Georgia Aquatic Nuisance Species Management Plan

State of Georgia,

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Table of Contents

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List of Acronyms

ANS	Aquatic Nuisance Species
APHIS-PPQ	Animal and Plant Health Inspection Service – Plant Protection and Quarantine
CAES	University of Georgia College of Agricultural and Environmental Sciences
CDCP	Centers for Disease Control and Prevention
CRD	Georgia Department of Natural Resources – Coastal Resources Division
DPH	Georgia Department of Human Resources – Division of Public Health
EDDMaps	Early Detection and Distribution Maps
EPD	Georgia Department of Natural Resources – Environmental Protection Division
GADNR	Georgia Department of Natural Resources
GDOT	Georgia Department of Transportation
GGIA	Georgia Green Industry Association
GIS	Geographic Information System
GNPS	Georgia Native Plant Society
GWF	Georgia Wildlife Federation
ISSG	Invasive Species Specialists Group
MAREX	University of Georgia Marine Extension Service
NISC	National Invasive Species Council
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resource Conservation Service
OTA	Office of Technology Assessment

PRHSD	Georgia Department of Natural Resources – Parks, Recreation and Historic Sites Division
SARP	Southeast Aquatic Resources Partnership
SEAFWA	Southeastern Association of Fish and Wildlife Agencies
TNC	The Nature Conservancy
UGA	The University of Georgia
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WRD	Georgia Department of Natural Resources – Wildlife Resources Division

Executive Summary

Georgia is home to more than 12,000 miles of streams, more than 500,000 acres of reservoirs, 192 miles of coast, and 2,300 miles of tidal waterways. The variety of aquatic native species found in Georgia is in part a reflection of the wide range of aquatic habitats within the state. From the north Georgia mountains, to the low rolling hills of central Georgia, to the swampy lowland, marshes and barrier islands of the coast, the state's various ecosystems make Georgia the sixth most biologically diverse state in the Union. Additionally, Georgia ranks second in amphibian diversity, third in freshwater fish diversity, and seventh in vascular plant diversity. Existing along with all these native species, however, are many nonnative species that have been introduced into the state. While many of these species are relatively benign, a few of them cause significant negative impacts. Nonnative species that are harmful are defined as invasive, and those invasive species that threaten the diversity or abundance of native aquatic species, the ecological stability of infested waters, or the commercial, agricultural, aquacultural, or recreational activities dependent on such waters are defined as aquatic nuisance species (ANS).

In response to this ANS challenge, the Georgia Invasive Species Advisory Committee (Committee) developed the Georgia Aquatic Nuisance Species Management Plan to describe the nature and extent of this environmental problem, and propose specific management actions to minimize negative impacts. Given the tremendous scope and complexity of the ANS problem in Georgia, Committee members did not attempt to outline detailed management programs for various groups of ANS. Rather, they sought to develop a document that could serve as a framework to facilitate such critical efforts in the future by summarizing current activities and priorities relating to ANS management, identifying gaps in programs and authorities, and providing recommendations for future additions and enhancements. This Committee also developed a Georgia Invasive Species Strategy that will serve as the State's guiding document for management of terrestrial and aquatic invasive species control efforts in the coming years (GA DNR 2009). Georgia's ANS Management Plan is a stand-alone plan, but has been incorporated into the Georgia Invasive Species Strategy.

The Committee used information from existing reports and databases, from ANS lists in adjacent states, and from the knowledge and expertise of individual Committee members to identify ANS threats, Georgia's existing resources for dealing with ANS, and new tools and additional programs that are needed to respond to ANS problems. The Committee identified 101 aquatic nuisance species that currently exist in Georgia or have a high probability of being introduced into Georgia. This list includes 28 plant species, 52 animal species (mollusks, amphibians, and crustaceans) and 21 disease causing organisms.

The goal of this effort is to prevent and control the introduction of ANS into Georgia and minimize the further spread and impacts of existing ANS on native species, environmental quality, human health, and the economy.

There are eight objectives to meet the goal of preventing additional ANS and minimizing the spread and negative effects of existing ANS populations:

1. Coordinate local, state, regional, federal and international activities and programs pertaining to ANS
2. Control and manage the introduction and spread of ANS in Georgia through education and outreach
3. Prevent the establishment of ANS populations in Georgia through early detection and rapid response programs
4. Control or eradicate established ANS in Georgia through cooperative management activities designed to minimize impacts to non-target species
5. Monitor the distribution and impacts of ANS in Georgia
6. Identify and implement needed research on impacts and control of ANS in Georgia
7. Prevent the introduction and spread of ANS in Georgia through legislative and regulatory efforts
8. Secure adequate long-term funding for ANS programs in Georgia.

There are 38 actions to address these objectives. They include development of educational materials, the employment of a statewide invasive species coordinator, and development of a rapid response plan to control or eradicate priority ANS populations and coordinate responses with full partner participation.

The purpose of the Georgia Aquatic Nuisance Species Management Plan is to describe a method for coordinating all state ANS efforts through collaboration and full communication among agencies and organizations. Cooperation among the Committee members (drawn from 15 state entities, seven federal agencies, and 10 non-governmental organizations) was central to the development of this management plan, and will be critical to its execution.

The Committee supports the establishment of the Georgia Invasive Species Council. This interagency group will provide broad coordination and support for invasive species management and research programs. The Council will be composed of representatives

from all state agencies involved in invasive species management. Representatives of federal agencies and nongovernmental organizations with invasive species management authority or expertise will also be invited to participate as stakeholders. The Council will advise state agencies on prevention and control of invasive species, provide a forum for discussion of invasive species issues and policies, facilitate development of a coordinated network among state agencies to document, evaluate, and monitor the effects of invasive species, and prepare and release a biennial report detailing progress toward attainment of the goals and objectives outlined in this plan.

This plan was written to meet the requirements of Section 1204(a) of the Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990, and will be submitted by the Governor of Georgia to the National Aquatic Nuisance Species Task Force for their approval and acceptance. Approval of this plan will make the Georgia Department of Natural Resources eligible to receive USFWS Aquatic Invasive Species Program funding to implement the various actions described in this document.

Introduction

Nonnative species are plants and animals that have been introduced, either intentionally or accidentally, into areas outside their natural ranges. They are not a new phenomenon. From the very beginning of New World colonization, European plants and livestock were introduced into North America. By the 1650s, settlers had substantially altered the types of plants and animals found where they lived. A second wave of nonnative introductions began during the 19th century, when higher living standards, a new interest in horticultural novelties, and improved transportation resulted in increased importation of nonnative species (Pauly 1996).

Over the course of human history, over 50,000 nonnative species have been introduced into North America. Many of these species, such as wheat, rice, cattle, and poultry were introduced for food stock and now provide more than 98 percent of the U.S. food system valued at approximately $800 billion per year (Pimentel et al. 2005). Other species were introduced for landscape restoration, biological pest-control, sport, or pets. While many introductions have imparted significant benefits, over time, accidental or intentional dispersal of some nonnative species into new environments has resulted in negative impacts to the ecological stability of infested areas, or to commercial, agricultural, aquacultural, or recreational activities dependent on these areas. Therefore, it has become an official public goal in the U.S. to reduce the environmental and economic harm done by harmful, nonnative species.

An invasive species is defined as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Exec. Order No. 13112, 64 Fed. Reg. 6183-6186 (1999)). In the Executive Summary of the National Invasive Species Management Plan, the term invasive species is further clarified and defined as "a species that is nonnative to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (ISAC 2000). For a nonnative organism to be considered an invasive species in the policy context, the negative effects that the organism causes or is likely to cause must outweigh any beneficial effects it may have (*id*.). Aquatic nuisance species (ANS) are nonnative species that threaten the diversity or abundance of native aquatic species or the ecological stability of infested waters, or commercial, agricultural, aquacultural, or recreational activities dependent on such waters (16 U.S.C. §4702(1)).

In 1990, the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) was enacted by Congress to address ANS problems in the U.S. This legislation provided federal cost-share support for implementation of state ANS plans. While programs created by this national legislation were initially aimed at problems in the Great Lakes region, the reauthorization of NANPCA in 1996 as the National Invasive Species Act (NISA) (16 U.S.C §4701 *et seq*. 2006) established a national goal of preventing new ANS

introductions and limiting the dispersal of existing ANS in all of the states. NISA specifies that state ANS plans must identify feasible, cost-effective management practices and measures that can be implemented by the state to prevent and control ANS infestations in a manner that is environmentally sound.

In accordance with NISA, and in recognition of the complex natural resource management issues posed by ANS, the Georgia Aquatic Nuisance Species Management Plan identifies and characterizes the scope of this problem in the state, and lays out a coordinated set of actions towards these eight objectives:

1. Coordinate local, state, regional, federal and international activities and programs pertaining to ANS
2. Control and manage the introduction and spread of ANS in Georgia through education and outreach
3. Prevent the establishment of ANS populations in Georgia through early detection and rapid response programs
4. Control or eradicate established ANS in Georgia through cooperative management activities designed to minimize impacts to non-target species
5. Monitor the distribution and impacts of ANS in Georgia
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7. Prevent the introduction and spread of ANS in Georgia through legislative and regulatory efforts
8. Secure adequate long-term funding for ANS programs in Georgia

The purpose of the Georgia Aquatic Nuisance Species Management Plan is to describe a method for coordinating all state ANS efforts through collaboration and full communication among agencies and organizations with the goal of preventing the introduction of additional ANS into Georgia and to minimize the spread and impacts of existing ANS populations on native species, environmental quality, human health, and the economy. The Plan will improve the efficacy of field actions, and open the doors to funding opportunities for the proposed actions. The management plan focuses on species identified by the Committee that currently inhabit or could potentially inhabit aquatic environments in Georgia.

Due to the multifaceted nature of ANS issues, the Committee defined the problem by breaking it down by both pathway and species. Species were then prioritized based on the time and money agencies and organizations are currently spending on control and management efforts for each particular species. The ANS efforts and activities of federal and state agencies, regional groups, and nongovernmental organizations are

described as are current gaps in Georgia's authorities and programs for ANS. These gaps occur in the broad categories of coordination, education and outreach, early detection and rapid response, control and management, monitoring populations and habitats, research, regulations and enforcement, and funding. Management actions were detailed according to the eight objectives listed above, and summarized in an implementation table that details funding information for each objective through 2012 as well as identifying agency involvement and projected man hours devoted to each action under the objective. The plan concludes with a glossary, literature cited section, and appendices.

The draft ANS plan was made available for public review from July 1 to July 30, 2008, and one public meeting was held. As part of public review, copies of the ANS plan were available in electronic form on the Wildlife Resources Division, Georgia Department of Natural Resources (WRD – GADNR) website and were also distributed to interested groups and individuals.

Participants in the planning process included members from state and federal agencies, universities, trade associations, private industries, port authorities, non-governmental organizations, and research centers (Appendix F). The Committee, which met four times throughout 2007-2008 to help assemble this plan. Staff from GADNR led the planning process and Committee, assisted by the Carl Vinson Institute of Government, UGA. Funding for this effort came from GADNR and from a grant supplied by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration.

Overview of Aquatic Nuisance Species in Georgia

The introduction of nonnative species has a long history in Georgia. When the English first entered what is now North Carolina, South Carolina and Georgia, they found nonnative peach trees growing both in the wild and in Native American orchards. This is probably because Spanish or French colonists had introduced peaches into Florida in the sixteenth century. From there, Native Americans spread peaches northward where they eventually became naturalized (Crosby 2004). Over time, more nonnative species were introduced into the state. For example, Benjamin Franklin sent upland rice and Chinese tallow tree seeds to Georgia in 1772. While attempts were made to cultivate these rice grains, upland rice was not grown with any great success in Georgia until it was reintroduced by Thomas Jefferson twenty years later (Bell 1966).

The committee identified 71 aquatic species that have been introduced and are currently found in Georgia. Sixty-four percent are categorized as Priority 1(a) species, 19% are categorized as Priority 2(a) and 16% categorized as Priority 3(a)(See Appendix A for Priority definitions). The committee identified 31 aquatic species not currently found in Georgia that have a high probability of introduction and these were prioritized

according to threats in a Aquatic Species Watch List (Appendix A). The Committee focused most of its attention on the 71 species that it considered to be established and that pose the highest risk of causing harm.

The introduction of ANS poses a profound threat to the state's biodiversity. Georgia ranks sixth in the nation for overall biological diversity (4,004 species) and twelfth in the nation for number of endemic species (58 species). Nationally, Georgia ranks second in amphibian diversity (77 species), third in freshwater fish diversity (268 species), and seventh in vascular plant diversity (2,986 species). Unfortunately, Georgia also ranks eighth in the number of imperiled species (533 species), and fourth in number of known or suspected extinctions (24 species), due in part to the introduction and spread of invasive species (Stein et al. 2000).

While most introduced aquatic species pose little threat to the state's environment or economy, a few do constitute a significant risk. Many native species are declining due to the prevalence of one or more ANS in their range. ANS can inflict ecological harm directly and indirectly. Examples of direct effects include preying and feeding on native species, causing or carrying diseases, preventing native species from reproducing, out-competing native species for food, nutrients, light, nest sites or other vital resources, or hybridizing with native species so frequently that within a few generations, few if any genetically pure native individuals remain. Indirect effects occur when native populations decline because ANS decrease the abundance of a native species that serves as their food source (ISAC 2006).

In addition to environmental harm, ANS can have large economic impacts in areas where they have become established. While the economic costs of ANS in Georgia have not been adequately determined, control and management of such ANS as purple loosestrife, aquatic weeds, non-indigenous fish, zebra mussels, green crabs, and Asian clams have cost state and federal governments billions of dollars (Lovell et al. 2006). Costs can be incurred through the loss of economic output, such as reductions in aquaculture, fisheries, and tourism, and also through the direct cost of combating and mitigating the impacts of the species (e.g., clogged waterways) (Mack et al. 2000). Hydrilla, for example, blocks irrigation and drainage canals, enhances sedimentation in flood control reservoirs, interferes with public water supplies, impedes navigation, and generally restricts public water uses. At high densities, hydrilla also reduces productivity of recreational fisheries (U.S. Congress OTA 1993).

ANS can be found throughout the state in each of its five major ecoregions: the Southwestern Appalachians/Ridge and Valley, Blue Ridge, Piedmont, Southeastern Plains, and Southern Coastal Plain. In the Southwestern Appalachians/Ridge and Valley the red shiner is suspected of having a serious impact on the native blue shiner in the Coosa River system through competition and hybridization. Other ANS of concern in this region include the Asian clam and the zebra mussel. Japanese stilt grass is a concern in

the Blue Ridge and Piedmont ecoregions while hydrilla, Japanese climbing ferns and the Asian clam threaten habitats and species in the Southeastern Plains. Finally, the Southern Coastal Plain is facing significant negative impacts caused by flathead catfish, water hyacinth, alligatorweed, parrotfeather, giant reed, and the channeled apple snail (GADNR 2005).

Figure 1. Georgia's Waterways: Along with its coastal waters, Georgia is home to 12,000 miles of streams and over 500,000 acres of reservoirs.

Pathways of Introduction

Understanding the mechanism, or pathway, by which ANS enter the state is important in order to prevent or minimize additional introductions. Species are introduced to new environments, either unintentionally or deliberately. Accidental introductions arrive through pathways, such as shipping, boating, and ballast water. Intentional introductions occur through deliberate actions by humans. Many ANS arrived as unintended by-products of cultivation, commerce, tourism, or travel. Many more ANS were intentionally imported as ornamental plants, pets, or aquaculture species, which later escaped. A number of ANS were imported and released for fishing. Some fish are imported intentionally to enhance sport fisheries; others are illegally released by

aquarium dealers or owners or escape from aquaculture facilities. Mollusks and other invertebrates usually hitchhike with plants, commercial shipments, baggage, household goods, ships' ballast water, or aquarium and aquaculture shipments (U.S. Congress OTA 1993). Many ANS have more than one pathway of introduction. For example, red swamp crayfish are farmed as food in Georgia may have escaped or been unintentionally released from aquaculture ponds, and are also used as bait and may have been accidentally released by anglers. In addition, there are ANS whose pathway into the state is unknown. The USGS estimates 29 species or 22.5 percent of the nonnative aquatic species in Georgia have unknown introduction pathways (USGS 2008). Several of these species may be nuisance species or may become so in the future.

Unintentional Introductions

Shipping: Ballast-water transport and hull fouling transfers by commercial ships are primary mechanisms for aquatic introductions. It is thought that the majority of nonnative marine species in Georgia were introduced through this pathway (Power et al. 2008). Georgia has a major deepwater port in both Savannah and Brunswick. Savannah is now the second busiest container port on the East Coast and the fourth busiest in the nation. More than 2,680 ships and 19.5 million tons of cargo passed through the Port of Savannah during the 2007 fiscal year. That amounts to a 10.6 percent increase in cargo volume since 2000.The combined value of imports and exports to Georgia passing through the Ports of Savannah and Brunswick and the Hartsfield-Jackson International Airport exceeded $82 billion in 2007. International trade also supports some 115,000 Georgia jobs (Southerland 2007).

The primary mechanism whereby ANS can enter state waters through shipping is by the discharge of ballast water from ships. Ballast water is pumped into a ship's hull to keep it stabilized and upright. This water is sometimes discharged at the receiving port when the cargo is being loaded or unloaded. Each ship may take on and discharge millions of gallons of water. Ballast water taken on in any port may include an abundance of live aquatic plants, animals, and pathogens not native to Georgia. The majority of trade in the Port of Savannah occurs with Asian countries and many ships last port of call before entering state waters is in Central/South America. Nonindigenous species introduced from outside the U.S. to the South Atlantic Bight (i.e., the ports of Wilmington, N.C. to Jacksonville, FL), in order of importance, are native to: Asia, Central and South America, Africa and Europe. In 2004, Savannah received the second largest volume of reported untreated ballast water in the nation at 44,618 metric tons (mt). Discharged foreign ballast water originated from Venezuela (21,546 mt), Australia, South Korea, Panama, Italy, and Brazil (140 mt each) (Power et al. 2006). Ballast water has been implicated in the introduction of several ANS to coastal Georgia including green mussels, charrua mussels, and the green porcelain crab (Powers et al. 2008).With

current projects underway to dredge and expand the Brunswick and Savannah ports, monitoring these areas for new introductions is increasingly important.

In 2004, the U.S. Coast Guard initiated mandatory ballast management for all ships entering U.S. waters from outside the Exclusive Economic Zone of the U.S. (33 C.F.R. 151) and has developed and enforces a nationwide Ballast Water Management Program. A number of provisions in that program allow the discharge of untreated ballast water under certain circumstances, and ballast water discharge continues to be of particular concern at the ports. There is, however, no legal authority for state officers to board and inspect vessels.

In addition to ballast water discharge, another important source for the introduction of nonnative aquatic species is the organic fouling community that grows on the hull, rudder, propellers, anchor, anchor chain or any other submerged structure of vessels that are not properly cleaned or maintained. In the past, such fouling communities were composed of massive layers of a variety of organisms, both attached and merely entwined with or living on that growth. Although such extensive growth is not as common on seagoing vessels in recent times, it still provides an opportunity for worldwide transport of fouling organisms, particularly on towed barges and other structures like mothballed ships and exploratory drilling platforms. Nonnative marine organisms that have been associated with hull fouling in Georgia are mainly from Pacific areas and are associated with invertebrate fouling communities on hard artificial substrates. These species include an isopod (Synidotea laticauda), the titan acorn barnacle, and the Australian tubeworm (Powers et al. 2008).

Hitchhikers (boating): Recreational boating is another pathway by which invasive species can both enter the state and continue to spread throughout Georgia's 12,000 miles of warm water streams and over 500,000 acres of reservoirs. The state's lakes, ponds, rivers, and coastal waters provide abundant recreational opportunities for boaters. According to the National Marine Manufacturers Association, in 2005, Georgia ranked 14th nationwide for the total number of registered boats and 31st in the number of registered boats per capita (NMMA 2006). Recreational boating is good for Georgia's economy, contributing approximately 18.1 million dollars in economic activity. The transportation of boats and boat trailers between water bodies presents a risk of nonnative aquatic species introduction through hull fouling, entanglements, and water discharge from bilge pumps and bait buckets. By not thoroughly washing or rinsing boats and boat trailers, boaters can easily transport aquatic species from one water body to another. These species can be spread when outboard motor propellers fragment vegetation. The use of recreational boats for fishing poses the additional risk of the release of imported bait species or species that serve as hosts for nonnative organisms. The green mussel is an example of an aquatic species that entered the state through this pathway (Rahn et al. 2007).

Accidental Introductions

Bait release: The transport and release of live bait by anglers may pose an invasive species risk. When live bait or the bait's packing material is discarded into a water body, ANS may inadvertently be introduced into that water body. By lodging in nets and other equipment used to harvest baitfish, ANS can unintentionally be transported into non-infested waters. Some ANS can survive up to two weeks out of water and remain viable when discharged into another water body. Fragments of ANS, such as hydrilla or Eurasian water milfoil, can be harvested along with target baitfish species. In addition, bait is often imported from outside the state or is brought into Georgia by out-of-state residents (Rahn et al. 2007). In 2006, nearly 140,000 anglers came to Georgia, many bringing with them bait that could be contaminated with nonnative plants and animals, associated diseases, and parasites (USFWS 2007). The red swamp crayfish and Asian clams were likely introduced into Georgia through bait release (Rahn et al. 2007).

Intentional Introductions

Stocking: Most federal and state government fish and wildlife agencies routinely stock game fish for recreational purposes. While many of the fish species being stocked in the state today are nonnative (i.e. rainbow trout), none are considered invasive in Georgia. Care must be taken to insure that water used to transport fish are not contaminated with invasive plants, invertebrates, or viruses. Fish stocking by unqualified individuals increases the chance of biological contamination, especially as these individuals are less likely to adhere to regulations and standards regarding transport methods and equipment. Unauthorized fish stocking can also result in the introduction of native or nonnative fish species into areas of the state where they are not native.

Aquarium release: The majority of plant and animal species sold in aquarium and pet stores are nonnative. Aquarium species are large and usually traded as adults, which, if released, have a greater probability of surviving and reproducing in their new environment. Many nonnative species including apple snails and Brazilian elodea were introduced to Georgia through aquarium release (Rahn et al. 2007 and Personal Communication, Woodward 2009). Releases usually occur when an aquarium or pet owner no longer wishes to care for his animal. The owner may release the pet into a water body, storm drain, or sewer system. Releases can also occur through escape from tanks and breeding farms (e.g., during storms), the drainage of water containing organisms from tanks or public aquariums, and the ritualistic release of species during religious practices. All of these activities can also release water-borne parasites and diseases (*id*.).

Aquaculture: Georgia has a diverse aquaculture industry. In 2005, there were 79 private aquaculture farms in Georgia with combined sales of $7.5 million. Food fish were grown by 66 farms, 11 farms grew sport fish, five farms grew baitfish, nine farms grew

ornamental fish, two grew crustaceans, and six grew miscellaneous species, including mollusks (clams). Farmed food fish species include trout, catfish, and tilapia. Farmed sport fish species include largemouth bass, crappie, and sunfish. Baitfish species include fathead minnows, golden shiners, and feeder goldfish. There are also a few fish farms in Georgia that sell ornamental fish, freshwater prawns, clams, and frogs (USDA 2006). While many of these species are native to Georgia and provide tremendous economic benefit, those that are invasive species would pose a threat to native species if they escaped cultivation and become established.

To curb deliberate stocking of ponds and reservoirs with invasive fish species, the state has made it illegal to "possess, import, transport, transfer or sell or purchase" most nonnative fish species without a wild animal license issued by GADNR (O.C.G.A. §27-5-4).

Water garden nurseries: Water gardening is one of the fastest growing sectors of the gardening and nursery industry. However, many ANS, such as water hyacinth, salvinia, Eurasian watermilfoil, hydrilla, and Brazilian elodea have been or are being widely sold to decorate water gardens and oxygenate aquariums or backyard ornamental ponds. ANS are released or travel through this pathway into local waterways, storm drains or sewer systems. ANS released through water gardening activities include alligatorweed, water hyacinth, and purple loosestrife (Rahn et al. 2007).

Aquatic Nuisance Species in Georgia

The Committee developed a list of 102 species of ANS that are of concern to the agencies and organizations that work on ANS management issues in Georgia. These species were prioritized based on actual or perceived threat as well as the amount of time, and money a participating agency or organization currently devotes to management of the species. The Committee also developed a Watch List of ANS that may result in future threats in Georgia based on occurrence and impacts in other states (See Appendix A for complete list of species). Descriptions of selected species from all three priorities and the Watch List are provided in Appendix B. It is recommended that the Georgia Invasive Species Council determine such priorities, and develop appropriate response plans for the highest ranking species.

Framework for ANS Management in Georgia

Federal ANS Management Efforts in Georgia

The growing challenges posed by ANS and the role of the federal government in coordination and regulation of activities that span state or international borders have prompted Congress to authorize a number of specific actions concerning ANS

management. While no single federal agency has authority over all aspects of ANS management, many agencies have programs and responsibilities that address aspects of the problem, such as importation, interstate transport, prevention, exclusion, control, and eradication.

U.S. Army Corps of Engineers (Corps): The Corps' Engineering Research and Development Center (ERDC) operates an active Aquatic Nuisance Species Research Program with the goal of minimizing adverse impacts and maximizing control opportunities with respect to ANS. The ERDC also has an Aquatic Plant Control Research Program, which is the Nation's only federally authorized research program directed to develop technology for the management of nonnative aquatic plant species. The Corps interacts with the public by posting educational signs at public access points (e.g., boat ramps) warning boaters to check for aquatic hitchhikers. It uses a variety of outreach tools, including displays, publications, workshops, promotional items, education programs and websites to reach target audiences. In Georgia, the Corps' involvement in ANS management is primarily related to the occurrence of nuisance populations of aquatic plants in Corps-operated navigation and multi-purpose reservoir projects. The Corps has an Aquatic Plant Management Plan for the Savannah River projects, and is also implementing a Hydrilla Action Plan in Lake Seminole. The Action Plan management objectives include: (1) control of hydrilla at the priority hydrilla management areas; (2) reduction of hydrilla-dominated aquatic vegetation to less than 40% surface coverage and; (3) significantly enhanced restoration of mixed native aquatic plant communities on the lake. The Corps is also in the process of developing a comprehensive management plan to address hydrilla management issues on Walter F. George Reservoir. The plan will delineate existing vegetation levels; develop an estimate for reasonable spread of aquatic plants within the lake based on reservoir/water conditions and plant biology; identify management objectives; evaluate management options and resource impacts; describe an implementation strategy, and define what plants will be monitored.

U.S.Department of Agriculture (USDA) – Animal and Plant Health Inspection Service - Plant Protection & Quarantine (APHIS PPQ): APHIS-PPQ safeguards agriculture and natural resources from risks associated with the entry, establishment, and spread of animal and plant pests and noxious weeds. APHIS-PPQ has a broad, active program of ANS detection in Georgia, including cooperative agreements with several state agencies. The Pest Detection Program identifies the top foreign insects, diseases and plants that pose a high-risk to agriculture and natural communities of Georgia. The program sets traps, inspects materials that would provide an entry pathway, and develops outreach information for the public regarding identification of exotic pests and how to report any suspects to state or USDA personnel. APHIS-PPQ has a Plant Inspection Station at the Hartsfield-Jackson International Airport which identifies ANS found in cargo and passenger baggage. APHIS-PPQ personnel at the cargo container

port in Savannah inspect agricultural products for ANS and monitor traps around the port environs for earliest possible detection of new species. APHIS-PPQ also develops and implements response plans, along with state cooperators, for eradicating, controlling or managing new ANS when they are discovered. Its Smuggling Interdiction & Trade Compliance group in Georgia and 10 other Southeast Central States has a mission to monitor the market place (e.g., ethnic food markets) for harmful, prohibited products.

U.S. Department of Commerce - National Oceanic and Atmospheric Administration (NOAA): NOAA funds research, education and outreach, and control activities on ANS issues primarily through the National Sea Grant Program, with some activities funded through the National Ocean Service and National Marine Fisheries Service. Its ANS management efforts focus on marine systems and the Great Lakes. Research efforts include monitoring the impacts of ANS on coastal and other ecosystems, developing control and mitigation options, and preventing new introductions by, among other things, developing new technologies for ballast water management. NOAA performs economic evaluations of the costs of ANS and conducts control programs to eradicate and prevent their spread. NOAA also has regulatory authority to prevent the introduction of ANS that may affect marine sanctuaries, such as the Gray's Reef National Marine Sanctuary; endangered or threatened species; coastal areas; and essential fish habitats.

U.S. Department of Homeland Security– U.S. Coast Guard: The Coast Guard is a military, maritime service within the Department of Homeland Security and one of the nation's five armed services. Its core roles are to protect the public, the environment, and U.S. economic and security interests in any maritime region in which those interests may be at risk, including international waters and America's coasts, ports, and inland waterways. One of the Coast Guard's responsibilities is the development and implementation of a ballast water management program designed to minimize the likelihood of ANS introduction into the U.S. through the ballast water of long-distance ocean vessels. This program applies to all vessels equipped with ballast water tanks that operate in U.S. waters and are bound for ports or places in the U.S. Regulations promulgated under the program require mandatory ballast water management practices for all vessels that operate in U.S. waters; establish additional practices for vessels entering U.S. waters after operating beyond the Exclusive Economic Zone (waters 200 miles from shore); and require the reporting and recordkeeping of ballasting operations by all vessels.

U.S. Department of the Interior – U. S. Fish and Wildlife Service (USFWS) and USFWS Region 4: The USFWS is responsible for preventing introductions of potentially harmful species, including ANS, on land and in waters under the Department of Interior's jurisdiction. This agency also acts as the administrative staff for the national ANS Task

Force and manages the ANS Program originally designed by the Task Force. The USFWS Region 4 employs an ANS coordinator who is based in Georgia and deals with invasive species issues. The USFWS is working with the State of Georgia and the National Park Service to reduce the threat of Asian Swamp eels in the Chattahoochee River. In addition, its Partners and Partnerships, including the National Fish Habitat Action Plan, for Fish and Wildlife Program provides funds for private landowners to manage invasive species, primarily plants, on their property. Specific projects involving ANS have focused on research on red shiner/blue shiner interactions. The USFWS also created grant agreements with The Nature Conservancy regarding aquatic nuisance plant control in the Altamaha basin, and funded research to increase understanding of ANS competition pressures on native fish populations. In order to increase public awareness of ANS, the Service's Regional Aquatic Nuisance Species Coordinators have developed informational websites, conducted workshops, and created outreach materials for national distribution, including traveling displays, exhibits, pamphlets, ANS identification cards, fact sheets, and videos.

U.S. Department of the Interior – National Park Service (NPS): The NPS has a program to control and eradicate ANS in lands and waters within NPS boundaries. The NPS cooperates with partners to respond to newly detected ANS. In some instances, local park staff and partners will actively respond to newly detected ANS and work to restore invaded areas to natural communities, depending on funding and authority. Public education and outreach varies depending on local park units. The agency also maintains a number of websites related to invasive species, particularly terrestrial plants, and works with partners to compile, manage, and distribute data on specific occurrences of ANS.

Regional ANS Management Efforts in Georgia

Gulf and South Atlantic Regional Panel on Aquatic Invasive Species: The Gulf and South Atlantic Regional Panel on Aquatic Invasive Species was established in accordance with a recommendation in NISA. The Regional Panel has been tasked with the following: identify priorities for the region with respect to ANS; make recommendations to the National Aquatic Nuisance Species Task Force regarding programs to address ANS; assist the Task Force in coordinating federal ANS program activities in the respective regions; coordinate, where possible, ANS program activities in the respective regions that are not conducted pursuant to NISA; provide advice to public and private individuals and entities concerning methods of controlling ANS; and submit an annual report to the Task Force describing activities within the respective regions related to ANS prevention, research, and control. Currently, Georgia holds a seat on the panel and contributes to planning, research and recommendations for combating aquatic nuisance species in the region.

Southeast Aquatic Resources Partnership (SARP): SARP was initiated in 2001 to address the many issues related to the management of aquatic resources in the Southeast. The partnership was formed in recognition of the fact that individually, members lack sufficient resources to effectively meet the aquatic resource management and conservation challenges that exist throughout the Southeast. The intent of SARP is to develop state and federal partnerships that will extend beyond the traditional boundaries of fishery resource management agencies and will shift the focus beyond what are individual federal and state responsibilities to what are joint responsibilities to the resource. SARP is made up of representatives from 14 southeastern states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia) as well as the USFWS, the National Marine Fisheries Service, the Gulf States Marine Fisheries Commission, and the Gulf and South Atlantic Fishery Management councils. SARP focuses on six key issue areas of greatest concern and interest to the Southeast including: public use; fishery mitigation; imperiled fish and aquatic species recovery; inter-jurisdictional fisheries; aquatic habitat conservation; and ANS. These entities have signed a Memorandum of Understanding pledging to work together for the conservation and management of aquatic resources in the Southeast. In addition, all Southeastern Association of Fish and Wildlife Agencies, states and non-governmental organizations, grassroots groups, industry, business, and private sector interests are invited to participate in SARP.

Southeastern Association of Fish & Wildlife Agencies (SEAFWA): The SEAFWA is an organization of state agencies with primary responsibility for management and protection of the fish and wildlife resources in 16 states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia), Puerto Rico, and the U.S. Virgin Islands. Among other activities, SEAFWA maintains a variety of committees including an ANS Committee, consisting of fish and wildlife professionals who explore and analyze a wide range of issues and factors affecting fish and wildlife resources and make recommendations as appropriate.

State ANS Management Efforts in Georgia

Georgia has a number of programs, agencies, and organizations that address both established and potential ANS, and combine education, regulation, prevention, detection, and control actions as the needed basis for managing all ANS.

Georgia Department of Agriculture - Plant Protection Division (GDA-PPD): The GDA-PPD conducts over 8,000 inspections of plant growers and plant retail centers each year with a portion of each inspection devoted to exotic pest detection. Eight hundred insect and plant disease samples are collected and submitted for identification. GDA-PPD personnel work with plant nurseries to keep their production premises free from

federal noxious weeds. Additionally, The GDA-PPD participates in the Cooperative Agriculture Pest Survey program for detection of harmful agriculture pests.

Georgia Department of Human Resources: Division of Public Health (DPH): The DPH's Zoonotic Disease Team works with mosquito control agencies to reduce the impact of some vector-borne diseases through proper mosquito control measures. Mosquito surveillance is performed in July-October for arboviral disease testing purposes. Because mosquitoes are identified by species, the Division is able to document the presence of invasive mosquito species in the state. Educational efforts are focused at reducing the breeding sites of *Aedes albopictus*, an invasive mosquito species that is a very aggressive biter and has been implicated in arboviral disease transmission. The DPH also keeps a database of mosquito species that have been tested for arboviral diseases through its West Nile Virus surveillance program.

Georgia Department of Natural Resources: Coastal Resources Division (CRD): The CRD manages Georgia's coastal natural resources. The CRD partners with scientists and resource managers to determine the level of potential risks and impacts that introduced ANS could have on coastal natural resources. The CRD's Coastal Management Program has funded a survey of Georgia's ports for ANS, and is currently funding an education and outreach campaign for ANS found in the port areas. The CRD also funds mapping and distribution of ANS in the ports. Because the impact of known ANS has not been determined in coastal waters, the CRD is currently funding assessments of introduced ANS along the coast. The CRD also funds boater education to prevent the transportation of ANS as well as educational brochures targeting ANS distribution.

Georgia Department of Natural Resources: Environmental Protection Division (EPD): The Watershed Protection Branch of the EPD works indirectly with ANS. Guidance developed or policies used by EPD incorporate information regarding the use of native plant species for re-vegetating land disturbances, stream buffers, stream restorations, and general erosion prevention/treatment. The removal of ANS is encouraged as a means of restoration and/or preservation. The EPD is currently promoting education and outreach regarding ANS identification and removal, and also publishes guidance documents regarding land disturbance and mitigation. The Coastal Adopt-A-Wetland program includes outreach on ANS. They also have a series of posters that are distributed throughout the Georgia coastline which ask people to report occurrences of ANS.

Georgia Department of Natural Resources: Parks, Recreation and Historic Sites Division (PRHSD): The PRHSD initiated an invasive species program in 2005, originally funded by federal grants. Five state priority sites were identified and a five-year management plan was developed for each site. Focal species could be any of Georgia's invasive species, including ANS. In addition to the five identified priority sites, the PRHSD is also working at

a number of other sites that have ongoing aquatic nuisance plant species control work but do not require the intensive professional management of the five priority sites. PRHSD staff has received aquatic nuisance plant species identification training and is the PRHSD's primary source of detection. A staff forester, parks biologist and division resource manager are assigned to manage each park and historic site and are knowledgeable about the ANS issues at each site. The Georgia Botanical Society, Georgia Exotic Pest Plant Council, and other groups participate as volunteers and visitors who provide the PRHSD with updated information about ANS threats. In addition, the PRHSD operates a number of restoration projects, including natural bog community and river corridor restoration.

Georgia Department of Natural Resources: Wildlife Resources Division (WRD): The WRD is charged with acting on ANS threats and also enforces state and federal laws regulating wildlife, boating and littering on behalf of the state's wildlife and citizens. Specifically, the WRD enforces regulations concerning aquaculture; wild animal licensing; general protection of wildlife and wildlife habitat; the liberation of wildlife (i.e., release and escape from captivity); transportation of trout; and wild animal auctions. The WRD currently monitors, inventories, and tracks the spread of aquatic nuisance species. Among other activities, the WRD conducts assessments of flathead catfish and channeled apple snails. The WRD also undertakes control and management activities involving flathead catfish in Southeast Georgia, funded a risk assessment for tilapia and has established control management activities on feral hogs on Ossabaw Island. After receiving an ANS outreach grant from USFWS in 2004, Division staff developed a freestanding display, brochures, and other materials highlighting ANS. In addition, Division staff members participate in numerous outreach efforts related to ANS, including presentations at conferences, workshops, outdoor festivals, and trade shows with the goal to educate the public about the dangers of ANS and to prevent their release into the environment. WRD biologists also work with the Georgia Native Plant Society, the Georgia Wildlife Federation, and other groups to promote landscaping with native plants, providing information on native plant nurseries and other sources of native plant materials. The WRD is a member of the Gulf and South Atlantic Regional Aquatic Nuisance Species Panel, and also actively participates in the Southeast Aquatic Resources Partnership and the SAFWA.

Georgia Department of Transportation - Office of Environment and Location (GDOT): GDOT ecologists, landscape architects, maintenance crews and construction personnel survey for aquatic nuisance plant species on all construction projects from the Coastal Plain to the Appalachian Mountains. The survey reports are catalogued and are reviewed by the Federal Highway Administration, USFWS and WRD. In situations where protected plant species are in proximity to project corridors, special provisions are used to target specific aquatic nuisance plant species with herbicide. Construction vehicles and equipment are required to be inspected for aquatic nuisance plant

species and removal of species must occur before vehicles and equipment are transferred between project locations. GDOT is preparing to work with the UGA Bugwood Network and the Georgia Exotic Pest Plant Council by contributing GPS data on the location of aquatic nuisance plant species throughout the state. GDOT owns and operates over 30,000 acres of stream and wetland mitigation banks in which restoration and preservation activities are conducted. These mitigation sites are monitored for plant success, species composition and water table fluctuations. Additionally, GDOT reports any hydrilla sightings to the WRD.

UGA – Center for Invasive Species and Ecosystem Health (Center): The Center was established at UGA in order to address issues on invasive species and ecosystem (agricultural, forested and natural system) health. The Center evolved from the Bugwood Network, a project that developed through faculty cooperation between the College of Agricultural and Environmental Sciences and the Warnell School of Forestry and Natural Resources at the University. The Center's goals include: becoming a preeminent national and international public service and outreach center; developing collaboration between UGA and state, university, federal and international partners; integrating and developing information and programs; serving as a clearing house for information, applied research and training; and promoting public awareness, education and applied research. The Center is currently developing and administering 20 educational web systems, seeking and archiving digital images in four topic-based web systems to support educational activities, managing the Georgia Cooperative Agricultural Pest Survey Program, developing policy and protocols for early detection and rapid response of invasive species, developing and administrating the Early Detection and Distribution Mapping System for the Southeast Exotic Pest Plant Council and the Everglades Cooperative Invasive Species Management Area, applying herbicide research on emerging invasive plants, and facilitating and extending program development in Europe and Central America. The Center also assumed management of the Georgia Invasive Species Task Force. The Task Force was created in collaboration with the Georgia Forestry Commission, USDA Forest Service, USDA APHIS-PPQ, Georgia Department of Agriculture, the Bugwood Network, and the Warnell School of Forestry and Natural Resources to expand involvement and cooperation of state agencies, non-government organizations and other interested parties to address invasive threats in Georgia.

UGA - College of Agricultural and Environmental Sciences - Aquaculture Unit (CAES): The CAES provides research, teaching and extension (or public service) at the undergraduate and graduate levels in a variety of specialties, including Agriculture and Environmental Sciences. The Aquaculture Unit is specifically charged with providing information regarding aquaculture, fisheries, and fresh water pond issues (including aquatic plant management, fish population management, and fish disease diagnostics). Through Cooperative Extension, CAES is often the first point of contact

when a member of the public observes an ANS. CAES also provides training to county extension agents, fish farmers, fish hobbyists, county governments, and others regarding ANS issues. CAES has direct contact with private individuals involved in interstate transportation of fish and invertebrates through its extension programs. CAES conducts pesticide testing for effective control of aquatic plants and snails. Faculty members work with the CAES, the Warnell School of Forestry and Natural Resources, and the Georgia Department of Agriculture to provide training for aquatic pesticide applicators several times each year in several locations across the state. This training involves private applicators, biologists for the GADNR and cooperative extension agents. Public education is conducted in conjunction with aquatic pesticide applicator training. Faculty members also act as advisors to the Georgia Aquaculture Association.

UGA - Department of Horticulture (Department): Members of the Department's faculty serve on the Board of the Georgia Exotic Pest Plant Council (GA-EPPC) and the Invasive Plant Task Force of the Georgia Green Industry Association. The Department works with these organizations to develop educational materials, including a table-top exhibit on aquatic nuisance plant species, a PowerPoint presentation on nuisance plant species, including ANS, and a list of alternative plant choices, both native and nonnative. These resources are used by organizations at trade shows and other events. They are also available on-line from the GA-EPPC web site, and they are used by county extension agents across the state in local programming. The Department is preparing awareness educational materials and disseminating them across the state in concert with GA-EPPC and the Georgia Green Industry Association. The Department promotes educational workshops offered by GA-EPPC for landowners, green industry professionals, and consumers. These workshops focus on ANS identification as well as management options and techniques.

UGA - Marine Extension Service (MAREX): MAREX conducts research programs to monitor coastal ANS and documents their biology and ecology. MAREX also conducts outreach efforts to increase public awareness and modify behaviors in order to prevent new introductions and reduce the further spread of existing problem species. MAREX's restoration activities include the formation of GEORGIA: Generating Enhanced Oyster Reefs in Georgia's Inshore Areas, a hands-on volunteer based oyster shell recycling program that broadens public awareness of oyster ecological functions, promotes a sense of stewardship, and restores lost oyster acreage. MAREX's public education and outreach activities include: the Aquatic Invaders program, public surveys to gauge understanding of ANS issues, "Have You Seen Me?" sheets, ANS fact sheets, Camden County 4-H officer training, production of the ANS volunteer monitoring manual, "Aquatic Invasive Species Volunteer Monitoring," future incorporation of ANS prevention best practices into the Georgia Clean Marina program, development of educational rack cards, booklets, and posters on ANS, and work on a public service announcement to highlight ANS and prevention tips. In addition, MAREX will conduct a

volunteer monitoring program for coastal fouling communities that will operate through the existing Adopt-A-Wetland program. MAREX conducts port surveys, participates in *Mytella* dock sampling, and hosts the Aquatic Invaders Zoo & Aquarium program, and also compiles volunteer monitoring data and public reports from "Have You Seen Me?" flyers and publishes the data in peer-reviewed research papers. MAREX also conducted a literature review for fish, mollusks, crustaceans and polychaetes in the South Atlantic Bight, and created a regional GIS database as part of port surveys. In all, the database now contains information from a total of 104 publications, representing locality information for 2,533 species.

UGA – Odum School of Ecology (School): In addition to having several faculty members who actively research ANS, the School participates in UGA's Species Invasions Science (SIS) group and also hosts the Drake Research Group. These groups bring together individuals interested in the study of invasive species, including ANS. The SIS group is interested in all aspects of the scientific study of species invasions. This includes the study of species-specific strategies for management, the search for general patterns and laws of species invasion, and the effort to use invasions as a source of insight to better understand the ecological and evolutionary processes that govern the natural world. SIS is an interdisciplinary and interdepartmental group comprised of individuals from the School, the Warnell School of Forestry & Natural Resources, the Department of Genetics, and the Department of Crop and Soil Sciences. Among the primary functions of SIS is to provide a forum for the exchange of knowledge and expertise among invasion science practitioners. Research by the Drake Research Group is devoted to integrating theory, statistical modeling, and conducting experiments to solve basic and applied problems in population ecology. Applied projects have focused on ANS to answer questions like how many individuals of a species it takes to establish a viable population, what characteristics predispose species to being good colonizers or having strong impacts on ecosystems, and where and how fast invading species will spread.

UGA - Warnell School of Forestry and Natural Resources (Forestry School): The Forestry School conducts programming to train professional resource managers, extension agents, landowners, and the general public on invasive species issues, identification, and management. The Forestry School developed the Early Detection & Distribution Mapping system for use by the eight Southeast Exotic Pest Plant Council state members. It has now expanded to projects in the Florida Everglades for all taxa mapping of invasive species and is being considered for implementation on additional regional and national projects. The Forestry School conducts extensive invasive species outreach programming along with development and publication of identification and management guidelines, control recommendations, and web-resources. The Forestry School is also part of the Species Invasions Science group and the Center for Invasive Species and Ecosystem Health.

Nongovernmental ANS Management Efforts in Georgia

Interest generated from state and federal policy also stimulates action by nongovernmental organizations. This section describes actions and programs involving ANS management activities carried out by various organizations in Georgia.

Georgia Aquarium: At this time, the Aquarium's involvement in ANS is limited to educational programs where the impact of ANS on biodiversity is discussed with middle and high school students. While the Aquarium exhibits flathead catfish, the exhibit does not include a discussion on ANS. The Aquarium also has a handout that it developed on ANS for the general public.

Georgia Exotic Pest Plant Council (GA-EPPC): GA-EPPC is a nonprofit group that concentrates exclusively on existing and potential invasive exotic pest plants in Georgia. GA-EPPC is a chapter of the regional Southeast Exotic Pest Plant Council and a member of the National Association of Pest Plant Councils. First organized in 1999, GA-EPPC's stated mission is to focus attention on the adverse effects exotic pest plants have on the diversity of Georgia's native plants and animals; the use of exotic pest plant management to prevent habitat loss; the socioeconomic impacts of these plants; changes in the seriousness of the different exotic pest plants over time; and the need to exchange information which helps land owners and managers set priorities for exotic pest plant management.

GA-EPPC developed the Invasive Nonnative Plants in Georgia list, which is currently the most comprehensive such list for the state. The organization provides an annual educational meeting, several workshops and other educational programs in a wide variety of venues throughout the state. GA-EPPC regularly collaborates with other organizations such as the Georgia Green Industry Association and the Georgia Native Plant Society to provide educational programs and materials. In addition, GA-EPPC has close working relationships with state and federal agencies that are involved in invasive plant management.

Through its programs, GA-EPPC reaches a wide audience that ranges from professional land managers to the general public and provides an important network for information and assistance with invasive plants. GA-EPPC members participate in volunteer work parties to control and remove invasive plants, add to the EDDMaps database, and assist with education by distributing materials provided by the organization.

Georgia Green Industry Association (GGIA): GGIA supports self-regulation and phasing out use of ANS through public education about desirable alternatives. It also hopes to self-regulate in the area of new introductions through the development of screening protocols. GGIA is presently working with the Georgia Exotic Pest Plant Council and the

Georgia Native Plant Society to develop a list of alternative plants for cultivation, both native and nonnative. The goal of this effort is to have a single list of accepted and prohibited plants that will be agreeable to all along with a unified message that can be conveyed to the gardening public. GGIA has worked with the Center for Applied Nursery Research in Dearing, Georgia to solicit help from the research community with problems associated with invasiveness and ways to combat invasiveness in ornamental plants. GGIA has also adopted the Voluntary Codes of Conduct for Nursery Professionals per the St. Louis Declaration on Invasive Plant Species, and provides assistance with productions of educational brochures in cooperation with UGA and the State Botanical Garden.

Georgia Native Plant Society (GNPS): The GNPS is involved with neighborhood restoration projects that encourage training in ANS identification, removal, and replanting with natives. Specific areas include Grant Park, Piedmont Park, and the Heritage Trail in Cobb County. The Society features at least one yearly lecture on invasive plants out of six general membership meetings a year. GNPS hosts a kiosk at the Southeastern Flower Show that includes an ANS poster, and has the GA-EPPC invasive brochure prominently displayed and available to the public. GNPS mails the GA-EPPC invasive brochures to Master Gardener groups on request. The GNPS also has a small research grant program that funds invasive research along with other topics.

Georgia Ports Authority (Ports Authority): The Ports Authority monitors ships while they are at berth and reports any detected ballast water discharge to the Coast Guard. The Ports Authority does not conduct ongoing monitoring for ANS, but has worked with researchers in the past conducting a baseline survey of terminals in the ports of Savannah and Brunswick.

Georgia Power Company: Georgia Power manages ANS in their 15 reservoirs across the state. Georgia Power manually removed and treated hydrilla found at its Lake Sinclair Little River Park marina during a routine aquatic plant management project at one of its operating plants. It also has a reservoir marina operator notification program and issues occasional notes to residents regarding ANS. In addition to the marina operator network, Georgia Power surveys Lakes Jackson, Juliette, Oconee, and Sinclair for aquatic nuisance plant species. Personnel involved in water quality work are also looking for ANS and the Company's reservoirs are surveyed on a quarterly basis. While Georgia Power personnel are trained to identify ANS, the Company also relies on local residents for ANS control requests, and has alerted resident marina operators to look out for ANS, especially hydrilla. Georgia Power does routine herbicide applications for a number of aquatic plants in its reservoirs including giant cutgrass, water hyacinth, spiny leaf naiad, Brazilian Elodea, and Eurasian Water milfoil. In 2006, Georgia Power made 44 herbicide applications to reservoirs and generating plant sites for aquatic plant management covering 270 acres. Georgia Power has accumulated annual end-of-

growing-season point intercept sampling data for Lake Juliette since 2001 showing native and aquatic nuisance plant species percentage occurrence.

Georgia Wildlife Federation (GWF): The GWF is Georgia's oldest and largest member-supported conservation organization and the state affiliate of the National Wildlife Federation. GWF's primary involvement with ANS has been public outreach and education. Its quarterly member newsletter, *The Call*, and the semi-annual *Sportsman's Connection* contain information about ANS such as flathead catfish. GWF partners with other nonprofit organizations such as the Satilla Riverkeeper and the Georgia River Network to educate the public about ANS. The GWF's involvement in the Adopt-A-Stream program is probably the only "surveillance" activity that the GWF conducts. While the GWF monitors ANS on its own property and through its involvement in Adopt-A-Stream, it also coordinates with the Teaming with Wildlife Coalition in Georgia, and looks for projects using these volunteers to promote the control and management of ANS. The GWF is also currently considering a Cooperative Agreement with the USFWS Partners for Wildlife program that will have a habitat restoration component at the Alcovy Conservation Center and possibly at the Wharton Conservation Center.

The Nature Conservancy (TNC): The Nature Conservancy is the world's largest conservation organization. In Georgia, the Conservancy has worked for years to abate the threats that ANS, both plants and animals, pose for Georgia's natural resources through partnerships, planning, and management action. A Conservancy employee serves as Vice President of the Georgia Exotic Pest Plant Council. Conservancy conservation planners in Georgia have long recognized the threat that exotic species pose for biodiversity, and appropriate strategies have been devised and implemented which abate those threats. These include working at the ground level as well as the state and U.S. policy level to effect changes in laws and regulations which control deliberate and accidental importation of potential nuisance species. On-the-ground management activities include removals of aquatic pest plants from Conservancy-owned preserves and priority lands and waterways by Conservancy personnel and volunteers. On the Georgia coast, TNC is mapping and treating infestations of aquatic nuisance plants including common reed, water hyacinth, and Chinese tallow. TNC also pursues communication strategies related to exotic invasive species, including ANS. The Conservancy has sponsored aquatic nuisance plant species workshops for land managers and other resource personnel in which participants are trained in the impact, identification, and control of exotic pest plants, including aquatic nuisance plant species.

Current Gaps in Georgia's Authorities & Programs for ANS

Although the programs and associated jurisdictions listed above are essential for the management of ANS in Georgia, they contain some gaps that reduce their effectiveness. Some of the known gaps and impediments include the following.

Coordination: Although a certain degree of coordination exists between state and federal agencies, industry groups, and economic development groups on ANS issues in the state, this coordination needs to be greatly improved. The current situation consists of particular agencies focusing on specific species, management protocols or priorities in place within said agency or among cooperating agencies and organizations. Georgia has no full-time ANS coordinator position, which, if it existed, could act as an important coordinating factor for planning and response programs. Finally, there is a need for greater regional coordination of ANS programs, since many ANS issues should be addressed at the regional as well as the state level.

Education and Outreach: Currently, the public at large is generally unaware of how their activities can create or exacerbate problems with ANS. Most boaters and anglers are not aware of the ANS problem and do not employ measures to prevent their spread. Likewise, most individuals involved with aquarium, landscaping, and garden pond hobbies, both consumers and merchants, are not aware of ANS problems. There is also a lack of awareness of existing regulations that pertain to ANS. To address this concern, the state needs a broadly focused education and information effort geared toward preventing introductions of ANS and other invasive species. Targets would include the general public, agency staff, landowners and volunteers. Technical assistance for landowners is needed to teach ANS management on private property. Outreach partnerships need to be developed or expanded with university groups, industry groups, such as horticulture, aquarium trade, shipping firms, marina operators, and a marketing strategy is needed to increase the effectiveness of ANS programs statewide.

Early Detection and Rapid Response: Georgia currently has limited inspection programs focused on ANS detection. No agency is actively, routinely and systematically surveying habitats for new ANS occurrences. Response times to new ANS invasions are often slow due to a lack of contingency plans, advance environments compliance arrangements, and funding. There is no institutionalized regular monitoring of aquatic plant trade, pet trade, and other markets, and the public is not sufficiently involved in early detection and rapid response.

Control and Management: Most ANS management activities in Georgia are focused on individual populations and do not address ANS in a strategic manner. In addition, control of pests may require herbicides or pesticides, host removal, trapping, animal depopulation, biological controls, etc., some of which are opposed by stakeholders. Expanding international trade and technological advances in transportation facilitate invasive species introductions. Also, the use of herbicides and other biocides is difficult on many federal lands, especially where listed species occur. There is a need to address restoration actions that are required after ANS eradication in order to maintain

the area as a sustainable system, as well as the ecological dynamics of semi-natural and manmade systems (i.e., impoundments).

Monitoring Populations and Habitats: Detecting the presence or absence of ANS in an area usually relies on costly and time-consuming field surveys. In addition, little training is provided to agency and private personnel to identify ANS and to provide avenues to report new sightings. Georgia lacks widely accepted protocols for monitoring and reporting ANS information. Therefore, monitoring programs for existing ANS populations as well as high priority natural habitats and conservation lands are needed. The state needs a central point for reporting information on ANS and methods for maintaining that information in an easily accessible format. Finally, there is a need for follow-up reports of presence/absence of ANS to ensure there is no viable, breeding population present.

Research: Coordination of research between agencies is needed as well as more research on cost/benefits and efficacy of existing control measures for high priority ANS. Research on life history characteristics, limiting factors, vectors, and pathways is needed for many ANS. More research is needed on: economic and ecological impacts on ANS in Georgia; how to develop effective educational material and marketing tools to reach target audiences; and development of new technologies for detection, control, eradication, and maintaining sustainable systems.

Regulations and Enforcement: Limited funding and staffing contribute to difficulties in the enforcement of existing statutes and regulations. There is also limited authority and funding to quarantine species and infested waters. In addition, economic gains in the smuggling and sale of exotic species often outweigh fines assessed by agencies, so smugglers have little financial incentive to comply with import regulations. There is more enforcement needed enforcing regulations in the aquarium trade. Also, more enforcement is needed to prevent the commercial sale, possession, and importation of nonnative aquatic species that have the potential to be invasive in Georgia.

Funding: There is limited funding for education, prevention, control, monitoring, eradication, and research efforts. There is also limited funding to implement laws and regulations relating to ANS, as well as for ongoing projects such as long-term management. Funding is the key to implementation of this ANS Management Plan. All of the priorities and action items listed below are meaningless unless secure, consistent, and adequate funding can be found to provide the resources needed to address the ANS issues faced by Georgia.

Goals, Objectives, and Actions

This section describes the various ongoing and proposed management actions identified by the Committee listed according to the objective they support. The

Committee recognizes that successful accomplishment of these actions will require close coordination with other state, regional, and federal authorities, and with local governments. Additional financial resources are needed to accomplish the objectives and actions in this plan

Goal: Prevent and control the introduction of aquatic nuisance species (ANS) into Georgia and minimize the future spread and impacts of existing ANS populations on native species, environmental quality, human health, and the economy.

Objective 1: Coordinate local, state, regional, federal and international activities and programs pertaining to aquatic nuisance species

Action 1: Establish the Georgia Invasive Species Council

Action 2: Hire a permanent, full-time Invasive Species Coordinator position to act as the point of contact and coordinate responsibilities. The IS coordinator would report to and act with the Georgia IS Council to ensure that each agency's goals are met.

Action 3: Establish a Memorandum of Understanding among agencies with overlapping ANS responsibilities in Georgia

Action 4: Work with other states to address ANS issues through the Gulf and South Atlantic Regional Panel on Aquatic Invasive Species, Southeastern Aquatic Resources Partnership, and other regional, national, and international organizations

Objective 2: Control and manage the introduction and spread of ANS in Georgia through education and outreach

Action 1: Compile information on existing publications, posters, videos, presentations, outreach programs and other outreach materials related to ANS

Action 2: Develop ANS outreach materials to be distributed to the general public at various events

Action 3: Use existing material and develop specific outreach materials to be distributed at plant nurseries and pet stores, targeting water garden hobbyists and aquarists and explaining existing regulations (i.e Stop Aquatic Hitchhikers and Habitattitude)

Action 4: Develop specific outreach materials to educate boaters, anglers, and marina operators about the potential spread of ANS through boating and recreational activities

Action 5: Develop specific outreach materials for the aquaculture industry (include information on regulatory issues, ANS concerns, etc.)

Action 6: Provide ANS curriculum resources and training to teachers (Project WET, Project Wild Aquatic, etc.)

Action 7: Coordinate an annual Georgia ANS symposium

Action 8: Provide training workshops to agency staff and various volunteer groups to assist with early detection, identification, and control of ANS

Action 9: Develop a comprehensive Georgia ANS website managed collaboratively by member organizations in the Georgia Invasive Species Council

Objective 3: Prevent the establishment of ANS populations in Georgia through early detection and rapid response programs

Action 1: Develop and implement a Georgia ANS early detection/rapid response plan

Action 2: Identify and implement rapid assessment sampling techniques for various habitats in Georgia waterways to detect new occurrences of ANS

Action 3: Implement protocols and new technologies for inspections of ships (including ballast areas) and cargo at Georgia ports, and watercraft on inland waters

Action 4: As appropriate technologies are developed, create and implement protocols for treatment of contaminated cargo, packaging, hulls, and ballast water to eradicate ANS

Objective 4: Control or eradicate established ANS in Georgia through cooperative management activities designed to minimize impacts to non-target species.

Action 1: Implement and identify existing control programs for ANS. Use plans developed by the Aquatic Nuisance Species Task Force when appropriate (i.e. Green crab, Chinese mitten crab, Eurasian Ruffe, Brown tree snake, Caulerpa spp. Asian carp, New Zealand mudsnail)

Action 2: Develop protocols for control of priority species

Action 3: Implement control programs for ANS based on established protocols

Objective 5: Monitor the distribution and impacts of ANS in Georgia

Action 1: Identify existing ANS monitoring efforts and data gaps

Action 2: Integrate existing GIS maps and data from state and federal sources and develop GIS-based distribution maps for Georgia

Action 3: Conduct surveys of aquatic habitats for ANS occurrences

Action 4: Develop and maintain a public database of collected and identified ANS specimens (freshwater and marine) from Georgia

Action 5: Access the impacts of ANS on populations of rare species and other high priority native species

Objective 6: Identify and implement needed research on impacts and control of ANS in Georgia

Action 1: Conduct research on economic and ecological impacts of ANS in Georgia

Action 2: Evaluate the cost/benefit of control or eradication of priority ANS

Action 3: Support research to determine limiting factors for growth and survival of priority ANS and to predict impacts related to changes in these factors (e.g., global climate change)

Action 4: Support research to develop effective methods and technologies for detection, control, and eradication of priority ANS and restoration of sustainable ecosystems

Action 5: Support research to develop effective ANS prevention and control marketing programs

Action 6: Support research on effectiveness of regulatory, education-based, and incentive-based programs in controlling ANS and their relative values

Objective 7: Prevent the introduction and spread of ANS in Georgia through legislative and regulatory efforts

Action 1: Maintain a comprehensive list of all current state and federal laws regulating ANS (including penalties)

Action 2: Where lacking, promulgate rules regulating importation of priority ANS not currently found in Georgia

Action 3: Where lacking, promulgate rules, including education and incentive-based, that limit the spread of priority ANS already found in Georgia.

Action 4: Coordinate enforcement of existing regulations and proposals, where necessary, for regulations pertaining to importation and sale of ANS through nursery and pet trades

Action 5: Work toward greater consistency of ANS regulations and enforcement within the Southeast

Objective 8: Secure adequate long-term funding for ANS programs in Georgia

Action 1: Seek new funding sources to expand existing ANS programs

Action 2: Develop budgets for new ANS management programs and request additional state and federal funding to support these programs

Program Monitoring and Evaluation

Program monitoring and evaluation is vitally important. It will enable the state to determine the effectiveness of objectives and actions identified in this management plan at stopping the introduction and spread of ANS. Timely oversight of program objectives will permit corrections as additional information becomes available. Overall program progress will involve three components: oversight, evaluation, and dissemination of information.

Oversight: The Georgia Invasive Species Council will be convened to oversee ANS program management issues and progress. The Council will be composed of representatives from all state agencies involved in invasive species management. The Council will be coordinated by the Invasive Species Coordinator other members of the Georgia Invasive Species Task Force, and will meet at least annually. The Council, as envisioned, will:

- Advise state agencies regarding the prevention and control of invasive species,
- Facilitate development of a coordinated network among state agencies to document, evaluate, and monitor effects from invasive species on the economy, the environment, and human health,
- Share information on a local, state, and national level and facilitate access to distribution and levels of invasive species, and
- Prepare and release a biennial state invasive species report in even numbered years.

Evaluation: Progress toward meeting program objectives is one element of the evaluation to be undertaken by the Council. More importantly, the Council must place special emphasis on the acquisition and assignment of funding necessary to meet tasks

identified in the plan. Evaluation should also include participation from interests affected by plan implementation.

Dissemination: The Council will prepare periodic reports highlighting progress toward meeting the plan's goals and objectives. These reports will be made available to the public, and local, state, and federal decision makers. Program monitoring and evaluation will be contingent on new and secure funding sources.

Implementation Table for ANS Management Plan

Goal: Prevent and control the introduction of aquatic nuisance species (ANS) into Georgia and minimize the further spread and impacts of existing ANS populations on native species, environmental quality, human health, and the economy.

Objectives and Actions						**Planned Efforts and Funding ($1,000s/FTEs)**				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
1	*Coordinate local, state, regional, federal and international activities and programs pertaining to ANS.*									
1.1	Establish the Georgia Invasive Species Council.	Unfunded	Members of Advisory Committee	GADNR	Members of Advisory Committee		5/0.5	5/0.5	5/0.5	5/0.5
1.2	Hire a full-time Invasive Species Coordinator. The IS coordinator will report to and act with the Georgia IS Council to ensure that each agency's programs, outreach materials, etc. are not contributing to the state's IS problem.	Unfunded	FA	GADNR			70/1	70/1	70/1	70/1
1.3	Establish a Memorandum of Understanding among agencies with overlapping ANS responsibilities in Georgia	Unfunded	GADNR	GADNR	GA ISC		2/0.02	0/0	0/0	0/0

Objectives and Actions						Planned Efforts and Funding ($1,000s/FTEs)				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
1.4	Work with other states to address ANS issues through the Gulf and South Atlantic Regional Panel on Aquatic Invasive Species, Southeastern Aquatic Resources partnership, and other organizations.	Funded	FA	GADNR	USDA, MAREX, GSARP on ANS, TNC	10/0.2	10/0.2	10/0.2	10/0.2	10/0.2
2	*Control and manage the introduction and spread of ANS in Georgia through education and outreach.*									
2.1	Compile information on existing publications, posters, videos, presentations, outreach programs and other outreach materials related to ANS.	Unfunded	Sea Grant, GADNR	MAREX, GADNR	Ass'n of Zoos & Aquariums, NOAA, NC Aquariums, CAES, TNC, GA-EPPC	0/0.01	3/0.21	3/0.21	3/0.21	3/0.21
2.2	Develop ANS outreach materials to be distributed to the general public at various events.	Unfunded	Various agencies, NGOs	MAREX	GADNR,TNC, SINERR, CAES, GA-EPPC,		12/ 0.15	12/ 0.15	5/0.05	5/0.05
2.3	Develop specific outreach materials to be distributed at plant nurseries and pet stores, targeting water garden hobbyists and aquarists and explaining existing regulations.	Unfunded	Various agencies, NGOs	MAREX	APHIS-PPQ, GDA, CAES, GA-EPPC, GA ISC		10/0.1	10/0.1	5/0.05	5/0.05

Objectives and Actions						Planned Efforts and Funding ($1,000s/FTEs)				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
2.4	Develop specific outreach materials to educate boaters, anglers, and marina operators about the potential spread of ANS through boating and recreational activities.	Unfunded	Various agencies, NGOs	GADNR, MAREX	GA ISC, GA-EPPC		10/0.1	10/0.1	5/0.05	5/0.05
2.5	Develop specific outreach materials for the aquaculture industry (include information on regulatory issues, ANS concerns, etc.).	Partially Funded	Various agencies, NGOs	GADNR-CRD, GDA, CAES	GA ISC, GA-EPPC	2/0.05	12/ 0.15	10/0.1	5/0.05	5/0.05
2.6	Provide ANS curriculum resources and training to teachers (Project WET, Project WILD Aquatic, etc.).	Unfunded	FA	GADNR-EPD, WRD, CRD, MAREX	CAES, GA-EPPC, UGA	12/ 0.25	25/ 0.41	24/0.4	24/0.4	24/0.4
2.7	Coordinate an annual Georgia ANS symposium.	Unfunded	GA ISC	GADNR	GA ISC, GA-EPPC		30/0.3	30/0.3	30/0.3	30/0.3
2.8	Provide training workshops to agency staff and various volunteer groups to assist with early detection, identification, and control of ANS.	Unfunded	GA ISC	MAREX, UGA Center, GADNR-EPD, WRD, TNC	GA ISC, CAES, GA-EPPC, NOAA	0/0.1	0.0.1	2/0.2	2/0.2	2/0.2

Objectives and Actions						Planned Efforts and Funding ($1,000s/FTEs)				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
2.9	Develop a comprehensive Georgia ANS website managed collaboratively by member organizations in the Georgia Invasive Species Council.	Unfunded	FA	UGA Center	GA ISC, USGS, CAES, GA-EPPC	0/0.05	3/0.25	3/0.25	3/0.25	3/0.25
3	*Prevent the establishment of ANS populations in Georgia through early detection and rapid response programs.*									
3.1	Develop and implement a Georgia ANS early detection/rapid response plan.	Unfunded	FA	GADNR	GA ISC				35/ 0.75	35/0.75
3.2	Identify and implement rapid assessment sampling techniques for various habitats in Georgia waterways to detect new occurrences of ANS.	Unfunded	FA	GADNR (Stream Team Intern)	GA ISC, Volunteers			17/ 0.75	17/ 0.75	17/0.75
3.3	Implement protocols and new technologies for inspections of ships (including ballast areas and hulls) and cargo at Georgia ports, and watercraft on inland waters.	Funded	FA	USCG, CBP, APHIS-PPQ	Ports Authority, GADNR	8/0.05	8/0.05	8/0.05	8/0.05	8/0.05
3.4	As appropriate technologies are developed, create and implement protocols for treatment of contaminated cargo, packaging, hulls, and ballast water to eradicate ANS.	Unfunded	FA	USFWS, APHIS-PPQ, CBP	Ports Authority					

Objectives and Actions						Planned Efforts and Funding ($1,000s/FTEs)				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
4	*Control or eradicate established ANS in Georgia through cooperative management activities designed to minimize impacts to non-target species.*									
4.1	Identify existing control programs for ANS.	Unfunded	FA	GADNR	GA ISC		7/0.1	0/0	0/0	0/0
4.2	Develop protocols for control of priority species.	Unfunded	FA, Other	GADNR	GA ISC		63/0.75	0/0	35/0.5	0/0
4.3	Implement control programs for ANS based on established protocols.	Funded	FA	GADNR, NPS	GA ISC	200/4	200/4	200/4	200/4	200/4
5	*Monitor the distribution and impacts of ANS in Georgia.*									
5.1	Identify existing ANS monitoring efforts and data gaps.	Unfunded	FA	GADNR	GA ISC, USGS		7/0.1	0/0	0/0	0/0
5.2	Integrate existing GIS maps and data from state and federal sources and develop GIS-based distribution maps for Georgia.	Unfunded	Various agencies, NGOs	UGA-Center	GADNR, USGS, USFS, NPS		15/ 0.25	10/ 0.17	10/ 0.17	10/0.17
5.3	Conduct surveys of aquatic habitats for ANS occurrences.	Partially Funded	GADNR, FA	GADNR-WRD, CRD, EPD	Volunteers (AAS, AAW), GWF, TNC, CAES, USFS	52/0.4	52/0.4	52/0.4	52/0.4	52/0.4

Objectives and Actions						Planned Efforts and Funding ($1,000s/FTEs)				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
5.4	Develop and maintain a public database of collected and identified ANS specimens (freshwater and marine) from Georgia.	Unfunded	Various agencies	UGA, Other Institutions	GA ISC, CAES		10/0.2	10/0.2	10/0.2	10/0.2
5.5	Assess the impacts of ANS on populations of rare species and other high priority native species.	Partially Funded	Various agencies	GADNR, USFWS, UGA, TNC, NPS	USFS, TNC, Volunteers	30/0.25	30/0.25	40/0.3	50/0.4	60/0.5
6	*Identify and implement needed research on impacts and control of ANS. in Georgia*									
6.1	Conduct research on economic and ecological impacts of ANS in specific sites in Georgia.	Partially Funded	Various agencies	GADNR, UGA, CAES	GA ISC	4/0.1	10/0.2	15/0.3	100/ 1.5	100/1.5
6.2	Evaluate the cost/benefit of control or eradication of priority ANS.	Unfunded	Various Agencies	GADNR, UGA, CAES	TNC, GA ISC					50/0.75
6.3	Support research to determine limiting factors for growth and survival of priority ANS and to predict impacts related to changes in these factors (e.g., global climate change).	Unfunded	Various Agencies	GA ISC	TNC, Other NGOs				10/0.2	5/0.1

Objectives and Actions						Planned Efforts and Funding ($1,000s/FTEs)				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
6.4	Support research to develop effective methods and technologies for detection, control, and eradication of priority ANS and restoration of sustainable ecosystems.	Unfunded	Various Agencies	GA ISC, CAES	TNC, Other NGOs			5/0.05	15/ 0.25	10/0.15
6.5	Support research to develop effective ANS prevention and control marketing programs.	Unfunded	Various Agencies	GA ISC	CAES, NGOs				11/ 0.21	6/0.11
6.6	Support research on effectiveness of regulatory, education-based, and incentive-based programs in controlling ANS and their relative values.	Unfunded	Various Agencies	GA ISC	CAES, UGA, NGOs				11/ 0.21	6/0.11
7	*Prevent the introduction and spread of ANS in Georgia through legislative and regulatory efforts.*									
7.1	Maintain a comprehensive list of all current state and federal laws regulating ANS (including penalties).	Unfunded	Various Agencies	GADNR	GA ISC		5/0.1	5/0.1	5/0.1	5/0.1
7.2	Where lacking, promulgate rules regulating importation of priority ANS not currently found in Georgia.	Unfunded	GADNR	GADNR, GDA	GA ISC				5/0.1	5/0.1

Objectives and Actions						Planned Efforts and Funding ($1,000s/FTEs)				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
7.3	Where lacking, promulgate rules, including education- and incentive-based, that limit the spread of priority ANS already found in Georgia.	Unfunded	GADNR	GADNR	GA ISC				5/0.1	5/0.1
7.4	Coordinate enforcement of existing regulations and proposals, where necessary, for new regulations pertaining to importation and sale of ANS through nursery and pet trades.	Unfunded	Various Agencies	GADNR, GDA	GA ISC			2/0.1	2/0.1	2/0.1
7.5	Work toward greater consistency of ANS regulations and enforcement within the Southeast.	Unfunded	Various Agencies	TNC, SARP, SEAFWA	GA ISC			2/0.1	2/0.1	2/0.1
8	*Secure adequate long-term funding for ANS programs in Georgia.*									
8.1	Seek new funding sources to expand existing ANS programs .	Unfunded	SeaGrant, Nongame, CIG, SWG,	GADNR	GA ISC	60/ 0.75	110/ 0.15	140/2	140/2	140/2

Objectives and Actions						Planned Efforts and Funding ($1,000s/FTEs)				
Number	**Description**	**Current Financial Status**	**Funding Source**	**Lead Agency or Organization**	**Cooperators**	**2008**	**2009**	**2010**	**2011**	**2012**
8.2	Develop budgets for new ANS management programs and request additional state and federal funding to support these programs.	Unfunded	FA	GADNR	GA ISC		14/0.2	14/0.2	14/0.2	14/0.2

AAS = Adopt-A-Stream
AAW = Adopt-A-Wetland
APHIS – PPQ = Animal and Plant Health Inspection Service – Plant Protection and Quarantine
CAES = UGA-College of Agricultural and Environmental Sciences
CBP = U.S. Customs and Border Patrol
CIG = Coastal Incentives Grant
CRD = Georgia Department of Natural Resources, Coastal Resources Division
DJ = Dingell-Johnson
EPD = Georgia Department of Natural Resources, Environmental Protection Division
FA = Federal aid
GADNR = Georgia Department of Natural Resources
GA-EPPC = Georgia Exotic Pest Plant Council
GA ISC = Georgia Invasive Species Council
GDA = Georgia Department of Agriculture
GSARP = Gulf and South Atlantic Regional Panel on ANS
MAREX = University of Georgia Marine Extension Service
NOAA = National Oceanic and Atmospheric Administration
Nongame = Nongame Wildlife Fund
Ports Authority = Georgia Ports Authority
SARP = Southeast Aquatic Resources Partnership

SEAFWA = Southeastern Association of Fish & Wildlife Agencies
SINERR = Sapelo Island National Estuarine Research Reserve
SWG = State Wildlife Grants
TNC = The Nature Conservancy
UGA = University of Georgia
UGA – Center = University of Georgia – Center for Invasive Species and Ecosystem Health
USCS = United States Coast Guard
USGS = United States Geological Survey
USDA = United States Department of Agriculture
WRD = Georgia Department of Natural Resources, Wildlife Resources Division

Glossary of Terms

Aquaculture: The production of fish or shellfish for consumption or for stocking. Also the breeding, rearing, and harvesting of plants and animals in all types of water environments, including ponds, rivers, lakes, and oceans.

Aquatic habitats: All bodies of flowing and standing water such as streams, rivers, reservoirs, lakes and ponds; estuarine, and forested wetlands; riparian areas along streams, rivers, lakes and reservoirs; karsts; coastal freshwater dune swales; coral reefs, oyster reefs, sand and algal flats; swamps, salt marshes, and beaches.

Aquarium industry: Collectively, any entities that breed, grow, import, hold, transport, and sell nonnative fish, invertebrates, and plants specifically for display in fresh and salt water aquaria.

Aquatic nuisance species (ANS): A nonnative species which threatens the diversity or abundance of native aquatic species or the ecological stability of infected waters, or commercial, agricultural, aquaculture, or recreational activities dependant on such waters.

Aquatic plant: A plant that naturally grows in water or saturated soils, including algae, submerged, and floating leafed or emergent plants.

Aquatic species: All organisms living at least partially in a water environment. Usage commonly refers to aquatic plants such as water hyacinth and salvinia, fish, and invertebrates, but also includes mammals such as nutria.

At risk: A description of populations that are likely to become severely reduced or extinct due to imminent threats.

Baitfish: Any species (fish, insect, invertebrate) commonly sold for use as recreational fishing bait.

Ballast: Water or other matter placed in specific areas of the hull of a vessel for navigation stability. Species are often inadvertently transported in ballast water when it is released in another water body. In earlier years, rocks and metal bars were used as ballast material. In all cases, species can be transported inadvertently or purposefully in or on ballast material.

Biodiversity: The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.

Ecosystem: A community of plants, animals and other organisms that are linked by energy and nutrient flows and that interact with each other and with the physical environment.

Endemic: A species restricted in distribution to a particular geographic area or drainage.

Established: The condition of growing in a particular location.

Fouling: Entanglement, clogging, or obstruction by an undesired organism that may threaten the diversity or abundance of native species or the ecological stability and/or uses of infested waters.

Habitat: Area where a species has the necessary food, water, shelter, and space to live and reproduce.

Indigenous species: Organisms naturally occurring in a specific geographic area or ecosystem. Synonym includes native species.

Infestation: An invasive population that is living in and overrunning an ecosystem to an unwanted degree or harmful manner.

Intentional introduction: An introduction made deliberately by humans, involving the purposeful movement of a species outside of its natural range and dispersal potential. Such introductions may be authorized or unauthorized.

Introduced species: An organism that has been brought into an area where it does not normally occur. Most introductions are caused by human activity. Introduced species often compete with and cause problems for native species. An introduced species is not necessarily an invasive species. Also called exotic, nonnative, or alien species.

Invasion: An infestation of an aquatic nuisance species.

Invasive species: Nonnative organisms whose introductions cause or are likely to cause adverse environmental, economic, and/or human health impacts. For purposes of this document,, these are nonnative species that threaten the diversity or abundance of native species or the ecological stability of infested areas, or commercial, agricultural, aquacultural, or recreational activities dependent on such areas.

Localized: A confined, reproducing population of an introduced organism that can be eliminated using standard methods.

Locally established: An introduced organism with one or more naturally reproducing populations but with a very restricted distribution and no evidence of natural range expansion (in general, limited to a relatively confined area, such as a small lake).

Marsh: A wetland with emergent vegetation, and located in zones progressing from terrestrial habitat to open water. May be dominated by either salt or freshwater.

Monitor: To watch, observe, or check for a special purpose. For purposes of this document, observing or checking activities based on scientific method to accumulate data about invasive species and their environs.

Native species: A species naturally present and reproducing within the state or that naturally expands from its historic range into this state.

Nonnative species: Any species or other viable biological material that enters an ecosystem outside of its historic range, including organisms transferred from one country to another. Species introduced or spread from one region of the U.S. to another outside their normal range are nonnative. *Synonyms*: Introduced, Exotic, Alien, Foreign, Nonindigenous species, Immigrant, Transplants.

Nuisance species: Nonnative organisms whose introductions cause or are likely to cause adverse environmental, economic, and/or human health impacts. For purposes of the management plan, these are nonnative species that threaten the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural, or recreational activities dependent on such waters.

Pathway: The means by which species are transported from one location to another.

Parasite: An organism living in or on another organism.

Pathogen: A specific agent causing disease. May be a bacteria, virus, or fungus.

Regulation: A rule or order having to do with details or procedures and having the force of law.

Riparian: Pertaining to, situated or dwelling on the margin of a river or other water body.

Shellfish: Shellfish are invertebrates that have a soft unsegmented body usually enclosed in a shell, and include crayfish, mollusks, crabs, shrimp clams, mussels, and oysters.

Species: A group of organisms that differ from all other groups of organisms and that are capable of breeding and producing fertile offspring. This is the smallest unit of classification for plants and animals.

Unintentional introduction: An accidental movement of a species into a new habitat outside of its native range, often as a result of a species using humans or animals as vectors for dispersal.

Vector: Transportation of a species on or in a media through a pathway.

Water body: Any area with water flowing or standing above ground to the extent that evidence of an ordinary high water mark is established in any normal year. It can be a stream, river, lake, spring, backwater, bayou, creek, ocean, bay, pond, or wetland.

Wetland: Land areas containing much soil moisture, usually poorly drained, and characterized by hydrophytic vegetation, and hydric soils. The land area may have

permanent or periodic inundation by water or prolonged soil saturation generally resulting in anaerobic soil conditions.

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Appendix A: ANS of Concern in Georgia

Priority 1(a) Species

Priority 1(a) species are those that are currently in Georgia and which an agency or an organization currently spends a significant amount of time and/or money on for some aspect of management or that the agency or organization definitely plans to spend time and money on in the next five years.

Common name	Scientific Name
Plants	
Brazilian elodea	*Egeria densa*
Common water hyacinth	*Eichhornia crassipes*
Hydrilla	*Hydrilla verticillata*
East Indian hygrophylia	*Hygrophila polysperma*
Asian marshweed	*Limnophila sessiliflora*
Creeping water primrose	*Ludwigia peploides*
Blue-green algae	*Lyngbya spp.*
Asian spiderwort, marsh dewflower	*Murdannia keisak*
Eurasian watermilfoil	*Myriophyllum spicatum*
Variable Leaf Milfoil	*Myriophylium heterophyllum*
Water lettuce	*Pistia stratiotes*
Common salvinia	*Salvinia minima*
Giant salvinia	*Salvinia molesta*
Giant cut grass (Southern wild rice)	*Zizaniopsis miliacea*
Fishes	
Red shiner	*Cyprinella lutrensis*
Asian swamp (rice) eel	*Monopterus albus*
Blue tilapia	*Oreochromis aureus*
Nile tilapia	*Oreochromis niloticus*
Lionfish	*Pterois volitans; Pterois miles*
Flathead catfish	*Pylodictis olivaris*
Mollusks	
Asian clam	*Corbicula fluminea*
Charrua mussel	*Mytella charruana*
Green mussel	*Perna viridis*
Channeled (island) apple snail	*Pomacea insularum*
Crustaceans	
Titan Acorn Barnacle	*Megalbalanus coccoporna*
Green porcelain crab	*Petrolisthes armatus*
Disease Organisms	
Baculovirus of Shrimp	*Baculovirus penaei*
Chytrid fungus	*Batrachochytridium dendrobatidis*

Great Asian Tapeworm	*Bothriocephalus opsarichthydis*
Yellow Head Virus	*Coronoviridae*
Avian vacuolar myelopathy (AVM)	*Cyanobacterium (unknown spp.)*
West Nile virus	*Flavivirus sp.*
Largemouth Bass Virus	*Iridoviridae*
Oyster mikrocytosis	*Mikrocytos mackini*
Whirling Disease	*Myxobolus cerebralis*
Infectious Haematopeietic Necrosis	*Novirhabdovirus*
Clam and Cockle Perkinsus	*Perkinsus olseni*
Dermo disease	*Perkinsus marinus*
Taura Syndrome Virus	*Picornaviridae*
Epizootic Haematopoietic Necrosis	*Ranavirus*
Bacterial Kidney Disease	*Renybacterium salmoninarum*
Spring Viremia of Carp	*Rhabdovirus*
Viral Hemorrhagic Septicemia	*Rhabdovirus*
Infectious Hypodermal Haematopoietic Necrosis	*Shrimp parvovirus*
White Spot Disease	Whispovirus

Priority 1(b) Species

Priority 1(b) species are those that are not currently present in Georgia but agencies or organizations are concerned about enough to spend a significant amount of time and/or money on for some aspect of management either now or in the next five years.

Common name	**Scientific Name**
Plants	
Spiny leaf naiad	*Najas marina*
Mollusks	
Giant East African snail	*Achatina fulica*
Zebra mussel	*Dreissena polymorpha*
Insects	
Swede midge	*Contarinia nasturtii*

Priority 2(a) Species

Priority 2(a) species are those that are currently present in Georgia and which the agency or organization deals with infrequently or attempts to control in selected high-priority areas (because they are thought to be lesser threats, or because they are widespread and difficult to control).

Common name	Scientific Name
Plants	
Alligatorweed	*Alternanthera philoxeroides*
Giant reed	*Arundo donax*
Parrotfeather	*Myriophyllum aquaticum*
Common reed	*Phragmites australis*
Fishes	
Grass carp	*Ctenopharyngodon idella*
Goldfish	*Carassius auratus*
Blueback herring	*Alosa aestivalis*
Mollusks	
Brown mussel	*Perna perna*
Crustaceans	
Gray-speckled crayfish	*Orconectes (Buannulifictus) palmeri creolanus*
Coelenterates	
Australian spotted jellyfish	*Phyllorhiza punctata*
Polychaetes	
Reef-building plychaete (Australian tubeworm)	*Ficopomatus enigmaticus*
Tubeworm	*Hydroides elegans*
Disease Organisms	
MSX	*Haplosporidium nelsoni*

Priority 2(b) Species

Priority 2(b) species are those that are not currently in Georgia and which agencies or organizations deal with infrequently (because they are thought to be lesser threats).

Common name	Scientific Name
Plants	
Purple loosestrife	*Lythrum salicaria*
Mollusks	
Amber snail	*Calcisuccinea dominicensis*

Asian date mussel	*Musculista senhousia*
Black-striped mussel	*Mytilopsis salleii*
Mediterranean mussel	*Mytilus galloprovincialis*

Crustaceans

European green crab	*Carcinus maenas*
Indo Pacific swimming crab	*Charybdis hellerii*
Chinese mitten crab	*Eriocheir sinensis*
Rusty crayfish	*Orconectes rusticus*
Rapa whelk	*Rapana venosa*

Polychaetes

Tubeworm	*Hydroides elegans*

Priority 3(a) Species

Priority 3(a) species are those that are currently present in Georgia but are dealt with only in unusual circumstances, either because they represent minor threats or are essentially naturalized and impossible to control with current methods.

Common name	Scientific Name
Fishes	
Pacus	*Colossoma macropomum*
Western mosquitofish	*Gambusia affinis*
Blue catfish	*Ictalurus furccatus*
Green sunfish	*Lepomis cyanellus*
Spotted bass	*Micropterus punctulatus*
White perch	*Morone americana*
Yellow bass	*Morone mississippiensis*
Mammals	
Nutria	*Myocastor coypus*
Crustaceans	
An isopod	*Synidotea laticauda*
Amphibians	
Greenhouse frog	*Eleutherodactylus planirostris*
Cuban treefrog	*Osteopilus septentrionalis*

Priority 3(b) Species

Priority 3(b) species are those that are not currently present in Georgia and are dealt with only in unusual circumstances because they are thought to represent only minor threats.

Common name	Scientific Name
Fishes	
Brook stickleback	*Culaea inconstans*
Mollusks	
Chinese mystery snail	*Cipangopaludina chivesis*
Amphibians	
Cane toad	*Bufo marinus*

Aquatic Species Watch List

These species are considered to be future threats by the Aquatic Nuisance Species Advisory Committee because, although they are known to be present in Georgia and are not currently considered to be serious pests, they have the potential to cause negative impacts based on their history in other states.

Common name	Scientific Name	Region
Plants		
Purple cabomba	*Cabomba pulcherrima*	May be in Lake Worth
Wild taro	*Colocasia esculenta*	Prevalent in state
Uruguayan water primrose	*Ludwigia hexapetala*	Lake Worth, Bull Sluice
Dwarf water clover	*Marsilea minuta*	
Brittle (European) Naiad	*Najas minor*	Lakes Oliver, Sinclair, Worth
Watercress	*Nasturtium officinale*	Present statewide
Torpedo grass	*Panicum repens*	Lakes Jackson, Worth
Bigpod sesbania	*Sesbania herbacea*	Coastal plain
French tamarisk	*Tamarix gallica*	Coastal plain
Crustaceans		
An isopod	*Paradella dianae*	

These following carp species are considered to be a future threat to Georgia although there are no known populations present in the state. However, these species have been documented in other southeastern states and have been shown to cause negative impacts where they occur.

Fishes	
Bighead	*Hypophthalmichthys molitrix*
Silver carp	*Hypophthalmichthys nobilis*
Black carp	*Mylopharyngodon piceus*

Appendix B: ANS Examples and Descriptions of ANS in Georgia

Priority 1(a) Species

Priority 1(a) species are those that are currently present in Georgia and which an agency or an organization currently spends a significant amount of time and/or money on for some aspect of management or agency or organization definitely plans to spend time and money on in the next five years. Examples of Priority 1(a) species identified by members of the Committee include the following:

Plants

Brazilian elodea (*Egeria densa*)

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Ann Murray, University of Florida, Bugwood.org

Brazilian elodea is a submersed, freshwater perennial herb, generally drifting or found rooted on the bottom of the water body in depths of up to 20 feet. The plant fragments readily and each fragment containing a double node has the potential to develop into a new plant. It is found in both still and flowing waters, in lakes, ponds, ditches, and quiet streams. Brazilian elodea is a popular aquarium plant and can be found for sale in most pet stores. It is also sold in aquarium or water garden dealerships, advertised on commercial websites, and may occur as a contaminant among plants that are offered for sale. A native of South America, Brazilian elodea is now found in Asia, Australia, Europe, New Zealand, and North America and has been present in Georgia since 1979. Brazilian elodea forms dense mono-specific stands that restrict water movement, trap sediment, and cause fluctuations in water quality. Dense beds interfere with recreational uses of a water body by interfering with navigation, fishing, swimming, and water skiing (Benson et al. 2001, ISSG 2008).

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Common water hyacinth (*Eichhornia crassipes*)

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Chris Evans, River to River CWMA, Bugwood.org

Water hyacinth is a free-floating aquatic plant that may form dense floating mats. It is found in shallow temporary ponds, wetlands and marshes, sluggish flowing waters, lakes, reservoirs and rivers, where its growth is greatly increased by nutrient rich waters, particularly those high in nitrogen, phosphorus and potassium. The majority of water hyacinth migration from South America to tropical and subtropical regions of the world can be attributed to deliberate planting in ponds or dams as an ornamental, or for use in aquariums. Dispersal may occur when unwanted plant material is discarded into creeks, rivers and dams. Hyacinth seeds can also be dispersed when carried by machinery, equipment, and road vehicles, contaminated boating and waterway equipment, and hikers' clothes and boots. Seeds can also be carried in water flow, mud and by birds (ISSG 2008). Water hyacinth has been present in Georgia since 1947, and currently extends north to the Upper Ocmulgee River drainage. It is also present in the Savannah River drainage, and is perennial in coastal tidewater regions of Georgia where marshes were impounded (Benson et al. 2001).

Environmental problems associated with water hyacinth are greater in warm areas where the weed grows throughout the year and develops into dense large, free-

floating mats that compete with other aquatic species for light, nutrients and oxygen. These mats shade out native submersed plant species and uproot native emergent species. They reduce dissolved oxygen levels and light, significantly altering ecosystems and plant and animal communities. Low oxygen levels can harm native fish populations, reduce some fish spawning areas, and degrade critical waterfowl habitat. Water hyacinth also has a detrimental impact on water use by humans. The plant reduces water flow in drainage canals, which can result in flooding and damage to canal banks and structures and impedes flow and clogs pump intakes in irrigation canals. Water flow patterns have also been disrupted in utility cooling reservoirs. Water hyacinth interferes with navigation of both recreational and commercial craft, negatively impacting fisherman, sports-fisherman, water-skiers and swimmers in recreational waters (ISSG 2008).

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Hydrilla (*Hydrilla verticillata*)

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Hydrilla is a submersed aquatic perennial with heavily branched stems. This plant is found in freshwater but tolerates salinities of up to seven percent. It is found in springs, lakes, marshes, ditches, rivers, and tidal zones. Plant fragments are dispersed by river flow as well as by boats, trailers, kayaks, and fishing equipment. Hydrilla has also been sold as an aquarium plant. A native to Asia and northern Australia, Hydrilla is now found on every continent except Antarctica (ISSG 2008). It has been present in Georgia since 1967 where plants are found primarily in the southwestern drainages of the state (Benson et al. 2001). The plant has been problematic at Lake Seminole for over a decade. Hydrilla is also found at a few smaller water bodies in Georgia's upper Ocmulgee drainage and at the Strom Thurmond Reservoir on the upper Savannah River (Jacono and Richerson 2006).

Hydrilla competes with native plants by growing to the water surface and forming dense mats that totally exclude sunlight from other plants, which in turn can significantly reduce aquatic plant and animal biodiversity. Large populations of hydrilla may affect fish size and population levels where predatory fish cannot hunt effectively within the dense mats. These mats also affect recreational activities. Along with interfering with fishing, Hydrilla can become tangled in boat motors and choke swimming areas. Hydrilla often slows or clogs rivers, irrigation ditches, and flood control canals, creating stagnant water that is prime mosquito breeding habitat. Dense stands can also cause flooding, and alter water quality by decreasing oxygen levels and increasing pH and water temperature (ISSG 2008). Hydrilla serves as a substrate for a species of cyanobacteria that is associated with avian vacuolar myelinopathy (AVM), a neurologic disease that has been shown to be lethal to several species of birds in Georgia, including coots and bald eagles (Wiley et al. 2007).

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Eurasian watermilfoil (*Myriophyllum spicatum*)

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Eurasian water milfoil is a submerged aquatic plant that rapidly colonizes lakes, ponds, shallow reservoirs, low energy areas of rivers and streams, and protected tidal creeks and bays. It is common in water bodies that have experienced disturbances such as nutrient loading, intense plant management, or abundant motorboat use. Native to Europe, Asia, and northern Africa, Eurasian water milfoil was intentionally imported to the U.S. in 1942, and has been present in Georgia since 1966 where it is widely distributed throughout the state in private impoundments (Benson et al. 2001). The plants may have initially been introduced through aquarium releases, or from potting material for bait worms. Spread occurred as Eurasian water milfoil was planted into lakes and streams across the country. Water currents disseminate vegetative propagules through drainage areas. Motorboat traffic contributes to this natural seasonal fragmentation and distribution of fragments throughout lakes (ISSG 2008).

Eurasian water milfoil grows into dense mats that shade out and replace other aquatic plants of higher value as food resources. The resulting degraded habitat may support fewer aquatic insects that serve as fish food and less foraging space for large predatory fish, resulting in less efficiency at obtaining prey. High milfoil densities can also result in a reduction of water oxygen levels due to the decay of large amounts of plant material. The dense mats created by the plant also impede water movement and interfere with recreational activities such as swimming, boating, fishing and water skiing (ISSG 2008, Jacono 2006).

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Giant salvinia (*Salvinia molesta*)

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Giant salvinia is a floating aquatic fern that thrives in slow-moving nutrient-rich warm freshwater including ditches, ponds, lakes, slow rivers and canals. Because growth is greatly stimulated by an increase in nutrient levels, the weed is particularly fast-growing in areas where the hydrological regime has been altered by humans, encouraging an increase in nutrient levels (for example by increased runoff or fertilizer leaching). Giant salvinia is a native of Southeastern Brazil and northern Argentina. Since the 1940s, this plant has been dispersed by humans to various tropical and subtropical regions in Africa, Asia, the Australasia-Pacific region and, more recently, the U.S. (USSG 2008). It has been present in Georgia since 1999 (Benson et al. 2001). The introduction of giant salvinia has been linked to the cultivation activities of botanical gardens and commercial horticulture sites. Giant salvinia may be spread over long distances (within or between water bodies) on anything entering infested waters, including boats, trailers,

vehicular wheels, engine intakes, fishing gear, recreational gear and boots. Animals may also contribute to spread (ISSG 2008).

The stagnant, shallow, dark environment created by infestations of giant salvinia negatively affects the biodiversity and abundance of freshwater species including native fish and submersed aquatic plants. Giant salvinia can degrade water quality, alter wetland ecosystems and cause wetland loss. Heavy infestations of giant salvinia have the potential to negatively impact industries that depend on clean water bodies, such as boating. Both local and commercial fisheries can be affected by the restricted access to fishing spots, the decreased fish densities, and the difficulty of using long lines and nets created by large mats of the plant. Giant salvinia may increase the level and spread of some human diseases due to the dense vegetative mats and the development of stagnant shallow water, which provide an ideal breeding ground for disease-carrying species of snails and mosquitoes. Finally, by blocking drainage channels and dams, giant salvinia may increase flood water levels, amplifying the amount of damage caused by floods (ISSG 2008).

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Fishes

Red shiner (*Cyprinella lutrensis*)

Garold W. Sneegas, U.S. Geological Survey

Predominantly a resident of creeks and small rivers, red shiners have adapted to a wide range of environmental conditions, including seasonal intermittent flows, degraded habitats, poor water quality and natural physiochemical extremes. Red shiners were initially introduced as a bait minnow, and recently, through the aquarium trade as well. Bait release is the primary mechanism by which red shiners spread into rivers and streams outside their native range in the Midwest (ISSG 2008). In the southeastern U.S., nonindigenous populations of red shiners occur in Alabama and Georgia (Mobile and Apalachicola river drainages), and North Carolina (Pee Dee and Roanoke River drainages). Red shiners were discovered in northwest Georgia in the upper Coosa River system in the early 1990s, and have since spread from the lower Etowah River throughout the Ostanaula River and into the lower Conasauga and Coosawattee rivers (Burkhead and Huge 2002).

Red shiners are formidable competitors when introduced beyond their native range, capable of establishing populations wherever they have been introduced. This is particularly the case if the new environments are degraded and have low fish diversity. They are known to eat small invertebrates and spawn in the mid-summer months (ISSG 2008). Introduced red shiners have become one of the most abundant species found in degraded streams in Georgia. In the upper Coosa River the red shiner is hybridizing with the blacktail shiner, *Cyprinella venusta*, a native *Cyprinella* species, and there is

concern the red shiner may hybridize with the threatened blue shiner *Cyprinella caerulea* as well (Benson et al. 2001).

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Asian swamp (rice) eel (*Monopterus albus*)

Paul Shafland, Florida Fish and Wildlife Conservation Commission

Asian swamp eels are nocturnal generalized predators that consume fishes, worms, crustaceans, and other small aquatic animals (Freeman and Burgess 2000, Straight et

al. 2005, Hill and Watson 2007). In their native habitat, they live in agricultural areas, muddy ponds, swamps, canals, and wetlands. Asian swamp eels are native to eastern Asia, including much of China. In the U.S., swamp eels have been introduced to Hawaii, Florida, and Georgia (Collins et al. 2002). In 1996, the eels were found in ponds at the Chattahoochee Nature Center, in Georgia. The population probably grew from an illegal aquarium release around 1990 (Starnes et al. 2000). The main concern in Georgia is that the eels will spread to adjacent water bodies, especially the Chattahoochee River. Since 2002, a multi-agency working group has been trying to contain and control the swamp eels at the Nature Center as well as determine what effects the eels are having on the ponds within the Center. To date it appears the swamp eels' impact may be limited to reducing food resources for other insectivorous fish/invertebrates within the system. However, as changes in habitat occur and if natural top predators are removed or increased, the larger swamp eels may become primary predators (Freeman et al. 2005).

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Lionfish (*Pterois volitans; P. miles*)

NOAA Archives, Bugwood.org

Lionfish are tropical, reef-associated carnivorous marine fish that originate from Indo-Pacific areas and have been introduced into U.S. and Caribbean waters through aquarium releases. While juveniles have been found off the eastern coast of the U.S. as far north as Rhode Island, established populations of lionfish occur from Florida to Cape Hatteras, North Carolina (Schofield et al. 2009). Adult lionfish now inhabit locations at Gray's Reef National Marine Sanctuary off the Georgia coast (Rahn et al. 2007, Personal Communication, Woodward 2009). Lionfish can pose a threat to fishermen, divers, and wildlife inspectors because they are venomous, a fact of which the general public may not be aware. Careless handling of recently dead specimens can also result in serious wounds. Symptoms of the sting may include: extreme pain, swelling, redness, bleeding, nausea, numbness, joint pain, anxiety, headache, disorientation, dizziness, paralysis, and convulsions (ISSG 2008). Without any natural predators in southeastern U.S. waters, lionfish exert direct negative impacts on indigenous marine species through competition for food and space, and as predators of smaller fish. Lionfish may also act synergistically with other existing environmental stressors, such as climate change, overfishing, and pollution, making invasions of this fish a significant concern (Albins and Hixon 2008).

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Flathead catfish (*Pylodictis olivaris*)

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Flathead catfish are one of the largest members of the catfish family, and are found in large rivers, streams, and lakes, usually over hard bottoms. They prefer deep, sluggish pools, with logs and other submerged debris that can be used as cover. The native range of flathead catfish includes a broad area west of the Appalachian Mountains encompassing the large rivers of the Mississippi, Missouri, and Ohio basins. Its native range extends north to North Dakota, west to New Mexico and south to the Gulf including eastern Mexico. Flathead catfish have been introduced east of the Appalachian Mountains and into several western states (ISSG 2008). While this species is native to the Tennessee and Coosa river basins in Georgia, they have been moved to the Altamaha River drainage, the Flint, Satilla, and Savannah River drainage (Fuller 2008). Flathead catfish were stocked in the Savannah and Altamaha Rivers in the 1970s (Fuller 2008).

Introductions of flathead catfish are among the most biologically harmful of all fish introductions in North America. Flathead catfish prey heavily on sunfish, and can also reduce the number of common carp and bullheads in a water body (ISSG 2008). The introduced flathead population in the Flint River system preys largely on crayfish, and young-of-the-year flathead catfish feed on darters, clupeids, catostomids, ictalurids, and centrarchids (Benson et al. 2001). Declines in native fish species, particularly native bullhead species, have been observed in Georgia (Thomas 1995). The flathead catfish is also seriously affecting the fish fauna of the Apalachicola River in Florida, where it consumes young Gulf sturgeons, a federally listed threatened species (Stein and Flack 1996). Georgia is currently trying to control flathead catfish in the Satilla River, and in 2007, 4,400 flatheads weighing a combined total of 25,357 pounds were removed. As of 2008, 3,285 flatheads weighing a combined total of 9,398 pounds have been removed (Personal Communication, Bonvechio 2009).

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Mollusks

Asian clam (*Corbicula fluminea*)

Shawn Liston, Audubon of Florida, Bugwood.org

Asian clams have a yellowish to black shell with concentric, evenly spaced ridges on the shell surface. They are found in lakes and streams of all sizes, and prefer fine, clean sand, clay, and coarse sand substrates. Asian clams are usually found in moving water because they require high levels of dissolved oxygen and are generally intolerant of pollution. These clams are native to southeastern China, Korea, southeastern Russia,

and the Ussuri Basin, and in the U.S. can be found in 38 states and the District of Columbia (ISSG 2008). They are so widespread in Georgia that specimens can be found in most counties (Benson et al. 2001). Asian clams are used as live bait throughout the U.S. and can sometimes escape into the water alive. They are also spread by the aquarium trade where they are known as "pygmy" or "gold" clams. Juvenile clams can be carried in ballast water all over the world. Researchers have also sometimes inadvertently released Asian clams into nonnative waters. Asian clams can out-compete many native clam species for food and space. While the introduction of Asian clams into the U.S. has resulted in the clogging of water intake pipes, affecting power, water, and other industries, these effects have not yet been experienced in Georgia (ISSG 2008, Candler 2009). Management of Asian clam populations costs U.S. utility corporations approximately $1 billion annually (OTA 1993).

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Green mussel (*Perna viridis*)

U.S. Geological Survey

U.S. Geological Survey

Green mussels are bivalve mussels native to the Asia-Pacific region where they are widely distributed. Green mussels generally inhabit intertidal, subtidal and estuarine environments with high salinity. They attach to hard substances, but are capable of relocating. Dense colonies can develop in optimal temperature and salinity conditions, sometimes with thousands of individuals per square meter. The introduction of green mussels into Australia, Japan, the Caribbean, North America, and South America was caused by fouling on boat hulls or ballast-water discharge. Because of its dispersed spawning nature, lack of local predators, fast growth, and high tolerance of environmental conditions, the green mussel population is expected to expand in Atlantic habitats until it reaches its ecologic limits (ISSG 2008). The green mussel was first introduced to the U.S. in Tampa Bay in 1999, where it resulted in significant ecological and environmental damage (Power et al. 2008). There are concerns that the species will establish populations at Gray's Reef National Marine Sanctuary, located off the Georgia coast (Power et al. 2004).

Green mussels form dense populations on a variety of structures including vessels, wharves, mariculture equipment, buoys, pilings and other hard substances. The mussels may clog crab traps and clam culture bags, making the commercial harvest of these native species more difficult. Green mussels can cause economic problems with water systems of industrial complexes by clogging pipes, increasing corrosion and reducing efficiency. Fouling of vessels can raise costs for owners due to increased maintenance, decreased fuel efficiency, and blocked or damaged internal pipes. Green mussels are able to out-compete many other fouling species, causing changes in community structure and trophic relationships. They have also been recorded with high levels of accumulated toxins and heavy metals and are linked to shellfish poisoning in humans (ISSG 2008).

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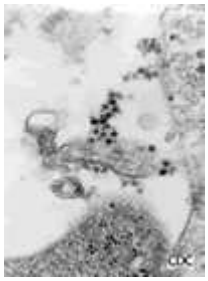
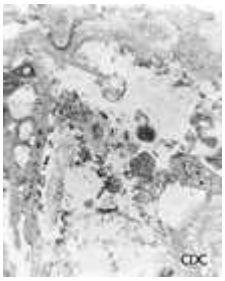
Disease Organisms

West Nile virus (*Flavivirus* spp.)





Scanned images are of West Nile virus isolated from brain tissue from a crow found in New

Bruce Cropp, Microbiologist, Division of Vector-Borne Infectious Diseases. CDCP

The West Nile virus (WNV) is a member of the family Flaviviridae, and is an arbovirus (arthropod borne viruses) spread by mosquitoes and known to cause disease in humans and horses, many types of birds, and some other animals, including alligators (Jacobson et al. 2005). In the U.S., birds appear to be the major carrier of the disease. When certain *Culex* spp. of mosquitoes feed on the blood of infected birds, the insects ingest the virus. When these mosquitoes subsequently bite people, horses or other animals, they can pass the virus onto a new host. The primary vectors for WNV in the U.S. are the *Culex* spp. of mosquito, which commonly breed in urban areas and prefer to feed on birds. Mosquitoes thrive wherever standing water exists, including wetlands, urban and agricultural areas. WNV is introduced to new locations through infected birds. The WNV was first isolated in Uganda in 1937, and commonly occurs in Africa, the Middle East, parts of Asia and Australia, and parts of Europe. The virus was first discovered in the U.S. in 1999, and its geographic range increased rapidly to include 44 states, the District of Columbia, and a number of Canadian provinces (ISSG 2008). Most people infected with WNV are asymptomatic or develop only mild illness. In the worst cases, however,

the virus causes encephalitis, an inflammation of the brain and its surrounding membrane. More than 3600 cases and 124 deaths from WNV were reported in the U.S. in 2007 (CDCP 2008).

WNV was first isolated in Georgia in the summer of 2001 and subsequently became widely spread across the state between 2001 and 2004. In 2000, 4.4% of Georgia counties reported positive wild avian species tests for WNV. By 2004 this percentage had increased to 65.4 (Gibbs et al. 2006a). The spread of WNV across the state was most likely facilitated by the presence of several competent mosquito vectors, including *Culex quinquefasciatus* (Gibbs et al. 2006b). In Georgia, there have been a total of 212 reported human cases of WNV between 2001 and 2007, resulting in 17 fatalities (CDCP 2008).

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Priority 1(b) Species

Priority 1(b) species are those that are not currently present in Georgia and which the agency or organization currently spends a significant amount of time and/or money on for some aspect of management or that the agency or organization definitely plans to spend time and money on in the next five years. Examples of Priority 1(b)) species identified by members of the Committee include the following:

Mollusks

Zebra mussel (*Dreissena polymorpha*)

Amy Benson, U.S. Geological Survey, Bugwood.org

Whitney Cranshaw, Colorado State University, Bugwood.org

Zebra mussels are found in estuaries, lakes, urban areas, and water courses. They are native to the Caspian, Azov, and Black Seas, but since the 1700s their range has expanded westward to include most of Western Europe, the U.K. and North America, where these mussels are found in the Great Lakes and in all of the major river drainages east of the Rocky Mountains. While Zebra mussels are not yet present in Georgia, they are a major concern to natural resource management agencies due to the costly negative impacts that have resulted in states where they are established. Zebra mussels were introduced between continents and among the Great Lakes in ballast water. They have also been introduced to smaller lakes by overland transport on boat hulls and trailers. Larvae may be transported during fish stocking, on scuba diver's wetsuits, or in scientific equipment. Adults may attach to anchors and boat hulls and be transported. Zebra mussels have also possibly been spread by aquarium dumping. Zebra mussels compete with zooplankton for food, thus affecting natural food webs. They also settle in large numbers on native mussels, causing suffocation, starvation, and energetic stress leading to death. Spawning reefs of fishes such as lake trout can be negatively affected by zebra mussel colonies. Zebra mussels cause great economic damage by fouling water intake pipes, beaches, boat hulls, docks, sinking navigation buoys, and clogging condenser pipes. (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Priority 2(a) Species

Priority 2(a) species are those that are not present in Georgia and which agencies or organizations deal with infrequently or attempts to control in selected high-priority areas (because they are thought to be lesser threats). Examples of Priority 2(a) species identified by members of the Committee include the following:

Plants

Alligatorweed (*Alternanthera philoxeroides*)

Chris Evans, River to River CWMA, Bugwood.org

Chris Evans, River to River CWMA, Bugwood.org

Alligatorweed is a perennial herb that can be found in many parts of the world, infesting rivers, lakes, ponds, estuaries, riparian zones, wetland, and irrigation canals, as well as many terrestrial habitats. A native of South America, alligatorweed was probably introduced into the U.S. through ballast water discharge and contaminated plant mulch. Alligatorweed was first documented in Mobile, Alabama in 1897, and is now found in coastal states from Virginia to Texas, the Tennessee Valley and Puerto Rico (DCR 1997). This plant has been present in Georgia since 1965 (USGS 2005). Alligatorweed grows out into waterways, forming dense floating mats that expand across the surface of the water. These mats clog waterways and out-compete native plants along the shore. The mats also impede water flow and lodge against structures, thereby promoting sedimentation and contributing to flooding. They prevent access to and use of water, promote health problems by providing habitats for mosquitoes and degrade natural aesthetics (ISSG 2008).

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USGS. 2005. *Alternanthera philoxeroides*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <http://nas.er.usgs.gov> Revision Date: June 7, 2005. Accessed 15 December, 2006.

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Giant reed (*Arundo donax*)

Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA NRCS. 1992. *Western wetland flora: Field office guide to plant species*. West Region, Sacramento.

Giant reed is a perennial grass that has been widely introduced into primarily riparian zones and wetlands in subtropical and temperate areas of the world. Giant reed invades riparian zones of low-gradient rivers and along ditches, and some wetlands and coastal marshlands, as well as agricultural and disturbed areas, natural and planted forests, range and grasslands, and urban areas. Considered native to the Indian sub-continent, giant reed now occurs worldwide in tropical to warm-temperate regions, including tropical islands. In Georgia, giant reed is present in four watersheds: the Upper Oconee, Broad River, Turtle River, and the Upper Ochlockonee (NRCS 2008).

It has been widely planted throughout the warmer areas of the U.S. as an ornamental, and is available in nursery trade. Fragments of giant reed stems are often carried by water to new colonization sites. Once established, giant reed forms dense, homogenous stands at the expense of native plant species, altering the habitat of the local wildlife. Giant reed displaces native riparian vegetation and provides poor habitat for terrestrial insects and wildlife. It is both a fire and flood hazard. Plants trap sediments and narrow flood channels, leading to erosion and overbank flooding. Giant reed also promotes wildfire and its debris blocks stream flow and damages bridges (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

National Resources Conservation Services. 2008. The PLANTS Database < http://plants.usda.gov> Accessed 25 June.

Parrotfeather (*Myriophyllum aquaticum*)

Nancy Loewenstein, Auburn University, Bugwood.org

Alison Fox, University of Florida, Bugwood.org

Parrotfeather is a perennial freshwater herb that has been introduced for use in indoor and outdoor aquaria. It is also a popular aquatic garden plant that has escaped cultivation and spread via plant fragments and intentional plantings. Parrotfeather plants grow in sluggish waters, edges of streams, lakes, ponds, drainage and irrigation ditches, as well as canals, backwaters, sloughs and lagoons. A native of South America, parrotfeather has been introduced throughout North America, Australia, New Zealand, and Java (ISSG 2008). Present in Georgia since 1951, it is found north through the Ridge and Valley Province, including the Upper Ocmulgee and Upper Coosa River drainages where plants occur at 950 ft. elevation (Benson et al. 2001). Parrotfeather populations

may be quite dense, sometimes as floating mats that have been uprooted, often choking waterways and impeding navigation. While parrotfeather may provide cover for some aquatic organisms, it can seriously change the physical and chemical characteristics of lakes and streams. Infestations can alter aquatic ecosystems by shading out the algae in the water column that serve as the basis of the aquatic food web. In addition, the plant provides choice habitat for mosquito larvae. The plant can also interfere with recreational opportunities in these water bodies (ISSG 2008).

Literature Cited

Benson, Amy J., Pam L. Fuller, and Colette C. Jacono. 2001. Summary Report of Nonindigenous Aquatic Species in the U.S. Fish and Wildlife Service Region 4. U.S. Department of the Interior, Geological Survey, Gainesville, Florida.

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Common reed (*Phragmites australis*)

Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln.

Common reed is a flowering plant found in coastland, disturbed areas, estuaries, lakes, riparian zones, urban areas, water courses, and wetlands. Common reed is especially abundant in alkaline and brackish environments and can also thrive in highly acidic wetlands. Various types of human manipulation and/or disturbance are thought to promote common reed, such as restriction of the tidal inundation of a marsh and sedimentation bay. Common reed is found on every continent except Antarctica, and is widespread in the U.S. (ISSG 2008). Within Georgia, this plant is found in the Turtle River watershed (NRCS 2008). Common reed has been used in many wetland rehabilitation

and stabilization projects to revegetate disturbed riparian areas, control shore erosion, stabilize river and canal banks, and reduce wave action on watershed structures. This plant spreads by sprouting from a rhizome fragment or from seed, and may also be transported by birds. In coastal marshes, common reed spread is facilitated by anthropogenic disturbance as well as natural disturbance caused by tidal movements of dead vegetation (ISSG 2008).

Common reed becomes a problem when it begins to out-compete native species in a given area. Many Atlantic coastal wetland systems have been invaded as a result of tidal restrictions imposed by roads, water impoundments, dikes and tide gates. These invasions may threaten wildlife by altering the structure and function of relatively diverse *Spartina* salt marshes. The invasions also increase the potential for marsh fires during the winter when the above ground portions of the plant die and dry out. Monitoring and control of mosquito breeding is nearly impossible in dense stands. In addition, common reed invasions can have adverse aesthetic impacts. (ISSG 2008).

Literature Cited

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National Resources Conservation Services. 2008. The PLANTS Database < http://plants.usda.gov> Accessed 25 June.

Crustaceans

Green porcelain crab (*Petrolisthes armatus*)

David Knott - SERTC

Green porcelain crabs are found in rocky rubble, oyster reefs, and other shallow sub-tidal and inter-tidal habitats. They are native to the waters off of Central and South America, the Gulf of Mexico and the Pacific Ocean. These crabs are currently invading Florida and are a threat to coastal Georgia waters. Green porcelain crabs are established throughout the Duplin River adjacent to Sapelo Island (USGS 2005). They may have been brought to the Atlantic and Gulf coasts by transport in ballast water and among cultured mollusks. While the full biological impacts of established green porcelain crab populations are unknown, they are thought to displace native bottom-dwelling crabs (ISSG 2008). In Georgia, green porcelain crabs may be having an indirect negative impact on oyster recruitment in areas where they have been reported (Power et al. 2008).

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Power, Alan, Thomas Bliss, Anna Rahn, and Randal Walker. 2008. Preventing the Introduction and Reducing the Spread of Invasive Aquatic Species in coastal Georgia through Research and a Public Awareness and Monitoring Campaign. NOAA's Coastal Incentive Grant Program <http://www.marex.uga.edu/shellfish/invasive%20webitems/Port%20monitoring/Georgia%20Ports%20Final%20Report%20April%2024%202008.pdf > Accessed 21 April, 2009.

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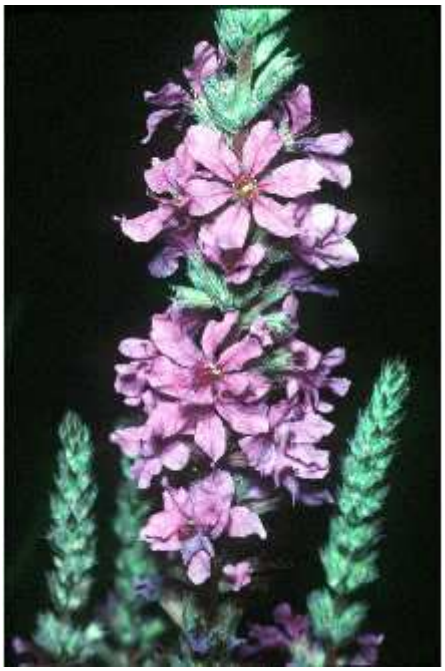
Priority 2(b) Species

Priority 2(b) species are those that are not present in Georgia and which the agency or organization deals with infrequently or attempts to control in selected high-priority areas (because they are thought to be lesser threats, or because they are widespread and difficult to control). Examples of Priority 2(b) species identified by members of the Committee include the following:

Plants

Purple loosestrife (*Lythrum salicaria*)



Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln.

Purple loosestrife is an erect perennial herb with a woody stem and whorled leaves. Plants are capable of invading a variety of riparian and wetland habitats, including marshes, river and stream banks, pond edges, lakes, road site ditches, and reservoirs. Disturbed areas are more prone to invasion because exposed soil is ideal for

germination. Purple loosestrife is native to Europe, Japan, Manchuria China, southeastern Asia, and northern India. It has invaded Canada, the U.S., Ethiopia, and Australia through floating vegetation and debris, garden escapes, and landscape improvement escapes. In the U.S., purple loosestrife has been recorded in 46 states, including the southeastern states of Alabama, North Carolina, South Carolina, and Tennessee. While this plant is not yet present in Georgia, purple loosestrife is a major concern to natural resource management agencies due to the costly negative impacts that have resulted in states with established populations (ISSG 2008).

As purple loosestrife is established, it out-competes and replaces native grasses, sedges, and other flowering plants that provide a higher quality food source and habitat for wildlife. Purple loosestrife stands can deleteriously impact wildlife habitat used by birds and mammals. Purple loosestrife forms dense homogeneous stands that restrict native wetland plant species, including some endangered plants. This plant can overrun wetlands and almost entirely eliminate open water habitat if left untreated. The recreational and aesthetic value of wetlands and waterways is diminished as dense stands of purple loosestrife choke waterways and decrease biodiversity (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Crustaceans

Chinese mitten crab (*Eriocheir sinensis*)

Lee Mecum, California Game and Fish

The Chinese mitten crab is a migrating crab that has invaded Europe and, more recently, North America. These crabs are found in estuaries, lakes, riparian zones, water courses, and wetlands, and have the ability to survive in highly modified aquatic habitats. A native of China, the Chinese mitten crab is now found throughout Europe and Russia. The crab has also been found in North America with reports from the Detroit River and Great Lakes (without establishment) as well as an isolated occurrence in Hawaii, and a growing population in San Francisco Bay. The mitten crab is a delicacy

and live crabs have been illegally imported to food markets. Another likely method of introduction is accidental release via ballast water. While Chinese mitten crabs are not yet present in Georgia, they are a concern to natural due to the costly negative impacts that have resulted in states with established populations (ISSG 2008).

Chinese mitten crabs contribute to the local extinction of native invertebrates and cause erosion through intensive burrowing activity. The crab may cost fisheries and aquaculture industries several of hundreds of thousands of dollars per year by stealing bait and feeding on trapped fish. Chinese mitten crabs may also block water intakes in irrigation and water supply structures. In California, the Chinese mitten crab has disrupted water diversion plants with large numbers of downstream-migrating crabs becoming trapped in holding tanks meant to keep fish out of turbines. This has caused fish mortality and high costs are needed to prevent the crabs' entry. Chinese mitten crabs may also carry the Oriental lung fluke, a parasite that can be passed onto humans by eating raw or poorly cooked crabs (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Rusty crayfish (*Orconecter rusticus*)

U.S. Geological Survey

Rusty crayfish inhabit lakes, ponds, and streams. They prefer areas that offer rocks, logs, or other debris as cover. Rusty crayfish inhabit both pools and fast water areas of streams, and need permanent lakes or streams that provide suitable water quality year-round. These crayfish are native to Indiana, Ohio, Kentucky, and Michigan. However, they have moved as far west as North and South Dakota, as far north as Canada and Maine, and as far south as Tennessee. Anglers using crayfish as bait are thought to be the primary cause of introduction. Rusty crayfish are also sold to schools by biological supply houses, where live crayfish may be given away to students or eventually be released into the wild. Although these crabs are not yet present in Georgia, they are a concern due to the costly negative impacts that have resulted in states with established populations. Rusty crayfish are aggressive and frequently displace native crayfish, reduce the quantity and diversity of aquatic plants and invertebrates, and decrease the populations of some fish species. Rusty crayfish displace native crayfish by crayfish-to-crayfish competition and increased fish predation (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Priority 3(a) Species

Priority 3(a) species are those that are currently present in Georgia but are dealt with only in unusual circumstances, either because they represent minor threats or are essentially naturalized and impossible to control with current methods. Examples of Priority 3(a) species identified by members of the Committee include the following:

Fishes

White perch (*Morone americana*)

Douglas Facey, USGS

White perch is a semi-anadromous fish that in its native range migrates from the saltier areas of bays and coastland into tidal-fresh portions of streams and rivers to spawn in

spring. White perch are found in coastland, lakes, marine habitats, and water courses. Outside of Georgia , white perch are native to North America's Atlantic Slope drainages from the St. Lawrence-Lake Ontario drainage in Quebec, south to the Pee Dee River in South Carolina. They were also introduced to 20 states through the Erie and Welland canals in the 1950s, and are present in the Savannah River system in Georgia. White perch have also been legally and illegally stocked in some areas for sport fishing, where they compete for food with native fish species and consume the eggs of walleye, white bass, and perhaps other species as well. In other states, they are believed to be a potential cause for declines in walleye populations. Collapse in certain fisheries have coincided with increases in white perch populations and are believed to be a result of egg predation and resulting lack of native fish recruitment. In addition, white perch have hybridized with native white bass (*M. chrysops*) in western Lake Erie. Hybrids capable of backcrossing with parent species as well as crossing among themselves could dilute the gene pool of both parent species (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Mammals

Nutria (*Myocastor coypus*)

U.S. Geological Survey

Nutria are large semi-aquatic rodent. They prefer habitats near the water, and are found in riparian zones and wetlands. Native to South America, nutria have been introduced into many areas of North America, Europe, Asia and Africa for breeding in fur farms. This rodent is established in all of the Southeastern states except for Kentucky and South Carolina, and populations may be on the increase in Alabama, North Carolina, and Tennessee (Benson et al. 2001). Historically, they have escaped and established independent populations. Nutria are voracious herbivores, capable of causing extensive damage to native wetland plants, reducing food and cover for migratory waterfowl, degrading water quality, displacing muskrat populations, and encouraging the spread of purple loosestrife. They also harbor a parasite that causes an itchy rash in humans. Because nutrias prefer tubers, they rip up the matted roots that support banks and shorelines, promoting erosion and damaging wetlands. As a result, marshes turn to open water while riverbanks and beaches slip away (ISSG 2008).

Literature Cited

Benson, Amy J., Pam L. Fuller, and Colette C. Jacono. 2001. Summary Report of Nonindigenous Aquatic Species in the U.S. Fish and Wildlife Service Region 4. U.S. Department of the Interior, Geological Survey, Gainesville, Florida.

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Cuban treefrog (*Osteopilus septentrionalis*)

U.S. Geological Survey

During the day Cuban treefrogs hide in moist areas such as cisterns, drains, cellars, and on the trunks of plants. They thrive in altered habitats and are most abundant around ornamental fish ponds and well lighted patios where they are often found on walls, glass windows, porches and potted plants. This species naturally occurs in Cuba, the Isla de Pinos, the Bahamas Islands, and the Cayman Islands, and has been introduced into a large part of southern Florida including the Keys where it is well-established, invasive, and dispersing northward along both coasts (ISSG 2008). A single adult Cuban treefrog was collected in a backyard pond in Savannah in 2004, and the frog is currently present in the Coastal plain of Georgia (Somma 2006). Original introduction into the U.S. probably occurred accidentally on vegetables imported from Cuba earlier in the century. The treefrogs continue to expand their range in Florida by hitchhiking on crates and transplanted shrubs. Cuban treefrogs are voracious predators, feeding on any small animals they can catch, especially insects, spiders, and other smaller native frogs. Thus, they may negatively effect native treefrog populations both through competition and direct predation (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Somma. 2006. *Osteopilus septentrionalis*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=48> Revision Date: April 26, 2006. Accessed 25 June, 2008.

Priority 3(b) Species

Priority 3(b) species are those that are not currently present in Georgia and are dealt with only in unusual circumstances because they are thought to represent only minor threats. Examples of Priority 3(b) species identified by members of the Committee include the following:

Amphibians

Cane toad (*Bufo marinus*)

U.S. Geological Survey

While the cane toad's original habitat was subtropical forests near fresh water, they can now be found in many places such as man-made ponds, gardens, drain pipes, debris, under cement piles, and rubbish beneath houses. Cane toads occur in agricultural areas, disturbed areas, lakes, natural forests, riparian zones, urban areas, water courses, and wetlands. They are indigenous to northern South America, Central America, and Mexico northward to extreme southern Texas. Cane toads are found extensively in Florida and are spreading northward. While the toad's sensitivity to cold weather and preference for disturbed habitats may halt or slow this northward spread, thermal adaptation and the effects of global warming could also allow for the establishment of this species outside of Florida (Somma 2008). Most cane toad introductions were made as early attempts to use biological control against various beetle pests of sugar cane, banana and other cash crops (ISSG 2008). While this frog is not yet present in Georgia, it is of concern to natural resource management agencies due to the costly negative impacts that have resulted in states with established populations

Cane toads are voracious predators that consume a wide variety of prey. Secretions from the cane toad's parotid glands are produced when the toad is provoked or localized pressure is applied to it, such as a predator grasping the toad in its mouth. These toxic secretions are known to cause illness and death in domestic animals that come into contact with toads, such as dogs and cats, and wildlife, such as snakes and lizards. Cane toads are able to squirt the toxic secretion over a meter when threatened, causing extreme pain if rubbed into the eyes. Human fatalities have been recorded from the cane toad following ingestion of the eggs or adults and there is a risk to children from their toxin. Cane toads are often seen as a nuisance in urban areas, as their calls can keep people awake (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Somma, Louis A. 2008. *Rhinella marina*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=48> Revision Date: May 13, 2008. Accessed 25 June.

Aquatic Species Watch List

These species are considered to be future threats by the Aquatic Nuisance Species Advisory Committee because, although they are either not present or are not currently considered to be serious pests, they have the potential to become aquatic nuisance species based on their history in other states.

Plants

Brittle Naiad (*Najas minor*)

Troy Evans, www.forestryimages.org

Brittle naiad is a rooted submersed annual aquatic plant found in fresh or brackish waters. It was introduced into the U.S. from Europe, and is present from New Hampshire west to Oklahoma and from Ontario southward to Florida. This plant has spread rapidly in the southeast and Mid-Atlantic states. In Georgia, brittle naiad is established in the following rivers: Upper Chattahoochee, Etowah, Oostanaula, Broad, Spring, Middle Chattahoochee-Lake Harding, Upper Oconee, Middle Flint, and the Upper Ocumlgee (USGS 2005). The plant is also present in Lakes Oliver, Sinclair, and Worth. Brittle naiad grows either in mixed stands with other invasive exotic species (e.g., hydrilla) or as a monoculture, excluding native plants and producing conditions adverse to fish and waterfowl. It can form dense shoals and surface mats in water 12 feet in depth, and is readily spread by boat traffic and water movements (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

USGS. 2005. *Najas minor*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. . <http://nas.er.usgs.gov> Revision Date: June 7, 2005. Accessed 25 June, 2008.

Torpedo grass (*Panicum repens*)

(c) 2009 Forest & Kim Starr

Torpedo grass is a perennial that frequently forms dense colonies and has long, creeping rhizomes. It grows in moist, often sandy soils, and its rhizomes frequently extend several feet out into the water. Torpedo grass is found in coastland, lakes, marine habitats, riparian zones, and water courses. It grows along ditch banks, around ponds, along roadsides, and in managed turfgrass areas, including golf courses. A native of Africa, Asia, and Europe, torpedo grass has spread throughout the Gulf coast region from Florida to Texas, and is present in Lakes Jackson and Worth in Georgia. It is a serious problem in the lower coastal plain of Alabama and Mississippi and in much of Florida. Torpedo grass frequently forms dense floating mats that impede water flow in ditches and canals and restrict recreational use of shoreline areas of lakes and ponds. It can form monocultures that displace native vegetation, particularly in or near shallow waters (ISSG 2008).

Literature Cited

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Black carp are considered to be a future threat to Georgia although there are no known populations present in the state (and there is not a formal program to prevent their occurrence). However, this species has been documented in other southeastern states and has been shown to have significant ecological, economic, or health impacts where they occur

Black carp (*Mylopharyngodon piceus*)

Leo Nico, USGS

The black carp is a bottom-dwelling molluscivore that has been used by U.S. fish farmers as a biological control for disease-carrying snails in their farm ponds. Black carp was first brought into the U.S. from Asia in the early 1970s as a "contaminant" in imported grass carp stocks. Subsequent introductions of black carp occurred in the early 1980s. During this period it was imported as a food fish and as a biological control agent to combat the spread of yellow grub (*Clinostomum margaritum*) in aquaculture ponds. The first known record of an introduction of black carp into open waters occurred in Missouri in 1994. The black carp has since been reported in Arkansas, Illinois, Mississippi, and Missouri (ISSG 2008). Black carp are considered to be a future threat to Georgia although there are no known populations present in the state. Current laws in Georgia prohibit the possession and importation of the species into the state. However, they have been documented in other southeastern states and have been shown to have significant ecological, economic, or health impacts where they occur.

Black carp could potentially negatively impact native aquatic communities by feeding on and reducing populations of native mussels and snails, many of which are considered endangered or threatened. Black carp could restructure benthic communities by direct predation and removal of algae-grazing snails. Mussel beds consisting of smaller individuals and juvenile recruits are probably most vulnerable to being consumed by black carp. Because the life span of black carp reportedly exceeds 15 years, sterile triploid black carp in the wild would be expected to persist many years and therefore have the potential to harm native mollusks by predation. In addition, black carp are host to parasites, flukes, and bacterial and viral diseases that could possibly be transferred to other fish species (Crosier and Molloy 1996; Nico 2008). Due to concerns about the potential impacts of black carp on native freshwater

mussels and snails in the Mississippi River basin, the species was listed under the injurious wildlife provision of the lace Act (18 U.S.C. 42) by the USFWS in 2007 (50 C.F.R Part 16).

Literature Cited

Crosier, Danielle M. and Daniel P. Molloy. 1996. Black Carp - *Mylopharyngodon piceus*. Environmental Laboratory, U.S. Army Corps of Engineers. <http://el.erdc.usace.army.mil/ansrp/mylopharyngodon_piceus.pdf> Accessed 11 April, 2008.

Invasive Species Specialists Group. 2008. Global Invasive Species Database. <http://www.issg.org/database/species> Accessed 16 April.

Nico, L.G., 2008. *Mylopharyngodon piceus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=573> Revision Date: July 20, 2007. Accessed 11 April.

Appendix C: Summary of Federal Laws Relevant to ANS

This appendix contains a brief description of a number of the major federal legal authorities that deal with invasive species.[1]

Clean Water Act (33 U.S.C. §1251 *et seq.*)

This Act is the primary federal law that protects U.S. waters, including lakes, rivers, aquifers, and coastal areas (33 U.S.C. §1251(a)). It provides a comprehensive framework of standards, technical tools and financial assistance to address the many causes of pollution and poor water quality, including municipal and industrial wastewater discharges, polluted runoff from urban and rural areas, and habitat destruction. Among other things, the Act protects wetlands and other aquatic habitats through a permitting process that ensures development and other activities are conducted in an environmentally sound manner (33 U.S.C. §1322).

Coastal Zone Management Act (16 U.S.C. §1451 *et seq.*)

The Coastal Zone Management Act (CZMA) is another avenue by which invasive species can be controlled and managed. Under the CZMA, the federal and state governments work together to "preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations" (16 U.S.C. §1452(1)). Specifically, the federal government is to encourage and assist the states to achieve "wise use" of land and water resources in the coastal zone (*id*. §1454(2)). Invasive species issues can be incorporated into State Coastal Zone Management Plans through modification or amendment, subject to the approval of the Department of Commerce (DOC) (*id*. §1455(e)). Section 1555a(b) allows the DOC to make grants to eligible costal states to assist them in preserving or restoring specific areas, redevelopment of deteriorating and underused urban waterfronts and ports, access to public beaches or development of a permit process to regulate aquaculture facilities in the coastal zone. In addition, the Act establishes the National Estuarine Research Reserve System (*id*. §1461(c)). Under this program, monitoring and other invasive species research could be sponsored.

Cooperative Forestry Assistance Act (41 U.S.C. §2104)

Under cooperative authorities, the Secretary of Agriculture may assist other federal, state, and private entities in controlling and managing invasive species on other federal lands and non-federal lands. The Secretary's primary cooperative authority for invasive

[1] See the National Invasive Species Council, National Management Plan: Appendix 3 – Legal Authorities Related to Invasive Species. Retrieved 3 February 2007 from www.invasivespeciesinfo.gov/council/appendix3.shtml.

species is section 8 of the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. §2104). Section 8(b) authorizes the Secretary of Agriculture to conduct activities and provide technical assistance relating to insect infestations and disease conditions affecting trees on National Forest System lands, on other federal lands (in cooperation with other federal departments) and on non-federal lands (in cooperation with state officials, other entities, or individuals). These activities include in part: conducting surveys to detect and appraise insect infestation and disease conditions, determining biological, chemical, and mechanical measures necessary to prevent, retard, control or suppress incipient, potential, threatening, or emergency insect infestations and disease conditions affecting trees and providing technical assistance to maintain healthy forests and manage the use of pesticides (*id*. §2104(b)). Section 8(g) of the Act also authorizes the Secretary to provide financial assistance through the Forest Service to state entities and private forestry or other organizations to monitor forest health and protect forest lands. The Act gives the USDA authority to provide support for good forest management practices, including financial assistance to maintain health timber ecosystem to prevent incursion of invasive species on privately owned non-industrial forest lands.

Section 8 of the Act applies only to insect infestations and disease conditions affecting trees. The Act does not contain similar authority for insect infestations and disease conditions not affecting trees or for invasive plants. Section 4 of the Act provides support for good forest management practices on privately owned non-industrial forestlands.

Endangered Species Act (16 U.S.C. §1531 *et seq.*)

The Endangered Species Act (ESA) is jointly administered by the Secretaries of Interior and Commerce and contains provisions regulating import and export of listed species. However, other provisions of the ESA, relating as to how invasive species may negatively affect a listed species are probably more significant and can provide powerful invasive species management tools. Section 7 of the ESA requires any federal agency to ensure that any action authorized, funded, or carried out by the agency not jeopardize the continued existence of any endangered or threatened species or adversely modify any critical habitat of such species (16 U.S.C. §1536(a)(2). Thus, each federal agency must consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, depending on the species, for any action that may affect a listed species. If the action is not likely to adversely affect a listed species, the appropriate Service issues a Biological Opinion, which may authorize take that is incidental to the action or, if the federal action would otherwise jeopardize the continued existence of the species, offer alternatives to the federal action that will avoid such jeopardy (*id*. §1536(b)).

Any take of an endangered or threatened fish species unless otherwise authorized is unlawful under the statute (i*d*. §1538). Thus, a federal agency will be held responsible

for any unauthorized take directly or indirectly caused by the authorization, funding, or other federal action associated with invasive species.

The ESA treats threatened or endangered plants somewhat differently from federally listed animals. Section 9 prohibitions on take do not apply to plants, (*id.* §1538(a)(2)), but cautions can be provided in a Biological Opinion on prohibitions against removal or disturbance of plants. Thus, a federal agency will be held responsible for prohibited acts affecting both animal and plants that result from authorization, funding, or other federal action associated with invasive species. Section 7 consultation requirements apply, however, only to federal action.

Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. §136 *et seq.*)

The primary focus of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is to provide federal control of pesticide distribution, sale, and use. The EPA has authority under FIFRA not only to study the consequences of pesticide usage but also to require users (farmers, utility companies, and others) to register when purchasing pesticides. Through later amendments to the law, users also must take exams for certification as pesticide applicators. All pesticides used in the U.S. must be registered (licensed) by EPA. Registration assures that pesticides will be properly labeled and that if used in accordance with specifications will not cause unreasonable harm to the environment. FIFRA is critical whenever pesticides are used to control or reduce the impact of invasive species. Examples include the use of a pesticide to control lamprey populations in the Great Lakes and the use of herbicides to control noxious weeds. FIFRA also gives EPA review authority for biological control agents when they are used to control invasive pests.

Federal Noxious Weed Act (7 U.S.C. §2801 *et seq.*)

The Federal Noxious Weed Act (FNWA) has been replaced by the Plant Protection Act, 7 U.S.C. §7701 *et seq*., except for Section 2814. This section requires each federal agency to manage plant species that are classified as "undesirable, noxious, harmful, exotic, injurious, or poisonous" (7 U.S.C. §2814(e)(7)) on federal lands. They are to develop and coordinate a management program to control such plants on federal land and to enter into cooperative agreements with state agencies to implement their management plants. However, a federal agency is not required to carry out a management plan on federal lands unless similar programs are being implemented on state or private lands in the same area.

Federal Seed Act (7 U.S.C. §1551 *et seq.*)

The Federal Seed Act (FSA) mandates accurate labeling and purity standards for seeds in commerce, and prohibits the importation and movement of adulterated or misbranded seeds. The FSA works in conjunction with the Federal Noxious Weed Act to

authorize USDA to regulate the importation and movement of field crop, pasture and forage, or vegetable seed that may contain noxious weed seeds. The FSA may offer protection against interstate transportation of invasive species because it requires labeling of seeds entering interstate commerce and requires standards for certain imported seeds.

The FSA allows interstate movement of agricultural seed containing noxious weed seeds if the shipment is accurately labeled as to the kinds of noxious weed seeds present and their rate of occurrence (7 U.S.C. §201). The rate of noxious weed seeds in an interstate shipment of agricultural seeds is not allowed to exceed the rate for shipment, movement, or sale in the state in which the seed is offered for transportation or transported, or in accordance with regulations issued by USDA. USDA has promulgated regulations setting tolerances for the nine noxious weeds specifically listed in the FSA in shipments of agricultural or vegetative seeds in interstate commerce.

The FSA also requires shipments of imported agricultural and vegetable seeds to be labeled correctly and to be tested for the presence of certain noxious weeds as a condition of entry into the U.S (*id*. §301). As is the case with the interstate movement of seeds, tolerances have been established for the seeds of nine specifically listed noxious weeds in imported seed.

Fish and Wildlife Coordination Act (16 U.S.C. §661 *et seq*.)

One of the purposes of the Fish and Wildlife Coordination Act (FWCA) is to give wildlife conservation equal consideration and coordination with other features of water resource development programs "through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation and rehabilitation. . . (16 U.S.C. §661). The FWCA requires the Department of Interior to provide assistance to, and cooperate with, federal, state, and public or private agencies and organizations to control, manage, and protect wildlife resources (*id*. §661(1)).

This Act authorizes the National Marine Fisheries Service to review development projects proposed or licensed by federal agencies and to make recommendations. It also makes funds available through grants and cooperative agreements that could encompass invasive species projects (*id*. §663).

Hawaii Tropical Forest Recovery Act (16 U.S.C. §4502a *et seq*.)

Section 3 of the Hawaii Tropical Forest Recovery Act (16 U.S.C. §4502(a)) authorizes the USDA's Forest Service to protect indigenous plants and animals from invasions, establish biological control agents for invasive species that threaten natural ecosystems, establish monitoring systems to identify baseline conditions and determine detrimental

changes or improvements over time, and provide assistance to states with tropical forests (*id*. 4501a).

International Forestry Cooperation Act (16 U.S.C. §4501 *et seq.*)

Under Section 602(b) of the International Forestry Cooperation Act (16 U.S.C. §4501(b)), the Secretary may, in support of forestry and related natural resource activities outside the United States and its territories and possessions, provide assistance for the prevention and control of insects, diseases, and other damaging agents.

Under these authorities, the USDA's Forest Service delivers research and development products for vegetation management and protection; wildlife, fish, water and air sciences; resource valuation and use; and inventory and monitoring. The Forest Service Research & Development program addresses all aspects of that agency's invasive species program activities. The Forest Service's research authorities provide for the Service to conduct prevention, rapid response, control, and management activities related to invasive species and to restore areas affected by invasive species.

Lacey Act (18 U.S.C. §42 *et seq.*)

The Lacey Act, administered by the USFWS, prohibits importation into the U.S. or any U.S. territory or possession and shipment between the continental U.S., the District of Columbia, Hawaii, the Commonwealth of Puerto Rico, and any possession of the U.S. of certain categories of animal species determined to be "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States" (18 U.S.C. §42(a)(1)). Wildlife and wildlife resources are defined broadly to include all wild animals and "all types of aquatic and land vegetation upon which such wildlife resources are dependent" (*id.*). The statute gives the USFWS the authority to export or destroy any injurious species at the expense of the importer, although permits may be issued to allow importation of otherwise injurious species for specific purposes (*id* §42(a)(3)). Regulations listing species found to be injurious under the Lacey Act are in 50 C.F.R. Part 16.

Several restrictions within the Lacey Act, however, limit its ability to comprehensively address invasive species introductions. First, the Act is limited to animals. In fact, the statute does not apply to all animals, but only those specifically listed along with mammals, birds, fish, amphibians, reptiles, mollusks, and crustaceans generally. In addition, the statute only applies to "wild" birds and mammals; presumably any species that has been domesticated could not be regulated. The statute also excludes restrictions on any species that is regulated under the Plant Pest Act, explicitly stating that Section 42 does not authorize "any action with respect to the importation of any plant pest as defined in the Federal Plant Pest Act, insofar as such importation is subject to regulation under that Act." Thus any animal species whose importation is regulated under the Plant Pest Act cannot be regulated under the Lacey Act.

The "other" Lacey Act (16 U.S.C. §3371 *et seq.*)

A separate provision known as the "other" Lacey Act also has implications for regulating introductions of invasive species. This law, administered by the Secretaries of the Interior, Commerce, and Agriculture, generally makes it unlawful for any person to import, export, transport, sell, receive, acquire, or purchase (or attempt to commit any such act) in interstate or foreign commerce any fish, wildlife, or plant taken, possessed, transported, or sold in violation of any federal, tribal, state, or foreign law (16 U.S.C. §3372(a)(1)(2)(4)). Thus, while the statute does not substantively grant authority to regulate the importation, transportation, exportation, or possession of any species, violation of another federal, state, tribal, or foreign law governing these activities would become a violation of federal law and subject to particular civil and criminal penalties. The Secretaries of the Interior and Commerce have the authority to enforce laws involving fish and wildlife, while the Secretary of Agriculture has the authority to enforce laws involving plants.

This statute also has restrictions, however, that limits its effectiveness to address invasive species introductions. As with 18 U.S.C. §42, the definition of fish or wildlife limits its application to "wild" animals. In addition, while the definition of fish or wildlife is broad ("any wild animal, whether alive or dead, including without limitation any wild mammal, bird, reptile, amphibian, fish, mollusk . . . or other invertebrate" (*id*. §3371(a)), the definition of plant is limited to "any wild member of the plant kingdom . . . which is indigenous to any state and which is either (A) listed on an appendix to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, or (B) listed pursuant to any State law . . . ." (*id*. §3371(f)). Thus plants covered by the act are limited to those indigenous to the United States and listed under CITES or a state endangered species law; all other plants are not covered.

Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 *et seq.*)

Essential fish habitat provisions of this Act (16 U.S.C. §1855) provide for review of federal and/or other actions that could affect essential fish habitat with authority to make recommendations necessary to conserve essential fish habitat. Specifically, the DOC, in consultation with participants in the fishery, must provide each Fishery Management Council with recommendations and information regarding each fishery under that council's authority (*id*. §1855(b)(1)(B)). The purpose is to assist the Councils in identification of essential fish habitat (EFH), the adverse impacts on that habitat, and the actions that should be considered to ensure the conservation and enhancement of that habitat. Also, the DOC must review programs it administers and ensure that any relevant programs further the conservation and enhancement of EFH (*id*. §1855(b)(1)(C)). Finally, the DOC must coordinate with and provide information to other Federal agencies to further the conservation and enhancement of EFH (*id*. §1855(b)(1)(D)).

Multiple-Use Sustained-Yield Act (16 U.S.C. §528 *et seq.*)

USDA manages National Forests for multiple uses under the Multiple-Use Sustained-Yield Act (MUSY). The policy behind the MUSY is that the "the national forests are established and shall be administered for outdoor recreations, range, timber, watershed, and wildlife and fish purposes" (16 U.S.C. §528). The MUSY authorizes the USDA to develop and administer renewable surface resources of the national forests and to cooperate with interested state and local government agencies and others in the development and management of national forests (*id*. §529). Therefore, the MUSY may be a possible source of authority if invasive species threaten the vitality of national forests and their ability to produce a sustained yield of products and services under the principles of multiple use.

National Environmental Policy Act (42 U.S.C. §4221 *et seq.*)

Compliance with the National Environmental Policy Act (NEPA) can serve to identify actions that are likely to affect invasive species or be affected by them. The rationale behind the NEPA process - that agencies should be fully informed of the consequences of their actions before making a decision – is especially important when dealing with an issue like invasive species, where problems are often unanticipated side effects of otherwise desirable actions. Analysis and interagency, intergovernmental, and public review and comment that identify potential problems with invasive species for a particular proposed action may also yield ideas for alternative methods of approaching an issue or other forms of mitigation.

Agencies also need to comply with NEPA for actions that are proposed to respond quickly to invasive species management. In some cases, agencies may chose to prepare programmatic analyses on particular methodologies for addressing either the prevention or control of invasive species. In emergency situations that call for an immediate response by an agency that would normally require preparation of an environmental impact statement, the agency can work out alternative arrangements to their normal NEPA procedures with the Council of Environmental Quality.

National Forest Management Act (16 U.S.C. §1604)

Congress has required that the USDA develop and maintain forests plans for each administrative unit of the National Forest System (16 U.S.C. §1604(f)). However, site-specific management decisions must be consistent with the relevant forest plan for that site, or the plan itself must be amended to permit the activity (*id*. §1604(i)). Moreover, each plan must be consistent with the NEPA, the Multiple-Use and Sustained-Yield Act, and other federal environmental laws (*id*. §1604(e), (g)(1)). Since forest management is specific to each area, management may relate to invasive species as they become an issue in particular national forest areas.

National Invasive Species Act (16 U.S.C. §4701 *et seq.*)

The National Invasive Species Act (NISA) reauthorized and amended the Non-Indigenous Aquatic Nuisance Prevention and Control Act. The focus of NISA is on the spread of aquatic nuisance species through ballast water releases. NISA created a national Task Force co-chaired by the Director of the USFWS and the Undersecretary of Commerce for Oceans and Atmosphere (16 U.S.C. §4721(a)). This Task Force was charged with developing and implementing a program to prevent the unintentional introduction and dispersal of aquatic nuisance species through ballast water management (*id*. §4722(a)). The Task Force was also directed to develop and implement a program for waters of the United States to prevent the introduction and dispersal of aquatic nuisance species; to monitor, control and study such species; and to disseminate related information (*id*. 4722(c)).

NISA requires the development of voluntary national guidelines to prevent the introduction and spread of nonindigenous species into U.S. waters via ballast water of commercial vessels (id. §4711). The guidelines apply to vessels equipped with ballast water tanks and direct vessels that enter U.S. waters after operating beyond the Exclusive Economic Zone (EEZ) to undertake ballast exchange in the seas. The Secretary is also required to establish record keeping and reporting procedures and sampling techniques, based on the best available science, to monitor compliance (*id*. §4711(2)(F)(i), (G), and (I)). However, a vessel is not required to conduct ballast water exchange if the exchange would threaten the safety or stability of the vessel, its crew, or its passengers (*id*. §4711(c)(2)).

Furthermore, the Secretary and Task Force are required to conduct ecological and ballast discharge studies and surveys in waters highly susceptible to invasion or requiring further study (*id*. §4712(a)). The purpose of conducting these surveys is to examine invasions and the effectiveness of ballast management and its guidelines.

States, through their respective Governors, may submit their own comprehensive management plans to the Task Force for approval (*id*. §4724). These management plans identify areas or activities within each state or the surrounding region, except for those related to public facilities, for technical, enforcement, or financial assistance (or any combination thereof) to reduce or eliminate the risks associated with aquatic nuisance species.

NISA promotes research on species that fall under the definition "aquatic nuisance species" through competitive research grants, educational programs, and technical assistance to state and local governments and persons (*id*. §4722(f)). Such research may include the environmental and economic risks associated with the introduction of such species, the pathways by which such species and introduced and dispersed,

possible methods for prevention, monitoring, and control, and assessment of the effectiveness of such methods.

National Marine Sanctuary Act (16 U.S.C. §1431 *et seq.*)

The National Marine Sanctuary Act (NMSA) established the National Marine Sanctuary System, the purpose of which is to "improve the conservation, understanding, management, and wise and sustainable use of marine resources, enhance public awareness, understanding, and appreciation of the marine environment, and maintain for future generations the habitat and ecological services of the natural assemblages of living resources that inhabit these areas" (16 U.S.C. §1431(a)(4)).

The Act requires the Department of Commerce (DOC) to take actions to promote and coordinate the use of sanctuaries for research, monitoring, and education (*id*. §1440). In addition, the DOC may issue special use permits for specific activities, if necessary, to "establish conditions of access and use of any sanctuary resources or to promote public use and understanding of a sanctuary resource (*id*. §1441(a)). The DOC may enter into cooperative agreements, contracts, or other agreements with states, local governments, regional agencies, interstate agencies, or other persons in order to carry out the purposes and policies of the Act (*id*. §1442(a)).

Grant and contract funds are available for research, monitoring, and education for conservation and management activities (*id*. §1440(b)(1)). Such purposes could include control and management of any invasive species that is or may be in the future in a particular Sanctuary.

Under NMSA, it is unlawful for any person to "destroy, cause the loss, or injure any sanctuary resource managed under law or regulations for the sanctuary (*id*. §1436(I)). Therefore, regulations for particular Sanctuaries could prohibit the introduction of invasive species into the Sanctuaries. For example, the management plan for the Florida Keys National Marine Sanctuary prohibits introduction of exotic species into the Sanctuary.

Plant Protection Act (7 U.S.C. §7701 *et seq.*)

The Plant Protection Act (PPA) authorizes the USDA to prohibit or restrict the importation or interstate movement of any plant, plant product, biological control organism, noxious weed, article, or means of conveyance if the Secretary of Agriculture determines that the prohibition or restriction is necessary to prevent the introduction into the U.S., or the dissemination within the U.S., of a plant pest or noxious weed (7 U.S.C. §411(a)).

The movement of plants, plant products, biological control organisms, noxious weeds, articles, and means of conveyance are also regulated (id. §412). The USDA may

prohibit or restrict the importation, entry, exportation, or movement of the aforementioned in interstate commerce if it determines that prohibition or restriction is necessary to prevent the introduction into the U.S. or the dissemination of a plant pest or noxious weed within the U.S. (*id*.). The USDA may also publish, by regulation, a list of noxious weeds that are prohibited or restricted in interstate commerce (*id*. §12(f)(1)).

The PPA specifically authorizes USDA to hold, seize, quarantine, treat, apply other remedial measures to destroy or otherwise dispose of any plant, plant pest, noxious weed, biological control organism, plant product, article or means of conveyance that is moving (or has moved) into or through the U.S. or interstate, if USDA considers it necessary in order to prevent the dissemination of a plant pest or noxious weed that is new to or not known to be widely prevalent or distributed within or throughout the U.S (*id*. §414(a)). This authority extends to progeny of prohibited items moved in violation of the PPA. The PPA also authorizes USDA to order an owner, or an agent of the owner, of a plant, plant pest, noxious weed, biological control organism, plant product, article or means of conveyance to treat, destroy, or otherwise dispose of those items (*id*.).

In addition, the PPA authorizes USDA to cooperate with other federal agencies or entities, states or political subdivisions of states, national governments, local governments of other nations, domestic or international organizations, domestic or international associations, and other persons to carry out the provisions of the PPA (*id*. §431).

Virus-Serum-Toxin Act (21 U.S.C. §151 *et seq*.)

This Act authorizes USDA to regulate veterinary biological products that are intended for use in the treatment (i.e., prevention, diagnosis, management, or cure) of animal diseases. These include, but are not limited to, vaccines, bacterins, sera, antisera, antitoxins, toxoids, allergens, diagnostic antigens prepared from, derived from, or prepared with microorganisms, animal tissues, animal fluids, or other substances of natural or synthetic origin. The Act prohibits the shipment or delivery for shipment in intrastate commerce, as well as in interstate commerce, and the importation or exportation of any veterinary biological product that is worthless, contaminated, dangerous, or harmful (21 U.S.C. §151). It also prohibits the importation or exportation of any biological product not prepared in compliance with regulations prescribed by USDA at an establishment licensed by USDA (*id*. §152).

Appendix D: Summary of Georgia State Laws and Regulations Relevant to ANS

Coastal Marshlands Protection Act of 1970 (O.C.G.A. §12-5-280): This Act created the Coastal Marshlands Protection Committee which grants, denies, revokes, and amends all permits provided for by the Act and details the process to handle grievances of a party in relation to any rules, or regulations adopted by the Board of Natural Resources. The Act outlines the powers and duties of the DNR and the Board of Natural Resources as to coastal marshlands. Marshlands may not be filled, drained, dredged, or otherwise altered without a permit from the committee. The Act indicates the process for obtaining a permit and explains the points reviewed by the committee prior to issuing or denying a permit. It authorizes the inspection of marshlands by GADNR officers and conservation rangers to verify compliance with the rules, regulations, and permits, and enforcement in the case of noncompliance.

Endangered Wildlife Act of 1973 (O.C.G.A. §27-3-130): This law provides for identification, inventory, and protection of animal species that are rare, unusual, or in danger of extinction. The Board of Natural Resources approves changes to the list of state protected species. The protection offered to these species is limited to those that are found on public lands of the State. It is a misdemeanor to violate the rules prohibiting capture, killing, or selling of protected species, and protection of protected species habitat on public lands. The rules and regulations are established and administered by GADNR for implementation of this Act. Acquisition of unique habitats and natural areas for the protection of rare species is encouraged.

Game and Fish Code (O.C.G.A. §27-1-1): This legislation provides the ownership of, jurisdiction over, and control of all wildlife to be vested in the State of Georgia. The Wildlife Resources Division of GADNR is the principal state agency vested with statutory authority for the protection, management and conservation of terrestrial wildlife and fresh water wildlife resources, including fish, game, nongame, and endangered species. All licensing of recreational and commercial fish and wildlife activities, excluding shellfish, is performed by the Wildlife Resources Division. The Coastal Resources Division of GADNR issues shellfish permits, regulates marine fisheries activities including the opening and closing of the commercial shrimp harvesting season, areas of shrimp harvest, regulates marine species size and creel limits, and enforces the National Shellfish Sanitation Program. The Commissioner of the DNR has directed that there will be cooperation and coordination between of GADNR's Divisions in the administration of their respective responsibilities.

- *Definitions:*
  - Domestic Species: Those animals that have traditionally lived in a state of dependence on and under the dominion and control of mankind and have been kept as tame pets or livestock. These may be possessed without permits (O.C.G.A. §27-1-2(23)).
  - Domestic Fish Species: Those fish which are lawfully obtained farmed fish which are held in confinement in private ponds, but only if they are fish species which are either indigenous to Georgia or are fish species which have been recognized before 1992 as having an established population in Georgia's public waters. White perch (*Morone americana*) cannot be considered a domestic fish (O.C.G.A. §27-1-2(23)).
  - Feral hog: Feral hog (*Sus scrofa*) means any hog which is normally considered domestic but which is living in a wild state and cannot be claimed in private ownership (O.C.G.A. §27-1-2(28)).
  - Game fish: Game fish include the following:
    - Bass
      - Largemouth (*Micropterus salmoides*)
      - Smallmouth (*Micropterus dolomieu*)
      - White (*Morone chrysops*)
      - Striped (*Morone saxatilis*)
      - Spotted (*Micropterus punctulatus*)
      - Redeye (Coosa) (*Micropterus coosae*)
      - Striped-white bass hybrid (*Morone saxatilis* X *Morone chrysops*)
      - Shoal bass (Flint River smallmouth) (*Micropterus cataractae*)
      - Suwannee (*Micropterus notius*)
    - Trout
      - Rainbow (*Oncorhynchus mykiss*)
      - Brown (*Salmo trutta levenensis*)
      - Brook *(Salvelinus fontinalis)*
    - Crappie
      - White (*Pomoxis annularis*)
      - Black (*Pomoxis nigromaculatus*)
    - Shad
      - American (*Alosa sapidissima*)
      - Hickory (*Pomolobus mediocris*)
    - Sunfish or bream
      - Flier (*Centrarchus macropterus*)
      - Spotted sunfish (*Lepomis auritus*)
      - Rock bass (*Ambloplites rupestris*)
      - Shadow bass (*Ambloplites ariommus*)
      - Redbreast sunfish (*Lepomis auritus*)

        - Redear sunfish (*Lepomis microlophus*)
        - Bluegill (*Lepomis macrochirus*)
        - Warmouth (*Lepomis gulosus*)
    - Perch
        - Walleye (*Sander vitreus*)
        - Sauger (*Sander canadense*)
    - Pickerel
        - Chain (*Esox niger*)
        - Grass (*Esox americanus vermiculatus*)
        - Redfin (*Esox americanus americanus*)
    - Catfish
        - Channel (*Ictalurus punctatus*)
        - Flathead (*Pylodictis olivaris*) (O.C.G.A. §27-1-2(36)).
- Wild animal: Wild animal means any animal not indigenous to Georgia and not normally a domesticated species. This group would include practically all exotic animals. Tilapia (*Oreochromis* spp.) and non-sterile grass carp (*Ctenopharyngodon idella*) are examples of fish that are included in this definition (O.C.G.A. §27-1-2(75)).
    - Wildlife: Wildlife refers to those species of animals (mammals, birds, fish, amphibians, reptiles, crustaceans, and mollusks) indigenous to Georgia (O.C.G.A. §27-1-2(77)).

- Aquaculture Registration (O.C.G.A. §27-4-255: Aquaculturists producing and selling or re-selling domestic fish may register with the GADNR. A Commercial Fish Hatchery License, Wholesale Fish Dealers License, or Retail Fish Dealers License are not needed to sell domestic fish if the seller has registered as an aquaculturist. Persons in possession of domestic fish from registered aquaculturists must have a bill of sale or lading which provides the date of the sale, identifies the seller and which details two of the following three criteria for each species of fish: number, weight, or average length. Grocery stores do not have to register to sell domestic fish. Aquaculture Registration certificates expire on April 1 following two years of registration. Information provided by the aquaculturist for registration must be updated if there are changes during the registration period. Registration certificates should be displayed in a prominent location at the place of business, and a copy should be in possession of the owner or his agents when conducting business off the premises. Examples of fish species that may NOT be raised or sold with an Aquaculture Registration and which require additional licenses include tilapia (*Oreochromis* spp.) and grass carp (*Ctenopharyngodon idella*), although these are not the only species. All grass carp dealers must be licensed through GADNR (Wild Animal License). Examples of species of fish that ARE included on the Aquaculture Registration application:

- Channel catfish (*Ictalurus punctatus*)
- Largemouth bass (*Micropterus salmoides*)
- Rainbow, Brown, and Brook trout (*Oncorhynchus mykiss*), (*Salmo trutta levenensis*), (*Salmo trutta levenensis*)
- Crappie (*Pomoxis* spp.)
- Bluegill (*Lepomis macrochirus*)
- Redear sunfish (*Lepomis microlophus*)
- Hybrid sunfish (*Lepomis hybrids*)
- Hybrid bass
- Golden shiner (*Notemigonus crysoleucas*)
- Fathead minnow (*Pimephales promelas*)
- Goldfish (*Carassius auratus*)
- Koi (*Cyprinus carpio* (ornamental)
- Common carp (*Cyprinus carpio*)
- Freshwater drum (*Aplodinotus grunniens*)
- Smallmouth buffalo (*Ictiobus bubalus*)
- Red drum (*Sciaenops ocellatus*)
- Gizzard shad (*Dorosoma cepedianum*)
- Threadfin shad (*Dorosoma petenense*)
- Paddlefish (*Polyodon spathula*)
- Yellow perch (*Perca flavescens*)
- Mosquitofish (*Gambusia affinis*)

- Fish Dealers Licenses (O.C.G.A. §27-4-76): A Wholesale or Retail Fish Dealers License is needed to sell live fish or fish eggs. Exceptions include persons with a Commercial Fish Hatchery License, persons selling fish for use in aquaria, and registered aquaculturists selling only domestic fish. A Wholesale License is needed for persons selling fish to others for the purpose of resale, and for those persons importing live fish or eggs into the state. A Retail License is needed in other instances. Nonresident persons may sell and import live fish and eggs into the state without purchasing a license if they sell to a GADNR licensed wholesale fish dealer. Fish sold from licensed dealers must be accompanied by a bill of sale or lading which provides the date of the transaction, identifies the seller and which details two of the following three criteria for each species of fish: number, weight, or average length.

- Wild Animal License to sell regulated fish : This license is required to possess, import, transport, transfer, sell or purchase any wild animal including exotic fish species. No license is needed for exotic fish if they are held in containers from which no water is discharged, except during periodic cleaning, and which discharged water is passed through a filtering system capable of removing all

fish and fish eggs and is disposed of only in a septic tank permitted by the county or in a waste water treatment system permitted by the EPD (O.C.G.A. §27-5-5(b)(6)). Exotic fish are all fish species not native to Georgia. However, rainbow trout, brown trout, common carp, goldfish, and fathead minnow are examples of nonnative fish that are not considered exotic fish for regulatory purposes. Exceptions: A wild animal license is always needed to posses:

- Banded tetra (*Astyanax faciatus*)
- Piranhas (all species including the Genera *Serrasalmus*, *Serrasalmo*, *Pygocentrus*, *Taddyella*, *Rooseveltiella*, and *Pygopristis*)
- Grass carp (*Ctenopharyngodon idella*)
- Silver carp (*Hypophthal-michthys molitrix*)
- Bighead carp (*Aristichthys nobilis*)
- Air-breathing catfishes (all species of the Family Clariidae)
- Parasitic catfishes (all species of the Genera *Vandellia* (candiru) and *Urinophilus*)
- Giant walking catfishes (all species of the Genus *Heteropneustes*)
- Snakeheads (all species of the Genera *Ophicephalus* and *Channa*)
- Fresh water stingray (all species of the Family Potamotrygonidae).

Licenses are individually conditioned to ensure that the requirements of the Game and Fish Code are met. Grass carp exception: no permit is required for persons buying triploid grass carp from wild animal dealers licensed by DNR to sell grass carp; if the buyer retains the bill of sale as proof, and the grass carp are stocked into a private pond.

- Exotic Animals: Animals listed as exotic species are regulated under Georgia Law. GADNR should be consulted before any exotic animals which are not normally domesticated are acquired. Hybrids or crosses between any combination of domestic animals, wildlife, or regulated wild animals and all subsequent generations are regulated in Georgia and may not be held with a license. Examples of exotic species which may also be invasive include:
    - Monk parakeet; *Myiopsitta monachus*
    - Sparrows: all species of genus *Passer* except English sparrow
    - Blackbirds, grackles, etc.; all species of genera *Molothrus*, *Quiscalus*, *Agelaius*
    - Starlings; all species except European starling
    - Crocodiles; all species
    - Alligators; all species
    - Cobras, vipers, etc.; all species
    - Gila monsters and beaded lizards; all species
    - Giant and marine toads; all species
    - Banded tetra; *Astyanax faciatus*
    - Piranha; all species

    - Grass, Silver, and Bighead carp; *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix*, (*Aristichthys nobilis*)
    - Air-breathing catfishes; all species
    - Parasitic catfishes; all species
    - Giant walking catfishes; all species
    - Snakeheads; al species of genera *Ophicephalus* and *Channa*
    - Fresh-water stingray; all species (OCGA §27-5-5(b))
- Liberation-of-wildlife and liberation-of-domestic fish permits: It is unlawful for any person to liberate any wildlife (except pen-raised quail) within the state or to liberate domestic fish except into private ponds without a permit from the GADNR (OCGA §27-2-14).

Georgia Environmental Policy Act (O.C.G.A. §12-16-1): The Georgia Environmental Policy Act (GEPA) requires that all state agencies and activities prepare an Environmental Impact Report (EIR) as part of the decision-making process for all activities that may have an impact on the environment. Alternatives to the proposed project or activity must be considered as part of the report. The Act states that any proposed governmental action which may "significantly adversely affect the quality of the environment" including the state's air, water, land, plants, and animals, requires an Environmental Effects Report. As outlined in the Act, an EIR describes the environmental impact and any adverse environmental effects of the action, alternative actions, mitigation, measures proposed to avoid or minimize impact, and other effects of the action. The government agency responsible for the action authors the report and provides it to the director of the Environmental Protection Division (EPD) in the GADNR. A notice that the report has been prepared is to be published in the legal organ of each county in which the action is to take place, which may lead to a public hearing regarding the action. The Act requires the EPD director to issue guidelines to assist government agencies in the preparation of environmental effects reports.

Nongame Wildlife Conservation Programs Act of 1985 (O.C.G.A. §12-3-600): This asserts that the policy of the State of Georgia is to enable and encourage citizens voluntarily to support nongame wildlife conservation programs and wildlife habitat acquisition programs and recognizes the need for a separate source of funds from game management sources. The Act establishes nongame wildlife conservation and acquisition programs, and educational and promotional activities in support of these programs. It allows for a funding source from contributions through an income tax return contribution mechanism and through fund raising or other promotional techniques. The Nongame Wildlife Conservation and Wildlife Habitat Acquisition Fund is established with this Act. Balances in the fund are deposited in an interest-bearing account identifying the fund and are to be used by these programs.

Wildflower Preservation Act of 1973 (O.C.G.A. §12-6-170): This legislation provides for the designation of officially protected plants and authorizes rules for the collection, transport, sale, and listing of these plants. Under this Act, the GADNR has the authority to list as protected any plants meeting the requirements approved by the Board of Natural Resources. Protected plants must not be collected on public lands unless authorized by the GADNR. The sale of protected plants is prohibited unless grown on private land and sold by the landowner or with the permission of the landowner. Protected plants must not be transported unless permission has been granted by the landowner as evidenced by the presence of an affixed tag from the department and a written document detailing such permission. This Act also authorizes the enforcement of these policies through prosecution of any violations of the Act.

Appendix E: Survey Results of ANS Management Activities in Georgia

As part of the process of drawing up an ANS Management Plan for Georgia, Committee members were asked to describe the type of ANS management responsibilities their various agencies and organizations undertake. The results are summarized in the table below.

Agency/Organization ANS Responsibilities in Georgia

Agency	Operations	Research	Public Outreach	Information Management	Agency Resource Expenditures
US Army Corps of Engineers	P, D, CM, R	Yes	Yes	No	N/A*
USDA-APHIS	D,RR, CM,	No	Yes	Yes	N/A
DOI-FWS	P, D, R	No	Yes	No	1/8 FTE
DOI-FWS Region 4	P, R	Yes	No	No	N/A
DOI-NPS	P, D, RR, CM, R	No	Yes	Yes	N/A
GADHR-DPH	D	No	Yes	Yes	2 FTE
GADNR-CRD	P, CM	Yes	Yes	Yes	$130,000,yr
GADNR-EPD	P, CM, R	No	Yes	No	N/A
GADNR-PRHSD	P, D, RR, CM, R	No	Yes	Yes	2 FTE
GADNR-WRD	P, D, RR, CM, R	Yes	Yes	Yes	8 FTE**
GDOT	P, D, RR, R	Yes	No	Yes	10 FTE
UGA-CAES	P, D, RR, CM,	Yes	Yes	Yes	0.1 FTE
UGA-Horticulture	P, CM	Yes	Yes	Yes	N/A
UGA-MAREX	P, D, R	Yes	Yes	Yes	< 1% of annual budget
UGA-Odum School of Ecology	R	Yes	Yes	No	N/A

Operations include: P = Prevention, D = Detection, RR = Rapid Response, CM = Control and Management, R = Restoration

*Not available

** Includes all direct and indirect staff involvement with ANS monitoring, education standardized sampling etc.

Agency	**Operations**	**Research**	**Public Outreach**	**Information Management**	**Agency Resource Expenditures**
UGA-Warnell School of Forestry & Natural Resources	P, D, RR, CM, R	Yes	Yes	Yes	N/A
GA Aquarium	None	No	Yes	No	N/A
GA Exotic Pest Plant Council	P, D	No	Yes	Yes	N/A
GA Green Industry Association	P, D	Yes	Yes	Yes	N/A
GA Native Plant Society	P, RR, R	Yes	Yes	No	N/A
GA Ports Authority	P, D	No	No	No	N/A
GA Power Company	P, D, CM	No	Yes	Yes	1.5 FTE
GA Wildlife Federation	D, CM, R	No	Yes	No	N/A
The Nature Conservancy	P, D, RR, CM, R	Yes	Yes	Yes	1 FTE

Operations include: P = Prevention, D = Detection, RR = Rapid Response, CM = Control and Management, R = Restoration

*Not available

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