

APPENDIX B. Species Technical Team Reports

Bird Technical Team Report

Prepared by Emily Jo Williams, Brad Winn, and Todd Schneider, Team Leaders

Technical Team Members

Team Leaders

Emily Jo Williams, WRD – Wildlife Biologist (*Emeritus*)

Brad Winn, WRD – Wildlife Biologist

Todd Schneider, WRD – Wildlife Biologist

Team Members participating at Bird Technical Committee Meetings

Greg Balkcom, WRD - State Waterfowl Biologist

Chris Baumann, WRD - Bobwhite Quail Initiative Biologist

Giff Beaton, Atlanta Audubon Society – Amateur ornithologist, bird records expert

Bob Cooper, University of Georgia – Ornithologist, Professor

Chuck Hunter, U. S. Fish and Wildlife Service – Region 4 Nongame Bird Coordinator

Nathan Klaus, WRD – Wildlife Biologist

Joe Meyers, U.S. Geologic Survey, University of Georgia - Researcher

Jim Wentworth, U. S. Forest Service – Wildlife Biologist

Matt Elliott, Georgia GAP – GIS Specialist

Team Members participating through email and correspondence

Dean Demarest, U. S. Fish and Wildlife Service – Region 4, Nongame Bird Biologist

Jim Ozier, WRD – Wildlife Biologist

Bob Sargent, Georgia Ornithological Society – Wildlife Biologist

Georgann Schmalz, Atlanta Audubon Society - Ornithologist

Invited but unable to participate:

Ray Chandler, Georgia Southern University - Professor

Steve Calver, U.S. Army Corps of Engineers - Biologist

Malcolm Hodges, The Nature Conservancy – Ecologist, Ornithologist

Terry Johnson, WRD – Program Manager

Peter Range, U. S. Fish and Wildlife Service – Biologist, Savannah Coastal Refuges

John Robinette, U. S. Fish and Wildlife Service – Biologist, Savannah Coastal Refuges

Keith Watson, National Park Service – Wildlife Biologist

Approach

A two-day Bird Team workshop was held at Indian Springs State Park on 18-19 March 2003. The primary purpose of the workshop was to develop a list of bird species of conservation concern for Georgia and evaluate each species' status and conservation parameters. We began by reviewing the existing list of bird species tracked by the Georgia Natural Heritage Program, discussing additions and deletions to the list, and comparing the list to the Partners in Flight priority rankings. Prior to the meeting,

participants were provided with the current tracking list and asked to consider needed changes and bring pertinent materials and knowledge necessary to evaluate each species. The Indian Springs participants discussed each species at length and determined the abundance, range, population trend, threats, protection needs, inventory needs, monitoring needs, stewardship needs, research needs, and importance of Georgia as it relates to global conservation of the species. This effort drew upon the individual and combined knowledge and expertise of the participants, particularly their knowledge of conservation issues and species characteristics in Georgia. The group of experts represented a broad range of expertise both geographically and taxonomically. Decisions were made based on expert opinion, peer reviewed scientific literature, technical reports, ornithological records, and other databases. We utilized the Partners in Flight planning and prioritization processes extensively as well as the North American Waterbird Management Plan, United States Shorebird Conservation Plan, and North American Waterfowl Management Plan.

While at Indian Springs, the team completed most of a lengthy spreadsheet detailing the characteristics and needs for each species. The information for several species was not completed during the workshop because of time limitations. For those species, information was completed by individual team members, distributed for review and comment to the entire Bird Team, and the spreadsheet was revised accordingly. Discussions also included recommended changes to the current list of state protected birds and recommendations are included in Appendix A. The spreadsheet was compiled and edited by the Team Leaders and sent to the Bird Team for review. This spreadsheet served as the basis for determining priorities for conservation action and research and survey.

Determination of species to include on the High Priority for Conservation list was based primarily on the species' population status, trends, habitat status and threats, rarity, vulnerability, and ability to serve as an indicator of ecological integrity of specific habitats or habitat conditions. Because of the planning efforts of Partners in Flight and other bird initiatives, the Georgia Breeding Bird Atlas, and a long history of ornithological research and activity in the state, conservation strategies for most species of conservation concern have been identified or at least considered. Therefore, no species were excluded from the list for lack of information. Some species, however, are not well studied and research and survey needs will necessarily precede active management or conservation action.

Assessment Results

The original list of species tracked by the Georgia Natural Heritage Program included 48 species. In adapting this list to fulfill the need to develop a list of birds to be used for conservation planning and implementation, the Bird Team recommended removal of 12 species. Because bird species are highly mobile, their rarity in the state may indicate occasional or accidental occurrences rather than ecological significance as rare or declining species or species at the periphery of their natural range. Such was the case for

the species recommended for removal. Fourteen species or subspecies were recommended for addition to the conservation concern list.

The Bird Team initially selected a total of 68 species for inclusion as high-priority species. Since this list was too large to allow us to adequately focus our efforts over the next decade, we developed a shortened list of 33 species that included species known, or thought to be, most critically in need of immediate conservation action. In a few cases the species included on this “short” list serve as umbrella species that represent a guild of species, habitat type(s), or habitat condition(s) that is significantly declining (e.g., Northern Bobwhite). The longer list will be maintained to guide long-term conservation efforts while the shorter list should be used in planning over the next several years. While these lists are fairly comprehensive they should be considered works in progress and modified as needed to best address conservation concerns in the future.

High Priority Bird Species in Georgia (Short List)

Species	Common Name
AIMOPHILA AESTIVALIS	BACHMAN'S SPARROW
AMMODRAMUS HENSLOWII	HENSLOW'S SPARROW
AMMODRAMUS SAVANNARUM	GRASSHOPPER SPARROW
CALIDRIS CANUTUS	RED KNOT (SE Winter Population)
CATHARUS BICKNELLI	BICKNELL'S THRUSH
CHARADRIUS MELODUS	PIPING PLOVER
CHARADRIUS WILSONIA	WILSON'S PLOVER
COLINUS VIRGINIANUS	NORTHERN BOBWHITE
DENDROICA CERULEA	CERULEAN WARBLER
DENDROICA KIRTLANDII	KIRTLAND'S WARBLER
EGRETTA TRICOLOR	TRICOLORED HERON
ELANOIDES FORFICATUS	SWALLOW-TAILED KITE
FALCO PEREGRINUS	PEREGRINE FALCON
FALCO SPARVERIUS PAULUS	SOUTHEASTERN AMERICAN KESTREL
GRUS CANADENSIS PRATENSIS	FLORIDA SANDHILL CRANE
HAEMATOPUS PALLIATUS	AMERICAN OYSTERCATCHER
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE
HIMANTOPUS MEXICANUS	BLACK-NECKED STILT
IXOBRYCHUS EXILIS	LEAST BITTERN

LANIUS LUDOVICIANUS MIGRANS	LOGGERHEAD SHRIKE
LATERALLUS JAMAICENSIS	BLACK RAIL
LIMNOTHLYPIS SWAINSONII	SWAINSON'S WARBLER
MYCTERIA AMERICANA	WOOD STORK
NUMENIUS PHAEOPUS	WHIMBREL
PASSERINA CIRIS	PAINTED BUNTING
PICOIDES BOREALIS	RED-COCKADED WOODPECKER
RALLUS ELEGANS	KING RAIL
RYNCHOPS NIGER	BLACK SKIMMER
SPHYRAPICUS VARIUS	APPALACHIAN YELLOW-BELLIED SAPSUCKER
STERNA ANTILLARUM	LEAST TERN
STERNA NILOTICA	GULL-BILLED TERN
TYTO ALBA	BARN OWL
VERMIVORA CHRYSOPTERA	GOLDEN-WINGED WARBLER

Examples of High Priority Species

Painted Bunting

The eastern population of the Painted Bunting, which breeds along the Atlantic Coast from North Carolina to Florida, has declined by 3% each year since the late 1960's - a decline of greater than 60% in 30 years (1966- 1995). The Painted Bunting is a Partners in Flight Continental Watch List species considered to be in need of immediate management attention. Suspected causes for population decline include loss and deterioration of habitat, factors that lead to increased predation of parents and offspring as well as increased nest parasitism. Eastern Painted Buntings winter in Cuba, south Florida, the Bahamas, and possibly the Yucatan Peninsula. Threats on the wintering grounds include habitat loss and possibly collection as caged birds for the commercial pet trade and personal collections.

Painted Buntings prefer the shrubby forests found on Georgia's barrier islands and coastal mainland. The mixture of thick vegetation and open, grassy areas provides ideal cover for nests and convenient nearby food sources. Unfortunately, development and land management practices have and continue to alter potential bunting nest sites, particularly on the mainland. Stands of shrubby wax myrtle and buckthorn or similar habitat in open-canopied pines and hardwoods are increasingly limited on Georgia's coast, and replacing native grasses and forbs with sod grass denies buntings important food sources.

Conservation of Painted Buntings will require education of both public and private land managers and coastal homeowners regarding appropriate habitat management for buntings. Land management should include 1) conservation of old growth maritime forests and shrubby grasslands with scattered trees, 2) Protection of beach dunes from prescribed and accidental fires, 3) Management of pine-oak or pine forests for saw timber with a basal area of 50 square feet per acre and an understory of scattered scrubs 3 to 18 feet high with many open grassy areas, 4) Use of prescribed burning in forests every 4 to 6 years to create mixed patches of shrub and grass cover, and 5) Maintenance of scattered medium to large trees (1-2 trees per hectare) for singing perches. Homeowners can include painted buntings in landscape planning by 1) Retaining freshwater wetlands, 2) Maintaining shrub cover and native grasses in their landscapes, 3) Mowing natural grass areas no more than once per year, and 4) Maintaining scattered medium to large trees for singing perches. Conservation will also require working with conservationists in wintering areas to address threats and protect habitats. Research needs include productivity in mainland habitats and extent and causes of losses in wintering areas.

Beach-nesting Birds

This group of birds includes the solitary nesting species - Wilson's Plover and American Oystercatcher - and colonial nesters such as Gull-billed Tern, Black Skimmer, and Least Tern. The factors that result in their inclusion as high priorities for conservation in Georgia are extremely limited and vulnerable breeding habitat, historic reductions in populations, and reduction in the number of extant, low disturbance, nesting locations. The species listed above represent a partial list of species in need of conservation action.

Beach nesting birds are dependent on similar, specific, beach attributes to fulfill nesting and chick rearing requirements. The attributes include wide accretional beach, adequate beach elevation to thwart normal tidal inundation, a degree of isolation from uplands, and proximity to quality feeding sites. These attributes rarely combine on the Georgia Coast, especially for the colonial birds dependent on the greatest level of isolation. When the attributes do combine, the resulting beach is frequently also favored by recreationists, ensuring frequent disturbance during incubation and chick rearing in spring and early summer. The primary threats to these species are 1) increasing access to historically isolated areas of coastal Georgia by recreational users and their dogs, 2) vehicular use of beaches for travel, recreating, law enforcement, and sea turtle nest patrols, 3) physical decrease of nesting locations based on sea level rise, 4) contaminants including dioxin, mercury, PCBs and toxaphene, 5) physical loss of emergent sands due to approximate beach nourishment projects, and 6) feral, introduced, and invasive animals, including cats, pigs, horses, bobcats, donkeys and fire ants.

Immediate conservation actions are needed and include 1) Develop a state legislative mechanism to automatically provide protection for newly developing, persistent, emergent, sand bars on the outer coast. Due to the highly dynamic, ephemeral nature of the state's only protected seabird nesting locations such as Little Egg Island Bar, a legal mechanism is needed to protect current and future sand bars as they become established and valuable to seabirds for nesting, 2) Continue to work with island managers to recognize and protect higher value shorebird nesting locations, 3) Limit or eliminate

vehicular use of beach areas recognized for high beach-nesting values. Examples include the south end of Middle Beach on Ossabaw Island, all of Little St. Simons Island, the south end of Sea, and Jekyll islands, Little Cumberland Island, and the South end of Cumberland Island. Limit or eliminate night patrols for sea turtle nesting projects, 4) Identify and control the source of contaminants that could negatively impact the health and reproductive ability of waterbirds, 5) Restrict use of nearshore sand sources for beach nourishment projects, opting for deeper water locations, 6) Eradicate feral hogs and cats on islands where they are found. Reduce feral horse populations on Cumberland. Continue to control fire ants on Little Egg Island Bar and Satilla Marsh Island, and 7) Continue to educate recreationists frequenting sensitive beach nesting locations.

Isolated Wetlands Dependent Birds

Some of the most at risk species and species of high conservation concern are those dependent on isolated wetlands including Tricolored Heron, Little Blue Heron, Wood Stork, Yellow-crowned Night Heron, White Ibis, Glossy Ibis, Least Bittern, American Bittern, and Black-necked Stilt. The recognition as high priority species is based, at least in part, on their dependency on isolated freshwater wetlands for nesting, feeding, and roosting. These birds represent a much larger group of species that include all of our wading birds, most of our rails, many migrant shorebirds, resident and migratory passerines, gallinules, and grebes. Wading birds in particular require specific flooded woodland habitats in which to nest. Most wading bird rookeries in Georgia are located within 20 miles of the coast. Even along the immediate coast, freshwater wetlands are used not only for nesting, but also used heavily as feeding locations.

Primary threats include 1) Isolated freshwater wetlands currently have no state or federal protection in Georgia, unless a specific location is recognized as a Wood Stork rookery with Endangered Species Act implications, 2) Direct loss of isolated wetlands due to increased residential and industrial development and intensive silvicultural practices, 3) Isolated freshwater wetland loss, combined with regional drought conditions over the last 5 years in Georgia, has put added stress on these species, and 4) Environmental contaminants particularly mercury, PCBs, and toxaphene.

These species are in need of immediate management action and recommended conservation actions are 1) Promote state legislative protection of isolated wetlands and non-flowing waters for the protection and stabilization of waterbirds and other dependant wildlife, 2) Use GIS and remote sensing to determine locations for all freshwater wetlands in regions experiencing heavy development, 3) Contact landowners of the most valuable sites to discuss important wildlife values of wetlands and long-term conservation options, and 4) Pursue acquisition for the highest valued locations.

High Priority Habitats and Associated Species

Southwestern Appalachians/Ridge & Valley

Hardwood Forests

The greatest bird conservation issue in this region is conversion of hardwood and mixed pine/hardwood forest to monocultures of loblolly pine, urbanization, and agriculture. A large percentage of natural vegetation has been cleared for other uses, and mature forest and the birds dependant on mature forest are less secure here than in any other physiographic area in the Southern Appalachians. The long-term health of populations of priority birds including Acadian Flycatcher, Wood Thrush, and Yellow-throated Warbler will depend on maintenance and management of remnant forest as well as aggressive restoration efforts. It is recommended that at least eight upland hardwood forest patches greater than 4,000 hectares be sustained and that the number of such patches in the 4,000 to 40,000 hectare range be increased. More than 80% of the mixed mesophytic hardwood acreage within these patches should be managed for long rotation or old growth.

Southern Yellow Pine

Existing short-rotation pine, while of less benefit to birds than mature forest, is nevertheless much more valuable than more intensive land uses, and it is recommended that the current percentage of land in this cover type be retained. All existing southern yellow pine and mixed pine hardwood habitats should be actively and appropriately managed with fire, and current acreage should be increased where possible. Priority species associated with mature pine forests in the Ridge and Valley include Brown-headed Nuthatch, and Bachman's Sparrow.

Scrub-Shrub and Early Succession

Suppression of natural disturbance regimes has depleted scrub-shrub and woodland habitats and birds adapted to those conditions such as Prairie Warbler, Orchard Oriole, and Red-headed Woodpecker persist largely in the early succession phases of actively managed forests. The needs of these birds, including game species such as American Woodcock and Northern Bobwhite, should be considered within the context of forest habitat objectives.

Blue Ridge

Mature Forests

This remains the most heavily forested physiographic area in the Southeast. Species of conservation concern in this habitat include Black-throated Blue Warbler, Yellow-throated Vireo, and Cerulean Warbler. The amount of land in agriculture has decreased in the last century, being replaced by forest. Nevertheless, BBS data indicate bird population declines in the Southern Blue Ridge in excess of those in any other areas in the region. Declines are seen in long-distance migrants, short-distance migrants, and permanent residents. However, this information should be interpreted with some caution since BBS routes are situated along roads, and most roads in the Southern Blue Ridge are

in valleys where there has been a great deal of development and habitat loss in recent years. These perceived trends may not be representative of population conditions in the bulk of the forested area in this region. This, however, is not necessarily a safe assumption, and there is cause for concern in at least some of the forest types and conditions.

Although some forest types, such as Appalachian oak, remain widespread, most of the area is in a mid-successional stage of closed canopy with a poorly developed understory and ground cover. Many mature forest birds including Wood Thrush, Worm-eating Warbler, and Canada Warbler may be suffering from this deficiency in structure. This will correct itself over time, although perhaps not soon enough to conserve some declining species such as Cerulean Warblers; therefore, some conservationists advocate hastening the process through management. In any case, a much greater extent of old-growth conditions in general is desirable for mature forest birds. Much of the mature forest in the Blue Ridge occurs on National Forest lands that are classified as unsuitable for commercial harvest activities, and it is likely that these areas will eventually provide substantial blocks of old-growth habitat. Although largely in USFS ownership, mature forest habitat and associated bird species may also be threatened by several exotic pest species advancing down the Appalachians. Upon arrival in other areas, these species dramatically altered forest structure and bird populations. These pest species include Hemlock Woolly Adelgid, Gypsy Moth, and Asian Long-horned Beetle.

Disturbed Forest

Other high priority birds inhabit early successional conditions, which also have decreased in extent in recent years. Indeed, the Appalachian subspecies of Bewick's Wren may have become extinct in the past two decades because of loss of this type of habitat. Maintenance of a suitable amount of mid- and high elevation early successional or woodland habitat is a priority conservation need particularly for species such as Golden-winged Warbler, Ruffed Grouse, and Appalachian Yellow-bellied Sapsucker.

Riparian Forests

The lowest elevation riparian forests are most affected by forest loss and fragmentation in recent years. Management of riparian zones and retention or restoration of fragments of suitable size is another conservation need in the Southern Blue Ridge and of particular importance for Swainson's Warbler, Louisiana Waterthrush, and Kentucky Warbler.

Piedmont

Grasslands and Scrub Shrub

Open woodlands, grasslands and savannas were extensive as late as the 1800s in the Piedmont, and because Native American settlements were apparently common in the area, agricultural fields and other large openings were historically part of the landscape. The three greatest challenges facing the conservation of habitat in the Piedmont today are unchecked urbanization, intensification of agriculture and forest management, and suppression of natural disturbance regimes. Of these, the former is of much greater concern because its effects are essentially permanent. Urban sprawl is an increasingly

important issue nationwide and the human population in the Southern Piedmont is growing rapidly. However, no comprehensive planning for growth is in place. Agriculture and forestry are significant land uses in the Southern Piedmont. The general decline in abundance of grassland species is mostly related to changing land use patterns from agriculture to intensive forestry. Remaining agricultural lands are intensively managed, which contributes to declines. The result is a loss of stable, grassland habitats with associated influences on species of conservation concern including Blue Grosbeak, Northern Bobwhite, Grasshopper Sparrow, and Red-headed Woodpecker.

Mature Forests of Southern Pine and Upland Hardwood

Although overall increasing forest acreage and maturity in the Piedmont would suggest greater security for vulnerable bird species, many species' populations have shown declines in patches of protected mature forests embedded within suburban settings where they were once common. Conservation opportunities to manage and maintain bird habitats will require significant involvement from public land managers, public agencies, and private industrial and non-industrial landowners. Public lands are an important component of the Southern Piedmont and may serve as core areas from which to manage or expand habitat. Timber companies are the largest private landowner in the Piedmont, creating tremendous opportunity for increased cooperative management strategies to accomplish bird conservation objectives. Private, non-industrial landowner incentive programs can be increased in key areas as well, further adding to core habitat acreage. Priority species dependent on Southern Pine forests include Red-cockaded Woodpecker, Brown-headed Nuthatch, and Bachman's Sparrow and Upland Hardwood forests are needed to support Wood Thrush and Kentucky Warbler.

Bottomland Hardwood Forests

Encroachment from urbanization, industrialization, and intensive pine management influence both the extent and connectivity of riparian forests in the Piedmont. In addition, closed canopy forests that lack a diverse understory and degradation of water quality due to development and sedimentation and chemical run-off from roads can negatively influence species such as Swainson's Warbler and Louisiana Waterthrush. Altered hydrology can also influence habitat quality for these species as well as Prothonotary Warbler. Consideration must be given to connecting large blocks of riparian forest, management prescriptions to improve understory structure, and appropriate management activities in streamside areas.

Southeastern Plains and Southern Coastal Plain

Pine Forests

As in other pine-dominated uplands of the Southeast, fire suppression, conversion to other land uses, and short-rotation pine plantations have significantly altered the nature of the South Atlantic Coastal Plain. Maintenance and restoration of large tracts of fire-maintained pine savanna are the keys to health of high priority pine and pine-grassland bird species including Red-cockaded Woodpecker, American Kestrel, Bachman's Sparrow, and Brown-headed Nuthatch. Pine plantations have some wildlife value, and

maintenance of a diversity of age classes over landscapes can help maintain many bird species, including some that are of reasonably high priority.

Bottomland Hardwood

The bottomland hardwood bird community requires large tracts of forest in river systems including the Savannah, Altamaha, Ogeechee and Satilla. These areas are needed to support significant numbers of breeding Swallow-tailed Kite, Northern Parula, Prothonotary Warbler, and Swainson's Warbler. Maintenance and restoration of large patches of bottomland forest ranging in size from 2,000 to 40,000 hectares in this physiographic area should assure the health of these birds.

Maritime Forest and Scrub-Shrub

Coastal maritime forest and scrub-shrub habitats not only support most of the eastern population of Painted Bunting but also are extremely important for in-transit migrants. Much of this forest has been developed for intensive human use, and what remains should be maintained. Although likely secure on several barrier islands, on the mainland, birds occupying these habitats may face additional challenges from parasitism by Brown-headed Cowbirds and increased predation by feral and domestic cats as well as avian predators such as crows and jays.

Coast and Islands

About eighty species of waterbirds use the coastal environs of Georgia during some part of their annual cycle. Some of these birds are coastal specialists, dependant on habitats found only on, or primarily within the coastal zone for all of their life-sustaining needs. Due to their specialization, many coastal dependant waterbirds are experiencing population stresses, or biological bottlenecks as a result of direct habitat loss or indirect loss due to disturbance. As breeding and feeding sites are increasingly restricted in scope and number, the flexibility needed by our priority species to respond to natural changes in their nesting and feeding habitats is eliminated. These coastal specialists are included on our High Priority Species List. Two groupings of high priority habitats critical to some of our most threatened waterbird species are described.

Beach/Dune/Tidal Flats/Saltmarsh

The combination of all of the tidally influenced habitats on the coast forms a particularly diverse and rich waterbird area. High priority species including all of our seabirds, and our highest ranked shorebirds such as Piping Plover, Red Knot, Wilson's Plover, American Oystercatcher, Marbled Godwit, and Whimbrel are all obligate tidal lands species. Of our priority wading birds, Tricolored Herons are restricted to our coastal zone, and the majority of the state's Wood Storks depend, in part, on the tidal pools and feeder creeks for foraging.

The most pressing waterbird conservation issues on Georgia's tidally influenced habitats include human disturbance of nesting areas by day-use recreation. Two of Georgia's shorebirds, and virtually all of Georgia's resident seabirds, including Brown Pelican, Royal Tern, Gull-billed Tern, Sandwich Tern, Laughing Gull, Least Tern, and Black Skimmer, nest directly on the ground, and depend on disturbance-free beach terrace and

dune habitat for nesting. Georgia's barrier beaches have been discovered by a rapidly increasing human population interested in shoreline recreational activities. The state needs a long-term mechanism to ensure disturbance-free nesting areas in this highly dynamic, ephemeral landscape.

All of our waterbirds depend on healthy abundant live food resources. Water quality will play a major role in the future of the migrant, wintering, and resident breeding birds on the Georgia Coast. Development of uplands, including hammocks, is impacting estuarine water quality with siltation and contaminant loading. Increased dock and marina development will deliver petroleum residues from increased numbers of boats. All of the water flowing down our five major Coastal Plain rivers, mixes with seawater to create the rich estuarine waters of the coastal marshes. Everything put into the watersheds of the Savannah, Ogeechee, Altamaha, Satilla, and St. Mary's rivers eventually ends up on the coast, influencing the quality and quantity of invertebrate and vertebrate foods for waterbirds. River born contaminants will end up in waterbird food resources, eventually influencing their health and reproductive potential. Contaminant control and monitoring will be an important aspect of waterbird conservation efforts.

Isolated Freshwater Wetlands

All of our wading birds, are either entirely dependent, or primarily dependent upon isolated freshwater wetlands for nesting. Wading birds nest above the freshwaters of Carolina bays, gum swamps, flooded interdune swales, cypress domes, and temporary depressional wetlands, anywhere shrubs and trees are sitting in standing water throughout the spring and early summer. Our high priority wading bird species also feed regularly in freshwater wetlands throughout the year. There are no state or federal laws currently protecting freshwater wetlands in Georgia. Dewatering is eliminating freshwater wetlands throughout the Coastal Plain, particularly on interior timberlands, and on the coast where development pressures are highest. To successfully manage our priority wading bird populations, we need to adequately address the loss of isolated freshwater wetlands, seeking a mechanism to protect the sites of highest current and future value.

Problems Affecting High Priority Species and Habitats

The overwhelming threat to high priority species is loss of suitable habitat and this loss is caused by a variety of factors. Urban and suburban expansion causes both direct loss of habitat and degradation of habitat quality, exposing birds to increased risk of predation from domesticated and natural predators and parasitism by brown-headed cowbirds. Coastal development, including an explosion of dock construction and a push to build bridges to many marsh hammocks is a significant problem for many species. Habitat fragmentation is also a significant threat resulting in loss of some species as breeding birds in remnant patches of habitat and reduced productivity of those that remain. Chemical, and possibly bacterial and viral, contamination of habitats and food resources impacts some high priority species, particularly on the coast.

A large suite of birds and other wildlife species are threatened by the loss of the longleaf pine ecosystem or other mature, frequently burned pine forests. Restrictions on the management of forests and wetland habitats including thinning and harvest, prescribed fire, and manipulation of water levels threaten the health of habitats and associated species. Human disturbance stresses numerous high priority species including beach-nesting birds, migrating and wintering shorebirds, birds utilizing rookeries for nesting, and birds using pre-migration staging areas. Poorly understood threats include anthropogenic causes of mortality including collisions with lighted buildings, communications towers, and wind turbines. Recent changes in federal Clean Water Act protections for small wetlands could also negatively affect many wetland-dependent species. For migratory species, threats may occur outside of Georgia's physical boundaries such as loss of winter or migratory stopover habitat, poisoning or shooting in countries with fewer protections, collection for the pet trade, or, in the case of pelagic species, conflicts with fishing gear and lighted navigational aids, masts and other structures on ships.

Addressing these problems will require a combination of regulatory enforcement, protection through acquisition and easement, appropriate management through management plans, agreements and incentives, technical assistance and advisement to land managers, and outreach to the public. Landowners, land managers, and Georgia's citizens must appreciate not only the value of our natural resources including birds and other wildlife, but must also be educated as to the threats facing these species and protections and management actions required to preserve these valuable resources.

Research and Survey Needs

Several areas of research and survey have been identified to assist in the conservation of priority bird species in Georgia. These needs fall into 5 broad categories.

Secretive Species

Some groups of birds, particularly secretive marsh birds and nocturnal species, are poorly understood. Inventory and monitoring protocols for these species should be developed and implemented, and should be compatible with similar efforts in other parts of the Southeast or the species' range.

Productivity

Although distribution and perhaps abundance of many species is fairly well known, productivity in various habitat types and conditions needs further research. The influence of external agents including contaminants, toxins, and pathogens on both survival and productivity are poorly understood for most species.

Management

Management issues in need of further study include the use of fire and the frequency, intensity, and timing of burning to benefit specific bird species. We must also conduct research and monitor responses to determine the influence of management strategies targeting particular species or groups of species such as game birds or endangered species

on other high priority species. For example, do frequent burning and use of restrictor plates on cavities, common management techniques for Red-cockaded Woodpecker, affect the habitat quality of mature pine forests for American Kestrel and Brown-headed Nuthatch? Do management practices promoted in agricultural landscapes for Northern Bobwhite also provide habitats for breeding and wintering songbirds?

Winter Distribution and Ecology

A survey of the winter distribution, habitat use, and ecology of high priority birds is needed for Georgia, because our state serves as an important wintering area for resident species and for many species that breed far north of our borders.

Migration

Perhaps one of the most difficult periods to study in the annual cycle of migratory birds, migration is no less important. A statewide survey of spring and fall migrant occurrence, distribution and abundance is needed. In addition, the distribution, quality and spatial characteristics of migration stopover habitat are poorly understood. For migratory species of birds breeding in Georgia, such as Swallow-tailed Kite, extent and causes of mortality during migration are critical to understanding the long-term health and stability of the population.

Taxonomy

The taxonomy of some bird species needs additional scrutiny and in many cases Georgia may provide significant habitats for a distinctive or geographically isolated subspecies such as Appalachian Yellow-bellied Sapsucker, Southeastern American Kestrel, and Florida Sandhill Crane.

Influences Beyond Georgia

We must also be involved in efforts to understand the population effects of influences that occur outside of our state boundaries and in assisting our international conservation counterparts in seeking solutions for any limiting factors, regardless of where they occur.

Mammal Technical Team Report

Prepared by Jim Ozier, Team Leader

Conservation of Georgia's native mammal diversity involves identifying those species and subspecies that are at greatest risk of being reduced to non-viable levels within Georgia and throughout their ranges, identifying the threats to the segments of those populations that use habitat in Georgia, and developing strategies for addressing those threats in order to enhance long-term survival. In order to guide the application of limited resources, conservation strategies need to be prioritized according to the critical needs for maintaining biodiversity while also considering the feasibility of actually implementing effective conservation measures. Final management decisions should involve information on all taxonomic units and habitats of concern to maximize effectiveness. Conservation of particular sensitive natural communities or habitat types might benefit many species of concern that use that habitat type. Lower priorities might be undertaken ahead of higher priorities to take advantage of valuable opportunities for funding or application of expertise.

Compared to some other vertebrate classes, relatively little information is available on most wild mammal species in Georgia other than those managed for sport harvest, probably because they are more difficult to observe and capture. Amateur naturalists tend to gravitate toward the observation and study of birds, reptiles, and amphibians because of their accessibility, and these interests sometimes lead to professional careers conducting research and management with these same taxonomic groups. Without doubt, the realm of mammal conservation in Georgia suffered a tremendous setback with the death of Dr. Joshua Laerm, Director of the University of Georgia Museum of Natural History, in 1997, and the death of Dr. Charles Wharton, retired from Georgia State University, within recent weeks. Both of these scientists made valuable contributions to our knowledge of Georgia's mammals and other native wildlife, and their participation in the development of this plan and other conservation efforts will be sorely missed.

Technical Team Members

The following individuals were asked to participate in this evaluation because of their reputed expertise with at least some portion of Georgia's mammal fauna:

Wilson Baker, Naturalist, Tallahassee: bats, small mammals

Dr. Brad Bergstrom, Biology Dept., Valdosta State University: round-tailed muskrat, South Georgia diversity

Dr. Larry Brown, Environmental Studies, Inc.: South Georgia diversity

Hal Bryan, Ecotech, Conyers: bats, small mammals, North Georgia diversity

Dr. Martha Jane Caldwell, Biology Dept., Savannah State University: marine mammals

Dr. Steven Castleberry, Warnell School of Forest Resources, University of Georgia: bats, wood rats, North Georgia diversity

Dr. Brian Chapman, Dean, Sam Houston State University: bats, diversity

Dr. Art Cleveland, Biology Dept., Columbus State University: bats, wood rats

Dr. Mike Conner, Research Biologist, Ichauway: predators, small mammals, bats

Dr. Les Davenport, Retired, Savannah: small mammals, diversity
Dr. Mark Ford, USFS Research Biologist, West Virginia: bats, small mammals, diversity
Milton Hopkins, Naturalist, Osierfield: diversity
Dr. Susan Loeb, USFS Research Biologist, Clemson University: bats, fox squirrels,
Elizabeth McGhee, Museum of Natural History, University of Georgia: diversity
Dr. Alex Menzel, Wildlife Biology Dept., University of West Virginia: bats, small mammals
Hans Neuhauser, Carl Vinson Institute, University of Georgia: marine mammals, diversity
Nick Nicholson, Wildlife Biologist, Georgia DNR: furbearers
Jim Ozier, Wildlife Biologist, Georgia DNR: bats, diversity
Carol Ruckdeschel, Naturalist, Cumberland Island Museum: marine mammals, diversity
Kathy Sakas, Naturalist, Grays Reef National Seashore: marine mammals, diversity
Dr. Doug Waid, Wildlife Biology Dept., Abraham-Baldwin Agricultural College, Tifton: diversity
Cindy Wentworth, USFS Biologist, Blairsville: bats, small mammals
Dr. Charles Wharton, Naturalist, Clayton (now deceased): diversity

Approach

Since potential technical team participants were widely scattered and individual fields of expertise appeared to be limited to a few species each, it appeared that correspondence, preferably by email, would be a more efficient and effective means of assimilating information than attempting to get the team together for a meeting. All potential participants were sent (most by email) information on the overall Comprehensive Wildlife Conservation Strategy development process and a table listing conservation status and general habitat for each mammal being tracked by the Natural Heritage Program because of conservation concerns. Potential participants were asked to complete (within their areas of expertise) additional fields in the table dealing with specific conservation problems in Georgia and potential solutions to those problems. They were also asked to suggest deletions and additions to the species list. Not all of the listed potential technical team members provided input, and team members have not yet seen the input of other team members. The information included in this interim report will be circulated to everyone on the list for review and comment.

The Natural Heritage Program tracking list of 35 species and subspecies was used as a starting point in assessing mammal conservation priorities. Team members then used their personal experiences and knowledge, published papers and books, technical reports, and Natural Heritage database occurrence records to provide information for completing fields in the assessment table. Also, the species list was modified as per suggestions from team members as follows:

1. Delete *Balaenoptera borealis* (sei whale) and *Physeter macrocephalus* (sperm whale) because there are no Georgia stranding records nor reliable reports.

2. Add *Tursiops truncatus* (bottlenose dolphin – coastal form), *Ziphius cavirostris* (Cuvier’s beaked whale), *Mesoplodon densirostris* (tropical beaked whale), *Mesoplodon europaeus* (Gervais’ beaked whale), and *Globicephala macrorhynchus* (short-finned pilot whale) because they are listed by the National Marine Fisheries Service (NMFS) as “depleted stock” and there are Georgia stranding records.

3. Delete *Canis rufus* (red wolf) and *Felis concolor cougar* (eastern cougar) because they no longer occur in Georgia, and are not likely to become re-established in the near future.

4. Delete *Geomys pinetis fontanelus* (Sherman’s pocket gopher) because it is apparently extinct.

5. Add *Geomys pinetis* (southeastern pocket Gopher) because it appears to have declined significantly and is facing continuing threats through habitat modification.

6. Delete *Clethrionomys gapperi* (southern red-backed vole) and *Sorex hoyi* (pygmy shrew) because they appear to be abundant and unthreatened within suitable habitat.

A recommendation to add the Ossabaw Island feral hog was not adopted because this species is not native to Georgia.

In setting priorities for conservation actions, several factors were considered. Species not known nor suspected to occur in Georgia obviously are not high conservation priorities. However, if additional surveying shows that these species do occur within the state, their status would likely change.

Species that are highly dependent upon habitat in Georgia are considered to be higher priorities. Endemism to Georgia or a small region of the southeast, and seasonal use of Georgia habitat by a significant portion of a species’ population are important factors. Also, Georgia habitat might be particularly important to some species even though only a very small fraction of the overall range includes Georgia. An example would be a small, relatively immobile species that survives in isolated populations at high elevation northern Georgia mountain sites. While the total number of individuals and the proportion of overall habitat might be very small relative to the entire population and range, these relictual populations might contain significant contributions to the species’ genetic diversity.

Another factor in establishing conservation priorities is the degree of threat to the species and its habitat, and our ability to address the threats and enhance the populations’ probability of survival. Higher priorities would be those species facing immediate and addressable threats, particularly if the threat is loss of a particular habitat type that threatens additional species of plants and animals as well.

Lack of occurrence information proved to be the biggest hurdle in assessing mammal conservation needs. The secretive nature of some mammals might lead biologists to the

conclusion that they are scarce, when in fact they might just be hard to find, and have not been specifically sought. On the other hand, since they can be hard to find and few biologists are actually doing survey work, we might assume they are still doing OK when in fact they are not. A surveying and monitoring program is needed to better assess conservation needs.

Another challenge is questionable taxonomy. For example, there is good evidence to suggest that all wood rats in Georgia are essentially the same: *Neotoma floridana floridana*. However, many sources (including the Georgia Natural Heritage Program database) still consider the animals in central north Georgia to be *N.f. haematoreia* and those in western north Georgia to be *N.f. illinoensis* – both of conservation concern. Another question involves the range of Sherman's fox squirrel (*Sciurus niger shermani*). Does its Georgia range encompass only the vicinity of Okefenokee Swamp or does it occur throughout the coastal plain?

Assessment Results

In spite of these challenges, we have attempted to identify measures needed to better ensure the continued contribution of mammals to Georgia's overall diverse natural heritage. Of course, priorities and actions can be modified as new information and opportunities become available. Twenty-three species of mammals were selected for inclusion in the list of high-priority animals for the Comprehensive Wildlife Conservation Strategy. Examples of some of these species and their habitats are provided below.

High Priority Species and Habitats

The following groupings, whether by taxonomy or habitat use, lend themselves to discussion because of general conservation needs shared by members of each group.

Marine mammals

Several species of whales occur in offshore waters along the eastern coast. In Georgia, these are essentially encountered only when they accidentally strand on the beaches. Three species of pinnepeds have also been recorded on the Georgia coast as occurring accidentally. These are the hooded seal (*Cystophora cristata*), Harbor seal (*Phoca vitulina*), and California sea lion (*Zalophus californianus*). All marine mammal occurrences documented on coastal beaches are recorded by the Marine Mammal Stranding Network. Carcasses are necropsied and sometimes salvaged for research and educational purposes. When otherwise healthy stranded animals are encountered, rescue efforts are conducted and these animals are returned to the water in the hope that they will become re-oriented and head away from shore. Sick or injured juveniles are sometimes transported to facilities for rehabilitation, and individuals that cannot be rescued nor rehabilitated are euthanized. Since there is little or nothing else other than opportunistic individual rescue that Georgia DNR can do to conserve populations of these species, they will not be considered high priorities, even though three of them [short-finned pilot whale (*Globicephala macrorhyncus*), Gervais' beaked whale (*Mesoplodon*

eurpaeus), and tropical beaked whale (*Mesoplodon densirostris*)] are listed as “depleted” by the NMFS.

However, a significant number of North Atlantic right whales (*Eubaleana glacialis*), which are perhaps the most endangered marine mammal in the world, migrate to Georgia’s nearshore waters to give birth each winter. This area that encompasses the seas off Cumberland Island, has been officially designated as “critical habitat” and is the only known calving ground for the species. The whales migrate along the eastern U.S. coast, and the Bay of Fundy area provides important habitat for the population as well. In Georgia, conservation actions include flying frequent aerial surveys to locate individual whales so their positions can be relayed to ship captains to minimize the risk of collisions in this busy shipping lane. Also, trained teams attempt to free whales that have become entangled in abandoned fishing gear.

Part of the bottle-nosed dolphins (*Tursiops truncatus*) found along Georgia’s shores are migratory and cover a lot of territory, including offshore waters. However, some are resident to nearshore waters and appear to be experiencing population declines. These resident dolphins are listed as “depleted” by NMFS. Conservation activities should include efforts to discourage feeding and harassment of dolphins.

Manatees (*Trichechus manatus*) venture from Florida waters into Georgia during warm weather and can be harmed by boat traffic and construction activities. DNR will continue efforts to warn boaters to slow down in high risk areas and to monitor construction sites for the presence of manatees that might be at risk.

Bats

Sixteen species of bats are known to occur in Georgia. These animals tend to generate public interest because of their unique habits and abilities, and because of widespread fear that they are harmful and carry diseases. Probably all bats should be viewed as “beneficial” to society because of their flying insect diet. Some species of bats, such as the Mexican free-tailed bat (*Tadarida brasiliensis*), evening bat (*Nycticeius humeralis*), and big brown bat (*Eptesicus fuscus*) appear to be doing very well, even contributing to widespread nuisance situations when they occupy buildings. We need to continue to work to see that nuisance bat situations are handled promptly and in a manner that avoids harm to the bats. Exclusions should be conducted outside the season when non-volant young are present if possible, and the provision of alternate roost structures should be encouraged. The eastern pipistrelle (*Pipistrellus subflavus*) also appears to be fairly common, but roosts in caves, mines, and other areas away from human habitation.

Other species that depend upon caves, such as the gray bat (*Myotis grisescens*) and Indiana bat (*Myotis sodalis*), are known to have experienced significant population declines. The fact that large segments of their populations gather into a few caves makes them particularly vulnerable, but also makes relatively accurate population estimates possible. The status of the gray bat appears to be improving and it might be down-listed soon. There are three known gray bat roost caves in northwest Georgia and each should be a high priority for protection. One roost cave is owned and protected by the

Southeastern Cave Conservancy. This cave contains several other life forms of conservation concern as well. One gray bat roost cave is unprotected and management at that site to prevent disturbance and vandalism during the summer should be a high priority. Indiana bat maternity colonies have been found just north of the state line, and it appears that suitable forest habitat exists in northern Georgia. Additional efforts should be expended to see if there are any maternity roosts in Georgia. If any are found, these and the surrounding habitat should become high conservation priorities.

Another cave-dwelling bat, the southeastern myotis (*Myotis austroriparius*), is of some concern because of probable population declines and continuing vulnerability. This species is known to use 3 caves in southwestern Georgia, but occasionally uses buildings as well. Each of known roost cave should be protected so that the caves themselves are not damaged, and the bats and other organisms are not disturbed. Protection of cave systems benefits many species that are found in no other habitat type. Other bat species are less social and roost in a variety of sites that are less easily identified. Some of these, such as Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) and the northern yellow bat (*Lasiurus intermedius*), appear to be uncommon to rare, but little is actually known about their status in Georgia. We need additional survey efforts to better determine the range, population trends, and management needs of these species.

High elevation forest mammals

Several species of mammals occur in Georgia only in the extreme northern portions of the state. Examples are the least weasel (*Mustela nivalis*), Southern Appalachian wood rat (*Neotoma floridana haematoreia*), hairy-tailed mole (*Parascalops breweri*), masked shrew (*Sorex cinereus*), long-tailed shrew (*Sorex dispar*), water shrew (*Sorex palustris*), Appalachian cottontail (*Sylvilagus obscurus*), southern bog lemming (*Synaptomys cooperi*), red squirrel (*Tamiasciurus hudsonicus*), southern red-backed vole (*Clethrionomys gapperi*), and small footed myotis (*Myotis leibii*). Many of these probably represent relict populations left isolated in high elevation sites as the boreal forests retreated northward following the last ice age. Though Georgia provides only a very small amount of the total occupied habitat and supports only a very small portion of the entire population for these species, maintenance of these range extremes could conserve a disproportionate amount of the species' genetic diversity because of isolation and adaptation. In general, these species need high quality forested habitat, with accompanying clean streams, rich soils, and rocky outcrops. Much of this habitat occurs on national forest land and is under no immediate threat. However, DNR should work with the Forest Service and private landowners to avoid alteration of these important habitats.

Mammals of coastal plain pine savannas

The extensive, open pine savannas of the southeastern coastal plain have disappeared from the vast majority of this community's former range. Conversion to agricultural fields, pasture, tree farms, residential areas, roads, etc., has eliminated and fragmented this habitat type. Sherman's fox squirrel is the large subspecies found in open pine forests of the upper peninsula of Florida and into southern Georgia. The exact extent of the range is undetermined, but this subspecies will certainly benefit from efforts to

manage remaining pine savannas with frequent fire, and to restore degraded areas. Another mammal that has suffered population declines due to alteration and fragmentation of this habitat type is the southeastern pocket gopher (*Geomys pinetis*). These burrowing mammals need soft, sandy soil with a grassy/herbaceous groundcover. Loss of longleaf pine savannas has apparently heavily impacted populations, and where they are still found they are often treated as pests because of their burrows. These burrows, however, provide crucial habitat for several other species of wildlife, some invertebrates of which are rarely if ever found elsewhere. DNR needs to work with landowners who still have suitable habitat for these species to promote proper management with frequent fire and responsible timber harvest. Restoration of degraded habitat could also play an important role in building populations of these species eventually.

Reptile and Amphibian Technical Team Report

Prepared by John B. Jensen, Team Leader

Technical Team Members

Dr. Carlos Camp, Piedmont College – Herpetologist/Professor
Jay Cantrell, WRD – Wildlife Biologist
Mark Dodd, WRD – Wildlife Biologist
Matt Elliott, UGA Institute of Ecology – GIS Specialist/Herpetologist
Dr. Ken Fahey, Brenau University – Herpetologist/Professor
Thomas Floyd, WRD – Wildlife Biologist
Dr. Laine Giovanetto, Georgia State University – Herpetologist/Professor
Dr. Bob Herrington, Georgia Southwestern University - Herpetologist/Professor
Dr. Mark Hughes, International Paper – Biologist
John Jensen, WRD – Wildlife Biologist
Steve Kyles, WRD – Law Enforcement
Robert Moulis, Savannah-Ogeechee Canal Museum – Herpetologist
Dr. Mark Patterson, Lanier Museum of Natural History – Museum Director/President of Georgia Herpetological Society
Dr. David Rostal, Georgia Southern University - Herpetologist/Professor
Dr. Lora Smith, Joseph W. Jones Ecological Research Center – Herpetologist
Dirk Stevenson, Ft. Stewart Fish and Wildlife Branch – Herpetologist
Amanda Subalusky, Joseph W. Jones Ecological Research Center - Herpetologist
Dr. Rebecca Yeomans, South Georgia College – Herpetologist/Professor

Invited but unable to participate:

Dr. Bruce Means, Coastal Plains Institute
Dr. Whit Gibbons, Savannah River Ecology Lab
Dr. Lawrence Wilson, Fernbank Science Center

Approach

A two-day herp team workshop was held at General Coffee State Park on 12-13 March 2003. The primary purpose of the workshop was to review the list of special concern reptiles and amphibians of Georgia and, as a group, evaluate each species' abundance, range, population trend, threats, protection needs, inventory needs, monitoring needs, research needs, and importance in Georgia as it relates to global conservation of the species. This effort required the knowledge of professionals who work closely with reptiles and amphibians in Georgia and their conservation, and the technical team assembled for this evaluation certainly represented that need. In addition to expert opinion provided by team members, information on conservation concerns and needs was gleaned from peer-reviewed scientific literature, technical reports, and natural history museum databases.

The team completed a standard spreadsheet developed by Georgia Natural Heritage Program by providing input on specifically prompted fields. Additionally, the team

discussed the current list of state protected reptiles and amphibians and recommended changes based on current status and threats (this information is not presented here, but will be used when the state protected list is formally reviewed). Following the meeting, the team leader “cleaned-up” the spreadsheet and resubmitted to the team for final review. This finalized spreadsheet was used by the team leader as an important tool for recommending top priorities for both conservation action and survey/research. These priority lists were also reviewed by the Reptile and Amphibian Technical Team.

Determination of species to include on the High Priority for Conservation list was based primarily on the species’ population trends, habitat trends, rarity, vulnerability, and, especially, availability of known, successful conservation strategies. Some species determined to be of significant conservation concern but for which we do not currently have sufficient knowledge of distribution, biology, natural history, clearly known threats, or proven conservation strategies, were not included on the High Priority for Conservation list, but instead are considered high priority species in need of survey and research.

Examples of High priority Habitats and Sites

Southwestern Appalachians/Ridge & Valley

Caves and rock outcrops

A high diversity of salamanders, including three of high conservation concern (green, Pigeon Mountain, and Tennessee cave salamanders), depend on these habitats. Caves and rock outcrops can be completely destroyed by mining activities, which are becoming increasingly common in this region. Forest moisture required by terrestrial salamanders may be compromised by significant logging operations. Water quality of subterranean streams threatened by septic tanks and other sources of toxins from upslope developments.

Sag ponds

Fishless, temporary wetlands that are critical breeding habitats for a number of amphibians.

Blue Ridge

Cove hardwood forests

Salamanders reach their highest worldwide diversity in the Southern Blue Ridge and cove hardwoods habitats harbor much of this diversity. Maintenance of mesic forest conditions and low silt loads in embedded seeps and small streams is threatened by certain forestry activities.

Mountain bogs

Primarily of concern because of the dependence on this habitat by the threatened bog turtle, although many other reptiles and amphibians can be found. The majority of these habitats are formed in low mountain valleys, mostly in private ownership. Mountain

bogs are often channelized, drained, or impounded, rendering them unsuitable for bog turtles. Beavers may be the primary force behind creation of these habitats, but their activities are rarely tolerated by most landowners.

Piedmont

There are no unique habitats in this province that are favored by reptiles or amphibians of conservation concern, and only a few herps of conservation concern range into the Piedmont.

Southeastern Plains and Southern Coastal Plain

Isolated wetlands

Includes Carolina bays, sinkhole ponds, cypress domes and similar habitats, plus adjacent upland habitats. A relatively high number of special concern herps (including gopher frog, flatwoods salamander, and striped newt) depend on the fishless (or lacking of large predatory fish), temporary conditions provided by isolated wetlands. However, most of these species spend considerably more time burrowed in adjacent uplands. Conservation of these species requires attention to both wetland and upland habitat needs. These wetlands are exempt from any protection under the Clean Water Act, thus they can be filled, drained, or deepened for permanency. The adjacent uplands are often heavily impacted by various forestry site preparation activities.

Longleaf pine-wiregrass habitats

Includes pine flatwoods, sandhills, and upland pine forest. Many species of reptiles and amphibians are endemic, or nearly so, to this broad habitat type. Thus, it is not surprising that the 97% loss of this habitat rangewide has led to drastic declines of closely associated herpetofauna. Species of conservation concern include gopher frog, flatwoods salamander, striped newt, mimic glass lizard, eastern indigo snake, southern hognose snake, pine snake, eastern diamondback rattlesnake, and gopher tortoise. Silviculture, agriculture, residential development, and fire suppression have all contributed to loss and alteration of longleaf-wiregrass habitats, and ultimately to declines of the aforementioned herp species.

Hammocks and other high ground within and adjacent to salt marshes

Georgia's extensive salt marshes are home to a unique and very specialized turtle of conservation concern, the diamondback terrapin. Terrapins must nest in sandy soil above the high tide level. Unfortunately, these higher grounds are premium land for developments and roads, which reduces the available nesting sites for terrapins and leads to high mortality of females and hatchlings while crossing roads.

Ocean Beach/Dunes

Georgia's ocean beach/dune habitat is critical for the recovery and maintenance of threatened loggerhead turtle populations. Loggerheads typically nest on ocean beaches between the high tide line and the front of the primary dune. Beachfront property is also perhaps the most highly prized real estate in Georgia for residential development and

recreation. Human activities have resulted in a wide variety of direct and indirect impacts to this important habitat. Indirect effects include reduced sediment input to the coastal sand-sharing system as a result of the impoundment of Georgia's major river systems. In addition, the construction of jetties and shipping channels have altered natural sand movement patterns increasing erosion on some beaches. Direct impacts to beach dune habitats include coastal development and construction activities such as beach nourishment projects, shoreline stabilization (rock armoring), home construction, artificial lighting and increased recreational use.

Examples of high priority species conservation actions

Flatwoods salamander, striped newt, gopher frog

These species require two habitats (aquatic breeding pond and terrestrial upland retreat) in close association with one another. Although the breeding ponds of many known populations of these amphibians are currently safe from human impacts, the critical adjacent upland habitats, in many cases, are not. All three of these species use shallow terrestrial burrows, often created by other animals, which are destroyed by most soil disturbances, especially those related to agriculture and silviculture. It is the loss and alteration of the uplands, much more so than disturbances to the wetlands, that has led to declines of these species. Actions will be undertaken to encourage land managers and landowners to manage and protect the occupied upland areas surrounding known breeding sites for the benefit of these rare animals.

Diamondback terrapin

The two greatest threats to diamondback terrapins are drowning in commercial and recreational crab traps and mortality of nesting females and dispersing hatchlings on roads through, and adjacent to, salt marshes. Reducing death from crab trap drownings can be accomplished by encouraging or requiring terrapin excluder ring use. An educational campaign to inform recreational crabbers about the need to check traps daily would also go a long way toward reducing trap-related mortality. A "ghost trap" buyback program would further reduce the chance that abandoned traps drown terrapins. Roads through and adjacent to known nesting areas for terrapins can be equipped with short (< 10") barrier fences to prevent turtles from entering roadways.

Sea turtles (all species)

There are numerous threats to the recovery of sea turtle populations in Georgia. Two examples include incidental capture and mortality associated with commercial fisheries and the loss or degradation of nesting habitat from coastal development. Of all commercial fisheries in the United States, shrimp trawling is the most damaging to sea turtle populations. The impact of incidental capture by shrimp trawlers has been reduced by requiring the use of Turtle Excluder Devices (TEDs) in all trawl nets. TEDs consist of a metal grid sewn into the throat of the net allowing shrimp to pass through into the bag while forcing turtles out a "trap door" in the net. An estimated 37% decline in sea turtle strandings followed the implementation of TEDs in Georgia. Although TEDs have been shown to reduce sea turtle mortality, they may not be efficient enough to ensure recovery of loggerhead populations. More research will be necessary to improve

performance of TEDs, both for turtle exclusion and shrimp retention. If further net modifications are not found to improve turtle survivorship sufficiently to recover populations, managers may also need to consider a reduction in overall fishing effort.

Loss of nesting habitat is also a serious threat to loggerhead turtle populations. Currently, approximately 8% of Georgia's beaches are armored to protect buildings/homes constructed in the dynamic dunefield. Loggerhead turtles are generally excluded from nesting in areas where shoreline stabilization structures have been installed. Disallowing the construction of structures in the dynamic dunefield will reduce the need to install shoreline stabilization structures and eliminate any further loss of nesting habitat.

Bog turtle

Bog turtle populations in Georgia are almost exclusively found on private lands, most of which are highly vulnerable to development as the real estate market in north Georgia continues to boom. The continued existence of this species in Georgia may depend on the establishment of populations on protected lands, especially the Chattahoochee National Forest. Eggs from wild gravid females and captive adults can be head-started and relocated to suitable sites on protected land. This procedure has been done with great success at two Tennessee sites.

Alligator snapping turtle, Barbour's map turtle

Both of these turtles are highly vulnerable to illegal collection for the international trade in meat (alligator snapping turtle) and pets (both species). Further, both are maliciously killed by unethical fishermen and those who find it great sport to shoot turtles off logs and rocks. Increased training of law enforcement officers and greater enforcement attention in stream sections occupied by these turtles can reduce this take. Strategically placed signage and educational materials can help get the word out that these species are protected and any take of them will not be tolerated.

Research and Survey Needs

The list of high priority species for conservation is not necessarily a list of the most at-risk species. Many species of native reptiles and amphibians are either so secretive or so difficult to find that we do not know enough about them to initiate conservation strategies (e.g. rainbow snake, spotted turtle, Florida worm lizard). Other species may not be so difficult to find, but have not been subject to many dedicated surveys or research projects (e.g. Chamberlain's dwarf salamander, waterdogs [3 spp], mountain chorus frog). These species clearly need more survey and research attention (nearly all of the reptiles and amphibians on the appended list of special concern herps that are *not* included in the list of high priority species for conservation fall into this category). Below are examples of high priority research and survey needs:

Rare upland squamate survey

Pine snakes, eastern indigo snakes, southern hognose snakes, eastern diamondback rattlesnakes, eastern coral snakes, and glass lizards (four species) are all in need of survey

on state lands. Drift fence arrays equipped with large box traps may be an effective way to sample for all of these species using just one technique.

Newly discovered/described salamander natural history research/survey

Several recently described species of salamanders (dwarf blackbelly, Chamberlain's dwarf, *P. shermani*) are known from Georgia though very little information about their distribution, natural history, and biology is known. Conservation of these species will require better knowledge of their needs.

Resurvey historic sites of poorly known salamanders

Research and surveys in other states within their range indicate that southern dusky salamanders and hellbenders have declined, or in some cases disappeared, from many historic locations. Historic sites in Georgia need to be resurveyed to evaluate their status here.

Terrestrial Invertebrate Technical Team Report

Prepared by Nathan Klaus, Team Leader

Technical Team Members

Dr. Jerry Payne – Entomologist-*Hymenoptera*, University of Georgia (Retired)
Dr. James Adams – Entomologist/Professor-*Lepidoptera*, Dalton State College, GA
Dr. David Jenkins – Research Entomologist-*Hymenoptera*, University of Georgia
Terry Price – Forest Pest Entomologist, Georgia Forestry Commission
Dr. Cecil Smith – Entomologist-*Coleoptera*, University of Georgia
Dr. Bob Matthews-Entomologist-*Hymenoptera*, University of Georgia
Chris Canalos – GIS Specialist, GA Natural Heritage Program
Nathan Klaus – Wildlife Biologist, GA Nongame Program

Consulting Members

Dale Schweitzer- Entomologist-*Lepidoptera*, Nature Conservancy, NJ
Steve Hall- Entomologist-*Lepidoptera*, Nature Conservancy, NC
Dr. Peter Adler- Entomologist-*Diptera*, Clemson University
Dr. John Morse- Entomologist-*Trichoptera*, Clemson University
Dr. Will Reeves- Entomologist-Cave Species, Clemson University
Brian Scholtens- Entomologist-*Lepidoptera*
Dr. Chris Carlton- Entomologist-*Coleoptera*
Jan Ceigler- Entomologist-*Coleoptera-Scarab Beetles*, W. Columbia, SC
Dr. Phillip Harpootlian- Entomologist-*Coleoptera-Scarab Beetles*, Simpsonville, SC

Invited but unable to participate:

Dr. Dan Otte – Entomologist-*Orthoptera* - Academy of Natural Sciences Philadelphia
Dan Spooner-Entomologist-*Orthoptera*
Dr. Al Wheeler – Entomologist-*Hemiptera*, Clemson University
Dr. Bob Wharton- Entomologist-parasitic *Hymenoptera*, Texas A&M University
Bo Sullivan- Entomologist-*Lepidoptera*
Dr. Richard Brown- Entomologist-*Lepidoptera*
Dr. Robert Turnbow- Entomologist-*Coleoptera*
Dr. Joe McHugh- Entomologist-*Coleoptera*
Dr. Rowland Shelley- Entomologist-*Centipedes/Millipedes*
Dr. Lionel Stange- Entomologist-*Neuropterans*
Keith Douce- Entomologist-*Collembolla*
Dr. Bill Birkhead
Dr. Reid Ipser- Entomologist-*Hymenoptera-Ants*
Dr. Gary Steck- Entomologist-*Diptera*, Florida Department of Agriculture
Dr. Dan Hagan- Entomologist-*Orthoptera*, Georgia Southern
Dr. Thomas Walker- Entomologist-*Orthoptera*
Jim Hanula- Entomologist-*Orthoptera-USFS*
Brian Sparks- Entomologist- University of Georgia
Dr. Fred Coyle- Entomologist-*Arachnids*
Dr. Dan Suiter- Entomologist-*Millipedes/Centipedes*, University of Georgia
Dr. Thomas Walker- Entomologist-*Orthoptera*, University of Florida

Approach

Two, one-day technical team meetings were held, April 18th 2003 at the Nongame-Endangered Wildlife Program office in Forsyth, and August 13, 2003 at the University of Georgia Natural History Museum. The primary purpose of the meetings was to familiarize the group with the current tracking list and the CWCS planning process and to identify experts in the field to review our list of special concern terrestrial invertebrates of Georgia and suggest additions and deletions and generally update the list. The first task identified by this steering committee was to round out the tracking list with representative species from all taxa, rather than focusing largely on *Lepidoptera* as in the past.

Since most species of terrestrial invertebrate lack fundamental information on abundance, range, population trend, threats, or protection needs our group was faced with a situation unique from other CWCS groups. It was quickly realized that no species group would be adequately served by this listing process, however some species which are better known, associated with rare or threatened habitats, or which are strongly suspected to be rare could be added to the tracking list to indicate high survey needs. Unlike other CWCS groups, terrestrial invertebrates span such a vast diversity (there are more species of beetle in the world than all other animals!) that most professionals are familiar only with a portion of one taxon. Finding professionals familiar with these taxa in the Southeast greatly limited the scope of our work, and ultimately many species groups remain unrepresented.

Of the many entomologists identified as experts in their field, the vast majority were unable or unwilling to help, because they could not take on the additional workload, were not familiar enough with Georgia habitats or taxa, were not familiar with species other than those of economic interest (i.e. pest species) or were out of the country for extended times. Through this process we discovered that relatively few entomologists are actively involved in conservation of the species they study and there is no network or community for conservation of terrestrial invertebrates as for other taxa (e.g. Audubon Society, The Wildlife Society and others) in the Southeast.

To the best of our ability the team completed a standard spreadsheet developed by Georgia Natural Heritage Program by providing input on specifically prompted fields. Following the meeting, the team leader “cleaned-up” the spreadsheet and resubmitted to the team (via email attachment) for final review. This finalized spreadsheet was used by the team leader as an important tool for recommending top priorities for both conservation action and survey/research.

The team discussed the possibility of nominating a terrestrial invertebrate for state protection and rejected the idea based upon a fundamental lack of information. The most critical needs for conservation of terrestrial invertebrates identified by the team were the creation of a position within state government to coordinate research and surveys and develop management strategies, greater funding for species surveys/inventories, especially in rare or threatened communities and protected lands, and creation of a peer

group concerned with conservation of terrestrial invertebrates in the Southeast. Development of a truly representative tracking list for terrestrial invertebrates should be an ongoing project, but will be difficult without hiring a specialist to oversee the process.

Assessment Results

At this time it was deemed that no terrestrial invertebrates are known well enough to be considered high priorities for conservation. Many species determined to be of significant conservation concern but for which we do not currently have sufficient knowledge of distribution, biology, natural history, clearly known threats, or proven conservation strategies, were not included on the high priority species list, but instead are considered high priority species in need of survey and research. Even so, we feel that it is better to describe these survey and research priorities in terms of high priority habitats rather than singling out representative species.

High Priority Species

All experts consulted agreed that at this time not enough is known about the distribution and abundance of any insect to consider it in need of conservation. In spite of this it was widely acknowledged that many species are probably in great need of conservation and some have probably gone extinct from human activities before they were discovered.

Undeniably the best known and understood group of terrestrial invertebrates in Georgia are the Lepidoptera. In spite of the fact that they comprise a major portion of the species on the “Special Concern” tracking list, most members of this group are widely distributed and most populations in Georgia are not considered critically important for conservation. This imbalance stems not from the fact that Lepidoptera are more imperiled than other taxa, only better known. However, of the two species deemed the highest conservation priority among the Lepidoptera, *Hemipachnobia subporphyria* and *Slossonella tenebrosa*, neither has been documented in the state though both are expected to be found here. Both are found in adjacent states in habitat that is also present in Georgia. The host plants of neither species is known nor is any habitat management recommended. This paucity of information surrounding our best known terrestrial invertebrate group strongly illustrates the serious data gap preventing meaningful conservation efforts.

Examples of High Priority Habitats and Sites

The range of terrestrial invertebrates is so diverse that they occupy every conceivable niche on the planet. Capable of colonizing inhospitable climates from geysers of nearly boiling water to Antarctica, we should not be surprised that many have specialized on rare habitats. Though most remain unstudied, those specialized habitats that have received attention invariably describe a rich fauna with many species new to science.

These specialized communities have received greater ecological study, probably because only by limiting the scope of the work to a very specialized and limited habitat can an author begin to grasp the complexity of terrestrial invertebrates. Though most of our

examples are from very specialized habitats, it is likely that a far greater diversity, including many species vulnerable to extinction, are found outside these specialized habitats.

Southeastern Plains and Southern Coastal Plain

Pocket gopher burrows

In 1987 Dr. Rupert Wenzel of the Florida Field Museum of Natural History drove to the only location where a single specimen of a beetle (*Onthophilus giganteus*) had been collected two decades earlier. This species had not been located anywhere else and had not been seen again since its initial discovery. The site, an old pasture, was not unlike many others, with the exception that it contained the burrows of pocket gophers (*Geomys pinetus*), a rare subterranean mammal which typically inhabits longleaf savannah in the coastal plain of Georgia, Alabama, and northern Florida. Other species of the genus *Onthophilus* are known to be associated with rodent burrows and, after honing in on this habitat type, further trapping and excavation led to the discovery of as many as a dozen species new to science including two species of hister beetles, three species of aphodiine scarab beetles, a camel cricket, a blind cave cricket, and several sightless lycosid spiders, all restricted to and specialists on pocket gopher burrows. In addition many species were documented that were previously unknown to the southeast.

Pocket gophers have undergone substantial declines over the last century with the introduction of agriculture and the nearly total destruction of the longleaf pine ecosystem. It is likely that some insects specializing on their burrows are very rare or have already gone extinct. Initial work has discovered many of these species (as well as additional species new to science) in Georgia. Conservation of this rare mammal would be essential to the continued presence of several dozen species of insect, many of which have not been found anywhere else.

Southwestern Appalachians/ Ridge & Valley

Caves and rock outcrops

With funding from the Georgia Nongame Wildlife Conservation Fund a five-year project involving exploration of the caves of Georgia was begun in 1998. Some of these caves were previously known to house rare mammals such as Gray Myotis (*Myotis sodalis*) and rare amphibians such as Georgia Blind Salamander (*Haideotriton wallacei*). What was not well known was the invertebrate fauna that would be encountered. By collecting and limited trapping in 43 of the nearly 500 known caves in Georgia, eleven undescribed species of terrestrial invertebrate were encountered. Six of these were new to science and one, a centipede, represents a new genus.

Caves and rock outcrops can be completely destroyed by mining activities, which are becoming increasingly common in this region. Forest moisture required by terrestrial invertebrates may be compromised by significant logging operations. Water quality of subterranean streams may be impacted by septic tanks and other sources of toxins from upslope developments.

Priorities for Research and Surveys

Very little is known about most terrestrial invertebrates found in our state. However, there are several species that are known to use rare or declining habitats. Surveys and research in these habitats may be logical starting points:

Canebrakes

Efforts should include rare cane obligate lepidoptera (e.g. *Amblyscirtes reversa*). Efforts should also be made to sample other fauna of significance, in particular spiders, weevils, and beetles.

Gopher tortoise and pocket gopher burrows

Several species are known to be endemic to this habitat, however their range has not been documented. In addition these burrows have only been sampled in a very small subset of the tortoise and pocket gopher ranges, it is likely that other endemic terrestrial invertebrates may be described from a thorough survey.

Rare plants and their pollinators

Numerous examples of symbiosis between plants and a specific pollinator have been documented. Working in coordination with GNHP botanists, surveys should be made of rare flowering plants where an endemic pollinator is suspected (e.g. plants with widely divergent reproductive success between populations).

Rare or uncommon edaphically controlled natural communities

Xeric aeolian dunes, Black Belt prairies, limestone glades, serpentine woodlands, and other rare or uncommon edaphically controlled communities have great potential to harbor species that are rare or endemic to the region. Field entomologists should be directed to these habitats and funding provided for basic field surveys to document the terrestrial invertebrate diversity of these unusual habitats.

Fishes and Freshwater Invertebrates Technical Team Report

Prepared by Brett Albanese, Team Leader

Technical Team Members

<u>Name</u>	<u>Affiliation</u>	<u>Taxonomic Group</u>
Brett Albanese	WRD, Georgia Natural Heritage Program	Fishes
Giff Beaton	Self-taught expert	Odonates
Gary Beisser	WRD, Fisheries Management Section	Fishes
Holly Blalock-Herod	USFWS, Panama City	Mussels
Jeff Herod	USFWS, Eglin AirForce Base	Mussels and Fishes
Broughton Caldwell	Retired from EPD	Aquatic Insects
Bud Freeman	Univ. of Georgia	Fishes
Mary Freeman	Univ. of Georgia	Fishes
Robert Jenkins	Roanoke College	Fishes
Paul Johnson	Tennessee Aquarium Research Institute	Mussels and Snails
Gene Keferl	Coastal Georgia Community College	Mussels and Snails
Patti Lanford	WRD, Stream Team	Fishes
Christopher Rogers	EcoAnalysts, Inc (California)	Fairy Shrimp
Chris Skelton	Georgia College and State University	Crayfish
George Stanton	Columbus State University	Crayfish
Ellie Sukkestaad	Fort Stewart	Mussels
Jim Williams	United States Geological Survey	Mussels
Jason Wisniewski	WRD, Georgia Natural Heritage Program	Mussels

This report was prepared by drawing on the expertise of the Fish and Freshwater Invertebrate Technical Team. This team comprises some of the best-known experts on aquatic biodiversity in Georgia and the southeastern United States. Each member of the team invested a considerable amount of time out of their busy schedules and their efforts are hereby acknowledged. I would also like to thank Bob Butler (USFWS-Asheville), Gerald Dinkins (Dinkins Biological Consulting), Burt Deener (DNR Fisheries), Jimmy Evans (DNR Fisheries), Mike Geihlsler (DNR Fisheries), Lee Keefer (DNR Fisheries), Russ Ober (DNR Fisheries), Rob Weller (DNR Fisheries), and Seth Wegner (UGA-Institute of Ecology) for reviewing the results of the assessment and providing additional comments.

The primary objectives of the technical team were to assess the status of Georgia's aquatic species and to identify the conservation actions necessary to conserve these species. Technical team members were also asked to recommend changes (i.e., additions, deletions, status changes) to the state protected animal's list. Each member of the team was sent a group of species and assessment guidelines during spring 2003 and given four to six weeks to complete the assessment. Team members then used their collective knowledge to fill in additional information gaps and reach consensus on conservation actions during a full day meeting. Team members with expertise on fishes, insects, and crayfish met at the Carl Vinson Institute of Government in Athens, Georgia on 2 May, 2003. Team Members with expertise on freshwater mussels met at TNC's Altamaha

Bioreserve office in Darien, GA on 17 May 2003. Our Odonate(Giff Beaton), fairy Shrimp (Christopher Rogers), and one of our fish experts (Bob Jenkins) were not able to attend these meetings, but their assessments were reviewed by other team members.

Approach

Selection of Species

GNHP staff initially selected 335 aquatic species for review by the technical team. This initial species list comprised all GA Special Concern species that are officially tracked in GNHP's Biological and Conservation Database (BCD) along with additional species of potential conservation importance (Taylor et al. 1996; Brim Box and Williams 2000; Warren et al. 2000; NatureServe 2003). The technical team revised this list by incorporating additional species and removing species that were not important conservation targets. Ultimately, 376 aquatic species and subspecies were considered for the assessment.

Documentation and Information Sources

The information needed to support the assessment and identification of conservation actions was recorded in a large spreadsheet. The spreadsheet includes fields where the habitats, range, status, threats, research needs, and conservation needs of each species can be recorded (see field_descriptions.doc for a complete list and explanation of spreadsheet fields). Because of the large number of species reviewed by the technical team, the spreadsheet was divided into three separate digital files: cwcs_mollusks_feb_2005.xls (includes 122 species and subspecies of mussels and snails), cwcs_aquatic_arthropods_feb_2005.xls (includes 114 species and subspecies of fairy shrimp, insects, and crayfish), and cwcs_fishes_feb_2005.xls (includes 140 species and subspecies of fish).

The information recorded in the spreadsheet was primarily derived from expert opinion, published literature, and information contained in the BCD. We drew heavily upon recent conservation assessments of southeastern fishes (Warren et al. 2000), North American crayfishes (Taylor et al. 1996), and Apalachicolan mussels (Brim Box and Williams 2000); rankings published in these sources were incorporated directly into the OtherRank field in the spreadsheets and will ultimately be incorporated into the BCD (see Appendix B for status abbreviations). We also relied on information from numerous other sources which are listed in Appendix C.

Dot distribution maps were created in ArcView for a subset of species (primarily fishes). These maps were attributed using collection data derived from the BCD and were essential for supplementing expert opinion on current and historic range, best sites for conservation, and the need for additional survey work. Limitations of our database (e.g., sparse data for insects and other poorly known groups) precluded preparation of these maps for all species in the assessment.

Proposed Changes to the Special Concern and State Protected Animals list

Proposed changes to the special concern list and state protected animals list were guided by expert opinion and decisions were made species by species. However, we adopted some general guidelines to improve consistency across species. The special concern list imposes no regulatory burden but highlights species that should be on the radar screen for conservation efforts. It also determines what species are tracked in the BCD. In most cases, species with an S rank of S1-S3 were added to the special concern list because of our desire to monitor imperiled species AND species that are currently stable but potentially vulnerable to future imperilment. Species that were ranked SX (thought to be extirpated), SP (potential occurrence in Georgia), and SH (historical occurrence in Georgia) were also added to the Special Concern list to illustrate the importance of any observations of these species. Species ranked SU (status unrankable without additional information) or SNR (species not ranked) were included on the Special Concern list to emphasize that additional information is needed to assess the status of these species.

In general, we did not recommend that species with ranks of SH, S?, or SU be added to the state protected list because more information (e.g., surveys) is needed to determine their status. Species with a rank of SX were not listed because they are believed to be extirpated. Our team felt that peripheral taxa were valuable conservation targets for the state, but may not warrant as much protection as species with a large portion of their range in the state. As a general rule, we listed these peripherals as rare if they were worthy of protection (i.e, could actually be lost from the state one day). If the species was doing fine and in no danger of extinction in the state--we did not list it, despite the fact that it may have a very small range in the state.

The changes proposed to the State list of Protected Animals should only be considered recommended changes until they can be formally approved and adopted by the Board of Natural Resources. If the technical team members still support the recommended changes in 2005, WRD staff will initiate the formal protected species determination process as outlined in DNR rules. Information contained in the CWCS spreadsheet and other sources will be carefully reviewed during that time period.

High Priority Species

A universal scheme for prioritizing species for conservation action was difficult to identify because threats, biology, and information gaps vary widely within and among the different taxonomic groups considered in the assessment. We used global rarity ranks (i.e., G ranks), state rarity ranks (i.e., S ranks) and protection status to identify high priority species because these variables reflect conservation importance and were known for almost all of the species in the assessment. Species with federal protection under the Endangered Species Act (Endangered, Threatened, or official Candidate) or with low G ranks (GH, G1-G2) are globally significant conservation elements and should receive the highest priority during CWCS implementation. Species with low S ranks (SH or S1) and state protected status (official endangered, threatened, rare, or unusual status or status recommended by technical team) are significant to the conservation of Georgia's aquatic

biodiversity and should also be given high priority in the CWCS. We decided not to designate extirpated species high priority except for species that should be considered for reintroduction programs. While we have evaluated alternative prioritization schemes based upon other spreadsheet fields (e.g., range size rank, threat rank, importance of Georgia conservation efforts to global conservation rank), we feel that G rank, S rank, and protection status adequately reflect the information contained in these other variables. Indeed, these other variables played a large role in revising the S rank and recommended state protected status during the species assessment.

High Priority Habitats

High priority waters were selected to protect important populations of high priority species and also to protect or restore representative aquatic systems throughout the state. We used three different sources of information to identify high priority streams. First, we examined the best sites field of the spreadsheet to identify streams containing important populations of high priority species. Next we selected all streams within TNC priority conservation areas (Smith et al. 2002). These conservation areas were selected to protect occurrences of rare aquatic species and also to protect high-quality aquatic systems. As in this assessment, TNC identified important populations of rare species using expert opinion. Aquatic systems were delineated by classifying stream segments according to major physiochemical parameters (e.g., elevation, geology, stream size) and then identifying all distinct combinations of these parameters (e.g, small, moderate-elevation streams in sandstone bedrock geology represents one aquatic system type). After these systems were delineated, TNC asked experts to identify the most viable representatives of each of these systems for inclusion in TNC conservation areas. TNC delineated conservation areas in the Mobile, Tennessee, and the South Atlantic Basins of Georgia, but not within the Gulf Slope Basin or South Atlantic drainages south of the Altamaha. Finally, we examined Index of Biological Integrity (IBI) scores for sites sampled by the Georgia DNR stream team. The IBI is a multimetric index that is designed to assess the ecological integrity of a site based upon attributes of the fish community. Streams with sites receiving an excellent IBI score (the highest integrity class) were selected as high priority streams. Like TNC's data, the stream team data set covers most but not all of the state. They have not yet scored any sites in the Blue Ridge or Southern Coastal Plain ecoregions and have not completed sampling within all drainages of the Southeastern Plains ecoregion.

After the initial list of high priority streams was compiled, we sought and received extensive feedback from aquatic biologists, resource professionals, and other stakeholders to help us improve the high priority streams list. We compiled comments on specific restoration needs, preservation needs, and threats to each high priority stream. We asked reviewers to consider streams that should be a focus for conservation efforts during the next 5-10 years. Streams that were considered too degraded to be considered a high priority for restoration, preservation, or other conservation activities within this time period were dropped from the list. Reviewers added streams that were considered important to the conservation of aquatic biodiversity in Georgia. These streams were selected because they contained important populations of anadromous fishes (e.g.,

Atlantic sturgeon), rare habitats (e.g., springs), or represented the least disturbed aquatic system within the region. We were more liberal in adding streams from the Southern Coastal Plain and Southeastern Plains ecoregions because of gaps in the data sets that were used to identify the initial list of high priority streams. Finally, following the suggestions of reviewers, we added all riverine-tidal, estuarine, and state marine waters to the list because of their importance for high priority coastal species (e.g., shortnose sturgeon, manatee, sea turtles, etc.).

Although there are many conservation actions that focus on individual stream reaches, protecting and restoring high priority streams requires a watershed-level focus. To emphasize the importance of watershed-level conservation efforts, we delineated all of the small watersheds (USGS HUC 12) that contained high priority stream reaches or contained tributaries that fed directly into high priority streams.

High Priority Research and Survey Needs

High priority research and survey needs and high priority conservation actions were determined by synthesis of the information in the spreadsheet and expert opinion. Surveys were considered high priority if they could target multiple species or systems that have received little sampling. Research was considered high priority if it could address knowledge gaps that truly limit conservation. Finally, to identify general conservation actions, technical team members were asked to identify the broader actions necessary to successfully implement the CWCS for aquatic species.

Assessment Results

High Priority Mollusk Species

Of the 122 mollusk species included in the assessment, 75 met at least one of the criteria to be included on the high priority list. Most (55) of these species are freshwater mussels, which probably reflects our limited knowledge of the taxonomy and status of snails in Georgia. Unfortunately, the highly endangered status of this group strongly limits conservation options for many of these high priority species. For example, the 25 species that are considered extirpated (SX) or possibly extirpated within the state (SH) can only be recovered if new populations are discovered or if the species can be successfully reintroduced. This status of this group underscores the importance of expanding conservation efforts for rare aquatic species in Georgia.

Despite the large number of extirpated species in this group, the technical team identified many important conservation actions necessary to recover and protect the extant fauna. Here we provide three examples of high priority mollusk species and the actions necessary to conserve them.

Southern elktoe (*Alasmidonta triangulata*)

This mussel species was considered endangered during a recent status assessment of mussels in the Apalachicola Basin (Brim Box and Williams 2000). It not protected at the federal or state level, but may warrant such status. This species is a high priority for genetic studies and its range and status cannot be properly determined before such studies are completed. If it is endemic to the Apalachicola Basin, as has often been suggested (e.g., Clench and Turner 1956; Johnson 1970; Brim Box and Williams 2000), only three extant (but not necessarily viable) populations of this species have been documented since the early 1990's. If it is synonymized with a more wide ranging species of *Alasmidonta*, this species is still vulnerable to extirpation from the state. High priority actions needed to conserve this species include 1) a genetic investigation of its taxonomic relationship to other southeastern *Alasmidonta* species, 2) monitoring and protection of all extant populations, 3) targeted surveys to identify additional populations for protection and monitoring, 4) identification of host-fishes to facilitate development of culture protocols and to improve our understanding of the life-history of this poorly known species, and 5) addition to the state list of protected animals at a status to be determined after the completion of genetic studies.

Apalachicola floater (*Anodonta heardi*)

This mussel species was considered threatened during a recent status assessment of mussels in the Apalachicola Basin (Brim Box and Williams 2000). It is not protected at the federal or state level, primarily because of information gaps concerning its status and distribution. This species is thought to be endemic to the Apalachicola Basin and has been recorded from the AL, GA, and FL portions of this basin. It is only known from a single Flint River tributary in GA. The technical team indicated that efforts to conserve this species in GA are somewhat important to the global conservation of this species and would be more important if additional populations are documented. This species is threatened by development and agricultural activities that degrade and/or dewater floodplain habitats. High priority actions needed to conserve this species include 1) identification of additional populations by surveying under-sampled backwater habitats, 2) monitoring of the only known extant population and other populations that may be discovered, and 3) habitat protection for the only known population and other populations that may be discovered.

Ocmulgee marstonia (*Marstonia agarhecta*)

This snail species is not protected at the state or federal level, but its global range is restricted to the Ocmulgee river system in Georgia. It is only known from two sites, but is apparently abundant in those sites. The spring habitats that this species is associated with are threatened by development and groundwater pumping. High priority actions needed to conserve this species include 1) protection of habitat for all known occurrences, 2) a survey of spring habitats in the Ocmulgee river system, and 3) pending the results of surveys, considered for addition to the state protected animals list.

High Priority Arthropod Species

Fourty-seven of the 112 arthropod species included in the assessment met at least one of the criteria to be selected as a high priority species. In contrast to mollusks, only one species in this group is thought to be extirpated from the state. However, it should be noted that our understanding of the status of many arthropods (especially non-crayfish arthropods) is severely constrained by a lack of distributional data. For example, state rarity ranks could not be assigned for 48 of the 73 non-crayfish arthropods included in the assessment. Despite these data gaps, the technical team was able to identify important conservation actions for many of the species in this group. Below we provide two examples of high priority species and the actions necessary to conserve them. To illustrate that our selection of high-priority species was imperfect, we also include an example of a conservation dependent species that did not meet the high priority criteria.

Cherokee clubtail (*Gomphus consanguis*)

This dragonfly species is not protected at the state or federal level. Less than 20 populations of this species have been documented in the Southern Appalachians, two of which are in northwest Georgia. However, the small spring-fed streams in which this species occurs are thought to be under-sampled by dragonfly experts. Threats to this species include general habitat degradation of spring habitats. High priority actions needed to conserve this species include targeted surveys to identify additional populations. Pending the results of those surveys, this species may warrant addition to the state list of protected animals.

Conasauga blue burrower (*Cambarus cymatilis*)

This species was considered endangered during a recent status assessment of North American crayfishes (Taylor et al. 1996). It is not protected at the federal or state level. Its total range is restricted to the Conasauga river basin in Georgia and Tennessee and the technical committee considered conservation efforts in GA to be critical to the global conservation of this species. Because it is a burrower, this species is vulnerable to degradation of aquatic and terrestrial habitats. High priority actions needed to conserve this species include 1) surveys to identify additional populations, 2) protection and monitoring of extant populations, and 3) addition to the state list of protected animals as endangered to reflect its current status.

Chattahoochee crayfish (*Cambarus howardi*)

Although this species did not make the high priority list, it was considered to be of special concern during a recent status assessment of North American crayfishes (Taylor et al. 1996). It is not protected at the federal or state level. Appropriately named, this species is endemic to the Chattahoochee drainage of Georgia and Alabama. Since most of its range is in Georgia, the technical team considered conservation efforts in Georgia to be critical to the conservation of this species. Because its range occurs within one of the most rapidly growing portions of the state, urbanization is the primary threat to this stream-inhabiting species. High priority actions needed to conserve this species include 1) watershed-level protection efforts (e.g., stream buffers, best-management practices,

etc.) in the Chattahoochee basin, and 2) addition to the list of GA special concern animals so its occurrences can be tracked in the BCD.

High Priority Fish Species

Of the 140 fishes reviewed during the assessment, 74 met at least one of the criteria for inclusion on the high priority list. Our knowledge of distribution and status is much more complete for fishes compared to arthropods and mollusks, but the technical team still identified important survey needs for fishes. Here we have included three examples of high priority fish species and the actions necessary to conserve them.

Alabama shad (*Alosa alabamae*)

This species was considered vulnerable to imperilment during a recent range-wide assessment conducted by the American Fisheries Society (Warren et al. 2000). It is a candidate for federal protection and is protected by the state of Georgia as unusual. Historically, this anadromous species was known to exhibit enormous spawning migrations into the Mississippi River and Gulf Coast rivers east of the Mississippi. This species is known from the Apalachicola and Suwannee drainages of Georgia, but is only represented by two recent records (post 1990) in the GNHP database. Mettee et al. (1996) considered the population below Jim Woodruff Dam to be one of the largest remaining and the technical team considered conservation efforts in Georgia to be very important to the global conservation of this species. The biggest threat to the persistence of this species in Georgia is impoundments which block access to spawning habitat. High priority actions needed to conserve this species include: 1) inclusion in current efforts by TNC and USACE to improve fish passage at Jim Woodruff Lock and Dam, 2) surveys to determine the size of the Suwannee basin shad run, and 3) changing state protected status from unusual to threatened to reflect the current status of this species. Many technical team members felt that the unusual category may be confusing to the public and is more appropriate for different circumstances (e.g, when a common plant is listed to protect a rare species that is similar in appearance).

Coldwater darter (*Etheostoma ditrema*)

This darter species was considered threatened during a recent range-wide assessment conducted by the American Fisheries Society (Warren et al. 2000). It is not federally protected but is currently recognized as threatened by the state of Georgia. This species is endemic to the Upper Coosa River system in GA, Alabama, and southeastern Tennessee and the technical team considered Georgia to be critical to its global conservation. With the exception of a single record near the Alabama state line, all recent collections of Coldwater darters have been restricted to a small portion of the Conasauga Basin. This a spring-adapted species and is threatened by degradation of springs and small streams. High priority actions needed to conserve this species include 1) protection of springs, adjacent streams, and riparian habitats at all sites where this species is known to occur, 2) identification of additional populations through targeted surveys of springs, 3) monitoring of several populations, and 4) changing protected status from threatened to endangered to reflect the current status of this species.

Blackbanded sunfish (*Enneacanthus chaetodon*)

This species was considered vulnerable to imperilment during a recent status assessment of southeastern fishes (Warren et al. 2000). It is not federally protected but is protected as a rare species in Georgia. The blackbanded sunfish occurs in the Coastal Plain from New Jersey to Florida but is considered to be rare or declining throughout most of its range. This species known from about five highly-localized populations in Georgia, most of which have not been sampled recently. Threats to this species include small population size and degradation of the clear, vegetated aquatic habitats upon which it depends. High priority actions needed to protect this species include 1) survey of historic localities and additional sites that contain suitable habitat, 2) protection of the best populations, as determined during survey, and 3) reconsideration of its state protected status after completion of surveys.

High Priority Waters

Two-hundred and twelve high priority waters were identified as part of the CWCS process (Table 1). The majority (n = 172, 81%) of these waters are considered to be important to the conservation of at least one high priority species and 77 (36%) of them are important to three or more high priority species. Streams in the Coosa Basin were exceptional in terms of the number of high priority species they were important to. For example, the Conasauga River was considered the best site for 17 high priority species. A large number of high-priority waters (n =119, 56%) were designated because they were representative of an aquatic system and its associated community, but most (n =83, 70%) were important for high priority species as well. To emphasize the importance of watershed-level protection, we identified 960 of Georgia's 1964 (49%) HUC 12 watersheds that contained high priority waters.

High priority waters and their surrounding watersheds are a high priority for a broad array of conservation activities, which include at least one of the following: watershed-level protection efforts, restoration activities, reforestation of banks and riparian areas with native vegetation, exclusion of livestock, maintenance or restoration of natural flow and temperature regimes, protection of surrounding lands through conservation easements or land acquisition, and development of physical and biological monitoring programs. We plan to promote the protection and restoration of these waters by incorporating them into the environmental review process at the Georgia Natural Heritage Program and by making the list widely available to other stakeholders (e.g., Mitigation Bank Review Team, Georgia Department of Transportation, Natural Resources Conservation Service, etc.). The GADNR stream team is also considering the high priority waters list when selecting new IBI monitoring sites.

Its important to realize, however, that the high priority waters list is only a starting point to guide conservation efforts. Additional information on land cover, land use change, nearness to existing protected areas, water quality, location of impoundments and other factors should also be considered when defining conservation priorities. We also strongly emphasize that this list should not be used to justify the degradation of streams not designated high priority in this assessment. Foremost, many of these "non high-priority"

waters may be added to the list in the future as new information becomes available. Similarly, because of the inherent connectivity in aquatic and coastal ecosystems, degradation of one system may impact another.

Detailed justifications for the designation of these high priority waters along with stakeholder/expert reviewer comments on each waterbody are available in digital format from the Georgia Natural Heritage Program. GIS files containing mapped locations of all high priority waters and watersheds are also available from the Georgia Natural Heritage Program upon request.

Research and Survey Needs

Savannah River Mollusk Survey

Technical team members concluded that the Savannah drainage is the most under-sampled drainage for mollusks in the state of Georgia. Thirteen mussels and one snail included in the assessment lack current distributional data within this basin. Several of these species may warrant addition to the state protected list (e.g., Savannah lilliput, *Toxolasma pullus*) but their status cannot be properly evaluated until survey efforts are completed. Collection of Savannah River specimens for genetic studies may also shed light on the taxonomic status and conservation importance of other species of Georgia mollusks. Given the size of the basin and the complexity of sampling large rivers, this survey will require the resources of many agencies and personnel. Lora Zimmerman of USFWS Charleston is trying to identify funding sources to initiate the Savannah River mollusk survey and GNHP staff agreed to participate in the survey during summer 2005.

Tennessee Drainage Fish Survey

Fifty fishes included in the assessment occur or historically occurred in Georgia portions of the Tennessee drainage. Twenty of these species were specifically identified as having survey needs in the spreadsheet. Some of these species have not been observed in Georgia for decades (e.g., ashy darter, *Etheostoma cinereum*) and their re-discovery in the state would have global conservation significance. Other species, such as the flame chub (*Hemitremia flammea*) are known from only a few sites in the state and vulnerable to extirpation unless additional sites can be identified and protected. Finally, several stream systems in the TN drainage have received very little recent sampling (e.g. lower lookout Creek system, Cole City Creek system, Toccoa River downstream of Blue Ridge reservoir, etc.). Targeted surveys in these systems is expected to increase the number of occurrence records for a large number of GA Special Concern fishes. GNHP staff has already begun targeted surveys in the Tennessee drainage of NW Georgia and plan to continue this effort as time allows.

Host Fish Identification for Mussels

Freshwater mussels have a parasitic larval stage that requires a fish host to complete development. While some mussel larvae can transform on a variety of fish species, others can only transform on a single or limited number of fish species. Identifying fish hosts is critical to the conservation of Georgia's freshwater mussels. Such information will give us a more complete understanding of the mussels life cycle and may indicate why a

particular mussel species is declining (i.e., if the fish host is declining, then mussel populations are also expected to decline). In addition, identifying a suitable fish host(s) is a key step in developing propagation protocols for our most critically imperiled mussels that may have to be reintroduced. The technical team identified twenty-four mussel species whose host fish is unknown. GNHP is currently contracting with the Tennessee Aquarium Research Institute to identify the host fish of some of these species (e.g., Altamaha spiny mussel, *Elliptio spinosa*), but filling these information gaps for the other species will require additional funding.

High Priority Conservation Actions

Data Acquisition

The BCD is used extensively in environmental review and identification of high priority sites for conservation. This database was extremely valuable for completing the species assessment and will be an important tool to monitor the distribution of Georgia's rare aquatic species into the future. However, the database's utility for these tasks depends upon the continued incorporation of distributional data. Staff of GNHP initiated this effort by incorporating all of the DNR stream team records (through 2002) into the BCD. This resulted in over 900 new distributional records for GA special concern fishes. We consider the stream team sampling as a critical component of a monitoring program for rare fishes and we hope to incorporate their data into the BCD annually. We have also acquired a large data set for Coosa Basin Mollusks from the Tennessee Aquarium Research Institute and are currently preparing this data set for incorporation into the BCD. In another effort to acquire and facilitate incorporation of rare species data into the BCD, we have developed a protocol for electronic submission of large rare-species data sets. This protocol has been placed on our web site and is also included with all new scientific collection permits issued by the WRD special permit unit. In the future, we hope to establish a regular data exchange with the UGA Museum of Natural History. Their data is extremely valuable because most their records have been verified by taxonomic experts (e.g., Byron J. Freeman) or are backed up by museum specimens.

Monitoring Programs for Georgia's Aquatic Species

When adequate sampling data is available, the BCD will allow us to identify declining species by plotting distributional records over time. Thus, as part of our CWCS, we intend to plot distribution maps for all GA special concern species at regular intervals in the future (perhaps every 5 years). This is clearly an imperfect approach to monitoring given the haphazard manner in which the state is sampled, but is probably the best approach for monitoring the bulk of Georgia's rare aquatic species. Species that are already declining will require more specific monitoring programs. The Coosa Fish survey is a good example of an ongoing monitoring program for rare species that should receive high priority for future funding (Burkhead et al. 2001; Freeman et al. 2003). We also need to develop specific monitoring programs for other rare aquatic species: the technical team indicated that monitoring programs are needed for 44 aquatic arthropods and 52 mollusk species. In some cases, many of these species can be monitored simultaneously. For example, a single monitoring program could be established for the seven endemic mussels that occur in the Altamaha basin. The goals of this program

would be to: 1) detect population declines for species that are relatively common now (e.g., Altamaha pocketbook, *Lampsilis dolabraeformis*) and 2) inform management of mussels that are already critically imperiled (e.g., monitoring data could be used to prioritize reintroduction sites for the Altamaha spiny mussel, *Elliptio spinosa*).

Increasing Resources Available for Aquatic Conservation Efforts in Georgia

Coordinating the aquatic species assessment for the CWCS gave me a good appreciation for the enormity of the task that lies before us. Successful implementation of the CWCS will require continued collaboration with other state agencies, conservation organizations and academic institutions. Ultimately, however, the Nongame and Natural Heritage Section is primarily responsible for the conservation of aquatic species outlined in the CWCS. I am convinced that we have to devote more resources to aquatic conservation. There are only two people in the Nongame Wildlife & Natural Heritage Section that focus on the conservation of rare aquatic species. We are responsible for coordinating and implementing aquatic conservation efforts for over 300 hundred species distributed across the largest state east of the Mississippi. To put this into perspective, North Carolina (a smaller state with far fewer aquatic species) has 6 full-time personnel with aquatic expertise in their Nongame program. They also have a full-time aquatic biologist within their Natural Heritage Program.

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Table 1. List of Georgia’s 212 high priority waters. Streams that contained important populations of high priority aquatic species or are representative of an aquatic system and its associated community were designated high-priority. All riverine-tidal , estuarine, and state marine waters were also designated high priority to protect high priority coastal species.

<u>SiteID</u>	<u>SiteName</u>	<u>Drainage</u>	<u>ShortJustification</u>
1	Conasauga River	Coosa	High Priority Species AND Aquatic Community Stream
2	Sumac Creek	Coosa	High Priority Species AND Aquatic Community Stream
3	Sugar Creek	Coosa	High Priority Species AND Aquatic Community Stream
4	Mills Creek	Coosa	High Priority Species Stream
5	Holly Creek	Coosa	High Priority Species AND Aquatic Community Stream
6	Coosawattee River	Coosa	High Priority Species AND Aquatic Community Stream
7	Oostanaula River	Coosa	High Priority Species AND Aquatic Community Stream
8	Etowah River	Coosa	High Priority Species AND Aquatic Community Stream
9	Rock Creek	Coosa	High Priority Species Stream
12	Amicalola Creek	Coosa	High Priority Species AND Aquatic Community Stream
13	Shoal Creek	Coosa	High Priority Species AND Aquatic Community Stream
14	Shoal Creek	Coosa	High Priority Species AND Aquatic Community Stream
15	Sharp Mountain Creek	Coosa	High Priority Species AND Aquatic Community Stream
16	Long Swamp Creek	Coosa	High Priority Species AND Aquatic Community Stream
17	Tiger Creek	Tennessee	High Priority Species AND Aquatic Community Stream
18	East Chickamauga Creek	Tennessee	High Priority Species AND Aquatic Community Stream
19	West Chickamauga Creek	Tennessee	High Priority Species AND Aquatic Community Stream
21	Crawfish Creek	Tennessee	High Priority Species AND Aquatic Community Stream
22	South Chickamauga Creek	Tennessee	High Priority Species AND Aquatic Community Stream
23	Beach Creek	Coosa	High Priority Species AND Aquatic Community Stream
24	Little River	Coosa	High Priority Species AND Aquatic Community Stream
26	Tallapoosa River	Coosa	High Priority Species AND Aquatic Community Stream
27	Armuchee Creek	Coosa	High Priority Species AND Aquatic Community Stream
28	Altamaha River	Altamaha	High Priority Species AND Aquatic Community Stream
29	Little Tennessee River	Tennessee	High Priority Species AND Aquatic Community Stream
30	Coosawattee River	Coosa	High Priority Species AND Aquatic Community Stream
31	Oconee River	Altamaha	High Priority Species AND Aquatic Community Stream
32	Ohoopee River	Altamaha	High Priority Species AND Aquatic Community Stream
33	Ocmulgee River	Altamaha	High Priority Species AND Aquatic Community Stream
34	Ellijay River	Coosa	High Priority Species AND Aquatic Community Stream
35	Mountaintown Creek	Coosa	High Priority Species AND Aquatic Community Stream
36	Cartecay River	Coosa	High Priority Species AND Aquatic Community Stream
37	Chattooga River	Coosa	High Priority Species AND Aquatic Community Stream
38	Long Creek	Savannah	High Priority Species AND Aquatic Community Stream
41	Cane Creek	Coosa	High Priority Species AND Aquatic Community Stream
42	Little Armuchee Creek	Coosa	High Priority Species AND Aquatic Community Stream
43	Johns Creek	Coosa	High Priority Species AND Aquatic Community Stream
44	Heath Creek	Coosa	High Priority Species AND Aquatic Community Stream
45	Broad River	Savannah	High Priority Species AND Aquatic Community Stream
46	Savannah River	Savannah	High Priority Species AND Aquatic Community Stream
47	Lookout Creek	Tennessee	High Priority Species AND Aquatic Community Stream
48	Sawhatchee Creek	Apalachicola	High Priority Species Stream
49	Stamp Creek	Coosa	High Priority Species Stream
50	Little Tallapoosa River	Coosa	High Priority Species AND Aquatic Community Stream
51	Big Indian Creek	Coosa	High Priority Species AND Aquatic Community Stream
53	Ocmulgee River	Altamaha	High Priority Species AND Aquatic Community Stream

<u>SiteID</u>	<u>SiteName</u>	<u>Drainage</u>	<u>ShortJustification</u>
54	Toccoa River	Tennessee	High Priority Species AND Aquatic Community Stream
56	Cooleewahee Creek	Apalachicola	High Priority Species Stream
57	Flint River	Apalachicola	High Priority Species Stream
59	Smithwick Creek	Coosa	High Priority Species AND Aquatic Community Stream
60	Chickasawhatchee Creek	Apalachicola	High Priority Species Stream
61	Toccoa River	Tennessee	High Priority Species Stream
63	North Oconee River	Altamaha	High Priority Species AND Aquatic Community Stream
64	Brier Creek	Savannah	High Priority Species AND Aquatic Community Stream
65	Towaliga River	Altamaha	High Priority Species AND Aquatic Community Stream
67	Cedar Creek	Coosa	High Priority Species AND Aquatic Community Stream
68	Big Creek	Tennessee	High Priority Species AND Aquatic Community Stream
69	Jacks Creek	Altamaha	High Priority Species AND Aquatic Community Stream
70	Cooper Creek	Tennessee	High Priority Species AND Aquatic Community Stream
72	Brushy Creek	Savannah	High Priority Species AND Aquatic Community Stream
73	Sandy Run Creek	Savannah	High Priority Species AND Aquatic Community Stream
74	Reedy Creek	Savannah	High Priority Species AND Aquatic Community Stream
75	Boggy Gut Creek	Savannah	High Priority Species AND Aquatic Community Stream
76	Falling Creek	Altamaha	High Priority Species AND Aquatic Community Stream
77	Shoal Creek	Altamaha	High Priority Species AND Aquatic Community Stream
78	North Fork Wolf Creek	Altamaha	High Priority Species AND Aquatic Community Stream
79	Little Towaliga River	Altamaha	High Priority Species AND Aquatic Community Stream
80	Talking Rock Creek	Coosa	High Priority Species AND Aquatic Community Stream
82	Buck Creek	Altamaha	High Priority Species AND Aquatic Community Stream
83	Big Sandy Creek	Altamaha	High Priority Species AND Aquatic Community Stream
86	Lake Creek	Coosa	High Priority Species AND Aquatic Community Stream
88	Little River	Altamaha	High Priority Species AND Aquatic Community Stream
90	Ogeechee River	Ogeechee	High Priority Species AND Aquatic Community Stream
91	Whooping Creek	Apalachicola	High Priority Species AND Aquatic Community Stream
92	Auchumpkee Creek	Apalachicola	High Priority Species AND Aquatic Community Stream
93	Brittens Creek	Apalachicola	High Priority Species AND Aquatic Community Stream
94	West Armuchee Creek	Coosa	High Priority Species AND Aquatic Community Stream
95	Allison Creek	Tennessee	High Priority Species AND Aquatic Community Stream
96	Chattanooga Creek	Tennessee	High Priority Species AND Aquatic Community Stream
97	Dry Creek	Tennessee	High Priority Species AND Aquatic Community Stream
98	Mill Creek	Tennessee	High Priority Species AND Aquatic Community Stream
99	Oconee River	Altamaha	High Priority Species AND Aquatic Community Stream
100	Apalachee River	Altamaha	High Priority Species AND Aquatic Community Stream
101	Murder Creek	Altamaha	High Priority Species AND Aquatic Community Stream
102	Teloga Creek	Coosa	High Priority Species AND Aquatic Community Stream
103	Lazer Creek	Apalachicola	High Priority Species AND Aquatic Community Stream
104	Raccoon Creek	Coosa	High Priority Species AND Aquatic Community Stream
105	Williamson Swamp Creek	Ogeechee	High Priority Species AND Aquatic Community Stream
106	Wilscot Creek	Tennessee	High Priority Species Stream
107	Chattooga County Spring	Coosa	High Priority Species Stream
108	Cohutta Hatchery Spring	Coosa	High Priority Species Stream
109	Suwannee River	Suwanee	High Priority Species Stream
110	Swamp Creek	Coosa	High Priority Species Stream
111	Ochlockonee River	Ochlockonee	High Priority Species Stream

<u>SiteID</u>	<u>SiteName</u>	<u>Drainage</u>	<u>ShortJustification</u>
113	Cochrans Creek	Coosa	High Priority Species Stream
114	Brasstown Creek	Tennessee	High Priority Species Stream
116	Bluff Creek	Altamaha	High Priority Species Stream
118	Chestatee River	Apalachicola	High Priority Species Stream
119	Smith Creek	Apalachicola	High Priority Species Stream
120	Chattahoochee River	Apalachicola	High Priority Species Stream
121	Hannahatchee Creek	Apalachicola	High Priority Species Stream
122	Hodchodkee Creek	Apalachicola	High Priority Species Stream
124	Flint River	Apalachicola	High Priority Species Stream
126	Cold Spring	Apalachicola	High Priority Species Stream
127	Little Cedar Creek	Coosa	High Priority Species Stream
129	Dry Branch	Tennessee	High Priority Species Stream
130	Wauhatchie Branch	Tennessee	High Priority Species Stream
131	Cathead Creek	Coastal	High Priority Aquatic Community Stream
132	Penholloway Creek	Altamaha	High Priority Aquatic Community Stream
133	Doctors Creek	Altamaha	High Priority Aquatic Community Stream
134	Mushmelon Creek	Altamaha	High Priority Aquatic Community Stream
135	McBean Creek	Savannah	High Priority Aquatic Community Stream
136	Chattooga River	Savannah	High Priority Aquatic Community Stream
137	East Fork Little River	Coosa	High Priority Aquatic Community Stream
138	Duck Creek	Coosa	High Priority Aquatic Community Stream
139	Big Indian Creek	Altamaha	High Priority Aquatic Community Stream
140	South Prong Creek	Altamaha	High Priority Aquatic Community Stream
141	Swan Creek	Altamaha	High Priority Aquatic Community Stream
142	Copeland Creek	Altamaha	High Priority Aquatic Community Stream
143	Hillabahatchee Creek	Apalachicola	High Priority Aquatic Community Stream
144	Beaver Creek	Apalachicola	High Priority Aquatic Community Stream
145	Patsiliga Creek	Apalachicola	High Priority Aquatic Community Stream
146	Bear Creek	Apalachicola	High Priority Aquatic Community Stream
147	North Mosquito Creek	Apalachicola	High Priority Aquatic Community Stream
148	Little Armuchee Tributary 1	Coosa	High Priority Aquatic Community Stream
149	Little Armuchee Tributary 2	Coosa	High Priority Aquatic Community Stream
150	Hannah Branch	Ogeechee	High Priority Aquatic Community Stream
151	Black Branch	Tennessee	High Priority Aquatic Community Stream
152	Kirkland Creek	Apalachicola	High Priority Species Stream
153	Flint River	Apalachicola	High Priority Species Stream
154	Swift Creek	Apalachicola	High Priority Species Stream
155	Little Pennahatchee Creek	Apalachicola	High Priority Species Stream
156	Turkey Creek	Apalachicola	High Priority Species Stream
157	Whitewater Creek	Apalachicola	High Priority Species Stream
159	Muckalee Creek	Apalachicola	High Priority Species Stream
160	Kinchafoonee Creek	Apalachicola	High Priority Species Stream
161	Spring Creek	Apalachicola	High Priority Species Stream
162	Pine Log Creek	Coosa	High Priority Species Stream
163	Euharlee Creek	Coosa	High Priority Species Stream
164	Dykes Creek	Coosa	High Priority Species Stream
165	Spring Creek	Coosa	High Priority Species Stream
166	Walker Creek	Coosa	High Priority Species Stream
167	Withlacoochee River	Suwanee	High Priority Species Stream

<u>SiteID</u>	<u>SiteName</u>	<u>Drainage</u>	<u>ShortJustification</u>
168	Alapaha River	Suwanee	High Priority Species Stream
169	Little River	Suwanee	High Priority Species Stream
170	Alcovy River	Altamaha	High Priority Species Stream
172	Beech Creek Tributary	Coosa	High Priority Species Stream
173	Potato Creek	Apalachicola	High Priority Species Stream
174	Alapahoochee River	Suwanee	High Priority Species Stream
176	Murphy Hollow Creek	Tennessee	High Priority Species Stream
177	Wolf Creek	Apalachicola	High Priority Species Stream
178	Water Mill Creek	Coosa	High Priority Species Stream
179	Ichawaynochaway Creek	Apalachicola	High Priority Species Stream
180	Canoochee River	Ogeechee	High Priority Aquatic Community Stream
181	Crane Eater Creek	Coosa	High Priority Aquatic Community Stream
182	Crawfish Creek	Tennessee	High Priority Species Stream
183	Echeconnee Creek	Altamaha	High Priority Aquatic Community Stream
184	Gilliam Spring	Coosa	High Priority Aquatic Community Stream
185	Mulberry Creek	Apalachicola	High Priority Aquatic Community Stream
186	Pataula Creek	Apalachicola	High Priority Species Stream
187	Pigeon Creek	Apalachicola	High Priority Aquatic Community Stream
188	Satilla River	Satilla/St. Mary's	High Priority Aquatic Community Stream
189	St. Mary's River	Satilla/St. Mary's	High Priority Aquatic Community Stream
190	Woodward Creek	Coosa	High Priority Species Stream
191	Mill Creek	Coosa	High Priority Species AND Aquatic Community Stream
192	Betty Creek	Tennessee	High Priority Species AND Aquatic Community Stream
193	Alligator Creek	Altamaha	High Priority Aquatic Community Stream
194	Sugar Creek	Altamaha	High Priority Aquatic Community Stream
195	Little Ocmulgee River	Altamaha	High Priority Aquatic Community Stream
196	Owl Creek	Tennessee	High Priority Species Stream
197	Hiawassee River	Tennessee	High Priority Species Stream
198	Centralhatchee Creek	Apalachicola	High Priority Species Stream
200	Moccasin Creek	Savannah	High Priority Aquatic Community Stream
201	Town Creek	Apalachicola	High Priority Aquatic Community Stream
202	Swallow Creek	Tennessee	High Priority Species AND Aquatic Community Stream
203	Ochlockonee River Tributary	Ochlockonee	High Priority Species Stream
204	Little Chickamauga Creek	Tennessee	High Priority Species Stream
205	Dry Creek	Apalachicola	High Priority Species Stream
206	Abrams Creek	Apalachicola	High Priority Species Stream
207	Mill Creek	Apalachicola	High Priority Species Stream
208	Limestone Creek	Apalachicola	High Priority Species Stream
209	Beard's Creek	Altamaha	High Priority Aquatic Community Stream
210	Big Creek Tributary	Ochlockonee	High Priority Species Stream
211	West Fork Little River	Coosa	High Priority Aquatic Community Stream
215	Altamaha-Riverine Tidal	Altamaha	High Priority Coastal Species
216	Atlantic	Coastal	High Priority Coastal Species
217	Buffalo	Coastal	High Priority Coastal Species
218	Canoochee	Ogeechee	High Priority Coastal Species
219	Crescent/Sapelo/Julienton	Coastal	High Priority Coastal Species
220	Crooked	Coastal	High Priority Coastal Species
221	Cumberland/Brickhill/St. Andrews	Coastal	High Priority Coastal Species
222	Cumberland/Kings Bay/Crooked	Coastal	High Priority Coastal Species

<u>SiteID</u>	<u>SiteName</u>	<u>Drainage</u>	<u>ShortJustification</u>
223	Darien/North/Back/Carnigan	Coastal	High Priority Coastal Species
224	Doboy/Teakettle/Mud/Cabretta	Coastal	High Priority Coastal Species
225	Jointer/Brunswick/Turtle/Mackay	Coastal	High Priority Coastal Species
226	Little Ogeechee/Skidaway	Coastal	High Priority Coastal Species
227	Little Satilla	Coastal	High Priority Coastal Species
228	Mackay/Frederica/Hampton/Village	Coastal	High Priority Coastal Species
229	Medway/Jerico/Bear	Coastal	High Priority Coastal Species
230	N. Newport	Coastal	High Priority Coastal Species
231	Ogeechee	Ogeechee	High Priority Coastal Species
232	S. Newport/Barbour Is./Wahoo/Johnson S. Newport/Johnson/Walburg/Bear/Ogee	Coastal	High Priority Coastal Species
233	chee	Coastal	High Priority Coastal Species
234	Satilla	Satilla/St. Marys	High Priority Coastal Species
235	Savannah	Savannah	High Priority Coastal Species
236	St. Andrews/Jekyll/Brunswick	Coastal	High Priority Coastal Species
237	St. Marys	Satilla/St. Marys	High Priority Coastal Species
238	Turtle	Coastal	High Priority Coastal Species
239	Wassaw/Skidaway/Wilmington	Coastal	High Priority Coastal Species
240	White Oak	Satilla/St. Marys	High Priority Coastal Species
241	Wilmington/Bull/Tybee	Coastal	High Priority Coastal Species
242	Altamaha-Estuarine	Altamaha	High Priority Coastal Species

Plants Technical Team Report

**Prepared by Jim Allison, Tom Patrick, Mincey Moffett and Eric VanDeGenachte,
Team Leaders**

Technical Team Members

Marshall Adams, private consultant
Jim Allison, WRD
Loran Anderson, Florida State University
Wilson Baker, private consultant
Julie Ballenger, Columbus State University
Steve Bowling, private consultant
John Bozeman, WRD (retired)
Paul Brown, private consultant
Bill Buck, New York Botanical Garden
Jim Candler, Georgia Power Co.
Richard Carter, Valdosta State University
Jennifer Ceska, State Botanical Garden
Linda Chafin, Florida Natural Areas Inventory
Kathy Chapman, U.S. Fish & Wildlife Service
Paul Davidson, University of North Alabama
Carol Denhoff, Atlanta Botanical Garden
Brian Dickman, private consultant
Don Drapalik, Georgia Southern University
Willard Fell, Georgia Forestry Commission
George Folkerts, Auburn University
Chick Gaddy, private consultant
Laurie Gawin, The Nature Conservancy
Angus Gholson, private consultant
Judy Gordon, Augusta College
Tom Govus, private consultant
Dana Griffin, University of Florida
Richard Harris, New York Botanical Garden
Robert Haynes, University of Alabama
Dana Heil, Georgia Transmission Corporation
Malcolm Hodges, The Nature Conservancy
Phil Hyatt, U.S. Forest Service
Kay Kirkman, Joseph Jones Ecological Research Center
Robert Kral, Vanderbilt University (retired)
Ron Lance, private consultant
Richard LeBlond, North Carolina Natural Heritage Program
Bob McCartney, Woodlanders, Inc.
Ed McDowell, Georgia Native Plant Society
Allison McGee, The Nature Conservancy
Mincey Moffett, WRD

Wayne Morris, North Georgia College
Robert Naczi, Delaware State University
Carl Nordman, NatureServe
Mike Owsley, U.S. Department of Agriculture
Tom Patrick, WRD
Pete Pattavina, U.S. Fish & Wildlife Service
Rich Reaves, private consultant
Anton Reznicek, University of Michigan
Jimmy Rickard, U.S. Fish & Wildlife Service
Carol Schneier, Georgia Botanical Society
Phil Sheridan, Meadowview Biological Field Station
Frankie Snow, South Georgia College
Bruce Sorrie, private consultant
Ray Spencer, Natural Resources Conservation Service
Dena Thompson, Ft. Stewart
Eric VandeGenachte, WRD
Richard Ware, Georgia Botanical Society
Cindy Wentworth, U.S. Forest Service
Harriet Whipple, Georgia College and State University
Mark Whitney, WRD
Wendy Zomlefer, University of Georgia

Approach

Primary information sources for this assessment were the files of the Georgia Natural Heritage Program (GNHP), selected publications (especially volumes published to date of the *Flora of North America*) and some reliable Internet sources such as the NatureServe website (www.natureserve.org). Other information came from consultations with specialists in such large and difficult groups as sedges (*Carex* spp.) and panic grasses (*Panicum* and *Dichanthelium*).

A one-day team meeting was held at Macon State College on September 15, 2003, with 27 team members in attendance. The meeting included presentations on the CWCS effort and the Plant Technical Team's role as well as an overview of the Georgia Wildflower Preservation Act. Following a discussion of the assessment process, members in attendance were asked to submit their top list of criteria to be used in prioritizing the team's list of high priority species.

Phase I of the assessment process began with the development of a matrix, in the form of an Excel spreadsheet, that featured, as column headers, various ranking factors (e.g. abundance) and critical data needs (e.g. best sites) and a row down the left side with the names of all the plant taxa in the GNHP database that were designated at the time as "Tracked" or "Watched" by the GNHP. This initial list contained 996 species. The primary reason for developing an initial prioritized species list is the sheer number of plants to be considered. With over 2500 species of vascular plants native to Georgia and

more than 3,000 including nonvascular plants, the task of assessing conservation needs of the entire group could not be accomplished in any reasonable time frame.

The two team leaders then apportioned lead responsibility for developing the matrix entries to one leader or the other, according to the species' taxonomic orders, so that, for example, Tom Patrick would prepare the initial matrix for the lilies and their relatives and Jim Allison the sunflowers and their kin. Each of the team leaders took responsibility for 498 species.

It was felt that guidance on ranking criteria was needed early on from the larger technical team. The first technical team meeting was used to bring the members' knowledge and understanding to bear on narrowing the factors to be considered to the ones that a majority of the team would want to see emphasized. Many in attendance at the meeting provided their suggested priority ranking factors before leaving the meeting; others sent them by e-mail or letter. GNHP Data Manager Greg Krakow analyzed the poll results to indicate the ranking factors that best represented a consensus of the team's input. These were then utilized in a modified version of the original matrix, tailored to the input from the meeting.

The primary ranking factors identified by the team, and thus the fields emphasized in the modified spreadsheet, included:

- Range-wide (global) abundance
- Narrowness of range in the state
- Overall perceived species trends
- Degree of demonstrable threat
- Number of already protected occurrences
- Statewide abundance, and
- Importance of efforts in Georgia to overall status of the species.

During the subsequent months the two co-leaders made assessments of each taxon's conservation status with respect to each priority ranking factor. Use of these ranking factors allowed the narrowing of the original list of 996 species to an initial draft list of 317 species. This marked the end of Phase I of the assessment process.

Assessment Results

Following completion of Phase I of the assessment, Jim Allison left employment with Georgia DNR. James Mincy Moffett was hired in December 2004 to replace Mr. Allison, and he began working with Tom Patrick to refine the list of high priority species further, through literature and database searches and consultation with various experts on the larger technical team. At the same time, these two team leaders added information on habitats, range, conservation emphasis and threats for each of the identified high priority species. In February 2005 a final list of 323 high priority plant species was produced. This list is included in a separate appendix in this document. The team leaders continued

to gather information on the 323 vascular and nonvascular plants on this list and develop specific research, survey, and conservation recommendations for these species.

Examples of High Priority Habitats and Species

Blue Ridge Ecoregion

Rich mesic hardwood forests

These include a range of forest habitats, all hosting a diverse groundcover. These forests, particularly those over basic soils or cation-rich soils (e.g. serpentine, mafic, ultra-mafic), harbor a wide diversity of rare plant species. These habitats have been impacted by incompatible forestry practices, forest conversion, disease, invasive exotic species, and residential development. Protection from disturbance is vital to the health of these habitats and the rare species they support.

Persistent trillium (*Trillium persistens*)

[Legal Status: State Endangered, Federal Endangered]

The persistent trillium is restricted to extreme northeast Georgia and western South Carolina in the Tallulah-Tugaloo river system. In Georgia it occurs only in Tallulah Gorge and is associated with several rare plants including the Carolina hemlock (*Tsuga caroliniana*), monkeyface orchid (*Platanthera integrilabia*), Indian olive (*Nestronia umbellula*). It was only recently discovered and described (1971). Because it is not a particularly strong competitor, populations are threatened by disturbance that promotes invasive exotic species. Moreover, due to its showy nature, this species could become the focus of collection by irresponsible horticulturalists.

Piedmont Ecoregion

Granite outcrops

Georgia hosts almost 90% of the Piedmont granite outcrops. These habitats host unique microhabitats that are characterized by a granitic substrate with pockets of acidic, nutrient-poor mineral soil. Vernal pools, or solution pits, occurring on the outcrops host several high priority species that are severely restricted in their range. Specific threats to these habitats include destruction of proximate habitat or adjacent uplands from quarrying activities, recreational use (trail bicycles, ORV traffic, littering, vandalism, fire building, overuse for education), eutrophication resulting from conversion of habitat to pasture (cattle waste adds nutrients that favors the growth of competitive aquatic species), pollution (dumping of trash and airborne deposition), invasive exotic species, and shading due to tree growth. The highest priority for management is to preserve the habitat and to avoid disturbance.

Pool sprite or snorkelwort (*Amphianthus pusillus*)

[Legal Status: State Threatened, Federal Threatened]

The pool sprite is endemic to granite outcrops of the Piedmont ecoregion in Alabama, Georgia, and South Carolina. It is the only member of the *Amphianthus* genus. One

unique characteristic is that the small flowers can be found both among the submerged leaves and between the floating surface leaves. On outcrops, this species is restricted to the shallow flat-bottomed solution pits where rainwater collects. Because its microhabitat is naturally quite stable (very slow to undergo change), the pool sprite is not adapted to withstand any habitat modification. Much of its habitat has been destroyed by quarrying activities or degraded by livestock, vehicular traffic, and pollution.

Southeastern Plains Ecoregion

Fire-maintained wetlands

Some of the unique wetlands in this ecoregion include wet pine savannas, herb and shrub bogs. Wet savannas are often a matrix of an open tree canopy with high groundcover diversity, interspersed with bogs. Threats to these habitats are numerous, and include altered fire regimes, altered hydrology and water quality, conversion to agriculture and silviculture, invasive and exotic species, incompatible agriculture and silviculture practices, and development of roads, utilities, and houses. These threats often compound one another. For example, conversion results in fragmented landscape, which promotes altered fire regimes, which in turn facilitate increased invasive species such as oaks which leads to habitat degradation for priority species.

Purple honeycomb head (*Balduina atropurpurea*)

[Legal Status: State Rare, Federal Candidate]

The purple honeycomb head is found primarily in South Georgia and Florida. The genus is endemic to the southern United States. This species thrives in the wetter areas of peaty pitcherplant bogs and pine savannas and is particularly vulnerable to woody encroachment and hydrologic alteration. It is important to maintain an appropriate fire regime through controlled burning and to avoid drainage of the site (i.e. take special care in the placement of firebreaks near these habitats). Controlling the impacts of feral hogs is also important.

Southern Coastal Plain Ecoregion

Longleaf pine-scrub oak woodlands

These habitats occupy the drier portion of the moisture gradient. Drier habitats, such as sand ridges and scrub communities, host several rare plants. The largest threat to these habitats is altered fire regime. This includes fire exclusion, fire suppression, alteration of habitats through unnatural timing, frequency, or intensity of prescribed burns, and other incompatible fire management practices. The result of altered fire regimes includes a shift in species composition (of pines and oaks) and reduced diversity in the groundcover.

Hairy rattleweed (*Baptisia arachnifera*)

[Legal Status: State Endangered, Federal Endangered]

The hairy rattleweed is only found in two counties in Georgia. This rare endemic is found on sandy soils in open pine flatwoods and sometimes persists on intensively managed slash pine plantations and power line rights-of-way where invading woody plants are kept under control. Maintaining an open condition through prescribed burning

is essential to the viability of this species. Avoiding the drainage of the site is also imperative.

Southwestern Appalachians & Ridge and Valley Ecoregion

Limestone glades and barrens

These are open habitats dominated by graminoids and forbs, with scattered eastern redcedars and other trees. These habitats contain a large number of endemic plant species. Glades occur on thin, rocky soils, and are typically dominated by forbs while barrens are in areas with deeper soils and are dominated by grasses. Although the soil characteristics of remnant prairies retard rapid establishment by trees and shrubs, hardwood encroachment due to fire suppression must be managed.

Limerock arrow-wood (*Viburnum bracteatum*)

[Legal Status: State Endangered, Federal Candidate]

The limerock arrow-wood is a deciduous shrub, inhabiting calcareous, rocky bluffs is found in less than six populations in the world. Quarrying operations are one of the primary threats to the species. The only known population in Alabama was destroyed by quarrying and two of the three Georgia populations, including the largest known in the state, jeopardized by quarrying, despite being located on a state-protected preserve.

Conservation Actions And Research Priorities

Conduct statewide assessment of significantly rare natural communities

Assess the status, distribution, and description of significantly rare natural communities. Although there are coarse landcover analyses for Georgia, none have thoroughly assessed many of the rarer (fine-scale) natural community types. Few of these communities have been adequately described using the ecological framework developed by NatureServe. GIS coverages, descriptions of natural communities, assessments of threats and status, addition of community records into Biotics. GIS coverages, descriptions of natural communities, assessments of threats and status, addition of community records into Biotics, recommendations for their protection and stewardship.

Develop Element Occurrence Rank specifications

This is particularly important for species that are either endemic to, or primarily within Georgia (plants and animals). Define specifications for ranking the quality of individual element occurrences (i.e. "observation standards" per NatureServe). EORanks are much needed by the conservation community in order to prioritize conservation efforts. Numerous metrics (e.g. population size, distribution, reproductive modes, viability, etc.) would have to be field-assessed.

Develop protocols and procedures for safeguarding rare plants

It is imperative that the State serve a leadership role in guiding safeguarding efforts by the suite of private and public entities now are involved in propagating and out-planting rare plants. The state should work with partners to define biologically- and ecologically-justifiable standards and practices for appropriate safeguarding, as well as oversee and coordinate such activities in some circumstances.

Conduct surveys for nonvascular species

One of the groups of plants least understood are the nonvascular bryophytes (mosses, liverworts, hornworts). Little is known about bryophytes in the state including distribution, habitat requirements, and abundance data. It would be important to survey for their diversity, habitat specifics, for rare, threatened, special concern mosses and liverworts.

Assess conservation status of selected wetlands of Northwest Georgia

There are a variety of wetlands in northwest Georgia (e.g. sag ponds, fens, seeps, spring runs, calcareous flatwoods., etc.) that support several rare plant species and communities (e.g. *Platanthera integrilabia* and *Xyris tennesseensis*, etc.) that have neither been appropriately assessed nor received needed conservation attention. Little is known about the current distribution and abundance of target habitats in the state. It is important to survey known existing, historic, and probable locations for target habitats to assess conservation status. These communities are currently under increased threat due to residential and commercial development. It is important to generate fine-scale GIS coverages (maps), community records in Biotics, number, size and condition of target habitats including assessment of hydrology, plant communities, threats, conservation opportunities, and ownership, etc.

Assess conservation status of rare graminoids

Very little is understood for this complex group of plants that makes up a large component of our state's diversity (focus on *Rhynchospora* and *Panicum*). Based on the CWCS evaluation, it is clear that there are numerous globally rare (G1, G2) species in need current status surveys.

Promote markets for the use of native species

Identify native species that could be used in lieu of invasive species for purposes of controlling erosion, landscaping, gardening, etc. Important measures would include collating information and conducting research on the capacity of native species to satisfy these uses from an economic, horticultural, and production standpoint.

Restore mountain bog habitats

Restore mountain bog communities, augment or establish rare plant populations and work in conjunction with restoration efforts for the bog turtle. Mountain bogs have been historically neglected from a stewardship perspective resulting in the decline or disappearance of many signature species. Restoration of bog habitats would include reduction of woody cover, expansion of *Sphagnum* mats, establishment and augmentation of rare species populations, and restoration of natural hydrology.

Conduct surveys for species historically recorded in the State

Many globally rare species have not been historically recorded in the state, but not seen for 25 or more years and are in need of current status surveys. Consequently, it is imperative that surveys and herbarium work be conducted to assist in locating populations, documenting their abundance and condition, and begin collecting landowner information to initiate conservation measures.

Provide incentives to conserve imperiled plants and habitats

Landowners have responded resoundingly to the availability of incentives for conservation practices. There are incentives to help conserve imperiled habitats and species, but we do not have the resources to support a biologist whose primary purpose is to work with a targeted group of private landowners to find conservation incentives and protection alternatives for isolated populations of high priority species for which acquisition is not likely.