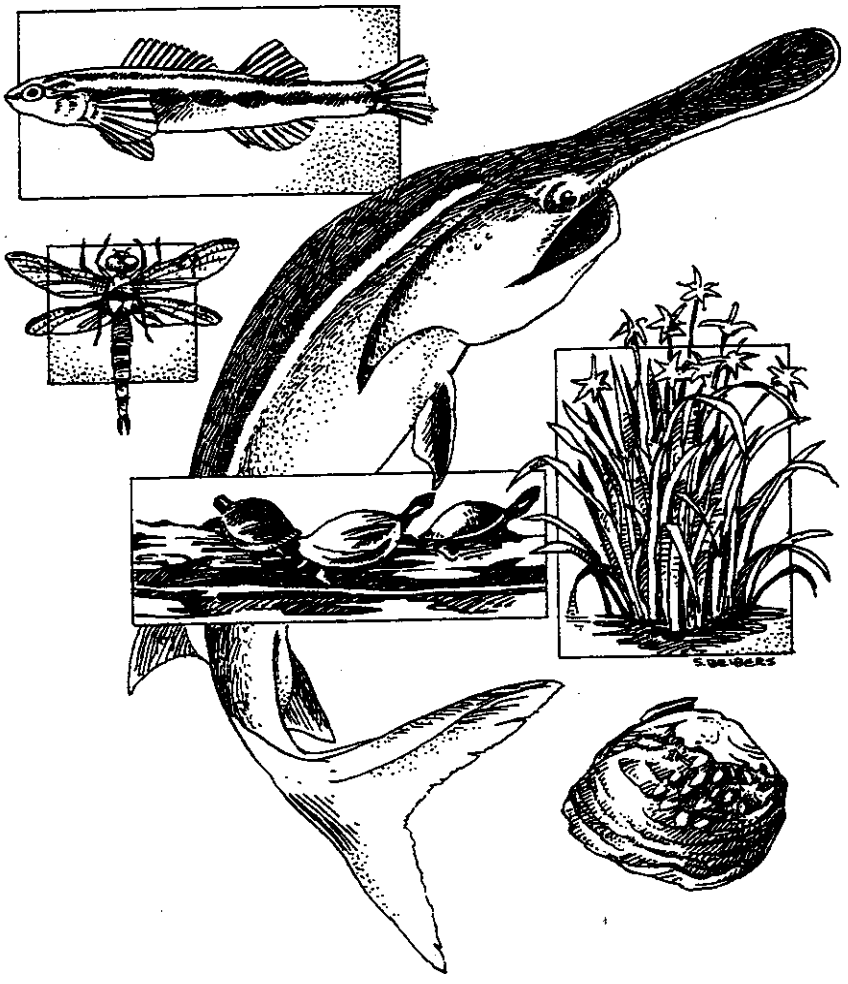
Recovery Plan for

Mobile River Basin Aquatic Ecosystem



U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

MOBILE RIVER BASIN AQUATIC ECOSYSTEM RECOVERY PLAN

Prepared by

Jackson, Mississippi Field Office
U.S. Fish and Wildlife Service

and

Mobile River Basin Coalition
Planning Committee

for

U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

Approved: _____
Regional Director, U.S. Fish and Wildlife Service

Date: Nov. 17, 2000

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Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans published by the U.S. Fish and Wildlife Service (Service), are sometimes prepared with the assistance of recovery teams, contractors, State agencies, and other affected and interested parties. Plans are reviewed by the public and are submitted to additional peer review before they are adopted by the Service. Objectives of the plan will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific tasks and may not represent the views or the official positions or approval of any individuals or agencies involved in developing the plan, other than the Service. Recovery plans represent the official position of the Service **only** after they have been signed by the Regional Director or Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

By approving this recovery plan, the Regional Director certifies that the data used in its development represent the best scientific and commercial information available at the time it was written. Copies of all documents reviewed in development of the plan are available in the administrative record, located at the Jackson Field Office in Jackson, Mississippi.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 2000. Mobile River Basin Aquatic Ecosystem Recovery Plan. Atlanta, GA. 128 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
Phone: 301/492-6403 or
800/582-3421

Fees for recovery plans vary, depending on the number of pages.

ACKNOWLEDGMENTS

A Technical/Agency Draft Mobile River Basin Aquatic Ecosystem Recovery Plan (Plan) was prepared by the Service's Jackson, Mississippi, Field Office, and released for public review in September 1994. Individuals who provided valuable suggestions, comments, and feedback during the initial development of the Plan, included: Dr. George Folkerts, Auburn University; Dr. Richard Neves and Noel Burkhead, U.S. Geological Survey; and Dr. Randy Haddock and Don Elder, Cahaba River Society.

In December 1994, the Alabama Department of Economic and Community Affairs, Office of Water Resources, requested a meeting among the Basin's stakeholders and the Service to discuss the draft recovery plan, its implementation, private and State concerns with the plan, the Endangered Species Act, and the Service's past and future actions in the Basin. Participating stakeholders included State and Federal government agencies, environmental organizations, landowners, and numerous business and industry representatives. Bimonthly meetings were conducted over the next 18 months to exchange information concerning the values and status of the Basin's biota (animal and plant life), human uses and values of its rivers and watersheds, and current regulations and programs to protect and manage the Basin's resources. During these discussions, participants agreed to form the Mobile River Basin Coalition to provide a forum for all interest groups who have a stake in the Basin. The purpose of the Coalition is to work together to develop and promote good management of the Basin's rivers and streams. Among other activities, the Coalition has worked with the Service to review and edit drafts of the recovery plan. Numerous individuals, agencies, organizations, and businesses have participated in the Coalition and contributed to this final recovery plan.

The information provided in this Plan was compiled from a variety of sources. All who have contributed to documenting the remarkable diversity of the Mobile River Basin aquatic fauna (animals) and flora (plants), as well as those who now document its decline and work for its recovery, are gratefully acknowledged.

The cover illustrations and plates were drawn by Sam Beibers, Beibers Creative Arts, Jackson, Mississippi. The cover illustration depicts, from top to bottom, a goldline darter (*Percina aurolineata*), Cherokee clubtail dragonfly (*Gomphus consanguis*), paddlefish (*Polyodon spathula*), Alabama red-bellied turtles (*Pseudemys alabamensis*), cahaba lily (*Hymenocallis coronaria*), and a stirrupshell (*Quadrula stapes*).

EXECUTIVE SUMMARY

Current Status: The Mobile River Basin (Basin) supports a highly diverse aquatic flora and fauna, especially manifested in its freshwater fishes, mussels, and snails. The Basin's endemic (native to a region and found nowhere else) fauna includes 40 fishes, 33 mussels, 110 aquatic snails, as well as turtles, aquatic insects, and crustaceans. The fauna and their habitats have been extensively affected over the years by impoundment, channelization, mining, dredging, and pollution from point (specific) and nonpoint (diffuse) sources. As a result, at least 17 mussels and 37 aquatic snails are presumed extinct, most within the past few decades. At the time this recovery plan was released for public review in 1998, there were 32 aquatic animal and plant species in the Basin that were protected under the Endangered Species Act of 1973, as amended (Act). These included 2 turtles, 10 fish, 17 mussels, 1 snail, and 2 plants. Since 1998, an additional seven aquatic species, six snails and the Alabama sturgeon, have received protection under the Act. We will develop an addendum to the Mobile River Basin Aquatic Ecosystem Recovery Plan, which will include specific recovery criteria for the six snails, and make it available for public review and comment in the near future. An additional recovery plan will be developed specifically for the Alabama sturgeon. In the interim, these seven species are directly benefitted by the actions implemented through the Mobile River Basin Aquatic Ecosystem Recovery Plan and are included in this final plan.

This document is currently the sole recovery plan for 22 aquatic species, including 4 fish, 11 mussels, and 7 snails respectively, as follows (E = endangered, T = threatened): Alabama sturgeon (E), Cherokee darter (T), Etowah darter (E), goldline darter (T), Alabama moccasinshell (T), Coosa moccasinshell (E), dark pigtoe (E), fine-lined pocketbook (T), orange-nacre mucket (T), ovate clubshell (E), southern acornshell (E), southern clubshell (E), southern pigtoe (E), triangular kidneyshell (E), upland combshell (E), cylindrical lioplax (E), flat pebblesnail (E), lacy elimia (T), painted rocksnail (T), plicate rocksnail (E), round rocksnail (T), and tulotoma snail (E). For profiles for each of these species, see Appendix A of this recovery plan. This Plan has also been developed to complement existing recovery plans for the other 17 listed aquatic species in the Basin.

Habitat Requirements and Limiting Factors: Each of the listed species within the Basin is unique in some aspect of its life history or habitat requirements, yet two factors are common to all: adaptation to some form of flowing water habitat; and dependence on habitat stability, including substrate (surface where a plant or animal grows, rests, or is attached) and water quality. Activities affecting these basic requirements represent the primary obstacles to survival and recovery for most of the Basin's listed species.

Recovery Objectives: To protect the Basin's native aquatic fauna and flora through aquatic ecosystem management (managing for all aquatic resources on a basin-wide scale). Specific recovery objectives for the 22 species are as follows:

Tulotoma snail - reclassify from endangered to threatened, and delist the species.

Goldline darter - delist.
Cherokee darter - delist.
Etowah darter - delist.

11 mussel species - neither reclassification nor delisting appear to be a realistic goal for any of these species at this time. Preventing the extinction of those listed as endangered, and arresting the continuing decline of those listed as threatened are the recovery objectives for these species.

Alabama sturgeon - to be developed.

Six snail species - to be developed.

Recovery Criteria: The tulotoma snail will be considered for reclassification to threatened status when recent studies related to the status of the species have been reviewed and we confirm that a stable or increasing population occurs in the Coosa River below Jordan Dam. The tulotoma snail will be considered for delisting from the Federal List of Endangered and Threatened Wildlife and Plants when the following criteria are met:

1. Four of the six known Coosa River tributary snail populations (Choccolocco, Hatchet, Kelly, and Weogufka Creeks) are shown to be stable or increasing for at least five years,
2. Community developed watershed plans are implemented to protect and monitor water and habitat quality in the four targeted watersheds,
3. A formal agreement has been developed with Alabama Power Company to maintain base flows below Jordan Dam that are protective for the snail.

The goldline darter will be considered for delisting when the following criteria are met:

1. The known populations of the species are shown to be stable or increasing for a period of at least five years,
2. There has been a demonstrated trend in water quality improvement in the reach of the Cahaba River occupied by this fish, and
3. Community developed watershed plans are implemented to protect and monitor water and habitat quality in all occupied watersheds.

The Cherokee and Etowah darters will be considered for delisting when the following criteria are met:

1. The known populations of the species are shown to be stable or increasing for a period of at least five years, and
2. Community developed watershed plans are implemented to protect and monitor water and habitat quality in all occupied watersheds.

Actions Needed:

1. Protect habitat integrity and quality.
2. Consider options for river and stream mitigation strategies that give high priority to avoidance and restoration.
3. Promote voluntary stewardship to reduce nonpoint pollution from private land use.
4. Encourage and support community based watershed stewardship planning and action.
5. Develop and implement public education programs and materials defining ecosystem management and watershed stewardship responsibilities.
6. Conduct basic research on endemic aquatic species and apply the results of this research toward management and protection.
7. Develop and implement technology for maintaining and propagating endemic species in captivity.
8. Reintroduce aquatic species into restored habitats, as appropriate.
9. Monitor listed species population levels and distribution and review ecosystem management strategy.
10. Coordinate ecosystem management actions and species recovery efforts.

Recovery Costs: Cost of full and appropriate implementation of Federal and State regulatory authorities will be absorbed under existing programs. Implementation of recovery tasks for which cost estimates can be made over the initial 3-year period of recovery effort total $2,565,000.

Date of Recovery: Estimated date of delisting of the tulotoma snail, the Cherokee darter, Etowah darter, and goldline darter is 2010, if recovery criteria are met.

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PART I

INTRODUCTION

"The perfectly adjusted perish with their environments."
- Loren Eiseley, author and anthropologist

This recovery plan has been developed to address the immediate recovery objectives of 22 aquatic species endemic to the Mobile River Basin (Basin) that have been recently listed under the Endangered Species Act of 1973, as amended (Act) (Table 1, Appendix A), and to complement recovery plans previously developed for an additional 17 listed aquatic species in the Basin (Table 2, Appendix B). Descriptions, ranges, life histories, and other information concerning each of these 39 species can be found in Appendices A and B.

Part I of the Mobile River Basin Aquatic Ecosystem Recovery Plan (Plan) summarizes historic and current information on the Basin's biota and their aquatic habitats, and modern human impacts on the ecosystem (all components, living and nonliving, of an ecological community, considered together as one unit). The Plan provides a basic foundation for discussions and negotiations that must occur at both ecosystem and watershed levels if listed aquatic species are to be protected and recovered. Part II presents recovery objectives and criteria for the species, and provides an outline of economically and scientifically practical recovery tasks.

The ecosystem approach to recovery proposed in the Plan acknowledges that irreversible changes to extensive portions of the Basin have occurred to meet human needs, and these changes have resulted in natural resource losses. It emphasizes the uniqueness and value of the Basin's imperiled native species and the aquatic and riparian habitats on which they depend. The Plan identifies the threats currently affecting these habitats and their biota. It also recognizes that humans and their activities are integral components of the ecosystem, and that recovery strategies and actions must allow for sustainable economic growth and other human needs.

The authority to address management needs for listed species from an ecosystem perspective is identified as a central purpose of the Act in section 2(b), where it states, "... **to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved**..."

TABLE 1: LISTED AQUATIC SPECIES IN THE MOBILE RIVER BASIN WITHOUT EXISTING RECOVERY PLANS

Common Name	Scientific Name	Federal Status
	FISH	
Alabama sturgeon	*Scaphirhynchus suttkusi*	Endangered
Cherokee darter	*Etheostoma scotti*	Threatened
Etowah darter	*Etheostoma etowahae*	Endangered
Goldline darter	*Percina aurolineata*	Threatened
	MUSSELS	
Alabama moccasinshell	*Medionidus acutissimus*	Threatened
Coosa moccasinshell	*Medionidus parvulus*	Endangered
Dark pigtoe	*Pleurobema furvum*	Endangered
Fine-lined pocketbook	*Lampsilis altilis*	Threatened
Orange-nacre mucket	*Lampsilis perovalis*	Threatened
Ovate clubshell	*Pleurobema perovatum*	Endangered
Southern acornshell	*Epioblasma othcaloogensis*	Endangered
Southern clubshell	*Pleurobema decisum*	Endangered
Southern pigtoe	*Pleurobema georgianum*	Endangered
Triangular kidneyshell	*Ptychobranchus greeni*	Endangered
Upland combshell	*Epioblasma metastriata*	Endangered
	SNAILS	
Cylindrical lioplax	*Lioplax cyclostomaformis*	Endangered
Flat pebblesnail	*Lepyrium showalteri*	Endangered
Lacy elimia	*Elimia crenatella*	Threatened
Painted rocksnail	*Leptoxis taeniata*	Threatened
Plicate rocksnail	*Leptoxis plicata*	Endangered
Round rocksnail	*Leptoxis ampla*	Threatened
Tulotoma snail	*Tulotoma magnifica*	Endangered

TABLE 2: LISTED AQUATIC SPECIES IN THE MOBILE RIVER BASIN WITH EXISTING RECOVERY PLANS

Common Name	Scientific Name	Federal Status
	REPTILES	
Alabama redbelly turtle	*Pseudemys alabamensis*	Endangered
Flattened musk turtle	*Sternotherus depressus*	Threatened
	FISH	
Amber darter	*Percina antesella*	Endangered
Blue shiner	*Cyprinella caerulea*	Threatened
Cahaba shiner	*Notropis cahabae*	Endangered
Conasauga logperch	*Percina jenkinsi*	Endangered
Gulf sturgeon	*Acipenser oxyrhynchus desotoi*	Threatened
Pygmy sculpin	*Cottus pygmaeus*	Threatened
Watercress darter	*Etheostoma nuchale*	Threatened
	MUSSELS	
Black clubshell	*Pleurobema curtum*	Endangered
Flat pigtoe	*Pleurobema marshalli*	Endangered
Heavy pigtoe	*Pleurobema taitianum*	Endangered
Inflated heelsplitter	*Potamilus inflatus*	Threatened
Southern combshell	*Epioblasma penita*	Endangered
Stirrupshell	*Quadrula stapes*	Endangered
	PLANTS	
Harperella	*Ptilimnium nodosum*	Endangered
Kral's water-plantain	*Sagittaria secundifolia*	Threatened

Background

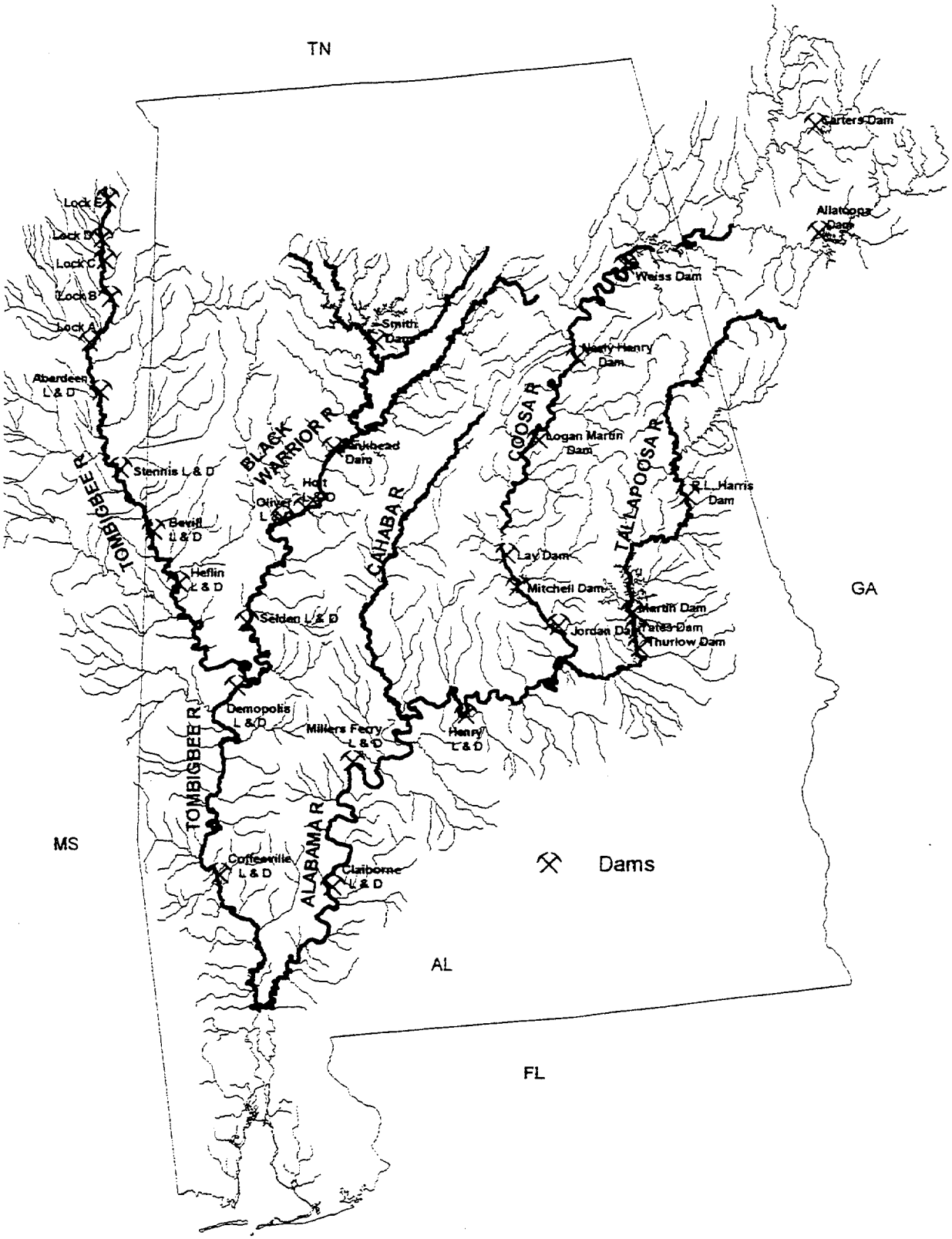
The Mobile River Basin is significant for its size, location, and its exceptional diversity of natural habitats. The Basin includes seven major river systems draining portions of ten physiographic provinces and subdivisions in four states, and forms the largest Gulf Coast drainage east of the Mississippi River (Figure 1). Defined by their soils, geology, topography, and other features, each physiographic province imparts unique chemical and physical characteristics to the waters flowing through them. As such, the Basin provides a wealth of habitats for aquatic plants and animals.

Ancient geologic events such as the rise and fall of the land mass and the ebb and rise of the ocean shoreline, resulted in river and tributary convergence (joining together) between the Basin and surrounding drainages. This allowed repeated opportunities for immigration (movement into an area in which one is not native) by aquatic species from the Mississippi, Atlantic, Tennessee, Apalachicola and other drainages into the Mobile Basin. The isolation of these species within the Basin's diverse aquatic habitats eventually led to high numbers of unique species found nowhere else in the world (endemic species).

The uniqueness of the Basin's aquatic fauna was first recognized in the 19th century (Boschung 1992, Stein 1976, van der Schalie 1981). In the early 1800's, naturalist explorers traveled to the Basin and made collections for study and description (e.g., Conrad in 1832-33, Agassiz in 1854). Other scholars corresponded with amateur naturalists living in the Basin requesting samples of snails, mussels, and fishes, among which numerous unknown species were encountered (e.g., I. Lea, whose publications on the Basin's fauna range from 1827 through 1874). In the first decade of the 20th century, a consortium of northern malacologists (scientists who study mollusks which includes snails and mussels) (including B. Walker, G.H. Clapp, and H.A. Pilsbry) employed H.H. Smith, a naturalist at the University of Alabama, to collect snails and mussels from throughout the Mobile and adjacent drainages (van der Schalie 1981). Historic collections resulting from these efforts are preserved at museums around the country, including the National Museum of Natural History, Philadelphia Academy of Science, University of Michigan Museum of Zoology, Harvard Museum of Comparative Zoology, University of Florida Museum of Zoology, and Carnegie Museum of Zoology. These museum collections form the foundation of our knowledge of past distributions of the Basin's aquatic species.

Sporadic collections and publications describing the Basin's aquatic communities continued through the mid-1900's. However, scientific interest intensified during the 1960's and 1970's due to developments in the fields of ecology and systematic biology, and because of requirements of new Federal and State environmental legislation (e.g., National Environmental Policy Act, Endangered Species Act, Clean Water Act, Alabama Water Pollution Control Act, etc.). As a result, hundreds of surveys and studies have been conducted by university scientists, State and Federal agencies, and industrial interests during the past 30 years on various aspects of the Basin's aquatic biota (see Appendix E for a partial list). These studies have further revealed the

FIGURE 1: MOBILE RIVER BASIN



Basin's unique biodiversity legacy, with new species still being described (e.g., vermilion darter (*Etheostoma chermocki*), Etowah darter, Cherokee darter, goldline darter, etc.).

The diversity of the Basin's freshwater animals is truly astounding, representing a large percentage of the aquatic fauna of North America (Table 3). For example, almost 40 percent of North America's aquatic turtles (17 species) inhabit the drainages of the Basin (Lydeard and Mayden 1995). The Basin ranks third in the nation in variety of fishes (160 species) (Swift *et al.* 1986), and is among the top ten river basins in the world in diversity of freshwater mussels (75 species). The Basin also provides habitat for the richest aquatic snail fauna in the world (120 species) (Bogan *et al.* 1995). As noted earlier, many of these aquatic animals are endemic to the Basin (Table 3).

The Basin's aquatic resources have also been vital to the development of the region by providing tremendous economic and recreational benefits. Since European settlement, streams and rivers have been variously used or modified for transportation, water supply, electricity production, irrigation, flood control, and waste disposal. As a result of such uses, significant changes in the nature and quality of aquatic habitats have occurred during the past century.

The surveys and studies conducted during the past few decades have revealed the severity of impacts on the aquatic fauna (Table 4). The Basin is noted for its high number of aquatic species that are listed under the Endangered Species Act, or are species of concern that may become candidates for listing (Lydeard and Mayden 1995; also Appendices A, B, and C). Imperiled species (which include Federally listed and candidate species and species of concern) are now found at all levels of the Basin's aquatic food chain, and include plants, insects, crustaceans, snails, mussels, fishes and turtles.

Over half of all known or presumed aquatic animal extinctions in the United States since European settlement have been freshwater mussels and snails unique to the Mobile Basin (Table 5, Appendix D). In an extinction event unparalleled in the history of the United States, many of these endemic mussels and snails have disappeared within the past few decades.

Aquatic Ecosystem Impacts and Their Effects on Biota

Each of the listed aquatic species within the Basin is unique in some aspect of its life history or habitat requirements, yet two factors are common to all: adaptation to some form of flowing water habitat, and dependence on habitat stability, including substrate (i.e., channel banks and bed) and water quality. The current condition of the Basin's aquatic ecosystem and the species it supports is the result of significant and widespread changes over time in flow, substrate, and/or water quality in river and stream habitats. Channel modification and water pollution have gradually eliminated those native species that are dependent upon a narrow range of flowing water habitat conditions from extensive portions of their former ranges within the Basin.

TABLE 3: MOBILE RIVER BASIN AQUATIC BIODIVERSITY LEGACY

	Total number of species historically known/species endemic to the drainage					
	Turtles	Fishes	Mussels	Snails	Drainage Area (square km)	(square miles)
U.S. and Canada*	44	792	297	342		
Mobile River Basin	17/3	160/40	75/33	120/110	110,701	43,173
Apalachicola River Basin	13/1	86/6	36/5	30/15	45,951	17,921
Pearl River Basin	13/1	106/0	7/0	10/0	21,336	8,321

* Total number of species historically known from the U.S. and Canada.
Sources:

Bogan *et al.* 1995
Burch 1989
Butler 1989 and pers. comm.
Harris 1990
Hartfield 1988
Lydeard and Mayden 1995
Mettee *et al.* 1996
Swift *et al.* 1986
Williams *et al.* 1992

TABLE 4: STATUS OF THE MOBILE RIVER BASIN AQUATIC BIOTA

	Amphibians	Reptiles	Fishes	Mussels	Snails	Plants	Insects/ Decapods
Extinct	0	0	0	14[1]	36[1]	0	0
Extirpated	0	0	1	1	0	0	0
Endangered[2] (E)	0	1	5	13	4	1	0
Threatened[2] (T)	0	1	6	4	0	1	0
Candidates (C)	1	0	0	1	1	0	0
Species of concern[3] (SC)	0	3	9	4	23	1	21

TOTAL NUMBER OF IMPERILED SPECIES (E+T+C+SC) = 100

(1) Since publication of the 1998 draft ecosystem plan, small populations of 3 mussels and 1 snail that were presumed extinct have been discovered in northwest Georgia.

(2) Federally listed aquatic species includes 22 species covered specifically by this Plan (Table 1) and 17 species with previously developed plans (Table 2).

(3) Previous "C2 candidates" now referred to as species of concern.

TABLE 5: COMPARISON OF ALL KNOWN U.S. AQUATIC FAUNAL EXTINCTIONS SINCE EUROPEAN SETTLEMENT WITH EXTINCTIONS IN THE MOBILE RIVER BASIN

	U.S. Total	Mobile River Basin
Amphibians and Reptiles	6	0
Freshwater Fishes	18	0
Freshwater Mussels	28	14[1]
Freshwater Snails	36	36[1]
TOTAL	89	51

[1] Since publication of the 1998 draft ecosystem plan, small populations of 3 mussels and 1 snail that were presumed extinct have been discovered in northwest Georgia.

Sources:

Natural Heritage Network Central Databases
The Nature Conservancy
U.S. Fish and Wildlife Service 1994
Bogan *et al.* 1995

DAMS constructed for navigation, water supply, electricity, recreation, and flood control have impounded more than 1,700 kilometers (km) (1,100 miles (mi)) of river and stream habitat in the Basin (Figure 1, Table 6). Impoundment results in burial of rock or other coarse substrate habitats by accumulating fine sediments, reduced velocities in impounded reaches, changes in current patterns below dams, and changes in water quality both above and below dams (Gore 1994).

Impounded waters have eliminated many native species from extensive portions of the Basin's larger rivers, and virtually all of the Basin's snail and mussel extinctions are a direct or indirect result of dam construction and river impoundment. For example, a series of dams impounded the Coosa River from near its mouth at Wetumpka, Alabama, to beyond the Georgia/Alabama State line, resulting in the extinction of more than 20 aquatic snails endemic to the Coosa River drainage (Stein 1976, Bogan *et al.* 1995).

The present primary adverse impact of existing dams and their impounded waters in the Basin is to form barriers to the movement of many species of fishes, mussels, snails, insects, and crustaceans, fragmenting populations and eliminating genetic interchange between them. As a result, imperiled aquatic species surviving in the Basin's unimpounded tributaries and mainstem river reaches have become isolated and virtually without avenues of immigration and emigration.

CHANNELIZATION, the straightening, deepening, and/or enlarging of stream and river channels, has occurred to some degree in every major river system of the Basin. Stream channelization has been particularly concentrated in the Tombigbee River drainage, where approximately 320 km (200 mi) of streams have been channelized (U.S. Army Corps of Engineers 1990). The effects of channelization on stream ecosystems include accelerated erosion; altered depth; and loss of habitat diversity, substrate stability, and riparian canopy (Brookes 1994). Such changes in habitat cause changes in the aquatic community, including the loss of species, reduced biomass, and shifts in species dominance (Hubbard *et al.* 1994).

Past channelization projects often caused headcutting (progressive channel bed and bank erosion that gradually advances upstream from a channelized reach and/or up the tributaries of a channelized stream). The aquatic community response to headcuts is similar to that of channelization, i.e., loss of diversity and biomass (Hartfield 1993). Headcuts are not only detrimental to aquatic and riparian communities, but also cause considerable offsite destruction of public and private property (Hartfield 1993).

Channelization of natural streams in the Basin has diminished in recent years as the detrimental effects of the practice have become recognized and weighed against the benefits. However, maintenance of channelized river and stream reaches and, more rarely, new channelization projects are still occasionally conducted for flood protection in heavily populated areas (e.g., Luxapalila Creek, Columbus, Mississippi) or areas of high agricultural use (e.g., East Fork of the Tombigbee River tributaries, Mississippi; upper Luxapalila Creek, Alabama). Such projects now normally include grade control structures or other efforts to prevent headcutting; however, loss of habitat still occurs in the channelized reach. The present primary adverse impact of channelization is the continuing geomorphic response of stream and river channels in previously channelized systems (including channel erosion, filling, and headcutting).

DREDGING for navigation or gravel mining physically destroys benthic (live on the river/stream bottom) organisms and their habitats, and may eliminate habitat and prey for fishes and turtles. Dredging may also initiate or perpetuate upstream channel instability and erosion. In-channel dredge spoil disposal may cover benthic species and their habitats and/or contribute to temporary downstream turbidity.

TABLE 6: MAJOR DAMS AND ASSOCIATED RESERVOIRS OF THE MOBILE BASIN*

DAM OR RESERVOIR NAME	DRAINAGE	COUNTY, STATE	SURFACE AREA Hectares (Acres)	APPROX. LENGTH Kilometers (Miles)
Coffeeville	Tombigbee R.	Choctaw, AL	3553 (8800)	156 (97)
Demopolis	Tombigbee R.	Marengo, AL	4037 (10000)	85 (53)
Howell Heflin	Tombigbee R.	Sumter, AL	2584 (6400)	73 (45)
Tom Bevill	Tombigbee R.	Pickens, AL	3351 (8300)	45 (27.9)
John C. Stennis	Tombigbee R.	Lowndes, MS	3597 (8910)	14 (8.4)
Aberdeen Lake	Tombigbee R.	Monroe, MS	1664 (4121)	23 (14)
Bluff Lake	Noxubee R.	Noxubee, MS	404 (1000)	4 (2.3)
Bankhead	Black Warrior R.	Tuscaloosa, AL	3714 (9200)	105 (65)
Holt	Black Warrior R.	Tuscaloosa, AL	1331 (3296)	31 (19)
W. B. Oliver	Black Warrior R.	Tuscaloosa, AL	within banks	15 (9)
Warrior	Black Warrior R.	Hale, AL	3149 (7800)	126 (78)
Lewis Smith	Sipsey Fk. Black Warrior R.	Walker, AL	8559 (21200)	61 (37.8)
Tuscaloosa	North River Black Warrior R.	Tuscaloosa, AL	2376 (5885)	40 (25)
Claiborne	Alabama R.	Monroe, AL	2362 (5850)	97 (60)
Millers Ferry	Alabama R.	Wilcox, AL	6944 (17200)	166 (103)
Robert F. Henry	Alabama R.	Autauga, AL	4966 (12300)	142 (88)
Purdy	Little Cahaba R.	Shelby, AL	424 (1050)	6 (3.7)
H. Neely Henry	Coosa R.	Calhoun, AL	4522 (11200)	93 (58)
Jordan/Bouldin	Coosa R.	Elmore, AL	2745 (6800)	25 (15.5)
Lay	Coosa R.	Shelby, AL	4845 (12000)	75 (46.5)
Logan Martin	Coosa R.	St. Clair, AL	6162 (15263)	75 (47)
Mitchell	Coosa R.	Chilton, AL	2362 (5850)	23 (14.2)
Weiss	Coosa R.	Cherokee, AL	12192 (30200)	85 (53)
Carters	Coosawattee R.	Murray, GA	1300 (3220)	9 (5.8)
Carters re.reg.	Coosawattee R.	Murray, GA	351 (870)	0.6 (0.4)
Allatoona	Etowah R.	Bartow, GA	4788 (11860)	33 (20.5)
Martin	Tallapoosa R.	Tallapoosa, AL	16149 (40000)	50 (31)
Thurlow	Tallapoosa R.	Elmore, AL	221 (547)	4 (2.7)
Yates	Tallapoosa R.	Elmore, AL	807 (2000)	10 (6)
Harris	Tallapoosa R.	Randolph, AL	4304 (10661)	39 (24)

* The Tennessee-Tombigbee Waterway Canal Section and some small headwater structures that have minimal impact on imperiled species are not included.

The Tombigbee, Black Warrior, Alabama and Mobile rivers have been gradually developed for navigation for more than a century. Deepening channels for navigation involved the removal of shallow shoals and other historic habitat for species that are now imperiled. Today, however, most navigation dredging consists of removing seasonally accumulated sediments in previously dredged reaches to maintain developed channels. Maintenance dredging and spoil disposal within such areas rarely adversely impact imperiled species, since these areas are too unstable for most of these species (Biggins 1994).

Gravel armored river bottoms provide important habitat for imperiled as well as commercial and sport species. Gravel armoring usually occurs in areas of a channel that naturally scour, and as such are not normally subject to maintenance dredging. Gravel armoring protects the river bed from erosion, stabilizes banks and bars, and prevents excessive sediment movement (Simons *et al.* 1982). Gravel dredging in such areas not only destroys bottom organisms and their habitats, but can also disrupt channel geomorphic stability causing channel bed and bank erosion (Lagasse *et al.* 1980, Kanehl and Lyons 1992). Currently, there are no active permitted instream gravel dredging operations in navigable waters of the Basin.

MINING for coal, sand, gravel, or gold is locally concentrated in areas within the Basin. Active and inactive coal mines are found in the upland drainages of the Black Warrior River, and in portions of the Cahaba and Coosa river drainages. Runoff from coal surface mining has resulted in acidification, mineralization, and sedimentation of streams and rivers, all of which are detrimental to aquatic species (Mason 1991). Such impacts are more closely associated with past activities and abandoned mines, since presently operating mines are required to employ environmental safeguards established by the Federal Surface Mining Control and Reclamation Act of 1977 and the Clean Water Act of 1972.

Instream sand and gravel mines can cause severe bank erosion, channel widening, destruction of riparian habitats, and other geomorphic changes including headcuts which can extend considerable distances upstream from the mines (Hartfield 1993). Poorly sited or inadequately designed mines in the flood plain can have similar effects. Concentrated sand and gravel mining activity in areas of the upper Tombigbee River and in the lower Tallapoosa River drainages have resulted in the decline or extirpation of rare endemic mollusks (Jones 1991, U.S. Fish and Wildlife Service 1993).

Gold mining historically occurred in the upper Coosa River drainage, and sediments in the headwaters of the Etowah River are contaminated by mercury from past mining actions (Leigh 1994). Small hydraulic dredge operations continue to impact streams in this area (The Atlanta Constitution 1982). The State of Alabama has also investigated the potential of mercury contamination of streams in eastern Alabama from past gold mining activities (ADEM *in litt.* 1994).

POLLUTION from inadequately treated effluent (waste discharge) of industrial plants and/or sewage treatment plants can eliminate, or reduce the density and diversity, of riverine species

(Hynes 1970). Effluents may be toxic to some species or may result in decreased dissolved oxygen concentrations, increased acidity and conductivity, and other changes in water chemistry which may adversely affect aquatic species. Carpet mills and fabric dying mills are believed to have had a major impact on stream communities in Coosa River tributaries in Alabama and Georgia (Hurd 1974). Large industrial plants, such as paper mills and refineries, are generally located on larger main-stem rivers because of their greater assimilation capacity (the capacity of a body of water to assimilate pollutants without environmental harm). When that assimilation capacity is exceeded, large river biotic communities are adversely impacted. In the past two decades, effluents from such industries have had less impact on the aquatic ecosystem because of the implementation of pollution control standards established by State and Federal water quality laws. In some stream/river segments, however, such improvements may have been negated by increases in the number of discharges.

Although more closely regulated than ever, industrial and municipal discharges may continue to threaten several populations of imperiled species in the Basin. Aquatic species vary in their sensitivities and reactions to effluent components. Stressors that have minimal effects on adults may prove limiting to reproduction, juveniles, and/or host fish. Current State and Federal water quality standards are assumed to be protective for all species. However, there is an almost total absence of toxicity data on listed and candidate species in the Basin. The Environmental Protection Agency (EPA) is working with the U.S. Fish and Wildlife Service (Service) to identify appropriate surrogates for imperiled aquatic species that can be used in toxicity studies to better define protective water quality standards and criteria.

> **Nonpoint source pollution** originates from land surface activities such as construction, agriculture, silviculture, urbanization, etc., and can be carried downstream. Stormwater runoff may carry: sediments, fertilizers, herbicides, and pesticides from lawns, sod farms, golf courses, cultivated fields, pastures, managed forests, and construction sites; animal wastes from cattle feedlots, dairy farms, poultry houses, and catfish ponds; septic tank leakage and greywater discharge from rural, suburban, and urban residences; and oils and greases from parking lots, highways, and roads. Some forms of nonpoint source runoff can be toxic to aquatic organisms at one or more of their life stages. Pollutants in stormwater runoff can also add to the effects of point source discharges from municipalities and industries. For example, recent studies indicate that imperiled aquatic species in the Cahaba River continue to decline due to the cumulative impacts of stormwater runoff and waste water treatment plant discharges (Shepard *et al.* 1996).

The current status and condition of the Basin's aquatic biota and habitats result from a historical progression of accumulating human use and impact to the ecosystem. Some impacts have been immediate and long lasting (e.g., physical habitat destruction). Others have changed over time with resource exploitation, regulation, or human population density.

Current and Future Threats to the Basin's Imperiled Aquatic Species

"This is the way the world ends,
Not with a bang but a whimper"
- T.S. Eliot, 1925.

The Basin's imperiled aquatic species currently survive in stream or river reaches (refugia) that are isolated from each other by impounded, dredged, polluted, or otherwise degraded channels. Impounding, channelizing, dredging, mining, or polluting river and stream refugia will result in, or contribute to, additional extinctions within the Basin. Several refugia are currently threatened. Tributaries that support a variety of imperiled species in the Tombigbee (e.g., Buttahatchee, East Fork, Luxapalila) and Tallapoosa (e.g., Uphapee, Chewacla, Opintloco) River drainages are eroding due to headcuts initiated by either local mines or channelization projects, or a combination of such activities (U.S. Fish and Wildlife Service 1993, Patrick and Dueitt 1996).

Refugia isolation also compounds the insidious (gradual, cumulative, harmful) effects of stormwater runoff on imperiled aquatic populations and communities. Isolated populations are more vulnerable to land surface runoff that affects water quality or the suitability of aquatic habitats within a watershed. Blocked from avenues of emigration (dispersal) to less affected watersheds, they gradually and quietly perish if changes in land use activities cause aquatic habitat conditions to deteriorate. Similarly, if positive land use changes improve previously degraded aquatic habitat conditions, barriers to immigration will, nevertheless, prevent natural recolonization.

While the detrimental effect of any one source or land use activity may be insignificant by itself, the combined effects of land use runoff within a watershed may result in gradual and cumulative adverse impacts to isolated populations and their habitats. For example, excessive sediments deposited on stream bottoms can smother and kill relatively immobile bottom-dwelling species, and can eliminate more mobile aquatic species by making their habitat unsuitable for feeding or reproduction (Brookes 1994, National Research Council 1992, Waters 1995, Hartfield and Hartfield 1996). Suspended sediments can interfere with feeding or affect behavior and reproduction (Waters 1995, Haag *et al.* 1995). Sediment is the most abundant pollutant in the Basin in terms of quantity produced (ADEM 1989). Potential sediment sources within a particular watershed include virtually all activities that disturb the land surface. Severe sedimentation problems are currently evident throughout most of the Basin, from headwater mountain streams to large coastal plain rivers.

Excessive nutrient input from multiple sources (e.g, nitrogen and phosphorus from fertilizer, sewage waste, animal manure, etc.) into an aquatic system can also have cumulative effects. In fact, land surface runoff contributes the majority of human-induced nutrients to water bodies throughout the country (Louisiana Department of Environmental Quality 1995). Large amounts of nutrients in surface runoff can result in periodic low dissolved oxygen levels that are detrimental to aquatic species (eutrophication) (Hynes 1970). They also promote excessive algal

growth that can eliminate habitat for aquatic species requiring clean rock or gravel substrate during one or more of their life stages (e.g., Hartfield and Hartfield 1996). Excessive nutrients within a stream or river can also indicate the potential presence of pathogenic microorganisms.

Although reservoirs do not provide habitat for the riverine species covered by this Plan, more than half of the large reservoirs in the Basin have excess nutrient levels (as measured by their Trophic Index) (ADEM 1994, Alabama Fisheries Association 1996). Some have nutrient levels that could endanger aquatic life and/or significantly diminish the reservoirs value for other uses.

Stream and river reaches that support the Basin's imperiled species remain vulnerable to progressive degradation from land surface runoff. In many cases, it is small, everyday, non-regulated activities considered "insignificant" by most of us that will ultimately cause continued decline and extinction of the Basin's aquatic species. Stream and river refugia can only be maintained by appropriate land and water stewardship within their respective watersheds.

Conservation Measures

Although the effects of modern human activities on the aquatic ecosystem may appear overwhelming, their potential impacts have been reduced by numerous mandated and voluntary conservation measures. Industrial and municipal compliance with State and Federal water quality regulations has substantially improved the quality of many receiving waters. Regulatory compliance by the surface mining industry has reduced detrimental mine drainage. Farms and ranches have applied new knowledge and improved technology to reduce agricultural erosion, protect wetlands, and refine fertilizer and herbicide applications. Voluntary forestry Best Management Practices (BMPs) have been developed in all four states drained by the Basin and are being implemented by many commercial and private interests. Programs and manuals are continuously being developed or refined by State and private interests to improve and to encourage the application of BMPs for construction, forestry, agriculture, and animal waste disposal that are more protective of water quality.

The Basin's citizens are also seeking to protect watershed quality and values by forming grass roots organizations. Community action groups such as the Cahaba River Society, Conasauga River Alliance, Friends of the Locust Fork River, Five Mile Creek Action Committee, Friends of Buck Creek, Friends of Little River, Coalition for the Preservation of Hatchet Creek, Alabama Rivers Alliance, and others advocate proper stewardship of the Basin's aquatic resources. The Mobile River Basin Coalition, a group of concerned business, environmental, and government representatives, has organized to promote effective stewardship of the ecosystem's natural resources through education, dialogue, and voluntary individual and community actions.

State and other Federal agencies are working with the U.S. Fish and Wildlife Service to monitor and protect listed species in the Basin, conduct research, and minimize conflicts. Various programs of State conservation agencies conduct inventories and surveys, distribute information, and regulate actions that could adversely impact water quality and quantity. In addition to such

contributions, the Alabama Department of Economic and Community Affairs, Office of Water Resources hosts and provides office support for the Mobile River Basin Coalition. The U.S. Forest Service has revised and strengthened stream management zone guidelines on National Forests in Alabama.

The EPA is reviewing the need for using additional surrogate species to test for impacts of pollution on listed aquatic species in recognition of the greater sensitivity of listed species to common pollutants. The U.S. Army Corps of Engineers, Natural Resources Conservation Service, Federal Energy Regulatory Commission, and other agencies have reviewed and revised programs, projects, and permits to protect listed species in the Basin. Surveys of historic habitat, status assessments of imperiled species, and water quality investigations are underway in portions of the Basin (see Appendices A and B for additional species specific conservation measures, and Appendix F for ongoing environmental and conservation programs in the Basin).

Human Demographic Trends and Implications for Imperiled Aquatic Species

The decline of the Basin's aquatic ecosystem and imperiled species are the result of increasing human populations, past modifications to meet their needs, and impacts of current land use activities. Demographic trends indicate that the human population and associated needs for housing, recreation, water, electricity, forest and agricultural products, waste disposal, sand and gravel, etc., will continue to increase within the Basin (Figure 2).

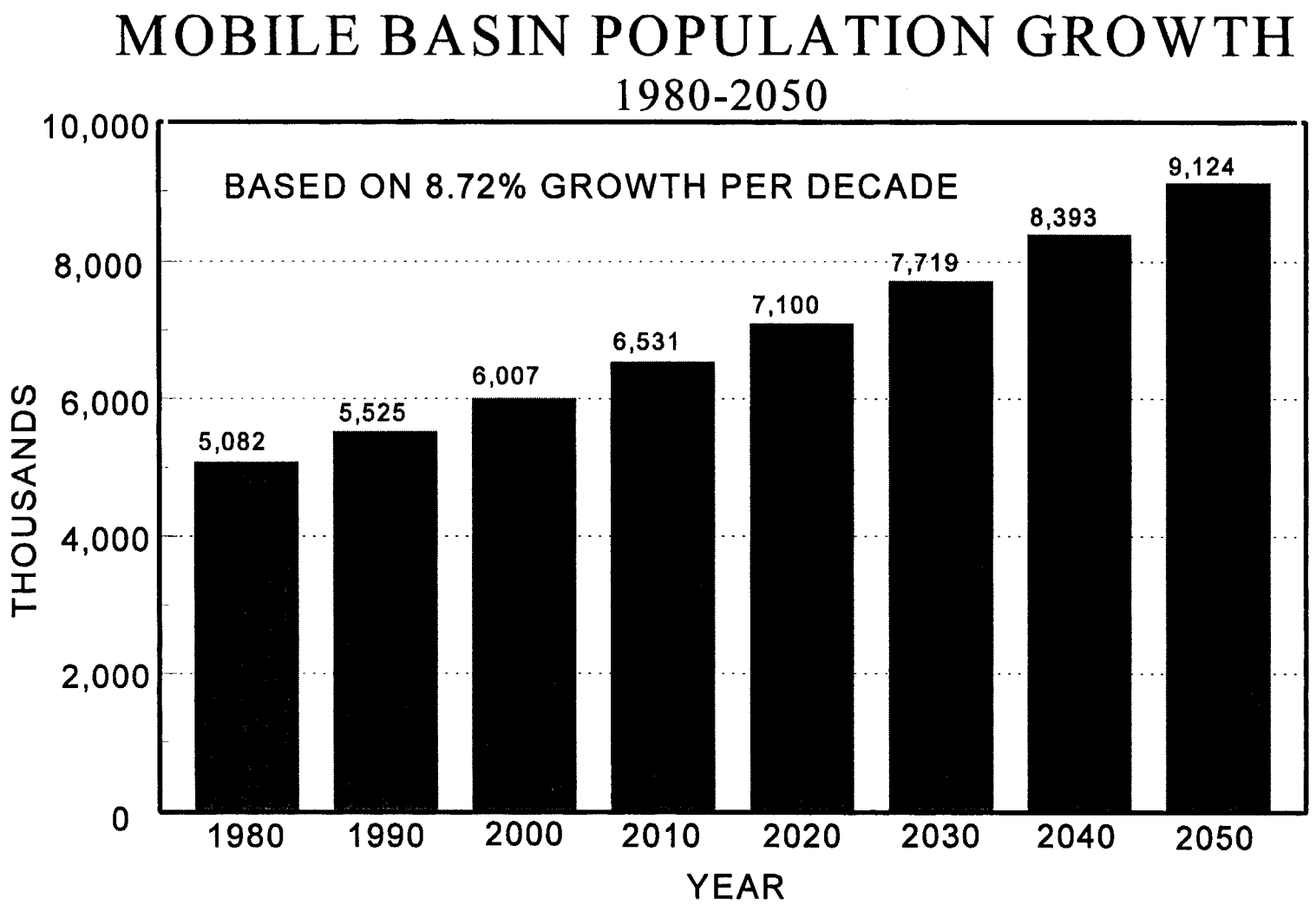
Although considerable State, Federal, and private efforts are currently underway to reduce pollution, protect habitat, and minimize conflicts, increasing and changing demands for the Basin's resources will continue to locally impact imperiled species populations and their habitats. Listed and other isolated imperiled species populations will remain vulnerable to random accidents, such as toxic spills, and to natural catastrophic events, such as droughts and floods, even if land uses and human populations were to remain constant within isolated watersheds. The implications are that it is highly unlikely that recovery can be achieved, or the *status quo* of the Basin's imperiled aquatic species can be maintained, without some degree of habitat management and aquatic species population manipulation.

Recovery Strategy

"Troubled by what we have wrought, we turn in
our role from local conqueror to steward."
- E.O. Wilson, Harvard University entomologist and author.

The major problems affecting the Basin's aquatic ecosystem are large in scale, interrelated, and highly complex. In addition to imperiled species, these problems result in direct social costs -- for water treatment and waste disposal, decreased recreational and commercial fisheries, and, in some locations, property losses and devaluation. Problems associated with complex

FIGURE 2:



Prepared by Dr. George Folkerts, Auburn University, Alabama. Source: 1990 Census.

issues such as urban and industrial waste management and water quality standards require considerable time and effort to resolve. Such problems also affect human health and quality of life and must be addressed regardless of their impacts upon other forms of life.

Current laws and regulations require that future projects that may cause impacts to aquatic species and their habitats (e.g., impoundments, channelization, etc.) are assessed in regard to need, environmental impact, possible alternatives, and costs. Laws and regulations, however, cannot guarantee that the most cost effective or least damaging alternative will be selected in every case. The best guarantee that such selections will be made is recognition of environmental functions and values, and an awareness of individual and societal stewardship responsibilities.

Therefore, the primary strategy of this Plan is to emphasize stewardship responsibilities shared by all inhabitants of the Basin in maintaining the aquatic ecosystem. All citizens, whether urban or rural, share the benefits of resource use and exploitation, and also benefit from maintaining environmental quality and biodiversity.

The Plan promotes three basic tenets:

1. Use to the fullest practical extent existing laws, regulations and policies to protect listed populations and their habitats, and to develop and encourage a stream management strategy that places high priority on conservation and restoration. Currently, over 75% of all U.S. faunal extinctions, and almost 50% of all listed species are from free-flowing river and stream habitats. As exceptional loci (places) of extinction and imperilment, the Basin's free-flowing riverine habitats require conservation priority. Management of imperiled aquatic species and their habitats must incorporate protection, restoration, and manipulation.

2. Encourage voluntary stewardship through joint initiatives and individual actions as the only practical and economical means of minimizing adverse effects of private land use and activities within watersheds. The watershed is the basic restoration unit of the Basin. Hundreds of stream watersheds converge to form river drainages, which coalesce to form the Basin. Land use practices within a watershed are intimately tied to the condition of the stream or river that drains it. Voluntary soil and water stewardship practices implemented by individual landowners and communities can result in significant contributions to watershed quality and imperiled species status. In general, landowners may feel threatened by the presence of listed species on or near their properties. They may be reluctant to participate in watershed stewardship practices oriented toward protecting, enhancing or restoring endangered and threatened species habitat. Giving landowners and communities primary stewardship responsibilities for the watersheds they inhabit, and providing mechanisms for them to play major

decision-making roles in watershed management may reduce fear of property and economic impacts.

3. Continue to promote research efforts on life histories, sensitivities, and requirements of imperiled aquatic species, and develop technological capabilities to maintain and propagate them. Such information derived from research will result in increased management flexibility.

It is known that human use, population numbers, and associated impacts will change within watersheds. Therefore, the ability to manipulate imperiled populations and their habitats will improve their chances of survival and greatly increase future management options. Current obstacles to management include: **public perceptions** that the presence of listed species within a watershed diminishes private property uses and values; **a lack of consensus for a stream management strategy** within the Basin; **depressed population numbers** of imperiled species, making relocations risky and augmentation impossible; and **technological barriers** to artificial propagation and population augmentation. This plan promotes education, communication, and partnerships as methods to minimize or eliminate current obstacles to management options.

The Mobile River Basin aquatic ecosystem has been converted by modern human activities from a free flowing water continuum to a scattered collection of isolated segments of rivers and streams that function as refugia of biodiversity. Maintaining the remnants of this unique legacy will require human intervention for decades to come. The primary responsibility for aquatic ecosystem management is, and should be, firmly in the hands of all of the Basin's inhabitants. We must work together to understand, promote, and achieve the proper balance of land and water use and stewardship. This is the only practical way to maintain the ecosystem's quality for both humanity and the Basin's unique aquatic communities.

PART II

RECOVERY

A. Ecosystem Management Objective

The U.S. Fish and Wildlife Service's goal in developing and implementing recovery plans is to improve the status of listed species to the point that protection under the Endangered Species Act is no longer required. Imperilment and extinction are Basin-wide aquatic ecosystem phenomena. Therefore, a primary objective of this Ecosystem Plan is to achieve increased management flexibility and options by promoting higher levels of innovative land and water stewardship. This objective can be accomplished by fully using existing State and Federal legislation and regulations to protect, enhance, and manage aquatic habitats throughout the Basin, and by encouraging and assisting private landowners and economic interests toward these goals. Aquatic ecosystem management is a permanent commitment if we are to minimize future listings and extinctions and maintain human options and quality of life in the Basin.

B. Listed Species Recovery Objectives and Criteria (see Appendices A & B for species specific information)

Tulotoma snail (Endangered)

The immediate recovery objective for the tulotoma snail is to reclassify the species from endangered to threatened status. Recent studies indicate that reclassification may currently be warranted. Since listing, two additional small Coosa River tributary tulotoma snail populations have been discovered, making a total of seven known populations within the drainage. The largest of these is found in the Coosa River, below Jordan Dam, Elmore County, Alabama. Since the tulotoma snail was listed, the Alabama Power Company (APC) has significantly increased minimum flows below Jordan Dam (FERC 1990). Results of a 3 year study by the APC indicate that this population is stable, reproducing, contains high numbers of individuals, and has the capacity to move into habitat made available by the increase in the minimum flow regime (Christman *et al.* 1995). Additionally, this study has provided valuable information regarding reproduction, fecundity, population demographics, and other important aspects of life history. Other studies funded by the State of Alabama have provided habitat information for several tributary populations (Devries 1994). The tulotoma snail will be considered for reclassification from endangered to threatened status when a status review of these studies is completed and confirmation is obtained that a stable or increasing population occurs in the Coosa River, below Jordan Dam. The estimated date for reclassification is 2002.

Delisting of the tulotoma snail will be considered when (1) a formal agreement has been developed with Alabama Power Company to maintain base flows below Jordan Dam that are protective for tulotoma, (2) four of the six known tributary snail populations (Choccolocco, Hatchet, Kelly, and Weogufka Creeks) are shown to be stable or increasing for at least five years, and (3) community developed watershed plans are implemented to protect and monitor water and habitat quality in the four targeted watersheds. The estimated date for delisting is 2010, if recovery criteria are met.

Goldline darter (Threatened)

The recovery objective for the goldline darter is to delist the species. Delisting will be considered when (1) the known populations of the goldline darter are shown to be stable or increasing for a period of at least 5 years; (2) there has been a demonstrated trend in water quality improvement in the reach of the Cahaba River occupied by this fish; and (3) community developed watershed plans are implemented to protect and monitor water and habitat quality in all occupied watersheds. The estimated date for delisting is 2010, if recovery criteria are met.

Cherokee (Threatened) and Etowah (Endangered) darters

The recovery objective is to delist the Cherokee and Etowah darters. Delisting these species will be considered when (1) their known populations are shown to be stable or increasing for a period of at least five years, and (2) community developed watershed plans are implemented to protect and monitor water and habitat quality in all occupied watersheds. The estimated date for delisting is 2010, if recovery criteria are met.

11 mussel species (3 Threatened, 8 Endangered)

Recovery of the 11 mussel species specifically covered by this plan to the point of downlisting or delisting is unlikely in the near future because of the extent of their decline, population isolation, their apparent sensitivity to common pollutants, and continued impacts upon their habitats (see Appendix A). Protecting surviving populations of threatened and endangered mussels and their stream and river habitats is the immediate recovery objective. For most of these populations, protection can best be achieved at watershed levels by voluntary community stewardship awareness, action, and planning.

A synopsis of recovery objectives for other listed species in the Basin with previous recovery plans is found in Appendix B. Recovery criteria for any of the Basin's 39 listed aquatic species may be revised on the basis of new information generated from the completion of recovery tasks.

C. Narrative Outline

1. **Protect habitat integrity and quality of river and stream segments that currently support or could support imperiled aquatic species.** Stemming the decline and loss of instream aquatic habitats throughout the Basin is essential for maintenance and management of the species and communities these habitats support. River and stream reaches known to be occupied by endangered or threatened aquatic species are generally protected by provisions of the Endangered Species Act from projects and actions that would adversely affect instream habitats. However, many high quality stream and river reaches currently without known listed populations may contain other unlisted imperiled species, or may be suitable for eventual restocking with listed aquatic species. Providing a higher degree of consideration for such areas will maintain options essential for the successful management of isolated populations within a fragmented ecosystem. Regulatory agencies, municipalities, businesses and industries, and private land owners should thoroughly consider and apply creative alternatives to habitat modification, waste disposal, and other impacts to the aquatic ecosystem. The key to successful recovery planning that minimizes impacts to both listed species and stakeholders is vigilant monitoring and management of remaining instream habitats through informed participation by all stakeholders.

   1.1 **Identify for protection free flowing stream and river reaches that support high native aquatic biodiversity.** Identification brings recognition of special protection needs. Basin river and stream reaches that support historically occurring, reproducing endemic species and communities are valuable but diminishing resources. These reaches should be recognized by regulatory agencies and given appropriate consideration to mitigate (i.e., avoid, minimize, or compensate for) adverse impacts.

   1.2 **Minimize aquatic habitat impacts resulting from activities or permits conducted or issued by regulatory authorities.** Major habitat modifications that have had the most serious impacts on the aquatic biota of the Basin have been either constructed or authorized by Federal and/or State regulatory agencies. Such modifications in the future for flood control, navigation, water supply, mining, etc., must be fully considered for need and alternatives. Practical alternatives such as floodplain easement purchases, relocation of floodplain structures or activities, protection of headwater wetlands, etc., should be used where and when appropriate. All construction activities permitted or conducted by Federal, State, County, or other local regulatory authority should effectively

implement Best Management Practices for stormwater runoff and sediment control.

1.3 **Encourage development and implementation of appropriate guidelines for mining sand and gravel from alluvial channels and floodplains.** Mining for sand and gravel within river and stream channels should be tightly regulated. Such activities, including the mining of point bars can change the geometry of the channel and result in channel adjustment, upstream channel degradation and bank erosion, and downstream sediment deposition and turbidity. In a study conducted for the U.S. Army Corps of Engineers, Mobile District, Simons *et al.* (1982) made recommendations to avoid channel degradation from gravel dredging operations within the Tennessee-Tombigbee Waterway. These included developing quantitative safe yield analyses prior to mining, before and after extraction hydrographic surveys of the channel, and maintenance of extraction amount records. Floodplain sand and gravel mines can be environmentally sound and economical sources of aggregates; however, improperly designed or sited mines can also initiate channel adjustment problems. Appropriate State agencies in the Basin should develop and implement guidelines to ensure that floodplain mines are properly designed and located, adequate buffer strips between mines and stream channels are maintained, waste treatment and discharges are monitored, and mine sites are rehabilitated upon closure. Geomorphic studies should be conducted on free flowing streams with current or past sand and gravel mining operations. Appropriate actions should be taken to protect stream channel integrity where geomorphic problems are identified.

1.4 **Work with States under the Triennial Review Process to ensure water quality standards and classifications that provide for ecosystem stabilization.** In many streams and rivers, even where instream physical habitats remain adequate, water quality degradation has caused the extirpation of entire faunal assemblages (e.g., pleurocerid snails and freshwater mussels in the Mulberry Fork, Black Warrior River drainage), or significantly reduced species diversity (e.g., mussels in the Cahaba and Coosa River drainages). Although measures taken to improve water quality over the past two decades have generally been effective, in some stream segments they have been overwhelmed by local increases in urban and agricultural runoff, and/or industrial and municipal discharges. Protection of water quality into the next century will require strict adherence to current standards and regulations. In some cases, changes of the standards and criteria may be necessary. Water quality standards and classifications of each State in the Basin are reviewed and revised at 3-

year intervals. State water quality classifications, waste load allocation models, permit review processes, and other important water quality actions should be revised where appropriate studies have identified and quantified inadequacies.

1.5 **Promote and support a watershed management approach to water quality.** A watershed management approach synchronizes water quality monitoring, inspections, and permitting within a defined watershed (see Appendix F (2)). It has the potential of integrating imperiled species habitat concerns with all other water quality issues, including economic and human health, within the defined watershed. Such an approach allows a greater degree of public education about, and involvement with, local water quality issues and decisions. It may prove useful in providing community incentive to reduce nonpoint source impacts to water quality.

1.51 **Develop coordinated plans to address sanitary wastewater treatment plant effluents within severely impacted watersheds.** Sanitary wastewater treatment plant effluents are a major contributor to stream eutrophication, particularly in urban areas. Many wastewater treatment plants need to be upgraded as necessary to protect aquatic resources. Alternative methods of handling urban and suburban wastes, such as constructed wetlands or land application (see EPA 1987), need to be investigated and adopted where possible.

1.52 **Encourage alternative disinfection measures for the treatment of sewage wastes in sensitive watersheds.** Residual chlorine and certain other wastewater components resulting from disinfectant procedures are toxic to aquatic organisms. There may be adverse long-term impacts from these diluted discharges on the survival and reproduction of the Basin's endemic aquatic fauna. The nature and extent of such impacts are currently unknown. However, many listed and imperiled aquatic species have disappeared from receiving stream reaches. Alternative disinfectant techniques, such as treatment with ultraviolet radiation, ozone, etc., are available and should be considered for use in sensitive watersheds (i.e., those with listed species and/or endemic communities).

1.53 **Encourage compliance with current water quality discharge limitations and regulations.** Current State and Federal enforcement programs should ensure consistent compliance with National Pollution Discharge Elimination System (NPDES) permit conditions and discharge limitations. Regulated industrial, sewage

treatment plant, surface mine permitted discharges, and stormwater runoff should be monitored with sufficient frequency to encourage compliance with water quality standards. Unpermitted discharges should be identified and brought into compliance. Increased public involvement and attention to watershed conditions may provide opportunities for community based monitoring.

1.54 **Encourage effective silt and sediment runoff control from all construction activities.** Uncontrolled sediments from temporary construction activities contribute to river and stream degradation. Excess sediments may smother stream bottom habitats and/or result in erosion and other channel changes. Construction contractors should be encouraged to use and maintain effective sediment control techniques and dispose of excess sediments such that these materials will not eventually reach surface waters.

1.55 **Encourage consideration of standards for water withdrawal from tributary streams in States drained by the Basin.** Water withdrawal from streams for irrigation and other uses severely affects some streams in the Basin during low flow periods. Surface water demands for domestic, industrial, and irrigation purposes will likely continue to increase. Identifying and adopting sustainable minimum flow standards applicable to water withdrawals will protect aquatic resources and communities, encourage consideration of alternative technology, and reduce future conflicts.

2. **Consider options for free-flowing river and stream mitigation strategies that give high priority to avoidance and restoration.** As noted above, avoidance of impact is the most important and immediate management need for maintaining existing imperiled populations and their habitats. However, long-term management requires the ability to accommodate changes in human use of the Basin's resources. Restoration of stream and river reaches, and rehabilitation of their aquatic communities will increase management options to accommodate future changes within the Basin. Compensating for aquatic habitat impacts can be an important component of aquatic habitat management.

2.1 **Identify appropriate mitigation measures for free flowing streams and rivers.** When destruction or alteration of stream or river habitat is unavoidable, there should be an effort to restore or rehabilitate a comparable amount of instream aquatic habitat elsewhere in the Basin. Unfortunately, there is little guidance or consensus for the amount and degree of measures that could satisfy mitigation goals for free flowing riverine habitat. Federal, State, and local environmental and regulatory

agencies and nongovernmental interests must work toward consensus on this problem, considering issues such as amount, quality, and location of river or stream segments under consideration for mitigation measures, and other alternatives, such as the need and possibility of establishing mitigation banks for permit applicants.

2.11 **Investigate the potential of partnerships and assistance to relieve land use problems within watersheds as a form of mitigation.** Concentrated land uses within watersheds can overwhelm the benefits of individual landowner Best Management Practices (BMPs). Animal wastes from concentrated husbandry of poultry, fish, and livestock is a major determinant of water quality in some watersheds. Urbanization of watersheds also causes complex runoff/water quality problems. Such problem areas may offer creative mitigation opportunities. Examples include developing equipment, facilities, or other components to establish centralized waste treatment for areas of high concentration of poultry farms and other animal feedlots; and providing assistance to communities for stormwater catchment and treatment.

3. **Promote voluntary stewardship as a practical and economical means of reducing nonpoint pollution from private land use.** BMPs can be effective and practical actions identified to prevent or reduce nonpoint pollution from specific land use activities (ADEM 1989, MSDEQ 1994). For example, agricultural BMPs are designed to reduce sediments, animal wastes, fertilizers, and pesticides in stormwater runoff (e.g., ASWCC 1995). Mining BMPs address sediments and water quality parameters such as acidity and metal concentrations (e.g., ADEM 1989). Silviculture BMPs include actions to minimize sediments, nutrients, organics, chemicals, and stream canopy removal (e.g., MFA 1989, AFC 1993). BMPs are also available for urban, construction, and homeowner activities that address stormwater runoff quality and quantity (ASWCC 1992, MSDEQ 1994). BMPs are developed by State and industry planning partnerships with public participation, and can be effective when they are properly implemented and adequately maintained. BMPs, however, are not always fully implemented or maintained. Industry groups and organizations, and State resource agencies should continue to promote and improve BMPs when necessary as a nonregulatory approach to aquatic ecosystem management.

3.1 **Work with State and private partners to promote land and water stewardship awareness.** Local offices of State and Federal agencies and private organizations can become a primary source of encouragement and information for imperiled species and aquatic ecosystem management. For example, local offices (e.g, Soil and Water Conservation Districts,

Natural Resources Conservation Service, State Forestry Commissions, private industry groups, environmental groups, etc.) can identify watersheds with listed species within their areas; inform local landowners of listed species presence, needs, and special management concerns; recommend appropriate BMPs; and mediate landowner concerns or conflicts with appropriate State and/or Federal agencies. In some watersheds, standard BMPs may need to be adjusted according to stream size, soil conditions, and land use intensity. Private industry groups can work with local landowners to customize BMPs where needed to address watershed problems and practices.

3.2 **Encourage the development and implementation of adequate Streamside Management Zones (SMZs) along all streams and rivers in the Basin.** Properly designed SMZs, acting as filter strips, can buffer the impacts of land use activities on water and stream bottom habitat quality. SMZs protect public and private property from erosion, reduce downstream sedimentation, and enhance fish and wildlife values for both game and nongame species. SMZs can also reduce nutrient levels in tributary streams in the Basin, which will help control eutrophication in Basin reservoirs (see Part I, Section C. Current and Future Threats to the Basin's Imperiled Aquatic Species). Some farmlands adjacent to streams and rivers may qualify for SMZ set aside under the U.S. Department of Agriculture's Conservation Reserve Program and other initiatives. SMZs are widely recognized as cost effective habitat management practices. For example, the American Forest and Paper Association's Sustainable Forestry Initiative requires its members to meet or exceed existing SMZ state standards. SMZs may be custom designed to protect stream habitat while achieving individual landowners management objectives. For example, the Natural Resources Conservation Service recommends SMZs from 22-91 meters (75-300 feet), with varying restrictions, depending on soil, slope, topography, and land use. Other government agencies and private groups make similar recommendations. SMZs are also effective in controlling urban and suburban stormwater runoff.

4. **Encourage and support community based watershed stewardship planning and action.** Protection, restoration, and management planning for imperiled aquatic habitats is best accomplished by partners and stakeholders within a watershed. Such grassroots community planning educates participants about aquatic species, their habitat needs, and sensitivities; acknowledges local activities, problems and their effects on water; and leads to buy-in to local solutions. Stewardship partnerships are essential in watersheds supporting listed or other imperiled aquatic species, and should be encouraged within any of the

Basin's watersheds. Resource and regulatory agencies should offer support, materials, and technical and facilitation assistance when requested.

4.1 **Reduce private land use/endangered species conflicts.** Landowners and other watershed inhabitants may feel threatened by the presence of listed aquatic species, and be reluctant to participate in watershed stewardship planning or action. In such cases, Watershed Habitat Conservation Plans, Safe Harbor Agreements, or other innovative avenues to assure and guarantee private land uses within watersheds should be developed.

5. **Develop and implement programs and materials to educate the public on the need and benefits of ecosystem management, and to involve them in watershed stewardship.** Only an informed and proactive public can bring about ecosystem stabilization and rehabilitation. Successful ecosystem management will require public involvement, monitoring, and commitment of resources. Educational materials and programs should describe the concept and need for ecosystem management, its long-term economic and environmental advantages, and public and individual stewardship responsibilities.

6. **Conduct basic research on endemic aquatic species and apply the results toward management and protection of aquatic communities.** The biology and ecology of endemic aquatic species in the Basin are poorly known. Information on distribution, habitat requirements, life stage sensitivity to contaminants, and the identification of mussel host fish is essential to the recovery of endemic species and management and protection of their communities and habitats. All partners should be aware of research efforts and results, so that information can be immediately applied.

6.1 **Survey and monitor the status of listed and other endemic aquatic species.** Extant populations of listed and other endemic species should be located and their status monitored.

6.2 **Conduct detailed physical and molecular genetic analyses of endemic species.** Most of the basin's endemic aquatic species have not been fully described anatomically. This information, in conjunction with genetic biochemical comparisons of populations and related species, may provide information important to population management and recovery.

6.3 **Determine contaminant sensitivity for each life stage.** It is known that juvenile and adult life stages of aquatic fauna may differ in sensitivity to contaminants. The technology and methodology should be developed to determine sub-lethal and lethal levels of pesticides, herbicides, and

common contaminants and discharges to listed species and other endemic organisms in the Basin.

6.4 **Conduct life history research on endemic species to include reproduction, food habits, age and growth, mortality factors, etc.** Life history information may provide insight into past declines, current status of endemic species, weak links in the life cycle, and management guidance for their recovery.

6.41 **Identify breeding periods of endemic species, mussel reproduction strategies, and host fish of endemic mussels.** Most mussels are dependent upon a host fish for completion of their life cycle. Hosts for many endemic mussel species in the basin are currently unknown. Identification and protection of host fish is critical to the continued survival of mussel species.

6.42 **Determine nutritional requirements of endemic species life stages.** It is possible that juvenile forms of many taxa feed on different items than adults. Such requirements may be limiting factors in the survival of these species. Nutritional requirements must be known for successful captive propagation of endemic species (see Task 7).

7. **Develop and implement technology for maintaining and propagating endemic species in captivity.** Populations of endemic species in the Basin are isolated by large expanses of impounded, or otherwise severely altered, habitat. Maintenance of genetic flow between extant populations, and reintroduction of species to restored habitats, will require human intervention. Populations of many species are currently too low to justify translocation of wild stock between drainages. Captive propagation will be required to produce reintroduction stock if ecosystem restoration is eventually successful (see Task 8). Large numbers of juveniles and adults will also be needed for research to determine sensitivity of species to common contaminants (Task 6.3).

8. **Reintroduce aquatic species into restored habitats, as appropriate.** For many listed species, this step will be possible only when, and if, successful captive propagation technology is developed. Reintroduction will be closely coordinated with appropriate State agencies and affected private landowners. No reintroduction or translocation of species should be made without the concurrence of the appropriate State wildlife resource agencies and the knowledge and consensus of local watershed inhabitants.

8.1 **Identify sites for translocation/reintroduction.** Potential sites for reintroduction consist of streams within the historic range of endemic species that meet the substrate, flow, water quality, and other environmental requirements of the species. Such sites need to be identified and monitored.

8.11 **Survey and prioritize potential sites.** Water quality, substrate composition, aquatic community composition, and watershed land uses should be characterized. Priority should be given to watersheds with appropriate habitat, diverse faunal assemblages, minimal land use impacts, and active management programs.

8.2 **Translocate target endemic species to priority sites.** Translocations should be conducted in a rigorous, scientific manner, and should be well-documented.

8.3 **Monitor translocated populations.** Stream and river reaches with translocated populations should be monitored and surveyed annually for a minimum of 5 years following translocation.

9. **Monitor listed species population levels and distribution and periodically review ecosystem management strategy.** Listed species will be monitored by Tasks 6.1 and 8.3. Changes in distribution (losses and gains) should be used to focus recovery efforts and priorities. Ecosystem management strategy should be periodically reviewed and revised, if appropriate, based on this information.

10. **Coordinate ecosystem management actions.** The above recovery tasks approach ecosystem stabilization and management on three tiers: Federal and State regulatory authority and responsibility; private activities, public education and involvement; and research. Implementation of these tasks will involve multiple partners including State and Federal agencies, municipal and county governments, environmental and recreational organizations, civic groups, educational and research institutions, business and industry groups, landowners, and interested individuals. Successful implementation requires development of partnerships, coordination of on-going activities, determination and prioritization of needed actions, and monitoring recovery progress within each of the Basin's major drainages.

10.1 **Support the Mobile River Basin Coalition (Coalition) in its efforts to define and coordinate aquatic ecosystem management.** Recovery tasks and subtasks outlined above are broad in scope, and will require broad participation and planning to be successfully implemented. The Coalition has the private/government representation needed to define, plan,

prioritize, and implement recovery tasks at the Basin, drainage, and watershed levels. Coalition partners can provide institutional, technical, and fiscal support as appropriate to accomplish ecosystem management objectives.

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PART III

IMPLEMENTATION SCHEDULE

Recovery plans are intended to assist the U.S. Fish and Wildlife Service and potential Federal, State, and private partners in planning and implementing actions to recover and/or protect endangered and threatened species. The following Implementation Schedule outlines recovery actions and their estimated costs for the first 3 years of this recovery program. It is a guide for planning and meeting the objectives discussed in Part II of this plan. The Schedule indicates task priorities, task numbers, task descriptions, duration of tasks, potential partners and responsible agencies, and lastly, estimated costs.

Recovery tasks are assigned numerical priorities to highlight the relative contribution they may make to species recovery. Priorities in column 1 of the Implementation Schedule are assigned as follows:

1. Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

2. Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

3. Priority 3 - All other actions necessary to meet the recovery objectives and provide for full recovery of the species.

While the Endangered Species Act assigns a strong leadership role for the U.S. Fish and Wildlife Service in recovery of listed species, it also recognizes the importance of other Federal agencies, States, and private citizens in the recovery process. The Responsible Agency column of the Implementation Schedule identifies partners who can make significant contributions to specific recovery tasks. **The identification of agencies within the Schedule does not constitute any additional legal responsibilities beyond existing authorities**, i.e., Endangered Species Act, Federal Land Policy and Management Act, Clean Water Act, etc.. **Recovery plans do not obligate other parties to undertake specific tasks and may not represent the views nor the official positions or approval of any individuals or agencies involved in developing the plan, other than the U.S. Fish and Wildlife Service.**

The Cost Estimates provided in the Implementation Schedule identify foreseeable expenditures that could be made to implement the specific recovery tasks during a three year period. **Actual expenditures by identified agencies/partners will be contingent upon appropriations and other budgetary constraints.**

Key to acronyms used in Implementation Schedule:

ADEM	-Alabama Department of Environmental Management
ALOWR	-Alabama Office of Water Resources
COE	-Corps of Engineers
EPA	-Environmental Protection Agency
ES	-Ecological Services Division, U.S. Fish and Wildlife Service
GADNR	-Georgia Department of Natural Resources
MSDEQ	-Mississippi Department of Environmental Quality
TNDEC	-Tennessee Department of Environment and Conservation
USDA	-U.S. Department of Agriculture, includes Forest Service and Natural Resources Conservation Service
USFWS	-U.S. Fish and Wildlife Service

Other State and Federal agencies which may participate in implementation:

Alabama Department of Conservation and Natural Resources
Alabama Department of Industrial Relations
Alabama Forestry Commission
Alabama Surface Mining Commission
Mississippi Department of Wildlife, Fisheries, and Parks
Office of Surface Mining
Tennessee Valley Authority
Tennessee Wildlife Resources Agency
U.S. Geological Survey

Other partners and stakeholders may include concerned businesses and industries, research institutions, County and City governments, private landowners, conservation organizations, etc..

MOBILE RIVER BASIN AQUATIC ECOSYSTEM IMPLEMENTATION SCHEDULE

PRIORITY #	(1) TASK #	TASK DESCRIPTION	TASK DURATION	RESPONSIBLE PARTY			COST ESTIMATES (2) ($K)			COMMENTS/NOTES
				USFWS						
				Region	Division	Other	FY 1	FY 2	FY 3	
1	1.0	Protect habitat integrity and quality	continuous	4	ES	All partners and stakeholders				Cost absorbed under existing programs
2	1.1	Identify high biodiversity stream and river reaches for protection	continuous	4	ES	Appropriate State and Federal agencies	20	20	20	
2	1.2	Minimize aquatic habitat impacts	continuous	4	ES	Federal, State Agencies, County and local governments				Cost absorbed under existing programs
2	1.3	Encourage development and implementation of mining guidelines	5 years	4	ES	COE, EPA, State Governments	30	30	30	Geomorphic studies
2	1.4	Work with States to ensure water quality	continuous	4	ES	EPA, ADEM, MSDEQ, GADNR, TNDEC	30	30	30	Toxicity studies
2	1.5	Promote and support a watershed management approach to water quality	continuous	4	ES	EPA, ADEM, MSDEQ, GADNR, TNDEC				Cost absorbed under existing programs
2	1.51	Develop coordinated plans to address WTP effluents within watersheds	5 years	4	ES	EPA, ADEM, MSDEQ, GADNR, TNDEC, other State and local partners				Cost absorbed under existing programs
2	1.52	Encourage alternative STP disinfection measures	5 years	4	ES	EPA, ADEM, MSDEQ, GADNR, TNDEC				Cost absorbed under existing programs
2	1.53	Encourage compliance with current water quality discharge limitations and regulations	continuous	4	ES	EPA, ADEM, MSDEQ, GADNR, TNDEC				Cost absorbed under existing programs
1	1.54	Encourage effective silt and sediment runoff control	continuous	4	ES	EPA, USDA, ADEM, MSDEQ, GADNR, TNDEC				Cost absorbed under existing programs
2	1.55	Encourage standards for water withdrawal from tributary streams	5 years	4	ES	EPA, COE, ADEM, MSDEQ, GADNR, TNDEC				Cost absorbed under existing programs

(1) For a complete task description, refer to the narrative outline.
(2) Reflects cost only for the implementation of the recovery task.

MOBILE RIVER BASIN AQUATIC ECOSYSTEM IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION	RESPONSIBLE PARTY			COST ESTIMATES ($K)			COMMENTS/NOTES
				USFWS						
				Region	Division	Other	FY 1	FY 2	FY 3	
2	2.0	Consider options for river and stream mitigation strategies	Continuous	4	ES	COE, EPA, USDA State Agencies				Cost may be absorbed under existing programs
2	2.1	Identify appropriate mitigation measures	3 years	4	ES	COE, EPA, USDA, State Agencies				Costs determined by measures recommended
2	2.11	Investigate partnerships and landowner assistance	3 years	4	ES	COE, EPA, USDA, State Agencies				Costs determined by measures recommended
2	3.0	Promote voluntary private land stewardship to reduce nonpoint pollution	Continuous	4	ES	All involved agencies and partners	50	50	50	
3	3.1	Promote land and water stewardship awareness	Continuous	4	ES	All involved agencies and partners	50	50	50	
2	3.2	Encourage development and implementation of adequate Streamside Management Zones	5 years	4	ES	All involved agencies and partners				Some costs may be absorbed under existing programs
2	4.0	Encourage and support community based watershed planning and action	Continuous	4	ES	All involved agencies and partners	50	50	50	
3	4.1	Reduce land use/endangered species conflicts	Indefinite	4	ES	All involved agencies and partners	25	25	25	
1	5.0	Develop and implement progams and materials to educate and involve the public in watershed stewardship	Continuous	4	ES	All involved agencies and partners	100	100	100	
1	6.1	Survey and monitor imperiled aquatic species	Indefinite	4	ES	Appropriate State and Federal agencies	100	100	100	
1	6.2	Conduct anatomical and biochemical analysis of endemic species	10 years	4	ES	Appropriate agencies and partners	100	100	100	

MOBILE RIVER BASIN AQUATIC ECOSYSTEM IMPLEMENTATION SCHEDULE										
				RESPONSIBLE PARTY			COST ESTIMATES ($K)			
				USFWS						
PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION	Region	Division	Other	FY 1	FY 2	FY 3	COMMENTS/NOTES
1	6.3	Determine contaminant sensitivity	10 years	4	ES	Appropriate agencies and partners	100	100	100	
1	6.4	Conduct life history research	10 years	4	ES	Appropriate agencies and partners	100	100	100	Includes subtasks 6.41 & 6.42
1	7.0	Develop and implement technology for maintaining and propagation of endemic species in captivity	10 years	4	ES	Appropriate agencies and partners	50	50	50	Additional funds are currently being expended at region level
3	8.0	Reintroduce aquatic species into restored habitats, as appropriate	Indefinite	4	ES	Appropriate agencies and partners	50	50	50	Includes subtasks 8.1 - 8.3
3	9.0	Monitor progress and review management strategy	Continuous	4	ES	All partners and stakeholders				
3	10.0	Coordinate ecosystem management actions	Continuous	4	ES					
3	10.1	Support the Mobile River Basin Coalition	Continuous	4	ES	All partners and stakeholders				Costs not determined

PART IV

APPENDICES

APPENDIX A*

LISTED AQUATIC SPECIES COVERED SOLELY BY
THE MOBILE RIVER BASIN AQUATIC ECOSYSTEM RECOVERY PLAN

Fish

Alabama sturgeon *Scaphirhynchus suttkusi*
Cherokee darter *Etheostoma scotti*
Etowah darter *Etheostoma etowahae*
Goldline darter *Percina aurolineata*

Mussels

Alabama moccasinshell *Medionidus acutissimus*
Coosa moccasinshell *Medionidus parvulus*
Dark pigtoe *Pleurobema furvum*
Fine-lined pocketbook *Lampsilis altilis*
Orange-nacre mucket *Lampsilis perovalis*
Ovate Clubshell *Pleurobema perovatum*
Southern acornshell *Epioblasma othcaloogensis*
Southern clubshell *Pleurobema decisum*
Southern pigtoe *Pleurobema georgianum*
Triangular kidneyshell *Ptychobranchus greeni*
Upland combshell *Epioblasma metastriata*

Snails

Cylindrical lioplax *Lioplax cyclostomaformis*
Flat pebblesnail *Lepyrium showalteri*
Lacy elimia *Elimia crenatella*
Painted rocksnail *Leptoxis taeniata*
Plicate rocksnail *Leptoxis plicata*
Round rocksnail *Leptoxis ampla*
Tulotoma snail *Tulotoma magnifica*

*A reference for the material contained in Appendices A and B was ~~The Red Book:~~

U.S. Fish and Wildlife Service. 1992. Endangered and threatened species of the southeast United States (The Red Book). Prepared by Ecological Services. Division of Endangered Species. Southeast Region. Government Printing Office. Washington, D.C. 1,242 pp. (two volumes).

ALABAMA STURGEON

Scaphirhynchus suttkusi

FAMILY: Acipenseridae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 65 FR 26437 May 5, 2000

DESCRIPTION: An elongate, slender fish growing to about 80 centimeters (cm) (31 in) in length and orange in coloration. A mature fish weighs 1-2 kilograms (2-4 pounds). The head is broad and flattened at the snout. Bony plates cover the head, back and sides. The body narrows abruptly to the rear, forming a narrow stalk between the body and tail.

HISTORIC RANGE: Large and small rivers of the Mobile River Basin, below the Fall Line, including the Black Warrior, Tombigbee, Alabama, Coosa, Tallapoosa, Cahaba, Mobile, and Tensaw Rivers.

KNOWN POPULATIONS: Lower Alabama River below Millers Ferry Lock and Dam to the confluence of the Tombigbee River. An Alabama sturgeon has also been recently collected from the lower Cahaba River near its confluence with the Alabama River.

POPULATION LEVEL: Population numbers of Alabama sturgeon appear to be very low, based on recent collection efforts.

HABITAT: Relatively stable river channels with flowing water.

LIFE HISTORY: Very little is known. Alabama sturgeon are believed to migrate upstream during late winter and spring to spawn. Eggs are adhesive and probably deposited on hard bottoms such as bedrock, cobble, or gravel. Larvae are planktonic, drifting with river currents. Postlarval stages settle out onto the river bottom, and juveniles and adults are benthic. Alabama sturgeon become sexually mature at 5-7 years of age. Spawning frequency is influenced by food supply and fish condition, and may occur every 1-3 years. Alabama sturgeon may live up to 15 years or more.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: The decline of the Alabama sturgeon is attributed to over-fishing, loss and fragmentation of habitat as a result of historical navigation development, and historical episodes of water quality degradation. Current threats primarily result from its reduced range and small population numbers. These threats are compounded by a lack of information on Alabama sturgeon habitat and life history requirements.

CONSERVATION MEASURES: The Alabama Department of Conservation and Natural Resources, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and the Alabama-Tombigbee Rivers Coalition implemented Alabama sturgeon conservation efforts in 1997, including broodstock collections, an attempt to spawn captive broodstock at a State hatchery, and habitat studies.

RECOVERY OBJECTIVE AND CRITERIA: To be developed.

CHEROKEE DARTER

Etheostoma scotti

FAMILY: Percidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 59 FR 65512 December 20, 1994

DESCRIPTION: The Cherokee darter is a small-sized percid fish, adults being about 40 to 65 millimeters (mm) (1.5 - 2.5 inches (in)) total length (TL). The body is elongate, subcylindrical (slightly compressed), with a relatively blunt snout. The side of adults is usually pigmented with eight small dark olive black blotches which develop into vertically elongate, slightly oblique bars in breeding adults, especially in males. The back usually has eight small dark saddles and intervening pale areas. The spinous dorsal (situated on the back) fin of breeding males has a dark olive black band at the base of the fin and nearly uniform russet orange red on the remaining fin, except for a blue margin.

HISTORIC RANGE: The Cherokee darter is endemic to the Etowah River system in north Georgia. Historically, it was thought to have occurred in most tributaries of the watershed.

KNOWN POPULATIONS: The Cherokee darter persists in about two dozen tributary streams of the middle and upper Etowah River. Present populations are isolated by Allatoona Reservoir and stretches of degraded habitat in tributary streams.

POPULATION LEVEL: Population size at known sites is generally small. However, total population level is not known.

HABITAT: Small to medium size creeks of moderate gradient in low current areas with large gravel, cobble, and small boulder substrates.

LIFE HISTORY: The life history is unknown. However, like most darters, the species spawns in spring, and probably lives two to three years.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Impoundments and deteriorating water and benthic habitat quality resulting from siltation and other pollutants threaten the species.

CONSERVATION MEASURES: Riparian zone protection, stream sedimentation abatement, controlling agricultural runoff, and the wise planning of suburban development in the Etowah River watershed are major conservation measures for this species. The Cherokee County Water Authority is purchasing conservation easements on one tributary with Cherokee darter populations.

RECOVERY OBJECTIVE AND CRITERIA: To protect the Cherokee darter from further population fragmentation and decline, and to eventually delist it. Delisting will be considered when known populations are shown to be stable or increasing for a period of at least five years, and plans are developed to protect and monitor water and habitat quality in all occupied streams. The estimated date for delisting is 2010.

ETOWAH DARTER

Etheostoma etowahae

FAMILY: Percidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 59 FR 65512 December 20, 1994

DESCRIPTION: The Etowah darter is a small-sized percid fish, adults being about 45 to 75 mm (1.75-3.0 in) TL. The body is elongate, moderately compressed, and has a moderately pointed snout. The background body color is medium brown or gray-olive. The lower opercle (gill covers) has a have a pale bluish-green wash which is intensified in breeding males. The side is usually pigmented with 13 or 14 small dark blotches just below the lateral line. The breast in breeding males is dark greenish-blue. The spinous dorsal fin is suffused dusky black olive with a red margin. The soft dorsal fin has four bands: dusky black olive on the basal two-thirds, followed by red, white (sometimes with hint of yellow), and black bands of nearly equal width. The caudal (tail) fin is similarly pigmented except the ventral (on the abdominal side of the body) leading rays have a pale blue wash. The anal fin is suffused with greenish-blue and never has red marks, like greenbreast darters do. The pelvic fins are clear to dusky black with a pale green blue wash; pectoral fins are dusky black. All these color patterns are more vivid in breeding males.

HISTORIC RANGE: The Etowah darter is endemic to the Etowah River system in north Georgia. Historically, it may have occurred further downstream in the Etowah River mainstem. However, pre-impoundment (Allatoona Lake) records are not known.

KNOWN POPULATIONS: The Etowah darter persists in the uppermost Etowah River mainstem and two headwater tributaries, Amicalola and Long Swamp Creeks. The species is known from a total of 19 sites in these streams.

POPULATION LEVEL: Population size at known sites is generally small. However, total population level is not known.

HABITAT: Medium to larger creeks and small rivers of moderate to high gradient in swift current areas in riffles with large gravel, cobble, and small boulder substrates.

LIFE HISTORY: The life history is unknown. However, like most darters, the species spawns in spring, and probably lives two to three years.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Deteriorating water and benthic habitat quality resulting from siltation and other pollutants threaten the species.

CONSERVATION MEASURES: State sponsored survey efforts are continuing to define the range and population of this species. Riparian zone protection, stream sedimentation abatement, and controlling agricultural runoff in the Etowah River watershed are major conservation measures for this species.

RECOVERY OBJECTIVE AND CRITERIA: To protect the Etowah darter from further population decline, and to eventually delist it. Delisting will be considered when known populations are shown to be stable or increasing for a period of at least 5 years, and plans are developed to protect and monitor water and habitat quality in all occupied streams. The estimated date for delisting is 2010.

GOLDLINE DARTER

Percina aurolineata

FAMILY: Percidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 57 FR 14786, April 22, 1992

DESCRIPTION: A slender, medium-sized fish, the goldline darter is about 75 mm (3 in) long with brownish-red and amber dorsolateral (on the upper side) stripes. It differs from other members of the subgenus *Hadropterus* in the color pattern of its back, which is pale to dusky.

HISTORIC RANGE: Historically known from 79 kilometers (km) (49 miles (mi)) of the Cahaba River, almost 11 km (7 mi) of the Little Cahaba River, and from Schultz Creek, also a Cahaba River tributary, Alabama; Coosawattee and its tributary Talking Rock Creek, Ellijay River and its tributaries Mountaintown and Boardtown Creeks, and the Cartecay River, Georgia. It is suspected that this species once ranged throughout the upper Alabama River drainage of Alabama and Georgia.

KNOWN POPULATIONS: Currently known from 43 km (27 mi) of the Cahaba River, 11 km (7 mi) of the Little Cahaba River, and from Schultz Creek, Cahaba River drainage, Alabama. The species also continues to be found in the Coosawattee River and its tributary Talking Rock Creek; Ellijay River, Mountaintown and Boardtown Creeks; and the Cartecay River, Georgia.

POPULATION LEVEL: Populations appear to be small and localized.

HABITAT: The goldline darter prefers a moderate to swift current and water depths greater than 0.5 meter (m) (2 feet (ft)). It is found over sand or gravel substrate interspersed among cobble and small boulders.

LIFE HISTORY: Little is known about this darter's life history.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Water quality degradation, particularly sedimentation, has reduced the goldline darter's range within the Cahaba River System and is the primary threat to the species throughout its range.

CONSERVATION MEASURES: Investigations of water quality and population trends of the goldline darter in the Cahaba River and Little Cahaba River are ongoing and may provide indications of the decline of the species in this system. The Georgia populations are periodically monitored. Recovery efforts will focus on habitat protection and improving water quality.

RECOVERY OBJECTIVE AND CRITERIA: The recovery objective for the goldline darter is to delist the species. Delisting will be considered when: known populations of the goldline darter are shown to be stable or increasing for a period of at least 5 years; there has been a demonstrated trend in water quality improvement in the Cahaba River; and plans are developed and implemented to improve and monitor water and habitat quality in all occupied drainages. The estimated date for delisting is 2010.

AN OVERVIEW OF UNIONID MUSSEL ANATOMY AND LIFE HISTORY

Anatomy: Freshwater mussels in the family Unionidae have two shells joined together at the dorsal surface by a hinge ligament. Two sets of hinge teeth on the inner dorsal surface keep the shells in position. The shells are secreted by a thin layer of tissue called the mantle, which envelops the body of the animal and also forms incurrent and excurrent openings (siphons) at the posterior end. The anterior portion of the animal is usually buried in the substrate. All mussels are filter feeders. Oxygen-bearing water and food are drawn into the incurrent siphon, and waste-carrying water is simultaneously passed out the excurrent siphon. The food, mostly detritus (small particles of matter), bacteria and small planktonic (passively floating or drifting) organisms, is filtered from the water by the gills. Mussels have four internal gills, a pair on each side of the body.

Life History: Freshwater mussel females extrude eggs through their oviducts and move them into the water tubes of the gills. During this time, the water tubes become more or less modified as gill pouches, or marsupia. Sperm shed by the males are drawn into the marsupial water tubes by ciliary (pertaining to small hair-like processes) action, and the fertilized eggs begin developing into unique larval forms known as glochidia. Depending on the genus, all, or only a portion of the gills may carry the developing embryos. Glochidia measure only a fraction of a mm (in) in size, and a single female may produce hundreds of thousands. The bivalved glochidium lacks most of the internal organs of the adults, and is not capable of swimming or crawling. All glochidia, with the possible exception of two species, appear to be obligate parasites of aquatic vertebrates. Most are parasitic on the gills or fins of certain species of fish, but the infections are usually light and cause little harm.

Some freshwater mussels discharge their glochidia individually when mature. Others release them attached along thin strands of mucous which float and suspend the glochidia. In many species, the mass of glochidia within a single water tube sticks together and is released as a unit called a conglutinate. Conglutinates of various species may be similar in appearance to small worms, grubs, leeches, aquatic insects, or other fish food items. Fish apparently feed on these conglutinates, breaking them up and releasing the glochidia which may then become attached to the fish's gill filaments.

Females of various species have a remarkable modification of the posterior edge of the mantle that may function to attract potential host fish. When extended outside of the shell these flaps mimic aquatic insects or small fish, depending on the species, and may be waved or jerked to attract the attention of a hungry fish. When a fish attacks the lure, the flap is quickly retracted and the fish receives a mouthful of glochidia, some of which may successfully attach to gill filaments. Several species have been recently identified that release all of their glochidia in a single mass called a superconglutinate. The glochidial mass, surprisingly similar in shape, coloration, and appearance to a minnow, is suspended at the end of a long transparent mucous line. Large, piscivorous (fish-eating) fish may attempt to consume these lures and become infected with glochidia.

Once ejected from the female, free-living glochidia have a life span of only a few days. When glochidia come into contact with a portion of gill or fin, their valves snap together, clamping over a portion of the fish tissue. The engulfed tissue is then slowly digested and absorbed, with perhaps additional nutrients absorbed from the host's tissue fluid. In a short time, glochidia become completely encysted within the fish tissue. The duration of the parasitic period ranges from a week to several months, depending on species, temperature, and other factors. After the appropriate time, the glochidia metamorphose into juveniles, the cyst wall is ruptured and the juveniles drop to the bottom, often after having been transported for some distance by the host fish.

Not all species of fish can successfully serve as hosts for all mussels. A given species of glochidium may readily attach to some fish but be quite unable to attach to others. Also, fish which have harbored a previous infection of glochidia may become immune and slough off subsequent infections. Most mussels can apparently complete their metamorphosis on several related species of fish. The problem of preserving threatened and endangered mussels must therefore include preserving the native fish fauna, including their natural migration and spawning patterns.

Of all the freshwater invertebrates, the freshwater mussels probably have the longest natural life spans. While a few of the thin-shelled species may live only 4 to 10 years, the thicker shelled river species normally survive over a span of 20-40 or more years. Reaching sexual maturity requires more than a year in all species; some of the slower growing species may require 4 or more years.

ALABAMA MOCCASINSHELL

Medionidus acutissimus

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: A small, delicate species, approximately 30 mm (1.2 in) in length. Shell is narrowly elliptical (oval), with a well-developed, acute posterior ridge that terminates in a sharp point on the posterior ventral margin. The posterior slope is finely corrugated. The periostracum (outer surface) is yellow to brownish yellow, with broken green rays across the entire surface of the shell. The nacre (inner surface) is thin and translucent along the margins and salmon-colored in the umbos (beak cavity).

HISTORIC RANGE: Alabama River and tributaries, Alabama; Tombigbee River and tributaries, Mississippi, Alabama; Black Warrior River and tributaries, Alabama; Cahaba River, Alabama; Coosa River and tributaries, Alabama, Georgia, Tennessee.

KNOWN POPULATIONS: Luxapalila Creek (Lowndes County, Mississippi), Buttahatchee River (Lowndes/Monroe County, Mississippi, Lamar County, Alabama), and tributary Sipsey Creek (Monroe County, Mississippi), Lubbub Creek (Pickens County, Alabama), Sipsey River (Green/Pickens County, Alabama), Sipsey Fork and tributaries (Winston/Lawrence County, Alabama), Hatchet Creek (Coosa County, Alabama), and Holly Creek (Murray County, Georgia).

POPULATION LEVEL: Populations are small and localized. Highest densities observed during field surveys have been from the Sipsey Fork and its headwater tributaries in Bankhead National Forest.

HABITAT: Inhabits sand/gravel/cobble shoals with moderate to strong currents in streams and small rivers.

LIFE HISTORY: Gravid females migrate to the surface of the stream bottom between March and June, and have been observed anchored to gravel by a thread emanating from the anterior end. Blackspotted topminnows, tuskaloosa darter, redfin darter, blackbanded darter, and logperch have been identified as host fish.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and water quality degradation are the primary causes of the decline of the Alabama moccasinshell. This species does not tolerate impoundment or channelization. The Alabama moccasinshell, one of the smallest unionid species, inhabits the interstices (small spaces between particles) of gravel and cobble substrates, and is very sensitive to sedimentation and erosion. Surviving populations are threatened by urban and agricultural runoff, surface mine drainage, small stream impoundment projects, industrial and sewage treatment plant discharges, and channel degradation caused by sand and gravel mining.

CONSERVATION MEASURES: The U.S. Forest Service has funded mussel surveys in streams under its jurisdiction, and has implemented improved stream management zone guidelines on National Forests in Alabama. Surveys of potential habitat are being conducted by Service, State and private biologists in efforts to locate extant populations. A flood control project on Luxapalila Creek, Mississippi, was modified by the Corps of Engineers to protect listed mussel habitat in that stream.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the Alabama moccasinshell to the point of delisting is unlikely in the near future. Therefore, the immediate recovery objective is to prevent the continued decline of this species by locating, protecting, and restoring stream drainages with extant populations.

COOSA MOCCASINSHELL

Medionidus parvulus

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: A small species occasionally exceeding 40 mm (1.6 in) in length. Shell is thin, elongate, and elliptical to squarish in outline. Posterior ridge inflated, smoothly rounded, terminating in a broadly rounded point; the posterior slope is finely corrugated. Periostracum yellow-brown to dark brown, with fine green rays. Nacre blue, occasionally with salmon-colored spots.

HISTORIC RANGE: Cahaba River, Alabama; Sipsey Fork, Black Warrior River drainage, Alabama; Coosa River and tributaries, Alabama, Georgia, Tennessee.

KNOWN POPULATIONS: Conasauga River (Murray/Whitfield County, Georgia, Bradley County, Tennessee), and its tributary, Holly Creek, (Murray County, Georgia).

POPULATION LEVEL: Populations are small and localized.

HABITAT: Inhabits sand/gravel/cobble shoals with moderate to strong currents in streams and small rivers.

LIFE HISTORY: Little is known of the Coosa moccasinshell. Closely related to the Alabama moccasinshell, it is likely that gravid (containing eggs) females of this species also migrate to the surface of the stream substrate during glochidial release periods. Host fish are probably darters and logperch.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and water quality degradation are the primary causes of the decline of the Coosa moccasinshell. This species does not tolerate impoundment or channelization. The Coosa moccasinshell is a small mussel that inhabits the interstices of gravel and cobble substrates, and is very sensitive to sedimentation and erosion. Surviving populations are threatened by household and agricultural runoff, surface mine drainage, and small stream impoundment projects.

CONSERVATION MEASURES: The U.S. Forest Service has funded mussel surveys in streams under its jurisdiction, and has implement improved stream management zone guidelines in Alabama National Forests. Surveys of potential habitat are being conducted by Federal, State and private biologists in efforts to locate extant populations.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the Coosa moccasinshell to the point of delisting is unlikely in the near future. Therefore, the immediate recovery objective is to prevent the continued decline of this species by locating, protecting, and restoring stream drainages with extant populations.

DARK PIGTOE

Pleurobema furvum

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: A small to medium-sized mussel, occasionally reaching 60 mm (2.4 in) in length. Shell is oval in outline. Umbos are located in the anterior portion of the shell. Posterior ridge is abruptly rounded and terminates in a broadly rounded, subcentral, posterior point. The periostracum is dark reddish brown, with numerous and closely spaced, dark growth lines. The hinge plate (connection of the two shells) is wide and the teeth are heavy and large, especially in older specimens. Nacre approaches white in the umbos, and is highly iridescent on the posterior margin.

HISTORIC RANGE: Black Warrior River and tributaries, Alabama, above the fall line.

KNOWN POPULATIONS: Sipsey Fork and its tributaries Caney, Brown, Rush, and Capsey Creeks (Winston/Lawrence County, Alabama); North River and its tributary Clear Creek (Fayette County, Alabama). Badly w[illegible]ered specimens have also found in the Locust Fork of the Black Warrior River near the Jefferson-Blount [illegible]ty line (Alabama).

POPULATION LEVEL: Populations are localized, and numbers of individuals are very low in all known occupied streams.

HABITAT: Sand/gravel/cobble shoals and rapids in small rivers and large streams.

LIFE HISTORY: Life history is unknown, however, largescale stoneroller, Alabama shiner, blacktail shiner, creek chub, and blackspotted topminnow have been confirmed as hosts.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and other forms of water quality degradation are the primary causes of decline of the dark pigtoe. This species can not tolerate impoundment. Surviving populations are threatened by impoundment projects, surface mine runoff, and household and agricultural runoff.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the dark pigtoe are being conducted by Federal, State and private biologists in efforts to locate extant populations. The U.S. Forest Service has implemented improved stream management zone guidelines in the Sipsey Fork and its headwaters in Bankhead National Forest.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the dark pigtoe to the point of downlisting to threatened is unlikely in the near future. The immediate recovery objective is to prevent the extinction of this species by locating, protecting, and restoring stream drainages with extant populations.

FINE-LINED POCKETBOOK
Lampsilis altilis

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: The fine-lined pocketbook is a medium-sized mussel, sub-oval in shape, and rarely exceeds 100 mm (4 in) in length. The ventral margin of the shell is angled posteriorly in females, resulting in a pointed posterior margin. The periostracum is yellow-brown to blackish and has fine rays on the posterior half. The nacre is white, becoming iridescent posteriorly.

HISTORIC RANGE: Alabama River and tributaries, Alabama; tributary rivers and streams of the Tombigbee and Black Warrior Rivers, Mississippi and Alabama; Cahaba River and tributaries, Alabama; Tallapoosa River and tributaries, Alabama, Georgia; and the Coosa River and tributaries, Alabama, Georgia, Tennessee.

KNOWN POPULATIONS: Upper Cahaba River and the Little Cahaba River, Alabama; Coosa River (Cherokee County, Alabama) and its tributaries, Conasauga River (Murray/Whitfield County, Georgia, Polk County, Tennessee) and Holly Creek (Murray County, Georgia), Terrapin Creek and South Fork Terrapin Creek (Cleburne County, Alabama), Big Canoe Creek (St. Clair County, Alabama), Cheaha Creek (Talladega/Clay County, Alabama), Yellowleaf Creek and its tributary Muddy Prong (Shelby County, Alabama), Kelly Creek and its tributary Shoal Creek (Shelby/St. Clair County, Alabama), Shoal Creek (Cleburne County, Alabama), and Tallasahatchee Creek (Talladega County, Alabama); and the Tallapoosa River (Cleburne County, Alabama) and tributaries, Uphapee Creek (Macon County, Alabama), Choctafaula Creek (Macon/Lee County, Alabama), Chewacla Creek (Macon/Lee County, Alabama), Opintlocco Creek (Macon County, Alabama), Cane and Little Cane Creeks (Cleburne County, Alabama), Muscadine Creek (Cleburne County, Alabama), Big Creek (Haralson County, GA), McClendon Creek (Paulding County, Georgia).

POPULATION LEVEL: Populations are small and localized within these streams. There is a potential of additional unknown, relict populations in small and moderate-sized streams.

HABITAT: Historically found in large river to small creek habitats. Recent collections have been from stable sand/gravel/cobble substrate in moderate to swift currents in small streams above the Fall Line.

LIFE HISTORY: Gravid females have been collected March through June. They have been observed releasing glochidia in a single, large mass termed a superconglutinate. Redeye bass, spotted bass, largemouth bass, and green sunfish have been identified as suitable hosts.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER : Habitat modification, sedimentation, eutrophication, and water quality degradation. This species can not tolerate impoundment. Surviving populations are threatened by urban and agricultural runoff, surface mine drainage, small stream impoundment projects, industrial and sewage treatment plant discharges, and channel degradation caused by sand and gravel mining.

CONSERVATION MEASURES: The U.S. Forest Service has funded mussel surveys in streams under its jurisdiction, and has revised and implemented protective stream management zone guidelines on National Forest lands in Alabama. Surveys of potential habitat are being conducted by State, Federal, and private biologists.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the fine-lined pocketbook to the point of delisting is unlikely in the near future. The immediate recovery objective is to prevent the continued decline of this species by locating, protecting, and restoring stream drainages with extant populations. A secondary objective is to work toward restoration of stream habitats to a degree that would allow expansion and/or reintroduction of this species.

ORANGE-NACRE MUCKET
Lampsilis perovalis

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: A medium-sized mussel, 50-90 mm (2-3.6 in) in length. The shell is oval in shape and moderately thick. The posterior margin of the shell of mature females is obliquely truncate (shortened). Nacre is usually rose colored, pink, or occasionally white. The periostracum ranges from yellow to dark reddish brown, with or without green rays.

HISTORIC RANGE: Alabama River and tributaries, Alabama; tributary rivers and streams of the Tombigbee and Black Warrior Rivers, Mississippi and Alabama; Cahaba River and tributaries, Alabama.

KNOWN POPULATIONS: Buttahatchee River (Lowndes/Monroe County, Mississippi; Lamar County, Alabama), East Fork Tombigbee River (Itawamba/Monroe County, MS), Luxapalila Creek (Monroe County, Mississippi), Sipsey River (Greene/Pickens/Tuscaloosa County, AL), Coalfire, Lubbub , and Trussels Creeks (Pickens County, Alabama), North River (Tuscaloosa/Fayette County, Alabama) and its tributary Clear Creek (Fayete County, Alabama), Locust and Blackburn Forks of the Black Warr iver (Blount County, Alabama), Sipsey For f the Black Warrior (Winston/Lawrence County, Alabama) a butaries, Thompson, Flannagin, and Borden Creeks (Lawrence County, Alabama) and Caney, North Fork Caney, Brushy, Capsey, Rush, Brown, and Beech Creeks (Winston/Lawrence County, Alabama), Cahaba River (Bibb/Jefferson/Shelby County, Alabama), and Little Cahaba River (Bibb/Shelby County, Alabama).

POPULATION LEVEL: Locally common in the Sipsey Fork and several of its tributaries. All other populations are small and localized.

HABITAT: Currently restricted to high quality stream and small river habitat, the species is found on stable sand/gravel/cobble substrate in moderate to swift currents.

LIFE HISTORY: The orange-nacre mucket expels mature glochidia as a superconglutinate. Discharge of superconglutinates by this species has been observed between March and June, with releases concentrated in early April. Redeye bass, spotted bass, and largemouth bass have been identified as host fish for the mucket.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and water quality degradation. This species does not tolerate impoundment or channelization. Surviving populations are threatened by urban and agricultural runoff, surface mine drainage, small stream impoundment projects, industrial and sewage treatment plant discharges, and channel degradation caused by sand and gravel mining. Superconglutinate lures would obviously be most effective in streams and rivers with low turbidity. The current distribution indicates that historic and gradual increases in chronic turbidity levels may be an important factor in the decline of the orange-nacre mucket.

CONSERVATION MEASURES: The U.S. Forest Service has funded mussel surveys in streams under its jurisdiction, and has strengthened stream management zone guidelines on National Forest lands in Alabama. Other Federal and State agencies continue to conduct surveys of historically occupied habitat. A flood control project on Luxapalila Creek, Mississippi, was modified by the Corps of Engineers to protect listed mussel habitat in that stream.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the orange-nacre mucket to the point of delisting is unlikely in the near future. The immediate recovery objective is to prevent the continued decline of this species by locating, protecting, and restoring stream drainages with extant populations.

OVATE CLUBSHELL

Pleurobema perovatum

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: A small to medium-sized mussel that rarely exceeds 50 mm (2.0 in) in length. Shell is oval to elliptical in shape, with nearly terminal umbos. Posterior ridge well-developed, broadly rounded, and often concave. Posterior slope is produced well beyond the posterior ridge. Periostracum color varies from yellow to dark brown, and occasionally has broad green rays that may cover most of the umbo and posterior ridge. The nacre is white.

HISTORIC RANGE: Tombigbee River and tributaries, Alabama, Mississippi; Black Warrior River and tributaries, Alabama; Alabama River, Alabama; Cahaba River and tributaries, Alabama; Chewacla, Uphapee and Opintlocco Creeks in the Tallapoosa River drainage, Alabama: Coosa River and tributaries, Alabama, Georgia, Tennessee.

KNOWN POPULATIONS: Buttahatchee River (Lowndes/Monroe County, Mississippi), Luxapalila Creek (Lowndes County, Mississippi), Sipsey River (Greene/Pickens/Tuscaloosa County, Alabama), Sucarnoochee River (Sumter County, Alabama), Coalfire Creek (Pickens County, Alabama), Chewacla Creek (Macon County, Alabama), and Coosa River (Cherokee County, Alabama).

POPULATION LEVEL: Populations are small and localized.

HABITAT: Sand/gravel shoals and runs of small rivers and large streams.

LIFE HISTORY: Unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and other forms of water quality degradation are the primary causes of decline of the ovate clubshell. This species can not tolerate impoundments or channelization. Surviving populations are threatened by channelization, household and agricultural runoff, and channel erosion.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the ovate clubshell are being conducted by Federal, State and private biologists in efforts to locate unknown extant populations. A flood control project on the Luxapalila Creek, Mississippi, was modified by the Corps of Engineers to protect listed mussels habitat in that stream.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the ovate clubshell to the point of downlisting to threatened is unlikely in the near future. The immediate recovery objective is to prevent the extinction of this species by locating, protecting, and restoring stream drainages with extant populations.

SOUTHERN ACORNSHELL

Epioblasma othcaloogensis

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: The southern acornshell is a small species that may grow up to 30 mm (1.2 in) in shell length. The shells are round to oval in outline and sexually dimorphic (two different forms of the same animal), with a swollen posterior ridge in females. The periostracum is smooth, shiny, and yellow in color.

HISTORIC RANGE: Coosa and Cahaba Rivers and their tributaries above the Fall Line in Alabama, Georgia, and Tennessee.

KNOWN POPULATIONS: No living populations have been confirmed in recent years.

POPULATION LEVEL: This species was last collected from tributaries of the upper Coosa River (Alabama, Georgia, Tennessee). Surveys of this area since listing have not relocated the species. Potentially suitable habitat can still be found in several rivers and streams of the upper Coosa River drainage. It has not been found in the Cahaba River drainage for several decades.

HABITAT: The southern acornshell was historically restricted to shoals in small rivers to small streams above the Fall Line. It was found on stable sand/gravel/cobble substrate in moderate to swift currents.

LIFE HISTORY: The host fish and other aspects of this species life history are unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and other forms of water quality degradation are the primary causes of decline. This species does not tolerate impoundment, and is highly sensitive to water quality degradation. Potential habitat is locally impacted by carpet mill and other industrial discharge, sewage treatment plant discharge, urban and agricultural runoff, and surface mine drainage.

CONSERVATION MEASURES: Surveys of potential habitat in the upper Coosa River drainage are being conducted by Federal, State and private biologists in efforts to locate extant populations.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the southern acornshell to the point of downlisting to threatened is unlikely in the near future. The immediate recovery objective is to prevent the extinction of this species by locating, protecting, and restoring stream drainages with extant populations.

SOUTHERN CLUBSHELL

Pleurobema decisum

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: A medium sized mussel about 70 mm (2.8 in) long, with a thick shell, and heavy hinge plate and teeth. Shell outline roughly rectangular, produced (protruding) posteriorly with the umbos terminal with the anterior margin, or nearly so. The posterior ridge ends abruptly with little development of the posterior slope at the dorsum of the shell. The periostracum color ranges from yellow to yellow-brown with occasional green rays or spots on the umbo in young specimens.

HISTORIC RANGE: Except for the Mobile Delta, this species was formerly known from every major stream system in the Mobile River basin, including the Alabama River and tributaries, Alabama; Tombigbee River and tributaries, Mississippi and Alabama; Black Warrior River and tributaries, Alabama; Cahaba and tributaries, Alabama; Uphapee and Chewacla Creeks, Tallapoosa River drainage, Alabama; Coosa River and tributaries, Alabama, Georgia, and Tennessee.

KNOWN POPULATIONS: East Fork of the Tombigbee River (Itawamba/Monroe County, Mississippi), Buttahatchee River (Monroe/Lowndes County, Mississippi), Luxapalila Creek (Lowndes County, Mississippi), Sipsey River (Greene/Pickens/Tuscaloosa County, Alabama), Alabama River and Bogue Chitto Creek (Dallas County, Alabama) Chewacla Creek (Macon County, Alabama), Coosa River (Dead River) below Weiss Dam (Cherokee County, Alabama), Kelly Creek (Shelby County, Alabama), Big Canoe Creek (St. Clair County, Alabama), and Terrapin Creek (Cherokee County, Alabama).

POPULATION LEVEL: The southern clubshell is relatively common in localized reaches of the Buttahatchee and Sipsey Rivers. It is rare to uncommon in other occupied streams.

HABITAT: Sand/gravel/cobble substrate in shoals and runs of small rivers and large streams.

LIFE HISTORY: Host fish, reproductive behavior, and other aspects of life history are unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, and water quality degradation are the primary causes of decline of the southern clubshell. This species can not tolerate impoundment or channelization. Surviving populations are threatened by channelization projects, household and agricultural runoff, and channel degradation caused by sand and gravel mining and/or channel maintenance projects.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the southern clubshell are being conducted by Federal, State and private biologists in efforts to locate extant populations. A flood control project on Luxapalila Creek, Mississippi, was modified by the Corps of Engineers to protect listed mussel habitat in that stream.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the southern clubshell to the point of downlisting to threatened is unlikely in the near future. The immediate recovery objective is to prevent the extinction of this species by locating, protecting, and restoring stream drainages with extant populations.

SOUTHERN PIGTOE

Pleurobema georgianum

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: A small to medium-sized mussel occasionally exceeding 60 mm (2.4 in) in length. Shell elliptical to oval in outline and somewhat compressed. Posterior slope is smoothly rounded. Pseudocardinal teeth (specialized hinge teeth unique to freshwater mussels) are small but well-developed, and the nacre is white. Periostracum is yellow to yellow-brown. Growth lines are numerous and may be dark brown. Small specimens may have green spots at the growth lines along the posterior ridge and near the umbo.

HISTORIC RANGE: Coosa River and its tributaries in Alabama, Georgia, and Tennessee.

KNOWN POPULATIONS: Conasauga River (Murray/Whitfield County, Georgia, Bradley County, Tennessee) and Holly Creek (Murray County, Georgia), Shoal Creek (Cleburne County, Alabama), and Big Canoe Creek (St. Clair County, Alabama).

POPULATION LEVEL: Populations are small and restricted.

HABITAT: Sand/gravel/cobble shoals and runs in small rivers and large streams.

LIFE HISTORY: Unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and other forms of water quality degradation are the primary causes of decline of the southern pigtoe. This species can not tolerate impoundments. Surviving populations are threatened by household and agricultural runoff on private lands, and to a lesser degree, by recreational activities on public lands.

CONSERVATION MEASURES: The U.S. Forest Service has funded mussel surveys in streams under its jurisdiction, and has strengthened stream management zone guidelines on Forest Service lands in Alabama. Federal, State and private biologists are conducting surveys in streams within the historic range of this species.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the southern pigtoe to the point of downlisting to threatened is unlikely in the near future. The immediate recovery objective is to prevent the extinction of this species by locating, protecting, and restoring stream drainages with extant populations.

TRIANGULAR KIDNEYSHELL

Ptychobranchus greeni

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: Shell oval to elliptical in outline, may approach 100 mm (4.0 in) in length, compressed, and may be flattened ventral to the umbos. Posterior ridge broadly rounded, terminating in a broad, round point post-ventrally. Pseudocardinal teeth are heavy, and the laterals are heavy, gently curved and short. Periostracum is straw-yellow in young specimens, becoming yellow-brown in older ones; occasionally with fine and wavy, or wide and broken, green rays anterior to the posterior ridge.

HISTORIC RANGE: Black Warrior River and tributaries, Alabama; Cahaba River, Alabama; Coosa River and tributaries, Alabama, Georgia, and Tennessee.

KNOWN POPULATIONS: Sipsey Fork and tributaries (Winston/Lawrence County, Alabama), Locust Fork (Blount County, Alabama), Cahaba River (Bibb County, Alabama), Kelly Creek (Shelby County, Alabama), Terrapin Creek (Cherokee County, Alabama), Conasauga River (Murray/Whitfield County, Georgia, Bradley County, Tennessee), Holly Creek (Murray County, Georgia), Coosawattee River (Gordon County, Georgia), and Oostanaula River (Floyd/Gordon County, Georgia).

POPULATION LEVEL: Populations are small and localized in the Sipsey Fork drainage and in the Conasauga River. A single fresh dead shell is the only recent evidence of the species in the Cahaba River.

HABITAT: Sand/gravel/cobble substrate in shoals and runs of small rivers and large streams.

LIFE HISTORY: Gravid triangular kidneyshell females were observed in March 1994. Glochidia are packaged into conglutinates that mimic dipteran larvae (larvae of insects such as flies and mosquitos) (Hartfield and Hartfield 1996). Fish hosts have been identified as Warrior darter, tuskaloosa darter, blackbanded darter and logperch.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and other forms of water quality degradation represent the major threats to the triangular kidneyshell. This species does not tolerate impoundment. Surviving populations are threatened by urban and agricultural runoff, surface mine drainage, industrial and sewage treatment plant discharges, and localized household discharges.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the ovate clubshell are being conducted by Federal, State and private biologists in efforts to locate extant populations. The U.S. Forest Service has strengthened stream management zone guidelines for streams under its jurisdiction in Alabama.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the triangular kidneyshell to the point of downlisting to threatened is unlikely in the near future. The immediate recovery objective is to prevent the extinction of this species by locating, protecting, and restoring stream drainages with extant populations.

UPLAND COMBSHELL

Epioblasma metastriata

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 58 FR 14339, March 17, 1993

DESCRIPTION: Shells rarely exceed 60 mm (2.4 in) in length, are squarish in outline and are sexually dimorphic. Males have a broadly curved posterior ridge. Females have a sharply elevated posterior ridge that swells post-ventrally forming a well-developed sulcus (the groove anterior to the posterior ridge). Posterior margin of the female is broadly rounded and comes to a point anterior to the posterior end. Periostracum color varies from yellowish-brown to tawny, and may or may not have broken green rays, or small green spots. Hinge teeth are well-developed and heavy.

HISTORIC RANGE: Black Warrior River and tributaries, Cahaba River and tributaries, Alabama; Coosa River and tributaries, Alabama, Georgia, and Tennessee.

KNOWN POPULATIONS: No living populations have been confirmed in recent years.

POPULATION LEVEL: Last collected from a restricted portion of the Conasauga River in the vicinity of the Georgia/Tennessee State Line, surveys since listing have not relocated the species. Potentially suitable habitat can still be found in rivers and streams of the upper Coosa River drainage. It has not been found in the Cahaba or Black Warrior River drainages for several decades.

HABITAT: Restricted to shoals in rivers and large streams above the Fall Line. It was found on stable sand/gravel/cobble substrate in moderate to swift currents.

LIFE HISTORY: This species likely releases glochidia during late spring or early summer. The host fish is unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, eutrophication, and other forms of water quality degradation are the primary causes of decline of the upland combshell. This species does not tolerate impoundment, and is highly sensitive to water quality degradation. Potential habitat is locally impacted by carpet mill and other industrial discharge, sewage treatment plant discharge, urban and agricultural runoff, and surface mine drainage.

CONSERVATION MEASURES: Surveys of potential habitat in the upper Coosa River drainage are being conducted by Federal, State and private biologists in efforts to locate extant populations.

RECOVERY OBJECTIVE AND CRITERIA: Recovery of the upland combshell to the point of downlisting to threatened is unlikely in the near future. The immediate recovery objective is to prevent the extinction of this species by locating, protecting, and restoring stream drainages with extant populations. Survival of this species may eventually depend on captive propagation if extant populations are located.

CYLINDRICAL LIOPLAX

Lioplax cyclostomaformis

FAMILY: Viviparidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 63 FR 57619, October 28, 1998

DESCRIPTION: The shell of the cylindrical lioplax is elongate, reaching about 28 mm (1.1 in) in length. Shell color is light to dark olivaceous-green externally, and bluish inside of the shell opening.

HISTORIC RANGE: Collection records for the cylindrical lioplax exist from the Alabama River, Alabama; Black Warrior River and tributaries, Prairie and Valley Creeks, Alabama; Coosa River and tributaries Oothcalooga, Coahulla, Armuchee, Little Wills, Choccolocco, and Yellowleaf Creeks, Alabama and Georgia; and the Cahaba River and its tributary, Little Cahaba River in Alabama.

KNOWN POPULATIONS: The cylindrical lioplax is currently known only from approximately 24 km (15 mi) of the Cahaba River above the Fall Line in Shelby and Bibb counties, Alabama.

POPULATION LEVEL: The snail is uncommon where it is currently found.

HABITAT: The cylindrical lioplax is found in mud under large rocks in rapid currents over stream and river shoals.

LIFE HISTORY: Little is known of the biology or life history of the cylindrical lioplax. It is believed to brood its young and filter-feed, as do other members of the Viviparidae. Life spans have been reported from 3 to 11 years in various species of Viviparidae.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Much of the former range of the cylindrical lioplax has been inundated by dam construction. The surviving population is threatened by sediments and nutrients from nonpoint source pollution.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the cylindrical lioplax have been conducted by Federal, State, and private sector biologists in efforts to locate additional extant populations.

RECOVERY OBJECTIVE AND CRITERIA: To be determined.

FLAT PEBBLESNAIL

Lepyrium showalteri

FAMILY: Hydrobiidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 63 FR 57619, October 28, 1998

DESCRIPTION: Hydrobiid snails are very small aquatic snails, often no larger than a pencil lead. The flat pebblesnail has a large and distinct shell, relative to other hydrobiid species, and is also distinguished from other members of the family by its depressed spire (pointed top) and expanded, flattened body whorl (spiral). The shells are ovate in outline, flattened, and grow to 3.5-4.4 mm (0.1-0.2 in) high and 4-5 mm (0.2 in) wide. The umbilical area is imperforate (no opening), and there are 2 to 3 whorls which rapidly expand.

HISTORIC RANGE: The flat pebblesnail was historically known from the mainstem Coosa River and the Cahaba and Little Cahaba Rivers in Alabama.

KNOWN POPULATIONS: The flat pebblesnail is currently known from one site on the Little Cahaba River, Bibb County, and from a single shoal series on the Cahaba River above the Fall Line, Shelby County, Alabama.

POPULATION LEVEL: The snail may be locally common where it survives.

HABITAT: The flat pebblesnail is found attached to clean, smooth stones in rapid currents of river shoals.

LIFE HISTORY: Eggs are laid singly in capsules on hard surfaces. Little else is known of the natural history of this species.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Much of the former range of the flat pebblesnail in the Coosa River has been inundated by dam construction. The surviving populations in the Cahaba River drainage are threatened by sediments and nutrients from nonpoint source pollution.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the flattened pebblesnail have been conducted by Federal, State, and private sector biologists in efforts to locate additional extant populations.

RECOVERY OBJECTIVE AND CRITERIA: To be determined.

LACY ELIMIA

Elimia crenatella

FAMILY: Pleuroceridae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 63 FR 57619, October 28, 1998

DESCRIPTION: Growing to about 1.1 centimeters (cm) (0.4 in) in length, the shell of the lacy elimia is cone-shaped, strongly striate (grooved), and often folded in the upper whorls. Shell color is dark brown to black, often purple in the aperture, and without banding. The aperture is small and ovate.

HISTORIC RANGE: The lacy elimia was historically abundant in the Coosa River main stem from St. Clair to Chilton County, Alabama, and was also known in several Coosa River tributaries--Big Will's, Kelley's, Choccolocco, and Tallaseehatchee creeks in Alabama

KNOWN POPULATIONS: Lacy elimia currently survives in three Coosa River tributaries--Cheaha, Emauhee, and Weewoka creeks, Talladega County, Alabama

POPULATION LEVEL: The snail may be locally common in small portions of Cheaha Creek.

HABITAT: Elimia snails are gill breathing snails that typically inhabit highly oxygenated waters on rock shoals and gravel bars.

LIFE HISTORY: Elimia snails generally graze on periphyton growing on the stream bottom. Individual snails are either male or female. Eggs are laid in early spring and hatch in about 2 weeks. Snails apparently become sexually mature in their first year, but, in some species, females may not lay until their second year. Some elimia may live as long as 5 years.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Much of the former range of the lacy elimia in the Coosa River has been inundated by dam construction. Many tributary populations were apparently eliminated by historic pollution episodes. The surviving populations are threatened by sediments and nutrients from nonpoint source pollution.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the lacy elimia have been conducted by Federal, State, and private sector biologists in efforts to locate additional extant populations.

RECOVERY OBJECTIVE AND CRITERIA: To be determined.

PAINTED ROCKSNAIL

Leptoxis taeniata

FAMILY: Pleuroceridae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 63 FR 57619, October 28, 1998

DESCRIPTION: The painted rocksnail is a small to medium snail about 19 mm (0.8 in) in length and oval in shape. The aperture is broadly ovate, and rounded anteriorly. Coloration varies from yellowish to olive-brown, and usually with four dark bands.

HISTORIC RANGE: The painted rocksnail had the largest range of any rocksnail in the Mobile River Basin. It was historically known from the Coosa River and tributaries from the northeastern corner of St. Clair County, Alabama downstream into the mainstem of the Alabama River to Claiborne, Monroe County, Alabama, and the Cahaba River below the Fall Line in Perry and Dallas counties, Alabama.

KNOWN POPULATIONS: The painted rocksnail is currently known from the lower reaches of three Coosa River tributaries--Choccolocco Creek, Talladega County; Buxahatchee Creek, Shelby County; and Ohatchee Creek, Calhoun County, Alabama.

POPULATION LEVEL: The snail may be locally common in small portions of these streams.

HABITAT: Rocksnails are found attached to cobble, gravel, or other hard substrates in the strong currents of rapids and shoals.

LIFE HISTORY: Adult rocksnails move very little, and females probably glue their eggs to stones in the same habitat. Longevity in the painted rocksnail is unknown, however, other rocksnails have been reported to live up to two years.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Much of the former range of the painted rocksnail has been inundated by dam construction. Many tributary populations were apparently eliminated by historic pollution episodes. The surviving populations are threatened by sediments and nutrients from nonpoint source pollution.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the painted rocksnail have been conducted by Federal, State, and private sector biologists in efforts to locate additional extant populations.

RECOVERY OBJECTIVE AND CRITERIA: To be determined.

PLICATE ROCKSNAIL

Leptoxis plicata

FAMILY: Pleuroceridae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 63 FR 57619, October 28, 1998

DESCRIPTION: The plicate rocksnail grows to about 20 mm (0.8 in) in length. Shells are subglobose with broadly rounded apertures. The body whorl may be ornamented with strong folds or plicae. Shell color is usually brown, occasionally green, and often with four equidistant (equally distant) color bands. The columella (central column or axis) is smooth, rounded, and typically pigmented in the upper half. The aperture is usually bluish-white, occasionally pink or white. The operculum (plate that closes the shell when the snail is retracted) is dark red, and moderately thick.

HISTORIC RANGE: The plicate rocksnail historically occurred in the Black Warrior River and its tributary, the Little Warrior River, and the Tombigbee River.

KNOWN POPULATIONS: Status survey efforts in the early 1990's found populations of plicate rocksnails only in an approximately 88 km (55 mi) reach of the Locust Fork of the Black Warrior River, Jefferson and Blount counties, Alabama. Surveys during 1996 and 1997 indicated that the snail had recently disappeared from the upstream two-third portion of that habitat and now appears restricted to an approximately 32 km (20 mi) reach in Jefferson County.

POPULATION LEVEL: The snail is uncommon to rare where it is found.

HABITAT: Rocksnails are found attached to cobble, gravel, or other hard substrates in the strong currents of rapids and shoals.

LIFE HISTORY: Adult rocksnails move very little, and females probably glue their eggs to stones in the same habitat. Longevity in the plicate rocksnail is unknown, however, other rocksnails have been reported to live up to two years.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: The plicate rocksnail was apparently eliminated from much of its historic range due to historic pollution episodes. The surviving population in the Locust Fork River is threatened by sediments and nutrients from nonpoint source pollution.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the plicate rocksnail have been conducted by Federal, State, and private sector biologists in efforts to locate additional extant populations. A captive breeding population has been established at the Southeast Aquatic Research Institute, however, to date the snail has failed to breed in captivity.

RECOVERY OBJECTIVE AND CRITERIA: To be determined.

ROUND ROCKSNAIL

Leptoxis ampla

FAMILY: Pleuroceridae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 63 FR 57619, October 28, 1998

DESCRIPTION: The round rocksnail grows to about 20 mm (0.8 in) in length. The shell is rounded, with an ovately rounded aperture. The body whorl may be ornamented with folds. Color may be yellow, dark brown, or olive green, usually with four entire or broken bands.

HISTORIC RANGE: The round rocksnail was historically found in the Cahaba River, and its tributary, Little Cahaba River, and the Coosa River and tributaries--Canoe, Kelly's, Ohatchee, Yellowleaf, and Waxahatchee Creeks in Alabama.

KNOWN POPULATIONS: The round rocksnail is currently known from a shoal series in the Cahaba River, and from the lower reach of the Little Cahaba River, and the lower reaches of Shade and Six-mile creeks in Alabama.

POPULATION LEVEL: The snail may be locally common in small portions of these streams

HABITAT: Rocksnails are found attached to cobble, gravel, or other hard substrates in the strong currents of rapids and shoals.

LIFE HISTORY: Adult rocksnails move very little, and females probably glue their eggs to stones in the same habitat. Longevity in the round rocksnail is unknown, however, other rocksnails have been reported to live up to two years.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Some of the former range of the round rocksnail in the Coosa River has been inundated by dam construction. Many tributary populations were apparently eliminated by historic pollution episodes. The surviving populations in the Cahaba River drainage are threatened by sediments and nutrients from nonpoint source pollution.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the round rocksnail have been conducted by Federal, State, and private sector biologists in efforts to locate additional extant populations.

RECOVERY OBJECTIVE AND CRITERIA: To be determined.

TULOTOMA SNAIL

Tulotoma magnifica

FAMILY: Viviparidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 56 FR 800, January 9, 1991

DESCRIPTION: A gill-breathing snail with a globular (spherical) shell, reaching a size somewhat larger than a golf ball, and typically ornamented with spiral lines of knob-like structures. Adult size and ornamentation distinguish it from all other freshwater snails in the Coosa-Alabama River system. Tulotoma is also distinguished by its oblique aperture with a concave margin.

HISTORIC RANGE: Coosa River and tributaries, St. Clair County, Alabama, to the Alabama River, Clarke/Monroe counties, Alabama.

KNOWN POPULATIONS: Coosa River below Jordan Dam, Elmore Co., Kelley Creek, Weogufka, Hatchet, Ohatchee, Choccolocco, Yellowleaf Creeks, Coosa River drainage, Alabama.

POPULATION LEVEL: Results of a 3-year study by the Alabama Power Company indicate the tulotoma may number in the millions within a 6-mile reach of the Coosa River below Jordan Dam. Populations are extremely restricted, but relatively abundant, in Kelley, Weogufka, Hatchet, and Choccolocco Creeks. Only a few individuals have been observed in Ohatchee and Yellowleaf Creeks.

HABITAT: Tulotoma are found under large rocks in shoals and runs with moderate to swift currents.

LIFE HISTORY: Tulotoma congregate in colonies under large rocks or boulders. Studies of the extant Coosa River population indicates a life span of 2 to 4 years, however, the size and bulk of historically collected shells may indicate longer life spans in historic populations. Offspring are born alive. Although females give birth year round, reproduction is concentrated in the spring. Tulotoma grow rapidly and reach sexual maturity in about 1 year. Dispersal is concentrated during periods of high water.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Extensive impoundment of the Coosa-Alabama River System for navigation and hydropower, industrial and urban discharges, and agricultural runoff. Surviving populations are threatened by urban, household, and agricultural runoff, and industrial and sewage treatment plant discharges.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of tulotoma have been conducted by Federal, State and private biologists in efforts to locate extant populations. The Alabama Power Company has increased minimum flows below Jordan Dam and has completed a 3-year population and life history study of the species. The Alabama Department of Conservation and Natural Resources has investigated habitat differences between populations and compared genetic relations between populations by electrophoresis.

RECOVERY OBJECTIVE AND CRITERIA: The immediate recovery objective for tulotoma is to reclassify the species from endangered to threatened status. The estimated date for reclassification is 2002. Delisting will be considered when four of the known tributary populations (Kelley, Weogufka, Hatchet, and Choccolocco Creeks) are shown to be stable or increasing, and plans are developed and implemented to improve and monitor water and habitat quality in those stream drainages. These criteria may be revised on the basis of new information generated from the completion of recovery tasks. The estimated date for delisting is 2010.

APPENDIX B

LISTED AQUATIC SPECIES WITH RECOVERY PLANS

This appendix consists of summary sheets for listed aquatic species with separate Recovery Plans which occur in the Mobile River Basin. Recovery Plans cited may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
301/492-6403, or 800/582-3421

Some of these recovery plans can also be downloaded from the Internet at http://endangered.fws.gov/recovery/recplans/index.htm.

Turtles
Alabama redbelly turtle *Pseudemys alabamensis*
Flattened musk turtle *Sternotherus depressus*

Fish
Amber darter *Percina antesella*
Blue shiner *Cyprinella caerulea*
Cahaba shiner *Notropis cahabae*
Conasauga logperch *Percina jenkinsi*
Gulf sturgeon *Acipenser oxyrhynchus desotoi*
Pygmy sculpin *Cottus pygmaeus*
Watercress darter *Etheostoma nuchale*

Mussels
Black clubshell *Pleurobema curtum*
Flat pigtoe *Pleurobema marshalli*
Heavy pigtoe *Pleurobema taitianum*
Inflated heelsplitter *Potamilus inflatus*
Southern combshell *Epioblasma penita*
Stirrupshell *Quadrula stapes*

Plants
Ptilimnium nodosum Harperella
Sagittaria secundifolia Kral's water-plantain

ALABAMA REDBELLY TURTLE

Pseudemys alabamensis

FAMILY: Emydidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 52 FR 22939, June 16, 1987

DESCRIPTION: This is a large (20 to 25 cm or 8 to 10 in carapace (top shell) length) freshwater turtle, normally with an orange to reddish plastron (bottom shell) and a prominent notch at the tip of the upper jaw, bordered on either side by a tooth-like cusp. The elongated carapace is highly arched and elevated along the midline; its highest point is often anterior to the midbody where the carapace is widest. The carapace is brown to olive, with yellow, orange or reddish streaks and mottling that form distinct, light vertical bars on the pleural scutes (the series of paired areas running on either side of the midline scutes (vertebrals) on the carapace). The skin is olive to black with yellow to light orange stripes. The Alabama redbelly turtle seems to feed almost entirely on aquatic plants.

HISTORIC RANGE: Mobile River System in Baldwin and Mobile Counties, Alabama.

KNOWN POPULATIONS: The Mobile River below David Lake in Mobile County.

POPULATION LEVEL: The Alabama redbelly turtle appears to be most abundant from a point on the Tensaw River adjacent to Hurricane Landing south along the river system to Interstate Highway 10 (21 km or 13 mi). Total population size is unknown.

HABITAT: The principal habitat of the species consists of broad, vegetated expanses of shallows in backwater areas of the bays which are 1 to 2 meters (m) (3.3 to 6.6 feet (ft)) in depth. The turtles use dense beds of aquatic vegetation for basking and predator avoidance, in addition to food.

LIFE HISTORY: The turtles lay their eggs in late spring and early summer on sand bars or islands. Juvenile habits are unknown. Turtles feed on submerged and emergent aquatic vegetation. Life span is unknown, however one captive turtle survived 11 years.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: The turtle's primary nesting site, Gravine Island, is a 20-acre dredged material disposal site located on one end of an island of wooded swamp. This area is intensively used for recreational activities which disturb nesting habitat, and have apparently reduced reproductive success and recruitment. Predation by fish crows, alligators, and feral pigs is also affecting the turtles and its nest success. Alabama redbelly turtles have been taken for food, for sale as pets, and as an incidental catch by commercial fisherman using gill, hoop and trammel nets, and crab pots. The turtle's eggs have apparently also been gathered by local residents for eating.

CONSERVATION MEASURES: Over 20,000 acres have been acquired in the Mobile-Tensaw Delta by the U.S. Army Corps of Engineers under the Tennessee-Tombigbee Waterway Wildlife Mitigation Project, including Gravine Island. The Alabama Department of Conservation and Natural Resources is managing these lands as part of the Mobile-Tensaw Delta Wildlife Management Area. Studies funded by these agencies are currently being conducted to develop information that will assist in management and protection of the turtles.

RECOVERY OBJECTIVE: To reclassify the Alabama redbelly turtle from endangered to threatened status.

FLATTENED MUSK TURTLE

Sternotherus depressus

FAMILY: Kinosternidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 52 FR 22418, June 11, 1987

DESCRIPTION: The flattened musk turtle is a small aquatic turtle with a distinctly flattened carapace up to 119 mm (4.7 in) long. Keels (carapace ridges) are virtually, if not altogether, lacking. The carapace is dark brown to orange with dark-bordered seams and is slightly serrated posteriorly. The plastron is pink to yellowish. The head is greenish with a dark reticulum (net-like pattern) that often breaks up to form spots on the top of the snout. Stripes on the top and sides of the neck, if present, are narrow. There are two barbels on the chin, all four feet are webbed, and males have thick, long, spine-tipped tails.

HISTORIC RANGE: The flattened musk turtle occurs in the upper Black Warrior River system of Alabama. Present populations are believed to exist upstream from Bankhead Dam in Blount, Cullman, Etowah, Jefferson, Lawrence, Marshall, Tuscaloosa, Walker, and Winston counties. Historically, the flattened musk turtle was reported as occurring in this river system from the fall line northward.

KNOWN POPULATIONS: Portions of Locust Fork, Mulberry Fork, and Sipsey Fork of the Black Warrior River and some of their tributaries.

POPULATION LEVEL: Exact population numbers are unknown. Within the current range, only about 15 percent of the habitat seems to contain healthy reproducing populations. Range wide the species appears to be declining.

HABITAT: Although the flattened musk turtle is capable of living in a variety of streams and lakes, its optimum habitat appears to be free-flowing large creeks or small rivers having vegetated shallows about 0.6 m (2 ft) deep alternating with pools 1 to 1.5 m (3.6 to 5 ft) deep. These pools have a detectable current and an abundance of crevices and submerged rocks, overlapping flat rocks, or accumulations of boulders. These aquatic habitats have should have an abundant molluscan fauna, low silt load and deposits, low nutrient content and bacterial count, moderate temperature, and minimal pollution.

LIFE HISTORY: The diet of the flattened musk turtle consists primarily of mollusks when available, and sometimes insects. Captive turtles also feed readily on worms, but it is unknown as to what extent they are utilized under natural conditions. This turtle reaches reproductive maturity at 4 to 8 years of age. Females usually deposit one to two clutches of eggs a year with one to three eggs per clutch.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification, sedimentation, over-collecting, and water quality degradation are the primary causes of the decline of the flattened musk turtle. Surviving populations are threatened by siltation arising from agriculture, forestry, and strip mining; over collecting for the commercial trade; and chemical and sewage pollution.

CONSERVATION MEASURES: Studies on population status have been conducted. Surveys have been conducted by Federal, State and private interests.

RECOVERY OBJECTIVE: To delist the flattened musk turtle.

AMBER DARTER

Percina antesella

FAMILY: Percidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 50 FR 31603, September 5, 1985

DESCRIPTION: The amber darter is a small, slender-bodied fish rarely exceeding 60 mm (2.5 in) in length. The upper body is golden brown with four dark saddles, and its belly is yellow to cream colored. The spinous (containing spines) dorsal fin is clear, with a vague gray-black basal and marginal band. The soft dorsal, caudal, and pectoral (breast) fin rays have clusters of dark chromatophores (pigment-bearing cell), while their membranes are unpigmented. The anal and pelvic (lower trunk) fins are unpigmented except for a few clusters of dark chromatophores.

HISTORIC RANGE: The amber darter is historically known from the Conasauga River, Georgia and Tennessee, and from the Etowah River and its tributary, Shoal Creek, Georgia.

KNOWN POPULATIONS: The darter is currently known to occur in approximately 54 kilometers (33.5 miles) of the Conasauga River, Georgia and Tennessee.

POPULATION LEVEL: Population level is unknown.

HABITAT: Vegetated, shallow riffles with sand/gravel/cobble substrates.

CRITICAL HABITAT: The Conasauga River from U.S. Route 411 bridge in Polk County, Tennessee, downstream approximately 54 km (33.5 mi) through Bradley County, Tennessee, and Murray and Whitfield counties, Georgia, to Tibbs Bridge Road bridge (Murray County Road 109/Whitfield County Road 100).

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: The species was listed due to its' limited range, threats presented by a proposed flood control and water supply reservoir in the Conasauga River, and water quality degradation. Threats to the amber darter include activities that degrade habitat and water quality, such as land use changes, chemical spills, increased logging activity, road and bridge construction, stream channel modifications, and increases in agricultural and urban runoff.

CONSERVATION MEASURES: The water supply project was amended through consultation under Section 7 of the Endangered Species Act. An overbank floodplain reservoir has been constructed that has minimal effect on the Conasauga River channel. Fish studies are being conducted as part of a monitoring agreement to determine effects of water withdrawal on the amber darter and other species in the stream.

RECOVERY OBJECTIVE: To protect the amber darter from future decline, and to eventually delist the species.

BLUE SHINER

Cyprinella caerulea

FAMILY: Cyprinidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 57 FR 14790, April 22, 1992

DESCRIPTION: The blue shiner is a medium-sized minnow that may grow up to 90 mm (3.5 in) standard total length. It often appears to be dusky blue with pale yellow fins. This fish has diamond-shaped scales outlined with melanophores (dark pigment-bearing cells). The lateral line is distinct.

HISTORIC RANGE: Historically known from the Cahaba River in Alabama, and the Coosa River and tributaries in Alabama, Georgia, and Tennessee.

KNOWN POPULATIONS: Its current Alabama range is Weogufka Creek, Choccolocco Creek, the lower reach of Little River, and Spring Creek in the Coosa River drainage. In Tennessee, the range includes the Conasauga River and a tributary, Minnewauga Creek. In Georgia, the blue shiner is found only in portions of the Conasauga River.

POPULATION LEVEL: Population levels are unknown. The blue shiner was last collected from the Cahaba River System in 1971. It has been extirpated from the mainstem of the Coosa River and the Coosawattee River.

HABITAT: The blue shiner occurs over a sand and gravel substrate among cobble in cool, clear water.

LIFE HISTORY: Spawning is believed to occur early May through late August. Life span is believed to be 3 years.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Water quality degradation has reduced the blue shiner's range. Populations have been extirpated because of urbanization, sewage pollution, strip-mining activities, and poor land management practices. Construction of reservoirs has fragmented and isolated some populations.

CONSERVATION MEASURES: Investigations of water quality, population trends, and habitat utilization in the Cahaba and Conasauga Rivers have been conducted. Some populations in Georgia and Tennessee are periodically surveyed.

RECOVERY OBJECTIVE: To delist the blue shiner.

CAHABA SHINER

Notropis cahabae

FAMILY: Cyprinidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 55 FR 42966, October 25, 1990

DESCRIPTION: The Cahaba shiner is a small, delicate-bodied, silvery- colored fish about 6 cm (2.5 in) long with a peach-colored narrow stripe over the dark lateral stripe. This species differs from the mimic shiner, a closely related species, by a lateral stripe that does not expand before the caudal spot and by the absence of a predorsal dark blotch. Also, the Cahaba shiner's dorsal, caudal, and peduncle scales (scales where the tail meets the body) are uniformly dark and pigmented and its peduncle scales are broadly outlined and diffuse.

HISTORIC RANGE: The Cahaba shiner is the only North American large stream fish that is endemic to the main stem of a single river. In the recent past, the Cahaba shiner was known from about 121 km (76 mi) of the Cahaba River from 4.8 km (3 mi) northeast of Heiberger in Perry County to Highway 52 bridge near Helena in Shelby County. There is speculation (Ramsey 1982; citation in Appendix E) that the Cahaba shiner once had a wider historical distribution which may have included the Coosa River.

KNOWN POPULATIONS: The Cahaba shiner inhabits about 96 km (60 mi) of the Cahaba River in Alabama, from 4.8 km (3 mi) northeast of Heiberger to 2.3 km (3.7 mi) above Booth Ford. The Cahaba shiner was recently found in a 106 km (64 mi) reach of the Locust Fork drainage of the Black Warrior River, from near Littleton upstream to the Alabama Highway 160 crossing near Cleveland, Alabama.

POPULATION LEVEL: According to recent collection efforts, populations are declining in the Cahaba River.

HABITAT: Cahaba shiner habitat appears to be large shoal areas of the main channel of the Cahaba and Locust Fork Rivers. The shiner is found in the quieter waters less than 0.5 m deep (1.64 ft), just below swift riffle areas. The Cahaba shiner seems to prefer patches of sandy substrate at the edge of or scattered throughout gravel beds or downstream of larger rocks and boulders.

LIFE HISTORY: Spawns from late May through June.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Water quality degradation is the primary cause of the decline of the Cahaba shiner. Sewage treatment plant effluents, drainage from limestone quarries and strip mining, and nonpoint source sedimentation continue to threaten the species.

CONSERVATION MEASURES: The counties of Perry and Dallas, which border over a third of the Cahaba River's lower main channel, passed resolutions in 1981 establishing scenic corridors along the river as buffer zones. Parties planning activities which might impact the environment in these corridors are required to obtain a permit from their County Commission. A Cahaba River Society, comprised of biologists, conservationists, land-owners and business leaders, has also been organized to protect the river.

RECOVERY OBJECTIVE: To reclassify the Cahaba shiner to threatened status.

CONASAUGA LOGPERCH

Percina jenkinsi

FAMILY: Percidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 50 FR 31597 September 5, 1985

DESCRIPTION: The Conasauga logperch grows to approximately 15 cm (6 in) in length and is characterized by having many tiger-like vertical stripes over a yellow background and a pig-like conical snout.

HISTORIC RANGE: Apparently restricted to the upper Conasauga River in Tennessee and Georgia. No historic records are known from other locations.

KNOWN POPULATIONS: The Conasauga logperch is found in about 18 km (11 mi) of the upper Conasauga River, where it has been observed from the vicinity of Halfway Branch, Polk County, Tennessee, downstream to the Georgia State Highway 2 Bridge, Murray County, Georgia.

POPULATION LEVEL: The population level of the Conasauga logperch is unknown, but survey results suggest a low population density.

HABITAT: The Conasauga logperch has most commonly been collected in pool areas having a perceptible current and a substrate of rubble, gravel and sand. Riffles are used at least seasonally for spawning.

LIFE HISTORY: No life history studies have been conducted on this species. Available information indicates that spawning occurs in the spring in fast riffles over gravel substrate. The fish probably reaches sexual maturity after 1 year and has a maximum life span of at least 4 years.

CRITICAL HABITAT: Conasauga River from the confluence of Halfway Branch with the Conasauga River in Polk County, Tennessee, downstream approximately 18 km (11 mi) to the Georgia State Highway 2 Bridge, Murray County, Georgia.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: The species was listed due to its' limited range, threats presented by a proposed flood control and water supply reservoir in the Conasauga River, and water quality degradation. Threats to the Conasauga logperch include activities that degrade habitat and water quality, such as land use changes, chemical spills, increased logging activity, road and bridge construction, stream channel modifications, and increases in agricultural and urban runoff.

CONSERVATION MEASURES: The water supply project was amended through consultation under Section 7 of the Endangered Species Act. An overbank flood plain reservoir has been constructed that has minimal effect on the Conasauga River channel. Fish studies are being conducted as part of a monitoring agreement to determine effects of reservoir construction and operation on the Conasauga logperch and other species in the stream.

RECOVERY OBJECTIVE: Recovery of the Conasauga logperch to the point of downlisting to threatened is unlikely in the near future due to low population levels and continued impacts on its' stream habitat. Therefore, the immediate recovery objective is to prevent the extinction of this species by protecting its' habitat in the Conasauga River.

GULF STURGEON
Acipenser oxyrhynchus desotoi

FAMILY: Acipenseridae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 56 FR 49653, September 30, 1991

DESCRIPTION: The gulf sturgeon is an anadromous fish with a sub-cylindrical body imbedded with bony plates or scutes. The snout is greatly extended and blade like with four fleshy chin barbels in front of the mouth, which is protractile on the lower surface of the head. The upper lobe of the tail is longer than the lower lobe. The subspecies is light brown to dark brown in color and pale underneath.

HISTORIC RANGE: Gulf sturgeon historically occurred in most major river systems from the Mississippi River to the Suwannee River, Florida, and marine waters of the Central and Eastern Gulf of Mexico, south to Florida Bay. In the Mobile River basin, Gulf sturgeon have been reported from the Mobile, Tensaw, Tombigbee, and Alabama Rivers, and Mobile Bay.

KNOWN POPULATIONS: In recent years, Gulf sturgeon have been caught or reported from the mouth of the Mississippi River; Lake Pontchartrain/Lake Borgne/Rigolets, and tributaries of the Lake Pontchartrain basin; Pearl River and Bogue Chitto River; Mississippi Sound; Biloxi Bay; Pascagoula River basin, including the bay, Pascagoula River, Chickasawhay, Leaf, and Bowie Rivers; Mobile River Basin, including the Bay, Mobile, Tensaw, Blakeley, Tombigbee, and Alabama Rivers; Pensacola Bay basin, including the bay, Escambia, Conecuh, Blackwater, and Yellow Rivers; Choctawhatchee Bay basin, including Santa Rosa Sound, Choctawhatchee Bay, Choctawhatchee River, and Pea River; Apalachicola Bay and River, and Brothers River; Ochlockonee River; Suwannee River; Tampa Bay; and Charlotte Harbor.

POPULATION LEVEL: Gulf sturgeon population estimates are unknown throughout its range; however, estimates have been completed for the Apalachicola and Suwannee rivers. Since 1984, the estimated annual number of fish in the Apalachicola River ranged from 96-131, with a mean of 115. In the Suwannee River, the estimated population size has ranged between 2,250-3,300 sturgeon averaging 18 kilograms (39.7 pounds) since 1986.

HABITAT: Gulf sturgeon are anadromous, spending 8 to 9 months each year in rivers, and 3 to 4 months in estuaries or Gulf waters. Sturgeon less than 2 years old may remain in riverine and estuarine habitats throughout the year. It is believed that preferable riverine habitat consists of deep channels or holes with sand/gravel/cobble/rock bottoms.

LIFE HISTORY: Timing, location and habitat requirements for Gulf sturgeon spawning are not well documented. Most subadult and adult Gulf sturgeon ascend coastal rivers from the Gulf of Mexico in late winter, early spring. Some adults are sexually mature and in ripe condition during this time. Gulf sturgeon eggs have been collected in March and April. Sexual maturity is reached at 7-8 years age.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Over-exploitation by fishermen, habitat modification, and water quality degradation are the primary factors believed to have led to the decline of the sturgeon. Sturgeon continue to be caught incidental to other fisheries, and habitat continues to be affected by dredging and water quality degradation. Sturgeon migration and reproduction are impeded by impoundments.

CONSERVATION MEASURES: Federal and State agencies have been conducting population, life history, and habitat studies on the Gulf sturgeon, and developing culture techniques for the species.

RECOVERY OBJECTIVE: To prevent further reduction of existing wild stock; establish population levels that would allow delisting of the Gulf sturgeon in discrete management units; and establish population levels that could withstand directed fishing pressure within discrete management units.

PYGMY SCULPIN

Cottus pygmaeus

FAMILY: Cottidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 54 FR 39846, September 28, 1989

DESCRIPTION: The pygmy sculpin is a small fish which rarely exceeds 45 mm (1.8 in) in length. It has a large head, moderately robust body, and an incomplete lateral line. Its coloration varies by sex, maturity, and breeding condition; but, its pigmentation is generally consistent with up to three dorsal saddles and mottled or spotted fins. Juveniles have a grayish-black body with three light-colored saddles. With maturity, the body becomes lighter; the grayish-black color that remains forms two dark saddles. In juveniles, the head is black, changing to white with small, scattered melanophores in adults. In breeding males, the dark spots in the spinous dorsal fin enlarge and become more intense and the fin margin becomes reddish orange. The entire body becomes suffused with black pigment which almost completely conceals the underlying pattern. The breeding color of females tends to be slightly darker than in non-breeding females.

HISTORIC AND CURRENT RANGE: This sculpin is only known from Coldwater Spring, Calhoun County, Alabama. The entire known historic range is the Spring pool and the Spring run of approximately 152 m (500 ft) in length. The entire range is owned by the City of Anniston.

POPULATION LEVEL: Populations are estimated at 720 to 1,555 individuals in the Spring run and 7,609 to 8,126 individuals in the Spring pool.

HABITAT: Coldwater Spring has an average flow of 32 million gallons a day with a fairly consistent temperature of 16 to 18 degrees centigrade (about 88 degrees Fahrenheit). The bottom is gravel and sand with large rocks where the Spring boils occur. Large mats of vegetation are present in the Spring pool and along the edges of the Spring run. The pool is formed by a low weir dam approximately 7 m (22 ft) length. The run is approximately 18 m (60 ft) wide and 152 m (500 ft) long. Substrate in the run is sand and gravel. Water depth in the run varies from 1 to several centimeters (inches) with very little pooling before the run joins Dry Creek.

LIFE HISTORY: Pygmy sculpin feed on small snails, microcrustaceans, and aquatic insect larvae. Sexual maturity is reached when individuals attain 2.54 cm (1 in) or more in length. Gravid females have been collected throughout the year, but spawning activity is most intense from April to August. Eggs are laid beneath cobble.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Contamination of the subsurface aquifer for Coldwater Spring threatens the pygmy sculpin. Water sampling on and adjacent to Anniston Army Depot indicates hexavalent chromium is discharged to Dry Creek and chlorinated hydrocarbons are in the groundwater at the Depot. Trichloroethylene occurs in strong concentrations (up to 120,000 parts per billion (ppb)) in test wells on the Depot and up to 3.4 ppb in Coldwater Spring. Shallow ground water in the area of the Spring likely contributes to the recharge of the Jacksonville fault zone, which includes Coldwater Spring. Since the species is restricted to Coldwater Spring, it could be eliminated by any single adverse action.

CONSERVATION MEASURES: Studies have been conducted to identify the recharge area of Coldwater Springs. The population is periodically monitored. Habitat needs are under investigation. An emergency plan has been developed as a caution against a catastrophic pollution spill.

RECOVERY OBJECTIVE: To protect and eventually delist the pygmy sculpin.

WATERCRESS DARTER

Etheostoma nuchale

FAMILY: Percidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 35 FR 16047, October 13, 1970

DESCRIPTION: The watercress darter is a small, robust species growing to a maximum size of just over 5 cm (2 in) in total length. Breeding males have red-orange and blue fins, and red-orange on the lower part of the body. The lateral line has 35 to 42 scales, is incomplete, and has 12 to 24 pored scales. The nape is naked.

HISTORIC RANGE AND CURRENT RANGE: Known naturally from three springs, Black Warrior River watershed, Jefferson County, Alabama; a new population has been introduced into a fourth spring.

POPULATION LEVEL: Population levels in the naturally occurring populations appear to be healthy.

HABITAT: The deeper, slow-moving backwaters of springs that are choked with aquatic vegetation.

LIFE HISTORY: Watercress darters feed on aquatic insects and small crustaceans. Spawning occurs from March through July.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: The limited distribution of the species, urbanization of areas surrounding its habitat, and the potential for groundwater contamination are the primary threats to the species.

CONSERVATION MEASURES: A new population has been successfully introduced into previously unoccupied habitat in Tawpawingo Spring, Jefferson County, Alabama. The Service has purchased Thomas Spring and adjacent habitat. This area has been designated as the Watercress Darter National Wildlife Refuge.

RECOVERY OBJECTIVE: Reclassification to threatened status, and eventually delist the species.

BLACK CLUBSHELL (CURTUS' PEARLY MUSSEL)

Pleurobema curtum

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, FR 52 11162, April 7, 1987

DESCRIPTION: The black clubshell is subtriangular in shape, and grows to about 50 mm (2 in) in length. Shell color varies from green in young shells to a dark greenish-black in older shells. The nacre is bluish-white, iridescent, and thin posteriorly. The shell has near-terminal, prominent umbos, and is elongated posteriorly.

HISTORIC RANGE: Tombigbee River above Pickensville, Alabama and Mississippi.

KNOWN POPULATIONS: East Fork of the Tombigbee River, in the vicinity of the Itawamba/Monroe County line, Mississippi.

POPULATION LEVEL: Population numbers are extremely low. Only a few fresh dead shells of the black clubshell have been recovered from the East Fork of the Tombigbee River since construction of the Tennessee-Tombigbee Waterway.

HABITAT: Stable sand/gravel runs and riffles.

LIFE HISTORY: Unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification is the primary cause of the decline of the black clubshell. This species can not tolerate impoundment or channelization. Water diversion, sand and gravel mining within and adjacent to the river channel, agricultural runoff, and low population levels were also causes of concern.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the black clubshell have been conducted by Federal, State and private biologists in efforts to locate extant populations. The State of Mississippi performs an annual assessment and survey of historical and occupied habitats in the East Fork of the Tombigbee River.

RECOVERY OBJECTIVE: Recovery of the black clubshell to the point of downlisting to threatened is unlikely in the near future. The recovery objective is to prevent the extinction of this species by protecting its remaining habitat.

FLAT PIGTOE (MARSHALL'S PEARLY MUSSEL)

Pleurobema marshalli

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 52 FR 11162, April 7, 1987

DESCRIPTION: The flat pigtoe is rounded subovate, or obliquely elliptical in outline, growing to 60 mm (2.4 in) in length. Periostracum is brown to reddish-brown in coloration, and the nacre is white. Very low pustules or welts are often present on the postventral surface of the shell. Umbos are near-terminal, and the umbonal cavity is shallow.

HISTORIC RANGE: Tombigbee River between Columbus, Mississippi, and Epes, Alabama.

KNOWN POPULATIONS: The flat pigtoe has not been collected alive since completion of the Tennessee-Tombigbee Waterway. The only known locality within its' historic range where adequate habitat and flows may still occur is below Gainesville Dam, Alabama.

POPULATION LEVEL: Recent searches of historic habitat have failed to locate the species.

HABITAT: Sand/gravel shoals and runs in the Tombigbee River.

LIFE HISTORY: Unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification is the primary cause of decline of the flat pigtoe. This species can not tolerate impoundment. All known historic habitat for this species is affected by impoundments for navigation.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the flat pigtoe, and intensive searches of the Gainesville Bendway have been conducted by Federal and State biologists in efforts to locate extant populations.

RECOVERY OBJECTIVE: Recovery of the flat pigtoe to the point of downlisting to threatened is unlikely. The recovery objective is to prevent the extinction of this species by protecting potential habitat.

HEAVY PIGTOE (JUDGE TAIT'S MUSSEL)

Pleurobema taitianum

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 52 FR 11162, April 7, 1987

DESCRIPTION: The shell of the heavy pigtoe is obliquely triangular in shape. Average shell size is about 50 mm (2 in) in length. Periostracum color is brown to brownish-black, and the nacre is pinkish. Umbos are located and directed anteriorly, and umbonal cavities are very shallow.

HISTORIC RANGE: Mainstem Tombigbee, Alabama, Cahaba, and Coosa Rivers, Alabama and Mississippi.

KNOWN POPULATIONS: East Fork of the Tombigbee, Buttahatchee Rivers, Mississippi; Alabama and Sipsey Rivers, Alabama.

POPULATION SIZE: A small population of the heavy pigtoe is known from the Alabama River near Selma, Alabama. The species has not been found alive at any other site since 1987.

HABITAT: Stable sand/gravel/cobble runs and riffles of small to large rivers.

LIFE HISTORY: Unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification for navigation is the primary cause of the decline of the heavy pigtoe. This species cannot tolerate impoundment. Agricultural runoff, sand and gravel mining within and adjacent to the river channel, and low population levels also threaten the species.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the heavy pigtoe have been conducted by Federal, State and private biologists. The State of Mississippi performs an annual assessment and survey of historical and potential habitats in the Buttahatchee and East Fork of the Tombigbee Rivers. The State of Alabama conducts annual survey of mussel beds in the Alabama River.

RECOVERY OBJECTIVE: Recovery of the heavy pigtoe to the point of downlisting to threatened is unlikely in the near future. The recovery objective is to prevent the extinction of this species by locating surviving populations and protecting its remaining habitat.

INFLATED HEELSPLITTER

Potamilus inflatus

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 55 FR 39868 September 28, 1990

DESCRIPTION: The inflated heelsplitter has an oval, compressed to moderately inflated, thin shell. The valves ma anteriorly, the umbos are low, and there is a prominent posterior wing that may extend anterior to the bea oung individuals. The shell is brown to black and may have green rays in young individuals. The umbonal cavity is very shallow and the nacre is pink to purple. Shell length reaches 140 mm (5.5 in) in adults.

HISTORIC RANGE: Amite and Tangipahoa Rivers, Louisiana; the Pearl River, Mississippi; and the Tombigbee, Black Warrior, Alabama, and Coosa Rivers, Alabama.

KNOWN POPULATIONS: Amite River, Louisiana; Pearl River, Mississippi; Alabama, Tombigbee and Black Warrior rivers, Alabama.

POPULATION LEVEL: In the Black Warrior-Tombigbee Waterway densities of inflated heelsplitters ranged from 0.0-1.73 per 100 square m (1076 square ft). Extensive surveys of the Alabama River have located only a single fresh dead shell of the species. During an intensive survey of the Amite River only 63 live and dead heelsplitters were found. Extensive surveys of the Pearl River have resulted in the collection of only a few fresh dead shells.

HABITAT: The preferred habitat of this species is soft, stable substrates in slow to moderate currents. It has been found in sand, mud, silt and sandy-gravel, but not in large gravel or armored gravel. It is usually collected on the protected side of bars and may occur in depths over 6 m (20 ft).

LIFE HISTORY: Shells of this species exhibit sexual dimorphism, with female shells being considerably smaller than males. There are also differences in nacre color and growth rates between sexes. Glochidial release is believed to occur in July, followed by spawning in August. The host fish has been identified as freshwater drum.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Historic habitat has been impacted by channel modification for navigation and flood control, impoundment, pollution, navigation dredging, and gravel dredging and mining.

MANAGEMENT AND PROTECTION EFFORTS: The New Orleans District, Corps of Engineers has issued cease and desist orders to illegal mining operations in the channel of the Amite River, and has conducted surveys for the species in the Pearl River. The Mobile District, Corps of Engineers has conducted studies on the biology and ecology of the species, as well as surveys and relocation efforts prior to channel maintenance dredging in the Tombigbee and Black Warrior Rivers. The U.S. Fish and Wildlife Service has conducted studies on life history and genetics.

RECOVERY OBJECTIVE: To delist the inflated heelsplitter.

SOUTHERN COMBSHELL (PENITENT MUSSEL)

Epioblasma penita

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 52 FR 11162, April 7, 1987

DESCRIPTION: The southern combshell is squarish in outline and grows to about 55 mm (2.2 in) in length. The periostracum is yellowish, greenish-yellow, or tawny in color, sometimes with darker dots. The posterior of the shell is swollen and radially sculptured in females, angulated and flattened in males. The ligament (shell attachment) is very short, and the nacre is white with iridescence in the umbonal cavity.

HISTORIC RANGE: Alabama River, Alabama; Tombigbee River and tributaries, Mississippi and Alabama; Black Warrior River below the Fall Line, Alabama; Cahaba River, Alabama; Coosa River, Alabama.

KNOWN POPULATIONS: East Fork of the Tombigbee and Buttahatchee Rivers, Tombigbee River drainage, Mississippi.

POPULATION LEVEL: Intensive surveys have failed to locate the southern combshell in the East Fork of the Tombigbee River. Southern combshells continue to be rarely found in the Buttahatchee River.

HABITAT: Sand/gravel shoals and runs in small to large rivers.

LIFE HISTORY: Unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification in the form of channelization and impoundment, sedimentation, and water quality degradation are the primary causes of decline of the southern combshell. This species can not tolerate impoundments. Surviving populations are threatened by channel degradation initiated by sand and gravel mining within and adjacent to river channels and agricultural runoff.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the southern combshell have been conducted by Federal, State and private biologists in efforts to locate extant populations. The State of Mississippi performs an annual assessment and survey of historical and occupied habitats in the Buttahatchee and East Fork of the Tombigbee Rivers.

RECOVERY OBJECTIVE: Recovery of the southern combshell to the point of downlisting to threatened is unlikely in the near future. The recovery objective is to prevent the extinction of this species by protecting its remaining habitat.

STIRRUPSHELL

Quadrula stapes

FAMILY: Unionidae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 52 FR 11162, April 7, 1987

DESCRIPTION: The stirrupshell grows to about 55 mm (2.2 in) in length, and is irregularly squarish in outline. The shell has a sharp posterior ridge ending abruptly. The posterior surface is tubercled, and yellowish-green to brown coloration. The nacre is white, iridescent posteriorly.

HISTORIC RANGE: Tombigbee, Black Warrior and Alabama Rivers, Alabama, Mississippi.

KNOWN POPULATIONS: Lower Sipsey River, Tombigbee River drainage, Alabama.

POPULATION LEVEL: A fresh dead shell was last collected from the lower Sipsey River in 1986.

HABITAT: Stable sand/gravel/cobble runs.

LIFE HISTORY: Unknown.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: Habitat modification is the major cause of decline of the stirrupshell. This species can not tolerate impoundments. Most of the species habitat has been impounded by the construction of locks and dams. The lower Sipsey River is vulnerable to nonpoint source pollution.

CONSERVATION MEASURES: Surveys of potential habitat throughout the historic range of the stirrupshell have been conducted by Federal, State and private biologists in efforts to locate extant populations.

RECOVERY OBJECTIVE: Recovery of the stirrupshell to the point of downlisting to threatened is unlikely in the near future. The recovery objective is to prevent the extinction of this species by protecting its remaining habitat.

HARPERELLA

Ptilimnium nodosum

FAMILY: Apiaceae

STATUS AND SOURCE OF INFORMATION: Endangered, Federal Register, 53 FR 37982 September 28, 1988

DESCRIPTION: This annual herb grows to a height of 0.15 to 1.0 m (6 to 36 in). The leaves are reduced to hollow, quill-like structures. The small, white flowers occur in heads, or umbels, not unlike those of Queen Anne's lace (*Daucus carota*). Flowers have five regular parts and are bisexual or unisexual, each umbel containing both perfect (male and female flowers) and male florets. Seeds are elliptical and laterally compressed, measuring 1.5 to 2.0 mm (0.06-0.08 in) in length. In pond habitats, flowering begins in May, while riverine populations flower much later, beginning in late June or July and continuing until frost.

RANGE AND POPULATION LEVEL: Harperella is known from 12 populations in Alabama, Arkansas, Georgia, South Carolina, North Carolina, West Virginia, and Maryland. Only two populations are known to occur in Alabama, Little River and its tributary Town Creek, Dekalb County, Alabama. Although the number of populations is limited, this plant is a relatively prolific annual, and large numbers may occur within each population, especially along rivers.

HABITAT: Harperella typically occurs in two habitat types: (1) rocky or gravel shoals and margins of clear, swift-flowing stream sections; and (2) edges of intermittent pineland ponds in the coastal plain.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: This plant tolerates and may actually require a very specific and unusual water regime, including moderately intensive spring floods, which may reduce or eliminate competing vegetation. Harperella is readily eliminated from its habitat by alterations of the water regime which result from impoundments, water withdrawal, and drainage or deepening of ponds. Other factors such as siltation, pollution, and shoreline development also threaten harperella populations. Over half the historically known populations have been eliminated by such factors.

CONSERVATION MEASURES: The Little River Canyon National Preserve in Alabama contains a population of harperella. Additional plants on lands managed by DeSoto State Park receive protection from adverse modification of habitat. A major road has been constructed close to the Maryland population, but intensive silt and erosion control methods have been used. A study of this population is being conducted by the Maryland Heritage Program, to determine the species' long-term distribution and response to such factors as water depth and quality, substrate, siltation, etc. Heritage programs, especially in West Virginia and South Carolina, have been active in obtaining landowner cooperation and acquiring habitat.

RECOVERY OBJECTIVE: To reclassify Harperella to threatened status, and eventually delist the species.

KRAL'S WATER-PLANTAIN

Sagittaria secundifolia

FAMILY: Alismataceae

STATUS AND SOURCE OF INFORMATION: Threatened, Federal Register, 55 FR 13911, April 13, 1990

DESCRIPTION: An aquatic, perennial herb, Kral's water plantain arises from a stiff, elongated rhizome (root-like plant stem) up to 100 mm (4 in) in length. This plant can float above or below the water. The shape of its leaves depends upon the velocity and depth of its habitat. In swift shallows, the leaves are linear, rigid, and sickle-shaped, 50-80 mm (2-3 in) and 2-5 mm (0.08-0.20 in) wide. In quiet deep waters, the leaves are more quill-like, being longer (100-300 mm (4 to 12 in) ear in shape, and tapering. Separate male and female flowers are produced on a stalk, 100-500 mm (4-20 in) . The petals are inconspicuous in the female flowers; however, in the male flowers, they are white and 10- (0.4 to 0.6 in). The fruit consists of a cluster of achenes approximately 2 mm (0.08 in) in length. Although in nt, flowering occurs from May into July, and intermittently into the fall.

RANGE AND POPULATION LEVEL: Little River Drainage System on Lookout Mountain in Northeast Alabama and Northwest Georgia. Twelve populations of this plant are scattered over approximately 40 river km (25 river mi). Eight of these populations are in pools or rivers with partial canopy coverage, and these all support only 5 to 40 plants. The other four populations, located on shallow shoals, had 75 to several hundred plants each. Kral's Water Plantain is also known from Town Creek in the Sand Mountain area of Northeast Alabama, and Sipsey Fork of the Black Warrior River in Bankhead National Forest, Alabama.

HABITAT: Kral's water plantain typically occurs on frequently exposed shoals or rooted among loose boulders in quiet pools up to 1 m (3.2 ft) in depth. The stream bottoms are typically narrow and bounded by steep slopes.

REASONS FOR CURRENT STATUS AS CITED IN THE FEDERAL REGISTER: A major threat to this species is the elimination or adverse modification of its already limited habitat. Clearing of the adjacent river banks for development, surface mining, or agricultural purposes poses a significant threat for this species by contributing to water quality degradation and increased stream turbidity and siltation from erosion. The Little River population may be adversely affected by eutrophication from garbage dumping and leaking sewage systems. A small number of sites are used as fords and are often a center for recreational activity, subjecting them to damage by off-road vehicle traffic.

CONSERVATION MEASURES: When listed, approximately 40 percent of Kral's water plantain habitat in Little River was owned by the Alabama Power Company, and 20 percent by the Alabama Department of Conservation and Natural Resources (DeSoto State Park). Since listing, the Little River Canyon National Preserve has been established that includes most of this habitat. The remainder is in private ownership within Alabama and Georgia. Alabama's DeSoto State Park personnel are working with the Dekalb County office of the Alabama Department of Health to sample water at various points within the Little River watershed to document any pollution that may exist and, if found, to determine the cause and take corrective action. The waters of the Little River have been designated as Outstanding Natural Resource Waters. The Georgia Department of Natural Resources is aware of this species in Georgia and is monitoring it through the Department's Freshwater Wetlands and Heritage Inventory program. Surveys for additional populations are ongoing in Alabama and Georgia.

RECOVERY OBJECTIVE: To delist Kral's water-plantain.

APPENDIX C

CANDIDATE SPECIES AND SPECIES OF CONCERN

Aquatic species that are candidates for listing under the Endangered Species Act, or that may become eligible for listing in the near future.

CANDIDATE SPECIES

Amphibian	Black Warrior waterdog *Necturus alabamensis*
Mussel	Alabama pearlshell mussel *Margaritifera marrianae*
	Alabama clubshell *Pleurobema troshelianum*
	Georgia pigtoe *Pleurobema hanleyanum*
	Painted clubshell *Pleurobema chattanoogaense*
Snail	Georgia rocksnail *Leptoxis downei*

SPECIES OF CONCERN

Taxa for which information now in the possession of the Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules.

Reptiles
Alligator snapping turtle *Macroclemys temminckii*
Gulf salt marsh snake *Nerodia clarkii*
Mississippi diamondback terrapin *Malaclemys terrapin pileata*

Fish
Alabama channel darter *Percina sp.*
Alabama shad *Alosa alabamae*
Blue sucker *Cycleptus elongatus*
Coldwater darter *Etheostoma ditrema*
Gulf striped bass *Morone saxatilis* (Mobile Basin population is currently maintained by hatchery stocking)
Paddlefish *Polyodon spathula*
Trispot darter *Etheostoma trisella*
Walleye *Stizostedium vitreum*
Warrior bridled darter *Percina sp. spp.*

Mussels
Tennessee heelsplitter *Lasmigona holstonia*

Snails
Black mudalia *Leptoxis melanoides*
Caper elimia *Elimia olivula*
Coosa pebblesnail *Somatogyrus coosaensis*
Domed ancylid *Rhodacmea elatior*
Dwarf pebblesnail *Somatogyrus nanus*
Fluted pebblesnail *Somatogyrus hendersoni*
Gladiator elimia *Elimia hydei*
Granite pebblesnail *Somatogyrus hinkleyi*
Hidden pebblesnail *Somatogyrus decipiens*

Knotty pebblesnail *Somatogyrus constrictus*
Moon pebblesnail *Somatogyrus obtusus*
Pygmy pebblesnail *Somatogyrus pygmaeus*
Puzzle elimia *Elimia varians*
Ringed hornsnail *Pleurocera annulifera*
Rough hornsnail *Pleurocera foremani*
Sculpin snail *Stiobia nana*
Spindle elimia *Elimia capillaris*
Spotted rocksnail *Leptoxis picta*
Stocky pebblesnail *Somatogyrus crassus*
Tallapoosa pebblesnail *Somatogyrus pilsbryanus*
Upland hornsnail *Pleurocera showalteri*
Wicker ancylid *Rhodacmea filosa*
[No Common Name] *Antrorbis breweri*

Insects
Alleghany snaketail dragonfly *Ophiogomphus incurvatus alleghaniensis*
American sandburrowing mayfly *Dolania americana*
Caddisfly *Agarodes alabamensis*
Caddisfly *Hydroptila lagoi*
Caddisfly *Ochrotrichia elongiralla*
Caddisfly *Polycentropus harrisi*
Caddisfly *Stactiobiella cahaba*
Caddisfly *Theliopsyche tallapoosa*
Cahaba saddle-case caddisfly *Protoptila cahabensis*
Cahaba sandfiltering mayfly *Homoeoneuria cahabensis*
Cheaha beloneurian stonefly *Beloneuria jamesae*
Cherokee clubtail dragonfly *Gomphurus consanguis*
Cobblestone tiger beetle *Cicindela marginipennis*
Folkert's hydroporus diving beetle *Hydroporus folkertsi*
Red Hills unique whirligig beetle *Spanglerogyrus albiventris*
Septima's clubtail dragonfly *Gomphurus septima*
Stark's false water penny beetle *Alabameubria starki*

Crayfish
Crayfish *Cambarus englishi*
Crayfish *Cambarus miltus*
Crayfish *Procambarus lagniappe*
Spinytail crayfish *Procambarus fitzpatricki*

Plant
Cahaba lily *Hymenocallis coronaria*

APPENDIX D

EXTIRPATED AND EXTINCT AQUATIC SPECIES

EXTIRPATED

Deertoe mussel *Truncilla truncata*
Lake sturgeon *Acipenser fulvescens*

EXTINCT SPECIES

Taxa endemic to the Mobile River basin that have not been reported for 20 or more years.

Mussels
Alabama pigtoe *Pleurobema johannis*
Coosa elktoe *Alasmidonta maccordi*
Coosa pigtoe *Pleurobema murrayense*
Hazel pigtoe *Pleurobema avellanum*
Highnut *Pleurobema altum*
Longnut *Pleurobema nucleopsis*
Tombigbee moccasinshell *Medionidus macglameriae*
True pigtoe *Pleurobema verum*
Warrior pigtoe *Pleurobema rubellum*
Yellow pigtoe *Pleurobema flavidulum*
[No Common Name] *Pleurobema aldrichianum*
[No Common Name] *Pleurobema hagleri*
[No Common Name] *Pleurobema hartmanianum*

Snails
Agate rocksnail *Leptoxis clipeata*
Bigmouth rocksnail *Leptoxis occultata*
Cahaba pebblesnail *Clappia cahabensis*
Closed elimia *Elimia clausa*
Cobble elimia *Elimia vanuxemiana*
Constricted elimia *Elimia impressa*
Coosa rocksnail *Leptoxis showalteri*
Excised slitshell *Gyrotoma excisa*
Fusiform elimia *Elimia fusiformis*
Hearty elimia *Elimia jonesi*
High-spired elimia *Elimia hartmaniana*
Interrupted rocksnail *Leptoxis foremani*
Lirate rocksnail *Leptoxis lirata*
Maiden rocksnail *Leptoxis formosa*
Oblong rocksnail *Leptoxis compacta*
Pagoda slitshell *Gyrotoma pagoda*
Pupa elimia *Elimia pupaeformis*
Pygmy elimia *Elimia pygmaea*

Pyramid slitshell *Gyrotoma pyramidata*
Ribbed elimia *Elimia laeta*
Ribbed slitshell *Gyrotoma pumila*
Rotund rocksnail *Leptoxis ligata*
Rough-lined elimia *Elimia pilsbryi*
Round slitshell *Gyrotoma walkeri*
Shoal sprite *Amphigyra alabamensis*
Short-spire elimia *Elimia brevis*
Striate slitshell *Gyrotoma lewisi*
Striped rocksnail *Leptoxis vittata*
Umbilicate pebblesnail *Clappia umbilicata*
[No Common Name] *Elimia gibbera*
[No Common Name] *Elimia lachryma*
[No Common Name] *Elimia macglameriana*
[No Common Name] *Leptoxis torrefacta*
[No Common Name] *Neoplanorbis carinatus*
[No Common Name] *Neoplanorbis smithi*
[No Common Name] *Neoplanorbis tantillus*
[No Common Name] *Neoplanorbis umbilicatus*

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APPENDIX F

ONGOING ENVIRONMENTAL AND CONSERVATION PROGRAMS
IN THE MOBILE RIVER BASIN

To improve the effectiveness of this recovery plan, agencies implementing the plan and entities affected by the plan should recognize that several other environmental and conservation programs are underway in the Mobile River basin. To the greatest extent possible, implementation of this recovery plan should be coordinated with and build upon these other ongoing programs. The five programs summarized below were presented to the Mobile River Basin Coalition (Coalition), and are examples of ongoing efforts in Alabama. Other States drained by the Basin are conducting similar efforts to reduce nonpoint source pollution, develop and implement Best Management Practices, and manage water and associated resources.

1) Comprehensive Study of the Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) River Basins, U.S. Army Corps of Engineers (Corps)

Due to an interstate controversy over proposed new water use projects and increasing water demands in the ACT and ACF basins, the Corps and the States of Alabama, Florida, and Georgia agreed to perform a Comprehensive Study of water availability, water demands, and water management issues in the two river basins shared by these states. Because the Comprehensive Study and the Mobile River Basin Aquatic Ecosystem Recovery Plan (Plan) both address water issues in the ACT basin, there is at least a 50% overlap in the geographic coverage of the these initiatives. Also, many of the Federal and State agencies involved in the Comprehensive Study are also involved in the Coalition. Consequently, data and information developed in the Comprehensive Study may be useful in assessing species recovery management alternatives in the Mobile Basin and coordination between the Comprehensive Study and the Plan is essential for the success of both initiatives.

The two main components of the Comprehensive Study are i) a data repository for use in making water management decisions, and ii) demographic projections on population and employment for use in assessing future water demands. The types of information to be included in the data repository consist of water availability data from both surface and groundwater sources. The water demand assessment will identify and describe all consumptive and nonconsumptive water needs for various purposes including: agriculture, riverine and estuarine ecosystems; wetland and riparian habitats; and hydropower, municipalities, industry, navigation, recreation, and waste assimilation.

Source: Presentation by Bob Grasser, Office of Water Resources, Alabama Department of Economic and Community Affairs, at the November 30, 1995 meeting of the MBAERP Coalition

2) Watershed Management Program, Alabama Department of Environmental Management (ADEM)

ADEM is currently involved in a process to reorient its water programs to a watershed management approach. While ADEM will continue implementing its existing regulatory programs under this approach, there will be significant changes in the implementation process. ADEM will continue to fulfill its monitoring, permitting, and inspection responsibilities, but all three of these activities will be carried out within a given watershed in a single year.

ADEM has delineated 14 basin management units (BMUs) in the state, eight of which are within the Mobile Basin. Within each BMU, all point source discharge permits will be scheduled to come up for renewal in the same year. During the same year that discharge permits within a BMU are up for renewal, ADEM will focus its monitoring and inspection activities in that BMU. Each BMU will receive this coordinated and targeted attention every five years and this rotating process is referred to as the basin management cycle.

Although not required by the Environmental Protection Agency (EPA), this approach is consistent with EPA's recent focus on watershed protection and is being implemented in several other states in the southeast. There are several advantages to the watershed approach including: temporal integration of problem identification, assessment, and response; more efficient use of limited agency resources over the long run; and increased public outreach and stakeholder involvement. The major disadvantages of this approach are associated with the transition and the implementation of the basin management cycle. ADEM hopes to complete the transition by 2001.

Source: Presentation by James McIndoe, Chief, Water Quality Branch, Water Division, ADEM, at the January 30, 1996 meeting of the MBAERP Coalition

3) Agricultural Best Management Practices (BMPs) Program, National Resources Conservation Service (NRCS)

The NRCS works with individuals and local organizations to develop farming practices that protect surface waters. Numerous agricultural BMPs have been developed and are being implemented by Alabama farmers. BMPs for managing animal wastes include the use of composting, waste lagoons, storage ponds and structures, constructed wetlands, livestock exclusions and watering facilities, runoff management, and waste utilization. Nutrients can be managed through the use of filter strips, proper timing, utilization, and application of fertilizers, riparian forest buffers, and wetland development and restoration. BMPs for pesticide use include the use of integrated pest management techniques and proper timing, utilization, and application of pesticides. Sediment BMPs include conservation tillage, contour farming, cover crops, crop residue management, crop rotation, diversions, field borders, irrigation water management, stream bank protection, buffer strip crops, and terraces. Farmstead pollutants can be managed by proper onsite sewage disposal, proper petroleum storage and handling, sealing abandoned wells, and water well protection.

Additional information on agricultural BMPs is available from the NRCS. An extensive discussion on the various types of agricultural BMPs is available in a manual entitled "Protecting Water Quality on Alabama's Farms" developed by the Alabama Soil & Water Conservation Committee, the Alabama Department of Environmental Management, the NRCS and the Alabama Cooperative Extension Service.

While the majority of agricultural BMPs are not mandatory, the NRCS is working to encourage voluntary application by farmers wherever appropriate. In cases where the use of agricultural BMPs is required under certain Federal farm programs, there is a 98% compliance rate.

Source: Presentation by John S. Richburg, Assistant Conservationist, NRCS, at the January 30, 1996 meeting of the MBAERP Coalition

4) Silvicultural Best Management Practices (BMPs) Program, Alabama Forestry Commission (AFC)

Although the AFC is not a regulatory agency, it worked with ADEM and the forest products industry in developing silvicultural BMPs. The AFC promotes voluntary use of silvicultural BMPs through education and training efforts. Silvicultural BMPs help reduce several types of nonpoint source pollutants including sediments, organic materials, temperature, trash, pesticides and nutrients.

In streamside management zones (35 foot buffer zones along streams and rivers), harvesting may be limited to conserve at least 50% of the crown cover and prevent migration of pollutants to waterways. Stream crossings can be built in a manner that minimizes water quality impacts. Forest roads can be constructed to avoid migration of pollutants to waterways by proper location and construction techniques. Options for reducing areas of exposed soil in connection with timber harvesting activities include: minimizing temporary road construction, avoiding use of equipment in natural drainage areas, and keeping landing areas small. Site preparation for reforestation can be conducted to minimize pollutant migration by bedding, disking, windrowing, and planting along contour lines.

Proper chemical site preparation and prescribed burning will also reduce water quality impacts. Finally, certain special precautions for access, harvesting, and reforestation may be mandatory in wetland areas.

Additional information on silvicultural BMPs is available from the AFC. A comprehensive discussion on the various types of agricultural BMPs is found in a manual entitled "Alabama's Best Management Practices for Forestry" prepared by the AFC in 1993.

The AFC has conducted surveys of voluntary compliance with the silvicultural BMP guidelines. A recent statistical survey of 400 sites in Alabama found a 92% compliance rate with these guidelines.

Source: Presentation by Tommy H. Patterson, AFC, at the January 30, 1996 meeting of the MBAERP Coalition

5) Mobile Bay National Estuary Program (MBNEP), Environmental Protection Agency (EPA) and MBNEP Management Conference

The National Estuary Program (NEP) was established in section 320 of the Federal Clean Water Act. The NEP focuses on unique types of water bodies called estuaries, which are formed where fresh water drains from the land and mixes with salt water from the sea. The EPA selects estuaries for the NEP based on an application prepared by the local community and signed by the state governor. For selected estuaries, EPA will provide 75% of the funding for a three-year program toward development of a Comprehensive Conservation Management Plan (CCMP). The remaining 25% of funding must come from state and local sources. The NEP is a community-based program that is dependent on financial support from and involvement of all estuary stakeholders. Currently, 28 estuaries around the country are included in the NEP.

To develop a CCMP, a Management Conference consisting of several committees is established to begin a three-year multi-media planning process for the estuary. The Management Conference will identify and prioritize problems in the estuary, link confirmed problems to their causes, consider alternatives for addressing confirmed priority problems, develop recommendations for restoring and maintaining the estuary over the long term, and prepare a CCMP for the estuary. The CCMP is a comprehensive document that summarizes identified problems and recommends conservation measures to address those problems. In effect, it is a blueprint for restoring and maintaining a healthy estuary ecosystem. Although the NEP is not a regulatory program, additional or different regulations may result from implementation of recommendations in the CCMP.

The MBNEP study area currently consists of Mobile Bay and that portion of the Mobile Basin lying within Mobile and Baldwin Counties. Based on available information, several priority problems in the Mobile Bay estuary have been identified. These include: point and nonpoint source discharges, declining fish populations, shoreline erosion, poor land use management, and poor enforcement of environmental regulations.

Source: Presentation by Kathryn H. Matthews, Project Officer for the MBNEP, Coastal Programs Section, Region IV, EPA, and Constance Alexander, Public Outreach & Education Coordinator, Coastal Programs Section, Region IV, EPA, at the January 30, 1996 meeting of the MBAERP Coalition

APPENDIX G

LIST OF RECIPIENTS

Mr. Pat Langan
US Army COE
P.O. Box 2288
Mobile, AL 36628

Ms. Margie Welch
Sierra Club, Alabama Chapter
P.O. Box 852102
Mobile, AL 36685-2102

Mr. Tom Conway
Macmillan Blodel Inc
P.O. Box 235016
Montgomery, AL 36123

Ms. Deborah Jordan
Boise Cascade Corp-Southern Reg.
Communications
10626 Linkwood Court
Baton Rouge, LA 70810

Mr. Clayton Doherty
Oglethorpe Power Corp/
Transmission Projects
P.O. Box 1349
Tucker, GA 30085

Mr. Bill Irby
James River Corp Naheola Mill
HC 66
Box 315
Pennington, AL 36916

Mr. Ray Vaughan
Wilderness Alliance
3320 Wellington Rd
Montgomery, AL 36106

Mr. Jerry Sailors
Coosa-AL River Improvement Assoc.
60 Commerce St, Suite 1201
Montgomery, AL 36104

Dr. Don Hines
University of West Alabama
Station One
Livingston, AL 35470

Mr. John Garrett
Alabama Rural Water Association
7770 Butler Mill Road
Montgomery, AL 36105

Mr. Murray Lloyd
Black Bear Conservation Committee
P.O. Box 52477
Shreveport, LA 71135

Mr. Jim Godwin
AL Dept Conservation
Natural Heritage Program
1500 Fairview Ave.
Montgomery, AL 36106

Mr. David Lazenby
AL River Pulp
P.O. Box 100
Perdue Hill, AL 36470

Mr. Scott Oglesby
CH2M Hill Daniel Bldg Suite 1105
15 So. 20th St
Birmingham, AL 35233

Mr. Patrick Byington
AL Environmental Council
2717 7th Avenue S Suite 207
Birmingham, AL 35233

Mr. Don Waldon
Tennessee-Tombigbee Waterway Dev Authority
P.O. Box 671
Columbus, MS 39703

Mr. J Donaghey
J.B. Donaghey, Inc.
P.O. Box 66647
Mobile, AL 36660

Dr. John Gamble
Dept of Agriculture & Industries
P.O. Box 3336
Montgomery, AL 36130-0336

Mr. Jim Decosmo
Kimberly Clark
P.O. Box 2447
Mobile, AL 36652

Mr. Jon Hornsby
AL Dept Conservation
Game And Fish Division
P.O. Box 456
Montgomery, AL 36130-1456

Mr. John Moore
Boise Cascade Corp
Route One Box 94C
Whatley, AL 36482

Mr. Melvin Dixon
James River Corporation
HC 66
Box 315
Pennington, AL 36916

Mr. William Satterfield
Balch & Bingham Attorneys & Counselors
P.O. Box 306
Birmingham, AL 35201

Dr. Mac Holmes
Troy State University Center For Bus. & Econ. Service
102 Bibb Graves Hall
Troy, AL 36082

Mr. Daniel Autrey
Union Camp
100 Jensen Road
Prattville, AL 36067

Mr. Hal Newman
Boise Cascade Corp
10626 Linkwood Court
Baton Rouge, AL 70810

Mr. Douglas Shelton
Barry A. Vittor & Assoc
2283 Crystal Key
Mobile, AL 36695

Mr. Walter Dennis
International Paper
South Caroline Region
P.O. Box 999
Natchez, MS 39120

Mr. Art Goddard
US Forest Service
2946 Chestnut St
Montgomery, AL 36107

Mr. David Miller
Alabama Power Company
600 N 18th St.
Birmingham, AL 35291

Mr. David Long
Alabama River Companies
P.O. Box 99
Perdue Hill, AL 36470

Mr. Bob Wilson
Kimberly Clark
89 Highway 333
Columbiana, AL 38057

Mr. Don Blancher
Alabama Chemical
1717 Old Shell Rd.
Mobile, AL 36604

Mr. Mark Fowler
Alabama Chemical Assoc.
2 N. Jackson St.
Montgomery, AL 36104

Mr. Robert Reid, Jr.
1400 Park Place Tower
Birmingham, AL 35203

Mr. Duncan Powell
US Environmental Protection Agency
395 Courtland St Ne 1400
Atlanta, GA 30365

Honorable. Richard Laird
Alabama House of Representatives
531 Bonner Dr.
Roanoke, AL 36274

Mr. Ed Varner
US Army COE
BWT/AL Coosa Project Office
101 21st Avenue
Tuscaloosa, AL 35401

Mr. W. Phillips
Malcolm Pirnei Inc.
2100 First Ave N Suite 600
Birmingham, AL 35203

Mr. Roy Kendrick
Al Soil & Water Conserv. Comm.
P.O. Box 304800
Montgomery, AL 36130-4800

Mr. Jerry McDonald
Kimberly Clark (PPRC)
370 Old Trammell Circle
Sylcauga, AL 35150

Mr. Ray Albright
USDA Forest Service
2946 Chestnut St
Montgomery, AL 36107

Ms. April Hargis
USDA Forest Service
294 Chestnut St
Montgomery, AL 36107

Mr. E. Byars
Electric System Operations
Alabama Power Company
P.O. Box 2641
Birmingham, AL 35291

Mr. Jimmy Huntley
US Forest Service
2946 Chestnut St
Montgomery, AL 36107

Mr. Randall Haddock
Cahaba River Society
2717 7th Ave S Suite 205
Birmingham, AL 35233

Mr. Nicholas Barchie
Seaport Shipping of Alabama
P.O. Box 2127
Mobile, AL 36652

Mr. Tom Carruthers
Porter, White and Company
P.O. Box 12367
Birmingham, AL 35202-2367

Mr. Steve Guy
ALFA Farmers Federation
P.O. Box 11000
Montgomery, AL 36191

Mr. Gene Hanson
Birmingham Water Works
P.O. Box C110
Birmingham, AL 35215

Mr. Leroy Nicholson
Kimberly Clark (PPRC)
150 Jones Drive
Sylacauga, AL 35150

Mr. Steve Duym
Zeneca Ag Products
P.O. Box 32
Bucks, AL 36512

Mr. Randy Abston
James River Corp
Naheola Mill
HC66 Box 315
Pennington, AL 36916

Mr. Gary Brocious
Union Camp Corp.
200 Jensen Rd.
Prattville, AL 36067

Ms. Constance Alexander
US EPA/ Coastal Program Planning
345 Courtland St NE
Atlanta, GA 30365

Mr. James McIndoe
AL Dept of Environmental Management
P.O. Box 1463
Montgomery, AL 36130-1463

Mr. Bill Moody
Stewards of Family Farms
P.O. Box 70482
Montgomery, AL 36107

Mr. Matt Bowden
Balch & Bingham
P.O. Box 306
Birmingham, AL 35201

Mr. Billy Powell
Alabama Cattlemen's Assn.
P.O. Box 2499
Montgomery, AL 36102

Ms. Martha Moore
Union Camp Corp.
100 Jensen Rd
Prattville, AL 36067

Ms. Diane Findley
US Army COE
Attn: PD-E1
P.O. Box 2288
Mobile, AL 36628-0001

Mr. Rick Oates
Alabama Forestry Assn/AL Pulp &
Paper Council
555 Alabama St.
Montgomery, AL 36104

Mr. Chester McConnell
Wildlife Management Inst.
110 Wildwoods Ln.
Lawrenceburg, TN 38464

Mr. Michael Smith
Rheem Manufacturing Co.
2600 Gunter Park Drive E
Montgomery, AL 36109

Ms. Kathryn Matthews
US Environmental Protection Agency
Coastal Program Planning
345 Courtland St NE
Atlanta, GA 30365

Mr. Bruce Shupp
Bass Inc.
5845 Carmichael Rd.
Montgomery, AL 36117

Mr. Tom Kelly
P.O. Box 7050
Spanish Fort, AL 36577-7050

Mr. Brian Peck
US Army COE
P.O. Box 2288
Mobile, AL 36628

Mr. Sheldon Morgan
Warrior-Tombigbee Development Assn.
P.O. Box 2863
Mobile, AL 36652

Mr. Allen Owen
Mead Corporation
1000 Broad Street
Phenix City, AL 36867

Dr. Charles Lydeard**
University of Alabama
Dept. of Biological Sciences
P.O. Box 870344
Tuscaloosa, AL 35487

Mr. Tim Gothard
Alabama Forestry Commission
P.O. Box 302550
Montgomery, AL 36130

Mr. Andrew Fischer
Rheem Manufacturing Co.
2600 Gunter Park Drive E
Montgomery, AL 36109

Dr. George Crozier
Dauphin Island Sea Lab
P.O. Box 369-70
Dauphin Island, AL 36528

Mr. Herbert Hoff
Alabama Bass Federation
2384 County Rd 59
Prattville, AL 36067

Mr. John Grogan
Alabama Power Company
P.O. Box 2691
Birmingham, AL 35291-0830

Mr. Roger Gerth
US Army COE
Attn: OP-TN
P.O. Box 2288
Mobile, AL 36628

Mr. Bob Swint
Mead Coated Board
P.O. Box 940
Phenix City, AL 36868

Mr. Maurice James
US Army Corps of Engineers
Attn: EN-HD
P.O. Box 2288
Mobile, AL 36628-0001

Mr. Brad McLane
Alabama State Rivers Alliance
2717 7th Ave S Suite 202
Birmingham, AL 35233

Mr. Randy McRay
International Paper
2835 Zelda Rd.
Montgomery, AL 36106

Ms. Riley Sikes
Business Council of Alabama
P.O. Box 76
Montgomery, AL 36101

Mr. Dick Werling
2 Walnut Rd.
Sylacauga, AL 35150

Mr. William Lott
AL Dept Environmental Management
1751 Dickinson Dr.
Montgomery, AL 36130

Mr. Fred Harders
AL Dept of Conservation
Game and Fish Division
64 N. Union Street
Montgomery, AL 36130

Ms. Beth Young
Cahaba River Publishing Inc.
700 28th St S Suite 204
Birmingham, AL 35232

Mr. Forrest Bridges
Alabama Forestry Assn.
555 Alabama St.
Montgomery, AL 36104

Mr. Steve Jones
Alabama Power Company
P.O. Box 2641
Birmingham, AL 35291

Ms. Danielle Dunbar
Alabama Environmental Council
2717 7th Ave S Suite 207
Birmingham, AL 35233

Mr. Bruce Schwenneker
Birmingham Water Works
Malcolm Pirnie
2100 First Ave North Suite 600
Birmingham, AL 35203

Mr. Carl Couret
USFWS
P.O. Box 1190
Daphne, AL 36525

Ms. Treena Piznar
AL Chemical Association
P.O. Box 99
Axis, AL 36505

Mr. Jerrel Smalley
AL Water Resources Commission
1020 Fry Gap Rd.
Arab, AL 35016

Mr. David Roberson
Environmental Guidance Corp.
P.O. Box 2386
Montgomery, AL 36102

Mr. Joe Addison
Alabama Dept of Conservation
Game and Fish Division
64 N. Union Street
Montgomery, AL 36130

Mr. Marvin Glass
Mcmillan Blodel Packaging Inc.
P.O. Box 336
Pine Hill, AL 36769

Mr. John Richburg
Natural Resources Conservation Service
P.O. Box 905
Grove Hill, AL 36451

Mr. Jess Weaver
US Geological Survey
Water Resources Division
2350 Fairlane Drive, Suite 120
Montgomery, AL 36116

Mr. Glenn Waddell
Balch & Bingham
P.O. Box 306
Birmingham, AL 35201

Mr. Robert Meintzer
Geological Survey of Alabama
P.O. Box 0
Tuscaloosa, AL 35486

Mr. Roy Mcauley
Union Camp Corp.
100 Jenson Rd.
Prattville, AL 36067

Mr. Ben Bowden
Westover Plantation
71 Bowden Rd
Eufaula, AL 36027

Mr. Tommy Patterson
Alabama Forestry Commission
P.O. Box 302550
Montgomery, AL 36130-2550

Mr. Bruce Windham
Drummond Company Inc.
P.O. Box 1549
Jasper, AL 35501

Mr. Larry Goldman
US Fish & Wildlife Service
P.O. Drawer 1190
Daphne, AL 36526

Dr. Wayne Curtis
211 Monticello Drive
Troy, AL 36081

Mr. Tom Counts
USDA-NRCS
P.O. Box 311
Auburn, AL 36830

Mr. Walter Cartwright
State Programs Division
649 Monroe Street
Montgomery, AL 36104

Mr. John Grant
Thompson Power System
P.O. Box 2083
Mobile, AL 36652

Mr. Douglas Baumgartuer
Choctaw Nat'l Refuge
US Fish & Wildlife Service
P.O. Box 808
Jackson, AL 36545

Ms. Gena Todia
US Corp of Engineers (OP-TR)
P.O. Box 2288
Mobile, Al 36628

Mr. Richard Hanan
Loeb & Hanan
P.O. Drawer 23117
Montgomery, AL 36117

Honorable. Stephen McMillan
Alabama House of Representatives
P.O. Box 337
Bay Minette, AL 36507

Mr. Willard Bowers
Alabama Power Company
P.O. Box 2641
Birmingham, AL 35291

Ms. Jan Johnson
AL National Heritage Program
1500 E. Fairview Ave.
Massey Hall-Huntingdon College
Montgomery, AL 36106

Mr. William Davenport
Russell Lands
2544 Willow Point Rd.
Alexander City, AL 35010

Mr. Robert Lawyer
Monsanto Chemical Corporation
P.O. Box 2204
Decatur, AL 35609

Dr. John Regnier
High Point, Inc.
1541 Pine Ridge Rd.
Montgomery, AL 36109

Mr. Steve Cauthen
Soil & Water Conservation
P.O. Box 304800
Montgomery, AL 36104-4800

Mr. Charlie Waldrep
Gorham & Waldrep, P.C.
2101 6th Avenue North, Suite 700
Birmingham, AL 35203

Mr. Randy Dempsey
Dempsey, Carson & Steed, P.C.
1122 22nd Street North
Birmingham, AL 35234-2725

Honorable Allen Layson
Alabama House of Representatives
P.O. Box 910
Reform, AL 35481

Dr. Elise Irwin
Fish & Wildlife Coop Research
Auburn University
119 Swingle Hall
Auburn University, AL 36830

Mr. Chris Oberholster
The Nature Conservancy
2821-C 2nd Avenue, S.
Birmingham, AL 35233

Mr. John Carey
Alabama State Docks
P.O. Box 1588
Mobile, AL 36633

Mr. Lincoln Walther
Continental Shelf Assn.
759 Parkway Street
Jupiter, FL 33477

Mr. Art Fowler
Alabama Sierra Club
P.O. Box 395
Double Springs, AL 35553

Mr. J. Hall
Malcolm Pirnie, Inc.
2100 First Ave. N., Suite 600
Birmingham, AL 36106

Dr. Susan Rees
Mobile Bay National Estuary Program
440 Fairhope Avenue
Fairhope, AL 36532

Mr. Walter Stevenson
ADECA, Office of Water Resources
401 Adams Avenue
Montgomery, AL 36103

Dr. Doug Phillips
University of Alabama
P.O. Box 870340
Tuscaloosa, AL 35487

Marian Renneker
Alabama Rivers Alliance
700 28th St. South
Birmingham, AL 35233

Kirsten Gerhart
Alabama Environmental Council
2717 7th Ave. South
Birmingham, AL 35233

Ms. Nancy Thomason
Malcolm Pirnie, Inc.
2100 1st Ave. N., Suite 600
Birmingham, AL 35203

Wetlands Resources
11100 Lawrence Road Extension
Fairhope, AL 36532

Ms. Jarel Hilton
Alabama Natural Heritage Program
1500 E. Fairview Avenue
Montgomery, AL 36106-1455

Mr. Howard Clonts
Auburn University
Environmental Institute
101 Comer Hall
Auburn University, AL 36849

Doug Fruge
Gulf Coast Fisheries/
Resource Coord. Office
USFWS
P.O. Box 825
Ocean Springs, MS 39566-0825

Division of Endangered Species
(Mail Stop 452 ARLSQ)
U.S. Fish and Wildlife Service
Washington, D.C. 20240

Project Manager (7507C)
Endangered Species Protection Program
Office of Pesticide Programs
401 M. Street, SW
Washington, D.C. 20460

Division of Refuges
(Mail Stop 670 ARLSQ)
U.S. Fish and Wildlife Service
Washington, D.C. 20240

Office of Public Affairs
(PA, 3240 MIB)
U.S. Fish and Wildlife Service
Washington, D.C. 20240

Mr. Mark Bosch
U.S. Forest Service
1720 Peachtree St.
Atlanta, GA 30367

Al Sherk
U.S.G.S./Biological Resources Division
12201 Sunrise Valley Drive
Mail Stop 301
Reston, VA 20192

Dr. David Zippin, Scientific Rev. Committee
UT Austin Chapter, Society for Conservation Biology
The Department of Botany
The University of Texas at Austin
Austin, TX 78713-7640

Division of Fish Hatcheries
(FH, Mail Stop 820 ARLSQ)
U.S. Fish and Wildlife Service
Washington, D.C. 20240

Asheville Field Office
U.S. Fish & Wildlife Service
160 Zillicoa Street
Asheville, NC 28801

Malcolm Pierson
Alabama Power Co.
P.O. Box 2641
Birmingham, AL 35291

John Jenkinson
TVA-Division of Air & Water Resources
Knoxville, TN 37902

Alabama Wildlife Federation
P.O. Box 2102
Montgomery, AL 36102

Dr. Art Bogan**
NC Museum of Natural Science
P.O. Box 29555
Raleigh, NC 27626

Bob Mount
Dept. of Zool. & Wildlife Science
Auburn University, AL 36849-5414

Lamar Alexander
P.O. Box 117
Moulton, AL 35650

Jim Williams
US Geological Survey
7920 NW 71st St.
Gainesville, FL 32606

Mitzi Cole
Chattahoochee National Forest
1755 Cleveland Hwy
Gainesville, GA 30501

Jim Herrig
Cherokee National Forest
P.O. Box 2010
Cleveland, TN 37320

Andrea Overstreet
Ogden Environmental & Energy
6510 Morehouse Drive
San Diego, CA 92121

Jennifer Crawford
Weinberg Group
1220 19th St, NW Suite 300
Washington, DC 20036

Tina Monical
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Margaret McMillan
Environmental Defense Fund
Suite 1016
1875 Connecticut Ave., N.W.
Washington, DC 20009

Shirley Brant
215 North Temple Drive
Diboll, TX 75941

H. Paul Friesema
Institute for Policy Research
Northwestern University
2040 Sheridan Road
Evanston, IL 60208-4100

Bill Peters, Director
Dept. Of Environmental Protection
Room 644, Courthouse
Birmingham, AL 35263

Ben Wigley
NCASI
P.O. Box 340362
Clemson, SC 29634-0362

Hugh E. (Trey) Wilson III
Boise Cascade
307 West Industrial Road
Jackson, AL 36545

Rachel Thomas
Box 4637
Huachuca City, AZ 85616

Gerald George, Esq.
Campbel & George, LLP
590 Ygnacio Valley Road, Suite 201
Walnut Creek, CA 94596-3889

Klienschmidt Associates
ATTN: Paul Cyr
101 Trade Zone Drive, Suite 21A
West Columbia, SC 29170

Alan Clemons
Huntsville Times
2317 South Memorial Parkway
Huntsville, AL 35801

Dr. Walter Stevenson, Jr.
ADECA, Office of Water Resources
401 Adkins Avenue
Montgomery, AL 36103

Steven A. Burns
VanNess Attorneys at Law
1050 Thomas Jefferson Street, NW
Washington, D.C. 20007-3877

Fred Jackson
TetraTech, Inc.
5203 Leesburg Pike, Suite 907
Falls Church, VA 22041

Joseph Kafkey
Geo-Marine, Inc.
550 East 15 Street
Plano, TX 75074

Bill Goodran
Temple Inland Forest Products Corp.
215 North Temple Dr.
Dibald TX 75941

Bill Kelce
Alabama Coal Association
2090 Columbiana Rd, Suite 2500
Birmingham, AL 35216

Ron Smith
Directorate of Environment, Game Management
Building 698, 2nd Avenue
Ft. McClellan, AL 36205

Chris Nagano
U.S. Fish and Wildlife Service
2105 Osuna Road, NE
Albuquerque, NM 87113

Antonio Bentivoglio
USFWS Oregon State Office
2600 SE 98th Ave., Suite 100
Portland, OR 97266

Joel Okula
Tombigbee National Forest
Hwy 15 S., Rural Route 1, Box 98A
Ackerman, MS 39735

Sam Hodges
c/o Newhouse News Service
1101 Connecticutt Ave., NW
Suite 300
Washington, DC 20036

Jon Ponstein
Birmingham Water Works Board
P.O. Box 830110
Birmingham, AL 35283-0110

Jamie Clark
ADECA-Office of Water Resources
401 Adams Avenue
Montgomery, AL 3610

Mike Zupko
Georgia Forestry Association
505 Pinnacle Court
Norcross, GA 30071

Beth Fraser
2887 Alabama Highway
Rome, GA 30165

Dr. Fred Thompson
Florida Museum of Natural History
Gainesville, FL 32611

Bill Dryden
Boise-Cascade Corp.
P.O. Box 50
Boise, ID 83707

Dr. Richard Neves**
Dept. of Fish and Wildlife
Virginia Polytechnic Institute
Blacksburg, VA 24061

Dr. George Folkerts**
Dept. of Zoology and Wildlife Science
Auburn University
Auburn, AL 36849-5414

Dr. David Stansbery
Museum of Zoology
The Ohio State University
Columbus, OH 43210

Melvin Warren, Jr.
Forest Hydrology Laboratory
P.O. Box 947
Oxford, MS 38655

District Engineer
US Army Corp of Engineers
P.O. Box 2288
Mobile, AL 36628

Robert Hatcher
Tennessee Wildlife Res. Agency
P.O. Box 40747
Ellington Agricultural Center
Nashville, TN 37204

Gary Myers
Executive Director, Wildlife Resources Agency
P.O. Box 40747
Nashville, TN 37204

Mr. Ned Mudd, Jr.
P.O. Box 130411
Birmingham, AL 35213

Natural Resources Conservation Service
100 West Capitol St.
Jackson, MS 39269

Ken Tenneson
Tennessee Valley Authority
Office Service Annex 1B
Muscle Shoals, AL 35660

Leigh Ann McDougall
U.S. Forest Service
110 Southpark Dr.
Blacksburg, VA 24060

Mr. Riley Boykin Smith
Dept. of Conservation and Natural Resources
64 N. Union St.
Montgomery, AL 36130

Tennessee Department of Environment and Conservation
401 Church St., L & C Tower Annex
Nashville, TN 37243

Regional Forester
U.S. Forest Service
1720 Peachtree Rd., NW
Suite 800
Atlanta, GA 30367

Mr. Joe Turner, Commissioner
Georgia Department of Natural Resources
205 Butler St., Floyd Towers East
Atlanta, GA 30334

Birmingham Chamber of Commerce
Attn: Envir. Economics Committee
P.O. Box 10127
Birmingham, AL 35202

Chuck Coomer
Georgia Dept. of Natural Resources
Game and Fish Division
2070 U.S. Hwy. 278, SE
Social Circle, GA 30279

Dr. Sam Polles
MS Dept. of Wildlife, Fisheries, & Parks
P.O. Box 451
Jackson, MS 39205

Randy Haddock
Cahaba River Society
2717 7th Avenue South, Suite 207
Birmingham, AL 35233

Mrs. Myrt Jones
The Mobile Bay Audubon Society
Box 9903
Mobile, AL 36691-9903

** PEER REVIEWERS

APPENDIX H

SUMMARY OF COMMENTS RECEIVED ON THE
1998 DRAFT MOBILE RIVER BASIN AQUATIC ECOSYSTEM RECOVERY PLAN

National Council of the Paper Industry for Air and Stream Improvement:
Comment: "In general, we found the draft plan to be quite positive with a strong emphasis on an approach (voluntary collaboration) that likely will be successful. We have identified several opportunities to further improve the draft plan..."

A. It is not reasonable to recommend alternatives to chlorine treatment of wastewater (Task 1.52) without documentation that chlorine actually causes detrimental long-term effects on aquatic organisms.

   Service Response: The toxicity of chlorine and other wastewater derivatives are well-documented, however, long-term chronic effects of diluted discharges are poorly understood. The Recovery Plan recommends *consideration* of available alternatives in sensitive watersheds.

B. It is most appropriate for silvicultural operations to use Streamside Management Zone (SMZ) recommendations from State Forestry Best Management Practices (BMPs) rather than recommendations by the Natural Resource Conservation Service (NRCS) (Task 3.2).

   Service Response: We agree. Task 3.2 promotes the value of SMZs to buffer the impacts of all land use activities. It is noted that there are multiple source recommendations for SMZs to address specific land uses, however. NRCS recommendations were highlighted because of the wide range in buffer width, and the influence of soil, slope, and topography in determining width and restrictions.

C. Without documentation it is inappropriate to contend that recent gains in implementing pollution control measures may have been negated by increases in the number of discharges (p. 14, POLLUTION).

   Service Response: The referenced statement is confined to some stream/river segments. In the paragraph following the referenced statement, a study on the Cahaba River is cited (Shepard *et al.* 1996) that documented the cumulative impacts of stormwater runoff and wastewater plant discharges on imperiled species in the Cahaba River. This study also noted that at low discharges, the flow in the River for a distance below Birmingham, Alabama, consists almost entirely of treated effluents.

D. The document should increase emphasis on factors unrelated to habitat, such as host fish for mussels and introduced species.

Service Response: The primary factors in the decline of aquatic species in the Basin, and the primary threats to their continued existence, have been habitat modification, loss, and fragmentation. Furthermore, potential effects of factors such as host fish losses or competition from introduced species are often due to, or magnified by, habitat changes, habitat fragmentation, or habitat isolation.

E. Watershed management should consider ongoing cooperative efforts such as the *Alabama Demonstration Watershed Project.*

Service Response: The Plan's Appendix F promotes coordinating efforts and gives examples of ongoing environmental and conservation programs. The Plan supports cooperative stewardship efforts such as the *Alabama Demonstration Watershed Project.*

F. Recovery efforts should focus on rewarding landowners who have maintained habitat integrity and on improving habitat integrity where it is degraded.

Service Response: There are no current programs to reward landowners for maintaining habitat integrity. However, even if such programs are developed, given the scope of effort needed to recover the Basin, we will have to rely primarily on voluntary actions. Therefore, the Plan promotes voluntary watershed stewardship by landowners and communities, not just in pristine watersheds, but also in degraded watersheds to maintain and/or improve aquatic habitat quality.

Robert Reid, Jr., on behalf of the Alabama Audubon Council, Alabama Environmental Council, Cahaba River Society, and Alabama Ornithological Society:
Comment: "We believe (the Recovery Plan) is a step forward in consolidating and making more efficient the handling of recovery plans for listed species under the Endangered Species Act and will provide a pattern for future watersheds. (We would) appreciate consideration of the following:"

1) Future listed aquatic species should be incorporated into this Plan.

Service Response: Since the draft Recovery Plan was released in 1998, an additional seven aquatic species, six snails and the Alabama sturgeon, have received protection under the Act. The Act and implementing regulations provide a process to develop recovery plans for listed species, which includes public review and comment. In the near future, we will develop an addendum to the Mobile River Basin Aquatic Ecosystem Recovery Plan, which will include specific recovery criteria for the six snails, and make it available for public review and comment. An additional recovery plan will be developed

specifically for the Alabama sturgeon. In the interim, these seven species are directly benefitted by the actions implemented through the Mobile River Basin Aquatic Ecosystem Recovery Plan and are included in this final plan.

2) Recently used common names should be used for Locks and Dams.

Service Response: Current officially recognized names are used in the Recovery Plan map and Table 6.

3) Recovery task 3.2 should give more examples of Streamside Management Zone (SMZ) width recommendations.

Service Response: There are numerous SMZ width recommendations within the four States covered by the recovery plan. SMZ widths vary with land use activity, soil, topography, and landowner management objectives. The permutations resulting from these factors are more numerous than can be reasonably enumerated. Therefore, the Recovery Plan highlights NRCS recommendations as an example because of the wide range in buffer width, and refers landowners to industrial, State, and other BMP recommendation sources. The narrative for this recovery task has been slightly modified to reflect this.

4) Walleye in the Basin should be referred to as Southern walleye, since there is evidence that it is a unique genetic strain.

Service Response: This has been incorporated into the final recovery plan.

Chester McConnell, Wildlife Management Institute, Lawrenceburg, Tennessee:
Comment: "I find the plan to be exceptionally well done. It clearly and simply spells out ...the status of the threatened and endangered species and what actions are necessary to recover and manage the current populations. The Wildlife Management Institute...strongly supports the draft plan."

U.S. Army Corps of Engineers, Mobile District, Mobile, Alabama
Comment: Language in recovery tasks 1.1 and 2.1 could be interpreted to require mitigation in navigable rivers should they meet certain criteria. Language should be modified to exempt existing authorized navigable rivers and harbors from this recommendation.

Service Response: Recovery plans are advisory documents and do not obligate individuals or agencies to undertake any specific task. Identification of tasks within a recovery plan does not impose any additional legal responsibilities to an agency beyond existing authorities. In this instance, the Plan discusses mitigation as opportunities to avoid, reduce, or compensate

for adverse impacts. This could be for future projects, or for past projects where feasible. A good example of mitigation in a navigable river is the 1998 cooperative effort by the Mobile District, Fish and Wildlife Service, and Alabama Department of Conservation and Natural Resources to avoid and minimize (mitigate) potential impacts from their navigation maintenance dredging program in the Alabama River. In consideration of the advisory nature of recovery plans, and ongoing mitigation measures, there is no reason to exclude any specific or general areas from this recommendation.

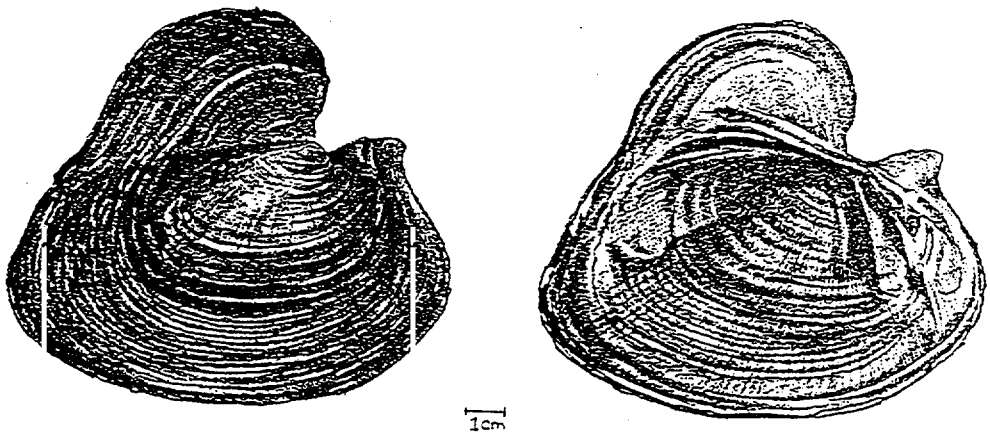
U.S.D.A. Forest Service, Southern Region, Atlanta, GA
Comment: "The revised Plan is well written, and we concur with the recovery objectives and tasks. We especially like the Plan's emphasis on community involvement in watershed management and restoration."

U.S.D.A. Natural Resources Conservation Service, Jackson, MS
Comment: "The Plan was very professional and contained a wealth of information. Our awareness of the conditions of the ecosystem has been expanded as a result of having seen the plan. We will keep the document for reference as we continue to improve our conservation efforts."

PART V

PLATES

Endangered and Threatened Mollusks of the Mobile River Basin
Mussels and the Tulotoma Snail



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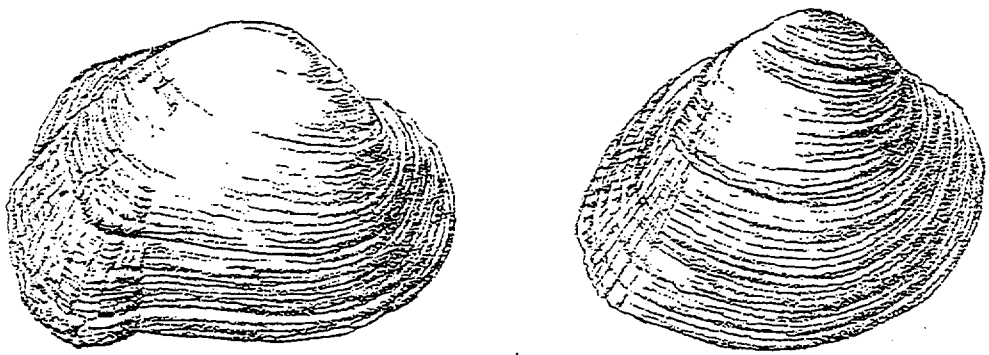

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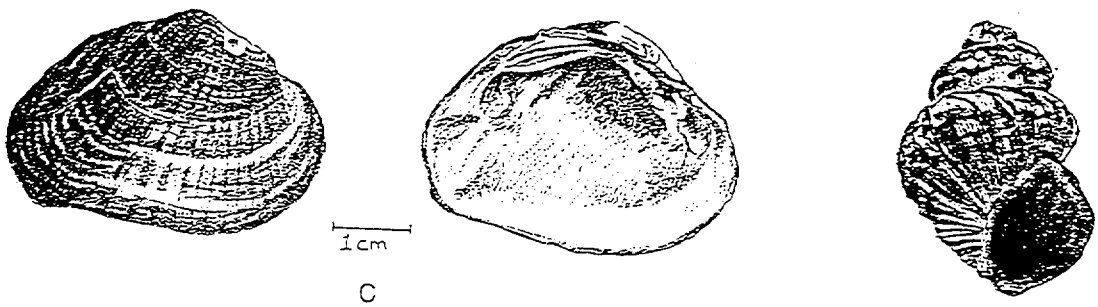
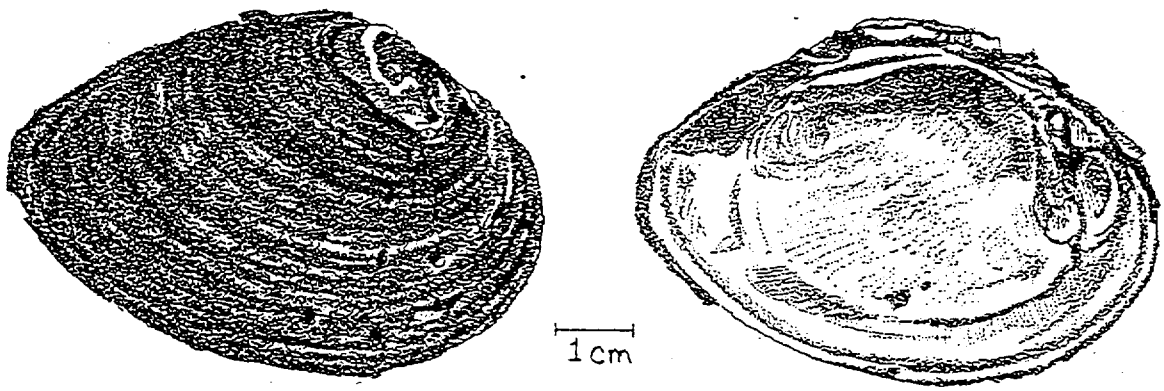


c

PLATE 1

d

a. Inflated heelsplitter, *Potamilus inflatus*
b. Upland combshell, *Epioblasma metastriata*
c. Southern combshell, *Epioblasma penita*
d. Tulotoma snail, *Tulotoma magnifica*



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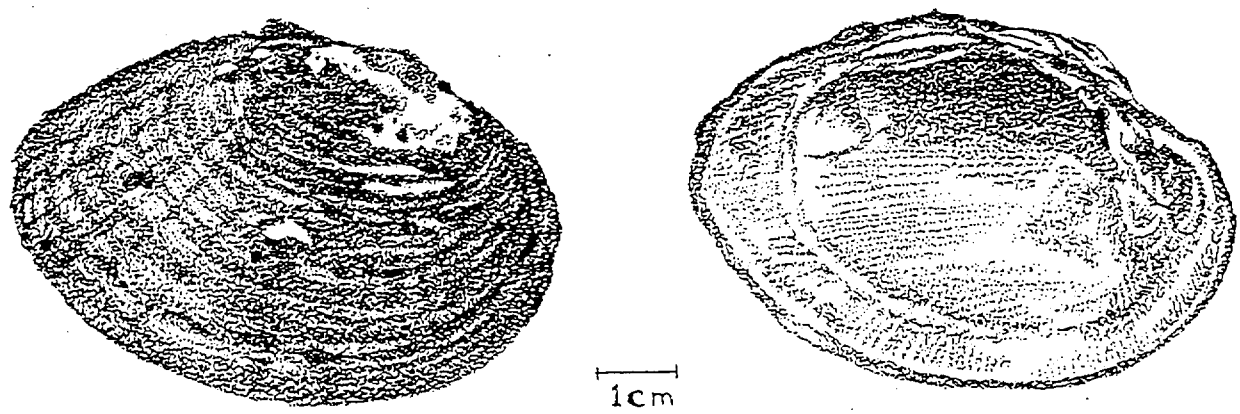
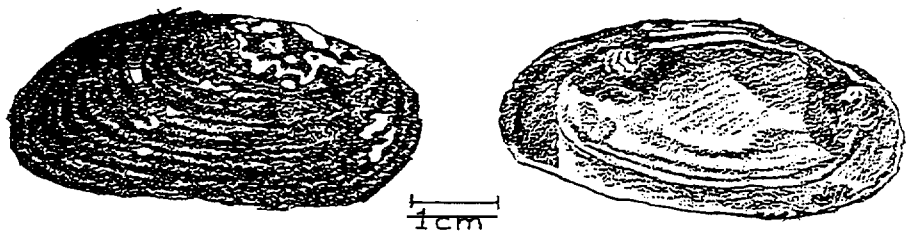


b

PLATE 2

a. Fine-lined pocketbook, *Lampsilis altilis*
b. Orange-nacre mucket, *Lampsilis perovalis*



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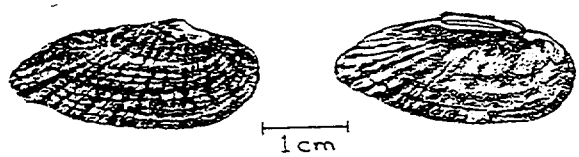

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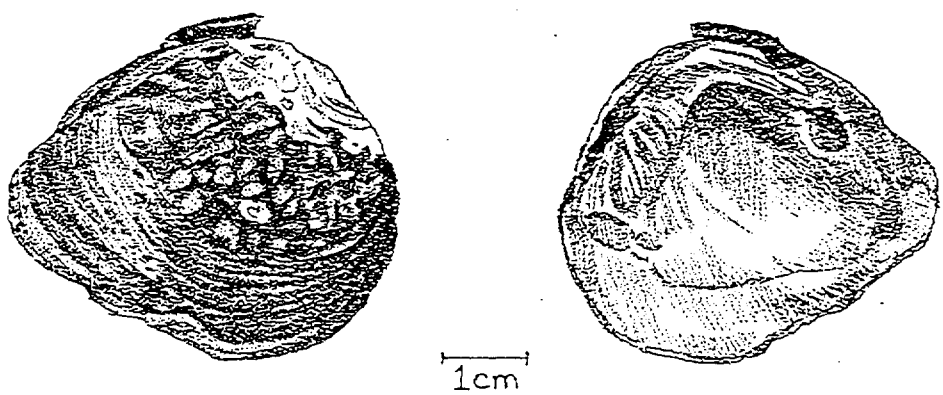
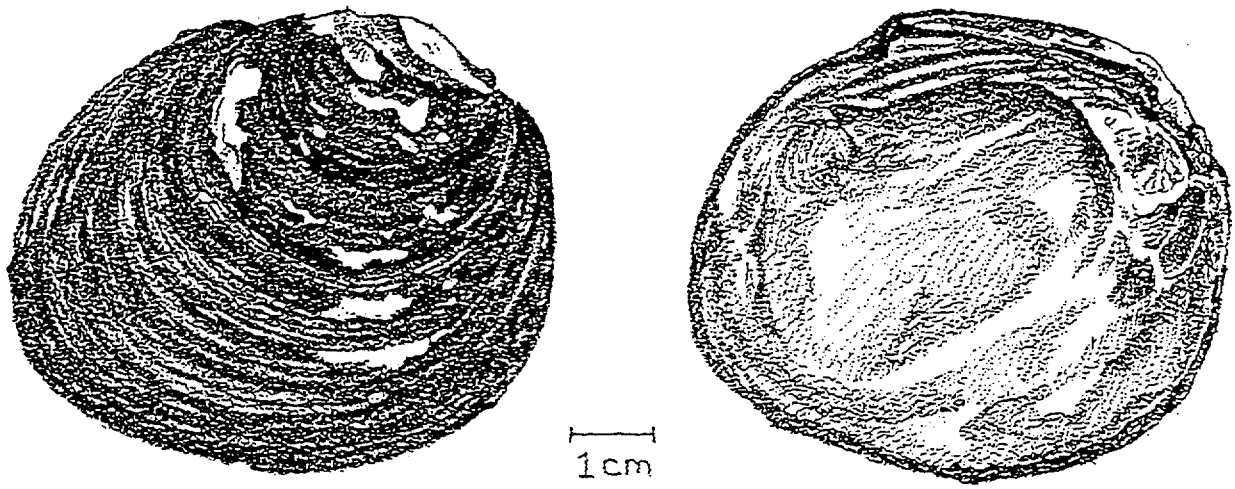


c

PLATE 3

a. Coosa moccasinshell, *Medionidus parvulus*
b. Alabama moccasinshell, *Medionidus acutissimus*
c. Stirrupshell, *Quadrula stapes*



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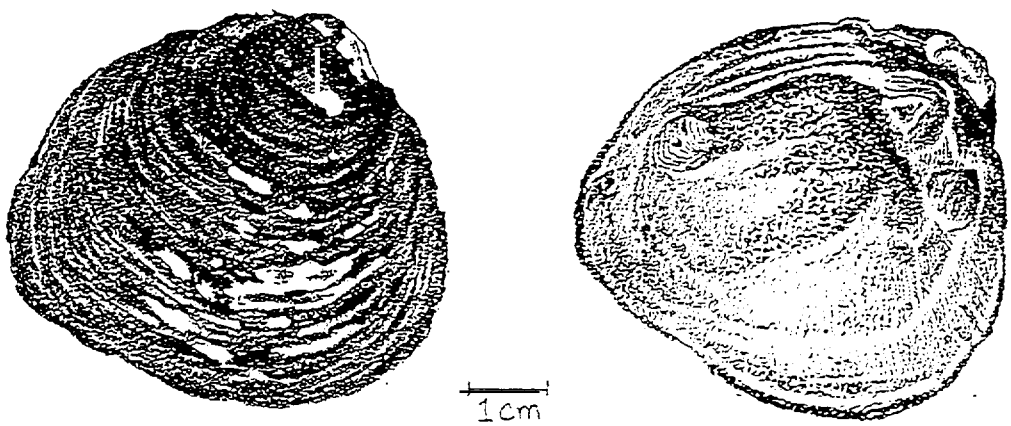
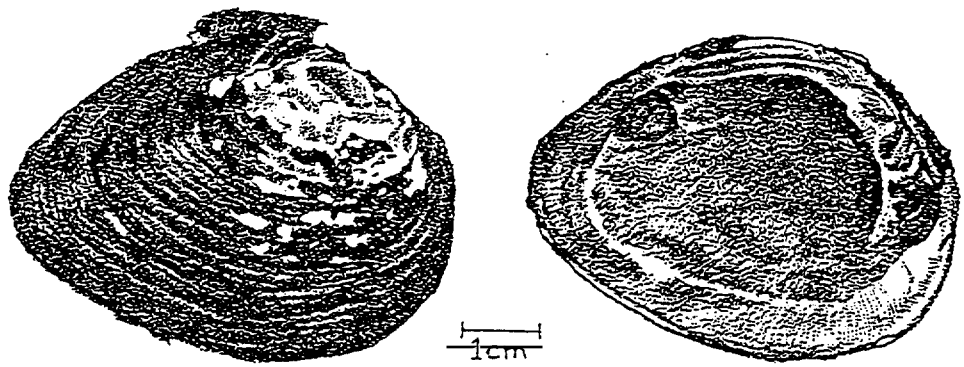


b

PLATE 4

a. Flat pigtoe, *Pleurobema marshalli*
b. Heavy pigtoe, *Pleurobema taitianum*



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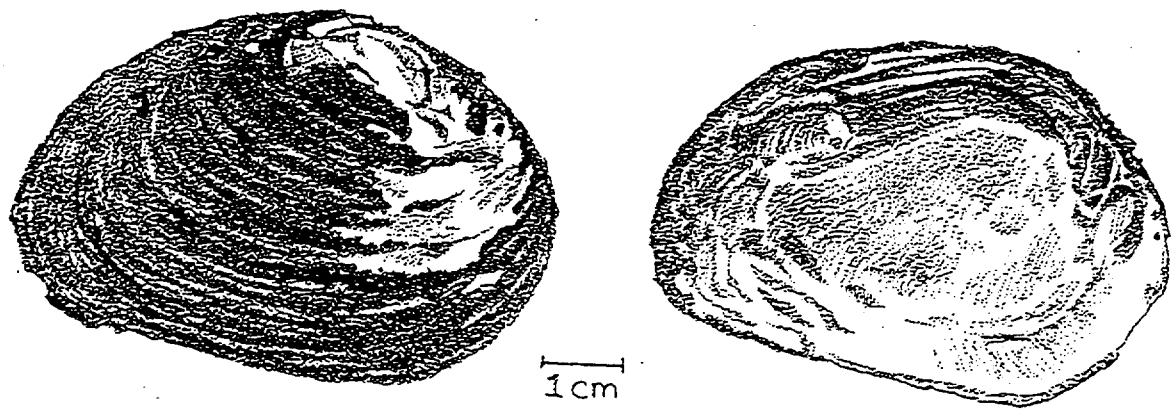

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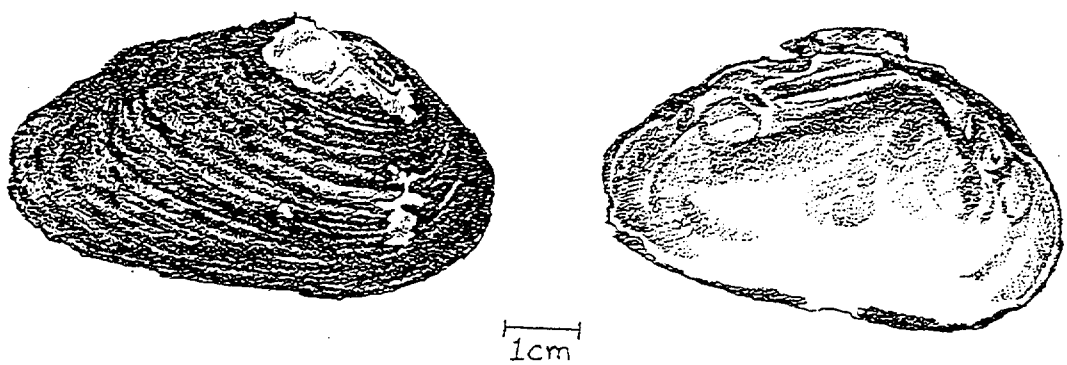
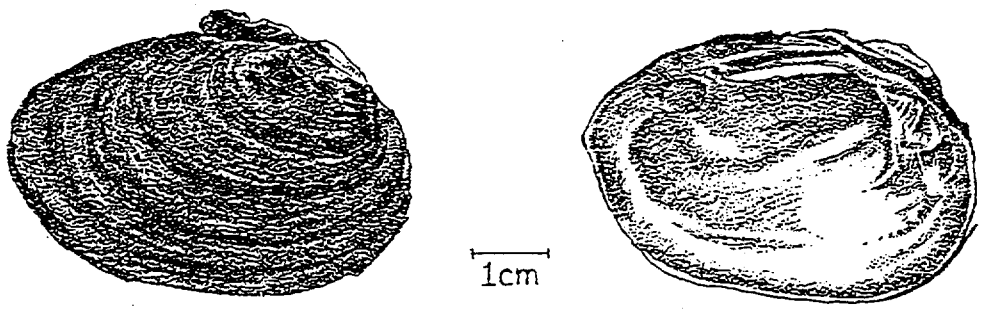


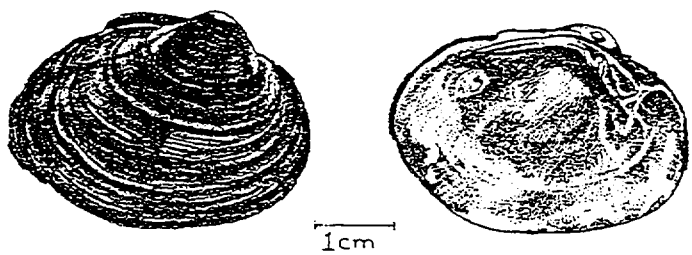
c

PLATE 5

a. Dark pigtoe, *Pleurobema furvum*
b. Southern pigtoe, *Pleurobema georgianum*
c. Triangular kidneyshell, *Ptychobranchus greeni*



a



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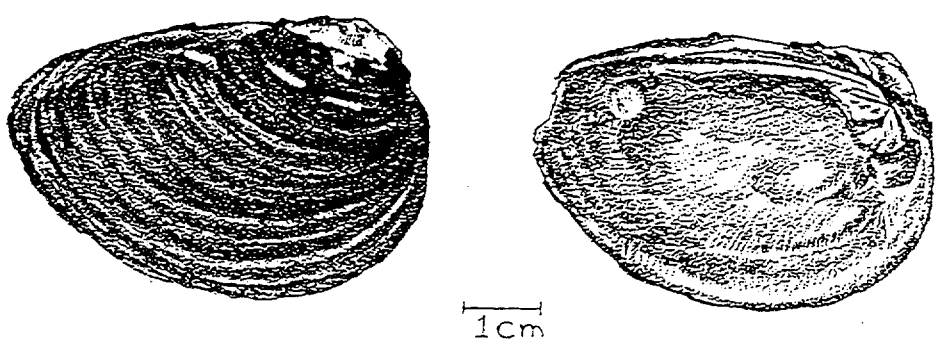

c

PLATE 6

a. Southern clubshell, *Pleurobema decisum*
b. Ovate clubshell, *Pleurobema perovatum*
c. Black clubshell, *Pleurobema curtum*