fork and Little Warrior River	Ala. Jefferson, Blount	Locust Fork main stem from its confluence with Tombigbee River upstream to the confluence of Little Warrior River; Little Warrior River main stem from its confluence with Tombigbee River upstream to the confluence of Locust Fork
13	Cahaba River and Little Cahaba River	Ala. Jefferson, Blount	Cahaba River main stem from its confluence with Tombigbee River upstream to the confluence of Little Cahaba River; Little Cahaba River main stem from its confluence with Tombigbee River upstream to the confluence of Cahaba River
14	Alabama River	Ala. Autauga, Limestone, Talladega	Alabama River main stem from its confluence with Tombigbee River upstream to the confluence of Alabama River
15	Alabama River	Ala. Autauga, Limestone, Talladega	Alabama River main stem from its confluence with Tombigbee River upstream to the confluence of Alabama River
16	Tallapoosa River and Coosa River	Ala. Chilton, Ga. Paulding, Hardee	Tallapoosa River main stem from its confluence with Tombigbee River upstream to the confluence of Coosa River; Coosa River main stem from its confluence with Tombigbee River upstream to the confluence of Tallapoosa River
17	Upriver, Chocoma, and Chocoma Creek	Ala. Marion, Lee	Upriver Creek main stem from its confluence with Tombigbee River upstream to the confluence of Chocoma Creek; Chocoma Creek main stem from its confluence with Tombigbee River upstream to the confluence of Upriver Creek
18	Coosa River and Terrell Creek	Ala. Chilton, Calhoun, Obediah	Coosa River main stem from its confluence with Tombigbee River upstream to the confluence of Terrell Creek; Terrell Creek main stem from its confluence with Tombigbee River upstream to the confluence of Coosa River
19	Shoal Creek	Ala. Calhoun, Obediah	Shoal Creek main stem from its confluence with Tombigbee River upstream to the confluence of Shoal Creek
20	Shoal Creek and Shoal Creek	Ala. Calhoun, Obediah	Shoal Creek main stem from its confluence with Tombigbee River upstream to the confluence of Shoal Creek
21	Shoal Creek and Shoal Creek	Ala. Calhoun, Obediah	Shoal Creek main stem from its confluence with Tombigbee River upstream to the confluence of Shoal Creek
22	Shoal Creek	Ala. Calhoun, Obediah	Shoal Creek main stem from its confluence with Tombigbee River upstream to the confluence of Shoal Creek
23	Shoal Creek and Shoal Creek	Ala. Calhoun, Obediah	Shoal Creek main stem from its confluence with Tombigbee River upstream to the confluence of Shoal Creek
24	Big Creek	Ala. Calhoun, Obediah	Big Creek main stem from its confluence with Tombigbee River upstream to the confluence of Big Creek
25	Coosa River, Coosa River, and Coosa River	Ala. Calhoun, Obediah, Wilcox, Wilcox, Wilcox	Coosa River main stem from its confluence with Tombigbee River upstream to the confluence of Coosa River
26	Coosa River	Ala. Calhoun, Obediah	Coosa River main stem from its confluence with Tombigbee River upstream to the confluence of Coosa River

Borden Creek - Unit 10



Cahaba River - Unit 13



Hatchet Creek - Unit 19



Locust Fork - Unit 12

Summary and Conclusion

- ❑ *Alabama is blessed with extraordinary aquatic resources and biodiversity*
- ❑ *We've come a long way, but we have much to do to prepare for the challenges of the future*
- ❑ *Determination and focus, while maintaining the necessary expertise and support, will be critical*
- ❑ *Coordination, Communication, Collaboration will be key*

Acknowledgements

□ Thanks to all who contributed to this presentation

■ ADEM Staff

- Field Operations Division
- Water Division
- NPS Program

■ ADCNR

- Paul Johnson and AABC staff
- Steve Rider

■ GSA

- Pat O'Neil and staff

■ USFWS

- Jeff Powell

Thank you!



Questions?

