

# Alabama Aquatic Nuisance Species MANAGEMENT PLAN

M A Y  
2010

State of Alabama  
Governor Bob Riley



Department of Conservation  
& Natural Resources,  
M. Barnett Lawley,  
Commissioner







BOB RILEY  
GOVERNOR

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May 10, 2010

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Dear Mr. Arroyo and Ms. Glackin,

On behalf of the State of Alabama, we are submitting to the Aquatic Nuisance Species Task Force (ANSTF) the enclosed *Alabama Aquatic Nuisance Species Management Plan*. The Alabama Aquatic Nuisance Species Task Force composed of 67 members representing Federal and State agencies, non-governmental organizations, citizen groups, and business interests has developed the plan to address threats of aquatic nuisance species in Alabama. The plan follows guidance provided in Public Law 101-646, as amended by the National Invasive Species Act of 1996 (P.L. 104-332), and included public input and review.

We respectfully request review and approval of the *Alabama Aquatic Nuisance Species Management Plan* at the fall 2010 ANSTF meeting so we may apply for federal grants to assist in implementing our plan.

Please direct technical comments and questions to Mr. Steve Rider, Aquatic Resources Coordinator, Alabama Division of Wildlife and Freshwater Fisheries at 334/844-8978 or [Steve.Rider@dcnr.alabama.gov](mailto:Steve.Rider@dcnr.alabama.gov). His mailing address is 64 N. Union St., Suite 551, Montgomery, AL 36104.

Sincerely,

Bob Riley  
Governor



# ALABAMA AQUATIC NUISANCE SPECIES MANAGEMENT PLAN

## Developed By:

THE ALABAMA AQUATIC  
NUISANCE SPECIES  
TASK FORCE

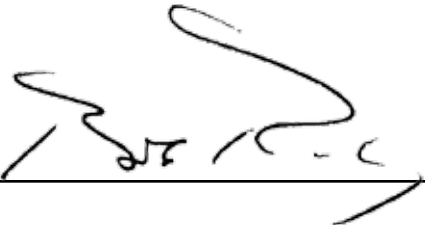
MONTGOMERY, AL - MAY 2010



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the State Wildlife Grants Program of the  
Alabama Division of Wildlife and Freshwater Fisheries  
and the U.S. Fish and Wildlife Service

# STATE OF ALABAMA

**Bob Riley, Governor**

Approved:  Date: 5/10/2010

ALABAMA DEPARTMENT OF CONSERVATION  
& NATURAL RESOURCES

**M. Barnett Lawley**



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# ACRONYMS:

AAPA	American Association of Port Authorities
ACES	Alabama Cooperative Extension Service
ADAI	Alabama Department of Agriculture and Industries
ADCNR	Alabama Department of Conservation and Natural Resources
ADEM	Alabama Department of Environmental Management
ALANSC	Alabama Aquatic Nuisance Species Council
ALCWCS	Alabama Comprehensive Wildlife and Conservation Strategy
ALCWP	Alabama Clean Water Partnership
ALDWFF	Alabama Division of Wildlife and Freshwater Fisheries
AMPD	Alabama Marine Police Division
AMRAT	Alabama-Mississippi Rapid Assessment Team
AMRD	Alabama Marine Resources Division
APHIS	Animal and Plant Health Inspection Service
BASS	Bass Anglers Sportsman Society
BWM	Ballast Water Management
FAO	Food and Agriculture Organization
GSMFC	Gulf States Marine Fisheries Commission
HACCP	Hazard Analysis Critical Control Point
IMO	International Maritime Organization
INHS	Illinois Natural History Survey
LGWF	Louisiana Department of Wildlife and Fisheries
MBNEP	Mobile Bay National Estuary Program
MICRA	Mississippi Interstate Cooperative Resource Association
MOU	Memorandum of Understanding
MRBP	Mississippi River Basin Panel
MSU	Mississippi State University
NANPA	Nonindigenous Aquatic Nuisance Species Prevention and Control Act
NISA	National Invasive Species Act
NOAA	National Oceanographic and Atmospheric Administration
OTA	Office of Technology Assessment
SARP	Southeast Aquatic Resources Partnership
SCUBA	Self-Contained Underwater Breathing Apparatus
SRAC	Southern Regional Aquaculture Center
TAMU	Texas A&M University
TVA	Tennessee Valley Authority
UA	University of Alabama
UAL	Universidad Autonoma de Nuevo Leon
UC	University of California
USCG	United States Coast Guard
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

## 1.) EXECUTIVE SUMMARY

Alabama has a wealth of water resources. An average rainfall of 55 inches each year and groundwater sources supplies the water for over 77,000 miles of perennial and intermittent streams; 563,000 acres of ponds, lakes and reservoirs; and over 3 million acres of marshes and wetlands. The state also boasts 50 miles of coast with over 400,000 acres of estuaries. These water resources act as a conduit for the invasion of nuisance species.

Aquatic Nuisance Species (ANS) pose a significant problem to the State of Alabama. They are species introduced outside of their native ranges that can grow in or are closely associated with the aquatic environment. These can have deleterious effects on the local economy, human health and or ecology. For example, Cuban bulrush (*Oxycaryum cubense*) has recently invaded Alabama's waterways in to Mobile River Basin. This species clogs and covers waterways, cripples boat traffic and competes with native vegetation, creating a monoculture unsuitable for recreation, commerce, native fish and wildlife species. The purpose of the Alabama Aquatic Nuisance Species Management Plan is to coordinate concise and proactive approach that will prevent or minimize threats to the State of Alabama similar to that of Cuban bulrush.

On 2 June 2005 Governor Bob Riley signed Executive Order Number 30, creating the Alabama Aquatic Nuisance Species Task Force (ALANSTF). It was charged with developing a comprehensive plan for coordination and response to ANS that pose economic, human health, or ecological risks to the State of Alabama. The ALANSTF quickly grew, and is now comprised of 67 members representing 28 governmental, non-governmental, private and university agencies/organizations. The ALANSTF first met on 3 August 2005 and subsequently four times thereafter through August 2006. Input from ALANSTF members at these meetings culminated in the Alabama Aquatic Nuisance Species Management Plan.

During that period, the ALANSTF identified and evaluated 32 ANS currently in Alabama or with potential to present problems to the state in the near future. Primarily fishes and aquatic plants, this group of ANS also includes mammals, crustaceans, and mollusks. A few of these species have not yet established reproducing populations in Alabama, but they are considered strong threats, based upon information about problems in neighboring states, the region or the nation. The species creating the most serious problems in Alabama are hydrilla, common salvinia, water hyacinth, Cuban bulrush and *Lyngbya wollei* (a complete description of these ANS is in Section 3B). Earlier ANS eradication and management efforts within the state suggested that management actions focus at the species level. However, through study, the task force noted that these 32 species most likely entered Alabama via specific pathways (means by which species are physically transported to new areas) and human involvement was apparent in the transport and spread. In some cases, the spread was unintentional or accidental during regular activities of commercial shipping, outdoor recreation, oil and gas industry, commercial fishing and commercial transportation. However, some spread was intentional, that is, nonnative species have been introduced for a positive reason but by their nature, the species has created an ecological, economic or human health problem in the state. These pathways include horticulture, aquaculture, and the aquarium and live pet trades. By comparing the existing and potential ANS and the pathways, the ALANSTF prioritized threats and formulated management strategies.

During this process, the ALANSTF concluded that management must involve federal and state agencies as well as various interest groups. International groups are also possible participants. As described in Chapter 4, governmental agencies have various jurisdictional responsibilities that might relate to one or more pathways, or to a group of species. Management must take these jurisdictions into account and provide for cooperation and coordination, possibly through changes to regulations.

The ALANSTF decided that this Plan will address both pathways and species for comprehensive management. Members set a goal to control and manage the introduction of new ANS and minimize impacts of existing ANS on native species, environmental quality, human health, and economics. Specifically, the ALANSTF identified the following objectives to achieve this goal (Chapter 5).

1. Coordinate local, state, regional, federal, and international activities and programs pertaining to ANS.
2. Control and manage the introduction and spread of new and existing ANS through educational outreach.
3. Actively control and manage the introduction and spread of existing ANS using accepted management techniques.
4. Prevent the introduction and spread of ANS through legislative and regulatory efforts.

To formulate management actions needed to abate ANS problems, priorities were assigned to pathways and species. These are described in Chapter 6. Because of the broad group of stakeholders and agencies with some involvement in ANS pathways and jurisdictions, many of the management actions are educational in nature. An MOU is proposed to increase cooperation among agencies. To ensure regular efforts to achieve the Plan's goal, the ALANSTF recommends creation of a council to oversee the appropriate use of personnel and funds to achieve the objectives of this plan.

Many of the identified management actions (Chapter 7) are currently unfunded in Alabama. According to the ALANSTF, the following are the top unfunded priority management actions:

1. Hire a permanent, full-time statewide ANS coordinator.
2. Develop an Alabama ANS early detection and rapid response plan.
3. Conduct rapid assessment sampling in all Alabama waterways to detect occurrences of new ANS.

The implementation table (Chapter 8) provides a tentative timetable and an estimate of the funds needed to initiate the plan, approximately \$380,000. Once implementation has begun, permanent funding will be needed to support ongoing ANS activities.

To ensure goals of the plan are being addressed, the ALANSTF has identified a process for program monitoring and evaluation. This process encompasses three components: program oversight, evaluation, and dissemination. Program oversight will ensure proposed strategies achieve goals of the plan. Evaluation will focus on the efficacy of management activities and dissemination will focus on distributing pertinent information. These components are described in detail in Chapter 9. The plan will be reviewed and updated every 4 to 5 years.

The ALANSTF and Plan development were led by the Fisheries Section of the Alabama Division of Wildlife and Freshwater Fisheries of the Alabama Department of Conservation and Natural Resources. Members of the ALANSTF are identified in Appendix B.



## 2.) INTRODUCTION

Alabama surpasses all eastern states in plant and animal diversity, and ranks fifth in the nation after California, Texas, Arizona, and New Mexico (ALNHP, 2003), providing each and every citizen with economic and ecological resources to enhance quality of life. Aquatic invasive species can alter, damage or destroy these resources, affecting human health and the state's economy and/or ecology. Wildlife management must include management of aquatic invasive species to sustain this resource for the economic and ecological benefit of present and future generations of Alabamians.

A major component of wildlife management entails controlling nonindigenous species, that is, species that are not native to Alabama, which have damaged or are damaging plants and animals or human health. These are sometimes called aquatic nuisance species (ANS) or exotic species. The need to actively manage is significant. Wildlife-based recreation, such as hunting, angling, birding and wildlife photography, annually contributes over \$2 billion to Alabama's economy. Such recreation stimulates income in the private and public sectors through trip-related expenses, equipment purchases, and payments for licenses, leases, and membership dues. In Florida, introduced ANS such as water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*) are altering the population demographics of recreationally-related fish and other aquatic animals, choking waterways, affecting nutrient cycles, and reducing the recreational value of rivers and lakes (Pimentel et al., 2000). Water hyacinth and water lettuce have been identified as ANS in Alabama (see Section 6B).

Industrial installations can be affected, too. For example, in June 1989, following heavy rainfall in northern Alabama, plant debris from large strands of hydrilla (*Hydrilla verticillata*) and Eurasian watermilfoil (*Myriophyllum spicatum*), also identified as ANS in Alabama, clogged downstream trash racks at Guntersville and Wheeler dams. In addition to manpower costs required to clear debris from the racks, more than \$200,000 in revenue was lost as a result of discharge through spill gates (TVA, 1993). Nationally, about \$100 million is invested in non-native aquatic plant control (U.S. Congress OTA, 1993), and an estimated \$137 billion are spent to combat the problem of nuisance species in the United States each year (Pimentel et al., 2000).

Commercial fishing, forestry and agriculture are cornerstones of Alabama's economy, and they are all vulnerable to ANS effects. Between 1993 and 2003, commercial fisheries contributed an average of approximately \$44.8 million annually to the state's economy (ALCWCS, 2005). The State's fishing industry supports nearly 23,000 jobs, resulting in wages and salaries annually of about \$412 million. Fishing related purchases in Alabama generated \$16 million in state tax revenues and \$42 million in federal income tax revenues in 2004 (USFWS, 2001). The forestry industry, employing about 13% of Alabama's total workforce, has an annual payroll of approximately \$2.2 billion (Alabama Forestry Commission, [http://www.forestry.state.al.us/publication/forest\\_facts.htm](http://www.forestry.state.al.us/publication/forest_facts.htm), accessed 3/13/07).

Water resources, essential to all Alabamians, are not exempt. Some ANS actually cause changes in water quality or water use. In Lake Austin, Texas, hydrilla is threatening the drinking water intakes as well as recreation and navigation. The city of Austin is trying to manage this invasive plant to protect life-sustaining water resource of its citizens (Austin City Connection, Watershed Protection Development Review, <http://www.ci.austin.tx.us/watershed/hydrilla.htm>, accessed 3/13/07).

Not all non-native species are invasive. Many of the crops produced in this and other states are nonindigenous, but they are not ANS – they do not threaten the economy or ecology of the state or threaten human health. Pimentel et al. (2000) estimated that 50,000 nonindigenous species (including

those that are beneficial) are now established within U.S. borders. Of those, about 15 percent have become invasive, leading to economic and/or ecological impacts (U.S. Congress OTA, 1993).

Fifteen percent is significant in Alabama. This state, along with its neighboring states in the southeastern U.S., is well known for aquatic biodiversity. Alabama is home to more species of animals and plants than any other state East of the Mississippi River (Stein et al., 2000). With 77,000 miles of waterways spanning three river basins and a complex network of small rivers, tributaries and streams draining directly into the gulf of Mexico (Figure 1), Alabama harbors 60 percent of mussel species in North America, 52 percent of freshwater turtles, 38 percent of freshwater fish and 20 percent of crayfish species (ALCWCS, 2005). Note that aquatic organisms are faring worse across the U.S.; a vast number of mussels (67 percent) and fish (37 percent) are susceptible to either extirpation or extinction (Stein et al., 2005). As a center of biological diversity Alabama and its citizens have an important role to play controlling ANS.

Existing research suggests that recently disturbed habitats are most receptive to invasion (Williams and Meffe, 1999). An estimated 10-20 percent of all species known to occur in Alabama are in peril due to the ever-increasing pressures associated with human alteration of the landscape and biological invasion (Stein et al., 2000; NatureServe Explorer, 2001). Some of the most notable negative effects on aquatic ecosystems caused by human activities during the past decade include the occurrence and persistence of harmful algal blooms (e.g., toxic red tide; Smayda, 1990; Hoagland et al., 2000; Anderson et al., 2000), disappearance and or/ or dying off of critical habitat (e.g., seagrass beds; Quammen and Onum, 1993; Onuf, 1996), species population reductions or degradation (Simberloff et al., 1997; Van Driesche and Van Driesche, 2000).

These activities can also threaten human health. In 1991 and 1992, the Latin American strain of cholera (*Vibrio cholerae*) was isolated from finfish and oysters in Mobile Bay (CDC, 1993). Although the disease and its source were identified before human health was damaged in the area, the Bay's oyster beds were closed to harvesting for nearly two months. Investigation showed that this human cholera bacterium was transported to Mobile Bay in a ship's ballast water, one of the pathways that can spread ANS. Planned expansion of the Port of Mobile and introduction of cruise line commerce can increase the possibility for ANS introductions through shipping into Alabama's coastal waters. However, ANS management can reduce that possibility and increase the probabilities of controlling negative effects of such introductions into the state.

This management plan expressly addresses the problem of ANS in Alabama. The Alabama Aquatic Nuisance Species Task Force (ALANSTF) has identified more than 80 potential ANS, most introduced, that have become established along Alabama's waterways and coastline. Introduction, establishment, and dissemination of nuisance organisms are facilitated by a hospitable, sub-tropical climate, and various shipping, industrial, land use and recreational activities vital to Alabama's economy. The Alabama Aquatic Nuisance Species Management Plan serves as 1) a guideline for prevention and educational awareness regarding the impact(s) of introduced non-native organisms and/or native transplants (i.e., organisms native to the U.S., but not endemic to Alabama) and 2) a practical management plan for rapid identification, management, and eradication of ANS in Alabama. Specifically, this plan defines the problem of ANS and outlines actions to be taken toward the following objectives:

- Coordinate local, state, regional, federal, and international activities and programs pertaining to ANS.
- Control and manage the introduction and spread of new and existing ANS through educational outreach.
- Actively control and manage the introduction and spread of existing ANS using accepted management techniques.
- Prevent the introduction and spread of ANS through legislative and regulatory efforts.

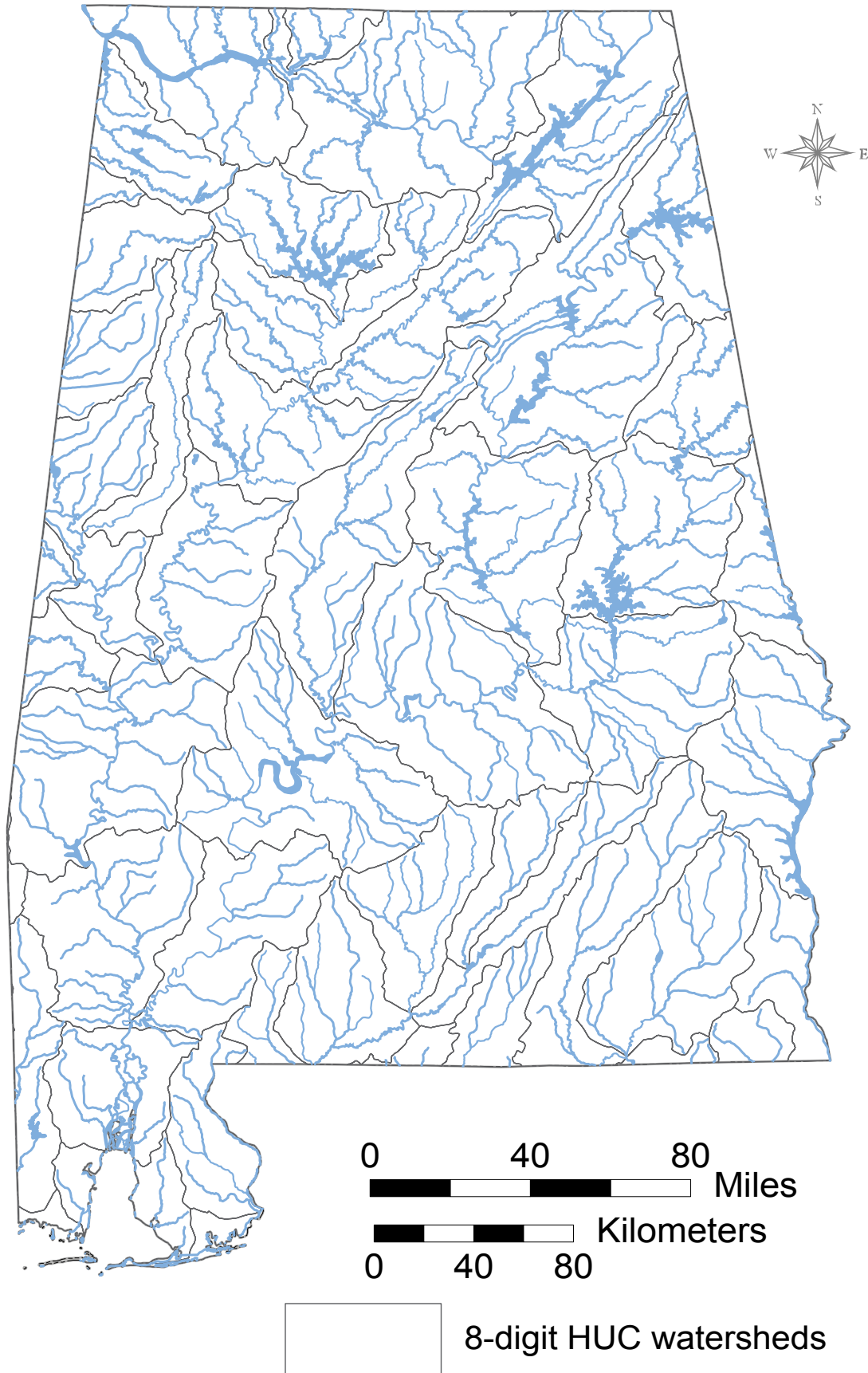
Toward achieving the objectives listed above, the Alabama Aquatic Nuisance species Task Force has defined ANS as invasive species that grow in (e.g., hydrilla, grass carp, and Australian jellyfish), or are closely associated with (e.g., common reed), the aquatic environment. Furthermore, emphasis was placed on pathways and vectors (e.g., thoroughfares, sport and recreational activities, human footpath, farming practices, etc.) that promote establishment, persistence, and dissemination of ANS in Alabama.

This plan outlines ANS-related planning for a period of five years. Development of this plan was accomplished by:

- Categorizing and ranking ANS according to “degree of threat” to Alabama’s economy and ecology.
- Prioritizing pathways of introduction [whether intentional or unintentional] and subsequent transport of ANS.
- Compiling information regarding laws and regulations pertaining to the transport, distribution, and propagation of ANS in Alabama.
- Developing management strategies to address the problem of ANS and objectives of this plan as outlined by the Alabama Aquatic Nuisance Species Task Force.

This plan represents an effort to coordinate and support ANS-related activities in Alabama. Herein, we define the problem of ANS and address issues pertaining to duplication and/or gaps in Statewide communication, as well as collaboration. The problem of nuisance species is complicated, requiring an interdisciplinary approach toward resolution. To this end, representatives from state and federal agencies, academia, research institutes, government and private sector industries, port authorities, and environmental enthusiasts were invited to serve as advisory members of the Alabama Aquatic Nuisance Species Task Force. Appendix B contains a list of all participants. These individuals met five times from August 2005 to August 2006 to assist with the drafting of this plan. Authority for this plan and the Alabama Aquatic Nuisance Species Task Force are derived from Executive Order No. 30: Establishing the Alabama Aquatic Nuisance Species Task Force, signed by Governor Bob Riley on June 2, 2005. This plan follows the guidelines of the National Aquatic Nuisance Species Task Force, the intergovernmental organization that oversees the standardization and approval of state ANS management plans, and is designed to meet the requirements of Section 1204(a) of the Nonindigenous Aquatic Nuisance Species Prevention and Control Act (NANPA) of 1990 as reauthorized in the National Invasive Species Act (NISA) of 1996.





*Figure 1. Map of Alabama rivers and streams.*

### 3.) PROBLEM DEFINITIONS

#### 3.A. PATHWAYS

This section of The Alabama Aquatic Nuisance Species Management Plan describes the scope of the ANS problem and the major pathways by which ANS can be transported to and across Alabama. Because the introduction and subsequent distribution of ANS can be either intentional or unintentional, this section is divided accordingly; pathways are further ordered relative to their economic importance to the state of Alabama. The control of biological invasions requires the efforts of and collaboration among those associated with the following pathways.

##### 3.A-1 Unintentional Introductions

ANS have been unintentionally introduced into Alabama through activities associated with commercial shipping, outdoor recreation, oil and gas industry, commercial fishing, and transportation corridors. Others, particularly aquatic plants, can be transported along waterways, and from basin to basin, as they become lodged in/on boat propellers, nets, traps, trawls, SCUBA equipment, trailers, as well as other gear.

##### 3.A-1a Commercial Shipping

The Alabama State Port Authority (ASPA) oversees a network of commercial shipping facilities that includes the Mobile State Docks, McDuffie Terminals, Mobile Middle Bay Port, Theodore Terminals, Terminal Railways, and ten inland docks. In 2005, the ASPA reported that 24.2 million cargo tons were imported and exported through Alabama (ASPA, <http://www.asdd.com/>). The entire port infrastructure supports an estimated 118,000 workers who generated \$87 million in revenue for the state of Alabama last year. State-wide, the total annual revenue associated with the shipping industry was estimated to be \$3 billion for the 2005 fiscal year; \$467 million were contributed in state tax revenue. In 2004, the Port of Mobile was ranked eleventh in the nation for total trade (36.2 million tons; AAPA, <http://www.aapa-ports.org/>). Containerized and general cargo types moved into and out of Alabama include: forest products, heavy metals, pipe, aluminum, vehicles, and bagged goods. Major imports from Canada, Mexico, Germany, Japan, and Austria consist of coal, aluminum, iron, steel, lumber, wood pulp, plywood, fence posts, veneers, roll and cut paper, and chemicals. National products (i.e., coal, lumber, plywood, wood pulp, laminate, flooring, roll and cut paper, iron, steel, poultry, soybeans, and chemicals) are primarily exported from Alabama to Germany, Canada, Mexico, Japan, the United Kingdom, Mainland China, and South Korea. In commercial shipping, ANS can be transported through several media, including: ballast water, cargo, dunnage, and equipment through fouling organisms attached to ships' hulls. As mentioned earlier, vibrio cholerae was introduced into Mobile Bay via a ship's ballast water, and a brown blu crab (*Callinectes bocourtil*) was found in Alabama's coastal waters via a *Probatu* ballast introduction.

##### 3.A-1b Outdoor Recreation

Recreational fishing, hunting, and wildlife watching contribute a combined annual income \$2 billion to Alabama's economy. Alabama is ranked ninth in the country for recreational fishery landings (NOAA, 2004) and boasts more than 300 boat ramps and marinas, maintained by cities, counties, local, state and federal agencies. According to a national survey, conducted in 2001, 851,000 anglers participated in fishing activities in Alabama; 610,000 were in-state residents (USFWS, 2001). An estimated \$724 million in annual revenue is generated by sport fishing activity in Alabama, with the high-profile Bass Anglers Sportsman Society (B.A.S.S.) organization contributing \$1 - 2 million each year.

The 2007 B.A.S.S. Classic, held on Lay Lake, generated more than \$26 million (C. Horton, B.A.S.S., pers. comm.). Recreational hunting activities contribute \$664 million to the State economy, annually. In 2001, 423,000 residents participated in hunting activities (USFWS, 2001). Of this group of hunters, 307,000 people were Alabama residents. Approximately 1.2 million residents spend time observing and photographing wildlife in Alabama each year. In Alabama, \$626 million were generated by wildlife watching enthusiasts in 2001 (USFWS, 2001). Aquatic nuisance species are often inadvertently spread via human footpath, boats, trailers, and other equipment associated with sport and recreational activities. Red shiner (*Cyprinella lutrensis*) have been introduced to Alabama via “bait-bucket” dumpings and pose a risk, due to hybridization, to the federally threatened blue shiner (*Cyprinella caerulea*).

### 3.A-1c Oil and Gas Industry (Example)

“Alabama supports a substantial oil and natural gas industry, generating an estimated \$1.6 billion in revenue. Presently, Alabama is ranked ninth in the nation for natural gas and 13th for liquid petroleum production” (ALGOB, <http://ogb.state.al.us>). The State boasts more than 4,000 oil and gas wells, 77 of which are off-shore natural gas rigs. Off-shore drilling accounts for 50 percent of Alabama’s natural gas production. The commercial boats and platforms associated with this industry are transferred around the world, inadvertently bringing the plants and animals from a waterbody in one region to another. These tools of the trade are media bringing potential ANS to Alabama waters.

### 3.A-1d Commercial Fishing

Gulf of Mexico fisheries comprise nearly 20 percent of all commercial fishing in the United States. In 2004, Gulf Coast landings totaled 1.5 billion pounds, worth approximately \$668 million (\$59 million, oyster; \$286 million, shrimp; \$323 million, finfish and other shellfish). Landings in Alabama totaled 26.6 million pounds, worth more than \$37 million (NOAA, 2004). The overall economic impact of Alabama’s seafood industry, including wages and support industries, has been estimated at \$350 million annually (Chang et al., 2006). Because fishermen are harvesting a moving resource, commercial fishing vessels regularly move coastwise in the Gulf of Mexico and the Gulf Intracoastal Waterway. Plants and animals from Florida, Mississippi, Louisiana and Texas waters may be accidentally transported into the State during fishing activities. Spotted jellyfish became present in the Gulf of Mexico in 2000 and may be spread in the Gulf by becoming fouled in fishing nets.

### 3A-1e Transportation Corridors

Nuisance species can be introduced and/or spread via transportation corridors (i.e., highways, railroads, minor and major navigable waterways, and their associated right-of-ways). Chinese tallow tree (*Triadica sebifera*) and congongrass (*Imperata cylindrica*) are two examples of invasive species that have been spread along right-of-ways and disturbed habitats from Texas to North Carolina (Figures 2 and 3).

**Figure 2. Distribution of Chinese tallow tree from California and Texas to North Carolina (<http://plants.usda.gov>).**



**Figure 3. Distribution of Chinese tallow tree from Oregon and Texas to North Carolina (<http://plants.usda.gov>).**



### 3.A-2 Intentional Introductions

The following pathways have been identified as those by which invasive species have been intentionally introduced into the State. Some ANS, actually introduced for a specific market or purpose, can escape or are unintentionally released into natural ecosystems, where they become invasive. Traditionally, agricultural, horticultural, and aquacultural industries foster the “controlled” introduction of non-native species. The assumption is that the risks of escape and subsequent invasion of native habitats are low. However, the specific case studies of hydrilla, Eurasian watermilfoil, Japanese honeysuckle, Chinese privet, Asian carp, and Asian clam provide evidence that this is not always the case. The pathways of intentional introductions of ANS into Alabama are nursery, landscape, and water garden industry, aquaculture, aquarium and pet trade, hunting and the fur trade.

#### 3.A-2a Nursery, Landscape and Water Garden Industry

The nursery and landscape industry represents a \$1.9 billion venture and supports 30,860 workers in the state of Alabama (ALNLA, 2003). Alabama is third in the nation for sod production; turfgrass is a \$100 million industry. Aside from turfgrass farming, nursery, landscape, and associated retail generate \$306, \$646 and \$856 million in annual profits, respectively (ALNLA, 2003). Although typically not aquatic, nursery and horticultural plants are readily spread upon transport and often are introduced to new environments as escapees from propagated populations. Examples of formidable, invasive nursery escapees include: Japanese honeysuckle (*Lonicera japonica*), Chinese privet (*Ligustrum sinense*), Bahia grass (*Paspalum notatum*), cypress vine (*Ipomoea quamoclit*), popcorn tree, and congongrass.

Specifically, water gardens have become a major source of aquatic nuisance species. Prominent examples of invasive plants that have been introduced into native waterways and basins include: water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratioides*), common salvinia (*Salvinia minima*), giant salvinia (*S. molesta*), naiad (*Najas* spp.), water primrose (*Ludwigia* spp.), and pond weed (*Potamogeton crispus*). These species characteristically exhibit rapid growth, efficient vegetative reproduction, and broad environmental tolerance. Giant salvinia was found in 5 ponds in East-Central Alabama in 2001 and was introduced through nurseries.

#### 3.A-2b Aquaculture

According to data compiled by the Alabama Cooperative Extension Service (ACES) for the 2005 fiscal year, Alabama’s aquaculture industry occupies approximately 25,000 water acres statewide. There are 250 producers, culturing 20 species of fishes, mollusks, and crustaceans. The industry employs 3,000 workers to support a \$105 million annual income. Of this \$105 million, more than \$98 million are generated by Alabama catfish farmers. In 2005, catfish farmers produced 142 million pounds of fish. An additional \$170 million in annual income are attributed to processing activities (ACES, <http://www.aces.edu/dept/fisheries/>).

Excluding those fishes reared for retail and restaurant industries, several species are farm-raised and either stocked for sport fishing or sold as bait. Fishes that are deliberately stocked include: grass carp (*Ctenopharyngodon idella*), largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*), yellow perch (*Perca flavescens*), and tilapia (*Oreochromis* spp.). Many farm-raised and/or stocked fish are non-native, but few are considered to be invasive. In fact, most stocked species are thought to be beneficial to aquatic ecosystems and Alabama’s economy. However, a few species have recently raised concern among scientists and managers; carp and tilapia species can out-compete native fish for space and resources. Furthermore, although fish stocks themselves might not be invasive, water used to transport animals could be contaminated. Stocks should be examined and precautions taken to minimize the introduction of invasive plants, invertebrates, fungi, bacteria, and viruses into natural waterbodies.

Golden shiners (*Notemigonus crysoleucas*), fathead minnow (*Pimephales promelas*), Gulf killifish (*Fundulus grandis*), goldfish (*Carassius auratus*), and sunfish (*Lepomis* spp.) are commonly cultured bait fish (SRAC, 2001). Bait fish pose a threat when anglers discard live organisms or packing material into a waterway or basin. Anecdotal reports suggest this seemingly small pathway (i.e., “bait bucket dumping”) might significantly contribute to the problem of biological pollution. Three specimens of the tiger prawn (*Peneaus monodon*) have been collected off the coast of Alabama. These are likely aquaculture escapees after Hurricanes Katrina/Rita from a nearby aquaculture facility. The impacts to Alabama’s coastal fisheries is unknown.

### 3.A-2c Aquarium and Pet Trade

The sale of non-native species through the aquarium and pet trade constitutes a pathway by which fishes, plants, amphibians, and reptiles can be introduced to the United States. To become invasive, an organism must escape, establish itself, reproduce, and spread to exert a negative impact. It is suspected that the majority of non-native plant and animal introductions are not true escapees, but are a direct result of “aquarium dumping.” As an alternative to waste or euthanasia, and with good intentions, owners “humanely” release organisms into the natural environment to flourish. The USGS estimates that approximately 185 exotic fish species have been caught in open waters around the United States; 75 species are known to have established viable, breeding populations. Scientists suspect that more than 50 percent of these introductions are a direct result of aquarium releases. In Alabama, one of the most prominent examples of an aquarium release is hydrilla (Schmitz et al., 1991). Since 2004, nearly 20 pacu have been collected around Alabama with sizes up to 6.5 lbs (S. Rider ALDWFF, unpublished data) and in September 2009, 29 Asian loaches (*Misgurnus* spp.) of various sizes (indicating recruitment) were collected from a tributary to the Coosa River (B. Kuhajda, UA, pers. comm.) indicating species of tropical and sub-tropical origins can over winter in Alabama.

### 3.A-2d Other Deliberate Introductions

Sometimes animals or plants are intentionally introduced directly into natural ecosystems under the assumption that they will fit into the existing ecological balance. Nutria (*Myocaster coypus*) is a prime example of an invasive species that has overrun the natural ecosystem into which it was deliberately introduced. These species is particularly harmful to fragile native flora and economically important crop species.

Nutria are semi-aquatic animals that consume approximately 25 percent of their weight in vegetation daily (LDWF, <http://www.nutria.com/>). Similar to hogs, they predominately feed on the base of plant stems, digging for roots and rhizomes in the winter. Due to rapid reproduction and high survival rates, nutria have been documented to decimate local plant populations and displace the native muskrat. In addition, nutria have been noted to damage economically important crop stands such as rive, sugar cane, and soybeans (Trillin, 1995).

### 3.B Species

Information pertaining to Alabama’s aquatic nuisance animals and plants of concern was gathered by two separate groups of experts, managers, and stakeholders to facilitate discussion and accurately rank species. Species in this section of the management plan are listed in order or rank based on a three-point scale, with three (3) being the greatest threat. Only descriptions of those species that are of greatest concern for ANS management (i.e., only species ranked 2 and above) are provided below. A complete list of Alabama’s ANS species of concern is provided in Appendix A. At this time, not all of the species listed and/or documented below have reached Alabama. However, task force members and experts believe these species have great potential impact and have, therefore, chosen to include them in this section of the plan. Because prevention is the most effective means to manage ANS, it is important to

identify existing problem-causers as well as species with potential to cause future problems. This section addresses species likely to enter the state and do harm, as well as those species that are currently causing problems to Alabama's ecology and economy or threatening the health of its citizens. The distribution maps accompanying each species description (except those cited) were created at the Geological Survey of Alabama using ArcGIS 9.2™ software, eight-digit hydrologic unit code (HUC 8) coverage bases upon information gathered from Task Force members, museum records, and scientific literature.

### 3.B-1 Animals

Eighteen animals were given a rank of two or greater by ALANSTF members and are presented in order of assigned rank. These species include: 11 fishes, two crustaceans, three mollusks, one mammal, and one jellyfish. Some animals of concern for ANS management have yet to become established in Alabama. Those animals receiving the highest rank and therefore of the greatest concern are bighead carp (*Hypophthalmichthys nobilis*), silver carp (*Hypophthalmichthys molitrix*), a bighead/silver carp hybrid, common carp (*Cyprinus carpio*), Asian clam (*Corbicula fluminea*), rudd (*Scardinius erythrophthalmus*), nutria (*Myocastor coypu*), rusty crayfish (*Orconectes rusticus*), and black carp (*Mylopharyngodon piceus*).

**Common Name:** BIGHEAD CARP

**Scientific Name:** *HYPOPTHALMICHTHYS NOBILIS*

**Family:** CYPRINIDAE

Alabama ANS Task Force Rank – 3.0



Photo by Pat O'Neil, Geological Survey of Alabama

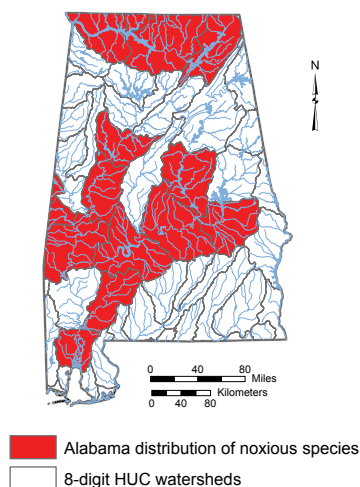


Bighead carp collected below Miller's Ferry Lock and Dam, Wilcox County.  
Photo by Rob McCarter, Alabama Division of Wildlife and Freshwater Fisheries

**Synonym(s):** *Aristichthys nobilis* and *Leuciscus nobilis*

**Identification:** Bighead carp is one of a number of exotic carp found in Alabama. Bighead carp are deep-bodied, laterally compressed fish with large heads. Scales are small with approximately 91 to 120 scales in the lateral line, which is complete. Fins of small specimens lack spines. Large specimens have a heavy, stiff, non-serrate spine at the origin of the dorsal fin and a slightly stiffened spine at the anal fin origin. The dorsal fin has eight (rarely nine) soft rays, the anal fin has 13 (rarely 14) soft rays. The gill rakers are long, slender and comb-like, not fused into a spongy plate. The pharyngeal teeth count is 4-4 (Schofield et al., 2005; Robison and Buchanan, 1988).

## Bighead Carp



**Native Range:** Lowland rivers of the north China plain and south China, including the Huai, Yangtze, Pearl, West, Han Chiang and Min rivers (Boschung, 1992).

**Alabama Distribution:** Recorded from the Black Warrior, Tombigbee, Alabama, Coosa, and Tallapoosa river drainages of the Mobile Basin and the Tennessee River (Courtenay et al., 1991).

**Pathway(s) of Introduction:** Bighead carp were originally imported into the United States in 1972 for study by university

aquaculture programs for food fish production and to control aquatic weeds in aquaculture ponds. Introduction occurred by escape from university research and aquaculture facilities.

**Impact(s) of Introduction:** The environmental impacts of this fish are largely unknown, but they could adversely impact many native fish species due to competition for food. Recent research indicates age-0 bighead carp compete with age-0 paddlefish for food resources

(Schrunk et al., 2003). Sport fish, such as bass and crappie, eat plankton early in their lifecycle, as do shad (Burke et.al, 1986). Large numbers of non-native carp could reduce availability of forage available for important sport and forage fishes. Anecdotal information exists that bighead carp are spawning and recruiting in the Alabama River as 45 individuals were snagged below Millers Ferry Power House during a single day in April 2006, with weights ranging from 2.3 to 16 kg (J. Ledbetter, USACE, pers. comm.). These fishes could displace native fishes by competing for the already limited backwater nursery habitat that is so critical to the survival of these species (Maceina and Slipke, 2004).

Large numbers of non-native carp in Alabama rivers could also adversely impact native mussel populations. Alabama has the largest diversity of mussels of any state, but many of these species are already threatened or endangered due to habitat loss. The presence of a large planktivore, like bighead carp, could dramatically impact threatened mussels by reducing food availability. (Outdoor Alabama, 2006).



**Common Name:** SILVER CARP

**Scientific Name:** *HYPOPHTHALMICHTHYS MOLITRIX*

**Family:** CYPRINIDAE

Alabama ANS Task Force Rank – 3.0

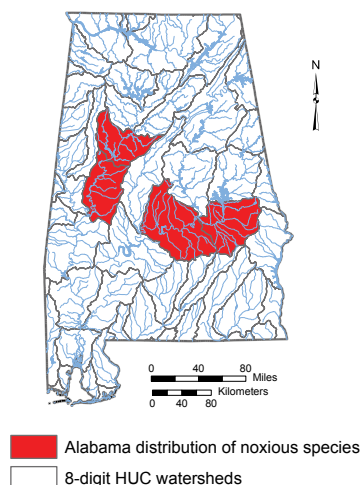


*Photo by Duane Chapman, U.S. Geological Survey*

**Synonym(s):** *Leuciscus molitrix*

**Identification:** The silver carp is a large, laterally compressed fish with a ventral keel that extends forward almost to the gill membranes. Silver carp are very silvery in color when young, fading with age, and becoming a greenish color on the back to silver on the belly. The scales are very small on the body with the head and opercles scaleless. Silver carp have a large mouth without jaw teeth. The pharyngeal teeth are in a single row and have striated surfaces. The eyes are situated far forward on the midline of the body and are slightly turned down. Silver carp can grow to over one meter in length and may reach weights of 45 kg (Nico, #2006b; Schofield et al., 2005).

### Silver Carp



**Native Range:** Several major Pacific drainages in eastern Asia from the Amur River of far eastern Russia south to the Pearl River in China, possibly including northern Vietnam (Li and Fang, 1990).

**Alabama Distribution:** Recorded in the Black Warrior and Tallapoosa river drainages of the Mobile Basin, including Yates Reservoir (Mettee et al., 1996; Rasmussen, 1998).

**Pathway(s) of Introduction:** This species was first introduced and stocked for phytoplankton control in eutrophic water bodies and as a food fish. It was imported into the United States in 1973

by a private fish farmer in Arkansas (Freeze and Henderson, 1982). During the 1970s, the silver carp was being raised at state, federal, and private facilities, and was stocked in several municipal sewage lagoons (Robison and Buchanan, 1988). By 1980 the species was discovered in natural waters, probably a result of escapes from fish hatcheries and other types of aquaculture facilities (Freeze and Henderson, 1982).

**Impact(s) of Introduction:** Pflieger (1997) considers the impact of this species difficult to predict as a result of its place in the food web. If the silver carp reaches high numbers it has the potential to have a great impact on native species because it feeds on plankton required by larval fish and native mussels (Laird and Page, 1996). This species could also be a potential competitor with adults of some native fishes that rely on plankton for food (Pflieger, 1997). Silver carp (including black and largescale carps) have recently been listed as “injurious species” under the federal Lacey Act. This prohibits the interstate trade and importation of these species.

**Common Name:** SILVER CARP X BIGHEAD CARP HYBRID

**Scientific Name:** *HYPOPHTHALMICHTHYS MOLITRIX* X *H. NOBILIS*

**Family:** CYPRINIDAE

Alabama ANS Task Force Rank – 3.0

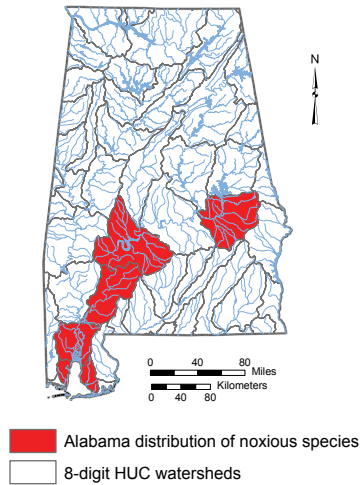


Photo by Duane Chapman, U.S. Geological Survey

**Synonym(s):** None noted

**Identification:** Bighead and silver carps can be easily distinguished by gill raker morphology (Kolar et al., 2005). Gill rakers of hybrids are intermediate in their development between the two species. In most cases, hybrids were found to appear more similar to one [or the other] of the parental species. Like most hybrid fishes, many characteristics are intermediate between the parental species. These include the ratios of head or gut length to body length, and the length of the extension of the pectoral fin past the insertion of the pelvic fin. Evidence of backcrossing can further confound identification.

## Silver Carp x Bighead Carp Hybrid



**Native Range:** The fact that fish can readily hybridize in the wild is linked to their overlapping native ranges in China. However, it's suspected that hybridization in rivers is probably the result of aquaculture escapes (Fuller and Benson, 2006; Kolar et al., 2005).

**Alabama Distribution:** Five specimens have been collected and identified from the Saugahatchee Creek arm of Yates Reservoir, Alabama. These fish were likely escapees from the Auburn University Department of Fisheries and Allied Aquaculture facility located near Saugahatchee Creek in Lee County.

**Pathway(s) of Introduction:** Individual species were intentionally stocked in aquaculture facilities for food and to improve water quality in catfish ponds through the reduction in phytoplankton load.

**Impact(s) of Introduction:** The impacts of this hybrid are most likely similar to those of individual species. Studies aimed at assessing the impacts of hybrids are underway (Fuller and Benson, 2006).



**Common Name:** COMMON CARP

**Scientific Name:** *CYPRINUS CARPIO*

**Family:** CYPRINIDAE

**Alabama ANS Task Force Rank – 3.0**



*Photo by Pat O'Neil, Geological Survey of Alabama*

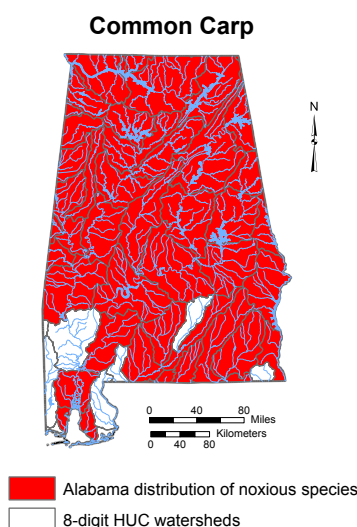


*Common carp collected below Miller's Ferry Power House, Alabama River, Wilcox County. Photo by Steve Rider, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** Leather carp and mirror carp

**Identification:** Dorsal spines: 3 to 4; dorsal soft rays: 15 to 23; anal spines: 2 to 3; anal soft rays: 5 to 6; vertebrae: 36 to 37. Pharyngeal teeth 1, 1, 3-3, 1, 1. Teeth are robust and molar-like, with flattened or somewhat furrowed crowns. The scales of this species are large and thick. This species is very variable in form, proportions, squamation, development of fins, and color. Head and body vary in coloration from bronze to light olive on the back to yellowish on the venter. The caudal fin is often red to an orange color. The common carp can be distinguished from other cyprinids by the heavy and strongly serrate spines in the anterior portion of its dorsal and anal fins, and by the presence of two rather long, fleshy barbells on each side of its upper jaw (Douglas, 1974).





**Native Range:** Prior to human influence, the common carp was found in the Black, Caspian, and Aral sea drainages, east into Siberia and China, and west as far as the Danube River (Balon, 1995).

**Alabama Distribution:** Common carp are found throughout the state. This species was introduced into the U. S. as early as 1831 (Fuller et al., 1999) and first documented in Alabama in 1882 (Bouschung and Mayden, 2004). In Florida, breeding populations are limited to the Apalachicola and Ochlockonee rivers, northward toward the state boundary (Shafland, 1996). There are reports of

hybridization between established populations of common carp and grass carp (Taylor and Mahon, 1977). Common carp are established in all of the Gulf States, but is limited to the panhandle in Florida (Courtenay et al., 1974; 1991).

**Pathway(s) of Introduction:** This species has been introduced worldwide (via aquaculture) into temperate freshwaters as a food fish, ornamental fish, and for angling (Aguirre and Poss, 2000). It also is known to escape from ponds and water gardens.

**Impact(s) of Introduction:** The common carp disturbs and impacts local species through its feeding activity; it stirs bottom sediments to increase siltation and turbidity. This species also preys on eggs and larvae of other fish (Lachner et al., 1970; Page and Burr, 1991).

**Common Name:** ASIAN CLAM

**Scientific Name:** *CORBICULA FLUMINEA*

**Family:** CORBICULIDAE

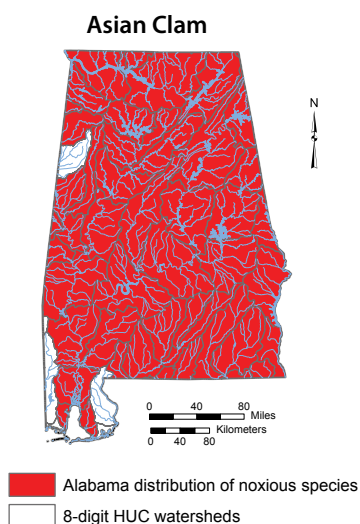
Alabama ANS Task Force Rank – 3.0



*Asians clams collected from Swift Creek, Autauga County. Photo by Steve Rider, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *Corbicula leana*, Asiatic clam, and prosperity clam

**Identification:** The Asian clam has a yellowish-brown to black shell with concentric, evenly spaced ridges on the surface (INHS, 1996). This species is usually greater than 25 mm, but can reach 50 to 65 mm in length (Aguirre and Poss, 1999). The Asian clam is found in freshwater and out-competes many native species for food and space. The Asian clam requires well-oxygenated waters and favors fine, clean sand, clay, and coarse sand substrates.



**Native Range:** The Asian clam is native to southeastern China, Korea, southeastern Russia, and the Ussuri Basin (Aguirre and Poss, 1999).

**Alabama Distribution:** This species has been documented in 35 counties and probably occurs in all counties and waterways of the state (D. Campbell, University of Alabama, pers. comm.). In addition to the expansion of western populations, this clam may have been accidentally introduced into Saugahatchee Creek during experimentation and scientific study at Auburn University, Department of Fisheries and Allied Aquaculture facility in the summer of 1972 (Jenkinson, 1979). The Asian clam

has been introduced or invaded into estuaries, lakes, and waterways in 38 states and the District of Columbia (Foster et al., 2000). The species is found in fresh waters throughout the United States including all five Gulf States and northern Mexico (Dundee, 1974; Carlton, 1992).

**Pathway(s) of Introduction:** Asian clams are spread primarily via boat attachment and ballast water, and can be carried with water currents. They also are used as live bait throughout the U.S. This species is also sold by the pet/aquarium trade as either the "pygmy" or "gold" clam. Juvenile forms of this clam are most likely transported worldwide in ballast water (Balcom, 1994).

**Impact(s) of Introduction:** The Asian clam can compete with many native clam species for food and space. The introduction of this species into the United States has resulted in the clogging of water intake pipes, affecting power, water, and other industries. Many of these problems result from weak-swimming juveniles that are pushed to the bottom of the water column where intake pipes are located. They are drawn into the intakes, where they attach, breed, and die. The intake pipes become clogged with live clams, empty shells, and dead body tissues (PNNL, 2005).

**Common Name:** RUDD

**Scientific Name:** *SCARDINIUS ERYTHROPHthalmus*

**Family:** CYPRINIDAE

**Alabama ANS Task Force Rank – 3.0**



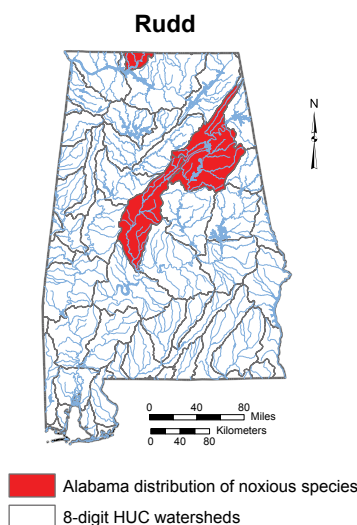
*Rudd collected from St. Clair County,  
Photo by Steve Rider, Alabama Division of  
Wildlife and Freshwater Fisheries*



*Photo by Noel Burkhead, U.S. Geological Survey*

**Synonym(s):** *Cyprinus erythrophthalmus*, *Leuciscus erythrophthalmus*, and *pearl roach*

**Identification:** The dorsal fin has 9 to 11 rays. There is a scaled, bony keel along the belly from the pelvic fins to the anal fin. The body is deep and compressed, with a small head. The mouth is oblique and terminal with a steeply angled protruding lower lip. The lateral line is low on side with 37 to 47 scales, while the dorsal fin's origin is behind that of the pelvic fin. Anal, pelvic, and pectoral fins are bright red and the eye is gold with red spot at top. Tail fins are reddish-brown. This fish is characterized by 10 to 11 anal fin rays. The scales are robustly marked, the back is dark greenish-brown, and the sides are brassy yellow, tapering to a whitish belly (Burkhead and Williams, 1991; Page and Burr, 1991; Nico et al., 2006a).



**Native Range:** This fish is widely spread in Europe and middle Asia among basins of the North, Baltic, Black, Caspian (from Emba, Ural and Volga to the rivers of the southern coast) and Aral seas (Berg, 1949).

**Alabama Distribution:** This species was reported from First Creek in Lauderdale County (Nico and Fuller, 2006c) and from St. Clair County, Alabama (D. Catchings, ALDWFF, pers. comm.).

**Pathway(s) of Introduction:** The rudd entered the U. S. during two widely separated periods of introduction. It was initially brought to this country either in the late 1800s or early 1900s as a baitfish, and then in the late 1960s and early 1970s, based on accounts from

Courtenay and Williams (1992). Although this popular baitfish is currently banned in Alabama, it is often accidentally mixed with other live bait. Bait bucket release seems to be the primary mode of spread (Nico and Fuller, 2006c; Nico et al., 2006a).

**Impact(s) of Introduction:** Impacts of this species are largely unknown. In a laboratory setting, Burkhead and Williams (1991) demonstrated that rudd readily hybridize with native golden shiner. The consequences of hybridization are unknown. In addition, unlike most native fishes, the rudd is omnivorous and can shift its diet to plants. Cadwallader (1977) indicated this species might out compete many native fishes in waters that are eutrophic or polluted due to its ability to adapt to harsh environments. The importation and/or possession of rudd into Alabama is prohibited under regulation 220-2-.93.



**Common Name:** NUTRIA

**Scientific Name:** *MYOCASTOR COYPUS*

**Family:** ECHIMYIDAE

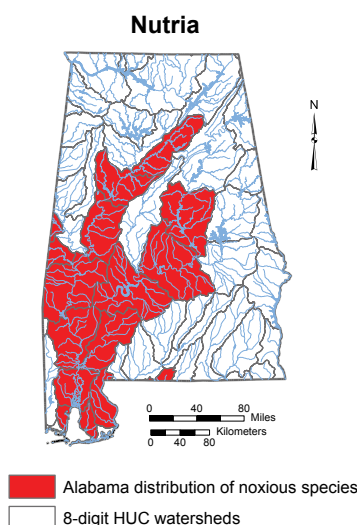
Alabama ANS Task Force Rank – 3.0



*Photo by David Nelson, University of South Alabama*

**Synonym(s):** *Myopotamus bonariensis*, *coypu*, *coypu rat*, *swamp beaver*, and *nutria rat*.

**Identification:** Nutria are large, brown rodents. They have a long tail which is rounded, scaly, and sparsely haired. The muzzle and chin are white and the ears and eyes are small. The incisors are large and dark orange, protruding beyond the lips. The four inner toes of the hind feet are webbed, facilitating swimming (Whitaker, 1988).



**Native Range:** Nutria are native to fresh and saline waters in southern Brazil, Bolivia, Paraguay, Uruguay, Argentina, and Chile (Norwak, 1991; Woods et. al, 1992).

**Alabama Distribution:** In the Gulf of Mexico ecosystem, they are established along coastal areas of all five Gulf states (Whitaker, 1988; Hollander et al., 1992). This species is common in Mobile and Baldwin counties, and on Dauphin Island. Prior to Hurricane Katrina, it was also found on Sand Island.

**Pathway(s) of Introduction:** Nutria were intentionally introduced in several places in the U. S. for fur farming. They dispersed locally by escaping confinement and overland range expansion. Nutria were first introduced into the Gulf of Mexico Region near New Orleans in the early 1930s (Griffo, 1957; Lowery, 1974; Trillin, 1995). Today spread is due primarily to range expansion.

**Impact(s) of Introduction:** Nutria rapidly consume native vegetation in coastal areas, resulting in wetland degradation (Trillin, 1995). Additionally, nutria damage to crops (e.g., rice, sugar cane, and soybeans) is well-documented (Ensminger, 1955; Lowery, 1974; O'Neil and Linscombe, 1977; Whitaker, 1988; Gingerich, 1994; Trillin, 1995; Wolfe, 1981). The decline of the native muskrats has been attributed to nutria as a result of competition for trophic resources (Griffo, 1957; Lowery, 1974; O'Neil and Linscombe, 1977). Wolfe (1981) reported nutria might be impacting coastal habitats by digging up and eating the roots and rhizomes of sea oats, which are of critical importance in stabilizing beach dunes. Lastly, these rodents are known to carry a number of parasites and diseases (Lowery, 1974; Howerth et. at., 1994). It is illegal to propagate or release nutria into the state of Alabama pursuant to regulation 220-2-.26.

**Common Name:** RUSTY CRAYFISH

**Scientific Name:** *ORCONECTES RUSTICUS*

**Family:** CAMBARIDAE

Alabama ANS Task Force Rank – 3.0

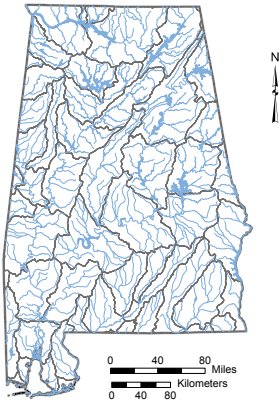


*Photo by Guenter Schuster, Eastern Kentucky University*

**Synonym(s):** *None noted*

**Identification:** The rusty crayfish can be identified by its brown body and large claws. Its claws are grayish-green to reddish-brown with dark, black bands on the tips. Also, there are two rusty patches on either side of the crayfish's body. However, these patches may be less pronounced on crayfish from different areas. The claws, when closed, have an oval gap in the middle. The moveable claw is smooth and S-shaped. Adults are generally 7 – 13 cm long. Males tend to be larger than females (Gunderson, 2004).

## Rusty Crayfish



8-digit HUC watersheds

**Native Range:** Rusty crayfish are unique, in that they are not native to Alabama, but native to the Ohio River Basin and the states of Ohio, Kentucky, Tennessee, Indiana, and Illinois. Rusty crayfish are now also found in Michigan, Missouri, Iowa, Minnesota, New Mexico, New York, New Jersey, Pennsylvania, Wisconsin, all New England states (except Rhode Island), and many areas in Ontario, Canada. The expanded range includes new sightings and rusty crayfish observations that are both documented and undocumented.

**Alabama Distribution:** The rusty crayfish has not been documented in Alabama.

**Pathway(s) of Introduction:** Anglers and the bait industry are the two most likely pathways for introduction into non-native areas of the United States. Rusty crayfish are also sold to schools by biological supply stores for classroom projects and are likely released into non-native areas.

**Impact(s) of Introduction:** The most serious impact of the rusty crayfish relates to the destruction of aquatic plant beds. Rusty crayfish have been shown to significantly reduce aquatic plant abundance and species diversity (Olsen et al., 1991; Taylor and Redmer, 1996). Rusty crayfish have been shown to out-consume other *Orconectes* species. Additionally, Lodge et al. (1994) noted conflicting results among studies, suggesting that the rusty crayfish disrupts littoral food webs.

**Common Name:** BLACK CARP

**Scientific Name:** *MYLOPHARYNGODON PICEUS*

**Family:** CYPRINIDAE

Alabama ANS Task Force Rank – 3.0

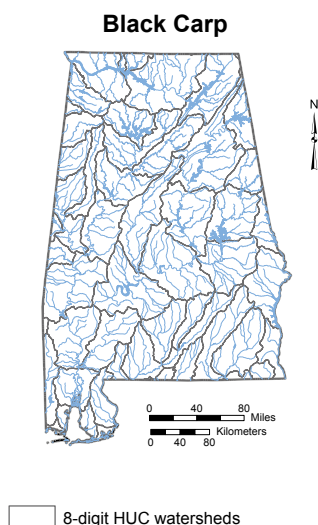


Photo by Leo Nico., U.S. Geological Survey

**Synonym(s):** *Leuciscus piceus*, Chinese black carp, and black amur

**Identification:** This fish has black-tipped scales that give the appearance of cross-hatching. The dorsal fin is short and pointed, contains 7 to 8 rays, and is located above the pelvic fin. The anal fin is located closer to the caudal fin when compared to that of the native minnows. The black carp closely resembles the grass carp in appearance, but can be most easily distinguished by differences in the formation of the pharyngeal teeth. The pharyngeal teeth of the grass carp are characterized by deep, parallel grooves, while those of the black carp appear molar-like. The mouth of the black carp is also more subterminal, the operculum is longer, snout more pointed, and the pectoral fins are longer than those of grass carp.





**Native Range:** The black carp occurs in most major Pacific drainages of eastern Asia, from the Pearl River basin in China, north to the Amur River and its major tributaries of China, and far eastern Russia. This fish is also thought to be native to the Red River of northern Vietnam (Nico and Williams, 1996).

**Alabama Distribution:** No black carp have been documented in Alabama. A single fish was collected from the White River, Arkansas, in April 2005. The first wild specimen was captured in March, 2003 from Horseshoe Lake, Illinois. Two specimens were captured from the wild in the lower Red River, Louisiana, in April 2004. Approximately 30 black

carp escaped from a fish farm into the Osage River, Missouri River basin, in April 1994. One specimen was collected June 10, 2004 in the Mississippi River near Lock and Dam 24, across the river from Clarksville, Missouri (Nico and Fuller, 2006b). They are now present in the Mississippi River (Nico et al., 2005).

**Pathway(s) of Introduction:** Black carp were first introduced into Arkansas as stowaways in the 1970s in imported grass carp stocks for a private fish farm (Nico and Williams, 1996). A second introduction occurred in the early 1980s when black carp were imported as a food fish and as a biological control agent for the yellow grub, *Clinostomum margaritum*, in aquaculture ponds (Nico and Williams, 1996). The first escape was documented in Missouri in 1994, when high water flooded hatchery ponds at an aquaculture facility near Lake of the Ozarks (LMRCC, 1994; Nico and Williams, 1996).

**Impact(s) of Introduction:** Although used in aquaculture facilities to control snails, black carp could negatively impact native aquatic communities by feeding on, and reducing, populations of native mussels and snails. Many native mussels and snails are considered to be endangered or threatened and are key elements of many aquatic systems (Nico and Williams, 1996). Black carp (including silver and largescale carps) have recently been listed as "injurious species" under the federal Lacey Act. This prohibits the interstate trade and importation of these species.

**Common Name:** RED SHINER

**Scientific Name:** *CYPRINELLA LUTRENSIS*

**Family:** CYPRINIDAE

**Alabama ANS Task Force Rank – 2.8**



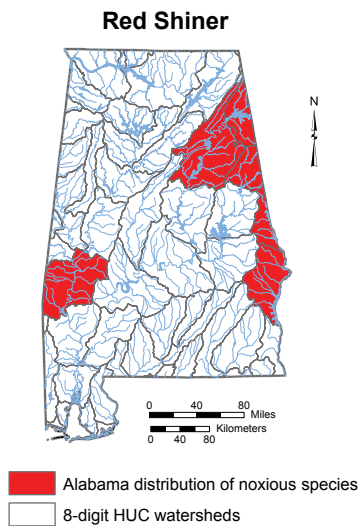
Photo by Steve herrington, The Nature Conservancy



Photo by Steve Herrington, The Nature Conservancy

**Synonym(s):** *Leuciscus lutrensis*, *Notropis lutrensis*, and red-horse minnow

**Identification:** Red shiner has a relatively deep-body with a high arching back (Mettee et al., 1996). Red shiner coloration varies from a blue-green to blue above, with silver on the sides. Spawning males become bluish on the sides and the fins redden. There are 7 to 8 rays in the dorsal fin. The anal fin has 8 to 10 rays (usually 9). Maximum size is 9#mm long. Red shiners may be confused with golden shiners, rudd, and roach.



**Native Range:** The fish is native to other parts of the U.S., including the Mississippi River Basin and Gulf Coast drainages west of the Mississippi River (Page and Burr, 1991).

**Alabama Distribution:** This species has been found in the Coosa and Tombigbee river drainages, and tributaries of the Chattahoochee River (Boschung, 1992; Mettee et al., 1996; Burkhead, 2003).

**Pathway(s) of Introduction:** This species is often mixed with other live bait, and then spread as a result of bait bucket releases, followed by prolific reproduction, dispersal, and vigorous colonization (Hubbs and Lagler, 1958; Minckley and Deacon, 1968; Minckley, 1973). Additional introductions include: aquarium releases (Moore et al., 1976), escapes from aquaculture (Hubbs, 1954), and intentional releases as a forage fish (Koehn, 1965).

**Impact(s) of Introduction:** The red shiner is aggressive and may hybridize and dilute the gene pool of native *Cyprinella* when introduced into new regions (Burkhead, 2003). This species has the potential to hybridize with at least eight native congeners in southeastern U.S. waters where populations are currently established (Boschung and Mayden, 2004). The red shiner is hybridizing with the blacktail shiner, *C. venusta* (Mettee et al., 1996; Burkhead, 2003), bluestripe shiner, *C. callitaenia* (Wallace and Ramsey, 1982), as well as the federally threatened blue shiner, *C. caerulea* (Burkhead, 2003). The red shiner has been identified as the source of the Asia tapeworm upon introduction into the Virgin River in Utah (Nico and Fuller, 2006c).

**Common Name:** ZEBRA MUSSEL

**Scientific Name:** *DREISSENA POLYMORPHA*

**Family:** DREISSENIDAE

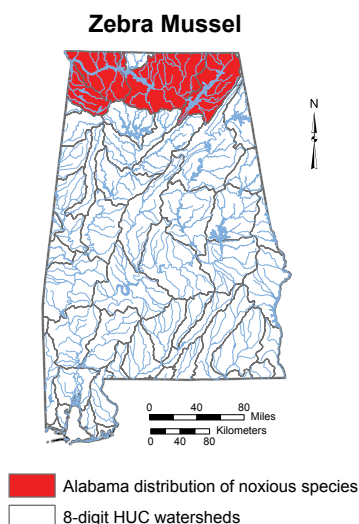
**Alabama ANS Task Force Rank – 2.8**



*Photo by University of Georgia*

**Synonym(s):** *Mytilus polymorpha*

**Identification:** Zebra mussels are variable in color with six basic variations on the alternating dark and light banding patterns according to Biochino (1989) and Smirnova et al. (1993). In the United States, this mussel is black or brown and/or white with a byssal attachment to hard substrates. The zebra mussel reaches a maximum size of approximately 3 cm in length. The shell is highly carinate, having an angle between the ventral and dorsal surfaces. Color patterns are highly polymorphic, ranging from almost pure black to unpigmented, with a variety of striped forms (McMahon, 1990).



**Native Range:** Prior to the 19th century, zebra mussels ranged throughout the Black, Caspian and Azov Seas (Stanczykowska, 1977). Between 1800 and 1900, the zebra mussel more than doubled its range in Europe (Schloesser, 1995), such that it is now found throughout most of Europe, extending east into western Asia and south into Turkey (Mackie et al., 1989).

**Alabama Distribution:** In North America, zebra mussels were first identified in Lake St. Clair, near Detroit in 1988 (Hebert et al., 1989).

The mussel is now found in the Mississippi River, from St. Paul Minnesota to Louisiana (Ram and McMahon, 1996). Zebra mussels have been detected in most of the major Mississippi River tributaries, including the Ohio, Tennessee, Cumberland, and Arkansas rivers (Griffiths et al., 1991; Ram et al., 1992; McMahon, 1992; O'Neill and Dextrase, 1994). According to the Gulf States Marine Fisheries Commission Invasive Species fact sheet (2005a), the zebra mussel is found in the lower Mississippi River and the Atchafalaya. A single live mussel was found in Mississippi Sound. Additional locations were noted along the Gulf Intracoastal Waterway between New Orleans and Morgan City, Louisiana. While this species has been documented in the Tennessee River, zebra mussels have yet to be found in the Tombigbee system.

**Pathway(s) of Introduction:** Zebra mussel introductions have been associated with floating vegetation/debris, aquarium dumping, ship ballast water, ship/boat hull fouling, and movement of equipment.

**Impact(s) of Introduction:** Zebra mussels form dense aggregates on hard surfaces that have to have led to serious economic impact in water systems. Settlement of large numbers of larvae in raw water systems result in the formation of thick mats that restrict water flow, increase sedimentation rates, and promote surface corrosion (Mackie et al., 1989; McMahon, 1992; Kovalak et al., 1993). Infestations along the lower Mississippi river have not been as catastrophic as those reported for northern systems, where fouling problems are severe (Griffiths et al., 1991; Le Page, 1993; Claudi and Mackie, 1993). Estimates of several billion dollars have been calculated for the cost of repair and replacement of equipment, and control of the mussel invasion (U.S. Congress OTA, 1993). This species has also made a significant impact on the native North American biota. In habitats that are densely colonized by zebra mussels, native unionid bivalves have experienced extensive mortalities and, in some cases, complete extirpation. As of the late 1990s, negative impacts of zebra mussel have been documented for 31 unionid species in North America (Tucker et al., 1993; Strayer et al., 1994).



## Common Name: BLUEBACK HERRING

Scientific Name: *ALOSA AESTIVALIS*

Family: CLUPEIDAE

Alabama ANS Task Force Rank – 2.6



Photo by D. Anthony Rabern, Georgia Department of Natural Resources

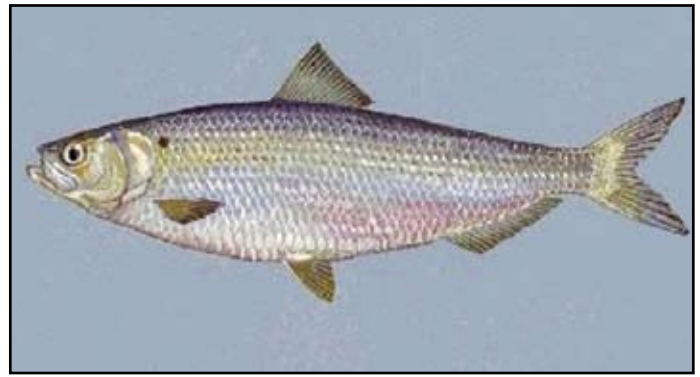
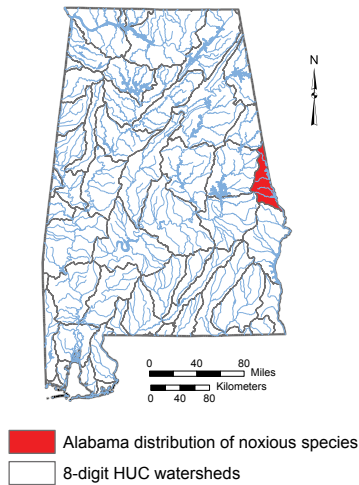


Photo by Duane Raver, U.S. Fish & Wildlife Service

**Synonym(s):** *Clupea aestivalis*, *Pomolobus aestivalis*, blueback shad, and river herring

**Identification:** Blueback herring are silvery in color, have a series of modified, compressed spiny and keeled scales (scutes) along the belly. Dorsal spines: 0 to 0; dorsal soft rays: 15 to 20; anal spines: 0; anal soft rays: 15 to 21; vertebrae: 47 to 53. The upper jaw is characterized by a distinct notch and the lower jaw steeply rises within mouth; minute teeth are present at the front of the jaws (disappearing with age). Lower gill rakers are slender and number 41 to 52 (fewer in fishes under 10 cm standard length). The back is dark blue, sometimes bluish-grey, with a dark spot on shoulder. The black to dusky color of the lining of the abdominal cavity (peritoneum) is also a diagnostic character of this species. Blueback herring and alewives (morphologically and collectively referred to as “river herring”) are morphologically difficult to separate (Whitehead, 1985; Page and Burr, 1991; Jenkins and Burkhead, 1994; Owens et al., 1998). Adult sizes range from 31 to 38 cm long.

## Blueback Herring



**Native Range:** Blueback herring are found on the Atlantic Coast from Cape Breton, Nova Scotia, to the St. Johns River, Florida, migrating up coastal rivers during spawning season (Page and Burr, 1991).

**Alabama Distribution:** One specimen was collected in 2002 from West Point Reservoir, Alabama (S. Rider, ALDWFF, pers. comm.). Blueback herring have been collected from the Tennessee River in Georgia and Tennessee.

**Pathway(s) of Introduction:** This species has been intentionally stocked for forage by state fisheries agencies or illegally stocked by anglers.

**Impact(s) of Introduction:** Blueback herring can negatively impact sportfishes by competing for limited food resources, preying upon fingerling sportfish, and altering trophic structure. Blueback herring were illegally stocked in Lake Burton, GA, in the early 1990s. By 1999, sportfish (i.e., largemouth bass, yellow perch, white bass, and black crappie) densities had sharply declined. Stomach analysis indicated significant dietary overlap between fingerling largemouth bass and adult blueback herring. In addition, fingerling bass comprised nearly 10 percent of the blueback herring stomach contents (Rabern, 2002).

Research conducted in New York suggest if blueback herring become established, they could spread throughout the Great Lakes and impede recovery of depressed populations of indigenous fishes such as cisco and lake trout (Owens et al., 1998). The introduction of blueback herring into Theo Reservoir, Texas, reduced the preferred food populations at the base of the food chain (Howells, 1992).

**Common Name:** CHANNELED APPLE SNAIL  
ISLAND APPLE SNAIL

**Scientific Name:** *POMACEA CANALICULATA*  
*P. INSULARUM*

**Family:** AMPULLARIIDAE

Alabama ANS Task Force Rank – 2.6



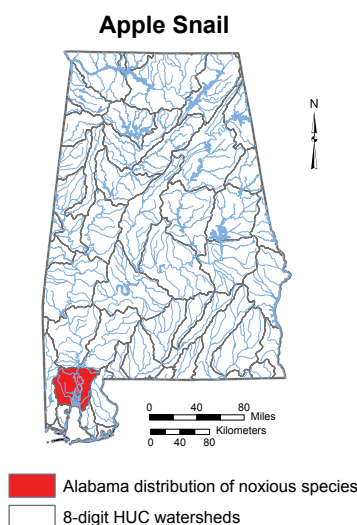
*Island apple snail collected from Langan Park, Mobile County. Photo by Steve Rider, Alabama Division of Wildlife and Freshwater Fisheries*



*Island apple snail egg masses, Langan park, Mobile County. Photo by Steve Rider, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *Ampullaria canaliculata*, golden apple snail, golden kuhol, and miracle snail

**Identification:** Apple snails are large (up to 10 cm), globular freshwater snails. The shell color is generally brownish or greenish, often with spiral banding patterns around the whorls. Some aquarium-bred animals are bright golden yellow. The body color of this snail can vary from dark, almost black to pale cream. The presence of snails is often first noted by the observation of their bright pink egg masses that are laid on solid surfaces up to 50 cm about the water surface.



**Native Range:** This species is a widespread freshwater snail, native to Argentina, Bolivia, Brazil, Paraguay and Uruguay (Albrecht et al., 1996). It has also been introduced into parts of Asia (Halwart, 1994; Albrecht et al., 1996).

**Alabama Distribution:** There are no confirmed Alabama records for channeled apple snails. However, island apple snails have been collected from Langan Park, Mobile County. Apple snails have been collected in Alabama, Arizona, California, Georgia, Hawaii, Florida, Louisiana, North Carolina, and Texas. This species has been reported as relatively common in several canals, ponds, and artificial lakes in coastal zones of south Florida (Thompson, 1997).

**Pathway(s) of Introduction:** The channeled apple snail has been imported and illegally established to support development of aquaculture projects for human food. This species is being sold as a domestic aquarium snail in pet stores. This species may also be introduced as eggs or small juveniles attached to aquatic plants. Local dispersal occurs via aquaculture, escape from confinement, and water currents. This species was likely accidentally dispersed as eggs or more likely, small juveniles on agricultural products; researchers also suspect that it was deliberately introduced to uncontained wetland systems, in the hope of harvesting the snails for food (Ghesquiere, 2005).

**Impact(s) of Introduction:** The channeled apple snail was originally introduced from South America to Southeast Asia (circa 1980) as a local food resource and potential gourmet export item. However, markets never developed, the snails escaped or were released and became a serious pest associated with rice paddies throughout many countries of southeast Asia. In the Philippines, it is considered the number one rice pest and has caused huge economic losses. This species can spread rapidly from agricultural areas into wetlands and other natural freshwater systems, where it can inflict serious impact. Potential impacts include: destruction of native aquatic vegetation, habitat modification, as well as competitive interactions with native aquatic fauna (e.g., native snails). It has been introduced to the U.S. and threatens the major rice crops of Texas and California (GSMFC, 2005b).

**Common Name:** GRASS CARP

**Scientific Name:** *CTENOPHARYNGODON IDELLA*

**Family:** CYPRINIDAE

**Alabama ANS Task Force Rank – 2.4**

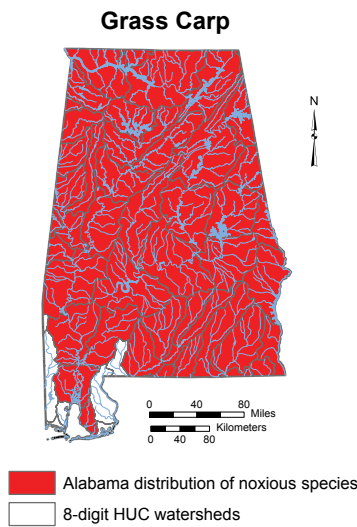


*Photo by Pat O'Neil, Geological Survey of Alabama*

**Synonym(s):** *Leuciscus idella*, *Ctenopharyngodon idellus*, and *white amur*

**Identification:** The grass carp is long and slender, and one of the largest members of the minnow family. The body is oblong with moderately large scales, while the head has no scales. There are three simple and seven branched rays on the dorsal fin; the anal fin is set closer to the tail than those of most cyprinids. Grass carp are silvery to olive in color, lacking the golden hue of common carp. The terminal mouth is slightly oblique with non-fleshy, firm lips and no barbels. Broad, ridged pharyngeal teeth with parallel grooves are arranged in a 2, 4-4, 2 formula (Mettee et al., 1996). Maximum size is 150 cm long and weight is 45 kg.





**Native Range:** The grass carp is native to large river systems of eastern Asia, from the Amur River on the Russian-Chinese border southward (Boschung and Mayden, 2004).

**Alabama Distribution:** This fish has been reported to occur in the Black Warrior, Tombigbee, Alabama, Coosa, and Tallapoosa river drainages of the Mobile Basin and the Tennessee River.

**Pathway(s) of Introduction:** Authorized and unauthorized stocking of grass carp has taken place for biological control of vegetation since the 1960s (Nico et al., 2006b). This species was first imported to United States aquaculture facilities at Auburn University and Stuttgart, Arkansas in 1963. (Courtenay et al., 1984). Numerous state and federal agencies have stocked grass carp throughout Alabama. Many of the early stockings in Arkansas were in lakes or reservoirs that are open to stream systems, leading to reports in the 1970s of grass carp captured in the Missouri and Mississippi Rivers (Pflieger, 1975). Rapid spread of this species has continued as a result of widely scattered research projects, stockings by federal, state, and local government agencies, legal and illegal interstate transport, release by individuals and private groups, escapes from farm ponds and aquaculture facilities, and natural dispersal from introduction sites (e.g., Pflieger, 1975; Dill and Cordone, 1997). This fish has also been stocked by private individuals and organizations. Grass carp continue to be stocked as a biological control for some aquatic plants in ponds and lakes. The ALOWFF has recently terminated stocking diploid grass and stocks only triploid grass carp into public waters of Alabama (S.Cook, ALOWFF, pers. comm.).

**Impact(s) of Introduction:** Negative effects attributed to grass carp, as reported by Shireman and Smith (1983), include interspecific competition for food with invertebrates (e.g., crayfish) and other fishes. This species of carp can consume significant amounts of aquatic plant biomass, thereby, destroying habitat for invertebrates and juvenile fishes, and forage for waterfowl to the detriment of sport fisheries and hunting, respectively (Nico et al., 2006b).

**Common Name:** AUSTRALIAN RED CLAW CRAYFISH  
AUSTRALIAN MARRON CRAYFISH  
AUSTRALIAN YABBY CRAYFISH

**Scientific Name:** *CHERAX QUADRICARINATUS*  
*C. DESTRUCTOR*  
*C. TENUIMANUS*

**Family:** PARASTACIDAE

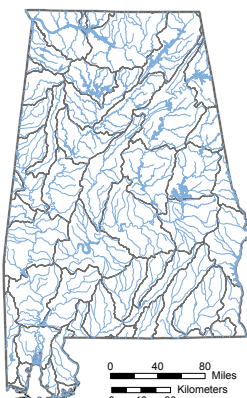
Alabama ANS Task Force Rank – 2.2

Photo by  
Chris Lukhaup



**Synonym(s):** None noted.

**Identification:** There are more than 100 species of Australian crayfish, but only three species are presently being cultured. The “marron” (*Cherax tenuimanus*), “yabby” (*Cherax destructor*), and “red claw” (*Cherax quadricarinatus*) are cultivated in the United States (Masser and Rouse, 1997). Their colors vary from olive-green to brown; they can also be blue, yellow, red or black depending on the habitat, location, and individual. The head and internal organs of all crayfish are protected by the carapace and the six segments of the abdomen are individually encased with a flexible membrane between them to allow movement. Crayfish have a pair of large claws at the front end, followed by four pairs of walking legs and four pairs of small swimming legs called swimmerets. These swimmerets are covered with fine hairs to which the female attaches her eggs. A central tail flap is surrounded by four other flaps that are used to move the crayfish rapidly through the water, as well as curling up to form a brood chamber. The red claw male has a red membrane covering the claw. Red claw crayfish are the largest of the three species with maximum weight of 600 g and a carapace length of 100 mm.

**Australian Crayfish**

8-digit HUC watersheds

**Native Range:** All of the aforementioned species are native to Northern and Western Australia.

**Alabama Distribution:** Several aquaculture facilities are currently raising Australian red claw in Alabama. No Australian crayfish have been collected in the public waters of Alabama. Aquaculture escapees were recorded in Puerto Rico, following Hurricane George, and in central Mexico. Australian red claw escapees have nearly eliminated native crayfishes from central Mexican streams (R. Mendoza, UAL, pers. comm.).

**Pathway(s) of Introduction:** The most common paths of introduction of crayfish species involve the unintentional release or escape from aquaculture and/or scientific research facilities.

**Impact(s) of Introduction:** Australian crayfish species are commonly omnivorous, exhibit high reproductive potential, rapid growth, resistance to diseases, and have shown environmental adaptability (especially the red claw). Escapees from aquaculture and research facilities have had a variety of effects on natural populations that include: displacement of native species as a consequence of competition for food, predation, removal of vegetation with the consequent elimination of food sources, shelter and spawning substrates, hybridization, transmittal of viruses and parasites, and generalized changes in the natural environment (Mendoza, 2001). Australian red claw crayfish have escaped aquaculture facilities and become established in Jamaica, Mexico, New Zealand, Puerto Rico, Singapore, South Africa, and Turkey (Ahyong and Yeo, 2007; Bortolini, 2007; Harlioglu and Harlioglu, 2006; Mendoza, 2004; Todd 2005; Vazquez, 2008; Zimmermann, 2003). The Australian yabby crayfish has become established outside its native range in Western Australia (Beatty et al., 2005).

**Common Name:** MARGINED MADTOM

**Scientific Name:** *NORURUS INSIGNIS*

**Family:** ICTALURIDAE

**Alabama ANS Task Force Rank – 2.2**

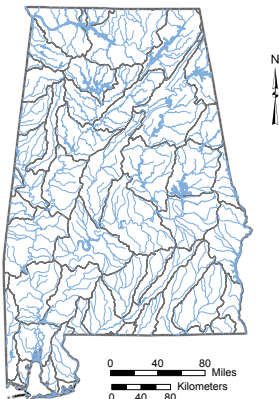


Photo from <http://www.cnr.vt.edu/efish/families/marmadtom.html>

**Synonym(s):** *Pimelodus insigne*

**Identification:** The margined madtom has a light, cream-colored belly, looks like a small catfish, and has a moderately elongate non-blotched body that is posteriorly compressed. The fish has some median fins with dark edges, a broad, depressed head and inferior mouth; barbels around the mouth are white to brown (Fuller and Jacobs, 2006). This madtom has a straight pectoral spine and an adipose fin that is attached along the length of the body; it is continuous with the square caudal fin (Smith, 1985; Page and Burr, 1991; Jenkins and Burkhead, 1994).

## Marginated Madtom



 8-digit HUC watersheds

**Native Range:** This fish is native to the Atlantic Slope, from the Delaware drainage, New York, to the upper Altamaha River drainage, Georgia, the upper Kanawha (New) River system in Virginia and North Carolina, as well as the upper Monongahela River system in Pennsylvania and Maryland (Page and Burr, 1991).

**Alabama Distribution:** No occurrences of this species have been recorded for Alabama.

**Pathway(s) of Introduction:** This species has spread through bait bucket releases in other areas of the U.S. (Jenkins and Burkhead, 1994).

**Impact(s) of Introduction:** The marginated madtom has a high fecundity with minimum population doubling time less than 15 months (Page and Burr, 1991). This life strategy could potentially lead to competition for limited resources with native fishes.



**Common Name:** AUSTRALIAN SPOTTED JELLYFISH

**Scientific Name:** *PHYLLORHIZA PUNCTATA*

**Family:** MASTIGIIDAE

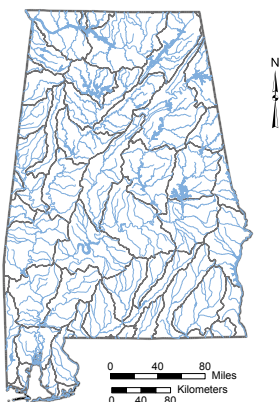
Alabama ANS Task Force Rank – 2.2



Photo by Dan Martin

**Synonym(s):** *Mastigias ocellatus*, *Mastigias albipunctatus*, *Mastigias andersoni*, *Mastigias scintillae*, *Cotylorhiza pacifica* and *Cotylorhizoide pacificus*

**Identification:** Graham et al. (2003) describe the Australian spotted jellyfish as having an umbrella that is nearly semi-spherical, about half as high as broad, having white crystalline inclusions that give the appearance of spots; there are 8 radial canals that attach directly with the stomach. Gulf of Mexico medusae are considerably larger than medusae in other described populations. Gulf medusae average 45 cm in bell diameter, with a maximum reported size of 62 cm (Graham et al., 1992).

**Australian Jellyfish**

8-digit HUC watersheds

**Native Range:** The Australian spotted jellyfish is indigenous to the tropical western Pacific Ocean (Graham et al., 2003). This species has a wide distribution in Australian waters and ranges throughout the Indo-Pacific Ocean, including along the Philippine archipelago (Heeger et al., 1992).

**Alabama Distribution:** This species was first reported in California in 1981 (Carlton and Geller, 1993). The first reported occurrence in the Gulf of Mexico was in 1993 by the National Marine Fisheries Service. Thousands of spotted jellyfish “invaded” coastal waters in Alabama, Mississippi, and Louisiana in the summer of 2000 (Perry et al., 2000; Gra-

ham et al., 2003). Graham et al. (2003) reported the presence of thousands of medusae in south Louisiana waters, west of the Mississippi River.

**Pathway(s) of Introduction:** The initial spread of the Australian spotted jellyfish has been attributed to hull-fouling transport of polyps (Larson and Arneson, 1990; Silveira and Cornelius, 2000). Graham (1998) suggests that transport from the Caribbean Sea to the northern Gulf of Mexico could be the result of natural ocean circulation processes and notes that similar transport of other Caribbean medusae has occurred in this way. Transport of the medusae that invaded the northern Gulf of Mexico waters in the summer of 2000 was attributed to circulation processes associated with the Loop Current and its spin-off eddies by Graham et al. (2003), as well as Johnson et al. (2004). Phylogeny of this species is uncertain as recent research, comparing molecular and morphological characteristics of *P. punctata*, places this species in the genus, *Mastigias* (Graham and Bolton, 2004).

**Impact(s) of Introduction:** Perry et al. (2000) found that the 2000 jellyfish invasion in the northern Gulf of Mexico had a direct economic impact on the shrimp fishery by clogging nets, damaging boat intakes and fishing gear, and closing areas to fishing activities. Indirect effects included predation on the eggs of important forage species and consumption of bivalve larvae (Graham et al., 2003). Jellyfish were abundant over commercial oyster reefs in Mississippi Sound; Graham et al. (2003) reported high predation rates on bivalve larvae.

**Common Name:** BLUE TILAPIA  
NILE TILAPIA

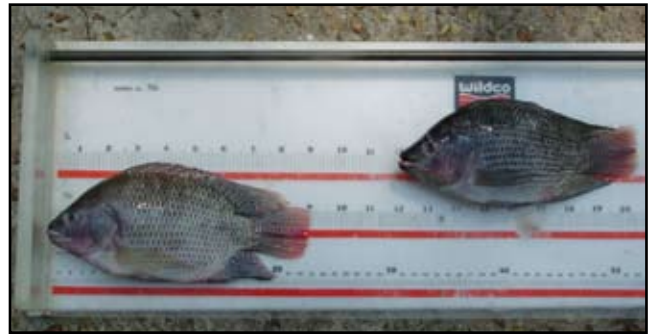
**Scientific Name:** *OREOCHROMIS AUREUS*  
*O. NILOTICUS*

**Family:** CICHLIDAE

**Alabama ANS Task Force Rank – 2.0**



Photo by Pat O'Neil, Geological Survey of Alabama

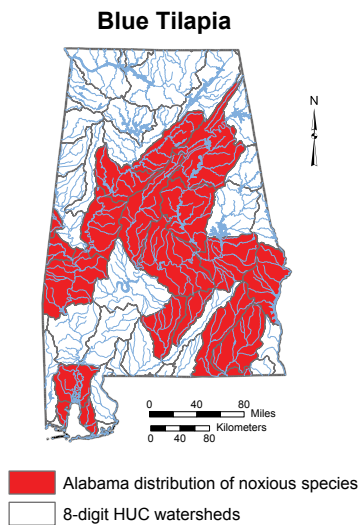


Nile tilapia from Lake Eufaula. Photo by Ken Weathers, Alabama Division of Wildlife & Freshwater Fisheries

**Synonym(s):** *Chromis aureus*, *Tilapia aurea*, *Sarotherodon aureus*, *Chromis niloticus*, *Tilapia nilotica*, *Tilapia affinis*, *Tilapia melanopleura*, *Tilapia monidi*, *Tilapia lemassoni*, *Tilapia kacherbi*, and *Tilapia kashabi*

**Identification:** The blue tilapia has 15 to 16 dorsal spines and 3 anal spines. The caudal fin is truncate and sides are bluish gray with a white belly. Breeding males have bright metallic blue on the head, a vermilion coloration on the edge of the dorsal fin, and pink coloration along the margin of the caudal fin. Breeding females have a paler, orange coloration along the edges of their dorsal and caudal fins (Trewavas, 1983; Boschung et al., 2004).

The Nile tilapia has 16 to 18 dorsal spines and rarely 16 dorsal spines, 3 anal spines, and 9 to 11 anal soft rays. The body is uniformly silver gray with a white to pink belly and a rounded caudal fin. In adults the opercle has a distinct black spot (Boschung and Mayden, 2004). The most distinguishing characteristic of the species is the presence of regular vertical stripes throughout the depth of the caudal fin (Trewavas, 1983). The margin of the dorsal fin is grey or black with 7 to 12 vertical bars on the caudal fin. Breeding males have red coloration in their dorsal and anal fins as well as along their flanks and lower head (Boschung and Mayden, 2004).



**Native Range:** Blue tilapia is native to tropical and subtropical Africa, and the Middle East. The native range includes Senegal, Niger, and many smaller drainages and lakes in Africa and the Middle East. The Nile tilapia is indigenous to Africa, where it is found from Egypt to Cape Horn. (Trewavas, 1983; Skelton, 1993).

**Alabama Distribution:** These species were annually stocked by the Alabama Department of Conservation and Natural Resources and Auburn University in lakes and farm ponds in Alabama from the late 1950s through the 1970s (Habel, 1975). Tilapia are currently cultured in cages and ponds by private and business interests. These species tend not

to survive in water temperatures below 13°C (Habel, 1975). However, an 8#lb. tilapia was caught in a farm pond near Houston County in June 2008, indicating over-winter survival (Ken Weathers, ALDWFF, pers. comm.).

**Pathway(s) of Introduction:** Main pathways for introduction include public stocking, experimental stations, and aquaculture. Tilapia are seasonally cultured in cases in farm ponds in AL. Blue tilapia appears to be dispersing downstream from areas where it was traditionally stocked (Nico, 2006a).

**Impact(s) of Introduction:** The blue and Nile tilapia compete with native species for spawning areas and food. Where blue tilapia is abundant, vegetation is heavily impacted and nearly all native fishes are impacted. Blue tilapia is one of the most common nonindigenous fish of the Gulf drainages. Zale and Gregory (1990) reported an overlap in diet of introduced juvenile blue tilapia with that of juvenile shad (*Dorosoma* spp.), and suggested competition as a possible reason for the decline of local populations of shad in Florida.





### 3.B.2 PLANTS

Thirteen plants and one blue-green algae were given a rank of two or greater by ALANSTF members and are presented in order of assigned rank. These plant species include: 11 herbaceous species and 2 ferns. Some of the ranked plant species have been eradicated from Alabama, but due to the potential of reintroduction, they continue to be of concern in aquatic invasive species management. The following species are listed in order from highest to lowest potential threat.



*Byrd Spring, near Huntsville, AL.  
Photo by Steve Rider, ALDWFF*

**Common Name:** HYDRILLA

**Scientific Name:** *HYDRILLA VERTICILLATA*

**Family:** HYDROCHARITACEAE

**Alabama ANS Task Force Rank – 2.9**



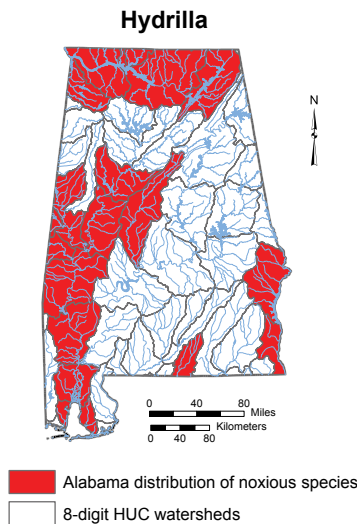
*Photo by Chris Green, Alabama Division of Wildlife and Freshwater Fisheries*



*Photo by Graves Lovell, ALDWFF*

**Synonym(s):** *None noted.*

**Identification:** Hydrilla is a submersed perennial herb that is rooted, with long stems that branch at the surface where growth becomes horizontal to form dense mats. Small, pointed leaves are arranged in whorls of 4 to 8. Leaves are variable and have serrated margins and one or more sharp teeth under the midrib (Godfrey and Wooten, 1979). Plants can reproduce by fragmentation as well as from tubers, produced at the ends of rhizomes. These characteristics may vary with location, age, and water quality (Kay, 1992). Southern populations are predominantly comprised of dioecious females (plants having only female flowers) that over-winter as perennials. Wheeler Reservoir on the Tennessee River in northern Alabama has both dioecious and monoecious (having both male and female flowers on the same plant) forms of hydrilla (D. Webb, TVA, pers. comm.).



**Native Range:** The common dioecious type originates from the Indian subcontinent. Historical reports specify the island of Sri Lanka (Schmitz et al., 1991), while random DNA analysis points to India's southern mainland (Madeira et al., 2000) as the source.

**Alabama Distribution:** This plant is widespread in the Mobile Delta, Tombigbee, Tennessee, and Chattahoochee drainages (Bates and Smith, 1994).

**Pathway(s) of Introduction:** Hydrilla was introduced into the United States via the ornamental aquarium plant trade in Florida. It has also

been introduced accidentally as fragments on boats, boat trailers and outboard motors, and deliberately by recreational fishermen trying to establish submerged cover to encourage popular angling species like bass.

**Impact(s) of Introduction:** Established hydrilla results in an array of ecosystem disruptions. Hydrilla grows aggressively and competitively, spreading through shallow areas to form thick mats in surface waters that block sunlight penetration to native plants below (van Dijk, 1985). In the southeast, hydrilla displaces beneficial native vegetation such as tapegrass (*Vallisneria americana*) and coontail (*Ceratophyllum demersum*) (Bates and Smith, 1994; van Dijk, 1985; Rizzo et al., 1996). This plant has been shown to alter physical and chemical characteristics of lakes. Colle and Shireman (1980) reported reductions in weight and size of sportfish when hydrilla occupied the majority of the water column, suggesting that foraging efficiency was reduced as open water space and natural vegetation gradients were lost. Stratification of the water column (Schmitz et al., 1991; Rizzo et al., 1996), decreased oxygen levels (Pesacrete, 1988), and fish kills (Rizzo et al., 1996) have been documented. Changes in water chemistry may also be implicated in zooplankton and phytoplankton declines (Schmitz and Osborne, 1984; Schmitz et al., 1991). In areas where hydrilla is the dominant species, it impacts water use and flow. Its heavy growth commonly impedes boating, swimming, and fishing in lakes and rivers.



**Common Name:** COMMON SALVINIA

**Scientific Name:** *SALVINIA MINIMA*

**Family:** SALVINIACEAE

**Alabama ANS Task Force Rank – 2.9**

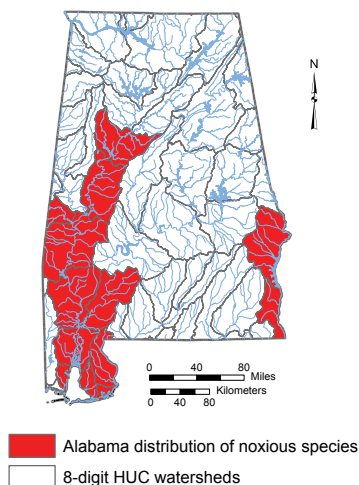


*Photo by Graves Lovell, ALDWFF*

**Synonym(s):** *Water spangles*

**Identification:** Common salvinia is a free-floating, rootless aquatic fern. Horizontal, branching rhizomes float just below the water surface and produce, at each node, two floating and/or emergent leaves, and a third, submersed filamentous leaf that resembles a root. Floating leaves are orbicular to oval in shape, with heart-shaped bases and rounded to notched tips. Leaf length ranges from 3.8 to 20 mm. Smaller, oval leaves often lie flat on the water surface, while larger leaves become elongated and fold upright from the midrib. Shade-grown leaves remain broadly orbicular and emerald green. Leaves grown in full sun become large and elongated, often changing from emerald green to rusty brown with maturity and senescence. Upper surfaces of floating leaves are uniformly covered with rows of thick white, bristly hairs. The stalks of each hair divide into four branches that spread at the tips and create a water-repellent shield. Long, chestnut colored hairs cover the underside of floating leaves, the submersed filaments, buds, and the rhizome (Jacono et al., 2001).

### Common Salvinia



**Native Range:** Common salvinia is native to Central and South America and is wide-ranging from southern Mexico to northern Argentina and Brazil (Mickel and Beitel, 1988; Stolze, 1983).

**Alabama Distribution:** Common salvinia was first noted in the Mobile Delta in 1982 (Haynes and Jacono, 2000). By 1987 this plant was common in creeks and bays of the Mobile-Tensaw Delta (Zolczynski and Eubanks, 1990), where population densities fluctuate seasonally. Common salvinia has extended its range up the Black Warrior and Tombigbee river drainages. It is also found in a few locations in east Alabama. (J. Jernigan, ALDWFF, pers. comm.).

**Pathway(s) of Introduction:** Common salvinia has been cultivated in greenhouses and water gardens in the U.S. since the late 1880s (Weatherby, 1921; 1937). This plant first entered natural areas in Florida as a result of flooding of cultivated pools or through intentional release (Jacono et al., 2001). This aquatic fern is widely sold through the water garden trade and often found as an aquacultural contaminant.

**Impact(s) of Introduction:** During earlier stages of colonization, *Salvinia minima* demonstrates exponential growth rates (Gaudet, 1973). In Texas and Louisiana, *S. minima* typically occurs in dense, expansive populations. In Lacassine Bayou, southwestern Louisiana, plants completely covered a waterway measuring 19.3 km long and 110 m wide (Jacono et al., 2001). Mats in Louisiana have been measured to be as thick as 20-25 cm (Montz, 1989).



**Common Name:** WATER HYACINTH

**Scientific Name:** *EICHHORNIA CRASSIPES*

**Family:** PONTEDERIACEAE

**Alabama ANS Task Force Rank – 2.8**



*Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries*

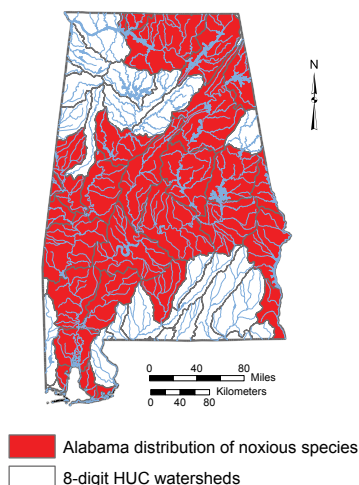


*Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *Common water hyacinth, floating water hyacinth*

**Identification:** Water hyacinth is a free-floating, aquatic plant growing to 0.5 m in height (Gopal, 1987). It forms dense, floating mats. As a free-floating plant, all of its nutrients come from the water column (Sculthorpe, 1985). Leaves are thick, waxy, rounded, and glossy, and rise above the water surface on stalks. The leaves are broadly ovate to circular, 10 to 20 cm in diameter, with gently incurved, often undulate sides. Leaf stalks are bulbous and spongy. The stalk is erect and is topped by a single spike of 8 to 15 showy flowers. Flowers have six petals, are purplish blue or lavender to pinkish; the uppermost petal is characterized by a yellow, blue-bordered central splotch. Water hyacinth vegetatively reproduces via short “runner” stems (stolons) that radiate from the base of the plant to form daughter plants; this plant also produces seed.

### Water Hyacinth



**Native Range:** Water hyacinth is native to the Amazon River basin of South America.

**Alabama Distribution:** This plant is widespread in Alabama, but populations rarely overwinter in the northern part of the state.

**Pathway(s) of Introduction:** Water hyacinth was introduced to the U. S. in 1884 at the Cotton States Exposition in New Orleans, Louisiana. It spread across the southeastern U. S., was identified in Florida in 1895, and was reported in California by 1904. This species has become widespread as a result of the water garden trade.

**Impact(s) of Introduction:** Water hyacinth forms large, free-floating, monospecific mats that compete with other aquatic species for light, nutrients, and oxygen. Fish spawning areas may be reduced and critical waterfowl habitat degraded (Schmitz et al., 1993). Mats reduce dissolved oxygen levels and light in the water column, and significantly alter faunal community composition. As the mats decompose, organic sedimentation dramatically increases resulting in decreased oxygen levels (Gopal 1987).

**Common Name:** ALLIGATORWEED

**Scientific Name:** *ALTERNANTHERA PHILOXEROIDES*

**Family:** AMARANTHACEAE

Alabama ANS Task Force Rank – 2.6



Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries

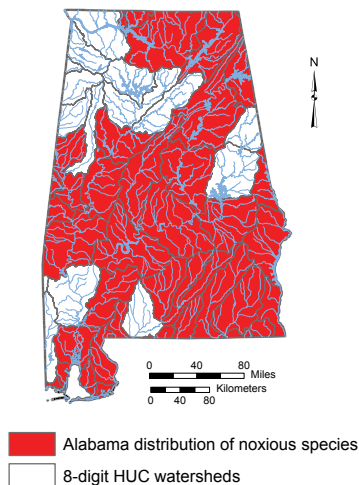


Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries

**Synonym(s):** *Achyranthes philoxeroides*, *Alternanthera paludosa*, *Alternanthera philoxerina*, pig weed.

**Identification:** Alligatorweed is a summer perennial herb. Alligatorweed has a hollow stem and small white papery flower heads that are 8 to 10 cm in diameter. The leaves are shiny, elliptic, opposite, sessile, entire, and about 2 to 7 cm long and about 1 to 2 cm wide. Alligatorweed produces masses of creeping and layering stems, up to 10 m long. Over water, the roots are adventitious and stems grow to 60 cm high and have large, hollow internodes. On land, adventitious roots with thickened taproots occur, and stems are shorter; internodes are smaller and much less hollow than when over water. Alligatorweed reproduces by fragmentation. It does not produce viable seed (Godfrey and Wooten, 1981).

## Alligatorweed



**Native Range:** Alligatorweed is native to South America.

**Alabama Distribution:** Alligatorweed occurs throughout Alabama.

**Pathway(s) of Introduction:** Alligatorweed is believed to have been introduced to the U. S. as a “stowaway” in ballast water. It was first documented in Mobile in 1897.

**Impact(s) of Introduction:** Alligatorweed forms dense, tangled mats that float on the surface of a body of water. It replaces desirable native aquatic vegetation by outcompeting it for sunlight. Alligatorweed

grows rapidly and spreads easily; stem fragments can float downstream to establish new mats (Simberloff et al., 1997). Mats can block waterways, alter aquatic and riverine ecology, and increase breeding habitat for mosquitoes (Simberloff et.al., 1997).



**Common Name:** GIANT SALVINIA

**Scientific Name:** *SALVINIA MOLESTA*

**Family:** SALVINIACEAE

Alabama ANS Task Force Rank – 2.5



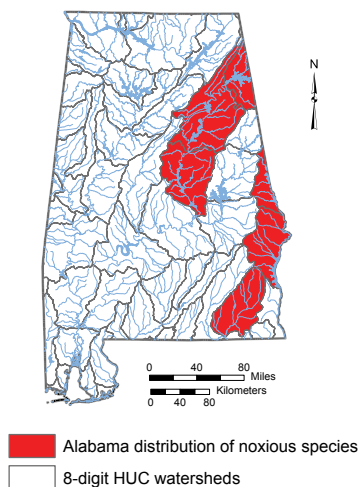
*Photo by Joe Jernigan, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *Kariba weed, African pyle, aquarium watermoss, koi kandy*

**Identification:** A floating, rootless aquatic fern, giant salvinia consists of horizontal stems that float just below the water surface, producing a pair of emergent leaves at each node. Floating and emergent leaves are green in color, suborbicular, 1.3 to 2.5 cm long and wide. A third, brown, highly divided leaf dangles underwater and is often mistaken for roots. The upper surfaces of the green leaves are covered with rows of white, bristly hairs; stalks of each hair divide into four thin branches that rejoin at the tips. These specialized hairs create a water repellent, protective covering. Giant salvinia reproduces by fragmentation.



### Giant Salvinia



**Native Range:** Giant salvinia is native to the coastal region of southern Brazil.

**Alabama Distribution:** Although several infestations were found in the 1990s, no populations are currently known in Alabama.

**Pathway(s) of Introduction:** Giant salvinia was introduced through the water garden and aquarium trades and continues to be sold through these venues. The first recorded escape occurred in 1995 in South Carolina. The plant is spread as fragments on boat trailers and outboard motors and is currently found in most southeastern states.

**Impact(s) of Introduction:** Giant salvinia dominates slow-moving or still freshwaters (Mitchell et al., 1980), and exhibits rapid growth, vegetative reproduction, and a high tolerance to environmental stress. This species is aggressive and one of the most competitive species known to impact aquatic environments, water use, and local economies. Under optimal conditions (light, temperature, and nutrients) in the laboratory, plant populations have been found to double in size every 2 to 4 days (Gaudet, 1973). A single plant has been documented to have covered forty square miles in three months (Creagh, 1991). It is listed on the Federal Noxious Weeds List making its transportation or sale illegal.

**Common Name:** CUBAN BULRUSH

**Scientific Name:** *OXYCARYUM CUBENSE*

**Family:** CYPERACEAE

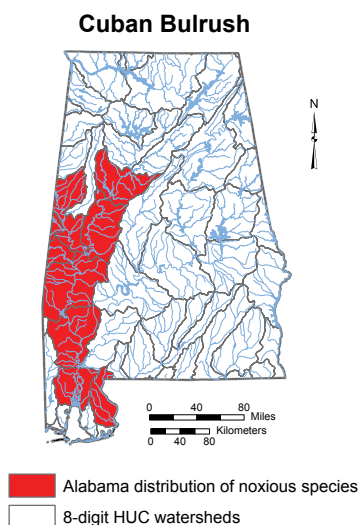
Alabama ANS Task Force Rank – 2.5



*Photo by Steve Rider, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *Scirpus cubensis*

**Identification:** The Cuban bulrush has scaly stolons, rooting at nodes or with long-hanging roots. The culms of the plant are 7.5 to 76 cm by 0.7 to 5 mm. The inflorescences have 1 to 13 heads and are globose to broadly ovoid (10 to 23 by 9 to 19 mm). The spikelets are 5 to many and are 3 to 6 by 2.5 to 6 mm in size. The achenes are pale or red-brown, ovoid or ellipsoid, 2.2 to 2.8 by 1 to 1.2 mm, with a beak to 0.7 mm. The achenes are subtended by scales ranging in color from transparent to pale brown with red-brown or purple marks (FNA, 2005).



**Native Range:** Although Cuban bulrush is native to south Florida, the strain found in Alabama is believed to have African origins (J. Jernigan, ALDWFF, pers. comm.).

**Alabama Distribution:** Found throughout the Mobile Delta, it is rapidly spreading throughout the Tombigbee River system.

**Pathway(s) of Introduction:** This species entered Alabama as packing material in the Port of Mobile. It is primarily dispersed by floating mats and as fragments, and it may also be incidentally dispersed by commercial barge traffic and recreational boaters.

**Impact(s) of Introduction:** Like water hyacinth, it forms large, free-floating, monospecific mats that compete with other aquatic plants for light, nutrients, and oxygen. This normally marginal plant takes advantage of extensive water hyacinth mats to grow over covered waterways (J. Jernigan, ALDWFF, pers. comm.). Mats reduce dissolved oxygen levels and light in the water column, and significantly alter faunal community composition. As the mats decompose, organic sedimentation dramatically increases, resulting in decreased oxygen levels (Gopal, 1987).

**Common Name:** BLUE-GREEN ALGAE

**Scientific Name:** *LYNGBYA WOLLEI*

**Family:** OSCILLATORIACEAE

Alabama ANS Task Force Rank – 2.4



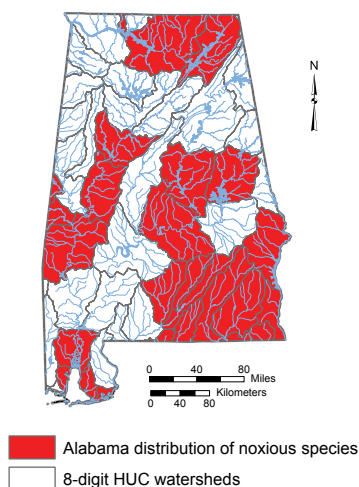
*Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *lyngbya, cyanobacteria*

**Identification:** This mat-forming cyanobacterium has filaments that are straight to slightly undulating. The filaments are rarely singular and often arranged in variably thick prostrate mats on substrate. Sheaths are always present and attached to the trichomes; they are variable in thickness and color (ranging from yellow to red and rarely blue). Cells are short and discoid, always shorter than wide, and most are lacking aerotopes (Wehr and Sheath, 2003; Graham and Wilcox, 2000; Yin et al., 1997).



### Blue-green Algae



**Native Range:** *Lyngbya* spp. are distributed through out the world.

**Alabama Distribution:** *Lyngbya* spp. have been noted in the Gulf of Mexico. Currently, the largest infestations of *Lyngbya wollei* occur on the Coosa River system in central Alabama Guntersville Reservoir.

**Pathway(s) of Introduction:** These species are dispersed through waterways by boats, trailers, waterfowl, and natural flow.

**Impact(s) of Introduction:** Some *Lyngbya* produces a potent neurotoxin(s), related to the saxitoxins, the compound responsible for paralytic shellfish poison, which is a major health risk (Carmichael et al., 1997; Yin et al., 1997). *Lyngbya* spp. forms dense benthic mats the displace native vegetation and prevent fish spawning. The mats break loose and float to the surface where they maintain a “sewage-like” appearance and foul smell as they decompose. Floating and benthic mats interfere with normal water-recreation activities including boating, swimming, and fishing. Potential economic impacts include decreased property values due to the affected aesthetic and recreational value, decreased utilization of the resource, as well as the potential for floating mats to interfere with hydroelectric power generation. Current treatment methods are expensive and minimally effective (Jason Carlee, Alabama Power Company, pers. comm.).



**Common Name:** PARROTFEATHER

**Scientific Name:** *MYRIOPHYLLUM AQUATICUM*

**Family:** HALORAGACEAE

**Alabama ANS Task Force Rank – 2.3**

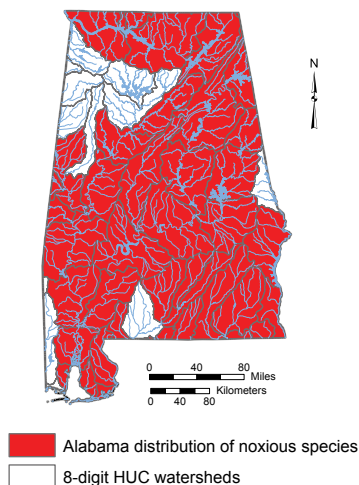


*Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *Enydria aquatica*, *Myriophyllum brasiliense*, *Myriophyllum proserpinacoides*,  
*Brazilian watermilfoil*

**Identification:** Parrotfeather is a bright green, perennial, rooted freshwater plant. It exhibits two different leaf forms, submerged and emergent. The submersed leaves are 1.5 to 3.5 cm long and have 20 to 30 divisions per leaf. The emergent leaves are 2 to 5 cm long and have 6 to 18 divisions per leaf. The bright green emergent leaves are stiffer and a darker green than submersed leaves. Emergent stems and leaves are the most distinctive trait of *M. aquaticum*, as they can grow up to a foot above the water surface (Godfrey and Wooten, 1981).

## Parrotfeather



**Native Range:** Parrotfeather is native to South America.

**Alabama Distribution:** Parrotfeather is widespread and has been documented in more than 20 waterways across Alabama.

**Pathway(s) of Introduction:** Parrotfeather was introduced worldwide for use in aquaria, and water gardens.

**Impact(s) of Introduction:** Populations may be quite dense, sometimes forming floating mats, that when uprooted, choke waterways and impede recreational navigation. Parrotfeather can change the physical and chemical characteristics of lakes and streams and provide habitat for mosquito larvae (NBII, 2005).

**Common Name:** EURASIAN WATERMILFOIL

**Scientific Name:** *MYRIOPHYLLUM SPICATUM*

**Family:** HALORAGACEAE

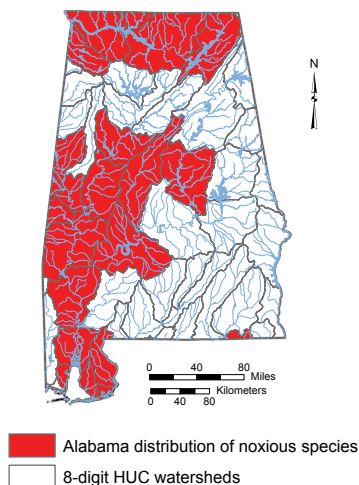
Alabama ANS Task Force Rank – 2.3



*Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *Spike watermilfoil*

**Identification:** Eurasian watermilfoil is a rooted, submersed perennial plant with finely dissected feather-like leaves (Godfrey and Wooten, 1981). The leaves are bright to dark green in color, arranged in whorls of 4, 2.5 cm in length, and at least 12 pairs of capillary segments. The flowering stem is slender and the bracts subtending the flowers are inconspicuous.

**Eurasian watermilfoil**

**Native Range:** This plant is native to Europe, Asia, and northern Africa.

**Alabama Distribution:** Eurasian watermilfoil exhibits a scattered distribution in Alabama, abundant in certain areas of the state (e.g., the Mobile-Tensaw Delta), some reservoirs along the Tennessee River in northern Alabama (e.g., Guntersville and Wheeler), and found in the Black Warrior, Tombigbee, and Coosa river systems.

**Pathway(s) of Introduction:** Eurasian watermilfoil was accidentally introduced from Eurasia in the 1940s. It is thought that either the plant was discarded from an aquarium or brought in attached to commercial or private boats (Remaley, 2006).

**Impact(s) of Introduction:** Eurasian watermilfoil often forms, large surface mats of vegetation on lakes, rivers, and other water bodies, effectively blocking light penetration to native aquatic plants. The dense surface mats can also impede water traffic. This plant thrives in areas that have been subjected to various kinds of natural and manmade disturbance, and exhibits high tolerance to pollution.



**Common Name:** DOTTED DUCKWEED

**Scientific Name:** *LANDOLTIA PUNCTATA*

**Family:** LEMNACEAE

Alabama ANS Task Force Rank – 2.3

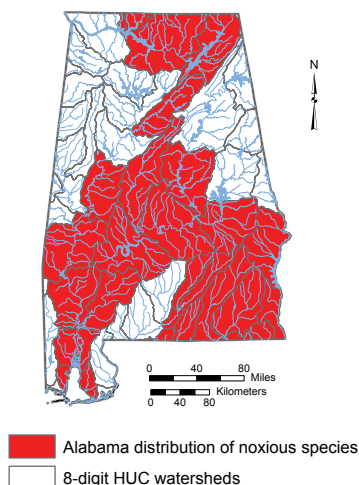


*U.S. Geological Survey*

**Synonym(s):** *Spirodela punctata*

**Identification:** Dotted duckweed is a tiny, free-floating aquatic plant comprised of one to four fronds that produce fine roots. Mature fronds are narrowly ovate to oblong and are 3.2 to 6.4 mm long and 3.2 to 4.2 mm wide. Fronds are deep green in color and have five or more conspicuous veins. The outside of the frond is covered by a waxy cuticle. The number of roots per frond is from two to four and can reach up to seven.



**Dotted Duckweed**

**Native Range:** The native range of dotted duckweed includes Australia and Southeast Asia.

**Alabama Distribution:** Dotted duckweed exhibits a wide distribution throughout the state.

**Pathway(s) of Introduction:** Landolt (1986) found that in the 1800s, many of the known localities of *Landoltia punctata* outside of Australia and southeastern Asia were localized near harbors, suggesting very early dispersal among continents by humans. This species is used extensively in the aquarium and water garden trades.

**Impact(s) of Introduction:** Impacts of this plant are largely unknown, however, it is regarded as a pioneer species. It is easily distributed, colonizes quickly, and exhibits a high rate of vegetative propagation (Landolt, 1986).

**Common Name:** URUGUAYAN WATERPRIMROSE

**Scientific Name:** *LUDWIGIA GRANDIFLORA SP. GRANDIFLORA*,  
*L. GRANDIFLORA SP. HEXAPETALA*

**Family:** ONAGRACEAE

Alabama ANS Task Force Rank – 2.1

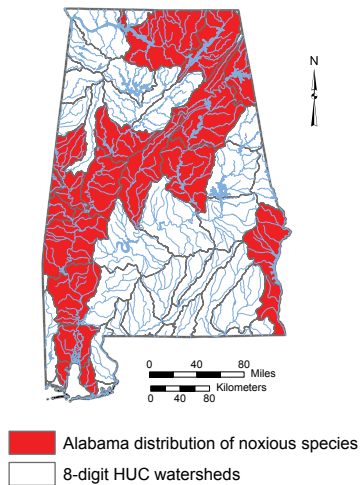


*Photo by Graves Lovell, Alabama Division  
of Wildlife and Freshwater Fisheries*

**Synonym(s):** *Ludwigia uruguayensis*, *L. hexapetala*

**Identification:** Uruguayan waterprimrose is an aquatic perennial plant. The stems are glabrous to sparsely pubescent, and they sprawl or grow horizontally on water or mud. The leaves are alternate. Early growth consists of rosette-like clusters of rounded (sub-orbicular to spatulate) leaves on the water surface. During flowering, leaves lengthen to a willow-like shape (lanceolate or elliptic). The stems also lengthen during flowering, growing upright. Flowering stems can rise to 1 m above the water surface. The flowers are bright yellow, growing from the leaf axils, on two to three cm peduncles (stalks). The sepals are persistent, 8 to 9 mm long, and the yellow petals are 15 to 30 mm long. The fruit is a cylindrical capsule. Roots are feathery at the nodes, dangling into the water. White, spongy, aerenchymous roots are also found at the nodes (Godfrey and Wooten, 1981).

## Uruguayan Waterprimrose



**Native Range:** This species is native to south Mexico, as well as South America. There is some debate pertaining to the native origin of this species.

**Alabama Distribution:** Uruguayan waterprimrose has been found from northeast Alabama, through the central region to the Mobile Delta, and in the Chattahoochee River drainage.

**Pathway(s) of Introduction:** This plant species is often introduced to new locations by the water garden industry. It is also locally dispersed via boating, human activity, waterways, and animal traffic.

**Impact(s) of Introduction:** Uruguayan waterprimrose reduces native species diversity through competition, elimination of open-water habitat, and reduction of oxygen levels that are critical for fish survival. Its woody biomass accumulation may increase flooding through reduction of flood control channel capacity.

**Common Name:** WATER LETTUCE

**Scientific Name:** *PISTIA STRATIOTES*

**Family:** ARACEAE

Alabama ANS Task Force Rank – 2.1



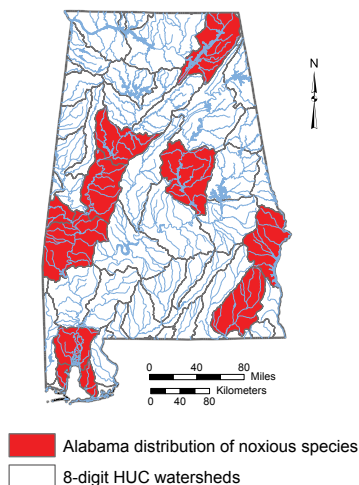
Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries



Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries

**Synonym(s):** None noted.

**Identification:** Water lettuce is a free-floating perennial and has rosettes up to 15 cm long (Glazier, 1996). It has long, feathery, hanging roots with obovate to spatulate-oblong leaves. The leaves are light green and velvety-hairy with many prominent longitudinal veins. Inflorescences are inconspicuous and up to 1.5 cm long.

**Water Lettuce**

**Native Range:** This plant is native to South America.

**Alabama Distribution:** Water lettuce is found in several drainages across Alabama.

**Pathway(s) of Introduction:** This free-floating plant is capable of forming dense mats on the surfaces of lakes, ponds, rivers, and other bodies of water (Rivers, 2002). It can spread by fragmentation with plant parts and whole plants being moved on boats from an infested to a clean body of water (Rivers, 2002). Water lettuce is readily available on the Internet. Dumping of aquarium or ornamental pond plants is often the means of spread (Rivers, 2002).

**Impact(s) of Introduction:** Water lettuce can severely impact the environment and economy of infested areas (Rivers, 2002). The dense mats, formed by connected rosettes that disrupt the natural ecosystems and block waterways, increasing navigation difficulties and hindering flood control efforts. These dense mats can lead to a lower concentration of oxygen in covered waters and sediments by blocking air-water interface and root respiration. Extremely thick mats can prevent sunlight from reaching underlying water and may impact native aquatic species.



**Common Name:** COMMON REED

**Scientific Name:** *PHRAGMITES AUSTRALIS*

**Family:** POACEAE

Alabama ANS Task Force Rank – 2.1



*Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries*

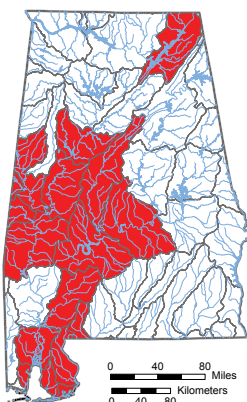




*Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries*

**Synonym(s):** *giant reed, giant reedgrass, roseau, roseau cane, yellow cane, and cane*

**Identification:** Common reed is a tall, warm-season, perennial, sod-forming grass (Uchytel, 1992). It reaches a height of up to 4 m, with elongate leaves, 2.5 to 3.8 mm at their widest point. Common reed has a feathery and drooping inflorescence that is purplish when flowering and becomes whitish, grayish or brownish in fruit. Flowering from July to October results in seeds. Reproduction is by seed and rhizomes.

## Common Reed



 Alabama distribution of noxious species  
 8-digit HUC watersheds

**Native Range:** Until recently, the origin of *Phragmites australis* (native to North America or introduced) was in dispute. Recent research, has demonstrated the existence of native and introduced genotypes of the common reed (Saltonstall, 2002). This species is distributed worldwide.

**Alabama Distribution:** The common reed is most common in two coastal counties in Alabama, but is documented in a variety of other habitats around the state.

**Pathway(s) of Introduction:** Seeds may be transported by birds nesting among the reeds (Marks et al., 1993). Additional spread may occur via human activities and tidal disturbances. Seeds or rhizome fragments can be carried to newly opened sites in soils and on machinery during construction (Marks et al., 1993). Rhizomes can also be transported via floodwaters and wind.

**Impact(s) of Introduction:** Stable populations may be difficult to distinguish from invasive populations. *Phragmites* is a problem when stands displace native vegetation. These invasions may threaten wildlife because *Phragmites* alters the structure and function of relatively diverse *Spartina* marshes (Roman et al., 1984; Marks et al., 1993). Invasions also increase the potential for marsh fires during the winter, when the above-ground portions of the plant die and dry out (Reimer, 1973; Marks et al., 1993).

**Common Name:** BRITTLE NAIAD

**Scientific Name:** *NAJAS MINOR*

**Family:** NAJADACEAE

Alabama ANS Task Force Rank – 2.1



Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries

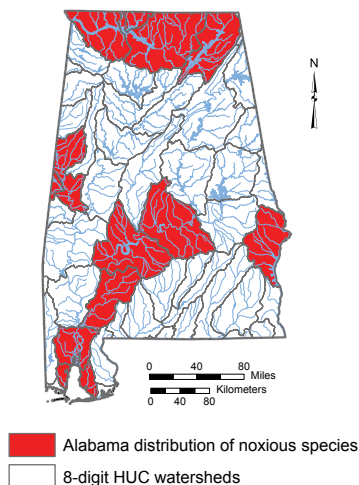


Photo by Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries

**Synonym(s):** *Caulinia minor*, brittle waternymph, slender naiad, spiny naiad

**Identification:** Brittle naiad is a submersed rooted annual. The stems are up to 2.5 m long and profusely branching near their apex. Leaves are opposite or sub-opposite, about one mm wide and 0.5 to 3.5 cm long, becoming stiff and recurved at maturity. The leaves have seven to 15 small, conspicuous teeth along each leaf margin. Sheaths at the base of the leaf are truncate to auriculate. Flowers are small, inconspicuous, and located in the leaf axils (Haynes, 1979).

## Brittle Naiad



**Native Range:** This plant is native to Eurasia and Africa.

**Alabama Distribution:** Brittle naiad is scattered across Alabama with records in five drainages and eight counties.

**Pathway(s) of Introduction:** Brittle naiad was first detected in Ashtabula County, Ohio, in 1932 (Wentz and Stuckey, 1971). It quickly spread to the Great Lakes and southward and is primarily dispersed by water currents and animals.

**Impact(s) of Introduction:** Brittle naiad can form dense, monospecific stands in shallow water, hindering swimming, fishing, boating, and other forms of water traffic and recreation. It often grows with other submersed aquatic plants such as southern naiad, pondweed, coontail, and watermilfoil. It is more tolerant of turbidity and eutrophic conditions than some of the native species of *Najas*, out-competing them in many instances (Wentz and Stuckey, 1971).

## 4. EXISTING LEGAL AUTHORITY

The following information, compiled by the National Sea Grant Law Center, describes several international, federal, regional, and state agency jurisdictions that are related directly and indirectly to managing aquatic invasive species in the state of Alabama. Because many agencies and groups have responsibility or regulatory authority for certain species, pathways or resources, their cooperative involvement will be needed to achieve the goals of this management plan. This summary provides ANS managers with an overview to note possible overlapping or conflicting jurisdictions that should be addressed by the involved organizations to facilitate implementation of this plan (see Appendix C for additional details).

### 4.A. International Authorities

#### 4.A.1 International Maritime Organization

Guidelines for the Control and Management of Ships' Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens, IMO Resolution A.868(20) (adopted on November 27, 1997).

The International Maritime Organization (IMO) is heavily involved in the effort to prevent the transfer of harmful organisms by ships. The IMO adopted ballast water guidelines in 1997 to assist member nations in minimizing the risk of introducing harmful aquatic organisms and pathogens. The Guidelines suggest the following precautionary practices: minimizing uptake of harmful aquatic organisms, pathogens, and sediments; removing ballast sediment on a timely basis; avoiding unnecessary discharge of ballast water; and ballast water management options such as ballast water exchange, non-release or minimal release of ballast water, or discharge to reception facilities. While these Guidelines are not binding on member nations, the United States is implementing many of the provisions through Coast Guard regulations at 33 C.F.R. Part 151. In addition, the IMO adopted the "International Convention for Control and Management of Ships' Ballast Water and Sediments" in 2004.

#### 4.A.2 International Plant Protection Convention

The International Plant Protection Convention was adopted under the auspices of the Food and Agriculture Organization (FAO) to secure harmonized action to prevent the spread and introduction of plant pests and plant product pests, and promote appropriate control measures. The United States became a party to the Convention in 1972. The Convention applies to quarantined pests in international trade. Pests are any form of plant or animal life or pathogenic agent which is injurious or potentially injurious to plants or plant products. Contracting parties agree to establish a national plant protection organization which shall be responsible for issuance of phytosanitary certifications, surveillance of growing plants and plant products in storage, inspection, disinfection, pest risk analysis, and training and development of staff. Contracting parties agree to assist with the development of international standards and are encouraged to cooperate regionally. The United States is a member of the North American Plant Protection Organization which is made up of representatives from Canada, Mexico, and the United States. The North American Plant Protection Organization has adopted standards to prevent and control the introduction of pests.

### 4.B. Federal Regulations

#### 4.B.1. National Aquatic Nuisance Prevention and Control Act of 1990/National Invasive Species Act of 1996

The National Invasive Species Act of 1996 (NISA) reauthorized the National Aquatic Nuisance Prevention and Control Act (NANPCA) and expanded the scope of the Act to address waters beyond the Great Lakes and threats of additional exotic species through nationwide preventive management measures. While the NANPCA only addressed ballast water, one of the purposes of the NISA is "to develop and carry out environmentally sound



control methods to prevent, monitor and control unintentional introductions of nonindigenous species from pathways other than ballast water exchange.” (16 U.S.C. § 4702). NANPCA created the Aquatic Nuisance Species Task Force to identify pathways by which aquatic organisms are introduced, evaluate whether measures to prevent introductions of aquatic nuisance species are effective, and authorize state management programs designed to prevent the spread of nonindigenous species. The NISA authorizes the development of interstate and regional plans to prevent the spread of nonindigenous species.

#### **4.B.2. Federal Noxious Weed Act of 1974**

The Act provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture, commerce, wildlife resources, or the public health. The Secretary of Agriculture may issue regulations to prevent the dissemination of noxious weeds and has the authority to seize, quarantine, treat, destroy, or dispose of any product or article infested by a noxious weed as an emergency measure to prevent dissemination.

#### **4.B.3. Plant Protection Act of 2000**

The Plant Protection Act prohibits the unauthorized movement of plant pests and empowers the Secretary of Agriculture to prohibit or restrict the import, export, or movement of any plant, plant product, biological control organism, noxious weed, or means of conveyance if necessary to prevent the introduction or dissemination of a plant pest or noxious weed. Animal and Plant Health Inspection Service (APHIS) is the responsible agency within the Department of Agriculture.

#### **4.B.4. Federal Seed Act**

The Federal Seed Act authorizes the Secretary of Agriculture to regulate the interstate and foreign commerce in seeds and imposes labeling requirements to prevent the misrepresentation of seeds in interstate commerce. Labels must identify the kinds of noxious weed seeds and the rate of occurrence.

#### **4.B.5. The Lacey Act**

Under the Act, it is illegal to “import, export, transport, sell, receive, acquire, or purchase any fish or wildlife or plant taken, possessed, transported, or sold in violation of any law, treaty, or regulation of the United States or in violation of any Indian tribal law.” (16 U.S.C. 3372). The Act also prohibits the import, export, transport, sale, receipt, acquisition, or purchase of any fish or wildlife taken in violation of any state law or regulation or any foreign law and any plant taken in violation of any state law or regulations.

#### **4.B.6. Animal Health Protection Act**

The Secretary of Agriculture “may hold, seize, quarantine, treat, destroy, dispose of, or take other remedial action with respect to – (1) any animal or progeny of any animal, article, or means of conveyance that – (A) is moving or has been moved in interstate commerce or has been imported and entered; and (B) the Secretary has reason to believe may carry, may have carried, or may have been affected with or exposed to any pest or disease of livestock at the time of movement or that is otherwise in violation of this subtitle; 7 U.S.C. § 8306 (2003). A pest is defined as any protozoan, plant, bacteria, fungus, virus, infectious agent, arthropod, parasite, or vector “that can directly or indirectly injure, cause damage to, or cause disease in livestock.” (7 U.S.C. § 8302).

#### **4.B.7. Endangered Species Act**

The Secretaries of Interior and Commerce determine the species that are endangered or threatened and are directed to designate critical habitat and develop and implement recovery plans for threatened and endangered species. Once a species is listed, federal agencies must insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of their critical habitat. If an aquatic nuisance species threatens

the survival or recovery of an endangered species, the Secretaries may provide for the control and management of the invasive in the recovery plans.

#### **4.B.8. Coast Guard Ballast Water Regulations (subpart D 33 C.F.R. part 151)**

On July 28, 2004, the U.S. Coast Guard published regulations establishing a mandatory ballast water management program for all vessels equipped with ballast water tanks that enter and operate within U.S. waters. Under 33 C.F.R. § 151.1514, masters, owners, operators, or persons-in-charge of all vessels equipped with ballast water tanks that operate in the waters of the U.S. must avoid the discharge or uptake of ballast water in areas within or that may directly affect marine sanctuaries and other sensitive areas. Operators must also rinse anchors and anchor chains to remove organisms and sediments at their place of origin and remove fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, State and Federal regulations. Vessels must maintain onboard a ballast water management plan that has been developed specifically for the vessel. If the vessel carries ballast water that was taken on in (BWM) areas less than 200 nautical miles from any shore into the waters of the U.S. after operating beyond the Exclusive Economic Zone, one of the following ballast water management practices must be employed:

- (1) Perform complete ballast water exchange in an area no less than 200 nautical miles from any shore prior to discharging ballast water in U.S. waters;
- (2) Retain ballast water onboard the vessel; or
- (3) Prior to the vessel entering U.S. waters, use an alternative environmentally sound method of ballast water management that has been approved by the Coast Guard.

If safety is a concern or a vessel's voyage does not take it into waters 200 nautical miles from shore for a significant period of time, the vessel is allowed to discharge, except in the Great Lakes or the Hudson River, that amount of ballast water which is operationally necessary. Penalties are imposed for failure to use one of the above practices, maintain a (BWM) plan onboard the vessel, or make the required reports available.

#### **4.B.9. U. S. Department of Agriculture Regulations (7 C.F.R Part 319)**

In a final rule published in the Federal register on 9/16/2004, the USDA amended its regulations with the goal of decreasing the risk of introducing plant pests into the U. S. USDA has adopted the international standard for wood packaging material (WPM) that was approved by the International Plant Pest

Convention (IPPC) on March 15, 2004. The IPPC standard calls for most WPM to be either heat treated or fumigated with methyl bromide in accordance with the guidelines and marked with an approved international mark certifying treatment. The final rule, which became effective on September 16, 2005, affects all persons using wood packaging material in connection with importing goods into the U. S.

### **4.C. Regional Efforts**

#### **4.C.1. 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 the National Invasive Species Act of 1996 (P.L. 104-332, § 1203 (c)). The Regional Panel has been tasked to: identify priorities for the region with respect to aquatic nuisance species; make recommendations to the National Aquatic Nuisance Species Task Force regarding programs to address aquatic invasive species; assist the Task Force in coordinating Federal aquatic nuisance species program activities in the respective regions; coordinate, where possible, aquatic nuisance species program activities in the respective regions that are not conducted pursuant to the National Invasive Species Act; provide advice to public and private individuals and entities concerning methods of controlling aquatic nuisance species; and submit annually a report to the Task Force describing activities within the respective regions related to aquatic nuisance species prevention, research, and control. The Gulf States Marine Fisheries Commission exercises administrative oversight of the Regional Panel of which Alabama is an active member.

#### **4.C.2. Mississippi River Basin Regional Panel on Aquatic Nuisance Species**

The Mississippi Interstate Cooperative Resource Association (MICRA) was invited by the National ANS Task Force (headquartered in Washington, D.C.) to host a Mississippi River Basin Panel (MRBP) on Aquatic Nuisance Species (ANS) in 2001. This new panel joined others already formed for the Great Lakes, Western States, Gulf of Mexico and Northeastern States, forming a national network to address the invasive species problem.

The roles and responsibilities of the MRBP include the following: identify priorities for activities in the Mississippi River Basin (Basin); develop and submit recommendations to the National ANS Task Force; coordinate aquatic nuisance species program activities in the Basin; advise public and private interests on control efforts; and submit an annual report to the ANSTF describing prevention, research and control activities in the Basin.

The Panel currently includes members representing five federal agencies, twenty-four states (including ADCNR), one Canadian province, five regional entities, two environmental/user groups, five private/commercial groups, two university/research institutions and two at-large stakeholders, for a total of forty-six members. Alabama is an active member of this panel.

(Source: <http://wwwaux.cerc.cr.usgs.gov/micra/MRB%20Panel%20on%20ANS.htm>).

#### **4.D. State Authorities**

##### **4.D.1. Alabama Department of Conservation and Natural Resources**

##### **4.D-1a. General Authority**

That Alabama Department of Conservation and Natural Resources (ADCNR) has the general authority to “protect, conserve, and increase the wildlife of the state and to administer all laws relating to wildlife and the protection, conservation, and increase thereof.” (Ala. Code § 9-2-2). This statute gives ADCNR

general control and authority over all aquatic species in the waters of Alabama. ADCNR has “full jurisdiction and control of all seafoods existing or living in the waters of Alabama, and it shall ordain, promulgate, and enforce all rules, regulations, and order deemed by it to be necessary for the propagation and conservation of the same” (Ala. Code § 9-2-4).

Ala. Code § 9-2-7 describes the authorities of the Commissioner of Conservation and Natural Resources (Commissioner). The Commissioner has general authority to: “enforce and administer all laws providing for the preservation, protection, propagation and development of wild birds, wild fur-bearing animals, game fish, saltwater fish, shrimp, oysters and other shellfish, crustaceans and all other species of wildlife within the state or within the territorial jurisdiction of the state which have not been reduced to private ownership, except as otherwise provided.” Under § 9-2-7 the Commissioner is also empowered: to formulate a state wildlife policy; “to regulate the manner, means and devices for catching or taking game fishes, game birds, game and fur-bearing animals and the manner, means and devices for catching or taking all other species of fish not designated as game fish”; “to close the season of any species of game in any county or area when, upon a survey by the department, it is found necessary to the conservation and perpetuation of such species and to reopen such closed season when it is deemed advisable”; and “to introduce desirable species of game, fish and birds.” The Commissioner has authority to promulgate “such reasonable rules and regulations...as he may deem for the best interest of the conservation, protection and propagation of wild game, birds, animals, fish and seafoods, which rules and regulations shall have the effect of law” (Ala. Code § 9-2-8). The Commissioner also has authority to make rules for ADCNR (Ala. Code § 9-2-12).

Under Ala. Code § 9-2-13, the Commissioner may prohibit the import of any bird, animal, reptile, amphibian, or fish when the importation of such species would not be in the state’s best interest. Alabama maintains a list of fish whose “sale, possession, importation, and release is prohibited.” (Ala. Admin. Code r. 220-2-.26, 220-2-.93). A violation of this provision is a misdemeanor. However, these prohibitions do not apply to animals used for

display in carnivals, zoos, and other like shows where provisions are made so that the animals will not escape or be released into Alabama (Ala. Code §9-2-13).

The Alabama Department of Conservation and Natural Resources contains two divisions with potential authority over aquatic invasive species: the Division of Wildlife and Freshwater Fisheries, which has authority over the wildlife and freshwater fish of Alabama, and the Marine Resources Division, which regulates the saltwater wildlife within Alabama's territorial jurisdiction (Ala. Code §§ 9-2-61, 81).

#### **4.D-1b. Fee Fishing**

The operation of a commercial fee fishing pond requires a letter permit and compliance with the laws relating to the importation and control of exotic fish species (Ala. Code § 9-11-450).

#### **4.D-1c. Private Shooting Preserves**

The Commissioner of the Department of Conservation and Natural Resources designates which species can be privately raised and hunted and in commercial hunting preserves (Ala. Code § 9-11-42).

#### **4.D-1d. Gulf States Marine Fisheries Compact**

The governor of Alabama is authorized to execute a compact on behalf of the state of Alabama with any one or more of the states of Florida, Mississippi, Louisiana, and Texas (Ala. Code § 9-2-180). The purpose of the compact is to "promote the better utilization of the fisheries, marine, shell and anadromous, of the seaboard of the Gulf of Mexico, by the development of a joint program for the promotion and protection of such fisheries and the prevention of physical waste of the fisheries from any cause" (Ala. Code §9-2-180).

#### **4.D-1e. Aquatic Plants**

Under the Nonindigenous Aquatic Plant Control Act, it is illegal to introduce any nonindigenous aquatic plant into any public waters of Alabama (Ala. Code § 9-20-3). The list of restricted nonindigenous aquatic plants is in Appendix C (Ala. Admin. Code r. 220-2-.124). A violation of this provision is a misdemeanor. However, the unintentional dispersal in the course of normal boating activities does not constitute a violation (Ala. Code § 9-20-3). ADCNR has rulemaking and enforcement authority under the Act (Ala. Code § 9-20-5).

### **4.D.2. Alabama Department of Environmental Management**

#### **4.D-2a. General Authority**

The Alabama Department of Environmental Management (ADEM) is responsible for developing the environmental policy of the state (Ala. Code § 22-22A-5).

#### **4.D-2b. Coastal Area Management Program**

Ala. Code § 9-7-11 states that it is the purpose of the Coastal Area Management Program to "promote, improve, and safeguard the lands and waters located in the coastal areas of this state through a comprehensive and cooperative program designed to preserve, enhance, and develop such valuable resources for the present and future well-being and general welfare of the citizens of this state." ADEM is required to "review the permitting activities of persons within the coastal area in order to ensure consistency with the coastal area management program and where necessary to issue permits to persons to ensure compliance and consistency with said program" (Ala. Code § 9-7-20). No agency can issue a permit for any activity in the coastal area that ADEM finds to be inconsistent with the coastal area management program (Alabama Code § 9-7-20).

#### **4.D.3. Alabama Department of Agriculture and Industries**

##### **4.D-3a. Marketing of Aquaculture**

The Commissioner of Agriculture and Industries “may establish and promulgate official grades and standards for farm products and fish produced and processed within the state for the purpose of sale” (Ala. Code § 2-11-52). This provision does not apply to saltwater fish and seafoods (Ala. Code § 2-11-50). Under the Alabama Catfish Marketing and Consumer Act of 1975, the Commissioner is required to regulate the labeling and advertising of catfish sold for human consumption (Ala. Code §§ 2-11-32, 33).

##### **4.D-3b. Noxious Weeds**

The Commissioner of Agriculture and Industries has the duty of protecting the agricultural and horticultural interests of Alabama from noxious weeds and may declare weeds or infested articles a public nuisance (Ala. Code § 2-25-3). The introduction of any noxious weed is prohibited, except under special permit from the Commissioner (Ala. Code § 2-25-10). The Commissioner may inspect plants or things likely to carry noxious weeds being moved or imported, and upon finding infestation or infection, may have the plants or things treated, returned, or destroyed (Ala. Admin. Code r. 80-10-14-.10). The Commissioner also has authority over the importation of seed and commercial feed.

##### **4.D-3c. Plant Pests**

The Commissioner of Agriculture and Industries has the duty of protecting the agricultural and horticultural interests of Alabama from plant pests and may declare pests or infested articles, a public nuisance (Ala. Code § 2-25-3). The Commissioner may inspect plants or things likely to carry plant pests being moved or imported, and upon finding infestation or infection, may have the plants or things treated, returned or destroyed (Ala. Code § 2-25-3).

#### **4.D4. Alabama State Board of Health**

The State Board of Health has the authority to exercise general control over the enforcement of the laws relating to public health (Ala. Code § 22-2-2). This authority includes the power to investigate potential health threats, inspect facilities, establish quarantine, and to examine drinking water conveyances whenever there are conditions discovered likely to bring about their pollution” Ala. Code § 22-2-2). The State Board of Health also has the authority to declare things menacing to the public health as nuisances (Ala. Code § 22-10-1). The Board can then either take legal action to have the nuisance abated, or if necessary for the protection of the public health, have the nuisance destroyed (Ala. Code §§ 22-10-2, 3). The Board also has the authority to inspect food service facilities and to promulgate regulations as needed (Ala. Code § 22-20-5).

#### **4.D5. Alabama State Port Authority**

The Port Authority has broad authority to promote, develop, construct, maintain, and operate, all harbors, sea-ports, or riverports within Alabama or its jurisdiction (Ala. Code §§ 33-1-1, 2). The Port Authority is empowered to write regulations for the operation of ports and harbors (Ala. Code § 33-1-31).

Ala. Code § 33-1-11 provides that the jurisdiction of the Port Authority in any harbor or seaport within the state extends over the waters and shores of a harbor and extends to the outer edge of the outer bar at the harbor or seaport. The jurisdiction of the Port Authority also extends over the waters and shores of all rivers and streams within the state which are navigable for commercial traffic, or which may be made so navigable at any time in the future.



## 5. GOAL AND OBJECTIVES

Achieving a goal is a long-term, ongoing process, accomplished by dealing with numerous objectives. Often, many approaches or strategies are collectively used to achieve an objective. Objectives and strategies change as problems are solved or new ones emerge while working toward a goal. The Alabama Aquatic Nuisance Species Task Force has identified the following goal to effectively manage ANS in the state and proposes that the following four objectives be addressed to accomplish this goal.

### 5.A Goal

Control and manage the introduction of new ANS in Alabama and minimize impacts of existing ANS on native species, environmental quality, human health, and economics.

### 5.B Objectives

#### 5.B.1 Objective 1

Coordinate local, state, regional, federal and international activities and programs pertaining to ANS.

#### 5.B.2 Objective 2

Control and manage the introduction and spread of new and exiting ANS through educational outreach.

#### 5.B.3 Objective 3

Actively control and manage the introduction and spread of existing ANS using accepted management techniques.

#### 5.B.4 Objective 4

Prevent the introduction and spread of ANS through legislative and regulatory efforts.

## 6. PRIORITIZATION OF PROBLEMS

The Alabama Aquatic Nuisance Species Task Force recognizes that ANS management can be approached by targeting specific species, taxa and pathways, as well as media of introduction and spread. To gauge the relative impact of approaching one or more of the plan's objectives when targeting certain species or pathways, the Task Force prioritized the aforementioned pathways and species based upon information gleaned from literature reviews, professional expertise of Task Force members, and a numerical ranking system, adapted from one developed by The Nature Conservancy. Target-specific approaches were designated as being of "high", "medium", or "low" priority to achieve specific objectives of this management plan. The results, as described in sections 6.A and 6.B, are the Task Force's recommendations for approaching ANS management in Alabama over the next two to five years.

### 6.A PRIORITIZATION OF PATHWAYS

Prioritization of Pathways by Objective	Approach			
	Objective 1: Coordinate programs	Objective 2: Control & manage through education and outreach	Objective 3: Active control measures	Objective 4: Prevent through legislation and regulation
Pathways / Media				
Shipping - ballast, cargo, dunnage, ships and equipment	HIGH	N/A	N/A	N/A
Oil & Gas Exploration - boats and equipment	MORE INFO	LOW	N/A	MORE INFO
Recreational Boating	N/A	HIGH	MEDIUM	LOW
Angling - boats, equipment, and live bait use	N/A	HIGH	HIGH	HIGH
Hunting - boats, equipment, and hunters	N/A	LOW	MEDIUM	N/A
Commercial Fishing- vessels and equipment	N/A	LOW	N/A	LOW
Transportation Corridors	MORE INFO	LOW	HIGH	LOW
Nursery, Landscape, and Watergarden Industries	MEDIUM	HIGH	LOW	HIGH
Aquaculture- for food	N/A	HIGH	MEDIUM	LOW
Aquaculture - for bait and stocking	N/A	LOW	HIGH	LOW
Aquarium and Pet Industries	LOW	HIGH	HIGH	HIGH

# AQUATIC NUISANCE SPECIES

## 6.B PRIORITIZATION OF SPECIES

Rank	Prioritization of Species by Objective		Approach			
			Objective 1: Coordinate programs	Objective 2: Control & manage thru education and outreach	Objective 3: Active control measures	Objective 4: Prevent through legislation and regulation
<b>Animals</b>	<b>Common Name</b>	<b>Scientific Name</b>				
3.00	Rusty Crayfish	<i>Orconectes rusticus</i>	N/A	HIGH	N/A	HIGH
3.00	Common Carp	<i>Cyprinus carpio</i>	N/A	LOW	N/A	N/A
3.00	Bighead Carp	<i>Hypophthalmichthys nobilis</i>	LOW	LOW	MEDIUM	N/A
3.00	Silver Carp	<i>Hypophthalmichthys molitrix</i>	LOW	LOW	MEDIUM	N/A
3.00	Hybrid Carp	<i>H. nobilis x molitrix</i>	LOW	LOW	MEDIUM	N/A
3.00	Black Carp	<i>Mylopharyngodon piceus</i>	LOW	LOW	N/A	N/A
3.00	Rudd	<i>Scardinius erythrophthalmus</i>	N/A	N/A	N/A	N/A
3.00	Nutria	<i>Myocastor coypu</i>	N/A	N/A	LOW	N/A
3.00	Asian Clam	<i>Corbicula fluminea</i>	N/A	LOW	N/A	N/A
2.80	Red Shiner	<i>Cyprinella lutrensis</i>	N/A	N/A	N/A	LOW
2.80	Zebra Mussel	<i>Dreissena polymorpha</i>	MEDIUM	MEDIUM	MEDIUM	N/A
2.60	Blueback Herring	<i>Alosa aestivalis</i>	N/A	LOW	N/A	N/A
2.60	Apple Snail	<i>Pomacea</i> spp.	LOW	HIGH	N/A	HIGH
2.40	Grass Carp	<i>Ctenopharyngodon idella</i>	N/A	LOW	MEDIUM	N/A
2.20	Australian Crayfish	<i>Cherax</i> spp.	LOW	HIGH	N/A	HIGH
2.20	Marginated Madtom	<i>Noturus insignis</i>	LOW	LOW	N/A	LOW
2.20	Australian Jellyfish	<i>Phyllorhiza punctata</i>	LOW	N/A	N/A	N/A
2.00	Tilapia	<i>Oreochromis</i> spp.	N/A	MEDIUM	N/A	N/A
<b>Aquatic Plants</b>	<b>Common Name</b>	<b>Scientific Name</b>				
2.9	Hydrilla	<i>Hydrilla verticillata</i>	MEDIUM	HIGH	HIGH	N/A
2.8	Common Salvinia	<i>Salvinia minima</i>	MEDIUM	HIGH	HIGH	LOW
2.8	Water hyacinth	<i>Eichhornia crassipes</i>	MEDIUM	HIGH	HIGH	N/A
2.6	Alligatorweed	<i>Alternanthera philoxeroides</i>	MEDIUM	LOW	HIGH	N/A
2.5	Giant Salvinia	<i>Salvinia molesta</i>	MEDIUM	HIGH	HIGH	N/A
2.5	Cuban Bulrush	<i>Oxycaryum cubense</i>	MEDIUM	MEDIUM	HIGH	LOW
2.4	Blue-Green Algae	<i>Lyngbya</i> spp.	MEDIUM	HIGH	HIGH	LOW
2.3	Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	MEDIUM	HIGH	HIGH	N/A
2.3	Parrotfeather	<i>Myriophyllum aquaticum</i>	LOW	HIGH	LOW	N/A
2.3	Dotted Duckweed	<i>Landoltia punctata</i>	MEDIUM	HIGH	LOW	LOW
2.1	Uruguayan Waterprimrose	<i>Ludwigia grandiflora</i> spp.	MEDIUM	LOW	HIGH	LOW
2.1	Water Lettuce	<i>Pistia stratiotes</i>	MEDIUM	HIGH	HIGH	N/A
2.1	Common Reed	<i>Phragmites australis</i>	LOW	LOW	MEDIUM	LOW
2.0	Brittle Naiad	<i>Najas minor</i>	MEDIUM	HIGH	MEDIUM	N/A

## 7. MANAGEMENT ACTIONS

This chapter of the Alabama ANS Management Plan addresses strategies and actions that are either ongoing or proposed as they pertain to each objective. These and other strategies will be implemented according to priority of problems and available resources.

### **GOAL: Control and manage the introduction of new ANS in Alabama and minimize impacts of existing ANS on native species, environmental quality, human health, and economics**

The Task Force identified the following actions as being critical to the success of the State Management Plan for Aquatic Nuisance Species in Alabama and recommends implementation.

#### **7.A OBJECTIVE 1: Coordinate local, state, regional, federal and international activities and programs pertaining to ANS.**

##### **7.A.1 Establish the Alabama ANS Council**

On June 2, 2005, Governor Bob Riley signed Executive Order 30 creating the Alabama Aquatic Nuisance Species Task Force (ALANSTF). The ALANSTF is responsible for formulating a comprehensive ANS management plan. This Executive Order is in effect until amended or modified by the Governor. During the next Alabama Legislative Session, legislation should be passed to establish a formal Alabama Aquatic Nuisance Species Council (ALANSC) to succeed the ALANSTF. Ideally, the proposed bill would designate an appropriate lead agency, describe the membership, designate responsibilities, and authorize the hiring of a statewide Alabama ANS Coordinator. Funding will be required to establish the ALANSC.

##### **7.A.2 Hire a Permanent, Full-time Statewide Alabama ANS Coordinator**

This individual would be responsible for assisting the ALANSC in carrying out its duties and responsibilities. Additional duties would include, but would not be limited to: coordinating all activities relating to ANS in Alabama, compiling and maintaining ANS databases, and searching for external funding opportunities to support ANS initiatives. Specific efforts must include coordination with the U.S. Coast Guard, as well as other appropriate federal and international agencies to address the problems of ballast water pollution and hull fouling. Moreover, dialog must be established with and among trade groups to discuss species of concern. This will be a newly-created position, assigned to an appropriate agency such as the ADCNR. Federal and State matching funds would be sought to support this action.

##### **7.A.3 Establish a Memorandum of Understanding (MOU) Among Agencies with Overlapping ANS Jurisdictions**

This MOU would recognize overlapping and competing jurisdictions related to ANS in Alabama, and propose cooperation to facilitate efficient ANS management.

#### **7.B OBJECTIVE 2: Control and manage the introduction and spread of new and existing ANS through educational outreach.**

##### **7.B.1 Expand Existing Educational Programs**

This action is focused on identifying current ANS educational programs and expanding their outreach efforts. The Alabama Clean Water Partnership (ALCWP) is currently leading a project to publish and distribute educational newspaper inserts in an effort to raise public awareness about Alabama's water resources; a section of the insert has been specifically devoted to the problem of ANS. The ALCWP is also working on an educational, interactive CD for grades 3-8 that will include information pertaining to ANS.

## **7.B.2 Develop Specific Education Materials to be Distributed at Plant Nurseries and Pet Stores, Targeting Water Garden Hobbyists and Aquarists**

Brochures should be developed in conjunction with Habitatitude™ and Stop Aquatic Hitchhikers and distributed to all plant nurseries and pet stores in Alabama. These handouts should specifically address the impacts of ANS on Alabama and those things that hobbyists can do to prevent the introduction or spread of ANS. Partnerships should be continued with businesses (e.g., WalMart, PetCo., Pet Smart, as well as plant and water garden dealers) to assist with funding and distribution of printed materials. At present, no state funding is in place for this project.

## **7.B.3 Develop ANS Brochures, Fact Sheets, Watch Posters, and Cards Specific to Alabama to be Distributed to the General Public at Various Events**

A brochure should be developed, to target the general public, for distribution at various events (i.e., state and county fairs, as well as fishing and boat shows). Species-specific facts sheets, watch posters/cards should be developed to educate the public. There are no funds available for these projects, but outreach efforts have been integrated into existing projects.

In 2006 and 2007, the Marine Resources Division printed 75,000 Marine Information Calendars annually for distribution to interested parties by coastal vendors, boat shows, and at various state-wide outreach activities. Each year, unique information regarding Invasive Species of Coastal Alabama was compiled and included with associated background information, photos, and ways in which the public might help to mitigate the invasive species problem. A new invasive species page is planned for 2011.

Several articles about ANS have been written by ALWFF personnel and featured in the Outdoor Alabama magazine. Additional articles are pending submission to the magazine.

In conjunction with the Gulf Coast Research Laboratory, the Mobile Bay National Estuary Program (MBNEP) recently (in early 2007) completed a series of information brochures for distribution.

In the past, the Alabama Power Company printed and distributed posters identifying and explaining the hazards of hydrilla.

## **7.B.4 Provide ANS Training Workshops and Materials to Teachers**

Workshops and ANS teaching manuals should be developed for teachers. No state funding is budgeted currently for this project.

## **7.B.5 Educate Boaters and Anglers About the Potential Spread of ANS Through Their Respective Activities**

The ALWFF has purchased 15,000 Help Stop Aquatic Hitchhikers brochures to be distributed at various statewide outdoor and fishing events. These brochures target boaters and anglers. No funds are available currently for the purchase of additional brochures.

Alabama Power Company maintains a toll-free number (1-800-Lakes-11) for users of its reservoirs to contact officials regarding aquatic plant issues, and gives presentations to various home owner/boat owner associations to address the problem of aquatic nuisance plants.

Develop ANS signs to be posted at boat ramps maintained by ALDWFF to encourage anglers and boaters to remove hitchhiking plants, animals, and debris from their boat and trailers.



## **7.B.6 Coordinate an Annual Alabama ANS Symposium**

In an effort to foster collaboration among agency representatives, university researchers, private interest groups, non-governmental agencies, and the public, an annual meeting should be held to discuss the status of ANS in Alabama. No state funding is budgeted currently for this project.

## **7.B.7 Partnership with the Aquaculture Industry**

A formal partnership (MOU) is recommended among state agencies, aquaculturists, and university researchers to devise and implement “best management” practices.

## **7.B.8 Provide Hazard Analysis Critical Control Point (HACCP) Training**

Hazardous Analysis Critical Control Point training should be provided to industry to prompt the development and incorporation of ANS prevention measures into routine operation. The USFWS currently provides HACCP training to willing participants.

## **7.B.9 Provide Training Workshops to Various Volunteer Groups to Assist with Early Identification and Detection of ANS**

Partnerships should be developed with volunteer groups (e.g., Alabama Clean Water Partnership, Alabama Water Watch, etc.), and training provided regarding the identification and documentation of ANS during routine sampling activities. No state funds are budgeted currently for this project.

In 2005, the Mobile Bay National Estuary Program and the Marine Resources Division entered a joint volunteer Crab Watch program. Ancillary to this program, a manual provided information on invasive species and included fact sheets with photos for volunteers. The AMRD also serves in an advisory capacity to review and identify any “unusual” species. While limited in scope, these activities provide educational opportunities and avenues for early detection.

## **7.B.10 Develop a Comprehensive Alabama ANS Website**

An Internet website should be developed that would concentrate all Alabama ANS data and link it to other ANS websites (e.g., [www.invasivespecies.gov](http://www.invasivespecies.gov), [www.natureserve.org](http://www.natureserve.org), etc.). The Mobile Bay National Estuary Program has volunteered to dedicate a portion of their web space to Alabama ANS issues. No state funds are budgeted currently for this project.

## **7.C OBJECTIVE 3: Actively control and manage the introduction and spread of existing ANS using accepted management techniques.**

### **7.C.1 Develop an Alabama ANS Early Detection / Rapid Response Plan**

This plan would facilitate identifying potential ANS and coordinating control responses before the ANS become established. It would also serve as an early warning system for spread of existing ANS in Alabama. Critical to this project is the need for specific individuals and agencies to be identified from throughout the state to participate in the development and implementation of an early detection/rapid response plan. The National Incident management System will be used to assist with a rapid response plan. This should be a top priority for the proposed Alabama Aquatic Nuisance Species Council. No state funds are budgeted currently for this project.

### **7.C.2 Conduct Rapid Assessment Sampling in All Alabama Waterways to Detect Occurrences of New ANS**

To date, this type of sampling has only been conducted in coastal Alabama by the Alabama-Mississippi Rapid Assessment Team (AMRAT). In 2004 and 2005, a group of scientists conducted rapid surveys to inventory plants and animals along the Alabama and Mississippi Gulf Coast, providing a “snapshot” of abundance and distribution of native and non-native species in coastal waters. The AMRAT was initiated by the Gulf Coast Research

Laboratory, Gulf States Marine Fisheries Commission, and Mobile Bay National Estuary Program. Participants also included state and federal agencies, as well as regional universities. The Rapid Assessment Team needs to be reorganized to include experts who are willing and able to participate in surveys of freshwater systems in Alabama. The National Incident Management System will be examined in the development of a rapid response plan. No state funds are budgeted for this project.

### **7.C.3 Bighead Carp Monitoring in the Alabama River**

Recent data suggest that bighead carp abundance might be increasing in the Alabama River. Three bighead carp were collected by ALWFF biologists in spring 2005, and 45 fish were snagged below Millers Ferry Power House on a single day in April, 2006. The impact of high bighead carp abundance on sport and native fishes is largely unknown. No state funds are budgeted currently for this project.

### **7.C.4 Zebra Mussel Monitoring**

Recently completed surveys indicate that zebra mussel densities are increasing along the Tennessee River. Zebra mussels are becoming more salt water tolerant and have been identified in coastal Louisiana and Mississippi's portion of the Mississippi Sound (Perry and Yeager, 2007). Monitoring is needed. No state funds are budgeted currently for zebra mussel monitoring.

## **7.D OBJECTIVE 4: Prevent the introduction and spread of ANS through legislative and regulatory efforts.**

### **7.D.1 All Ranked Animal ANS Not Currently Found in Alabama Should be Added to ALWFF Regulation 220-2-.26 that Prohibits Importation into Alabama**

Animal species that should be added to ALDWFF Regulation 220-2-.26 include: Asian carp (*Hypophthalmichthys* spp.), rusty crayfish (*Orconectes rusticus*), channeled apple snail (*Pomacea canaliculata*), and margined madtom (*Noturus insignis*).

### **7.D.2 All Ranked ANS Found in Alabama Should be Reviewed by the Proposed ALANSC for Regulatory Authority**

### **7.D.3 Legislation Should Be Enacted to Create a Non-native Species Review Committee with Regulatory Authority**

The proposed committee should be composed of representatives from state agencies, non-governmental organizations, business, private and public interests, and would oversee and make decisions pertaining to the importation of non-native species into Alabama. Committee members would serve a pre-determined time limit.

### **7.D.4 The Proposed ALANSC Should Develop Approved Non-Native Aquaculture, Research, and Aquarium Species Lists**

These species lists would indicate which non-native organisms can be readily imported into Alabama for aquaculture, research, and aquarium use without a permit. If not on these lists, species would be subject to review by the Non-Native Species Review Committee prior to importation. The Review Committee should have the authority to approve or deny the importation of any species based upon potential harm to Alabama as so deemed by committee members. The individual and/or business requesting importation would be responsible for species review and any associated costs.

### **7.D.5 Regulation is Needed to define "Baitfish" Species, Use, Possession, and Importation into Alabama**

The establishment of an approved species list for "baitfish" would, in part, prevent the introduction of nuisance species into Alabama's waters (e.g., red shiner).

## **7.D.6 Regulation is Needed that Requires All Baitfish Producers Who Raise, Sell or Import “Baitfish” into Alabama to have an Approved HACCP Plan**

Require that all baitfish producers have and use an approved HACCP plan. An approved HACCP plan can prevent the introduction and/or spread of ANS in Alabama waters by identifying sources of contamination within the production, transport, and selling procedures of the baitfish trade. Using this analysis, producers could revise or redesign those procedures that may allow ANS to accidentally contaminate Alabama’s waters. Educational materials are available for training (See 7.B.8).

## **7.D.7 Regulation is Needed that Requires All Grass Carp Produced, Sold, Imported, and Stocked in Alabama be Triploid**

Deliberate stocking of triploid individuals would reduce the reproductive potential of grass carp.

## **7.D.8 Regulation is Needed that Requires ANS Identification and Removal Training be Added to the Boater’s License Examination in Alabama**

Including ANS information and training on license examinations would increase public awareness regarding how boats, trailers, and boating equipment can contribute to the transport of invasive species. Furthermore, a small fee added to those associated with boat registration would help to raise awareness and defray costs of ANS educational and control measures.

### 8. IMPLEMENTATION TABLE

This implementation table summarizes the management actions described in Chapter 7. For effective implementation, Alabama needs to identify additional funding sources.

**Goal: Control and manage the introduction of new Aquatic Nuisance Species (ANS) in Alabama and minimize impacts of existing ANS on native species, environmental quality, human health, and economics.**

**Objective 1.** Coordinate local, state, regional, federal and international activities and programs pertaining to ANS.

**Objective 2.** Control and manage the introduction and spread of new and existing ANS through educational outreach.

**Objective 3.** Actively control and manage the introduction and spread of existing ANS using accepted management techniques.

**Objective 4.** Prevent the introduction and spread of ANS through legislative and regulatory efforts.

Tasks / Actions		Current Status	Objective Addressed	Funding Source	Implementing Entity	Cooperating Agencies	Recent Efforts (FY 05-07)		Planned Efforts (FY 10-11)			
Number	Title / Summary						\$000	FTE	\$000	FTE	\$000	FTE
7.A.1	Establish an Alabama ANS Council (ALANSC)	Unfunded	1, 2, 3, 4		Legislature	ALANSTF	-	-				
7.A.2	Hire a permanent, full-time statewide Alabama ANS Coordinator	Unfunded	1, 2, 3, 4		ADCNR (possibly)	ALANSTF	-	-			100	1
7.A.3	Establish a Memorandum of Understanding (MOU) among agencies with overlapping ANS jurisdictions	Unfunded	1, 2, 3, 4		ADCNR	ALANSTF	-	-				
7.B.1	Expand existing educational programs.	Unfunded	2		ADCHR, MBNEP	ALANSC	40	-				
7.B.2	Develop specific education materials to be distributed at plant nurseries and pet stores, targeting water garden hobbyists and aquarists	Unfunded	2		ADAI	ALANSC	-	-			5	
7.B.3	Develop ANS brochures, fact sheets, watch posters, and cards specific to Alabama that can be distributed to the general public at various events	Unfunded	2		ADAI ADCNR ADEM MBNEP	ALANSC	8	-			5	
7.B.4	Provide ANS training workshops and materials to teachers	Unfunded	2		ADAI ADCNR ADEM	ALANSC	-	-			5	
7.B.5	Educate boaters and anglers about the potential spread of ANS through their respective activities	Unfunded	2		ADCNR	ALANSC	-	-			10	

Tasks / Actions		Current Status	Objective Addressed	Funding Source	Implementing Entity	Cooperating Agencies	Recent Efforts (FY 05-07)		Planned Efforts (FY 10-11)		
Number	Title / Summary						\$000	FTE	\$000	FTE	Requested
7.B.6	Coordinate an annual Alabama ANS Symposium	Unfunded	1, 2		MBNEP	ALANSC	-	-			FTE
7.B.7	Partnership with aquaculture industry	Unfunded	1, 2		ADAI ADCNR	ALANSC	-	-			
7.B.8	Provide Hazardous Analysis Critical Control Point (HACCP) training	Unfunded	3		ALANSC	SARP	3	-			
7.B.9	Provide training workshops to various volunteer groups to assist with early identification and detection of ANS	Unfunded	2		MBNEP	ADAI ADCNR ADEM	-	-			
7.B.10	Develop a comprehensive Alabama ANS website	Unfunded	2		MBNEP	ALANSC	-	-			10
7.C.1	Develop an Alabama Early Detection / Rapid Response Plan	Unfunded	1, 3		ALANSC	ADAI ADCNR ADEM MBNEP	-	-		100	1
7.C.2	Conduct Rapid Assessment Sampling in all Alabama waterways to detect occurrences of new ANS	Partial Funding	1, 3		ADCNR MBNEP	ALANSC	19	-		100	1
7.C.3	Bighead carp monitoring in the Alabama River	Unfunded	3		ALWFF		-	-			35
7.C.4	Zebra mussel monitoring	Unfunded	3		ALWFF		-	-			10
7.D.1	All ranked animal ANS not currently found in Alabama should be added to ALWFF Regulation 220-2-.26 that prohibits importation into Alabama	Unfunded	4		ALWFF		-	-			
7.D.2	All ranked ANS found in Alabama should be reviewed by the proposed ALANSC for regulatory authority	Unfunded	4		ALANSC	ADAI ADCNR ADEM selected experts	-	-			
7.D.3	Legislation should be enacted to create a permanent Non-native Species Review Committee with regulatory authority	Unfunded	4		Legislature		-	-			
7.D.4	The proposed ALANSC should develop approved non-native aquaculture, research, and aquarium species lists	Unfunded	4		ALANSC	ADAI ADCNR ADEM selected experts	-	-			



Tasks / Actions		Current Status	Objective Addressed	Funding Source	Implementing Entity	Cooperating Agencies	Recent Efforts (FY 05-07)		Planned Efforts (FY 10-11)			
Number	Title / Summary						\$000	FTE	\$000	FTE	\$000	FTE
7.D.5	Regulation is needed that defines "Baitfish" species, use, possession, and importation into Alabama	Unfunded	4		ALWFF AMRD		-	-				
7.D.6	Regulation is needed that requires all Baitfish Producers who raise, sell or import "Baitfish" into Alabama to have an approved HACCP Plan	Unfunded	4		ALWFF AMRD		-	-				
7.D.7	Regulation is needed that requires all grass carp produced, sold, imported, and stocked in Alabama be triploid	Unfunded	4		ALWFF		-	-				
7.D.8	Regulation is needed that requires ANS identification and removal training be added to the boater's license examination in Alabama	Unfunded	4		AMP	ALANSC	-	-				
	Approximate Total Funding and FTEs						70	0	0	0	380	3

## 9. PROGRAM MONITORING AND EVALUATION

The Alabama Aquatic Nuisance Species Task Force recognizes that program monitoring and evaluation is a key component to determine the efficacy of identified objectives and tasks in the management plan. Timely oversight and review of stated tasks and objectives will allow for appropriate re-prioritization as new threats occur. This will allow for the re-allocation of funds and personnel as necessary to counter new invasive species or effectively counter existing threats. Simultaneously it will review the effectiveness of current tasks and determine the success of current management efforts. The Task Force recommends that the proposed ALANSC have the responsibility to create any panel or committee deemed necessary to oversee the appropriate use of personnel and funds to achieve the objectives of this plan. Members of such panels or committees would be expected to be able to understand and address the socio-economic, public health and ecological concerns associated with invasive species.

The Task Force has identified three components for program evaluation: oversight, evaluation and dissemination and suggests a periodic evaluation every 4 to 5 years.

- Oversight considers application of proposed strategies toward achieving the plan's objectives. This panel would encompass representatives from all sectors: public, associated private industries, academia, government agencies, the Governor's office and the statewide ANS coordinator. A balance between functionality and interest would need to be maintained and, as the ALANSC determines, appointments may be limited by term period or number to maximize overall participation while ensuring effective and efficient oversight. As deemed necessary this oversight panel/committee should meet semi-annually.
- Evaluation establishes and applies objective quantitative criteria to project planning and outcomes with special emphasis on funding. This panel/committee may be narrower in its membership as emphasis will be on two parameters – objective project evaluation and acquisition of funds. Members would evaluate current projects for effectiveness based on criterion such as: have stated objectives been achieved, what is the current rate of spread of specific ANS species, status of native threatened or endangered species, and status of legislative or regulatory changes? Funding to support these efforts is essential and panel members would place special effort in soliciting all available funding sources necessary for project implementation. As funding needs require, this panel/committee may need to meet semi-annually and at specially called sessions to ensure continuity of funding and implementation.
- Dissemination provides for professional and outreach reports to engage and inform decision makers, partners, and the public. As the ALANSC determines, this panel/committee will review all outreach efforts and summarize state efforts in concise reports. As needed, at least two reports would be generated annually to provide adequate information for policy makers and management agencies and also for the general public. Reports would highlight progress in ANS management including fiscal expenditures, listed outreach efforts and potential threats.

## 10. GLOSSARY OF TERMS

**Aquatic Nuisance Species (ANS)** – a species introduced outside of its native range that can grow in or is closely associated with the aquatic environment and can have deleterious effects on the local ecology, economy and / or human health.

**Aquatic species** – all organisms dependent at least partially on a water environment. Usage commonly refers to aquatic plants (e.g., water hyacinth and hydrilla), fish, and invertebrates, as well as some mammals (e.g., nutria). For purposes of this management plan, aquatic species are those that grow in or are closely associated with the aquatic environment.

**Baitfish** – any species (fish, insect, invertebrate) sold for use as bait for fishing.

**Ballast** – water or weighted material placed in specific areas of the hull of a vessel for navigation stability. Species can be transported in or on ballast material.

**Biodiversity** – the variation of life forms within a given ecosystem.

**Community** – organisms found in a localized region that interact either peripherally or directly for food and shelter. Food web.

**Drainage basin** – an area or region of land that catches rain from that area and funnels it to creeks, streams and rivers until it drains into the ocean.

**Dunnage** – any packing material used to protect cargo from movement, moisture, contamination, or other damage. Species can be transported in or on dunnage.

**Ecological** – relating to the interrelationships of organisms and their environment.

**Ecosystem** – a community of organisms and its environment functioning as an ecological unit.

**Endemic** – native to a particular area.

**Eradication** – total elimination of a pest or weed from an area.

**Exotic species** – a species not native or endemic to a particular area. Synonyms include: non-native, nonindigenous, introduced, foreign, and alien. Not all exotic species are harmful or invasive.

**Feral** – any member of a domesticated species that has escaped and reverted to the wild. Feral species no longer rely on humans for food, shelter or medical attention.

**Habitat** – an area providing life needs for all periods of a species life cycle. It includes the ecosystems within which a species participates.

**Hazard Analysis and Critical Control Points (HACCP)** – a systematic approach to hazard prevention and control that emphasizes monitoring an entire process at selected steps, or critical points, rather than just the end product. Originally designed to provide astronauts uncontaminated food, Pillsbury implemented HACCP program to allow safety monitoring at critical food processing steps. The plan is based on seven established principles: hazard analysis, identify critical control points, establish acceptable limits for control points, establish monitoring requirements for control points, and establish corrective actions, record keeping procedures and verify HACCP is working as intended. Can be modified to any type of process including aquaculture from importation through grow out and sale.

**Hybrid** – the result of interbreeding between two animals or plants of different taxa. Hybrids between different species within the same genus are sometimes known as interspecific hybrids or crosses. Hybrids between different sub-species within a species are known as intraspecific hybrids.

**Hydrologic unit** – a national standard system of watersheds that are classified into four types of units: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units or sub-basin) to the largest (regions). Each hydrologic unit is identified by a unique hydroelectric unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

**Indigenous** – native to a particular ecosystem (see endemic).

**Introduced species** – a species not native to an ecosystem (see exotic species).

**Invasive species** – organisms that, when introduced, are likely to have negative economical, environmental, and/or human health impacts.

**Media** – natural and man-made materials (e.g., ballast water, dunnage, cargo, and equipment) infested with or utilized by species as they are transported (intentionally or unintentionally) to new locations.

**Morphology** – the study of the form or shape of an organism or part thereof.

**Native species** – a species that normally lives and thrives in an ecosystem (see endemic).

**Nuisance species** – a plant or an animal pest. For purposes of this management plan, these are non-native species that threaten the economy (e.g., commerce, agriculture, aquaculture, and recreation), ecology (e.g., biodiversity, abundance of native species, and/or ecological stability), or human health.

**Parasite** – an organism that lives in or on a host, typically deriving nourishment to the detriment of the host.

**Pathogen** – an agent or organism that causes disease (i.e., virus, bacterium or fungus).

**Pathway** – means by which species are physically transported to new areas.

**Population** – a collection of organisms of a particular species, living in a given geographic area.

**Rapid response** – a timely response to contain or eliminate potentially damaging invasive species.

**Regulation** – a rule or order having to do with details or procedures and having the force of law.

**Species** – the basic unit of biodiversity. A species generally consists of all the individual organisms of a population that are able to interbreed, generally sharing similar appearance, characteristics, and genetics.

**Triploid** – an organism with three copies of its chromosomes instead of two. The third copy of the chromosome interferes with reproduction and renders a species infertile.

**Vector** – any device of transportation or movement. For purposes of this management plan, this term is a combination of “media” and “pathway”.

**Watershed** – this term may refer to 1) a water divide, meaning the ridge of land that separates two adjacent drainage basins or 2) a drainage basin, meaning the region of land whose water drains into a specified body of water.



## 11. LITERATURE CITED

- Aguirre, W. and Poss, S.G. 1999. Nonindigenous species in the Gulf of Mexico ecosystem: *Corbicula fluminea* (Muller 1774). Gulf States Marine Fisheries Commission (GSMFC).
- Aguirre, W. and Poss, S.G. 2000. *Cyprinus carpio* Linnaeus, 1758. Nonindigenous Species in the Gulf of Mexico Ecosystem – Gulf States Marine Fisheries Commission (GSMFC).
- AAPA, American Association of Port Authorities. 2004. <http://www.aapa-ports.org/>. Retrieved 6 August 2006.
- ACES, Alabama Cooperative Extension Services. 2005. <http://www.aces.edu/dept/fisheries/>. (Retrieved 26 June 2006).
- Alabama Forestry Commission website. Alabama's World Class Forests. [http://www.forestry.state.al.us//publication/forest\\_facts.htm](http://www.forestry.state.al.us//publication/forest_facts.htm). Retrieved 13 March 2007.
- ALNHP, Alabama Natural Heritage Program. 2003. Annual Report; fiscal year 2003. Alabama Natural Heritage Program, Montgomery.
- Alabama Invasive Plant Council. 2004. Cogongrass in Alabama: the takeover of our lands and what it means. <http://www.se-eppc.org/alabama/alabamacogon/pdf>. Retrieved 4 April 2007.
- Albrecht, E.A., Carreno, N.B. and Castro-Vasquez, A. 1996. A quantitative study of copulation and spawning in South American Apple-snail *Pomacea canaliculata* (prosobranchia: Ampullariidae). *The Veliger*. 39(2): 142-147.
- ALCWCS, Alabama Comprehensive Wildlife and Conservation Strategy. 2005. Alabama Department of Conservation and Natural Resources, Montgomery, Ala. 322 pp.
- ALNLA, Alabama Nursery and Landscape Association. 2003. AL NLA brochure: The Economic Impact of the Green Industry in Alabama.
- ALOGB, Alabama State Oil and Gas Board. no date. <http://www.ogb.state.al.us/>. (Retrieved 26 June 2006).
- Anderson, D.M., Hoagland, P., Kaoru, Y. and White, A. 2000. Economic impacts from harmful algal blooms (HABs) in the United States. Woods Hole Oceanographic Institute and SeaGrant Woods Hole. Technical report No. WHOI-2000-11.
- ASPA, Alabama State Port Authority. 2005. <http://www.asdd.com/>. (Retrieved 26 June 2006)
- Austin City Connection, Watershed Protection Development Review. <http://www.ci.austin.tx.us/watershed/hyd-rilla.htm>. (Retrieved 13 March 2007).
- Balcom, N.C. 1994. Aquatic Immigrants of the Northeast, No. 4: Asian Clam, *Corbicula fluminea*. Connecticut Sea Grant College Program.
- Balon, E.K. 1995. Origin and domestication of the wild carp, *Cyprinus carpio*: from Roman gourmets to the swimming flowers. *Aquaculture*. 129: 3-48.

- Bates, A. L. and Smith, C.S. 1994. Submersed plant invasions and declines in the southeastern United States. *Lake and Reservoir Management*. 10(1): 53-55.
- Belden, R.C. and Pelton, M.R. 1975. European Wild Hog Rooting in the Mountains of Eastern Tennessee. *Proceedings of The Annual Conference of The Southeastern Association Of Game And Fish Commissioners*. 29: 665-671.
- Berg L.S. 1949. *Freshwater Fishes of the U.S.S.R. and Adjacent Countries*. Vol. 3, pp. 929-1381. Izd.
- Biochino, G.T. 1989. A Phenetic Method Of *Dreissena Polymorpha* (Pallas) Investigation. *Nauchnye doklady Vyshevi Shkoly*. 10:36-41. (Russian with English abstract).
- Boschung, H.T. 1992. Catalogue of freshwater and marine fishes of Alabama. *Alabama Museum of Natural History Bulletin*. 14:1-266.
- Boschung, H.T. and Mayden, R.L. 2004. *Fishes of Alabama*. Smithsonian Books. Washington, D.C. pp. 157-158.
- Bratton, S.P., Harmon, M.E. and White, P.S. 1982. Patterns of European wild boar rooting in the western Great Smokey Mountains. *Castanea*. 47(2): 230-242.
- Bruce, K.A., Cameron, G.N., Harcombe, P.A. and Jubinsky, G. 1997. Introduction, impact on native habitats, and management of a woody invader, the Chinese tallow tree, *Sapium sebiferum* (L) Roxb. *Natural Areas Journal*. 17(3): 255-260.
- Burke, J.S., Bayne, D.R. and Rea, H. 1986. Impact of silver carp and bighead carp on plankton communities of channel catfish ponds. *Aquaculture*. 55:59-68.
- Burkhead, N.M. 2003. The case of the red shiner: what happens when a fish goes bad? [http://cars.er.usgs.gov/Southeastern\\_Aquatic\\_Fauna/Freshwater\\_Fishes/Shiner\\_Research/shiner\\_research.html](http://cars.er.usgs.gov/Southeastern_Aquatic_Fauna/Freshwater_Fishes/Shiner_Research/shiner_research.html) (Retrieved 24 April 2007).
- Burkhead, N.M. and Williams, J.D. 1991. An intergeneric hybrid of a native minnow, the golden shiner, and an exotic minnow, the rudd. *Transactions of the American Fisheries Society*. 120(6): 781-795.
- Cadwallader, P.L. 1977. Review of the ecology of rudd and the implications of its introduction into New Zealand. Pp. 1-18 In: *Introduction of rudd Scardinius erythrophthalmus into New Zealand*. N.Z. Ministry of Agriculture and Fisheries, Fisheries Technical Report 147. 24 pp.
- Carlton, J.T. 1985. Transoceanic and interoceanic dispersal of coastal marine organisms: the biology of ballast water. *Oceanography and Marine Biology, An Annual Review*. 23: 313-371.
- Carlton, J.T. 1992. Introduced marine and estuarine mollusks of North America: An end-of-20th-century perspective. *Journal of Shellfish Research*. 11: 489-505.
- Carlton, J.T. and Geller, J.B. 1993. Ecological roulette: the global transport of nonindigenous marine organisms. *Science*. 261: 78-82.
- Carlton, J.T., Reid, D.M. and van Leeuwen, H. 1995. Shipping Study. The role of shipping in the introduction of nonindigenous aquatic organisms to the coastal waters of the United States (other than the Great Lakes) and an analysis of control options. The National Sea Grant College Program/Connecticut Sea Grant Project R/ES-6.

- Carmichael, W. W., Evans, W.R., Yin, Q.Q., Bell, P. and Moczydlowski, E. 1997. Evidence for paralytic shellfish poisons in the freshwater cyanobacteria *Lyngbya wollei* (Farlow ex Gomont) comb. Nov. Applied and Environmental Microbiology. 63(8): 3104-3110.
- CDC, Centers for Disease Control and Prevention. 1993. Morbidity and Mortality Weekly Report. <http://www.cdc.gov/mmwr/preview/mmwrhtml/00019553.htm>.
- Chang, S., Denson, C. and Anson, K. 2006. Economic impact of Hurricane Katrina on the Alabama seafood industry. Center for Business and Economic Research Reports, University of South Alabama, Mobile, Ala.
- Claudi, R. and Mackie, G.L. 1993. Practical Manual For Zebra Mussel Monitoring And Control. Lewis Publishers, Boca Raton, Fla.
- Colle, D.E. and Shireman, J.V. 1980. Coefficients of condition for largemouth bass, bluegill, and redear sunfish in hydrilla-infested lakes. Transactions of the American Fisheries Society. 109: 521-531.
- Courtenay, W.R., Jr., Hensley, D.A., Taylor, J.N. and McCann, J.A. 1984. Distribution of exotic fishes in the continental United States. Page 41-77 In: Distribution, Biology and Management of Exotic Fishes. (W.R. Courtenay, Jr., and J.R. Stauffer, Jr., editors). Johns Hopkins University Press, Baltimore, Md.
- Courtenay, W. R., Jr., Jennings, D.P. and Williams, J.D. 1991. Appendix 2: exotic fishes. Pages 97-107 in Robins, C. R., R. M. Bailey, C.E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. Common and scientific names of fishes from the United States and Canada, 5th edition. American Fisheries Society Special Publication 20. American Fisheries Society, Bethesda, Md.
- Courtenay, W.R., Jr., Sahlman, H.F., Miley, W.W. II and Herrema, D.J. 1974. Exotic fishes in fresh and brackish waters of Florida. Biological Conservation. 6(4): 292-302.
- Courtenay, W.R., Jr. and Williams, J.D. 1992. Dispersal of exotic species from aquaculture sources, with emphasis on freshwater fishes. In Dispersal of Living Organisms into Aquatic Systems. (A. Rosenfield & R. Mann, ed.) Maryland Sea Grant College, College Park, pp. 49-81.
- Creagh, C. 1991/1992. A marauding weed in check. ECOS. 70: 26-29.
- Dill, W.A., and Cordone, A.J. 1997. History and status of introduced fishes in California, 1871-1996. Manuscript for Fish Bulletin of the California Department of Fish and Game, 178.
- Douglas, N.H. 1974. Freshwater Fishes of Louisiana. Louisiana Wildlife and Fisheries Commission. Baton Rouge, LA. 443 pp.
- Dundee, D.S. 1974. Catalog of introduced molluscs of eastern North America (North of Mexico). Sterkiana. 55: 1-37.
- Ensminger, A. 1955. The economic status of nutria in Louisiana. Proceedings of the Southeastern Association of Game and Fish Commissioners Meeting. October 2-5, 1955. Daytona Beach, Fla.
- Faircloth, W.H., M.G. Patterson, J.H. Miller, D.H. Teem. 2004. Wanted Dead not Alive: Cogongrass. Online fact-sheet. <http://www.ag.auburn.edu/agrn//cogongrass/cogongrass%20fact%20sheet.htm>. (Retrieved 24 April 2007).

FNA, Flora of North America. 2005. Volume 23. Cuban bulrush. Pp. 139-140.

Foster, A.M., Fuller, P., Benson, A. 2000. Nonindigenous Aquatic Species Program Factsheet: *Corbicula fluminea*. United States Geological Survey. (Retrieved 13 February 2003 from [http://nas.er.usgs.gov/mollusks/docs/co\\_flumi.html](http://nas.er.usgs.gov/mollusks/docs/co_flumi.html)).

Freeze, M. and Henderson, S. 1982. Distribution and status of the bighead carp and silver carp in Arkansas. *North American Journal of Fisheries Management*. 2(2): 197-200.

Fuller, P. and Benson, A. 2006. *Hypophthalmichthys molitrix x nobilis*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <<http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=550>> Revision Date: 4/26/2006.

Fuller, P. and Jacobs, G. 2006. *Noturus insignis*. USGS Nonindigenous Aquatic Species Database, Gainesville, Fla. <<http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=748>> Revision Date: 7/13/2005.

Fuller, P.L., Niko, L.G. and Williams, J.D. 1999. Nonindigenous fishes introduced into inland waters of the United States: Bethesda, Md., American Fisheries Society, Special Publication 27, 613 p.

Gaudet, J.J. 1973. Growth of a floating aquatic weed, *Salvinia*, under standard conditions. *Hydrobiologia*. 41: 77-106.

Ghesquiere, S.A.I. 2005. Personal website. Apple snail hobbyist. <http://www.applesnail.net/> (Retrieved 24 April 2007).

Gingerich, J.L. 1994. *Florida's Fabulous Mammals*. World Publications. Tampa Bay. 128 pp.

Glazier, K. 1996. *Pistia stratiotes* L.. Ecology and Evolutionary Biology Conservatory.

Godfrey, R.K. and Wooten, J.W. 1979. *Aquatic and Wetland Plants of Southeastern United States, Monocotyledons*. University of Georgia Press, Athens, GA. 712 pp.

Godfrey, R.K. and Wooten, J.W. 1981. *Aquatic and Wetland Plants of Southeastern United States: Dicotyledons*. University of Georgia Press, Athens, GA. 933 pp.

Gollasch, S., MacDonald, E., Belson, S., Botnen, H., Christensen, J.T., Hamer, J.P., Houvenaghel, G., Jelmert, A., Lucas, I., Masson, D., McCollin, T., Olenin, S., Persson, A., Wallentinus, I., Wetsteyn, L.P.M.J. and Wittling, T. 2002. Life in ballast tanks. In: *Invasive Species of Europe-Distribution, Impact and Management*. (E. Leppakoski, S. Gollash, and S. Olenin, ed.), Kluwer Academic Publishing, Dordrecht, 217-231.

Gopal, B. 1987. *Water-hyacinth*. Elsevier, New York, NY.

Graham, L. E. and Wilcox, L.W. 2000. *Algae*. Prentice Hall, Upper Saddle River, NJ.

Graham, W.M. 1998. First report of *Carybdea alata* var. *grandis* (Reynaud 1830) (Cnidaria: Cubozoa) from the Gulf of Mexico. *Gulf of Mexico Science*. 1998: 28-30.

Graham, W.M. and Bolton, T.F. 2004. Molecular and morphological comparisons of native and non-native popu-

lations of a jellyfish invader. American Society of Limnology and Oceanography, Summer Meeting, Abstract.

Graham, W.M., Martin, D.L., Felder, D.L., Asper, V.L. and Perry, H.M. 2003. Ecological and economic implications of a tropical jellyfish invader in the Gulf of Mexico. *Biological Invasions*. 5: 53-69.

Griffiths, R.W., Schloesser, D.W., Leach, J.H. and Kovalak, W.P. 1991. Dispersal of the zebra mussel *Dreissena polymorpha* in the Great Lakes Region. *Can. J. Fish. Aquat. Sci.* 48: 1381-1388.

Griffo, J.V., Jr. 1957. The status of the nutria in Florida. *Quarterly Journal of Florida Academy Science*. 20: 209-225.

GSMFC, Gulf States Marine Fisheries Commission. 2003. Fact Sheet. *Hypothalmichthys nobilis*. [http://nis.gsmfc.org/nis\\_factsheet.php?toc\\_id=190#ref](http://nis.gsmfc.org/nis_factsheet.php?toc_id=190#ref) (Retrieved 24 March 2007).

GSMFC, Gulf States Marine Fisheries Commission. 2004. Fact sheet. *Sus scrofa*. [http://nis.gsmfc.org/nis\\_factsheet2.php?toc\\_id=215](http://nis.gsmfc.org/nis_factsheet2.php?toc_id=215) (Retrieved 24 March 2007).

GSMFC, Gulf States Marine Fisheries Commission. 2005a. Fact sheet. *Dreissena polymorpha*. [http://nis.gsmfc.org/nis\\_factsheet.php?toc\\_id=131](http://nis.gsmfc.org/nis_factsheet.php?toc_id=131) (Retrieved 24 March 2007).

GSMFC, Gulf States Marine Fisheries Commission. 2005b. Fact sheet. *Pomacea canaliculata*. [http://nis.gsmfc.org/nis\\_factsheet.php?toc\\_id+154](http://nis.gsmfc.org/nis_factsheet.php?toc_id+154) (Retrieved 24 March 2007).

Gunderson, J. 2004. Rusty crayfish factsheet – rusty crayfish: a nasty invader, biology, identification, and impacts. <http://www.seagrant.umn.edu/exotics/rusty.html>.

Habel, M.L. 1975. Overwintering of the cichlid, *Tilapia aurea*, produces fourteen tons of harvestable size fish in a south Alabama bass-bluegill public fishing lake. *Progressive Fish Culturist*. 37: 31-32.

Halwart, M. 1994. The golden apple snail *Pomacea canaliculata* in Asian rice farming systems: present impact and future threat. *International Journal of Pest Management*. 40(2): 199-206.

Haynes, R.R. 1979. Revision of North and Central American *Najas* (Najadaceae). *Sida*. 8: 34-56.

Haynes, R.R. and Jacono, C.C. 2000. Status of *Salvinia* (Salviniaceae) in Alabama. *Castanea*. 65: 225-227.

Hebert, P.D.N., Muncaster, B.W. and Mackie, G.L. 1989. Ecological and Genetic Studies on *Dreissena polymorpha* (Pallas): a new mollusc in the Great Lakes. *Can. J. Fish. Aquat. Sci.* 46: 1587-1591.

Heeger, T., Piatkowski, U. and Moeller, H. 1992. Predation on jellyfish by the cephalopod *Argonauta argo*. *Marine Ecology Progress Series*. 88: 293-296.

Hoagland, P., Anderson, D.M., Kaoru, Y. and White, A.W. 2000. Average annual economic impacts of harmful algal blooms in the United States: some preliminary estimates. *Estuaries*. 25(4b): 677-695.

Hollander, R.R., Robertson, R.N. and Kinucan, R.J. 1992. First records of the nutria, *Myocastor coypus*, in the trans-pecos region of Texas. *Texas Journal of Science*. 44(1): 119.



- Holm, L.G., Donald, P., Pancho, J.V. and Herberger, J.P. 1977. *The World's Worst Weeds: Distribution and Biology*. The University Press of Hawaii, Honolulu, Hawaii. 609 pp.
- Howells, R.G. 1992. Annotated list of introduced non-native fishes, mollusks, crustaceans and aquatic plants in Texas waters. Texas parks and Wildlife Department, Management Data Series 78, Austin, Tx. 19 pp.
- Howerth, E.W., Reeves, A.J., McElveen, M.R. and Austin, W. 1994. Survey for selected diseases in nutria (*Myocastor coypus*) from Louisiana. *Journal of Wildlife Diseases*. 30(3): 450-453.
- Hubbs, C.L. 1954. Establishment of a forage fish, the red shiner (*Notropis lutrensis*), in the lower Colorado system. *California Fish and Game*. 40(3): 287-294.
- Hubbs, C.L. and Lagler, K.F. 1958. *Fishes of the Great Lake Region*, Revised ed. Cranbrook Inst. Sci. Bull 26. 186 pp. and plates.
- INHS, Illinois Natural History Survey. 1996. *Corbicula fluminea* (Muller 1774). Illinois Department of Natural Resources. [http://www.inhs.uiuc.edu/cbd/musselmanual/page174\\_5.html](http://www.inhs.uiuc.edu/cbd/musselmanual/page174_5.html)
- Jacono, C.C., Davern, T.R. and Center, T.D. 2001. The adventive status of *Salvinia minima* and *S. molesta* in the southern United States and the related distribution of the weevil *Cyrtobagous salviniae*. *Castanea*. 66(3): 214-226.
- Jenkins, R.E., and N.M. Burkhead. 1994. *Freshwater Fishes of Virginia*. American Fisheries Society, Bethesda, Md.
- Jenkinson, J.J. 1979. The occurrence and spread of *Corbicula manilensis* in East-central Alabama. *Nautilus*. 94(4):149-153.
- Johnson, D.R., Perry, H.M. and Graham, W.M. 2004. Using nowcast model currents to explore transport of nonindigenous jellyfish into the Gulf of Mexico. *Marine Ecology Progress Series*. (In Press).
- Johnson, E.R.R.L., and Shilling, D.G. 1998. PCA alien plant working group: cogon grass. <http://www.nps.gov/plants/alien/fact/imcyl.htm> (Accessed 29 July 2006).
- Jubinsky, G., and Anderson, L.C.. 1996. The invasive potential of Chinese tallow-tree (*Sapium sebiferum* Roxb.) in the Southeast. *Castanea*. 61(3): 226-231.
- Kay, S.H. 1992. Hydrilla: a rapidly spreading aquatic weed in North Carolina. North Carolina Cooperative Extension Service, North Carolina State University, Pub. AG-449, 11 pp.
- Koehn, R.K. 1965. Development and ecological significance of nuptial tubercles of the red shiner, *Notropis Lutrensis*. *Copeia*. 1965(4): 462-467.
- Kolar, C.S., Chapman, D.C., Courtenay, W.R., Jr., Housel, C.M., Williams, J.D. and Jennings, D.P. 2005. Asian Carps of the Genus *Hypophthalmichthys* (Pisces, Cyprinidae) A biological Synopsis and Environmental Risk Assessment. Report to U.S. Fish and Wildlife Service per Interagency Agreement 94400-3-0128.
- Kovalak, W.P., Longton, G.D. and Smithee, D. 1993. Infestation Of Power Plant Water Systems By The Zebra Mussel (*Dreissena polymorpha* Pallas) In: *Zebra Mussels: Biology, Impacts, and Control*. pp. 359-380. (T.F. Nalepa and D.W. Schloesser Eds). Lewis Publishers, Boca Raton, Fla.

- Lachner, E.A., Robins, C.R. and Courtenay, W.R., Jr. 1970. Exotic fishes and other aquatic organisms introduced into North America. *Smithsonian Contributions to Zoology*. 59: 1-29.
- Laird, C.A. and Page, L.M. 1996. Non-native fishes inhabiting the streams and lakes of Illinois. *Illinois Natural History Survey Bulletin*. 35(1): 1-51.
- Landolt, E. 1986. The family of Lemnaceae – a monographic study. Vol 1. In: *Biosystematic Investigations in the Family of Duckweed (Lemnaceae)*. Veroff. Geobot. Inst. ETH, Stiftung Rubel. No. 71.
- Lard, C.F., C. Hall and V. Salin. 2001. The economic impact of the red imported fire ant on the homescape, landscape, and urbanscape of selected metroplexes in Texas. Department of Economics, Texas A&M University, College Station, Tx.
- Larson, R.J. and Arneson, A.C. 1990. Two medusae new to the coast of California: *Carybdea marsupialis* (Linnaeus, 1758), a cubomedusa and *Phyllorhiza punctata* (von Ledenfeld, 1884), a rhizostome scyphomedusa. *Bulletin of the Southern California Academy of Sciences*. 89(3): 130-136.
- Lavoie, D.M., Smith, L.D and Ruiz, G.M. 1999. The potential for intracoastal transfer of nonindigenous species in the ballast water of ships. *Estuarine, Coastal and Shelf Science*. 48: 551-654.
- Laycock, G. 1984. Hogs in the hills. *Audubon*. 86(5): 32-35.
- LDWF, Louisiana Department of Wildlife and Fisheries. no date. <http://www.nutria.com/>. Retrieved 7 August 2006
- Le Page, W.L. 1993. The Impact of *Dreissena polymorpha* on Water Works Operations At Monroe Michigan: A Case History. In: *Zebra Mussels: Biology, Impacts, and Control*. pp. 333-358. T.F. Nalepa and D.W. Schloesser Eds). Lewis Publishers, Boca Raton, Fla.
- Li, S. and Fang, F. 1990. On the geographical distribution of the four kinds of pond-cultured carps in China. *Acta Zoologica Sinica*. 36(3): 244-250.
- LMRCC, Lower Mississippi River Conservation Committee. 1994. Black carp escape to Missouri waters. *Newsletter* 1(1) (June): 11.
- Lockley, T.C. 1996. Imported fire ants. Imported Fire Ant Station, USDA/APHIS/PPQ. University of Minnesota. <http://ipmworld.umn.edu/chapters/lockley.htm> [Accessed 04 May 2005].
- Lodge, D.M., Kershner, M.W., Aloj, J.E. and Covich, A.P. 1994. Effects of an omnivorous crayfish (*Orconectes rusticus*) on a freshwater littoral food web. *Ecology*. 75(5): 1265-1281.
- Lowery, G.H. Jr. 1974. *The Mammals of Louisiana and its Adjacent Waters*. Louisiana State University Press. 565 pp.
- Maceina, M.J. and Slipke, J.W. 2004. The influence of river connectivity and sedimentation on fish populations characteristics in Demopolis Reservoir, Alabama. Final Report. Alabama Department of Conservation and Natural Resources, F-40, Study 50.

- Mackie, G. L., Gibbons, W.N., Muncaster, B.W. and Gray, I.M. 1989. The Zebra Mussel, *Dreissena polymorpha*: A Synthesis of European Experiences and a Preview for North America. Toronto: Queens Printer for Ontario.
- Madeira, P.T., Jacono, C.C. and Van, T.K. 2000. Monitoring hydrilla using two RAPD procedures and the Nonindigenous Aquatic Species Database. *J. Aquat. Plant Management*. 38: 33-40.
- Marks M., Lapin, B. and Randall J. 1993. Element Stewardship Abstract for *Phragmites australis*. The Nature Conservancy.
- Masser, M.P. and Rouse, D. 1997. Australian Red Claw Crayfish. SRAC Publication No. 244
- McMahon R.F. 1990. The zebra mussel: U.S. utility implications. Research Project 1689-24. EPRI GS-6995. Electric Power Research Institute, Palo Alto, California.
- McMahon, R.F. 1992. The zebra mussel – the biological basis of its macrofouling and potential for distribution in North America. In: Corrosion '92: Proceedings Of The 47th Nace Annual Conference, pp. 342-1 - 342-14. National Association of Corrosion Engineers, Houston, Tx.
- Mendoza, R. 2001. Examples from aquaculture in Mexico. In: Preventing the Introduction and Spread of Aquatic Invasive Species in North America: Workshop Proceedings. Commission for Environmental Cooperation of North America. Montréal (Québec) Canada.
- Mettee, M.F., O'Neil, P.E. and Pierson, J.M. 1996. Fishes of Alabama and the Mobile Basin. Oxmoor House, Inc. Birmingham, AL. 820 pp.
- Mickle, J.T. and Beitel, J.M. 1988. Pteridophyte flora of Oaxaca, Mexico. *Mem. New York Bot. Gard.* 46: 328-329.
- Miller, J.H. 2003. Non-native Invasive Plants of Southern Forests: a Field Guide for Identification and control.. Gen. Tech. Rep. SRS – 62. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 93 pp.
- Minchin, D. and Gollasch, S. 2002. Vectors: how exotics get around. In: *Invasive Species of Europe-Distribution, Impact and Management*. (E. Leppakoski, S. Gollash & S. Olenin, ed.), Kluwer Academic Publishing, Dordrecht, 183-192.
- Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix. pp. 160-162.
- Minckley, W. L. and Deacon, J.E. 1968. Southwestern fishes and the enigma of "endangered species". Man's invasion of deserts creates problems for native animals, especially for freshwater fishes. *Science*. (1968) 29;159(822): 1424-32.
- Mitchell, D.S., Petr, T. and Viner, A.B. 1980. The water fern *Salvinia molesta* in the Sepik River, Papua New Guinea. *Environmental Conservation*. 7: 115-122.
- Montz, G.N. 1989. Distribution of *Salvinia minima* in Louisiana. In: Proceedings of the twenty-third annual meeting, Aquatic Plant Control Research Program. Misc. Paper A-89-1. U.S. Army Corps of Engineers, Vicksburg, Mississippi. pp. 312-316.

Moore, R.H., R.A. Garrett, and P.J. Wingate. 1976. Occurrence of the red shiner, *Notropis lutrensis*, in North Carolina: a probable aquarium release. *Transactions of the American Fisheries Society*. 102(2): 220-221.

MSU, Mississippi State University. 2004. Fact sheet, Fireants. MSU Coordinated Access to the Research and Extension System. <http://msucares.com/insects/fireants/index.html> (Accessed 24 April 2007).

NBII, National Biological Information Infrastructure, Invasive Species Specialist Group (ISSG) <http://www.issg.org/database/species/ecology.asp?si=401&fr=1&sts=> (Accessed 30 July 2006).

NOAA, National Oceanographic and Atmospheric Administration Fisheries – National Marine Fisheries Service. 2004. <http://www.st.nmfs.gov/> (Retrieved 6 August 2006).

NatureServe Explorer: An online encyclopedia of life [web application]. 2001. Version 1.6. Arlington, VA, USA: NatureServe. Available: <http://www.natureserve.org/explorer>.

Nico, L. 2006a. *Oreochromis aureus*. USGS Nonindigenous Aquatic Species Database, Gainesville, Fla. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=463> revision Date: 4/20/2006.

Nico, L.G. 2006b. *Hypophthalmichthys molitrix*. USGS Nonindigenous Aquatic Species Database, Gainesville, Fla. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=549>.

Nico, L. and Fuller, P. 2006a. *Mylopharyngodon piceus*. USGS Nonindigenous Aquatic Species Database, Gainesville, Fla.

Nico, L. and Fuller, P. 2006b. *Mylopharyngodon piceus*. USGS Nonindigenous Aquatic Species Database, Gainesville, Fla. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=573> Revision Date: 4/19/2006.

Nico, L. and Fuller, P. 2006c. *Cyprinella lutrensis*. USGS Nonindigenous Aquatic Species Database, Gainesville, Fla. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=518> Revision Date: 4/11/2006.

Nico, L., Fuller, P. and Jacobs, G. 2006a. *Scardinius erythrophthalmus*. USGS Nonindigenous Aquatic Species Database, Gainesville, Fla. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=648> Revision Date: 4/21/2006.

Nico, L., Fuller, P. and Schofield, P.J. 2006b. *Ctenopharyngodon idella*. USGS Nonindigenous Aquatic Species Database, Gainesville, Fla. <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=514> Revision Date: 2/2/2006

Nico, L.G., and Williams, J.D. 1996. Risk assessment on black carp (Pisces: Cyprinidae). Final Report to the Risk Assessment and Management Committee of the Aquatic Nuisance Species Task Force. U.S. Geological Survey, Biological Resources Division, Gainesville, FL. 61 pp.

Nico, L.G., Williams, J.D. and Jelks, H.L. 2005. Black carp: biological synopsis and risk assessment of an introduced fish. American Fisheries Society Special Publication 32, Bethesda, Md.

Nowak, R.M. 1991. *Walker's Mammals of the World*. The John Hopkins University Press, Baltimore. 1629 pp.

Olsen, T.M, Lodge, D.M., Capelli, G.M. and Houlihan, R.J. 1991. Mechanisms of impact of an introduced crayfish (*Orconectes rusticus*) on littoral congeners, snails, and macrophytes. *Canadian Journal of Fisheries and Aquatic Sciences*. 48 (10): 1853-1861.

- O'Neil, T. and Linscombe, G. 1977. The Fur Animals, The Alligator, and The Fur Industry in Louisiana. Louisiana Department of Wildlife and Fisheries. Wildlife Education Bulletin No. 109. 68 pp.
- O'Neill, C.R., Jr. and Dextrase, A. 1994. The introduction and spread of the zebra mussel in North America. In: Proceedings: Fourth International Zebra Mussel Conference. pp. 433-446. (A.H. Miller Ed.). Wisconsin Sea Grant Institute, Madison, WI.
- Onuf, C.P. 1996. Biomass patterns in seagrass meadows of the Laguna Madre, Texas. *Bulletin of Marine Science*. 58(2): 404-420.
- Outdoor Alabama. 2006. <http://www.outdooralabama.com/fishing/freshwater/fish/carp/asian.cfm>.
- Owens, R. W., O'Gorman, R., Mills, E.L. Rudstam, L.G., Hasse, J.J., Kulik, B.H. and MacNeill, D.R. 1998. Blueback herring (*Alosa aestivalis*) in Lake Ontario: First record, entry route, and colonization potential. *Journal of Great Lakes Research*. 24(3): 723-730.
- Page, L.M. and Burr, B.M. 1991. A Field Guide to Freshwater Fishes of North America North of Mexico. The Peterson Field Guide Series, volume 42. Houghton Mifflin Company, Boston, Mass.
- Perry, H. and Yeager, D. 2007 Invertebrate Invaders: Established and Potential Exotics Gulf of Mexico Region. Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, Ms.
- Perry, H.M., Van Devender, T., Graham, W., Johnson, D., Larsen, K., Burke, W.D. and Trigg, C. 2000. Diaphanous denizens from down under: first occurrence of *Phyllorhiza punctata* in Mississippi coastal waters. Gulf and Caribbean Fisheries Institute Annual Meeting, Biloxi, Mississippi. November 6-10, 2000.
- Pesacreta, G. 1988. Water Chemistry from North Carolina Piedmont Impoundments with *Hydrilla* (*Hydrilla verticillata* (L.f.) Royle). Ph.D. dissertation, North Carolina State University, Raleigh, NC.
- Pflieger, W.L. 1975. The Fishes of Missouri. Missouri Department of Conservation. 343 pp.
- Pflieger, W.L. 1997. The Fishes of Missouri. Missouri Department of Conservation, Jefferson City, MO. 372 pp.
- Pimentel, D., Lach, L., Zuniga, R. and Morrison, D. 2000. Environmental and economic costs of nonindigenous species in the United States. *BioScience*. 50(1): 53-65.
- PNNL, Pacific Northwest National Laboratory. 2005. <http://www.in.gov/dnr/invasivespecies/Asiatic%20Clam.pdf>.
- Quammen, M.L. and Onuf, C.P. 1993. Laguna Madre: seagrass changes continue decades after salinity reduction. *Estuaries*. 16:303-311.
- Rabern, D.A. 2002. Georgia's blueback herring invasion and management strategy. Abstract, 132nd American Fisheries Society Annual Meeting, August 22, 2002, Baltimore, Md.
- Ram, J. L., Fong, P.P., Croll, R.P., Nichols, J.S. and Wall, D.M. 1992. The zebra mussel (*Dreissena polymorpha*), a new pest in North America: reproductive mechanisms as possible targets of control strategies. *Invert. Rep. Dev.* 22: 77-86.



- Ram, J.L. and McMahon, R.F. 1996. Introduction: the biology, ecology and physiology of zebra mussels. *American Zoologist*. 36(3): 239-243.
- Rasmussen, J.L. 1998. Aquatic nuisance species of the Mississippi River basin. 60th Midwest Fish and Wildlife conference, Aquatic Nuisance Species Symposium, Dec. 7, 1998, Cincinnati, Ohio.
- Reimer, D.N. 1973. Effects of rate, spray volume, and surfactant on the control of *Phragmites* with glyphosate. *Proceedings of the Northeast Weed Science Society* 27: 101-104.
- Remaley, T. 2006. PCA Alien Plant working group. <http://www.nps.gov/plants/alien/fact/mysp1.html>
- Rivers, L. 2002. Water Lettuce (*Pistia stratiotes*). University of Florida and Sea Grant.
- Rizzo, W.M., Boustany, R.G. and Meaux, D.R. 1996. Ecosystem changes in a subtropical Louisiana lake due to invasion by *Hydrilla*. Abstract in : From Small Streams to Big Rivers, Society of Wetland Scientists 17th Annual Meeting, June 9-14, 1996, Kansas City, Mo.
- Robison, H.W., and Buchanan, T.M. 1988. *Fishes of Arkansas*. University of Arkansas Press, Fayetteville, Ark.
- Roman, C.T., Niering, W.A. and Warren, R.S. 1984. Salt marsh vegetation change in response to tidal restriction. *Environmental Management*. 8: 141-150.
- Saltonstall, K. 2002. Cryptic invasion by a non-native genotype of *Phragmites australis* into North America. *Proceedings of the National Academy of Sciences, USA*. 99(4): 2445-2449.
- Schloesser, D.W. 1995. Introduced species, zebra mussels in North America. In: *Encyclopedia of Environmental Biology*. pp. 337-356. Academic Press, Inc., San Diego, Calif.
- Schmitz, D.C., Nelson, B.V., Nall, L.E. and Schardt, J.D. 1991. Exotic aquatic plants in Florida: a historical perspective and review of the present aquatic plant regulation program. *Proceedings of the Symposium on Exotic Pest Plants*, Univ. Miami, Nov. 2-4, 1988, Miami, Fla.
- Schmitz, D.C. and Osborne, J.A. 1984. Zooplankton densities in a *Hydrilla* infested lake. *Hydrobiologia*. 111: 127-132.
- Schmitz, D.C., Schardt, J.D., Leslie, S.J., Dray Jr., F.A., Osborne, J.A. and Nelson, B.V. 1993. The ecological impact and management history of three invasive alien aquatic plant species in Florida. In: *Biological Pollution: the Control and Impact of Invasive Exotic Species*. McKnight, B.N. (ed). Indiana Academy of Science. Indianapolis, In.
- Schofield, P.J., Williams, J.D., Nico, L.G., Fuller, P. and Thomas, M.R., 2005, *Foreign Nonindigenous Carps and Minnows (Cyprinidae) in the United States – A Guide to Their Identification, Distribution, and Biology*. U.S. Geological Survey Scientific Investigations Report 2005-5041, 103 p. [http://fisc.er.usgs.gov/Carp\\_ID/html/contents.html](http://fisc.er.usgs.gov/Carp_ID/html/contents.html) (Accessed 24 April 2007)
- Schrank, S.J., Guy, C.S. and Fairchild, J.F. 2003. Competitive Interactions between Age-0 bighead carp and paddlefish. *Transactions of the American Fisheries Society*. 132(6): 1222-1228.
- Sculthorpe, C.D. 1985. *The Biology of Aquatic Vascular Plants*. Koeltz Scientific Books, Königstein, West Germany.

- Shafland, P.L. 1996. Exotic Fishes of Florida-1994. *Reviews in Fisheries Science*. 4(2): 101-122.
- Shireman, J.V. and Smith, C.R. 1983. Synopsis of biological data on the grass carp *Ctenopharyngodon idella* (Cuvier and Valenciennes, 1844). *FAO Fisheries Synopsis No. 135*. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. 86 pp.
- Siemann, E. and Rogers, W.E. 2003. Reduced resistance of invasive varieties of the alien tree *Sapium sebiferum* to a generalist herbivore. *Oecologia*. 135(3): 451-457.
- Silveira, F.L. and Cornelius, P.F.S. 2000. New observations on medusae (Cnidaria, Scyphozoa, Rhizostomae) from the northeast and south Brazil. *Acta Biologica Leopoldensia*. 22: 9-18.
- Simberloff, D., Schmitz, D.C. and Brown, T.C. 1997. *Strangers in Paradise: Impact and Management of Nonindigenous Species in Florida*. Island Press.
- Singer, F.J., Swank, W.T. and Clebsch, E.E.C. 1984. Effects of wild pig rooting in a deciduous forest. *Journal of Wildlife Management*. 48(2): 464-473.
- Skelton, P.H. 1993. *A Complete Guide to the Freshwater Fishes of Southern Africa*. Southern Book Publishers, Halfway House, South Africa.
- Smayda, T.J. 1990. Novel and nuisance phytoplankton blooms in the sea: evidence for a global epidemic. In: *Toxic Marine Phytoplankton*. Graneli, E. et al. (Eds.) Elsevier Science Publishing Co., Inc.
- Smirnova, N.F., Biochino, G.I. and Vinogradov, G.A. 1993. Some aspects of the zebra mussel (*Dreissena polymorpha*) in the former European USSR with morphological comparisons to Lake Erie. In: *Zebra Mussels: Biology, Impacts, And Control*. (Nalepa, T.F. and Schloesser, D., eds.), Lewis Publishers, Boca Raton, FL, Pp. 217-226.
- Smith, C.L. 1985. *The Inland Fishes of New York State*. New York State Department of Environmental Conservation, Albany, NY. 522 pp.
- SRAC, Southern Regional Aquaculture Center. Stone, N. and Thomforde, H. 2001. Common farm-raised bait fish. SRAC Publication No. 120.
- Stanczykowska, A. 1977. Ecology of *Dreissena polymorpha* (Pallas) (*Bivalvia*) in lakes. *Polish Archives of Hydrobiology*. 24: 461-530.
- Stein, B.A., Kutner, L.S. and Adams, J.S. 2000. *Precious Heritage: The Status of Biodiversity in the United States*. The Nature Conservancy & Assoc. for Biodiversity Info. Oxford University Press.
- Strayer, D.L., Hunter, D.C., Smith, L.C. & Borg, C.K. 1994. Distribution, abundance, and roles of freshwater clams (*Bivalvia*, *Unionidae*) in the freshwater tidal Hudson River. *Freshwater Biol*. 31: 239-248.
- Tabor, P. 1949. Cogon grass, *Imperata cylindrical*(L.) Beauv., in the Southeastern United States. *Agron.J.* 41:270.
- TAMU, Texas A&M University. 2007. Texas Imported Fire Ant Research and Management Project from <http://fire-ant.tamu.edu/antfacts/biology.cfm>.

- Taylor, C.A. and Redmer, M. 1996. Dispersal of the crayfish *Orconectes rusticus* in Illinois, with notes on species displacement and habitat preference. *Journal of Crustacean Biology*. 16(3): 547-551.
- Taylor, J. and Mahon, R. 1977. Hybridization Of *Cyprinus carpio* and *Carassius auratus*, The First Two Exotic Species In The Lower Laurentian Great Lakes. *Environmental Biology of Fishes* 1(2): 205-208.
- Thompson, F.G. 1997. *Pomacea canaliculata* (Lamarck, 1822) (Gastropoda, Prosobranchia, Pilidae): a freshwater snail introduced into Florida, U.S.A. *Malacological Review*. 30: 91.
- Tisdell, C.A. 1982. *Wild Pigs: Environmental Pest or Economic Resource?* Pergamon Press, Sydney.
- Trewavas, E. 1983. *Tilapia Fishes of the Genera Sarotherodon, Oreochromis and Danakilia*. Cornell University Press, Ithaca, NY.
- Trillin, C. 1995. The nutria problem. *Atlantic Monthly*. 275(2): 30-32, 40-42.
- Tucker, J.K., Theiling, C.H., Blodgett, K.D. and Theil, P.A. 1993. Initial occurrence of zebra mussels (*Dreissena polymorpha*) on freshwater mussels (Family Unionidae) in the upper Mississippi River system. *J. Freshwater Ecol.* 8: 245-251.
- TVA, Tennessee Valley Authority. 1993. Supplemental Environmental Impact Statement for the TVA Aquatic Plant Management Program. Volume I. TVA/WM-93/8. Knoxville, Tenn.
- UC, University of California. 2005. UC Pest Management Guidelines: Red Imported Fire Ant, Statewide IPM Program, The Regents of the University of California from <http://www.ipm.ucdavis.edu/PMG/r785301611.html>.
- Uchytel R.J. 1992. *SPECIES: Phragmites australis* U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory.
- USCG, United States Coast Guard. 2004. Mandatory Ballast Water Management Program for U.S. Waters. Final Rule by the Department of Homeland Security. 69 Federal Register 44952, pp. 44953, 44961.
- United States Congress, Office of Technology Assessment (OTA). 1993. *Harmful Nonindigenous Species in the United States*. U.S. Government Printing Office, Washington, D.C.
- USDA, United States Department of Agriculture – NASS. 2005. Retrieved 6 August 2006 from <http://www.nass.usda.gov/>.
- USDA, United States Department of Agriculture – NRCS, 2001. <http://www.invasive.org/browse/subject.cfm?sub=2433> (Retrieved December 2006).
- USDA, United States Department of Agriculture – NRCS. 2006. The PLANTS Database <http://plants.usda.gov> (Accessed 7 August 2006). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
- USFWS, United States Fish and Wildlife Service and Department of Commerce & U.S. Census Bureau. 2001. *National Survey of Fishing, Hunting and Wildlife-Associated Recreation*. United States Department of the Interior.

- University of Tennessee. 2004. Imported Fire Ant Identification: Three Types of Imported Fire Ants. Agricultural Extension Service. Summary: Available from: <http://fireants.utk.edu/Webpages/ldpage.htm> (Accessed 04 May 2005)
- van Dijk, G. 1985. Vallisneria and its interactions with other species. *Aquatics*. 7(3): 6-10.
- Van Driesche, J. and Van Driesche, R. 2000. *Nature Out of Place: Biological Invasions in the Global Age*. Island Press.
- Vinson, S. B. and Sorenson, A. Imported Fire Ants: Life History and Impact, Texas Department of Agriculture, Austin, Tx, 1986.
- Wallace, R.K., Jr., and Ramsey, J.S. 1982. A new cyprinid hybrid, *Notropis lutrensis* x *N. callitaenia*, from the Apalachicola drainage in Alabama. *Copeia*. 1982: 214-217.
- Weatherby, C.A. 1921. Other records of *Salvinia natans* in the United States. *Amer. Fern J.* 11: 50-53.
- Weatherby, C.A. 1937. A further note on *Salvinia*. *Amer. Fer. J.* 27: 98-102.
- Wehr, J.D. and Sheath, R.G. 2003. *Freshwater Algae of North America*. Academic Press, New York.
- Wentz, W.A. and Stuckey R.L. 1971. The changing distribution of the genus *Najas* (Najadaceae) in Ohio. *Ohio Journal of Science*. 71: 292-302.
- Whitaker, J.O., Jr. 1988. *The Audubon Society Field Guide to North American Mammals*. Alfred A. Knopf, Inc. New York. 745 pp.
- Whitehead, P.J.P. 1985. *FAO species catalogue*. Vol. 7. Clupeoid fishes of the world (suborder Clupeoidei). An annotated and illustrated catalogue of the herrings, sardines, pilchards, sprats, shads, anchovies and wolf-herrings.. Part 1 – Chirocentridae, Clupeidae and Pristigasteridae. *FAO Fish. Synop.* 125(7/1): 1-303.
- Williams, J.D., and Meffe, G.K. (1999). Nonindigenous species. *Status and Trends of the Nation's Biological Resources*. United States Geological Survey. Available online at <http://biology.usgs.gov/s+t/SNT/index.htm>.
- Wolfe, J.L. 1981. Nutria: Our newest furbearer. *Mississippi Outdoors*. 44(5):9.
- Woods, C. A., Contreras, L., Willner-Chapman, G. and Whidden, H.P. 1992. *Myocastor coypus*. *Mammalian Species*. 398:1-8.
- Yin, Q., Carmichael, W.W. and Evans, W.R. 1997. Factors influencing growth and toxicity of the freshwater cyanobacterium *Lyngbya wollei* Farlow ex Gomont. *Journal of Applied Phycology*. 9:55-63.
- Zale, A.V. and Gregory, R.W. 1990. Food selection by early life stages of blue tilapia, *Oreochromis Aureus*, in Lake George, Florida: overlap with sympatric shad larvae. *Florida Scientist*. 53(2): 123-129.
- Zolczynski J. and Eubanks, M.J. 1990. Mobile Delta submersed aquatic vegetation survey, 1987. Alabama Department of Natural Resources, Aquatic Plant Control Program, Spanish Fort, Alabama and U.S. Army Corps of Engineers, Environment and Resources Branch, Mobile.

## 12. APPENDICES

### 12.A. Appendix A. ANS found in Alabama.

TAXA	GENUS	SPECIES	COMMON NAME
algae	<i>Lyngbya</i>	spp.	Blue-Green Algae
amphibians	<i>Eleutherodactylus</i>	<i>planirostris</i>	Greenhouse Frog
crustacean	<i>Cherax</i>	spp.	Australian Crayfish
crustacean	<i>Cherax</i>	<i>quadricarinatus</i>	Red Claw Crayfish
crustacean	<i>Lordocythere</i>	<i>petersi</i>	Cumberland Cryafish
crustacean	<i>Orconectes</i>	<i>rusticus</i>	Rusty Crayfish
crustacean	<i>Orconectes</i>	<i>virile</i>	Virile Crayfish
crustacean	<i>Procambarus</i>	<i>acutus</i>	White River Crayfish
fish	<i>Alosa</i>	<i>aestivalis</i>	Blueback Herring
fish	<i>Alosa</i>	<i>pseudoharengus</i>	alewife
fish	<i>Ameiurus</i>	<i>catus</i>	White Catfish
fish	<i>Carassius</i>	<i>auratus</i>	Goldfish
fish	<i>Colossoma</i>	<i>macropomum</i>	Red-Bellied Pacu
fish	<i>Ctenopharyngodon</i>	<i>idella</i>	Grass Carp
fish	<i>Culaea</i>	<i>inconstans</i>	brook stickleback
fish	<i>Cyprinella</i>	<i>lutrensis</i>	Red Shiner
fish	<i>Cyprinus</i>	<i>carpio</i>	Common Carp
fish	<i>Gambusia</i>	<i>holbrooki</i>	Eastern Mosquitofish
fish	<i>Gambusia</i>	<i>affinis</i>	Western Mosquitofish
fish	<i>Hypophthalmichthys</i>	<i>nobilis</i>	Bighead Carp
fish	<i>Hypophthalmichthys</i>	<i>molitrix</i>	Silver Carp
fish	<i>Hypophthalmichthys</i>	<i>molitrix x nobilis</i>	Bighead x Silver Carp
fish	<i>Ichthyomyzon</i>	<i>bdellium</i>	Ohio Lamprey
fish	<i>Lepomis</i>	<i>auritus</i>	Redbreast Sunfish
fish	<i>Morone</i>	<i>chrysops</i>	White Bass
fish	<i>Morone</i>	<i>chrysops x saxatilis</i>	Palmetto Bass
fish	<i>Noturus</i>	<i>insignis</i>	marginated madtom
fish	<i>Oreochromis</i>	<i>aureus</i>	Blue Tilapia
fish	<i>Oreochromis</i>	<i>niloticus</i>	Nile Tilapia
fish	<i>Oreochromis</i>	<i>mossambicus</i>	Mozambique Tilapia
fish	<i>Oncorhynchus</i>	<i>mykiss</i>	Rainbow Trout
fish	<i>Perca</i>	<i>flavescens</i>	Yellow Perch
fish	<i>Pimephales</i>	<i>promelas</i>	fathead minnow
fish	<i>Salmo</i>	<i>trutta</i>	Brown Trout
fish	<i>Salvelinus</i>	<i>fontinalis</i>	Brook Trout
fish	<i>Scardinius</i>	<i>erythrophthalmus</i>	Rudd
fish	<i>Tilapia</i>	<i>zillii</i>	Redbelly Tilapia
fish	<i>Tinca</i>	<i>tinca</i>	Tench
mammal	<i>Myocastor</i>	<i>coypus</i>	Nutria
mussel	<i>Corbicula</i>	<i>fluminea</i>	Asian Clam
mussel	<i>Dreissena</i>	<i>polymorpha</i>	Zebra Mussel
snail	<i>Pomacea</i>	spp.	Apple Snails
snail	<i>Viviparus</i>	<i>malleatus</i>	Chinese Mystery Snail
plant	<i>Alternanthera</i>	<i>philoxeroides</i>	Alligatorweed
plant	<i>Cabomba</i>	<i>pulcherrima</i>	Purple Cabomba
plant	<i>Colocasia</i>	<i>esculenta</i>	Wild Taro
plant	<i>Egeria</i>	<i>densa</i>	Brazilian Elodea
plant	<i>Eichhornia</i>	<i>crassipes</i>	Water Hyacinth
plant	<i>Hydrilla</i>	<i>verticillata</i>	Hydrilla



# AQUATIC NUISANCE SPECIES

plant	<i>Landoltia</i>	<i>puntata</i>	Dotted Duckweed
plant	<i>Ludwigia</i>	<i>grandiflora</i> spp.	Uruguayan Waterprimrose
plant	<i>Ludwigia</i>	<i>peploides</i>	Creeping Waterprimrose
plant	<i>Myriophyllum</i>	<i>aquaticum</i>	Parrotfeather
plant	<i>Myriophyllum</i>	<i>spicatum</i>	Eurasian Watermilfoil
plant	<i>Najas</i>	<i>minor</i>	Brittle Naiad
plant	<i>Nelumbo</i>	<i>nucifera</i>	Sacred Lotus
plant	<i>Neobeckia</i>	<i>aquatica</i>	hyek watercress
plant	<i>Nymphoides</i>	<i>peltata</i>	Yellow Floating Heart
plant	<i>Oxycaryum</i>	<i>cubense</i>	Cuban Bulrush
plant	<i>Panicum</i>	<i>repens</i>	Torpedo Grass
plant	<i>Phalaris</i>	<i>arundinacea</i>	Redd Canary Grass
plant	<i>Phragmites</i>	<i>australis</i>	Common Reed
plant	<i>Pistia</i>	<i>stratoides</i>	Watter Lettuce
plant	<i>Potamogeton</i>	<i>crispus</i>	Curlyleaf Pondweed
plant	<i>Sagittaria</i>	<i>sagittifolia</i>	Arrowhead
plant	<i>Salvinia</i>	<i>minima</i>	Common Salvinia
plant	<i>Salvinia</i>	<i>molesta</i>	Giant Salvinia
plant	<i>Triadica</i>	<i>sebifera</i>	Chinese Tallow Tree
plant	<i>Typha</i>	spp.	Cattails
reptile	<i>Trachemys</i>	<i>scripta elegans</i>	Red-Ear Slider
virus			Largemouth Bass Virus
virus			Spring Viremia of Carp Virus
virus	<i>Flavivirus</i>	spp.	West Nile Virus
zooplankton	<i>Daphnia</i>	<i>lumholtzi</i>	Waterflea

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## **12.C Appendix C. Alabama state laws, programs and regulations relevant to ANS**

### **12.C.1 Overview**

Alabama maintains a list of noxious weeds, a list of prohibited nonindigenous aquatic plants, and a list of birds, fish, and animals whose sale, possession, importation, and release are prohibited. Alabama has no formal pest survey program. Alabama regulates plants, invertebrates, wildlife, fungi, and insects.

### **12.C.2 Invasive Species Councils and Plans**

Alabama does not have a statewide invasive species council or plan for addressing invasive species in the state.

### **12.C.3 Relevant Authorities**

#### **12.C.3a Wildlife**

##### **12.C.3a(1) General Authority**

In Alabama, there is a list of birds and animals whose sale, possession, importation, and release is prohibited.<sup>1</sup> The Commissioner of the Department of Conservation and Natural Resources may prohibit an importation when the importation would not be in the best interest of Alabama.<sup>2</sup> These prohibitions do not apply to animals used for display in carnivals, zoos, circuses, and other like shows where provisions are made so that the animals will not escape or be released into Alabama.<sup>3</sup> No animal that is infected with any infectious or transmissible disease may be imported without written permission from the state veterinarian.<sup>4</sup> Animals infected with a disease that is likely to become a menace to public health are declared to be public nuisances per se.<sup>5</sup> When the diseased animals, in the opinion of the county board of health, should be abated by destruction rather than disinfecting, the board will order their summary destruction.<sup>6</sup> Wild and semi-wild animals under domestication or in custody may be imported, provided that a report of the number of animals is made to the state veterinarian and that an immediate opportunity for examination is afforded.<sup>7</sup> English sparrows, crows, and starlings are not protected by the game laws and may be killed at any time.<sup>8</sup> The Commissioner of Conservation and Natural Resources may introduce desirable species of game and birds.<sup>9</sup> A violation is a misdemeanor.<sup>10</sup> Unlawful importation is punishable by a fine of between \$50 and \$250.<sup>11</sup>

##### **12.C.3a(2) Falconry**

The Department of Conservation and Natural Resources regulates falconry.<sup>12</sup> A permit is required for any person to take, transport, or possess raptors for falconry purposes, and a federal permit is needed for propagation.<sup>13</sup> The intrastate and interstate trade and transfer of raptors is regulated.<sup>14</sup> Those with permits must file a falconry report each year to the issuing authority.<sup>15</sup> All raptors, except those held for scientific or zoological purposes, must carry markers.<sup>16</sup> A permit holder must obtain written permission from the Department before releasing into the wild any species not indigenous to Alabama.<sup>17</sup> A violation is cause for revocation of permits.<sup>18</sup>

##### **12.C.3a(3) Shooting Preserves**

The operation of a commercial fowl hunting preserve requires a license from the Department.<sup>19</sup> Issuance of a license requires a prior inspection of the tract to be used.<sup>20</sup> The siting of the preserves is regulated, and exterior boundaries must generally be bordered by wire or fencing.<sup>21</sup> Game to be hunted on a preserve may include bobwhite quail, pheasants, chukar partridge, and any other species of fowl the Commissioner of Conservation and Natural Resources designates.<sup>22</sup> Licensed private commercial shooting preserves may, by obtaining a special letter permit from the Commissioner, provide for the hunting of any species of exotic or non-native birds.<sup>23</sup> The department may enter and inspect licensed hunting preserves.<sup>24</sup> Preserve operators must maintain records, which will be subject to inspection by the department at any reasonable time.<sup>25</sup> Bobwhite quail must be tagged prior to release.<sup>26</sup> Violators are subject to revocation of licenses.<sup>27</sup>

##### **12.C.3a(4) Miscellaneous Animals**

The concentration, collection, or assembly of poultry, including waterfowl and wild and exotic birds, at a private or public place, for purposes of sale, is prohibited.<sup>28</sup>

## 12.C.3b. Aquatic Life

### 12.C.3b(1) General Authority

In Alabama, there is a list of fish whose sale, possession, importation, and release is prohibited.<sup>29</sup> The Commissioner of Conservation and Natural Resources may prohibit an importation when the importation would not be in the best interest of Alabama.<sup>30</sup> The sale, transportation, or importation of game fish is unlawful, subject to certain exceptions.<sup>31</sup> The Commissioner of Conservation and Natural Resources may introduce desirable species of fish.<sup>32</sup> Fish infected with a disease that are likely to become a menace to public health are declared to be public nuisances per se.<sup>33</sup> When the diseased fish, in the opinion of the county board of health, should be abated by destruction rather than disinfecting, the board will order their summary destruction.<sup>34</sup> A violation is a misdemeanor.<sup>35</sup>

### 12.C.3b(2) Fee Fishing

The operation of a commercial fee fishing pond requires a letter permit and compliance with the laws relating to the importation and control of exotic fish species.<sup>36</sup>

### 12.C.3b(3) Aquatic Plants

There is a list of prohibited nonindigenous aquatic plants compiled by the Department of Conservation and Natural Resources.<sup>37</sup> It is unlawful to introduce any nonindigenous aquatic plant into any public waters.<sup>38</sup> The unintentional adherence to a boat or boat trailer of a nonindigenous aquatic plant and its subsequent unintentional transportation or dispersal through ordinary activities does not constitute a violation.<sup>39</sup> Possession of prohibited aquatic plants through natural dispersion, where such possession poses neither danger nor intent to disperse, is not a violation.<sup>40</sup> A violation is a Class C misdemeanor.<sup>41</sup>

### The plants are:

#### COMMON NAME

- African elodea
- alligatorweed
- Brazilian elodea
- curlyleaf pondweed
- Eurasian watermilfoil
- floating waterhyacinth
- giant salvinia
- hydrilla
- hygrophila
- limnophila
- parrot-feather
- purple loosestrife
- rooted waterhyacinth
- spinyleaf naiad
- water-aloe
- waterlettuce
- water chestnut
- water spinach

#### SCIENTIFIC NAME

*Lagarosiphon spp*  
*Alternanthera philoxeroides*  
*Egeria densa*  
*Potamogeton crispus*  
*Myriophyllum spicatum*  
*Eichhornia crassipes*  
*Salvinia molesta*  
*Hydrilla verticillata*  
*Hygrophila polysperma*  
*Limnophila sessiliflora*  
*Myriophyllum aquaticum*  
*Lythrum salicaria*  
*Eichhornia azurea*  
*Najas minor*  
*Stratiotes aloides*  
*Pistia stratiotes*  
*Trapa natans*  
*Ipomea aquatica*

## 12.C.3c. Plants

### 12.C.3c(1) Noxious Weeds

The Commissioner of the Alabama Department of Agriculture and Industries has the duty of protecting the agricultural and horticultural interests of Alabama from noxious weeds and may declare weeds or infested articles a public nuisance.<sup>42</sup> Noxious weeds are plants that may be a serious agricultural threat.<sup>43</sup> Alabama has a list of noxious weeds, which is divided into three classes.<sup>44</sup> Class A weeds include those on the Federal Noxious Weed List, as well as any noxious weed that is not native to Alabama, not currently known to occur in Alabama, and poses a serious threat to Alabama.<sup>45</sup> Class B weeds include those that are not native to Alabama, are of limited distribution statewide, and pose a serious threat to Alabama.<sup>46</sup> Class C weeds include any other designated noxious weeds that pose harm to Alabama's various industries.<sup>47</sup> There is a list of regulated areas and regulated articles.<sup>48</sup> The Board of Agriculture and Industries may designate noxious weeds upon public hearing and determination that doing so is in the best interest of Alabama agriculture.<sup>49</sup> The introduction into Alabama of any noxious weed is prohibited, except under special permit from the Commissioner.<sup>50</sup> The Commissioner may inspect plants, places, or things that may be capable of carrying noxious weeds and may enter any place and open any container thought to contain plants or things capable of carrying weeds and demand full information as to the origin and source of plants or things likely to carry noxious weeds.<sup>51</sup> The Commissioner may treat or destroy plants and other articles capable of harboring noxious weeds if the plants or articles are infested.<sup>52</sup> Quarantine against certain noxious weeds has been established.<sup>53</sup> All weeds growing on streets, sidewalks, or private property in municipalities that are noxious or dangerous may be declared a public nuisance by the governing body and abated.<sup>54</sup> After a public hearing, the municipality is authorized to enter the property to abate the nuisance.<sup>55</sup> Regarding the outside premises of a food storage facility, weeds must be cut or killed.<sup>56</sup> Weeds at solid waste transfer stations and processing facilities must be trimmed regularly.<sup>57</sup> The Legislature may by local act authorize or require the Jefferson County Commission to prohibit the overgrowth of weeds.<sup>58</sup> The Commissioner may inspect plants or things likely to carry noxious weeds being moved or imported, and upon finding infestation or infection, may have the plants or things treated, returned, or destroyed.<sup>59</sup> A certificate or permit must accompany the movement of regulated articles from regulated areas into Alabama, and a certificate or permit must accompany the intrastate movement of regulated articles from a regulated area to a non-regulated area.<sup>60</sup> Certificates may be issued if the articles have not been exposed to infestation, have been examined and found to be free of noxious weeds, have been treated, or have been handled in such a manner that designated noxious weeds would not be transmitted by movement.<sup>61</sup> Limited permits may be issued for the movement of non-certified regulated articles upon a determination that no hazard of spread of noxious weeds exists, and scientific permits may also be issued.<sup>62</sup> As a condition of issuance of certificates or limited permits, an applicant may be required to sign a compliance agreement.<sup>63</sup> It is unlawful to import, sell, or possess fruits, nuts, vegetables, flowers, or plant or plant products that are infested with noxious weeds to an extent that it is likely that serious damage will be caused to susceptible products.<sup>64</sup> The Board may declare a quarantine in reference to noxious weeds.<sup>65</sup> Articles moved in violation of the quarantine will be declared contraband, confiscated, and destroyed.<sup>66</sup> The Federal Noxious Weed Regulations are adopted by reference.<sup>67</sup> A violation is a Class C misdemeanor.<sup>68</sup>

### 12.C.3c(2) Seeds

Noxious weed seed includes prohibited noxious weeds and restricted noxious weeds.<sup>69</sup> The Board of Agriculture and Industries may, upon public hearing and determination that doing so is in the best interest of Alabama agriculture, designate noxious weeds.<sup>70</sup> Sellers and distributors of seed must secure an annual permit from the Commissioner.<sup>71</sup> The Commissioner may inspect and sample seeds to determine that they are in compliance with these laws and may enter any public or private premises during business hours to have access to seeds.<sup>72</sup> The Department's Seed Division will perform seed testing, sampling, and analysis work.<sup>73</sup> Records of the sale, delivery, and distribution of seeds must be maintained and accessible to the department.<sup>74</sup> It is unlawful to sell or distribute any agricultural or vegetable seed containing prohibited noxious weed seeds or restricted noxious weed seeds in excess of limitations prescribed by the board or any seed containing weed seed in excess of two percent of the whole by weight.<sup>75</sup> There is also a list of detailed adulterations and seed mixtures that may not be sold or distributed.<sup>76</sup> Certain restrictions also apply to the sale or distribution of dallisgrass and Johnson grass seed.<sup>77</sup> The Commissioner may issue and enforce stop sale, suspension from sale, and nonuse orders to owners of any lot of seed found to be in violation.<sup>78</sup> Agricultural seed must be labeled with the percentage by weight of all weed seeds and the name and rate of occurrence per

pound of each kind of noxious weed seed.<sup>79</sup> Vegetable seed must be labeled, and if any weed seeds are present a full analysis must be given.<sup>80</sup> Any lot of seed not in compliance with these provisions is subject to suspension from sale, seizure, and condemnation.<sup>81</sup> The Commissioner, with the approval of the board, may promulgate rules to eradicate and prevent the spread of fungus growths and diseases, as well as to remove noxious weeds, from seed and small grain used for planting purposes by cleaning or treating.<sup>82</sup> A violation is a misdemeanor.<sup>83</sup>

### **12.C.3c(3) Feed**

The Commissioner of the Department of Agriculture and Industries administers the commercial feed laws.<sup>84</sup> The manufacture, sale, and distribution of commercial feed requires a license.<sup>85</sup> The Commissioner may enter, during business hours, any establishment or vehicle where commercial feeds are located, and upon refusal of admittance, the Commissioner may seek a warrant from a state court.<sup>86</sup> The Commissioner may also enter any public or private premises, including vehicles, during business hours to obtain samples and examine records.<sup>87</sup> It is unlawful to manufacture or distribute adulterated commercial feed or to adulterate commercial feed.<sup>88</sup> Commercial feed is adulterated if it contains viable weed seeds in amounts exceeding limits established by regulation.<sup>89</sup> All screenings or by-product of grains and seeds containing weed seeds, when used in commercial feed, must be ground or treated to destroy the viability of the weed seeds.<sup>90</sup> The Commissioner may, upon reasonable cause to believe that commercial feed is in violation of the laws, enforce stop sale or suspension from sale orders.<sup>91</sup> Non-complying feed is subject to seizure and condemnation on complaint to a court.<sup>92</sup> A violation is a misdemeanor.<sup>93</sup> Any person selling mill oats, corn, oats, rye, wheat, or barley that has been adulterated by means of the addition of weed seed is guilty of a misdemeanor, and the adulterated product is subject to seizure and confiscation.<sup>94</sup>

### **12.C.3d. Plant Pests and Diseases**

#### **12.C.3d(1) General Authority**

The Commissioner of the Department of Agriculture and Industries has the duty of protecting the agricultural and horticultural interests of Alabama from plant pests and may declare pests or infested articles, a public nuisance.<sup>95</sup> Plant pests include insects, mites, nematodes, slugs, snails, protozoa, or other invertebrate animals, bacteria, fungi, other parasitic plants, or viruses, or any similar organisms, or any infectious substances which can injure plants and which may be a serious agricultural or horticultural threat.<sup>96</sup> The introduction into Alabama of any live plant pest, regulated article, or specimen of plant disease, except under special permit from the Commissioner, is prohibited.<sup>97</sup> The Commissioner may inspect plants, places, or things that may be capable of carrying plant pests and may enter any place and open any container thought to contain plants or other things capable of carrying pests.<sup>98</sup> The Commissioner may treat or destroy plants and other articles capable of harboring plant pests if the plants are infested.<sup>99</sup> The board may declare a quarantine in reference to plant pests or noxious weeds.<sup>100</sup> Articles moved in violation of the quarantine will be declared contraband, confiscated, and destroyed.<sup>101</sup> The Commissioner may inspect plants or things likely to carry plant pests being moved or imported, and upon finding infestation or infection, may have the plants or things treated, returned, or destroyed.<sup>102</sup> It is unlawful to import, sell, or possess fruits, nuts, vegetables, flowers, or plant or plant products that are infested or infected with plant pests to an extent that it is likely that serious damage will be caused to susceptible products.<sup>103</sup> Pursuant to the regulations of the Department of Environmental Management, no person may ignite an open fire except for enumerated reasons, including fires for prevention or control of disease or pests.<sup>104</sup> A violation is a Class C misdemeanor.<sup>105</sup>

#### **12.C.3d(2) Nurseries**

The Commissioner of the Department of Agriculture and Industries may inspect nurseries.<sup>106</sup> Nurserymen and dealers must retain records.<sup>107</sup> The sale or distribution of nursery stock requires a certificate of inspection.<sup>108</sup> The owner of infected or infested plants, plant products, or nursery stock must within 10 days of notice remove and destroy the materials, if the materials are incapable of successful treatment, and upon the owner's failure to do so, the Commissioner may do so.<sup>109</sup> The Commissioner may fumigate or treat infected or infested nursery stock, plants, or plant products.<sup>110</sup> Intrastate and imported shipments of nursery stock may, upon a finding of infestation with a serious plant pest, be returned, treated, or destroyed.<sup>111</sup> Imported stock must be certified as apparently free from plant pests and must carry certificate tags. All plant material entering Alabama must be found apparently free from plant pests upon inspection.<sup>112</sup> All nursery stock moving within or imported into Alabama must bear a tag with a copy of the certificate of



inspection.<sup>113</sup> Common carriers may only move nursery stock and plant products carrying an official state or federal tag.<sup>114</sup> Non-complying materials must be reported and held for inspection.<sup>115</sup> It is unlawful to throw cuttings or prunings from fruit trees, nursery stock, or ornamental trees into public areas or watercourses if these materials contain plant pests or noxious weeds.<sup>116</sup> Aviolation is a Class C misdemeanor.<sup>117</sup>

## **12.C.3d(3) Forests**

The State Forestry Commission must cooperate with federal entities with respect to the protection of timbered and forest-producing land from insects and disease.<sup>118</sup> Where an insect infestation or disease infection is believed to exist on forestland, the state forester must investigate.<sup>119</sup> Upon finding an infestation or infection, the state forester must give notice to forest landowners within the affected area, advising them of the nature of the problem and the recommended control measures, and offering technical advice for carrying out the measures.<sup>120</sup> When the state forester determines that there is an infestation or infection injurious to timber or forest growth on privately owned lands and that the infestation or infection will be a menace to the timber on forestlands of adjacent owners, the forester may declare the existence of a control zone.<sup>121</sup> Upon establishment of the zone, the state forester will give written notice to owners, advising them of the nature of the problem and the recommended control measures, and offering technical advice for carrying out the measures.<sup>122</sup> If the owner fails to initiate reasonable and practicable control measures within two weeks, the forester may carry out the suppression, eradication, or destruction measures.<sup>123</sup> Alabama has established a "control of forest tree insects and diseases fund" to be used for the purposes of this article.<sup>124</sup> Alabama has also established an emergency forest fire, insect, and disease fund, from which funds may be drawn as deemed necessary by the state forester and the governor for emergency forest fire, insect, and disease suppression and control.<sup>125</sup>

## **12.C.3d(4) Specific Quarantines**

### **12.C.3d(4a) Sweet Potato Weevil Quarantine**

There is a quarantine against the sweet potato weevil.<sup>126</sup> The regulations set forth a list of regulated articles and a list of regulated areas.<sup>127</sup> The Commissioner may stop and inspect, without a warrant, any person or means of conveyance moving within, into, or from Alabama upon probable cause to believe that such conveyance or articles are infested and may seize, treat, destroy, or otherwise dispose of articles not in compliance.<sup>128</sup> Sweet potatoes imported from weevil-free areas must carry a tag indicating that they were grown, stored, and inspected in a sweet potato weevil free area and a certificate of quarantine compliance.<sup>129</sup> Sweet potatoes imported from regulated areas must be accompanied by a certificate of quarantine, be certified as fumigated, be packed and handled to eliminate any danger of spreading the weevil, and be certified as apparently free from infestation of the weevil.<sup>130</sup> Sweet potatoes produced intrastate in weevil-free areas and moved intrastate do not require certification, but persons in possession must provide documentation upon request.<sup>131</sup> Seed sweet potatoes and sweet potato plants may not be sold, traded, or given away unless they are certified.<sup>132</sup> The Commissioner may waive any quarantine requirements if doing so is in the best interests of agriculture, the sweet potato industry, and Alabama's citizens.<sup>133</sup> A violation is a Class C misdemeanor.<sup>134</sup>

### **12.C.3d(4b) St. Augustine Grass Decline Virus Quarantine/Phony Peach Disease Quarantine**

There is a quarantine against St. Augustine Grass Decline Virus and phony peach disease.<sup>135</sup> The regulations establish regulated articles and regulated areas.<sup>136</sup> Regulated articles may not be imported without a certificate of quarantine compliance.<sup>137</sup> The Commissioner of the Department of Agriculture and Industries may waive quarantine requirements for experimental or scientific purposes in accordance with specified conditions.<sup>138</sup> The Commissioner may stop and inspect, without a warrant, any person or means of conveyance moving within, into, or from Alabama upon probable cause to believe that such conveyance or articles are infested and may seize, treat, destroy, or otherwise dispose of articles not in compliance.<sup>139</sup> Infested or non-certified articles will be returned to the shipper.<sup>140</sup> There are requirements for certification of Prunus nursery stock.<sup>141</sup>

## **12.C.3d(4c) Japanese Beetle Quarantine/Pine Shoot Beetle Quarantine**

There is a quarantine against the Japanese beetle and the pine shoot beetle.<sup>142</sup> The regulations set forth a list of regulated articles and a list of regulated and suppressive areas.<sup>143</sup> The Commissioner of the Department of Agriculture and Industries may stop and inspect, without a warrant, any person or means of conveyance moving within, into, or from Alabama upon probable cause to believe that such conveyance or articles are infested and may seize, treat, destroy, or otherwise dispose of articles not in compliance with these rules.<sup>144</sup> Unless otherwise specified, a certificate or permit must accompany the movement of regulated articles from any regulated area into or through any other area.<sup>145</sup> The Commissioner may issue certificates if the regulated articles have originated in non-infested premises and have not been exposed to infestation, are found free from infestation upon examination, have been treated to destroy infestation, or have been handled to avoid infestation.<sup>146</sup> Regulated articles may be moved within regulated areas without restriction unless the articles originate on infested properties and the Commissioner has determined that a hazard of spread exists and the property owner has been notified.<sup>147</sup> The signing of a compliance agreement may be required as a condition for the issuance of a certificate or permit.<sup>148</sup> A violation is a Class C misdemeanor.<sup>149</sup>

## **12.C.3d(4d) Brown Garden Snail Quarantine**

There is a quarantine against the brown garden snail.<sup>150</sup> The regulations establish regulated articles and regulated areas.<sup>151</sup> The Commissioner may stop and inspect, without a warrant, any person or means of conveyance moving within, into, or from Alabama upon probable cause to believe that the conveyance or articles are infested and may seize, treat, destroy, or otherwise dispose of articles not in compliance.<sup>152</sup> Regulated articles must carry a certificate of quarantine compliance.<sup>153</sup> A violation is a Class C misdemeanor.<sup>154</sup>

## **12.C.3d(5) Specific Plant Pests Controls**

### **12.C.3d(5a) Sweet Potato Pests**

The Commissioner may enter any place and open any package containing sweet potatoes carrying pests or non-complying sweet potato plants or seeds.<sup>155</sup> Certified sweet potato seed and plants are those found to be apparently free of pests in the field, plant bed, and storage.<sup>156</sup> There are detailed standards governing sweet potato certification, inspection, and growing.<sup>157</sup> The importation and movement of sweet potato seeds or plants for propagating purposes requires proper certification, tagging, and inspection.<sup>158</sup> Transportation and common carriers must refuse to ship sweet potato plants and seeds not accompanied by certificate tags.<sup>159</sup> Sweet potato seeds and plants may be moved or imported for scientific purposes as long as the propagating material is apparently pest-free.<sup>160</sup> Sweet potato seeds and plants in violation of these laws are a public nuisance and will be suspended from sale, confiscated, returned, or destroyed.<sup>161</sup> A violation is a Class C misdemeanor.<sup>162</sup>

### **12.C.3d(5b) Boll Weevil**

The boll weevil is a public nuisance and a pest.<sup>163</sup> The Commissioner of the Department of Agriculture and Industries is authorized to carry out programs to destroy and eliminate boll weevils.<sup>164</sup> The Board may certify a cotton growers' organization.<sup>165</sup> Upon passage of a grower referendum, growers in eradication areas must participate in the eradication program, pay assessments, and satisfy other obligations.<sup>166</sup> The Commissioner may enter cotton fields and other premises and to inspect any fields or premises and any property located there for infestation during daylight hours.<sup>167</sup> The Commissioner may also stop any person and inspect any article or means of conveyance moving into, within, or from Alabama when he has reasonable grounds to believe that such items are infested, and may seize, treat, destroy, or otherwise dispose of any articles found to be moving in violation.<sup>168</sup> Cotton growers must satisfy reporting requirements.<sup>169</sup> Elimination zones, in which boll weevil eradication programs will be undertaken, may be designated.<sup>170</sup> There is a quarantine on the boll weevil and the regulations establish regulated areas and regulated articles.<sup>171</sup> The movement of regulated articles from regulated areas requires a certificate, but the movement of regulated articles from outside of regulated areas does not, if accompanied by point-of-origin documentation and if the Commissioner is satisfied that the articles have been adequately protected from infestation.<sup>172</sup> Compliance agreements may be required as a condition of certificate issuance.<sup>173</sup> The Commissioner may destroy non-complying cotton and may destroy or treat volunteer or noncommercial cotton in elimination zones when necessary.<sup>174</sup> A violation is a Class C misdemeanor.<sup>175</sup>

## **12.C.3d(6) Other Related Activities**

### **12.C.3d(6a) Alabama Agricultural Experiment Station System**

The Auburn University Agricultural Experiment Station System is to conduct research, experiments, and investigations for the study of plant and animal diseases and insect pests.<sup>176</sup>

### **12.C.3d(6b) Mining**

Reclamation plans for surface coal mining, including surface operations and impacts incident to an underground coal mine, should include plans for revegetation, with reference to pest and disease control measures, if any.<sup>177</sup>

## **12.C.3e. Insects**

### **12.C.3e(1) Apiaries**

The Commissioner of the Department of Agriculture and Industries is authorized to deal with contagious and infectious diseases of honeybees.<sup>178</sup> Honeybee colonies, bee yards, and apiaries must be registered.<sup>179</sup> The importation of honeybees requires a certificate of inspection, and the importation of honeybees for pollination purposes requires a compliance agreement, which will include a requirement that the bees are certified free from certain pests and pre-treated with approved pesticides.<sup>180</sup> Used beekeeping equipment and supplies may not be imported, except under limited circumstances, and their shipment or movement requires a permit.<sup>181</sup> The Commissioner may inspect, at all reasonable hours, any premises where honeybees or beekeeping equipment or supplies are kept.<sup>182</sup> Honeybees imported for pollination purposes are subject to immediate inspection, and upon a finding of infestation, to removal, quarantine, or destruction.<sup>183</sup> Apiaries that are infected or are otherwise in violation of these laws will be quarantined, and quarantined bees and equipment may not be moved except by permission of the Commissioner.<sup>184</sup> Bees or equipment found to be infected with a disease that cannot be controlled are declared a public nuisance and must be destroyed by the owner, or upon the owner's failure to act, by the Commissioner.<sup>185</sup> Violations are misdemeanors, punishable by a fine of up to \$500 and imprisonment for up to 6 months.<sup>186</sup>

### **12.C.3e(2) Fire Ants**

There is a quarantine against black and red imported fire ants.<sup>187</sup> The regulations establish a list of regulated articles and a list of regulated areas.<sup>188</sup> The Commissioner may stop and inspect, without a warrant, any person or means of conveyance moving within, into, or from Alabama upon probable cause to believe that the conveyance or articles are infested and may seize, treat, destroy, or otherwise dispose of articles not in compliance.<sup>189</sup> A certificate or permit must accompany the movement of regulated articles from a regulated area into or through any other point, but no certificate or permit is required for regulated articles originating outside of a regulated area as long as certain conditions are met.<sup>190</sup> The Commissioner of the Department of Agriculture and Industries may issue certificates if the regulated articles have originated in non-infested premises and have not been exposed to infestation, are found free from infestation, have been treated to destroy infestation, or have been handled to avoid infestation.<sup>191</sup> Permits will issue for the movement of non-certified regulated articles to locations outside the regulated areas if the movement will not result in the spread of the ant.<sup>192</sup> Regulated articles may be moved within regulated areas without restriction unless the articles originate on infested properties and the Commissioner has determined that a hazard of spread exists and the property owner has been notified.<sup>193</sup> The Commissioner may waive the requirements for movement of regulated articles for experimental or scientific purposes.<sup>194</sup> The signing of a compliance agreement may be required as a condition for the issuance of a certificate or permit.<sup>195</sup>

## Endnotes

1. Ala. Admin. Code r. 220-2-.26, 220-2-.93.
2. Ala. Code §9-2-13.
3. Id.
4. Ala. Admin. Code r. 80-3-6-.13.
5. Ala. Code §22-10-1.
6. Ala. Code §22-10-3.
7. Ala. Admin. Code r. 80-3-6-.23.
8. Ala. Code §9-11-233.
9. Ala. Code §9-2-7.
10. Ala. Code §9-1-4.
11. Ala. Code §9-2-13.
12. Ala. Admin. Code r. 220-2-.09.
13. Id.
14. Id.
15. Id.
16. Id.
17. Id.
18. Id.
19. Ala. Code §9-11-410.
20. Ala. Code §9-11-413.
21. Ala. Code §9-11-411.
22. Ala. Code §9-11-412.
23. Ala. Admin. Code r. 220-2-.25.
24. Ala. Code §9-11-418.
25. Ala. Code §9-11-416.
26. Ala. Code §9-11-415.
27. Ala. Code §9-11-419.
28. Ala. Admin. Code r. 80-3-18-.10.
29. Ala. Admin. Code r. 220-2-.26, 220-2-.93.
30. Ala. Code §9-2-13.
31. Ala. Code §9-11-84.
32. Ala. Code §9-2-7.
33. Ala. Code §22-10-1.
34. Ala. Code §22-10-3.
35. Ala. Code §9-1-4.
36. Ala. Code §9-11-450.
37. Ala. Admin. Code r. 220-2-.124.
38. Ala. Code §9-20-3.
39. Id.
40. Ala. Code §9-20-4.
41. Ala. Code §9-20-6.
42. Ala. Code §2-25-3.
43. Ala. Code §2-25-1.
44. Ala. Admin. Code r. 80-10-14-.04.
45. Ala. Admin. Code r. 80-10-14-.02.
46. Id.
47. Id.
48. Ala. Admin. Code r. 80-10-14-.05, .06.
49. Ala. Code §§2-26-1, 2-26-3.
50. Ala. Code §2-25-10.
51. Ala. Code §2-25-3.
52. Id.
53. Ala. Admin. Code §§80-10-14-.01, 80-10-14-.03.
54. Ala. Code §§11-67-2, 11-67-3.
55. Ala. Code §11-67-6.
56. Ala. Admin. Code r. 80-1-22-.20.
57. Ala. Admin. Code r. 420-3-5-.12, 420-3-5-.13.
58. Ala. Const. amend. 497.
59. Ala. Admin. Code r. 80-10-14-.10.
60. Ala. Admin. Code r. 80-10-14-.07.
61. Ala. Admin. Code r. 80-10-14-.08.
62. Id.
63. Id.
64. Ala. Code §2-25-15.
65. Ala. Code §2-25-4.
66. Ala. Code §2-25-13.
67. Ala. Admin. Code r. 80-10-14-.13.
68. Ala. Admin. Code r. 80-10-14-.12.
69. Ala. Code §§2-26-1, 2-26-3.
70. Id.
71. Ala. Code §§2-26-5, 2-26-6.
72. Ala. Code §2-26-2.
73. Ala. Code §2-26-4.
74. Ala. Code §2-26-10.
75. Ala. Code §2-26-11.
76. Ala. Admin. Code r. 80-11-1-.05.
77. Ala. Code §2-26-11.
78. Ala. Code §2-26-2.
79. Ala. Code §2-26-7.
80. Id.
81. Ala. Code §2-26-12.
82. Ala. Code §2-26-30.
83. Ala. Code §2-26-13.
84. Ala. Code §§2-21-18, 2-21-25.
85. Ala. Code §2-21-19.
86. Ala. Code §2-21-26.
87. Ala. Code §§2-21-26, 2-2-37.
88. Ala. Code §2-21-23.
89. Ala. Code §2-21-22.
90. Ala. Admin. Code r. 80-1-5-.11.
91. Ala. Code § 2-21-27.
92. Id.
93. Ala. Code ' 2-21-31.
94. Ala. Code §2-20-4.
95. Ala. Code §2-25-3.
96. Ala. Code §2-25-1.
97. Ala. Code §2-25-10.
98. Ala. Code §2-25-3.
99. Id.
100. Ala. Code §2-25-4.
101. Ala. Code §2-25-13.

102. Ala. Code §2-25-3.
103. Ala. Code §2-25-15.
104. Ala. Admin. Code r. 335-3-3-.01.
105. Ala. Code §2-25-22.
106. Ala. Code §2-25-3.
107. Ala. Admin. Code r. 80-10-1-.05.
108. Ala. Code §2-25-6.
109. Ala. Code §2-25-17.1.
110. Ala. Code §2-25-17.2.
111. Ala. Admin. Code r. 80-10-1-.10.
112. Ala. Admin. Code r. 80-10-1-.06.
113. Ala. Admin. Code r. 80-10-1-.07.
114. Ala. Code §§2-25-11, 2-25-12.
115. Ala. Code §2-25-15.1.
116. Ala. Code §2-25-16.
117. Ala. Code §2-25-22.
118. Ala. Code §9-3-4; Ala. Admin. Code r. 390-X-1-.01.
119. Ala. Code §9-13-121.
120. Id.
121. Ala. Code §9-13-122; Ala. Admin. Code r. 390-X-5-.01.
122. Ala. Code §9-13-123.
123. Id.
124. Ala. Code §9-13-126.
125. Ala. Code §9-3-10.1.
126. Ala. Admin. Code r. 80-10-5-.01, 80-10-5-.03.
127. Ala. Admin. Code r. 80-10-5-.04 - .06.
128. Ala. Admin. Code r. 80-10-5-.14.
129. Ala. Admin. Code r. 80-10-5-.07.
130. Ala. Admin. Code r. 80-10-5-.08.
131. Ala. Admin. Code r. 80-10-5-.09.
132. Ala. Admin. Code r. 80-10-5-.12.
133. Ala. Admin. Code r. 80-10-5-.17.
134. Ala. Admin. Code r. 80-10-5-.15.
135. Ala. Admin. Code r. 80-10-10-.01, 80-10-7-.01.
136. Ala. Admin. Code r. 80-10-10-.03, .04,  
80-10-7-.03, .04.
137. Ala. Admin. Code r. 80-10-10-.05, 80-10-7-.05.
138. Ala. Admin. Code r. 80-10-7-.09.
139. Ala. Admin. Code r. 80-10-10-.07.
140. Ala. Admin. Code r. 80-10-10-.05.
141. Ala. Admin. Code r. 80-10-7-.06.
142. Ala. Admin. Code r. 80-10-4-.01, 80-10-4-.03,  
80-10-4-.05, 80-10-15-.03.
143. Ala. Admin. Code r. 80-10-4-.06, .07,  
80-10-15-.03, .04.
144. Ala. Admin. Code r. 80-10-4-.12, 80-10-15-.06,.07.
145. Ala. Admin. Code r. 80-10-4-.08, 80-10-15-.06.
146. Ala. Admin. Code r. 80-10-4-.09.
147. Ala. Admin. Code r. 80-10-4-.10.
148. Ala. Admin. Code r. 80-10-4-.11.
149. Ala. Admin. Code r. 80-10-4-.13, 80-10-15-.08.
150. Ala. Admin. Code r. 80-10-8-.01, 80-10-8-.03.
151. Ala. Admin. Code r. 80-10-8-.04, .05
152. Ala. Admin. Code r. 80-10-8-.08.
153. Ala. Admin. Code r. 80-10-8-.06.
154. Ala. Admin. Code r. 80-10-8-.09.
155. Ala. Admin. Code r. 80-10-2-.11.
156. Ala. Admin. Code r. 80-10-2-.04.
157. Id.
158. Ala. Admin. Code r. 80-10-2-.05, .07.
159. Ala. Admin. Code r. 80-10-2-.08.
160. Ala. Admin. Code r. 80-10-2-.09.
161. Ala. Admin. Code r. 80-10-2-.10.
162. Ala. Admin. Code r. 80-10-2-.12.
163. Ala. Code §2-19-120.
164. Ala. Code §2-19-122.
165. Ala. Code §§2-19-30, 2-19-131.
166. Ala. Admin. Code r. 80-10-12-.12, 80-10-12-.14.
167. Ala. Code §2-19-123.
168. Ala. Admin. Code r. 80-10-12-.10.
169. Ala. Admin. Code r. 80-10-12-.11.
170. Ala. Code §2-19-126.
171. Ala. Admin. Code r. 80-10-12-.03 - .06.
172. Ala. Admin. Code r. 80-10-12-.07.
173. Ala. Admin. Code r. 80-10-12-.09.
174. Ala. Code §§2-19-126, 127.
175. Ala. Code §2-19-129.
176. Ala. Code §2-30-41.
177. Ala. Admin. Code r. 880-X-8F-.09, 880-X-8I-.08.
178. Ala. Code §2-14-9.
179. Ala. Code §2-14-3.
180. Ala. Code §2-14-4, Ala. Admin. Code r. 80-10-11-.04.
181. Ala. Code §§2-14-5, 6.
182. Ala. Code §2-14-9.
183. Ala. Admin. Code r. 80-10-11-.05.
184. Ala. Code §2-14-10.
185. Ala. Code §§2-14-11, 2-14-12.
186. Ala. Code §2-14-15.
187. Ala. Admin. Code r. 80-10-6-.01.
188. Ala. Admin. Code r. 80-10-6-.03, .04.
189. Ala. Admin. Code r. 80-10-6-.14.
190. Ala. Admin. Code r. 80-10-6-.05.
191. Ala. Admin. Code r. 80-10-6-.07.
192. Ala. Admin. Code r. 80-10-6-.08.
193. Ala. Admin. Code r. 80-10-6-.09.
194. Ala. Admin. Code r. 80-10-6-.12.
195. Ala. Admin. Code r. 80-10-6-.13.



**12.D APPENDIX D. STATE EXECUTIVE ORDER NO. 30: ESTABLISHING THE ALABAMA AQUATIC NUISANCE SPECIES TASK FORCE****EXECUTIVE ORDER NUMBER 30**

**WHEREAS**, the State of Alabama is blessed with a bounty of natural resources largely unmatched by any other state; and

**WHEREAS**, these natural resources support a vast array of recreational, commercial, and environmental interests that are vital to the continued well being of the State and its citizens; and

**WHEREAS**, the sport fishing industry alone generates approximately \$840 million annual retail sales and employs close to 23,000 Alabamians; and

**WHEREAS**, these vital natural resources are being threatened by the increasing proliferation of aquatic nuisance species (ANS) -- non-indigenous species that can destroy the balance and survival of the indigenous ecosystems; and

**WHEREAS**, non-indigenous species -- both aquatic and terrestrial -- are estimated to cause over \$138 billion in environmental and economic damage each year throughout the United States and often pose a direct threat to public health; and

**WHEREAS**, the imminent threat to the State of Alabama must be met with a carefully coordinated defense to ensure the protection of its citizens and its natural resources from the predations of these invading aquatic nuisance species; and

**WHEREAS**, to achieve the necessary coordinated and rapid response by the appropriate agencies, the State of Alabama must develop and implement an Aquatic Nuisance Species Plan to reduce or eliminate the economic, public health, and ecological risks associated with ANS.

**NOW THEREFORE**, based upon these considerations, and for other good and valid reasons which relate thereto, I, Bob Riley, Governor of the State of Alabama, by virtue of the authority vested in me by the Constitution and laws of the State of Alabama, do hereby create the "Alabama Aquatic Nuisance Species Task Force" to be chaired by the Commissioner of the Department of Conservation and Natural Resources (DCNR) or his designee, and comprised of a broad collection of bi-partisan experts from both state and non-governmental agencies.

**BE IT ORDERED** that the Task Force shall include the department heads or their designees, from the following State agencies:

Alabama Department of Conservation and Natural Resources, Chairman  
DCNR, Wildlife and Freshwater Fisheries Division  
DCNR, Marine Resources Division  
DCNR, Marine Police Division  
DCNR, State Lands Division  
DCNR, State Parks Division  
Department of Agriculture and Industries

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Department of Environmental Management  
 Department of Economic and Community Affairs  
 Department of Public Health  
 Alabama Cooperative Extension System  
 Alabama State Port Authority  
 Geological Survey of Alabama

**BE IT FURTHER ORDERED** that representatives selected by the Agency Director or Chief Administrator from the following federal agencies shall be invited to join and participate in the Task Force:

Natural Resources Conservation Services  
 Tennessee Valley Authority  
 U.S. Fish and Wildlife Services  
 U.S. Army Corps of Engineers  
 U.S. Coast Guard  
 U.S. Forestry Service  
 U.S. Geological Survey  
 U.S. Environmental Protection Agency  
 U.S.D.A. -- Animal Plant Inspection Service

**BE IT FURTHER ORDERED** that representatives selected by the President, Chairman or head of the following non-governmental organizations, shall be invited to join and participate in the Task Force:

Alabama Farmers Federation  
 Alabama Catfish Producers  
 Alabama Invasive Plant Council  
 Alabama Nurseymen's Association  
 Alabama Nursery and Landscape Association  
 Alabama Power Company  
 Alabama Rivers Alliance  
 Alabama Sea Grant  
 Alabama Wildlife Federation  
 Auburn University  
 B.A.S.S. Federation  
 Gulf States Marine Fisheries Commission  
 Southeast Aquatic Resource Partnership  
 The Nature Conservancy  
 Mobile Bay National Estuary Program  
 The University of Alabama  
 The University of South Alabama

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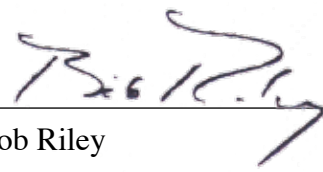
**BE IT FURTHER ORDERED** that the Task Force shall be responsible for formulating a comprehensive plan to ensure the best possible economic and environmental future of the State of Alabama.

**BE IT FURTHER ORDERED** that the Governor and the Chairman may elect to appoint additional and appropriate stakeholders as members at a later date if deemed necessary.


**BE IT FURTHER ORDERED** that this Executive Order shall become effective immediately upon its execution and shall remain in effect until amended or modified by the Governor.

**DONE AND ORDERED** this 2nd day of June, 2005.



  
\_\_\_\_\_  
Bob Riley  
Governor

Attested:

  
\_\_\_\_\_  
Nancy L. Worley  
Secretary of State

## 12.E Appendix E. Federal Laws, Programs, and Regulations relevant to ANS

### 12.E.1 Federal Laws

#### 12.E.1a Clean Water Act, 33 U.S.C. § 1251 et seq.

The Clean Water Act (CWA) protects the Nation's waters, including lakes, rivers, aquifers, and coastal areas.<sup>1</sup> The CWA includes a framework of standards and requires the development of technology and financial assistance to address the causes of pollution and poor water quality.<sup>2</sup> The CWA provides for a permitting process to protect wetlands and other aquatic habitats in order to ensure environmentally sound development.<sup>3</sup> The Environmental Protection Agency (EPA), the Department of Defense (DOD), and the U.S. Coast Guard share authority to manage incidental liquid discharges, including clean ballast water, from Armed Forces vessels through the Uniform National Discharge Standards.<sup>4</sup>

The CWA's permitting process may provide EPA with some authority to control and manage invasive species. EPA currently is reviewing its authority under the CWA with regard to invasive species.<sup>5</sup>

#### 12.E.1b 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."<sup>6</sup> Specifically, the Federal government is to encourage and assist the States to achieve "wise use" of land and water resources in the coastal zone.<sup>7</sup> Issues surrounding invasive species could be incorporated into States' Coastal Zone Management Plans through modification or amendment, subject to the approval by the Department of Commerce (DOC).<sup>8</sup> Section 1455a(b) allows the DOC to make grants to eligible coastal states to assist them in preserving or restoring specific areas, redevelopment of deteriorating and underutilized urban waterfronts and ports, access to public beaches, or development of a permit process to regulate aquaculture facilities in the coastal zone. The DOC also shall assist States in identifying and obtaining technical assistance and other financial assistance so they may carry out the objectives of the CZMA.<sup>9</sup>

The CZMA calls for coordination and cooperation between the DOC and other interested Federal agencies to the maximum extent practicable.<sup>10</sup> The agency also shall not approve any coastal zone management program submitted by any State pursuant to Section 1455 unless the views of Federal agencies "principally affected" by such program have been considered.<sup>11</sup>

Section 1461 establishes the National Estuarine Research Reserve System. Research in designated national estuarine reserves is to help identify and establish priorities of coastal management issues.<sup>12</sup> This program could sponsor monitoring and other research of invasive species.

#### 12.E.1c Cooperative Forestry Assistance, 41 U.S.C. § 2104

Under the Cooperative Forestry Assistance (CFA), the Department of Agriculture (USDA) is responsible for protecting the health of the National forests and on other lands in the United States. Protection of forests from invasive species is included in the CFA. The USDA may conduct surveys to "detect and appraise insect infestations and disease conditions ... and establish a monitoring system ... to determine detrimental changes or improvements that occur over time ...."<sup>13</sup> The USDA may also implement the biological, chemical, and mechanical measures necessary "to prevent, retard, control, or suppress incipient, potential, threatening, or emergency insect infestations and disease conditions affecting trees."<sup>14</sup> Furthermore, the USDA is required to provide technical information, advice, and related assistance on available techniques to maintain healthy forests.<sup>15</sup>

Included is the USDA's authority to appropriate funds to implement this policy to other Federal agencies to prevent, retard, control, or suppress insect infestations and diseases affecting trees on said lands.<sup>16</sup> Moreover, the USDA may contract or enter into a cooperative agreement to provide financial assistance to State forestry officials or the equivalent thereof and private forestry and other organizations to monitor forest health and to protect forest lands.

Such State officials or private or other organizations shall make contributions in the amount and manner deemed appropriate by the USDA.<sup>17</sup>

However, the CFA only applies to insect infestations and disease conditions affecting trees. There is no authority in the CFA for invasive plant species.

## **12.E.1d Endangered Species Act, 16 U.S.C. § 1531 et seq.**

The U.S. Department of the Interior (DOI) is in charge of implementing The Endangered Species Act (ESA). The ESA relates to invasive species that pose a threat to local endangered species.<sup>18</sup> If invasive species threaten local endangered species, then the ESA could be used as a basis for control and eradication. However, the ESA does not contain specific language that directly relates to invasive species or language that mentions how the DOI could regulate particular pathways by which invasive species may become a threat to endangered species.

## **12.E.1e Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136 et seq.**

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) focuses on Federal control of pesticide distribution, sale, and use. The EPA studies the effects of pesticide use and requires users to register when purchasing certain pesticides. All pesticides used in the United States must be registered with EPA.<sup>19</sup> Registration ensures proper labeling and that if pesticides are used in accordance with specification, then they will not cause unreasonable adverse effects on the environment.<sup>20</sup>

If pesticides are used to control or reduce the impacts of invasive species, then FIFRA will apply. FIFRA also gives EPA review authority for biological control agents when they are used to control invasive pests.<sup>21</sup>

## **12.E.1f 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. Section 2814 of the FNWA requires each Federal agency to manage “undesirable plants”<sup>22</sup> on Federal lands. They are to develop and coordinate a management program to control such plants on said land and to enter into cooperative agreements with State agencies to implement management plans.

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.

## **12.E.1g Federal Seed Act, 7 U.S.C. § 1551 et seq.**

The Federal Seed Act (FSA) regulates interstate and foreign commerce in seeds, requires labeling to prevent misrepresentation of seeds in interstate commerce; and requires certain standards with respect to certain imported seeds. The FSA may offer protection against invasive species entering the States because it requires labeling of seeds entering interstate commerce and requires standards for certain imported seeds.

It unlawful for a person to transport or deliver for transportation in interstate commerce any agricultural seeds or mixture thereof unless each container bears a label that includes information in accordance with regulations and prescribed by law under Section 402 of the FSA.<sup>23</sup> One piece of required information on a label is the origin of each agricultural seed, which has been designated by the USDA as one on which knowledge of the origin is important from the standpoint of crop production.<sup>24</sup> This section specifically includes noxious weed seeds in its labeling requirement.

The FSA requires all persons transporting, delivering for transportation, in interstate commerce, agricultural seeds shall keep for three (3) years a complete record of origin, treatment, germination, and purity of each lot of such agricultural seeds. This requirement also applies to all persons transporting or delivering for transportation, in interstate commerce, vegetable seeds.<sup>25</sup>



The FSA lists exemptions to the labeling and recording requirements. The provisions of Sections 201 and 202 do not apply to any carrier in respect to any seed transported or delivered for transportation in the ordinary course of its business as a carrier, provided that such carrier is not engaged in processing or merchandising seed subject to the provisions of this Act.<sup>26</sup> Such provisions also do not apply to seeds produced by any farmer on his own premises and sold by him directly to the consumer, provided that such farmer is not engaged in the business of selling seeds not produced by him.<sup>27</sup> However, such seeds produced or sold when transported or offered for transportation to any State, Territory, or District, shall not be exempted from Sections 201 and 202 unless the seeds are in compliance with the operation and effect of the laws of such State, Territory, or District, which are enacted in the exercise of its police power.<sup>28</sup>

The FSA prohibits the dissemination of any false advertisement concerning seed, by the United State mail or in interstate and foreign commerce, in any manner or by any means, including radio broadcasts.<sup>29</sup>

Finally, the FSA prohibits the importation into the United States of any agricultural or vegetable seeds if any such seeds contain noxious weed seeds or the labeling of which is false or misleading in any respect.<sup>30</sup>

## **12.E.1h. 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 ...”<sup>31</sup> The FWCA requires the DOI to provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations to control, manage, and protect wildlife resources.<sup>32</sup> The FWCA encourages consultation between agencies. If an impoundment, diversion, or deeper channeling of the waters of any stream or other water body by any Department or agency of the United States or by any public or private agency under Federal permit or license is necessary, then that Department or agency first shall consult with the Fish and Wildlife Service, DOI, and the head of the agency exercising administration over the wildlife resources that may be affected by the action.<sup>33</sup> Furthermore, the DOI shall make reports and recommendations on the wildlife aspects of such projects.<sup>34</sup> Such goals and cooperation between Departments and agencies could encompass control and management of invasive species through research and recommendations.

Projects to control and manage invasive species also may be funded through grants and cooperative agreements.<sup>35</sup>

## **12.E.1i Hawaii Tropical Forest Recovery Act, 16 U.S.C. § 4502a et. seq**

The Hawaii Tropical Forest Recovery Act (HTFRA), enacted in 1992, largely amended the International Forestry Cooperation Act. (See below.) The HTFRA 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 that determine detrimental changes or improvements over time, and provide assistance to States with tropical forests.<sup>36</sup>

## **12.E.1j International Forestry Cooperation Act, 16 U.S.C. § 4501 et. seq**

The main focus of the International Forestry Cooperation Act (IFCA) is to provide assistance to foreign countries that promote sustainable development and global environmental stability for the world's forests.<sup>37</sup> The IFCA concentrates on key nations which “could have a substantial impact on emissions of greenhouse gases related to global warming.”<sup>38</sup> Under the IFCA the Secretary of the USDA provides assistance in the form of grants, contracts, or cooperative agreements to prevent and control invasions from nonindigenous animals, plants, and pathogens in tropical forests.<sup>39</sup>

Under the authority of the IFCA, the USDA's Forest Service, as part of its Forest Research and Development Program, conducts research and development for management and protection of vegetation, fish, and wildlife and delivers research and development products in water and air sciences, resource valuation and use, and inventory and monitoring.<sup>40</sup>

This program addresses all aspects of the USDA's invasive species activities, including prevention, control, rapid response, management, and restoration of areas affected by invasive species.<sup>41</sup>

## **12.E.1k National Forest Management Act, 16 U.S.C. § 1604**

Congress has required that the USDA develop and maintain forest plans for each administrative unit of the National Forest System.<sup>42</sup> 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.<sup>43</sup> Moreover, each plan must be consistent with the National Environmental Policy Act, the Multiple-Use and Sustained-Yield Act, and other Federal environmental laws.<sup>44</sup> Since forest management is specific to each area, management may relate to invasive species as it becomes an issue in particular forest areas.

## **12.E.1l Lacey Act, 18 U.S.C. § 42 et seq. and the "Other" Lacey Act, 16 U.S.C. § 3371 et seq.**

There are two separate Lacey Acts. The Lacey Act, 18 U.S.C. § 42, is a law administered by the U.S. Fish and Wildlife Service that prohibits the importation of into the U.S. or any of its territories certain categories of animal species. The "other" Lacey Act, 16 U.S.C. § 3371 et seq., is a separate provision administered by the DOI, DOC, and USDA. The "other" Lacey Act generally makes it unlawful to import, export, sell, receive, acquire, purchase (or attempt to commit any such act) certain animals and plants in violation of Federal, State, Tribal, or foreign law. Each has common purposes and restrictions, as well as limitations on how they may be utilized to control and manage invasive species.

18 U.S.C. § 42(a)(1) of the Lacey Act prohibits importation of animal species that the Secretary of the Interior has prescribed by regulation as "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States." However, the Secretary may allow the importation for zoological, educational, medical, and scientific purposes, where such importation would otherwise be prohibited by this Act.<sup>45</sup> Also, the Act does not restrict importation by Federal agencies for their own use.<sup>46</sup>

It is important to note that Section 42 contains restrictions that limit DOI's ability to fully address the control and management of invasive species. First, Section 42 is limited to specific animals. It applies only to those animal species specified in the Act plus mammals, fish, birds, reptiles, amphibians, mollusks, and crustaceans. In addition, the Lacey Act seems to exclude domesticated birds and mammals because only "wild"<sup>47</sup> birds and mammals are specified in the Act. Finally, the Act excludes from regulation under the Lacey Act species already regulated under the Plant Pest Act. The Act specifically states that § 42 does not authorize "any action with respect to the importation of any plant pest as defined by the FPPA, insofar as such importation is subject to regulation under that Act."<sup>48</sup>

16 U.S.C. § 3372(a)(1) (i.e., the "other" Lacey Act) prohibits the import, export, sale, receipt, acquirement, or purchase of any wildlife, fish, or plant "taken, possessed, transported, or sold in violation of any law, treaty, or regulation of the United States or in violation of any Indian tribal law." This section also prohibits the import, export, or transport in interstate commerce any container or package containing any fish or wildlife unless it has been previously marked, labeled, or tagged in accordance with regulations issued pursuant to the "other" Lacey Act (OLA).

Sale or purchase of fish or wildlife for the illegal taking, acquiring, receiving, transport, or possession of fish or wildlife is prohibited by the OLA.<sup>49</sup> It is also unlawful for a person to make or submit a false record, account, label for, or any false identification of any fish, wildlife, or plant which has been, or is intended to be, imported, exported, sold, purchased, or received from any foreign country; or transported in interstate or foreign commerce.<sup>50</sup>

All fish, wildlife, or plants imported, exported, transported, sold, received, acquired, or purchased in violation of the OLA or any regulation thereto shall be subject to forfeiture to the United State as well as any civil or criminal penalties that may be assessed.<sup>51</sup> In addition, all vessels, vehicles, aircraft, or other equipment used to aid in the violation shall be subject to forfeiture to the United States if the facts meet certain criteria. If the owner at the time of the alleged violation was a consenting party or privy thereto or in the exercise of due care should have known his property would be used in a criminal violation of the OLA, and the violation involved the sale or purchase of or the offer or intent to sell or purchase fish, wildlife, or plants, then his property shall be subject to forfeiture.<sup>52</sup>

The OLA has restrictions similar to those in 18 U.S.C. § 42. The definition of “fish or wildlife” is also limited to wild animals, though it is broader than the one in Section 42.<sup>53</sup> What the OLA includes that Section 42 does not include is plant species. However, the definition of “plant” is limited to “any wild member of the plant kingdom, including roots, seeds, and other parts thereof (but excluding common food crops and cultivars), which is indigenous to any State and which is either listed on an appendix to the Convention on International Trade in Endangered Species of Wild Flora and Fauna or listed pursuant to any State law that provides for the conservation of species threatened with extinction.”<sup>54</sup> This means that any plant that falls outside of this definition is not covered, and some plant species that are not covered may be invasive plant species in Alabama that need to be managed.

There are exceptions to prohibitions under the OLA. For instance, the prohibitions of the OLA do not apply to activities regulated by plan under the Magnuson-Stevenson Fishery Management and Conservation Act. Second, the provisions of paragraph 1 of subsection 3(a) of the OLA do not apply to any activity regulated by a fishery management plan in effect under the Magnuson-Stevenson Fishery Management and Conservation Act. Also, the OLA does not prevent the States or Indian tribes from making or enforcing laws or regulations as long as they are consistent with the OLA.<sup>55</sup>

## **12.E.1m Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1801 et seq.**

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson Act) may apply to invasive species and their pathways through Section 1855(b). The Essential Fish Habitat (EFH) provisions allow for review of Federal and/or other actions that could affect EFH with authority to make recommendations for conservation of EFH.

Specifically, the Department of Commerce (DOC), in consultation with participants in the fishery, shall provide each Fishery Management Council with recommendations and information regarding each fishery under that Council’s authority.<sup>56</sup> The purpose is to assist the Councils in identification of essential fish habitat, the adverse impacts on that habitat, and the actions that should be considered to ensure the<sup>57</sup> conservation and enhancement of that habitat. Also, the DOC shall review programs it administers and<sup>58</sup> ensure that any relevant programs further the conservation and enhancement of essential fish habitat. Finally, the DOC shall coordinate with and provide information to other Federal agencies to further the<sup>59</sup> conservation and enhancement of essential fish habitat.

In a similar regard, each Federal agency shall consult with the DOC with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH identified under this Act.<sup>60</sup>

Each Council may comment on and make recommendations to the DOC and any Federal or State agency concerning any activity authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by any Federal or State agency that may affect habitat, including EFH, of a fishery resource under its authority.<sup>61</sup> The Council shall comment on and make recommendations to the DOC and any other Federal or State agency concerning activity that, in the view of the Council, is likely to substantially affect the habitat, including EFH, of an anadromous fishery resource under its authority.<sup>62</sup>

## **12.E.1n Multiple-Use Sustained-Yield Act, 16 U.S.C. § 528 et seq.**

The policy behind the Multiple-Use Sustained-Yield Act (MUSY) is that the “national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.”<sup>63</sup> 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.<sup>64</sup>

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.<sup>65</sup>

**12.E.1o National Environmental Policy Act, 42 U.S.C. § 4321 et seq.**

The National Environmental Policy Act (NEPA) applies to all departments and agencies. The purposes of NEPA that are relevant here are: to declare a national policy that will encourage productive and enjoyable harmony between man and his environment; to promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; and to enrich the understanding of the ecological systems and natural resources important to the nation.<sup>66</sup> NEPA calls for cooperation between agencies to share information and coordinate efforts in order to administer NEPA to the fullest extent possible.<sup>67</sup> If invasive species pose a threat to the environment through intentional introductions related to major Federal actions, then NEPA requires the Federal government agencies to consider the effects of their actions by preparing Environmental Impact Statements (EIS).<sup>68</sup> That is, the effects of invasive species, if they would be harmful to the environment, must be included in the EIS. However, the Animal and Plant Health Inspection Service (APHIS) may approve and issue permits for importing invasive species after the preparation of an Environmental Assessment (EA).<sup>69</sup> Permits for importing invasive species into containment facilities or interstate movement between containment facilities are excluded from NEPA regulations.

**12.E.1p 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 (NANPCA). 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 U.S. Fish and Wildlife Service and the Undersecretary of Commerce for Oceans and Atmosphere.<sup>70</sup> This Task Force was charged with developing and implementing a program to prevent the unintentional introduction and dispersal of aquatic nuisance species<sup>71</sup> through ballast water management.<sup>72</sup>

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.<sup>73</sup> The guidelines apply to vessels equipped with ballast water tanks and directs vessels that enter U.S. waters after operating beyond the EEZ to undertake ballast exchange in the seas.<sup>74</sup> The Secretary<sup>75</sup> is also required to establish record keeping and reporting procedures and sampling techniques, based on the best available science, to monitor compliance.<sup>76</sup> 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.<sup>77</sup>

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.<sup>78</sup> The purpose of conducting these surveys is to examine invasions and the effectiveness of ballast management and its guidelines.<sup>79</sup>

States, through their respective governors, may submit their own comprehensive management plans to the Task Force for approval.<sup>80</sup> 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.<sup>81</sup>

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.<sup>82</sup> Such research may include the environmental and economic risks associated with the introduction of such species, the pathways by which such species are introduced and dispersed, possible methods for prevention, monitoring, and control, and assessment of the effectiveness of such methods.<sup>83</sup>

**12.E.1q 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 assemblage of living resources that inhabit these areas.”<sup>84</sup> Some of the major goals of the NMSA include research, monitoring, and education.<sup>85</sup> The DOC is to coordinate and

promote the use of sanctuaries for such purposes. 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.”<sup>86</sup> 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 NMSA.<sup>87</sup>

Grant and contract funds are available for research, monitoring, and education for conservation and management purposes.<sup>88</sup> Such purposes could include control and management of any invasive species that is or may be in the future in a particular Sanctuary.

Under the 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.”<sup>89</sup> Therefore, regulations for particular Sanctuaries could prohibit the introduction of invasive species into the Sanctuaries. For example, the Florida Keys National Marine Sanctuary’s management plan explicitly prohibits the introduction of invasive species into the Sanctuary.<sup>90</sup>

## **12.E.1r Plant Protection Act, 7 U.S.C. § 7701 et seq.**

The underlying policy of the Plant Protection Act (PPA) is to prevent the introduction or dissemination of plant pests<sup>91</sup> into the United States.<sup>92</sup> With certain exceptions, no person is authorized to import, enter, export, or move in interstate commerce any plant pest, unless such importation, entry, exportation, or movement is authorized under a general or specific permit and is in accordance with USDA regulations.<sup>93</sup>

As previously noted, there are exceptions to the rule. The USDA may allow the importation, entry, exportation, or movement in interstate commerce of specified plant pests without further restriction if the USDA finds that a permit is not necessary.<sup>94</sup> Any person may petition the USDA to add or remove a plant pest from the regulations.<sup>95</sup>

The PPA prohibits unauthorized mailing of plant pests.<sup>96</sup> “Any letter, parcel, box, or other package containing any plant pest, whether sealed as letter-rate postal matter or not, is not mailable and shall not be knowingly conveyed in the mail or delivered from any post office or by any mail carrier unless it is mailed in compliance with regulations to prevent the dissemination of plant pests into the United States or interstate.”<sup>97</sup> Moreover, no person is authorized to open any mailed letter or other mailed sealed matter except in accordance with the postal laws and regulations.<sup>98</sup>

The movement of plants, plant products, biological control organisms, noxious weeds, articles, and means of conveyance are also regulated.<sup>99</sup> 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 United States or the dissemination of a plant pest or noxious weed within the United States.<sup>100</sup> The USDA may publish, by regulation, a list of noxious weeds that are prohibited or restricted in interstate commerce.<sup>101</sup> Likewise, the USDA may publish, by regulation, a list of organisms that are not prohibited or restricted in interstate commerce.<sup>102</sup> However, lists may take into account distinctions between organisms such as “indigenous,” “invasive,” “newly introduced,” or “commercially raised.”<sup>103</sup>

The PPA includes notification and holding requirements upon arrival. The Department of the Treasury (the Treasury) is required to promptly notify the USDA of the arrival of any plant, plant product, biological control organism, plant pest, or noxious weed at a port of entry.<sup>104</sup> Then the Treasury is required to hold the plant, plant product, biological control organism, plant pest, or noxious weed until it has been inspected and authorized for entry into or transit movement through the United States or is otherwise released by the USDA.<sup>105</sup> However, these requirements do not apply to any plant, plant product, biological control organism, plant pest, or noxious weed that is imported from a country or region of a country designated as exempt by the USDA.<sup>106</sup>

Parties who are responsible for any such plants, biological organisms or means of conveyance have certain duties under the PPA. Parties are required to have a permit under Sections 411 or 412 and shall notify the USDA “as soon as possible” after the arrival of the plant, biological organism, or the means of conveyance at the port of entry and be-



fore it is moved from the port of entry.<sup>107</sup> No person is to move from a port of entry or interstate any plant, biological organism, or means of conveyance unless it is inspected and authorized for entry into or transit movement through the United States or otherwise released by the USDA.<sup>108</sup>

The PPA authorizes the USDA to hold, treat, or destroy items if necessary to prevent dissemination of a plant pest or noxious weed that is “new or not known to be widely prevalent or distributed within and throughout the United States.”<sup>109</sup> Likewise, the USDA may order the owner of any plant, biological organism, or means of conveyance subject to action under Section 414(a), or the owner’s agent, to treat, apply other remedial measures to, destroy, or otherwise dispose of it without cost to the Federal government.<sup>110</sup>

The PPA encourages cooperation between the USDA and 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 this law.<sup>111</sup>

## **12.E.1s Virus-Serum-Toxin Act, 21 U.S.C. § 151 et seq.**

Persons, firms, and corporations are not authorized to deal in any worthless, contaminated, dangerous, or harmful biological product<sup>112</sup> for use in the treatment of domestic animals unless prepared under and in compliance with regulations prescribed by the USDA at an establishment licensed by the USDA.<sup>113</sup> Also, USDA regulates the importation and exportation of any biological product for use in the treatment of domestic animals without a permit from the USDA or, in the case of an article originating from Canada, a permit by Canada.<sup>114</sup>

## **12.E.2 Federal Programs 12.E.2a Conservation Technical Assistance**

The USDA Natural Resources Conservation Service (NRCS) administers Conservation Technical Assistance (CTA). CTA is a voluntary program for landowners, communities, State and local governments, and other Federal agencies for assistance in “planning and implementing natural resource solutions to reduce soil erosion, improve soil and water quantity and quality, improve and conserve wetlands, enhance fish and wildlife habitat ... and improve woodlands.”<sup>115</sup> The CTA program also provides assistance for implementation of programs authorized by the 1996 Farm Bill, such as Highly Erodible Land and wetlands conservation provisions.<sup>116</sup> The CTA program can be used for management of invasive species. The NRCS can provide technical assistance in preventing invasions and controlling, managing, and eradication of invasive species.

## **12.E.2b Environmental Quality Incentives Program**

The Environmental Quality Incentives Program (EQIP), administered by the NRCS, was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill 2002). Both governmental organizations and private landowners that engage in agricultural and livestock production to control and manage invasive species can utilize the EQIP.<sup>117</sup> Participation in the EQIP is voluntary.<sup>118</sup> EQIP activities are implemented according to the operation plans developed by both the government and producer.<sup>119</sup> The program provides financial assistance, through incentive payments and cost-shares, to protect against threats to soil, water, and other natural resources.<sup>120</sup> Specifically, the EQIP can provide technical assistance for preventing invasions and the use of cropping systems that discourage the introduction and spread of invasive species.<sup>121</sup> The program also can provide technical, educational, and financial assistance to eradicate/control invasive species and to manage lands to prevent future invasions.<sup>122</sup> Finally, the NRCS also can provide assistance for planning and installation measures, such as structural and land management practices, to protect land from future invasions after eradication.<sup>123</sup>

## **12.E.2c Plant Materials Program**

The Plant Materials Program, administered by the NRCS, provides plant recommendations and technology for the Farm Bill 2002 programs, such as EQIP, Wetlands Reserve Program, and the Wildlife Habitat Incentives Program. Plant Materials Centers assemble, test, and release plant species for commercial production and use of plant materials for natural resource conservation and development, including but not limited to soil erosion on all lands, protection of upstream watersheds, and improvement of wildlife food and cover.<sup>124</sup> Plant Materials Centers work in cooperation with other agencies in the USDA and with other Federal and State research agencies to achieve these goals.<sup>125</sup> Plant

materials are produced in the quantity required to do a specific conservation job that will serve the public and only if the plant materials are not commercially available.<sup>126</sup> Currently, there are 24 Plant Materials Centers in the United States, including the National Plant Materials Center in Beltsville, Maryland.<sup>127</sup>

## 12.E.2d Wetlands Reserve Program

Farm Bill 2002 reauthorized the Wetlands Reserve Program (WRP), which is a voluntary program administered by the NRCS. The purpose of the WRP is to “offer landowners the opportunity to protect, restore, and enhance wetlands on their property” in the long term.<sup>128</sup> The WRP provides financial, technical, and educational assistance to landowners through a Wetlands Reserve Plan of Operations in order to maintain healthy wetlands and to manage the hydrological conditions of the soil, native vegetation, and natural topography of eligible lands.<sup>129</sup> The USDA may provide cost-share assistance to landowners, as well as assistance with planning and installing features to restore wetland habitat, which could include wetlands altered by invasive species.<sup>130</sup>

## 12.E.2e Wildlife Habitat Incentives Program

Farm Bill 2002 reauthorized the Wildlife Habitat Incentives Program (WHIP), a voluntary program administered by the NRCS. The purpose of WHIP is to “help participants develop habitat for upland wildlife, wetland wildlife, threatened and endangered species, fish, and other types of wildlife.”<sup>131</sup> Protection of wildlife would include protections against the threats to wildlife posed by invasive species, as well as the lands that they inhabit. WHIP provides financial and technical assistance to landowners who develop wildlife habitat through a Wildlife Habitat Development Plan (WHDP).<sup>132</sup> Financial assistance is through cost-share payments and agreements.<sup>133</sup> Technical assistance includes application, assessment, monitoring, enforcement, and other actions necessary to fulfill the goals of the WHIP and the WHDP.<sup>134</sup> (For more is available from <http://www.nrcs.usda.gov/programs/whip/>)

## 12.E.3 Citations to the Code of Federal Regulations

CleanWater Act	• 14 CFR § 137
• 7 CFR § 601	• 19 CFR § 12
• 9 CFR § 590	• 21 CFR § 211
• 40 CFR § 6, 25, 35, 122, 123, 130, 401	• 40 CFR § 2, 17, 22, 23, 35, 40, 129, 152, 154, 158, 159, 160, 163, 164, 166, 167, 170-173 Federal NoxiousWeed Act
Coastal Zone Management Act	• 7 CFR § 340, 371
• 49 CFR § 1105	• 50 CFR § 24
Cooperative Forestry Assistance Act	Federal Plant Pest Act
• 36 CFR § 200, 230	• 7 CFR § 351
Endangered Species Act	• 50 CFR § 24
• 7 CFR § 319, 355, 356, 371, 650	Federal Seed Act
• 15 CFR § 904, 922	• 7 CFR § 97, 201, 371
• 19 CFR § 12, 10	Fish andWildlife Coordination Act
• 21 CFR § 25	• 30 CFR § 773, 736
• 30 CFR § 773	• 40 CFR § 122
• 32 CFR § 190	• 43 CFR § 8, 24
• 36 CFR § 2, 13	• 50 CFR § 10005
• 43 CFR § 414, 8340	Food Security Act
• 49 CFR § 1105	• 7 CFR § 400, 614, 1940
• 50 CFR § 10, 14, 17, 23, 81, 222, 402, 424, 453	• 9 CFR § 205
Federal Agricultural Improvement and Reform Act	• 46 CFR § 381
• 7 CFR § 12, 1794	• 9 CFR § 205
Federal Insecticide, Fungicide, and Rodenticide Act	• 46 CFR § 381
• 7 CFR § 110, 301, 319, 760	The Lacey Act
• 9 CFR § 71, 85, 121	• 50 CFR § 10, 11, 12, 13, 14, 16
	The Lacey Act Amendments of 1981

- 7 CFR § 356, 371
- 15 CFR § 904
- 50 CFR § 10, 11, 12, 14, 300
- Magnuson-Stevens Fishery Management and Conservation Act
- 15 CFR § 904, 905
- 50 CFR § 229, 300, 600, 622, 640, 648
- Multiple-Use Sustained-Yield Act
- 36 CFR § 200, 219
- National Environmental Policy Act
- 7 CFR § 372, 520, 622, 624, 632, 650, 799, 1710, 1780, 1794, 3407
- 10 CFR § 51, 1021
- 12 CFR § 408, 1815
- 14 CFR § 1216
- 16 CFR § 1, 1021
- 18 CFR § 2, 380, 707, 725
- 21 CFR § 25
- 22 CFR § 161
- 23 CFR § 751, 771
- 24 CFR § 50
- 28 CFR § 61
- 29 CFR § 11
- 32 CFR § 775
- 33 CFR § 230
- 36 CFR § 805, 907, 1010
- 38 CFR § 26
- 39 CFR § 775
- 40 CFR § 6, 1500, 1501- 1508, 1515
- 43 CFR § 1601, 1610, 3160, 3400, 3430
- 44 CFR § 9, 10
- 46 CFR § 504
- 49 CFR § 80, 260, 520, 622, 1105
- 50 CFR § 402, 530
- National Forest Management Act
- 36 CFR § 200, 215, 219
- National Invasive Species Act
- 33 CFR § 151
- National Marine Sanctuary Act
- 15 CFR § 904, 922
- Plant Protection Act
- 7 CFR § 301, 318, 319, 330, 340, 351, 352, 355, 360, 371
- Soil Conservation and Domestic Allotment Act
- 7 CFR § 7, 601, 701
- Virus-Serum-Toxin Act
- 9 CFR § 101, 102, 105, 114, 115, 116, 121, 123
- 32 CFR § 627

## Endnotes

1. See 33 U.S.C. § 1251(a).
2. See id.
3. See id. § 1342.
4. See id. U.S.C. § 1322.
5. See National Agricultural Library for the National Invasive Species Council, National Management Plan: Appendix 3 – Legal Authorities Related to Invasive Species. Retrieved 25 July 2003 from [www.invasivespecies.gov/council/appendix3.shtml](http://www.invasivespecies.gov/council/appendix3.shtml).
6. See 16 U.S.C. § 1452(1).
7. See id. § 1454(2).
8. See id. § 1455(e).
9. See id. § 1455a(f).
10. See id. § 1456(a).
11. See id. § 1456(b).
12. See id. § 1461(c).
13. 16 U.S.C. § 2104(b)(1).
14. Id. § 2104(b)(2), (3).
15. See id. § 2104 (b)(4).
16. See id. § 2104(e).
17. See id. § 2104(g).
18. See 16 U.S.C. § 1533.
19. See 7 U.S.C. § 136a for registration requirements and procedure and classification of pesticides.
20. See id.
21. See id.
22. “Undesirable plant species” means “plant species that are classified as undesirable, noxious, harmful, exotic, injurious, or poisonous, pursuant to State or Federal law.” 7 U.S.C. § 2814(e)(7).
23. See 7 U.S.C. § 201.
24. See id.
25. See id. § 202.
26. See id. § 203.
27. See id.
28. See id.
29. See id. § 205.
30. See id. § 301.
31. 16 U.S.C. § 661.
32. See id. § 661(1).
33. See id. § 662(a).
34. See id. § 662(b).
35. See id. § 663. See also §§ 661 and 662.
36. See 16 U.S.C. § 4501a.
37. See 16 U.S.C. § 4501(b).
38. Id. § 4501(a).
39. See id. § 4502a(b).
40. USDA Forest Service, Research and Development. Retrieved 26 February 2003 from <http://www.fs.fed.us/research>.

41. See *id.*
42. See 16 U.S.C. § 1604(f).
43. See *id.* § 1604(i).
44. See *id.* § 1604(e), (g)(1).
45. See *id.* § 42(3).
46. See *id.*
47. According to 16 U.S.C. § 42(a)(1), “wild” refers to “any creatures that, whether or not raised in captivity, normally are found in a wild state.”
48. See *id.* § 42(a)(1).
49. “Sale” of fish or wildlife in violation of this Act means a person for money or other consideration who offers or provides guiding, outfitting, or other services or a hunting or fishing license or permit. 16 U.S.C. § 3372(c)(1)(A)-(B). “Purchase” of fish or wildlife in violation of this Act means a person who obtains for money or other consideration guiding, outfitting, or other services or a hunting or fishing license or permit. 16 U.S.C. § 3372(c)(2)(A)-(B).
50. 16 U.S.C. § 3372(d)(1)-(2).
51. See 16 U.S.C. § 3374(1).
52. 16 U.S.C. § 3374(a)(2)
53. The definition of “fish and wildlife” in 16 U.S.C. § 3371(a) includes “any wild animal, whether alive or dead, including without limitation any wild mammal, bird, reptile, amphibian, fish, mollusk other invertebrate.”
54. 16 U.S.C. § 3371(f).
55. 16 U.S.C. § 3378(a)
56. See 16 U.S.C. § 1855(b)(1)(B).
57. See *id.*
58. See 16 U.S.C. § 1855(b)(1)(C).
59. See 16 U.S.C. § 1855(b)(1)(D).
60. See 16 U.S.C. § 1855(b)(2).
61. 16 U.S.C. § 1855(b)(3)(A).
62. See 16 U.S.C. § 1855(b)(3)(B).
63. 16 U.S.C. § 528.
64. See *id.* § 529.
65. *Id.* “Multiple use” means the management of all the various renewable surface resources of the national forests so that they are used in the combination that best meets the needs of the American people. See *id.* § 531(a). “Sustained yield” means the achievement and maintenance “in perpetuity” (i.e., forever) of a high level annual or regular periodic output of resources without impairment of the productivity of the lands of the national forests. See *id.* § 531(b).
66. 42 U.S.C. § 4321
67. 42 U.S.C. § 4332
68. An EIS is a document that describes the effects on the environment as a result of a proposed Federal action. See 40 C.F.R. § 1508.11. It also describes impacts of alternatives as well as plans to mitigate impacts. “Environment” means “the natural and physical environment, and the relationship of people with that environment.” 40 C.F.R. § 1508.14. The “environment” considered in an EIS includes land, water, air, structures, living organisms, environmental values at the site, and the social, cultural, and economic aspects. See *id.* “Effect” means a change in consequence that results from an activity. 40 C.F.R. § 1508.8. Impacts can be positive, negative, or both. See *id.* An EIS describes impacts, as well as ways to mitigate impacts. “Mitigate” means “to lessen or remove negative impacts.” 40 C.F.R. § 1508.20.
69. An EA is a concise public document, for which a Federal agency is responsible, that briefly provides sufficient evidence and analysis for determining whether there is a need to prepare an EIS or a Finding of No Significant Impact. It also aids in an agency’s compliance with the Act when no EIS is necessary and facilitates preparation of a statement when one is necessary. An EA shall include brief discussions of the need for the proposal, of alternatives as required by 42 U.S.C. § 4332 (2) (E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted. See 40 C.F.R. § 1508.9.
70. See 16 U.S.C. § 4721(a).
71. Under NISA, “aquatic nuisance species” means “a nonindigenous species that threatens 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.” *Id.* § 4702(1). “Nonindigenous species” means “any species or other viable biological material that enters an ecosystem beyond its historic range, including any such organism transferred from one country to another.” *Id.* § 4702(11).
72. See *id.* § 4722(a).
73. See *id.* § 4711.
74. See *id.*
75. Under the NISA, “Secretary” means the Secretary of the Department in which the U.S. Coast Guard is operating. See 16 U.S.C. § 4702(12).
76. 16 U.S.C. § 4711(2)(F)(i), (G), and (I).
77. See *id.* § 4711(c)(2).
78. 16 U.S.C. § 4712(a).
79. See *id.*
80. See *id.* § 4724.
81. See *id.*
82. See *id.* § 4722(f).
83. See *id.*
84. 16 U.S.C. § 1431(a)(4).

85. See id. § 1440.
86. See id. § 1441(a).
87. See id. § 1442(a).
88. See id. § 1440(b)(1).
89. Id. § 1436(1).
90. See National Agricultural Library for the National Invasive Species Council, National Management Plan: Appendix 3 - Legal Authorities Related to Invasive Species. Retrieved 25 July 2003 from <http://www.invasivespecies.gov/council/appendix3.shtml>.
91. See 7 U.S.C. § 403(14) for a definition of "plant pest."
92. See id. § 411(a).
93. See id.
94. See id. § 411(c).
95. See id.
96. See id. § 411(d).
97. Id.
98. See id.
99. See id. § 412.
100. See id.
101. See id. § 12(f)(1).
102. See id.
103. See id. § 412(g).
104. See id. § 413.
105. See id.
106. See id.
107. See id. § 413(b).
108. See id.
109. Id. § 414(a).
110. See id.
111. See id. § 431.
112. The term "biological product" includes, but is not limited to, "vaccines, bacterins, allergens, antibodies, antitoxins, toxoids, immunostimulants, certain cytokines, antigenic or immunizing components of live organisms, and diagnostic components, that are of natural or synthetic origin or that are derived from synthesizing or altering various substances or components of substances ..." 9 C.F.R. § 101.2.
113. See 21 U.S.C. § 151.
114. See id. § 152.
115. 7 C.F.R. § 601.1(f)(1)(i).
116. See id.
117. See 7 C.F.R. § 1466.4(d).
118. See id. § 1466.4(a).
119. See id. See also 7 C.F.R. § 1466.6(a).
120. See id.
121. See id. § 1466.8(a).
122. See id. § 1466.1.
123. See id.
124. See 7 C.F.R. §§ 613.1, 613.2.
125. See id. § 613.2.
126. See id. § 613.4.
127. See id. § 613.5.
128. See The US DANatural Resources Conservation Service, Wetlands Reserve Program. Retrieved 28 February 2003 from [www.nrcs.usda.gov/programs/wrp/](http://www.nrcs.usda.gov/programs/wrp/).
129. See 7 C.F.R. § 1467.4(a).
130. See id.
131. 7 C.F.R. § 636.1(a).
132. See id. § 636.7.
133. See id. §§ 636.8, 636.10.
134. See id. § 636.4.



## 12.F Appendix F. Section 1204 of the National Invasive Species Act of 1996

### SECTION 1204. STATE AQUATIC NUISANCE SPECIES MANAGEMENT PLANS

#### (a) STATE OR INTERSTATE INVASIVE SPECIES MANAGEMENT PLANS —

(1) IN GENERAL – After providing notice and opportunity for public comment, the governor of each State may prepare and submit, or the Governors of the States and the governments of Indian Tribes involved in an interstate organization, may jointly prepare and submit —

(A) A comprehensive management plan to the Task Force for approval which identifies those areas or activities within the State or within the interstate region involved, other than those related to public facilities, for which technical, enforcement, or financial assistance (or any combination thereof) is needed to eliminate or reduce the environmental, public health, and safety risk associated with aquatic nuisance species, particularly the zebra mussel; and

(B) A public facility management plan to the Assistant Secretary for approval which is limited solely to identifying those public facilities within the State or within the interstate region involved for which technical and financial assistance is needed to reduce infestations of zebra mussels.

(2) CONTENT – Each plan shall, to the extent possible, identify the management practices and measures that will be undertaken to reduce infestations of aquatic nuisance species. Each plan shall —

(A) Identify and describe State and local programs for environmentally sound prevention and control of the target aquatic nuisance species;

(B) Identify Federal activities that may be needed for environmentally sound prevention and control of aquatic nuisance species and a description of the manner in which those activities should be coordinated with State and local government activities;

(C) Identify any authority that the State (or any State or Indian Tribe involved in the interstate organization) does not have at the time of the development of the plan that may be necessary for the State (or any State or Indian Tribe involved in the interstate organization) to protect public health, property, and the environment from harm by aquatic nuisance species; and

(D) A schedule of implementing the plan, including a schedule of annual objectives and enabling legislation.

#### (3) CONSULTATION —

(A) In developing and implementing a management plan, the State or interstate organization should, to the maximum extent practicable, involve local governments and regional entities, Indian Tribes, and public and private organizations that have expertise in the control of aquatic nuisance species.

(B) Upon the request of a State or the appropriate official of an interstate organization, the Task Force or the Assistant Secretary, as appropriate under paragraph (1), may provide technical assistance in developing and implementing a management plan.

(4) PLAN APPROVAL — Within 90 days after the submission of a management plan, the Task Force or the Assistant Secretary in consultation with the Task Force, as appropriate under paragraph (1), shall review the proposed plan and approve it if it meets the requirements of this subsection or return the plan to the Governor or the interstate organization with recommended modifications.

(b) GRANT PROGRAM —

(1) STATE GRANTS — The Director may, at the recommendation of the Task Force, make grants to States with management plans approved under subsection (a) for the implementation of those plans.

(2) APPLICATION — An application for a grant under this subsection shall include an identification and description of the best management practices and measures which the State proposes to utilize in implementing an approved management plan with any Federal assistance to be provided under the grant.

(3) FEDERAL SHARE —

(A) The Federal share of the cost of each comprehensive management plan implemented with Federal assistance under this section in any fiscal year shall not exceed 75 percent of the cost incurred by the State in implementing such management program and the non-Federal share of such costs shall be provided from non-Federal sources.

(B) The Federal share of the cost of each public facility management plan implemented with Federal assistance under this section in any fiscal year shall not exceed 50 percent of the cost incurred by the State in implementing such management programs and the non-Federal share of such costs shall be provided from non-Federal sources.

(4) ADMINISTRATIVE COSTS — For the purposes of this section, administrative costs for activities and programs carried out with a grant in any fiscal year shall not exceed 5 percent of the amount of the grant in that year.

(5) IN-KIND CONTRIBUTIONS — In addition to cash outlays and payments, in-kind contributions of property or personnel services by non-Federal interests for activities under this section may be used for the non-Federal share of the cost of those activities.

(c) ENFORCEMENT ASSISTANCE — Upon request of a State or Indian Tribe, the Director or Under Secretary, to the extent allowable by law and in a manner consistent with section 141 of title 14, United States Code, may provide assistance to a State or Indian Tribe in enforcing an approved State or interstate invasive species management plan.

## 12.G Appendix G. Federal Executive Order 13112 of February 3, 1999

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

### Section 1. Definitions.

(a) “Alien species” means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) “Control” means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) “Ecosystem” means the complex of a community of organisms and its environment.

(d) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.

(e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "Native species" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) "Stakeholders" means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) "United States" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

## Section 2. Federal Agency Duties.

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law;

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and

(3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

## Section 3. Invasive Species Council.

(a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protec-

tion Agency. The Council shall be co-chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

#### Section 4. Duties of the Invasive Species Council.

The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species;

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(g) prepare and issue a national Invasive Species Management Plan as set forth in section 5 of this order.

#### Section. 5. Invasive Species Management Plan.

(a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the

duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk that introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to the Office of Management and Budget on whether the order should be revised.

### Section. 6. Judicial Review and Administration.

(a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs.

(d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.

WILLIAM J. CLINTON  
THE WHITE HOUSE  
February 3, 1999



## 12.H Appendix H. Summary of International Laws and Treaties Relevant to ANS

### 12.H.1 International Laws

#### 12.H.1a Codex Alimentarius Commission

The United Nations' Food and Agricultural Organization (FAO) and the World Health Organization (WHO) created the Codex Alimentarius Commission (Codex) in 1962.<sup>1</sup> The purpose of the Codex is to encourage fair international trade in food while promoting the health and economic interests of consumers.<sup>2</sup> In the United States, Codex activities are coordinated by the USDA, EPA, and Food and Drug Administration.<sup>3</sup>

Volume 1A of the Codex empowers the Commission to create specialized committees. One such committee that relates to invasive species is the Committee on Import/Export Inspection and Certification Systems.<sup>4</sup> To fulfill its goal of protecting consumer health in the area of food safety, The Codex has formulated standards for specific food commodities, pesticide and drug residues, food contaminants and additives, labeling, and food safety.<sup>5</sup> Invasive species are relevant to the Codex if they threaten food safety or the international food trade.

#### 12.H.1b Convention on Biological Diversity

The Convention on Biological Diversity (CBD) recognizes the importance of "ecological, genetic, social, economic, scientific, educational, cultural, recreational, and aesthetic" values of biological diversity throughout the world.<sup>6</sup> Countries have rights over their own biological resources, but also have the responsibility of conserving them and using them in a sustainable manner.<sup>7</sup> A fundamental requirement for the conservation of biological diversity is In-Situ conservation.<sup>8</sup> The CBD recognizes the need to "prevent the introduction of and control or eradicate those alien species which threaten ecosystems, habitats, or species."<sup>9</sup> The CBD has a program to target introduction of invasive species.<sup>10</sup> The Global Invasive Species Programme works with the CBD to provide expertise through the CBD's Subsidiary Body on Science, Technology, and Technical Assistance.<sup>11</sup> The United States has not ratified the agreement.

#### 12.H.1c Convention on International Trade in Endangered Species of Wild Flora & Fauna

The purpose of The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) is to foster international cooperation in order to protect certain species of flora and fauna from over-exploitation through international trade.<sup>12</sup> CITES divides species of wild flora and fauna into three appendices. Trade of any species in Appendices I, II, or III is prohibited, except in accordance with provisions set forth in CITES.<sup>13</sup> Trade of species included in Appendices I, II, and III are regulated through a system of import, export, and re-export permits.<sup>14</sup> Appendix I includes species threatened with extinction that are or may be affected by trade. Trading members of these species are the most strictly regulated in order not to further endanger their survival.<sup>15</sup> For these species, trade is authorized in only "exceptional" circumstances.<sup>16</sup>

Appendix II includes species that currently are not threatened with extinction, but would become so threatened without strict regulation.<sup>17</sup> Appendix II also recognizes that trade in other species also must be regulated in order to effectively protect species included in Appendix II.<sup>18</sup>

Appendix III includes all species that any Party to CITES declares to be subject to regulation within its jurisdiction to prevent or restrict exploitation, and "as needing cooperation of other parties in the control of trade."<sup>19</sup>

#### 12.H.1d Office of International Epizootics

The Office of International Epizootics (OIE) is an international organization created by agreement in 1924. Its purposes are to guarantee the transparency of animal diseases worldwide; to collect, analyze, and disseminate veterinary scientific information; to provide expertise and promote international solidarity for the control of animal diseases; and to guarantee the sanitary safety of world trade by developing sanitary rules for international trade in animals and animal products.<sup>20</sup>

The OIE collects and disseminates information through cooperation between Member Countries. Each Member reports to the OIE animal diseases that it identifies within its territory.<sup>21</sup> The OIE thereby disseminates this information to other Members so that each may act upon this information accordingly.<sup>22</sup> The OIE provides technical support to Member Countries that request assistance in controlling and eradicating animal diseases.<sup>23</sup> The OIE also creates “normative documents relating to rules that Member Countries can use to protect themselves from diseases without setting unjustified sanitary barriers.”<sup>24</sup> Such normative documents include the International Animal Health Code<sup>25</sup> and Manual Standards for Diagnostic Tests and Vaccines.<sup>26</sup> While the OIE generally focuses on issues such as livestock diseases and developing standards for diagnostic tests and vaccines, it recently has started to focus on diseases affecting wildlife, including aquatic species, by publishing its International Aquatic Animal Health Code.<sup>27</sup>

## **12.H.1e International Plant Protection Convention**

The purpose of the International Plant Protection Convention (IPPC) is to prevent the introduction and spread of pests of plants and plant products and to promote appropriate control measures.<sup>28</sup> The IPPC was adopted in 1951 and was revised in November 1997. However, the 1997 revision, while adopted, is not yet in force.<sup>29</sup> Under the IPPC, each contracting party agrees to cooperate with each other to prevent the introduction of plant pests and diseases and prevent their spread across national boundaries.<sup>30</sup> The Food and Agriculture Organization of the United Nations disseminates information on import restrictions, requirements, prohibitions, and regulations to all contracting parties and regional plant protection organizations.<sup>31</sup> Each contracting party is responsible for creating a national plant organization to carry out the provisions of the IPPC, such as inspection of consignments of plants and plant products moving in international traffic that may carry pests and diseases and protecting endangered areas.<sup>32</sup> If necessary for phytosanitary conditions, contracting parties may regulate the entry of plants into their territories by setting requirements of importation; prohibiting importation of specific plants; inspecting and detaining specific plants; and treating, destroying, or refusing entry to specific plants.<sup>33</sup> However, contracting parties shall not take measure more stringent than necessary to accomplish the goals of the IPPC in order to minimize interference with international trade.<sup>34</sup>

## **12.H.1f North American Free Trade Agreement**

The main objectives of the North American Free Trade Agreement (NAFTA) are to eliminate trade barriers and to promote fair competition between the Parties to the Agreement.<sup>35</sup> NAFTA requires that each Party to the greatest extent practicable, participate in international and North American standardizing organizations, such as the Codex, OIE, IPPC, and North American Plant Protection Organization, to promote the “development and periodic review of international standards, guidelines and recommendations.”<sup>36</sup>

Chapter 7 relates to invasive species. It allows each Party to adopt sanitary or phytosanitary measures necessary for the protection of human, animal, or plant life or health in its territory.<sup>37</sup> Such measures may be more stringent than international standards, guidelines, or recommendations.<sup>38</sup> Such measures should be based on research and risk assessment.<sup>39</sup> However, measures should not arbitrarily or unjustifiably discriminate against another Party’s goods.<sup>40</sup> Furthermore, in conducting risk assessments in order to determine appropriate measures of protection, one of the factors that the Parties must take into account is “the prevalence of relevant diseases or pests, including the existence of pest-free or disease-free areas or areas of low pest or disease prevalence.”<sup>41</sup>

## **12.H.1g World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures**

The Sanitary and Phytosanitary Measures Agreement (SPS Agreement) is a supplement to the World Trade Organization Agreement. It encourages Members to adopt measures necessary to protect human, animal or plant life or health.<sup>42</sup> However, such measures should not arbitrarily or unjustifiably discriminate against Members that experience the same conditions in their territories or be disguised as a restriction on international trade.<sup>43</sup> The SPS Agreement also encourages Members to use other international guidelines, such as the Codex, OIE, and IPPC<sup>44</sup> to promote within these organizations the development and periodic review of standards, guidelines, and recommendations with respect to all aspects of sanitary and phytosanitary measures.<sup>45</sup> The SPS Agreement Members should conduct scientific research and collect evidence in order to set appropriate levels of sanitary and phytosanitary protection

with the least impact on international trade.<sup>46</sup> Such evidence includes the prevalence of specific diseases or pests, existence of pest-free or disease-free areas, relevant ecological and environmental conditions, and quarantine or other treatment.<sup>47</sup>

## Endnotes

1 See Food Safety and Inspection Service U.S. Codex Office, Codex Alimentarius Commission. Retrieved 17 February 2003 from [www.fsis.usda.gov/OA/codex/](http://www.fsis.usda.gov/OA/codex/).

2 See id.

3 See id.

4 See FAO/WHO Food Standards, Codex Alimentarius. Retrieved 17 February 2003 from [www.codexalimentarius.net/](http://www.codexalimentarius.net/).

5 See id.

6 Convention on Biological Diversity, June 5, 1002, Preamble.

7 See id.

8 In-Situ conservation means "the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties." Id. Article 2.

9 Id. Article 2(h).

10 See Convention on Biological Diversity, Alien Species Introduction. Retrieved 17 February 2003 from [www.biodiv.org/programmes/cross-cutting/alien/](http://www.biodiv.org/programmes/cross-cutting/alien/).

11 See Convention on Biological Diversity, Alien Species Introduction. Retrieved 17 February 2003 from [www.biodiv.org/programmes/cross-cutting/alien/gisp.asp](http://www.biodiv.org/programmes/cross-cutting/alien/gisp.asp).

12 See Convention on International Trade of Endangered Species of Wild Flora and Fauna, March 3, 1973, Preamble.

13 See id. Article II.4.

14 See id. Article III.2, III.3, and III.4. See also Article IV.2, IV.3, IV.4, and IV.5 and Article V.2, V.3, and V.4.

15 See id. Article II.1.

16 Id.

17 See id. Article II.2(a).

18 See id. Article II.2(b).

19 See id. Article II.3.

20 See Office of International Epizootics, What is the OIE?. Retrieved 17 February 2003 from [www.oie.int/eng/OIE/en\\_oie.htm](http://www.oie.int/eng/OIE/en_oie.htm).

21 See id.

22 See id.

23 See id.

24 See id.

25 See Office of International Epizootics, Terrestrial Animal Health Code 2003. Retrieved 25 July 2003 from [www.oie.int/eng/normes/mcode/A\\_summry.htm](http://www.oie.int/eng/normes/mcode/A_summry.htm).

26 See Office of International Epizootics, Manual Standards for Diagnostic Tests and Vaccines 2000. Retrieved 28 February 2003 from [www.oie.int/eng/normes/mmanual/A\\_summry.htm](http://www.oie.int/eng/normes/mmanual/A_summry.htm).

27 See Office of International Epizootics, International Aquatic Animal Health Code 2002.

Retrieved 28 February 2003 from [www.oie.int/eng/normes/fcode/A\\_summry.htm](http://www.oie.int/eng/normes/fcode/A_summry.htm).

28 See International Plant Protection Convention, December 6, 1951, current text adopted in 1979, Article I.1.

29 See International Phytosanitary Portal, Documents and Publications. Retrieved 3 March 2003 from [www.ippc.int/cds\\_ippc\\_prod/IPP/En/publications.htm](http://www.ippc.int/cds_ippc_prod/IPP/En/publications.htm).

30 See International Plant Protection Convention, December 5, 1951, current text adopted in 1979, Preamble.

31 See id. Article VI.4.

32 See id. Article IV.1(a)(i), (ii).

33 See id. Article VI.1.

34 See id. Article VI.2.

35 See North American Free Trade Agreement, 17 December 1992, Article 102.

36 Id. Chapter 7, § B, Art. 713(5).

37 See id. Chapter 7, § B, Art. 712(1).

38 See id.

39 See id. Chapter 7, § B, Art. 715(1).

40 See id. Chapter 7, § B, Art. 712(4))

41 Id. Chapter 7, § B, Art. 715(1)(e).

42 See Agreement on Sanitary and Phytosanitary Measures, 15 April 1994, Preamble.

43 See id. Article 5.5.

44 See id. Preamble. See also Article 3.4.

45 See id. Article 3.4.

46 See id. Article 5.4.

47 See id. Article 5.2.

## 12.I Appendix I. Public Comments Received and Responses

A Press Release was issued on December 29, 2008, that the *Alabama Aquatic Nuisance Species Management Plan* was posted on the Alabama Department of Conservation and Natural Resources web site for public review and comment. The following comments were received and addressed.

### Received via e-mail on January 8, 2009 @ 3:01 PM

Dear Mr. Rider,

I would like to submit a couple of comments regarding the AANS Management Plan.

First, while the distribution maps of each species are undoubtedly as accurate as possible I couldn't help but notice that the map for *Lygodium japonicum* (Japanese climbing fern) is quite poorly distributed. *Lygodium japonicum* occurs almost ubiquitously in the lower 2/3 of the state and particularly in east-central and southeastern Alabama (based on herbarium collections at Auburn University). I have documented records of probably a dozen more counties in which this plant occurs than is highlighted on the map. A change to better reflect the actual distribution of this plant would be recommended. *This species has been removed from the Plan as suggested by the ANS Task Force.*

Second, plant nomenclature is often puzzling at best and nearly impossible at worst, and I understand that the target audience for this management plan is not trained systematic botanists. However, what name is applied to a particular plant, scientifically speaking, has direct implications for not only managing and protecting rare and endangered species but also has bearing on how to treat invasive species as well.

While it is a mess and confusing, I want to bring up a clarification with the nomenclature and synonym listed for *Ludwigia hexapetala* (Uruguayan Waterprimrose). Both *Ludwigia hexapetala* and *Ludwigia uruguayensis* are now currently recognized as subspecies of *Ludwigia grandiflora*, they are not synonyms of one another. The following indicates the more accurate way to list these names:

*Ludwigia grandiflora* ssp. *grandiflora* (syn. *Ludwigia uruguayensis*) *Ludwigia grandiflora* ssp. *hexapetala* (syn. *Ludwigia hexapetala*). In other words, *L. uruguayensis* and *L. hexapetala* are "older" names not currently recognized. The two names that are recommended for use are *L.*

*grandiflora* ssp. *grandiflora* and *L. grandiflora* ssp. *hexapetala*. Both subspecies are listed by other states as noxious weeds and this current nomenclature can be confirmed by visiting the USDA Plants Database (<http://usda.plants.gov>) or The Missouri Botanical Garden's plant database, Tropicos at (<http://www.tropicos.org/Home.aspx>). This has been corrected in the Plan.

Thank you for your time and for all the work toward eradicating invasive species from our beautiful state.

Best regards,  
Curtis Hansen

Curtis J. Hansen, Curator  
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Received via e-mail on January 27, 2009 @ 8:39 PM

Steve,

Thank you for the opportunity to serve on the Alabama Aquatic Nuisance Species Task Force and be a part of the development of the Alabama Aquatic Nuisance Species Plan. The Alabama Catfish Producers, a division of the Alabama Farmers Federation represents the interests of Alabama's catfish industry which has a vested interest in this plan. In reviewing the draft plan, there are a couple of areas of concern that should be addressed.

Sections 7.D.3 – 7.D.4 of the plan discuss the creation of a Permanent Non-native Species Review Committee with regulatory authority. This committee could unilaterally determine which species could be imported without any type of public input. If this is the case, is there any means for an appeals process? There is also concern that this would be a permanent committee. There should be some means of rotating these members. The plan should allow for input from the public in not only the creation of the committee and who sits on the committee, but decisions made by the committee regarding the importation of species. *This proposed committee would also be represented by public interests and proposed decisions would require public review and comments. A recommendation would be made for committee members to serve a pre-determined time limit.*

Section 7.D.3 also discusses approval of a Non-native Aquaculture, Research, and Aquarium Species List. It seems that it would be virtually impossible for the committee to list every species that could be imported into the state for reasons such as aquaculture or research. It would be much less confusing to create a list of species that are truly a threat that cannot be imported without a permit. This list could be based on sound science and not just speculation. In this case, if a species is planned to be introduced into an aquaculture setting and does not appear on a list of banned species, then no communication with this committee should be required, making complying with this plan much less burdensome on the producer. Also, as you know many species continue to be reclassified by taxonomists, and new species are still being discovered. A list of approved species would simply be too fluid and too large to be effective. Additionally, would the persons tasked with enforcing such regulations rather have a list of a few banned species to keep track of, or check something against hundreds of approved species? *The Alabama Aquatic Nuisance Species Task Force decided to take a proactive approach to the importation of aquatic nuisance species in Alabama by proposing an "approved" list. The Task Force viewed a "prohibited or banned" list as retroactive. For some species that are imported into Alabama, if they escape from their holding area and become established then it can be too late to eradicate (i.e., bighead carp in the Alabama and Tennessee rivers). Developing such a list is a proactive means to preclude the establishment of non-native species and while it will be "fluid", the Task Force believes it is the most effective.*

Section 7.D.4 also discusses individuals wishing to import species having to come before the committee and pay associated costs for the review. This statement points back to the list of approved species. There is a concern that this list would not be broad enough to keep producers from having to pay for a review of a species without any real justification. Just because the list did not include that species, is it really a risk, or did someone just not think to put it on the list? Who is paying to establish this initial list of approved species? Why couldn't these same funds pay for individual reviews? This approach simply opens too many questions that the creation of a list of "banned" species would alleviate.

While we agree that invasive species have been problematic in this state, this plan must allow farmers to be farmers and researchers to be researchers and explore new opportunities. The use of a list of "banned" species as opposed to a list of approved species would give them that chance. A list of "banned" species would be simple to establish, could be based on sound science by considering the real risks, could target species where there is a known concern, and could easily be complied with by the various stakeholders. If this committee sets up a list of approved species, there are many questions to be considered. In essence, this list would have to include every species that is not considered to be a risk and that seems virtually impossible to establish.

Thank you in advance for strongly considering these very real concerns.

Sincerely,

Mitt Walker

Director, Catfish and Meat Goat & Sheep Divisions

Alabama Farmers Federation

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Received via e-mail on January 28, 2009 @ 4:16 PM

Steve,

I recently learned that you have recommended that red claw crayfish, *Cherax quadricarinatus* be a restricted species in Alabama. *The State of Alabama has a prohibited list (not restricted) and this species has not been recommended for the list.* I began working with Australian crayfish in 1989 and probably brought in my first red claw in 1992. Since that time I have published almost 30 manuscripts on red claw. These papers have covered almost every aspect of the life cycle of red claw, their culture techniques and market potential. The earliest papers looked at potential environmental concerns. In my 17 to 18 years of working with red claw I have not seen anything that would give me concerns to have red claw in Alabama. There have been no diseases or pathogens that I have found on any of the dozens of shipments that I have received. They are not aggressive which is a good trait for an aquaculture species and which puts them at a disadvantage if competing with our native crayfish which are quite aggressive and territorial. The trait that I believe should relieve most that might be concerned with introduced species is that they are tropical and will not survive our winters. I have tested this on several occasions and have witnessed several producers try to overwinter them in outdoor ponds even as far south as Mobile and Baldwin County. I have not observed any survive our winters. They quit growing at about 20 C (68 F). Their lower temperature tolerance is usually give to be between 7 to 12 C but this is in indoor tank studies. Much below 18 to 20 C, they lose resistance and usually die from secondary infections.

*In recent years, the Australian redclaw crayfish (Cherax quadricarinatus), has been imported into numerous countries for aquaculture purposes and has escaped from some facilities. Scientific literature indicates wild populations are now established in Mexico, Singapore, South Africa, Jamaica, and Puerto Rico. In central Mexico, the impacts of Australian redclaw crayfish on native crayfishes is just becoming evident as native crayfish numbers are in decline (R. Mendoza, Univ. of Nuevo Leon-Mexico, pers. comm.).*

I've attached some key papers that include this earliest work on environmental interactions as well as some summary papers but I will be very glad to share any of the papers I have written or probably most that have been written by anyone on red claw. Having seen no detrimental effects from my research or from observing them in Alabama and in a number of other states and countries around the world, I see no problems in allowing *Cherax quadricarinatus* to be cultured in Alabama.

My advise to people who have asked is that its economic potential in outdoor ponds is doubtful but folks have worked with them in indoor tanks with some success. It is a great teaching tool in several high schools around Alabama.

I would support a ban on *Cherax destructor*. It has lower temperature tolerance and is a burrower so potential damage can result from its introduction. I would be glad to talk with you more about any of the Australian crayfish if you need more information.

David

David Rouse, Professor  
Department of Fisheries  
Auburn University

Received via e-mail on January 10, 2009 @ 4:43 PM

Dear Steve:

My name is Julian Stewart and I am the aquaculture science teacher at Bryant High School in South Mobile County. We have had an ongoing aquaculture program since 1998 and have conducted a number of scientific studies on a number of freshwater and saltwater species. We have been trying to identify a species that has sufficient economic potential to fund our program. Far and away the best candidate species for us is the Australian redclaw crawfish *Cherax quadricarinatus*. Contrary to what you have told me in past conversations, I see the redclaw crawfish is a species of concern in the ANS plan. *The decision to place any animal or plant in the Plan is decided by the Task Force, not one individual. It was never said this animal would be excluded from the Plan.* This is not a problem for me...I feel there needs to be a set of regulations and guidelines for the possession and culture of any non-native species, including the redclaw crawfish. However, I feel this plan should be sensible and use good science and not an all out ban of any non-native species.

The State of Florida is extremely proactive in these matters and has a sensible set of regulations regarding redclaw crawfish. *The State of Florida is a poor example for non-native species control since this state has more non-native species than most other states combined.* They do not allow any open pond culture of redclaw crawfish...tanks only. A large portion of southern Florida is considered tropical and redclaws stand a very real chance of surviving in the wild there whereas none of the State of Alabama has any areas that are even close to being considered tropical. *The same was thought about tilapia, but Alabama now has established wild populations in Baldwin and Mobile counties. This crayfish species has escaped from facilities outside its native range in Australia where it now thrives in a sub-tropical region (J. Furse, Griffith University, pers. comm.).* The State of Florida has periodic inspections of redclaw facilities and they feel their program is more than adequate to prevent any possible environmental damage resulting from the culture of this species. This approach should certainly be acceptable for Alabama. *The potential for escape is real as wild populations are now established in Mexico, Singapore, South Africa, Jamaica, and Puerto Rico.*

We culture all of our crawfish in lined above-ground tanks and they are either inside completely enclosed greenhouses or they are completely sealed with tank covers.

Our facilities are surrounded by 8-foot chain-link fences with 3 strands of barbed wire around the top. Gates are kept locked at all times and I and my principal are the only personnel with keys. All tank overflow drains are fitted with strainers and all of our wastewater goes into a pond full of hungry bass and bream that is also within the fence. We are nowhere near any natural creeks, streams, or other bodies of water. We do not sell, give or otherwise transfer any live crawfish to anyone. When we get to the point where we start to market our crawfish, they will either be cooked prior to leaving our facility or we will have a secure program worked out with the owner of the restaurant selling the redclaws. We will not sell any live redclaw to the general public or any other entity where they will be alive when sold. There is zero chance of live redclaws escaping or creating an environmental problem...NONE! We have an outstanding biosecurity program and this is an integral part of the subject matter I teach. *In Australia, this species readily escapes from "controlled" environments in areas outside its native range. The Task Force commends your efforts to keep these animals confined and from escaping and hopes it is enough. However, the following is an excerpt from e-mail from Australian researcher, James Fruse, Griffith University, on the ability of this animal to escape. "Be assured that they will escape from enclosed systems, they are resourceful little darlings, we are always rounding up escapees from ours: despite our best and quite elaborate efforts to keep them within". Again, the Task Force commends your bio-security program, but current evidence suggests if this species escapees there may be impacts and therefore the Task Force viewed it as prudent to add this species to the Plan.*

I would like to be actively involved in the development of any ANS management plan regarding aquaculture. This is my career and I take it very seriously. I think that Alabama can develop a successful aquaculture industry that is environmentally friendly if good science and common sense is applied. I look forward to hearing back from you.

Sincerely,  
Julian R. Stewart  
251-604-2605



# Alabama Aquatic Nuisance Species MANAGEMENT PLAN

