

# Alabama Aquatic Nuisance Species Management Plan



**Alabama Department of Conservation and Natural Resources  
Division of Wildlife and Freshwater Fisheries  
Fisheries Section**

**Final Management Plan  
October 2021**



**Montgomery, Alabama**

**Developed By:**

The Alabama Aquatic Nuisance Species Task Force  
and the  
Alabama Division of Wildlife and Freshwater Fisheries

Funded by the State Wildlife Grant and Sportfish Restoration Programs of the  
Alabama Division of Wildlife and Freshwater Fisheries  
and the U. S. Fish and Wildlife Service

**State of Alabama**  
**Kay Ivey, Governor**

Approved:                     *Kay Ivey*                    

Date:                     10/7/21                    

**Alabama Department of Conservation and Natural Resources**  
**Division of Wildlife and Freshwater Fisheries**  
**Fisheries Section**

**Christopher M. Blankenship**  
**Commissioner**



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## STATE OF ALABAMA

September 28, 2021

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Mr. David Hoskins, Co-Chair, Aquatic Nuisance Species Task Force  
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Dear Dr. Lee and Mr. Hoskins:

On behalf of the State of Alabama and the Alabama Aquatic Nuisance Species Task Force (ALANSTF), we are resubmitting the Alabama Aquatic Nuisance Species Management Plan to the Aquatic Nuisance Species Task Force for review and consideration for final approval. This plan addresses the threat of aquatic nuisance species in Alabama as developed by the ALANSTF, a group representing Federal and State entities, non-governmental organizations, citizen groups, as well as business interests.

This revised version of the conditionally approved Alabama Aquatic Nuisance Species Management Plan includes up-to-date scientific citations, new species information from the last 10 years, re-evaluation of species, and new species evaluations for inclusion in the plan. This version represents the most contemporary plan as possible for the State of 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.

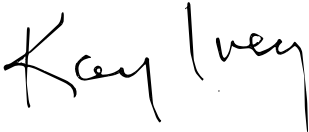
Please direct the ANS Task Force's comments regarding the plan to the following individual who is responsible for the state's efforts to develop the plan:

Mr. Steven J. Rider, River and Streams Fisheries Program Supervisor  
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Page Two  
Aquatic Nuisance Species Task Force  
September 28, 2021

We look forward to Task Force approval of the plan and the potential awarding of Federal funds to help implement the plan.

Respectfully,

A handwritten signature in black ink that reads "Kay Ivey". The signature is written in a cursive style with a large, prominent "K" and "I".

Kay Ivey  
Governor, State of Alabama



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Honorable Kay Ivey  
Governor of Alabama  
Alabama State Capitol  
600 Dexter Avenue  
Montgomery, AL 36130

Dear Governor Ivey:

On behalf of the Aquatic Nuisance Species (ANS) Task Force, this letter confirms the approval of the *Alabama Aquatic Nuisance Species Management Plan* (Alabama Plan) during the ANS Task Force's meeting on November 16 - 18, 2021. The Alabama Plan meets the requirements of Section 1204(a) of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended, and outlines a comprehensive approach to address ANS threats in Alabama.

The Alabama Plan is now eligible for Federal funding beginning in fiscal year (FY) 2022. Each State with an approved management plan will be notified of the opportunity and process for requesting these funds once the U.S. Fish and Wildlife Service receives its FY2022 Federal budget.

The ANS Task Force applauds Alabama's efforts, particularly those of Steve Rider, the River and Stream Fisheries Program Supervisor for Alabama's Department of Conservation and Natural Resources, and the rest of the Alabama Aquatic Nuisance Species Task Force. We look forward to a continued relationship with Alabama as your Plan is implemented. If you have questions or need additional information, please contact the ANS Task Force's Executive Secretary, Susan Pasko (via the contact information detailed above), or Donald MacLean, State and Interstate ANS Grant Program Coordinator at 703-358-2108.

Sincerely,

**MICHAEL  
OETKER**

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For: David Hoskins, ANSTF Co-  
Chair  
U.S. Fish and Wildlife Service



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cc: Chris Blankenship, Commissioner, Alabama Department of Conservation and Natural Resources  
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Dave Armstrong, AIS Coordinator, Alabama Division Wildlife & Freshwater Fisheries  
Cindy Williams, Regional AIS Coordinator, U.S. Fish and Wildlife Service

## ACKNOWLEDGEMENTS

The Alabama Aquatic Nuisance Species Task Force extends thanks to the following persons, without whom this plan would not have been possible:

Marilyn Barrett-O’Leary and the Southeast Aquatic Resources Partnership for guidance and support throughout plan development,

Steve Rider, Alabama Division of Wildlife and Freshwater Fisheries, Fisheries Section of the Department of Conservation and Natural Resources for leadership in plan development, and with drafting, writing, updating, and completing the plan,

David Yeager of the Mobile Bay National Estuary Program, and Jim McHugh of the Alabama State Wildlife Grants Program for providing plan development funds,

Travis Powell, Greg Miles, Jason Dattilo, Hunter Rider, Graves Lovell, Dave Armstrong, and Jeff Garner of the Alabama Division of Wildlife and Freshwater Fisheries, Fisheries Section of the Department of Conservation and Natural Resources for plan updating,

Stephanie Showalter and the National Sea Grant Law Center, for providing information on national and Alabama jurisdictions and laws related to aquatic nuisance species.

Kelly and Clinton Major, Southeastern Biological Inventories, for compiling information and data and drafting sections of the original plan.

## 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
ALANSTF	Alabama Aquatic Nuisance Species Task Force
ALCWP	Alabama Clean Water Partnership
ALDWFF	Alabama Division of Wildlife and Freshwater Fisheries
ALOGB	Alabama Oil and Gas Board
AMRAT	Alabama-Mississippi Rapid Assessment Team
AMRD	Alabama Marine Resources Division
ANSTF	Aquatic Nuisance Species Task Force
APHIS	Animal and Plant Health Inspection Service
BASS	Bass Anglers Sportsman Society
BWM	Ballast Water Management
FAO	Food and Agricultural Organization
GSMFC	Gulf States Marine Fisheries Commission
HACCP	Hazard Analysis Critical Control Point
IMO	International Maritime Organization
INHS	Illinois Natural History Survey
MBNEP	Mobile Bay National Estuary Program
MICRA	Mississippi Interstate Cooperative Resource Association
MOU	Memorandum of Understanding
MRBP	Mississippi River Basin Panel on Aquatic Nuisance Species
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
TVA	Tennessee Valley Authority
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

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## 1) EXECUTIVE SUMMARY

Alabama has a wealth of water resources (Figure 1). An average rainfall of 56 inches (ALNET, 2020) each year and groundwater sources supply the water for over 132,000 miles of rivers, perennial and intermittent streams; 563,000 acres of ponds, lakes and reservoirs; and over 3.6 million acres of marshes and wetlands (ARA, 2020). The state also boasts 60 miles of coast with over 400,000 acres of estuaries (EAL, 2020). These water resources act as a conduit for the invasion of aquatic nuisance species (Figure 1). Alabama surpasses all states in fish, mussel, snail, and crayfish biodiversity (Garner, 2017; Henderson and Smith, 2017; Rider, 2017). Over 815 species from the aforementioned taxa are found in Alabama providing citizens with economic and ecological resources to enhance quality of life. Although some non-native species exist with native species in Alabama, they are relatively benign and cause little ecological impacts. However, other non-native species are harmful and defined as Aquatic Nuisance Species (ANS) that are introduced outside of their native ranges that can grow in or are closely associated with the aquatic environment. These species can alter, damage, or destroy these resources, affecting human health and the state's economy and/or ecology.

Aquatic Nuisance Species pose a significant problem to the State of Alabama. These species can have deleterious effects on the local economy, human health and/or ecology. For example, silver carp (*Hypophthalmichthys molitrix*) have recently invaded the Tennessee River basin and have the potential to negatively affect native (i.e., sport and imperiled) fish distribution and abundance by competing for phytoplankton and zooplankton. This in turn can affect local economies if sportfish populations decline then anglers may limit their fishing expenditures due to poor fishing/population conditions. This example exemplifies how ANS can affect Alabama and why ANS should be prevented/minimized before they become a problem. The purpose of the Alabama Aquatic Nuisance Species Management Plan is to coordinate a concise and proactive approach that will prevent, control, and/or minimize ANS threats to the State of Alabama like that of silver carp.

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 (Appendix 12.A). The ALANSTF quickly grew to 67 members representing 28 governmental, non-governmental, private and university agencies/organizations. The ALANSTF first met on 3 August 2005 and subsequently 4 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 81 non-native aquatic species currently in Alabama with the potential to present problems to the state as ANS (Appendix 12.B). 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, and the nation. The species creating the most serious problems in Alabama in the early 2000s were bighead carp (*H. nobililis*), hydrilla (*Hydrilla verticillata*), common salvinia (*Salvinia minima*), water hyacinth (*Eichhornia crassipes*), island apple snail (*Pomacea maculata*) Cuban bulrush (*Cyperus blepharoleptus*), and blue-green algae

(*Lyngbya wollei*), and most recently, silver carp (a complete description of these ANS is in Section 3.B.1 and 3.B.2). Earlier ANS eradication and management efforts within the state suggested that management actions focus on the species level. However, through study, the ALANSTF noted that 35 of the 81 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, non-native species were introduced for a specific reason but by their nature, the species 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 their 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 consider these jurisdictions and provide for cooperation and coordination, possibly through changes to regulations.

The ALANSTF decided this Plan will address both pathways and species for comprehensive management. Members set a goal to prevent, control, and manage the introduction of new and existing ANS in Alabama to minimize impacts 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. Prevent, control, and manage the introduction and reintroduction and spread of new and existing ANS through education about species and pathways, targeting the general public, industries, user groups, government agencies, non-governmental agencies.
3. Eliminate, control, and manage ANS through monitoring, early detection, and rapid response.
4. Prevention of ANS through legislation, regulation, and enforcement.

To formulate management actions needed to abate ANS problems, priorities were assigned to pathways and species, 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 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 Alabama waterways to detect occurrences of new ANS.
4. Statewide bighead and silver carp monitoring in Alabama and studying impacts on native fishes (funding is currently only available for the Tennessee River).

The implementation table (Chapter 8) provides a tentative timetable and an estimate of the funds needed to initiate the plan (\$200K). Once implementation has begun, permanent funding will be needed to support ongoing ANS activities.

To ensure goals of the plan are addressed, the ALANSTF identified a process for program monitoring and evaluation (Chapter 9). The ALANSTF and Plan development were led by the Fisheries Section of the Division of Wildlife and Freshwater Fisheries of the Alabama Department of Conservation and Natural Resources and members of the ALANSTF (Appendix 12.C).

The ALANSTF submitted the Alabama ANS Management Plan to the National Aquatic Nuisance Species Task Force (ANSTF) in 2010 for review. The ANSTF conditionally approved the Alabama ANS Management Plan but required additional comments and corrections to be addressed before the plan could be finalized. Due to a set of unforeseen circumstances, the plan was not submitted in a timely fashion after the initial review in 2010 and the ALANSTF was required to update the plan prior to review for final approval. As part of this update, 9 additional ANS were evaluated for ranking whether or not to be included or not included in the plan. These species included: alewife (*Alosa pseudoharengus*), oriental weatherfish (*Misgurnus anguillicaudatus*), virile crayfish (*Faxonius virilis*), Chinese mystery snail (*Cipangopaludina chinensis*), Japanese mystery snail (*Cipangopaludina japonica*), assassin snail (*Clea helena*), torpedo grass (*Panicum repens*), wild taro (*Colacasia esculenta*), and variable-leaf watermilfoil (*Myriophyllum heterophyllum*). After updating and revising the plan, the ALANSTF evaluated a total of 90 species for their potential or current ability to become an ANS in Alabama. This plan has been updated and revised to reflect current changes and conditions of ANS in Alabama since 2010.

## 2) INTRODUCTION

Over 50,000 non-native species have been introduced into North America with introductions occurring as soon as migrants began to settle the new world (Pimentel et al., 2004). Of those, about 15% have become nuisance/invasive, leading to economic and/or ecological impacts (U.S. Congress OTA, 1993). Fifteen percent is significant in Alabama. Alabama, along with its neighboring states in the southeastern U.S., is well known for aquatic biodiversity. With a complex network of small rivers, tributaries and streams draining directly into the Gulf of Mexico, Alabama harbors 60% of mussel species in North America, 52% of freshwater turtles, 38% of freshwater fishes, and 20% of crayfish species (Shelton-Nix, 2017). Note that aquatic organisms are faring worse across the U.S.; a vast number of mussels (67%) and fish (37%) are susceptible to either extirpation or extinction (Stein et al., 2000). As a center of biological diversity, Alabama and its citizens have an important role to play controlling ANS.

However, some of these introductions have proved beneficial to humankind that involved agriculture and horticulture plants. These agriculture introductions include terrestrial species such as wheat, rice, cattle, and poultry. Beneficial horticulture introductions consisted of landscaping and garden establishments such as Japanese maple cultivars (*Acer palmatum*) and various hydrangea (*H. macrophylla* and *H. paniculata*) (GAEPPC, 2021). However, other vintage non-native introductions have resulted in negative impacts from species such as common carp (*Cyprinus carpio*), hydrilla, feral swine (*Sus scrofa*), and giant reed (*Arundo donax*) (Simberloff and Rejmanek, 2011).

Non-native species become nuisance/invasive when “a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, and plant health (Federal Executive Order 13751 of December 5, 2016-Appendix 12.D). These introductions that become invasive 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 species can have deleterious effects on the local economy, human health and/or ecology.

A major component of wildlife and fisheries management entails controlling non-native and/or invasive species. The ability to prevent, minimize, and manage non-native species has become a major part of natural resource management for all involved. Wildlife-based recreation, such as hunting, angling, birding, and wildlife photography, annually contributes over \$156.9 billion to the nation’s economy with \$2.2 billion generated for Alabama’s economy (USFWS, 2013; 2018). Such recreation stimulates income in the private and public sectors through trip-related expenses, equipment purchases, and payments for licenses, leases, and membership dues. Forestry, agriculture, and commercial fisheries are cornerstones of Alabama’s economy, and all vulnerable to ANS effects. The total output and employment impacts of these industries in Alabama is \$70.4 billion and over 580 thousand jobs, respectively (ACES, 2013). The State’s fishing industry supports over 23,000 jobs, resulting in wages and salaries annually of about \$456 million. Fishing related purchases in Alabama generated \$17.7 million in state tax revenues and \$46.5 million in federal income tax revenues with retail sales of \$218 million and an economic output of \$326 million (USFWS, 2013; ASA, 2020). The forestry industry employs 170,000 Alabamians with an annual payroll of \$4.2 billion (Truesouth, 2021). Although the

economic cost of ANS to the State of Alabama has not been adequately determined, ANS (i.e., *Lyngbya* spp., hydrilla, Eurasian milfoil (*Myriophyllum spicatum*), blueback herring (*Alosa aestivalis*), and silver carp may very well cost the state and federal governments billions of dollars (Cuthbert et al. 2021).

Existing research suggests that recently disturbed habitats are most receptive to invasion (Gonzalez-Moreno et al., 2015). An estimated 10-20% of all species known to occur in Alabama are in peril due to increasing pressures associated with human alteration of the landscape and biological invasion (Stein et al., 2000; Shelton-Nix, 2017). Some of the most notable negative effects on aquatic ecosystems caused by human activities during the past decade in the U.S. include the occurrence, persistence, and spread of silver carp in the Tennessee River (Ridgway and Bettoli, 2017), harmful algal blooms (e.g., toxic red tide; Gravinese et al., 2020), continued spread of zebra and quagga mussels throughout the U.S. (Karatayev et al. 2015), and native species decline related to ANS (Murphy and Romanuk, 2014; Mollot et al. 2017).

Aquatic nuisance species 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 2 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 of 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 90 non-native species throughout the entire plan process and their potential for becoming ANS, most introduced, or that have become established along Alabama's waterways and coastline. Introduction, establishment, and dissemination of nuisance organisms 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:

1. Coordinate local, state, regional, federal, and international activities and program pertaining to ANS.
2. Prevent, control and manage the introduction/reintroduction and spread of new and existing ANS through education about species and pathways, targeting the general public, industries, user groups, government agencies, non-governmental agencies.

3. Eliminate, control, and/or manage ANS through monitoring, early detection, and rapid response.
4. Prevention of ANS through legislation, regulation, and enforcement.

Toward achieving the objectives listed above, the ALANSTF 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 10 years. Development of this plan was accomplished by:

1. Categorizing and ranking ANS according to “degree of threat” to Alabama’s economy and ecology.
2. Prioritizing pathways of introduction (whether intentional or unintentional) and subsequent transport of ANS.
3. Compiling information regarding laws and regulations pertaining to the transport, distribution, and propagation of ANS in Alabama.
4. 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 ANS 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 ALANSTF. Authority for this plan and the ALANSTF are derived from the Executive Order No. 30: Establishing the ALANSTF, 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 Nonindigenous Aquatic Nuisance Species Prevention and Control Act (NANPA) of 1990 as reauthorized in the National Invasive Species Act (NISA) of 1996 (Appendix 12.E).



Figure 1. Map of water bodies and waterways of Alabama.

### **3) PROBLEM DEFINITIONS**

#### **3.A Pathways**

This section of the Alabama Aquatic Nuisance Species Management Plan describes the scope of the ANS problems 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 effort 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. It is believed hydrilla was introduced into Lake Eufaula via boat trailer in the mid-2000s.

##### **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 10 inland docks. In 2019, the ASPA reported that 26 million cargo tons were imported and exported through Alabama (ASPA, 2021). The entire port infrastructure supports an estimated 154,447 direct and indirect workers with \$559.3 million in direct and indirect tax impact with a total economic impact of \$25.4 billion (ASPA, 2021). In 2020, the Port of Mobile ranked sixteenth in the nation for total trade (56.8 million tons) (AAPA, 2021).

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, China, 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. The bacteria, *vibrio cholerae* was introduced into Mobile Bay via a ships ballast water, and a tropical swimming crab (*Callinectes bocourti*) found in Alabama's coastal waters was likely introduced via this pathway.

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

Recreational fishing, hunting, and wildlife watching contribute a combined annual income of \$2.1 billion to Alabama's economy (USFWS, 2013). Alabama ranks sixth in the country for 2019 recreational fishery landings (NOAA, 2021) 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 2011, 683,000 anglers participated in fishing activities in Alabama; 473,000 were in-state residents (USFWS, 2013).



An estimated \$456 million in annual revenue is generated by sport fishing activity in Alabama, with the high-profile Bass Anglers Sportsman's Society (B.A.S.S.) organization contributing to Alabama's economy. For example, the 2020 Bassmaster Classic, held on Guntersville Reservoir, had an economic impact of \$35.9 million (BBJ, 2020). Additionally, recreational hunting activities contribute \$913 million to the State economy, annually. In 2011, 535,000 residents participated in hunting activities (USFWS, 2013). Of this group of hunters, 492,000 people were Alabama residents. Approximately 1.7 million residents spend time observing and photographing wildlife in Alabama each year. In Alabama, \$2.7 billion were generated by wildlife watching enthusiasts in 2011 (USFWS, 2013). Aquatic nuisance species are often inadvertently spread via human footpath, boats, trailers, and other equipment associated with sport and recreational activities, or incidental escapement from aquaculture facilities (i.e., silver carp). These introductions could impact hunting and fishing in Alabama. Silver carp compete for food resources and habitat with sportfish (Sass et al., 2014; Zhang et al., 2016). With the recent introduction in the Alabama section of the Tennessee River, impacts to these Tennessee River fisheries has yet to be realized. Guntersville Reservoir is ranked at the top in most polls examining the best black bass fishing lakes in the U.S. and if the black bass fishery collapsed due to silver carp, millions in economic output would be lost.

### **3.A.1c Oil and Gas Industry**

Alabama supports a substantial oil and natural gas industry, generating an estimated \$2.0 billion in revenue. Presently, Alabama is ranked ninth in the nation for natural gas and 13<sup>th</sup> for liquid petroleum production (ALOGB, 2021). The state boasts more than 4,000 oil and gas wells, 77 of which are offshore natural gas rigs. Offshore 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 spreading plants and animals from one waterbody to another, and potentially introducing ANS to Alabama waters. This is also known as marine biofouling, or undesirable colonization of maritime vessels, structures, and equipment immersed in fresh and marine waters. Zebra mussels found in the Tennessee River are believed to be introduced from fouling of boats traveling from northern infested waters.

### **3.A.1d Commercial Fishing**

Gulf of Mexico fisheries comprise nearly 20 percent of all commercial fishing in the United States. In 2015, Gulf Coast landings totaled 1.5 billion pounds, worth approximately \$858 million (GOMR, 2015). Landings in Alabama totaled 26.6 million pounds, worth more than \$37 million (NOAA, 2021). 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 invasive in the Gulf of Mexico in 2000 and may be spread in the Gulf by becoming fouled in fishing nets.

### **3.A.1e Transportation Corridors**

Aquatic 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). Water hyacinth (*Eichhornia crassipes*) is an example of an ANS that has spread via waterway

corridors around the State. It's not uncommon to see water hyacinth floating downriver through navigation locks during commercial traffic operations or go over low-head dam spillways during high water events. Other ANS are extremely effective at invading new habitats, such as silver carp. Silver carp can and will migrate upstream and invading new habitats via navigation lock operations.

### **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, introduced for a specific market or purpose, can escape, or are unintentionally released into a natural ecosystem, where they become invasive. Traditionally, agricultural, horticultural, and aquaculture industries foster the “controlled” introduction of non-native species. The assumption is the risk of escape and subsequent invasion of native habitats are low. However, the specific case studies of hydrilla, Eurasian watermilfoil, Japanese honeysuckle (*Lonicera japonica*), Chinese privet (*Ligustrum sinense*), bigheaded carp (*Hypophthalmichthys* spp.), and *Corbicula* clam (*Corbicula fluminea*) 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 represent a \$2.9 billion venture and supports 44,000 workers in the state of Alabama (ALNLA, 2021). Alabama's nursery, greenhouse, and sod industries generated \$294 million in total sales in 2017 (VSC, 2019). Although typically not aquatic, nursery and horticultural plants are readily spread upon transport and often introduced to new environments as escapes from propagated populations. Examples of formidable, invasive nursery escapee include Japanese honeysuckle, Chinese privet, bahiagrass (*Paspalum notatum*), and cypress vine (*Ipomoea quamoclit*).

Specifically, water gardens have become a major source of ANS. Prominent examples of invasive plants that have been introduced into native waterways and basins include water hyacinth, water lettuce (*Pistia stratiotes*), common salvinia, 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 2016 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 \$172 million annual income with catfish farmers accounting for over 75% of the sales (ACES, 2016). In 2016, catfish farmers produced 104 million pounds of fish (ACES, 2016). In addition, the ALDWFF currently operates 3 state run aquaculture facilities in Marion, Carbon Hill, and Eastaboga, Alabama.

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 but not limited to: grass carp (*Ctenopharyngodon idella*), largemouth bass (*Micropterus salmoides*), and tilapia (*Oreochromis* spp.). Many farm raised and/or stocked fish are non-native, but few are 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 outcompete 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*), and goldfish (*Carassius auratus*) 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 invasion.

### **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 most of the non-native plant and animal introductions are not true escapees but are in 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 reports that 223 exotic fish species have been caught in waters around the United States; with at least 100 species are known to have established viable, breeding populations. (USGS, 2021). Scientist suspect that more than 50 percent of these introductions are a direct result of aquarium releases. Aquarium release examples in Alabama include hydrilla (Schmitz et al., 1991) and island apple snails. In addition, 20 pacu (*Piaractus brachypomus*) have been caught in Alabama with sizes up to 6.5 lbs. (S. Rider ALDWFF, unpublished data) and from 2013-2014, 112 oriental weatherfish (*Misgurnus anguillicaudatus*) of various sizes (indicating recruitment) were collected from the Coosa River drainage, indicating species of tropical and sub-tropical origins can over winter in Alabama (White and Meade, 2015).

### **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 ANS that has overrun the natural ecosystem into which it was deliberately introduced. This species is particularly harmful to fragile native flora and economically important crop species.

Nutria are semi-aquatic animals that consume approximately 25% of their weight in vegetation daily. Analogous 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 rice, 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. The Nature Conservancy’s Threat Ranking System (Salzer, 2007) was adopted to determine at what level (i.e., High (3), Medium (2), or Low (1)) a species was considered an ANS. This rank was assigned based on criteria in the following categories: Ecological Impact, Current Distribution and Status, Trend in Distribution and Abundance, Management Difficulty, and Economic Impact (Appendix 12.F). Within each category values were assigned (1-3) to each criterion, then the mean score was calculated for each category. Each individual assigned a score based on their expert and best biological opinion for each species evaluated. The overall mean score was calculated from the mean score of all categories (see Appendix 12.G for an example score sheet). Only descriptions of those species that are of greatest concern for ANS management (i.e., only species ranked 2 and above) are provided below.

At this time, not all the species listed and/or documented below have reached Alabama. However, ALANSTF 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 ANS 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.

Twenty-one animal species (including silver/bighead carp hybrid (*H. nobilis x molitrix*)) were given a rank of two or greater by ALANSTF members and are presented in order of assigned rank. These species include: ten fishes, five crustaceans, four mollusks, one mammal, and one jellyfish. Some of the animals of concern for ANS management have yet to become established in Alabama; however, there is great concern these species have the potential to invade and compete with native species. Those animals receiving the highest rank and therefore of the greatest concern are bighead carp, silver carp, bighead/silver carp hybrid (*H. nobilis x molitrix*), common carp, black carp (*Mylopharyndon piceus*), rudd (*Scardinius erythrophthalmus*), rusty crayfish (*Faxonius rusticus*), virile crayfish, island apple snail (*Pomacea maculata*), and nutria (*Myocastor coypus*). The following ranked ANS animals and plants are listed in order from highest to lowest potential threat and are found on the following pages:

<u>Ranked ANS Animals</u>	<u>Page Number</u>
bighead carp	15
silver carp	18
silver x bighead carp	20
common carp	22
black carp	24
rudd	26
virile crayfish	28
rusty crayfish	30
nutria	32
<i>Corbicula</i> clam	34
red shiner	36

zebra mussel	38
blueback herring	40
island apple snail	42
channeled apple snail	42
grass carp	44
Australian red claw crayfish	46
Australian marron crayfish	46
Australian yabby crayfish	46
Australian spotted jellyfish	49
blue tilapia	51
Nile tilapia	51

Thirteen plants and one blue-green alga were assigned a rank of two or greater by ALANSTF members and are presented in order of rank. These plant species include: eleven herbaceous species and two 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 ANS management. The following aquatic plant species are listed in order from highest to lowest potential threat and are found on the following pages:

<u>Ranked ANS Plants</u>	<u>Page Number</u>
common salvinia	53
hydrilla	55
water hyacinth	57
alligatorweed	59
Cuban bulrush	61
giant salvinia	63
<i>Lyngbya wollei</i>	65
dotted duckweed	67
Eurasian milfoil	69
parrotfeather	71
brittle waternymph	73
common reed	75
Uruguayan waterprimrose	77
water lettuce	79

### 3.B.1 Animals

**Common Name:** Bighead Carp

**Scientific Name:** *Hypophthalmichthys nobilis*

**Family:** Cyprinidae

**Alabama ANS Task Force Rank – 3.0**



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

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

**Identification:** Bighead carp is one of several invasive bigheaded carp species found in Alabama, the others being grass carp and silver carp. Bighead carp are deep-bodied, spindle-shaped, and moderately compressed with large heads (Kolar et al., 2007). Scales are small and cycloid with approximately 95 to 120 in a complete lateral line. Small fish lack spines; however, large fish have a heavy, non-serrate spine at the origin of the dorsal fin and a slightly stiffened spine at the anal fin origin. The number of dorsal fin rays is typically 8, anal fin rays 12 to 14, pelvic fin rays 8 or 9, and pectoral fin rays 17 to 19 (Kolar et al., 2007). The gill rakers are long, slender, and comb-like. The pharyngeal teeth are smooth with a spoon-like shape, in a single row with four on each arch. Bighead carp have a well-developed ventral keel which differentiates them from all other native North American cyprinids, except the golden shiner (Kolar et al., 2007). Coloration of the body is dark gray, fading to white toward the underside, and with dark blotches on the sides (Nico et al., 2020a).

**Native Distribution:** The bighead carp is native to eastern China, eastern Siberia, and North Korea (Kolar et al., 2007).

**Alabama Distribution:** Bighead carp have been collected from Yates Reservoir of the Tallapoosa River; Jones Bluff and Millers Ferry reservoirs, Claiborne Pool, and the lower Alabama River (below Claiborne Lock and Dam) of the Alabama River system; Mobile and Tensaw rivers of the Mobile Delta; Coffeerville, Demopolis, Warrior, Oliver, Holt, and Bankhead reservoirs of the Tombigbee River system including the lower Tombigbee River (below Coffeerville Lock and Dam) of the Mobile River basin (S. Rider, ALDWFF, unpublished data). In the Tennessee River basin, bighead carp have been collected from Pickwick, Wilson, Wheeler, and Guntersville reservoirs (S. Rider, ALDWFF, unpublished data).

**Pathway(s) of Introduction:** Bighead carp were originally imported into the United States in 1973 for study by university aquaculture programs for food fish production and to control aquatic weeds in aquaculture ponds (Conover et al., 2007). Introduction occurred by escape from university and aquaculture facilities. In Alabama, bighead carp first appeared in Sougahatchee Creek in 1984, which runs into Yates Reservoir of the Tallapoosa River. The Auburn University North Fisheries Station is located on the banks of Sougahatchee Creek and these bighead carp are more than likely escapees from aquaculture research ponds in the late 1970's to early 1980's (J. Hornsby, ALDWFF, retired, pers. comm.).

**Impact(s) of Introduction:** Bigheaded carps (i.e., bighead and silver carp) can adversely impact non-native freshwater ecosystems (Kolar et al., 2007; Wahl et al., 2011; Sass et al., 2014; Solomon et al., 2016; Collins and Wahl, 2018). Several models predicted bigheaded carp would alter the food web through food resource competition with native planktivorous fishes (Zhang et al., 2016). When bighead carp were translocated outside their native range within China, declines in native planktivorous fishes occurred (Xie and Chen, 2001; Li and Xie, 2002). Schrank et al. (2003) determined when zooplankton densities were limited, age-0 bighead carp out-competed age-0 paddlefish for food resources. Sampson et al. (2009) showed through dietary overlap that bigheaded carp competed with gizzard shad (*Dorosoma cepedianum*) and bigmouth buffalo (*Ictiobus cyprinellus*). Body condition also decreased for gizzard shad and bigmouth buffalo following the establishment of bigheaded carps in the Illinois River, which could also decrease fecundity (Irons et al., 2007).

As all sportfish and native fishes consume plankton early in their life cycle (Burke et al., 1986), large numbers of bigheaded carp could reduce availability of forage. Anecdotal information exists that bighead carp are spawning and recruiting in the Alabama River as 45 individuals were snagged below Millers Ferry powerhouse on a single day in April 2006 with weights ranging from 2.3 to 16 kg (J. Jernigan, ALDWFF, retired, pers. comm.). Other small bighead carp specimens have been collected in the Alabama River indicating successful reproduction (S. Rider, ALDWFF, unpublished data). These fishes could also 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 bigheaded carps 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 and degradation (Williams et al., 2008). The presence of large numbers of a large-sized planktivore, like bigheaded carp could dramatically impact imperiled mussels by reducing food availability (P. Johnson, ALDWFF, pers. comm.).

Bighead carp is a prohibited species in Alabama under regulation 220-2-.163 (Restriction of Certain Species of Asian Carp; effective 25 August 2019), which states “No person, firm, corporation, partnership, or association shall possess, sell, offer for sale, release, or cause to be distributed within the State of Alabama any live fish of the genus *Hypophthalmichthys spp.* (silver carp, bighead carp, largescale silver carp) except for holders of valid commercial fishing licenses engaged in harvesting individuals of these species from the public waters of Alabama for sale to licensed fish dealers and/or processors and aquaculture producers holding a valid written permit issued by the Commissioner of Conservation and Natural Resources.” This species is listed as injurious under the Lacey Act effective 22 March 2011 (USFWS, 2011), which prohibits the importation into the U.S. and interstate transport between States. Although with good intentions, these retroactive regulations/measures may prove ineffective as bighead carp have become established in Alabama prior to 2011 and were found in 27 States before the listing (Nico et al, 2020a).

**Common Name:** Silver Carp  
**Scientific Name:** *Hypophthalmichthys molitrix*  
**Family:** Cyprinidae

**Alabama ANS Task Force Rank – 3.0**



Photo by Duane Chapman, USGS.

**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 and both the head and opercles are 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 1 meter in length and may reach weights of 45 kg (Nico et al., 2021a; Schofield et al., 2005). Silver carp are sexually dimorphic, with males displaying a rough patch on the dorsal surface of each pectoral fin that is absent in females (Wolf et al., 2018).

**Native Distribution:** Silver carp are native to 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:** Documented in the Black Warrior and Tallapoosa river drainages of the Mobile Basin, including Yates Reservoir (Mettee et al., 1996; Rasmussen, 1998). Recent Tennessee River collections (2017-2020) within Pickwick Reservoir have captured individuals from Bear Creek in Colbert County, Second Creek in Lauderdale County and upstream to River

Mile 256 at Florence Harbor (K. Floyd, ALDWFF, unpublished data) below Wilson Dam. During March 2017, one collection was made from Baker Creek in Wheeler Reservoir, near River Mile 301 in Decatur, Morgan County (Nico et al., 2021a).

**Pathway(s) of Introduction:** Public-sector agencies and universities encouraged the development and use of bigheaded carps and are the likeliest pathways for the first-reported escapes and subsequent introductions of silver carp, as well as grass carp and bighead carp (Kelly et al., 2011). Silver carp were 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). Throughout 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 aquaculture facilities (Freeze and Henderson, 1982). Alternate invasion pathways include live fish markets and online purchasing (Herborg et al., 2007; Olden et al., 2020).

**Impact(s) of Introduction:** Negative impacts of silver carp have been documented on zooplankton communities (Sass et al., 2014), and ultimately, loss in biomass of native fishes (Solomon et al., 2016; Kramer et al., 2019; Chick et al., 2020). Pflieger (1997) considers the impact of this species difficult to predict as a result of its place in the food web. If silver carp abundance is high, they have the potential to greatly impact native species because of diet overlap for plankton required by larval fish and native mussels (Laird and Page, 1996, Tristano et al., 2019). This species could also be a potential competitor with adults of some native fishes that rely on plankton for food (Pflieger 1997, Sampson et al., 2009; Sass et al., 2014; Chick et al., 2020).

Silver carp is a prohibited species in Alabama under regulation 220-2-.163 (Restriction of Certain Species of Asian Carp; effective 25 August 2019), which states “No person, firm, corporation, partnership, or association shall possess, sell, offer for sale, release, or cause to be distributed within the State of Alabama any live fish of the genus *Hypophthalmichthys spp.* (silver carp, bighead carp, largescale silver carp) except for holders of valid commercial fishing licenses engaged in harvesting individuals of these species from the public waters of Alabama for sale to licensed fish dealers and/or processors and aquaculture producers holding a valid written permit issued by the Commissioner of Conservation and Natural Resources.” This species is listed as injurious under the Lacey Act effective 9 August 2007 (USFWS, 2007), which prohibits the importation into the U.S. and interstate transport between States. Although with good intentions, these retroactive regulations/measures may prove ineffective since silver carp recently (2017) invaded the Alabama section of the Tennessee River.

**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, USGS.

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

**Identification:** 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 2 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. Interestingly, Lamer et al. (2010) found that fish identified as either bighead or silver carp using gill raker morphology, genetically exhibited a 13% incidence of hybridization. Moreover, though F<sub>1</sub> hybrids were often identifiable (88%) by the presence of twisted gill rakers, post-F<sub>1</sub> hybrids were difficult to identify with certainty.

**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 (Kolar et al., 2005; J. Hornsby, ALDWFF, retired, pers. comm.). Lu et al. (2020) noted that hybridization of bighead and silver carps in native China is rare though it is comparatively extensive in U.S. waters given the homogeneity of reservoir habitats and lack of reproductive isolation in introduced waters.

**Alabama Distribution:** Five specimens have been collected and identified from the Sougahatchee Creek arm of Yates Reservoir and one individual from the Mobile-Tensaw Delta (J. Hornsby, ALDWFF, retired, unpublished data) Alabama. These fish were likely escapees from the Auburn University School of Fisheries, Aquaculture, and Aquatic Sciences facility located near Sougahatchee Creek in Lee County. Though introduction of these potential silver x bighead carp hybrids has not been studied in Alabama, Lamer et al. (2010, 2015) found extensive introgressive hybridization (in both F<sub>1</sub> and post-F<sub>1</sub>) among these two species in upper Mississippi and Illinois River populations.

**Pathway(s) of Introduction:** In the southern U.S., individual species were intentionally stocked in aquaculture facilities for food and to improve water quality in catfish ponds through reduction of phytoplankton load (Kelly et al., 2011).

**Impact(s) of Introduction:** The impacts of this hybrid are likely similar to those of the individual species (Wahl et al. 2011; Sass et al. 2014; Solomon et al., 2016; ; Collins and Wahl, 2018; Kramer et al., 2019; Tristano et al., 2019; Chick et al., 2020). Studies aimed at assessing the impacts of hybrids are underway. See the previous aforementioned species (i.e., bighead and silver carp) for a description of impacts of introduction.

Bigheaded carp of the genus *Hypophthalmichthys* spp. are a prohibited species in Alabama under regulation 220-2-.163 (Restriction of Certain Species of Asian Carp; effective 25 August 2019), which states “No person, firm, corporation, partnership, or association shall possess, sell, offer for sale, release, or cause to be distributed within the State of Alabama any live fish of the genus *Hypophthalmichthys* spp. (silver carp, bighead carp, largescale silver carp) except for holders of valid commercial fishing licenses engaged in harvesting individuals of these species from the public waters of Alabama for sale to licensed fish dealers and/or processors and aquaculture producers holding a valid written permit issued by the Commissioner of Conservation and Natural Resources.”

**Common Name:** Common Carp  
**Scientific Name:** *Cyprinus carpio*  
**Family:** Cyprinidae

**Alabama ANS Task Force Rank – 3.0**



Photo by Matt Thomas, Kentucky Department of Fish and Wildlife Resources.

**Synonym(s):** Carp, leather carp, mirror carp, European carp, and koi carp

**Identification:** Common carp are large, deep bodied, and robust. The upper jaw contains two pair of well-developed barbels. The lateral scale count is 32 to 41. The first ray of the dorsal and anal fin is stiff and serrated. There is a total of 15 to 23 soft rays in the dorsal fin and four to six soft rays in the anal fin. Pharyngeal teeth are in three rows and molarlike. Head and body are typically brassy, reddish, or yellowish colored with anal fin and lower lobe of caudal fin reddish orange (Boschung and Mayden, 2004). Koi carp are an ornamental strain which are brightly colored with variations of orange, yellow, white, and black markings; if they escape into the wild, however, koi carp soon revert to the wild coloring. Some variants, known as mirror carp and leather carp, have no scales or only partly scaled, with a few very large scales in patches or along the midline (NSW Department of Primary Industries, 2005).

**Native Distribution:** The common carp is native to the Black, Caspian, and Aral Sea drainages, east into Siberia and China, and west as far as the Danube River (Balon, 1995).

**Alabama Distribution:** In Alabama, the common carp is presently found in all major rivers of the Mobile Basin, as well as the Tennessee and Chattahoochee. It also occurs in the Conecuh and Choctawhatchee drainages in Alabama (Boschung and Mayden, 2004). This species was introduced into the U. S. as early as 1831 (Fuller et al., 1999) and first documented in Alabama in 1882 (Boschung and Mayden, 2004).

**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 is also known to escape from ponds and water gardens.

**Impact(s) of Introduction:** Common carp increase suspended solids in the water column, reduce water transparency and macrophyte coverage, and decrease habitat heterogeneity for native species (Zambrano et al., 2006). Several studies have documented carp feeding on eggs and larvae of other fish species (Lachner et al., 1970; Miller and Beckman, 1996; Page and Burr, 1991). Common carp may compete with ecologically similar species such as carpsuckers and buffalos. Because this species has been present in many areas since the first surveys, its impacts on many of the native fishes are difficult to determine (Laird and Page, 1996). On every continent where it has been introduced it has reduced water quality and degraded aquatic habitats (Jones and Stuart 2006). Bonneau and Scarnecchia (2015) found that carp eradication and exclusion from reservoir tributaries allowed for increased benthic invertebrate community diversity and abundance, and the return of submerged aquatic vegetation.

The negative impacts of this species when introduced to new areas has been known and studied for decades. Eradication efforts are very expensive and rarely 100% effective. Physical removal and chemical toxins are methods that can be effective for small reservoirs and ponds, but for a larger scale, targeted biological controls would be necessary. Currently the most promising biological control for carp is using a virus known as CyHV-3 (Beckett et al., 2019). Australia has been researching a plan to use this virus to control their non-native carp but due to public fears and certain unknown factors, full implementation of this plan has not yet been achieved (Mehmet et al., 2018; Hardaker et al., 2020).

Common carp is designated as a commercial or non-game fish under regulation 220-2-.45 and commercial fishers must abide by commercial fishing regulations (220-2-.46 and 220-2-.47) to harvest this species. There are no regulations prohibiting the possession, sale, or importation of common carp in Alabama.

**Common Name:** Black Carp  
**Scientific Name:** *Mylopharyngodon piceus*  
**Family:** Cyprinidae

**Alabama ANS Task Force Rank – 3.0**



Photo by Greg Whitley, Southern Illinois University.

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

**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 (Page and Burr, 2011). 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 the grass carp.

**Native Range:** The black carp is native to 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 (Nico and Neilson, 2020). This fish is also thought to be native to the Red River of northern Vietnam (Nico and Williams, 1996).

**Alabama Distribution:** Black carp have not been documented or reported from Alabama to date. However, with recent collections in Tennessee and Mississippi there is concern black carp may find their way to Alabama via the Tennessee River. Approximately 30 black carp escaped from a fish farm into the Osage River, Missouri River basin, in April 1994. 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. One specimen was collected June 10, 2004 in the Mississippi River near Lock and Dam 24, across the river from Clarksville, Missouri (Nico and Neilson, 2020). A single fish was collected from the White River, Arkansas, in April 2005, and they are now present in the Mississippi River. In the last 8 years this species range and numbers have expanded in Arkansas, Illinois, Kentucky, Louisiana, Missouri, Mississippi, and Tennessee



with nearly 600 specimens collected (USGS, 2020a). Established black carp populations now occur in central North America (CABI, 2019).

**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 was imported as a food fish and as a biological control agent for the yellow grub, (*Clinotomum 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 (Ip et al., 2014). Many native mussels and snails are endangered or threatened and are key elements of many aquatic systems (CABI, 2019). Due to their diet preferences black carp could alter benthic assemblages by direct predation on algae-grazing snails (Nico and Neilson, 2020). Mussel beds consisting of smaller individuals and juvenile recruits are probably most vulnerable to being consumed by black carp (Nico and Neilson, 2020). It has been suggested that black carp can eliminate 100% of the snails in a single pond (Wui and Engle, 2007). However, to date, impacts to native snails and mussels is uncertain and no studies currently exist documenting direct impacts from black carp on native mollusk populations. Due to a lack of peer-reviewed science indicating deleterious effects on native aquatic organisms from black carp, the USFWS assigned an overall risk assessment of “uncertain” to the black carp (USFWS, 2019a).

Black carp are prohibited from possession, sale, and importation in Alabama under regulation 220-2-.26 (Restrictions on Possession, Sale, Importation and /or Release of Certain Animals and Fish). This regulation states “ No person, firm, corporation, partnership, or association shall possess, sell, offer for sale, import, or bring into the State of Alabama any of the following live fish or animals: Any Black Carp of the genus *Mylopharyngodon*.” This species was listed as an “injurious species” under title 18 of the Lacey Act effective 19 November 2007. This prohibits the importation of this species into the U.S., and its shipment between the continental United States, the District of Columbia, Hawaii, the Commonwealth of Puerto Rico, or any possession of the United States. However, this reactive measures may be too late in preventing the importation, escapement, and establishment of black carp in central North America and more than likely to the southeast region of the U.S.

**Common Name:** Rudd

**Scientific Name:** *Scardinius erythrophthalmus*

**Family:** Cyprinidae

**Alabama ANS Task Force Rank – 3.0**



Rudd collected from an unnamed stream in St. Clair County, AL.

Photo by Steve Rider, ALDWFF.

Photo by Noel Burkhead, USGS.

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

**Identification:** A stocky, deep-bodied fish with a forked tail (Nico et al., 2020b). There is a scaled, bony keel along the belly from the pelvic fins to the anal fin. The mouth is oblique and terminal with a steeply angled protruding lip (Page and Burr, 2011). The dorsal fin has 9 to 11 rays and 10 or 11 anal fin rays. The lateral line has 37 to 47 scales with the dorsal fin origin behind the pelvic fin. The anal, pelvic, and pectoral fins are bright red, and the eye is gold with a red spot at the top (Nico et al., 2020b).

**Native Distribution:** This rudd is native to Western Europe of the Caspian and Aral sea basins (Berg 1949).

**Alabama Distribution:** This species was first reported in Alabama from First Creek in Lauderdale County (Nico et al., 2020b). It has also been collected from an unnamed stream in St. Clair County, Alabama (D. Catchings, ALDWFF, retired, pers. comm.).

**Pathway(s) of Introduction:** This species entered the U.S. during two widely separated periods of introduction. It was initially brought into this country either in the late 1800's or early 1900s as a baitfish, and then in the late 1960s and early 1970s, based on accounts from Courtenay and Williams (1992). Bait bucket release seems to be the primary mode of spread (Nico et al., 2020b). It appears that the greatest dispersal of rudd has been through interstate traffic rather than direct European import. In fact, much of its recent culture and spread can be attributed to its popularity as a bait among striped bass anglers. As a result, rudd have been widely introduced through a combination of bait bucket releases, escapes from aquaculture facilities and farm ponds, and, presumably, by dispersal from various points of introduction (Burkhead and Williams 1991).

Although many rudd introductions are considered accidental, it is likely that rudd also have been intentionally released into public waters during the past few decades (Nico et al., 2020b).

**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 this demonstrated hybridization is unknown at this time. However, with the large number of native Cyprinidae species that occur in Alabama (Boschung and Mayden, 2004), the potential exists for hybridization if rudd become established. In addition, unlike most native fishes, the rudd is omnivorous and can shift its diet to plants (Guinan et al., 2015). Rudd have been found to feed upon endangered aquatic macrophytes in the Czech Republic (Zapletal et al., 2019). Selective feeding by rudd could alter macrophyte assemblages and hinder attempts to restore plant communities as demonstrated by Kapuscinski et al. (2014). 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.

Rudd are prohibited from possession, sale, and importation in Alabama under regulation 220-2-.26 (Restrictions on Possession, Sale, Importation and /or Release of Certain Animals and Fish). This regulation states “ No person, firm, corporation, partnership, or association shall possess, sell, offer for sale, import, or bring into the State of Alabama any of the following live fish or animals: Any species of fish “rudd” (*Scardinius erythrophthalmus*) or “roach” (*Rutilus rutilus*) or any hybrids of either species.”

**Common Name:** Virile Crayfish  
**Scientific Name:** *Faxonius virilis*  
**Family:** Cambaridae

**Alabama ANS Task Force Rank – 3.0**



Photo by Robert Aguilar, Smithsonian Environmental Research Center.

**Synonym(s):** Northern crayfish (*Orconectes virilis*) (Hagen, 1870). *Faxonius virilis* underwent a reclassification in August 2017, changing the genus of non-cave dwelling *Orconectes* to *Faxonius* (Crandall and De Grave, 2017).

**Identification:** Virile crayfish are overall light brown to greenish brown color. Each abdominal segment has a pair of dark angled blotches which are especially prominent in young and individuals that have recently molted. The upper part of the main body (carapace) usually has dark mottling. Pinchers often are covered with dark specks, have numerous yellow bumps on the inside sides of the pinchers, and have orange or orange-red tips (Pflieger, 1996; Taylor et al., 2015).

**Native Distribution:** Broadly, the virile crayfish is native to the Great Lakes, Missouri River, upper Mississippi River, lower Ohio River, and up to east of the continental divide in Montana, with disjunct populations in the Black River in Missouri and Arkansas, the upper White River in Oklahoma and Arkansas, the Red River in Texas and Oklahoma, and Lake Champlain in New York (Taylor et al., 2015).

**Alabama Distribution:** Virile crayfish has been documented in Alabama as far back as 1967. It has presently been found in watersheds of the Tennessee, Black Warrior, Cahaba, Coosa, and Tallapoosa rivers (Durland Donahou, 2019; ADCNR, 2021).

**Pathway(s) of Introduction:** Virile crayfish is the most widely distributed crayfish throughout North America and parts of Europe and is considered invasive in many locations (Taylor et al., 2015). This species has spread through bait-bucket transfers by anglers, deliberate stocking by state wildlife agencies as sport fish forage, and escaping from laboratory ponds (DiStefano et al.,

2015). Welsh and Loughman (2015) have shown that virile crayfish can use fish-specific dam passages to move upstream in areas in which they are introduced.

**Impact(s) of Introduction:** Introduction of virile crayfish can potentially cause decline or local extirpation of native crayfish and threaten freshwater biodiversity and macroinvertebrate community abundance and structure (Hanson et al., 1990). A genetic study has shown them to hybridize with native spothanded crayfish (*Faxonius punctimanus*) in the Current River watershed in Missouri after introduction (Rozansky, 2019). This species is known to eat juvenile reptiles and amphibians, fish eggs, and macroinvertebrates (Recsetar and Bonar, 2015). In Arizona, where there are no native crayfish species, this species contributes to the decline in native fish by outcompeting them for food resources (Carpenter, 2005). Virile crayfish have been shown to increase turbidity and damage levees through burrowing activity (Davidson et al., 2010). In the Netherlands, water bodies that have been invaded with virile crayfish have shown decreases in water quality and macrophyte biomass (Roessink et al., 2017).

Attempts to control invasive populations have utilized microbial agents (Davidson et al., 2010) and chemicals (Recsetar and Bonar, 2015), but eradication has been unsuccessful. Trapping and electrofishing have been tested for removing invasive virile crayfish but were found to be ineffective. As is the case with other ANS, the removal of established populations has proven difficult (Rogowski et al., 2013). There are currently no regulations prohibiting the possession, sale, or importation of virile crayfish in Alabama.

**Common Name:** Rusty Crayfish

**Scientific Name:** *Faxonius rusticus*

**Family:** Cambaridae

**Alabama ANS Task Force Rank – 3.0**



Photo by Guenter Schuster, Eastern Kentucky University.

**Synonym(s):** Rusty crayfish (*Orconectes rusticus*) (Girard, 1852) underwent a reclassification in August 2017, changing the genus from *Orconectes* to *Faxonius* (Crandall and De Grave, 2017).

**Identification:** Rusty crayfish can be identified by its brown body, large claws, and its dark brown W-shaped patches on the dorsal portion of its abdomen (Taylor and Schuster, 2004). Its claws are grayish green to reddish-brown with dark, black bands on the tips. Also, there are 2 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, 2008).

**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, Illinois, and Michigan. Rusty Crayfish are also found in more than 20 states outside their native range, including Connecticut, Iowa, Maine, Maryland, Massachusetts, Minnesota, Missouri, Nebraska, Nevada, New Hampshire, New Mexico, New York, New Jersey, North Carolina, Oregon, Pennsylvania, South Dakota, Vermont, West Virginia, Wisconsin, Wyoming, and many areas in Ontario, Canada. The expanded range includes new sightings and rusty crayfish observations that are both documented and undocumented (Donahou et al., 2021).

**Alabama Distribution:** During June 2000, rusty crayfish were documented in two Alabama systems. These waters included Flat Tire Creek on the Cahaba River in Bibb County and Sandy Creek, located on the middle Coosa River in Calhoun County (Donahou et al., 2021)

**Pathway(s) of Introduction:** Anglers and live bait markets are two of the most likely pathways for introduction of rusty crayfish into non-native areas of the United States (Kilian et al., 2012) and Canada (Kerr et al., 2005) despite attempts to prohibit retail sales and introductions by fisherman (Olden et al., 2006). Intentional releases for nuisance weed control in lakes has been documented (Olden et al., 2006). Rusty crayfish are also sold to schools by biological supply stores for classroom projects and are likely released into non-native areas (Gunderson, 2008; Kilian et al., 2012).

**Impact(s) of Introduction:** Rusty crayfish impacts contribute to the destruction of aquatic plant beds, significantly reducing aquatic plant abundance and species diversity (Olsen et al., 1991; Taylor and Redmer, 1996). Lodge et al. (1994) noted that rusty crayfish exhibit indirect effects on littoral food webs, controlling the abundance of aquatic plants, snails and periphyton. Rusty crayfish have been shown to out-consume other *Orconectes* species, displacing native crayfishes in Ohio and Illinois (Lodge et al., 2000). Evidence of rapid dominance of this species and displacement of native crayfish species was documented in a study on Lake Ottawa in Michigan's Upper Peninsula. Here, rusty crayfish were first documented in 1987, comprising about 20% of the crayfish community. By 1997, it had dominated the community, comprising 75% of the total crayfish population, and since 2001, it has accounted for 100% of the crayfish species caught in traps (Rosenthal et al., 2006; Peters et al., 2008). Reduction in the total quantity of benthic insects was further observed in the presence of rusty crayfish populations, reducing food sources for juvenile native gamefish species (McCarthy et al., 2006). A long-term study further demonstrated that fish species competing for prey with rusty crayfish (e.g., bluegills and other sunfishes), experience population decline over time post-introduction of rusty crayfish (Wilson et al., 2004). This invader has also been confirmed genetically to hybridize with native crayfish species (Lodge et al., 2000). There are currently no regulations prohibiting the possession, sale, or importation of rusty crayfish in Alabama.

**Common Name:** Nutria  
**Scientific Name:** *Myocastor coypus*  
**Family:** Echimyidae

**Alabama ANS Task Force Rank – 3.0**



Photo by Christian Fisher.

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

**Identification:** Large rodent, resembling both native beavers and muskrats. The nutria has a long, thin round tail that distinguishes it from the beaver which has a flat tail and the muskrat which has a laterally flattened tail (Fuller, 2015). The typical coloration is dark brown with long coarse guard hairs. The muzzle and chin are white, and the ears and eyes are small. The hind feet are webbed between the inner four toes, facilitating swimming. The incisors are dark orange and extremely large, often protruding past their lips. Weights of mature adults range from 20 to 25 pounds with males being slightly larger than females (Whitaker, 1988).

**Native Distribution:** Native to fresh and saline waters of South America south of 23° latitude, including Argentina, Bolivia, southern Brazil, Chile, Paraguay, and Uruguay (Carter and Leonard, 2002).

**Alabama Distribution:** Nutria have been documented in 29 states and are currently established in 19 states and expanding their range (Hilts et al., 2019; USGS 2020a). The nutria is most



abundant in the states along the Gulf of Mexico coast, but they are also a problem in other southeastern states and along the Atlantic coast (Fuller, 2015). Nutrias were brought into Alabama by the Department of Conservation and Natural Resources and by private individuals in 1949 as weed control agents. A viable feral population now exists in Alabama, and it is increasing (Carter and Leonard, 2002). They can be found in the Alabama and Tombigbee River systems and are most common in Mobile and Baldwin counties (USGS, 2020a).

**Pathway(s) of Introduction:** Nutria were first imported into the United States between 1899 and 1930 in an attempt to establish a fur farm industry. When the nutria fur market collapsed in the 1940s, thousands were released into the wild. Wildlife agencies further expanded the range of the nutria by introducing the species into new areas of the United States with the intent that nutria would control undesirable vegetation and enhance trapping opportunities. A hurricane in the late 1940s aided dispersal by scattering nutria over wide areas of coastal southwest Louisiana and southeast Texas. Accidental and intentional releases have led to the establishment of widespread and localized populations of nutria in various wetlands throughout the United States (Fuller, 2015).

**Impact(s) of Introduction:** Nutria rapidly consume native vegetation in coastal areas, resulting in wetland degradation (Trillin, 1995). Their feeding activities destroy marsh vegetation, their burrows undermine water control structures, and they feed on agricultural crops. Nutria also have been associated with parasites that affect humans and livestock and can adversely affect wildlife (Carter and Leonard, 2002). The decline of native muskrats has been attributed to nutria as a result of competition for trophic resources (Griffo, 1957; Lowery, 1974; O'Neil and Linscombe, 1977). Recently, Bertolino et al. (2011) provided evidence nutria are not egg predators, but may be nest destroyers, with a potentially high impact on the reproduction performance of waterbirds. Nutrias are not attracted by the eggs and do not eat them, but rather jump on the nests repeatedly to rest, during both day and night. It is currently illegal to propagate or release nutria into the state of Alabama pursuant to regulation 220-2-26. Nutria may be harvested during daylight hours with no bag limit or closed season.

**Common Name:** *Corbicula* Clam  
**Scientific Name:** *Corbicula fluminea*  
**Family:** Cyrenidae

**Alabama ANS Task Force Rank – 3.0**



*Corbicula* clam collected from Covington County. Photo by Jeff Garner, ALDWFF.

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

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

**Native Distribution:** The *Corbicula* 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 65 of the 67 counties in Alabama, with no known records from Baldwin and Lamar counties (J. Garner, ALDWFF, unpublished data). The *Corbicula* clam has also been found in all drainages of the state except the Perdido and Blackwater, two streams with depauperate native molluscan faunas. In addition to the expansion of western populations, this clam may have been accidentally introduced into Sougahatchee Creek during experimentation and scientific study at the Auburn University School of Fisheries, Aquaculture, and Aquatic Sciences' facility in the summer of 1972 (Jenkinson, 1979). The *Corbicula* clam has been introduced into or invaded estuaries, lakes, and waterways in 48 states, as well as the District of Columbia and Puerto Rico (Foster et al., 2021).

**Pathway(s) of Introduction:** *Corbicula* clams are thought to have entered the United States as a food source but may also have come with the importation of the Giant Pacific oyster (Foster et al., 2021). The mechanism for dispersal within North America is unknown. Current methods of introductions are believed to be accidental introductions associated with aquaculture and intentional introductions by people who buy them as food in markets (Counts, 1986; Devick, 1991). The only other significant dispersal agent is thought to be passive movement via water currents (Isom, 1986).

**Impact(s) of Introduction:** The *Corbicula* 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. There are currently no regulations prohibiting the possession, sale, or importation of *Corbicula* clams in Alabama.

**Common Name:** Red Shiner  
**Scientific Name:** *Cyprinella lutrensis*  
**Family:** Cyprinidae

**Alabama ANS Task Force Rank – 2.8**



Photos 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-cm long. Red shiners may be confused with golden shiners, rudd, and roach.

**Native Range:** Red shiners are native to the south and central plains, 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; Nico et al., 2021b).

**Pathway(s) of Introduction:** This species is often mixed with other live bait, and then spread as a result of bait bucket releases (DeVivo, 1995; DeVivo and Freeman 1995), 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:** DeVivo (1995) suggested the use of red shiner as a bait fish and the continued degradation of stream systems within the Atlanta metropolitan area constitute a serious threat to native fishes, including the bluestripe shiner (*C. callitaenia*). Red shiners tended to be the dominant or co-dominant species in degraded streams of urban Atlanta watersheds, representing

up to 77% of individuals and 12.5% of species at a site (DeVivo, 1995). This study attests to the aggressiveness of red shiner that 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 8 native congeners in southeastern U.S. waters where populations are currently established (Boschung and Mayden, 2004). For example, the red shiner is hybridizing with the blacktail shiner (*C. venusta*) (Mettee et al., 1996; Burkhead, 2003; Walters et al., 2008), bluestripe shiner (*C. callitaenia*) (Wallace and Ramsey, 1982), as well as the federally threatened blue shiner (*C. caerulea*) (Burkhead, 2003). Red shiners were found to prey on fish larvae in two Colorado rivers (Ruppert et al., 1993), including the endangered razorback sucker (*Xyrauchen texanus*) (Carpenter and Mueller 2008). Poulos et al. (2012) suggested that potential spread of this species both eastward and westward beyond its native and currently invaded ranges could threaten the stability of native U.S. minnow populations with similar habitat requirements because of red shiner's ability to outcompete. Herrington (2004) found similar results where red shiner habitat and diet overlapped with four other species in Georgia streams. This invasive has also been identified as the source of the Asia tapeworm upon introduction into the Virgin River in Utah (Nico et al., 2021b). There are currently no regulations prohibiting the possession, sale, or importation of red shiner in Alabama.

**Common Name:** Zebra Mussel  
**Scientific Name:** *Dreissena polymorpha*  
**Family:** Dreissenidae

**Alabama ANS Task Force Rank – 2.8**



Zebra mussel collected from Tennessee River drainage. Photo by Jeff Garner, ALDWFF.

**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, but sometimes unpigmented, 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 Distribution:** 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). 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. Zebra mussels have been present in Alabama reaches of Tennessee River since the late 1980s (J. Garner, ALDWFF, pers. obs.) but there are no reports from the Tombigbee River, with which it is connected via the Tennessee-Tombigbee Waterway (Benson et al., 2021). Since 2017 there have been reports of zebra mussels in the Black Warrior River, specifically at sites in Holt Reservoir in Tuscaloosa County, as well as further downstream in Seldon Pool (Benson et al., 2021). Zebra mussel density remains at a low level wherever they occur in Alabama, but during the summer of 2017 at least one area of the Tennessee River (upper Pickwick Reservoir) experienced exponential growth and reached approximately 17,000 per m<sup>2</sup> (J. Garner, ALDWFF, unpublished data). High densities persisted in this reach through the winter of 2017-18 but declined to near 2016 levels (< 5 per m<sup>2</sup>) by autumn 2018 (J. Garner, ALDWFF, pers. obs.).

**Pathway(s) of Introduction:** Zebra mussel was thought to have arrived in North America via ballast water in commercial vessels in the 1980s (O'Neill and Dextrase, 1994). Continued invasions and spread have been contributed to floating vegetation/debris, aquarium dumping, and movement of boats, and aquatic equipment and most recently moss balls.

**Impact(s) of Introduction:** Zebra mussels form dense aggregates on hard surfaces that have led to serious economic effects 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; LePage, 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 significantly affected 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). There are currently no regulations prohibiting the possession, sale, or importation of zebra mussel in Alabama.

**Common Name:** Blueback Herring

**Scientific Name:** *Alosa aestivalis*

**Family:** Clupeidae

**Alabama ANS Task Force Rank – 2.6**



Photo by Zachary Randall, Florida Museum of Natural History.

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

**Identification:** This fish is silvery in color, with blueish green to blueish grey backs. The back and upper side has thin dark stripes, and the belly has a series of scutes (modified scales that are spiny and keeled) along the bottom. The lining of the abdominal cavity has a black or dusky color. The dorsal fin contains 15 to 20 rays and the anal fin has 15 to 21 rays. The upper jaw has a distinct notch with the lower jaw rising steeply within the mouth. A dark spot is present behind the upper edge of the gill opening. Blueback herring and alewife are difficult to distinguish from one another and are often regarded collectively as river herring. Alewife has larger eyes, greater body depth, and white lining of the abdominal cavity (Jenkins and Burkhead, 1994; Owens et al., 1998; Page and Burr, 2011; Whitehead, 1985).

**Native Distribution:** Blueback herring are native to the Atlantic coast from Nova Scotia to the St. Johns River in Florida. They ascend the lower reaches of coastal rivers during the spring spawning season (Page and Burr, 2011).

**Alabama Distribution:** In 2010, Lewis Smith Lake in the Black Warrior River drainage was the first reservoir in Alabama to document the establishment of blueback herring populations. Fisheries biologists with the ALDWFF have also captured this species from the Tallapoosa, Chattahoochee, and Alabama River drainages. In the Tallapoosa drainage, they were first collected from Lake Martin in 2014. Five years later they were verified downstream in Yates and Thurlow Reservoirs where they are considered well established. They have been collected as far back as 2002 in West Point Lake in the Chattahoochee drainage by both Alabama and Georgia biologists (Rider et al., 2003). This species was illegally introduced into Lewis-Smith Reservoir and Lake Martin by striped bass guides and anglers. A single specimen was captured by Alabama biologists from Jones Bluff on the Alabama River in 2017 (G. Lovell, ALDWFF, pers. comm.).



**Pathway(s) of Introduction:** Blueback herring have been introduced (both unintentionally and intentionally) to a number of Southeastern US reservoirs by state fisheries agencies or illegally stocked by anglers (Prince and Barwick, 1981; Guest and Drenner, 1991; Nestler et al., 2002).

**Impact(s) of Introduction:** Blueback herring in their native range are anadromous, though it has been well established that landlocked populations of introduced blueback herring are capable of reproducing and developing self-sustaining populations (Bulak and Walker, 1979; Prince and Barwick, 1981). Blueback herring have the potential to directly affect sport fish populations through egg predation and by consuming larval fish (Guest and Drenner, 1991; Wheeler et al., 2004; Grove, 2016). For example, in North Carolina, walleye populations in Lake Glenville and Hiwassee Reservoir, and largemouth bass populations in Lake Norman were reported to decline after the stocking of blueback herring. In Georgia, Lake Burton experienced a complete year-class failure of largemouth bass as well as decreased abundances of both black crappie and white bass which may have been related to the introduction of blueback herring (Grove, 2016; Rabern, 2002).

Brooks and Dodson (1965) documented the dramatic effects that landlocked blueback herring can have on small landlocked lakes. These authors found that this species had the ability to reduce large zooplankton abundance, leading to an overall reduction in zooplankton size in the system. Guest and Drenner (1991) observed on Lake Theo, Texas a shift in the zooplankton community from predominately cladocerans to copepods which can greatly reduce the available forage for planktivores because copepods tend to be more difficult prey to capture than cladocerans.

Blueback herring may negatively impact resident fishes through indirect and direct competition with other forage species and piscivorous sport fish species. Direct competition with threadfin shad, gizzard shad, and sunfish can lead to population reductions (Prince and Barwick 1981). Blueback herring abundance can lead to decreased abundance of prey for piscivorous sport fishes like largemouth bass and crappie. Blueback herring spend more time in the pelagic zone away from typical largemouth bass habitat in southern reservoirs and limited habitat overlap reduces the available forage fish for largemouth bass and crappie, which could result in population declines (Bozeman et al., 1989; Nestler et al., 2002).

Blueback herring was recently removed from regulation 220-2-.26 (Restrictions on Possession, Sale, Importation and /or Release of Certain Animals and Fish). This was done to allow striper guides and anglers to catch and use blueback herring as bait in infested reservoirs. However, live blueback herring are prohibited from being moved outside of the waterbody where they were caught under regulation 220-2-.162 (Wild Baitfish Regulation). However, these regulations have proved ineffective as this species was illegally introduced into Alabama.

**Common Name:** Island Apple Snail  
Channeled Apple Snail

**Scientific Name:** *Pomacea maculata*  
*Pomacea canaliculata*

**Family:** Ampullariidae

**Alabama ANS Task Force Rank – 2.6**



Island apple snail and island apple snail egg masses on giant cutgrass Langan Park, Mobile County.  
Photos by Steve Rider, ALDWFF.

**Synonym(s):** *Pomacea insularum*, golden apple snail, golden kuhol, giant apple snail and miracle snail

**Identification:** Island and channeled 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 above the water surface. Confusion in identification of these two similar has been clarified in a re-description of morphological and conchological differences between the two species (Hayes et al., 2012). These species differ slightly in shell morphology as the island apple snail has an angulate body whorl at the shoulder, while the channeled apple snail is more rounded at the shoulder for the body whorl (Hayes et al. 2012).

**Native Range:** Island apple snails have a wide native range in South America extending from the lower Paraná River basin in the Rio de la Plata region of Argentina and Uruguay, through Paraguay and northwards in Brazil through the Pantanal to north of Manaus in Amazonia, overlapping with the range of channeled apple snails in the south, and perhaps extending west into Bolivia, Ecuador and Peru (Hayes et al., 2008, 2009a, 2009b, 2012; Cowie et al., 2017). Channeled apple snails have a lesser distribution across Argentina, Bolivia, Brazil, Paraguay and Uruguay (Albrecht et al., 1996) that is mostly overlapped by that of the island apple snail (Hayes et al., 2012). Channeled apple snails have 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 (Martin et al., 2012) and the Alabama State Docks in Mobile County (D. Armstrong, ALDWFF, unpublished data). These infestations occur in two neighboring watersheds, Threemile Creek and Chickasaw Creek, respectively. Apple snails of either one or both species have been collected in Alabama, Arizona, California, Georgia, Hawaii, Florida, Mississippi, Louisiana, South Carolina, and Texas. (Cowie et al., 2007; Burks et al., 2017; Benson, 2021). Channeled apple snails have been reported as relatively common in several canals, ponds, and artificial lakes in coastal zones of south Florida (Thompson, 1997).

**Pathway(s) of Introduction:** Island apple snails were more than likely introduced in Alabama via aquarium dumping (S. Rider, ALDWFF, unpublished data). Channeled apple snails have been imported and illegally established to support development of aquaculture projects for human food and are sold as a domestic aquarium snail in pet stores (Martin et al., 2012; Cowie et al., 2017). 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). Though channeled apple snails only inhabit coastal portions of six Gulf and Atlantic states, they have the potential to invade most of the lower portions of these states, limited primarily by water pH, temperature, and salinity (Byers et al., 2013). Given their relative similarity for tolerance of varying abiotic conditions (Bernatis et al., 2016), it is likely that both island and channeled apples snails may inhabit similar habitats and regions of the southern U.S.

**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 (Martin et al., 2019) 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 and macroinvertebrates; Martin et al., 2019). It has been introduced to the U.S. and threatens the major rice crops of Texas and California (Howells and Smith, 2002). Invasive apple snails are also responsible for outbreaks of parasitic diseases, including human eosinophilic meningitis (Teem et al., 2013; Martin et al., 2019). There are currently no regulations prohibiting the possession, sale, or importation of island or channeled apple snails in Alabama.

**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 3 simple and 7 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:** From 1978, collections of this species have been reported from the Alabama, Black Warrior, Cahaba, Chattahoochee, Choctawhatchee, Conecuh, Coosa, Perdido, Sepulga, Sipsey, Tallapoosa, and Tombigbee river drainages of the Mobile Basin and the Tennessee River (Nico et al., 2021c)

**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., 2021c). This species was first

imported to United States aquaculture facilities at Auburn University and Stuttgart, Arkansas, in 1963. (Courtenay et al., 1984; Mitchell and Kelly, 2006). 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; Cudmore and Mandrak, 2004, Kelly et al., 2011). 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. Numerous state and federal agencies have stocked grass carp throughout Alabama. The ALDWFF has terminated stocking diploid grass and stocks only triploid grass carp into public waters of Alabama (S. Cook, ALDWFF, retired, pers. comm.).

**Impact(s) of Introduction:** Negative effects attributed to grass carp are reviewed by Shireman and Smith (1983) and Dibble and Kovalenko (2009) and included changes in aquatic plant community structure (e.g., reduction of macrophytes), interspecific competition for food with invertebrates (e.g., crayfish, plankton), reduced water quality, and reduced diversity among fish communities (Pipalova, 2006; Wittmann et al., 2014). 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., 2021c). There are currently no regulations prohibiting the possession, sale, or importation of grass carp in Alabama.

**Common Name:** Australian Red Claw Crayfish  
Australian Marron Crayfish  
Australian Yabby Crayfish

**Scientific Name:** *Cherax quadricarinatus*  
*Cherax destructor*  
*Cherax tenuimanus*

**Family:** Parastacidae

**Alabama ANS Task Force Rank – 2.2**



Australian Red Claw Crayfish  
Photo by Dave Wilson.



Australian Marron Crayfish  
Photo by Daniel Allison.



Australian Yabby Crayfish  
Photo by Daiju Azuma.

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

**Identification:** These three crayfish species appear lobster-like but are native to freshwater habitats of Australia. The Australian red claw crayfish can be identified by the four long distinct ridges on the surface of the head. The body color ranges from a dark brown to blue green with a green color in clear water (QLD, 2018). Color will also vary based on geographic location. Adult males have a distinct red patch on the outer margin of the claws, which is absent in females (QLD, 2018). This species can grow to a length of 25 cm and reach a weight of 0.6 kg.

The Australian marron crayfish can be identified by examining the head. This species has two raised longitudinal ridges extending backwards from behind the eyes; two raised ridges extending backwards from each edge of the rostrum; and one raised ridge in the middle of the two raised rostral ridges (Galli and Raadik, 2018). Its color ranges from black to brown in the wild, but a cobalt blue form is present in aquaculture specimens (Galli and Raadik, 2018). Individuals can grow to 38 cm in length and weigh up to 2.2 kg with this being the third largest crayfish species in the world (GWA, 2011).

The Australian yabby crayfish has a smooth carapace with a single pair of post-orbital ridges forming a pair of long keels on the anterior carapace (Fusaro et al., 2020). There are no spines on the shoulders behind the cervical groove and the dorsal surface of the telson is without spines (Fusaro et al., 2020). The rostrum is short, broad, and triangular with unraised, spineless borders tapering to an indistinct acumen with no spines present along the borders and an indistinct median carina (Fusaro et al., 2020). The color ranges from green beige to almost black, with blue grey

being typical of individuals kept in captivity (CABI, 2013). The Australian yabby crayfish can reach lengths of 30 cm and weigh up to 0.3 kg (CABI, 2013).

**Native Distribution:** The Australian red claw crayfish is native range is from the Gulf of Carpentaria Drainage and from the Jacky River basin south to the Normanby River basin on the north east coast of Queensland (QLD, 2018). The Australian marron crayfish and yabby crayfish are native to Western Australia and the State of Victoria, respectively (Galli and Raadik, 2018).

**Alabama Distribution:** No records of the Australian red claw crayfish in the wild currently exist in Alabama. (Daniel, 2019). However, a specimen was collected from Lake Balboa in Los Angeles, California in 2019 (Morningstar et al., 2020). Since the early 1990's, the Auburn University School of Fisheries, Aquaculture, and Aquatic Sciences has been conducting aquaculture studies with Australian red claw crayfish (Pinto and Rouse, 1996) and a south Alabama high school has been raising Australian red claw crayfish in indoor aquaculture facilities (USDA, 2012). No records of the Australian yabby crayfish or Australian marron crayfish from the wild in Alabama or the U.S. exist to date (USFWS, 2019b).

**Pathway(s) of Introduction:** Australian red claw crayfish have been introduced into non-native regions around the globe through the aquaculture and ornamental/aquarium trades, scientific research facilities via escapement from so-called closed aquaculture facilities, outside aquaculture earthen ponds, and aquarium/ceremonial release have been documented (Snovsky and Galil, 2011; USFWS, 2019b). Australian red claw crayfish were first moved out of Australia and introduced to Spain in 1983 for commercial reasons and were originally restricted to Spanish waters (Arias and Torralba-Burrial, 2021). Since then, they have been moved throughout Europe and into Africa and became established as a wild species. For example, they were illegally introduced and/or escaped from aquaculture/ornamental trade facilities in Singapore (Ahyong and Yeo, 2007; Belle and Yeo, 2010), Slovenia (Jaklič and Vrezec, 2011), Mexico (Tapia-Varela et al., 2020), Costa Rica (Azofeifa-Solano et al., 2017), western Australia (Doupe et al., 2004; Lynas et al., 2006), Israel (Snovsky and Galil, 2011), Puerto Rico (Williams et al., 2001), South Africa and Swaziland (Nunes et al., 2017), Ecuador (Romero, 1997), Jamaica (Pienkowski et al., 2015), Thailand (Chaichana and Wanjit, 2018), and Zambia (Douthwaite et al., 2018). This species is widely translocated to 67 countries/territories with various established populations in 22 countries (Haubrock et al., 2021).

Australian yabby crayfish were introduced to Western Australia in 1932 by spreading through natural river systems (Scalici et al., 2009). It has been introduced to Switzerland, Austria, Netherlands, England, and Germany (Chucholl, 2013). Australian marron crayfish have been experimentally introduced to Louisiana (USA) for aquaculture purposes in the 1970's (Shireman, 1973).

**Impact(s) of Introduction:** Australian crayfish species are commonly omnivorous, exhibit high reproductive potential, rapid growth, resistance to diseases, and have shown environmental adaptability. Australian red claw crayfish are tolerant of variations in water quality (i.e., low dissolved oxygen, water salinity, pH changes), which makes it a significant worldwide aquaculture species. 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). Studies in Jamaica and anecdotal evidence suggest Australian red claw crayfish outcompete and prey on native shrimps (Wong, 2007). In Singapore, it outcompetes native crabs for limited habitats (Zeng et al., 2019). The Australian red claw crayfish has also been responsible for introductions of non-native parasites (Nunes et al., 2017). The potential for specimens to be released and become established is extremely high, especially in temperate and warmer climates (CABI, 2013). Haubrock et al. (2021) provide the most up-to-date review on the invasive potential of Australian red claw crayfish. There are currently no regulations prohibiting the possession, sale, or importation of the Australian red claw, marron, and yabby crayfishes in Alabama.



**Common Name:** Australian Spotted Jellyfish

**Scientific Name:** *Phyllorhiza punctata*

**Family:** Mastigiidae

**Alabama ANS Task Force Rank – 2.2**



Photo by Nick Hobgood.

**Synonym(s):** Spotted jellyfish, white-spotted Australian jellyfish, *Mastigias ocellatus*, *Mastigias andersoni*, *Mastigias scintillae*, *Mastigias albipunctatus*, *Cotylorhiza pacifica*, and *Cotylorhiza pacificus*

**Identification:** Graham et al. (2003) describes 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, and eight 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, 1998). The Gulf of Mexico population also differs from populations in their native waters by lacking the dark brown pigmentation from the presence of a symbiotic algae (Graham et al., 2003).

**Native Distribution:** 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 Phillipine archipelago (Heeger et al., 1992).

**Alabama Distribution:** This species was first reported along the California coast 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; Graham 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). The Naval Research Laboratory at the Stennis Space Center confirmed this through satellite imagery (Martin, 2000).

**Impact(s) of Introduction:** Perry et al. (2000) found that the 2000 jellyfish invasion in the northern Gulf of Mexico had a direct 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. There are currently no regulations prohibiting the possession, sale, or importation of Australian spotted jellyfish in Alabama.

**Common Name:** Blue Tilapia  
Nile Tilapia  
**Scientific Name:** *Oreochromis aureus*  
*Oreochromis niloticus*  
**Family:** Cichlidae

**Alabama ANS Task Force Rank – 2.0**



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

Photo by Ken Weathers, ALDWFF.

**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 and Mayden, 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 to 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:** The 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 stocked annually by the Alabama Department of Conservation and Natural Resources and the Auburn University School of Fisheries, Aquaculture, and Aquatic Sciences in lakes and farm ponds in Alabama from the late 1950s through the 1970s (Habel, 1975). Though tilapia have been documented in the Choctawhatchee and lower Tallapoosa

rivers, most collections have been found in the subtropical waters draining into Mobile Bay (Nico et al. 2021d). Nile and blue 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.). From 2008-2012, numerous individual Nile tilapia from 38 to 363 mm have been captured in several coastal Baldwin and Mobile County watersheds, including Fish and Bon Secour rivers, Bay Minette Basin, as well as Eslava and Threemile creeks (Dave Armstrong, ALDWFF, unpublished data). Size distribution data suggest recruitment of this species occurs in the warm coastal waters that provide some thermal refuge with winter groundwater temperatures typically exceeding 14°C. Successful reproduction and establishment of Nile tilapia in similar waters of coastal Mississippi was documented by Peterson et al. (2004; 2005) and Grammer et al. (2012).

**Pathway(s) of Introduction:** Main pathways for introduction include public stocking, experimental stations, and aquaculture (Peterson et al., 2005; Nico and Neilson, 2021; Nico et al., 2021d). Nile and blue tilapia are seasonally cultured in Alabama farm ponds.

**Impact(s) of Introduction:** The blue and Nile tilapia compete with native species for spawning areas and food. Where blue tilapias are abundant, vegetation is heavily impacted as well and nearly all native fishes are impacted (Traxler and Murphy, 1995). 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. In Warm Springs, Nevada, invasion of blue tilapia caused a decline in native fishes by direct predation subsequent to invasion by this species (Scoppettone et al., 2005). Howells (1995) further suggested that blue tilapia caused a decline in unionid mussels in two Texas water bodies. Two similar studies examined competitive interactions between Nile tilapia and native fishes (Martin et al., 2010; Champneys et al., 2020). In both studies, the more aggressive Nile tilapia displaced subordinate natives from shelters. This suggests that interference competition may reduce native species where Nile tilapia are introduced and persist. There are currently no regulations prohibiting the possession, sale, or importation of blue and/or Nile tilapia in Alabama.

### 3.B.2 Plants

**Common Name:** Common Salvinia

**Scientific Name:** *Salvinia minima*

**Family:** Salviniaceae

**Alabama ANS Task Force Rank – 2.9**



Photo by Graves Lovell, ALDWFF.

**Synonym(s):** Salvinia, water fern, water spangles

**Identification:** Common salvinia is a small, floating aquatic fern occupying still waterways. The leaves are borne in threes, two of which are floating or slightly emersed, while the third is finely dissected, submersed and resembles a root. The surface leaves are rounded, 1-1.5 cm long, and folded at the midrib. The top side of the leaves have tiny hairs in groups of four not joined at the tips. The separate surface hairs distinguish it from giant salvinia, which has hairs in groups of four that are joined, resembling an eggbeater. Leaves of common salvinia can become rusty brown with maturity and increased sunlight exposure. Reproduction in common salvinia occurs asexually through fragmentation. Buds and rhizome fragments can remain dormant for periods of time when growth is less favorable (GISD, 2020). Common salvinia is found primarily in areas of slow-

moving water, such as canals, swamps, farm ponds, or on larger bodies of water protected by other marginal vegetation.

**Native Distribution:** Common salvinia originates from Central and South America and is wide-ranging from southern Mexico to North America (Mickle and Beitel, 1988).

**Alabama Distribution:** Common salvinia was first documented in the Mobile Delta in 1982 (Haynes and Jacono, 2000) and by 1987 had become common in creeks and bays throughout the Mobile-Tensaw Delta (Zolczynski and Eubanks, 1990). Since then, it has extended its range up the Black Warrior and Tombigbee drainages where it is widespread (C. McKee, ALDWFF, pers. comm.). Isolated occurrences have also been documented including: two in the Lower Tallapoosa drainage (1998 and 2003 in private ponds), in Bankhead Reservoir (2018), and in the Mulberry drainage (USGS, 2020b). Common salvinia is also widespread on Walter F. George Reservoir in the Chattahoochee drainage and Gantt Lake of the Conecuh River system (K. Weathers, 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). The aquatic fern is widely sold through the water garden trade and likely enters natural waterways as a result of flooding of cultivated pools or through intentional release (Jacono et al., 2001).

**Impact(s) of Introduction:** During colonization, common salvinia demonstrates exponential growth rates and in favorable conditions, it can completely dominate the surface of the water (Gaudet, 1973). These dense infestations reduce sunlight penetration and negatively affect oxygen levels and plant communities beneath the surface. Expansive mats of common salvinia are common in Texas and Louisiana. There are currently no regulations prohibiting the possession, sale, or importation of common salvinia in Alabama.

**Common Name:** Hydrilla  
**Scientific Name:** *Hydrilla verticillata*  
**Family:** Hydrocharitaceae

**Alabama ANS Task Force Rank – 2.9**



Photo by Leslie J. Mehrhoff, University of Connecticut.

**Synonym(s):** waterhyme

**Identification:** Hydrilla is a submersed aquatic plant with long stems that branch at the surface where growth becomes horizontal to form dense mats. The strap-like leaves are arranged in whorls of 3 to 8 around the stem. The leaves are distinguished from similar plants by having serrated margins and one or more sharp teeth under the midrib (Godfrey and Wooten, 1979). These characteristics can vary with location, age, and water quality (Kay, 1992). Plants can reproduce by fragmentation as well as from axillary buds and subterranean tubers. Tubers are resistant to most control techniques (Schardt, 1994). Alabama has both dioecious and monoecious (having both male and female flowers on the same plant) biotypes of hydrilla.

**Native Distribution:** The common dioecious type originates from southern India (Madeira et al., 2000), while Korea appears to be the origin of the monoecious type (Madeira et al., 1997).

**Alabama Distribution:** The dioecious hydrilla is widespread in the Mobile Delta, Tombigbee, Tennessee, and Chattahoochee drainages (Bates and Smith, 1994). The monoecious form was first documented in Wheeler Reservoir in 2007 and in Guntersville Reservoir in 2018, both in the

Tennessee River drainage. It has also been documented in the Chattahoochee River drainage, specifically in Bartlett's Ferry Reservoir in 2012 and Walter F. George Reservoir in 2015 (USGS, 2020c). An unidentified strain of hydrilla was found in small, isolated patches on the Tallapoosa River above Harris Reservoir in 2010 (J. Carlee, APC, pers. comm.). The monoecious form of hydrilla was first observed above Bouldin Dam in Jordan Reservoir in 2012 and the dioecious form was observed in Neely Henry Reservoir around the same time (J. Yerby, APC, pers. comm.). Both of these isolated infestations were being controlled by Alabama Power Company. Hydrilla is also present in Lake Tuscaloosa in the Black Warrior River drainage (C. McKee, ALDWFF, pers. comm.).

**Pathway(s) of Introduction:** Hydrilla was likely first introduced into the United States via the ornamental aquarium plant trade. It has been introduced throughout Alabama unintentionally as fragments on watercrafts and trailers, and intentionally by recreational fishermen to create habitat that will enhance their fishing experience.

**Impact(s) of Introduction:** Established hydrilla results in an array of ecosystem disruptions. Hydrilla grows aggressively and competitively, forming thick mats across the surface, blocking sunlight to native plants (Van Dijk, 1985). Many of these displaced native plants are preferred by waterfowl and other invertebrates (G. Hepp, Auburn University, pers. comm.). Hydrilla has been shown to alter physical and chemical characteristics of lakes. Colle and Shireman (1980) reported reductions in growth of sportfish when hydrilla infestations became severe, suggesting a reduced foraging efficiency. Infestations can result in water stratification (Schmitz et al., 1991; Rizzo et al., 1996), decreased oxygen levels (Pesacreta, 1988), and fish kills (Rizzo et al., 1996). The reduction of available nutrients for plankton growth can cause changes in water chemistry (Schmitz and Osborne, 1984; Schmitz et al., 1991), as well as fish productivity. Heavy infestations impede boating, swimming, and fishing in lakes and rivers.

Hydrilla is listed on the Federal Noxious Weed List, State of Alabama Weed List (80-10-14-.04), and under the nonindigenous aquatic plant regulation 220-2-.124. These regulations prohibit the transport of designated noxious weeds into or within Alabama, along with prohibiting the introduction of noxious weeds into the public waters of Alabama.



**Common Name:** Water Hyacinth  
**Scientific Name:** *Eichhornia crassipes*  
**Family:** Pontederiaceae

**Alabama ANS Task Force Rank – 2.8**



Photo by Graves Lovell, ALDWFF.

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

**Identification:** Water hyacinth is a large, floating, aquatic plant that can form dense mats, or disperse individually across large water bodies. Leaves are thick, rounded, glossy, and curve up on the sides and down on the end. The leaves rise up to 0.5 m above the surface on thick, spongy stalks that are inflated at the base for buoyancy. The roots dangle beneath and are feathery and finely divided. Flowers in the summer are purple and showy. Water hyacinth leaves resemble those of frog's bit (*Limnobium spongia*), which is a rooted plant restricted to the margin. Water hyacinth can reproduce sexually or vegetatively, forming a "daughter plant" from a horizontal stolon. Like other floating plants, water hyacinth thrives in stagnant coves of reservoirs and backwater areas; however, individual plants can move with wind and current across large water bodies.

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

**Alabama Distribution:** Water hyacinth is widespread throughout the major drainages of Alabama. Populations rarely overwinter in the northern part of the state.

**Pathway(s) of Introduction:** Water hyacinth was thought to have originally entered the United States 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 plant has become widespread as a result of the water garden trade.

**Impact(s) of Introduction:** Water hyacinth forms large, floating mats that compete with other aquatic species for light, nutrients, and oxygen. Fish spawning areas and waterfowl habitat is degraded by the plant (Schmitz et al., 1993). In areas of dense infestations, faunal community composition can greatly be altered. As the mats decompose, organic sedimentation dramatically increases, and oxygen levels decline (Gopal, 1987). Hydroelectric dam operations are greatly impacted by the massive free-floating mats of water hyacinth.

Water hyacinth is listed on the State of Alabama Weed List (80-10-14-.04), and under the nonindigenous aquatic plant regulation 220-2-.124. These regulations prohibit the transport of designated noxious weeds into or within Alabama, along with prohibiting the introduction of noxious weeds into the public waters of Alabama.

**Common Name:** Alligatorweed  
**Scientific Name:** *Alternanthera philoxeroides*  
**Family:** Amaranthaceae

**Alabama ANS Task Force Rank – 2.6**



Photo by Graves Lovell, ALDWFF.

**Synonym(s):** Pigweed, alligator weed, alligator grass, red legs, *Achyranthes philoxeroides*, *Alternanthera paludosa*, *Alternanthera philoxerina*, *Bucholzia philoxeroides*, *Telanthera philoxeroides*.

**Identification:** Alligatorweed is a rooted, emersed aquatic plant that is generally restricted to the margins. Leaves are elliptic, measuring 2 to 7 cm long and 1 to 2 cm wide and arranged oppositely on a hollow green to reddish stem. Flowers are small, resembling those of white clover. Stems can be relatively stiff and erect, or in mature stands some stems will be inflated and up to 10 m long. These buoyant stems allow the plant to grow far from the bank where it is rooted, and occasionally it can detach entirely and form floating mats. Alligatorweed reproduces by fragmentation and does not produce viable seed (Godfrey and Wooten, 1979).

**Native Distribution:** Alligatorweed is native to South America. It has since expanded to over 30 different countries (NSW Weedwise, 2019).

**Alabama Distribution:** Alligatorweed is widespread throughout all major drainages in Alabama.

**Pathway(s) of Introduction:** Alligatorweed is believed to have been unintentionally brought into the U.S. and other countries in the ballasts of cargo ships from South America. It was first documented in Mobile in 1897 (Spencer and Coulson, 1976). Alligatorweed fragments are easily transported on watercrafts and trailers, particularly when infestations are near the edges of boat access areas.

**Impact(s) of Introduction:** Alligatorweed grows rapidly and spreads easily from stem fragments that move to other uninfected areas (Simberloff et al., 1997). Dense mats of alligatorweed along the shoreline replaces native species by outcompeting them for sunlight. In extreme cases, floating mats can disrupt the water quality and flora and fauna communities in a body of water. Mats can block waterways, alter aquatic ecology, and increase breeding habitat for mosquitos. Alligatorweed is difficult to eradicate with herbicide.

Alligatorweed is listed on the State of Alabama Weed List (80-10-14-.04), and under the nonindigenous aquatic plant regulation 220-2-.124. These regulations prohibit the transport of designated noxious weeds into or within Alabama, along with prohibiting the introduction of noxious weeds into the public waters of Alabama.

**Common Name:** Cuban Bulrush  
**Scientific Name:** *Cyperus blepharoleptos*  
**Family:** Cyperaceae

**Alabama ANS Task Force Rank – 2.5**



Photo by Joe Jernigan, ALDWFF.

**Synonym(s):** Burhead sedge, *Oxycaryum cubensis*, *Scirpus cubensis*

**Identification:** Cuban bulrush is a floating, epiphytic bulrush, with a slender triangular stem that is 1 to 3 feet in height (McLaurin et al., 2020). Slender, ribbon-like leaves form at the base of the stem and extend 90 to 120 cm above the water surface. Multiple inflorescences, either umbellate or monocephalous depending on form, are produced at the apical portion of each stem. Inflorescences are comprised of one-to-many spherical heads that are 1-2 cm in diameter. The inflorescence is surrounded by 2 to 6 long leaflike bracts. Seeds are in the form of spiked, buoyant achenes, which form spring through fall. Reddish runners form the base of floating mats and are the means of vegetative spread.

**Native Distribution:** Cuban bulrush is native to South America and the West Indies.

**Alabama Distribution:** Cuban bulrush has been in the Mobile Delta since the early 1900s and by the 2000s had become widespread in the Tombigbee and Warrior river drainages (C. McKee,

ALDWFF, pers. comm.). It was also found in the Tennessee River system in 2004, specifically at the mouth of Mink Creek on Gunterville Reservoir (USGS, 2020d).

**Pathway(s) of Introduction:** Cuban bulrush was likely introduced into North America by migratory birds or with ship ballasts (Bryson et al., 1996). The corky, buoyant achenes of Cuban bulrush are adapted to dispersal by moving water. Its mat-forming, floating habit facilitates asexual reproduction and transport of vegetative fragments by moving water (Haines and Lye, 1983). It is also dispersed incidentally by commercial and recreational water traffic.

**Impact(s) of Introduction:** The dense, floating mats compete with native aquatic plants for light, nutrients, and oxygen. These mats can reduce dissolved oxygen levels and light penetration, thus significantly altering floral and faunal communities. Further degradation occurs when the mats decompose and decrease oxygen levels (Gopal, 1987). There are currently no regulations prohibiting the possession, sale, transport, or importation of Cuban bulrush in Alabama.

**Common Name:** Giant Salvinia  
**Scientific Name:** *Salvinia molesta*  
**Family:** Salviniaceae

**Alabama ANS Task Force Rank – 2.5**



Photo by Troy Evans, Great Smoky Mountains National Park.

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

**Identification:** Giant salvinia is a floating aquatic fern occupying still waterways. The leaves are borne in threes, two of which are green and emergent and the third is brown, finely dissected, and submersed, resembling a root. The surface leaves are rounded, 1.3-2.5 cm long, often with wavy margins, and folded at the midrib. The leaves have tiny hairs on the top side that are in groups of four and joined at the tips, resembling an eggbeater. The joined surface hairs distinguish it from common salvinia, which has hairs in groups of four that are separate. Leaves of common salvinia can become rusty brown with maturity and increased sunlight exposure. Reproduction in giant salvinia occurs asexually through fragmentation. It is found primarily in swamps and backwater areas and can cover large waterbodies if the water remains relatively still.

**Native Distribution:** Giant salvinia is native to the coastal region of southern Brazil (USGS, 2020e).

**Alabama Distribution:** Several isolated infestations of giant salvinia were documented in the 1990s and early 2000s, most of which were private ponds where they were likely introduced intentionally. More recently, giant salvinia has been reported in Gainesville Reservoir and backwater areas on the Tombigbee River in 2017 and 2018 (USGS, 2020e). By 2020, it had become widespread in the Black Warrior and Tombigbee river drainages (C. McKee, ALDWFF, pers. comm.).

**Pathway(s) of Introduction:** Giant salvinia was introduced through the water garden trade and continues to be sold through these venues. Escape likely occurs from flooding of cultivation systems or intentional introductions and it spreads further by fragments on watercrafts and trailers.

**Impact(s) of Introduction:** Giant salvinia can dominate large bodies of still water and exhibits rapid growth, vegetative reproduction, and a high tolerance to environmental stress (Mitchell et al., 1980). Dense infestations reduce sunlight penetration and negatively affect oxygen levels and plant communities beneath the surface. Infestations also negatively impact boating access, hydroelectric operations, and other water uses. Giant salvinia is one of the most aggressive aquatic plants known to impact aquatic environments, water use, and local economies. Under optimal conditions, populations have been shown to double in size every 2 to 4 days (Gaudet, 1973).

Giant salvinia is listed on the Federal Noxious Weed List and the nonindigenous aquatic plant regulation 220-2-.124. These regulations prohibit the transport of designated noxious weeds into or within Alabama, along with prohibiting the introduction of noxious weeds into the public waters of Alabama.



**Common Name:** Lyngbya  
**Scientific Name:** *Lyngbya wollei*  
**Family:** Oscillatoriaceae

**Alabama ANS Task Force Rank – 2.4**



Photo by Graves Lovell, ALDWFF.

**Synonym(s):** blue-green algae, cyanobacteria, wool algae

**Identification:** *Lyngbya* is a filamentous cyanobacteria (blue-green algae) that grows on the bottom but will detach and float to the surface forming dense mats. When water is squeezed out, it is dark greenish brown to nearly black, very dense, and hard to pull apart compared to other filamentous algae species. Accurate identification can be determined under microscope. Filaments are unbranching, cells are discoid, and a myelin sheath is present and extends beyond the filament of cells. Appearance and growth habit are similar to *Pithophora* spp. which has branching filaments that can be seen with the naked eye. Reproduction is asexual where filaments break apart and new ones are formed from a single cell.

**Native Distribution:** *Lyngbya* is native to Asia, Africa, and Australia.

**Alabama Distribution:** *Lyngbya* is widespread throughout the state, primarily in small impoundments managed for aquaculture or recreational fishing. The largest infestations are currently on the Coosa River impoundments.

**Pathway(s) of Introduction:** *Lyngbya* is easily dispersed by watercraft, animals, and water flow, and is widespread throughout the world.

**Impact(s) of Introduction:** The dense surface mats greatly impede water navigation and make angling nearly impossible. Dense infestations displace native vegetation and can reduce fish spawning habitat. When dense infestations die suddenly, the reduction in oxygen often leads to fish kills, particularly in small impoundments. *Lyngbya wollei* produces off-flavor compounds that can give an earthy-musty flavor to water as well as fish flesh. High levels of these compounds are detrimental to city water reservoirs and aquaculture facilities. Control efforts are difficult as herbicide treatments and stocking grass carp are minimally effective. There are currently no regulations prohibiting the possession, sale, or importation of *Lyngbya* in Alabama.

**Common Name:** Dotted Duckweed  
**Scientific Name:** *Landoltia punctata*  
**Family:** Lemnaceae

**Alabama ANS Task Force Rank – 2.3**



Photo by Victor Ramey, University of Florida.

**Synonym(s):** Dotted duckmeat, *Spirodela punctata*

**Identification:** Dotted duckweed is a tiny, floating plant occupying still waterways. The oblong to shoe-shaped fronds range in size from 3.2 to 6.4 mm long and 3.2 to 4.2 mm wide, and often attached in pairs. Each frond has a barely visible ridge of raised dots and is green on top and underneath. The fronds have a waxy cuticle that glistens in the light and some have a dark red margin. Each frond has 2 to 5 roots dangling beneath. Dotted duckweed resembles the native greater duckweed (*Spirodela polyrhiza*) which has larger fronds that are more rounded, often having a red dot on top, above where the roots attach. Dotted duckweed usually reproduces by vegetative budding of daughter plants.

**Native Distribution:** Dotted duckweed originates from Africa, Australia, and Southeast Asia.

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

**Pathway(s) of Introduction:** Dotted duckweed was thought to have been first transported to the U.S. on boats in the 1800s (Landolt, 1986). Since then, it has been spread extensively through the aquarium trade. These tiny plants likely are transported by animals between water bodies.

**Impact(s) of Introduction:** Dotted duckweed is easily distributed, colonizes quickly, and exhibits a high rate of vegetative propagation (Landolt, 1986). It has the potential to greatly impact the flora and fauna of water bodies, primarily by limiting sunlight beneath. There are currently no regulations prohibiting the possession, sale, or importation of dotted duckweed in Alabama.

**Common Name:** Eurasian Watermilfoil  
**Scientific Name:** *Myriophyllum spicatum*  
**Family:** Haloragaceae

**Alabama ANS Task Force Rank – 2.3**



Photo by Alison Fox, University of Florida.

**Synonym(s):** spike watermilfoil

**Identification:** Eurasian watermilfoil is a submersed aquatic plant with long branching stems that grow horizontally on the surface and form dense mats. The leaves are whorled around the stem and finely divided into about 24 leaflets, giving a feathery appearance. The flowering stem is frail and flowers inconspicuous. It reproduces primarily vegetatively with rhizomes or by fragmentation and often becomes established in areas of disturbance.

**Native Distribution:** Eurasian milfoil is native to Europe, Asia, and northern Africa (Madsen et al., 1991).

**Alabama Distribution:** Eurasian watermilfoil exhibits a scattered distribution in Alabama, including the Mobile-Tensaw Delta and reservoirs on the Tennessee, Black Warrior, Tombigbee, and Coosa river systems.

**Pathway(s) of Introduction:** Eurasian watermilfoil was accidentally introduced from Eurasia in the 1940s. It was likely discarded from an aquarium or brought in attached to watercraft (Remaley, 2006).

**Impact(s) of Introduction:** Eurasian milfoil infestations result in an array of ecosystem disruptions. It grows aggressively and competitively, forming thick mats across the surface blocking sunlight to native plants below. Infestations can significantly affect aquatic food chains by soaking up nutrients and reducing foraging efficiency of predator species. Many of these displaced native plants are preferred by waterfowl and other invertebrates (G. Hepp, Auburn University, pers. comm.). Heavy infestations of Eurasian watermilfoil impede boating, swimming, and fishing in lakes and rivers. It has hybridized with native watermilfoil species in northern states, making eradication efforts difficult.

Eurasian milfoil is listed on the State of Alabama Weed List (80-10-14-.04) and under the nonindigenous aquatic plant regulation 220-2-.124. These regulations prohibit the transport of designated noxious weeds into or within Alabama, along with prohibiting the introduction of noxious weeds into the public waters of Alabama.

**Common Name:** Parrotfeather  
**Scientific Name:** *Myriophyllum aquaticum*  
**Family:** Haloragaceae

**Alabama ANS Task Force Rank – 2.3**



Photo by Graves Lovell, ALDWFF.

**Synonym(s):** *Enydria aquatica*, *Myriophyllum brasiliense*, *Mryiophyllum proserpinatcoides*, Brazilian watermilfoil, parrots-feather, parrot feather watermilfoil

**Identification:** Parrotfeather is a rooted, emerged aquatic plant that is generally restricted to the shallow margins of lakes, ponds, reservoirs, and low energy rivers and streams. Stems can trail along moist ground or can float far from the bank with submersed leaves dangling beneath. The ends of floating stems are stiff and turn vertical above the surface. The emerged leaves are whorled around the stem and are pinnately divided into 6 to 18 leaflets, giving a feathery appearance. The submersed leaves are finely divided into about 20 to 30 leaflets. The emerged leaves are stiff and bright greenish blue. The presence of emerged stems and leaves distinguish it from other *Myriophyllum* spp. Reproduction is asexual with new plants forming from root fragments.

**Native Distribution:** Parrotfeather is native to the Amazon River basin in South America.

**Alabama Distribution:** Parrotfeather is widespread throughout all major drainages in Alabama.

**Pathway(s) of Introduction:** Parrotfeather was first discovered in Washington D.C. in the late 1890s and has since spread throughout the U.S. through the aquarium and water garden trade (USGS, 2020f). Fragments are easily transported on watercrafts and trailers but can also be spread intentionally when cleaning out aquariums and water gardens.

**Impact(s) of Introduction:** Dense mats of parrotfeather can outcompete native vegetation along the shoreline. It can also detach and form floating mats that choke waterways and impede water navigation. Dense infestations can alter the physical and chemical characteristics of water bodies and provide habitat for mosquito larvae (USGS, 2020f).

Parrotfeather is listed on the State of Alabama Weed List (80-10-14-.04) and under the nonindigenous aquatic plant regulation 220-2-.124. These regulations prohibit the transport of designated noxious weeds into or within Alabama, along with prohibiting the introduction of noxious weeds into the public waters of Alabama.



**Common Name:** Brittle Waternymph

**Scientific Name:** *Najas minor*

**Family:** Najadaceae

**Alabama ANS Task Force Rank – 2.1**



Photo by Graves Lovell, ALDWFF.

**Synonym(s):** Slender naiad, spiny-leaf naiad, brittle naiad

**Identification:** Brittle naiad is a frail, submersed aquatic plant. The highly branching stems can be as long as 1.2 m (USGS, 2020g). The slender leaves are oppositely arranged, have serrations along the margin, and curl downward. Branches and leaves become more prolific toward the apex of the stem, resembling a feather duster. Leaves appear similar to *Chara* spp. branchlets which are arranged in more distinctly separate whorls. Flowers are inconspicuous and located in the leaf axils (Haynes, 1979). Stems fragment easily and can propagate from fragments or small seeds along the stem.

**Native Distribution:** Brittle naiad is native to Eurasia and Africa.

**Alabama Distribution:** Brittle naiad is present in most drainages in Alabama. Most severe infestations appear in small impoundments.

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

**Impact(s) of Introduction:** Brittle naiad can form dense, monospecific stands in shallow water, hindering water recreation and reducing the foraging efficiency of predatory fish (USGS, 2020f). It often fills the voids among other stands of submersed vegetation. Brittle naiad is more tolerant of turbidity and eutrophic conditions than native *Najas* species, giving it a competitive edge (Wentz and Stuckey, 1971). Brittle naiad is prohibited by regulation 220-2-.124 from being introduced or placed or caused to be introduced or placed into the public waters of Alabama.

**Common Name:** Common Reed  
**Scientific Name:** *Phragmites australis*  
**Family:** Poaceae

**Alabama ANS Task Force Rank – 2.1**



Photo by Leslie J. Mehrhoff, University of Connecticut.

**Synonym(s):** Giant reed, roseau, yellow cane, cane, *Phragmites*

**Identification:** Common reed or more commonly referred to as *Phragmites* is a tall, perennial, sod-forming grass that can grow slightly submerged or on dry soil. It reaches a height up to 4 m, with elongate leaves, 2.5 to 3.8 mm at their widest point (Uchytel, 1992). Flowers in late summer are in bushy panicles, usually golden to light purple. Reproduction is primarily clonally through rhizomes, but also seeds (Fofonoff, et. al., 2020).

**Native Distribution:** The native distribution of *Phragmites* has been in question until recent research indicated 3 distinct genotypes are found in the U.S. (Swearingen and Saltonstall, 2010). One native to the U.S. where it is widespread (subsp. *americanus*), one form still in question that inhabits much of the southern U.S. coast (subsp. *berlandieri*), and a non-native invasive form from Europe (subsp. *australis*).

**Alabama Distribution:** *Phragmites* is present in Alabama, particularly in the coastal areas of the Mobile Delta. However, due to the unofficial nativity of the 3 genotypes found in the U.S. and the difficulty to distinguish each one, the distribution of a non-native common reed in Alabama is unknown.

**Pathway(s) of Introduction:** European common reed was thought to have come in as ballast or shipping material in the late 1700s to early 1800s and first established on the Atlantic Coast. It has been identified in 49 states, but primarily along the East Coast and around the Great Lakes (Swearingen and Saltonstall, 2010). While in the U.S. it has been used as filter plants in wastewater lagoons as well as for erosion control (INDNR, 2005).

**Impact(s) of Introduction:** The dense and tall growth habit of common reed greatly threatens the biodiversity of coastal and marsh habitats by displacing native vegetation in these areas (Swearingen and Saltonstall, 2010). Faunal species that use these native plants for food and habitat can decline. Furthermore, *Phragmites* alters wetland hydrology through increased evaporation and trapping of sediments, causing marsh soils to dry out. *Phragmites* is listed on the State of Alabama Weed List (80-10-14-.04) prohibiting the importation into and within Alabama and movement of any regulated article infested with *Phragmites*.

**Common Name:** Uruguayan Waterprimrose

**Scientific Name:** *Ludwigia uruguayensis*

**Family:** Onagraceae

**Alabama ANS Task Force Rank – 2.1**



Photo by Graves Lovell, ALDWFF.

**Synonym(s):** *L. grandiflora*, *L. hexapetala*, Uruguayan primrose-willow, Uruguay waterprimrose, Uruguayan primrosewillow, water primrose, creeping waterprimrose

**Identification:** Uruguayan waterprimrose is a rooted, emersed, aquatic plant that is generally restricted to the margins but can form free-floating mats. Stems are hollow and can float far from the margins with the ends becoming dense and rising up to 1 m at maturity. Leaves are alternate along the stem and can have many different shapes. Leaves along the floating stem can be spatulate to nearly round lying flat on the surface, while leaves on the erect stems are longer and lanceolate. The stems and leaves of the erect portions are covered in fine hairs. Uruguayan waterprimrose has feathery roots dangling from each node along the floating stem. White, spongy, aerenchymous roots are also found at the nodes (Godfrey and Wooten, 1979). Flowers arise from the leaf axils and are showy, yellow, and have five petals. There are many native species of *Ludwigia*, that are difficult to distinguish until mature, as the flowers have identifying characteristics (Jacono, 2017).

There are two common *Ludwigia* species native to the U.S. that are very similar in appearance to Uruguayan waterprimrose, all of which have 5-petal yellow flowers. Anglestem primrose-willow (*L. leptocarpa*) has smaller flowers, and the petals are tear-drop shaped, narrowing at the base. The erect portions of floating waterprimrose (*L. peploides*) may only rise 0.5 m above the surface and have shiny leaves and stems that lack hair. Reproduction of Uruguayan waterprimrose can be by seeds or fragmentation. Before flowers are present, the appearance and growth habit of *Ludwigia* spp. is very similar to alligatorweed, which has opposite leaves.

**Native Distribution:** Uruguayan waterprimrose is native to South and Central America.

**Alabama Distribution:** Uruguayan waterprimrose has been found from northeast Alabama, through the central region of the Mobile Delta, and in the Chattahoochee River drainage. However, the difficulty distinguishing this plant from other *Ludwigia* spp. makes its prevalence questionable.

**Pathway(s) of Introduction:** Uruguayan waterprimrose is often introduced to new locations by the water garden industry. It is also dispersed by watercraft, human activity, natural dispersion via waterways and animal transportation.

**Impact(s) of Introduction:** Dense mats of Uruguayan waterprimrose along the shoreline replace native species by outcompeting them for sunlight. In extreme cases, floating mats can disrupt the water quality and flora and fauna communities in a body of water. Mats can alter aquatic ecology and increase breeding habitat for mosquitos. Uruguayan waterprimrose accumulation may increase flooding through reduction of flood control channel capacity (Nehring and Kolthoff, 2011). There are currently no regulations prohibiting the possession, sale, or importation of Uruguayan waterprimrose in Alabama.

**Common Name:** Water Lettuce  
**Scientific Name:** *Pistia stratiotes*  
**Family:** Araceae

**Alabama ANS Task Force Rank – 2.1**



Photo by Graves Lovell, ALDWFF.

**Synonym(s):** none

**Identification:** Water lettuce is a large, floating, aquatic plant that can form dense mats, or disperse individually across large water bodies. Leaves can be 15 cm long (Glazier, 1996) and are spatulate and arranged in rosettes, resembling a head of cabbage. The leaves are light green and have velvety hair with prominent longitudinal veins. Roots hang beneath and are finely divided and feathery. Flowers are inconspicuous. Water lettuce can reproduce sexually or vegetatively, forming “daughter plants” from a horizontal stolon. Like other floating plants, water lettuce thrives in stagnant coves of reservoirs and backwater areas; however, individual plants can move with wind and current across large water bodies.

**Native Distribution:** The species is pantropical, occurring on all continents except Antarctica (Adebayo et al., 2011). The center of origin for water lettuce is unknown. Fossil records for this species can be found around the globe (Stoddard, 1989).

**Alabama Distribution:** Water lettuce is found in several drainages across Alabama, including the Coosa, Chattahoochee, Tombigbee, and Black Warrior river systems.

**Pathway(s) of Introduction:** Water Lettuce can spread by fragmentation as parts of the plant are moved on watercraft and trailers to uninfected waters (Rivers, 2002). Water lettuce is readily available at pond and aquarium supply stores as well as the internet. Dumping of aquarium and pond plants is often the means of spread.

**Impact(s) of Introduction:** Water lettuce can severely impact the environment and economy of infested areas (Rivers, 2002). Large, floating mats compete with other aquatic species for light, nutrients, and oxygen. In areas of dense infestations, faunal community composition can be altered greatly. Water navigation and hydroelectric dam operations can be severely impacted by free-floating mats of water lettuce. Water lettuce is prohibited by regulation 220-2-.124 from being introduced or placed or caused to be introduced or placed into the public waters of Alabama.



## **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. Appendices 12. H and I detail current laws that existing authorities have related to ANS in Alabama.

### **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 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.5 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.6 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 ensure 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.7 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.

On December 4, 2018, the President signed into law the Vessel Incidental Discharge Act (VIDA). It restructures the way the Environmental Protection Agency (EPA) and the U.S. Coast Guard (USCG) regulate incidental discharges, primarily from commercial vessels, into waters of the United States and the contiguous zone. Specifically, VIDA amends Clean Water Act (CWA) Section 312 to include a new subsection (p) titled, “Uniform National Standards for Discharges Incidental to Normal Operation of Vessels.”

Subsection 312(p) requires the EPA to develop new national standards of performance for commercial vessel discharges and the USCG to develop corresponding implementing regulations. The following interim requirements apply until EPA publishes future standards and the USCG publishes corresponding implementing regulations (anticipated in 2022):

- (1) For large, non-fishing commercial vessels: The existing vessel discharge requirements established through the EPA 2013 Vessel General Permit (VGP) and the USCG ballast water regulations, and any applicable state and local government requirements.
- (2) For small vessels and fishing vessels of any size: The existing ballast water discharge requirements established through the EPA 2013 VGP and the USCG ballast water regulations, and any applicable state and local government requirements.

#### **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, 24 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 46 members. Alabama is an active member of this panel.

## **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 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.1d 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 following aquatic plants are prohibited from being introduced or placed into the public waters of Alabama under regulation (220-2-.124): African elodea (*Lagarosiphon* spp.), alligatorweed (*Alternanthera philoxeroides*), Brazilian elodea (*Egeria densa*), curlyleaf pondweed (*Potamogeton crispus*), Eurasian watermilfoil (*Myriophyllum spicatum*), floating waterhyacinth (*Eichhornia crassipes*), giant salvinia (*Salvinia molesta*), hydrilla (*Hydrilla verticillata*), hygrophila (*Hygrophila polysperma*) limnophila (*Limnophila sessiliflora*), parrotfeather (*Myriophyllum aquaticum*), purple loosestrife (*Lythrum salicaria*), rooted waterhyacinth (*Eichhornia azurea*), spinyleaf naiad (*Najas minor*), water-aloe (*Stratiotes aloides*), water lettuce (*Pistia stratiotes*), water chestnut (*Trapa natans*), and water spinach (*Ipomea aquatica*).

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.D.4 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.D.5 Alabama State Port Authority**

The Port Authority has broad authority to promote, develop, construct, maintain, and operate, all harbors, seaports, 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. The ALANSTF decided upon the following goal and objectives to shape Alabama's nuisance species management responses:

### **5.A Goal**

Prevent, control, and manage the introduction of new and existing ANS in Alabama to minimize impacts 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**

Prevent, control, and manage the introduction/reintroduction and spread of new and existing ANS through education about species and pathways, targeting the general public, industries, user groups, government agencies, and non-governmental agencies.

#### **5.B.3 Objective 3**

Eliminate, control, and manage ANS through monitoring, early detection, and rapid response.

#### **5.B.4 Objective 4**

Prevention of ANS through legislation, regulation, and enforcement.



## 6) PRIORITIZATION OF PROBLEMS

Prioritizing invasive species problems and solutions presents a special challenge. The ALANSTF Force has conducted literature reviews and engaged in discussions and debate. It was decided that “exacerbating circumstances” would not be prioritized because all are equally important, and some are unresolvable. The ALANSTF has concluded that its collective intuition and professional judgment are the best guides to prioritize these aspects into “high,” “medium,” and “low” categories under the four objectives, rather than reliance on an overly complex and often misleading quantitative mechanism. Section 6.A lists the ALANSTF Prioritization of Pathways. Priorities were also based on the objectives of the Plan. It is important to note that ranking species by objective (Section 6.B) was conducted relative to that species group. For example, controlling island apple snails was ranked “high” as a priority among other animals, but this does not necessarily imply it’s as high a priority as controlling certain aquatic plants, such as hydrilla, that have proven far more problematic than the island apple snail. (See Section 7, Management Actions, for more information on the goal and objectives of this Plan). The results, as described in sections 6.A and 6.B, are the Task Force’s recommendations for approaching ANS management in Alabama for the next 10 years.

### 6.A Prioritization of Pathways

Prioritization of Pathways by Objective	Approach			
	<u>Objective 1:</u> Coordination of Activities and Programs	<u>Objective 2:</u> Prevention, Control, and Manage Through Education	<u>Objective 3:</u> Eliminate, Control and Manage	<u>Objective 4:</u> Prevent Through Legislation, Regulation, and Enforcement
Pathways / Media				
Shipping - ballast, cargo, damage, ships & equipment	LOW	MEDIUM	LOW	MEDIUM
Oil & Gas Exploration - boats and equipment	LOW	MEDIUM	LOW	MEDIUM
Recreational Boating	MEDIUM	HIGH	LOW	MEDIUM
Angling - boats, equipment, live bait use	MEDIUM	HIGH	LOW	MEDIUM
Hunting - boats, equipment, hunters	MEDIUM	HIGH	LOW	MEDIUM
Commercial Fishing- vessels, equipment	MEDIUM	HIGH	LOW	MEDIUM
Transportation corridors	MEDIUM	HIGH	HIGH	MEDIUM
Nursery, landscape, watergarden industry	MEDIUM	HIGH	LOW	HIGH
Aquaculture- for food	LOW	MEDIUM	LOW	HIGH
Aquaculture - for bait and stocking	LOW	HIGH	MEDIUM	HIGH
Aquarium / Pet Industries	MEDIUM	HIGH	HIGH	HIGH

## 6.B Prioritization of Species

Rank	Prioritization of Species by Objective		Approach			
			Objective 1: Coordination of Activities and Programs	Objective 2: Prevention, Control, and Manage Through Education	Objective 3: Actively Control and Manage	Objective 4: Prevent Through Legislation, Regulation, and Enforcement
Animals	Common Name	Scientific Name				
3.00	Bighead Carp	<i>Hypophthalmichthys nobilis</i>	MEDIUM	MEDIUM	MEDIUM	MEDIUM
3.00	Silver Carp	<i>Hypophthalmichthys molitrix</i>	HIGH	HIGH	HIGH	HIGH
3.00	Silver x Bighead Carp Hybrid	<i>H. molitrix x nobilis</i>	LOW	LOW	LOW	LOW
3.00	Common Carp	<i>Cyprinus carpio</i>	LOW	LOW	LOW	LOW
3.00	Black Carp	<i>Mylopharyngodon piceus</i>	HIGH	HIGH	HIGH	MEDIUM
3.00	Rudd	<i>Scardinius erythrophthalmus</i>	LOW	LOW	LOW	LOW
3.00	Virile Crayfish	<i>Faxonius virilis</i>	HIGH	HIGH	HIGH	HIGH
3.00	Rusty Crayfish	<i>Faxonius rusticus</i>	HIGH	HIGH	HIGH	HIGH
3.00	Nutria	<i>Myocastor coypus</i>	MEDIUM	LOW	MEDIUM	LOW
3.00	Corbicula Clam	<i>Corbicula fluminea</i>	LOW	LOW	LOW	LOW
2.80	Red Shiner	<i>Cyprinella lutrensis</i>	MEDIUM	MEDIUM	MEDIUM	MEDIUM
2.80	Zebra Mussel	<i>Dreissena polymorpha</i>	HIGH	MEDIUM	LOW	LOW
2.60	Blueback Herring	<i>Alosa aestivalis</i>	HIGH	MEDIUM	MEDIUM	MEDIUM
2.60	Island and Channeled Apple Snail	<i>Pomacea maculata</i> and <i>P. canaliculata</i>	MEDIUM	HIGH	HIGH	HIGH
2.40	Grass Carp	<i>Ctenopharyngodon idella</i>	HIGH	LOW	MEDIUM	LOW
2.20	Australian Red Claw, Marron, and Yabby Crayfish	<i>Cherax quadricarinatus</i> , <i>C. destructor</i> , and <i>C. tenuimanus</i>	HIGH	MEDIUM	MEDIUM	HIGH
2.20	Australian Jellyfish	<i>Phyllorhiza punctata</i>	LOW	LOW	LOW	LOW
2.00	Blue and Nile Tilapia	<i>Oreochromis aureus</i> and <i>O. niloticus</i>	HIGH	MEDIUM	MEDIUM	MEDIUM
Aquatic Plants	Common Name	Scientific Name				
2.9	Common Salvinia	<i>Salvinia minima</i>	MEDIUM	HIGH	HIGH	LOW
2.9	Hydrilla	<i>Hydrilla verticillata</i>	MEDIUM	HIGH	HIGH	LOW
2.8	Water Hyacinth	<i>Eichhornia crassipes</i>	MEDIUM	HIGH	HIGH	LOW
2.6	Alligatorweed	<i>Alternanthera philoxeroides</i>	MEDIUM	LOW	HIGH	LOW
2.5	Cuban Bulrush	<i>Cyperus blepharoleptos</i>	MEDIUM	MEDIUM	HIGH	LOW
2.5	Giant Salvinia	<i>Salvinia molesta</i>	MEDIUM	HIGH	HIGH	LOW
2.4	Blue-Green Algae	<i>Lyngbya wollei</i>	MEDIUM	HIGH	HIGH	LOW
2.3	Dotted Duckweed	<i>Landoltia punctata</i>	MEDIUM	HIGH	LOW	LOW
2.3	Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	MEDIUM	HIGH	HIGH	LOW
2.3	Parrotfeather	<i>Myriophyllum aquaticum</i>	LOW	HIGH	LOW	LOW
2.1	Brittle Waternymph	<i>Najas minor</i>	MEDIUM	HIGH	MEDIUM	LOW
2.1	Common Reed	<i>Phragmites australis</i>	LOW	LOW	MEDIUM	LOW
2.1	Uruguayan Waterprimrose	<i>Ludwigia uruguayensis</i>	MEDIUM	LOW	HIGH	LOW
2.1	Water Lettuce	<i>Pistia stratoites</i>	MEDIUM	HIGH	HIGH	LOW

## 7) MANAGEMENT ACTIONS

This chapter describes the various ongoing and proposed management actions identified by the ALANSTF, listed according to the objective they support. A table version of this list appears in Section 8, including relevant budget and needed employee information, where available.

**Goal: Prevent, control and manage introduction of new and existing ANS in Alabama to minimize impacts on native species, environmental quality, human health, and economics.**

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

### Actions

The ALANSTF identified the following actions as the most important activities to be implemented:

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

One of the first actions to be taken will be to begin the process to establish a permanent Alabama ANS Council (ALANSC) through legislation. The ALANSC would replace or supersede the ALANSTF. A proposed bill would designate an appropriate lead agency, describe Council membership, tasks, and responsibilities, and authorizes the hiring of fulltime ALANSC staff.

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

Task force members agreed that a full-time coordinator will be essential for assisting the ALANSC in carrying out its duties. The coordinator should be housed within the lead agency and could be a new employee hired specifically to serve as the statewide ANS coordinator. Additional duties would include but would not be limited to coordinating all activities relating to ANS in Alabama, compiling and maintain ANS databases, and searching for external funding opportunities to support ANS initiatives. The ALANSTF is requesting federal funding to implement with a requested budget of \$150,000 to cover a coordinator's salary and small operating budget.

#### **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. Once established, the ALANSC will establish one or several MOUs to recognize overlapping and competing jurisdictions related to ANS in Alabama and propose cooperation to facilitate efficient ANS management.

**7.B OBJECTIVE 2: Prevent, control, and manage the introduction/reintroduction and spread of new and existing ANS through education about species and pathways, targeting the general public, industries, user groups, government agencies, and non-governmental agencies.**

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

This action is focused on identifying current ANS educational programs and expanding their outreach efforts in Alabama. The ALANSC along with the proposed state ANS coordinator would identify educational opportunities that would allow the expansion or enhancement of ANS

curriculum. For example, the Alabama Clean Water Partnership (ALCWP) is currently leading a project to publish and distribute educational newspaper inserts to raise public awareness about Alabama's water resources with an insert specifically devoted to the problem of ANS. The ALANSC should identify partners like ALCWP to assist with similar ANS educational projects.

### **7.B.2 Education of Water Garden and Aquatic Hobbyists/Enthusiasts**

Unintentional and intentional introduction of ANS plants, fishes, and mollusks from water garden and aquatic hobbyists is a major pathway for dispersal of these organisms into the public waters of Alabama. The ALANSC along with jurisdictional state agencies should establish an approved species regulation. The species on this regulation would be allowed in Alabama without further restriction. However, all other nonnative species would be placed on the restricted/prohibited regulation. These regulations, in conjunction with responsible possession and ownership guidelines for preventing intentional release should be distributed to all stores that sell aquatic plants and animals. Signage and educational pamphlets should be developed and distributed to plant nurseries, pet stores, veterinary offices, and fish and water garden societies/associations with a footprint in Alabama. Signs could also be placed at boat ramps. This activity could be done in conjunction with the "Stop Aquatic Hitchhikers" program. These signs and educational pamphlets would address the impacts of ANS on Alabama and those things that hobbyists can do to prevent the introduction or spread of ANS. Partnerships (i.e., Pet Industry Joint Advisory Council) should be developed and/or continued with water garden and pet businesses and associations to assist with funding and distribution of printed materials.

### **7.B.3 Develop Educational Materials for to the General Public**

Educational materials (i.e., brochures, pamphlets, posters, fact sheets and cards) 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 and cards should be developed to educate the public. For example, the Marine Resources Division prints 75,000 Marine Information Calendars annually for distribution to interested parties by coastal vendors, boat shows, and at various statewide outreach activities. Each year, unique information regarding invasive species of coastal Alabama is compiled and included with associated background, and ways in which the public can help to mitigate the invasive species problem. Additional educational material will be developed similar to the aforementioned calendars to be distributed at public events.

### **7.B.4 Produce and Provide ANS Guide for Teachers and Students**

This action is designed to produce ANS educational material oriented for teachers and students in grades K-12. Targeted distribution centers include schools, visitor centers, nursery/gardening centers, pet stores, and other locations.

### **7.B.5 Education of Boaters and Anglers**

Boat traffic is one of the primary pathways for aquatic plant dispersal. Public boat launches should receive signage, and private or non-state boat launches could be provided signs for posting at little-to-no cost to the boat ramp operators/owners. Aquatic plant information could be placed in boat license information, fishing regulations, and other sources of boating-related information. This activity could be done in conjunction with the "Stop Aquatic Hitchhikers" program run by

USFWS. For example, the Mobile District Corps of Engineers has posted “Stop Aquatic Hitchhiker” signs at all Corps boat ramps along the Tennessee-Tombigbee Waterway.

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

The ALANSC will coordinate an Alabama ANS Meeting to foster collaboration and communication among agency representatives, university researchers, private interest groups, non-governmental agencies, and the public. This meeting will also highlight ANS issues and disseminate for public education and appreciation in understanding of ANS in Alabama.

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

To assess the risks associated with introducing aquatic species for cultivation, agencies must collaborate with the aquaculture industry. A formal partnership (MOU) is recommended among state agencies, aquaculture entities, and university researchers to devise and implement “best management” practices to prevent the introduction of non-native aquatic species used in aquaculture into the public waters of Alabama.

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

Hazard Analysis Criteria Control Point, which is a management tool that provides a structured method to identify risks and focus procedures used in natural resource pathway activities, 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. For example, Alabama has many state and private fish hatcheries. Participants should include workers from all hatcheries. Other industries would be identified by the ALANSC.

#### **7.B.9 Provide Training Workshops for 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.

#### **7.B.10 Develop a Statewide ANS Educational and Informational Website**

To facilitate information dissemination and educational efforts regarding aquatic nuisance species in Alabama, the proposed ALANSC and statewide coordinator should work together to design and maintain an ANS website for Alabama. This site would serve as a comprehensive source of information for citizens as well as local and state agency personnel regarding state ANS efforts, activities, and publications. The website should include a comprehensive list of points of contact on various issues and other relevant web links. The site should allow users to report ANS occurrences and access relevant state agency regulations, state laws, and news releases concerning ANS. Finally, the website should be very user-friendly so that lay persons can easily become educated and report potential AIS sightings.

### **7.C OBJECTIVE 3: Eliminate, control, and manage ANS through monitoring, early detection, and rapid response.**

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

This plan would facilitate identifying potential ANS and coordinating control response before the ANS became established. It would also serve as an early warning system for spread of existing

ANS in Alabama. Criteria 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.

### **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. With approval of the ANS plan, the Rapid Assessment Team needs to be reorganized to include experts who are willing and able to participate in marine, estuarine, and freshwater surveys of Alabama. The National Incident Management System will be examined in the development of a rapid response plan.

### **7.C.3 Bighead and Silver Carp Monitoring in Alabama and Studying Impacts on Native Fishes**

Bighead carp abundance has increased in the Tombigbee and Alabama rivers (S. Rider, ALDWFF, unpublished data). In addition, silver carp were first collected in 2010 from Pickwick Reservoir, Tennessee River, and have since been documented Wilson to Wheeler reservoirs. With the expansion of silver carp in the Alabama section of the Tennessee River and in the same habitats where valuable fishery resources occur, additional silver carp distribution, movement, and reproduction data is needed to model potential impacts on native fishes and to better manage the silver carp invasion. These data will also be used to understand the silver carp invasion in Alabama and the process to ultimately control and/or eradicate them.

### **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 saltwater tolerant and have been identified in coastal Louisiana and Mississippi’s portion of the Mississippi Sound (Perry and Yeager, 2007). Continued monitoring is needed to obtain abundance, distribution, and habitat data to understand the zebra mussel invasion and ultimately how to control and/or eradicate them in Alabama .

### **7.C.5 Risk Assessment Guidelines**

A process of risk assessment should be conducted to determine the potential invasive characteristics of a new species that may be introduced for recreational and/or commercial reasons in Alabama. For the species to be added to the proposed approved or regulated prohibited regulations, a thorough scientific risk assessment should be conducted.

### **7.C.6 Screening Process for Risk Assessment**

Because formalized “risk assessments” of nonnative species require in-depth analysis and can be very time-consuming, the Mississippi River Basin Panel on Aquatic Nuisance Species has

developed a draft model state natural resources agency screening process. This “screening process” is defined as an approach taken to evaluate a list of species quickly and efficiently and then decide which are:

- species with assessed low risk of impact (i.e., no need for regulation at this time);
- species with assessed high risk of impact (i.e., immediately regulate and manage if in public waters); and
- species for which formalized risk assessment is recommended.

Formal “risk assessments” are more time consuming, expensive, and require more in-depth analysis than screening species in this manner. Screening is recommended to minimize the number of risk assessments that an agency will conduct. It is recommended that the ALANSC and the ALANS coordinator use this screening process to recommend to the relevant state agencies whether a formal risk assessment should be conducted for a particular aquatic species.

#### **7.C.7 Statewide Annual ANS Aquatic Plant Surveys**

Conduct annual statewide aquatic plant surveys of public water bodies and waterways in Alabama to locate new infestations of ANS aquatic plants. Early infestations may prove easier to treat and eradicate before an ANS infestation becomes widespread.

### **7.D OBJECTIVE 4: Prevention of ANS Through Legislation, Regulation, and Enforcement.**

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

The ALDWFF regulation 220-2-.26 is the State of Alabama’s prohibited animal species list. A number of species ranked in this plan are not listed in this regulation. The proposed ALANS coordinator should recommend that these ranked ANS species be listed on this prohibited species list.

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

The ALANSC should review all ranked ANS and assist with determining which State agency has jurisdiction over a particular ANS. For example, aquatic plants do not seem to have a particular State agency that claims designated jurisdictional authority.

#### **7.D.3 Create a Non-Native Species Review Committee**

This committee under the auspices of the ALANSC will be composed of representatives from state agencies, non-governmental organizations, business, private and public interests, and will oversee and make decisions pertaining to the importation of non-native species in Alabama. Committee members would serve a predetermined time limit.

#### **7.D.4 Develop 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 reviews 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 Define “Baitfish” Species, Use, Possession, and Importation**

The establishment of an approved species list for “baitfish” would, in part, prevent the introduction of ANS into Alabama’s waters (e.g., red shiner). Sales of invasive species through the “baitfish” trade continue, despite known risks. In addition to education efforts, legislation action should be recommended by the ALANSC to the Alabama Legislature to regulate elements of this industry to prevent ANS introduction.

#### **7.D.6 Require 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.

#### **7.D.7 Require Only Triploid Grass Carp to be Produced, Sold, Imported or Stocked in Alabama**

Alabama is one of six states. (i.e., Mississippi, Arkansas, Missouri, Iowa, Nebraska) that still allows stocking of diploid grass carp. Grass carp is considered an ANS due to its prolific spawning and foraging ability that can disrupt native ecosystems. Many border states of these six states only allow triploid grass carp. For Alabama, those states are Georgia and Tennessee. Deliberate stocking of triploid individuals would reduce the reproductive potential of grass carp, remove diploids from the commercial supply chain, and reduce/prevent diploids from migrating out of state.

#### **7.D.8 Require ANS Identification and Removal Training to Acquire Boater’s License**

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.

#### **7.D.9 Increase Federal Agriculture Quarantine Inspection**

Increase USDA APHIS and U.S. Bureau of Customs and Border Protection personnel inspections for foreign arriving vessels, cargo, and cruise ship passengers at the Port of Mobile for non-native plant and animal pests. This includes maritime containers arriving in Alabama by rail from east and west coast ports. The ALANSC would partner with USDA APHIS and U.S. Bureau of Customs and Border Protection to seek additional funding to increase inspections.



## 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: Prevent, control, and/or manage the introduction of new and existing ANS in Alabama to minimize impacts 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.** Prevent, control, and manage the introduction/reintroduction and spread of new and existing ANS through educational outreach.

**Objective 3.** Eliminate, control, and manage ANS through monitoring, early detection, and rapid response.

**Objective 4.** Prevention of ANS through legislation, regulation, and enforcement.

Tasks / Actions		Current Status	Objective Addressed	Funding Source	Implementing Entity	Cooperating Agencies	Recent Efforts		Planned Efforts			
Number	Title / Summary						\$000	FTE	Planned		Requested	
		\$000	FTE	\$000	FTE	\$000			FTE			
7.A.1	Establish the 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	ALANSTF	-	-	-	-	150	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	-	ADCNR MBNEP	ALANSC	-	-	-	-	-	-
7.B.2	Education of Water Garden and Aquatic Hobbyists/Enthusiasts.	Unfunded	2	-	ADCNR ADAI	ALANSC	-	-	-	-	5	-
7.B.3	Develop Educational Materials for the General Public.	Unfunded	2	-	ADAI ADCNR ADEM MBNEP	ALANSC	-	-	-	-	5	-
7.B.4	Produce and Provide ANS Guide for Teachers and Students.	Unfunded	2	-	ADAI ADCNR ADEM	ALANSC	-	-	-	-	5	-
7.B.5	Education for Boaters and Anglers.	Unfunded	2	-	ADCNR	ALANSC	-	-	-	-	5	-
7.B.6	Coordinate Annual Alabama ANS Meeting.	Unfunded	1, 2	-	MBNEP	ALANSC	-	-	-	-	10	-

Tasks / Actions		Current Status	Objective Addressed	Funding Source	Implementing Entity	Cooperating Agencies	Recent Efforts		Planned Efforts			
Number	Title / Summary						Planned		Requested			
							\$000	FTE	\$000	FTE	\$000	FTE
7.B.7	Partner with the Aquaculture Industry.	Unfunded	1, 2	-	ADAI ADCNR	ALANSC	-	-	-	-	-	-
7.B.8	Provide Hazard Analysis Critical Control Point (HACCP) Training.	Unfunded	3	-	ALANSC	SARP	-	-	-	-	-	-
7.B.9	Provide Training Workshops for Early Identification and Detection of ANS.	Unfunded	2	-	MBNEP	ADAI ADCNR ADEM	-	-	-	-	-	-
7.B.10	Develop a statewide ANS Educational and Informational Website.	Unfunded	2	-	MBNEP	ALANSC	-	-	-	-	20	-
7.C.1	Develop an Alabama ANS Early Detection and Rapid Response Plan.	Unfunded	1, 3	-	ALANSC	ADAI ADCNR ADEM MBNEP	-	-	-	-	-	-
7.C.2	Conduct Rapid Assessment Sampling in Alabama Waterways.	Unfunded	1, 3	-	ADCNR MBNEP	ALANSC	-	-	-	-	-	-
7.C.3	Bighead and Silver Carp Monitoring.	Partially Funded	3	USFWS	ALDWFF	-	220	1	-	-	-	-
7.C.4	Zebra Mussel Monitoring.	Unfunded	3	-	ALDWFF	TVA	-	-	-	-	-	-
7.C.5	Develop Risk Assessment Guidelines.	Unfunded	3	-	ALANSC	-	-	-	-	-	-	-
7.C.6	Develop Screening Process for Risk Assessment.	Unfunded	3	-	ALANSC	-	-	-	-	-	-	-
7.C.7	Conduct Statewide Annual ANS Aquatic Plant Surveys.	Unfunded	3	-	ALDWFF	TVA	-	-	-	-	-	-
7.D.1	Include all Ranked ANS Animals in Regulation 220-2-.26.	Unfunded	4	-	ALDWFF	-	-	-	-	-	-	-
7.D.2	Review all ranked ANS for Regulatory Authority.	Unfunded	4	-	ALANSC	ADAI ADCNR ADEM selected experts	-	-	-	-	-	-
7.D.3	Create a Non-Native Species Review Committee.	Unfunded	4	-	Legislature	ALANSC	-	-	-	-	-	-

Tasks / Actions		Current Status	Objective Addressed	Funding Source	Implementing Entity	Cooperating Agencies	Recent Efforts		Planned Efforts			
Number	Title / Summary						Planned		Requested			
		\$000	FTE	\$000	FTE	\$000	FTE					
7.D.4	Develop Non-Native Aquaculture, Research, and Aquarium Species Lists.	Unfunded	4	-	ALANSC	ADAI ADCNR ADEM selected experts	-	-	-	-	-	-
7.D.5	Define "Baitfish" Species, Use, Possession, and Importation.	Unfunded	4	-	ALDWFF AMRD	ALANSC	-	-	-	-	-	-
7.D.6	Require Baitfish Producers to have an Approved HACCP Plan.	Unfunded	4	-	ALDWFF AMRD	ALANSC	-	-	-	-	-	-
7.D.7	Require only Triploid Grass Carp to be Produced, Sold, Imported, or Stocked in Alabama.	Unfunded	4	-	ALDWFF	ALANSC	-	-	-	-	-	-
7.D.8	Require ANS Identification and Removal Training be added For Boater's License.	Unfunded	4	-	ADCNR	ALANSC	-	-	-	-	-	-
7.D.9	Increase Federal Agriculture Quarantine Inspections.	Unfunded	3, 4	-	ALANSC	-	-	-	-	-	-	-
Requested Funding and FTEs							220	1	0	0	200	1

## **9) PROGRAM MONITORING AND EVALUATION**

The ALANSTF recognizes that program monitoring and evaluation is a key component to determine the efficacy of identified objectives in the Alabama ANS management plan. Therefore, this plan was developed by the ALANSTF to understand the status of ANS, determine management options and actions to eliminate, control, and/or manage problems created by ANS in Alabama. This plan represents an initial assessment of ANS in Alabama; however, it is a “living document” that is flexible and adaptive for future efforts. The ALANSTF also recognizes that effective implementation of this and future versions of the Alabama ANS management plan depends upon objective monitoring and evaluation of program progress. To that end, the ALANSTF has recommended the development of an ALANSC staffed by a full-time coordinator. Among other responsibilities, including seeking funding and developing MOUs for overlapping jurisdictions between state agencies, the ALANSC and ALANS Coordinator will be charged with developing a program to monitor the progress of the Alabama ANS management plan in the prevention, elimination and control of aquatic nuisance species in Alabama. Monitoring and evaluation ensure effective implementation of management actions and provides a basis for periodically improving and updating the Alabama ANS management plan.

### **Who should do the evaluation?**

The ALANSTF suggests creation of an internal oversight board or working group within the to-be-established ALANSC. The oversight board should consist of appropriate representatives of state natural resource management agencies, a representative from the governor's office, representatives from the ALANSTF, and at least one out-of-state, qualified professional to participate in the monitoring and evaluation. The oversight board will examine progress on management actions, evaluate the success of each action by examining the level of achievement of the tasks defined within each action, disseminating the results of their evaluation, and identifying amendments to enhance the effectiveness of the Alabama ANS management plan.

### **How should the evaluation be accomplished?**

The four management objectives described in Section 7 provide the focal point for monitoring and evaluation. However, evaluation should also emphasize funding needs to successfully accomplish goals and associated tasks. Evaluation should also incorporate information from those groups affected by implementation of the Alabama ANS management plan.

Specific methods for program monitoring and evaluation will be developed by the to-be-established ALANSC, but the following evaluative approaches should be considered:

**Indicator actions-** In this approach, evaluators select a representative group of actions as indicative of management plan progress. The degree to which those “indicator actions” acquire funding and are executed in their entirety is the degree to which success is declared. Advantages of this approach are that it is straightforward, inexpensive, and may be implemented in the early years of plan execution. The disadvantages are that it is based upon a small sample, does not address the larger issue of spreading of invasive species, and may not satisfy the public’s right to know overall program effectiveness: “Are we better off now than when this effort commenced?”

**Quantitative biological measures-** In this approach, field work is conducted to answer questions such as: (a) Has the range of a particular species expanded? (b) Have new invasive species arrived? (c) Have ecological costs of the impact of certain species increased or spread? (d) Biologically speaking, is this problem greater than it was 5 years ago?

Advantages of this approach include its scientific and quantitative nature, and it addresses fundamental questions rather than bureaucratic ones. Disadvantages include its costliness, its highly focused nature (one species may contract in range while another may expand), and the need to wait until the end of the 5-year cycle for actions to take potential effect. It may also be “setting the bar too high” to expect to control or eliminate certain species. Several monitoring programs are already in existence in Alabama and may be considered by the internal oversight board as a method of gathering evaluation data (see Section 7, Management Actions).

**Quantitative social measures-** In this approach, surveys are conducted among stakeholders to answer such questions as: (a) Can you define the term “aquatic nuisance species?” (b) Have you seen posted signs about aquatic nuisance species at boat ramps and docks? (c) Do you wipe off your outboard motor, trailer, and hull upon extracting it from the water?

**When should the evaluation be done?**

Initial evaluations should be submitted at the end of years 2 and 3 and will probably be limited to the “indicator actions” approach. Deeper assessments should occur in the latter 5 years of the Alabama ANS management plan, when the biological and social quantitative methods should be employed, provided baseline data and funding are available. The ALANSC may develop a “performance budget” funding request through the Alabama Cooperative Extension Service or encourage universities in the state to develop research projects evaluating task force actions. Details and the actual execution of program monitoring and evaluation will be left up to the internal oversight board of the ALANSC, which will be responsible for a report to the Alabama Legislature every 2 years on progress, problems, and recommendations for plan improvement. The target audience of the report will include the general public; local, state, and federal resource managers; and legislative decision-makers.

## 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 an 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 and restricted to a certain place.

**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 resides.

**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 4 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 2 to 8 digits based on the 4 levels of classification in the hydrologic unit system.

**Indigenous** – originating or occurring naturally in a particular location.

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

**Invasive species** – organisms that, when introduced, are likely to have negative economic, 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).

**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 can interbreed, generally sharing similar appearance, characteristics, and genetics.

**Triploid** – an organism with 3 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.



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## 12) APPENDICES

### 12.A State Executive Order Number 30: Establishing the ALANSTF

#### 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 in 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 ecosystem; 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

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 Service  
Tennessee Valley Authority  
U.S. Fish and Wildlife Service  
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 Nurserymen'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

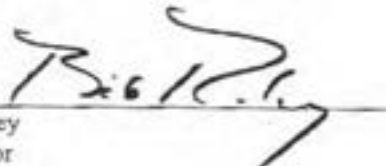
**BE IT FURTHER ORDERED** that the Task Force shall be responsible for formulating a comprehensive plan to ensure the best possible economic and environmental future of the State of Alabama.

**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.

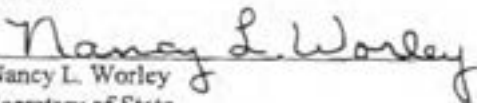
**BE IT FURTHER ORDERED** that this Executive Order shall become effective immediately upon its execution and shall remain in effect until amended or modified by the Governor.

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



  
Bob Riley  
Governor

Attested:

  
Nancy L. Worley  
Secretary of State

## 12.B Non-Native Aquatic Species 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>	<i>quadricarinatus</i>	Red Claw Crayfish
crustacean	<i>Faxonius</i>	<i>rusticus</i>	Rusty Crayfish
crustacean	<i>Faxonius</i>	<i>virilis</i>	Virile Crayfish
crustacean	<i>Procambarus</i>	<i>acutus</i>	White River Crayfish
crustacean	<i>Procambarus</i>	<i>zonangulus</i>	Southern White River Crayfish
fish	<i>Alosa</i>	<i>aestivalis</i>	Blueback Herring
fish	<i>Alosa</i>	<i>pseudoharengus</i>	Alewife
fish	<i>Archocanthus</i>	<i>nigrofasciatus</i>	Convict Cichlid
fish	<i>Astronotus</i>	<i>ocellatus</i>	Oscar
fish	<i>Carassius</i>	<i>auratus</i>	Goldfish
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>Cyprinus</i>	<i>rubrofuscus</i>	Koi Carp
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>Morone</i>	<i>chrysops x saxatilis</i>	Palmetto Bass
fish	<i>Misgurnus</i>	<i>anguillicaudatus</i>	Oriental Weatherfish
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>Phraetocephalus</i>	<i>hemiolepterus</i>	Redtail Catfish
fish	<i>Piaractus</i>	<i>brachypomus</i>	Red-Bellied Pacu
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>	Red-Belly Tilapia
fish	<i>Tinca</i>	<i>tinca</i>	Tench
jellyfish	<i>Craspedacusta</i>	<i>sowerbyi</i>	Freshwater Jellyfish
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
plant	<i>Acorus</i>	<i>calamus</i>	Single-Vein Sweetleaf
plant	<i>Alternanthera</i>	<i>philoxeroides</i>	Alligatorweed
plant	<i>Cabomba</i>	<i>pulcherrima</i>	Purple Cabomba
plant	<i>Callitriche</i>	<i>stagnalis</i>	Pond Water-Starwort
plant	<i>Colocasia</i>	<i>esculenta</i>	Wild Taro
plant	<i>Cyperus</i>	<i>blepharoleptus</i>	Cuban Bulrush
plant	<i>Egeria</i>	<i>densa</i>	Brazilian Waterweed
plant	<i>Eichhornia</i>	<i>crassipes</i>	Water Hyacinth
plant	<i>Hygrophila</i>	<i>polysperma</i>	Hygro
plant	<i>Hydrilla</i>	<i>verticillata</i>	Hydrilla
plant	<i>Iris</i>	<i>pseudacorus</i>	Yellow Iris

plant	<i>Landoltia</i>	<i>puntata</i>	Dotted Duckweed
plant	<i>Ludwigia</i>	<i>grandiflora</i>	Large Flower Waterprimrose
plant	<i>Ludwigia</i>	<i>peplodes</i>	Creeping Waterprimrose
plant	<i>Ludwigia</i>	<i>uruguayensis</i>	Uruguayan Waterprimrose
plant	<i>Lycopus</i>	<i>europaeus</i>	Gypsywort
plant	<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife
plant	<i>Marsilea</i>	<i>mutica</i>	Australian Waterclover
plant	<i>Marsilea</i>	<i>minuta</i>	Dwarf Waterclover
plant	<i>Myosotis</i>	<i>scorpioides</i>	Forget-Me-Not
plant	<i>Murdannia</i>	<i>keisak</i>	Marsh Dayflower
plant	<i>Myriophyllum</i>	<i>aquaticum</i>	Parrotfeather
plant	<i>Myriophyllum</i>	<i>heterphyllum</i>	Variable Leaf Watermilfoil
plant	<i>Myriophyllum</i>	<i>spicatum</i>	Eurasian Watermilfoil
plant	<i>Najas</i>	<i>minor</i>	Brittle Naiad
plant	<i>Naturium</i>	<i>officinale</i>	Watercress
plant	<i>Nelumbo</i>	<i>nucifera</i>	Sacred Lotus
plant	<i>Neobeckia</i>	<i>aquatica</i>	Lakecress
plant	<i>Nymphoides</i>	<i>peltata</i>	Yellow Floating Heart
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>	Water Lettuce
plant	<i>Potamogeton</i>	<i>crispus</i>	Curlyleaf Pondweed
plant	<i>Rotala</i>	<i>rotundifolia</i>	Roundleaf Toothcup
plant	<i>Sagittaria</i>	<i>montevidensis</i>	Giant Arrowhead
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>Selaginella</i>	<i>uncinata</i>	Peacock Spikemoss
plant	<i>Triadica</i>	<i>sebifera</i>	Chinese Tallow Tree
plant	<i>Typha</i>	<i>angustifolia</i>	Narrow-Leaved Cattail
reptile	<i>Trachemys</i>	<i>scripta elegans</i>	Red-Ear Slider
snail	<i>Pomacea</i>	<i>maculata</i>	Island Apple Snail
snail	<i>Cipangopaludina</i>	<i>chinensis</i>	Chinese Mystery Snail
snail	<i>Cipangopaludina</i>	<i>japonica</i>	Japanese Mystery Snail
virus	<i>Ranavirus</i>	spp.	Largemouth Bass Virus
virus	<i>Vesiculovirus</i>	spp.	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.D Federal Executive Order 13751 of December 5, 2016**

By the authority vested in me as President by the Constitution and to ensure the faithful execution of 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.), the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, (16 U.S.C. 4701 et seq.), the Plant Protection Act (7 U.S.C. 7701 et seq.), the Lacey Act, as amended (18 U.S.C. 42, 16 U.S.C. 3371-3378 et seq.), the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), the Noxious Weed Control and Eradication Act of 2004 (7 U.S.C. 7781 et seq.), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control, and to minimize the economic, plant, animal, ecological, and human health impacts that invasive species cause, it is hereby ordered as follows:

Section 1. Policy. It is the policy of the United States to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established. Invasive species pose threats to prosperity, security, and quality of life. They have negative impacts on the environment and natural resources, agriculture and food production systems, water resources, human, animal, and plant health, infrastructure, the economy, energy, cultural resources, and military readiness. Every year, invasive species cost the United States billions of dollars in economic losses and other damages.

Of substantial growing concern are invasive species that are or may be vectors, reservoirs, and causative agents of disease, which threaten human, animal, and plant health. The introduction, establishment, and spread of invasive species create the potential for serious public health impacts, especially when considered in the context of changing climate conditions. Climate change influences the establishment, spread, and impacts of invasive species.

Executive Order 13112 of February 3, 1999 (Invasive Species), called upon executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. Executive Order 13112 also created a coordinating body -- the Invasive Species Council, also referred to as the National Invasive Species Council -- to oversee implementation of the order, encourage proactive planning and action, develop recommendations for international cooperation, and take other steps to improve the Federal response to invasive species. Past efforts at preventing, eradicating, and controlling invasive species demonstrated that collaboration across Federal, State, local, tribal, and territorial government; stakeholders; and the private sector is critical to minimizing the spread of invasive species and that coordinated action is necessary to protect the assets and security of the United States.

This order amends Executive Order 13112 and directs actions to continue coordinated Federal prevention and control efforts related to invasive species. This order maintains the National Invasive Species Council (Council) and the Invasive Species Advisory Committee; expands the membership of the Council; clarifies the operations of the Council; incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and strengthens coordinated, cost-efficient Federal action.

Sec. 2. Definitions. Section 1 of Executive Order 13112 is amended to read as follows:

"Section 1. Definitions.

- (a) 'Control' means containing, suppressing, or reducing populations of invasive species.
- (b) 'Eradication' means the removal or destruction of an entire population of invasive species.
- (c) 'Federal agency' means an executive department or agency but does not include independent establishments as defined by 5 U.S.C. 104.
- (d) 'Introduction' means, as a result of human activity, the intentional or unintentional escape, release, dissemination, or placement of an organism into an ecosystem to which it is not native.
- (e) 'Invasive species' means, with regard to a particular ecosystem, a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.
- (f) 'Non-native species' or 'alien species' means, with respect to a particular ecosystem, an organism, including its seeds, eggs, spores, or other biological material capable of propagating that species, that occurs outside of its natural range.
- (g) 'Pathway' means the mechanisms and processes by which non-native species are moved, intentionally or unintentionally, into a new ecosystem.
- (h) 'Prevention' means the action of stopping invasive species from being introduced or spreading into a new ecosystem.
- (i) 'United States' means the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the U.S. Virgin Islands, the Commonwealth of the Northern Mariana Islands, all possessions, and the territorial sea of the United States as defined by Presidential Proclamation 5928 of December 27, 1988."

Sec. 3. Federal Agency Duties. Section 2 of Executive Order 13112 is amended to read as follows:

Sec. 2. Federal Agency Duties. (a) Each Federal agency for which that agency's actions may affect the introduction, establishment, or spread of invasive species shall, to the extent practicable and permitted by law,

- (1) identify such agency actions;
- (2) subject to the availability of appropriations, and within administrative, budgetary, and jurisdictional limits, use relevant agency programs and authorities to:
  - (i) prevent the introduction, establishment, and spread of invasive species;
  - (ii) detect and respond rapidly to eradicate or control populations of invasive species in a manner that is cost-effective and minimizes human, animal, plant, and environmental health risks;
  - (iii) monitor invasive species populations accurately and reliably;
  - (iv) provide for the restoration of native species, ecosystems, and other assets that have been impacted by invasive species;
  - (v) conduct research on invasive species and develop and apply technologies to prevent their introduction, and provide for environmentally sound methods of eradication and control of invasive species;
  - (vi) promote public education and action on invasive species, their pathways, and ways to address them, with an emphasis on prevention, and early detection and rapid response;

(vii) assess and strengthen, as appropriate, policy and regulatory frameworks pertaining to the prevention, eradication, and control of invasive species and address regulatory gaps, inconsistencies, and conflicts;

(viii) coordinate with and complement similar efforts of States, territories, federally recognized American Indian tribes, Alaska Native Corporations, Native Hawaiians, local governments, nongovernmental organizations, and the private sector; and

(ix) in consultation with the Department of State and with other agencies as appropriate, coordinate with foreign governments to prevent the movement and minimize the impacts of invasive species; and

(3) refrain from authorizing, funding, or implementing actions that are likely to cause or promote the introduction, establishment, or spread of invasive species in the United States 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.

(c) Federal agencies shall pursue the duties set forth in this section in coordination, to the extent practicable, with other member agencies of the Council and staff, consistent with the National Invasive Species Council Management Plan, and in cooperation with State, local, tribal, and territorial governments, and stakeholders, as appropriate, and in consultation with the Department of State when Federal agencies are working with international organizations and foreign nations.

(d) Federal agencies that are members of the Council, and Federal interagency bodies working on issues relevant to the prevention, eradication, and control of invasive species, shall provide the Council with annual information on actions taken that implement these duties and identify barriers to advancing priority actions.

(e) To the extent practicable, Federal agencies shall also expand the use of new and existing technologies and practices; develop, share, and utilize similar metrics and standards, methodologies, and databases and, where relevant, platforms for monitoring invasive species; and, facilitate the interoperability of information systems, open data, data analytics, predictive modeling, and data reporting necessary to inform timely, science-based decision making."

Sec. 4. Emerging Priorities. Federal agencies that are members of the Council and Federal interagency bodies working on issues relevant to the prevention, eradication, and control of invasive species shall take emerging priorities into consideration, including:

(a) Federal agencies shall consider the potential public health and safety impacts of invasive species, especially those species that are vectors, reservoirs, and causative agents of disease. The Department of Health and Human Services, in coordination and consultation with relevant agencies as appropriate, shall within 1 year of this order, and as requested by the Council thereafter, provide the Office of Science and Technology Policy and the Council a report on public health impacts associated with invasive species. That report shall describe the disease, injury, immunologic, and safety impacts associated with invasive species, including any direct and indirect impacts on low-income, minority, and tribal communities.

(b) Federal agencies shall consider the impacts of climate change when working on issues relevant to the prevention, eradication, and control of invasive species, including in research and monitoring efforts, and integrate invasive species into Federal climate change coordinating frameworks and initiatives.

(c) Federal agencies shall consider opportunities to apply innovative science and technology when addressing the duties identified in section 2 of Executive Order 13112, as amended, including, but not limited to, promoting open data and data analytics; harnessing technological advances in remote sensing technologies, molecular tools, cloud computing, and predictive analytics; and using tools such as challenge prizes, citizen science, and crowdsourcing.

Sec. 5. National Invasive Species Council. Section 3 of Executive Order 13112 is amended to read as follows:

Sec. 3. National Invasive Species Council. (a) A National Invasive Species Council (Council) is hereby established. The mission of the Council is to provide the vision and leadership to coordinate, sustain, and expand Federal efforts to safeguard the interests of the United States through the prevention, eradication, and control of invasive species, and through the restoration of ecosystems and other assets impacted by invasive species.

(b) The Council's membership shall be composed of the following officials, who may designate a senior-level representative to perform the functions of the member:

- (i) Secretary of State;
- (ii) Secretary of the Treasury;
- (iii) Secretary of Defense;
- (iv) Secretary of the Interior;
- (v) Secretary of Agriculture;
- (vi) Secretary of Commerce;
- (vii) Secretary of Health and Human Services;
- (viii) Secretary of Transportation;
- (ix) Secretary of Homeland Security;
- (x) Administrator of the National Aeronautics and Space Administration;
- (xi) Administrator of the Environmental Protection Agency;
- (xii) Administrator of the United States Agency for International Development;
- (xiii) United States Trade Representative;
- (xiv) Director or Chair of the following components of the Executive Office of the President: the Office of Science and Technology Policy, the Council on Environmental Quality, and the Office of Management and Budget; and
- (xv) Officials from such other departments, agencies, offices, or entities as the agencies set forth above, by consensus, deem appropriate.

(c) The Council shall be co-chaired by the Secretary of the Interior (Secretary), the Secretary of Agriculture, and the Secretary of Commerce, who shall meet quarterly or more frequently if needed, and who may designate a senior-level representative to perform the functions of the Co-Chair. The Council shall meet no less than once each year. The Secretary of the Interior shall, after consultation with the Co-Chairs, appoint an Executive Director of the Council to oversee a staff that supports the duties of the Council. Within 1 year of the date of this order, the Co-Chairs of the Council shall, with consensus of its members, complete a charter, which shall include any administrative policies and processes necessary to ensure the Council can satisfy the functions and responsibilities described in this order.

(d) The Secretary of the Interior shall maintain the current Invasive Species Advisory Committee established under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council. The Secretary shall, after consultation with other



members of the Council, appoint members of the advisory committee who represent diverse stakeholders and who have expertise to advise the Council.

(e) Administration of the Council. The Department of the Interior shall provide funding and administrative support for the Council and the advisory committee consistent with existing authorities. To the extent permitted by law, including the Economy Act, and within existing appropriations, participating agencies may detail staff to the Department of the Interior to support the Council's efforts.

Sec. 6. Duties of the National Invasive Species Council. Section 4 of Executive Order 13112 is amended to read as follows:

Sec. 4. Duties of the National Invasive Species Council. The Council shall provide national leadership regarding invasive species and shall:

(a) with regard to the implementation of this order, work to ensure that the Federal agency and interagency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective;

(b) undertake a National Invasive Species Assessment in coordination with the U.S. Global Change Research Program's periodic national assessment, that evaluates the impact of invasive species on major U.S. assets, including food security, water resources, infrastructure, the environment, human, animal, and plant health, natural resources, cultural identity and resources, and military readiness, from ecological, social, and economic perspectives;

(c) advance national incident response, data collection, and rapid reporting capacities that build on existing frameworks and programs and strengthen early detection of and rapid response to invasive species, including those that are vectors, reservoirs, or causative agents of disease;

(d) publish an assessment by 2020 that identifies the most pressing scientific, technical, and programmatic coordination challenges to the Federal Government's capacity to prevent the introduction of invasive species, and that incorporate recommendations and priority actions to overcome these challenges into the National Invasive Species Council Management Plan, as appropriate;

(e) support and encourage the development of new technologies and practices, and promote the use of existing technologies and practices, to prevent, eradicate, and control invasive species, including those that are vectors, reservoirs, and causative agents of disease;

(f) convene annually to discuss and coordinate interagency priorities and report annually on activities and budget requirements for programs that contribute directly to the implementation of this order; and

(g) publish a National Invasive Species Council Management Plan as set forth in section 5 of this order.

Sec. 7. National Invasive Species Council Management Plan. Section 5 of Executive Order 13112 is amended to read as follows:

Sec. 5. National Invasive Species Council Management Plan. (a) By December 31, 2019, the Council shall publish a National Invasive Species Council Management Plan (Management Plan), which shall, among other priorities identified by the Council, include actions to further the implementation of the duties of the National Invasive Species Council.

(b) The Management Plan shall recommend strategies to:

- (1) provide institutional leadership and priority setting;
- (2) achieve effective interagency coordination and cost-efficiency;
- (3) raise awareness and motivate action, including through the promotion of appropriate transparency, community-level consultation, and stakeholder outreach concerning the benefits and risks to human, animal, or plant health when controlling or eradicating an invasive species;
- (4) remove institutional and policy barriers;
- (5) assess and strengthen capacities; and
- (6) foster scientific, technical, and programmatic innovation.

(c) The Council shall evaluate the effectiveness of the Management Plan implementation and update the Plan every 3 years. The Council shall provide an annual report of its achievements to the public.

(d) Council members may complement the Management Plan with invasive species policies and plans specific to their respective agency's roles, responsibilities, and authorities."

Sec. 8. Actions of the Department of State and Department of Defense. Section 6(d) of Executive Order 13112 is amended to read as follows:

"(d) The duties of section 3(a)(2) and section 3(a)(3) of this order shall not apply to any action of the Department of State if the Secretary of State finds that exemption from such requirements is necessary for foreign policy, readiness, or national security reasons. The duties of section 3(a)(2) and section 3(a)(3) of this order shall not apply to any action of the Department of Defense if the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy, readiness, or national security reasons.

Sec. 9. Obligations of the Department of Health and Human Services. A new section 6(e) of Executive Order 13112 is added to read as follows:

(e) The requirements of this order do not affect the obligations of the Department of Health and Human Services under the Public Health Service Act or the Federal Food, Drug, and Cosmetic Act.

Sec. 10. General Provisions. (a) Nothing in this order shall be construed to impair or otherwise affect:

- (1) the authority granted by law to an executive department or agency, or the head thereof; or
- (2) the functions of the Director of the Office of Management and Budget relating to budgetary, administrative, or legislative proposals.

(b) This order shall be implemented consistent with applicable law and subject to the availability of appropriations.

(c) This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

BARACK OBAMA

THE WHITE HOUSE,  
December 5, 2016.

## 12.E 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.F Scoresheet for Aquatic Nuisance Species of Alabama

The following process was used to determine if a species was considered to be of greatest (maximum = 3) or lowest (minimum = 1) threat as an aquatic nuisance species. Values ranging from 3 (High), 2 (Medium), and 1 (Low) were assigned to each item within a category. The mean score was then calculated for each category and then the overall mean score was determined among the five categories.

Species name:

Native Range:

Categories:

### I. Ecological Impact:

1. Impact on ecosystem processes and system-wide parameters.
2. Impact on ecological community structure.
3. Impact on ecological community composition.
4. Impact on individual native plant or animal species.
5. Conservation significance of the communities and native species threatened.

### II. Current Distribution and Status:

1. Current range size in region.
2. Proportion of current range where species is negatively impacting biodiversity.
3. Proportion of region's biogeographic units invaded.
4. Diversity of habitats or ecological systems invaded in region.

### III. Trend in Distribution and Abundance:

1. Current trend in total range within region.
2. Proportion of potential range currently occupied.
3. Long-distance dispersal potential within region.
4. Local range expansion or change in abundance.
5. Inherent ability to invade conservation areas and other native species habitats.
6. Similar habitats invaded elsewhere.
7. Reproductive characteristics.

### IV. Management Difficulty:

1. General management difficulty.
2. Minimum time commitment.
3. Impacts of management on native species.
4. Accessibility of invaded areas.

### V. Economic Impact:

1. Commercial Fishing.
2. Recreational Boating.
3. Sportfishing/Angling.
4. Tourism.
5. Pet.
6. Horticulture/Home improvement.
7. Food.

## 12.G Example Scoresheet for Aquatic Nuisance Species of Alabama

Species name: Island Apple Snail

Native Range: South America

Categories: Values: High (3), Medium (2), Low (1)

### I. Ecological Impact:

1. Impact on ecosystem processes and system-wide parameters. - 3
2. Impact on ecological community structure. - 3
3. Impact on ecological community composition. - 3
4. Impact on individual native plant or animal species. -3
5. Conservation significance of the communities and native species threatened. -3

**Score: 15 Mean Score: 3.00**

### II. Current Distribution and Status:

1. Current range size in region. - 3
2. Proportion of current range where species is negatively impacting biodiversity. - 2
3. Proportion of region's biogeographic units invaded. - 2
4. Diversity of habitats or ecological systems invaded in region. - 3

**Score: 10 Mean Score: 2.50**

### III. Trend in Distribution and Abundance:

1. Current trend in total range within region. - 2
2. Proportion of potential range currently occupied. - 2
3. Long-distance dispersal potential within region. - 3
4. Local range expansion or change in abundance. - 3
5. Inherent ability to invade conservation areas and other native species habitats. - 3
6. Similar habitats invaded elsewhere. - 3
7. Reproductive characteristics. - 3

**Score: 19 Mean Score: 2.71**

### IV. Management Difficulty:

1. General management difficulty. - 3
2. Minimum time commitment. - 2
3. Impacts of management on native species. - 3
4. Accessibility of invaded areas. - 3

**Score: 11 Mean Score: 2.75**

### V. Economic Impact:

1. Commercial Fishing. - 3
2. Recreational Boating. - 3
3. Sportfishing/Angling. - 3
4. Tourism. - 3
5. Pet. - 1
6. Horticulture/Home improvement. - 1
7. Food. - 2

**Score: 16 Mean Score: 2.29**

Overall Score: (I)3.00 + (II)2.50 + (III)2.71 + (IV)2.75 + (V)2.29 = 13.25/5 = **2.65**

**Category: High**

## **12.H Alabama State Laws, Programs, and Regulations Relevant to ANS**

### **12.H.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.H.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.H.3 Relevant Authorities**

#### **12.H.3a Wildlife**

##### **12.H.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.H.3a(2) 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>12</sup>

##### **12.H.3a(3) Restrictions on Possession, Sale, Importation and/or Release of Certain Animals**

(1) No person, firm, corporation, partnership, or association shall possess, sell, offer for sale, import, bring, release, or cause to be brought or imported into the State of Alabama any of the following live fish or animals: Any Walking Catfish or any other fish of the genus *Clarias*; Any Piranha or any fish of the genera *Serrasalmus*, *Pristobrycon*, *Pygocentrus*, *Catoprion*, or *Pygopristus*; Any Nile Perch, Asian Seabass, Barramundi, or any fish from the genus *Lates* or *Macquaria*; Any Giant African Snail or Giant African Land Snail (*Lissachitina fulica*) or (*Achatina fulica*); Any Black Carp of the genus *Mylopharyngodon*; Any species of sturgeon not native to Alabama; Any species of Chinese perch *Siniperca spp.*; Any species of Snakehead fish from the



family Channidae *Channa spp*; Any species of Mud carp *Cirrhinus spp.*; Any species of fish rudd (*Scardinius erythrophthalmus*) or roach *Rutilus* or any hybrids of either species; Zander (*Sander lucioperca*); European Perch (*Perca fluviatilis*); Eurasian Minnow (*Phoxinus phoxinus*); Wels Catfish (*Silurus glanis*); Prussian Carp (*Carassius gibelio*); Crucian Carp (*Carassius carassius*); Any species of eel from the family of Anguillidae not native to Alabama; Amur Sleeper (*Perccottus glenii*) Any species of venomous reptile which has never naturally existed in the wild in Alabama including but not limited to venomous snakes of the families *Viperidae*, *Atractaspididae*, *Elapidae*, *Hydrophiidae* and *Colubridae*, except for hognose snakes (genus *Heterodon*); Any species of bird, mammal, reptile, or amphibian listed as injurious wildlife under the Lacey Act (18 U.S.C. 42) from the U.S. Fish and Wildlife Service; Any species of Tegus (*Salvator spp.*); Any species of Mongoose; San Juan Rabbits, Jack Rabbits or any other species of wild rabbit or hare; or Any of the following from any area outside the state of Alabama: any member of the family *Cervidae* (to include but not be limited to deer, elk, moose, caribou), species of coyote, species of fox, species of raccoon, species of skunk, wild rodent, or strain of wild turkey, black bear (*Ursus americanus*), mountain lion (*Felis concolor*), bobcat (*Felis rufus*), Pronghorn Antelope, any non-domestic member of the families *Suidae* (pigs), *Tayassuidae* (peccaries), or *Bovidae* (except bison). No person, firm, corporation, partnership, or association, shall transport within the state, any member of the above-stated species (whether such member originated within or without the state), except for properly licensed game-breeders pursuant to Section 9-11-31, Code of Alabama 1975, or persons engaged in the interstate transport of any of the above-stated species through the state who are otherwise specifically authorized by permit of the Director of the Division of Wildlife and Freshwater Fisheries or his designee. (2) It shall be unlawful to release any tame turkey, or any other turkey, whether wild or tame, into any of the wild areas of this State. The provisions of this regulation shall not apply to any turkeys kept by any farmer or landowner of this State for normal agricultural purposes or for personal consumption. (3) Except as authorized by permit issued by the Department prior to the date of this amendment, it shall be unlawful for any person to have in possession any live, protected wild bird or wild animal or live embryo or eggs of these protected wild birds or animals. "Possession" in this section does not include deer restricted by natural or man-made barriers as long as the deer remain wild and are not subject to management practices of domesticated animals. (4) It shall be unlawful for any person to release any form of mammal, reptile, or amphibian which did not originate from this state, or any captive raised mammal, reptile, or amphibian other than those species raised under a license or permit from the Commissioner. (5) It shall be unlawful to release any non-indigenous seafoods, as defined by Section 9-2-80, Code of Alabama, 1975, into any public waters of the state. (6) The provisions of this regulation shall not apply to the exceptions provided for in Section 9-2-13(b), Code of Alabama 1975. Accredited educational, research, and rehabilitation facilities shall be exempt from this regulation through the written permission of the Commissioner or his designee.

### **12.H.3b. Aquatic Life**

#### **12.H.3b(1) General Authority**

In Alabama, there is a list of fish whose sale, possession, importation, and release is prohibited.<sup>13</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>14</sup> The sale, transportation, or importation of game fish is unlawful, subject to certain exceptions.<sup>15</sup> The Commissioner of Conservation and Natural Resources may introduce desirable species of fish.<sup>16</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>17</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>18</sup> A violation is a misdemeanor.<sup>19</sup>

### **12.H.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>20</sup>

### **12.H.3b(3) Aquatic Plants**

There is a list of prohibited nonindigenous aquatic plants compiled by the Department of Conservation and Natural Resources.<sup>21</sup> It is unlawful to introduce any nonindigenous aquatic plant into any public waters.<sup>22</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>23</sup> Possession of prohibited aquatic plants through natural dispersion, where such possession poses neither danger nor intent to disperse, is not a violation.<sup>24</sup> A violation is a Class C misdemeanor.<sup>25</sup>

These plants are African elodea, alligatorweed, Brazilian elodea, curlyleaf pondweed, Eurasian watermilfoil, floating waterhyacinth, giant Salvinia, hydrilla, hygrophila, limnophila, parrotfeather, purple loosestrife, rooted waterhyacinth, spinyleaf naiad, water-aloe, waterlettuce, water chestnut, water spinach.

### **12.H.3c Plants**

#### **12.H.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>26</sup> Noxious weeds are plants that may be a serious agricultural threat.<sup>27</sup> Alabama has a list of noxious weeds, which is divided into three classes.<sup>28</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>29</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>30</sup> Class C weeds include any other designated noxious weeds that pose harm to Alabama's various industries.<sup>31</sup> There is a list of regulated areas and regulated articles.<sup>32</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>33</sup> The introduction into Alabama of any noxious weed is prohibited, except under special permit from the Commissioner.<sup>34</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>35</sup> The Commissioner may treat or destroy plants and other articles capable of harboring noxious weeds if the plants or articles are infested.<sup>36</sup> A quarantine against certain noxious weeds has been established.<sup>37</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>38</sup> After a public hearing, the municipality is authorized to enter the property to abate the nuisance.<sup>39</sup> Regarding the outside premises of a food storage facility, weeds must be cut or killed.<sup>40</sup> Weeds at solid waste transfer stations and processing facilities must be trimmed regularly.<sup>41</sup> The Legislature

may by local act authorize or require the Jefferson County Commission to prohibit the overgrowth of weeds.<sup>42</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>43</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 nonregulated area.<sup>44</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>45</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>46</sup> As a condition of issuance of certificates or limited permits, an applicant may be required to sign a compliance agreement.<sup>47</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>48</sup> The Board may declare quarantine in reference to noxious weeds.<sup>49</sup> Articles moved in violation of the quarantine will be declared contraband, confiscated, and destroyed.<sup>50</sup> The Federal Noxious Weed Regulations are adopted by reference.<sup>51</sup> A violation is a Class C misdemeanor.<sup>52</sup>

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

#### **12.H.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>53</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>54</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>55</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>56</sup> The Commissioner may treat or destroy plants and other articles capable of harboring plant pests if the plants are infested.<sup>57</sup> The board may declare a quarantine in reference to plant pests or noxious weeds.<sup>58</sup> Articles moved in violation of the quarantine will be declared contraband, confiscated, and destroyed.<sup>59</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>60</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>61</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>62</sup> A violation is a Class C misdemeanor.<sup>63</sup>

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

The Commissioner of the Department of Agriculture and Industries may inspect nurseries.<sup>64</sup> Nurserymen and dealers must retain records.<sup>65</sup> The sale or distribution of nursery stock requires a certificate of inspection.<sup>66</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>67</sup> The Commissioner may fumigate or treat infected or infested nursery stock, plants, or plant products.<sup>68</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>69</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>70</sup> All nursery stock moving within or imported into Alabama must bear a tag with a copy of the certificate of inspection.<sup>71</sup> Common carriers may only move nursery stock and plant products carrying an official state or federal tag.<sup>72</sup> Non-complying materials must be reported and held for inspection.<sup>73</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>74</sup> A violation is a Class C misdemeanor.<sup>75</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. 80-3-18-.10.
13. Ala. Admin. Code r. 220-2-.26, 220-2-.93.
14. Ala. Code §9-2-13.
15. Ala. Code §9-11-84.
16. Ala. Code §9-2-7.
17. Ala. Code §22-10-1.
18. Ala. Code §22-10-3.
19. Ala. Code §9-1-4.
20. Ala. Code §9-11-450.
21. Ala. Admin. Code r. 220-2-.124.
22. Ala. Code §9-20-3.
23. Id.
24. Ala. Code §9-20-4.
25. Ala. Code §9-20-6.
26. Ala. Code §2-25-3.
27. Ala. Code §2-25-1.
28. Ala. Admin. Code r. 80-10-14-.04.
29. Ala. Admin. Code r. 80-10-14-.02.
30. Id.
31. Id.
32. Ala. Admin. Code r. 80-10-14-.05, .06.
33. Ala. Code §§2-26-1, 2-26-3.
34. Ala. Code §2-25-10.
35. Ala. Code §2-25-3.
36. Id.
37. Ala. Admin. Code §§80-10-14-.01, 80-10-14-.03.
38. Ala. Code §§11-67-2, 11-67-3.
39. Ala. Code §11-67-6.

40. Ala. Admin. Code r. 80-1-22-.20.
41. Ala. Admin. Code r. 420-3-5-.12, 420-3-5-.13.
42. Ala. Const. amend. 497.
43. Ala. Admin. Code r. 80-10-14-.10.
44. Ala. Admin. Code r. 80-10-14-.07.
45. Ala. Admin. Code r. 80-10-14-.08.
46. Id.
47. Id.
48. Ala. Code §2-25-15.
49. Ala. Code §2-25-4.
50. Ala. Code §2-25-13.
51. Ala. Admin. Code r. 80-10-14-.13.
52. Ala. Admin. Code r. 80-10-14-.12.
53. Ala. Code §2-25-3.
54. Ala. Code §2-25-1.
55. Ala. Code §2-25-10.
56. Ala. Code §2-25-3.
57. Id.
58. Ala. Code §2-25-4.
59. Ala. Code §2-25-13.
60. Ala. Code §2-25-3.
61. Ala. Code §2-25-15.
62. Ala. Admin. Code r. 335-3-3-.01.
63. Ala. Code §2-25-22.
64. Ala. Code §2-25-3.
65. Ala. Admin. Code r. 80-10-1-.05.
66. Ala. Code §2-25-6.
67. Ala. Code §2-25-17.1.
68. Ala. Code §2-25-17.2.
69. Ala. Admin. Code r. 80-10-1-.10.
70. Ala. Admin. Code r. 80-10-1-.06.
71. Ala. Admin. Code r. 80-10-1-.07.
72. Ala. Code §§2-25-11, 2-25-12.
73. Ala. Code §2-25-15.1.
74. Ala. Code §2-25-16.
75. Ala. Code §2-25-22.

## **12.I Federal Laws, Programs, and Regulations Relevant to ANS**

### **12.I.1 Federal Laws**

#### **12.I.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) and the U.S. Coast Guard share authority to manage discharges from vessels, including ballast water.<sup>4</sup>

Amendments in 2018 to the CWA, the Vessel Incidental Discharge Act (VIDA) (P.L. 115-282, §§ 902-203), revised the law to address aquatic nuisance species introduced by ballast water discharges. VIDA directed EPA to establish standards for the discharge of pollutants from vessels and put the Coast Guard in charge of enforcing those standards as well as giving it primary responsibility for designing the onboard equipment and practices for reducing pollutants and invasive species from ballast discharges.

In addition to incorporating the definition of aquatic nuisance species into the CWA, VIDA defined a ballast water discharge standard based on existing regulations. The goal is to render organisms in the ballast water nonviable. The amendment allows ballast water exchanges by two different means, requiring best management practices. But ballast water exchanges will be shifted to a requirement for ballast water management systems other than exchanges as a way to render organisms in ballast water nonviable. The amendment provides for the repeal of the regulations issued under the Nonindigenous Aquatic Nuisance Control and Prevention Act (NANCPA) once enforceable regulations are promulgated under the amended law. States are afforded the ability to petition EPA or the Coast Guard regarding any standard of performance, policy, or regulation.

In 2004 the International Maritime Organization proposed ballast water management standards with the goal of requiring all vessels to install on-board ballast water treatment systems in order to eliminate the spread of aquatic invasive species. The treaty, the International Convention for the Control and Management of Ships' Ballast Water and Sediments, went into effect in 2017. The United States never ratified the treaty and therefore is not bound by it, although it can voluntarily meet its standards, such as by establishing those under VIDA.

#### **12.I.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>5</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>6</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>7</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>8</sup>

The CZMA calls for coordination and cooperation between the DOC and other interested Federal agencies to the maximum extent practicable.<sup>9</sup> The department 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>10</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>11</sup> This program could sponsor monitoring and other research of invasive species.

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

The U.S. Department of the Interior (DOI) and the Department of Commerce (DOC) share responsibility for implementing the Endangered Species Act (ESA).<sup>12</sup> Invasive species, including plants, threaten the continued existence of some endangered species, typically by reducing available habitat. However, the ESA does not contain specific language that directly relates to invasive species or language that mentions how the DOI or DOC could regulate particular pathways by which invasive species may become a threat to endangered species.

#### **12.I.1d 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>13</sup> Registration ensures proper labelling and that if pesticides are used in accordance with specification, then they will not cause unreasonable adverse effects on the environment.<sup>14</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>15</sup>

#### **12.I.1e 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>16</sup> on Federal lands. Federal agencies must develop and coordinate a management program to control such plants on their lands 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.I.1f 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>17</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>18</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, and the head of the agency exercising administration over the wildlife resources that may be affected by the action.<sup>19</sup> Furthermore, the DOI shall make reports and recommendations on the wildlife aspects of such projects.<sup>20</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>21</sup>

### **12.I.1g Lacey Act, Injurious Species Provisions, 18 U.S.C. §§ 42-43**

The Lacey Act is divided into two separate sections based on the type of behavior being regulated. The injurious species provisions of the Lacey Act, found in 18 U.S.C. § 42, prohibit importing into the United States or any of its territories certain categories of animal species found to be “injurious.” That list of species includes many aquatic nuisance animal species. It is administered by the U.S. Fish and Wildlife Service (FWS) and the U.S. Customs and Border Protection.

To be listed as injurious under Title 18, the species must be found to be “injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States.” However, permits may be issued by the FWS to import injurious species for zoological, educational, medical, and scientific purposes.<sup>22</sup> To avoid redundancy, the Act excludes adding by regulation those species already regulated under the Plant Pest Act.

It is important to note that Section 42 restricts FWS’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 or listed by regulation. Finally, the Act has limited enforcement authority, authorizing interdiction of those species only when discovered at the time of import. Therefore, species which are not intentionally imported, such as zebra and quagga mussels, evade the reach of the Act.

The other portion of the Lacey Act addresses trade and does not reference injurious species. That section, 16 U.S.C. §§ 3371 et seq., 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. This part of the Lacey Act does not directly regulate invasive species, although it could indirectly apply to them. It is administered by the FWS, the U.S. Customs and Border Protection, and the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce.

The trade provisions of Lacey Act, 16 U.S.C. § 3372(a), makes it a federal crime to act in a way that violates federal, state, tribal, or international law with regard to protected plants and wildlife. Specifically, it 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 [or any foreign law].” To the extent that a party violated a state law regarding trade or purchase of an aquatic nuisance species or violated the injurious species provisions of the Lacey Act, the Title 16 provisions of the Lacey Act could offer a means of enforcement under federal law.

Behavior related to illegally buying or selling fish, plants, or wildlife such as receiving, transporting, or possessing species is prohibited by the Lacey Act.<sup>23</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 for sale.<sup>24</sup> All fish, wildlife, or plants imported, exported, transported, sold, received, acquired, or purchased in violation of the Lacey Act or its regulation are subject to forfeiture to the United State as well as any civil or criminal penalties that may be assessed.<sup>25</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 Act, 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>26</sup>

The Lacey Act does not prevent states or Indian tribes from making or enforcing laws or regulations consistent with the Act.<sup>27</sup>

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

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) indirectly considers aquatic nuisance species through 16 U.S.C. § 1855(b), which requires consideration of essential fish habitat (EFH).<sup>28</sup> The EFH provisions require federal and states taking action that could impact EFH to consult with the Department of Commerce National Marine Fisheries Service (NMFS). NMFS has the authority to make recommendations so that those actions conserve EFH, which would include the adverse introduction of species.<sup>29</sup>

Each of the eight regional Fishery Management Councils may comment on and make recommendations 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.

#### **12.I.1i National Environmental Policy Act, 42 U.S.C. § 4321 et seq.**

The National Environmental Policy Act (NEPA) applies to all federal departments and agencies. NEPA declares a national policy to encourage productive and enjoyable harmony between man and his environment. A fundamental requirement of NEPA is for agencies planning major federal actions to consider the environmental impacts of those actions. This will include direct and indirect effects of those actions. For example, building a road could have the indirect effect of introducing invasive species along the right of way. NEPA requires the Federal government agencies to consider the effects of their actions by preparing written environmental reviews to determine whether the project will adversely affect the human environment and design alternatives to harmful actions.<sup>30</sup>

### **12.I.1j 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 to prevent the spread of aquatic nuisance species through ballast water releases. The U.S. Coast Guard is responsible for enforcing ballast water regulations, and it issued regulations pertaining to ballast water exchanges. The sections of NISA directing ballast water regulations were superseded in 2018 by the Vessel Incidental Discharge Act. That act requires the Coast Guard to establish national standards of performance for marine pollution control devices and water quality. (See, Clean Water Act, above.)

NISA also 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>31</sup> This Task Force was charged with developing and implementing a program to prevent the unintentional introduction and dispersal of aquatic nuisance species<sup>32</sup> through ballast water management.

States, through their respective governors, may submit their own comprehensive management plans to the Task Force for approval.<sup>33</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>34</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>35</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>36</sup>

### **12.I.1k 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, endwise 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>37</sup> Some of the major goals of the NMSA include research, monitoring, and education.<sup>38</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>39</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>40</sup>

Grant and contract funds are available for research, monitoring, and education for conservation and management purposes.<sup>41</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>42</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.

#### **12.I.11 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>43</sup> into the United States.<sup>44</sup> With certain exceptions, no person is authorized to import, enter, export, or move in inter- state 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>45</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>46</sup> Any person may petition the USDA to add or remove a plant pest from the regulations.<sup>47</sup>

The PPA prohibits unauthorized mailing of plant pests.<sup>48</sup> “Any letter, parcel, box, or other package containing any plant pest, whether sealed as letter-rate postal matter or not, is notailable 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>49</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>50</sup>

The movement of plants, plant products, biological control organisms, noxious weeds, articles, and means of conveyance are also regulated.<sup>51</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>52</sup> The USDA may publish, by regulation, a list of noxious weeds that are prohibited or restricted in interstate com- merce.<sup>53</sup> Likewise, the USDA may publish, by regulation, a list of organisms that are not prohibited or restricted in interstate commerce.<sup>54</sup> However, lists may take into account distinctions between organisms such as “indigenous,” “invasive,” “newly introduced,” or “commercially raised.”<sup>55</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>56</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>57</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>58</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 Usamas soon as possible” after the arrival of the plant, biological organism, or the means of conveyance at the port of entry and before it is moved from the port of entry.<sup>59</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>60</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>61</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>62</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>63</sup>

#### **12.1.1.m Transportation of Water Hyacinths 18 U.S.C. § 46**

This federal law bans the interstate transport of alligator grass, water chestnuts, or water hyacinths, including their seeds. They are all aquatic nuisance species. Selling, purchasing, or exchanging one of these plants or seeds after illegal interstate transportation is also against the law, subject to six months in jail or a fine. Alligator grass and water hyacinths are invasive species in Alabama.

#### **12.I.1n 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>64</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>65</sup> Also, USDA regulates the import and export 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>66</sup>

#### **12.I.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>67</sup>

The CTA program also helps with implementation of programs authorized by the 1996 Farm Bill, such as Highly Erodible Land and wetlands conservation provisions.<sup>68</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.I.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>69</sup> Participation in the EQIP is voluntary.<sup>70</sup> EQIP activities are implemented according to the operation plans developed by both the government and producer.<sup>71</sup> The program provides financial assistance, through incentive payments and cost-shares, to protect against threats to soil, water, and other natural resources.<sup>72</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>73</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>74</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>75</sup>

### **12.I.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>76</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>77</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>78</sup> Currently, there are 24 Plant Materials Centers in the United States, including the National Plant Materials Center in Beltsville, Maryland.

### **12.I.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. 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. 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.

### **12.I.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.” 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). Financial assistance is through cost-share payments and agreements. Technical assistance includes application, assessment, monitoring, enforcement, and other actions necessary to fulfill the goals of the WHIP and the WHDP.

### **12.I.3 Citations to the Code of Federal Regulations**

Clean Water Act

- 7 CFR § 601
- 9 CFR § 590
- 40 CFR § 6, 25, 35, 122, 123, 130, 401 Coastal Zone Management Act
- 49 CFR § 1105 Cooperative Forestry Assistance Act
- 36 CFR § 200, 230 Endangered Species Act
- 7 CFR § 319, 355, 356, 371, 650
- 15 CFR § 904, 922
- 19 CFR § 12, 10
- 21 CFR § 25
- 30 CFR § 773
- 32 CFR § 190
- 36 CFR § 2, 13
- 43 CFR § 414, 8340
- 49 CFR § 1105
- 50 CFR § 10, 14, 17, 23, 81, 222, 402, 424, 453 Federal Agricultural Improvement and Reform Act
- 7 CFR § 12, 1794 Federal Insecticide, Fungicide, and Rodenticide Act
- 7 CFR § 110, 301, 319, 760
- 9 CFR § 71, 85, 121
- 14 CFR § 137
- 19 CFR § 12
- 21 CFR § 211
- 40 CFR § 2, 17, 22, 23, 35, 40, 129, 152, 154, 158, 159, 160, 163, 164, 166, 167, 170-173 Federal Noxious

Weed Act

- 7 CFR § 340, 371
- 50 CFR § 24 Federal Plant Pest Act
- 7 CFR § 351
- 50 CFR § 24 Federal Seed Act
- 7 CFR § 97, 201, 371 Fish and Wildlife Coordination Act
- 30 CFR § 773, 736
- 40 CFR § 122
- 43 CFR § 8, 24
- 50 CFR § 10005 Food Security Act
- 7 CFR § 400, 614, 1940
- 9 CFR § 205
- 46 CFR § 381
- 9 CFR § 205
- 46 CFR § 381 The Lacey Act
- 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 16 U.S.C. § 1452(1).
6. See id. § 1454(2).
7. See id. § 1455(e).
8. See id. § 1455a(f).
9. See id. § 1456(a).
10. See id. § 1456(b).
11. See id. § 1461(c).
12. See 16 U.S.C. § 1533.
13. See 7 U.S.C. § 136a for registration requirements and procedure and classification of pesticides.
14. See id.
15. See id.
16. “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).
17. 16 U.S.C. § 661.
18. See id. § 661(1).
19. See id. § 662(a).
20. See id. § 662(b).
21. See id. § 663. See also §§ 661 and 662.
22. See id. § 42(3).
23. “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).
24. 16 U.S.C. § 3372(d)(1)-(2).

25. See 16 U.S.C. § 3374(1).
26. 16 U.S.C. § 3374(a)(2)
27. 16 U.S.C. § 3378(a)
28. See 16 U.S.C. § 1855(b)(2).
29. 16 U.S.C. § 1855(b)(3)(A).
30. 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.
31. See 16 U.S.C. § 4721(a).
32. 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).
33. See id. § 4724.
34. See id.
35. See id. § 4722(f).
36. See id.
37. 16 U.S.C. § 1431(a)(4).
38. See id. § 1440.
39. See id. § 1441(a).
40. See id. § 1442(a).
41. See id. § 1440(b)(1).
42. Id. § 1436(1).
43. See 7 U.S.C. § 403(14) for a definition of “plant pest.”
44. See id. § 411(a).
45. See id.
46. See id. § 411(c).
47. See id.
48. See id. § 411(d).
49. Id.
50. See id.
51. See id. § 412.
52. See id.
53. See id. § 12(f)(1).
54. See id.
55. See id. § 412(g).
56. See id. § 413.
57. See id.
58. See id.
59. See id. § 413(b).
60. See id.
61. Id. § 414(a).
62. See id.
63. See id. § 431.
64. 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.
67. See 21 U.S.C. § 151.
68. See id. § 152.



69. 7 C.F.R. § 601.1(f)(1)(i).
70. See id.
71. See 7 C.F.R. § 1466.4(d).
72. See id. § 1466.4(a).
73. See id. See also 7 C.F.R. § 1466.6(a).
74. See id.
75. See id. § 1466.8(a).
76. See id. § 1466.1.
77. See id.
78. See 7 C.F.R. §§ 613.1, 613.2.

## 12.J 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  
The Freeman Herbarium (AUA)  
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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 regard- ingtheimportationofspecies.**This proposed committee would also be represented by public interests and proposed decisions would require public review and comments. Are commendation would be made for committee members to serve apre-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

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 given 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 red claw 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 red claw 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 biosecurity program, but current evidence suggests if this species escapes 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 Stewart