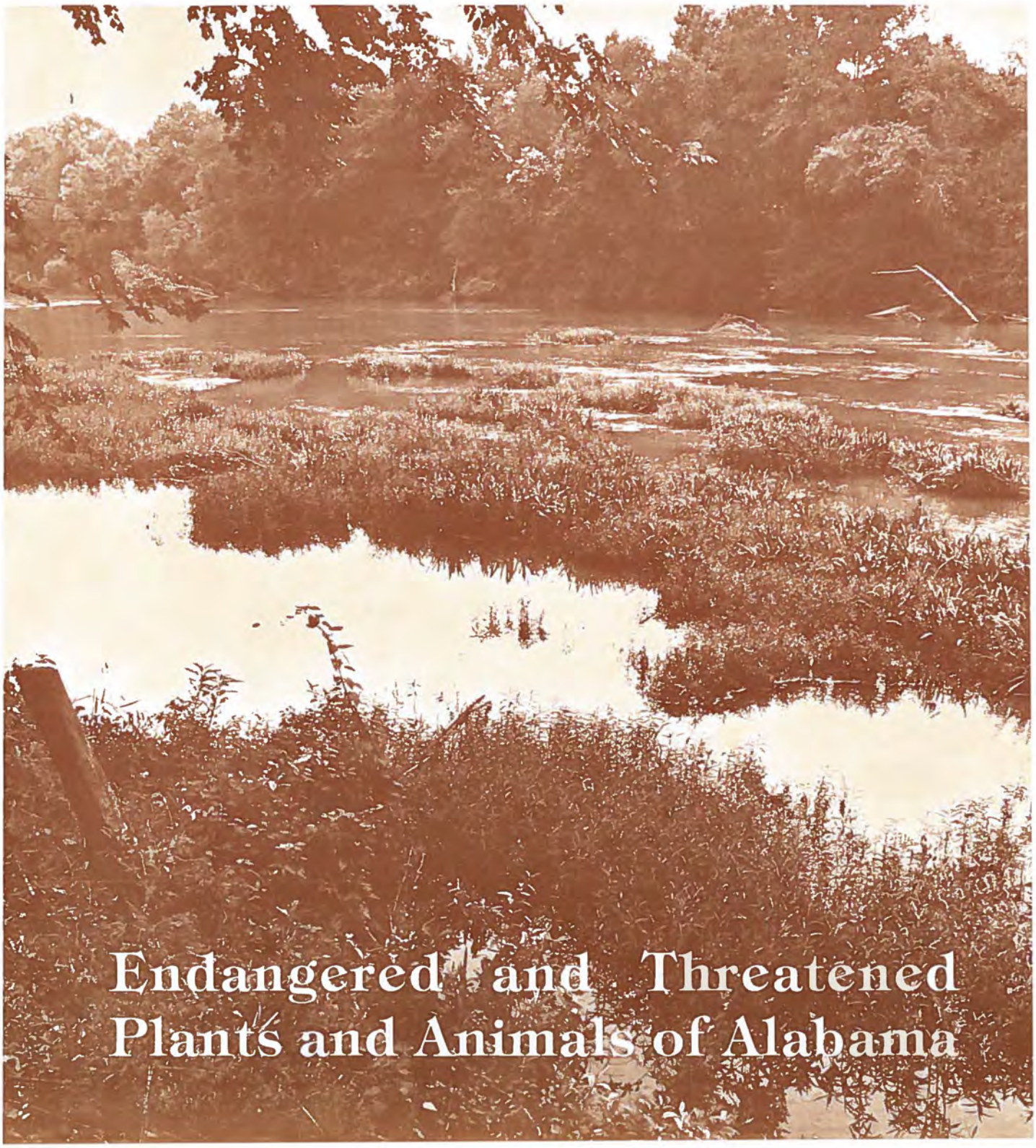
Bulletin
Alabama Museum of Natural History

october 15, 1976

number two



Endangered and Threatened Plants and Animals of Alabama

BULLETIN ALABAMA MUSEUM NATURAL HISTORY is published by the Alabama Museum of Natural History, The University of Alabama. The BULLETIN is devoted primarily to the subjects of Anthropology, Archaeology, Botany, Geology and Zoology of the Southeast. The BULLETIN will appear irregularly in consecutively numbered issues. Manuscripts of 100 to 200 pages are desirable, and will be evaluated by the editor and by an editorial committee selected for each paper.

Authors are requested to conform with the CBE Style Manual, 3rd edition, 1972, published by the American Institute of Biological Science, Washington, D.C. An abstract not exceeding three percent of the original text or four pages must accompany the manuscript.

For information and policy on exchanges, write to the Librarian, The University of Alabama, Box S, University, Al. 35486.

Numbers may be purchased individually; standing orders are accepted. Remittances should accompany orders and made payable to The University of Alabama.

Communication concerning manuscripts, editorial policy, and orders for individual numbers should be addressed to the editor:

Herbert Boschung
Alabama Museum of Natural History
The University of Alabama
Box 5897
University, Alabama 35486

When citing this publication authors are requested to use the following abbreviation: Bull. Alabama Mus. Nat. Hist.

Price this number: $5.00

Cover: Cahaba River, photo by Patrick O'Neil

BULLETIN
ALABAMA MUSEUM OF NATURAL HISTORY NUMBER 2

Endangered and Threatened Plants and Animals of Alabama

The results of a symposium sponsored

by

Game and Fish Division of the
Alabama Department of Conservation
and Natural Resources

and

Alabama Museum of Natural History,
The University of Alabama

Herbert Boschung, editor

THE UNIVERSITY OF ALABAMA
UNIVERSITY, ALABAMA
1976

FOREWORD

The Department of Conservation and Natural Resources recognizes the need for a current list of plant and animal life that, according to the best sources of information available, are *endangered, threatened* or of *special concern* within Alabama. This list provides the public and educational institutions with information not previously obtainable on the status of certain species. It will also be of invaluable help in fulfilling the requirements for completing Environmental Impact Statements by various organizations and agencies who are planning projects that may alter the environment.

Laws were not passed during the 1975 regular session of the Alabama Legislature which would allow the State of Alabama to comply with the Endangered Species Act of 1973; therefore, this list of threatened and endangered plants and animals is highly desirable for the purposes mentioned above. The Alabama Department of Conservation and Natural Resources endorses this publication as the list of *threatened* and *endangered* species of plants and animals of Alabama.

Claude D. Kelley, Commissioner

May 31, 1976

CONTENTS

Introduction

Herbert Boschung
Director, Alabama
Museum of Natural History
The University of Alabama
University, Alabama

The first symposium, on endangered and threatened species in Alabama, was held at Birmingham-Southern College in 1972. The results of the symposium, which only considered vertebrates, were edited by Mr. James Keeler and published by the Alabama Department of Conservation and Natural Resources. Late in 1974, a group of biologists in the State expressed a need to revise the 1972 list of endangered species and a Steering Committee was convened to organize a second symposium. The committee consisted of Jack Brown, George Folkerts, Dan Holliman, James Keeler, Joab Thomas and myself. The duties of the Steering Committee were 1) to establish a time and place for the symposium, 2) to decide what group or organisms should be covered, 3) to establish definitions for the categories (see below), and 4) to appoint a chairperson for each committee (panel).

The second symposium was held on March 6-7, 1975 at The University of Alabama, and was sponsored by the Alabama Department of Conservation and Natural Resources and The University of Alabama Museum of Natural History. It brought together conservationists, professional biologists, teachers, students, and interested laymen for the purpose of establishing a list of endangered and threatened species of plants and animals of Alabama for local, state, and federal agencies and industries.

The Steering Committee recognized the need to expand the scope of the second symposium to include plants, mollusks, crayfishes and shrimps, in addition to the vertebrate species. It was necessary for the Steering Committee to establish precise definitions for the following terms: *Species* include subspecies and varieties. *Endangered species* are those species in danger of extinction throughout all or a significant portion of their range in Alabama. Endangered species are those whose prospects for survival are in immediate jeopardy. An endangered species must have help, or extinction and/or extirpation from Alabama will probably follow. *Threatened species* are those species which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range in Alabama. *Special concern* are those species which must be continually monitored because eminent degrading factors, their limited distribution in Alabama or other physical or biological characteristics may cause them to become threatened or endangered in the foreseeable future.

A chairperson for each of the eight subject groups, i. e., plants, fishes, etc., was appointed and each in turn organized a panel of experts to participate in the panel discussions and decision making processes. Each "workshop" session convened at 2:00 P.M. on March 6 and continued until the work was completed. Reports by the chairpersons and open discussions were moderated by Dr. George Folkerts on March 7 in a general assembly. At that time interested persons had the opportunity to contribute additional information on species.

Chairpersons were given the freedom to present their material in the form they thought most appropriate. Consequently, as you read through the various sections, you will notice that the formats differ. Also the requirements of an abstract and an evaluation by an editorial committee, as stated in the inside cover, were waived for this Bulletin of the Alabama Museum of Natural History.

I wish to thank the participants in the symposium, especially the chairpersons whose responsibility it was to write the reports, for their fine cooperation in all matters pertaining to this publication. No one was paid to participate in this endeavor, and in many cases the participants provided their time and expertise at great personal sacrifice. To these dedicated people we owe a debt of gratitude. I also wish to acknowledge the help of Dr. Jack Brown, University of North Alabama, for his aid in editing some of the sections; however, I assume the responsibility for any editorial errors. In addition to the Steering Committee, panel chairpersons and participants, we thank Dr. David Mathews, President, The University of Alabama; and Mr. Charles D. Kelley, Director, Game and Fish Division, Alabama Department of Conservation and Natural Resources, for their interesting remarks to the general assembly prior to the reports of the panels and open discussions on March 7. To Dr. George Folkerts, Auburn University, who did his usual fine job as moderator, we give our heartfelt thanks.

This publication is the result of the symposium and represents the best thinking and opinion of the various panels regarding endangered and threatened species at that time. A report of this kind is never current. As additional data on the biology and geography of species are available, we must continue to revise our opinions regarding the ability of a species to cope with the changing environment. The fortune of some species will improve; that of others will worsen. As time goes by it is our fondest hope that we will be able to delete species from the list. About eighteen months have elapsed between the symposium and this publication, and if these same panel members were in session today, the lists would be different. We should not allow too many years to pass before reconvening for the purpose of updating these reports and for considering expansion of the scope of the previous work to include geological formations and scenic areas.

Historical Review and Comments

Ralph L. Chermock
Chief, Environmental Division
Geological Survey of Alabama
University, Alabama

There has been an increasing nationwide concern for the preservation of our wildlife. In the past, Federal legislation has played an important role in protecting many species of animals (U. S. Bureau of Sport Fisheries and Wildlife, 1973a). A few of the more significant acts are the following:

Migratory Bird Treaty Act, 1918. Implements treaties with Great Britain (for Canada) ratified in 1916, and Mexico ratified in 1936, for the protection of migratory birds. The act provides for regulations to control the taking, selling, transporting and importing of migratory birds, and it provides penalties for violations. This act stopped the killing of birds for their feathers and played an important role in protecting many species such as the Snowy Egret.

Migratory Bird Conservation Act, 1929. Provides for the acquisition and development of land for migratory bird refuges. It also authorizes investigations and publications on North American birds.

Migratory Bird Hunting Stamp Act (Duck Stamp Act), 1934. Provides for the sale of duck stamps, the revenue of which is used to acquire waterfowl production areas and migratory bird refuges, and to guarantee their management. This, and the above act, have played an important role in protecting such birds as the Trumpeter Swan and the Whooping Crane.

Federal Aid in Wildlife Restoration Act (Pittman-Robertson Act), 1937. Provides Federal aid to states for wildlife restoration work, including land acquisition, research, development and management projects. It is supported by an excise tax on firearms and ammunition. This act has played an important role in increasing our knowledge of wildlife and in providing them protection.

Bald Eagle Act, 1940. Provides for the protection of the Bald Eagle and Golden Eagle.

Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, 1940. Under this treaty, the government of the United States and 11 other American Republics express their wish to "protect and preserve in their natural habitat representatives of all species and genera of their native flora and fauna, including migratory birds." This includes the wintering grounds of many birds which nest in the United States.

Federal Aid in Fish Restoration Act (Dingell-Johnson Act), 1950. Provides aid to the states in sport fish restoration work, including land acquisition, development, and management. Funds are provided from an excise tax on sport fishing tackle. This act has been important in protecting fishes and in increasing our knowledge of them.

Wilderness Act, 1964. Provides for the formal preservation of wilderness areas. In Alabama, the West Fork of the Sipsey River in the Bankhead National Forest is one such area where habitats of several rare Alabama plants and animals are found.

Anadromous Fish Conservation Act, 1965. Provides aid to the states for the conservation, development, and enhancement of the Nation's anadromous fishes (such as salmon, shad and striped bass), including species in the Great Lakes that ascend streams to spawn.

Estuary Protection Act, 1968. Provides for Federal cost-sharing agreements with states and their subdivisions for the management of estuarine areas.

Wild and Scenic Rivers Act, 1968. Establishes a national wild and scenic river system. It is hoped that eventually wild river areas will be located in Alabama. This program could play an important role in protecting aquatic animals.

Endangered Species Conservation Act, 1969. Provides broad authority to the Federal Government to establish a comprehensive program for the conservation, restoration and propagation of selected fish and wildlife in the United States which are threatened with extinction. The act also provides assistance on an international level for the preservation of foreign wild animals.

Marine Mammal Protection Act, 1972. Establishes a moratorium on the taking and importation of marine mammals and products made from them. Included are any marine mammal on the official endangered list in addition to the Polar Bear, Sea Otter, Walrus, Dugong and three species of Manatees.

The above Federal Acts apply to all of the states. In addition, the State of Alabama prohibits the hunting of bear, mountain lion, and alligator.

The most recent legislation to protect endangered species was passed by Congress in December, 1973, and is called the Endangered Species Act of 1973. In addition to protecting endangered and threatened species of plants and animals, this law emphasizes the need to preserve critical habitats on which endangered species depend for their continued existence. Individual states are also encouraged to establish guidelines which will complement the goals outlined in the 1973 act.

A concern for wildlife in danger of extinction has also been developing. In response to this, the U. S. Bureau of Sport Fisheries and Wildlife first published a list of rare and endangered vertebrates of the United States in 1968. Species were classified as follows:

Endangered. An endangered species or subspecies is one whose prospects of survival and reproduction are in immediate jeopardy. Its peril may result from one

or many causes—loss of habitat, overexploitation, predation, competition, and disease. An endangered species must have help or extinction will probably follow.

Rare. A rare species or subspecies is one that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens. Close watch of its status is necessary.

Peripheral. A peripheral species or subspecies is one whose occurrence in the United States is at the edge of its natural range which is rare or endangered within the United States although not in its range as a whole. Special attention is necessary to assure its retention in our Nation's fauna.

Status Undetermined. A status-undetermined species or subspecies is one that has been suggested as possibly rare or endangered, but about which there is not enough information to determine its status. More information is needed.

This list was prepared with the cooperation of hundreds of knowledgeable scientists and naturalists from throughout the country.

In 1973, the U. S. Bureau of Sport Fisheries and Wildlife revised its 1968 publication (1973b) in which they combined "Endangered" and "Rare" species into a single category termed "Threatened."

The Endangered Species Conservation Act of 1969 provides authority for the Federal Government's endangered species conservation program. This act requires the Secretary of the Interior to periodically publish in the Federal Register lists of vertebrates, mollusks and crustaceans which are threatened with extinction as a "List of Endangered Native Fish and Wildlife." This list includes those threatened species which officially have been declared "Endangered." The list of endangered species has been prepared and is regularly updated. (U.S. Bureau Sport Fisheries and Wildlife, 1973b, appendix C; U.S. Fish and Wildlife Service, 1974)

The Smithsonian Institution (Ripley, 1975) prepared a report on the endangered, threatened, and recently extinct plant species of the United States for the 94th Congress. The following criteria were used:

Endangered species. Those species of plants in danger of extinction throughout all or a significant portion of their ranges. Existence may be endangered because of the destruction, drastic modification, or severe curtailment of habitat, or because of over-exploitation, disease, predation, or even unknown reasons. Plant taxa from very limited areas, e.g., the type localities only, or from restricted fragile habitats usually are considered endangered.

Threatened species. Those species of plants that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range. This includes species categorized as rare, very rare, or depleted.

Recently extinct or possibly extinct species. Those species of plants no longer known to exist after repeated search of the type localities and other known or likely places. Some species may be extinct in the wild, but preserved by cultivation in gardens—such as the "Lost Franklinia."

In 1972, the Alabama Department of Conservation (Keeler, editor, 1972) published the "Rare and Endangered Vertebrates of Alabama" which was based on the results of a symposium on the subject in which professional biologists and competent laymen participated. This list carefully evaluated the status of vertebrate species within the state. Three categories were used, endangered and rare species, and those with an undetermined status.

The criteria for endangered species were essentially the same as that of the 1968 U.S. list, but was restricted to Alabama. Rare species were divided into two groups. *Rare-1* used the same criteria employed in the U.S. list. The *Rare-2* group included "A species or subspecies that may be quite abundant where it does occur, but is known in only a few localities or in a restricted habitat within Alabama." The definition for status-undetermined was essentially the same as in the U.S. list. The category of peripheral animals used in the U.S. list was not included in the Alabama list.

Within historical times, one fish species and two species of birds which formerly were found in Alabama have become extinct. These are the Hairlip Sucker (*Lagochila lacera*), Passenger Pigeon (*Ectopistes migratorius*), and the Carolina Parakeet (*Conuropsis carolinensis*). Two species of Alabama plants have also become extinct. These are *Linum macrocarpum*, a flax which was only known from Mobile, and *Helianthus smithii*, a sunflower which was found in Randolph County. A number of other species of animals have also become extirpated in Alabama, although they still are found elsewhere. Among these are Spotfin chub (*Hybopsis monacha*), Streamline chub (*Hybopsis dissimilis*), Popeye shiner (*Notropis ariommus*), Sand shiner (*Notropis stramineus*), Whiteline topminnow (*Fundulus albolineatus*), Ashy darter (*Etheostoma cinereum*), Trispot darter (*Etheostoma trisella*), American crocodile (*Crocodylus acutus*), Indigo snake (*Drymarchon corais couperi*), Scarlet ibis (*Eudocimus ruber*), Roseate spoonbill (*Ajaia ajaia*), American flamingo (*Phoenicopterus ruber*), Whooping crane (*Grus americana*), Ivory-billed woodpecker (*Campephilus principalis*), Common raven (*Corvus corax*), Red Wolf (*Canis n. niger*), and Florida manatee (*Trichecus manatus latirostris*).

By acquainting the public with those species which are in danger of extirpation, it is hoped that no additional species will be added to the above list and that perhaps some of these will again return to Alabama.

The reasons for species of plants and animals becoming threatened, endangered, or even extinct vary widely and normally involve an interaction between man's activities and the habits, habitats, and population characteristics of the organism. Large carnivorous mammals such as the cougar, bear, and wolf were extensively hunted by man to eliminate their potential predation on domesticated animals, competition for game, and possible harm to man himself. Today, their populations are of a

critically small size in Alabama and are almost limited to the wildest parts of the state or, as in the case of the red wolf, probably extirpated.

Large predatory birds such as eagles, hawks, and owls also decreased in numbers because of hunting pressure. In more recent years, the use of certain insecticides has contributed to their decline by affecting their ability to reproduce. Birds which have accumulated these pesticides in their bodies produce thin-shelled eggs which often break before hatching. This is not only true for large predatory birds but also for many species of game birds, shore birds and song birds. There is some recent evidence that increased control of the use of harmful insecticides is reflected in some increase in numbers of these birds.

Game and fur animals also decreased in abundance because of hunting and the progressive elimination of their habitats for agricultural development and urban growth. However, with the initiation of conservation practices earlier in this century, their decline was often stopped and their numbers increased. In addition, many have been restocked in areas where they were extirpated. In Alabama, this has been true of deer, turkey, beaver, and, more recently, ruffed grouse and bear. Wildlife can be preserved with proper protection and management.

Some animals and plants which may be considered as rare are those which occur peripherally in Alabama. These are species which may be abundant elsewhere, but their range of distribution barely extends into Alabama. These are often restricted to small areas of limited habitats where suitable environmental conditions exist for their survival. Many of these are classified as being of special concern in Alabama. Among these are the Sandhill crane, Wood stork, Meadow jumping mouse, Florida yellow bat, Wood frog, Least treefrog, and Rhododendron. These are rare components of Alabama's biota which should be protected and their habitats preserved.

Included in the Alabama list of endangered and threatened species are several animals and plants which are endemic to the state and are found nowhere else in the world. Among these are the Alabama croton, Red hills salamander, Pigmy sculpin, Watercress darter, Coldwater darter, and Tuscumbia darter. If these are eliminated from the state's biota, they will become totally extinct. Many of these are very restricted in their distribution and habitat, often being limited to a single cave, spring or stream. Because of their limited distribution and highly restricted environment, they are vulnerable to man's activities if unprotected.

Endangered and threatened organisms generally fall into two groups. The first includes those species which have been extensively hunted by man. To prevent further depletion of their populations, strict regulations concerning their hunting must be rigidly enforced. The other group includes those species which are restricted to distinctive, often sensitive, habitats. Often two or more rare species may be found in the same location. These distinctive areas need to be identified and protected from further disturbances by man in order to preserve their distinctive inhabitants.

LITERATURE CITED

Keeler, J. E. 1972. Rare and endangered vertebrates of Alabama: Montgomery, Alabama, Alabama Dept. Conserv. Game and Fish Div., 92 p.

Ripley, S. D. 1975. Report on endangered and threatened plant species of the United States: 94th Congress, 1st Session, House Document No. 94-51, 200 p.

U.S. Bureau of Sport Fisheries and Wildlife. 1968. Rare and endangered fish and wildlife of the United States: U.S. Bur. Sport Fisheries and Wildlife, Resource Publ. 34, 130 p.

U.S. Bureau of Sport Fisheries and Wildlife. 1973a. Selected list of Federal laws and treaties relating to sport fish and wildlife: U.S. Bur. Sport Fisheries and Wildlife, WL-489, 7 p.

U.S. Bureau of Sport Fisheries and Wildlife. 1973b. Threatened wildlife of the United States: U.S. Bur. Sport Fisheries and Wildlife, Resource Publ. 114, 289 p.

U.S. Fish and Wildlife Service. 1974. United States list of endangered fauna: Washington, D. C., U.S. Dept. Interior, 22 p.

PLANTS

JOAB L. THOMAS[1]
Vice President of Student Affairs
The University of Alabama
University, Alabama

Acknowledgments

Many people have contributed to the development of these lists of plants with available habitat data. It is most important that these people and many others continue to accumulate information on the habitat and distribution of the plants of Alabama so that these lists can be continuously refined. Special appreciation is extended to the members of the committee that made the final decisions and gathered habitat data on these species. Members of the committee were: Mrs. Rebecca Bray, Chesapeake, Virginia; Mr. Lloyd Crawford, Andalusia; Dr. John D. Freeman, Auburn; Mrs. Verda Horne, Fairhope; Dr. Robert Kral, Nashville, Tennessee; Dr. Kenneth Landers, Jacksonville; Dr. Mike Lelong, Mobile; Mr. Jim Manasco, Jasper; Mrs. Louise Smith, Birmingham; Mr. George Wood, Northport; Dr. Shogo Yamaguchi, Tuskegee; and Dr. Joab Thomas, Tuscaloosa, Chairman.

Introduction

The mild climate, plentiful rainfall, and diverse geology and topography of Alabama provide a diversity of habitats that support a native flora unusually rich in species. Many of these species are narrowly distributed, however, and others are so delicately adapted to the limited habitats that their existence is precarious, indeed. Moreover, it should be emphasized that concern for endangered plant species must be expressed in terms of concern for endangered habitats; for the two are literally inseparable.

The following lists must be considered as preliminary at best. Hopefully, these preliminary lists will serve as a stimulus and as a framework for developing a comprehensive treatment of the *endangered* and *threatened* species and species of *special concern* in Alabama. In each list the plants are arranged alphabetically by three major categories. The pteridophytes include the ferns and the vascular cryptogams. The spermatophytes include all the seed plants and are divided into gymnosperms, the non-flowering and mostly cone-bearing species, and the angiosperms—the flowering plants. Within each of these categories the plants are arranged alphabetically and within each family alphabetically by genus and species.

Hymenocallis coronaria in the Cahaba River
(Patrick O'Niel)

In order to insure precise communication only scientific names are used. During the development of this list the improper application of a common name led to a newspaper story naming honeysuckle as an endangered species. This kind of error is best avoided through the use of scientific nomenclature that is controlled through an international code. Common names for these species can be found in the index of most of the major botanical works including Small's *Manual of the Southeastern Flora*; Gray's *Manual of Botany;* and Radford et. al. *Manual of the Flora of the Carolinas.*

The authors would welcome additional information concerning the distribution of the species on the list and the suggestion of additional species that should be included. A revised edition should be published as soon as sufficient additional information is gathered to warrant a second publication.

ENDANGERED SPECIES

Pteridophyta

Aspidiaceae

Leptogramma pilosa var. *alabamensis* (Crawford) Wherry

Fissures of Pottsdam sandstone, west fork Sipsey River. Winston County.

Polypodiaceae

Trichomanes boschianum Sturm *ex* Bosch

Sandrock ledges, in shade, dripping rock. Franklin, Marion, and Winston Counties.

1. Presently Chancellor, University of North Carolina State, Raleigh, North Carolina.

Trichomanes petersii Gray
Sandrock ledges, in shade, dripping rock.
Winston County.

Selaginellaceae

Selaginella tortipila A. Brown
Sandrock or granitic outcrops.
Marion and Shelby Counties.

Spermatophyta
Angiospermae
Monocotyledoneae
Amaryllidaceae

Hymenocallis coronaria (Le Conte) Kunth
Shallows of swift-flowing streams or rivers.
Bibb County.

Cyperaceae

Rhynchospora crinipes Gale
Savannas, flatwoods. Mobile County.

Liliaceae

Lilium iridollae M. G. Henry
Acidic swamp woodland clearings.
Baldwin and Covington Counties.

Lilium superbum L.
Bogs, seeps, clearings in rich woods, and natural peaty meadowy places. Butler, Escambia, Geneva, Henry, Houston, and Sumter Counties

Trillium pusillum Michx.
Alluvium of low woods. Madison County

Orchidaceae

Epidendrum conopseum R. Br.
Rich hammock woods and bottoms.
Baldwin and Mobile Counties.

Dicotyledoneae
Aquifoliaceae

Ilex amelanchier M. A. Curtis
Swamp woodlands and acid areas.
Mobile and Washington Counties.

Araliaceae

Panax quinquefolia L.
Rich mesic forest. Franklin and Jackson Counties.

Aristolochiaceae

Hexastylis speciosa Harper
Sandy loam, usually acidic, in rather open pine-hardwoods on well-drained situations above acidic streams. Autauga and Chilton Counties.

Asclepiadaceae

Cyclodon alabamense (Vail) Small
Hillsides and thickets in sandy soil. Dale County.

Asteraceae

Aster chapmanii T. & G.
Black, wet sandy peat of pineland savannas.
Geneva and Houston Counties.

Aster eryngiifolius T. & G.
Black, wet sandy peat of pineland savannas.
Covington, Geneva and Houston Counties.

Echinacea laevigata (Boynton & Beadle) Blake
Jackson County.

Jamesianthus alabamensis Blake & Sherff
Streambanks; wet, sunny places where streams flow over limestone or shale.
Colbert and Franklin Counties.

Marshallia mohrii Beadle & Boynton
Peaty open places, moist.
Cherokee and Cullman Counties.

Brassicaceae

Arabis perstellata E. L. Br.
Limerock bluffs and drained bottoms. Bibb County.

Leavenworthia alabamica var. *brachystyla* Rollins
Limestone outcrops. Marshall County.

Leavenworthia crassa Rollins
Glades. Marshall County.

Leavenworthia crassa var. *elongata* Rollins
Glades. Marshall County.

Leavenworthia exigua var. *lutea* Rollins
Around limestone outcrops.
Jefferson and St. Clair Counties.

Lesquerella densipila Rollins
Fields, pastures in calcareous districts.
Franklin and Marshall Counties.

Lesquerella lyrata Rollins
Fields and pastures in calcareous districts.
Franklin County.

Caprifoliaceae

Viburnum bracteatum Rehder
Banks of the Coosa River. Etowah County.

Ericaceae

Rhododendron prunifolium Millais
Rich acidic woods. Henry County.

Euphorbiaceae

Croton alabamensis E. A. Smith
Dolomitic limestone bluffs.
Bibb and Tuscaloosa Counties

Fabaceae

Psoralea simplex Nutt.
Low, wet pinelands, savannas.
Mobile and Washington Counties.

Gentianaceae

Gentiana elliottii Chapm.
Rich low woods and bottoms. Covington, Dale, Geneva, Houston and Lee Counties.

Gentiana saponaria L.
Rich low woods and swales, usually in moist, sunny situations. DeKalb, Jackson and Shelby Counties.

Gentiana villosa L.
Dryish upland woods, usually oak-pine-hickory.
Jefferson, Lee, and Shelby Counties.

Lamiaceae

Synandra hispidula (Michaux) Baillon
Rich woods: usually rocky, wet places.
Jackson County.

Lauraceae

Lindera mellissaefolium (Walter) Blume
Swamp woodlands. Wilcox County.

Malvaceae

Hibiscus coccineus Walt.
Bases submerged in shallow waters in limestone ponds. Covington County.

Onagraceae

Oenothera grandiflora Ait.
Rich low woods or even rich mesic woods. Baldwin and Sumter Counties.

Plantaginaceae

Plantago cordata Lam.
Creek banks in shade or full sun. Colbert and Franklin Counties.

Polemoniaceae

Phlox pulchra Wherry
Acidic sandy open oak-pine woods or arenaceous shale outcrop areas in the same. Autauga, Bibb, Butler, Shelby, and Tuscaloosa Counties.

Polygonaceae

Eriogonum harperi Goodman
Limerock outcrops and surrounding calcareous clearings or open woods. Colbert and Franklin Counties.

Portulacaceae

Talinum appalachianum W. Wolf
Gneissal outcrops. Coosa County.

Primulaceae

Lysimachia fraseri Duby
Woods and slopes over non-calcareous rocks.

Lysimachia graminea (Greene) Hand-Mazetti
Moist, peaty open places, Cherokee and Cullman Counties.

Ranunculaceae

Aconitum unsinatum L.
Rich woods and creek banks over limestone bedrock. Blount and DeKalb Counties.

Clematis gattingeri Small
Limestone bluffs. Coosa County.

Hydrastis canadensis L.
Rich mesic woods, usually over basic bedrock. Jackson and Marshall Counties.

Rosaceae

Neviusia alabamensis A. Gray
Rich, limerock woods and bluffs. DeKalb, Jackson, Madison, and Tuscaloosa Counties.

Sarraceniaceae

Sarracenia alabamensis Case & Case
Wet sphagnous woods, clearings. Autauga and Chilton Counties.

Sarracenia oreophila (Kearney) Wherry
Acidic wet places along streams, openings in low woods. Cherokee, DeKalb ,and Jackson Counties.

Saxifragaceae

Parnassia asarifolia Vent.
Seepy, sphagnous, acid places in woods. Jackson County.

Parnassia caroliniana Michx.
Open or lightly wooded slopes. Probably Choctaw County.

Schisandraceae

Schizandra glabra (Bricknell) Rehder
Rich bluff woods usually over limestone or alluvium. Bibb, Greene, and Sumter Counties.

THREATENED SPECIES

Pteridophyta

Aspleniaceae

Asplenium bradleyi D. C. Eaton
Acidic rocks.

Asplenium ebenoides Scott
Cool crevices of rocks; moist shaded areas with northern exposure. Jefferson County.

Asplenium ruta-muraria L.
Limestone rocks.

Lycopodiaceae

Lycopodium porophyllum Lloyd and Underwood
Arenaceous, shaded, dripping bluffs. Franklin County.

Pteridaceae

Cheilanthes alabamensis (L.) Ames
Bluffs of Tennessee River at Muscle Shoals. Lauderdale County.

Schizaeaceae

Lygodium palmatum (Bernh.) Swartz
Along sandy-bottomed creeks in the Cumberlands. Jackson, Cherokee Counties.

Spermatophyta

Angiospermae

Monocotyledoneae

Araceae

Rhapidophyllum hystrix (Fraser) H. Wendl.
Sandy low woods, higher places in alluvial woods. Houston, Pike, Geneva, Covington and Bibb Counties.

Cannaceae

Canna flaccida Salisb.
Low places, swamps near coast, full sun or light shade. Mobile, Baldwin Counties.

Cyperaceae

Carex baltzellii Chapm.
Sandy, loamy rich ravine slopes. Dale, Geneva, Houston Counties.

Juncaceae

Juncus gymnocarpus Coville
Swamp woodlands. Houston, Covington and Dale Counties.

Liliaceae

Disporum maculatum (Buckley) Britton
Rich woods. Jackson County.

Lilium canadense L.
Wet thickets and meadows, various provinces. Rarely Coastal Plain.

Trillium lancefolium Raf.
Alluvial woods. Choctaw, Sumter, Greene and Lawrence Counties.

Trillium erectum L. var. *sulcatum* Barksdale
Rich, acidic woods. Marshall County.

Orchidaceae

Cleistes divaricata (L) Ames
Bogs, acidic open low woods. Baldwin, Mobile, and Autauga Counties.

Cypripedium acaule Ait.
Acid woods, usually mountain and plateau regions.

Cypripedium calceolus var. *pubescens* (Willd) Correll.
Well-drained loams, thickets—local throughout. Jackson, Clarke, and Talladega Counties.

Poaceae

Panicum nudicaule Vasey
Mucky, swampy acidic creek bottoms. Washington County.

Xyridaceae

Xyris drummondii Malme.
Seeps, acid, wet, sandy and sphagnous sites. Full sun. Geneva, Covington, Baldwin, Mobile, and Washington Counties.

Dicotyledoneae

Apiaceae

Ptilimnium fluviatile (Rose) Mathias
Banks of swift acidic streams, bars. Cherokee, Jackson, and DeKalb Counties.

Asteraceae

Brickellia cordifolia Robinson
Open beech-magnolia woods. Lee, Dale and Butler Counties.

Cacalia diversifolia T. & G.
River bottoms, creek bottoms. Houston County.

Coreopsis gladiata Walter
Pineland ditches, savannas, pitcher plant bogs. Baldwin, Mobile, Washington, Conecuh, Covington, Geneva, and Houston Counties.

Echinacea pallida Nutt.
Chalk prairies. Marengo and Greene Counties.

Rudbeckia auriculata (Perdue) Kral
Clearings in acidic low woods, wet savanna ditches. Covington, Geneva, Butler, Barbour, Pike Counties.

Viguiera porteri (A. Gray) Blake
Granite outcrops. Chambers, Randolph Counties.

Brassicaceae

Leavenworthia alabamica Rollins
Limestone glades. Franklin and Lawrence Counties.

Leavenworthia torulosa A. Gray
Thin soil over limestone, cedar glades. Madison County.

Warea amplexifolia Small
Sandy, longleaf pine hills. Pike County.

Warea sessilifolia Nash
Pinelands. Southern Coastal Plain.

Caryophyllaceae

Arenaria godfreyi Shinners
Seepage slopes in marl woods.

Croomiaceae

Croomia pauciflora (Nutt.) Torr.
Rich woods, ravines over limestone. Choctaw, Etowah, Clarke, Wilcox and Tuscaloosa Counties.

Ericaceae

Pieris phillyreaefolia DC
Cypress-*Ilex myrtifolia* ponds. Geneva and Covington Counties.

Fabaceae

Astragalus tennesseensis Gray
Limestone glades. Morgan County.

Petalostemon foliosus A. Gray
Limestone glades, wetter places. Morgan County.

Fagaceae

Quercus georgiana M. A. Curtis
Granite outcrops. St. Clair County.

Gentianaceae

Sabatia brevifolia Raf.
Sandy openings in longleaf pinelands, hills and savannas. Baldwin County.

Hypericaceae

Hypericum dolabriforme Vent.
Cherty, open places. Cherokee County.

Hypericum nitidum Lam.
Acidic swales, bogs, savannas. Geneva, Houston, Dale, Baldwin and Mobile Counties.

Lamiaceae

Scutellaria alabamensis Alexander
Moist clearings in oak-pine flats. Etowah County.

Linaceae

Linum sulcatum var. *harperi* (Small) C. M. Rogers
Basic soils in open, dry habitats.

Melastomataceae

Rhexia salicifolia Kral and Bostick
Sandy shores of limesink ponds. Covington, Houston Counties.

Onagraceae

Ludwigia arcuata Walter
Pond banks, sandy peat, peat muck. Mobile and Geneva Counties.

Papaveraceae

Stylophorum diphyllum (Michx.) Nutt.
Rich limestone woods. Jackson County.

Portulacaceae

Talinum mengesii W. Wolf
Granitic outcrops, sandstone outcrops. Franklin, Tallapoosa, Jackson, Randolph, and Chambers Counties.

Ranunculaceae

Thalictrum debile Buckl.
Mesic woodlands in blackbelt, sometimes low places in hardwoods north. Lawrence, Sumter, Greene, Wilcox, and Hale Counties.

Rhamnaceae

Sageretia minutifolia (Michx.) Trel.
Seastrand, beaches. Mobile County.

Santalaceae

Nestronia umbellula Raf.
Open sandy acidic oak-hickory-pine woods. DeKalb, Cherokee and Jackson Counties.

Sarraceniaceae

Sarracenia psittacina Michx.
Bogs, lower coastal plain. Washington, Mobile, Baldwin, Conecuh, and Geneva Counties.

Sarracenia rubra Walter
Bogs, lower coastal plain, throughout lower coastal plain. Autauga and Chilton Counties

Saxifragaceae

Heuchera longiflora (Ryd.) Rosend.
Rich, sandy acidic woods, bluffs. Talladega County.

Ribes curvatum Small
Sandy rocky slopes in mountains. Jackson, Talladega and Cleburne Counties.

Theaceae

Gordonia lasianthus (L) Ellis
Pocosin borders. Baldwin, Mobile and Geneva Counties.

Ulmaceae

Momisia iguanea (L) Rose and Standley
Rises in beach strands. Mobile, Baldwin Counties.

SPECIES OF SPECIAL CONCERN

Pteridophyta

Isoetaceae

Isoetes melanopoda Gay and Durieu
Low places in oak-pine flats. Cherokee County.

Lycopodiaceae

Lycopodium cernuum L.
Sphagnous seeps. Baldwin, Escambia, Mobile, and Washington Counties.

Lycopodium flabelliforme (Fern.) Blanchard
Dry woods, slopes, pinelands.

Ophioglossaceae

Ophioglossum crotalophorioides Walt.
Cemeteries, open grassy places. Baldwin, Butler, Choctaw, Marengo, Mobile, and Tuscaloosa Counties.

Polypodiaceae

Polypodium virginianum L.
Bluff woods, usually on sandrock. Cherokee, Clay, DeKalb, Jackson, Franklin, Lawrence, and Winston Counties.

Spermatophyta

Gymnospermae

Cupressaceae

Chamaecyparis thyoides (L.) BSP
Banks of acidic, sandy, cool streams. Baldwin, Conecuh, Escambia, and Mobile Counties.

Chamaecyparis thyoides var. *henryae* (Li) Little
Swamp forests of extreme south coastal plain.

Pinaceae

Pinus serotina Michx.
Acidic low places, pocosins. Butler, Covington, and Geneva Counties.

Angiospermae

Monocotyledoneae

Eriocaulaceae

Eriocaulon lineare Small
Sandy, peaty edges of ponds. Baldwin, Covington, Escambia, Geneva, and Houston Counties.

Eriocaulon texense Korn.
Pitcher plant bogs. Escambia, Mobile, and Washington Counties.

Liliaceae

Erythronium albidum Nutt.
Rich woods, over limestone, usually alluvial, but well-drained. Colbert, Franklin, and Marshall Counties.

Pleea tenuifolia Michx.
Pitcher plant bogs. Baldwin County.

Schoenolirion croceum (Michx.) Gray
Moist grassy places, seeps in sandy and calcareous places. Cherokee, Colbert, DeKalb, Franklin, Jackson, Marshall, Pike, and Sumter Counties.

Trillium decumbens Harbison
Rich woods, usually in shaley and/or limestone woods. Blount, Cherokee, Cullman, Etowah, Jackson, and Tuscaloosa Counties.

Trillium recurvatum Beck
Rich low woods, alluvial places. Colbert, Cullman, Lawrence, Pickens, and Sumter Counties.

Trillium sessile L.
Rich woods in limestone country. DeKalb, Hale, Lawrence, Madison, and Marshall Counties.

Veratrum parviflorum Michx.
Rich sandy woods.

Marantaceae

Thalia dealbata Roscoe
Wet ditches and margins of swamp forests.

Orchidaceae

Aplectrum hyemale (Muhl. *ex* Willd.) Torrey
Rich woods. Bibb County.

Corallorhiza wisteriana Conrad
Moist, shady areas in rich ravines. Tuscaloosa County.

Habenaria integra (Nutt.) Spreng.
Swamps, pine barrens, flatwoods. Mobile County.

Habenaria lacera (Michx.) Lodd.
Grassy, low meadows. Lee and Walker Counties.

Habenaria peramoena Gray
Low clearings. Madison County.

Isotria verticellata (Muhl. *ex* Willd.) Raf.
Moist hardwood slopes, stream margins.

Orchis spectabilis L.
Rich woods, over limestone usually. Lawrence, Madison, Marshall, and Winston Counties.

Ponthieva racemosa (Walt.) Mohr
Low woods, usually drained silts and in limestone districts. Clark County.

Poaceae

Manisuris tuberculosa Nash
Low places in pineland savannas. Baldwin, Covington, and Geneva Counties.

Xyridaceae

Xyris longisepala Kral
Edges of limestone sink ponds.
Covington and Houston Counties.

Dicotyledoneae

Acanthaceae

Dyschoriste oblongifolia (Nees) Kuntze
Longleaf pine sandhills.
Henry and Houston Counties.

Anacardiaceae

Cotinus obovatus Raf.
Limerock outcrops, usually along ridge tops.
Jackson and Madison Counties.

Rhus typhina L.
Calcareous bluff woods, along the Tennessee River.
Colbert County.

Apocynaceae

Amsonia rigida Shuttlw.
Acidic low clearings in woods. Geneva County.

Araliaceae

Aralia racemosa L.
Rich ravine woods, usually acidic.
DeKalb and Marshall Counties.

Asteraceae

Aster spectabilis Ait.
Dryish, sandy, open oak-pine woods, around sandrock outcrops. DeKalb County.

Echinacea purpurea (L.) Moench.
Meadows and clearings in rich woods.
Jackson and Marshall Counties.

Liatris chapmanii (T. & G.) Kuntze
Sandy pinelands, longleaf pine hills.
Baldwin and Escambia Counties.

Liatris cylindracea Michx.
Calcareous glades. Bibb County.

Ratibida columnifera Woot & Standl
Blackbelt pasture. Lowndes County.

Rudbeckia heliopsidis T. & G.
Around sandrock outcrops in sandy, peaty seeps.
Cherokee, DeKalb, and Jackson Counties.

Rudbeckia mollis Ell.
Sandy longleaf pine hills, clearings.
Henry and Houston Counties.

Solidago elliotti T. & G.
Sandy woods. Houston County .

Solidago uliginosa Nutt.
Moist places in sandy woods. Jackson County.

Berberidaceae

Diphylleia cymosa Michx.
Seepage areas and moist coves on mixed deciduous slopes. Cherokee County.

Jeffersonia diphylla (L.) Persoon
Rich woods over limestone.
Jackson, Madison, and Marion Counties.

Brassicaceae

Armoracia aquatica Wiegand
In shallows of backwaters, full sun.
Sumter County.

Buxaceae

Pachysandra procumbens Michx.
Rich woods, usually over limestone.
Lauderdale, Limestone, and Marion Counties.

Capparidaceae

Cleome tenuifolia Le Conte *ex* T. & G.
Sandy sand pine woods and clearings.
Baldwin and Dale Counties.

Caprifoliaceae

Lonicera flava Sims.
Sandrock areas in the mountains. Calhoun, Cherokee, Cleburne, DeKalb, Jefferson, Shelby, St. Clair, and Talladega Counties.

Triosteum angustifolium L.
Deciduous or mixed woods or openings on basic and neutral soils.

Viburnum obovatum Walt.
Bottomland woods. Houston County.

Viburnum rafinesquianum Schultes
Woodlands and thickets on basic and neutral soils.

Caryophyllaceae

Arenaria uniflora (Walt.) Muhl.
Sandrock or granitic outcrops. Chambers, DeKalb, Jackson, and Randolph Counties.

Silene ovata Pursh.
Rich woods.

Silene rotundifolia . Nutt.
Sandrock ledges. Fayette County.

Silene wherryi Small
Sandstone and granite outcrop areas; always rooted in sand. Autauga, Bibb, Cherokee, Chilton, DeKalb, Jackson, Jefferson, Marshall, Montgomery, and St. Clair Counties.

Celastraceae

Celastrus scandens L.
Limerock areas, usually around bluffs and outcrops; hedgerows in calcareous pastures.
Bibb and Colbert Counties.

Euonymus atropurpureus Jacq.
Rich woods, over limestone.
Morgan and Sumter Counties.

Clethra alnifolia var. *alnifolia* L.
Pocosins, bays, and pine barrens of the coastal plain.

Convolvulaceae

Cuscuta harperi Small
Parasitic on *Hypericum gentianoides* (L.) BSP on sandstone rocks. Cherokee County.

Ericaceae

Kalmia hirsuta Walt.
Moist acidic, sandy peaty pocosins, savannas, flatwoods. Baldwin and Geneva Counties.

Rhododendron atlanticum (Ashe) Rehder
Flat pinewoods and savannas, usually moist situations.

Rhododendron austrinum (Small) Rehder
Low, sandy woods. Coffee, Covington, Escambia, Geneva, Houston, and Pike Counties.

Rhododendron calendulaceum (Michx.) Torrey
Sandy, open oak-hickory,pine woods, summits.
Cleburne and Talladega Counties.

Euphorbiaceae

Andrachne phyllanthoides (Nutt.) Muell.
Rocky calcareous bluffs. Blount County.

Fabaceae

Cladrastis lutea (Michx.) K. Koch
Bluffs in calcareous areas, usually along the rivers and streams. Jackson, Madison, Marshall, and Tuscaloosa Counties.

Gymnocladus dioica (L.) K. Koch
Rich limestone woods, ravines.
Colbert and Madison Counties.

Psoralea onobrychis Nutt.
Calcareous clearings. Jackson County.

Quercus arkansana Sarg.
Upland sandy oak-hickory-pine forest.
Autauga, Pike, and Tuscaloosa Counties.

Fagaceae

Quercus bicolor. Willd.
Rich damp soil. Hale County

Quercus imbricaria Michx.
Upland calcareous outcrop woods. Blount County.

Quercus macrocarpa Michx.
Low, blackbelt woods.
Montgomery, Pickens, and Tuscaloosa Counties.

Quercus minima (Sarg.) Small
Low, sandy savannas. Baldwin County.

Quercus pumila Walt.
Low, sandy savannas.
Geneva, Houston, and Mobile Counties.

Fumariaceae

Dicentra cucullaria (L.) Bernh.
Rich woods, usually in calcareous districts. Colbert Etowah, Jackson, Lawrence, and Marshall Counties.

Gentianaceae

Eustoma exaltatum (L.) Griseb.
Edges of salt marshes, on sand. Mobile County.

Sabatia difformis (L.) Druce
Low, sandy peaty savannas. Geneva County.

Sabatia foliosa Fernald
Ditches and sandy, peaty low places.
Baldwin, Mobile, and Washington Counties.

Sabatia grandiflora Small
Banks of limesink ponds. Houston County.

Sabatia quadrangula Wilbur
Sandy, peaty savannas swales. Houston County.

Swertia caroliniensis (Walt.) Kuntze
Rich limestone woods.
Colbert, Franklin, and Jackson Counties.

Hamamelidaceae

Fothergilla gardenii Murray
Edges of pocosins, or in pocosins.
Escambia and Geneva Counties.

Fothergilla major (Sims) Lodd.
Rich woods over sandstones, usually along streams and rivers. Cherokee, DeKalb, Jackson, and Marshall Counties.

Hydrophyllaceae

Hydrophyllum appendiculatum Michx.
Rich, calareous woods.
Colbert, Jackson, and Marshall Counties.

Hypericaceae

Hypericum iloydii (Svenson) Adams
Dry woods and pinelands, inner coastal plain.

Hypericum nudiflorum Michx. *ex* Willd.
Rich woods, usually over sandrock or gneiss.
Chilton County.

Hypericum reductum (Svenson) Adams
Acidic pineland savannas. Baldwin County.

Lamiaceae

Hedeoma drummondii Benth.
Chalk outcrops.
Marengo and Sumter Counties.

Monarda clinopodia L.
Rich woodlands, in limestone areas.
Madison and Tuscaloosa Counties.

Lentibulariaceae

Pinguicula planifolia Chapm.
Black peat around cypress domes, in bogs.
Baldwin and Geneva Counties.

Pinguicula primulifolia Wood and Godfrey
Sphagnous seeps, usually creekbanks, in pinelands.
Baldwin and Washington Counties.

Utricularia resupinata B. D. Greene
Sandy edges of limesink ponds. Covington County.

Melastomaceae

Rhexia aristosa Britt.
Sphagnous seeps, cypress domes. Barbour County.

Onagraceae

Oenothera heterophylla Spach.
Sand of clearings, fields, borrow pits, or dryish places. Greene, Pickens, and Sumter Counties.

Orobanchaceae

Orobanche uniflora L.
Rich alluvial woods.
Blount and Tuscaloosa Counties.

Oxalidaceae

Oxalis grandis Small
Rich woods and clearings, over limestone.
Jackson and Madison Counties.

Polygonaceae

Polygonella americana (Fisch. & Mey.) Small.
Sandy clearings in woods, bluff woods.
Cherokee County.

Portulacaceae

Talinum calcaricum Ware
Limestone glades.
Franklin, Lawrence, and Marshall Counties.

Primulaceae

Hottonia inflata Ell.
Lakes. Greene County.

Ranunculaceae

Actaea pachypoda Ell.
Rich woods, usually in limestone areas, but not exclusively. Cherokee, Choctaw, Clarke, DeKalb, Etowah, Jackson, Madison, and Marion Counties.

Anemone caroliniana Walt.
Calcareous or clay soils in clearings. Madison County.

Ranunculus flabellaris Raf.
Moist banks and in shallow water; in partial to almost complete shade. Greene County.

Rosaceae

Spiraea tomentosa L.
Bogs, wet meadows, and low woodland borders.

Salicaceae

Salix humilis Marshall
Low, open places, grassy meadows. St. Clair County.

Salix sericea Marshall
Marshes, ditches, and low woods.

Santalaceae

Comandra unbellata (L.) Nutt.
Grassy areas, usually in oak-hickory or oak-pine forests. DeKalb and Jackson Counties.

Pyrularia pubera Michx.
Sandy oak-hickory-pine woods. Cherokee, DeKalb, and Jackson Counties.

Saxifragaceae

Ribes cynosbati L.
Sandy, bluff woods. Jackson County.

Scrophulariaceae

Agalinus heterophylla Small
Chalk prairies. Greene, Hale, Pickens, and Sumter Counties.

Agalinus pseudophylla (Fennell) Shinners
Low places in pineland savannas and pitcher plant bogs. Baldwin and Escambia Counties.

Castilleja coccinea (L.) Spreng.
Moist grassy areas, swales in natural clearings, and around sandrock outcrops. Cherokee, DeKalb, Etowah, and Jackson Counties.

Lindernia monticola Muhl. *ex* Nutt.
Sandstone outcrops and adjacent clearings. Chambers, DeKalb, Jackson, and Randolph Counties.

Penstemon multiflorus Chapm.
Sandy long leaf pinelands, fields. Baldwin and Geneva Counties.

Veronica anagallis - aquatica L.
Banks of streams, over limestone. Jackson and Madison Counties.

Theaceae

Stewartia malacodendron L.
Rich sandy woods, bluffs, creek banks. Crenshaw and Marion Counties.

Stewartia ovata (Cav.) Weatherby
Rich sandy woods, stream margins. Cherokee, DeKalb, Jackson, and Marion Counties.

Valerianaceae

Valeriana pauciflora Michx.
Rich, creek bank woods, mesic forest. Madison County.

Violaceae

Viola canadense L.
Rich bluff woods. Tuscaloosa County.

Vitaceae

Vitis munsoniana Simpson
Sandy riverbank woods. Escambia County.

CRAYFISHES and SHRIMPS

RAYMOND W. BOUCHARD[1]
National Museum of Natural History
Smithsonian Institution, Washington, D. C.

Cahaba River (Patrick O'Neil)

Acknowledgments

The list was drawn from the collections at the University of Tennessee which has received significant contributions from Dr. John S. Ramsey, Auburn University and Dr. Robert A. Stiles, Samford University. The primary source, however, is the vast collection at the National Museum of Natural History, Smithsonian Institution. I am especially indebted to the committee members for their assistance with the following list, making possible a far more up-to-date account, and for their suggestions in reviewing the manuscript. Those individuals who freely gave of their time and expertise are: Dr. Horton H. Hobbs, Jr., Smithsonian Institution, whose extensive knowledge of the Alabama fauna was invaluable; Dr. Joseph F. Fitzpatrick, Jr., of the University of South Alabama for his comments on the south Alabama fauna; and John E. and Martha R. Cooper of the North Carolina State Museum who contributed a great deal of information on troglobitic crustaceans. I am also indebted to my wife Judith who assisted me during several collecting trips to Alabama and who completed the accompanying illustrations.

Introduction

The freshwater decapod crustacean fauna of Alabama at present ranks second only to the state of Tennessee in its species diversity. There are 58 nominal species of crayfishes and six species of shrimps (Table 1) known from Alabama with descriptions of additional crayfishes in press or in manuscript form. It is estimated that approximately 75 species of crayfishes will be represented in the State when the fauna has been completely surveyed. Except for Tennessee, it seems unlikely that any other state's native fauna will exceed 60 species.

The freshwater decapod crustacean populations occurring in the State appear, in general, to be maintaining themselves. Of major concern for the future are possible adverse effects caused by degradation of water quality, siltation, channelization and introductions of crayfishes. The application of the insecticide Mirex in Alabama for the control of the fire ant and its deleterious effects on crayfishes (Ludke *et al.,* 1971) is also of concern. The resistance of Mirex to degradation together with the additive effect of this chlorinated hydrocarbon on crayfishes makes it an especially toxic compound to lentic and/or burrowing species.

The committee also would caution against the introduction of additional species into the State. Introduced species might well replace native ones, a number of which are unique to the state of Alabama. *Orconectes virilis,* which is indigenous to certain northern and western parts of the United States, is presently known from Alabama in Guntersville Lake and limited portions of the Black Warrior and Coosa river systems. It seems likely that these introductions were made by fishermen using imported crayfish as bait. *O. virilis* has been shown by Schwartz *et al.* (1963) to have replaced native crayfishes in certain streams in Maryland. The appearance of this species in certain tributaries of Douglas Lake, Tennessee, has reduced the diversity of the crayfish fauna in them. In Alabama, few other species have been collected where *O. virilis* was introduced. We recommend that the Alabama Department of Conservation and Natural Resources ban the importation of crayfishes into the State. With such a large fauna, crayfishes can surely be collected by fishermen from local tributaries of lakes and rivers in which they are to be used.

Interest has been expressed in importing *Procambarus clarkii* into the State as a possible food resource. This species, along with *Procambarus acutus acutus,* has long been utilized as such by residents of south Louisiana. The native range of the former is the Mississippi River valley, from Illinois southward to the Gulf coast, westward to northern Mexico and east to Escambia County, Florida. Alabama lies at the eastern terminus of its range and, within the state, the species seems to have exploited few available habitats. Outside of its natural range, *P. clarkii* has been collected in Lee, Jefferson and Lauderdale counties. In Lee County, *P. clarkii,* imported for study by the Department of Fisheries and Allied Aquacultures, Auburn University, has escaped into the wild and become established. In Jefferson County (Black Warrior and Cahaba River systems), it also appears to have become established. Its presence in Pickwick Lake, Lauderdale County, seems likely to have originated from the unintentional introduction by fishermen. Whether or not a breeding population exists in the lake is not known. Since laboratory experiments have demonstrated that

1. Presently Assistant Professor of Biology, University of North Alabama, Florence, Alabama.

P. clarkii "destroyed any other crayfish species present" (Yarbrough, 1973), it seems unwise to import *P. clarkii* into the State. This is particularly true since *P. a. acutus*, an integral part of the Alabama fauna (Tennessee River system and Gulf Coastal Plain province), can be utilized. *P. clarkii* has shown itself to be a pest in California, Hawaii, Japan and Africa (see Penn, 1954; Riegel, 1959).

The following annotated list contains 14 species of crayfishes and one shrimp, classified with one exception as *special concern*. Almost half of the species are obligate cavernicoles. The concern for these troglobites is due to their generally low population densities, low fecundity and long maturation period. Inasmuch as populations could be irreversibly affected by degradation of water quality and/or possible overcollecting, their potentially precarious existence should be pointed out. Survival of the Alabama freshwater decapod crustacean fauna is best maintained through habitat preservation.

Table 1

Nominal species of freshwater decapod crustaceans of Alabama

Family Cambaridae
Subfamily Cambarellinae Laguarda 1961

Genus *Cambarellus* Ortmann 1905
Cambarellus diminutus Hobbs 1945
Cambarellus shufeldtii (Faxon 1884)

Subfamily Cambarinae Hobbs 1942

Genus *Cambarus* Erichson 1846
Subgenus *Aviticambarus* Hobbs 1969
Cambarus (A.) hamulatus (Cope 1881)
Cambarus (A.) jonesi Hobbs and Barr 1960
Subgenus *Cambarus* Hobbs 1969
Cambarus (C.) howardi Hobbs and Hall 1969
Subgenus *Depressicambarus* Hobbs 1969
Cambarus (D.) englishi Hobbs and Hall 1972
Cambarus (D.) graysoni Faxon 1914 (see Bouchard in press)
Cambarus (D.) halli Hobbs 1968
Cambarus (D.) latimanus (LeConte 1856)
Cambarus (D.) obstipus Hall 1959
Cambarus (D.) striatus Hay 1902
Subgenus *Erebicambarus* Hobbs 1969
Cambarus (E.) cahni Rhoades 1941
Cambarus (E.) rusticiformis Rhoades 1944
Cambarus (E.) tenebrosus Hay 1902
Subgenus *Hiaticambarus* Hobbs 1969
Cambarus (H.) girardianus Faxon 1884 (see Bouchard in press)
Subgenus *Jugicambarus* Hobbs 1969
Cambarus (J.) distans Rhoades 1944
Cambarus (J.) unestami Hobbs and Hall 1969
Subgenus *Lacunicambarus* Hobbs 1969
Cambarus (L.) d. diogenes Girard 1852
Genus *Fallicambarus* Hobbs 1969
Subgenus *Creaserinus* Hobbs 1973
Fallicambarus (C.) byersi (Hobbs 1941)
Fallicambarus (C.) danielae Hobbs 1975
Fallicambarus (C.) fodiens (Cottle 1863)
Genus *Faxonella* Creaser 1933
Faxonella clypeata (Hay 1899)
Genus *Hobbseus* Fitzpatrick and Payne 1968
Hobbseus prominens (Hobbs 1966)
Genus *Orconectes* Cope 1872
Orconectes alabamensis (Faxon 1884)
Orconectes a. australis (Rhoades 1941)
Orconectes compressus (Faxon 1884)
Orconectes erichsonianus (Faxon 1898)
Orconectes forceps (Faxon 1884)
Orconectes mirus (Ortmann 1931)
Orconectes perfectus Walls 1972
Orconectes spinosus (Bundy 1877)
Orconectes validus (Faxon 1914)
Orconectes virilis (Hagen 1870)
Genus *Procambarus* Ortmann 1905
Subgenus *Girardiella* Hobbs 1972
Procambarus (G.) hagenianus (Faxon 1884)
Subgenus *Leconticambarus* Hobbs 1972
Procambarus (L.) capillatus Hobbs 1971
Procambarus (L.) escambiensis Hobbs 1942
Procambarus (L.) *hubbelli* (Hobbs 1940)
Procambarus (L.) shermani Hobbs 1942
Subgenus *Ortmannicus* Hobbs 1972
Procambarus (O.) acutissimus (Girard 1852)
Procambarus (O.) a. acutus (Girard 1852)
Procambarus (O.) bivittatus Hobbs 1942
Procambarus (O.) evermanni (Faxon 1890)
Procambarus (O.) hayi (Faxon 1884)
Procambarus (O.) hybus Hobbs and Walton 1957
Procambarus (O.) lecontei (Hagen 1870)
Procambarus (O.) lewisi Hobbs and Walton 1959
Procambarus (O.) lophotus Hobbs and Walton 1960
Procambarus (O.) marthae Hobbs 1975
Procambarus (O.) verrucosus Hobbs 1952
Procambarus (O.) viaeviridis (Faxon 1914)
Subgenus *Pennides* Hobbs 1972
Procambarus (P.) clemmeri Hobbs 1975
Procambarus (P.) spiculifer (LeConte 1856)
Procambarus (P.) suttkusi Hobbs 1953
Procambarus (P.) versutus (Hagen 1870)
Subgenus *Remoticambarus* Hobbs 1972
Procambarus (R.) pecki Hobbs 1967
Subgenus *Scapulicambarus* Hobbs 1972
Procambarus (S.) clarkii (Girard 1852)
Procambarus (S.) okaloosae Hobbs 1942
Procambarus (S.) paeninsulanus (Faxon 1914)

Family Atyidae

Genus *Palaemonias* Hay 1901
Palaemonias alabamae Smalley 1961

Family Palaemonidae

Genus *Macrobrachium* Bate 1868
Macrobrachium acanthurus (Weigmann 1836)
Macrobrachium carcinus (Linnaeus 1758)
Macrobrachium olfione (Smith 1874)
Genus *Palaemonetes* Heller 1869
Palaemonetes kadiakensis Rathbun 1902
Palaemonetes paludosus (Gibbes 1850)

List of Freshwater Decapod Crustaceans of *Threatened* Status (T), *Special Concern* Status (S)

Family Cambaridae
Subfamily Cambarellinae
(S) *Cambarellus diminutus*
(S) *Cambarellus shufeldtii*
Subfamily Cambarinae
(S) *Cambarus (Aviticambarus) hamulatus*
(S) *Cambarus (Aviticambarus) jonesi*
(S) *Cambarus (Aviticambarus)* sp. B
(T) *Cambarus (Aviticambarus)* sp. A
(S) *Procambarus (Leconticambarus) capillatus*
(S) *Procambarus (Leconticambarus) escambiensis*
(S) *Procambarus (Ortmannicus) bivittatus*
(S) *Procambarus (Ortmannicus) evermanni*
(S) *Procambarus (Ortmannicus) lecontei*
(S) *Procambarus (Pennides) clemmeri*
(S) *Procambarus (Remoticambarus) pecki*
Family Atyidae
(S) *Palaemonias alabamae*

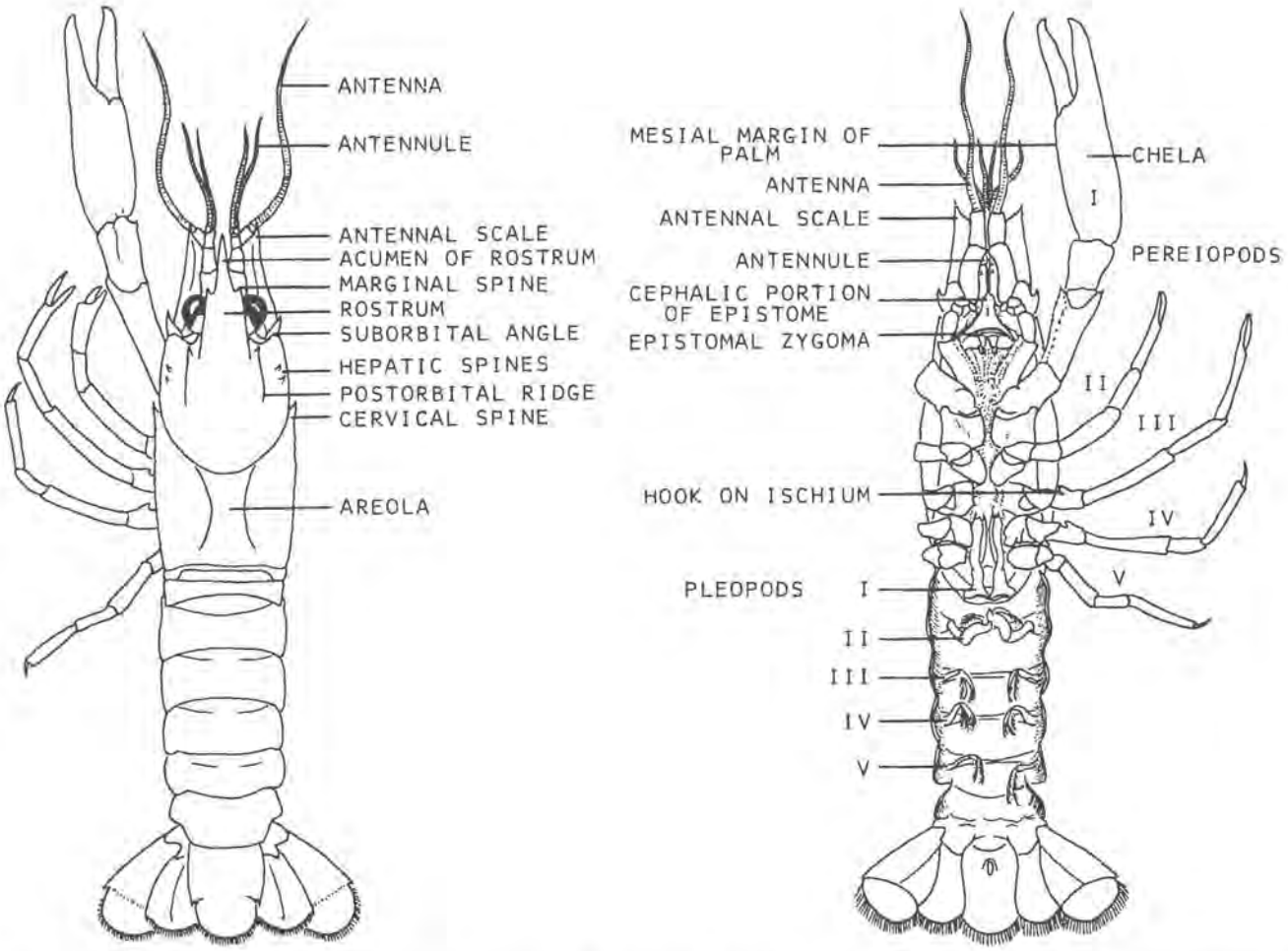


Figure 1. Dorsal (left) and ventral (right) views of generalized male crayfish illustrating structures referred to in text (after Hobbs, 1972).

THREATENED SPECIES

Carbarus (Aviticambarus) sp. A

This undescribed troglobitic crayfish, presently being studied by Martha R. and John E. Cooper is known from only a single cave along the Tennessee River in Limestone County. Its habitat seems to be silt bottomed pools where it is outnumbered approximately ten to one by *Cambarus jonesi*. The cave, developed in strata of Mississippian age, is located near a field occasionally under agricultural use, and the resulting increased siltation and possible associated chemical pollution in the cave system could prove harmful to this species. Little else is known of this rare crayfish, but like other troglobites in the area it is expected to display physiological activities in accord with the low food resources of the ecosystem of which it is a part. Because of low fecundity and long maturation coupled with a very limited range and small population size, this crayfish is regarded as *threatened*.

SPECIES OF SPECIAL CONCERN

Cambarellus diminutus Hobbs

Cambarellus diminutus is the smallest known crayfish in the world. A sexually mature male with a total carapace length of 5.5 mm (3.9 mm postorbital carapace length and 12.5 mm total length) is known from Jackson County, Mississippi. The smallest ovigerous female, from the same locality, has corresponding carapace measurements of 6.0 mm and 4.1 mm.

The following are characteristics which distinguish this species: the body and eyes are pigmented and the rostrum possesses straight, subparallel margins which terminate in acute spines. The areola is wide with seven or eight punctations across the narrowest part. There is a single large, acute cervical spine on each side of the carapace. The suborbital angle is well developed while the postorbital ridges are weak and terminate cephalically in an acute spine. The antennal scale is moderately wide, with a low rounded margin on the lamellar portion. The

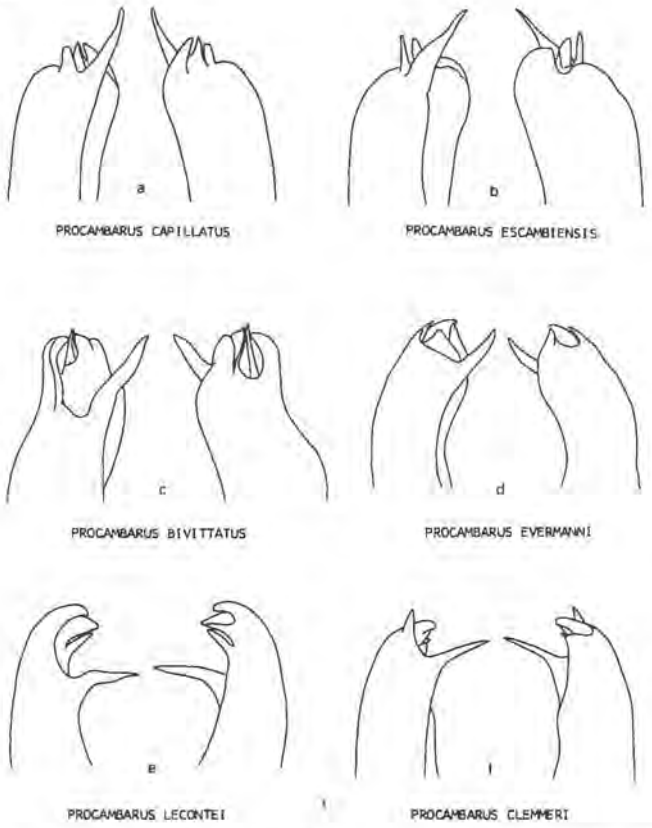


Figure 2. Form 1 male, left gonopod, of six species of *Procambarus* (right, lateral view; left, mesial view).

cephalic portion of the epistome is short and moderately broad; the epistomal zygoma is arched. The chela is narrow and unadorned. Hooks are present on the ischia of the second and third pereiopods, those on the latter bituberculate. The first pleopod of the first form male terminates in three distinct parts with the central projection corneous; the terminal elements are bent caudally at an angle of approximately 45 degrees to the shaft of the appendage. The annulus ventralis is suboval in caudal view with a small postannular sclerite that fits into a depression on the caudal side of the annulus when the abdomen is flexed. This species most notably differs from its Alabama congeners in that the first form male gonopod possesses terminal elements in which the broadly triangular caudal process obscures the mesial process when viewed in lateral aspect.

C. diminutus is known presently from two localities in Mobile County, Alabama, and from George and Jackson counties, Mississippi. These localities are in areas that drain deposits of Miocene, Pliocene and Quaternary ages. The species seems to prefer lentic habitats such as roadside ditches, small ponds and backwaters of creeks. Additional field studies are needed to determine if it is more widespread in the southwestern portion of Alabama.

Because this species is easily overlooked when sampling, due to its very small size, and because of the lack of sufficient field work in southwestern Alabama, *C. diminutus* is listed as *special concern.*

Cambarellus shufeldtii (Faxon)

Although not as small as *Cambarellus diminutus* (usually less than 3.0 cm total length), nevertheless *Cambarellus shufeldtii* is often overlooked in samples as juvenile members of the genus *Procambarus.*

This species is characterized as follows: the body and eyes are pigmented, and the rostrum possesses straight, subparallel margins with marginal spines. The areola is moderately wide with approximately five punctations across the narrowest part. There is a single acute cervical spine on each side of the carapace. The suborbital angle is well developed, while the postorbital ridges are poorly developed and terminate cephalically in an acute spine. The antennal scale is moderately wide; the lamellar portion has a low rounded margin. The cephalic portion of the epistome is short and wide and the epistomal zygoma is arched. The chela is narrow and unadorned. There are bituberculate hooks on the ischia of the second and third pereiopods, often simple on the former. The first pleopod of the first form male terminates in three distinct parts with the central projection corneous. The terminal elements of the first form male gonopod are straight in relation to the shaft of the appendage. The annulus ventralis is suboval in caudal view with a postannular sclerite that fits into a depression on the caudal side of the annulus when the abdomen is flexed. *Cambarellus shufeldtii* differs from other members of the genus by possessing straight terminal elements on the gonopod.

C. shufeldtii ranges through the Mississippi River drainage from Illinois to the Gulf coast eastward to Mobile County, Alabama. In Alabama this species is presently known from a single locality draining deposits of Quaternary age. It prefers lentic habitats such as roadside ditches, small ponds and backwaters of creeks.

Since Alabama is the eastern terminus of the range of this species, it is possible that the species may indeed be very rare here and warrants being placed in a category more indicative of its precarious situation within the State. Until a more concerted effort is expended on field work in southwestern Alabama, it seems prudent to list this species as *special concern.*

Cambarus (Aviticambarus) hamulatus (Cope)

The body and eyes of this troglobitic crayfish lack pigment. The rostrum possesses nearly straight, parallel margins with lateral spines. The areola is wide and long with six to eight punctations across the narrowest part. There are one or more pairs of large, acute cervical spines. The suborbital angle is obsolete, while the postorbital ridges are moderately developed and terminate cephalically in an acute spine. The antennal scale is wide with a broadly rounded to angulate margin on the lamellar portion. The cephalic portion of the epistome is broad and short; the epistomal zygoma is well arched. The chela is long and narrow with numerous small setal tufts. There are hooks on the ischia of the third pereiopods. The first pleopod of the first form male terminates in two distinct parts with the central projection corneous and directed caudally at an angle of approximately 90

degrees to the shaft of the appendage. The annulus ventralis is subquadrate with a narrow elevated caudal wall and swollen ridges parallel to the longitudinal or moderately inclined anterior trough. *Cambarus hamulatus* differs from its closest ally, *C. jonesi,* in possessing an areola seven or more times longer than broad (less than seven times in *jonesi*); the hepatic area of the carapace contains spines or spiniform tubercles with one or more pairs of large, acute cervical spines; the chela has small tufts of setae rather than long single ones; and the central projection of the first form male gonopod is inclined at an angle of approximately 90 degrees.

Cambarus hamulatus occupies subterranean waters draining Mississippian deposits in the Sequatchie Valley. It is presently known from nine caves in Tennessee, ten in Alabama, and probably occurs in Dade County, Georgia. In Alabama, most of the known localities are in the dissected Cumberland Plateau in northern Jackson County. The species has been collected from two caves at the southern end of the Sequatchie Valley in Blount County and may occur similarly in exposed Mississippian deposits of the valley in Marshall County. *C. hamulatus* occurs primarily in silt bottomed pools of streams. Hay (1902) described the habitat as follows: "It was not until I began to look for them under the rocks in the cave stream that I found how common they were. They appeared habitually to live under such, where they had scooped out a cavity in which to lie and from which they seemed seldom to travel."

Although no life history studies of this species are available, *C. hamulatus* is assumed to be similar to all other troglobitic species in the region, exhibiting low fecundity and a long maturation period. All known populations are of small size compared with epigean crayfish populations. For these reasons *C. hamulatus* is listed as *special concern.*

Cambarus (Aviticambarus) jonesi Hobbs and Barr

The body and eyes of this troglobitic crayfish lack pigment. The rostrum possesses straight, subparallel margins with lateral spines. The areola is moderately wide and long with four to six punctations across the narrowest part. There is a single small acute cervical spine on each side of the carapace. The suborbital angle is obsolete, while the postorbital ridges are moderately well developed and terminate cephalically in an acute spine. The antennal scale is moderately wide, the lamellar portion having a broadly angulate margin. The chela is long and studded with numerous long setae. Hooks are present on the ischia of the third pereiopods. The first pleopod of the first form male terminates in two distinct parts, with the central projection corneous and recurved at an angle distinctly greater than 90 degrees. The annulus ventralis is subquadrate with a narrow elevated caudal wall and reduced ridges parallel to the cephalic, diagonally situated trough. The cephalic portion of the epistome is short and wide, and the epistomal zygoma is thick and well arched. *Carbarus jonesi* differs from its close ally *C. hamulatus* in possessing an areola less than seven times longer than broad (seven or more times in *hamulatus*); the hepatic area is granular and there is only a single pair of small, acute cervical spines on the carapace; the chelae have numerous long, conspicuous setae; and the central projection of the first form male gonopod is recurved at an angle distinctly greater than 90 degrees to the shaft of the appendage.

Cambarus jonesi occupies subterranean waters draining Mississippian deposits along the east-west portion of the Tennessee River valley from Lauderdale and Colbert counties eastward to the bend of the River near Guntersville, Marshall County. *C. jonesi,* like *C. hamulatus,* occurs primarily in silt bottomed pools under rocks.

Despite a fairly widespread range, this species is uncommon, and, similar to its troglobitic congeners, exhibits low fecundity and a long period of maturation. For these reasons *C. jonesi* is listed as *special concern.*

Cambarus (Aviticambarus) sp. B

This newly discovered troglobitic crayfish is known only from Shelta Cave in Huntsville, Madison County. The species was discovered during a study of the ecology of the decapod crustacean inhabitants in the cave by Martha R. and John E. Cooper. The anticipated description is being completed by these workers.

The available information compiled by the Coopers on this new species indicates that it is extremely rare in that the only known population is estimated to consist of no more than 200 individuals. This small crayfish occupies permanent silt bottomed subterranean pools and lakes.

The only known natural entrances to Shelta Cave are under control and ownership of the National Speleological Society which is preserving the cave and its inhabitants. So long as the water quality is maintained in the system this species appears to be protected. Since the crayfish is rare and is affected by limiting factors of habitat, low reproduction rates and long period of maturation, it is listed as *special concern.*

Procambarus (Leconticambarus) capillatus Hobbs

Procambarus capillatus, like certain representatives of the subgenera *Austrocambarus, Girardiella* and sibling species within the subgenus *Leconticambarus,* exhibits a brush of setae on the mesial surface of the palm of the chela.

A description of this crayfish is as follows: the body and eyes are pigmented and the rostrum possesses acuminate margins which lack tubercles or spines. The areola is moderately wide with two or three punctations across the narrowest part. There are no cervical spines or tubercles. The suborbital angle is obsolete, while the postorbital ridges are moderately well developed and lack spines or tubercles. The antennal scale is wide, the lamellar portion possessing a broadly rounded to three-sided margin. The cephalic portion of the epistome is of moderate width; the epistomal zygoma is arched. The chela is of moderate width with several rows of tubercles over the mesial surface of the palm which also bears a conspicuous brush in first form males, less hirsute in

second form males and sparse or lacking in females. Hooks are present only on the ischia of the third pair of pereiopods. The first pleopod of the first form male terminates in four corneous elements (Fig. 2a) with the central projection heavily cornified. The annulus ventralis is subcircular, and deeply embedded in the sternum; a cephalic trough, flanked by high, multituberculate ridges, continues caudally as an S-shaped sinus. *Procambarus capillatus* differs from its close allies in possessing on the first form male gonopod an acute, corneous caudal process which is parallel to the shaft of the appendage.

P. capillatus is known with certainty from only Escambia and Conecuh counties, Alabama. Here the uncommon species occupies burrows (secondary burrower) and lentic habitats such as roadside ditches and small ponds located in Eocene and Miocene deposits of the Escambia River system.

Since it is an uncommon species *P. capillatus* is listed as *special concern*.

Procambarus (Leconticambarus) escambiensis Hobbs

Like its close ally *Procambarus capillatus,* this species also possesses a brush of setae on the mesial surface of the palm of the chela.

The following are characteristics which distinguish this species: the body and eyes are pigmented, and the rostrum possesses acuminate margins which lack tubercles or spines. The areola is moderately broad with three or four punctations across the narrowest part. There are no cervical spines or tubercles. The suborbital angle is moderately to well developed, while the postorbital ridges are slightly developed and lack spines or tubercles. The antennal scale is of medium width, the lamellar portion possessing a wide, three-sided margin. The cephalic portion of the epistome is of moderate width; the epistomal zygoma is slightly bent. The chela is of moderate breadth with several rows of tubercles over the mesial area of the palm and smaller ones extending over the dorsal surface. The mesial margin of the palm bears a conspicuous brush in first form males which is lacking in second form males and females. Hooks are present on the ischia of the third and fourth pereiopods. The first pleopod of the first form male terminates in five corneous elements (Fig. 2b) with the central projection heavily cornified. The annulus ventralis is subcircular and deeply embedded in the sternum; the cephalic trough, flanked by multituberculate ridges, continues caudally as an S-shaped sinus. *Procambarus escambiensis* differs from its closest allies in possessing a caudodistally directed mesial process and subacute caudal process.

P. escambiensis is known from a single locality in Alabama—"Escambia River at Flomaton" (Faxon, 1890:621 as *Cambarus barbatus*) and the type-locality in Escambia County, Florida. This species occupies, in Miocene and Quaternary deposits, lentic habitats such as roadside ditches and small ponds where it often burrows (secondary burrower).

Although the species is known from only a single locality in Alabama, a record obtained prior to 1890, it probably should be considered as *special concern* until more extensive field work can be completed in the Escambia and Perdido River drainages.

Procambarus (Ortmannicus) bivittatus Hobbs

Procambarus bivittatus, which exhibits a diagnostic dark band on the dorsolateral aspect of the thorax and also often shows a striking red margin on the forward edge of the outer ramus of the uropod in juveniles, has a rather spotty distribution within its range.

Procambarus bivittatus is characterized as follows: the body and eyes are pigmented and the rostrum is long with convex, subparallel margins which terminate in spines. The areola is very narrow with space for only one or two punctations across the narrowest part. There is a single large, acute cervical spine on each side of the carapace. The suborbital angle is obtuse but prominent, while the postorbital ridges are well developed and terminate cephalically in an acute spine. The antennal scale is very long; the lamellar portion has a three-sided margin. The cephalic portion of the epistome is of moderate width; the epistomal zygoma is broadly rounded along its cephalic margin. The chela is long and narrow with a row of six to eight well spaced, prominent tubercles on the mesial surface of the palm and additional smaller ones scattered over the palm. There are hooks on the ischia of the third and fourth pereiopods. The first pleopod of the first form male terminates in five separate elements with the central projection and caudal process corneous (Fig. 2c). The annulus ventralis contains an elevated oval portion with a shallow sinuate sinus bisecting the sclerite. *P. bivittatus* differs from its closest allies in that the first form male possesses a gonopod with a well developed caudal knob which extends distally to approximately the same level as the caudal process and central projection.

P. bivittatus ranges from Escambia and Santa Rosa counties in Florida (Escambia River drainage), to Washington and St. Tammany parishes, Louisiana (Pearl River drainage). In Alabama, *P. bivittatus* is known from Mobile, Washington, Monroe and Escambia counties. Here the species occupies backwaters and isolated waters of streams as well as deep pools in streams flowing over deposits of Miocene, Pliocene and Quaternary ages.

P. bivittatus is a widespread but uncommon species. Because it is uncommon in the state of Alabama, this crayfish is listed as *special concern*.

Procambarus (Ortmannicus) evermanni Faxon

The body and eyes of *Procambarus evermanni* are pigmented and the rostrum is moderately long and subacuminate with or without marginal spines. The areola is of moderate width possessing three or four punctations across the narrowest part. Cervical spines are usually lacking. The suborbital angle is obtuse while the postorbital ridges are moderately well developed and lack cephalic tubercles or spines. The lamellar portion of the antennal scale has a three-sided margin. The cephalic portion of the epistome is of moderate width; the epistomal zygoma is arched. The chela is long and narrow

with a row of seven to nine well spaced, prominent tubercles on the mesial surface of the palm and additional smaller ones scattered over the palm. Hooks are present on the ischia of the third and fourth pereiopods. The first pleopod of the first form male terminates in five separate elements with the central projection, cephalic process, caudal process and adventitous process corneous (Fig. 2d). The annulus ventralis is situated deep in the sternum, spindle-shaped with an oval, elevated area bisected by a shallow, sinuate sinus. The sternum immediately anterior to the annulus ventralis has several small tubercles. *P. evermanni* differs from its closest allies in possessing a first form male gonopod with the central projection, cephalic and caudal processes tightly appressed and the mesial process extending freely from the other elements.

Procambarus evermanni ranges from Okaloosa County, Florida, to Jackson County, Mississippi. In Alabama, *P. evermanni* is known from a single locality in Mobile County. The species occurs in lotic habitats such as ponds and ditches as well as slowly flowing streams draining deposits of Miocene, Pliocene and Quaternary ages.

In 1942, Hobbs remarked that "*Procambarus evermanni* is one of the least known of the North American crayfishes," and his statement remains apropos today. Although uncommon, this species is conservatively listed as *special concern* until a more concerted effort has been expended toward sampling southern Alabama.

Procambarus (Ortmannicus) lecontei Hagen

First form males of *Procambarus lecontei* have a distinctive gonopod with four separate terminal elements bent at an angle of approximately 90 degrees to the shaft of the appendage.

The following characteristics are typical for this species: the body and eyes are pigmented, and the rostrum is provided with long convex, subparallel margins terminating in marginal spines. The areola is moderately wide with three to five punctations across the narrowest part. There is a single acute cervical spine on each side of the carapace. The suborbital angle is poorly developed and obtuse, while the postorbital ridges are well developed and terminate in an acute spine. The antennal scale is very long; the lamellar portion has a three sided margin. The cephalic portion of the epistome is of moderate width; the epistomal zygoma is arched. The chela is long and narrow with scattered tubercles over the palm and a row of seven to nine well spaced prominent tubercles on the mesial surface. There are hooks on the ischia of the third and fourth pereiopods. The first pleopod of the first form male terminates in four parts with the central projection, cephalic process and caudal process corneous (Fig. 2e). The annulus ventralis is spindle-shaped with a shallow sinus bisecting the sclerite. The sternum immediately anterior to the annulus ventralis exhibits numerous small tubercles and overhangs the annulus.

Procambarus lecontei differs from its closest known allies in the character of the first form male gonopod possessing a cephalic process and central projection that are bent at an angle of approximately 90 degrees to the shaft of the appendage.

P. lecontei ranges from the Pascagoula River system in Stone, George and Jackson counties, Mississippi, to tributaries of the Mobile River and Bay in Mobile County, Alabama. Here the species occupies low gradient streams flowing over deposits of Miocene, Pliocene and Quaternary ages.

This species is known only from a few localities in Mobile County. Because of this limited range in one of the most populous counties in Alabama, *P. lecontei* is listed as *special concern*.

Procambarus (Pennides) clemmeri Hobbs

Procambarus clemmeri like other members of the subgenus *Pennides* exhibits a striking color pattern. The distinct thoracic saddle and red markings on the abdomen are especially noticeable.

The following are characteristics which distinguish this species: the body and eyes are pigmented, and the rostrum is long with convex, subparallel margins terminating in marginal spines. The areola is moderately broad with four to six punctations across the narrowest part. There is a pair of acute cervical spines on each side of the carapace. The suborbital angle is prominent, yet small, while the postorbital ridges are well developed and terminate in an acute spine. The antennal scale is very long and narrow; the lamellar portion has a three sided margin. The cephalic portion of the epistome is of moderate width; the epistomal zygoma is arched. The chela is long and narrow with scattered tubercles over the palm and a row of six or seven well spaced prominent tubercles on the mesial surface. There are hooks on the ischia of the third and fourth pereiopods. The first pleopod of the first form male terminates in five distinct elements with the central projection and caudal process heavily cornified (Fig. 2f). The annulus ventralis is subquadrate in outline with elevated lateral and caudomesial ridges and is bisected by a sinuate sinus. The sternum immediately anterior to the annulus ventralis exhibits a few small tubercles and two large ones which overhang the annulus. *Procambarus clemmeri* differs from its closest known allies in characters of the first form male ganopod among which is a well-developed cephalomesially situated cephalic process (lateral aspect) and caudally directed caudal process.

P. clemmeri occurs in tributaries of the Jourdan River in Mississippi eastward to the Pascagoula (including Escatawpa) River drainage in Alabama. In Alabama the species occupies streams flowing over deposits of Miocene and Pliocene ages.

P. clemmeri is known from a single locality in Alabama, but until more thorough field work has been completed in the southwestern part of the state, this species should be listed as *special concern*.

Procambarus (Remoticambarus) pecki Hobbs

The body and eyes of *Procambarus pecki* lack pigment, and the rostrum possesses straight, subparellel margins with spines. The areola is moderately wide with three

or four punctations across the narrowest part. There are one to three cervical spines present on each side of the carapace. The suborbital angle is obsolete, while the postorbital ridges are weak and terminate cephalically in an acute spine. The antennal scale is moderately broad, and the lamellar portion has a broadly angulate margin. The chela is narrow with two to three irregular rows of tubercles over the mesial surface of the palm and others scattered over the dorsal side. Numerous small setal tufts are also present on the chela. There are hooks on the ischia of the third pereiopods. The first pleopod of the first form male terminates in two distinct parts with the central projection corneous. The elements of the first form male gonopod are bent cephalodistally at an angle of approximately 45 degrees to the shaft of the appendage. The annulus ventralis is elevated and suboval in outline with a median, shallow, longitudinal trough terminating caudally in a short, arclike sinus. The unique gonopod of the first form male of this crayfish with its longer cephalically inclined terminal elements will serve to separate it from any other species.

Procambarus pecki is known from only three localities, all in Alabama—one each in Lauderdale, Colbert and Morgan counties. The species occupies silt bottomed pools in caves draining limestone deposits of Mississippian age.

P. pecki is a phylogenetically important crayfish, the significance of which in the evolutionary study of crayfishes adds credance to the theory that the genus *Orconectes* evolved from a stock of the genus *Procambarus*. With the ranges of *O. australis, C. pristinus, C. obeyensis, C. bouchardi, P. pecki* and an undescribed member of the genus *Cambarus*, together known from the Kentucky, Tennessee and Alabama area, "it seems probable that the centers of origin for *Orconectes, Cambarus* and the Mexicanus Section [= subgenus *Austrocambarus*] of the genus *Procambarus* existed in the area of northern Alabama northward through the limestone belt of Tennessee onto the Cumberland Plateau" (Hobbs, 1967:15).

Despite a relatively wide range this crayfish is very rare and is listed as *special concern*.

Palaemonias alabamae Smalley

The blind shrimp, *Palaemonias alabamae*, is distinguished from its closest ally, *P. ganteri*, "by its smaller size; shorter rostrum; absence of ventral rostral spines (only four of the type series possess ventral spines); fewer number of dorsal rostral spines; greater length of penultimate segment of third maxilliped, which is shorter than the distal segment in *P. ganteri*; and absence of spine on merus of third pereiopod. The exopods and setobranchs of *P. alabamae* have fewer setae than those of *P. ganteri*" (Smalley, 1961:129).

This small crustacean is known with certainty only from Shelta Cave. An additional population of *Palaemonias* from a cave on the Redstone Arsenal, which may belong to this species, is under study.

Palaemonias alabamae occurs in subterranean pools over a silt substrate. It seems unlikely that *P. alabamae* occurs outside its known limited range in Madison County. Longevity and growth rates of this species are unknown, but studies by John and Martha Cooper have shown its reproductive potential to be much smaller than that of epigean shrimps of similar size.

Shelta Cave is currently protected by the National Speleological Society which owns the land upon which the entrances occur, and as long as water quality is maintained in the ground water system, this species is protected. Because of its rarity *Palaemonias alabamae* is listed as *special concern*.

Literature Cited

Bouchard, R. W. in press, Georgraphy and ecology of crayfishes of the Cumberland Plateau and Cumberland Mountains, Kentucky, Virginia, Tennessee, Georgia and Alabama. Part II. The genera *Fallicambarus* and*Cambarus*. In James W. Avault, Jr., editor, Freshwater Crayfish, Papers from the Second International Symposium on Freshwater Crayfish, Baton Rouge, Louisiana, U.S.A. Division of Continuing Education, Louisiana State University.

Cope, E. D. 1881. *Orconectes hamulatus*. *In* E. D. Cope and A. S. Packard, Jr. The fauna of the Nickajack Cave. Amer. Natur. 15:881-882.

Faxon, W. 1884. Descriptions of new species of *Cambarus*, to which is added a synonymical list of the known species of *Cambarus* and *Astacus*. Proc. Amer. Acad. Arts and Sci. 20:107-158.

Faxon, W. 1890. Notes on North American crayfishes, family Astacidae. Proc. U. S. Nat. Mus. 12(785):619-634.

Hagen, H. A. 1870. Monograph of the North American Astacidae. Illus. Cat. Mus. Comp. Zool., Harvard Coll. 3:viii + 109 pp.

Hay, W. P. 1902. Observations on the crustacean fauna of Nickajack Cave, Tennessee, and vicinity. Proc. U. S. Nat. Mus. 25(1292):417-439.

Hobbs, H. H., Jr. 1942. The crayfishes of Florida. Univ. Fla. Publ., Biol. Sci. Ser. 3(2):v + 179 pp.

Hobbs, H. H., Jr. 1945. Two new species of crayfishes of the genus *Cambarellus* from the gulf coastal states, with a key to the species of the genus (Decapoda, Astacidae). Amer. Midl. Natur. 34(2):466-474.

Hobbs, H. H., Jr. 1967. A new crayfish from Alabama caves with notes on the origin of the genera *Orconectes* and *Cambarus* (Decapoda, Astacidae), Proc. U. S. Nat. Mus. 123(3621):1-17.

Hobbs, H. H., Jr. 1971. New crayfishes of the genus *Procambarus* from Alabama and Texas (Decapoda, Astacidae). Proc. Biol. Soc. Washington. 84(11):81-94.

Hobbs, H. H., Jr. 1972. *Crayfishes (Astacidae) of North and Middle America, Identification Manual* 9, x + 173 pp. *In* Biota of Freshwater Ecosystems. U.S. Environ. Protec. Agen., Water Pollut. Res. Cont. Ser.

Hobbs, H. H., Jr. 1975. New crayfishes (Decapoda: Cambaridae) from the southern United States and Mexico. Smithsonian Contrib. Zool. No. 201:iii + 34 pp.

Hobbs, H. H., Jr. and T. C. Barr, Jr. 1960. The origins and affinities of the troglobitic crayfishes of North America (Decapoda, Astacidae). I. The genus *Cambarus*. Amer. Midl. Natur. 64(1):12-33.

Ludke, J. L., M. T. Finley and C. Lusk. 1971. Toxicity of Mirex to crayfish, *Procambarus blandingi*. Bull. Environ. Contam. and Toxicol. 6(1):89-96.

Penn, G. H. 1954. Introductions of American crawfishes into foreign lands. Ecol. 35(2):296.

Schwartz, F. J., R. Rubelmann and J. Allison. 1963. Ecological population expansion of the introduced crayfish, *Orconectes virilis*. Ohio Jour. Sci. 63(6):266-273.

Smalley, A. E. 1961. A new cave shrimp from Southeastern United States (Decapoda, Atyidae). Crustaceana. 3(2):127-130.

Riegel, J. A. 1959. The systematics and distribution of crayfishes in California. California Fish and Game. 45(1):29-50.

Yarbrough, J. E. 1973. An ecological and taxonomic survey of the crayfish of the Tallapoosa and Chattahoochee River drainages in Lee County, Alabama. Unpublished M.S. Thesis, Auburn Univ. viii + 96 pp.

GASTROPODS

CAROL B. STEIN,
Curator of Gastropods,
Museum of Zoology
The Ohio State University
Columbus, Ohio

Cahaba River (Patrick O'Neil)

Acknowledgments

Mr. Leslie Hubricht, malacologist, of Meridian, Mississippi, who probably has done more intensive collecting of Alabama land snails than anyone else now living, participated in the Gastropod Committee meeting at the symposium on March 6-7, 1975. He has provided most of the information on the land snails included in this paper, and also has contributed data on some of the aquatic forms, especially *Horatia micra,* the Manitou Cave Snail.

Dr. John Thurmond, geologist, of Birmingham-Southern College, and Mr. John McCaleb, biologist, of the Tennessee Valley Authority, also participated in the Gastropod Committee meeting and helped to evaluate the status of the species which they had collected. Dr. George M. Davis, Chairman, Department of Malacology, Philadelphia Academy of Natural Sciences, was unable to attend the symposium, but sent a list of *"Goniobasis"* species which he had put together from collecting, examination of museum collections, and the literature. Dr. Alan Solem, Curator of Invertebrates, Field Museum of Natural History, Chicago, provided a list of land snail species from Alabama which he felt could easily be endangered.

Dr. David H. Stansbery, Director of the Museum of Zoology, The Ohio State University, and Dr. Joseph P. E. Morrison, Curator Emeritus of the United States National Museum, patiently helped me work through the tangled nomenclature of the Pleuroceridae — a task which is still far from being completed.

Dr. Marc J. Imlay, of the Office of Endangered Species, U.S. Department of Interior, kindly provided copies of unpublished reports on the status of certain gastropod species by Davis (1974) and Thompson (1975)

This paper would not have been possible without the early collections made by Schowalter, Smith, and others, as well as the analyses of these collections written and published by Clapp, Goodrich, Walker, and others whose works are cited here. They have laid the foundation of our understanding of Alabama's gastropod fauna. It is up to today's generation to build upon this foundation in constructing a more detailed understanding of this fauna, and to preserve as much as possible of it as a heritage for future generations.

Introduction

Timothy Abbott Conrad, best known for his studies of Tertiary fossils, collected and escribed a number of living species, including the remarkable *Tulotoma magnifica.* This species, now evidently extinct, he discovered "occurring in vast abundance on the masses of calcareous rock, which have fallen from the strata above, into the Alabama River at Claiborne."

Isaac Lea, during the 1800's, described hundreds of species of snails and bivalves sent to him by his correspondents in Alabama. Chief among these was E. R. Schowalter, M.D., who lived at Uniontown in Perry County. Schowalter collected mollusks near his home and also from the Coosa River in places where it could be reached by railroad. Samples of his specimens were sent to Lea and became the type specimens of many of Lea's species. Others were sent to John G. Anthony and were described by him. Schowalter maintained an extensive private collection, which for years after his death was stored beneath his cellarless home at Point Clear. The bulk of this collection was salvaged, some of it scooped up with a shovel, through the efforts of Dr. Eugene A. Smith, who placed it in the Alabama Museum of Natural History.

According to Goodrich (1944c), at least ten men, but probably no more than thirteen, collected mollusks in the Coosa River system up to the present century.

In 1903 Herbert H. Smith began to collect the land and freshwater mollusks of Alabama. His field work in the state continued until his death in 1919, and was so competently done that Walker was able to write in 1928: "I doubt whether any other state in the Union has been worked more thoroughly and systematically than Alabama, by Mr. Smith's assiduous collecting. He not only personally collected over a very large part of the state, both north and south, but through local collectors, many of them trained by him, he reached into many localities that he did not personally visit."

Smith's extensive collections formed the basis of Bryant Walker's 1928 monograph of the land snails of Alabama, as well as Calvin Goodrich's many papers on the aquatic mollusks of the Coosa, Cahaba, and Alabama river system, and several papers by George H. Clapp.

The studies of these researchers firmly established Ala-

bama's reputation among malacologists as a state endowed with a great natural heritage of molluscan diversity. Probably no state in the nation had such an extensive endemic freshwater gastropod fauna as Alabama, or has had so much of its native fauna extinguished so rapidly as Alabama during the first half of the twentieth century.

The Coosa River, according to Goodrich (1944a), "had more endemic molluscan genera and species than any other in North America. The colonies were often huge. . . . It seems likely that some, if not most, of the strange races are wholly gone. For the waters have backed up behind great dams, miles of reefs are covered, and formerly quiet reaches between rapids have been expanded into silt-accumulating lakes. At the foot of the lowermost dam are remains of the old Wetumpka rapids, but I have been told that ten to fifteen feet of water rush over them in the hours that the dynamos are operating. Moreover, upstream sections which once ran clear, Rome to Cedar Bluff, for example, are turbid with field wash, even in a dry August, and one gets specimens, if any, by feeling for them."

As one of the first malacologists to make the great diversity of Alabama snails known to science, Goodrich was also one of the first to call attention to the habitat destruction which destroyed so many of the state's endemic aquatic species. In his last review of the Coosa River basin Pleuroceridae (1944c), he stated, "Great populations of the gastropods have been destroyed and it is very likely that entire races have been wiped out as well. It seems fitting to review this molluscan fauna if only as a sort of autopsy. Besides being the richest of its kind in forms and numbers of individuals, that fauna embodied an endemic genus [*Apella*] and, shells of tributaries included, nearly fifty endemic species [of Pleuroceridae]."

In 1959 Dr. Paul F. Basch and Dr. John B. Burch visited the Coosa River in search of pulmonate snails of the endemic genera *Amphigyra* and *Neoplanorbis,* but no specimens of either genus could be found (Basch, 1959).

Herbert D. Athearn, a very capable collector from Cleveland, Tennessee, has done extensive work in the streams of Alabama during the past three decades. He called the destruction of the Coosa River and its molluscan fauna to the attention of malacologists in 1964, and again pointed out the changes and reductions in America freshwater molluscan populations in 1967. In the latter paper he observed that a consideration of the rare and endangered mollusk species in the planning of impoundments could have resulted in modification of the project design so as to save the endemic fauna while still achieving the purpose of the project. He states (1967) "Several species of rare mollusks, one of which is *Tulotoma magnifica,* the large viviparid gastropod with bands of prominent tubercles, were destroyed in the lower section of Choccolocco Creek in Talladega County, Alabama, when it was inundated by the impounding of Coosa River waters behind Logan Martin Dam. Some of these species do not live in Choccolocco Creek above the present reservoir. It appears possible that this creek could have been diverted at a point above its mouth, to flow southward to enter the Coosa below the dam. A great stream which contained an extraordinary amount of endemic plant and animal life would have been preserved."

In 1965 Athearn wrote to Clench (1965): "This past Tuesday I returned to the Coosa to examine the 'progress' on the new Lock 3 Dam. Water has now been raised about 20 feet at its base and this has been sufficient to inundate all the remaining shoals that we have known as 'Ten Island Shoals.' My main work, however, on this day was to do some final collecting on Big Canoe Creek. This stream will be completely inundated by Lock 3 Dam for about one-half mile above Williams. The stream contains such species as *Tulotoma magnifica* and *Apella pyramidatum* in large numbers. Hundreds of live specimens of the latter species were taken as well as several dozen more live *Tulotoma,* probably for the last time here."

The Tennessee River system, which drains a good portion of northern Alabama, also has been well-known for its many endemic gastropod species. Some of these forms were restricted to the shoals of the main river and evidently have become extinct with the impoundment and pollution of their habitat. A few, such as the spectacular *Io fluvialis,* have apparently been extirpated from the main river but still survive as relict populations in a few of the major tributaries which are still in relatively natural condition above the impoundments (Athearn, (1967; Sinclair, 1969).

Alabama's land snails have been systematically collected and studied in recent years by Leslie Hubricht, who published a list of species with new county records in 1965, supplementing the data given by Walker in his 1928 monograph.

In general, it appears that most of the land snails of Alabama are less endangered than the riverine species. This is chiefly because most of them are less restricted to a narrow range. The total range of a land snail is not usually altered by any one development, and small areas of habitat often remain to shelter relict populations of land snails even in strip-mined countryside. In contrast, a river habitat, which has remained relatively constant for eons during the evolution and adaptation of its endemic biota, can be totally altered beyond the ability of these species to survive and reproduce in it, by a single man-made modification. The riverine species cannot migrate across divides to new habitats, except in rare cases of stream capture. If they cannot adapt to the new environmental conditions, they die.

A few Alabama streams appear to have remained in relatively natural condition and still serve as refugia for what remains of the state's unique fauna of aquatic gastropods. The Cahaba River above Centreville probably supports the greatest diversity of endemic molluscan species. Some of the tributaries of the Coosa River, such as Choccolocco Creek, above their flooded mouths, reportedly still have relict populations of some of the endemic Coosa drainage species which were not restricted

to the main stream of the river. The Choctawhatchee River near Geneva currently supports the world's only known population of *Oxytrema clenchi*.

If these streams can be given protection against further degradation of their natural conditions, perhaps some of the rare endemic species of gastropods and other forms of aquatic life they support may continue to survive and reproduce, maintaining seed populations for the future.

Despite the extensive studies made in the state during the early 1900's, recently published data on the present distribution and abundance of Alabama's freshwater gastropods is very incomplete. A thorough and systematic study of all the streams and lakes in the state must be undertaken by carefully-trained collectors in order to obtain adequate population samples of all species which still occur in each of these habitats. The samples must be analyzed by specialists in the different taxa so that the taxonomic problems in each of the various families can be worked out. Then, and only then, Alabama can have an accurate, realistic evaluation of its gastropod fauna.

In addition to a systematic and zoogeographic study, much work is needed to obtain information on the life history, behavior, population structure, ecological tolerance, and other information for each of the endangered and threatened forms if action is to be taken to assure their continued survival.

In the present paper, no species have been assigned to distinct categories of "Threatened," "Endangered," etc., because it is believed that all of the forms included are in danger of becoming extinct if present trends continue. Some of them are almost certainly extinct now. The absence of adequate data on the present abundance and distribution of most of these species precludes any definitive evaluation of their current status. I have attempted to present all the available evidence concerning the present status of the species in each discussion. It is up to the reader to decide which category best fits the evidence.

Common names, generally based on translations of the scientific names, have been provided for the various species. However, these animals are not commonly known to the public by any specific common names. The scientific name, complete with author and date of description, forms the best basis for communication about the species. It is unfortunate that the limitations of time and space prevent the inclusion of a full synonymy in this paper.

LAND SNAILS

Family Pupillidae—The Pupa Snails

Alabama Vertigo

Vertigo alabamensis alabamensis Clapp, 1915

This small species was found by H. H. Smith in 1909 "Among rotting leaves in a ravine near junction of North River with Black Warrior, Tuscaloosa Co., Ala." (Clapp, 1915). It is not known from any other locality. Hubricht (pers. com., 1975) has looked for it in the original locality, but did not find it there. The type locality is now flooded by an impoundment on the Black Warrior River.

Conecuh Vertigo

Vertigo alabamensis conecuhensis Clapp, 1915

This subspecies, described from Evergreen, Conecuh Co., Alabama, has been found by Hubricht (1965) in Chilton and Geneva counties. It may be more widespread than the present records indicate, for it is small and easily overlooked.

Family Valloniidae—The Valley Snails

Thin-lipped Valley Snail

Vallonia perspectiva Sterki, 1892

The type specimen of this species was taken at Woodville, Jackson Co., Alabama, by H. E. Sargent. According to Hubricht (pers. com., 1975), this is the only *Vallonia* of any species which has ever been collected in Alabama. *V. perspectiva* "is generally spread in snail country of the southern half of New Mexico and Arizona, but is more local in the northern parts of these states. East of the [Rocky] mountains it occurs sparsely northward into North Dakota. Its distribution in the southeastern states is still quite imperfectly known; specimens and records from east of the Mississippi are remarkably few and scattered. It may occur on the coastal plain from Florida and Georgia to southern New Jersey, but evidence of its presence there is still wanting" (Pilsbry, 1948). The species is also recorded from Mexico and from Virginia northwest to Minnesota.

Family Zonitidae—The Zonitid Snails

Peck's Cave Snail

Glyphyalinia pecki Hubricht, 1966

This species was described from McClunney (= Alabama Crystal) Cave, 2 miles west of Clay, Jefferson Co., Alabama. It has also been taken in another cave ¾ mile northeast of the type locality, but to date has not been found anywhere else.

Blue Ridge Snail

Vitrinizonites latissimus (Lewis, 1875)

Vitrinizonites is widely distributed in the Great Smoky Mountains at elevations above 2,000 feet, though it does not occur in great numbers. It is restricted to moist places where moss carpets the rocks or logs, according to Pilsbry (1946). The only known Alabama record is Pilsbry's (1946) citation of a collection made by H. B. Baker in the hills around Gurley, Madison Co. However Hubricht (1965) says "Pilsbry's record of this species from Madison County is erroneous according to H. B. Baker. It is very doubtful if this species occurs in Alabama."

Family Polygyridae—The Polygyrid Snails

Umbilicate Forest Snail

Allogona profunda (Say, 1821)

Widely distributed in the northern states from New York to Minnesota and Nebraska, this species is known in Alabama only from two localities in Jackson County. It is believed to be a Pleistocene relic in this state, where Walker (1928) has reported it from Princeton and Stevenson.

Banded Mesodon

Mesodon clausus trossulus Hubricht, 1966

Only about a dozen specimens of this recently-dis-

covered species are known. It has been collected at the base of a bluff along Bailey's Creek, 2.5 miles east of Gainestown, Clarke Co., Alabama, the type locality, and from another location about a mile away. Hubricht (pers. com., 1975) believes it may be a distinct species.

Talladega Stenotreme
Stenotrema brevipila brevipila (Clapp, 1907)

Archer, in his 1948 monograph of the land snails of the genus *Stenotrema* of the Alabama region, says: "This species occurs in the Talladega Range, extending from about the area of Cheaha State Park northeastward into Georgia where the Etowah River Valley divides it from the related species, *S. cohuttense*. H. H. Smith, who first collected the species, gave the type locality as 'Horseblock Mountain,' a name rarely used to designate Mount Cheaha. In fact the name, Horseblock, is apt to be confused with another Horseblock Mountain in the same county, where *S. brevipila* has never been found, and in any event the county designation [Talladega] is wrong. The following localities are recorded for this species: The west slope of Mount Cheaha, Cleburne County, Alabama, Alabama Museum Expedition of 1940; A. F. Archer, 1947. This is the true *type locality*. Indian Mountain, Cherokee County, Alabama, abundant (170 specimens), Archer, 1938. Pleasant Gap, Cherokee County, Alabama, and Floyd County, Georgia are also recorded (Pilsbry 673). . . . An obligatory rupicole, this species ranges between 1000 and 2000 feet elevation. It inhabits the rock slopes of mature mountains, particularly congregating in shallow ravines in oak-hickory and oak-pine cover and even in pure pine on west-facing slopes. The snails burrow deeply in quartzite talus, under rocks, in leaf mold on rocky ground, and in pine-straw carpet." This endemic species of northeast Alabama and northwest Georgia is included here because of its restricted geographic and ecological distribution, though it may not be in danger of extinction at present.

Cherokee Stenotreme
Stenotrema brevipila cherokeensis (Clapp, 1916)

Walker (1928) follows Clapp in considering this dwarf form a subspecies of *brevipila*, but Pilsbry (1940) and Archer (1948) lump it into the synonymy of the main species. This form was described from "near Pleasant Gap, Cherokee Co., Ala., 'in a shady but dry ravine on the mountain side, about 1200 ft. generally under stones.'" A single specimen was found near Cave Spring, Floyd Co., Georgia, about 20 miles northeast of the Alabama locality. Its taxonomic status should be re-examined.

FRESHWATER SNAILS

Family Viviparidae—The Live-bearing Snails

Choctawhatchee Lioplax
Lioplax pilsbryi choctawhatchensis Vanatta, 1935

This subspecies is confined to the Choctawhatchee River from the area around Geneva, Geneva Co., Alabama, downstream to Westville, Florida, according to Thompson (1975). Clench and Turner (1956) consider this subspecies invalid, but recent studies by Thompson and Heard indicate that it is distinct and deserving of recognition as a taxonomic entity (Thompson, 1975).

Cylindrical Lioplax
Lioplax cyclostomaformis (Lea, 1841)

The Coosa-Alabama River system constitutes virtually the entire known range for this species (Clench and Turner, 1955; Clench, 1962b). Specimens reported as *cyclostomaformis* from the Flint River by Call (1894) have since been described as *Lioplax pilsbryi* Walker, 1905. The only known record for *L. cyclostomaformis* outside Alabama River system is the Tensas River, 6 miles east of Delhi, Madison Parish, Louisiana (Clench, 1962b). The existence of this disjunct population should be verified. The drastic modifications of environmental conditions which have occurred and are continuing to occur in the Coosa-Alabama River system have greatly reduced the abundance of this species, and if the trend continues it may well become extinct.

Call (1894) observed: "Its habitat in the Cahaba and Coosa rivers, where we collected it in very large numbers, is very interesting and peculiar. It was found buried in the mud under large, flat rocks, from under a single one of which it was sometimes possible to take 300 or more examples! It occurred rarely in the Black Warrior at Tuscaloosa. Unlike the northern shell many specimens were obtained in certain small creeks but always under conditions similar to those which obtained in the Cahaba."

Davis (1974) and his colleagues searched for this species in the Coosa River and its tributaries, but did not find it anywhere there. However, they did find specimens in the Cahaba, and believe that the species is not endangered so long as the Cahaba River is not impounded or polluted. According to Davis (1974), this species is not now found in the Alabama River. Its status in the Black Warrior and Tombigbee rivers is not known and should be investigated.

Alabama Live-bearing Snail
Tulotoma magnifica (Conrad, 1834)

Clench (1962a) has given the following account of this spectacular endemic Alabama snail, which now stands at the very brink of extinction:

> *Tulotoma magnifica* is limited to the Coosa-Alabama River system in Alabama. This species prefers rocks and rock ledges and at one time probably lived throughout much of this river system wherever suitable conditions occurred. Heavy silting in this river during the past century has killed most of the populations of this species. Dr. van der Schalie and I failed to find it at Claiborne in 1933, at the type locality where Conrad found it "occurring in vast abundance on the masses of calcareous rock, which have fallen from the strata above into the Alabama at Claiborne.
>
> It is impossible to say that its former distribution included the large tributaries of the Coosa-Alabama system, that is, the Tombigbee and Black Warrior Rivers. Specimens of *Tulotoma magnifica* have been found in Indian burial sites at Moundville on the Black Warrior, but these burial sites also contained

Io fluvialis Say, a genus occurring only in the Tennessee River system from Bridgeport, Alabama and north into its various tributaries. These Moundville specimens of *Tulotoma* may well have been items of trade as was the case with *Io*.

Different populations of *Tulotoma* have been given four different species names. Some workers (e.g. Heard, 1970; Davis, 1974) have recognized several of these as taxonomically distinct; others (e.g. Clench, 1962a) have lumped them all into one species, *T. magnifica*. All populations of *Tulotoma* have suffered so much loss of habitat that they are now either extinct or nearly so. In 1933 Clench searched the type locality on the same rocks mentioned by Conrad, but failed to find any *Tulotoma* (Clench, 1965b). The Ohio State University Museum of Zoology has *Tulotoma* specimens collected by Herbert D. Athearn from Big Canoe Creek in 1956, before the inundation of the site by Lock 3 dam on the Coosa River; from lower Choccolocco Creek in 1963 before the site was flooded by Logan Martin Dam (Athearn, 1967) and from Kelly Creek in 1962. Davis (1974) searched the Coosa below dams when the electrical facilities stopped operating, but did not find any *Tulotoma*. He reports that Athearn, who has extensively collected in the Coosa system, now believes *Tulotoma* is extinct. There is a slim possibility that a few specimens may still survive in Choccolocco Creek or in the Coosa River near Wetumpka.

Family Pilidae—The Hard-Hat Snails

Everglade Kite Snail

Pomacea paludosa (Say, 1829)

Widely distributed throughout all of central and southern Florida in rivers, lakes, ponds, and even roadside ditches, this large snail is generally restricted to large springs and spring-fed creeks in the northern part of its range (Clench and Turner, 1956). It once existed in southeastern Georgia as far north as the lower Altamaha River, but recent collections indicate that it no longer extends so far north. Heard (1970) says the species occurs in southern Alabama, as well as in southern Georgia and throughout Florida. This snail is of special concern because it is the sole source of food for the Florida Everglade Kite, also known as the Florida Snail Kite, *Rosthrhamus sociabilis plumbeus* (Ridgeway), a species now on the United States List of Endangered Native Fish and Wildlife (Federal Register, 38 (106) June 4, 1973).

Destruction of the snail's habitat by drainage, resulting in frequent drought and fire, has seriously diminished the natural range of this species, and reduced the food supply available to the Florida Everglade Kite (Heard, 1970; Office of Endangered Species, 1973). The status of this species in Alabama should be investigated and efforts should be made to protect the natural condition of any habitat where surviving populations are found.

Family Lepyriidae—The Scale Shells

This family, wholly endemic to Alabama, contains only one genus and species: *Lepyrium showalteri* Lea, (1861 b). These small freshwater snails originally were considered to be members of the family Neritidae, but Pilsbry and Olsson (1951) recognized that the characters of the radulae and operculae indicated a closer affinity with the Hydrobiidae, and they proposed a new family, Lepyriidae, for these snails. Morrison (pers. com., 1967) considers that these snails should be grouped in the subfamily Hydrobiinae of the family Hydrobiidae.

Coosa Scale Shell

Lepyrium showalteri showalteri (Lea, 1861)

The original specimens of this form were collected 10 miles above Fort William, Shelby Co., Alabama, in the Coosa River (Dall, 1896). This nerite-like shell lived clinging to stones in rapid current, according to Pilsbry and Olsson (1951). Impoundment of the Coosa River, resulting in the elimination of such habitat, evidently has caused the extinction of this subspecies. No recent records of this form are known, and there are no known records outside the Coosa River.

Cahaba Scale Shell

Lepyrium showalteri cahawbensis Pilsbry, 1906

This subspecies is endemic to the Cahaba River, and is now believed to have been eliminated from much of its former range in this stream because of pollution and other habitat alterations. According to Hubricht (pers. com., 1975), a population of this form still survives in the Cahaba River north of Centreville. Protection and restoration of the Cahaba as a natural stream would help to ensure the survival of this unique snail as well as a number of other vanishing endemic Alabama mollusk species which still survive in this river.

Family Hydrobiidae—The Hydrobiids

Cahaba Hydrobiid

Clappia cahabensis Clench, 1965a

In 1964 this small species, only three millimeters long, was discovered first on a rock in the Cahaba River 1 mile north of Centreville, Bibb Co., Alabama. No other specimens are known. The species is evidently endemic to the Cahaba, which also supports what is probably Alabama's richest remaining assemblage of endemic freshwater mollusks. Protection of this river in its natural state is essential if these species are to be saved from extinction.

Clapp's Hydrobiid

Clappia clappi Walker, 1909

Known only from the Coosa River at Duncan's Ripple, The Bar, and Higgins Ferry, all in Chilton County, and at Butting Ram Shoals in Coosa County (Clench, 1965a), this species is probably now extinct because of the destruction of the Coosa River shoals by impoundment of the river since 1909. Goodrich (1944a) considered this species a synonym of *Somatogyrus umbilicatus* Walker, 1904. However, Clench (1965a) considers *Clappia clappi* to be a distinct species in a distinct genus.

Manitou Cave Snail

Horatia micra (Pilsbry and Ferriss, 1906)

The first specimens of this species were discovered as dead shells, possibly fossil, in drift debris of the Guadelupe River at New Braunfels, Texas, in 1903. A living population was discovered by Hubricht many years later

in the stream in Manitou Cave, Ft. Payne, DeKalb Co., Alabama. This is the only known living population of the species.

When Hubricht first visited Manitou Cave, the snails were living on rocks in the stream. When he returned later, the stream had been "cleaned up," and the essential substrate for the animals had been almost completely removed. Only a very few snails were found (Hubricht, pers. com., 1975). Thompson (1975) observes that the commercialization of the cave has caused the snail population to decline, probably due to the reduction of the bat population. The bat guano, he states, was a source of food for the snails. It is possible that restoration of the cave and stream to their natural condition, with a reduction in visitation and encouragement of the bat population, could also re-build this unique snail population.

Olive Hydrobiid

Marstonia olivacea (Pilsbry, 1895)

Professor H. E. Sargent discovered this species in Huntsville, Alabama, and wrote to Pilsbry: "In April, I visited the original locality . . . and was surprised to find this species in vast numbers. The stream has a mud bottom which is much indented with cow tracks. In these the Amnicola had congregated—not as a layer on the surface, but as a solid mass. To get an idea of how many there were I scooped up the contents of three holes, and after washing them thoroughly, found I had a full quart of the living animals. There must have been bushels of them in the few rods of stream which I inspected. The stream receives some of the city sewerage, so it is probably a good feeding-ground." (Sargent, 1894).

The type locality has probably been destroyed by the growth of Huntsville, but a search should be made in the vicinity to determine whether *M. olivacea* still survives. Goodrich (1944a) wrote that it was "somewhat common in streams and springs in and about Huntsville, Madison County, Alabama, drained by the Tennessee River." Thompson (1975) says the species has been found in Big Spring Creek, but on field trips he has made from 1968 to 1975 he failed to find it there. "If it still survives," he states, "it is confined to Big Spring Creek in the Redstone Arsenal, Huntsville, Alabama."

Thick-shelled Marstonia

Marstonia sp.

This recently-discovered and still-undescribed hydrobiid is confined to the lower two miles of Limestone Creek and Piney Creek, which flow into Wheeler Reservoir of the Tennessee River in Limestone County, Alabama, according to Thompson (1975). It is considered to be endangered because of its extremely restricted distribution.

Golden Hydrobiid

Somatogyrus aureus Tryon, 1865

Goodrich (1944a) reports this species "In the Coosa River bordering St. Clair and Talladega Counties, Alabama. Shells referable to the species have been taken in Kelly's Creek, St. Clair County, not far from the mouth, and in the upper part of Yellowleaf Creek, Shelby County." The present distribution of this species is not known.

Constricted Hydrobiid

Somatogyrus constrictus Walker, 1904

"Specimens, few in number, were found by Hinkley in the Coosa five miles above Wetumpka, and also at Wilsonville, Shelby County. He wrote that occurrence was 'on the under side of the rocks associated with *S. coosaensis* and *S. hinkleyi,* very seldom more than one on the same rock' " (Goodrich, 1944a). Its present distribution is not known; it may be extinct due to modification of the natural conditions in the Coosa River.

Coosa Hydrobiid

Somatogyrus coosaensis Walker, 1904

"The range in the Coosa is from two miles above Slackland, Cherokee County, Alabama, to Wetumpka, Elmore County. It was taken plentifully in creeks of St. Clair, Shelby and Talladega counties, but appears to have been a rarity in Waxahatchee Creek, farther downstream" (Goodrich, 1944a). Its present distribution is unknown. Impoundment of the Coosa River has probably eliminated it from the main river, but perhaps some creek populations may yet survive.

Thick-shelled Hydrobiid

Somatogyrus crassus Walker, 1904

Goodrich (1924a) notes that this snail was found in the Coosa River "rapids of Elmore, Chilton and Coosa counties, and unknown to side streams. It is the dominant species of the group at Wetumpka, at the Falls Line." This species may well be extinct, since it evidently was restricted to the main stem of the Coosa River. Possibly some specimens may yet survive below the dam at Wetumpka.

Deceptive Hydrobiid

Somatogyrus decipiens Walker, 1909

Coosa River at The Bar, Chilton County, Alabama, is the type locality for this species. It was also taken from the Coosa at Cedar Island, Butting Ram Shoals, Higgins Ferry, Duncan Riffle, and other rapids in Coosa and Chilton counties. Goodrich (1944a) noted "It is rare on Fort William shoals, farther upstream and seemingly is absent at Wetumpka." Its present status is unknown. As it evidently has not been found outside the main stream of the Coosa River, it probably is now extinct.

Henderson's Hydrobiid

Somatogyrus hendersoni Walker, 1909

Goodrich (1944a) reports that this species was found by Smith at four sites in the Coosa River rapids in Coosa and Chilton counties. No recent records of this species are available, and it is presumed to be extinct because of the impoundment of the Coosa River.

Hinkley's Hydrobiid

Somatogyrus hinkleyi Walker, 1904

Walker (1904) published records of this species from the Coosa River at Wetumpka, Alabama (the type locality), five miles above Wetumpka, Wilsonville and Fort William Shoals, and from the Tallapoosa River at Tallassee, Alabama. Goodrich (1944a) observed that the

species occurs in many of the tributary streams. Its present distribution is not known, but perhaps some of the tributaries of the Coosa still have living populations.

Dwarf Hydrobiid
Somatogyrus namus Walker, 1904

This Coosa River species reportedly ranged from Ten-Acre Islands, Etowah Co., Alabama, downstream to Wetumpka (Goodrich, 1944a). Weogufka Creek, of Coosa County, is the only tributary stream from which it is known. Hinkley (in Goodrich, 1944a) found the species in the "open" and "showing very plainly through the clear water, but owing to the swift current it was difficult and tedious collecting them." The present status of this species is unknown, but it is presumably absent from the Coosa proper. Tributaries such as Weogufka Creek may still harbor living populations.

Obtuse Hydrobiid
Somatogyrus obtusus Walker, 1904

"Smith collected more than a thousand examples in Upper Clear Creek, Talladega County, Alabama, and others in several neighboring side-streams. The range in the [Coosa] river itself is apparently from Center Landing, Cherokee County, to the Coosa-Chilton counties shoals" (Goodrich, 1944a). This Coosa drainage species has no affinities closer than a form taken in Arkansas, according to Goodrich (1944a). Its present status is not known, but some tributary streams may support remnant populations.

Pilsbry's Hydrobiid
Somatogyrus pilsbryanus Walker, 1904

This species was discovered by Hinkley in the Tallapoosa River at Tallassee, Alabama, the type locality. Walker (1904) noted "It occurred quite abundantly and is a well marked and distinct form." It evidently did not occur in the Coosa, as it is not mentioned by Goodrich (1944a). Its present status is unknown.

Pygmy Hydrobiid
Somatogyrus pygmaeus Walker, 1909

About 25 specimens of this diminutive species were taken by Smith at The Bar, Chilton County, in the Coosa River. According to Goodrich (1944a), no other specimens of this species are known. It may well be extinct.

Sargent's Hydrobiid
Somatogyrus sargenti Pilsbry, 1895

H. E. Sargent (1895) found this species "in considerable numbers, twenty miles northeast of here [Woodville, Alabama] in a spring, tributary to Mud Creek, which is in turn tributary to the Tennessee River. It is found attached to the dead leaves. . . . " Its current status and distribution are unknown.

Family Pleuroceridae—The River-snails

The Coosa Slit-shells
Genus *Apella* "Mighels" Anthony, 1843

This unusual genus is wholly endemic to the Coosa River, where it often occurred in great numbers in the swift water and heavy currents of the main channel rapids. Goodrich, whose 1924 monograph is still the most comprehensive treatment of the genus, stated that it has not been found even within the mouths of creeks flowing into the Coosa. There are records for various species of *Apella* from Wetumpka upstream to Lock 2 in St. Clair County.

Since the Coosa River rapids have been either submerged in slack-water reservoirs behind power dams or subjected to enormous fluctuations in water flow below these dams, it is highly probable that this endemic Alabama genus is wholly extinct today.

As explained by Turner (1946), the generic name *Schizostoma* Lea, 1843, is a homonym and cannot be used for this genus. The manuscript name *Apella* of Mighels was published by Anthony (1843), and hence must replace *Gyrotoma* Shuttleworth (1845). The following list of the species and their recorded distribution is compiled from Goodrich's 1924 publication. No living specimens of *Apella* are known to have been found since the construction of the Coosa River dams.

Alabama Coosa Slit-shell
Apella alabamensis (Lea, 1860)

This species ranged from Peckerwood Shoals, Talladega County, to Duncan's Riffle, Chilton County.

Large Coosa Slit-shell
Apella ampla (Anthony, 1860)

The range of this species was in the Coosa River from Three-Island Shoals to Peckerwood Shoals.

Babylon Coosa Slit-shell
Apella babylonica (Lea, 1845)

This species, considered unidentifiable by Goodrich (1924), was described from a single broken and deformed shell, supposedly from Tuscaloosa.

Carinate Coosa Slit-shell
Apella carinifera (Anthony, 1860)

This species is known only from Fort William Shoals, where it survived as recently as 1914.

Cylindrical Coosa Slit-shell
Apella cylindracea (Mighels, 1844)

Mighels gave Warrior River, Alabama, as the type locality for this species. Mighels' types were destroyed by fire, and Goodrich concluded that the species is unidentifiable.

Excised Coosa Slit-shell
Apella excisa (Lee, 1843)

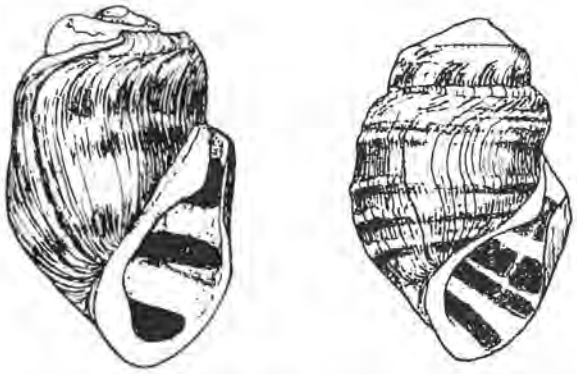
This species had the longest range of all the *Opella*, extending from Three-Island Shoals downstream as far as Wetumpka.

Henderson's Coosa Slit-shell
Apella hendersoni ("Smith" Goodrich, 1924)

The only known locality for this species is Fort William Shoals, Talladega County, where it lived as recently as 1914.

Incised Coosa Slit-shell
Apella incisa (Lea, 1843)

The distribution of this species was from Weduska Shoals, Shelby County, to Wetumpka.



Apella incisa (left); *Apella spillmani* (right), after Goodrich, 1924.

Laciniate Coosa Slit-shell
Apella laciniata (Lea, 1845)

This species has been recorded from Fort William Shoals, Talladega County, to Wetumpka.

Lewis' Coosa Slit-shell
Apella lewisi (Lea, 1869)

This species was collected on Fort William Shoals. Wilsonville, which Goodrich says "would seem to be on or within touch of Three-Island Shoals," was also given as a locality for this form by Hinkley (1904).

Pagoda Coosa Slit-shell
Apella pagoda (Lea, 1845)

The known range for this species was from The Bar, Chilton County, to Wetumpka.

Pyramidal Coosa Slit-shell
Apella pyramidata Shuttleworth, 1945

This species extended farther upstream than any other *Gyrotoma,* ranging from Hall's Island, Talladega County, upstream to Lock 2, St. Clair County. Goodrich (1924a) considers Shuttleworth's record for "near Wetumpka" to be an error.

Little Coosa Slit-shell
Apella pumila (Lee, 1860)

This species occurred in the Coosa from Weduska Shoals to Wetumpka.

Spillman's Coosa Slit-shell
Apella spillmani (Lea, 1861)

Peckerwood Shoals and "Coosa River, Shelby County, Ala." are the only known localities for this species.

Walker's Coosa Slit-shell
Apella walkeri ("Smith" Goodrich, 1924)

The known localities for *walkeri* were Weduska Shoals, Shelby County; The Bar, Cedar Island, Higgin's Ferry, and Duncan's Riffle, all in Chilton County; and Butting Ram Shoals, Coosa County.

Genus *Athearnia* Morrison, 1971—Athearn's River-snails

Morrison (1971) proposed the name *Athearnia* as a replacement for the name *Eurycaelon* Lea, 1864, whose type species *Goniobasis umbonata* Lea, 1864, (designated by Nevill, 1885) is biologically a *Pleurocera*. Two species are recognized in the genus *Athearnia* by Morrison: *Anculosa anthonyi* Redfield, 1854, the type-species, and *Anculosa crassa* Haldeman, 1842.

Anthony's River-snail
Athearnia anthonyi (Redfield, 1854)

In Alabama, this species was collected from the Tennessee River at Bridgeport and Florence prior to the construction of the TVA dams. Other localities where it once occurred include the Tennessee River at Knoxville and Loudon; Sequatchie River at Jasper; Little Sequatchie River at Sequatchie, Battle Creek at Ketchall; Little Tennessee River, probably near its mouth; and French Broad River near its mouth, all in Tennessee (Goodrich, 1931). Herbert Athearn found living specimens in South Chickamauga Creek, 7 miles NNW of Ringgold, Catoosa Co., Georgia, on May 16, 1960 (Morrison, 1971). Impoundment of the Tennessee has eliminated the main river habitat of this species. It is possible that a careful search of the tributary streams may reveal one or more relict populations of *anthonyi,* but at present it appears to have been extirpated from Alabama and to be virtually extinct throughout its former range.

Genus *Io* Lea, 1831—The Spiny River-snails

Spiny River-snail
Io fluvialis (Say, 1825)

The genus *Io,* which includes the largest and most spectacular of the North American Pleuroceridae, is wholly endemic to the rock ledges and swift water of the bars and shoals of the upper Tennessee River system. It reached its downstream limits in Alabama. Adams (1915) collected it "On the Widows Bar, 4 or 5 miles above the town [of Bridgeport]. I was told that the Government officials had blasted out this bar about three years previously. A single live specimen and the last live shell that I found was taken October 26, 1901. It gives the downstream limit of live *Io* in my collecting." Adams also mentions his efforts to find *Io* farther downstream in the Tennessee River and in the shell mounds bordering it, but without success. However, one additional live-collected specimen was found in the Tennessee River at

Io fluvials. Drawn by John J. Jenkins.

the foot of Muscle Shoals by A. A. Hinkley on November 10, 1904. This shell represents the downstream known limit of *Io*, and at the same time its extreme western limit, according to Adams (1915).

Genus *Leptoxis*—The Round River-snails

As pointed out by Pilsbry (1917) and again by Morrison (1954), the oldest available name for the genus typified by *Melania praerosa* Say, 1824, is *Leptoxis* Rafinesque, 1819, and not *Anculosa* Say, 1821.

Between the years 1901 and 1918, prior to the impoundment of the Coosa River, Mr. Herbert H. Smith collected these snails at many places in the Alabama River system. Unfortunately, he died before completing his paper on the results of his studies. Mr. Calvin Goodrich of the University of Michigan obtained Smith's material and monographed the genus in the Alabama River system in 1922. As he noted,

> The Anculosae [*Leptoxis*] of the Alabama River system represent a distinct section of the genus. No species of *Anculosa* [*Leptoxis*] within the drainage occurs also without it. No species which is spoken of as an Atlantic, Ohio, a Cumberland or Tennessee form occurs within it.
>
> . . . This is the more remarkable because there has been an interchange of stream flow through piracy between the Tennessee tributaries and the Conasauga, and opportunities for the transfer of species, other than by means of stream capture, must have occurred repeatedly farther to the west. A glance at the map will show that Wills Creek and Little River of the Coosa today very nearly touch Lookout Creek of the Tennessee. The latter is known to be inhabited by a typical Tennessee *Anculosa* [*Leptoxis*]. Branches of Black Warrior River, belonging to the Alabama system, and Flint Creek of the Tennessee, both having Anculosae [*Leptoxis*] come within a little distance of each other. If the means of dispersal such as carriage by birds, mammals, wind, tornadoes and such floods as on a plateau bring streams of different drainage systems together—if such means were operative in the case of the Anculosae [*Leptoxis*] the forms of the Alabama and Tennessee rivers would long since have mingled. This study has made plain that intermingling has not taken place in recent geological time.

In 1922 Goodrich recognized 26 species of this genus, all endemic to the Alabama River system. Of these, 12 were described as new to science. In 1941 he relegated three of the new species to the synonymy of others, leaving 23 endemic species which he considered valid. Two of these, *melanoides* (Conrad, 1834) and *compacta* (Anthony, 1854), may properly be grouped with other genera when further evidence becomes available. Goodrich (1944c) re-interpreted the relationships of some of the species of *"Anculosa,"* believing that further lumping was needed.

Because of the extensive modifications of the Coosa River by impoundment, the canalization of the Alabama and Black Warrior rivers, and the pollution of many streams in the Alabama River system, it is probable that most of these unique Alabama species are now extinct. Possibly a few of the headwaters species may yet survive. Only careful, thorough survey work can determine the list of surviving species. Any relatively undisturbed stream in the Alabama River system, such as the Cahaba River and Choccolocco Creek, should be investigated for relict populations of this and other genera of endemic freshwater mollusks.

Aldrich's Round River-snail

Leptoxis aldrichi ("H. H. Smith" Goodrich, 1922)

This species apparently was restricted to its type locality, a shoal of the Coosa River near the mouth of Yellowleaf Creek, Chilton Co., Alabama, according to Goodrich (1922). It is probably extinct following the impoundment of the Coosa River.

Large Round River-snail

Leptoxis ampla form *ampla* (Anthony, 1855)

This form has been taken in the Coosa River at Wetumpka and "is the characteristic member of the genus in the Cahaba River," according to Goodrich (1922). Specimens from creeks in the Coosa basin assigned to this species by Goodrich (1922), were later assigned by him (1941a) to *choccoloccoensis*, and still later were renamed *Anculosa taeniata lucida* by Goodrich (1944a). The Cahaba population of this form may still survive, but it is doubtful if any *ampla* now remain in the Coosa River.

Mimic River-snail

Leptoxis ampla form *mimica*

("H. H. Smith" Goodrich, 1922)

Originally described as a distinct species, this form was later regarded by Goodrich (1941) as "Probably only an ecological form" of *ampla*. It has been taken in the Little Cahaba River 3 miles east of Piper, Bibb County (the type locality), and occasionally in the main Cahaba River.

Short-spired River-snail

Leptoxis brevispira ("H. H. Smith" Goodrich, 1922)

This species was originally described from the Coosa River at Fort William Shoals, Talladega Co., Alabama. Goodrich (1922) says: "One doubtful specimen of *brevispira* was taken at Three Island Shoals. The species appears to be exceedingly common on parts of Fort William Shoals. It was not found apparently from there down the river until The Bar and Duncan's Riffle in Chilton County were reached, though doubtless it does exist at favorable stations between these shoals." Its downstream limit evidently was Higgin's Ferry, Chilton County. In view of the alteration of the Coosa River, this species must be considered to be extinct unless a relict population can be discovered.

Choccolocco River-snail

Leptoxis choccoloccoenis

("H. H. Smith" Goodrich, 1922)

Goodrich (1922) reported that this species was collected by Smith at three localities, all on Choccolocco Creek in Talladega County: Jackson Shoals (type locality), Eureka, and two miles above the Coosa River.

He later (1941a) determined that the creek forms of the Coosa basin which he had earlier assigned to *ampla* should instead be considered *choccoloccoensis*. This would expand the range of *choccoloccoensis* to "five western and three-eastern tributaries of the Coosa, including Canoe Creek, St. Clair County, Oxhatchee Creek, Calhoun County, Kelly's Creek, St. Clair County, Yellowleaf Creek, Shelby County, and Waxahatchee Creek, Shelby-Chilton counties." In view of its wide distribution in the headwaters creeks, it seems likely that this endemic Coosa basin species may still survive in one or more creeks. However, Goodrich (1944c) decided that the "shell of Coosa tributaries that in 1922 was identified as *A. ampla* Anthony" should be described as a new subspecies, *A.* [*L.*] *taeniata lucida*. If this interpretation is correct, then *choccoloccoensis* is known only from Choccolocco Creek, and "may be simply a small stream race of *A.* [*L.*] *taeniata*."

Shield River-snail

Leptoxis clipeata ("H. H. Smith" Goodrich, 1922)

Confined to the Coosa River, this snail once occurred from below Riverside, St. Clair County, to Butting Ram Shoals. It reached its maximum development at Fort William Shoals, according to Goodrich (1922). It is probably extinct.

Compact River-snail

Leptoxis compacta (Anthony, 1854)

Mostly confined to the middle part of the Cahaba River, this species has also been taken at two upstream localities and in Buck Creek, Shelby Co., Alabama (Goodrich, 1941a). Goodrich also notes that the radula of this species does not appear to group with the other members of this genus, "yet where it properly belongs is not clear." This species probably still survives in the upper Cahaba drainage.

Coosa Round River-snail

Leptoxis coosaensis (Lea, 1861)

One of the most narrowly-confined of the leptoxids, this species was found by Smith "only on the Fort William and the Peckerwood shoals of the Coosa River, the second group of shoals being not much more than an extension of the first," according to Goodrich (1922). Goodrich (1944c) observed that this species is "Very like *A. taeniata* and quite likely identical with it, as Tryon believed."

Downie's Round River-snail

Leptoxis downiei (Lea, 1868)

Smith found this species in the Conasauga River east of Dalton, Georgia, downstream to about Riverside on the Coosa, and in Terrapin Creek, Cherokee Co., Alabama (Goodrich, 1922). Goodrich (1941a) later placed *modesta* "H. H. Smith" Goodrich, 1922, in the synonymy of *downiei*, considering his species merely a depauperate form of Lea's. He gave its distribution as: "Head streams of the Coosa River and Terrapin Creek, Cherokee County, Alabama." It may still survive in Terrapin Creek and some of the other Coosa headwaters. Goodrich (1944c) noted that *downiei* is "the characteristic upstream form of the genus, and in all probability simply a phase of *A.* [*L.*] *formosa*."

Flexuose River-snail

Leptoxis flexuosa ("H. H. Smith" Goodrich, 1922)

"This species, so far as is known, is confined to the [Coosa River in the] vicinity of Wetumpka, unless a somewhat puzzling shell more nearly conic, taken by Mr. Smith at Duncan's Riffle, Chilton County, can be assigned to it. Specimens taken by Schowalter, Call and T. H. Aldrich have been brought together in the Alabama collection, indicating that while *flexuosa* is not exactly a common mollusk it cannot be pronounced rare" (Goodrich, 1922). Today it should probably be pronounced extinct. Goodrich (1944c) noted "There are strong reasons for believing it not a good species, but rather a hybrid of *A. taeniata* and *griffithiana*."

Foreman's Round River-snail

Leptoxis formani (Lea, 1843)

Goodrich (1922) says this species is known from the Coosa River at Three Island Shoals, Talladega County, to Butting Ram Shoals, Coosa County. Like the other species restricted to the main stem of the Coosa, this species is probably extinct today.

Globose River-snail

Leptoxis formosa (Lea, 1860)

This species is known from Talladega Creek, Talladega County, and Yellowleaf Creek, Shelby County, Alabama, as well as from the Coosa River, Minnesota Bend below Gadsden, Etowah County, to Wetumpka, according to Goodrich (1922, 1941a). While the main river population has probably been extirpated, relict populations may still survive in the tributaries.

Griffith's Round River-snail

Leptoxis griffithiana (Lea, 1841)

Smith found this species in great numbers in the Coosa River at Wetumpka, and in smaller numbers eight miles upstream. He took only a single specimen at Noble's Ferry, and none at all above the northern line of Chilton County. One lot of *griffithiana* in the Schowalter collection bears a Cahaba River label, but as "These shells appear to be identical with Wetumpka material, and as Mr. Smith himself did not find the species in the Cahaba this may be considered an error on the part of Dr. Schowalter," according to Goodrich (1922). This species is probably extinct.

Bound River-snail

Leptoxis ligata (Anthony, 1860)

This species has been reported from the lower reaches of the Coosa River from Weduska Shoals, Shelby County, to Wetumpka. Specimens in the Schowalter collection purportedly from Buck Creek, Shelby County, in the Cahaba River drainage, are believed by Smith and Goodrich (Goodrich, 1922) to have been misplaced. If this species was confined to the main stream of the Coosa, it is probably now extinct.

Lirate Round River-snail

Leptoxis lirata ("H. H. Smith" Goodrich, 1922)

Originally described from the Coosa River at Fort William Shoals, Talladega County, Alabama, this snail has also been taken at Three Island Shoals. Its taxo-

nomic status should be re-examined, though the species is probably extinct.

Black Warrior River-snail
Leptoxis melanoides (Conrad, 1834)

This species is restricted to the Black Warrior River and possibly the Alabama River, according to Goodrich (1922). Goodrich (1922) speculates: "The uniformity in the size and proportions of this species would seem to indicate that it is one of the older members of the Pleuroceridae, having passed through the era of variability and plasticity and become suited to a varying environment. That it is perhaps a vanishing race might be assumed from the apparently narrow range and the smallness of its numbers." Later Goodrich (1941a) noted: "In shell characters, this species resembles certain mollusks of more northern distribution which have been transferred to the genus *Nitocris* because of the . . . character of the radula. It may be that the present position of *melanoides* will also be changed when its radula is obtainable." It is doubtful whether living populations of this species still exist.

Hooded River-snail
Leptoxis occultata ("H. H. Smith" Goodrich, 1922)

This species has been found at Duncan's Riffle (the type locality), Higgin's Ferry, The Bar, Butting Ram Shoals, and "near the mouth of Yellowleaf Creek," all in the Coosa River and within the reaches touching Chilton and Coosa counties, according to Goodrich (1922). Damming the Coosa has probably rendered this species, like so many other endemic Alabama snails, extinct.

Painted River-snail
Leptoxis picta (Conrad, 1834)

"A single specimen of this species was found among the pleurocerids taken by Clench and Van der Schalie in the Cahaba River twelve miles west of Selma, Dallas County [in 1933]. The locality is probably the same, or near it, that was visited by Schowalter in the 1850's and wherein *picta* was collected plentifully. The type locality is Alabama River at Claiborne, Monroe County. It has penetrated the Coosa River to the foot of the last rapids, which are at Wetumpka, Elmore County" (Goodrich, 1941b). It is possible that members of this species still persist in the Cahaba River, but the Coosa-Alabama population apparently has been extirpated.

Pleated Round River-snail
Leptoxis plicata form *plicata* (Conrad, 1834)

Although Conrad originally described this species as inhabiting "tributaries of the Tennessee River in Alabama," Goodrich (1922) states that the description of *plicata* fits the characteristic species of the Black Warrior River and no species of the Tennessee drainage. He believes that Conrad's material actually came from the headwaters of the Black Warrior River, which "very nearly interlock" with those of the Tennessee in northern Alabama. He reports specimens of this species from Forks of the Black Warrior, Walker County; The Black Warrior in Jefferson County and at Tuscaloosa; the Little Warrior River and the Tombigbee River. The species may still persist in the Tombigbee system, where it would be threatened by the proposed Tennessee-Tombigbee canal, and in some of the headwaters of the Black Warrior which have remained in relatively natural condition.

Smith's Round River-snail
Leptoxis plicata form *smithi* (Goodrich, 1922)

First described by Goodrich as a distinct species, *smithi* was later (1941a) considered "probably a creek form of *A.* [*L.*] *plicata.*" It is known only from its type locality, Valley Creek, at Toadvine, Jefferson County, Alabama. Valley Creek is a tributary of the Black Warrior River. The present status of *smithi* is unknown; it may be extinct, or there may be other populations in various headwater streams of the Black Warrior system.

Mainstream River-snail
Leptoxis praerosa (Say, 1821)

This species once occurred in most of the larger rivers in the Ohio River basin. Goodrich (1940) reports its occurrence from the "Ohio River, below Cincinnati, Ohio, to Elizabethtown, Illinois, together with a few tributaries; Cumberland River and branches; Duck River, Coffee County, Tennessee, to mouth; Tennessee River, and lower parts of tributaries." However, it appears to have disappeared from nearly all of its former range. Sinclair (1969) notes that it once occurred throughout the Tennessee River from Knoxville to its mouth, "but is no longer represented by recent records." Davis (1974) searched for it in the Duck River and a number of other streams in 1972 and 1973, and found it only in the Nolichucky River. He states "There is little doubt that *praerosa* is endangered." It may be extirpated from Alabama.

Showalter's Round River-snail
Leptoxis showalteri (Lea, 1860)

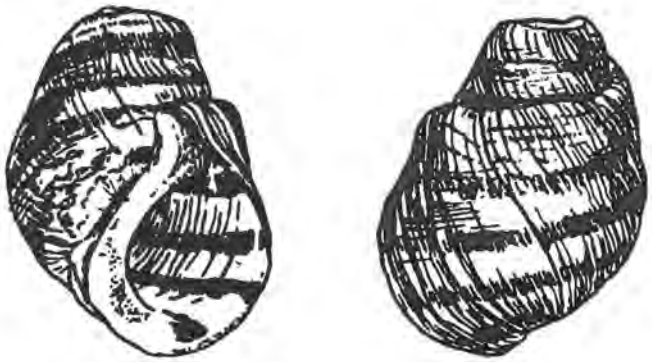
This species was first described from the Coosa River at Uniontown, Alabama. Goodrich (1922) noted that it "appears to be confined to the Fort William and Peckerwood Shoals of the Coosa River. Judging from the material collected by Dr. Schowalter and Mr. Smith, it is not nearly as numerous in individuals as many other members of the genus." This is evidently another of the many species for which the impoundment and siltation of the Coosa River sounded the death knell.

Sulcate River-snail
Leptoxis sulcata ("H. H. Smith" Goodrich, 1922)

Confined to the stretch of the Coosa River from its type locality, Ten Island Shoals, St. Clair County, to Peckerwood Shoals, near the southern end of Talladega County (Goodrich, 1922), this species also appears to have vanished from the globe with the impoundment of the Coosa River. It may have been a synonym of *L. showalteri,* as suggested by Goodrich (1944c).

Banded Round River-snail
Leptoxis taeniata (Conrad, 1834)

According to Goodrich (1922), this species had "the longest range of any of the [*Leptoxis*] of the Alabama system. Conrad described it from Claiborne, which is much nearer to the Gulf of Mexico than it is to the mouth of the Coosa River. Mr. Smith collected it as high



Leptoxis taeniata, after Goodrich, 1922.

on the Coosa as the northeastern point of St. Clair County and on all the big shoals below as far as Wetumpka. Material in the Schowalter collection is credited to the Cahaba River. It has been taken at Selma on the Alabama below the mouth of the Cahaba." Despite this wide range, the survival of this species is in doubt. There may perhaps be a relict population in the Cahaba. If, as suggested by Goodrich in 1944c, *choccoloccoensis, coosaensis, aldrichi,* and the shell of the Coosa tributaries he identified in 1922 as *A. ampla* are all varieties of *taeniata,* then this species was indeed the commonest leptoxid of the Alabama system, and probably the most widespread.

Subangulate River-snail
Leptoxis torrefacta ("H. H. Smith" Goodrich, 1922)

This species apparently was confined to its type locality, Weduska Shoals of the Coosa River, Shelby County, Alabama. Along with the many other endemic species of the main stem of the Coosa River, it is now presumed to be extinct because of the impoundment of the shoal habitat in which it evolved.

Striped River-snail
Leptoxis vittata (Lea, 1860)

Restricted to the main stem of the Coosa River from Wetumpka upstream to The Bar, Chilton County, this is another species which evidently became extinct when the Coosa was dammed.

Genus *Mudalia* Haldeman, 1840

These snails are very similar to members of the genus *Leptoxis,* but they have been grouped apart from that genus by most recent workers. Their taxonomic status should be further studied. *Mudalia* Haldeman, 1840, whose type-species *Paludina dissimilis* Say, 1819 [= *Mudalia carinata* (Bruguiere, 1789)] was designated by Hannibal (1912), has priority over the name *Nitocris* H. and A. Adams, 1854, which in any event is preoccupied.

Mussel Shoals Mudalia
Mudalia minor (Hinkley, 1912)

This species was discovered "Near Florence, Alabama, in the Tennessee River, near the south bank, in a shaded situation where there was but little current and a good many leaves in the water and on the bed of the stream." No other localities are known for this form (Goodrich, 1940). It may be extinct due to the modification of its habitat by impoundment of the Tennessee River.

Virgate Mudalia
Mudalia virgata (Lea, 1841)

Sinclair (1969) states, "This species once was found throughout the eastern section and the upper part of the middle section [of the Tennessee River]. It is apparently no longer present." It occurred in the Tennessee River as far downstream as Jackson County, Alabama (Goodrich, 1940), but has probably been extirpated from the state as a result of modification of its Tennesse River habitat. It is possible that relict populations may survive in the lower reaches of some of the major tributaries in Tennessee.

Genus *Oxytrema* Rafinesque, 1819
The High-spired River-snails

The genus *Oxytrema* has as its type-species *Pleurocera acuta* Rafinesque, 1831, by designation by Blainville in 1824. All of the species called *"Pleurocera"* by Bryant Walker and those who followed him in the belief that *acuta* was the type-species of *Pleurocera* are members of the genus *Oxytrema.* The name *Pleurocera* Rafinesque, 1818, must be reserved for those forms which are now considered to be congeneric with its type-species by monotypy, *Pleurocera verrucosa* Rafinesque, 1820. Virtually all of the species which have commonly been referred to as *"Goniobasis"* are now considered to be congeneric with *acuta* Rafinesque, 1831 and so must also be placed in the genus *Oxytrema,* as recognized by Morrison (1954). The generic name *Goniobasis* Lea, 1862, must give way to the earlier name *Oxytrema* Rafinesque, 1819, if its type-species, *G. osculans* Lea, 1862 (designated by Hannibal, 1912) is congeneric with *acuta* Rafinesque, 1831.

The taxonomic and zoogeographic problems remaining to be solved in this assemblage of over 300 described species are immense. Undoubtedly many local forms have already become extinct even before they have been discovered and described. The possibility of obtaining a clear understanding of this complex group becomes less likely each year as more and more streams are canalized, impounded, polluted, or otherwise altered beyond the ability of their unique faunas to survive. If the present trend of river destruction continues, soon all that will remain of this rich diversity will be the few "jigsaw puzzle pieces" that have found their way into museums. The unexplored treasure of genetic diversity will be lost to the future as we heedlessly race toward short-term economic goals.

Alabama High-spired River-snail
Oxytrema alabamensis (Lea, 1861)

This Coosa River basin endemic species has been listed as endangered by Athearn (1970), Stansbery (1971) and Davis (1975). It is known from Yellowleaf Creek, Shelby Co., and Choccolocco and Cahatchee creeks, Talladega Co., and was "Particularly common in middle sections of the Coosa" (Goodrich, 1936; 1944c).

Albany River-snail
Oxytrema albanyensis (Lea, 1864)

Clench and Turner (1956) noted that this snail was "abundant in the upper Flint River, particularly in the vicinity of Albany. . . . Formerly this species probably occupied all of the Apalachicola system. At the present time it is limited to the Flint River drainage and tributaries of the Chattahoochee River. Silting has probably killed it out of the main stream. We found it in the Apalachicola River, only on the Flint River side, just below the town of Chattahoochee, Florida." They give the following Alabama localities for *albanyensis*: Uchee Creek at Fort Mitchell and 6 mi NE of Seale, both in Russell Co., and Howard Creek, 1 mi S of Gordon, Houston Co.

Thompson (1975) reports that this species "is presently confined to the lower Flint River near Albany, Georgia and adjacent tributaries, the Apalachicola River at Chattahoochee, Florida, and perhaps some small creeks near Columbus, Georgia. The taxonomic status of these creek populations is uncertain." He considers the species to be threatened, and cites "pollution, damming and channeling of streams and rivers" as reasons for its decline, suggesting that measures be taken to maintain rivers and streams within the present range of the species in as nearly a natural state as possible.

Hollow River-snail
Oxytrema alveare (Conrad, 1834)

Goodrich (1940) said the range of this species included the lower Ohio, Wabash, and Green Rivers, together with a few tributaries; Cumberland River from above Burnside to tributaries of the river in Trigg County, Kentucky; streams of north Arkansas and southern Missouri, as well as the Tennessee River at Muscle Shoals, Alabama, and nearby creeks. Sinclair (1969) sampled the Tennessee River from Paducah to Knoxville from 1956 to 1966 and reported that *alveare* "apparently did not survive impoundment" in this river. The present status of other populations is not known and should be investigated.

Large Cahaba River-snail
Oxytrema ampla (Anthony, 1854)

"Specimens that came to Anthony were probably collected in the Cahaba River at or near Centreville. Call found the species on Lily Shoals and Smith at the foot of these rapids. It has not been come upon in recent years, and no one has taken it in large numbers. The very narrow range of *ampla,* together with the relative rarity of individuals, suggests that the mollusk may simply be an enlarged and conic phase of the [*O.*] *clara* of the transition zone" (Goodrich, 1941b). The present status of this Cahaba River species is unknown.

Annette's River-snail
Oxytrema annettae (Goodrich, 1941)

This river-snail is known only from the main stem of the Cahaba River in Bibb County, Alabama, from its type locality at Lily Shoals to Pratt's Ferry (Goodrich, 1941c). Its taxonomic and distributional status should be investigated. Goodrich (1941c) has indicated that it may be a downstream form of *cahawbensis.* If it proves to be a valid taxon, its limited range would place it in jeopardy from any alteration in its habitat.

Annulate Black Warrior River-snail
Oxytrema annulifera (Conrad, 1834)

First discovered in the Black Warrior River south of Blount's Springs, this heavily striate shell is known only from the upper and middle parts of the Black Warrior and from Village Creek, Jefferson Co., Alabama (Goodrich, 1941a). Its present status should be investigated, since its restricted distribution makes it susceptible to extinction from habitat modification.

Elk River-snail
Oxytrema bacula (Anthony), 1854)

This species is confined to the Elk River and some of its tributaries, according to Goodrich (1930). He gives only Tennessee localities, but the species may occur in the Elk River drainage in north Alabama. Its present status is not known.

Beautiful Coosa River-snail
Oxytrema bellula (Lea, 1861)

Described from Yellowleaf Creek, Shelby County, Alabama, this species was much more common in the middle part of the Coosa River, and also has been taken in Choccolocco Creek (Goodrich, 1944c). Athearn (1970) and Stansbery (1971) list it as endangered, and Davis (1975) considers it extinct.

Boykin's Chattahoochee River-snail
Oxytrema boykiniana (Lea, 1840)

Clench and Turner (1956) reported, "So far as we know now, this species is nearly extinct. All the early records were from the Chattahoochee River and Randall's Creek in the vicinity of Columbus, Georgia. The latest date that we can assign to this material is 1855. Sometime after that date, over-farming and the consequent silting of this river apparently destroyed most of its mollusk fauna. Herbert Athearn collected a few specimens of this species in 1955, near West Point, Troup County, Georgia." John McCaleb (pers. com., 1975) says he has also collected them near West Point, Georgia, but the locality is now within a new impoundment. There is a possibility that a relict population of the species may be discovered, but present evidence indicates that it is probably extinct.

Brief River-snail
Oxytrema brevis (Lea, 1843)

Restricted to the middle and lower reaches of the Coosa River, this species was listed as endangered by Athearn (1970) and Stansbery (1971). Davis (1975) believes it is now extinct.

Bridges' River-snail
Oxytrema bridgesiana (Lea, 1862)

This Cahaba River snail is listed as endangered by Davis (1975). Goodrich (1941b) regarded this form as a synonym of *clara* (Anthony, 1854), which is also a Cahaba River form.

Bubble River-snail
Oxytrema bullula (Lea, 1861)

This shell was described from Yellowleaf Creek, Shelby County, Alabama, where it evidently was limited to the lowermost four miles. In the Coosa River it occurred from Cherokee County, Alabama, to near The Narrows, Coosa County. It was taken two to four miles above the mouths of Canoe and Kelly's creeks, St. Clair County, and in at least two other tributaries of the Coosa (Goodrich, 1936; 1944c). Athearn (1970) and Stansbery (1971) list it as endangered, and Davis (1975) believes it is now extinct.

Cahaba High-spired River-snail
Oxytrema cahawbensis cahawbensis (Lea, 1861)

This species is listed as endangered by Davis (1975). Goodrich (1941b) reported it in the upper Cahaba River at Trussville and the next station downstream, noting that below this point it dropped off rapidly in the main stream. He added, "The species is a common one of the Cahaba tributaries, especially the northern ones, and it has been taken in a few instances in springs." A few years later Goodrich (1944c) noted that *cahawbensis* was "Commonest in the Cahaba River, but has crossed into Waxahatchee Creek of the Coosa, Shelby and Chilton counties, Alabama." It would appear that the headwaters of the Cahaba and perhaps Waxahatchee Creek or other tributaries of the Coosa system may still harbor populations of this species in areas where relatively natural conditions have been maintained.

Fraternal Cahaba River-snail
Oxytrema cahawbensis fraterna (Lea, 1864)

This subspecies has been reported as endangered by Athearn (1970) and Stansbery (1971). Museum specimens in the Alabama Museum of Natural History, labeled as coming from a branch of the Cahaba River in Bibb County, have been identified as this subspecies by Goodrich (1941b). Goodrich notes: "The locality has not been rediscovered. Somewhat similar specimens occur in Murphy's Creek, Blount County, Alabama. This is in the drainage basin of the Black Warrior River." The taxonomic and distributional status of this form, like so many other Alabama Pleuroceridae, should be carefully investigated.

Fine-sculptured River-snail
Oxytrema capillaris (Lea, 1861)

This spiral-sculptured snail is listed as endangered by Athearn (1970), Stansbery (1971), and Davis (1974). In the Coosa River it ranged from Floyd County, Georgia, to shoals of Chilton and Coosa counties. It is known also from the Etowah River at Rome, Georgia, Big Cedar Creek, Floyd Co., Georgia, Chattooga River, Cherokee Co., Alabama, and Choccolocco Creek, Talladega Co., Alabama (Goodrich, 1936; 1944c). Since it is known from some of the tributary streams, possibly a thorough survey of the Coosa River basin's unimpounded streams might turn up one or more relict populations.

Columbus River-snail
Oxytrema catenoides (Lea, 1842)

"This species, so far as we know now, is extinct. . . . Though known only from Columbus (Georgia), this species probably had a fairly wide distribution in the Chattahoochee River and apparently was exterminated by river silt" (Clench and Turner, 1956). No recent collections of this species are known.

Clear Cahaba River-snail
Oxytrema clara (Anthony, 1854)

This species has been found in the Cahaba River from near Roper, Jefferson Co., downstream to Centerville, Bibb Co., and "has been taken in Shades and Buck Creeks, but so near their discharges that the habitats can be considered riverine" (Goodrich, 1941b). The survival of this species is completely dependent upon continued natural conditions in the Cahaba River where it occurs. Mine pollution, sewage, impoundments, or other modifications could easily cause its extinction.

Closed Coosa River-snail
Oxytrema clausa (Lea, 1861)

Confined to the shoals of the Coosa River in St. Clair Co. (Goodrich, 1936, 1944c), it was listed as endangered by Athearn (1970) and Stansbery (1971), and is now considered by Davis (1975) to be extinct.

Clench's Choctawhatchee River-snail
Oxytrema clenchi (Goodrich, 1924)

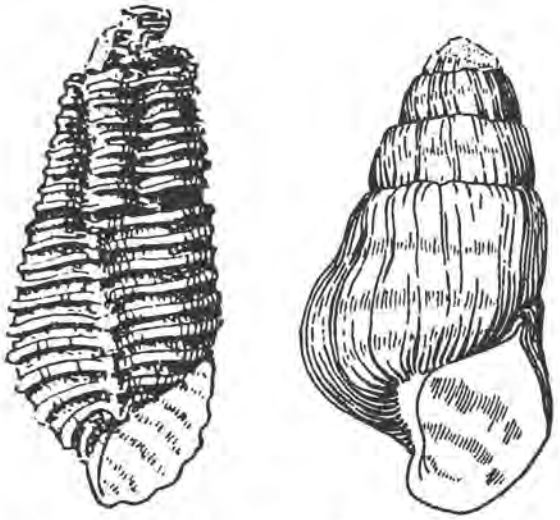
The type locality of this species is the Choctawhatchee River at Newton, Dale Co., Alabama, where it was taken "on rocks and along bank on ledges; when in middle of river on rocks in one to three feet of water; the Pleuroceridae crawling there on a fine deposit of silt or very soft mud" (Clench, in Goodrich, 1924b). Thompson (1975) reports that this species is now confined to the Choctawhatchee River and its tributaries from the region about Geneva, Alabama, south to Westville, Florida. He believes it is endangered because of its extremely restricted distribution, and has recommended that the Choctawhatchee River be maintained in as nearly natural a state as possible above Westville, Florida. There are no known records of this species outside the Choctawhatchee River system.

Stout River-snail
Oxytrema corpulenta (Anthony, 1854)

"Anthony's shell appears to have been a rarity for a long time. At least it was not collected in numbers until Hinkley in 1904 and H. H. Smith in 1909 'worked' the Tennessee River near Florence, Alabama, intensively. The type, I judge, came from the vicinity of Bridgeport, Jackson County, Alabama, . . . In the autumn of 1923, I collected the species in Battle Creek at Ketchall, Marion County, Tennessee. This stream empties into the Tennessee River not far north of Bridgeport" (Goodrich, 1928). The Tennessee River population is probably extirpated today as a result of the impoundment of this river, but it is possible that the species still survives in Battle Creek or other tributaries of the Tennessee in northern Alabama.

Crenate River-snail
Oxytrema crenatella (Lea, 1860)

This endemic Alabama species was collected by H. H. Smith in the Coosa River from Ten Island and Fort Wil-



Oxytrema crenatella (left), *O. hartmaniana* (right), after Goodrich, 1936.

liam Shoals in Talladega Co. downstream to Higgin's Ferry, Chilton Co., and Weoguska Shoals, Coosa Co. He also found it in four Coosa tributaries: Big Will's Creek, Etowah Co.; Kelly's Creek, St. Clair Co.; and Choccolocco and Tallaseehatchee creeks, Talladega Co. (Goodrich, 1936; 1944c). It is considered endangered by Athearn (1970), Stansbery (1971), and Davis (1975).

Short River-snail
Oxytrema curta (Haldeman, 1841)

This species has been found in "Upstream tributaries of the Tennessee River; the main river, Knoxville, Tennessee, to Muscle Shoals, Alabama, together with larger branches; Cumberland River, above Burnside, Pulaski County, Kentucky, to vicinity of Nashville, Davidson County, Tennessee; Caney Fork, Tennessee" (Goodrich, 1940). The main river population of this form has presumably been extirpated from the Tennessee River because of the alteration of its habitat by impoundment. However, Alabama may still have some relict populations of *curta* in one or more of the larger tributaries of the Tennessee River which have remained in relatively natural condition.

Fallacious River-snail
Oxytrema fallax (Lea, 1861)

Goodrich (1936) regarded this endemic Coosa River snail as a slight variant of *alabamensis* Lea, 1861, but Davis (1975) lists it as a distinct species, which he believes is now extinct.

Fascinating River-snail
Oxytrema fascinans (Lea, 1861)

Davis (1975) has listed "*Pleurocera fasciens* Lea 1861," evidently referring to this species, as "probably extinct." Its type locality is Yellowleaf Creek, Shelby County, Alabama. Goodrich (1944c) says that *fascinans* is a creek form, found in Coosa River tributaries from Calhoun to Coosa County, and found occasionally in the main stream.

Foreman's High-spired River-snail
Oxytrema foremani (Lea, 1842)

An endemic Alabama species, *foremani* is a Coosa River snail which is known to occur also in three small tributaries of the Coosa for short distances above their mouths (Goodrich, 1941a). It is also reported from the Cahaba River at a single locality, Pratt's Ferry, Bibb Co. (Goodrich, 1941b). Athearn (1970) and Stansbery (1971) have listed this species as endangered.

Dusky River-snail
Oxytrema furva (Lea, 1852)

Originally described from a branch of the Coosa River in Alabama, this species is listed as endangered by Davis (1975).

Fusiform River-snail
Oxytrema fusiformis (Lea, 1861)

Confined to the main stream of the Coosa from Weduska Shoals, Shelby Co., to Wetumpka, Elmore Co. (Goodrich, 1944c), this species has presumably become either endangered or extinct in recent years, as noted by Davis (1975).

Gerhardt's High-spired River-snail
Oxytrema gerhardi (Lea, 1862)

Lea originally described this species from the "Chattanooga" [= Chattooga ?] River, Georgia, and from the Coosa River, Alabama. Goodrich (1941a) reports it from "North Georgia to lower tributaries of the Coosa River, Alabama." Davis (1975) lists this form as endangered.

Germane River-snail
Oxytrema germana (Anthony, 1860)

Originally described from the Cahaba River, Alabama, this species has been listed as endangered by Davis (1975).

Humpbacked River-snail
Qxytrema gibbera ("Smith" Goodrich, 1936)

Described from the Coosa River at Lonigan Shoals, two miles below Lock 2, St. Clair Co., Alabama, this species has been seen only from the Coosa River shoals of St. Clair Co. (Goodrich, 1944c). It is listed as endangered by Athearn (1970) and Stansbery (1971); Davis (1975) believes it is extinct.

Prairie Creek Snail
Oxytrema grata prairiensis (Lea, 1862)

This form was originally described from Big Prairie Creek, a tributary of the Black Warrior River, mostly in Hale County, Alabama. It evidently has not been taken anywhere else, and is considered endangered by Davis (1975).

Hartman's High-spired River-snail
Oxytrema hartmaniana (Lea, 1861)

Lea originally described this form from the Coosa and Cahaba Rivers, but the Cahaba record does not appear to have been substantiated. Goodrich (1941b) does not list it in his Cahaba paper. In his Coosa River papers Goodrich (1936 and 1944c) lists the species from the main stream of the Coosa from Leoto Shoals, St. Clair Co., to Wetumpka, Elmore Co. Noting that Tryon (1873) made *hartmaniana* a synonym of *ampla* (Anthony, 1854),

a Cahaba River species, Goodrich remarked, "As pleurocerids go, the two have little in common except large size." This form is listed as endangered by Athearn (1970), Stansbery (1971), and Davis (1975).

Hays' Coosa River-snail
Oxytrema haysiana (Lea, 1842)

Once the commonest pleurocerid at the Wetumpka shoals, this form is restricted to the lower Coosa River. It has been taken as far upstream as The Bar, Chilton Co., with a dubious record for the Coosa near the mouth of Yellowleaf Creek, Shelby Co. (Goodrich, 1936). Athearn (1970) and Stansbery (1971) have listed the species as endangered; Davis (1975) believes it is extinct.

Hyde's Black Warrior River-snail
Oxytrema hydei (Conrad, 1834)

Conrad (1834b) found this snail living on "rocks in the Black Warrior River, south of Blount's Springs, Alabama, and very abundant." Goodrich (1941a) noted that it is "confined to Black Warrior and branches." Highly sculptured, cylindrical forms are found in the main stream, with less sculptured, more conic shells in the smaller streams. The present status of this species should be investigated. It is listed here because of its restricted distribution and the modifications of its Black Warrior River habitat.

Impressive River-snail
Oxytrema impressa (Lea, 1841)

"This species is confined to the Coosa River, entering none of its tributary streams. The range is from Leoto Shoals, St. Clair County, Alabama, to shoals of Coosa County. No shell from Wetumpka has come to my notice . . . " (Goodrich, 1936). It was considered endangered by Athearn (1970) and Stansbery (1971). Davis (1975) regards it as extinct.

Intervening River-snail
Oxytrema interveniens (Lea, 1862)

This species is known only from Shoals and Cypress creeks and the Tennessee River, all in the vicinity of Florence, Alabama (Goodrich, 1930). Because of the impoundment of the Tennessee River, which presumably has eliminated the main river population, and because of the restricted distribution of this species in the tributaries, it appears probable that this species is threatened or endangered.

Jones' Coosa River-snail
Oxytrema jonesi (Goodrich, 1936)

"The range of *jonesi* in the Coosa River is from Ten Island Shoals, St. Clair County, to The Bar, Chilton County, Alabama. Hinkley (1904) reports this species from Spring Creek, Farmer, Shelby County. I have seen no creek specimens. A note of H. H. Smith's speaks of the species as abundant 'through the shoals region of the Coosa. It prefers quiet water, pools and eddies, and is often found along the shore in still stretches between the shoals' " (Goodrich, 1936). Davis (1975) lists it, as *wheatleyi* Lea, 1868 [non *wheatleyi* Lea, 1866], as probably extinct.

Nodulose Coosa River-snail
Oxytrema lachryma ("Anthony" Reeve, 1861)

"The species occurs in a stretch of the Coosa River about forty or fifty miles long, beginning at Gilbert's Ferry, Etowah County, and ending near Childersburg, Talladega County, Alabama" (Goodrich, 1936). Athearn (1970) and Stansbery (1971) consider it endangered. Since it is not known outside the Coosa main stream, it is doubtful if the species survives at all today.

Pleasant Coosa River-snail
Oxytrema laeta (Jay, 1839)

This species occurs in the Coosa River from Cedar Bluff, Cherokee Co., to Wetumpka. Only two creek localities are known: Big Canoe Creek, St. Clair Co., and "Bean Creek, near Coosa River" (Goodrich, 1936). Athearn (1970) and Stansbery (1971) list it as endangered, and Davis (1975) believes it is extinct.

Mac Glamery's Coosa River-snail
Oxytrema macglameriana (Goodrich, 1936)

This river-snail was found by H. H. Smith in sparing numbers in the Coosa River from Yancy's Landing just below Rome, Georgia, to Riddle's Bend, St. Clair County, Alabama. The greatest numbers were taken at Center Landing, Cherokee Co., Alabama, the type locality (Goodrich, 1936). It was listed as endangered by Athearn (1970) and Stansbery (1971); Davis (1975) believes it is endangered or possibly extinct.

Morrison's Coosa River-snail
Oxytrema morrisoni, new name

= *Trypanostoma Showalterii* Lea, 1862 (Proc. Acad. Nat. Sci. Phila., 14: 172)
non Lithasia Showalterii Lea, 1860 (Proc. Acad. Nat. Sci. Phila., 12: 188) [= *Oxytrema showalteri* (Lea, 1860)]
non Melania Showalterii Lea, 1861 (Proc. Acad. Nat. Sci. Phila., 13: 120) [= *Oxytrema pilsbryi* (Goodrich, 1927)]

Because the name *Showalterii* Lea, 1862, is preoccupied in the genus *Oxytrema*, as shown above, I propose that this species be named *Oxytrema morrisoni* in honor of Dr. Joseph P. E. Morrison, whose efforts to untangle the systematics and nomenclature of the pleurocerids have made a major contribution to the knowledge of this difficult group.

In Lea's original description of this species, he gave both "Cahaba River, Ala." and "Oostenaula River, Ga." as type localities. The Cahaba designation appears to have been erroneous, since Goodrich (1941b) makes no mention of this species in his monograph of the Pleuroceridae of the Cahaba drainage. The species is known from the Oostanaula River, which joins with the Etowah to form the Coosa. In the Coosa River drainage *morrisoni* is "a transition form, extremely variable, of the lower part of the main Coosa headwaters and that part of the river which is in Georgia" (Goodrich, 1944c). The present status of this species should be further investigated. It is listed as endangered by Athearn (1970) and Stansbery (1971).

Olive River-snail
Oxytrema olivula (Conrad, 1834)

This species has been taken in the Alabama River from near Tyler, Dallas Co., to Claiborne, Monroe Co.

It also enters the lower parts of the Tombigbee and Cahaba Rivers (Goodrich, 1936). In the Cahaba River, Goodrich (1941b) reports it from eight miles north of Sprott, Perry Co.; ten miles west of Selma, Dallas Co.; and immediately above Sprott. Athearn (1970), Stansbery (1971), and Davis (1975) unanimously agree that it is endangered.

Kissing River-snail
Oxytrema osculata (Lea, 1862)

This Coosa River snail was the first species described by Lea in his new genus *Goniobasis*, and has subsequently been designated the type-species of that genus by Hannibal (1912). If the name *Goniobasis* is to be used, either as a distinct genus or as a subgenus of *Oxytrema*, then it must be used for the group of species most closely allied to *osculata*. Goodrich (1936) placed *osculata* in the synonymy of *alabamensis* Lea, 1861, noting: "The first reason that Lea gave for separating this form from *alabamensis* was its smaller size. By Lea's measurements, the difference amounts to three-fourths of a millimeter in altitude and one-fourth in diameter." Tryon (1873) gives the correct literature reference to the original description and correctly copies Lea's description and figure of *osculata*—but under the name *inosculata* Lea a quite different species from Little Uchee Creek in the Chattahoochee drainage. At any rate, since *osculata* is known only from the Coosa River, it is probably now extinct.

Pilsbry's Coosa River-snail
Oxytrema pilsbryi (Goodrich, 1927)

"The mollusk is restricted to the Coosa River, the range being from about Hall's Island, Talladega County, to the mouth of Yellowleaf Creek of Chilton County," according to Goodrich (1936). Athearn (1970) and Stansbery (1971) list the species as endangered. No recent records are known.

Pupiform Coosa River-snail
Oxytrema pupaeformis (Lea, 1864)

The range of *O. pupaeformis* is restricted to the Coosa River from the vicinity of Riverside, St. Clair Co., to Wetumpka. It is not known from any tributaries, according to Goodrich (1936). Davis (1975) lists it as extinct.

Pupoid Alabama River-snail
Oxytrema pupoidea (Anthony, 1860)

Closely allied with *haysiana* of the Coosa River, *pupoidea* has been taken in the Alabama River six miles north of Tyler, Dallas Co.; in the Cahaba River at and above Selma; and in the Black Warrior River (Goodrich, 1936; 1941b). Davis (1975) reports it as endangered.

Pygmy Coosa River-snail
Oxytrema pygmaea ("H. H. Smith" Goodrich, 1936)

Found "on gravel shoals, gentle current; a few on rocks, swifter current" in the Coosa River at Three Island Shoals, Talladega Co., Alabama, by H. H. Smith, this species has not been reported from any other locality (Goodrich, 1936; 1944c). It is presumably extinct (Davis, 1975) following the impoundment of the Coosa River.

Showalter's Cahaba River-snail
Oxytrema showalteri (Lea, 1860)

The type locality "Coosa River, at Wetumpka, Alabama" given by Lea (1860b) in his original description of this species evidently was an error, as Lea later (1863) gave its habitat as "Cahaba River, at Centreville, Alabama." Goodrich (1941b) said "Lea obtained his specimens of *showalterii* from the Cahaba River at Centreville," adding, "The species is confined to the transition zone [of the Cahaba], its range being from Lily Shoals to two miles east of Harrisburg, Bibb County." Davis (1975) lists it as endangered. Along with the many other relict populations now living in the Cahaba near Centerville (Hubricht, 1975, pers. com.), this species should be able to survive if this stretch of the river is given adequate protection from mine drainage, agricultural siltation, urban pollution, impoundment, channelization, and other man-made modifications.

Vanuxem's Coosa River-snail
Oxytrema vanuxemiana (Lea, 1843)

This species appears "in feeble colonies in the Coosa River bordering Etowah and St. Clair counties. It is conspicuous first at Fort William Shoals, Talladega County, is particularly common at Wetumpka, and inhabits the Alabama River as far downstream as Claiborne. A few creeks of the Coosa River are entered, but for only a short distance above the mouths" (Goodrich, 1936). Because of the impoundment and siltation of its habitat, it is either endangered or perhaps extinct at present (Davis, 1975).

Variable Cahaba River-snail
Oxytrema varians (Lea, 1861)

Although Lea gave "Coosa River, Alabama," as the type locality, his specimens, preserved in the United States National Museum, are labeled "Cahawba River," according to Goodrich (1941b). It has been taken in the Cahaba River from Pratt's Ferry to seven miles below Centerville, only in Bibb County. Davis (1975) lists it as endangered. Its survival will depend upon the maintenance of natural river conditions in this stretch of the Cahaba River.

Variegated Cahaba River-snail
Oxytrema variata (Lea, 1861)

Davis (1975) has listed this species as endangered. Lea gave the type locality as "Coosa River, at Wetumpka and Montevallo, Bibb County, Alabama." The Coosa River record is probably an error, as Goodrich does not include this species in his 1936 or 1944c Coosa River papers. In his Cahaba River paper (1941b), he mentions specimens of this form taken in Town Creek at Montevallo, Shelby County, and notes that Lea's types "appear to be of the Montevallo phase." Other localities given by Goodrich for this species are Peavine Creek; Buck Creek at Helena, Shelby Co.; Little Cahaba River of Jefferson Co.; Little Cahaba River of Bibb Co.; and the Cahaba River near the mouth of Buck Creek, on Lily Shoals, and at the Old Tuscaloosa Pike crossing.

Walker's High-spired River-snail
Oxytrema walkeri (Goodrich, 1928)

Goodrich described this species from the Sequatchie River, Jasper, Marion Co., Tennessee, and reported it also from the Little Sequatchie River near Sequatchie, Tenn., in the Cumberland River at Granville, Jackson Co., Tenn., and from the Tennessee River at Muscle Shoals and Shoals Creek, Lauderdale Co., Alabama. The current status of this form should be investigated. It is probable that the Muscle Shoals population in the main stream of the Tennessee River has vanished with the impoundment of the river, but perhaps a living population may exist in Shoals Creek or other tributaries of the Tennessee in north Alabama.

The Stony River-snails
Genus *Pleurocera* Rafinesque, 1818

The generic name *Pleurocera* must be used for those forms which are congeneric with *Pleurocera verrucosa* Rafinesque, 1820, its type-species by monotypy and by subsequent designation by Hannibal (1912), as has been explained by Pilsbry (1917) and Morrison (1954). Walker (1917) argued that *verrucosa* does not fall within the original generic diagnosis and is thus unavailable for use as the type-species of *Pleurocera* under Opinion 46 of the International Commission of Zoological Nomenclature. However, in 1948 the International Commission recognized the ambiguity of Opinion 46, noting that "of all the Opinions rendered by the Commission, Opinion 46, more than any other, had given rise to confusion and difficulty." They therefore agreed to recommend that the subjective first part of Opinion 46 be deleted, and that the Rules be modified to make it clear that "for a genus established . . . with no nominal species distinctly referred to it, the first nominal species to be subsequently so referred to it by the same or another author is deemed to have been an originally included species and that species automatically becomes the type species of the genus in question" (Bull. Zool. Nomen., (1905) 4: 160.)

Knobby Ohio River-snail
Pleurocera (Ellipstoma) gibbosa (Rafinesque, 1820)

This large-river species of the Ohio River basis is listed by Stansbery (1971) as an endangered species. It has been found in the "lower Ohio River, the lower Wabash River; Cumberland River from above Burnside, Pulaski County, Kentucky, to branches in Trigg County, Kentucky; [and] Tennessee River in the vicinity of Florence, Lauderdale County, Alabama" (Goodrich, 1940). Sinclair (1969) says that although it was originally found in the middle and lower sections of the Tennessee River, it is "now apparently restricted to the tailwater of Kentucky Dam." The Alabama population of this species apparently has been extirpated following the impoundment of the Tennessee River. Morrison (1954) has discussed the nomenclature of this species, which has generally been referred to in the literature as *Angitrema* or *Lithasia armigera* (Say, 1821).

Elk River File Snail
Pleurocera lima (Conrad, 1834)

In his original description of *lima*, Conrad said it "Inhabits Elk river, Alabama, adhering to stones, and is a common species." Goodrich (1940) reports it from "Elk River, Tennessee and Alabama; branch of Elk River in Franklin County, Tennessee; Tennessee River, Alabama, Muscle Shoals and three near-by creeks." The Tennessee River and lower Elk River populations evidently have been eliminated by impoundment. Davis (1974) reports finding this form in Anderson Creek, an Elk River tributary, in Alabama. This is the only recent record for the species in Alabama. Davis (1974) believes *lima* is not endangered because he found it at six locations on the Elk River in Tennessee, as well as in Anderson Creek, during his 1972-1973 survey. Stansbery (1971) lists it as endangered because its range has been much reduced by impoundment and by sedimentation in the Elk River from gravel washing operations (Stansbery, pers. com., 1976). The status of the species in other Elk River tributaries should be investigated. It appears to have been almost extirpated from Alabama.

Rugged River-snail
Pleurocera salebrosa (Conrad, 1834)

Conrad found this species "adhering to logs in the Tennessee River, at Florence, where it is abundant," and adds that it has also been found in the Holston River, Tennessee. Goodrich (1940) cited it from both the Tennessee River and Cypress Creek in Lauderdale County, Alabama, and in the lower Cumberland River, with a subspecies, *florentiana* (Lea, 1861) from Muscle Shoals and a near-by tributary, as well as Elk River, Alabama and Tennessee. Davis (1974) cites previous records of this species from Caney Fork and Duck River. He found only one population of this form in his 1972-1973 survey, and feels that this Duck River population consists largely of hybrids of this form with *fuliginosa* and *duttoniana*. Pure *salebrosa*, Davis believes, is probably extinct. "Impounding the Tennessee and Cumberland Rivers destroyed this species," he states, noting "The presently proposed Columbia Dam on the Duck River will cause the one locality with *salebrosa* now known to be flooded. With flooding, all [*Pleurocera*] at that locality will perish. Stansbery (1971) also considers this species endangered.

Verrucose River-snail
Pleurocera verrucosa Rafinesque, 1820

Once widespread throughout the larger streams of the Tennessee River system, the lower Ohio River, and the Wabash River, as well as the Black and Spring rivers, Arkansas, this species has been virtually destroyed by impoundment of the Tennessee River system. The only recent records for the species known to me are reports by Sinclair (1969) that it "is now found sporadically in the tailwaters of Kentucky and Pickwick Reservoirs" in the Tennessee River; Davis' 1974 report of finding it "in abundance at one locality in the Nolichucky River"; and a small isolated colony discovered by Stansbery in the Ohio River at Wrightsville, Adams Co., Ohio, in 1961 (OSUM-7005). In Alabama, the species once occurred in Cypress Creek and Flint River. It is possible that a relict population may yet survive in one of these streams. Previous records cited by Davis (1974) for the

Etowah River in the Coosa River drainage are believed to be erroneous (Morrison, pers. com., 1976). Goodrich (1941a; 1944c) does not include any of the *verrucosa* forms in his studies of the Coosa-Alabama system Pleuroceridae.

Family Ancylidae—The Freshwater Limpets

McNeill's Freshwater Limpet

Ferrissia mcneilli Walker, 1925

The type locality of this species is Mandeville Creek, Mobile County, Alabama, according to Basch (1963), not "Mandeville Co., Alabama," as erroneously stated in the original description. Basch (1963) says the species is known to him only from Alabama specimens, though the UMMZ has a lot of questionable specimens from "Florida." Authentic material is all from the Mobile area, and Basch speculates that this may be an exotic tropical form introduced accidentally into southern Alabama. The status of this species should be further investigated.

(?) Subfamily Neoplanorbinae

Hannibal (1912) established the subfamily Neoplanorbinae to accommodate five nominal species in two genera, all known specimens of which have been collected in the lower Coosa River bordering Coosa, Chilton, and Elmore counties, Alabama. The impoundment of the habitat of these riverine mollusks by Lay Dam, Mitchell Dam, and Jordan Dam between 1914 and 1929 destroyed the habitats and presumably caused the extinction of all known Neoplanorbinae, which lived on stones in the swift current of the Coosa River (Basch, 1962b; Goodrich, 1944b). In June, 1959, Paul F. Basch and John B. Burch visited the Coosa River in search of these snails, but no specimens of Neoplanorbinae could be found (Basch, 1959).

Basch (1962b) extracted and prepared the radulae of museum specimens of Neoplanorbinae and found that the species studied were all similar in radular characters, but have diverged considerably from other groups of the Basommatophora. Walter (1970) made comparative studies of the microsculpture of the shells of all the described species of Neoplanorbinae and found "every possible gradation" in shell characters among the various specimens, so he viewed them as merely one species, *Amphigyra alabamensis*. He found the radulae of these specimens to be very similar to the radulae of *Micromenetus*, and believed that *Amphigyra* and *Micromenetus* constitute a tribe of Planorbidae linked to the Ancylidae.

The five described species which have been referred to the Neoplanorbinae are listed below, together with comments on their distribution as given by Goodrich (1944b).

Neoplanorbis tantillus Pilsbry, 1906

"Taken by Hinkley in the Coosa River at Wetumpka 'on rocks in swift water, generally on the under side; they are so small that collecting them was tedious, though they were abundant in places' (Hinkley). Not reported from any other place."

Neoplanorbis carinatus Walker, 1908

"'They live on the under sides of stones in the more or less rapid current and in suitable localities are very abundant. Mr. Smith took 50 from one small stone' (Walker). The mollusk, like the other three species of the genus, is confined to the lower Coosa River, being taken in the rapids bordering Chilton and Coosa Counties, Alabama."

Neoplanorbis smithi Walker, 1908

"Found in a moderate current at Duncan's Riffle and Higgin's Ferry, Chilton County; Butting Ram Shoals, Coosa County."

Neoplanorbis umbilicatus Walker, 1908

"The preferred habitat is seemingly a strong current. Smith found it in the Coosa at the Bar and Cedar Island, Chilton County."

Amphigyra alabamensis Pilsbry, 1906

Hinkley "collected it in the Coosa River at Wetumpka, Elmore County, Alabama. It was taken later by Smith at Higgin's Ferry and Duncan's Riffle, Chilton County, farther upstream."

Subfamily Rhodacmeinae

Tall Freshwater Limpet

Rhodacmea elatior (Anthony, 1855)

Although the type locality of *elatior* is the Green River, Kentucky, Basch (1963) "can see no way of separating" this form from *cahawbensis* Walker, 1917, whose type locality is the Cahawba [= Cahaba] River, Gurnee, Shelby County, Alabama. Basch (1960) studied the anatomy of living specimens found in the Cahaba River rapids west of Helena, Section 19, T19S, R4W, Shelby County, on stones and dead naiad shells, in June, 1959. The extent of its present range is unknown, but until it is rediscovered at other localities it must be regarded as a rare and perhaps endangered species.

Ribbed Freshwater Limpet

Rhodacmea filosa (Conrad, 1834)

This species was described from the Black Warrior River south of Blount's Springs, Alabama, where it was abundant on various species of pleurocerid snails. Basch (1963) reports it from the Black Warrior and Coosa rivers, and tributaries, noting "I have never collected this form; perhaps it is now extinct." He suggested (1963) "It may be conspecific with *R. elatior*, but the shells are generally thinner and more delicate."

Hinkley's Freshwater Limpet

Rhodacmea hinkleyi (Walker, 1908)

Basch (1963) notes the "Present distribution is unknown; the species has not been collected within recent years to my knowledge. Early records indicate that this form was present in the Coosa River, Alabama, and the Tennessee River drainage, extending irregularly northward to the southern borders of Illinois and Indiana," where it occurred "On stones in fast water, or on shells of Pleuroceridae." It was originally described from the Ohio River at Golconda, Illinois.

Family Planorbidae—The Ramshorn Snails

Wheatley's Ramshorn Snail

Planorbula (Haldemanina) wheatleyi (Lea, 1858)

The type locality of this species is Cotoma (= Catoma) Creek, a tributary of the Alabama River, in Montgomery

County, Alabama. Goodrich (1944b) comments, "Smith found it in streams of three other counties of the same basin. As a snail commonly of stagnant waters, it is most likely also within the drainage of the Coosa." According to Baker (1945), it is "not at present known outside of the state of Alabama." The taxonomic and distributional status of this species should be investigated.

Literature Cited

Adams, C. C. 1915. The variations and ecological distribution of the snails of the genus *Io*. Mem. Nat. Acad. Sci., 12 (2): 7-94, 61 pls.

Anthony, John G. 1843. [Letter on *Schizostoma, Melatoma* and *Apella*.] Proc. Acad. Nat. Sci. Philadelphia, 1: 251.

_____. 1854. Descriptions of new fluviatile shells of the genus *Melania* Lam. from the western states of North America. Ann. Lyc. Nat. Hist. New York, 6: 80-130, pls. 1-3.

_____. 1855. Descriptions of new species of *Ancylus* and *Anculosa* from the western states of North America. Ann. Lyc. Nat. Hist. New York, 6: 158-160, pl. 5, figs. 20-23.

_____. 1860. Descriptions of new species of American fluviatile gastropods. Proc. Acad. Nat. Sci. Philadelphia, 12: 55-72.

Archer, Allan F. 1948. Land snails of the genus *Stenotrema* in the Alabama region. Geol. Surv. Alabama, Mus. Paper 28: 7-85.

Athearn, Herbert D. 1964. The Coosa River and its shells (ABSTRACT). Amer. Malacological Union Ann. Repts. for 1964: 14-15.

_____. 1968. Changes and reductions in our freshwater molluscan populations. Amer. Malacological Union Ann. Repts. for 1967: 44-45.

_____. 1970. Discussion of Dr. Heard's paper. Malacologia, 10 (1): 28-31.

Baker, Frank C. 1939. Fieldbook of Illinois Snails. Nat. Hist. Div., State of Illinois, Manual 2. 166 pp., figs.

_____.1945. The molluscan family Planorbidae. Univ. Illinois Press, Urbana. Pp. i-xxxvi; 1-530; 141 pls.

Basch, Paul F. 1959. The Coosa revisited. Amer. Malacological Union Ann. Repts. for 1959: 17.

_____. 1960. Anatomy of *Rhodacmea cahawbensis* Walker, 1917, a river limpet from Alabama. Nautilus, 73 (3): 88-95, pls. 7-9.

_____. 1962a. Radulae of North American ancylid snails. I. Subfamily Rhodacmeinae. Nautilus, 75 (3): 97-101.

_____. 1962b. Radulae of North American snails. II. Subfamily Neoplanorbinae. Nautilus, 75 (4): 145-149.

_____. 1963. A review of the Recent freshwater limpet snails of North America (Mollusca: Pulmonata). Bull. Mus. Comp. Zool., Harvard Coll., 129 (8): 401-461.

Call, R. E. 1894. On the geographic and hypsometric distribution of North American Viviparidae. Amer. J. Sci., 148: 132-141, 1 map.

Clapp, George H. 1915. Description of a new species of *Vertigo*, with notes on other forms. Nautilus, 28 (12): 137.

Clench, William J. 1962a. A catalogue of the Viviparidae of North America with notes on the distribution of *Viviparus georgianus* Lea. Occ. Papers on Moll., Mus. Comp. 2001., Harvard Univ., 2 (27):261-287.

_____. 1962b. New records for the genus *Lioplax*. Occ. Papers on Moll., Mus. Comp. Zool., Harvard Univ., 2 (27): 288.

_____. 1965a. A new species of *Clappia* from Alabama. Nautilus, 79 (1): 33-34.

_____. 1965b. Preface. Occ. Papers on Moll., Mus. Comp. Zool., Harvard Univ., 2: xiv-xvi.

Clench, William J., and Ruth D. Turner. 1955. The North American genus *Lioplax* in the family Viviparidae. Occ. Papers on Moll., Mus. Comp. Zool., Harvard Univ., 2 (19): 1-20.

_____. 1956. Freshwater mollusks of Alabama, Georgia, and Florida from the Escambia to the Suwannee River. Bull. Florida St. Mus., Biol. Sci., 1: 94-239, 9 pls.

Conrad, Timothy A. 1834a. Description of some new species of fresh water shells from Alabama, Tennessee, &c. Amer. J. Sci., 25 (2): 338-343, 1 pl.

_____. 1834b. New fresh-water shells of the United States, with colored illustrations, and a monograph of the genus Anculosus of Say; also a synopsis of the American naiades. Philadelphia. 73 pp., 8 pls.

Dall, William H. 1896. Note on *Neritina showalteri* Lea. Nautilus, 10 (2): 13-15.

Davis, George M. 1974. Report on the rare and endangered status of a selected number of freshwater Gastropoda from southeastern U.S.A. Unpublished report submitted to the Fish and Wildlife Service, U.S. Dept. of Interior, Washington, D.C., 15 December 1974. 51 pp., maps.

_____. 1975. Species of Alabama *Pleurocera* previously considered *Goniobasis* by authors. Unpublished list furnished for use in connection with the Endangered and Threatened Plants and Anmals of Alabama Symposium held at Tuscaloosa, Alabama, March 6-7, 1975. 8 pp.

Goodrich, Calvin. 1922. The Anculosae of the Alabama River drainage. Misc. Pub., Mus. Zool., Univ. Michigan, (7): 3-57, 3 pls.

_____. 1924a. The genus *Gyrotoma*. Misc. Pub., Mus. Zool., Univ. Michigan, (12): 1-32, 2 pls.

_____. 1924b. Some old pleurocerids and a new one. Nautilus, 38 (2): 43-48.

_____. 1928. Strephobasis: A section of *Pleurocera*. Occ. Papers, Mus. Zool., Univ. Michigan, (192): 1-16, 2 pls.

_____. 1930. Goniobases of the vicinity of Muscle Shoals. Occ. Papers, Mus. Zool., Univ. Michigan, (209): 1-25.

_____. 1931. The pleurocerid genus *Eurycaelon*. Occ. Papers, Mus. Zool., Univ. Michigan, (223): 1-9, 1 pl.

_____. 1936. *Goniobasis* of the Coosa River, Alabama. Misc. Pub., Mus. Zool., Univ. Michigan, (31): 1-60, 1 pl.

_____. 1940. The Pleuroceridae of the Ohio River drainage system. Occ. Papers, Mus. Zool., Univ. Michigan, (417): 1-21.

_____. 1941a. Pleuroceridae of the small streams of the Alabama River system. Occ. Papers, Mus. Zool., Univ. Michigan, (427): 1-10.

_____. 1941b. Distribution of the gastropods of the Cahaba River, Alabama. Occ. Papers, Mus. Zool., Univ. Michigan, (428): 1-30.

_____. 1941c. Two new species of *Goniobasis*. Occ. Papers, Mus. Zool., Univ. Michigan, (426): 1-4, 2 figs.

_____. 1944a. Certain operculates of the Coosa River system. Nautilus, 58: 1-10.

_____. 1944b. Pulmonates of the Coosa River. Nautilus, 58: 11-15.

_____. 1944c. Pleuroceridae of the Coosa River basin. Nautilus, 58: 40-48.

Haldeman, S. Stehman. 1840. A monograph of the Limniades and other fresh water univalve shells of North America, supplement to No. 1. Privately printed.

_____. 1841. A monograph of the Limniades and other freshwater univalve shells of North America. No. 3. Privately printed. January 1841.

Hannibal, Harold. 1912. A synopsis of the Recent and Tertiary fresh water Mollusca of the Californian Province, based on an ontogenetic classification. Proc. Malac. Soc. London, 10: 112-183, pls. 5-8.

Heard, William H. 1970. American Malacological Union Symposium *Rare and Endangered Mollusks* (II). The South Atlantic and Gulf drainages. Malacologia, 10 (1): 23-27.

Hinkley, A. A. 1904. List of Alabama shells collected in October and November, 1893. Nautilus, 18: 40-41.

_____. 1912. A new species of *Anculosa*. Nautilus, 26 (4): 47-48, pl. 1.

Hubricht, Leslie. 1965. The land snails of Alabama. Sterkiana, (17): 1-5.

_____. 1966. Four new land snails. Nautilus, 80 (2): 53-56.

Lea, Isaac. 1841. Continuation of Mr. Lea's paper on fresh water and land shells. Proc. Amer. Philos. Soc., 2: 81-83.

_____. 1843. Continuation of paper on fresh water shells. Proc. Amer. Philos. Soc., 2: 241-243.

_____. 1845. Description of new fresh water and land shells. Proc. Amer. Philos. Soc., 4: 162-168.

_____. 1852. Description of a new genus (*Basistoma*) of the family Melaniana, together with some new species of American Melaniae. Trans. Amer. Philos. Soc., 10 (n.s.): 295-302.

_____. 1858. Description of a new Helix and two new Planorbs. Proc. Acad. Nat. Sci. Philadelphia, 10: 41.
_____. 1860a. Descriptions of four new species of Melanidae of the United States. Proc. Acad. Nat. Sci. Philadelphia, 12: 93.
_____. 1860b. Descriptions of fourteen new species of Schizostomae, Anculosae, and Lithasiae. Proc. Acad. Nat. Sci. Philadelphia, 12: 186-188.
_____. 1861a. Descriptions of new species of *Schizostoma, Anculosa,* and *Lithasia*. Proc. Acad. Nat. Sci. Philadelphia, 13: 54-55.
_____. 1861b. Description of a new species of *Neritina,* from Coosa River, Alabama. Proc. Acad. Nat. Sci. Philadelphia, 13: 55.
_____. 1862a. New Melanidae of the United States. Jour. Acad. Nat. Sci. Philadelphia, n.s., 5: 217-356, pls. 34-39.
_____. 1862b. Description of a new genus (*Goniobasis*) of the family Melanidae and eighty-two new species. Pro. Acad. Nat. Sci. Philadelphia, 14: 262-272.
_____. 1863. Observations on the Genus *Unio,* together with descriptions of new species, their soft parts, and embryonic forms in the Family Unionidae, and descriptions of new genera and species of the Melanidae. Read before their Journal. Printed Sciences of Philadelphia, and published in their Journal. Printed for the author, Philadelphia. 180 pp., 16 pls.
_____. 1864a. Descriptions of eleven new species of *indigenous* Melanidae. Proc. Acad. Nat. Sci. Philadelphia, 16: 3-5.
_____. 1864b. Descriptions of thirteen new species of Melanidae of the United States. Proc. Acad. Nat. Sci. Philadelphia, 16: 111-113.
_____. 1868. Descriptions of twenty-six new species of Melanidae of the United States. Proc. Acad. Nat. Sci. Philadelphia, 20: 151-153.
_____. 1869. Descriptions of six new species of fresh water shells. Proc. Acad. Nat. Sci. Philadelphia, 21: 124-125.
Lewis, James. 1875. Descriptions of new species of American land and fresh-water shells. Proc. Acad. Nat. Sci. Philadelphia for 1875: 334-337.
Mighels, J. W. 1844. [Some specimens of shells, with descriptions.] Proc. Boston Soc. Nat. Hist., 1: 187-189.
Morrison, Joseph P. E. 1954. The relationships of Old and New World Melanians. Proc. U.S. Nat. Mus., 103 (3325): 357-394.
_____. 1971. *Athearnia,* a new name for a genus of pleurocerid snails. Nautilus, 84 (3): 110-111.
Nevill, G. 1885. Hand List, Mollusca. Indian Museum, Calcutta, Part II, pp. 1-306.
Office of Endangered Species and International Activities, Bureau of Sports Fisheries and Wildlife, U.S. Dept. of Interior (compiler). 1973. Threatened wildlife of the United States. Bureau of Sports Fisheries and Wildlife, U.S. Govt. Printing Ofc., Washington, D.C. 289 pp.
Pilsbry, Henry A. 1895a. New forms of American shells. Nautilus, 8 (9): 102.
_____. 1895b. New American fresh-water mollusks. Nautilus, 8 (10): 114-116.
_____. 1906a. Two new North American genera of Basommatophora. Nautilus, 20: 49-51, pl. 3.
_____. 1906b. Note on *Lepyrium*. Nautilus, 20 (5): 51.
_____. 1917. Rafinesque's genera of freshwater snails. Nautilus, 30: 109-114.
_____. 1940. Land Mollusca of North America (north of Mexico). Vol. 1, Pt. 2. Acad. Nat. Sci. Philadelphia, Monogr. (3), v. 1, pt. 2: i-vi, 575-994.
_____. 1946. Land Mollusca of North America (north of Mexico). Vol. II, Pt. 1. Acad. Nat. Sci. Philadelphia, Monogr. (3), v. II, pt. 1: i-vi, 1-520.
_____. 1948. Land Mollusca of North America (north of Mexico). Vol. II, Pt. 2, Acad. Nat. Sci. Philadelphia, Monogr. (3), v. II, pt. 2: i-xlvii, 521-1113.
Pilsbry, Henry A., and James H. Ferriss. 1906. Mollusca of the southwestern states, II. Proc. Acad. Nat. Sci. Philadelphia, 58: 123-175, 37 figs.
Pilsbry, Henry A., and Axel A. Olsson. 1951. The Lepyriidae, a new family of fresh-water snails (Gastropoda : Rissoacea). Notulae Naturae, Acad. Nat. Sci. Philadelphia, (233): 1-5, 2 figs.
Rafinesque, Constantine S. 1818. Discoveries in natural history, made during a journey through the western region of the United States. Amer. Monthly Mag. & Crit. Rev., 3: 354-355.
_____. 1819. Prodrome de 70 nouveaux genres d'animaux découverts dans l'interieure des Etats-Unis d'Amerique, durant l'année 1818. J. Phys., Chim., Hist. Nat., 88: 423-428.
_____. 1820. Annals of nature, or annual synopsis of new genera and species of animals, plants, &c., discovered in North America, first annual number. Philadelphia. pp. 10-11.
_____. 1831. Enumeration and account of some remarkable natural objects in the cabinet of Prof. Rafinesque, in Philadelphia. Philadelphia, privately printed, 4 pp.
Redfeld, J. H. 1854. Descriptions of new species of shells. Ann. Lyc. Nat. Hist. New York, 6: 130-132, pl. 1.
Sargent, H. E. 1894. *Amnicola olivacea* Pils. Nautilus, 8 (8): 95-96.
_____. 1895. *Ferussacia subcylindracea* and two new species in Jackson Co., Alabama. Nautilus, 8 (9): 104-105.
Say, Thomas. 1821. Descriptions of univalve shells of the United States. J. Acad. Nat. Sci. Philadelphia, 2: 150-178.
_____. 1829. Descriptions of some new terrestrial and fluviatile shells of North America. New Harmony Disseminator of Useful Knowledge, 2 (17): 260. August 28, 1829.
Shuttleworth, R. J. 1845. Mittheilungen der Naturforschenden Gesellschaft in Bern, No. 50, July 22, 1845, p. 88.
Sinclair, Ralph M. 1969. The pleurocerid fauna of the Tennessee River : Gastropoda : Prosobranchia. Amer. Malacological Union Ann. Repts. for 1969: 45-47.
Stansbery, David H. 1971. Rare and endangered freshwater mollusks in eastern United States. *In*: Jorgensen, S. E., and R. W. Sharp (editors). 1971. Proceedings of a Symposium on Rare and Endangered Mollusks (Naiads) of the U.S. U.S. Dept. of Interior, Fish & Wildlife Service, Bur. Sports Fisheries & Wildlife, Region 3, Twin Cities, Minn. pp. 5-18, 5 pls.
Sterki, Victor. 1892. [Original description of *Vallonia perspectiva* Sterki.] *In*: Pilsbry, H. A., 1892. Manual of Conchology; Structural and Systematic. Second Series: Pulmonata. Acad. Nat. Sci. Philadelphia. 8: 257-258, pl. 33, figs. 39-45.
Thompson, Fred G. 1975. [Final report on endangered/threatened mollusk species of streams of the Coastal Plain region of southeastern United States.] Unpublished report submitted to the Office of Endangered Species, Fish & Wildlife Service, U.S. Dept. of Interior, Washington, D.C. 13 January 1975.
Tryon, George W., Jr. 1873. Land and fresh-water shells of North America. Part IV. Strepomatidae (American Melanians). Smithsonian Misc. Coll., 253: i-liii, 1-435.
Turner, Ruth D. 1946. John Gould Anthony with a bibliography and catalogue of his species. Occ. Papers on Moll., Mus. Comp. Zool., Harvard Univ., 1 (8): 81-108.
Vanatta, E. G. 1935. *Lioplax pilsbryi choctawhatchensis,* n. subsp. Nautilus, 49 (2): 66-67.
Walker, Bryant. 1904. New species of *Somatogyrus*. Nautilus, 17 (12): 133-142, pl. V.
_____. 1905. List of shells from northwest Florida. Nautilus, 18 (12): 133-136, pl. IX.
_____. 1908. New species of Ancylidae. Nautilus, 21: 138-140.
_____. 1909. New Amnicolidae from Alabama. Nautilus, 22 (9): 85-90, pl. VI.
_____. 1917a. Revision of the classification of the North American patelliform Ancylidae. Nautilus, 31 (1): 1-10.
_____. 1917b. The type of *Pleurocera* Rafinesque. Occ. Papers Mus. Zool., Univ. Michigan, (38): 1-10.
_____. 1918. A synopsis of the classification of the freshwater Mollusea of North America, north of Mexico, and a catalogue of the more recently described species, with notes. Univ. Michigan, Mus. 2001. Miss. Pub. No. 6: 1-213, 233 figs.
_____. 1925. New species of North American Ancylidae and Lancidae. Occ. Papers Mus. Zool., Univ. Michigan, (165): 1-12, 3 pls.
_____. 1928. The terrestrial shell-bearing Mollusca of Alabama. Misc. Publ. Mus. Zool., Univ. Michigan, (18): 1-180.
Walter, Harold J. 1970. *Amphigyra,* miniplanorbs and microsculpture in Planorbidae systematics. Amer. Malacological Union Ann. Repts. for 1970: 47-51.

NAIAD MOLLUSKS

DAVID H. STANSBERY
Director and Professor
Museum of Zoology
The Ohio State University
Columbus, Ohio

Shells in Cahaba River (Patrick O'Neil)

Acknowledgements.

The evaluations (*endangered, threatened,* etc.) assigned below constitute the consensus of the Bivalve Mollusk Committee in session at The University of Alabama on 6 March 1975. The committee consisted of Mr. Samuel L. H. Fuller, Academy of Natural Sciences of Philadelphia; Mr. Randall Grace, Tuskegee Institute; Dr. John Hurd, LaGrange College; Mr. John J. Jenkinson, Ohio State University Museum of Zoology; Dr. Joseph P. E. Morrison, Smithsonian Institution; Dr. James D. Williams, United States Fish and Wildlife Office of Endangered Species; Dr. Paul Yokley, University of North Alabama; and myself, Chairman. I wish to express my appreciation for the contributions made by the committee members.

Any acknowledgement would be incomplete without mention of those who were responsible for bringing our knowledge of this fauna to the point where it was possible to prepare this preliminary listing. To those working with the early literature on Alabama naiades, the names of Conrad (1834-1854), Lea (1827-1874) and Lewis (1869-1877) are especially familiar. The work of these early pioneers was supplemented later by the efforts of Hinkley (1904, 1906), Simpson (1900, 1914), Walker (1901-1918), Frierson (1900-1927) and Ortmann (1912-1925).

Several more recent workers, including van der Schalie (1938, 1939), Clench and Turner (1956), Johnson (1967, 1969), Isom (1968, 1969) and Athearn (1964, 1968, 1970), were unable to attend the Tuscaloosa meeting but contributed, in one way or another, to the fund of information upon which this study is based.

Many of the actual collections used by these writers were not made by the authors themselves, but are the results of the labors of a number of non-professional malacologists over the years. This is especially true of the early years of descriptive work. Between 1830 and 1870 Isaac Lea received specimens for describing from an impressive number of correspondents including: Judge Charles Tait (Claiborne); the Reverend George White (Florence); B. Pybas and L. B. Thornton (Tuscumbia); E. R. Schowalter, M.D. (Coosa and Cahawba rivers); Garrett Hallenbeck (eastern Alabama); and William Spillman, M.D. (western Alabama) to mention just a few.

Probably the greatest contribution in numbers of specimens was made by Herbert H. Smith with the aid of his wife and others during the first two decades of this century. Clapp (1920) notes "I have not any very accurate figures on the number of specimens of Unionidae that he collected, but I think that from 40,000 to 50,000 would not be an over-estimate. His Black Warrior collection alone he reported as 10,000." Much of this material has yet to be critically studied but is indicative of the richness of the Alabama naiad fauna of that time.

Introduction

The results of any scientific study can only be as accurate as the quantity and quality of the data available. When one examines the information available concerning the present status of the freshwater bivalve mollusks of Alabama one is impressed by how little we know concerning the current distribution and abundance of most of the species recorded from this state. This is not to say that Alabama has a meager fauna, or that relatively little work has been done here. The evidence we have indicates that Alabama probably has a greater species diversity of unionid mollusks than any other state in the union! A review of the literature reveals as many or more published works on Alabama naiades than are known from most other states. The problems faced in evaluating the status of these river mollusks are those faced in most large-scale zoogeographic problems concerning naiades. With certain exceptions, the data on occurrence are either too meager or too old to reveal present conditions. In addition to these problems, and largely a result of them, we have the difficulty of an area having a great many unsolved taxonomic problems. Fundamentally, however, Alabama has an exceptional number of problems in this field because it has an exceptionally rich fauna.

For a report such as this to have maximum value it should be based upon the data gathered by a team of specialists. Collections should represent each reasonably accessible point on each stream throughout the drainage systems of the state. Neither time nor funds made this

List of Species of the Naiad Mollusks in the *Endangered* Status (E), *Threatened Status* (T), *Special Concern* Status (S), *Extirpated* Status (X), and *Uncertain* Status (U).

Order Unionoida Stoliczka, 1871
Superfamily Unionacca Fleming, 1828
Family Margaritiferinae Ortmann, 1911
(E) *Margaritifera hembeli* ssp
Subfamily Cumberlandinae Heard and Guckert, 1970
(S) *Cumberlandia monodonta*
Family Unionidae (Fleming, 1828) Ortmann, 1910
Subfamily Anodontinae (Rafinesque, 1820) Ortmann, 1910
(S) *Alasmidonta marginata*
(E) *Alasmidonta mccordi*
(S) *Alasmidonta wrightiana*
(S) *Alasmidonta triangulata*
(E) *Pegias fabula*
(E) *Lasmigona holstonia*
(U) *Lasmigona georgiana*
Subfamily Ambeminae (Rafinesque, 1820) Morrison, 1955
(S) *Quadrula apiculata apiculata*
(E) *Quadrula cylindrica cylindrica*
(E) *Quadrula intermedia*
(E) *Quadrula stapes*
(S) *Quadrula nodulata*
(E) *Fusconaia maculata maculata*
(E) *Fusconaia cuneolus*
(E) *Fusconaia cor*
(S) *Fusconaia escambia*
(E) *Fusconaia barnesiana*
(E) *Lexingtonia dolabelloides*
(S) *Plethobasus cyphyus*
(E) *Plethobasus cicatricosus*
(E) *Plethobasus cooperianus*
(E) *Pleurobema altum*
(E) *Pleurobema nucleopsis*
(E) *Pleurobema clava*
(E) *Pleurobema oviforme*
(E) *Pleurobema decisum*
(E) *Pleurobema perovatum*
(E) *Pleurobema curtum*
(E) *Pleurobema showalteri*
(E) *Pleurobema hartmanianum*
(E) *Pleurobema bulbosum*
(T) *Pleurobema pyriforme*
(E) *Pleurobema rubellum*
(E) *Pleurobema plenum*
(E) *Pleurobema taitianum*
(E) *Pleurobema marshalli*
(X) *Pleurobema rubrum*
(E) *Elliptio arcus*
(E) *Hemistena lata*
Subfamily Lampsilinae (von Ihering, 1901) Ortman, 1910
(S) *Ptychobranchus fasciolaris*
(E) *Plychobranchus subtentum*
(T) *Plychobranchus greeni*
(E) *Cyprogenia stegaria*
(E) *Dromus dromas*
(E) *Actinonaias ligamentina ligamentina*
(E) *Actinonaias pectorosa*
(E) *Obovaria olivaria*
(E) *Obovaria jacksoniana*
(E) *Obovaria unicolor*
(E) *Obovaria subrotunda*
(E) *Obovaria retusa*
(T) *Truncilla truncata*
(E) *Leptodea leptodon*
(E) *Potamilus inflatus*
(E) *Potamilus laevissimus*
(E) *Toxolasma lividus lividus*
(E) *Toxolasma cylindrella*
(E) *Medionidus conradicus*
(E) *Medionidus mcglameriae*
(X) *Lemiox rimosus*
(E) *Villosa fabalis*
(E) *Villosa taeniata taeniata*
(U) *Villosa taentata punctata*
(E) *Lampsilis virescens*
(S) *Lampsilis orbiculata*
(E) *Lampsilis ovata*
(E) *Lampsilis binominata*
(E) *Lampsilis perovalis*
(E) *Epioblasma triquetra*
(X) *Epioblasma arcaeformis*
(T) *Epioblasma brevidens*
(E) *Epioblasma penita*
(T) *Epioblasma metastriata*
(E) *Epioblasma othcaloogensis*
(X) *Epioblasma haysiana*
(X) *Epioblasma sulcata sulcata*
(X) *Epioblasma lenior*
(X) *Epioblasma personata*
(X) *Epioblasma flexuosa*
(X) *Epioblasma lewisi*
(X) *Epioblasma stewardsoni*
(X) *Epioblasma biemarginata*
(X) *Epioblasma turgidula*
(X) *Epioblasma florentina*
(X) *Epioblasma torulosa torulosa*
(X) *Epioblasma propinqua*

possible at this time. This should not in any way, however, discourage such a study of the state of Alabama or of any of its streams.

The evaluations listed herein are based upon the best efforts of the Bivalve Committee. Each member present brought to this community effort his knowledge of records from the literature and from most of the major museum collections in this country. Of equal or perhaps greater importance here were the personal field experiences of these specialists in Alabama streams over the past decade or more. Almost none of this information is in print since most of these studies have yet to be completed. It is sincerely hoped that this symposium will be only a first step toward a continuing program of monitoring the changing status of our natural resource of largely uninvestigated species of Alabama mollusks. The fact that we are the stewards of this resource for generations in the future as well as for ourselves is more than just a noble thought.

The conservative nature of the evaluations provided below should be clarified in several regards. First, the *Threatened* status was used sparingly — only when the committee was aware that a species was threatened by a specific disruption, present or impending. Second, the list could have been much longer since not all of the persons having knowledge of the Alabama fauna could attend the symposium and because only the naiades (Order Unionoida) were considered. Estuarine, marine, and other freshwater groups were passed over. Even so the list is long and what evidence we have indicates that further study will most probably confirm the accuracy of our evaluations. Even with our limited data it is

clear that the destruction of one of the most diverse endemic faunas on earth is well under way.

The annotations included here are those of the committee chairman and are added to give the reader a better appreciation of the evaluations of the committee as well as a better grasp of some of the taxonomic, nomenclatorial, and zoogeographic problems involved. **All distributions, unless noted otherwise, are expressed as within Alabama.** In the interests of time and space, the extralimital range of the various species was usually omitted.

Synonyms are listed for nearly all species dealt with since nearly all have been referred to in the literature under names other than those currently used. No effort was made to include all of the various generic combinations in the literature, however, and only original descriptions are cited.

It was the intent of the committee to communicate as clearly as possible with non-malacologists in spite of the taxonomic and nomenclatorial handicaps mentioned and the limited data available.

ENDANGERED SPECIES

Margaritifera hembeli ssp.

Unio hembeli Conrad, 1838.

This subspecies (Alabama Pearl Shell) is presently known from only small areas of south-central Alabama. Known for some years from small tributaries of the Escambia River system, it has only recently been found in Limestone Creek of the Alabama River system. A careful systematic search should be made for remaining populations of this rare form in this entire area.

This subspecies is distinct from one found in Louisiana (Louisiana Pearl Shell) and is being described by Dr. Joseph P. E. Morrison of the United States National Museum. The potential threats of clear-cutting (for pulp wood) and stream channelization endanger the continued existence of these small, highly restricted populations. The Alabama Pearl Shell was previously cited as *endangered* by Athearn (1970) and Stansbery (1971).

Alasmidonta mccordi Athearn, 1964.

Known only from the type locality (Athearn 1964a), McCord's Shell may, in fact, be extinct. It is one of the rarest naiades, the holotype being the only specimen known (Hurd, 1974). Athearn has already listed McCord's Shell as *endangered* (1970). The type locally is the Coosa River.

Pegias fabula (Lea, 1838)

Margaritana fabula Lea, 1938.
Margaritana curreyana Lea, 1840.
Margarita fabula Lea, 1836. [nomen nudum]

In Alabama this species is recorded only for the Tennessee River system. It is endangered in, if not extirpated from, the state. Its habitat is the riffles of small, cool, high-gradient streams. *Pegias* has been cited as *endangered* by Stansbery (1970, 1971).

Lasmigona holstonia (Lea, 1838)

?Alasmodon badium Rafinesque, 1831. [?nomen dubium]
Margaritania holstonia Lea, 1938.

A headwater species, this naiad is recorded from some of the smallest streams in both the Tennessee and Mobile systems.

Quadrula cylindrica cylindrica (Say, 1817)

Unio cylindricus Say, 1817.
Unio naviformis Lamarck, 1819.

This is the downstream form of *Q. c. strigillata* of the tributaries of the upper Tennessee. This form, *Q. c. cylindrica,* was recognized as *endangered* by Stansbery (1970, 1971). Although thought by some to be an environmental expression associated with stream size rather than a genetic form, west of the Mississippi River *Q. c. cylindrica* may be found in both large and small streams.

Quadrula intermedia (Conrad, 1836)

Unio intermedius Conrad, 1836.
?Unio tuberosus Lea, 1840. [relationship uncertain]

In Alabama this species is restricted to the Tennessee River system. If *Q. tuberosa* is not the big river expression of *Q. intermedia,* then it should also be listed as *endangered* unless it has become extinct. *Quadrula intermedia* resembles *Q. tuberosa, Q. metanevra, Q. sparsa,* and *Q. stapes* but integrades with none of these. This species was listed as *endangered* by Stansbery (1970, 1971).

Quadrula stapes (Lea, 1831)

Unio stapes Lea, 1831.

Originally found in the Alabama and Tombigbee Rivers of the Mobile system, this species is apparently restricted to the Tombigbee River today. The Stirrup Shell has been cited as *endangered* by Athearn (1970) and Stansbery (1971). Any modification of the Tombigbee River which would render it more like the Alabama River of today might very well cause the extinction of this species.

Quadrula stapes from Upper Tombigbee River (*OSUM* 27358.1)

Fusconaia maculata maculata (Rafinesque, 1820)

Obliquaria subrotunda maculata Rafinesque, 1820.

Unio subrotundus Lea, 1831.
Unio pilaris Lea, 1840.
Unio globatus Lea, 1871.
Quadrula andrewsi Marsh, 1902.
Quadrula beauchampi Marsh, 1902.

It is restricted, in Alabama, to the Tennessee system and apparently, entirely to the Tennessee River itself. This variable subspecies integrades with *F. maculata lesueuriana* in the upper Tennessee system and with *F. maculata kirtlandiana* in the upper Ohio (sensu stricto) system.

Fusconaia cuneolus (Lea, 1840)

Unio cuneolus Lea, 1840.
Unio tuscumbiensis Lea, 1871.
Unio appressus Lea, 1871.
Unio flavidus Lea, 1871.

In Alabama this species was found only in the Tennessee system, but has not been seen here in recent years. *Fusconaia cuneolus* has been recorded as *endangered* by Stansbery (1970, 1971).

Fusconaia cor (Conrad, 1834)

Unio cor Conrad, 1834.
Unio edgarianus Lea, 1840.
Unio obuncus Lea, 1871.
Unio andersonensis Lea, 1872.

Known in Alabama only from the Tennessee system and several of its tributaries, specimens have been recovered from the Paint Rock River, Elk River, and the Tennessee proper within the past several decades. This species has been listed as *endangered* by Stansbery (1970, 1971).

Fusconaia barnesiana (Lea, 1838)

Unio barnesianus Lea, 1838.
Unio bigbyensis Lea, 1841.
Unio estabrookianus Lea, 1845.
Unio tumescens Lea, 1845.
Unio meredithi Lea, 1858.
Unio pudicus Lea, 1860.
Unio lyoni Lea, 1865.
Unio fassinans Lea, 1868.
Unio crudus Lea, 1871.
Unio radiosus Lea, 1871.
Unio tellicoensis Lea, 1872.
Unio lenticularis Lea, 1872.
Pleurobema fassinans rhomboidea Simpson, 1900.

This form is limited in Alabama to the Tennessee system. Its wide geographic range within the Tennessee system and its wide habitat range from headwaters to large rivers has given rise to a striking variety of forms described under the synonyms listed above.

Lexingtonia dolabelloides (Lea, 1840)

Unio maculatus Conrad, 1834. [name preoccupied by *U. maculatus* Raf., 1820.]
Unio dolabelloides Lea, 1840.
Unio thorntoni Lea, 1857.
Unio mooresianus Lea, 1857.
Unio recurvatus Lea, 1871.
Unio circumactus Lea, 1871.
Unio subglobatus Lea, 1871.
Unio appressus Lea, 1871. [not as described but as used by Simpson, 1914.]
Pleurobema conradi Vanatta, 1915.

Found only in the Tennessee River System. The variability of this species is illustrated by the list of synonyms above. This species has been cited as *endangered* by Stansbery (1970, 1971).

Plethobasus cicatricosus (Say, 1829)

Unio cicatricosus Say, 1829.
Unio varicosus Lea, 1829. [name preoccupied by *U. varicosa* Lam., 1819.]
Unio detectus Frierson, 1911.
Unio cicatricoides Frierson, 1911.

Restricted to the Tennessee River. This species is known today only from the lower Tennessee River. Evidence of reproduction in recent years is entirely lacking. Its continued existence is in grave doubt. It was listed as *endangered* by Stansbery (1970, 1971).

Plethobasus cooperianus (Lea, 1834)

?Obovaria striata Rafinesque, 1820.
Unio cooperianus Lea, 1834.

Restricted to the Tennessee River. The only recent records of this species are from the lower Tennessee system. There is no known evidence of reproduction in recent years. Unless conditions improve, its extinction appears inevitable. This species was recorded as *endangered* by Stansbery (1970, 1971).

Pleurobema altum (Conrad, 1854)

Unio altus Conrad, 1854.
Unio fibuloides Lea, 1859.

Restricted to the Alabama system within the Mobile basin. This species was listed an *endangered* by Athearn (1970) and Stansbery (1971). It was *not* taken by Hurd (1974) in his study of the Coosa River.

Pleurobema nucleopsis (Conrad, 1849)

Unio nucleopsis Conrad, 1849.
Unio lewisi Lea, 1861.
Unio medius Lea, 1861.

Restricted to the Coosa system within the Mobile basin (Simpson 1914). Hurd (1974) includes this species in his synonymy of *Pleurobema rubellum* but did *not* find it in the course of his study of the Coosa River. It seems probable that this species is either extremely rare or extinct.

Pleurobema clava (Lamarck, 1819)

Unio clava Lamarck, 1819.
Pleurobema mytiloides Rafinesque, 1820. [not as used by Conrad, 1836.]
Unio patulus Lea, 1829.

Found only in the Tennessee system (Simpson 1914). I have seen no specimens from above Florence, Alabama, and none from tributaries of the Tennessee in Alabama. The Northern Club Shell has been cited as *endangered* by Stansbery (1970, 1971) and has been extirpated from much if not most of its former range.

Pleurobema oviforme (Conrad, 1834)

Unio oviforme Conrad, 1834.
Unio ravenelianus Lea, 1834.
Unio patulus Lea, 1829. [only as used by Conrad, 1838.]
Unio holstonensis Lea, 1840.
Unio argenteus Lea, 1841.
Unio lesleyi Lea, 1860.
Unio ornatus Lea, 1861.
Unio tesserulae Lea, 1861.
Unio striatissimus Anthony, 1865.
Unio clinchensis Lea, 1867.
Unio planior Lea, 1868.
Unio pattinoides Lea, 1871.

Unio acuens Lea, 1871.
Unio lawi Lea, 1871.
Unio conasaugaensis Lea, 1872.
Unio bellulus Lea, 1872.
Unio brevis Lea, 1872.
Unio swordianus Wright, 1897.

Found in Alabama only in the Tennessee system. This species is as variable as the above synonymy suggests and there remains some doubt as to whether or not it is, in fact, a single species. Its habitat range extends from small headwater tributaries to the Tennessee River proper as far downstream as Florence, Alabama.

Pleurobema decisum (Lea, 1831)

Unio decisus Lea, 1831.
Unio anaticulus Lea, 1861.
Unio consanguineus Lea, 1861.
Unio crebrivattatus Lea, 1861.

The range of this species is within the Mobile basin. The Southern Club Shell has been listed as *endangered* by Athearn (1970) and Stansbery (1971) but still lives in the Tombigbee River. Shells were recently collected from the Coosa by Hurd (1974).

Pleurobema perovatum (Conrad, 1834)

Unio perovatus Conrad, 1834.
Unio nux Lea, 1852.
Unio cinnamomicus Lea, 1861.

The range of this species appears to be limited to the Mobile basin. This species was listed as *endangered* by Athearn (1970) and Stansbery (1971). Since its habitat includes small streams, its rarity may be more apparent than real. Hurd (1974) was successful in collecting seven lots of this species in his study of the Coosa River naiades.

Pleurobema perovatum from Upper Tombigbee River (*OSUM* 32967.11)

Pleurobema curtum (Lea, 1859)

Unio curtus Lea, 1859.

This species is unknown outside the Tombigbee River system of the Mobile basin. The transformation of the Tombigbee River into a barge canal, as proposed, could result in the extinction of this species. Its habitat within the Tombigbee is the shallow, fast-flowing, coarse substrate riffles and runs.

Pleurobema showalteri (Lea, 1860)

Unio showalteri Lea, 1860.

The known range of this species is the Coosa River system within the Mobile basin (Simpson 1914). This species was *not* found in Hurd's study (1974) of the Coosa River. This species has been previously recognized as *endangered* by Athearn (1970) and Stansbery (1971).

Pleurobema hartmanianum (Lea, 1860)

Unio hartmanianum Lea, 1860.
Unio stabile Lea, 1861.

This species is found only in the Coosa River system. This form, *P. hartmanianum,* has been identified as a *Fusconaia* and *U. stabile* as a distinct species by Hurd (1974), but I am unable to do either with the evidence at hand. More study is clearly needed here before the status of this (these) species can be evaluated with confidence. This species was listed as *endangered* by Athearn (1970) and Stansbery (1971).

Pleurobema bulbosum (Lea, 1857)

Unio bulbosus Lea, 1857.

Distribution in Alabama uncertain. This described form may be a synonym of *Pleurobema pyriforme.* A single specimen taken by Prof. Paul Yokley from the Tombigbee River in recent years may be this species. This occurrence supports the time-honored record of Hinkley (1906).

Pleurobema rubellum (Conrad, 1834)

Unio rubellus Conrad, 1834.
Unio rudis Conrad, 1837. [in part]
Unio pulvinulus Lea, 1845.
?Unio verus Lea, 1861.
?Unio irrasus Lea, 1861.

This form is apparently restricted to the Black Warrior and Alabama River systems. Listed as *endangered* by both Athearn (1970) and Stansbery (1971), this species was *not* found in Hurd's study of the Coosa naiades (1974).

Pleurobema plenum (Lea, 1840)

Unio plenus Lea, 1840.

In Alabama only in the Tennessee River proper. This species closely resembles *Pleurobema cordatum,* is sympatric with it in Alabama but remains distinct morphologically. A single record from the Tombigbee River (van der Schalie, 1939) may represent the similar *Pleurobema taitianum* (Lea). *Pleurobema plenum* was previously listed as *endangered* by Stansbery (1971).

Pleurobema taitianum (Lea, 1834)

Unio taitianus Lea, 1834.
Pleurobema tombigbeanum Frierson, 1908. [See Frierson (1927)]

This species is recorded for the lower Alabama system and the Tombigbee River. The only recent records for this species are from the Tombigbee River. Recent collections from the Coosa River (Hurd, 1974) and the lower Alabama River failed to reveal its presence.

Pleurobema marshalli Frierson, 1927

Pleurobema marshalli Frierson, 1927.

This species has apparently never been found outside the Tombigbee River drainage. Planned modifications of the Tombigbee River may result in its extinction.

Elliptio arcus (Conrad, 1834)

Unio arcus Conrad, 1834.

This species is apparently restricted to the Mobile basin. The great similarity of some individuals of this species to some individuals of *E. dilatatus* has frequently led to its listing under the latter name. Several populations within the Mobile system should be designated subspecies if the distinctive differences are genetic rather than environmental. The described form *arcus* may eventually be found to be a subspecies of *E. dilatatus* as suggested by the frequent synonymizing of the two names.

Hemistena lata (Rafinesque, 1820)

Anodonta (Lastena) lata Rafinesque, 1820.
Unio dehiscens Say, 1829.
Unio oriens Lea, 1831.
Odatelia radiata Rafinesque, 1832.
Unio hildrethi Delessert, 1841.

Restricted to the Tennessee River system. This species was recognized as *endangered* by Stansbery (1970). It has been collected on at least one occasion in recent years from the Tennessee River near Florence, Alabama, by Dr. Paul Yokley.

Ptychobranchus subtentum (Say, 1825)

Unio subtentus Say, 1825.

Restricted to the Tennessee River system. This species has been listed as *endangered* by Stansbery (1970, 1971).

Cyprogenia stegaria (Rafinesque, 1820)

Obovaria stegaria Rafinesque, 1820.
Unio irroratus Lea, 1827.
Unio verrucosus albus Hildreth, 1828.
Cyprogenia irrorata pusilla Simpson, 1900. [based upon one of several dwarfed populations]

Restricted to the Tennessee River system. The Eastern Fan Shell has been collected in recent years from the Tennessee River below Wilson Dam.

Dromus dromas (Lea, 1834)

Unio dromas Lea, 1834.
Unio caperatus Lea, 1845.

Restricted to the Tennessee River system. This naiad is the most abundant species in some of the prehistoric middens near Florence, Alabama, along the Tennessee River but has not been seen living there in several decades. It was listed as *endangered* by Stansbery (1970, 1971).

Actinonaias ligamentina ligamentina (Lamarck, 1819)

?Unio crassus Say, 1817.
Unio ligamentina Lamarck, 1819.
Lampsilis ligamentinus gibbus } of authors, not of Simpson, 1900.
Actinonaias carinata gibba }

Restricted to the Tennessee River system. The form described by Simpson (1900) as *gibbus* is the same as that described by Lamarck (1819) and is the form found in the Tennessee River as well as in the Ohio River in the early part of the last century. The elongate northern form was described under the name of *U. carinatus* by Barnes (1823). The Southern Mucket has never been common in the lower Tennessee (from Alabama downstream) and may be extirpated from Alabama.

Actinonaias pectorosa (Conrad, 1834)

Unio pectorosus Conrad, 1934 (May).
Unio perdix Lea, 1834 (August).
Unio biangularis Lea, 1840.

Restricted to the Tennessee River system. The Cumberland Mucket may be entirely extirpated from the lower Tennessee River proper, but there are recent records from this river's tributaries in northern Alabama.

Obovaria olivaria (Rafinesque, 1820)

Amblema olivaria Rafinesque, 1820.
Unio ellipsis Lea, 1827.
Unio peali Lea, 1871.

Restricted to the Tennessee River system. Although not common, this species still persists in the Tennessee River below Wilson Dam.

Obovaria jacksoniana (Frierson, 1912)

Unio castanea Lea, 1831. [preoccupied by *Unio castaneus* Rafinesque, 1831.]
Unio (Obovaria) jacksonianus Frierson, 1912.

Known from the Mobile system but should also occur in streams to the west of this system. The overall range extends west into Texas. Some individuals of this species are very similar to some individuals of *Obovaria unicolor* with which it sometimes occurs.

Obovaria unicolor (Lea, 1845)

Unio unicolor Lea, 1845.
Unio tinkeri B. H. Wright, 1899.
Obovaria nux Simpson, 1914.

Known from the Mobile drainage west in Gulf coast streams to, but not including, the Mississippi River. The taxonomy of this species and *O. jacksoniana* should be studied in detail and with care utilizing material from throughout the range of both species.

Obovaria subrotunda (Rafinesque, 1820)

Obliquaria subrotunda Rafinesque, 1820.
Unio circulus Lea, 1829.
Unio lens Lea, 1831.
Unio levigata Rafinesque, 1820.

Restricted to the Tennessee River system. This species has not been recorded from the Tennessee River proper but rather from its tributaries in Alabama.

Obovaria retusa (Lamarck, 1819)

Unio retusa Lamarck, 1819.
Obovaria torsa Rafinesque, 1820.

Restricted to the Tennessee River system. This is a species of large rivers and, when found in Alabama, was found in the Tennessee River proper. It has become increasingly rare in recent years and has apparently ceased reproducing here. It was recognized as *endangered* by Stansbery (1970, 1971).

Leptodea leptodon (Rafinesque, 1820)

Unio (Leptodea) lephodon Rafineesque, 1820.
Anodon purpurascens Swainson, 1823.
Unio velum Say, 1829.
Symphynota tenuissima Lea, 1829.
?Lasmonos fragilis Rafinesque, 1831.
Lampsilis blatchleyi Daniels, 1902.

Restricted to the Tennessee River system. The Scale Shell has not been recorded from Alabama in over half a century indicating its probable extirpation from this part of its former range. It was listed as *endangered* by Stansbery (1970, 1971).

Potamilus inflatus (Lea, 1831)

Symphynota inflata Lea, 1831.
Unio alabamensis Conrad, 1834.

Known here only from the Mobile River system. Only one specimen of this rare species has been taken from Alabama in recent years—a single fresh shell from the Black Warrior River by Prof. Randall Grace in 1975. This species was cited as *endangered* by Stansbery (1971).

Potamilus laevissimus (Lea, 1829)

?Anodonta (Lastena) ohiensis Rafinesque, 1820.
Symphynota laevissima Lea, 1829.

Restricted to the Tennessee River system. First recorded for the Tennessee system by Ortmann (1925), this species has continued to be rare in the Alabama portion of its range.

Toxolasma lividus lividus (Rafinesque, 1831)

Unio lividus Rafinesque, 1831.
Unio moestus Lea, 1841.

Present in both the Tennessee and Mobile basins. This is typically a small stream species. Its analog of the interior low plateau, *T. l. glans,* is found in larger rivers although both subspecies are best termed headwater forms. The generic name *Toxolasma* remains valid since *U. lividus* is identifiable from the original description. *Villosa vanuxemi* does not occur in the Rockcastle River, type locality of *U. lividus,* and *Toxolasma* Rafinesque, 1831, has priority over *Carunculina* Simpson (in Baker) 1889.

Toxolasma cylindrellus (Lea, 1868)

Unio cylindrellus Lea, 1868.

Present in both the Tennessee and Mobile basins. The elongate, solid, light-colored, cylindrical shell distinguishes this rare species from *T. l. lividus* with which it sometimes occurs. While occasional intergrades might be expected between such closely related species, none have been found to date. This species was cited as *endangered* by Stansbery (1970, 1971).

Medionidus conradicus (Lea, 1834)

Unio conradicus Lea, 1834.

Found in both the Tennessee River and Mobile River basins. This is typically a small stream species. The several species of this genus in the east Gulf coast drainage, and especially in the Mobile drainage, are in need of study.

Medionidus mcglameriae van der Schalie, 1939

Medionidus mcglameriae van der Schalie, 1939.

This species is known only from the type locality on the Tombigbee River in Alabama. The conversion of the Tombigbee into a barge canal could result in the extinction of this species.

Villosa fabalis (Lea, 1831)

Unio fabalis Lea, 1831.
Unio capillus Say, 1831.
Unio lapillus Say, 1832.

Restricted to the Tennessee River system. The typical habitat of this species is medium to small rivers. It is perhaps the smallest of Alabama naiades and is rarely common anywhere. This makes its status especially difficult to ascertain.

Villosa taeniata teaniata (Conrad, 1834)

Unio taeniatus Conrad, 1834.
Unio pictus Lea, 1834.

Restricted to the Tennessee River system. This is typically a medium to small stream species that has been redescribed numerous times. The press of time does not permit the inclusion of a complete synonymy of original descriptions.

Lampsilis virescens (Lea, 1858)

Unio virescens Lea, 1858.

Restricted to the lower Tennessee River system from tributaries of the lowermost Clinch to Tuscumbia, Alabama. Recent records include the Paint Rock River and Crow Creek in Alabama. This species has been listed as *endangered* by Stansbery (1970, 1971).

Lampsilis ovata (Say, 1817)

Unio ovatus Say, 1817.

Restricted to the Tennessee River proper. The range of this species appears to be reduced in Alabama to the Tennessee River proper and to those areas having appreciable current. It is frequently confused with *L. ventricosa* since their shell characters overlap giving the appearance of intergradation.

Lampsilis binominata Simpson, 1900

Unio lineatus Lea, 1840. [preoccupied by *Unio lineatus* Valenciennes, 1827].

Found only in the Chattahoochee River system. This species is similar to, yet distinct from, *L. ornatus* [. = *Unio excavatus*] Athearn (1970) and Stansbery (1971) recognized this species as *endangered.*

Lampsilis perovalis (Conrad, 1834)

Unio perovalis Conrad, 1834.

Known only from the Mobile River system. Known previously only from the Alabama and Black Warrior Rivers, this species has recently been found in the Tombigbee River system. This latter population, the only one presently known, could be destroyed by a major modification of the Tombigbee River.

Epioblasma triquetra (Rafinesque, 1820)

Truncilla triquetra Rafinesque, 1820.
Unio triangularis Barnes, 1823.
Unio cuneatus Swainson, 1823.
Unio formosus Lea, 1831.

Restricted to the Tennessee River system.

Epioblasma penita (Conrad, 1834)

Unio penitus Conrad, 1834.

Known only from the Alabama and Tombigbee River systems. The only recent specimens seen are those from the Tombigbee River. This species is very similar to, yet distinct from *Epioblasma metastriata.* Athern cited both of these species as *endangered* (1970), as did Stansbery (1971).

Epioblasma othcaloogensis (Lea, 1857)

Unio othcaloogensis Lea, 1857.

Known only from the upper Coosa River system. Recognized as *endangered* by Athearn (1970) and Stansbery (1971).

Epioblasma penita from Upper Tombigbee River (*OSUM* 36365.1).

THREATENED SPECIES

Pleurobema pyriforme (Lea, 1857)

Unio pyriforme Lea, 1857.
Unio modicus Lea, 1857
Unio amabilis Lea, 1865.
Unio reclusum B. H. Wright, 1898.
Unio harperi B. H. Wright, 1899.
Pleurobema simpsoni Vanatta, 1915.

Streams tributary to the Apalachicola system (Clench and Turner, 1956). This species is listed as *endangered* by Athearn (1970) and Stansbery (1971).

Ptychobranchus greeni (Conrad, 1834)

Unio greeni Conrad, 1834.
Unio foremanianus Lea, 1842.
Unio simplex Lea, 1845.
Unio flavescens Lea, 1845.
Unio velatus Conrad, 1853.
Unio woodwardianus Lea, 1857.
Unio trinacrus Lea, 1861.

Found in the Mobile River system only, but it is apparently absent from certain parts of this drainage such as the Tombigbee River above the mouth of the Black Warrior River. Its continued presence in the Coosa River system, and especially so in the upper Conasauga River, has been recently demonstrated by Hurd (1974). This species was previously recognized as *endangered* by Athearn (1970) and Stansbery (1971).

Truncilla truncata Rafinesque, 1820

Truncilla truncata Rafinesque, 1820.
Unio elegans Lea, 1831.

Restricted to the Tennessee River system.

Epioblasma brevidens (Lea, 1831)

Unio brevidens Lea, 1831.
Unio interruptus Conrad, 1834.

Restricted to the Tennessee River system.

Epioblasma metastriata (Conrad, 1840)

Unio metastriatus Conrad, 1840.
?*Unio compactus* Lea, 1859.
?*Unio modicellus* Lea, 1859.

Restricted to the Alabama River system and the Black Warrior River of the Tombigbee system. Recognized as *endangered* by Athearn (1970) and Stansbery (1971).

SPECIES OF SPECIAL CONCERN

Cumberlandia monodonta (Say, 1829)

Unio monodonta Say, 1829.
Unio soleniforms Lea, 1831.

The Alabama range of this species is restricted to the Tennessee River system where it is apparently limited to the main stream. Although once a common species in this section of the Tennessee River, it is rarely found there today. Our evaluation is based upon its continued existence in parts of the Tennessee River during and following major modifications. This species is apparently extirpated from the Ohio and Mississippi Rivers where it was once found in fair numbers. A few populations still survive in the headwaters of the Tennessee River in east Tennessee and Virginia and in several clear, cold, high-gradient rivers in the Ozarks of Missouri. The Cumberland Pearl Shell was previously cited as *endangered* by Stansbery (1970, 1971).

Alasmidonta marginata Say, 1818

Alasmodonta marginata Say, 1818.
Margaritana raveneliana Lea, 1834.
Alasmodon scriptum Rafinesque, 1831.
Alasmodon atropurpureum Rafinesque, 1831.
Unio swanaonensis Hanley, 1842.
Margaritana marginata truncata B. H. Wright, 1898.

The Elk-Toe is known from Alabama only from the Tennessee River system where it has become rare.

Alasmidonta wrightiana (Walker, 1901)

Strophitus wrightianus Walker, 1901.

This species was described from tributaries of the Flint River, Baker County, Georgia (Walker, 1901). It has been reported from the Choctawhatchee-Pea River system in Alabama in recent years.

Alasmidonta triangulata (Lea, 1858)

Margaritana triangulata Lea, 1858.

This species is apparently limited (in Alabama) to tributaries of the Apalachicola River system (Clench and Turner, 1956). It was previously recognized as *endangered* by Athearn (1970).

Quadrula apiculata apiculata (Say, 1829)

Unio apiculatus Say, 1829.
Unio nobilis Conrad, 1854. [in part]

This subspecies of *Q. apiculata* appears to be restricted to the lower reaches of rivers tributary to the Gulf of Mexico and was formerly found from the Mobile system west to Texas. It is sometimes taken with estuarine species. This form intergrades with *Q. apiculata aspera* going upstream away from brackish water and with *Q. apiculata speciosa* to the west along the Gulf coast in Texas. It is believed by some to be a variant of *Quadrula quadrula* of the Mississippi system.

Quadrula nodulata (Rafinesque, 1820)

Obliquaria nodulata Rafinesque, 1820.
Unio pustulatus Lea, 1831.

This species may be a relatively recent arrival in Alabama since it is known from this state only from a few

recent collections from the Tennessee River.

Fusconaia escambia Clench and Turner, 1956
Fusconaia escambia Clench and Turner, 1956.

Clench and Turner (1956) note that this species, described from the Escambia River, three miles southeast of Century, Escambia County, Florida, is "Known only from the type locality." There are also reports of this form from the Yellow River system of Alabama and Florida.

Plethobasus cyphyus (Rafinesque, 1820)
Obliquaria cyphya Rafinesque, 1820.
Unio aesopus Green, 1827.
Unio scyphius Kuster, 1861.
Unio compertus Frierson, 1911.

Restricted to the Tennessee River.

Ptychobranchus fasciolaris (Rafinesque, 1820)
Obliquaria fasciolaris Rafinesque, 1820.
Unio phaseolus Hildreth, 1828.
Unio planulatus Lea, 1829.
Unio camelus Lea, 1834.
Unio compressimus Lea, 1845.

Restricted to the Tennessee River system.

Lampsilis orbiculata (Hildreth, 1828)
Unio orbiculatus Hildreth, 1828.
Unio abruptus Say, 1831.

Restricted to the Tennessee River proper. This uncommon species still survives below Wilson Dam in the Tennessee River. It has been listed as *endangered* by Stansbery (1970, 1971).

EXTIRPATED

Pleurobema rubrum (Rafinesque, 1820)
Obliquaria rubra Rafinesque, 1820.
Unio pyramidatus Lea, 1831.

Known only from the Tennessee River. This species, found in the literature most frequently as either *P. cordatum pyramidatum* or *P. cordatum rubrum*, has *P. taitianum* (Lea) as its Mobile system analog. Formerly found in the Tennessee River in northern Alabama, it has not been seen for several decades and may be extirpated. It was recognized as *endangered* by Stansbery (1970, 1971).

Lemiox rimosus (Rafinesque, 1831)
Unio rimosus Rafinesque, 1831.
Unio caelatus Conrad, 1834.

Restricted to the Tennessee River system. This species has been recorded as far downstream in the Tennessee River as Florence, Alabama, but not in recent years. Stansbery (1970, 1971) listed this species as *Conradilla caelata*, as *endangered*.

Epioblasma arcaeformis (Lea, 1831)
Unio arcaeformis Lea, 1831.
Unio nexus Say, 1831.

Restricted in Alabama to the Tennessee River. Evidence of the continued existence of this species has not been seen for over 50 years. Nearly all of its former habitat has been subject to major modification. Stansbery (1970) concludes that this species is most probably extinct.

Epioblasma haysiana (Lea, 1834)
Unio haysianus Lea, 1834.
Unio sowerbyanus Lea, 1839.

Restricted to the Tennesseee River system. Recognized as *endangered* by Stansbery (1970, 1971) this species has not been collected in Alabama in recent years.

Epioblasma sulcata sulcata (Lea, 1829)
Obliquaria obliquata Rafinesque, 1820.
Unio sulcatus Lea, 1829.

Restricted to the Tennessee River system. This species has not been recorded from Alabama in over 50 years and is probably extirpated from the state. It is recognized as *endangered* by Stansbery (1970, 1971).

Epioblasma lenior (Lea, 1843)
Unio lenior Lea, 1843.

Restricted to the Tennessee River system. This species has not been found living in Alabama since 1918. The last population known anywhere is now covered by an impoundment of Stones River in Tennessee. It has been cited as probably extinct by Stansbery (1970, 1971).

Epioblasma personata (Say, 1829)
Unio personatus Say, 1829.
Unio pileus Lea, 1831.
Unio capillaris Lea; 1834.

Restricted to the Tennessee River system. This species has not been seen living for over 50 years and has been presumed extinct by Stansbery (1970, 1971).

Epioblasma flexuosa (Rafinesque, 1820)
Obliquaria flexuosa Rafinesque, 1820.
Unio foliatus Hildreth, 1828.
Epioblasma biloba Rafinesque, 1831.

Restricted to the Tennessee River system. The last known evidence of the continued existence of this species was a specimen taken from the Ohio River in 1900. It has been presumed extinct by Neel and Allen (1964) and by Stansbery (1970, 1971).

Epioblasma lewisi (Walker, 1910)
Truncilla lewisii Walker, 1910.

Restricted to the Tennessee River system. Neel and Allen (1964) found this species still living in the Cumberland River. It may yet survive there, but more recent evidence is lacking. It has been presumed extinct by Stansbery (1970, 1971).

Epioblasma stewardsoni (Lea, 1852)
Unio stewardsoni Lea, 1852.

All records known except two cited by Hurd (1974) are from the Tennessee River system. The labels with these specimens, "Coosa R., Al." and "Etowah R., Ga." are possible errors. This species has not been seen living for over 50 years and is thought to be extinct (Stansbery, 1970, 1971).

Epioblasma biemarginata (Lea, 1857)
Unio biemarginatus Lea, 1857.

Restricted to the Tennessee River system. The last known population of this species (in the Elk River of

Tennessee) was largely or entirely smothered with the washings from a quarry operation. The species has been presumed extinct by Stansbery (1970, 1971). Hopefully, some individuals or another population still survives.

Epioblasma turgidula (Lea, 1858)

Unio turgidulus Lea, 1857.
Unio deviatus Reeve, 1864.

Restricted to the Tennessee River system. This species has been confused with *E. florentina* and *E. biemarginata* because of the similarity of some individuals of these forms. The possibility that *turgidula* and *biemarginata* are subspecies of the same species remains, but the evidence of intermediate forms is lacking. The last remaining population of *E. turgidula* known is that in the upper Duck River in the vicinity of Normandy. I was ignorant of this population when I listed the species as "presumed extinct" in 1971. This is the site of the proposed Normandy dam and impoundment.

Epioblasma florentina (Lea, 1857)

Unio florentinus Lea, 1857.
Unio sacculus Reeve, 1864.

Restricted to the Tennessee River system. This was apparently a large river species related to *E. curtisi* (Utterback, 1916) of the Ozark Plateau and *E. walkeri* (Wilson and Clark, 1914). Material is scarce in museums and possible intergrades are absent. It has not been seen living for over 50 years and has been presumed extinct by Stansbery (1970, 1971).

Epioblasma torulosa torulosa (Rafinesque, 1820)

Amblema torulosa Rafinesque, 1820.
Amblema gibbosa Rafinesque, 1820.
Unio perplexus Lea, 1831.
?*Unio cincinnatiensis* Lea, 1840.

Restricted to the Tennessee River system. This subspecies appears to intergrade with *E. t. rangiana* in the northern streams of the Ohio River drainage and with *E. t. gubernaculum* in the southern headwaters in eastern Tennessee and western Virginia. All three subspecies appear to be *endangered* (Stansbery, 1970, 1971), and *E. t. torulosa*, once so abundant in the Tennessee River of northern Alabama, may be extinct.

Epioblasma propinqua (Lea, 1857)

Unio propinquus Lea, 1857.

Restricted to the Tennessee River system. This species has not been seen living for over 50 years and has been presumed extinct by Stansbery (1970, 1971). It was once a common species on the shoals of the Tennessee River in northern Alabama.

STATUS UNCERTAIN

Lasmigona georgiana (Lea, 1859)

Margaritana elowahensis Lea, 1858. [name preoccupied]
Margaritana georgiana Lea, 1859.

Hurd (1974) reports the range of this species to be restricted to the Coosa River drainage. The habitat of this species is essentially the same as that of *L. holstonia*—small, clear, cool, shallow, swift-flowing streams having a predominantly sand-gravel substrate.

Villosa taeniata punctata (Lea, 1865)

Unio punctatus Lea, 1865.

A single Alabama record exists for this species: Tuscumbia, Ala. Tuscumbia, Alabama, was listed along with Caney Fork, Tennessee, as the type locality of this upper Cumberland River species. This citation may be in error. There are additional synonyms of this name.

SUMMARY

	ENDANGERED	THREATENED	SPECIAL CONCERN	EXTIRPATED	UNCERTAIN
Tennessee River System	32	2	6	14	1
Tennessee and Mobile Systems	2	0	0	1	0
Mobile River System	21	2	1	0	1
Mobile System and Apalachicolan Area	1	0	0	0	0
Apalachicolan Area	0	1	3	0	0
TOTALS	56	5	10	15	2

LITERATURE CITED

Athearn, Herbert D. 1964a. Three new unionids from Alabama and Florida and a note on *Lampsilis jonesi*. Naut. 77(4):134-139, pl. 9.

_____1964b. The Coosa River and its shells. (ABSTRACT) Amer. Malacogical Union Ann. Repts. for 1964:14-15.

_____1968. Changes and reductions in our fresh-water molluscan populations. Amer. Malacological Union Ann. Rept. for 1967:44-45.

_____1970. Discussion of Dr. Heard's paper [see Heard 1970], *in* Arthur Clarke (ed.). Papers on the rare endangered mollusks of North America. Malacologia 10(1):28-31.

Barnes, Daniel W. 1823. On the genera *Unio* and *Alasmidonta*; with introductory remarks. Amer. Jour. Sci. & Arts 6:107-127, 258-280, 22 figs.

Clapp, George H. 1920. Herbert Huntington Smith. Naut. 33 (4):136-141.

Clench, William J., and Ruth D. Turner 1956. Freshwater mollusks of Alabama, Georgia, and Florida from the Escambia to the Suwannee River. Bull. Fla. State Mus. 1 (3):98-239, 9 pls.

Conrad, Timothy A. 1834a. Description of some new species of fresh water shells from Alabama, Tennessee, etc. Amer. Jour. Sci. & Arts 25:338-341, 1 pl., 15 figs.

_____1834b. New fresh-water shells of the United States,

with colored illustrations, and a monograph of the Genus *Anculotus* of Say: also a synopsis of the American naiades. Philadelphia, 73 pp., 8 pl.

_____1835-1838. Monograph of the Family Unionidae, or naiades of Lamarck, fresh-water bivalve shells), of North America, illustrated by figures drawn on stone from nature. J. Dobson, Philadelphia, 119 pp., 66 pl.

_____1853a. A Synopsis of the family of naiades, with notes, and a table of some of the genera and subgenera of the family, according to their geographical distribution, and descriptions of genera and subgenera. Proc. Acad. Nat. Sci. Phila. 6:243-269.

_____1853b. Omissions and corrections to the synopsis of the North American naiades. Proc. Acad. Nat. Sci. Phila. 6:449.

_____1854. Descriptions of new species of *Unio*. Jour. Acad. Nat. Sci. Phila. 2:295-298, 2 pl.

Frierson, Lorraine S. 1900. A new Alabama *Unio*. Naut. 13 (10): 109-110.

_____1905. New Unionidae from Alabama. Naut. 19(2):13-14.

_____1927. A classified and annotated check list of the North American naiades. Baylor University Press, Waco, Texas, 111 pp.

Heard, William 1970. 3. Eastern freshwater mollusks (II) The south Atlantic and Gulf drainages, *in* Arthur Clarke (ed.). Papers on the rare and endangered mollusks of North America. Malacologia 10(1):23-27.

Hinkley, Anson A. 1904. List of Alabama shells collected in October and November, 1903. Naut. 18(4):37-45, (5):54-57.

_____1906. Some shells from Mississippi and Alabama. Naut. 20(3):34-36,, (4):40-44, (5):52-55.

Hurd, John C. 1974. Systematics and zoogeography of the unionacean mollusks of the Coosa River drainage of Alabama, Georgia and Tennessee. Xerox University Microfilms, Ann Arbor, Michigan, 240 pp., 10 tables, 6 fig., 63 maps.

Isom, Billy G. 1969. The mussel resource of the Tennessee River. Malacologia 7(2-3):397-425, 2 fig., 10 tables.

Isom, Billy G., and Paul Yorkley, Jr. 1968. Mussels of Bear Creek watershed, Alabama and Mississippi, with a discussion of the area geoglogy. Amer. Midland Naturalist 79(1):189-196, 1 fig., 3 tables.

Jenkinson, John Joseph. 1975. The fall line as a barrier to the distribution of some unionids (Bivalvia: Unionidae). Bull. Amer. Malac. Union for 1974:30-31.

Johnson, Richard I. 1967. Additions to the Unionid fauna of the Gulf drainage of Alabama, Georgia, and Florida (Mollusca: Bivalvia). Breviora 270:1-21, 3 pl.

_____1969. Further additions to the unionid fauna of the Gulf drainage of Alabama, Georgia and Florida. Naut. 83(1):34-35.

Lea, Isaac 1827-1874. Observations on the Genus *Unio*. Privately published, Philadelphia. The 13 volumes that comprise this series contain reprints and expanded species redescriptions of the author's nearly 50 productive years in this field.

Lewis, James 1869. Catalogue of the shells of the Coosa River, Alabama. Amer. Jour. Conch. 5(3):166-169.

_____1876. Fauna of Alabama 1. Fresh water and land shells. Ala. Geol. Surv., Rept. of Progress for 1876:61-71, 89-93.

_____1877. Unionidae of Ohio and Alabama. Proc. Acad. Nat. Sci. Phila.: 26-36.

Morrison, Joseph P. E. 1942. Preliminary report on mollusks found in the shell mounds of the Pickwick Landing basin in the Tennessee River valley. *in* William S. Webb and David L. Dejarnette, an archeological survey of Pickwick basin in the adjacent portions of the states of Alabama, Mississippi and Tennessee. Smithsonian Inst. Bur. Amer. Ethnol. Bull. 129:337-392, 11 tables.

Neel, Joe Kendall, and William Ray Allen. 1964. The mussel fauna of the upper Cumberland basin before its impoundment. Malacologia 1(3):427-459, 69 figs.

Ortmann, Arnold E. 1912. Notes upon the families and genera of the naiades. Ann. Carnegie Mus. 8(2):222-365, 28 fig., 3 pl.

_____1918. The niaide freshwater mussels) of the upper Tennessee drainage. With notes on synonymy and distribution. Proc. Amer. Philos. Soc. 57(6):521-626, 1 map.

_____1923. The anatomy and taxonomy of certain Unioninae and Anodontinae from the Gulf drainage. Naut. 36(3):73-84, (4):129-132.

_____1923-1924a. Notes on the anatomy and certain Lampsilinae from the Gulf drainage. Naut. 37(2):56-60, (3):99-105, (4):137-144.

_____1924b. Mussel Shoals. Science 60 (1564):565-556.

_____1925. The naiad-fauna of the Tennessee River system below Walden George. Amer. Midl. Nat. 9(8):321-373, 1 map.

Simpson, Charles T. 1900a. On the evidence of the Unionidae regarding former courses of the Tennessee and other southern rivers. Science (n.s.) 12:133-136.

_____1900b. Synopsis of the naiades, or pearly fresh-water mussels. Proc. United States Nat. Mus. 22:501-1044, 1 map.

_____1914. A descriptive catalogue of the naiades, or pearly fresh-water mussels. Bryant Walker, Detroit, Michigan, 3 volumes, 1540 pp.

Stansbery, David H. 1970. 2. Eastern freshwater mollusks (I) The Mississippi and St. Lawrence River systems, *in* Arthur Clarke (ed.). Papers on the rare and endangered mollusks of North America. Malacologia 10(1):19-21, 2 pl., 12 fig.

_____1971. Rare and endangered fresh-water mollusks in eastern United States, *in* E. S. Jorgensen and R. W. Sharp (ed.), Proceedings of a symposium of rare and endangered mollusks (naiads) of the United States. Bur. Sport Fish & Wildlife, U. S. Dept. of the Interior, Twin Cities, Minnesota: 5-18f, 50 fig.

Utterback, William Irvin. 1915-1916. The naiades of Missouri. Amer. Midl. Nat. 1915. 4(3):1-14; 4(4):15-70; 4(5):70-93; 4(6):93-123. 1916. 4(7):123-139; 4(8):139-155; 4(9):155-168; 4(10):169-197.

van der Schalie, Henry. 1938. The naiades (fresh-water mussels) of the Cahaba River in northern Alabama. Occ. Pap. Mus. Zool. Univ. Mich. 392:1-29, 1 map.

_____1939. *Medionidus mcglameriae*, a new naiad from the Tombigbee River, with notes on other naiads of that drainage. Occ. Pap. Mus. Zool. Univ. Mich. 407:1-6, pl. 1,. 2 tables.

Walker, Bryant. 1901. A new species of *Strophitus*. Naut. 15 (6): 65-66, pl. 3.

_____1910. Description of a new species of *Truncilla*. Naut. 24 (4):42-44.

_____1916. *Pleurobema lewisi* (Lea). Naut. 29(10):114-116.

_____1918a. The Unione fauna of Alabama (ABSTRACT). Twentieth Rept. Mich. Acad. Sci. Arts & Lett. :137-138.

_____1918b. A synopsis of the classification of the freshwater mollusca of North America. North of Mexico, and a catalogue of the more recently described species, with notes. Miscl. Publ. Mus. Zool. Univ. Mich. 6:1-213, 233 fig.

Wright, Berlin H. 1898a. New varieties of Unionidae. Naut. 11 (11) :123-124.

_____1898b. New Unionidae. Naut. 12(1):5-6.

FRESHWATER FISHES

JOHN S. RAMSEY
Alabama Cooperative Fishery Research Unit
U. S. Fish and Wildlife Service
Auburn University
Auburn, Alabama

Coldwater Spring Run (John McCaleb)

Acknowledgments

Special thanks are due Dr. Herbert Boschung, who gave freely of data on University of Alabama Ichthyological Collection records for all of the rare species covered (those catalogued and entered as computer data sets up to February 10, 1975). He was assisted by Dr. T. S. Jandebeur and Dr. M. F. Mettee, Jr. Dr. Mettee kindly sent information on other records deposited at the University of Alabama. Dr. R. M. Bailey generously provided data on Alabama records for seven species catalogued at the University of Michigan Museum of Zoology (as of March 1, 1976). Our efforts were strengthened immeasurably by Dr. R. D. Suttkus' extensive summary of Tulane University holdings in 16 Alabama species (catalogued as of April 15, 1976), as well as by his sharing the wisdom and insight he has gained in more than 6500 personal fish collections.

The decisions at the Symposium were not those of the official panel members alone. A far more effective body of information and opinion was met in the numerous students of fishes who took part in the March 6 panel working session. Beside those mentioned below, the extended panel on fishes was made up of Mr. E. C. Beckham, Dr. R. W. Bouchard, Dr. G. H. Clemmer, Mr. D. L. Dycus, Dr. D. A. Etnier, Dr. C. R. Gilbert, Dr. T. S. Jandebeur, Mr. J. E. McCaleb, Mr. W. C. Starnes, Mr. B. R. Wall, Jr., and Dr. R. W. Yerger. The 20 ichthyologists present are estimated to have engaged in over 16,000 samples collectively. Their experience amounted to over 30,000 total hours of field observation on freshwater fishes and their habitats.

Written accounts were submitted pursuant to the meeting by Herbert Boschung, J. E. Cooper, W. M. Howell, M. F. Mettee, Jr., R. A. Stiles and J. D. Williams, whose contributions were heavily drawn upon in completing this report. It was anticipated at the outset that individual authorship of species accounts would be possible. However, this proved technically unfeasible upon review by the Symposium editor. Apologies are extended to those who prepared extensive manuscripts, some of which would be publishable in their own right. Other sources of information have been cited in the species accounts, and all are acknowledged most gratefully.

Introduction

Alabama's freshwater fishes represent one of the most diverse regional faunas in North America. The state's political boundaries encompass parts of four important centers of evolution and dispersal of aquatic organisms in the southeastern United States—the Tennessee, Mobile, Apalachicola, and Choctawhatchee-Escambia river basins. Each is well endowed with endemic species, especially the upland drainages. Moreover, the state is at or near the endpoint of recent waves of invasion by Coastal Plain fishes more typical of southern Atlantic and main Mississippi River systems. The area's geologic and climatic backdrop—diverse yet stable rock and soil formations, protected from the earth-moving effects of glaciation, ample precipitation throughout the year—set a stage favorable for survival of at least 252 native species of typically freshwater fishes by the time Alabama became a state.

The panel on fishes sought to improve upon an earlier effort on status of Alabama's less competitive freshwater fishes (Ramsey et al. 1972). Each panel member reviewed an annotated draft checklist of the 252 native freshwater species (including 19 undescribed forms), of which 57 were proposed for later panel discussion. The restricted list included only environmentally sensitive fishes whose ranges are thought to have diminished or which live in limited habitats currently subject to deterioration or proposed modification.

The preliminary worklist excluded rarely encountered fishes known from Alabama reservoirs (e.g., *Ichthyomyzon bdellium, Lepisosteus platostomus, Hiodon alosoides, Carpiodes carpio, Ictiobus niger, Ictalurus brunneus, I. serracanthus* and *Stizostedion canadense*) and moderately common small-stream fishes known to recover from habitat disturbances (e.g., *Hybopsis harperi, Notropis ardens, N. welaka* and *Etheostoma davisoni*). Certain large-river species also were not considered because of their present habitation of disturbed areas, such as the Black Warrior River at Tuscaloosa (e.g., *Notropis edwardraneyi* and *Percina copelandi*).

The panel members agreed to review status of selected species prior to the Symposium, using literature records, recent information from cooperating museums and their

own collecting observations. The panel met from 3:00 to 8:00 p.m. on March 6, 1975, during which summary data were presented by Herbert Boschung (*Hybopsis insignis, Notropis ariommus, N. boops, N. coccogenis, Noturus flavus, N. miurus* and *Etheostoma boschungi*), J. E. Cooper (*Speoplatyrhinus poulsoni* and *Typhlichthys subterraneus*), W. M. Howell (*Etheostoma blennius, E. cinereum, E. nuchale, E.* sp. cf. *E. squamiceps, E. trisella* and *E. zonale*), M. F. Mettee, Jr. (*Lampetra lamotteni, Elassoma* sp., *Percina lenticula* and *Cottus bairdi*), R. L. Shipp (*Fundulus cingulatus, Leptolucania ommata, Lucania goodei, L. parva, Heterandria formosa* and *Enneacanthus gloriosus*), *R. A. Stiles* (*Hybopsis dissimilis, Notropis caeruleus, N. stramineus, Phenacobius uranops* and *Lagochila lacera*), R. D. Suttkus (*Acipenser oxyrhynchus, Notropis euryzonus, Cycleptus elongatus* and *Noturus munitus*), J. D. Williams (*Scaphirhynchus* sp., *Chrosomus erythrogaster, Hemitremia flammea, Notropis* sp. cf. *N. stramineus, Ammocrypta asprella* and *Etheostoma tuscumbia*), and J. S. Ramsey (the remainder herein reported, as well as *Notropis uranoscopus*). Each species presentation was followed by discussion and designation of a conservation status category.

Part of this report is an attempt to catalog the known populations of each species regarded as rare in Alabama. Experience shows that distribution maps (as in Ramsey et al. 1972), although illuminating and easily grasped, should be supplemented by precise locality information to best serve users of works on rare organisms. Future monitoring and search efforts probably will be focused on the populations mentioned.

The reader should note well the possible (if not probable) occurrence of undiscovered populations elsewhere in the state. Much more collecting is needed—especially using suitable techniques—before aquatic biologists will be substantially more confident in summary statements on distribution and limitation. It is anticipated that new information will enable revisors to subtract from and add to the list of less competitive freshwater fishes in Alabama.

Species Accounts

The panel on fishes found 50 Alabama species worthy of listing as *endangered, threatened,* or *of special concern.* The following summaries list brief data on habitat, major and specific drainage basin occupied, probable local extirpation when known, and trends or proposals which probably will influence well-being. The nomenclature follows Bailey et al. (1970) except in the case of genus *Chrosomus* (McPhail and Lindsey 1970) and spelling of *Lampertra lamotteni* (emended ex Vladykov et al. 1975).

Specific locality information is listed by county in the form of research museum records (ANSP—Academy of Natural Sciences of Philadelphia, AU—Auburn University, FSU—Florida State University, MSU—Mississippi State University, SU—Samford University, TU—Tulane University, UAIC—University of Alabama Ichthyological Collection, UMMZ—University of Michigan Museum of Zoology, USNM—U. S. National Museum of Natural History). The museum catalog number is followed by number of specimens (in parentheses), brief locality with survey coordinates when available, and date. Brackets enclose comments not supplied in the original locality data. Some abbreviations include airmi—airline miles, uncat.—

List of Species of Fishes in the *Endangered* Status (E), *Threatened* Status (T), *Special Concern* (Extirpated) Status (X), and *Special Concern* (Surviving) Status (S).

Family Petromyzonidae
(E) *Lampetra lamotteni.* American brook lamprey
Family Acipenseridae
(X) *Acipenser fulvescens.* Lake sturgeon
(T) *Acipenser oxyrhynchus.* Atlantic sturgeon
(E) *Scaphirhynchus* sp. Alabama shovelnose sturgeon
Family Cyprinidae
(S) *Chrosomus erythrogaster.* Southern redbelly dace
(S) *Hemitremia flammea.* Flame chub
(X) *Hybopsis dissimilis.* Streamline chub
(S) *Hybopsis insignis.* Blotched chub
(X) *Hybopsis monacha.* Spotfin chub
(X) *Notropis ariommus.* Popeye shiner
(S) *Notropis boops.* Bigeye shiner
(S) *Notropis caeruleus.* Blue shiner
(S) *Notropis callitaenia.* Bluestripe shiner
(S) *Notrophis coccogenis.* Warpaint shiner
(S) *Notropis cummingsae.* Dusky shiner
(S) *Notropis euryzonus.* Broadstripe shiner
(X) *Notropis stramineus.* Sand shiner
(E) *Notropis* sp. Cahaba shiner
(S) *Notrophis* sp. Sawfin shiner
(S) *Phenacobius uranops.* Stargazing minnow
Family Catostomidae
(T) *Cycleptus elongatus.* Blue sucker
(X) *Lagochila lacera.* Harelip sucker
Family Ictaluridae
(S) *Noturus elegans.* Elegant madtom
(S) *Noturus flavus.* Stonecat
(S) *Noturus miurus.* Brindled madtom
(E) *Noturus munitus.* Frecklebelly madtom
Family Amblyopsidae
(E) *Speoplatyrhinus poulsoni.* Alabama cavefish
(S) *Typhlichthys subterraneus.* Southern cavefish
Family Cyprinodontidae
(X) *Fundulus albolineatus.* Whiteline topminnow
(S) *Fundulus cingulatus.* Banded topminnow
(S) *Leptolucania ommata.* Pygmy killifish
(S) *Lucania goodei.* Bluefin killifish
Family Centrarchidae
(E) *Elassoma* sp. Spring pygmy sunfish
(S) *Micropterus* sp. Shoal bass
Family Percidae
(T) *Ammocrypta asprella.* Crystal darter
(S) *Etheostoma blennius.* Blenny darter
(T) *Etheostoma boschungi.* Slackwater darter
(X) *Etheostoma cinereum.* Ashy darter
(T) *Etheostoma ditrema.* Coldwater darter
(E) *Etheostoma nuchale.* Watercress darter
(X) *Etheostoma trisella.* Trispot darter
(T) *Etheostoma tuscumbia.* Tuscumbia darter
(S) *Etheostoma z. zonale.* Northern banded darter
(S) *Etheostoma* sp. Unnamed snubnose darter
(E) *Percina aurolineata.* Goldline darter
(S) *Percina burtoni.* Blotchside logperch
(T) *Percina lenticula.* Freckled darter
(T) *Percina* sp. ssp. Warrior muscadine darter
Family Cottidae
(S) *Cottus bairdi.* Mottled sculpin
(E) *Cottus pygmaeus.* Pygmy sculpin

uncatalogued, Hwy—highway, and RM—river miles from the mouth of the stream named. Additional references commenting on some or all of the same populations are listed at the end of each discussion.

It is important to note that each locality list usually excludes earlier samples representing the same populations. Exceptions are made when the data suggest possible trends in abundance or if a complete inventory of museum specimens is desirable.

The Top Ten Habitats for Rare Fishes in Alabama[1]

Habitat	Endangered	Threatened	Special Concern	Total
Cahaba River	4	3	1	8
Alabama River	2	4	0	6
Tombigbee River	2	4	0	6
Little Bear Creek	1[2]	0	2	3
Glenn Spring	1	0	0	1
Coldwater Spring	1	1	0	2
Moss Spring	1	1	1	3
Key Cave	1	0	0	1
Cypress Creek	0	1	5	6
Shoal Creek	0	0	8	8

[1] As defined by presence of endangered and threatened species or by a high number of species of special concern (excludes probably extirpated forms).
[2] No concern nationally.

ENDANGERED SPECIES

American brook lamprey

Lampetra lamotteni (Lesueur)

Known only from the Tennessee drainage in Franklin Co. Although the species is fairly common elsewhere, the panel declared it to be of *endangered* status in Alabama. Two samples are available from Little Bear Creek, a stream proposed for impoundment.

FRANKLIN CO: UAIC 1884(35) Little Bear Cr. below Jordan Dam (T7S, R14W, Sec. 15), 11 Mar. 1966; AU 4417 (1) Little Bear Cr. 3.0 airmi SSE of Pleasant Site, RM 2, 28 Sept. 1971. References: Smith-Vaniz (1968), Wall (1968).

Alabama shovelnose sturgeon

Scaphirhynchus sp.

The shovelnose sturgeon in Alabama is restricted to the Mobile River basin, where it occurs in large rivers below the Fall Line. It appears dependent upon the presence of substantial current. Inasmuch as it has not been found in existing reservoirs or in channels modified for navigation, active proposals for future construction render the species of *endangered* conservation status. The Mobile basin form probably represents a species distinct from the typical *S. platorynchus,* and is under study by Dr. J. D. Williams and Dr. G. H. Clemmer. Additional sampling is required to fully understand its distribution and abundance in Alabama waters.

DALLAS CO: UAIC 3634, Alabama R. at confluence with Cahaba R., 21 Mar. 1969 [preimpoundment]. ELMORE CO: USNM 200617(1) Coosa R. 1 mi below Wetumpka, 27 Nov. 1961. SUMTER CO: UAIC 401, Tombigbee R. at Epes. WILCOX CO: UAIC 2180 and 2845, Alabama R. ca. 10 mi below Millers Ferry; UAIC 2616, Alabama R. at Millers Ferry [preimpoundment]. Reference: Smith-Vaniz (1968).

Cahaba shiner

Notropis sp.

As its name implies, this rare minnow is endemic to the Cahaba River in Alabama. It is unique in being the only vertebrate restricted to this drainage basin, and has been captured only in shoals of the main river channel between Centreville and Helena. Water quality in the Cahaba River has been gradually deteriorating within the past 10 years. A combination of urbanization in the headwaters and increased strip mining activity has yielded a high silt load. Eutrophication has commenced in response to enrichment from newly constructed sewage treatment plants. The Cahaba shiner is difficult to collect consistently, so there are no clear trends to suggest its numbers are declining. However, the habitat clearly is changing. A forthcoming description will serve to distinguish the Cahaba shiner from the similar mimic shiner (*N. volucellus*), which is taken quite commonly in the entire Cahaba basin.

BIBB CO: AU 6176(48) Cahaba R. 6.2 airmi NE Centreville, Hwy 27 (T24N, R5W, Sec. 33), 16 May 1970; UAIC 4123(1) same locality, 3 Mar. 1975. SHELBY CO: AU 5865(14) Cahaba R. 2.6 airmi N of Marvel (T21S, R4W, Sec. 30), 16 May 1970.

Frecklebelly madtom

Noturus munitus Suttkus and Taylor

In Alabama this small catfish appears to be an obligatory inhabitant of clean, current-swept rock and packed gravel substrate, in moderate to large rivers of the Mobile River system. The species was known from six localities in the Alabama River between River Miles 135.7 and 107.5 in 1966, but apparently had been extirpated in the main channel by 1968 (Dr. R. D. Suttkus, pers. comm. 1974). Its abrupt disappearance undoubtedly was correlated with construction of Millers Ferry, Claiborne and Jones Bluff dams and associated navigational changes. A population in Cahaba River is jeopardized by deteriorating water quality. Construction of the proposed Tennessee-Tombigbee Waterway almost certainly would extirpate the Tombigbee River population. The panel on fishes is indebted to Dr. R. D. Suttkus and Dr. G. H. Clemmer for the completeness of their information on sampling for the frecklebelly madtom in the Tombigbee and Alabama rivers (continuing to the present). Their results are to be published elsewhere. Basic distributional data are presented in the original description (Suttkus and Taylor 1965). R. D. Suttkus (pers. comm. 1975) will document its status in Alabama River proper. Some recent data are presented here.

PERRY CO: AU 1236(1) Cahaba R. at Marion Fish Hatchery, 6.0 airmi NE Marion, 17 July 1968. PICKENS CO: UAIC 4393(1) Tombigbee R. (T24N, R2W, Sec. 9), 7 June 1972. SUMTER CO: UAIC 4394(9) Tombigbee R. (T23N, R2W, Sec. 28), 7-8 June 1972.

Alabama cavefish

Speoplatyrhinus poulsoni Cooper and Kuehne

Known only from Alabama, in Key Cave, Lauderdale Co. Although it has not been found in nearby caves the

species may occur in other subterranean waters of the general area. The Alabama cavefish is among the rarest of all North American vertebrates. Only nine specimens had been collected by the time of its description (Cooper and Kuehne 1974). Access to Key Cave can be controlled easily by the Tennessee Valley Authority, which administers land along the northern bank of the Tennessee River. However, virtually nothing is known of hydrologic factors which may influence the wellbeing of this highly specialized troglobite. Unlike most other rare fishes in Alabama, cave species are especially vulnerable to extirpation by overzealous scientific collecting.

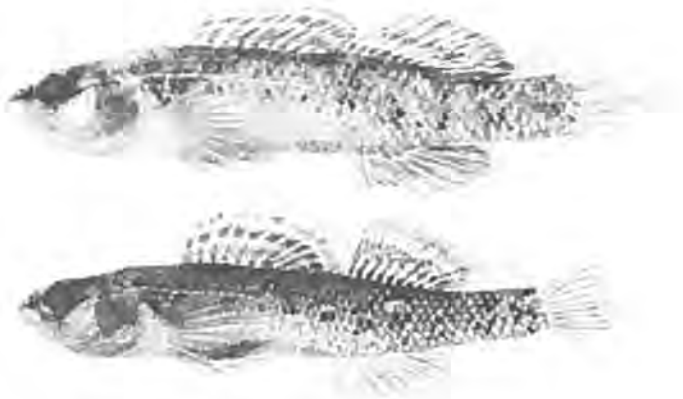
Spring pygmy sunfish
Elassoma sp.

This Alabama endemic was thought to be extinct at the two spring localities from which it had been collected. Biologists were highly elated in 1973, when Dr. D. A. Etnier discovered a living population in Moss Spring, Limestone Co. Although the species remains undescribed, Dr. M. F. Mettee, Jr. is continuing in studies on its ecology and life history (Mettee 1974). The spring pygmy sunfish probably lives only about a year after hatching, so an unsuccessful spawning season easily could bring about its extinction. The fish usually associates with dense submerged aquatic vegetation in water ranging from six inches to two feet deep. The Moss Spring locality should be protected from further degradation, such as siltation from tillage of the adjacent farmland.

LAUDERDALE CO: UMMZ 132689(1) and UMMZ 132690(5) Cave Spring, TVA Map 35 SW, 5 Nov. 1937 [preimpoundment]. LIMESTONE CO: UMMZ 133263(55) Pryor Springs, Wheeler Reservoir [area] [T4S, R4W, Sec. 22], 25 Apr. 1941; UAIC 4923, Moss Spring Run 1.5 mi NE Greenbrier (T4S, R3W, Sec. 15), 5 Aug. 1974.

Watercress darter
Etheostoma nuchale Howell and Caldwell

Known only at Glenn Spring and Run along county route 20 (old U. S. Hwy 11), Jefferson Co., Alabama (T19S, R4W, Sec. 17). The Secretary of the Interior has recognized the watercress darter as an *endangered* species, and a recovery team has been nominated under provisions of the Endangered Species Act of 1973. Although the present owner, a private individual, does not wish to sell the property, he is amenable to protection of the spring and its 400 to 700 watercress darters (independent estimates by Dr. R. D. Caldwell and Dr. W. M. Howell). Although highway widening does not represent a threat (Mr. H. A. Snow, County Engineer, pers. comm. 1970), the population is extremely vulnerable to accidental destruction. The watercress darter is unique among Alabama's rare spring, stream, and river fishes in that it possibly can be extirpated through over-use of a minnow seine. The technique is notably inefficient in other, more extensive habitats, although excellent representative samples usually can be obtained thereby.

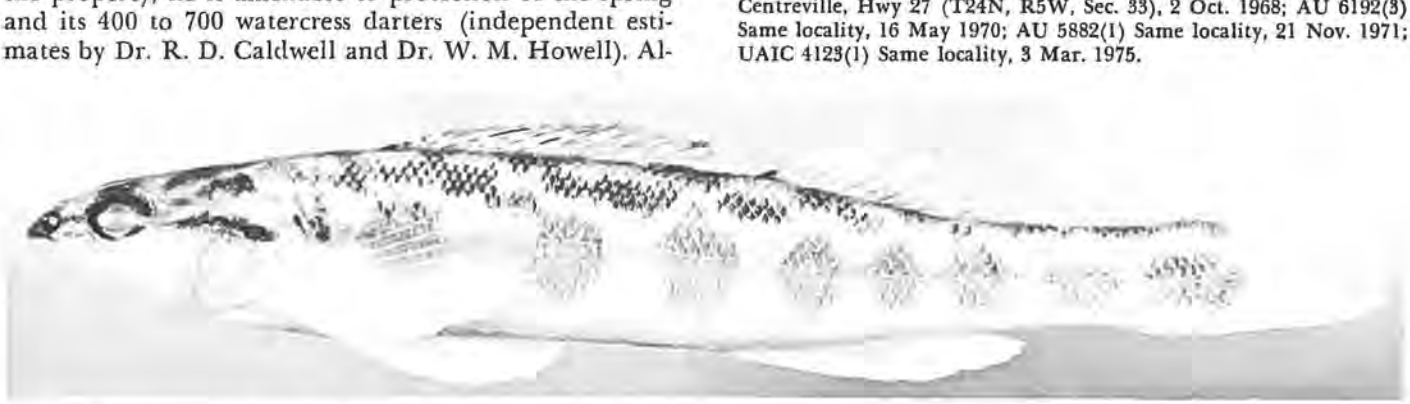


Etheostoma nuchale (Jack Dendy)

Goldline darter
Percina aurolineata Suttkus and Ramsey

Restricted to the upper Cahaba River in Alabama and the upper Coosawattee River in Georgia, a unique distribution pattern among fishes in southeastern United States. Habitat degradation in Cahaba River has been discussed above (see Cahaba shiner). Although typically the goldline darter occupies gravel bars in the river proper, a recent collection suggests it can be found also in the lower courses of sizeable tributaries. All positive Alabama records examined beyond those listed in the original description (Suttkus and Ramsey 1967) are summarized below.

BIBB CO: UAIC 2720(1) Little Cahaba R. below Bulldog Bend (T24N, R10E, Sec. 24), 13 Oct. 1967; AU 1605(1) Cahaba R. 2.2 mi N Centreville, 18 July 1968; AU 1220(12) Cahaba R. 6.2 airmi NE of Centreville, Hwy 27 (T24N, R5W, Sec. 33), 2 Oct. 1968; AU 6192(3) Same locality, 16 May 1970; AU 5882(1) Same locality, 21 Nov. 1971; UAIC 4123(1) Same locality, 3 Mar. 1975.



Percina aurolineata (John Ramsey)

Pygmy sculpin
Cottus pygmaeus Williams

The pygmy sculpin is phenomenally abundant in Coldwater Spring proper and in Coldwater Creek for about 150 yards below the spring. The area is located in the Coosa River drainage in Calhoun Co., about 5.7 miles west of Anniston, and is the only locality known for the species. The City of Anniston Waterworks and Sewers Board protects Coldwater Spring for water supply purposes. While recognizing uniqueness of the pygmy sculpin (Mr. J. E. Standridge, Chief Engineer and General Manager, pers. comm. 1971), waterworks authorities have made no commitment to its protection. The Anniston area is developing rapidly, and future water demand conceivably could force total utilization of the Coldwater Spring flow. Present average discharge is 32 million gallons per day (range 20 to 34 mgd). Maximum water supply pumping capacity (with existing gravity feed) is 22.5 mgd. Although available flow records indicate that peak water use coincides with maximum discharge, it is rumored that overflow into Coldwater Creek ceased for 10 minutes in August of a recent year (Mr. J. E. McCaleb, pers. comm. 1971). Water supply officials also say they wish to control aquatic vegetation in the spring, evidently for esthetic reasons and because floating plant material tends to clog the water supply intake screens. A visit in late 1975 (personal observation) showed that young and adult pygmy sculpins occur abundantly in the submerged vegetation in Coldwater Spring proper. There probably are more than 8000 individuals (casual estimate) living in the ca. 1.2-acre spring pool, which was impounded and lined with concrete walls in 1937. The species may expand its range further downstream in Coldwater Creek during 1976—a treatment program was initiated in March to detoxify chemical wastes flowing into Dry and Coldwater creeks from the U. S. Army's Anniston Ordnance Depot (Mr. J. D. Brittain, pers. comm. 1976).

CALHOUN CO: AU 12489(146) Coldwater Spring proper (T16S, R7E, Sec. 29), 11 Dec. 1975. References: Williams (1968), McCaleb (1973).

Cottus pygmaeus (John Ramsey)

THREATENED SPECIES

Atlantic sturgeon
Acipenser oxyrhynchus Mitchill

Unlike the lake sturgeon in Alabama, this species spends part of its existence in the Gulf of Mexico, presumably in estuaries and close to shore. The Atlantic sturgeon penetrates into small rivers during its spawning migrations, wherein lies its limitation. It appears unable to surmount dams placed along migration routes. Museum specimens are notably rare, principally because ichthyological sampling tends to neglect large fishes in the main channel habitat. Auburn University's Dr. E. H. Williams (pers. comm. 1975) tapped a noteworthy source in his partial review of newspaper accounts of large sturgeon captures, probably all of which refer to this species (summarized below). Further investigation of status definitely is indicated. The most recent sighting was made by Mr. Pete Hale, Tallassee. Mr. Hale said he saw a 7-ft. sturgeon in the Tallapoosa River below Thurlow Dam in April 1973 (J. Hornsby, pers. comm. 1973). Other unpublished sightings include a 6-ft., 180 lb. individual gillnetted in 1961 in Alabama River just above its confluence with Tombigbee River (Dr. W. A. Rogers, pers. comm. 1972) and a 5-ft., 71 lb. fish hoop-netted in 1968 in Tombigbee River near Demopolis (Dr. P. A. Hackney, pers. comm. 1968, identification verified by J. S. Ramsey). Spencer et al. (1965) noted over 60 sturgeon weighing collectively 468 lbs. captured in the Mobile River delta in one year. Juveniles still are taken uncommonly in coastal waters. The records below refer only to captures in fresh waters of Alabama.

GENEVA CO: AU 1559(1) Choctawhatchee R. at RM 56.6, 19 July 1957; MOBILE CO: AU 1558(1) Mobile R. near Mobile Bay, 1967.

NEWSPAPER AND MAGAZINE ACCOUNTS (courtesy of Dr. E. H. Williams): Cahaba R. at Centreville, 27 sturgeon, 350-850 lbs. in 1880's, and one 8-ft., 360 lb. fish in May 1941 (*Centreville Press*, March 20, 1969); Tallapoosa R. 4 mi S of Tallassee, one at 417 lbs in 1930 (*Alabama Game and Fish News*, July 1930); Coosa R. 1 mi below Wetumpka, one at 265 lbs in 1940 (*Alabama Game and Fish News*, May 1940); Tensaw R., one, 1930? (*Alabama Conservation*, 1971, No. 4),

Blue sucker
Cycleptus elongatus (Lesueur)

The blue sucker probably used to occur in the main Tennessee River and its larger tributaries, but Alabama records exist only from main channels of the Tombigbee, Cahaba, Coosa (Scott 1951), lower Tallapoosa (Mr. B. W. Smith, pers. comm. 1974) and Alabama rivers. The discovery of a moribund waif at Dauphin Island (Swingle 1971) shows it to be present through the entire Mobile River and Alabama River main channels. As Smith-Vaniz (1968) pointed out, its rarity in museums partly reflects the difficulty with which it is captured. One usually must use electrofishing, fish toxins or traps to determine its presence and abundance. Unless a regular monitoring program is maintained, ideally with the continuing support of state and university fishery biologists, status of the blue sucker and other large river species might be considered undetermined within a few years. Despite abun-

dance locally, its main channel habitat is increasingly subject to impoundment, channelization, eutrophication and siltation. The blue sucker is vulnerable to recent and proposed modifications, which gave reason for the fish panel's decision on its conservation status. The species already seems to have disappeared from the Tennessee basin and from much of the Coosa River and probably Alabama River main channels.

BIBB CO: AU 8084(1) Cahaba R. 2.1 airmi SE Harrisburg, 15 July 1954. DALLAS CO: UAIC 3634(1) Confluence of Cahaba and Alabama rivers, 21 Mar. 1969 [preimpoundment]. GREENE CO: UAIC 1789(1) Tombigbee R. below confluence with Sipsey R., 5 Aug. 1965. PERRY CO: UAIC 2167(1) Cahaba R. between Sprott and Marion Fish Hatchery, 12 July 1966; AU uncat. (2 skeletons) Cahaba R. between Heiberger and Sprott, 10 July 1967; AU uncat. (2 skeletons) Cahaba R. below Hwy 183 bridge above Sprott, 11 Oct. 1967; AU 5115(2) Cahaba R. ca. 2 mi W Suttle, 18 July 1968. SUMTER CO: AU 9224(3) Tombigbee R. near Epes, 31 July 1953. COUNTY UNKNOWN: AU uncat. (1) Alabama R., 1951. Additional Alabama records are to be found at Tulane University.

Crystal darter
Ammocrypta asprella (Jordan)

This species has been widely extirpated in the central United States. In Alabama it presently is limited to main channel habitats in the Tombigbee, lower Cahaba, lower Tallapoosa, Alabama and Mobile Rivers. Dr. R. D. Suttkus (pers. comm. 1976) has searched extensively for crystal darters, especially in Choccolocco Creek, Calhoun Co. (whence a specimen was reported by Gilbert 1891), and in the main Alabama River. In his words, "We [Tulane University] have over a hundred collections of *Ammocrypta asprella* from the state of Alabama . . . A general statement about the population in the Alabama River in Wilcox and Monroe counties is that it is in serious trouble. Our last record was a single specimen taken in September 1975. We took a total of ten specimens during 1975 in 47 collections . . . Our many attempts to collect *Ammocrypta asprella* in the Choccolocco Creek area failed so I believe we can assume that it has been extirpated from that part of the Coosa." The lower Cahaba River population is being subjected to increased siltation and eutrophication from headward urbanization and strip mining. The Tombigbee River stock may not survive construction of the proposed Tennessee-Tombigbee Waterway. The crystal darter appears to be doing well in the Tallapoosa River, which demonstrates it will reinhabit disturbed areas providing suitable refugia are available. Dr. J. D. Williams (pers. comm. 1976) has examined specimens from three localities in Elmore and Macon counties, including one he collected in Uphapee Creek, a large tributary stream. The species possibly occurs over current-swept sand and gravel beds elsewhere in the lower Mobile River system, inasmuch as Swingle and Bland (1974) reported a specimen trawled in May 1971 in the Mobile River proper at the L & N Railroad crossing. However, it is also possible that this specimen was a waif displaced by upriver construction activity.

BIBB CO: AU 2886(6) Cahaba R. 2.1 airmi SE Harrisburg, 15 July 1954. DALLAS CO: TU 35233(3) Alabama R. at Cahaba, 27-28 June 1964 [preimpoundment]. MACON CO: UAIC uncat. (1) Tallapoosa R. 2 mi below Thurlow Dam, 21 Nov. 1959. MONROE CO: UMMZ 187313(26) Alabama R. at Stein Island, RM 107.5, 27 Sept. 1967. PERRY CO: UAIC 2514(1) Cahaba R. E Heiberger, 31 Mar. 1967. PICKENS CO: UAIC 2705(18) Tombigbee R. at Vienna, 29 Sept. 1967.

Slackwater darter
Etheostoma boschungi Wall and Williams

This recently described darter (Wall and Williams 1974) is almost entirely confined within Alabama. One apparently marginal population occurs in the extreme headwaters of Buffalo River in Tennessee. The remainder exist as two widely disjunct stocks in the Tennessee River basin of Alabama—three localities in the Flint River watershed (Madison Co.), two of which are subject to urbanization around Huntsville, and numerous localities in the Cypress Creek basin (Lauderdale Co.), where its distribution was unchanged as of February 1976 (H. Boschung, pers. comm. 1976). The panel on fishes was impressed with the darter's unique abundance in Cypress Creek and its tributaries, which led to assignment of *threatened* status. The USDA Soil Conservation Service proposes to modify the Cypress Creek watershed through bedload removal, placement of floodwater retarding structures, and limited channelization. Increased siltation and higher water temperatures resulting from these practices easily could bring about its extirpation in the area. Dr. Boschung, Dr. T. S. Jandebeur and the SCS currently are investigating life history and ecology in the slackwater darter.

Coldwater darter
Etheostoma ditrema Ramsey and Suttkus

Restricted to heavily vegetated backwaters of limestone springs and adjacent runs in the Coosa River Valley of Alabama, Georgia, and Tennessee. There are at least four populations of coldwater darters in Alabama (seven if the aberrant specimens from Shelby Co. prove to be conspecific), of which only two can be regarded as strongholds for the species. The spring at Glencoe still supported a high population density as of April 1976 (Ms. W. E. Seesock, pers. comm. 1976), and is the site of a roadside park maintained by the city. Coldwater Spring proper also had a high number of fish as of late 1975 (personal observation), although the species is uncommon in marginal vegetation below in the spring run. Coldwater Spring is maintained by the City of Anniston as a major source of water supply. Both of these springs probably will be subject to increased water demand as Etowah and Calhoun counties become more urbanized. The Martin Spring locality, similar to numerous other limestone springs, has been modified as a sport fishing pond, and its aquatic vegetation accordingly is discouraged. Additional populations are to be sought, especially as suggested by the single waif specimen collected in Choccolocco Creek.

CALHOUN CO: AU 12488(56) Coldwater Spring proper (T16S, R7E, Sec. 29), 11 Dec. 1975; AU 421(3) Martin Spring, trib. to Kelly Cr., 4 mi E Ohatchee, 1 Sept. 1967; TU 56263(1) Choccolocco Cr. 6.4 mi E Oxford, Hwy 78, 27 Jan. 1969. ETOWAH CO: AU 4692 (42) Spring and run 0.5 mi S Glencoe, Hwy 431, 12 Jan. 1972. SHELBY CO: (the following records are included provisionally upon the advice of Dr. R. D. Caldwell, pers. comm. 1975) UAIC 2012(18) Camp Br. 5 mi NE Calera, 10 May 1966; UAIC 2628(2) Mill

Cr. near Bay Springs, 13 Aug. 1967; SU uncat. (12) Watson Cr. 5 mi. SE Calera, 24 June 1967.

Tuscumbia darter
Etheostoma tuscumbia Gilbert and Swain

The Tuscumbia darter is a spring-dwelling species endemic to the Tennessee River drainage. It has been extirpated in Tennessee and probably in eight of the 11 Alabama springs cited by Bailey and Richards (1963). A total of 10 localities have yielded specimens since 1963. In addition to records mentioned below, Mr. W. C. Reeves (pers. comm. 1975) said he found *E. tuscumbia* moderately abundant in Meridianville Spring (T2S, R1E, SW¼ Sec. 19), Madison Co., on 6 Dec. 1972. Buffler Spring yielded only two specimens on 1 May 1975 (Mr. E. Scott, pers. comm. 1975). Pryor Spring is disturbed by livestock and by being sprayed with 2,4-D weedkiller, which is applied directly on emergent spring vegetation about three times each summer (W. C. Reeves, pers. comm. 1976). The Tuscumbia Spring population seems in jeopardy, possibly because of periodic aquatic vegetation removal by Tuscumbia authorities. Dr. H. L. Lindsay and Mr. W. H. Adams (pers. comm. 1976) captured only three Tuscumbia darters in an intensive half-hour sample attempted on 25 Jan. 1976—well below the 221 fish captured in 1.2 hours in April 1963. These trends suggests that the species definitely needs protection. Its presumably short life cycle, combined with dependence on vegetated limestone spring and spring run conditions, renders the Tuscumbia darter exceptionally vulnerable to extirpation.

COLBERT CO: TU 30248(221) Tuscumbia Spring at Tuscumbia, 10 Apr. 1963; UAIC 1588(121) Same locality, 2 Apr. 1965; UAIC 4614(55) Same locality, 4 Mar. 1972. LAUDERDALE CO: UAIC 4886(239) Buffler Spring (also called King Spring), trib to Cox Cr. (T2S, R11W, Sec. 25), 7 July 1974. LAWRENCE CO: UAIC 1592 (113) Wheeler Spring near Wheeler (T4S, R7W, Sec. 36), 3 Apr. 1965. LIMESTONE CO: UAIC 1952(4) Pryor Spring (T4S, R4W, Sec. 22), 16 July 1966; UAIC 1950(17) Unnamed spring (T5S, R3W, Sec. 2), 16 July 1966; AU 8331(1) Same locality? (trib. to Beaverdam Cr.), 5 July 1972; TU 89596(1) Beaverdam Cr., 5 Aug. 1974; UAIC 4923, Moss Spring Run 1.5 mi NE Greenbrier (T4S, R3W, Sec. 15), 5 Aug. 1974. MADISON CO: UAIC 1960(44) Indian Spring (T3S, R2W, Sec. 2), 17 July 1966; UAIC 3237(1) Braham Spring in Huntsville, 19 Oct. 1968; UAIC 1967(18) Unnamed spring (T2S, R1E, Sec. 27), 10 Sept. 1966. Reference: Armstrong and Williams (1971).

Warrior muscadine darter
Percina sp. ssp.

This undescribed subspecies of a yet unnamed species was discovered subsequent to the distributional summary given by Smith-Vaniz (1968, under the name "bridled darter"). It is distributed only in Sipsey Fork of the Black Warrior River above the backwater of Lake Lewis Smith, about 5.3 miles E of Ashridge, Alabama. Known from a four-mile stretch of the main river and from one tributary in the same area. The Warrior muscadine darter probably occurred downstream in the presently inundated portion of Sipsey Fork. *Threatened* status was assigned because the population may be surviving only marginally. Maximum pool level in the Smith Lake backwater might cause it to be vulnerable to lacustrine predators. Its main channel habitat is subject to possible disturbance from upstream forestry and stripmining activities. Confirmation of its status is needed.

WINSTON CO: UAIC 3851(35) Sipsey R. [Fork] ca. 2.5 mi W Grayson (T9S, R8W, Sec. 10), 29 Oct. 1971; AU 5060(8) Sipsey Fk. 5.3 airmi E Ashridge, 3 July 1971; UAIC 3855(3) Sipsey R. ca. 4 mi SW Grayson (T9S, R8W, Sec. 22), 8 Nov. 1971; UAIC 3853(3) Sipsey R. ca. 4.25 mi SW Grayson (T9S, R8W, Sec. 16), 3 Nov. 1971; UAIC 3859(6) Caney Cr. ca. 5 mi E Rabbittown (T9S, R8W, Sec. 20), 17 Nov. 1971. Reference: Dycus and Howell (1974).

Freckled darter
Percina lenticula Richards and Knapp

The freckled darter shares certain habitat and distributional characteristics of the shovelnose sturgeon, blue sucker, frecklebelly madtom, and crystal darter in Alabama. Although the panel determined it to be *threatened* and on the verge of *endangered* status, Dr. R. L. Shipp (pers. comm. 1975) has taken specimens in minnow traps placed in cutoffs along the lower Alabama River. Several other records suggest the species enters the lower courses of sizeable tributaries at least temporarily. Further work is needed to fix the conservation status of this presumably vagile inhabitant of large-stream rapids and slackwaters. Its spawning habits particularly should be examined. Museum records from Alabama supplementary to those presented by Suttkus and Ramsey (1967) are cited below.

BIBB CO: AU 1606(1) Cahaba R. 2.2 mi N Centreville, 18 July 1968; AU 3495(1) Schultz Cr., 22 Aug. 1968. CHEROKEE CO: AU 1937(2) Little R. at RM 2, 28 Oct. 1958 [preimpoundment]. MACON CO: AU 85(2) Calebee Cr. [at railroad crossing above confluence with Tallapoosa R.], 24 June 1967; AU 6568(1) Uphapee Cr. 3.5 airmi N Tuskegee, Hwy I-85, 29 Oct. 1971. PERRY CO: AU uncat. (1) Cahaba R. [in commercial fisherman's slat trap, depth ca. 5 feet], 25 Sept. 1964; AU 1282(2) Cahaba R. at Marion Fish Hatchery, 6.0 airmi NE Marion, 17 July 1968. WILCOX CO: (all of the following are from the main Alabama R. channel) TU 40930(1), 28 June 1966; TU 47849(1), 19 Aug. 1967; TU 48000(1), 27 Sept. 1967; TU 62785(9), 23 June 1970; TU 78174(4), 1 June 1972.

SPECIES OF SPECIAL CONCERN

Lake sturgeon
Acipenser fulvescens Rafinesque

The habitat is large rivers in the Tennessee and Coosa drainages. The lake sturgeon may be extirpated in Alabama, although its status presently is undetermined. It last appeared in commercial catches in the Tennessee Valley in 1961 (B. Carroll, pers. comm. 1971). There are occasional rumors concerning sturgeon captures by commercial fishermen in the Coosa River basin of Georgia. However, the only concrete record in the Alabama drainage is that reported by Scott (1951). Additional large river sampling is needed before its status can be decided. Pollution and impoundment seem to have interfered with its success in Alabama.

MADISON CO: UMMZ 122910(1) Indian Cr. above mouth (T5S, R2W, Sec. 27) [preimpoundment], 29 June 1938.

Southern redbelly dace
Chrosomus erythrogaster (Rafinesque)

In Alabama the species is known only from the Tennessee drainage in four northwestern counties. Restricted

to permanent springs and cool streams, usually those having abundant aquatic vegetation. Although this type of habitat now appears fairly widespread in northern Alabama, the dace may have been widely extirpated in central and northeastern portions. Common only in tributaries of the Cypress Creek watershed, Lauderdale Co., extremely rare in Elk River and Bear Creek basins.

COLBERT CO: UAIC 1965 (13) Newsome Springs (T5S, 813W, Sec. 4), 30 July 1966. FRANKLIN CO: UAIC 1963(2) Spring Br. (T6S, R12W, Sec. 27), 29 July 1966; UAIC 2328(1) Dismal Br. (T8S, R12W, Sec. 27), 26 Aug. 1966. LAUDERDALE CO: UAIC 4807(2) Lindsey Cr. (T1S, R13W, Sec. 24), 22 May 1974; UAIC 4865(52) Threet Cr. (T1S, R13W, Sec. 2), 14 June 1974; UAIC 4853(1) Middle Cypress Cr. (T1S, R12W, Sec. 10), 11 June 1974; UAIC 4836(1) Little Cypress Cr. (T1S, R11W, Sec. 4), 4 June 1974; UAIC 4802(8) Cypress Cr. (T1S, R12W, Sec. 8), 20 May 1974; UAIC 4895 (6) Olive Spring (T1S, R11W, Sec. 4), 7 July 1974; UAIC 1990(18) Unnamed Spring (T1S, R11W, Sec. 28), 23 Mar. 1967; UAIC 1590(11) Bailey Spring (T2S, R10W, Sec. 10), 2 Apr. 1965; UAIC 1987(2) Needmore Spring (T1S, R7W, Sec. 9), 5 Mar. 1967; UAIC 2422(1) Bluewater Cr. (T2S, R9W, Sec. 13), 25 Jan. 1967; UAIC 4805(21) Burcham Cr. (T1S, R13W, Sec. 26), 21 May 1974. LIMESTONE CO: AU 1848(2) Wheeler Reservoir [area], 8 June 1938; UAIC 1982 (26) Spring Run (T1S, R6W, Sec. 21), 25 Jan. 1967; UAIC 2792(5) Spring Run, Big Cr. bridge at O'Neal, 29 Dec. 1967. References: Wall (1968), Armstrong and Williams (1971), Jandebeur (1972).

Flame chub
Hemitremia flammea (Jordan and Gilbert)

The flame chub is moderately common north of the Tennessee River proper but is rare southward. It typically inhabits limestone springs and small to moderate streams within the immediate influence of such springs. Recent records in Alabama include two localities in the Coosa River drainage and at least 55 localities in the Tennessee drainage. The majority of the latter (31) are from the Cypress Creek watershed in Lauderdale Co. The species is most abundant in Lauderdale, Limestone, and Madison counties. Only seven samples are from the area south of the Tennessee River. Early records from Huntsville Spring, Tuscumbia Spring Run, and Veta Wright Creek, Decatur (Gilbert 1891) demonstrate that the flame chub probably was much more widespread than it is today. Its decline probably has been the result of agricultural clearing, which tends to increase water temperature and turbidity. It may have been more widespread in the Choccolocco Creek basin of Talladega Co. prior to the severe pollution of the main channel and impoundment of the lower end.

JACKSON CO: UAIC 1946(5) Spring at Little Nashville (T3S, R4E, Sec. 29), 16 Apr. 1966; UAIC 1942(13) Spring 0.2 mi S Princeton (T2S, R4E., Sec. 31), 16 Apr. 1966; USNM uncat. (5) Guess Cr. (T3S, R4E, Sec. 23), 22 May 1965. LAUDERDALE CO: UAIC 4864(4) Cypress Cr. (T1S, R12W, Sec. 8), 14 June 1974; UAIC 4837(22) North Fork Cypress Cr. (T1S, R12W, Sec. 17), 5 June 1974; UAIC 4855(12) Middle Cypress Cr. (T2S, R12W, Sec. 13), 12 June 1974; UAIC 4860 (10) Little Cypress Cr. (T1S, R11W, Sec. 21), 13 June 1974; UAIC 4866(9) Cox Cr. T2S, R11W, Sec. 25), 14 June 1974; UAIC 4857(1) Lindsey Cr. (T1S. R12W, Sec. 33), 12 June 1974; UAIC 4838(3) Threet Cr. (T1S, R12W, Sec. 20), 5 June 1974; UAIC 4863(14) Burcham Cr. (T2S, R12W, Sec. 16), 13 June 1974; UAIC 2959(1) Anderson Cr. 0.5 mi S Anderson, 30 May 1968; UAIC 3241(4) Oakley Spring Branch (T1S, R12W, Sec. 36), 29 January 1969; AU uncat. (5) Olive Spring (T1S, R11W, Sec. 4), 7 Aug. 1974. Dr. H. T. Boschung, (pers. comm. 1976) is finding the Cypress Creek populations basically unchanged in current sampling. LAWRENCE CO: UAIC 4615(3) Wheeler Spring (T4S, R7W, Sec. 34), 4 Mar. 1972; UAIC 3884(1) Gillespie Cr. (T8S, R7W, Sec. 1), 4 July 1971; UAIC 3883(1) Lee Cr. (T8S, R7W, Sec. 1 and 12), 4 July 1971. LIMESTONE CO: UAIC 3133(1) Sugar Cr. 1 mi N Mt. Rozell (T1S, R6W, Sec. 22), 29 Sept. 1968; UAIC 1950(5) Unnamed spring (T5S, R3W, Sec. 2), 16 July 1966. MADISON CO: UAIC 2543(4) Mountain Fork Flint R. at New Market, 8 Apr. 1967; UAIC 1960(29) Indian Springs (T3S, R2W, Sec. 2), 17 July 1966; UAIC 1959(2) Unnamed spring (T2S, R1W, Sec. 25), 17 July 1966; UAIC 1958(7) Acuff Spring (T3S, R1E, Sec. 14), 17 July 1966; AU uncat, Hurricane Cr. near New Market (T2S, R2E, Sec. 11), 22 May 1965. MORGAN CO: AU 4698(1) Cotaco Cr. 5.9 airmi N of Hulaco, 12 July 1966. TALLADEGA CO: UAIC 2574(1) Spring tributary to Kelly Cr. (T18S, R6E, Sec. 9), 30 Sept. 1967. *Reference: Armstrong and Williams (1971).

Streamline chub
Hybopsis dissimilis (Kirkland)

The only known collection of this species from Alabama was 22 specimens recorded by Fowler (1922) from the Paint Rock River in Jackson and Madison counties (Smith-Vaniz 1968). The population may well have been extirpated because of channelization and increased siltation. However, recent sampling in the Elk River and Shoal Creek drainages (Jandebeur 1972; Wagers 1974) shows that the streamline chub still exists in the Tennessee portions of these streams. It may occur downstream in Alabama, at least sporadically. Further collecting may help clarify the status of this large-stream fish.

Blotched chub
Hybopsis insignis Hubbs and Crowe

Hubbs and Crowe (1956) stated that the blotched chub occurs in the Tennessee drainage of Alabama, yet listed no positive records. Dr. R. M. Bailey (pers. comm. 1976) found no catalogued material from Alabama among holdings at the University of Michigan. The National Museum of Natural History may have some older records, perhaps including that reported from Shoal Creek, Florence, as *Hybopsis dissimilis* (Gilbert 1891; Smith-Vaniz 1968). Fairly recent records are available from Big Butler Creek and Little Butler Creek (the latter sample deposited at Cornell University), both tributary to Shoal Creek in Lauderdale Co. Its current status should be examined closely.

LAUDERDALE CO: AU 2916(2) Big Butler Cr. near Pruitton (T1S, R10W, Sec. 18), 19 May 1956.

Spotfin chub
Hybopsis monacha (Cope)

This species appears to have been extirpated in Alabama. It probably occupied large clear streams through all of the Tennessee Valley. Dr. R. E. Jenkins (pers. comm. 1974) is reviewing its status.

COLBERT CO: UMMZ 132502(1) Little Bear Cr., 27 Oct. 1937. LAUDERDALE CO: UMMZ 192582(1) Shoal Cr., Florence, no date [probably collected by Gilbert and Swain in 1884, cf. R. E. Jenkins].

Popeye shiner
Notropis ariommus (Cope)

Like the preceding species, the popeye shiner seems to have disappeared from the ichthyofauna of Alabama. Judging from its present distribution and ecology (C. R.

Gilbert 1969) it probably was widespread in sizeable streams in the Tennessee River basin. Siltation from logging and agricultural practice may have brought about its demise. The only records of the species from Alabama are those taken in Cypress Creek near Florence, Lauderdale Co., in 1884 (5 specimens) and in 1889 (17 specimens), reported by Gilbert (1891). Intensive collecting in the Cypress Creek and Shoal Creek drainages in Alabama and Tennessee during the summer of 1974 produced no specimens. It is doubtful that the species still exists in Alabama.

Bigeye shiner
Notropis boops Gilbert

The panel on fishes regarded this Tennessee River form as marginally worthy of listing because of its limited Alabama distribution. However, its seeming rarity may reflect inadequate collecting of the slackwater habitat rather than actual lack of competitiveness. A large sample recently came to light (1976), taken in Paint River during high water. Inasmuch as this stream has been channelized, the bigeye shiner probably will be eliminated from future lists of rare fishes in Alabama. It should be sought primarily in large streams.

COLBERT CO: UAIC 2085(8) Rock Cr. (T5S, R15W, Sec. 24), 11 June 1966. FRANKLIN CO: UAIC 860(1) Cedar Cr. (T7S, R12W, Sec. 12), 21 Sept. 1962; UAIC 2133(2) Lost Cr. (T6S, R13W, Sec. 9), 1 July 1966; AU 4035(1) Bear Cr. (T7S, R14W, Sec. 30), 2 Sept. 1970; AU 9500(1) Little Bear Cr. (T7S, R14W, Sec. 5), 20 Sept. 1973. JACKSON CO: UAIC 1939(1) Hurricane Cr. (T1S, R5E, Sec. 32), Apr. 1966; AU 12003 (74) Backwater of Paint Rock R. ca. 1.8 mile S Hollytree, Hwy 65, 11 Jan. 1972. LIMESTONE CO: AU 4612(1) Piney Cr. (T4S, R4W, Sec. 25), 23 June 1966. Reference: Wall (1968).

Blue shiner
Notropis caeruleus (Jordan)

This handsome minnow occurs as widely scattered populations above the Fall Line in the Coosa and Cahaba river basins. It inhabits medium to large clear streams, some of which are being subjected to decreasing water quality. Good populations still exist in the relatively undisturbed Weogufka Creek and parts of upper Choccolocco Creek watersheds, but the Cahaba River is increasingly stressed because of headward urbanization (with associated eutrophication and siltation) and strip mining. The status of other populations needs to be determined. The largest and most recent of 56 samples from seven Alabama counties are listed below.

BIBB CO: TU 19404(67) Cahaba R., 8 Sept. 1958; TU 69090(1) Cahaba R., 9 Apr. 1971. CALHOUN CO: TU 70317(37) Shoal Cr., 1 June 1971; TU 87839(2) Shoal Cr. 2.3 mi E White Plains, 11 June 1974; TU 60316(49) Choccolocco Cr., 16 Oct. 1969; TU 78965(2) Choccolocco Cr., 12 Sept. 1972. CHEROKEE CO: AU 2935(3) Little R. at RM 2, 28 Oct. 1958 [preimpoundment]. COOSA CO: SU uncat. (4) Weogufka Cr. 2.6 airmi W Mt. Moriah Church (T22N, R17E, Sec. 4), 6 Apr. 1974. DEKALB CO: UMMZ 175655(1) Wills Cr. at Lebanon, 11 Sept. 1958. JEFFERSON CO: UAIC 952(8) Creek 8 mi E Bessemer near Paradise Lake, 16 Sept. 1962; UAIC 2516(4) Cahaba R. at Overton (T17S, R1W, Sec. 33), 6 Apr. 1967. SHELBY CO: TU 38183(9) Cahaba R., 24 June 1965; AU 2557(1) Cahaba R. 2.6 mi SW Helena (T20S, R3W, Sec. 20), 13 May 1969. Reference: May (1963).

Bluestripe shiner
Notropis callitaenia Bailey and Gibbs

This large-river minnow is proposed for classification as a threatened species by the American Fisheries Society's Committee on Endangered Species (Dr. J. E. Deacon, pers. comm. 1976). Its total range is in the Apalachicola River basin, where its habitat has been seriously depleted by impoundment and pollution. However, there is no evidence suggesting its Alabama distribution is any less than it always has been, with the exception of the lower course of Halawakee Creek, Lee Co. A quirk of geography has spared Alabama populations from the most adverse effects of changes in the Chattahoochee River, whose western bank (before impoundment) represents much of the boundary between Georgia and Alabama. Inasmuch as we were aware of no actively proposed modification of large streams in the Uchee Creek and Halawakee Creek watersheds, where the species is doing well, the fish panel decided the bluestripe shiner must be regarded as of *special concern* in Alabama. Three presently isolated populations are known.

BARBOUR CO: AU 1009(1) Little Barbour Cr. 6.7 mi S Cottonton, Hwy 165, 17 Apr. 1968. LEE CO: AU uncat. Halawakee Cr. at confluence with Lake Harding, 19 May 1975. RUSSELL CO: AU 701 (26) Igahee Cr. 15.8 mi N of Barbour Co. line, Hwy 185, 1 Sept. 1967; AU 1311 (1) Uchee Cr. 6.2 mi S of Crawford, Hwy 169, 4 Nov. 1968; AU 2863(72) Uchee Cr. ca. 2 mi below confluence with Little Uchee Cr., 2 Oct. 1954; AU 1506(36) Uchee Cr. 10.0 mi SW Phenix City, Hwy 431, 4 Nov. 1968; AU uncat. (3) Cowpen Cr. 6.8 mi NE Seale, 24 May 1964. Reference: R. J. Gilbert (1969).

Warpaint shiner
Notropis coccogenis (Cope)

The warpaint shiner reaches the southern limit of its range in the Tennessee River basin of Alabama, where it is limited to three creek systems in Lauderdale and Madison counties. The species rather commonly occupies small and large streams in the Cypress Creek and the upper Elk River and Shoal Creek drainages in the state (Jandebeur 1972; Boschung and Jandebeur 1974; Wagers 1974). Although it does not seem as habitat-specific as *Hemitremia flammea*, small watershed development as proposed for Cypress Creek perhaps will increase stream temperatures beyond suitable levels. Gilbert (1964) suggested that Alabama and adjacent Tennessee populations may be relicts dependent upon permanently cool stream flow. It seems probable that the warpaint shiner once occurred throughout the Tennessee drainage in Alabama.

Dusky shiner
Notropis cummingsae Myers

It might be more suitable to assign a status undetermined category to Alabama populations of this widespread minnow. It is restricted to small, weedy streams of the Uchee Creek drainage on the upper Coastal Plain. Although Hubbs and Raney (1951) possessed enough material to suggest there has been genetic divergence of an upper Chattahoochee race, there is a dearth of more recent samples. A study on its taxonomic and conservation status needs to be made.

RUSSELL CO: AU 1924(1) Uchee Cr. S of Marvyn, 26 Sept. 1938; AU 1312(4) Uchee Cr. 6.2 mi S Crawford, Hwy 169, 4 Nov. 1968;

TU 10701(48) Trib. to Uchee Cr. 3.2 mi W Crawford, 17 Sept. 1955. Reference: R. J. Gilbert (1969).

Broadstripe shiner
Notropis euryzonus Suttkus

The broadstripe shiner shares part of its habitat with the preceding species. Both inhabit Apalachicola basin streams which appear more typical of the lower Coastal Plain—small, somewhat stained but clear waters, with heavy aquatic vegetation trailing in moderate current. Although there has been a greater number of positive samples made since its description (Suttkus 1955), its status also needs to be explored further.

HENRY CO: AU 616(3) Foster Cr. 5.0 mi N Columbia, Hwy 95, 31 Aug. 1967; FSU uncat., same locality, monthly samples taken in Feb.-May 1971. HOUSTON CO: AU 1177(162) Mill Cr. 1.2 mi SE Gordon, Hwy 95, 2 Aug. 1968. LEE CO: AU uncat. (2) trib to Watoola Cr. 1 mi N Marvyn, Hwy 37, 25 July 1964; AU uncat., Snake Cr. 4.0 airmi NNE Marvyn (T17N, R27E, Sec. 3 and 4), 27 Apr. 1965. RUSSELL CO: AU 677(1) Igahee Cr. 15.8 mi N Barbour Co. line, Hwy 165, 1 Sept. 1967; AU 1322(9) trib to Uchee Cr. 3.1 mi S Huguley, 4 Nov. 1968. Reference: R. J. Gilbert (1969).

Sawfin shiner
Notropis sp.

This undescribed minnow is surprisingly rare in Alabama. It is one of the most common species in medium to large upland streams tributary to the Cumberland and Tennessee drainages in neighboring Tennessee. Although it appears tolerant of eutrophication in parts of its range, the sawfin shiner may not survive long periods of siltation. It has disappeared from Big Nance Creek at Courtland since the late 1800's (Gilbert 1891). On the other hand, its recent capture in Paint Rock River indicates the species can reinvade channelized streams—assuming a population survives somewhere within reach of the affected watershed.

JACKSON CO: ANSP 109033(8) Paint Rock R., 13 Oct. 1921; AU 12007(7) Backwater of Paint Rock R. ca. 1.8 mi S Hollytree, Hwy 65, 11 Jan. 1972; UAIC 1938(1) Lick Fk. Paint Rock R. at Princeton, Hwy 65, 16 Apr. 1966; UAIC 1939(1) Hurricane Cr. 3.3 mi NE Estill Fk, 16 Apr. 1966. LAUDERDALE CO: UAIC 1763(1) Butler Cr. NE of Florence, 25 Sept. 1965. LAWRENCE CO: USNM 43477(2) Big Nance Cr., Courtland. Reference: Smith-Vaniz (1968).

Sand shiner
Notropis stramineus (Cope)

Known until recently only from a specimen captured at Big Nance Cr. at Courtland in Lawrence Co. (Gilbert 1891; Smith-Vaniz 1968). Repeated efforts to collect this and other rarities reported from the locality have been fruitless. The sand shiner is widespread outside the state.

Stargazing minnow
Phenacobius uranops Cope

In Alabama this slender fish has been found in the Shoal Creek and Elk River drainages of the Tennessee River basin. It inhabits moderate to large streams, and usually is found over clean gravel, cobble or boulder riffles. Its status needs additional monitoring.

LAUDERDALE CO: UAIC 1763(2) Big Butler Cr. NE Florence (T1S, R10W, Sec. 8), 25 Sept. 1965, LIMESTONE CO: UAIC 3131 (2) Sugar Cr. ca. 1.8 mi N Cairo (T2S, R6W, Sec. 2), 29 Sept. 1968.

Harelip sucker
Lagochila lacera Jordan and Brayton

Almost certainly extinct throughout its former range, which included the Tennessee River basin in Alabama. Smith-Vaniz (1968) vividly summarized the demise of this once abundant fish. He also documented an 1884 record from Cypress Creek, Lauderdale Co.

Elegant madtom
Noturus elegans Taylor

This small catfish is extremely rare in the Tennessee River drainage of Alabama, which is puzzling when compared with its abundance in small to medium streams elsewhere. The elegant madtom may be extirpated in Piney Fork in Limestone Co. (reported by Taylor 1969). The fish panel overlooked this species during its 1975 coverage, but discovery of specimens in a recent TVA rotenone sample provided part of the basis for this report. Its status needs closer examination.

FRANKLIN CO: AU 4092(2) Cedar Cr. 2.9 airmi WNW Pleasant Site, RM 9 (T6S, R15W, Sec. 9), 8 Sept. 1970. LIMESTONE CO: UMMZ 165877(1) Piney Cr. [Fork] (T4S, R4W, Sec. 12), 9 June 1941.

Stonecat
Noturus flavus Rafinesque

Although it is extremely widespread and abundant northward, the stonecat in Alabama seems restricted to Shoal Creek. Dr. G. H. Clemmer (pers. comm. 1975) recently affirmed the existence of a population based on an older record discussed by Smith-Vaniz (1968).

LAUDERDALE CO: MSU uncat. (1) Shoal Cr. at Hwy 8 crossing, 7 Oct. 1972.

Brindled madtom
Noturus miurus Jordan

Six records from the Bear Creek drainage in the northwestern corner of the state extend the range of this widespread form into Alabama, as predicted by R. W. Taylor (in Smith-Vaniz 1968). All were from TVA rotenone samples, again illustrating the value of using a variety of sampling procedures in total faunistic survey. The brindled madtom sometimes can be seined readily at night, but usually is scarce in daytime riffle samples. Perhaps by day it remains in the slackwater habitat—the transitional zone between current-swept shoals and long, sluggish pools. The problematic record from Cypress Creek in Lauderdale Co. (Smith-Vaniz 1968) remains in doubt.

FRANKLIN CO: AU 6463(1) and AU 6479(1) Cedar Cr. (T6S, R14W, Sec. 9 and 10), 12 Oct. 1972; AU 8771(22) Little Bear Cr. (T7S, R13W, Sec. 35) 18 Sept. 1973; AU 9433(18) Little Bear Cr. (T7S, R13W, Sec. 29), 18 Sept. 1973; AU 9458(4) Little Bear Cr. (T7S, R13W, Sec. 19), 19 Sept. 1973; AU 9482(3) Little Bear Cr. (T7S, R14W, Sec. 13), 19 Sept. 1973.

Southern cavefish
Typhlichthys subterraneus Girard

The southern cavefish is an obligate cave dweller found in subterranean waters tributary to the Tennessee and Coosa river drainages. Outside Alabama it has the most extensive range of any North American troglobitic fish.

Although studies by Dr. J. E. Cooper (pers. comm. 1975) suggest that most known populations contain far fewer than 150 individuals, the species occurs fairly commonly in northern Alabama. Records are available from 25 caves of the nine Tennessee Valley counties and from two caves within the Coosa drainage in DeKalb Co. (Cooper and Iles 1971).

Whiteline topminnow
Fundulus albolineatus Gilbert

The whiteline topminnow, probably extinct as a species, is known only from specimens captured in Spring Creek, Huntsville (Gilbert 1891). Huntsville Spring and Run today are developed as the center of an attractive park in the downtown section of the city. The waters flow within concrete retaining walls. Spring Creek further downstream has been much modified over the years. It is doubtful that the whiteline topminnow will be found again at the type locality, although exploration in spring-influenced streams of the Huntsville region should continue. A related form survives on the eastern Highland Rim of central Tennessee.

Banded topminnow
Fundulus cingulatus Valenciennes

The banded topminnow is locally abundant outside of Alabama, yet there are only two state records known. One was cited by Smith-Vaniz (1968) from Big Escambia Creek at Flomaton, Escambia Co. Its continued presence in Alabama has not been verified, although it actually may be fairly widespread in poorly accessible areas.

BALDWIN CO: UAIC 847(11) Freshwater lake, Gulf Shores, 24 Feb. 1962.

Pygmy killifish
Leptolucania ommata (Jordan)

This tiny species occurs in clear, weedy swamps and backwaters of streams in extreme southern Alabama. It is common to the east, especially in Florida, and may be more widespread than state records indicate. Smith-Vaniz (1968) listed data for a June 1965 sample from Dyas Creek, Perdido River drainage in Baldwin County. Four more recent collections are available, none from areas subject to proposed modification. Swingle and Bland (1974) reported four specimens each from Magnolia River and Sandy Creek, Baldwin County, 20 April 1972.

BALDWIN CO: AU 6787(34) Swamp just W of Perdido R., ca. 1.5 airmi ENE Seminole, Hwy 90, 8 April 1973; TU 94886(6) Blackwater R., 13 July 1975.

Bluefin killifish
Lucania goodei Jordan

Smith-Vaniz (1968) reported what is still the unique record of *L. goodei* from Alabama (Bazemore Mill Spring and Pond, Houston Co.). No state records were found in a thorough survey of the Choctawhatchee River drainage (Mettee 1970).

Shoal bass
Micropterus sp.

Long confounded with the relatively widespread redeye bass (*Micropterus coosae*), the shoal bass is an Apalachicola River endemic known in Alabama only from four tributaries to the Chattahoochee River. Remarks on its taxonomic and conservation status were presented by Ramsey (1975). The shoal bass occurs only in large flowing streams, a habitat much depleted outside of Alabama by impoundment, canalization, and pollution. Although it has been proposed as being of *threatened* conservation status nationally, there is no evidence its Alabama habitat has diminished substantially or will deteriorate in the near future. It is a locally popular gamefish in eastern Alabama and still is caught at all of the locations mentioned below.

LEE CO: AU 9359(2) Wacoochee Cr. 1 mi above mouth, 17 Apr. 1970; AU 1610(1) Halawakee Cr. at rapids just above Lake Harding, 24 Sept. 1968; AU 10789(1) Sturkie Cr. (T18N, R28E, Sec. 15), 17 Oct. 1971. RANDOLPH CO: AU 6523(1) Wehadkee Cr. 4.6 airmi SE Rock Mills, 30 June 1972. RUSSELL CO: AU 2897(1) Uchee Cr. 6.3 mi S of Crawford, 1 Oct. 1955.

Blenny darter
Etheostoma blennius Gilbert and Swain

Known in Alabama from Cypress and Shoal creeks in Lauderdale Co., Tennessee River drainage. Proposed modification of the Cypress Creek watershed might have an adverse effect on its wellbeing, especially if heated epilimnetic waters are released from floodwater retarding structures placed on the upper reaches of small tributary streams. Dr. Herbert Boschung, (pers. comm. 1976) captured and released 4 and 15 blenny darters in Little Cypress and Cypress creeks respectively, during February 1976, so the species continues to do well in this area.

LAUDERDALE CO: TU 80110(7) Butler Cr. 4 Nov. 1972; UMMZ 132640(13) Second Cr., trib. to Tennessee R., TVA Map 25 NE, 4 Nov. 1937; UAIC 4844(1) Cypress Cr. (T1S, R12W, Sec. 5), 7 June 1974; UAIC 4819 (2) Middle Cypress Cr. (T1S, R11W, Sec. 7), 28 May 1974; UAIC 4838(1) Threet Cr. (T1S, R12W, Sec. 20), 5 June 1974; UAIC 4865(2) Little Cypress Cr. (T1S, R13W, Sec. 2), 14 June 1974.

Ashy darter
Etheostoma cinereum Storer

The only known Alabama record of this species is that based on specimens from Florence, Tennessee River system, in the early 1800's. These specimens served as the basis of the original description of *E. cinereum* (Storer 1845). The types apparently have been lost (Smith-Vaniz 1968). Its primary habitat elsewhere is in deeper rocky pools of moderate to large streams with some current influence. Proper sampling techniques may yield additional specimens, but it is suggested that the ashy darter has been extirpated in Alabama. It may have reached its demise with the advent of agriculture in the Tennessee Valley, perhaps through increased insolation of streams and siltation of its spawning substrate.

Unnamed snubnose darter
Etheostoma sp.

This undescribed species is uncommon in parts of the Coosa River basin of Georgia and Tennessee. Smith-Vaniz (1968) discovered the only known Alabama population in Shoal Creek, Calhoun and Cleburne counties. The species appears to require cooler water than do other members

of the subgenus *Ulocentra* in Alabama. Inasmuch as the Shoal Creek watershed falls within the Talladega National Forest and the state's Choccolocco Game Management Area, its status under present conditions probably is fairly secure. Construction of a Soil Conservation Service floodwater retarding structure in the area may not have affected the darter's well-being, although its influence should be examined closely.

CALHOUN CO: AU 11492(3) Shoal Cr. 5.6 airmi NW Heflin (T15S, R9E, Sec. 24), 6 Aug. 1974. CLEBURNE CO: AU 9349(1) Shoal Cr. 5.4 airmi NNW Heflin (T15S, R10E, Sec. 17), 6 Aug. 1974.

Trispot darter
Etheostoma trisella Bailey and Richards

Only two specimens are known from Alabama, both from the Coosa River basin. The original description (Bailey and Richards 1963) was based upon a single specimen collected in 1947 from Cowans Creek, Cherokee Co., an area later inundated by Weiss Reservoir. A second individual was taken in 1958 from Coosa River proper. Intensive collecting has failed to produce additional records, and the species probably has been extirpated in Alabama. It still persists in a limited area elsewhere.

ETOWAH CO: AU 7009(1) Coosa R. 7.8 airmi SSW Gadsden, 2.0 airmi above McCardneys Ferry (RM 175.7), 17 July 1958.

Northern banded darter
Etheostoma z. zonale (Cope)

Aside from the three 1889 Alabama collections cited by Smith-Vaniz (1968), the banded darter has been captured recently only in the Cypress Creek and Shoal Creek watersheds, Tennessee River drainage in Lauderdale Co. It appears to be rare to uncommon in these areas, and probably is extirpated in Big Nance Creek, Courtland (Gilbert 1891). Alabama stocks represent a morphological race of *E. z. zonale* which is more abundant far to the east (Tsai and Raney 1974). The Cypress and Shoal creek relicts presumably will not tolerate siltation or elevated water temperatures.

LAUDERDALE CO: UAIC 3271(5) Little Cypress Cr. (T2S, R11W, Sec. 32), 21 Mar. 1969; AU 3833(1) Little Cypress Cr. just above confluence with Cypress Cr., 27 Nov. 1970; AU 3820(1) Cypress Cr. 0.5 mi NW confluence with Little Cypress Cr., 27 Nov. 1970; UAIC 1763(20) Butler Cr. (T1S, R10W, Sec. 8), 25 Sept. 1965; TU 80117(19) Butler Cr. 1.6 mi N of Hwy 8 on Hwy 61. 4 Nov. 1972; UAIC 1762 (1) Shoal Cr. (T1S, R10W, Sec. 21), 25 Sept. 1965.

Blotchside logperch
Percina burtoni Fowler

A specimen of this rare darter was captured by Dr. G. H. Clemmer (pers. comm. 1975) in Little Butler Creek 3 miles N of County Hwy 8 on Hwy 61, 7 Oct. 1972, Lauderdale Co. (Shoal Creek basin of the Tennessee River drainage). Dr. Clemmer's record is the first known from the state. The Shoal Creek drainage contains quite a few of Alabama's rare fishes. The panel considered the basin presently little disturbed and not subject to active proposals for modification. The area should be monitored closely for potential habitat changes.

Mottled sculpin
Cottus bairdi Girard

Although abundant in central North America, the mottled sculpin in Alabama occurs only as isolated populations in coldwater springs and streams across the extreme northern part of the state.

JACKSON CO: UAIC 2529(6) Unnamed spring (T2S, R9E, Sec. 15), 15 Apr. 1967; AU uncat. (18) Salt R. Just below Tennessee line, 9.0 airmi NE Hytop (T1S, R6E, Sec. 2), 9 Nov. 1972; AU uncat. (19) Tunnel Spring, trib. to Salt R., just S Tennessee line (T1S, R6E, Sec. 2), 9 Nov. 1972; AU uncat. (2) Little Crow Cr. at large oxbow ca. 8 airmi NW Stevenson, 26 Oct. 1972; AU uncat. (75) Salt R. at confluence Little Crow Cr., 9.2 airmi NE Hytop, 6 July 1973. LAUDERDALE CO: UMMZ 132681(22) Colbert Cr. [ca. 6.2 airmi W Oakland], 5 Nov. 1937; UAIC 2001(6) Bluff Cr. on Hwy 14, 24 Apr. 1966; UAIC 2423(1) Second Cr. 2 mi E Lexington, Hwy 64, 25 Jan. 1967. References: Robins (1954), Williams (1968), Armstrong and Williams (1971).

LITERATURE CITED

Armstrong, J. G., and J. D. Williams. 1971. Cave and spring fishes of the southern bend of the Tennessee River. J. Tenn. Acad. Sci. 46(3):107-115.

Bailey, R. M., et al. 1970. A list of common and scientific names of fishes from the United States and Canada, third edition. Spec. Publ. Am. Fish Soc. 6. 149 p.

Bailey, R. M., and W. J. Richards. 1963. Status of *Poecilichthys hopkinsi* Fowler and *Etheostoma trisella*, new species, percid fishes from Alabama, Georgia, and South Carolina. Occ. Pap. Mus. Zool. Univ. Mich. 630. 21p.

Boschung, H. T., Jr., and T. S. Jandebeur, 1974 MS. A report on the fauna of the Cypress Creek watershed, with emphasis on fishes. Unpublished report to USDA Soil Conservation Service, State Office, Auburn, Alabama. 165p., app.

Cooper, J. E., and A. Iles. 1971. The southern cavefish, *Typhlichthys subterraneus*, at the southeastern periphery of its range. Bull. Nat. Speleol. Soc. 33(1):45-49.

Cooper, J. E., and R. A. Kuehne. 1974. *Speoplatyrhinus poulsoni*, a new genus and species of subterranean fish from Alabama. Copeia 1974(2):486-493.

Dycus, D. L., and W. M. Howell. 1974. Fishes of the Bankhead National Forest of Alabama. Ala. Dept. Cons. Nat. Res., Div. Game and Fish, Montgomery. 51 p.

Fowler, H. W. 1922. Records of fishes from the southern and eastern United States. Proc. Acad. Nat. Sci. Phila. 74:1-27.

Gilbert, C. H. 1891. Report of explorations made in Alabama during 1889, with notes on the fishes of the Tennessee, Alabama, and Escambia rivers. Bull. U.S. Fish Comm. 9(1889):143-159.

Gilbert, C. R. 1964. The American cyprinid fishes of the subgenus *Luxilus* (genus *Notropis*). Bull. Fla. State Mus. 8(2):1-194.

Gilbert, C. R. 1969. Systematics and distribution of the American cyprinid fishes *Notropis ariommus* and *Notropis telescopus*. Copeia 1969(3):474-492.

Gilbert, R. J. 1969. The distribution of fishes in the central Chattahoochee River drainage. Masters thesis, Auburn Univ., Auburn, Ala.

Hubbs, C. L., and W. R. Crowe. 1956. Preliminary analysis of the American cyprinid fishes, seven new, referred to the genus *Hybopsis*, subgenus *Erimystax*. Occ. Pap. Mus. Zool. Univ. Mich. 578. 8 p.

Hubbs, C. L., and E. C. Raney. 1951. Status, subspecies, and variations of *Notropis cummingsae*, a cyprinid fish of the southeastern United States. Occ. Pap. Mus. Zool Univ. Mich. 535. 25 p., 1 pl.

Jandebeur, T. S. 1972. A study of the fishes of the Elk River drainage in Tennessee and Alabama. Masters thesis, Univ. of Alabama, Tuscaloosa, Ala.

May, M. M. 1963. A study of fishes of the Cahaba River drainage system of Alabama. Masters thesis, Univ. of Alabama, Tuscaloosa, Ala.

McCaleb, J. E. 1973. Some aspects of the ecology and life history of

the pygmy sculpin, *Cottus pygmaeus* Williams, a rare spring species of Calhoun County, Alabama (Pisces: Cottidae). Masters thesis, Auburn Univ., Auburn, Ala.

McPhail, J. D., and C. C. Lindsey. 1970. Freshwater fishes of northwestern Canada and Alaska. Bull. Fish. Res. Bd. Can. 173. 381 p., pl.

Mettee, M. F., Jr. 1970. A survey of the fishes of the Choctawhatchee Bay drainage in Alabama and Florida. Masters thesis, Univ. of Alabama, Tuscaloosa, Ala.

Mettee, M. F., Jr. 1974. A study on the reproductive behavior, embryology and larval development of the pygmy sunfishes of the genus *Elassoma*. Doctoral dissertation, Univ. of Alabama, Tuscaloosa, Ala.

Ramsey, J. S. 1975. Taxonomic history and systematic relationships among species of *Micropterus*. Pp. 67-75 *in* R. H. Stroud and H. Clepper, eds. Black bass biology and management. Sport Fishing Institute, Washington, D. C.

Ramsey, J. S., W. M. Howell, and H. T. Boschung, Jr. 1972. Rare and endangered fishes of Alabama. Pp. 57-86 *in* J. E. Keeler, ed. Rare and endangered vertebrates of Alabama. Ala. Dept. Cons. Nat. Res., Div. Game and Fish, Montgomery.

Robins, C. R. 1954. A taxonomic revision of the *Cottus bairdi* and *Cottus carolinae* species groups in eastern North America (Pisces, Cottidae). Doctoral dissertation, Cornell Univ., Ithaca, N. Y.

Scott, D. C. 1951. Sampling fish populations in the Coosa River, Alabama. Trans. Am. Fish. Soc. 80(1950):28-40.

Smith-Vaniz, W. F. 1968. Freshwater fishes of Alabama. Auburn Univ. Agr. Exp. Sta., Auburn, Ala. 211 p.

Spencer, S. L., W. E. Swingle, and T. M. Scott, Jr. 1965. Commercial fishing in the Mobile delta, Alabama during the period July 1, 1963 to June 30, 1964. Proc. Southeast. Assoc. Game Fish Comm. 19:432-438.

Storer, D. H. 1845. Description of hitherto undescribed fishes. Proc. Boston Soc. Nat. Hist. 2:47-49.

Suttkus, R. D., 1955. *Notropis evryzonus*, a new cyprinid fish from the Chattahoochee River system of Georgia and Alabama. Tulane Stud. Zool. 3 (5):85-100.

Suttkus, R. D., and J. S. Ramsey. 1967. *Percina aurolineata*, a new percid fish from the Alabama River system and a discussion of ecology, distribution, and hybridization of darters of the subgenus *Hadropterus*. Tulane Stud. Zool. 13(4):129-145.

Suttkus, R. D., and W. R. Taylor. 1965. *Noturus munitus*, a new species of madtom, family Ictaluridae, from the southern United States. Proc. Biol. Soc. Wash. 78-169-178.

Swingle, H. A. 1971. Biology of Alabama estuarine areas—Cooperative Gulf of Mexico Estuarine Inventory. Ala. Mar. Res. Bull. 5. 123 p.

Swingle, H. A., and D. G. Bland. 1974. A study of the fishes of the coastal watercourses of Alabama. Ala. Mar. Res. Bull. 10:17-102.

Taylor, W. R. 1969. A revision of the catfish genus *Noturus* Rafinesque, with an analysis of higher groups in the Ictaluridae. Bull. U.S. Nat. Mus. 282. 315 p., pl.

Tsai, C., and E. C. Raney. 1974. Systematics of the banded darter, *Etheostoma zonale* (Pisces: Percidae). Copeia 1974(1):1-24.

Vladykov, V. D., E. Kott, and S. Pharand-Coad. 1975. A new nonparasitic species of lamprey, genus *Lethenteron* (Petromyzonidae), from eastern tributaries of the Gulf of Mexico, U.S.A. Publ. Zool. Can. Nat. Mus. Nat. Sci. 12. 36 p.

Wagers, D. L. 1974. A survey of the ichthyofauna of Shoal Creek in Alabama and Tennessee. Masters thesis, Samford Univ., Birmingham, Ala.

Wall, B. J., Jr. 1968. Study on the fishes of the Bear Creek drainage of the Tennessee River system. Masters thesis, Univ. of Alabama, Tuscaloosa, Ala.

Wall, B. R., Jr., and J. D. Williams. 1974. *Etheostoma boschungi*, a new percid fish from the Tennessee River drainage in northern Alabama and western Tennessee. Tulane Stud. Zool. Bot. 18(4): 172-182.

Williams, J. D. 1968. A new species of sculpin, *Cottus pygmaeus*, from a spring in the Alabama River basin. Copeia 1968 (2):334-342.

AMPHIBIANS and REPTILES

ROBERT H. MOUNT
Professor of Zoology-Entomology
Auburn University
Auburn, Alabama

Habitat of *Phaeognathus hubrichti* (Robert Mount)

Acknowledgments

Members of the panel, other than myself, who selected and categorized the reptiles and amphibians that appear on the following list were Dr. Wayne Adams, Troy State University; Dr. Jack Brown, University of North Alabama; Dr. Kenneth Marion, University of Alabama at Birmingham; Dr. Ralph Chermock, Alabama Geological Survey; Mr. Ralph Jordan, Jr., Tennessee Valley Authority; Mr. James Peavy, The Birmingham Zoo; and Drs. James Dobie and Dan Speake, both of Auburn University. These panelists also supplied much of the information in the accounts, and I deeply appreciate their advice and assistance.

Introduction

According to the most recent assessment, 182 species and subspecies of reptiles and amphibians, exclusive of marine turtles, are native to Alabama. In overall diversity, the herpetofauna of the state is rivaled by those of few other areas of comparable size in the country. The great majority of our reptiles and amphibians are harmless, and many are obviously beneficial. Most appear to be declining in number. Included in the following list are 9 species in the endangered category, 7 considered threatened, and 17 in the category of special concern. Yet, at the present time, only the alligator and marine turtles in Alabama are accorded specific legal protection.

Many factors are responsible for the plight of Alabama's declining reptiles and amphibians. Natural habitat is being destroyed at an alarming rate by clearing, stripping, damming, draining, and dredging. Forests, which could, if managed as natural ecosystems, provide havens for many sensitive species, are gradually being clearcut and converted into tree farms, and the end is not in sight.

Deliberate persecution, although becoming somewhat less a problem as education replaces unreasonable fear and prejudice with tolerance and appreciation, is still being practiced. Examples include shooting turtles and harmless water snakes for "sport" and introducing gasoline into burrows of gopher tortoises in attempts to drive out snakes. Some people still collect large numbers of gopher tortoises for food, a practice which can eliminate the animal from large areas of its range. Widespread use of pesticides may be responsible in part for the decline of some species. Research to determine the effects of pesticides on reptiles and amphibians is badly needed. Armadillos and imported fire ants, both alien predators, may be affecting reptiles and amphibians adversely in Alabama, a possibility that should be investigated.

The ultimate ecological consequences of decimating the state's herpetofauna cannot be accurately predicted. It can be stated with certainty, however, that one effect will be a diminution in the color and fascination that the Alabama out-of-doors holds for a large and steadily growing number of our citizens and visitors.

ENDANGERED SPECIES

Flatwoods salamander
Ambystoma cingulatum (Cope)

Ambystoma cingulatum is a salamander of medium build, attaining a maximum total length of about 130 mm. The tongue is fleshy and free at the sides. The head is small. The ground color is blackish and most individuals have a reticulum of gray or white markings on the dorsum. Costal groove count averages 15, with a range of between 13 and 16.

Martof (1968) reviewed the literature on *A. cingulatum*. The known range extends from southern South Carolina across Georgia, northern Florida and southern Alabama to southeastern Mississippi. In Alabama the species has been found in Baldwin, Mobile, and Covington counties. The Covington County record, the only recent one, is based on a small population north of Florala. The breeding site of that population was possibly destroyed by road construction (Mount, 1975).

The habitat of *A. cingulatum* is low pine flatwoods of the type usually dominated by slash pine and wiregrass. Bruce Means has studied the species in Florida and believes that wiregrass is necessary for successful breeding (pers. comm.). The breeding habitats are shallow flatwoods ponds and swamps.

Not only is the species rare, but the habitat is being destroyed or rendered unsuitable by clearcutting and intensive mechanical site preparation of forestlands, which often destroys wiregrass, and by converting the

List of Amphibians and Reptiles of *Endangered* Status (E), *Threatened* Status (T), and *Special Concern* Status (S).

Class Amphibia—Amphibians
Order Anura—Frogs and Toads

Family Hylidae—Hylid frogs
(S) *Limnaoedus ocularis*—Little grass frog
Family Ranidae—True frogs
(T) *Rana areolata sevosa*—Dusky gopher frog
(S) *Rana heckscheri*—River frog
(S) *Rana sylvatica*—Wood frog

Order Caudata—Salamanders

Family Ambystomatidae—Mole salamanders
(E) *Ambystoma cingulatum*—Flatwoods salamander
Family Cryptobranchidae—Giant salamanders
(T) *Cryptobranchus alleganiensis alleganiensis*—Hellbender
Family Plethodontidae—Woodland salamanders
(S) *Desmognathus aeneus*—Seepage salamander
(S) *Desmognathus ochrophaeus*—Mountain dusky salamander
(E) *Phaeognathus hubrichii*—Red Hills salamander
(S) *Eurycea aquatica*—Brown-backed salamander
(S) *Gyrinophilus palleucus*—Tennessee cave salamander
(S) *Plethodon cinereus polycentratus*—Georgia red-backed salamander
Family Proteidae—Mudpuppies, Waterdogs
(S) *Necturus* ssp—West Sipsey Fork waterdog
Family Sirenidae—Sirens
(S) *Siren lacertina*—Greater siren

Class Reptilia
Order Crocodilia—Crocodilians

Family Alligatoridae—Alligators
(T) *Alligator mississippiensis*—American alligator

Order Squamata—Lizards and Snakes

Family Colubridae—Colubrid snakes
(E) *Drymarchon corais couperi*—Eastern indigo snake
(S) *Lampropeltis triangulum triangulum*—Eastern milk snake
(S) *Lampropeltis triangulum syspila*—Red milk snake
(E) *Pituophis melanoleucus lodingi*—Black pine snake
(E) *Pituophis melanoleucus mugitus*—Florida pine snake
(S) *Rhadinaea flavilata*—Pine woods snake
(S) *Natrix cyclopion floridana*—Florida green water snake
(S) *Seminatrix pygaea pygaea*—North Florida black swamp snake
Family Viperidae—Vipers
(S) *Crotalus adamanteus*—Eastern diamondback rattlesnake

Order Testudinidata—Turtles

Family Cheloniidae—Sea turtles
(E) *Caretta caretta caretta*—Atlantic loggerhead
(E) *Chelonia mydas*—Green turtle
(E) *Eretmochelys imbricata imbricata*—Atlantic hawksbill
(E) *Lepidochelys kempi*—Atlantic ridley
Family Dermochelidae—Leatherback sea turtle
(T) *Dermochelys coriacea*—Atlantic leatherback
Family Emydidae—Emydid turtles
(S) *Graptemys barbouri*—Barbour's map turtle
(T) *Pseudemys* (= *Chrysemys*) *alabamensis*—Alabama red-bellied turtle
Family Kinosternidae—Mud and musk turtles
(T) *Sternotherus minor depressus*—Flattened musk turtle
Family Testudinidae—Tortoises
(T) *Gopherus polyphemus*—Gopher tortoise
Family Trionychidae—Soft-shelled turtles
(S) *Trionyx ferox*—Florida softshell
(S) *Trionyx spiniferus spiniferus*—Eastern spiny softshell

natural flatwoods ponds and depressions into hog-wallows or farm ponds for watering stock and culturing fish.

Efforts should be made to locate areas still inhabited by flatwoods salamanders and to manage them in ways that will insure the species' continued survival in Alabama. It is possible that some such areas could be found in the Conecuh National Forest. The integrity of the wiregrass flatwoods communities can be maintained by periodic control burning. Clearcutting and intensive mechanical preparation in such areas should be avoided. Breeding sites should be left in their natural state and protected from intensive use by hogs or other livestock.

Red Hills salamander
Phaeognathus hubrichti Highton

Phaeognathus hubrichti is a fairly large, terrestrial salamander attaining a maximum total length of about 255 mm. Nasolabial grooves are present; the body is elongate; the limbs are relatively short. There are more than 12 intercostal folds between the adpressed limbs (hind limbs pressed forward, front limbs pressed backward). The color is dark gray to brownish, and there are no markings. The costal groove count ranges from 20 to 22, the usual number 21.

The range of this species, whose existence was unknown until 1960, is confined to the Red Hills region of southern Alabama between the Conecuh and Alabama rivers. It occurs locally within the area, living in burrows on the slopes of mesic ravines in the Hatchetigbee and Tallahatta formations (Schwaner and Mount, 1970; Jordan and Mount, 1975). Surface activity is confined to occasional appearances at the mouths of the burrows at night (Highton, 1961; Valentine, 1963; Brandon, 1965; Schwaner and Mount, 1970; Jordan and Mount, 1975).

Little is known of the species' reproduction. Nests have never been found. Apparently, there is no aquatic larval stage, and it is believed that the eggs are laid within the recesses of the burrow system. Jordan (1975), after observing a population of *P. hubrichti* for 2½ years, concluded that the species' evolutionary strategy involved a low rate of predation, low reproductive success, and extremely limited capability of dispersal and adjustment to changing habitat conditions. The continued existence of the species seems dependent on preserving the integrity of hardwood-dominated, mesic ravine ecological communities within the range.

The Red Hills salamander has been listed as threatened by the International Union for the Conservation of Nature and is proposed for listing as endangered by the Southeastern Wildlife Society. On October 1, 1975 the Fish and Wildlife Service, USDI, proposed that it be placed on the national list of endangered wildlife (Fed. Reg., vol. 40, no. 191, p. 39). Jordan and Mount (1975) reported that the amount of suitable habitat within the range is steadily shrinking, and that only about 63,000 acres remain. Approximately 44 percent of the habitat is owned or leased by large paper companies dedicated to the clear-cut and replant system of forestry management, emphasizing short-rotation pine culture. Clearcutting apparently results in the demise of the animals,

Phaeognathus hubrichti (Robert Mount)

and the detrimental effect on the habitat is magnified by the mechanical preparation that usually precedes replanting.

Conversion of hardwood-dominated forest-types to pine is also thought to be detrimental. It was pointed out by Jordan and Mount (1975) that none of the habitat is in public ownership, and that pressures to clear-cut and convert to pine are increasing. In addition, much of the remaining habitat is underlain by deposits of lignite, and pressures are beginning to develop to exploit this resource by strip-mining.

Although several landowners have indicated a willingness to protect the Red Hills salamander and its habitat on some tracts on which the animals occur, there are no binding commitments to that effect. Steps should be taken by appropriate public agencies to secure enough habitat, either through purchase or donation, to insure the continued survival of this remarkable animal.

Eastern indigo snake

Drymarchon corais couperi (Holbrook)

Drymarchon corais couperi is a very large, fairly stout snake attaining a maximum total length of about 2630 mm. The head is only slightly distinct from the neck; the anal scute is undivided; the scales are large, smooth, and shiny, in 17 rows at mid-body. The color is uniform lustrous blue-black, except for some reddish or cream-colored suffusion about the chin, throat, and cheeks in some individuals.

The eastern indigo snake occurs locally in peninsular Florida, in a few widely scattered areas of the Georgia Coastal Plain, and in at least one portion of the Florida Panhandle. Within relatively recent times the snake occurred in southern Mississippi, Alabama, and South Carolina. The Alabama records are those of Löding (1922), Grand Bay and Satsuma, Mobile County; Haltom (1931), Baldwin County; and Neill (1954), 12 miles north of Florala, Covington County. To my knowledge, there have been no records of the species from Alabama since that reported by Neill, and it is possible that it no longer exists in our state.

The eastern indigo snake occurs in a wide variety of habitat types in southern Florida, but in other parts of the range it is found almost exclusively in the vicinity of burrows of the gopher tortoise, *Gopherus polyphemus*, which are used as refuges and hibernacula. Dry, sandy ridges interspersed with low brushy areas and small floodplains constitute particularly good habitat.

The eastern indigo snake is oviparous, with clutches of between 5 and 11 eggs having been reported laid by captives. The species usually does well in captivity if given proper care and attention.

The form is declining seriously virtually throughout its entire range. Florida protects the snake, and it is proposed for listing as *threatened* by the Southeastern Wildlife Society. Several reasons have been proposed for its decline. It is, first of all, a conspicuous, relatively slow snake and an easy mark for those who kill snakes indiscriminately. Habitat destruction is doubtless playing a role, particularly in areas where human population growth is increasing rapidly. It has been postulated that the introduction of gasoline into the burrows of gopher tortoises by participants in "Rattlesnake Roundups" is a detriment to the indigo snake (Speake and Mount, 1973). Finally, the snake is in great demand as a pet, and many have been taken from the wild by collectors.

Maintenance of the eastern indigo snake as a part of Alabama's herpetofauna will probably require the establishment of sanctuaries. Areas of suitable habitat which could be thus designated are present in at least two state forests and in the Conecuh National Forest. Land management practices on such sanctuaries should encourage the development and maintenance of community types that enhance the welfare of the snake. These include periodic control burning and denial of access to persons who might harm the snakes. Such sanctuaries could be stocked with individuals hatched in captivity. The sanctuaries would also enhance the welfare of the gopher tortoise (*Gopherus polyphemus*), the Florida pine snake (*Pituophis melanoleucus mugitus*), and the dusky gohper frog (*Rana areolata sevosa*). (See account of gopher tortoise under *threatened species.*)

In addition, the introduction of gasoline or gasoline fumes and other toxic materials into the burrows of gopher tortoises in Alabama should be discouraged, as this practice appears to be detrimental to a number of animals including the eastern indigo snake (Speake and Mount, 1973.).

Black pine snake

Pituophis melanoleucus lodingi Blanchard

The black pine snake is a large, terrestrial form, attaining a maximum length of about 1875 mm. The body is moderately stout; the tail fairly short; and the head is small, only slightly wider than the neck. The scales are keeled and the anal is undivided. The rostral scale is enlarged, curving backward between the internasals and ending in a point. The dorsal color of the adults is typically almost uniform dark brown to black, with some individuals having a trace of pattern. The belly is dark brown to black, occasionally with a few light markings mainly near the tail. The young are similar to the adults except in having a somewhat lighter color and in showing a tendency to have widely scattered light scales.

The snake's total range is a relatively small area of southwestern Alabama and southeastern Mississippi (Conant, 1956). In Alabama the range includes Mobile, Washington, and Clarke counties, and possibly the southern portion of Choctaw County. The subspecies integrades with *P. m. mugitus,* the Florida pine snake, in Baldwin and Escambia counties (Mount, 1975).

The black pine snake occurs in areas having well-drained, sandy soil, especially where longleaf pine, turkey oak or sandhill associations are the dominant community types. Apparently it relies heavily on burrows of the gopher tortoise, *Gopherus polyphemus,* for shelter. Occasional openings in the forest cover, such as widely scattered old fields, are apparently beneficial to the black pine snake.

It is uncommon to rare virtually throughout its limited range. It was proposed for listing as *"threatened"* in the Southeast by a panel on reptiles convened by the Southeastern Wildlife Society.

In Alabama the major threats to the black pine snake are extensive land-clearing for agriculture and forestry, deliberate persecution, and, in some areas, the degradation of the natural environment that inevitably accompanies an increasing human population. Collecting for the pet trade may be contributing to the problem, and "gassing" of gopher tortoise burrows may be killing some black pine snakes (Speake and Mount, 1973).

Several steps could be taken to improve the outlook for the black pine snake. It should be, first of all, protected from exploitation by commercial collectors and pet-fanciers. Gassing of gopher burrows should be discouraged. The state owns, or manages, at least three large tracts within the snakes' range: Upper State Management Area and Salt Springs Management Area, both in Clarke County, and Rob Boykin Management Area in Washington and Mobile counties. Steps should be taken to insure that the black pine snake is not molested on these tracts, and that the presence of gopher tortoises on them is encouraged.

Pituophis melanoleucas lodingi (Robert Mount)

Florida pine snake
Pituophis melanoleucus mugitus Barbour

Pituophis melanoleucus mugitus is a large, moderately heavy-bodied snake attaining a maximum length of about 2285 mm. The color is tan or brown with poorly defined brown blotches, the posterior ones most evident. The belly is plain white. The scales are keeled and the anal scute is undivided. The rostral scute is enlarged, curving backward and ending in a point between the internasals.

The Florida pine snake occurs in Florida, and in the Coastal Plain of Georgia, South Carolina, and Alabama. In Alabama it is recorded from Russell and Covington counties, and it probably occurs in Coffee, Dale, Geneva, Henry, Houston, and Barbour counties as well. In Escambia and Baldwin counties, this form intergrades with *P. m. lodingi,* the black pine snake, another form considered endangered in this report (Mount, 1975).

The Florida pine snake inhabits dry, sandy habitats of the type that typically support longleaf pine-turkey oak or sandhill associations. It also occurs in dry, sandy fields and to some extent in longleaf pine flatwoods associations. It is usually associated with habitats where gopher tortoises occur, and it relies heavily on the burrows of these tortoises for retreats.

On a southeastern regional basis, it is proposed for listing under the category *special concern* by a panel recently convened by the Southeastern Wildlife Society. The snake is becoming increasingly scarce in Alabama. It is a large snake, and the hostile attitude it displays when confronted would cause many people to kill it on sight. Also, the snake has similar habitat preferences to those of the eastern diamondback rattlesnake, uses gopher burrows for hibernacula, and is subject to being "gassed" by participants in "Rattlesnake Roundups." Speake and Mount (1973) reported that the Florida pine snakes they "gassed" experimentally died, apparently from the effects of the gassing, as did indigo snakes similarly tested. There is strong reason to believe that the decline of the Florida pine snake is due in some measure to practices encouraged by the "Rattlesnake Roundups." (See also accounts in this report of the eastern indigo snake, black pine snake, dusky gopher frog, and gopher tortoise.)

The Florida pine snake needs protection by law from commercial exploitation by collectors. Other measures that would benefit the Florida pine snake are those suggested for the eastern indigo snake in the account of that form.

Atlantic loggerhead turtle
Caretta caretta caretta (Linnaeus)

Caretta c. caretta is a large sea turtle attaining a maximum carapace length of about 2130 mm. The head is noticeably large; the pleural scutes on the carapace are usually in 5 pairs; the bridge between the carapace and plastron usually has 3 enlarged scutes; the carapace is widest near the front and tapers posteriorly. The color of the carapace of mature turtles is reddish brown. The limbs are paddle-shaped.

The Atlantic Loggerhead occurs in the Atlantic and Gulf coastal waters of the southeastern United States, nesting on beaches above the mean high-water line (Caldwell, *et al.,* 1959). In Alabama the turtle was reported by Jackson and Jackson (1970) to nest "regularly" on the seaward beaches of Dauphin Island, Mobile Coun-

ty. Apparently, nesting no longer occurs on Dauphin Island; the only indications of recent nesting in Alabama are a few reports from Ft. Morgan Peninsula, Baldwin County (Wayne Swingle, pers. comm.).

Increasing development and recreational use of the coastal beaches have already rendered most of them unsuitable as nesting sites. Although the turtle and its eggs are protected by law, this measure alone will not suffice to enable it to breed successfully in Alabama. Secluded stretches of beach without artificial lights are apparently required, and it is unlikely that any such habitat will be preserved along our coast. On a regional basis, a panel convened by the Southeastern Wildlife Society considered the Atlantic Loggerhead *threatened*.

Green sea turtle
Chelonia mydas (Linnaeus)

Chelonia mydas is a large marine turtle, attaining a carapace length of about 1525 mm. The carapace is heart-shaped and dark brown with light brown to yellowish mottling. The pleurals on the carapace are usually in 4 pairs, the first not touching the nuchal. The limbs are paddle-shaped.

Although the range of the green sea turtle in the Gulf of Mexico is well south of Alabama, an occasional individual may be expected to visit our state's coastal waters. Nesting in the U.S. is limited to the Atlantic Coast. Green sea turtles may be found in the open ocean or in estuarine habitats (Carr, 1967; Rebel, 1974).

The green sea turtle and its eggs have been heavily exploited for food in many tropical areas, and destruction of the nests by wild and feral animals has been a serious problem. The turtle has become scarce and is thought to be existing at population levels barely above those needed for its continued existence. It has been proposed for *endangered* listing at the national level.

Atlantic hawksbill turtle
Eretmochelys imbricata imbricata (Linnaeus)

The Atlantic hawksbill is a relatively small sea turtle, attaining a carapace length of about 915 mm. The carapace is elongate-oval in shape and has straight sides. The carapace plates overlap; the pleurals are usually in 4 pairs, the first not touching the nuchal. The carapace color is greenish or reddish brown with small markings of lighter color. The limbs are paddle-shaped. The beak is hawklike.

The Atlantic hawksbill may be found in the Atlantic and Gulf coastal waters of the Southeast, showing a preference for reef areas. Nesting along the U.S. coast is infrequent and has not been reported from Alabama.

It has been ruthlessly exploited for its shell, the source of "tortoise shell." Alabama can do little to enhance the welfare of this form except to rigidly enforce the laws designed to protect it (Carr, *et al.*, 1966; Carr, 1967).

Atlantic ridley
Lepidochelys kempi (Garman)

The Atlantic ridley is a relatively small sea turtle, attaining a carapace length of about 700 mm. The carapace is short, relatively wide, and more nearly round in outline than those of the other sea turtles. There are 5 pairs of pleurals, the first touching the nuchal. The bridge has 4 enlarged scutes. The color of the carapace is grayish. The limbs are paddle-shaped.

The Atlantic ridley occurs in the Gulf of Mexico and along the Atlantic coast. It prefers shallow coastal waters and estuarine habitats. It nests along a 90-mile stretch of the Tamaulipas coast north of Tampico, Mexico. The turtle might be expected as an occasional transient along the Alabama coast.

The turtle and its eggs have been exploited heavily for food, and there is little assurance that the government of Mexico has taken adequate steps to protect it from continued overexploitation (Carr, 1967). Alabama can do little to enhance the welfare of this turtle other than to rigidly enforce the protective legislation now in force.

THREATENED SPECIES

Dusky gopher frog
Rana areolata sevosa Goin and Netting

The dusky gopher frog is a rather large, stout-bodied frog attaining a maximum snout-vent length of about 100 mm. The hind feet are extensively webbed; the toes are pointed; the dorsum has dorsolateral ridges, but these are often inconspicuous due to the roughness or rugosity of the skin. The dorsal color is gray to light brown with dark blotches and interspersed small, dark markings; the belly is light with numerous dark spots, many of which coalesce; the groin and inner surfaces of the thighs are tinged with yellow in live animals.

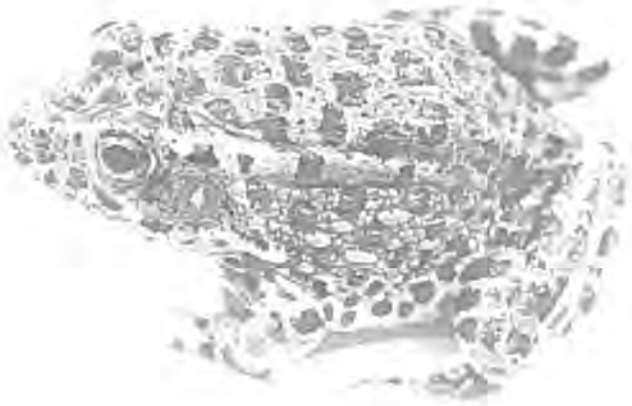
The range of the dusky gopher frog is the Florida Panhandle west of the Choctawhatchee River, southern Alabama, southern Mississippi, and extreme eastern Louisiana. Within the range it is local in occurrence. In Alabama the form has been recorded from Barbour, Covington, Escambia, Mobile, and Baldwin counties. A single specimen was collected from north of Montevallo in Shelby County, but the presence of a breeding population there has not been documented by additional material or observation (Mount, 1975).

Most records of this frog are from areas where the burrows of gopher tortoises (*Gopherus polyphemus*) occur in the general vicinity of suitable breeding sites—shallow, transient or semi-permanent ponds. The gopher burrows provide shelter during cold weather and during the day in warm weather. It is possible that crawfish burrows or other such cavities provide marginal microhabitats in some parts of the range. The Shelby County specimen provides some evidence to that effect, as the locality is well outside the range of the tortoise.

A *threatened* listing has been proposed for the frog in the Southeastern Region by a panel convened recently by the Southeastern Wildlife Society. The threats to the frog include clearing and drainage of land, conversion of suitable breeding sites into hog-wallows and ponds for watering stock or raising fish, and, very likely, "Rattle-

snake Roundups." Most of the range of the dusky gopher frog in Alabama is within the Lower Coastal Plain area, where gopher tortoise burrows are being "gassed" to obtain rattlesnakes for these events. The gopher frog, along with a number of other animals, may be inadvertently destroyed by this practice (Speake and Mount, 1973).

Several measures could be taken to enhance the welfare of the dusky gopher frog in Alabama. The breeding sites of known populations should be located and, where practicable, preserved. One record of this frog is from the Conecuh National Forest, for instance, and it should not be difficult to insure protection of the breeding site for the population when it is found. The gassing of gopher tortoise burrows should be prohibited on public lands and discouraged or prohibited on other lands.



Rana arcolata sevosa (Robert Mount)

Hellbender

Cryptobranchus alleganiensis alleganiensis (Daudin)

The hellbender is a large, aquatic salamander attaining a maximum total length of about 750 mm. The body and head are flattened; the skin along the lower sides is loose and folded; both pairs of limbs are well developed; the hind foot has 5 toes; the tail is strongly compressed, with a deep dorsal keel; gills are lacking in the adults. The dorsal color is brownish to gray, with or without irregular dark spots or bloches.

The hellbender is found locally in a large portion of the eastern United States. In Alabama it is confined to the Tennessee River system. Most recent records are from north of the Tennessee River and include Butler Creek, Cypress Creek, and Little Cypress Creek in Lauderdale County and Flint River and Walker Creek in Madison County. Shoal Creek in Lauderdale County and some of the streams in Limestone County may also support hellbender populations.

South of the Tennessee River the hellbender has been collected, in recent years, only in Bear Creek, Marion County (Mount, 1975).

Hellbenders are found exclusively in streams and virtually never leave the water. Medium-sized and rather large, free-flowing streams with rocky bottoms and clear water are the most suitable hellbender habitats. Streams with large rocks, overhangs, or other provisions for shelter are needed.

Impoundment, channelization, and pollution are detrimental to hellbenders (Nickerson and Mays, 1972). Several streams in the Tennessee River system in Alabama, including the Tennessee River itself, have, from all indications, been rendered unsuitable as habitats for breeding hellbender populations because of unfavorable alterations on pollution. A continuation of this trend will ultimately eliminate hellbenders from the state.

On a southeastern regional basis the hellbender was proposed for *special concern* status by a panel recently convened by the Southeastern Wildlife Society. The hellbender could very likely continue to exist in Alabama by protecting the natural integrity of some of the streams in which it occurs. Good candidates include Cypress, Little Cypress, and Walker creeks and the Flint River. Impoundments, channelization, snagging, and other physical alterations of the streams should be prohibited, and pollution should be kept at a minimum. The watersheds should be protected to minimize siltation, and clearcutting of timber along the stream margins should not be permitted. The latter causes undesirable increases in water temperature and increases the likelihood of streambank erosion.

American alligator

Alligator mississippiensis (Daudin)

The American alligator is a huge aquatic or semi-aquatic reptile capable of attaining a maximum total length of about 584 cm. The snout is broadly rounded; the general coloration is black, but the light markings of the young may persist into adulthood. There is no bony ridge between the eyes, as in the caiman, and the fourth tooth in the lower jaw is not visible when the mouth is closed.

Apparently the alligator was at one time generally distributed in permanently aquatic habitats throughout most of the Lower Coastal Plain (southernmost tier of counties), and occurred along the major streams and some of their tributaries as far north as the Fall Line. Today they persist in sizable numbers only in the anastomosing streams, lakes, and swamps that constitute the "delta" of the Mobile Bay drainage and in places where they are rigidly protected, such as Eufaula National Wildlife Refuge. Widely scattered, small populations occur on many privately owned lakes and swamps in the Coastal Plain.

Despite the fact that the alligator population in Alabama is still far from what it once was, it is probably as large now as it has been in 50 years and is apparently still growing. The animal appears out of danger for the time being and with adequate protection should continue to repopulate some of the more secluded areas of its range from which it was eliminated.

The alligator is now listed as *threatened* by the United States Department of the Interior. Florida has suggested

a listing of "threatened" for the alligator in that state, and a listing under "special concern" was proposed for the species on a southeastern regional basis by a panel convened recently by the Southeastern Wildlife Society.

Regardless of how the alligator is listed, it continues to be extremely vulnerable to human predation, and in Alabama it should continue to be rigidly protected by law. Removals of "problem individuals" and "thinning," if needed, should be under the strict supervision of state personnel. For information on the ecology and life history of the alligator see McIlhenny, 1935 and Joanen, 1969.

Leatherback sea turtle

Dermochelys coriacea (Linnaeus)

The leatherback is the largest of the world's turtles, attaining a maximum carapace length of about 2440 mm. The carapace lacks plates and is covered instead with tough, leathery skin. It has 7 longitudinal ridges, and the plastron has 5 ridges. The carapace color is black with white flecking. The limbs are paddle-shaped.

The leatherback is found worldwide, occurring with greatest frequency in tropical waters. It has been recorded nesting on both coasts of Florida, and there is a record of its nesting on Padre Island, Texas (Pritchard, 1971). It may be expected as an occasional visitor to Alabama coastal waters.

The species is considered *threatened* in Alabama and has been proposed for such listing on a southeastern regional basis by a panel convened recently by the Southeastern Wildlife Society. Alabama can do little to enhance the welfare of this species except to rigidly enforce existing laws.

Alabama red-bellied turtle

Pseudemys (=Chrysemys) alabamensis Baur

Pseudemys alabamensis is a large, predominantly freshwater turtle attaining a maximum carapace length of about 350 mm. It is the only member of its family in Alabama in which the upper jaw has a prominent notch flanked on each side by cusps. The carapace is olive brown to black, with yellow, orange or reddish stripes. The shell is deep. The plastron is orange to reddish, plain or with a variable pattern. The adult male's plastron often develops wormlike dark markings.

This turtle is known to occur with certainty only in Alabama (Mount, 1975). It is found in the lower portion of the Mobile Bay drainage, from Little River, Baldwin and Mobile counties southward.

Sluggish rivers, oxbows, and lakes provide optimum habitat, especially where aquatic vegetation is abundant. Although an occasional individual turns up in a brackish-water or salt-water habitat, the species cannot be considered a salt-marsh form, as was indicated by Ernst and Barbour (1972). The adults are almost entirely herbivorous. Nothing is known about the reproductive habits of this species.

The turtle is also proposed for listing under the *threatened* category on a southeastern regional basis by a panel convened recently by the Southeastern Wildlife Society. Aside from its having a small range within which the habitats are subjected to relatively heavy pollution, the turtle is trapped at its basking sites and wantonly shot with rifles by "sportsmen" (Mount, 1975).

The welfare of the Alabama red-bellied turtle would be greatly enhanced by prohibiting the possession of loaded 22-rifles by persons boating in navigable waterways in the turtle's range. Firing rifles over public waters from the bank should also be prohibited. Such actions would not interfere with legitimate hunting and would benefit not only the red-bellied turtle, but a host of other native animals that are frequently shot for no good reason.

Flattened musk turtle

Sternotherus minor depressus Tinkle and Webb

Sternotherus minor depressus is a small, fresh-water turtle attaining a maximum carapace length of about 114 mm. The carapace is noticeably flattened, brown, and usually has radiating dark lines on the large scutes. The top of the head is greenish with a reticulum of dark markings. The plastron is pinkish in young and yellowish in adults. The heads of the old adults of this form do not become conspicuously enlarged as they do in the other subspecies of *S. minor*.

This turtle is endemic to Alabama and is confined to streams of the Black Warrior River system from about Tuscaloosa, Tuscaloosa County, northward. It apparently intergrades with *S. m. peltifer* in the upper Cahaba River system and in the vicinity of Tuscaloosa in the Black Warrior River.

The habitat requirements of this turtle are poorly known. Most specimens have been collected in relatively clear, rock-bottomed streams at depths ranging from 1 to 5 feet. Some others have been found in relatively large, sluggish streams with sand, silt, and mud bottoms. Deep impoundments with relatively little shallow water are apparently less suitable as habitats than free-flowing streams, and may not be capable of supporting breeding populations. Ponds and temporary watercourses are not inhabited. (See Tinkle, 1958; Estridge, 1970; Mount, 1975).

The flattened musk turtle is listed as *threatened* on a southeastern regional basis by a panel convened recently by the Southeastern Wildlife Society. Population densities have not been determined, but in most of the range they appear to be low. Many streams that are thought to have supported populations of *S. m. depressus* are now uninhabited because they have been excessively polluted by industrial wastes. Many others have been impounded, making them undesirable or unsuitable as habitats. Finally, the range of the species is entirely within the major coal-mining district of Alabama. Runoff from strip-mines kill the molluscs and other invertebrate life that constitute the turtles chief food.

One small area within the range appears reasonably safe from serious degradation, the West Sipsey Fork of the Warrior River above Smith Lake. The area is within the Bankhead National Forest, and a portion is within the Sipsey National Wilderness. My observations indi-

cate, however, that population densities are very low in that area, and the habitats available may be less than optimal.

The welfare of this turtle depends on maintaining the natural integrity of the stream habitats within its range. Any restrictions that would inhibit pollution by industry or strip-mining will be beneficial. Also to the turtle's benefit would be to ban future impoundment, channelization, or "snagging" of the natural streams. The natural vegetation along the streambanks should, of course, be preserved to enhance the quality of the water and the welfare of the stream ecosystem.

Gopher tortoise
Gopherus polyphemus (Daudin)

The gopher tortoise is a large terrestrial turtle attaining a maximum carapace length of about 368 mm. The top of the head is conspicuously scaled; the front toenails are large and flattened; the hind feet are elephantine; the gulars of the plastron project well forward. The carapace is brown, and the scutes are yellow-centered in the young. The soft parts are yellow to yellowish brown in the young, darkening to brown or almost black in the adults.

The gopher tortoise is locally distributed in the Coastal Plain from South Carolina and Florida to eastern Louisiana. In Alabama it is relatively common on the Lower Coastal Plain, and very local in the Red Hills and eastern Fall Line Hills. It is absent from the western Fall Line Hills and Black Belt.

Within the range, the gopher occurs only where the soil is sandy and excessively well-drained. The suitable habitats, in most cases, support high pine-turkey oak or sandhill communities. These are fire-subclimax types whose dominant components are, in the natural state, longleaf pine (*Pinus palustris*) and turkey oak (*Quercus laevis*). Gophers are entirely herbivorous, feeding on a wide variety of herbaceous plants and berries. Wiregrasses are dominant dietary components in many areas. The long burrows constructed by the gophers provide dens and temporary retreats for a wide variety of animal life, including eastern indigo snakes, Florida pine snakes, black pine snakes, dusky gopher frogs, and eastern diamondback rattlesnakes. The burrows are also used by skunks, foxes, and opossums; some insects are found exclusively in the burrows.

The gopher tortoise is listed as *threatened* by the Southeastern Wildlife Society. Despite the relative abundance of gophers in some parts of the range, the species is declining markedly in overall numbers (Ernst and Barbour, 1972; Howard Campbell, pers. comm.; Mount, 1975).

Reasons for the decline include destruction of habitat for building purposes and agriculture; fire prevention; unfavorable alteration of habitat by forestry, such as large-scale clearcutting followed by intensive mechanical site-preparation; and collecting for food or for the pet trade. The practice of introducing gasoline into gopher burrows to drive out snakes may have a deleterious effect on the gopher, but this has not been documented by research. (See Speake and Mount, 1973).

The life history of the gopher tortoise is poorly known in most parts of its range. Individuals apparently are slow to attain sexual maturity, but live for many, possibly in excess of 100, years. Annual average reproductive potential is apparently low, but natural predation on adults appears to be low also. Nothing is known of the minimum population density necessary for successful reproduction on a population basis.

All factors considered, the gopher would appear to be a good candidate for extinction if it is shown no more concern than it has been in the past. Florida is the only state which specifically prohibits commercial trade in gophers, but even Florida imposes a bag limit of 10, much larger than should be allowed. In Alabama, as well as in the other states where gophers occur, a maximum of 3 should be set as a bag limit, and taking of gophers on all public lands should be prohibited.

Greater use of prescribed burning in high pine-turkey oak associations would greatly benefit the gopher; this forestry management practice should be employed wherever practicable. Serious consideration should be given to prohibiting the introduction of gasoline or other toxic materials into the burrows of gopher tortoises, not only for the sake of the tortoise but to prevent the destruction of the other animals that reside in the burrows as well.

SPECIES OF SPECIAL CONCERN

Little grass frog
Limnaoedus ocularis (Bosc and Daudin)

Limnaoedus ocularis is the smallest of North American frogs, attaining a maximum snout-vent length of about 18 mm. The tips of the digits are expanded; the color is tan or grayish brown; a dark lateral stripe begins on the snout, passes through the eye and backward onto the side, gradually blending with the ground color before reaching the groin. The dorsum has a less prominent median stripe, and, on some individuals, 2 obscure dorsolateral stripes.

This frog is abundant in southern Georgia and Florida. The range barely extends northwestward into Alabama, where it is known to occur only in southern Houston County. It possibly occurs in southern Geneva County as well. Low pine flatwoods is the preferred habitat type. The frog breeds in temporary and semi-permanent pools and ponds, especially flooded roadside ditches, where tall grasses predominate. The males call while clinging to stems and blades of grass, from 3 inches to 3 feet above the water level (Brown, 1956; Mount, 1975).

Suitable habitat within the range in Alabama is limited, but populations appear relatively safe for the time being. The little grass frog could be eliminated, however, by extensive land-clearing and draining operations in southern Houston County.

River frog
Rana heckscheri Wright

Rana heckscheri is a large frog, attaining a maximum snout-vent length of about 140 mm. The toes

are pointed; the hind feet are extensively webbed between the toes; dorsolateral ridges are absent or poorly defined; the dorsum is dark brown or greenish brown and mottled; the venter is gray to grayish brown with light spots. (In the bullfrog and pig frog the venter is plain white or white with dark markings.) The lower lip is dark with light spots.

The river frog is common in parts of southern Georgia and in parts of Florida. It is known from extreme southern Alabama, which is at the northwestern periphery of the range, from 4 localities, one each in Baldwin, Mobile, Escambia, and Covington counties. The frog probably occurs in Geneva and Houston counties, but records are lacking (Mount, 1975).

In Alabama, the optimal habitat appears to be swampy margins of relatively small streams, and ponds associated with small streams, where the growth of titi (*Cyrilla racemiflora* and *Cliftonia monophylla*), bay (*Magnolia virginiana*), and cypress (*Taxodium spp.*) is favored (Mount, 1975). Breeding occurs at night.

Because the species is peripheral in Alabama, and because suitable habitat is limited in the range in Alabama, the river frog is considered a species of *special concern*. Extensive land-clearing and drainage activities in the extreme southern portion of the state continue to jeopardize the frog's continued existence there.

Wood frog

Rana sylvatica LeConte

The wood frog is a medium-sized frog attaining a maximum snout-vent length of about 85 mm. The hind feet are extensively webbed; the tips of the digits are pointed; the dorsum has dorsolateral ridges. The ground color is tan to brown; the face has a dark brown to blackish mask extending from the snout to behind the tympanum. The upper jaw has a light stripe bordering the facial mask. The venter is white, plain or with dark markings on the throat and breast.

A fairly common species in parts of the North, the wood frog is known to occur in Alabama only in the immediate vicinity of Mt. Cheaha. It may also occur in some of the other mountainous areas in northeastern Alabama (Mount, 1975). The wood frog is a terrestrial form, inhabiting moist, deciduous forests. Clearcutting and conversion to pine of such habitats within the species range in Alabama would probably be detrimental to its welfare. Because of the limited distribution in Alabama, the seemingly low population density, and the trend toward more intensive forest management, in the state, the species is one of *special concern*.

Seepage salamander

Desmognathus aeneus Bishop and Brown

Desmognathus aeneus is a very small salamander attaining a maximum total length of about 57 mm. Nasolabial grooves are present; the face has a light line from the eye to the angle of the jaw; the costal groove count is usually 14. The tail is rounded in cross section, never keeled; the dorsum has a longitudinal yellow to reddish-brown stripe from the head to near the tail tip; the sides have irregular mottling or reticulations, often with 1 to 6 light oval spots. The top of the thigh has a conspicuous light oval spot, one of the most distinctive features of this species (in Alabama populations). The venter is light with variable dark markings.

In Alabama, *D. aeneus* occurs in the Blue Ridge, upper Piedmont, and in a portion of the Fall Line Hills region paralleling the Fall Line from northern Hale County to southern Marion County (Mount, 1975).

Folkerts (1968) characterized the habitat of *D. aeneus* in Alabama as "shaded seepage areas in moist deciduous or semideciduous ravines." He stated that it never appears in the open, but remains beneath the leaf litter and among spongy masses of entangled roots.

Not only is it extremely habitat-specific, but the habitats are easily eliminated or rendered unsuitable by such practices as stream-channelization and clear-cutting, the latter of which is becoming more widespread in the state. Channelization of small streams within the species range should be avoided as should clear-cutting of mesic, deciduously forested ravines.

Mountain dusky salamander

Desmognathus ochrophaeus Cope

Desmognathus ochrophaeus is a highly variable, medium-sized salamander attaining a maximum total length of about 110 mm. (Alabama specimens seldom exceed 85 mm.) Nasolabial grooves are present; the face has a light line extending from the eye to the angle of the jaw; the costal groove count is usually 14; the tail is trigonal in cross-section but rounded above, lacking a prominent keel (differing markedly in this respect from *D. fuscus* and *D. monticola*); the tip of the tail is attenuate; the body is somewhat flattened. Dorsal color is variable, but usually brownish with 5 or 6 pairs of alternating spots, which are sometimes fused to form a broad stripe with zig-zag edges. The commissure of the jaws is markedly sinuate; the head is lighter in front of the eyes than behind them.

The mountain dusky salamander is found in Alabama only on the northeastern extremities of Sand Mountain and Lookout Mountain, in northeastern Alabama, where it inhabits moist cliff faces and talus areas beneath waterfalls. It is often found considerable distance from water. At sites where it occurs in Alabama, it is usually abundant. Such sites are, however, apparently relatively few in number in our state. The salamander is abundant in much of the remainder of its range, which is situated northeast of Alabama (Valentine, 1961, 1964; Folkerts, 1968; Mount and Folkerts, 1968).

Brown-backed salamander

Eurycea aquatica Rose and Bush

The brown-backed salamander was described by Rose and Bush (1963) from specimens obtained from springs and small streams two miles west of Bessemer, Jefferson County, Alabama. It was said to resemble the two-lined salamander, *Eurycea bislineata*, but to differ from it having a short tail; short, stout body; dark sides and brownish dorsum. It was also said to produce more eggs than *E. bislineata* and to be different in certain features of the skull. *E. aquatica* was said to be permanently

aquatic, while *E. bislineata* was predominantly terrestrial.

The habitat was described as springs and spring runs choked with watercress (*Nasturtium officinale*). Mount (1975) considered the form to be a variant of *E. bislineata*. Conant (1975) recognized the form as a species, but noted that some authorities disagree. Specimens referable to *E. aquatica* have been collected from several localities within the Ridge and Valley region of Alabama, and have been found on land under rocks and logs as well as in springs and spring runs. Until the status of *E. aquatica* is clarified by future research, the form should be considered one of *special concern*.

Tennessee cave salamander
Gyrinophilus palleucus McCrady

The Tennessee cave salamander is a fairly large cave-dwelling species attaining a maximum total length of about 155 mm. External gills are present throughout life; nasolabial grooves are present; the head is broad and the snout is flattened and spatulate; the eyes are very small (eye diameter entering distance from anterior corner of eye to snout tip 4 to 5 times, as opposed to 1.5 to 3.5 times in larval *G. porphyriticus*, a form with which *G. palleucus* might be confused); color pale pinkish to flesh-colored except for gills, which are bright red in life.

The Tennessee cave salamander is known from several caves above the Tennessee River in Jackson County; from Shelta Cave in Madison County; and from Rockhouse Cave in Limestone County. It is known on the basis of one specimen from a cave below the Tennessee River in Colbert County (Cooper and Cooper, 1968).

The Tennessee cave salamander is found in water in caves and feeds predominantly on arthropods. Little else is known of its biology. Notes on its habitats and ecological associates are provided by Cooper (1968) and Cooper and Cooper (1968). The limited distribution of the species in Alabama and the fragility of its habitats are the reasons for listing *G. palleucus* under *special concern*.

Georgia red-backed salamander
Plethodon cinereus polycentratus
Highton and Grobman

The Georgia red-backed salamander is a relatively small form, attaining a maximum total length of about 125 mm. Nasolabial grooves are present; the upper sides are dark gray to nearly black; the dorsum is reddish, unstriped, or, more often, with an even-edged red stripe; the stripe, when present, does not widen at the tail base as is usually the case in *P. d. dorsalis*, a similar form with which *P. cinereus polycentratus* is sympatric; the stripe never has lateral lobes as do most *P. d. dorsalis*.

Costal grooves are usually 20 or 21; the mental gland on chin of sexually active males is shelflike and situated near the apex of the lower jaw rami. (The mental gland of *P. d. dorsalis* is rounded or oblong and does not contact the jaw rami laterally.)

P. c. polycentratus, the only subspecies of its species occurring in Alabama, is known only from a few localities around Anniston, Calhoun County. All specimens have been collected by Thomas Yarbrough. The species would be expected to occur in Cleburne and Cherokee counties, and may be present in DeKalb County as well.

Because of the scarcity and limited distribution of this salamander in Alabama, it is considered one of *special concern*. In addition, the salamander apparently requires moist, forested habitats, and could possibly be destroyed by clear-cutting and intensive site-preparation of forestland, practices which are being employed on a large scale in Alabama. (See Smith, 1963; and Mount, 1975.)

West Sipsey Fork waterdog
Necturus ssp.

Brode (1969), in his unpublished doctoral dissertation, stated that the West Sipsey Fork of the Black Warrior River contains an unnamed subspecies of *Necturus maculosus*. Members of the genus *Necturus* are large, aquatic salamanders having permanent external gills, two pairs of well-developed limbs, and four toes on each foot. The unnamed form was said to have dark stripes extending from the nostrils onto the gills, thence backward, becoming progressively wider and darker, to the tail tip. Flanking the dark stripes above were said to be light brown stripes that begin on the back of the head and converge along the upper keel of the tail.

The upper reaches of the West Sipsey Fork are in the Bankhead National Forest, and part of the stream is within the Sipsey National Wilderness. The population appears to be safe. However, if the form proves to be valid, it should be listed under *special concern* because it is an Alabama endemic with a very small known range (Mount, 1975).

Greater siren
Siren lacertina Linnaeus

The greater siren is an elongate, aquatic amphibian attaining a maximum length of about 915 mm. The body is eel-like, becoming stout with age; the tail is compressed, with a fin; external gills are present throughout life; forelimbs are present, hindlimbs absent; costal grooves typically 36 to 39, the usual number 37 (*Siren intermedia*, a smaller, closely related form, usually has 31 to 36 costal grooves.); the ground color is variable, but usually some shade of gray or olive; the back is darker than the sides; the sides and belly have numerous small greenish spots and dashes, these less obvious on preserved animals; and dark spots are occasionally visible on the head, back and sides of some individuals.

Greater sirens are common to abundant in many parts of Georgia and Florida. In Alabama, the northwestern terminus of the range, they are known from a pond in Henry County and from the Fish River in Baldwin County. The Baldwin County record is based on a single specimen which, though conforming in costal groove count to *S. lacertina*, is unusual in coloration (Mount, 1975).

The habitats of *S. lacertina* include ponds, sloughs,

lakes, oxbows, and sluggish rivers, especially those where aquatic vegetation is abundant (Martof, 1973; Ultsch, 1973). Sirens are active mostly at night. The species is considered one of *special concern* in Alabama because of its scarcity and limited distribution in the state. Practices that would probably be detrimental to greater sirens include drainage of swamps and other wetland habitats and "pond improvement," which typically involves eliminating much of the aquatic vegetation and deepening the pond edges.

Eastern milk snake
Lampropeltis triangulum triangulum (Lacépède)

The eastern milk snake is a form of moderate size, attaining a maximum total length of about 1140 mm. The head is slightly or not at all distinct from the neck; the anal scute is undivided; the scales are smooth, usually in 21 rows at mid-body. The dorsum is gray to tan with 24 to 54 (average 36) black-bordered dark gray to reddish blotches, these terminating laterally on the third or fourth scale row (counting from bottom); a ventrolateral row (or 2 rows) of irregularly shaped dark blotches on each side alternate with the dorsal blotches. The first dorsal blotch usually connects to the dark head markings, encircling a medial Y- or V-shaped light area on the nape or back of the head.

A reasonably common snake to the northeast, the eastern milk snake is known to occur in Alabama only on Lookout Mountain in DeKalb County (Mount, 1975). On the adjacent portion of Sand Mountain, and in Jackson County above the Tennessee River, the eastern milk snake intergrades with the red milk snake, *Lampropeltis triangulum syspila,* a population of which is known to occur in Bankhead National Forest. It is probable that intergradient populations will be found in Cullman, Madison, and Limestone counties, and possibly other areas of northern Alabama as well.

Little is known of the habits of the eastern milk snake in Alabama. It would appear that the preferred habitats are relatively dry, rocky woods, bluff tops, and similar situations.

Because of the scarcity of this form in Alabama and its limited range within the state, the eastern milk snake is a form of *special concern.*

Red milk snake
Lampropeltis triangulum syspila (Cope)

The red milk snake is a medium-sized form, attaining a maximum total length of about 990 mm. The head is only slightly, if at all, distinct from the neck; the anal is undivided; the scales are smooth, in 21 rows at mid-body. The body has red dorsal saddles or blotches, usually around 23 in number (range = 16 to 31), that extend downward on each side to about the first scale row; interspaces between the blotches are white, cream, yellowish or gray. The first body blotch, or saddle, is usually not connected to the head pattern but is separated from it by a light band or collar. The head lacks the "spearpoint" that characterizes the corn snake, *Elaphe guttata,* with which the red milk snake may be confused. The ventrolateral surface of the body often has a series of small blotches alternating with the dorsal body blotches.

The red milk snake is known with certainty to occur only in the Bankhead National Forest, where at least 7 specimens have been found. It seems likely that the form will ultimately be found in some other areas within the northwestern quadrant of the state as well. The red milk snake intergrades with the eastern milk snake, *Lampropeltis t. triangulum,* in several areas to the east of its known range.

The red milk snake, like the eastern milk snake and intergrades between the two, are scarce in Alabama. For this reason it is a form of *special concern.* The habitats in which red milk snakes are known to occur in the state are rather dry, rocky forested areas, having a mixture of pine and hardwood. Most specimens have been collected by turning rocks and logs in fairly open spots. Little else is known of the snake in Alabama.

Northwestern Alabama is on the southeastern edge of the range of the red milk snake, and it is understandable that the snake would be scarce in the state. The snake should be protected from commercial exploitation in Alabama, and should not be collected without special permission on public lands within the state. Fortunately, the new Sipsey National Wilderness includes the area in which most specimens have been seen, and with adequate protection, the population there should be relatively safe.

Pine woods snake
Rhadinaea flavilata (Cope)

Rhadinaea flavilata is a small, terrestrial snake, attaining a maximum total length of about 390 mm. The head is slightly distinct from the neck; the tail is relatively long; the scales are smooth, in 17 rows at mid-body; the anal scute is divided. The dorsum is golden brown and is occasionally marked with diffuse mid-dorsal and lateral stripes; the top of the head is darker than the body and sometimes has pale vermiculations; a dark band extends from the snout through the eye to the corner of the mouth; the upper labials are yellowish, and sometimes have dark spots; the belly is plain yellowish white to yellow.

The pine woods snake is scarce in Alabama and is recorded only from Baldwin, Mobile, and Washington counties, in the southwestern portion. It is usually encountered under a log, in a rotting stump, or in some other sheltered place in mesic pine flatwoods (Myers, 1967; Mount, 1975).

Florida green water snake
Natrix cyclopion floridana Goff

Natrix cyclopion floridana is a relatively large, heavy-bodied snake, attaining a maximum total length of about 1880 mm. The tail is relatively short; the head is distinct from the neck; the scales are keeled (except for the first row on each side which may lack keels), usually in 27 rows at mid-body in males and 29 rows in females; the anal is divided; the orbit is separated from the labials by a series of subocular scales.

Dorsal color is dark olive to dark green, with a series

of mid-dorsal dark blotches alternating with dark lateral bars, the markings becoming indistinct in old individuals. The belly is mostly light, becoming somewhat clouded posteriorly; the undersurface of the tail is gray to brown with light half-moons.

Specimens of the Florida green water snake have been found only in southern Baldwin County, the westernmost extremity of the subspecies' range. It occurs mostly in weedy ponds, marshes, and swamps (Mount, 1975). It is an abundant snake in many parts of Florida, but because of its scarcity in Alabama, it is a form of *special concern*. In all probability, the snake was once much more common in Baldwin County than it is today, but many of the natural, fresh-water aquatic habitats in that county have been sacrificed in the interest of agriculture.

North Florida black swamp snake
Seminatrix pygaea pygaea (Cope)

Seminatrix pygaea pygaea is a small, secretive snake, attaining a maximum total length of about 425 mm. The head is slightly distinct from the neck; the tail is short; the anal is usually undivided; the scales are smooth, in 17 rows at mid-body; the dorsum is shiny black; the first 3 to 4 scale rows have obscure light longitudinal lines. The ventrals usually number more than 117; the belly is red, unmarked or with long, narrow, curved black bars on the leading edges of the ventrals.

This form, abundant in portions of Florida and Georgia, barely enters southern Alabama from the southeast. It is known with certainty only from three localities in southern Covington County, but a shed skin believed to be of this form was found in southern Houston County (Mount, 1975).

The snake occurs in swamps and weedy ponds and lakes and is fairly common around Lake Jackson in Covington County. The population there appears to be stable. Nevertheless, the extremely limited range of the form in Alabama and the apparent scarcity of the snake in most other areas of the state where it should occur warrant a listing under *special concern*. Any practice that would damage the remaining natural swamps and sinkhole pond habitats in the southern portions of Houston, Geneva, or Covington counties would be detrimental to the North Florida black swamp snake.

Eastern diamondback rattlesnake
Crotalus adamanteus Beauvois

Crotalus adamanteus is an extremely large, heavy-bodied snake attaining a maximum total length of about 2440 mm. The tail is short and stout and has a rattle or "button" at the end; the scales are keeled, in 27 or 29 rows at mid-body. The head is large and has a pit on each side between the eye and the nostril; the front of the upper jaws have movable, recurved fangs; the top of head in back of eyes has small scales.

The ground color of the dorsum is brownish; the dorsal pattern consists of dark diamonds with light centers and yellow borders; the head has a dark band extending obliquely from the eye to the labials.

The eastern diamondback occurs in Alabama locally in the Lower Coastal Plain and Red Hills. In eastern Alabama it ranges northward approximately to Eufaula, Barbour County, and in western Alabama to near Butler, Choctaw County (Mount, 1975).

It occurs in a wide variety of terrestrial habitats, including pine flatwoods, longleaf pine-turkey oak associations, and scrub. Dry, sandy places are preferred, especially those where forested habitat is interspersed with old fields and some crop land.

The eastern diamondback is apparently declining virtually throughout its range, which extends from North Carolina to Mississippi. (The population that inhabited Louisiana until relatively recent years is now believed to be extinct.) Reasons for the decline include deliberate persecution, habitat destruction, and commercial exploitation. "Rattlesnake Rodeos" are held annually in several places within the snake's range, including Opp, Covington County, Alabama. Participants typically introduce gasoline into gopher tortoise burrows in attempts to drive out the snakes (Speake and Mount, 1973). Because of the declining numbers of diamondbacks in Alabama and the increasing adversity confronting the species, it warrants *special concern* status. A similar listing for the species was proposed on a southeastern regional basis by a panel convened recently by the Southeastern Wildlife Society.

Barbour's map turtle
Graptemys barbouri Carr and Marchand

Barbour's map turtle is a medium-sized to large species, attaining a maximum carapace length of about 270 mm in the female and 130 mm in the male. The carapace has a median keel accentuated by spines or prominent knobs on some of the vertebral scutes, those most pronounced on the second and third vertebrals and becoming inconspicuous on large females. The carapace is serrate behind; the plastron is large and rigid. The ground color of the carapace is olive or greenish; the tips of the carapacial spines are black; the pleurals typically have yellowish circular or C-shaped markings; the upper surfaces of the marginals have narrow, yellowish markings, the lower surfaces have dark markings. The carapace of the adult females becomes very dark with age, and the markings become obscure. The plastron is yellowish and unmarked, except for dark lines following the sutures.

The head has a large greenish or yellow-green blotch behind each eye; the top of the head is predominantly light. The chin has an isolated yellow bar paralleling the lower jaw, followed by an inverted light U-shaped mark. The females attain much larger sizes than the males and develop greatly enlarged heads.

This turtle is confined to the Apalachicola River drainage. In Alabama it occurs in the Chattahoochee River northward to Lake Eufaula, Barbour and Russell counties. The turtle is a confirmed stream-dweller and is fond of basking on snags and logs. The adult females feed almost exclusively on molluscs. *Graptemys barbouri* is scarce in the Chattahoochee River. The reasons for the

scarcity are not apparent. (See Carr and Marchand, 1942; Walquist and Folkerts, 1973.) Because of its scarcity and limited range within the state, it is a species of *special concern.*

Florida softshell
Trionyx ferox (Schneider)

The Florida softshell is a large, aquatic turtle, attaining a maximum carapace length of about 460 mm in the female and 285 mm in the male. The body is flattened and the shell lacks horny epidermal scutes, covered instead with soft, leathery skin; the snout is prolonged into a tubular proboscis. The leading edge of the carapace has low, rounded protuberances; the anterolateral edge of the carapace is folded over, forming a ridge that has a distinct inner margin. The carapace of the juveniles has a light margin and conspicuous dark blotches, these sometimes light-centered. The carapace pattern becomes obscure with age. The large females have enlarged, flattened knobs in the nuchal region of the carapace and posteriorly in the center.

The Florida softshell has been found in Alabama at two localities in southern Covington County and on Fort Morgan Peninsula in Baldwin County. It is obviously scarce in Alabama, the northwestern terminus of its range, although it is common in much of Florida and southern Georgia. The turtle inhabits ponds, lakes, sloughs, and sluggish streams (Ernst and Barbour, 1972). In Alabama it has been found only in shallow ponds and lakes (Mount, 1975). Because of its scarcity and limited range in Alabama, it is considered a species of *special concern.*

Eastern spiny softshell
Trionyx spiniferus spinigerus Le Sueur

The eastern spiny softshell is a rather large aquatic turtle attaining a carapace length of about 430 mm in females and about half that in males. The body is flattened; the carapace lacks horny epidermal scutes and is covered instead with soft skin; the snout ends in a tubular proboscis. The leading edge of the carapace has tubercles or spiny projections; the carapace has a single encircling dark line inside the margin; the carapace of juveniles and males has well-defined ocelli and spots; the adult female's carapace is irregularly mottled with dark and light markings. The carapace of large females has enlarged flattened knobs in the nuchal region and posteriorly in the center; the carapace of adult males is "sandpapery" in texture.

In Alabama the range of the eastern spiny softshell is the Tennessee River drainage. The optimal habitat for this turtle is a free-flowing creek or river with a sand-gravel bottom. The impoundment of the Tennessee River throughout its length in Alabama has been detrimental to the eastern spiny softshell, and there are no recent records of the species from the Tennessee River. The turtle does occur in some of the free-flowing tributaries of the river, however, although population densities are apparently low (Mount, 1975).

The restricted range of the eastern spiny softshell in Alabama and the continuing degradation of the remaining habitats by damming, channelization, and pollution are justification for placing this form in a category of *special concern.*

Literature Cited

Brandon, R. A. 1965. Morphological variation and ecology of the salamander *Phaeognathus hubrichti* Copeia, 1965: 67-71.

Brode, W. E. 1969. A systematic study of the genus *Necturus* Rafinesque. Ph.D. dissertation, Univ. of Sou. Mississippi, Hattiesburg. 137 pp.

Brown, J. S. 1956. The frogs and toads of Alabama. Ph.D. dissertation,Univ. of Alabama, Tuscaloosa. 323 pp.

Caldwell, D. K., A. F. Carr, Jr., and L. H. Ogren. 1959. Nesting and migration of the Atlantic loggerhead turtle. Bull. Florida St. Mus., 4: 295-308.

Carr, A. F., Jr. 1967. So excellent a fishe. Natural History Press, Garden City, N. Y. xii + 248 pp.

Carr, A. F., Jr., H. Hirth, and L. Ogren. 1966. The ecology and migrations of sea turtles, 6. The hawksbill in the Caribbean. Amer. Mus. Novitates, No. 2248: 1-29.

Carr, A. F., Jr. and L. J. Marchand. 1942. A new turtle from the Chipola River, Florida. Proc. New England Zool. Club, 20: 95-100.

Conant, R. 1956. A review of two rare pine snakes from the Gulf Coastal Plain. Amer. Mus. Novitates, No. 1781: 1-31.

Conant, R. 1975. A field guide to reptiles and amphibians of eastern and central North America, 2nd ed. Houghton Mifflin Co., Boston, 429 pp.

Cooper, J. E. 1968. The salamander *Gyrinophilus palleucus* in Georgia with notes on Alabama and Tennessee populations. J. Alabama Acad. Sci., 39: 182-185.

Cooper, J. E. and M. R. Cooper. 1968. Cave-associated herpetozoa II: salamanders of the genus *Gyrinophilus* in Alabama caves. Natl. Speleol. Soc. Bull., 30: 19-24.

Ernst, C. H. and R. W. Barbour. 1972. Turtles of the United States. The Univ. Press of Kentucky, Lexington x + 347 pp.

Estridge, R. W. 1970. The taxonomic status of *Sternothaerus depressus* (Testudinata, Kinosternidae), with observations on its ecology. M.S. thesis, Auburn University, Auburn. 49 pp.

Folkerts, G. W. 1968. The genus *Desmognathus* Baird (Amphibia: Plethodontidae) in Alabama. Ph.D. dissertation, Auburn University, Auburn, Ala. 129 pp.

Haltom, W. L. 1931. Alabama reptiles. Alabama Geol. Surv. Nat. Hist. Mus., Pap. No. 11. vi + 145 pp.

Highton, R. 1961. A new genus of lungless salamander from the Coastal Plain of Alabama. Copeia, 1961: 65-68.

Jackson, C. G., Jr. and M. M. Jackson. 1970. Herpetofauna of Dauphin Island, Alabama. Quart. J. Florida Acad. Sci., 33: 281-287.

Joanen, T. 1969. Nesting ecology of alligators in Louisiana. Proc. S. E. Game and Fish Comm., 23: 141-151.

Jordan, J. R., Jr. 1975. Observations on the natural history and ecology of the Red Hills salamander, *Phaeognathus hubrichti* Highton (Caudata: Plethodontidae). M.S. thesis, Auburn University, Auburn, Alabama.

Jordan, J. R., Jr. and R. H. Mount. 1975. The status of the Red Hills salamander, *Phaeognathus hubrichti* Highton. J. Herpetol. 9:211-215.

Löding, H. P. 1922. A preliminary catalog of Alabama reptiles and amphibians. Alabama Geol. Surv. Nat. Hist. Mus., Pap. No. 5, 59 pp.

McIlhenny, E. A. 1935. The alligator's life history. The Christopher Publ. House, Boston. 117 pp.

Martof, B. S. 1968. *Ambystoma cingulatum.* Cat. Amer. Amph. Rept., 57.1-57.2.

Martof, B. S. 1973. *Siren lacertina,* Cat. Amer. Amph. Rept: 127.1-127.2.

Mount, R. H. 1975. The reptiles and amphibians of Alabama. Alabama Agr. Exp. Sta., Auburn. viii + 347 pp.

Mount, R. H. and G. W. Folkerts. 1968. Distribution of some Alabama reptiles and amphibians. Herpetologica, 24: 259-262.

Myers, C. W. 1967. The pine woods snake, *Rhadinaea flavilata* (Cope). Bull. Florida St. Mus., 11: 47-97.

Neill, W. T. 1954. Ranges and taxonomic allocations of amphibians and reptiles in the southeastern United States. Publ. Res. Div. Ross Allen's Reptile Inst., 1: 75-96.

Nickerson, M. A. and C. E. Mays. 1972. The hellbenders. Milwaukee Public Mus. Pub. in Biol. and Geol., No. 1, viii + 106 pp.

Pritchard, P. C. 1971. The leatherback or leathery turtle, *Dermochelys coriacea*. IUCN Monograph No. 1, Int. Union for Cons. Nature and Nat. Resour., Morges, Switzerland. 1-39.

Rebel, T. P. 1974. Sea turtles and the turtle industry of the West Indies, Florida, and the Gulf of Mexico. Univ. of Miami Press, Miami, Fla. 250 pp.

Rose, F. L. and R. M. Bush. 1963. A new species of *Eurycea* (Amphibia: Caudata) from the southeastern United States. Tulane Stud. Zool., 10: 121-128.

Schwaner, T. D. and R. H. Mount. 1970. Notes on the distribution and ecology of the salamander *Phaeognathus hubrichti* Highton. Copeia, 1970: 571-573.

Smith, P. W. 1963. *Plethodon cinereus*. Cat. Amer. Amph. Rept.: 5.1-5.3.

Speake, D. W. and R. H. Mount. 1973. Some possible ecological effects of "Rattlesnake Roundups" in the southeastern Coastal Plain. Proc. 27th Ann. Conf. S. E. Assoc. Game and Fish Comm., 27: 267-277.

Tinkle, D. W. 1958. The systematics and ecology of the *Sternotherus carinatus* complex (Testudinata, Chelydridae). Tulane Stud. Zool. 6: 1-56.

Ultsch, G. R. 1973. Observations on the life history of *Siren lacertina*. Herpetologica, 29: 304-305.

Valentine, B. D. 1961. Variation and distribution of *Desmognathus ocoee* Nicholls (Amphibia: Plethodontidae). Copeia, 1961: 315-322.

Valentine, B. D. 1963. The plethodontid salamander *Phaeognathus*: collecting techniques and habits. J. Ohio Herpetol. Soc., 4:49-54.

Valentine, B. D. 1964. *Desmognathus ocoee*. Cat. Amer. Amphib. Rept: 71.1-71.2.

Walquist, H. and G. W. Folkerts. 1973. Eggs and hatchlings of Barbour's map turtle, *Graptemys barbouri* Carr and Marchand. Herpetologica, 29: 236-237.

BIRDS

JAMES E. KEELER
Chief, Game Research
Alabama Department of
Conservation and Natural Resources

Waterfowl habitat (Helen Kittinger)

Acknowledgments

The author extends his thanks and appreciation to all the participants of the symposium for their contribution to this report. Special recognition is due the panel members: Dr. Julian L. Dusi, Auburn University; Dr. Dan C. Holliman, Birmingham Southern College; Mr. Thomas A. Imhof, Birmingham; Dr. David T. Rogers, Jr., The University of Alabama; and Dr. Charles W. Summerour, Jacksonville State University.

Introduction

Approximately 380 species of birds have been observed in Alabama in recorded history. Once occupying parts of Alabama but now extinct are the Carolina Parakeet and the Passenger Pigeon. It has been a hundred years since the American Flamingo graced the state of Alabama. While some species disappear or become scarce, others increase in number and extend their breeding ranges into Alabama. Witness the success of the Barn Swallow, Brown-headed Cowbird, Robin and the Cattle Egret in Alabama.

Birds fastidious in food and habitat selections are the specialists. The specialists are more vulnerable to extirpation or extinction. The generalized species, and the species adaptable to changes wrought by man, will be the last survivors. House Sparrows and Starlings are good examples of adaptable species. But no matter how specialized or generalized the species may be, populations are not stable. Acts of nature, such as plant succession, tornadoes, hurricanes, flooding and fire, are constantly changing the habitat. Acts of man that result in river impoundments, clear-cutting of forests, strip mining, building of cities and highways, and the use of pesticides and chemical pollutants effect the ecosystem and consequently bird populations.

Species that only pass through Alabama on migratory flights and do not establish territories are not considered for the endangered and threatened list.

List of Species of Birds of *Endangered* status (E), *Threatened* Status (T), and *Special Concern* status (S).

Order Pelicaniformes
Family Pelicanidae
(E) *Pelecanus occidentalis*—Brown Pelican
Order Anseriformes
Family Antatidae
(T) *Anas fulvigula*—Mottled Duck
Order Falconiformes
Family Accipitridae
(S) *Accipiter cooperii*—Cooper's Hawk
(S) *Accipiter striatus*—Sharp-shinned Hawk
(E) *Aquila chrysaetos*—Golden Eagle
(S) *Buteo lineatus*—Red-shouldered Hawk
(S) *Elanoides forficatus*—Swallow-tailed Kite
(E) *Haliaeetus leucocephalus*—Bald Eagle
Family Falconidae
(S) *Falco columbarius*—Merlin
(E) *Falco peregrinus*—Peregrine Falcon
Family Pandionidae
(E) *Pandion haliaetus*—Osprey
Order Gruiformes
Family Gruidae
(S) *Grus canadensis*—Sandhill Crane
Family Rallidae
(S) *Laterallus jamaicensis*—Black Rail
Order Charadriiformes
Family Charadriidae
(E) *Charadrius alexandrinus*—Snowy Plover
Family Haematopodidae
(S) *Haematopus palliatus*—American Oystercatcher
Order Ciconiiformes
Family Ardeidae
(T) *Dichromanassa rufescens*—Reddish Egret
(S) *Florida caerulea*—Little Blue Heron
(S) *Mycticorax mycticorax*—Black-crowned Night Heron
Family Ciconiidae
(S) *Mycteria americana*—Wood Stork
Order Piciformes
Family Picidae
(E) *Campephilus principalis*—Ivory-billed Woodpecker
(E) *Dendrocopos borealis*—Red-cockaded Woodpecker
Order Passeriformes
Family Fringillidae
(S) *Aimophila aestivalis*—Bachman's Sparrow
Family Parulidae
(S) *Limnothlypis swainsonii*—Swainson's Warbler
(E) *Vermivora bachmanii*—Bachman's Warbler
Family Troglodytidae
(S) *Thryomanes bewickii*—Bewick's Wren

ENDANGERED SPECIES

Brown Pelican
Pelecanus occidentalis Linnaeus

The Brown Pelican is a very large dark brown bird which carries its big bill and pouch on its breast. The adult has some white on the head, but the immature bird has a dark head.

The Brown Pelican breeds along the Pacific Coast from California to Chile, wintering north to British Columbia. Along the Atlantic, Gulf, and the Caribbean coasts it breeds from North Carolina to British Guiana, wintering north to North Carolina.

Until 1957, the Brown Pelican was considered abundant along the Alabama Gulf Coast. Since that time, the local population was almost decimated by the widespread use of chlorinated hydrocarbon pesticides, especially DDT. The population declined from about 1,800 birds in 1956 to about 60 birds in 1971. Since the use of DDT and its allies has been banned or restricted, the Brown Pelican population is again increasing. In 1974, approximately 400 birds were recorded on the Alabama Gulf Coast. The Brown Pelican population was drastically reduced throughout its continental range.

The Brown Pelican does not breed in Alabama. It feeds exclusively on fish. Pesticides will continue to present a threat to the survival of this species. The Brown Pelican is also listed as *endangered* by the U. S. Department of the Interior.

Golden Eagle
Aquila chrysaetos (Linnaeus)

The adult Golden Eagle is a large dark bird which, when seen from below, shows a small amount of light color at the base of the primaries and at the base of the tail feathers. It closely resembles the immature Bald Eagle. At very close range, the golden color of the hindneck and the feathering close to the toes is evident on the Golden Eagle. In flight it greatly resembles a big soaring hawk.

The Golden Eagle breeds in mountainous country from northern Alaska and northern Quebec south to northern Lower California, central Mexico, western Texas, New York, and Maine, and possibly farther south in the Appalachian Mountains. It winters throughout most of this range but less commonly south to the Gulf States.

The Golden Eagle is rare in winter in Alabama. It does not breed here. Mated pairs appear to spend the winter together. It is a bird of the wild country and occurs particularly in mountains and heavily wooded areas. This eagle eats a variety of rodents and large birds.

Illegal shooting can be attributed to its rarity in Alabama.

Bald Eagle
Haliaeetus leucocephalus (Linnaeus)

The adult Bald Eagle is black with a white head and tail, a yellow bill, and yellow legs. The immature bird lacks the white head and tail and usually shows much white in the under wing linings. It can be recognized as an eagle by its large size, dark color, and long rounded wings. Immature birds are easily confused with Golden Eagles.

The Bald Eagle is resident from northwestern Alaska, northern Mackenzie, and Labrador south to Lower California, northern Mexico, and Florida. It breeds locally throughout this range. Most northern birds retire southward in winter, and southern breeding birds migrate north after the winter breeding season.

This bird was once locally common during the winter months on the Gulf Coast and in the Tennessee Valley and uncommon in the winter in the remainder of the state. It occurs near rivers and lakes. They formerly nested along the Gulf Coast and in the Tennessee Valley but no recent nesting records are known in Alabama.

Fish is the main food item of the Bald Eagle. It obtains its food mostly from other fish-eating birds such as the Osprey. The Bald Eagle worries the Osprey until it drops its fish; whereupon the eagle swoops down and snatches the fish in mid-air. The Bald Eagle also eats carrion, small mammals, birds and snakes.

Pesticides, human disturbance of nesting sites, and illegal shooting have caused its decline. The Bald Eagle is also listed as *endangered* by the U. S. Department of the Interior.

Osprey
Pandion haliaetus (Linnaeus)

In wing spread and total length, the Osprey is almost as large as an eagle but its body is much smaller. This bird has a black back, a white head with a black mask, a white belly, and black wrist marks on the bend of the wing. It has a rather long tail and its long wings have a noticeable crook in them so that in flight the Osprey closely resembles a gull.

The Osprey occurs near water in nearly all temperate and tropical parts of the world. In North America it breeds as far north as there are trees, south to Lower California, western Mexico, the Gulf States, and the Florida Keys. It winters from Lower California and the Gulf States south to Peru and Brazil, and occasionally farther. The Osprey population was drastically reduced during the last ten years due to their susceptibility to DDT and its derivitives. Ingestion of these chlorinated hydrocarbons causes thin eggshells which results in reproduction failure.

This bird was formerly common on migration in spring and uncommon in fall throughout Alabama. On the Gulf Coast, in the Tennessee Valley, and possibly in the intervening area, it was a fairly common, breeding, summer resident. During the past decade, the Osprey was rare in Alabama and no nests were recorded until the summer of 1974, when one nest was discovered near the Gulf Coast. Since the use of DDT was banned, the Osprey population has shown a slight increase.

The nest of the Osprey is a large, bulky affair usually built in the top of a tall tree near water. Sticks, twigs,

grasses, moss, and debris are the building materials, and the nest is used year after year. The two to four yellowish or pinkish dull white eggs are marked with coppery red and various shades of brown. They feed exclusively on fish.

Peregrine Falcon
Falco peregrinus Tunstall

This crow-sized falcon is very dark above, lighter below, and has a black mustache mark running down from the eye.

In the Western Hemisphere, the Peregrine Falcon breeds locally from Alaska, northern Baffin Island, and Greenland south to Lower California, central Mexico, Texas, and the Gulf States. It winters from Vancouver Island, Colorado, Nebraska, southern Ontario, and New Brunswick south to Chile and Argentina.

The Peregrine Falcon is rare and local in winter and on migration in Alabama. It formerly bred along the Tennessee Valley. Pesticides, especially the chlorinated hydrocarbons such as DDT, drastically reduced the Peregrine Falcon population and its reproduction success. No recent breeding records are known in Alabama.

This falcon feeds chiefly on birds, especially waterfowl, shorebirds and pigeons.

The Peregrine Falcon is also listed as *endangered* by the U. S. Department of the Interior.

Snowy Plover
Charadrius alexandrinus Linnaeus

The Snowy Plover is slightly smaller and paler than the Piping Plover. It also differs in having a bigger head, a thinner, longer, black bill, bluish legs, a black ear patch, and a black bar on each side of the breast.

In North America this bird breeds inland in river valleys from Washington, Utah, Oklahoma, and Kansas south to southern Lower California and northern Texas; on the northern Gulf Coast from Texas to Florida; and in the Bahamas and the Greater Antilles. It winters on the Pacific Coast from Oregon to Mexico, and on the Atlantic Coast from Louisiana and Florida south to Venezuela, the Bahamas, and the Greater Antilles.

The Snowy Plover was formerly a local but regular permanent resident only on the outer beaches and sandbars in Baldwin and Mobile Counties. It is now becoming rare in these areas. It breeds on the more deserted sand islands. The two to three pale buffy eggs are marked with dark brown and black and are laid in a depression in the sand on a deserted beach close to the Gulf.

The Snowy Plover eats small crustaceans, mollusks, marine worms, aquatic insects and seeds.

Habitat manipulation and human encroachment are the main reasons for the decline of the Snowy Plover.

Red-cockaded Woodpecker
Dendrocopos borealis (Vieillot)

The Red-cockaded Woodpecker, about the size of the Hairy Woodpecker, is black and white and has a zebra-like back, a black crown and hindneck, a small red spot near the ear, and a large white cheek patch.

This woodpecker is resident in southern pine forests from eastern Oklahoma, Kentucky, and southern Maryland south to eastern Texas and southern Florida.

The Red-cockaded Woodpecker is a local, permanent resident in piney woods in most of Alabama south of the Tennessee River. It usually lives and nests in woods in which about one-quarter or more of the trees are pines.

This species nests about thirty feet from the ground, almost invariably in a living pine that has a dead heart. The outside of its nest hole is smeared with pitch, and on a bed of wood chips inside it lays two to six glossy white eggs. They use the same tree year after year. Pine mast and the larvae of wood-boring insects form the greater part of this woodpecker's food. It also eats other insects, berries and seeds.

Habitat destruction, especially the elimination of large pine trees with a dead heart, usually called "red-heart" is causing a decline in the population by eliminating their nesting trees. The Red-cockaded Woodpecker is also listed as *endangered* by the U.S. Department of the Interior.

Ivory-billed Woodpecker
Campephilus principalis (Linnaeus)

The Ivory-billed Woodpecker closely resembles the Pileated Woodpecker but is larger and has a pale yellow bill and large white wing patches, much like those of the Red-headed Woodpecker. Both sexes are crested; the male has red on the rear half of the head and the neck, but the female shows no red at all.

This woodpecker was formerly resident from southeastern Oklahoma, southern Indiana, and southeastern North Carolina south to southern Texas and southern Florida.

The Ivory-billed Woodpecker may now be extinct. It lived in virgin bottomland hardwood forests and as these woodlands were exploited, the bird, apparently unable to adapt itself, steadily retreated. It was last reported in Alabama in 1907. A century ago it was probably an uncommon, permanent resident in the Coastal Plain. It is extremely doubtful that the Ivory-billed Woodpecker exists in Alabama at the present time.

Habitat destruction is the primary cause. The Ivory-billed Woodpecker is also listed as *endangered* by the U. S. Department of the Interior.

Bachman's Warbler
Vermivora bachmanii (Audubon)

Bachman's Warbler is probably the rarest of North American songbirds. It is a small olive-green bird with bright yellow under parts. The male has a black bib, a black cap, and a yellow forehead, and thus resembles a male Hooded Warbler with an incomplete hood. The female, rather nondescript, lacks the black and closely resembles a female Hooded or Wilson's Warbler except that it is dull whitish below. The yellow eye ring of the female Bachman's Warbler stands out against the blue-gray of the cap and cheeks.

Bachman's Warbler formerly bred in the upper part of the Coastal Plain and in the Mississippi Valley from southern Indiana and eastern Missouri south to Louisiana, east through the Gulf States, and north to coastal Virginia. It migrates through the Florida Keys, occasionally the Bahamas, to winter in western Cuba, the Isle of Pines, and rarely Mississippi, Georgia and Florida.

This small warbler was common throughout its range in Alabama in the early 1900's but was quite rare by the 1920's. Small numbers frequented swamps near Tuscaloosa and Montgomery until 1940. The last nesting record in Alabama was in 1937. The nest is one to three feet from the ground in dense shrubs, usually blackberry. The female lays three or four white eggs. Caterpillars and the remains of Hymenoptera, probably ants, have been recorded as the food eaten by Bachman's Warbler.

The reason for its decline is not known, however the cutting of bottomland and swampland timber may be a contributing factor. Bachman's Warbler is also listed as *endangered* by the U. S. Department of the Interior.

THREATENED SPECIES

Reddish Egret

Dichromanassa rufescens (Gmelin)

The Reddish Egret has two color phases. The more common is dark blue-gray with a reddish-brown head and neck; the other phase is all white. In either phase the Reddish Egret may be recognized by the pale pinkish base of the dark bill. It closely resembles the Little Blue Heron but is slightly larger. The unusual feeding antics help identify the Reddish Egret. When feeding, it chases fish in shallow water and dances, acts drunk, staggers, stops short, partly opens its wings, and goes through many other odd motions.

This egret breeds from Lower California, coastal Texas, Louisiana, and southern Florida south to Sinaloa, Yucatan, Jamaica, and Hispaniola. After the breeding season it wanders to the northern Gulf Coast and northern Florida, and in winter, south to Venezuela.

On the Alabama Gulf Coast, the Reddish Egret is sometimes fairly common on migration, and it occasionally lingers into winter. It is not known to breed in the state. It is most common on the bay side of the outer islands and peninsulas. It prefers to stay near salt water, and it feeds in shallow bays or on mudflats with shorebirds. Fishes and crustaceans make up the main items of its diet.

Since it is a bird of the coastal shores, human encroachment and reduction of habitat are the major reasons for its decline.

Mottled Duck

Anas fulvigula Ridgway

This duck resembles the Black Duck in pattern, but it is paler in color. The Mottled Duck is buffy throughout with a rich, unstreaked throat and a prominent white border behind the bluish speculum. The Mottled Duck closely resembles the female Mallard but the latter has a blotched bill, a whitish tail, and a white border on front and rear of the bluer speculum.

The Mottled Duck is resident on the Gulf Coast from southern Texas to southern Florida and inland in the states of Florida, Texas, and Louisiana. It is a local and uncommon permanent resident on the Gulf Coast of Alabama. In summer it nests on the outer islands and peninsulas and their sheltered bays. During the remainder of the year it is more widespread, and often winters at the head of Mobile Bay.

The nest consists of a neat mound of fine bits of grass, lined with down and is well concealed in dense grass, usually *Spartina*. One nest on the west portion of Dauphin Island contained eight bluish-green eggs.

Mollusks, particularly snails, form more than half of the Mottled Duck's food. It also eats insects, crustaceans, a few fish, and the roots, stems, and especially the seeds of bulrush, spikerush, wild rice, pickerelweed, and naiad.

Habitat destruction and human encroachment are factors restricting its range.

SPECIES OF SPECIAL CONCERN

Little Blue Heron

Florida caerulea (Linnaeus)

The adult Little Blue Heron is a dark blue bird with a dark maroon neck, dark greenish legs, and a dark blue bill which is lighter at the base. At a distance the bird looks black. The size ranges from 50 to 62 cm. Immature birds are white except for a tinge of blue in the wing tips, and the bill and legs are dark. Young Snowy Egrets are sometimes suspected of being immature Little Blue Herons.

This heron breeds in southern United States from Massachusetts south to Peru and the West Indies. In late summer and fall, many birds, mostly young, wander north as far as southern Canada. It winters from coastal North Carolina and Texas southward.

Prior to the arrival of the Cattle Egret in 1957, the Little Blue Heron was a common to abundant, breeding, summer resident in the Coastal Plain and the Tennessee Valley in Alabama. In late summer and fall it occurred commonly throughout the state and was the most abundant and widespread heron. Cattle Egrets appear to be strong nest competitors with Little Blue Herons.

The Little Blue Heron usually nests with other herons, in large colonies on lake shores, in swamps, or on islands. The twig nest may be constructed high in a tree or in a low bush over water, and contains two to four bluish-green eggs.

The Little Blue Heron, a wading bird, frequents moist areas such as lake shores, swamps, ponds, and bottomlands. It feeds mainly on small fishes, crawfish and frogs.

No attempt has been made, nor would it be feasible to attempt to breed these birds in captivity.

Stream alterations, water pollution, and clearcutting are reducing the feeding habitat of this species. This, coupled with nest competition, appears to be reducing the population of Little Blue Herons in Alabama.

Black-crowned Night Heron
Nycticorax nycticorax (Linnaeus)

The adult Black-crowned Night Heron is black on the top of the head and back, gray-blue on the wings, and clear white below, with a black bill and yellow legs. The immature birds are brown, heavily streaked below and spotted above. Night herons are stockier than most other herons. The immature ones sometimes resemble the American Bittern and immature Yellow-crowned Night Herons.

In the Western Hemisphere the Black-crowned Night Heron breeds from Washington and Quebec south to Patagonia, and it winters from Oregon, Texas, Alabama, and Massachusetts southward.

The Black-crowned Night Heron, a locally common permanent resident on the Gulf Coast, formerly bred on Dauphin Island, and probably still breeds at the head of Mobile Bay and near Mississippi Sound. It is uncommon inland. It feeds actively in salt marshes and on the borders of large bodies of water. For roosting and nesting this species chooses a variety of trees but especially likes cedars and other evergreens. Although it may feed at any hour, it usually prefers to forage at night and then spend the day in its roost. The main food is fish, but it also eats crawfish, shrimp, crabs, frogs, tadpoles, mice, grasshoppers and other insects.

This heron breeds in small numbers by itself or with other herons. The nest, loosely made of twigs, contains three to six pale sea-green eggs, and is placed in trees or in bushes. Rarely a nest will be found on the ground.

Drainage of marsh and swamplands and human encroachment along the coastal areas of Alabama have restricted the habitat of this species.

Wood Stork
Mycteria americana Linnaeus

The Wood Stork is a large white bird almost as tall as the Great Blue Heron and is heavier. It has a naked, dark brown head, and its wings show extensive black areas, including the trailing edges. It flies with its neck outstretched and often soars at a great height. Its manner of flight and its shape set it apart from the White Pelican and white herons, and its larger size distinguish it from the White Ibis.

Wood Storks are winter residents from Sonora, coastal Texas, and South Carolina south to Argentina and Peru. In summer and fall they wander north regularly to California, Arizona, and Tennessee, and irregularly to southern Canada.

This bird was fairly common in the Coastal Plain of Alabama in summer and fall and rare to uncommon farther north in the Tennessee Valley. The present population appears to be declining throughout Alabama. The Wood Stork frequents wet places, mainly swamps, where it perches in dead treetops or soars high overhead for long periods of time. It forages in shallow ponds, on the shores of deeper fresh water, and in river bottom sloughs. These birds feed by stirring up the bottom of shallow ponds, forcing acquatic animals to the surface, and then spearing them. Young alligators, fish, frogs, and other water animals are the main items of food. Wood Storks are not known to breed in Alabama.

The population of Wood Storks in Alabama is dependent upon favorable breeding habitat in Florida. The breeding habitat in Florida is being reduced due to habitat destruction and human encroachment.

Swallow-tailed Kite
Elanoides forficatus (Linnaeus)

This large, strikingly marked, black and white hawk resembles a swallow in shape and flight. It is white with black upper parts, black forked tail, and black flight feathers in its long, pointed wings.

The Swallow-tailed Kite breeds locally from central Texas, central Alabama, South Carolina and south to Bolivia and Argentina. It winters in Central and South America and rarely in Florida.

In Alabama the Swallow-tailed Kite is an uncommon to rare summer resident in the Coastal Plain. It inhabits river swamps and spends much of its time on the wing just over the treetops or over fields near the river. The nest of twigs and grass, usually with some Spanish moss, is in the top of a tall tree near water. The two or three eggs are white or buffy and marked with rich chestnut brown and dark brown.

Because it eats live insects and lizards, it is little affected by pesticides; however, its numbers are limited by available river swamps which are constantly being encroached upon.

Sharp-shinned Hawk
Accipiter striatus Vieillot

The Sharp-shinned Hawk is a small hawk with short, rounded wings and a long tail. The adult male, much smaller than the female, is dark blue above and whitish, heavily barred with rufous, below. The female and the immature birds are dark brown above and heavily streaked with brown below. This species is similar in all plumages to the crow-sized Cooper's Hawk but the smaller Sharp-shinned Hawk's tail is square when spread and notched when folded.

The Sharp-shinned Hawk breeds from northwestern Alaska, southern Labrador, and Newfoundland south to California, Texas, central Alabama, and South Carolina. It winters from British Columbia, the Great Lakes, and New England south to Panama.

This species is a locally common permanent resident in the northern half of Alabama and winters throughout the state. It builds a large nest of twigs, usually in a conifer 15 to 25 feet from the ground. The two or more dull bluish-white eggs are boldly marked with brown.

The Sharp-shinned Hawk feeds on birds from the smallest to those larger than itself. Occasionally it eats mice, frogs, lizards and grasshoppers. As a predator near the top of the food chain, the probable reason for its decline is excessive use of pesticides.

Cooper's Hawk
Accipiter cooperii (Bonaparte)

The Cooper's Hawk is almost identical to the Sharp-shinned Hawk except that it is larger, being almost crow-sized and has a rounded tail.

Cooper's Hawk breeds from British Columbia across southern Canada to Nova Scotia and south to northern Mexico and Florida. It winters from Washington, southern Michigan, and southern New England south to Costa Rica.

This species was a common, breeding, permanent resident throughout Alabama. Although not numerous, it was widespread and wide-ranging, and was recorded commonly, especially in moderately wooded areas. It is more common in winter, when northern birds augment the local population. Cooper's Hawks usually build their own nest, but it often appropriates a nest which another hawk or crow has abandoned. The nest is from ten to fifty feet from the ground, near the trunk of a tree in secluded woods. The two to four pale bluish-white eggs are sometimes spotted with pale reddish-brown.

Like the Sharp-shinned Hawk, this bird feeds on other birds and is the principal marauder of poultry yards. It also eats squirrels, rabbits, rats, mice, chipmunks, reptiles, amphibians, and insects. The Cooper's Hawk population appears to be decreasing more rapidly than the Sharp-shinned Hawk population and probably for the same reason.

Red-shouldered Hawk
Buteo lineatus (Gmelin)

The adult Red-shouldered Hawk is dark above with reddish-brown shoulders and whitish underparts narrowly barred with reddish brown. Its tail is black with narrow white bars. The immature bird can usually be distinguished from the Red-tailed Hawk by its slimmer proportions and longer tail.

The Red-shouldered Hawk breeds from Minnesota, Ontario, and southern Quebec south to central Mexico and the Florida Keys. It winters north to Kansas, Illinois, and New York.

This species was the most common and widespread of all soaring hawks in Alabama until about six years ago. Since then the population has experienced a rapid decline. Habitat destruction caused mainly by large-scale clear-cutting operations and strip mining is partially responsible for the population decline. The Red-shouldered Hawk is a permanent breeding resident. The large and bulky nest is usually twenty to one hundred feet above ground in a hardwood or pine. It is composed of sticks and grasses with a lining of softer materials such as green leaves, pine needles, and Spanish moss. The one to three dull white eggs range from dirty white to those marked heavily with brown, gray, and lavender spots and blotches.

This highly valuable hawk eats destructive insects and rodents, as well as certain aquatic animals. Habitat destruction and pesticides are factors influencing the declining population.

Merlin
Falco columbarius Linnaeus

The Merlin or Pigeon Hawk is about the size of a Sparrow Hawk. The male is dark blue above, the female and the immature bird are dark brown. All are heavily streaked below, and the tail has light and dark stripes.

In America the Merlin breeds from as far north as trees grow in northwestern Alaska, Labrador, and Newfoundland south to California and the northern parts of our northern states. It winters from British Columbia, Wyoming, and the Gulf States, south to Peru, Venezuela, and the West Indies.

The Merlin, on fall migration, is fairly common on the Gulf Coast and uncommon elsewhere in the state. It is not known to nest in Alabama. It occurs most frequently over open areas, especially beaches and meadows. It lives most of the summer in the far north and is not very suspicious of man.

This hawk feeds mostly on small birds up to the size of pigeons, flickers, and grackles. It can outdistance most birds, for it even catches swifts and swallows occasionally. It also varies its diet with small mammals and large insects.

The Merlin population in Alabama has never been large and since it does not breed here, habitat destruction does not play an important role in limiting its numbers. Since it feeds on animals at the top of the food chain, pesticides have probably played a small part in limiting the Merlin population.

Sandhill Crane
Grus canadensis (Linnaeus)

This large, long-legged gray bird has a bare red crown and long back feathers that curl down over the tail. It is about the size of the Great Blue Heron but is heavier bodied, has a thinner bill and flies with its neck extended.

The Sandhill Crane breeds from northeastern Siberia, Alaska, and Baffin Island south locally to California, Colorado, South Dakota, and Michigan, and also coastal Mississippi and southern Georgia to southern Florida. It winters from California, Texas, and the northern Gulf Coast south to central Mexico and southern Florida.

This bird is rare and local in winter in Baldwin County. Inland it is a casual transient. It frequents the open pine flats, especially boggy openings with small ponds and marshes. Although it is very shy and avoids man as much as possible, it sometimes forages in cornfields. The population in southern Baldwin County probably numbers less than thirty. It is doubtful if any Sandhill Cranes breed in Alabama.

The Sandhill Crane feeds mainly on roots, bulbs, and grains, particularly corn. This diet is varied with grasshoppers, beetle grubs, other large insects, spiders, frogs, lizards, snakes, and mice.

Habitat destruction, human disturbance and illegal shooting are factors contributing to its rarity in Alabama.

Black Rail

Laterallus jamaicensis (Gmelin)

The Black Rail is a small slaty or blackish bird with a black bill. It is about five inches in length with a bobbed tail. The back is speckled with white. This bird is very secretive and difficult to flush.

This tiny rail breeds from Florida along the coast to Massachusetts and inland to Iowa and Kansas. It winters south of the United States.

The Black Rail is rarely seen in Alabama, however, due to its shy habits, its difficulty to flush, and its ability to run, it could be much more common than formerly supposed. It has been recorded in the Mobile area. It inhabits wet meadows and salt marshes. When observed in its natural habitat it resembles more closely a rat running through the vegetation than it does a bird. It is not known to breed in Alabama but future observations may prove that it does.

The food habits of the Black Rail are not known in Alabama but it probably feeds on seeds of sedges, bristlegrass and other plants as well as snails, insects, and various crustaceans.

Habitat destruction, especially drainage of wetlands will probably reduce the Black Rail population.

American Oystercatcher

Haematopus palliatus Temminck

The American Oystercatcher is about the size of an average duck. It has a black head and neck and a large, bright red bill adapted to opening the shells of mollusks. Its back is dark bronzy-brown; its belly, white; and its legs, flesh colored.

This bird is resident and local on the Atlantic and Gulf Coasts from New Jersey to the West Indies, Texas, and Argentina, but it is rarer in winter north of North Carolina. On the Pacific Coast it is resident from Lower California to Chile.

In Alabama the American Oystercatcher frequents sand flats and beaches, especially those near oyster reefs. Its distribution along the coast is spotty, apparently determined by the location of these reefs. It is an uncommon, breeding, permanent resident in coastal Baldwin and Mobile counties.

This bird lays two to three creamy-white eggs speckled with brown, black, or lavender in a slight depression in the sand of a deserted beach, often a small sandbar in a shallow bay.

Oysters, clams, mussels, and other shellfish are the main food of this bird. Occasionally it eats sea-worms and insects.

Human disturbance and restriction of habitat is responsible for the low numbers of this species. Alabama is also on the western fringe of the oystercatcher's range and even with ideal habitat conditions it would probably be present in limited numbers.

Bewick's Wren

Thryomanes bewickii (Audubon)

The Bewick's Wren is smaller than the Carolina Wren and larger than the House Wren. This wren is brown above and white below and has a prominent white stripe over the eye. Its long, fan-shaped tail has white spots near the tip.

Bewick's Wren breeds from southern British Columbia, southern Utah, southern Iowa, southern Michigan, southern Ontario, and central Pennsylvania south to southern Mexico, central Arkansas, northern Mississippi, central Alabama, and northern Georgia. It winters from southern British Columbia, southern Nevada, southern New Mexico, central Arkansas, southern Illinois, and southwestern Ohio south to southern Mexico and central Florida.

This wren breeds uncommonly in the Tennessee Valley and Mountain Region of Alabama. In winter it is uncommon to fairly common in Alabama but rare on the Gulf Coast.

The Bewick's Wren chooses any kind of cavity around houses, including nest boxes. It fills the cavity with sticks, straw, and coarse grass and lines the nest with feathers, hair, or other soft material. The eggs, numbering five to seven, are white marked with reddish brown or lavender.

Like other wrens, the Bewick's Wren is an insect eater and consumes large numbers of beetles, caterpillars, grasshoppers, ants and spiders.

Competition for nesting space with the House Wren and the Carolina Wren probably plays a part in suppressing the breeding population in north Alabama. In 1958 its numbers in the southeast declined drastically and it has never recovered. The cause of its original demise is poorly understood and habitat does not appear to be a factor in its decline.

Swainson's Warbler

Limnothlypis swainsonii (Audubon)

Swainson's Warbler is one of the least colorful warblers. It is olive-brown above and pale brownish to buffy below with a reddish-brown crown and a conspicuous white line over the eye.

This warbler breeds locally from Oklahoma, the Ohio Valley, and southeastern Maryland south to southern Louisiana and northern Florida. It winters in eastern Mexico, British Honduras, Jamaica, and Cuba.

Swainson's Warbler is an uncommon and local summer resident in the Coastal Plain and Tennessee Valley of Alabama. In the breeding season it inhabits river swamps, usually where cane *(Arundinaria)* grows. This species lives in dense thickets and they are difficult to locate. Only a few breeding records are known from Alabama.

The bulky, loosely-built nest is usually in a clump of cane from three to ten feet above ground and often resembles a bunch of leaves lodged there by high water. The lining is generally of fine rootlets, pine needles, cypress leaves, moss and sometimes horsehair. The two or three eggs are very round and usually dull white but on rare occasions they are spotted. The food of this warbler consists mostly of insects.

Recent evidence indicates that the population in Alabama may be too thinly scattered for the birds to locate available mates and breed properly.

Bachman's Sparrow
Aimophila aestivalis (Lichtenstein)

Bachman's Sparrow is streaked reddish brown above and unstreaked buffy below, and has a rather large bill and flat head. It resembles the Grasshopper Sparrow but Bachman's Sparrow has a longer tail and lacks the white crown stripe.

This species breeds from southeastern Missouri, northeastern Illinois, southwestern Pennsylvania, and Maryland south to central Texas, the northern Gulf Coast, and central Florida. It winters from northeastern Texas, northern Alabama, and central North Carolina south to southeastern Texas and southern Florida.

In Alabama this sparrow is a permanent resident in suitable habitat almost everywhere, but has been noted only in the summer in the Tennessee Valley. It breeds in dry piney and scrub-oak woods, particularly the drier ridge tops with few shrubs. The nest, which has a dome-shaped top, is made of dry grasses and weed stems and lined with fine grass tops. Generally it is in woods on the ground in clumps of grass, palmetto, or vine tangles. The usual clutch is four pure white eggs. The food of Bachman's Sparrow consists of insects, spiders, snails, millipedes, and various seeds.

Habitat destruction and human encroachment is partially responsible for its small population.

REFERENCES

Keeler, James E. 1972. Birds *in* Rare and Endangered Vertebrates of Alabama. Ala. Dept. Conser. and Nat. Res., Montgomery.

Imhof, Thomas A. 1962. Alabama Birds. The University of Alabama Press, University, Alabama.

Peterson, Roger Tory. 1947. A Field Guide to the Birds. Boston.

MAMMALS

JULIAN L. DUSI
Professor of Zoology-Entomology
Auburn University
Auburn, Alabama

Typical Sea Oats—Dune habitat of Beach Mice. (J. L. Dusi).

Acknowledgements

The symposium panel for mammals was headed by myself and contained the following as members: Thomas W. French, Auburn University; Dan C. Holliman, Birmingham-Southern College; Donald W. Linzey, University of South Alabama; Francis X. Lueth, Alabama Department of Conservation and Natural Resources; and L. G. Sanford, Jacksonville State University. In addition, John E. Cooper, North Carolina State Museum of Natural History and Merlin D. Tuttle, Milwaukee Public Museum, have provided most of the information on which the bat accounts are based. The success of this panel is largely due to the participation of these individuals and their helpful suggestions. Our thanks and appreciation are extended to them for their good work.

Introduction

Since the symposium in 1971, on the "Rare and Endangered Vertebrates of Alabama," we have added greatly to our knowledge of the mammals of Alabama. Some of this knowledge has been used in reevaluating the status of mammals, such as leading us to conclude that the Red Wolf is now extirpated in Alabama.

By using the presently more uniform classification categories: *endangered, threatened* and *special concern,* we now list 7 *endangered* mammals, none as *threatened,* and 11 in the *special concern* category.

Most of the reasons for the listing of these mammals are the results of man's behavior, by habitat destruction and by persecution of the mammals themselves. For example, the channelization of streams and drainage of swamps removes the habitat of many semi-aquatic and moist habitat forms. The over-utilization of beach areas destroys the dunes and their vegetation, destroying the beach mouse habitat. Converting caves for commercial use makes them unsuitable for bats. Man's persecution of all of the large predators is removing them from the Earth. Man's actual destruction of the bats in some caves is bringing them nearer to extirpation.

Game management activities in Alabama have increased the numbers of most of the game species but have only peripheral effects on the others. These non-game species have been ignored by game biologists and administrators because no funds have been allocated for their study or management and little has been done to develop management practices for them.

Measures must be taken to preserve the habitat of the endangered mammals, if they are to survive in Alabama. Concern should also be given to the habitat preservation of the other species, so that they will not become *endangered.* Senseless persecution of mammals must be stopped also, if they are to survive. Those species of *special concern* should be adequately studied, so that we can plan for their survival.

List of Species of Mammals in the *Endangered* Status (E) and the *Special Concern* Status (S)

Order Insectivora
Family Soricidae
(S) *Sorex longirostris longirostis.* Southeastern Shrew
Order Chiroptera
Family Vespertilionidae
(E) *Myotis grisescens.* Gray Myotis
(S) *Myotis austroriparius austroriparius.* Southeastern Myotis
(S) *Myotis lucofugus lucifugus.* Little Brown Bat
(S) *Myotis keenii septentrionalis.* Keen's Myotis
(E) *Myotis sodalis.* Indiana Myotis
(S) *Plecotus rafinesquii.* Rafinesque's Big-eared Bat
(S) *Lasiurus floridanus.* Florida Yellow Bat
Order Lagomarpha
Family Leporidae
(S) *Sylvilagus palustris palustris.* Marsh Rabbit
(S) *Sylvilagus transitionalis.* New England Cottontail
Order Rodentia
Family Sciuridae
(S) *Sciurus carolinensis fuliginosus.* Bayou Gray Squirrel
Family Cricetidae
(E) *Peromyscus polionolus ammobates.* Alabama Gulf Beach Mouse
(E) *Peromyscus polionotus trissyllepsis.* Perdido Bay Beach Mouse
(S) *Microtus ochrogaster ochrogaster.* Prairie Vole
Family Zapodidae
(S) *Zapus hudsonius americanus.* Meadow Jumping Mouse
Order Carnivora
Family Ursidae
(E) *Ursus americanus americanus.* Northern Black Bear
(E) *Ursus americanus floridanus.* Florida Black Bear
Family Felidae
(E) *Felis concolor coryi.* Florida Panther

ENDANGERED SPECIES

Gray Myotis
Myotis grisescens Howell

Myotis grisescens is a medium-sized bat with a grayish brown color; the hairs not obviously darker at the base, and the wing membranes attached to the tarsus, not the foot. Unlike other eastern bats, its colonies are restricted to caves or cave-like habitats at all seasons. Its range occupies all, or most of 11 states, including Alabama and Florida.

According to Tuttle (1974, 1975) and John Cooper (per. comm.), suitable maternity caves are few because they must have rooms with dome-like roofs, where thousands can roost in compact clusters, creating incubator-like conditions. Therefore, Tuttle estimates that two caves in northern Alabama contain approximately 22 percent of the entire *M. grisescens* maternity population and 65 percent of the entire species population hibernates in a single cave in northern Alabama. He also indicates that any disturbance in a maternity colony causes confusion among the adults and results in thousands of young being dropped to the floor to die. Since the females give birth to only one young, a high mortality rate is disasterous.

Commercialization of several of the caves in the species' range has resulted in the destruction of many individuals. Rabies research and spelunking are causing increased disturbances in other caves. Because of its fragile habitat requirements and the destructive activities of man, unless the more important caves used by this species are protected, it will soon be extirpated.

John Cooper indicates that Shelta Cave, in Huntsville city limits, should be further protected from human activity and Tuttle says that Sauta Cave, Jackson County, is in danger of being commercialized and should be obtained by some conservancy organization and be protected from further depredations. It is recommended that habitat preservation be accomplished by conservation organizations as rapidly as possible.

Indiana Myotis
Myotis sodalis Miller and Allen

Myotis sodalis is a small bat that attains a head and body length up to 49 mm. The dorsal hair is tricolor, the basal two-thirds being blackish, followed by a slight grayish band and chestnut tipped, giving the back an overall grayish chestnut color. The ventral fur is pinkish white.

The Indiana Bat inhabits caves from east of Kansas and Oklahoma, north to the Great Lakes, east to Vermont, Connecticut, and Massachusetts and south to northwestern Florida (Hall and Kelson, 1959). Its distribution in Alabama is not well documented.

The decline in numbers of this species throughout its range is probably due to the commercialization of caves, the desecration of caves by vandals, and disturbances created by careless spelunkers. Steps to prevent further commercialization and disturbances of Alabama's caves would enhance the survival potential of this bat. *Myotis sodalis* is also on the Federal list of *endangered* species.

The panel recommends that the important bat caves be acquired by the State or some conservation agency, and that they are protected from commercialization and other disturbances by man, except controlled scientific studies.

Alabama Gulf Beach Mouse
Peromyscus polionotus ammomates Bowen

Peromyscus polionotus ammomates is a small mouse, never exceeding 22 mm in body length. The color is light, blending well with the sandy beach soils and vegetation of the dunes that constitute its habitat.

The distribution of the species is southwestern South Carolina, most of Georgia, the eastern two-thirds of Alabama and the upper two-thirds of Florida. *P. p. ammobates* is endemic to the dunes of the beaches between Mobile Bay and Perdido Bay (Bowen, 1968).

Residential development and recreational activities are very rapidly destroying the dune habitat on the Alabama Gulf. This has placed this beach mouse in a precarious position, so it is classified *endangered.* Action, like the law protecting the sea oats, the principal food of the mouse, which will protect the dunes habitat from destruction, will be the only guard against extirpation of this small mouse. Beach dune refuges, which would exclude man from the habitat, seem to be the only possible solution to the dilemma of the Alabama Beach Mouse.

A Beach Mouse outside a burrow opening. (J. L. Dusi).

Perdido Bay Beach Mouse
Peromyscus polionotus trissyllepsis Bowen

This beach mouse is smaller and paler than *P. polionotus ammobates.* Its range is restricted to the beach dunes between Perdido Bay, Alabama and Pensacola Bay, Florida (Bowen, 1968).

Because the same habitat destruction pressures that affect *P. p. ammobates* apply, *P. p. trissyllepsis* is considered *endangered.* It does have the slight advantage in that the beaches it occupies are not presently as well developed as those between Mobile and Perdido Bays. Therefore, refuges would be more easily established now.

Northern Black Bear
Ursus americanus americanus Pallas

Ursus a. americanus is a large dark brown, or black, short-tailed mammal. Once distributed over much of the United States and Canada, this black bear is absent from much of its former range. Francis Lueth, in a recent discussion, says that he doubts whether any sightings after 1950 are wild bears. In all probability they are escapees.

Large tracts of forests are essential to their survival. In some parts of the country they may co-exist, at least some of the time, with man. Where bears and human activities overlap, bears become less timid, raid garbage cans and dumps, bee hives, and gardens. When in conflict with man, they are shot as dangerous beasts or destructive nuisances.

Florida Black Bear
Ursus americanus floridanus Merriam

The Florida Black Bear is distinguished from the northern subspecies by the presence of a dorsal hump on the rostrum, whereas *Ursus a. americana* has a flat rostrum.

The Florida subspecies was once distributed over all of Florida, and the southern counties of Georgia, Alabama and into Mississippi. It is still present in much of its former range. The estimation of its numbers, by the Alabama Department of Natural Resources, is that about 150 bears still are present in Alabama (Barkalow, 1949; Lueth, per. comm.).

Since the densely forested river bottom habitat in Alabama is increasingly being utilized by man, the bears are more in conflict with man, making their status precarious.

Florida Panther
Felis concolor coryi Bangs

Felis concolor, is a large, long-tailed cat, with a dark color.

Originally it ranged over much of North and Central America. The Florida subspecies, ranged from western Arkansas and Louisiana, eastward and southward from northern Arkansas, western Tennessee, northern Alabama, Georgia and middle South Carolina. The present distribution in Alabama is in the large and remote river swamps and large forested areas, especially in the coastal plains (Hall and Kelson, 1959).

We estimate present numbers to be small, possibly less than a dozen. The most recent positive record was reported by Ralph Allen (per. comm.) who observed a pair of panthers with cubs in Baldwin County in 1974, and they are also reported in the same locality in 1975. Lueth reports them from Greene County also.

SPECIES OF SPECIAL CONCERN

Southeastern Shrew
Sorex longirostris longirostris Bachman

The Southeastern Shrew is a very small, long-tailed shrew, ranging from 79 to 108 mm in length. Its color is dark brown to reddish brown dorsally, becoming lighter colored ventrally.

In Alabama, this shrew prefers river floodplains and swamps, especially annually flooded areas with an abundance of fallen, decaying logs and thick understory vegetation, like Japanese honeysuckle, *Lonicera japonica.* It is found occasionally in upland oldfields and woods. In preferred habitat it may be abundant but it is rare in any other situation.

This shrew is found in parts of 15 states, from Illinois to Alabama and northern Florida, mainly east of the Mississippi River. In most of its range and in Alabama it should be considered to be rare, because the amount of its preferred habitat is limited (French, 1975). About 700 specimens are known from the entire range and of this number, about 300 are from Alabama.

Because channelization of streams and drainage of swamps is continuing, reduction of the preferred habitat is taking place. Therefore, the Southeastern Shrew should be placed in the *special concern* category. If habitat destruction increases, this species may very well become *endangered.*

Sorex longirostris longirostris, (T. W. French)

Southeastern Myotis
Myotis austroriparius austroriparius (Rhodes)

Myotis a. austroriparius is a small brown bat whose head and body length ranges between 45.5 and 53 mm. Its hairs are uniformly colored medium orange-brown to buff-brown, on its back, and dull buff underneath.

The species ranges from southern Indiana and Illinois, south through most of Kentucky, Tennessee and Georgia, through most of Arkansas, to the west, and east through most of Louisiana and all of Mississippi, Alabama and Florida. Most of the known specimens in Alabama are from Sander's Cave, in Conecuh County (LaVal, 1967).

This cave bat is disturbed and persecuted by man in his activities in caves. Because of this and our imperfect

knowledge of its distribution in Alabama, we have placed it in the *special concern* category.

Little Brown Myotis
Myotis lucifugus lucifugus (LeConte)

The Little Brown Myotis is a medium-sized bat, the largest of our Alabama *Myotis* species, of a uniform brown color, the dorsal hairs being longer, silky, and shiny.

Myotis lucifugus is the most widely distributed *Myotis,* ranging from southern Canada, through most of the United States, and into most of Alabama. A cave bat of timbered areas, it also uses attics, old houses and other cave substitutes. It is greatly affected by the commercialization of caves, depredation of roosting colonies, remodeling and razing of old houses (LaVal, 1967).

Because of the general degradation of the cave and cave-like habitats used by this bat, and our lack of adequate knowledge of its present status in Alabama, we place it in the *special concern* category.

Keen's Myotis
Myotis keenii septrionalis (Troussart)

Keen's Myotis is the smallest Alabama *Myotis,* and has a pelage similar to that of *Myotis lucifugus,* except that it is dull (Hall and Kelson, 1959).

It is distributed in most of the eastern United States, west through Montana and into the lower Canadian provinces. Chermock and White (1953) report its presence in Alabama, and Hall and Kelson (1959) report it from near Marianna, Florida. It is a cave bat, or one that uses cave substitutes for roosting. Therefore, the degradation of cave habitats makes its position precarious, as in the other *Myotis* species.

Because of its insecure position and our lack of knowledge, we place it in the *special concern* category.

Rafinesque's Big-eared Bat
Plecotus rafinesquii (Lesson)

Plecotus rafinesquii is a medium-sized bat, with ears 3 to 4 times the usual size for bats. Its hairs have blackish bases and are brown tipped, dorsally, and white tipped, ventrally.

Its distribution is middle and southeastern United States. In Alabama, it is associated with cave habitats. All of the records given by Howell (1921) are above the fall line.

Because this bat is usually in small groups and usually bear only one young (Hall and Kelson, 1958) and since it has never been an abundant species, cave disturbances likewise have an undesirable effect on it. Therefore, we place it in the *special concern* category.

Florida Yellow Bat
Lasiurus floridanus Miller

Lasiurus floridanus is slightly larger than the familiar Red Bat, *Lasiurus borealis* but similar in its light yellowish-brown color to the Eastern Pipistrelle, *Pipistrellus subflavus.*

Alabama is on the periphery of its range and the one specimen, collected by Donald Linzey near Mobile, is the only record of its occurrence in Alabama, even though it is common in Florida. Since it is a tree bat, man's cave activities do not affect it.

Since so little is known about this bat in Alabama, we place it in the category of *special concern.*

Marsh Rabbit
Sylvilagus palustris palustris (Bachman)

Sylvilagus p. palustris is a rabbit the size of the cottontail but unlike the cottontail has a tail that is brownish or gray, instead of being cottony.

Its distribution in Alabama is thought to be in the tier of counties, from Mobile Bay east to Georgia. It extends from Alabama to the Florida Gulf coast and eastward to the Atlantic coast, then northward into Virginia.

It has not been well studied in Alabama. In addition to being present in the salt-water marshes, it may be more widely distributed in the grassy marshes bordering the rivers of south Alabama. Because we know so little about the Marsh Rabbit, we place it in the *special concern* category.

Sylvilagus palustris, in typical habitat. (T. W. French).

New England Cottontail
Sylvilagus transitionalis (Bangs)

Sylvilagus transitionalis is smaller than the Eastern Cottontail, *Sylvilagus floridanus,* its body length ranging from 386 to 415 mm (Chapman, 1975). In coloration, its upper parts are more pinkish buffy and it has a narrow black patch between the ears. Reliable identification can be made only from specimens in the hand. Therefore, sight records are questionable.

Since Howell (1921) reported taking three specimens no other studies have reported specimens taken in Alabama. The range of the species originally was the forests from the Atlantic coast in southern Maine, along the Allegheny and Appalachian mountains into the mid-eastern edge of Alabama. Chapman (1975) stated that recent studies indicate that the range is more restricted

today and that there is no longer a population at the type locality in Connecticut.

Reasons for the change in abundance are believed due to changes in the habitat, and to the introduction of many other species and subspecies of *Sylvilagus* into the range, replacing *S. transitionalis* (Chapman and Morgan, 1973).

Because of its questionable occurrence and our lack of knowledge in general about this species in Alabama, we place it in the *special concern* category.

Bayou Gray Squirrel

Sciurus carolinensis fuliginosus Bachman

This small Gray Squirrel is one of six subspecies of the well known game species, the Gray Squirrel. Its range is limited to the southern parts of Washington and Mobile counties, coastal Mississippi and the southern half of Louisiana (Lowery, 1974).

Besides being slightly smaller, its color is darker and its underparts buffy to rusty. Although L. G. Sanford and R. D. Hurst have collected a number of specimens from Alabama, they all appear to be intergrades.

Since the subspecies is peripherally distributed in Alabama and its preferred swamp habitat limited, we have placed it in the *special concern* category.

Prairie Vole

Microtus ochrogaster ochrogaster (Wagner)

Microtus o. ochrogaster is a short-tailed meadow mouse, smaller than the Cotton Rat, *Sigmodon hispidus*. It occupies the same general habitat but does not coexist with the Cotton Rat, being distributed to the north of the main Cotton Rat range. The Prairie Vole ranges in the prairies of the United States and Canada and extends its range south into northern Alabama, where it is recorded from Madison and Jackson counties (Whitaker and Zimmerman, 1968; and Jordan, pers. comm.).

Since little is known of the distribution of this vole in Alabama, we have placed this species in the *special concern* category.

Microtus ochrogaster, in typical habitat. (T. W. French)

Meadow Jumping Mouse

Zapus hudsonius americanus (Barton)

Zapus h. americanus is a medium-sized mouse, with a tail much longer than its head and body and hind legs much longer than forelegs. Its color is dark brown to ochraceous above and lighter to almost white underneath.

Zapus hudsonius, posed in habitat. (T. W. French)

The species is distributed through much of the eastern and mid-western states, west to eastern Montana and south just into Oklahoma and Arkansas, most of Tennessee and into eastern Alabama. *Zapus h. hudsonius* is known in Alabama from only a few localities in Lee and Chambers counties (Sullivan, 1954; Scott and French, 1974).

Preferred habitat is wet grassy and brushy meadows and adjacent woodland stream bottoms. Because of this, distribution is very localized in its range in Alabama.

This subspecies, while being currently studied, is peripherally distributed in Alabama and not well known; therefore, it is recommended for *special concern* status.

LITERATURE CITED

Barkalow, F. S., 1949. A game inventory of Alabama. Montgomery,

Bowen, W. W., 1968. Variation and evolution of gulf coast populations of beach mice, *Peromyscus polionotus*. Bull. Fla. State Mus. 12(1): 1-91.

Chapman, J. A., 1975 *Sylvilagus transitionalis*. Mammalian Species 55: 1-4. Am. Soc. Mamm.

Chapman, J. A. and R. P. Morgan, III, 1973. Systematic status of the cottontail complex in western Maryland and nearby West Virginia. Wildlife Monographs 36: 1-54.

Chermock, R. L. and J. S. White, 1953. *Myotis keenii septentrionalis*, a new bat for Alabama. Ala. Acad. Sci. 25: 24.

French, T. W., 1975. Biology of the Southeastern Shrew, *Sorex longirostris longirostris* Bachman. Unpublished Master's Thesis, Auburn University.

Hall, E. R. and K. R. Kelson, 1959. The mammals of North America. Ronald, New York, 546 pp.

Howell, A. H., 1921. Biological survey of Alabama, Part II, the mammals. North American Fauna No. 45: 1-88.

LaVal, R. K., 1967. Records of bats from the southeastern United States. J. Mamm. 48(4): 645-648.

Lowery, G. H., Jr., 1974. The mammals of Louisiana and its adjacent waters. Louisiana State University Press, Baton Rouge. 565 pp.

Scott, A. F. and T. W. French, 1974. Rediscovery of *Zapus hudsonius* (Zimmerman) in Alabama. Ala. Acad. Sci. 45 (1): 77-78.

Sullivan, E. G., 1954. *Zapus hudsonius* reported from Lee County, Alabama. J. Mamm. 35 (4): 592.

Tuttle, M. D., 1974. Population ecology of the gray bat *(Myotis grisescens)*. Ph.D. Dissertation. The University of Kansas. 109 pp.

Tuttle, M. D., 1975. Population ecology of the gray bat *(Myotis grisescens)*: factors influencing early growth and development. Occ. papers, Mus. of Nat. Hist., University of Kansas 36: 1-24.

Whittaker, J. O. and E. G. Zimmerman, 1968 *Michrotus ochrogaster* in Alabama and Tennessee. J. Mamm. 49 (2): 328.

LIST OF PUBLICATIONS

MUSEUM PAPERS*

1. Smith Hall, the new museum and home of the Geological Survey. Eugene A. Smith. 7 pp., 1 plate. 1910. out of print
2. The museum as an educator. Herbert H. Smith. 25 pp., 8 plates. 1912. $1.00
3. Directions for collecting land shells. Herbert Smith. 12 pp., 1912. 1.00
4. Annotated list of the Avery Bird Collection. Ernest G. Holt. 142 pp., 1 plate. 1921. $2.00
5. Preliminary catalogue of Alabama amphibians and reptiles. H. P. Loding. 59 pp., 1922. $1.50
6. The Anculosae of the Alabama River drainage. Calvin Goodrich. 57 pp., 3 plates. 1922. $1.50
7. The genus Gyrotoma. Calvin Goodrich. 32 pp., 2 plates. 1924. $1.25
8. The terrestrial shell-bearing mollusca of Alabama. Bryant Walker. 32 pp., illus. 1928. out of print
9. Footprints from the coal measures of Alabama. T. H. Aldrich, Sr., and Walter B. Jones. 64 pp., illus. 1930. $1.50
10. Goniobases of the vicinity of Muscle Shoals. Calvin Goodrich. 25 pp. 1930. out of print
11. Alabama reptiles. William L. Haltom. 145 pp., 39 plates, 57 fig. 1931. $1.00
12. Description of a few Alabama Eocene species and remarks on varieties. T. H. Aldrich, Sr. 21 pp., 6 plates. 1931. $1.00
13. Moundville culture and burial museum. Walter B. Jones and D. L. DeJarnette. 8 pp., 22 illus. 1936. out of print
14. The Argiopidae or orb-weaving spiders of Alabama. Allan F. Archer. 77 pp., 5 plates. 1940. $1.50
15. Anthropological studies at Moundville. Part I. Indian skeletons from the museum burials at Moundville. Part II. Possible evidence of scalping at Moundville. C. E. Snow. 57 pp., illus. $2.00
16. Condylo-diaphysial angles of Indian humeri from North Alabama. C. E. Snow. 38 pp., illus. 1940. $1.00
17. The Bessemer site (Excavation of three mounds and surrounding village areas near Bessemer, Alabama). D. L. DeJarnette and S. B. Wimberly. 122 pp., illus. 1941. $2.00
18. Supplement of the Argiopidae of Alabama. Allan F. Archer. 47 pp., 4 plates. 1941. $1.00
19. McQuorquodale Mound. A manifestation of the Hopewellian phase in South Alabama. S. B. Wimberly and H. A. Tourtelot. 42 pp., illus. (1941) 1943. $1.00
20. Mound State Monument. 19 pp., illus. 1942. $ .50
21. Two prehistoric Indian dwarf skeletons from Moundville. C. E. Snow. 90 pp., 2 plates. 1946. $1.20
22. The Theridiidae or comb-footed spiders from Moundville. Allan F. Archer. 67 pp., 2 plates. 1946. $1.20
23. The Flint River site, Ma□ 48. William S. Webb and D. L. DeJarnette. 44 pp., illus. 1948. $1.20
24. The Whitesburg Bridge site, Ma^v 10. William S. Webb and D. L. DeJarnette. 44 pp., illus. 1948. $ .70
25. The Perry site, LU□ 25. William S. Webb and D. L. DeJarnette. 69 pp., illus. 1948. $1.20
26. Little Bear Creek site, CT□ 8. William S. Webb and D. L. DeJarnette. 64 pp., illus. 1948. $1.00
27. New Anophthalmid beetles (Fam. Carabidae) from the Appalachian region. J. Manson Valentine. 19 pp., 2 plates. 1948. $1.00
28. Land snails of the genus Stenotrema in the Alabama region. Allan F. Archer. 85 pp., 10 plates. 1948. $1.30
29. Moundville: an historic document. Carl E. Guthe. 14 pp. 1950. out of print
30. A study of the Theridiid and Mimetid spiders with descriptions of new genera and species. Allan F. Archer. 44 pp., 4 plates. 1950. $1.00
31. Carvernicolous Pselaphid beetles of Alabama and Tennessee, with observations on the taxonomy of the family. Orlando Park. 107 pp., illus. 1951. $2.50
32. Guntersville basin pottery. Marion D. Hemilich. 69 pp., illus. 1952. $2.50
33. A key to the amphibians and reptiles of Alabama. Ralph L. Chermock. 88 pp., illus. 1952. $3.00
34. New Genera of Anophthalmid beetles from Cumberland Caves (Carabidae, Trechini). J. Manson Valentine. 41 pp., 5 plates. 1952. $1.00
35. New Genera and species of Cavernicolous Diplopods from Alabama. Richard L. Hoffman. $1.00
36. Archaeological investigations in Mobile County and Clarke County, Southern Alabama. Steve Wimberly. 262 pp., 7 plates. 1960. $4.00

*The series of Museum Papers was discontinued with the publication of Museum Paper No. 36.

BULLETIN ALABAMA MUSEUM OF NATURAL HISTORY: No. 1 Systematics of the Percid Fishes of the Subgenus *Ammocrypta*, Genus *Ammocrypta*, with Descriptions of Two New Species. James D. Williams. 56 pp., illus. June 1975. $2.50

SPECIAL PUBLICATIONS: Moundville: An Introduction to the Archaeology of a Mississippi Chiefdom. John A. Walthall. 60 pp., illus. 1976. $2.50

You may order these publications from
ALABAMA MUSEUM OF NATURAL HISTORY
The University of Alabama
P. O. Box 5897
University, Alabama 35486
Please make checks and money orders payable to The University of Alabama